

AS/400 APPN Configuration Guide

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Take Note!

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

First Edition (April 1994)

This edition applies to IBM Advanced Peer-to-Peer Networking functions as it is implemented in AS/400 with OS/400 Version 2 Release 3, VTAM Version 4 Release 1, 3174 with Configuration Support C3, 5494 with LEN End Node Support, and PS/2 with Communications Manager/2.

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Abstract

This document describes the concepts, configurations and flows between Advanced Peer-to-Peer Networking (APPN) network nodes, Advanced Peer-to-Peer Networking (APPN) end nodes and LEN end nodes. It provides a number of scenarios with these nodes interacting both through and independently of a subarea network. It also provides discussion of the most recent implementations of APPN, for AS/400, PS/2, 3174, 5394, 5494, RISC/6000 and VTAM 4.1.

This publication also provides the reader with an understanding of the mechanisms which underpin the implementation of APPN on these systems, and does not merely provide configuration examples.

This document is intended for use by IBM system engineers, system planners, and network administrators who are involved in designing APPN networks within a single corporation or between different corporations. A basic knowledge of networking concepts and terminology is assumed.

(480 pages)

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Special Notices

This publication is intended to provide IBM systems engineers and customer personnel with a guide for implementation of AS/400 APPN in conjunction with VTAM APPN, PS/2 APPN, 3174 APPN, RS/6000 APPN. Implementations of 5394, 5494 T2.1 and subarea support are also explored. The information in this publication is not intended as the specification of any programming interfaces that are provided by VTAM Version 4 Release 1, OS/400 Version 2 Release 2, OS/2 Extended Services or OS/2 Communications Manager/2. See the PUBLICATIONS section of the IBM Programming Announcement for the above products for more information about what publications are considered to be product documentation.

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Preface

This document is intended for use by IBM system engineers, system planners and network administrators who are involved in designing APPN networks within a single corporation or between different corporations. A basic knowledge of networking concepts and terminology is assumed.

The purpose of Advanced Peer-to-Peer Networking (APPN) is to provide a network that is easy to use, has decentralized network control but centralized network management, allows for arbitrary topologies, has connection flexibility and continuous operation, and requires no specialized communications hardware.

Until recently, Advanced Peer-to-Peer Networking was an extension of the SNA architecture implemented only on the AS/400* and System/36. APPN is now a part of the SNA and SAA* architectures and implementations are now also available on the PS/2*, DPPX/370, 3174, RS/6000 and VTAM* Version 4 Release 1.

The purpose of this residency was to test, document, illustrate and discuss how the current implementations of APPN operate in various networks. Consideration will be made of various options for connecting one or more corporation's remote APPN branches via an SNA subarea network. Consideration will also be made for the new APPN functions introduced to VTAM with Version 4 Release 1.

All current APPN implementations (excluding DPPX/370) are considered; they are:

- AS/400 with OS/400* Version 2 Release 2
- AIX SNA Server/6000
- VTAM Version 4 Release 1
- 3174 with Configuration Support C1, C2, and C3
- PS/2 with OS/2 Extended Services 1.0
- PS/2 with OS/2 Communications Manager/2

The LEN nodes considered are:

- VTAM Version 4 Release 1
- AIX SNA Services/6000
- 5394 with the Type 2.1 Node Support RPQ 8Q0775
- 5494 Remote Control Unit
- 5494 with RPQ 8Q0932
- DOS PC or PS/2 with PC Support/400.

In addition, consideration is given to new functions now available in OS/400 V2R1, VTAM V4R1, AIX SNA Server/6000.

Document Organization

On a global level, this document builds, chapter by chapter, into a scenario which may be a realistic one for many corporations. In doing so, it focuses on issues of remote branch connection via an SNA subarea network. With recent APPN announcements, there are now a number of options that may be considered in such an environment. On another, more localized level, the chapters may be read independently of the scenario built in the document, and of each other. They are organized as follows:

- Chapter 1, "Introduction," provides a poetically indulgent introduction to the document as a whole.
- Chapter 2, "AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network," provides configuration examples, an SNA flow and trace analysis, and considerations for AS/400 and CM/2 nodes in an APPN network. In this chapter, the APPN network discussed is independent of an SNA subarea network.
- Chapter 3, "The 5394 Remote Control Unit," Chapter 4, "The 5494 Remote Control Unit," Chapter 5, "Including a 3174 APPN Node in the Branch Network," and Chapter 6, "The RISC System/6000," provide discussion of the functions available with the announcement of APPN on the 3174, with the 5394 T2.1 Node Support RPQ, with the 5494 controller, and the RISC/6000. In these chapters, the two control units are connected to the network built earlier. Configuration examples and SNA trace analyses are included. Consideration is given in later chapters for connectivity via a subarea network.
- Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" and Chapter 8, "APPN VTAM," provide discussion of the options available to connect our previously constructed branch via a subarea network to another branch. The branches may be either in the same corporation or in a different one, and connectivity may be via AS/400, 3174, OS/2 APPN, 5394, 5494 and RISC/6000. Configuration examples and an SNA trace analysis are also included.

Related Publications

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

- *AS/400 Communications: Advanced Peer-to-Peer Networking User's Guide*, SC21-8188
- *AS/400 Communications: Advanced Peer-to-Peer Networking V2.2 Guide*, SC41-8188
- *AS/400 PC Support Technical Reference*, SC21-8091
- *AS/400 PC Support Technical Reference for DOS and OS/2*, SC41-8091
- *PC Support/400 DOS Installation and Administration Guide*, SC41-0006
- *SNA Formats Manual*, GA27-3136
- *5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775 Supplement*, SC30-3531
- *5394 Remote Control Maintenance Library, Maintenance Analysis Procedures, Maintenance Information, Parts Catalog Release 1.0*, SY27-0311
- *5494 Remote Control Unit Planning Guide*, GA27-3936
- *5494 Remote Control Unit User's Guide*, GA27-3960
- *5494 Remote Control Unit Function Reference*, SC30-3533
- *5494 Remote Control Unit SNA RPQ 8Q0932*, SC30-3566
- *IBM 3174 Configuration Support C Planning Guide*, GA27-3918
- *IBM 3174 Utilities Guide Configuration Support C*, GA27-3920
- *Using AIX SNA Services/6000 Reference*, SC31-7014
- *AIX AS/400 Connection Program/6000 User's Guide*, SB35-4069

International Technical Support Organization Publications

- *APPN Architecture and Product Implementations Tutorial*, GG24-3669
- *AS/400 APPN with PS/2 APPN, 3174 APPN, 5394 and Subarea Networking*, GG24-3717
- *Networking Services/2 Installation, Customization and Operation, APPN for OS/2*, GG24-3662
- *IBM Extended Services for OS/2 Communications Manager New Features and Enhancements*, GG24-3876
- *AS/400 Communications Definitions Examples Volume 2*, GG24-3763
- *AS/400 SNA Pass-Through Communications Definitions and Examples*, GG24-3919
- *AS/400 and RISC System/6000 Connectivity*, GG24-4039
- *VTAM 3.4 and 3.4.1 Planning Guide for New Functions*, GG24-3569
- *IBM 3174 Establishment Controller Installation Guide*, GG24-3061
- *5494 and OS/2 Extended Services: Connecting Remote User Groups to AS/400s*, GG24-3828

- *IBM Communications Manager/2 Version 1.0 New Features*, GG24-3958
- *IBM Communications Manager/2 Version 1.1 Enhancements*, GG24-4142

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

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

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Chapter 1. Introduction

Systems Network Architecture (SNA) has proven to be the stable foundation upon which many companies have built their corporate information exchange technology. Since its announcement in 1974, SNA has provided flexible and powerful networking structures, while ensuring network stability and security.

SNA has evolved progressively toward more flexible and powerful networking structures which are easier to use and yet still secure and stable. Advanced Peer-to-Peer Networking* (APPN*) has come of age with the announcement of VTAM* Version 4 Release 1. VTAM Version 4.1 now completes the picture as Advanced Peer-to-Peer Networking is embraced as a networking technology by all of IBM's major products. APPN is now supported by S/390*, AS/400*, 3174, PS/2 with OS/2 Extended Services 1.0 Communications Manager*, Communications Manager/2*, and AIX SNA Services/6000. on the RS/6000 AIX* platform.

The purpose of APPN is to provide a network that is easy to use, has decentralized network control but centralized network management, allows for arbitrary topologies, has connection flexibility and continuous operation, and requires no specialized communications hardware.

In this book, it is our intention to provide the AS/400 user with a guide to implementing APPN in their networks which incorporate VTAM networks, RS/6000, and PS/2s, and the more recent AS/400 remote control units 5494. This document will provide analysis, instruction, illustration and configuration details of AS/400 APPN with VTAM APPN, PS/2 APPN, 3174 APPN, 5494 and traditional subarea networking. We trust that it holds value for customer technicians and systems engineers alike.

1.1 SNA Node Types

The SNA architecture is built upon the interaction of different types of communications nodes with defined roles. The SNA *node type* determines the role the node should play in communicating with other SNA nodes.

An SNA node is also referred to as a physical unit (PU). Thus, for example, a node type 2 (T2) may also be referred to as a PU2. Within a physical unit resides one or more logical units (LUs). There are a number of different LU types used for different purposes. Only the two key LU types discussed in this book are included in Table 1. Please refer to 1.3, "Independent versus Dependent Communications" on page 3 for more discussion of LU types. For those unfamiliar with SNA node and LU types, Table 1 provides a useful reference point for further discussion.

Table 1. Some SNA Node, LU Types and Examples

NODE/PU/LU TYPE	FUNCTION PERFORMED	EXAMPLE IBM PRODUCT
T5	Session services and routing	Host with VTAM (or SSCP)
T4	Intermediate node routing	Communications Controller with NCP (IBM 37XX)
PU T2.0	Services for locally attached LUs (screens attached to an IBM 3174)	"Small" system or remote cluster controller (IBM S/38 or IBM 3174)
PU T2.1	Support for communications between peer computers in a network without the services of a T5 host	IBM PS/2 or PC, IBM S/36, IBM S/38, IBM AS/400, AIX SNA Services/6000. IBM 370 host with VTAM 3.2 (or later) and corresponding NCP appears as an APPN LEN end node to other APPN LEN end nodes
LEN end node	An APPN node (without the APPN extensions)	See PU T2.1
EN,NN nodes	Extends APPN LEN node so that sessions may be started between non-adjacent peers	S/36 with APPN, AS/400, PS/2 with NS/2, PS/2 with CM/2, 3174, DPPX/370, APPN VTAM, AIX SNA Server/6000
LU 2	Protocol for 3270 terminal connections to the host via a 3270 controller	Supports 3278, 3192, 3472 connectivity via a 3174
LU 6.2	Protocol for application-to-application communications between peer systems	Supports APPC programs (IBM programs: DSPT, DDM, or user-written programs)
APPC	Also known as LU 6.2	See LU 6.2

1.2 Introduction to Advanced Peer-to-Peer Networking

There are a number of documents now available which describe both the Advanced Peer-to-Peer Networking architecture and its implementation in the various products which now support APPN. Therefore, while it is our intention in writing this document to focus upon APPN, to illustrate and clarify some of its central constructs, we do assume a basic understanding of APPN concepts.

In order to gain a more broad introduction to Advanced Peer-to-Peer Networking, we refer you to the *APPN Architecture and Product Implementations Tutorial*, this publication provides an excellent introduction to APPN and the current implementations of APPN in the IBM AS/400, PS/2, 3174, and APPN VTAM.

1.3 Independent versus Dependent Communications

When considering connectivity options to an SNA subarea network, it is useful to group the kinds of connectivity which may be performed into the following two categories:

1. Dependent communications
2. Independent communications

Understanding the characteristics of these two communications categories is key to understanding the possibilities for establishing sessions between APPN networks via a traditional subarea. This is important as APPN deals exclusively with independent communications. To clarify, we now consider the two terms briefly.

The term *dependent communications* refers to traditional SNA subarea communications. With dependent communications, a session may be established only by the host sending a BIND. The key usage for dependent communications is with *PU Types 2.0*. PU type 2.0 is the SNA terminology which refers to a 3270 control unit (for example a 3174). Ordinary 3270 screens and printers communicate to the host by attaching to a 3270 control unit. These devices are referred to as LU types 2 and 1 or 3, respectively, and are the principle examples of dependent communications. LU type 0, used by the SNUF facility of the AS/400, is also an example of dependent communications. An LU which is used for dependent communications is given the name of *dependent LU*.

From an AS/400 perspective, dependent communications to the host refers, for example, to 3270 emulation, Remote Job Entry (RJE), Host Command Facility (HCF), SNA Upline Facility (SNUF) and Network Routing Facility (NRF).

AS/400 SNA Primary LU Support is a special example which uses both independent and dependent communication to support a connection from a host-attached 3270 terminal to the AS/400. This implementation will not be discussed in detail in this publication.

The term *independent communications* refers to SNA communications where the host need not have responsibility for establishing a session. That is, where the host need not send the BIND, but rather is able to both send a BIND to and accept a BIND from another node. Any node, apart from the host, which is capable of sending a BIND is referred to as a *PU type 2.1 or APPN node*. An LU that is used for independent communications is given the name of *independent LU*. The LU type used by independent LUs is LU 6.2 (APPC).

Again, from an AS/400 perspective, independent communications refers to APPC programs such as Display Station Pass-Through (DSPT), PC Support/400 or Object Distribution Facility (ODF).

Chapter 2. AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network

The introduction of APPN into the SNA architecture has been accompanied by an increased number of members in the APPN fold. No longer is APPN networking synonymous with AS/400 and System/36 networking. VTAM Version 4.1, 3174, PS/2 and RS/6000 now stake claims on IBM's communications future with the announcement of implementations of APPN for each of these platforms.

In addition, the 5394 with the T2.1 RPQ and 5494 cluster controller move beyond the shackles of traditional communications by providing the capability of establishing independent AS/400 sessions into an APPN network. In doing so, it now sits comfortably at the periphery of an APPN network.

In this chapter we:

- Provide configuration details of a small APPN network that includes AS/400s, PS/2 with OS/2 Extended Services 1.0, PS/2 with OS/2 Communications Manager/2, and DOS PCs with PC Support/400. This network may be considered as a branch in a corporation. In the following four chapters, this network will be expanded to include a 5494, a 5394 with the T2.1 node support PRPQ, a 3174 APPN node, and a RISC/6000 system. In later chapters, it is connected via the corporation's subarea network (with and without VTAM 4.1 with APPN function) to other branches, or to other corporations.
- Highlight salient considerations in relation to new APPN features in OS/400* Version 2. A primary concern is the *multinetwork capability* of the AS/400 in an APPN network (that is, the ability to directly connect APPN network nodes which have different network IDs). This capability is also called the *border node (BN)* function.
- Discuss details of SNA flows and traces in conjunction with the above considerations. In doing so, we have illustrated some of the mechanisms of APPN.

Note: A basic knowledge of APPN concepts and SNA terminology is assumed. For more information on these concepts refer to *APPN Architecture and Product Implementations Tutorial*, GG24-3669.

2.1 Constructing the Branch Network

The APPN network which we configure here is based on an IBM Token-Ring LAN connection. All nodes are, therefore, directly connected to each other. However, in each of the scenarios which are built, the configurations are performed as if there is no any-to-any connectivity between the nodes. That is, we configure only the sessions that we would like to consider for each specific scenario.

In the final scenario of this chapter, 2.1.5, "AS/400, ES, CM/2, (and PCAT) in a Connection Network" on page 42, we consider what is required in order to enable the any-to-any functionality of the LAN. With the *connection network* function of APPN implemented for LANs, it is no longer required to define all nodes to each other. Rather, each node specifies that it has a connection to the same *virtual routing node* via the LAN.

The token-ring LAN environment built in this chapter is described in Figure 1 on page 6.

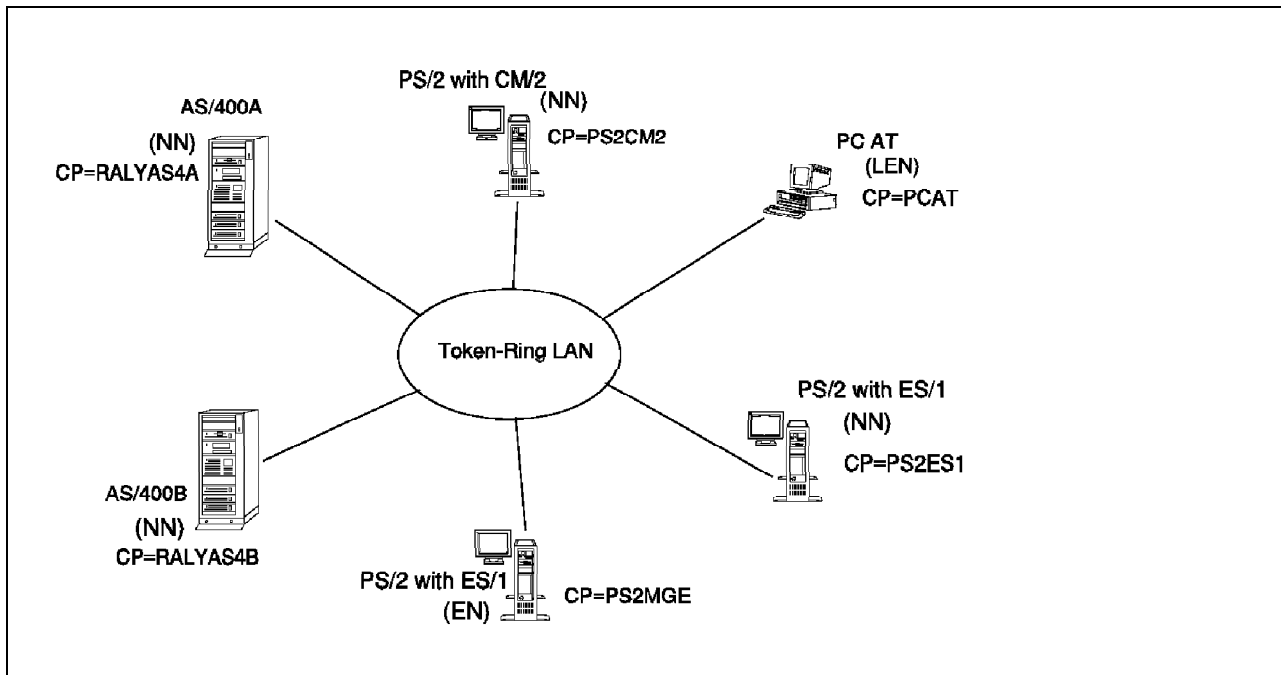


Figure 1. The IBM Token-Ring LAN Environment Built in This Chapter

The explicit scenarios considered from the above environment are:

1. RALYAS4A to RALYAS4B, both network nodes (NN)
2. RALYAS4B to PS2ES1 and PS2MGE, two network nodes and an end node (EN)
3. RALYAS4B to PS2ES1 to PCAT and PS2MGE, two Network Nodes, a LEN end node (LEN) and an end node
4. RALYAS4A to RALYAS4B to PS2ES1 to PCAT and PS2MGE, three Network Nodes, a LEN end node and an end node
5. RALYAS4A, RALYAS4B, PS2ES1, PCAT, PS2CM2, PS2MGE in a token-ring connection network. Here we will change RALYAS4A and PS2ES1 to be end nodes.

2.1.1 RALYAS4A (NN) to RALYAS4B (NN)

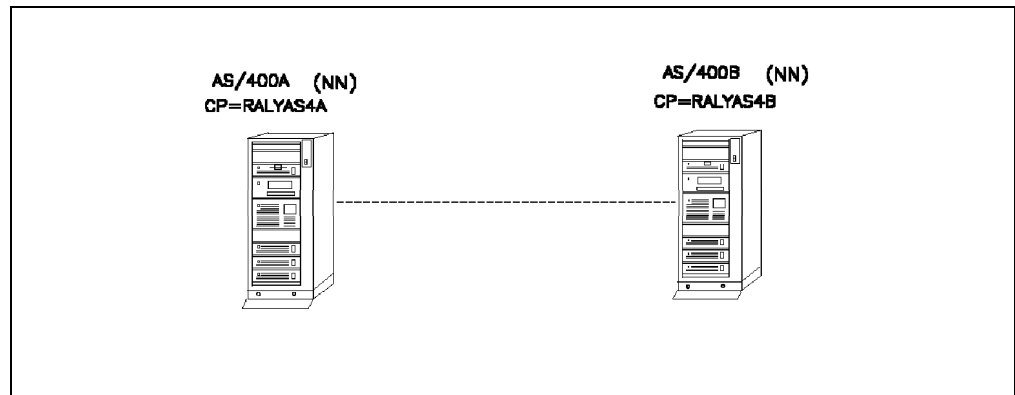


Figure 2. RALYAS4A (NN) to RALYAS4B (NN)

We begin our network construction by including two AS/400 Network Nodes, RALYAS4A and RALYAS4B. The CP names of RALYAS4A and RALYAS4B are RALYAS4A and RALYAS4B, respectively.

Prior to OS/400 V1R3 in a token-ring LAN environment, line definition and control unit definition were required for both RALYAS4A and RALYAS4B. Configuration in such a case does not require a large amount of effort. However, the same configuration requirement is true of PS/2s communicating with an AS/400 across a LAN. When a large number of PS/2s are connected, the configuration effort becomes considerable in defining control units for each PS/2.

With OS/400 V1R3 or later, the APPC control unit definition is automatically created for incoming call requests in a token-ring LAN environment. At XID exchange, the AS/400 receiving the call request is capable of examining the received XID frame (an XID format 3 frame) and extracting the required information, in particular the caller's control point name, token-ring address and node type, in order to auto-create an APPC control unit definition for it. Previously, automatic control unit creation was possible only in a twinax DLC environment (that is, for connection via a local workstation controller or a 5394).

Consequently, since OS/400 V1R3, it has not been necessary to create APPC control unit definitions for PS/2s that contact the AS/400. In particular, control units need not be created in the case of the 5250 Work Station Feature (5250 WSF). As a corollary, it is only necessary to create one APPC control unit definition for an AS/400-to-AS/400 connection. In this scenario, we create a line and controller description on RALYAS4A, but only a line description for RALYAS4B. These definitions are shown in Figure 3 on page 8 and Figure 4 on page 9.

Display Line Description		RALYAS4A
		01/15/93 14:35:10

```

Line description . . . . . : L41TR
Category of line . . . . . : *TRLAN

Resource name . . . . . : LIN041
Online at IPL . . . . . : *YES
Vary on wait . . . . . : *NOWAIT
Maximum controllers . . . . . : 5
Line speed . . . . . : 4M
Maximum frame size . . . . . : 521
TRLAN manager logging level . . . . : *OFF
Current logging level . . . . . : *OFF
TRLAN manager mode . . . . . : *OBSERVING
Log configuration changes . . . . . : *NOLOG
Token-ring inform of beacon . . . . : *YES
Local adapter address . . . . . : 400010020001

Exchange identifier . . . . . : 05615078
Error threshold level . . . . . : *OFF

Link speed . . . . . : 4M
Cost/connect time . . . . . : 0
Cost/byte . . . . . : 0
Security for line . . . . . : *NONSECURE
Propagation delay . . . . . : *LAN
User-defined 1 . . . . . : 128
User-defined 2 . . . . . : 128
User-defined 3 . . . . . : 128
Autocreate Controller . . . . . : *YES
Autodelete controller . . . . . : *NONE

----Source service access points-----
SSAP      MAXIMUM FRAME    TYPE
  04      *MAXFRAME      *SNA
  08      *MAXFRAME      *SNA
  06      *MAXFRAME      *NONSNA
  AA      *MAXFRAME      *NONSNA

Text . . . . . : Token-ring line description

```

Figure 3. Token-Ring Line Definition for RALYAS4A. The token-ring LAN line definition for RALYAS4B is defined in the same way except with a token-ring adapter address of 400010020002.

Display Controller Description		RALYAS4A
		01/15/93 14:36:50
Controller description	RALYAS4B	
Category of controller	*APPC	
Link type	*LAN	
Online at IPL	*NO	
Active switched line	L41TR	
Character code	*EBCDIC	
Maximum frame size	16393	
Remote network identifier	USIBMRA	
Remote control point	RALYAS4B	
Initial connection	*DIAL	
Switched disconnect	*NO	
Data link role	*NEG	
LAN remote adapter address	400010020002	
LAN DSAP	04	
LAN SSAP	04	
-----Switched Lines-----		
L41TR		
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*CALC	
APPN transmission group number	*CALC	
APPN minimum switched status	*VRYON	
Model controller description	*NO	
Control owner	*USER	

Figure 4. Control Unit Definition for AS400 B with CP Name RALYAS4B. In a token-ring LAN environment, only the calling AS/400 need define an APPC control unit; in this case RALYAS4A defines RALYAS4B. The control unit description for RALYAS4A will be automatically created on AS400 B, and there is, therefore, no definition for it.

So far, we have only built the basis for our small APPN network. Relevant to further network construction are two APPN functions that were announced with OS/400 Version 2:

- Automatic control-point-to-control-point (CP-CP) session reactivation
- Multinetwork connectivity

2.1.1.1 Automatic CP-CP Session Reactivation

Prior to OS/400 V2R1, CP-CP session establishment between AS/400 APPN nodes happened only at XID exchange. In turn, the XID exchange was initiated only at link establishment time by varying on the appropriate APPC control unit. Thus, in a case where CP-CP sessions were lost, a controller and its device had to be located and varied off and on again. As an example, if a link fails, a CP-CP session will be lost between an end node (EN) and its network node (NN) server. Such a case is particularly important for an EN since, with no CP-CP session, it can no longer utilize the server functions of its original network node server, even though it may have an active link to an alternate NN. More importantly, other locations in the network are no longer able to access the end node that has lost its server (even though the end node can still access the rest of the network).

Now, CP-CP sessions between an EN and its NN server, or two NNs, are established as appropriate, not necessarily at XID exchange. CP-CP sessions will

still be established at XID exchange. However, additionally, each CP is able to detect when it loses CP-CP sessions and re-establish them. It is possible for CP-CP session re-establishment to be automatically attempted if CP-CP sessions are lost between two NNs or an EN and its NN server. For the latter case, an EN will go through its NN server list to either re-select its previous NN server or select a new server if the link to the previous NN server is still unavailable. This possibility is only available with OS/400 V2R1 or later versions of OS/400.

The automatic CP-CP reactivation is useful for CP-CP sessions between two NNs primarily when there are parallel transmission groups (TGs) between these nodes. For AS/400s, parallel TGs are equivalent to parallel physical links.

Note: This function is only available for CP-CP sessions and not for user sessions. Thus, if a user session fails, perhaps a session carrying a Pass-Through conversation, then it must be manually restarted. Moreover, if there are no other active links to an adjacent EN or NN, then a CP-CP session cannot be re-initiated. The support does not include restarting of lines. Therefore, in particular, in order to use the support for ENs to automatically initiate CP-CP sessions with a different NN server after a failure to its first server, the link to the alternate server must already be activated. In case of a switched link which is currently in a varied on pending state, the system does have the ability to activate the switched link.

2.1.1.2 Multinetwork Connectivity

When considering connectivity between different corporations, it is important for each corporation to maintain independent networks, with different network IDs, and, yet, still communicate effectively.

However, a single APPN network requires the same network ID (net ID) for all its participating network nodes. According to the APPN architecture, network nodes that do not have the same network ID cannot establish a connection with each other.

On the other hand, end nodes are not required to have the same network ID as their network node server. End nodes, therefore, have the ability to connect to an NN in each of two networks. However, they cannot provide the APPN intermediate routing function for sessions to be established between various nodes in each of the networks.

Thus, to provide the EN's *multinetwork connectivity* while maintaining the NN routing functions between networks with different network IDs, an extension to the network node functions has been introduced into the APPN architecture: the *peripheral border node (BN)* provided by AS/400 and the *extended border node* provided by VTAM 4.2.

The border node provides additional function on top of the APPN network node to enable:

- AS/400 locations (LUs) to establish sessions with dynamically discovered LUs in an adjacent network (with a different net ID)
- Isolation of network topology information between adjacent networks

A peripheral or extended border node, acts as a network node in its own network. Thus, it receives topology information and search requests from adjacent NNs in its network. A border node connects to a network node in the adjacent network. However, since network nodes cannot connect to each other

with different net IDs, the peripheral border node provides an EN image to the network node in the other network.

The EN function in the border node establishes CP-CP sessions with the network node in the adjacent network and indicates that it requires NN server support as if it were an EN. Importantly, however, it is an EN which can support locate search requests from its NN server.

Only one of the adjacent network nodes between two different networks needs to be a border node. If, however, both network nodes can provide the peripheral border node function, then they will negotiate as to which of the nodes should play the end node role.

The AS/400 is the first APPN system to implement the peripheral border node function. With OS/400 V2R1, an AS/400 may now act as a border node between two different APPN networks.

When connecting different networks via a peripheral border node, it is not possible to establish a session across more than one adjacent network. That is, it is not possible to establish a session from network A, through network B, to network C. The APPN VTAM implementation of the extended border node doesn't have this limitation.

We look more closely at restrictions, configuration, security, topology database considerations, and mechanisms for multinet connectivity in 2.1.4, "A Multinet Connectivity Scenario" on page 38.

2.1.2 RALYAS4B (NN) to OS/2 Extended Services (NN) and OS/2 Extended Services (EN)

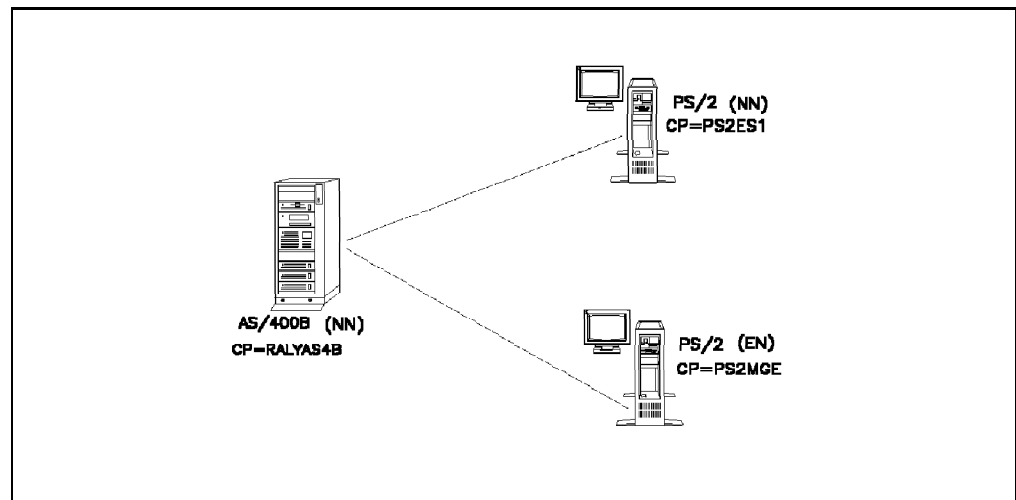


Figure 5. RALYAS4B (NN) to OS/2 Extended Services (NN) and OS/2 Extended Services (EN)

Now we define an Extended Services (ES) end node, with RALYAS4B as its network node server, and an Extended Services network node. Extended Services is an OS/2 product which currently runs in conjunction with OS/2 Version 1.3.1 or later and provides communications and database support. The Communications Manager component of OS/2 Extended Services provides full APPN functionality to the PS/2. The CP names of the Extended Services (NN) and Extended Services (EN) are PS2ES1 and PS2MGE, respectively.

The primary interest here is the Extended Services configuration. Since the AS/400 needs little definition, only the token-ring line needs to be defined. Please refer to the previous section for these definitions. We will point out salient considerations for Extended Services configuration with reference to the Extended Services configuration panels and configuration files created (see below). For a more detailed discussion on Extended Services configuration, particularly with respect to usage of the OS/2 Extended Services Presentation Manager* configuration interface, please refer to *IBM Extended Services for OS/2 Communications Manager New Features and Enhancements*, GG24-3876.

We must configure the following Communications Manager components within PS/2 with OS/2 Extended Services 1.0:

- Data Link Control (DLC) drivers, (LAN Configuration)
- SNA DLC profiles (token-ring)
- SNA network definitions
- 5250 Work Station Feature (WSF) session assignment

2.1.2.1 OS/2 Extended Services Communications Manager LAN Configuration

Let us now step through the configuration of the network node PS2ES1. PS/2 with OS/2 Extended Services 1.0 configuration uses a combination of OS/2 full screen configuration panels and Presentation Manager windows.

First we must configure the support for the LAN adapter. We do this using the Communications Manager **Advanced Configuration**. You can get to this screen by selecting from the CM Advanced Configuration menu.

1. Bring up **CM Main Menu**.
2. Select **Advanced**.
3. Select **Configuration**
4. Select **6. LAN Adapter and Protocol Support**.
5. At the Options panel, chose **Configure Workstation**. This will bring you to the panel shown in Figure 6 on page 13.

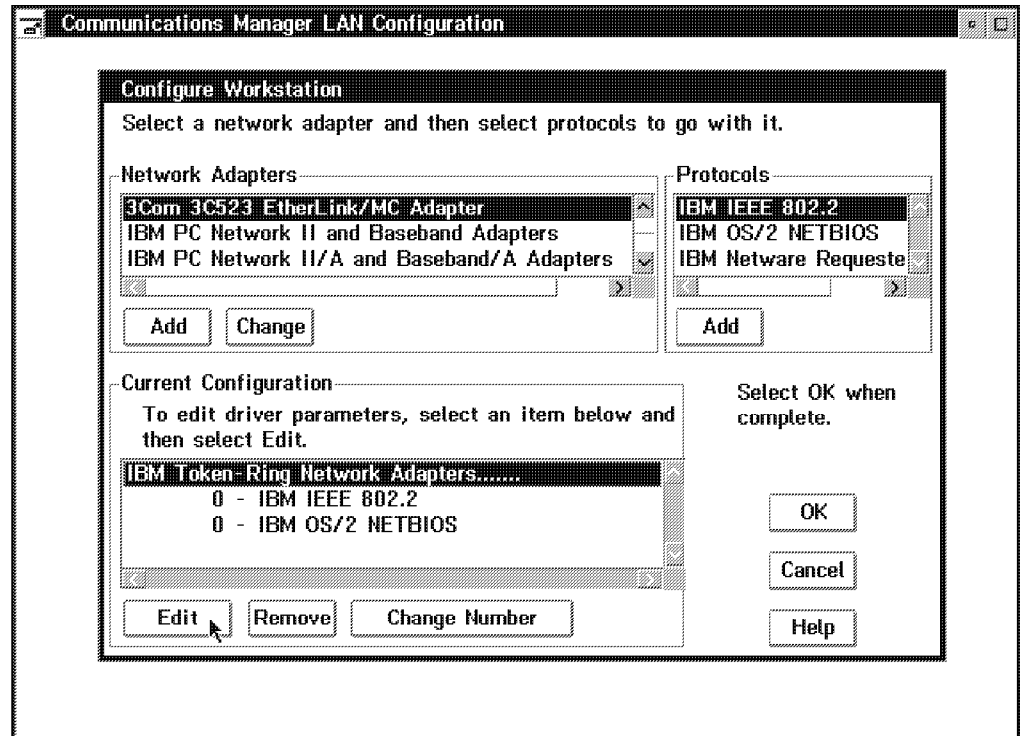


Figure 6. Communications Manager LAN Configuration - Select Adapter

1. In the list of Network Adapters, select **IBM Token-Ring Network Adapters** and click on **Add**.
2. In the Current configuration window, click on **IBM Token-Ring Network Adapters** to select it.
3. Then click on **Edit** as indicated in Figure 6 to configure the adapter.
4. This will bring you to the panel shown in Figure 7.

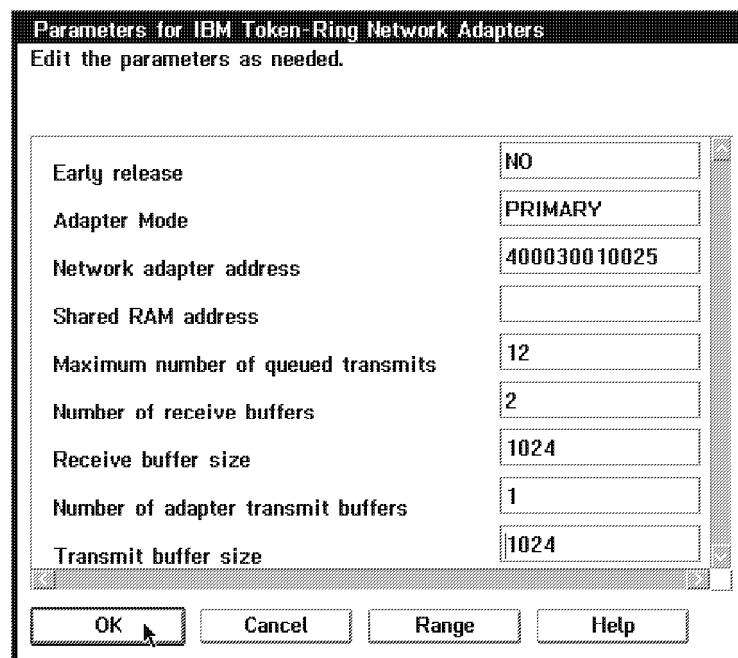


Figure 7. Communications Manager LAN Configuration - Configure Adapter

- Here you may enter the LAN adapter address which will be used for this workstation. If you don't enter one, the "burnt-in" adapter address will be used. The default values for all other parameters will generally produce acceptable performance. Click on **OK** to continue.

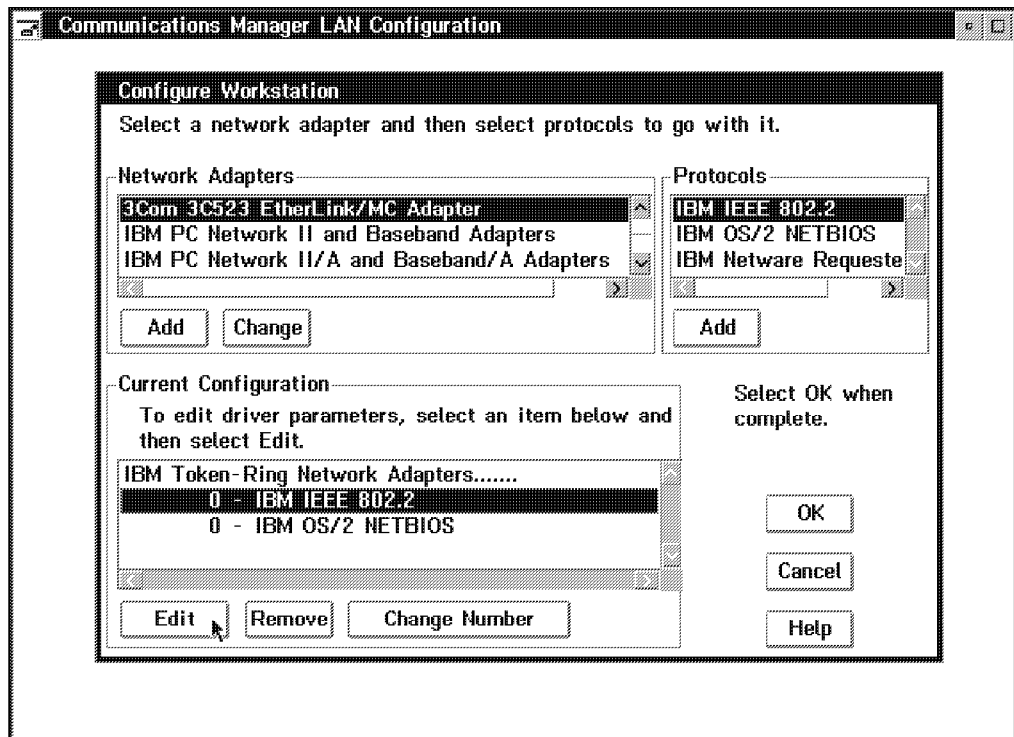


Figure 8. Communications Manager LAN Configuration - Add Protocol 802.2

- We must add the LAN protocols that will be used in this configuration. Click on **IBM IEEE 802.2** to continue.

IEEE 802.2 will be used by all SNA communications, for APPN connections or PU Type 2.0 connections. NetBIOS is used by OS/2 LAN requester. Figure 9 on page 15 through Figure 17 on page 19 outline the steps involved in adding these protocols.

- In each case the protocol is selected from the Protocols sub-window in Figure 8 by clicking on the chosen protocol. The now highlighted protocol is then added by clicking on the **Add** button in the same window. This will add the chosen protocol to the list below the Adapter type being configured in the Current Configuration window, Figure 8.

Click on the **Edit** button, as indicated by the mouse pointer in Figure 8, to edit the LAN protocol.

Parameters for IBM IEEE 802.2

Edit the parameters as needed. Except for parameters preceded by "*", changes affect all instances of the driver.

*Network adapter address	T400030010025
*Type of Ethernet driver support	1
*System key value	0
*Adapter open options	2000
*802 trace level	0
*Maximum link stations	20
*Maximum SAPs	4
*Maximum group SAPs	0
*Maximum number of users	4

OK Cancel Range Help

Figure 9. Communications Manager LAN Configuration - Configure 802.2 Part 1

- Figure 9 to Figure 11 on page 16 show the configuration of the 802.2 LAN protocol. For most users the default settings will provide adequate performance.

Parameters for IBM IEEE 802.2

Edit the parameters as needed. Except for parameters preceded by "*", changes affect all instances of the driver.

*Maximum number of users	4
*Group 1 inactivity timer - Ti	255
*Group 1 response timer - T1	15
*Group 1 acknowledgment timer - T2	3
*Group 2 inactivity timer - Ti	255
*Group 2 response timer - T1	25
*Group 2 acknowledgment timer - T2	10
*I-frame descriptors	250
*UI-frame descriptors	100

OK Cancel Range Help

Figure 10. Communications Manager LAN Configuration - Configure 802.2 Part 2

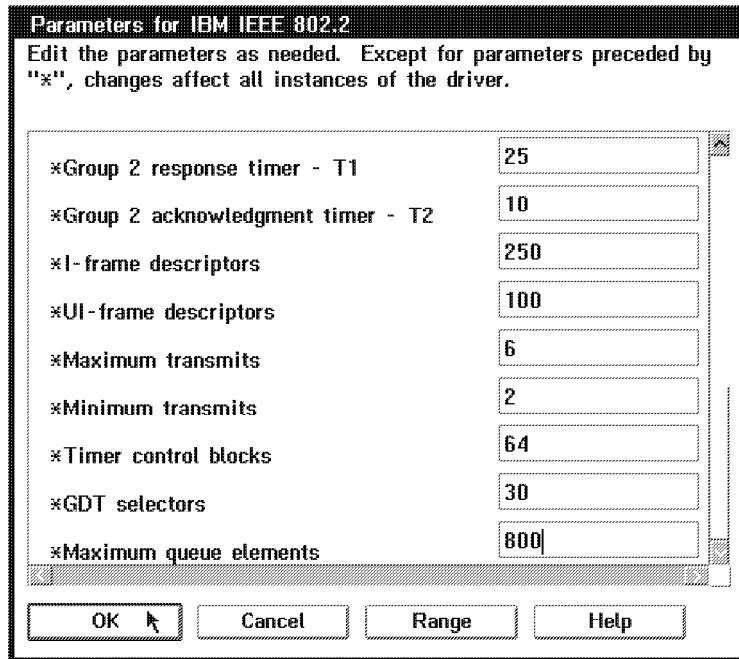


Figure 11. Communications Manager LAN Configuration - Configure 802.2 Part 3

- In Figure 12 we add the NetBIOS protocol to the token-ring adapter. This is not required for SNA communications but it is common to add a second LAN protocol to enable the PS/2 user to take advantage of other LAN facilities. In this case, the NetBIOS protocol is required for IBM LAN Requester support. IBM LAN Server/Requester installation and configuration will not be discussed in this publication.

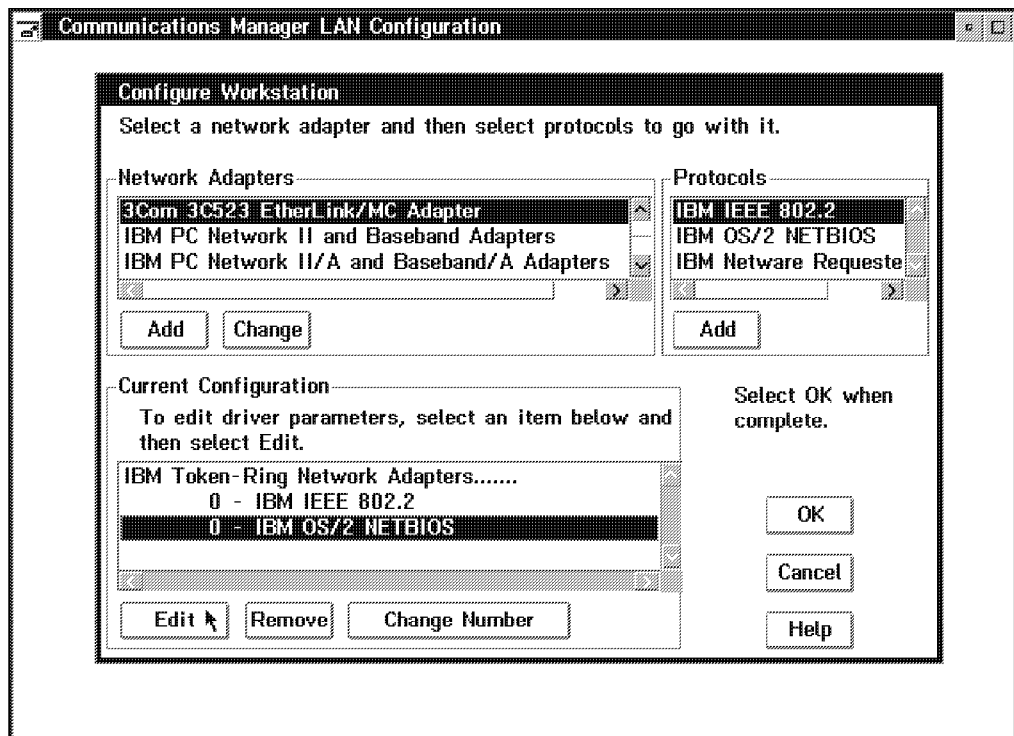


Figure 12. Communications Manager LAN Configuration - Add Protocol NetBIOS

- For most users the default settings for the NetBIOS parameters will produce acceptable performance and will not need to be changed from the default values. They are shown here in Figure 13 on page 17 to Figure 16 on page 18 for completeness.

Parameters for IBM OS/2 NETBIOS

Edit the parameters as needed. Except for parameters preceded by "x", changes affect all instances of the driver.

*Network adapter address	
Type of Ethernet driver support	1
Universally administered address reversed	YES
NETBIOS trace level	
Maximum sessions	40
Maximum commands	95
Maximum names	21
GDT selectors	5
Full buffer datagrams	NO

OK Cancel Range Help

Figure 13. Communications Manager LAN Configuration - Configure NetBIOS Part 1

Parameters for IBM OS/2 NETBIOS

Edit the parameters as needed. Except for parameters preceded by "x", changes affect all instances of the driver.

Full buffer datagrams	NO
Adaptive windowing interval	1000
Window errors	0
Maximum receive data size	4168
Inactivity timer - Ti	30000
Response timer - T1	500
Acknowledgment timer - T2	200
Maximum receives outstanding	1
Maximum transmits outstanding	1

OK Cancel Range Help

Figure 14. Communications Manager LAN Configuration - Configure NetBIOS Part 2

Parameters for IBM OS/2 NETBIOS

Edit the parameters as needed. Except for parameters preceded by "x", changes affect all instances of the driver.

Maximum transmits outstanding	1
Query timeout	500
NETBIOS retries	8
Number of names in remote name directory	0
Piggybacked acknowledgments	1
UI-frame descriptors	2
I-frame descriptors	350
Loopback frame descriptors	1
Pipeline packets	5

OK Cancel Range Help

Figure 15. Communications Manager LAN Configuration - Configure NetBIOS Part 3

Parameters for IBM OS/2 NETBIOS

Edit the parameters as needed. Except for parameters preceded by "x", changes affect all instances of the driver.

Number of names in remote name directory	0
Piggybacked acknowledgments	1
UI-frame descriptors	2
I-frame descriptors	350
Loopback frame descriptors	1
Pipeline packets	5
Maximum transmits	6
Minimum transmits	2
DLC retries	5

OK Cancel Range Help

Figure 16. Communications Manager LAN Configuration - Configure NetBIOS Part 4

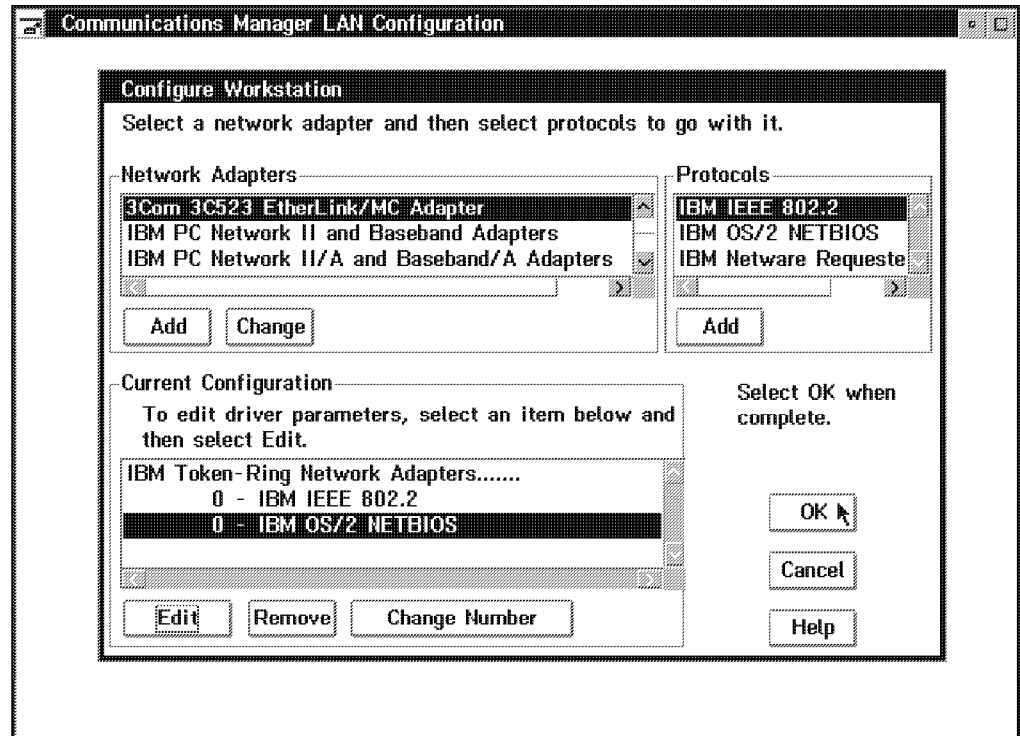


Figure 17. Communications Manager LAN Configuration - End LAN Configuration

- When the LAN Adapter and protocol configuration is complete, click on **OK**, as indicated in Figure 17 to continue with our configuration.

2.1.2.2 OS/2 Extended Services and Communications Manager SNA Data Link Control Configuration

Now we must configure the SNA Data Link Control parameters for the token-ring adapter. This is done by selecting **4. SNA Feature profiles** within Communications Manager Advanced Configuration.

At the SNA Feature Configuration panel, chose **SNA Network Definitions**. Then select **Data Link Control Profile**. This will bring you to the panel shown in Figure 18 on page 20. The parameters of particular interest here are:

1. Maximum number of link stations. This should be large enough to account for all nodes that will have SNA sessions with this PS/2.
2. Maximum RU size is the maximum amount of data transferred at one time. Its range is from 256 to 4096. The value used will vary depending on the data transmission media used.

Display IBM Token-Ring Network DLC Adapter Profile	
Adapter number	: 0
Load DLC	: Yes
Maximum number of link stations.	: 4
Percent of incoming calls.	: 0 %
Free unused link	: No
Congestion tolerance	: 80 %
Maximum RU size.	: 1920 bytes
Send window count.	: 2
Receive window count	: 1
C&SM LAN ID.	: PU000000
Send alert for beaconing	: No

Esc=Cancel F1=Help	

Figure 18. OS/2 Extended Services SNA DLC Profile Screen

2.1.2.3 OS/2 Extended Services Communications Manager SNA Network Definition for a network node (NN)

The SNA network must now be defined.

It is possible to configure the SNA network definitions in two ways:

1. Via a Presentation Manager (PM) interface

The Extended Services PM interface is relatively easy to use and is, thus, the quick way to configure Extended Services. Configuring Extended Services in this way results in the creation of an ASCII file with a suffix of ".NDF". However, not all configuration options can currently be configured using the PM interface: Connection network, for example. Please refer to 2.1.5.2, "ES/1 Requirements for Connection Network" on page 44. It is, in these circumstances, necessary to use the PM interface in combination with the next method of configuration.

2. Directly in an ASCII file with a suffix of .NDF

It is possible to edit an existing .NDF file or build a configuration from the beginning. To build an .NDF configuration file requires a knowledge of the APPN LU 6.2 verb set used. Refer to Figure 32 on page 27 for our first example of an .NDF file and the verbs that are contained in it. This is the .NDF file that was created when we configured PS2ES1 using the Extended Services Communications Manager PM windows in Figure 19 on page 21 to Figure 31 on page 26.

Once configuration is completed using either of the above methods, it must be verified. The verification procedure creates a binary configuration file with a suffix of .CF2. This is the SNA Network Definition's equivalent of the Communications Manager's .CFG file. You are prompted to verify the configuration as you exit the Communications Manager configuration panel.

Verification of the .NDF must be done after the .NDF file has been edited, using the Verify SNA Network Definitions folder, in the Communication Managers Folder on the OS/2 desktop.

In summary, with either PS/2 with OS/2 Extended Services 1.0 Communications Manager or Communications Manager/2 there are three configuration files: two binary configuration files and an ASCII file that allows the SNA Network Definitions to be configured directly rather than via a PM interface:

- .CFG file** Binary configuration file for Communications Manager
- .CF2 file** Binary configuration file for SNA Network Definitions
- .NDF file** ASCII configuration file for directly editing SNA Network Definitions configurations

In most cases, it is not necessary to consider these files since they are built automatically when configuration is performed via the appropriate CM menus. Apart from using a binary editor, there is no direct access to the .CFG and .CF2 files. As already mentioned, the .NDF file may, however, be edited directly.

Let us now configure the SNA Network Definitions for PS2ES1 using the PM panels. We will then discuss the .NDF file which results from this configuration.

To configure the Local Node Characteristics, from the Advanced Configuration panel:

1. Select **4. SNA Feature Profiles**.
2. Select **2. SNA Network Definitions**.
3. Select **Change/Create**.
4. Select **Local Node Characteristics**.
5. Click on **Configure**.

This brings us to the panel shown in Figure 20 on page 22.

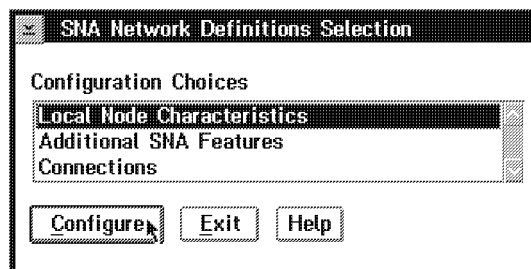
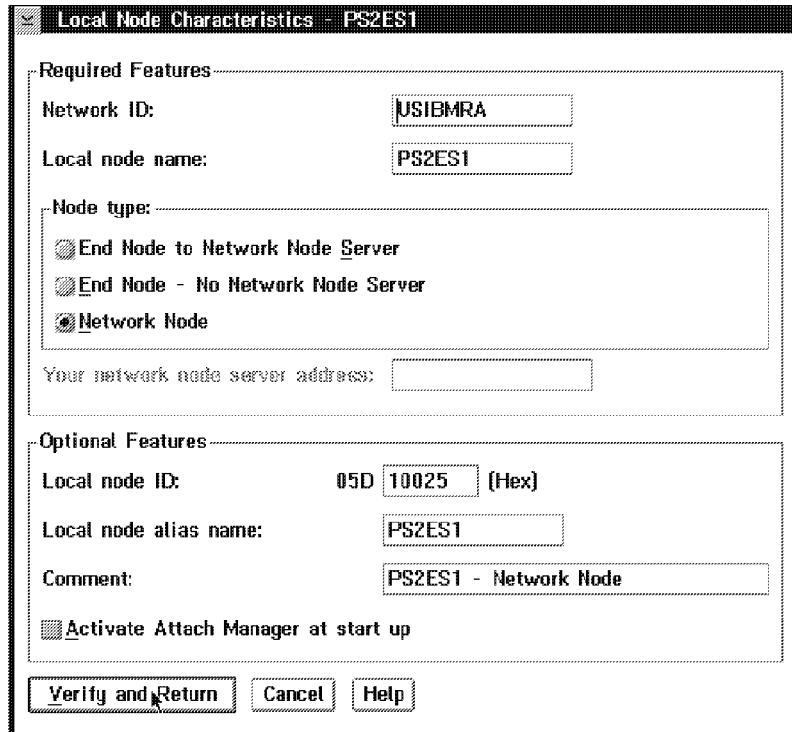


Figure 19. SNA Network Definitions - Select Local Node Characteristics



Local Node Characteristics - PS2ES1

Required Features

Network ID:

Local node name:

Node type:

☐ End Node to Network Node Server

☐ End Node - No Network Node Server

☒ Network Node

Your network node server address:

Optional Features

Local node ID: 05D (Hex)

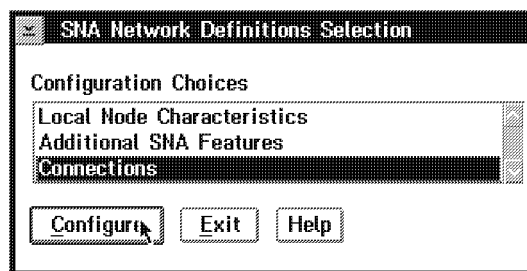
Local node alias name:

Comment:

☐ Activate Attach Manager at start up

Figure 20. Local Node Characteristics

- The fully qualified control point (CP) name for this PS/2 is USIBMRA.PS2ES1, it is a network node, and it has an exchange ID of 05D10025. The first three digits of the XID (ID Block) are fixed at '05D' for an OS/2 system using Communications Manager. The remaining five digits (ID number) are at your discretion. I have chosen to use the last five digits of the system's token-ring address. This is an easy way of ensuring that a unique XID is chosen. The default XID of '05D00000' could also have been used. For further discussion see 2.2.1.4, "The XID3" on page 69.



SNA Network Definitions Selection

Configuration Choices

Figure 21. SNA Network Definitions - Select Connections

- The next step is to configure the "connections" or "links" this system will have to other nodes in the network.
 - Click on **Connections** to select it.
 - Click on **Configure**, as indicated by the mouse pointer in Figure 21.

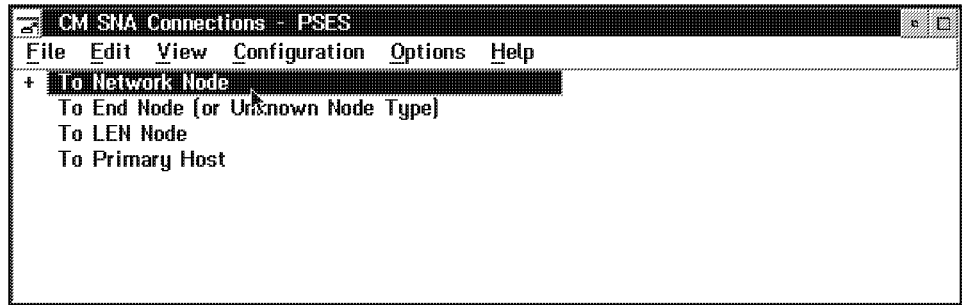


Figure 22. SNA Connections - Configure Network Node Connection Part 1

- Here we configure a connection to the network node RALYAS4B. We do this by first "double-clicking" on the **To Network Node** field as indicated by the mouse pointer in Figure 22.

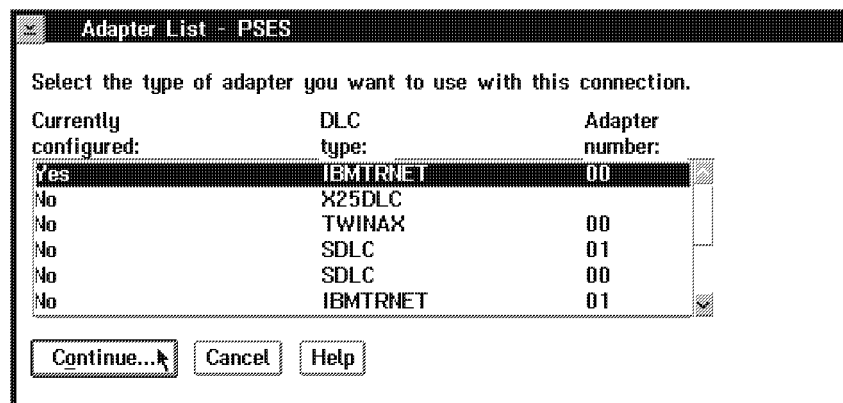


Figure 23. SNA Connections - Configure Network Node Connection Part 2

- The token-ring protocol will be used (Figure 23).
 1. Select **IBMTRNET** line.
 2. Click on **Continue**.

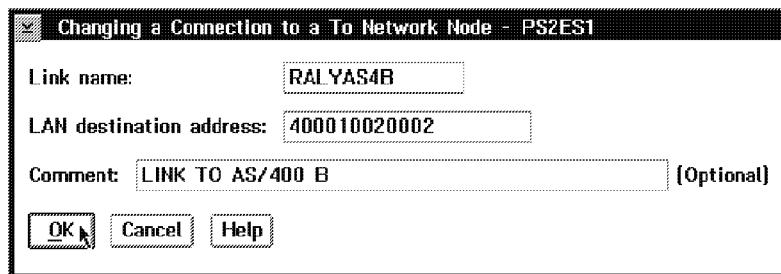


Figure 24. SNA Connections - Configure Network Node Connection Part 3

- The name used for the link is not significant. In Figure 24 RALYAS4B has been used for clarity. Select **OK** to continue.

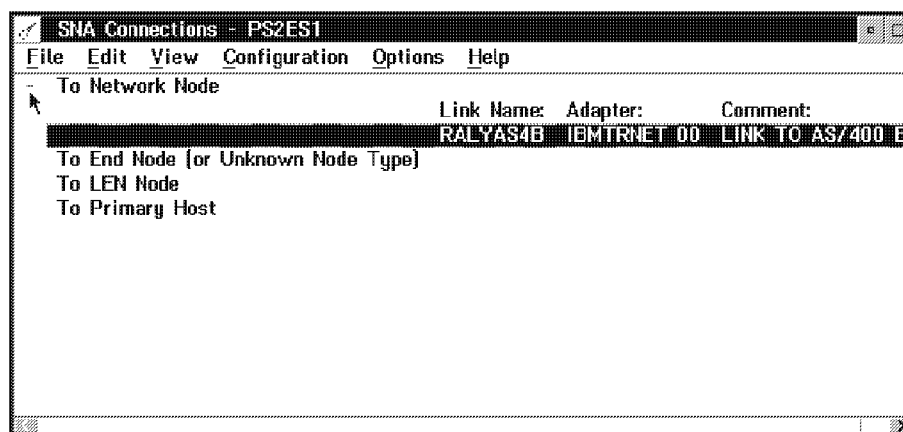


Figure 25. SNA Connections - Configure Network Node Connection Part 4

- The connection has now been configured, and appears under the To Network Node list. This list, of only one item at this stage, may be expanded or collapsed by clicking on the $\pm$ sign. This is indicated by the mouse pointer in Figure 25.

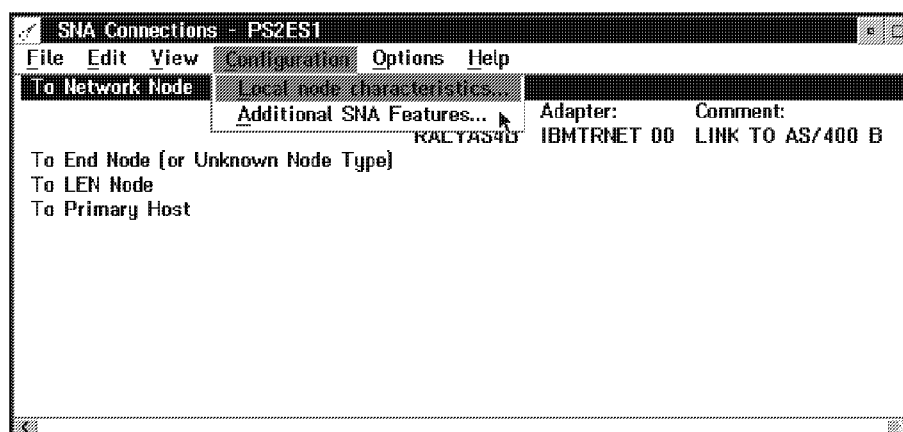


Figure 26. SNA Network Definitions - Select Additional SNA Features

- Next we configure the SNA features for this system. We have, first, to define partner LUs which allow applications on this PS/2 to have sessions with, secondly, modes that will be used for these sessions. Select **Configuration** and **Additional SNA Features** from the pull-down menu as indicated in Figure 26.

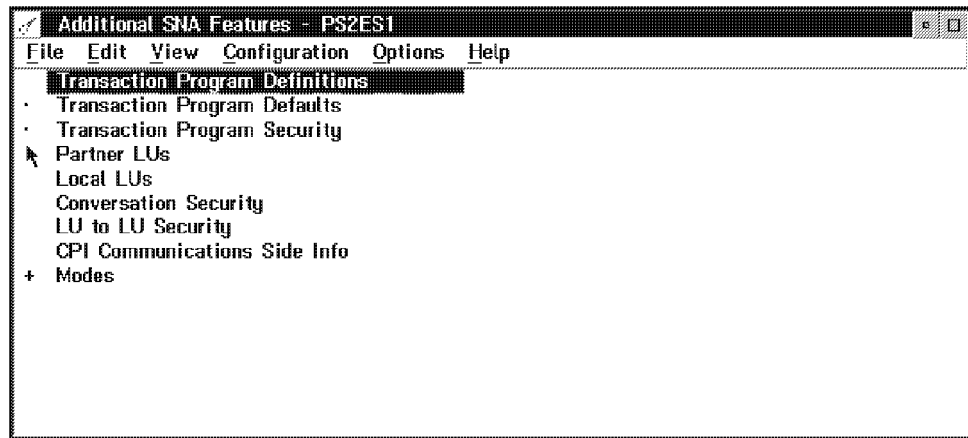


Figure 27. Additional SNA Features - Select Define Partner LU

- Double click on **Partner LUs**, Figure 27, to begin configuration of the partner LUs.

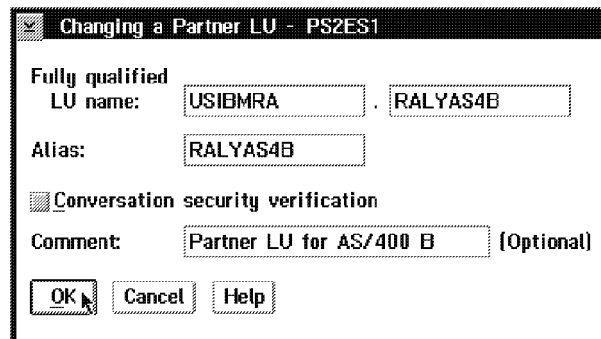


Figure 28. Additional SNA Features - Define Partner LU

- The partner LU here defines the partner LU alias that will be used by applications on this system for sessions with the remote system indicated by the network-qualified LU name. In this case the application is 5250 WSF, and in the 5250 WSF configuration we will configure the partner LU alias as RALAS4B. Select **OK** to continue.

Note: The partner LU alias is case sensitive.

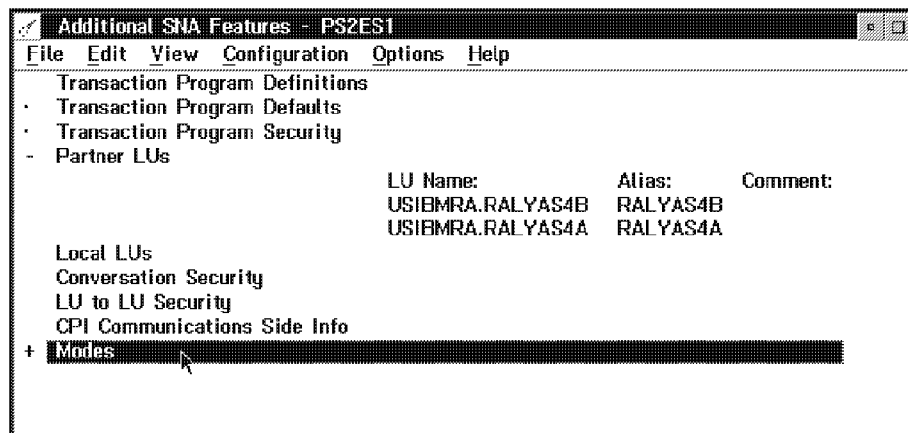


Figure 29. Additional SNA Features - Select Define Mode QPCSUPP

- We now double click on **Modes** to add the mode QPCSUPP to those already known by this system. Note that a partner LU for RALYAS4A has also been defined (Figure 29).

Changing a Mode Definition - PS2ES1

Mode name: QPCSUPP

Class of service: HCONNECT

Mode session limit: 64 (0 - 32767)

Minimum contention winners: 0 (0 - 32767)

Receive pacing window: 7 (0 - 63)

RU size

☒ Default RU size

☐ Maximum RU size: (256 - 16384)

Comment: PC Support Mode (Optional)

OK Cancel Help

Figure 30. Additional SNA Features - Define Mode QPCSUPP

Additional SNA Features - PS2ES1

File Edit View Configuration Options Help

Local LUs

Conversation Security

LU to LU Security

CPI Communications Side Info

Modes

Mode Name:	Comment:
QPCSUPP	PC Support Mod
BLANK	
#BATCH	
#BATCHSC	
#INTER	
#INTERSC	
CPSVCMG	
SNASVCMG	

Figure 31. Additional SNA Features - Defined Modes

- All the modes defined here are default modes supplied with CM, with the exception of QPCSUPP, which we defined in Figure 30.

The SNA network definitions in the preceding figures will result in the creation of an .NDF file. As we stated earlier the .NDF file may be edited directly to change the SNA network definitions. In Figure 32 on page 27 we show the .NDF configuration files for PS2ES1, an NN, and in Figure 33 on page 30 we show the configuration for PS2MGE, an EN.

Some of the significant features of these .NDF files will be highlighted.

<pre> DEFINE_LOCAL_CP FQ_CP_NAME(USIBMRA.PS2ES1) DESCRIPTION(PS2ES1 - Network Node) CP_ALIAS(PS2ES1) NAU_ADDRESS(INDEPENDENT_LU) NODE_TYPE(NN) NODE_ID(X'10025') HOST_FP_SUPPORT(NO); </pre>	1
<pre> DEFINE_LOGICAL_LINK LINK_NAME(RALYAS4B) DESCRIPTION(LINK TO AS/400 B) ADJACENT_NODE_TYPE(NN) PREFERRED_NN_SERVER(NO) DLC_NAME(IBMTRNET) ADAPTER_NUMBER(0) DESTINATION_ADDRESS(X'400010020002') CP_CP_SESSION_SUPPORT(YES) ACTIVATE_AT_STARTUP(YES) LIMITED_RESOURCE(NO) LINK_STATION_ROLE(USE_ADAPTER_DEFINITION) SOLICIT_SSCP_SESSION(NO) EFFECTIVE_CAPACITY(USE_ADAPTER_DEFINITION) COST_PER_CONNECT_TIME(USE_ADAPTER_DEFINITION) COST_PER_BYTE(USE_ADAPTER_DEFINITION) SECURITY(USE_ADAPTER_DEFINITION) PROPAGATION_DELAY(USE_ADAPTER_DEFINITION) USER_DEFINED_1(USE_ADAPTER_DEFINITION) USER_DEFINED_2(USE_ADAPTER_DEFINITION) USER_DEFINED_3(USE_ADAPTER_DEFINITION); </pre>	2
<pre> DEFINE_PARTNER_LU FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4B) PARTNER_LU_ALIAS(RALYAS4B) PARTNER_LU_UNINTERPRETED_NAME(RALYAS4B) MAX_MC_LL_SEND_SIZE(32767) CONV_SECURITY_VERIFICATION(NO) PARALLEL_SESSION_SUPPORT(YES); </pre>	3
<pre> DEFINE_PARTNER_LU FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4A) PARTNER_LU_ALIAS(RALYAS4A) PARTNER_LU_UNINTERPRETED_NAME(RALYAS4A) MAX_MC_LL_SEND_SIZE(32767) CONV_SECURITY_VERIFICATION(NO) PARALLEL_SESSION_SUPPORT(YES); </pre>	

Figure 32 (Part 1 of 2). The .NDF File for PS2ES1 Defined as a Network Node

<pre> DEFINE_MODE MODE_NAME(QPCSUPP) DESCRIPTION(PC Support Mode) COS_NAME(#CONNECT) DEFAULT_RU_SIZE(YES) RECEIVE_PACING_WINDOW(7) MAX_NEGOTIABLE_SESSION_LIMIT(32767) PLU_MODE_SESSION_LIMIT(64) MIN_CONWINNERS_SOURCE(0); </pre>	4
<pre> DEFINE_DEFAULTS IMPLICIT_INBOUND_PLU_SUPPORT(NO) DESCRIPTION(Defaults) DEFAULT_MODE_NAME(BLANK) MAX_MC_LL_SEND_SIZE(32767) DIRECTORY_FOR_INBOUND_ATTACHES(*) DEFAULT_TP_OPERATION(NONQUEUED_AM_STARTED) DEFAULT_TP_PROGRAM_TYPE(BACKGROUND) DEFAULT_TP_CONV_SECURITY_RQD(NO) MAX_HELD_ALERTS(10); </pre>	5
<pre> CNOS LOCAL_LU_ALIAS(PS2ES1) FQ_PARTNER_LU_NAME(USIBMRAB.RALYAS4B) MODE_NAME(QPCSUPP) SET_NEGOTIABLE(NO) PLU_MODE_SESSION_LIMIT(32) MIN_CONWINNERS_SOURCE(0) MIN_CONWINNERS_TARGET(0) AUTO_ACTIVATE(0); </pre>	6

Figure 32 (Part 2 of 2). The .NDF File for PS2ES1 Defined as a Network Node

1 The DEFINE_LOCAL_CP verb defines the characteristics of the local Extended Services node. We have defined it as an NN.

2 The DEFINE_LOGICAL_LINK verb defines the characteristics of a link to the adjacent nodes. Here we have a single link to RALYAS4B (CP=RALYAS4B) which is defined as an NN with CP-CP session support and token-ring LAN address of 400010020002. Naturally, RALYAS4B is not the PREFERRED_NN_SERVER of PS2ES1 since PS2ES1 is not an EN.

The other parameters specified for this verb are mainly associated with APPN class of service (COS).

3 The DEFINE_PARTNER_LU verb is not required if Extended Services is installed and the PS/2 APPC application used is capable of issuing session requests to fully qualified LU names (that is, with net ID included in a request for an LU-LU session). The partner LU need not be defined since it can be found using an APPN search.

In our example, the application we use is 5250 WSF, which specifies an APPC partner LU alias and not a fully qualified partner LU Name.

The partner LU must be defined in the .NDF file in order to match the CM unqualified *alias* name with a fully qualified partner LU name. Communications Manager will not try to establish a session to an unqualified LU name. In fact, the partner LU must be defined twice, once when defining the *partner LU alias* in

the 5250 *session assignments* and again when matching the alias with the SNA network definitions partner LU definition.

4 The DEFINE_MODE parameter is used to explicitly define a mode other than the IBM-supplied ones. Here we define the QPCSUPP mode for PC Support/400.

5 The DEFINE_DEFAULTS verb allows default modes to be built dynamically by ES. It is not a required parameter, but means that a different mode from the IBM-supplied ones need not be defined. Notice that we have specified IMPLICIT_INBOUND_PU_SUPPORT(NO) and, thus, we must define the mode for QPCSUPP.

6 The CNOS verb is always built when Extended Services is installed and configured using the Basic configuration option. Having this verb in your .NDF file means that the change number of sessions (CNOS) process will take place with defined partner LUs, for the modes specified in the CNOS verbs at Communications Manager startup, and whenever a session is requested that requires initialization of session limits. Thus, when a session is requested to a defined partner LU using the modes specified in the CNOS verbs, the CNOS negotiation will have already taken place, and the session is established more quickly. The CNOS verb may be deleted. CNOS will then take place only when each LU-LU session is requested. For more information on CNOS please refer to section 2.2.1.9, "Change Number of Sessions (CNOS)" on page 79.

Note: Care should be taken when using the CNOS verb as any changes to the configuration made using the PM interfaces will not effect the CNOS verb. It can only be changed by direct editing of the .NDF ASCII file. Note also that the CNOS verb is inserted in the .NDF file when Extended Services is installed and configured using the Basic configuration and installation. See 2.2.1.9, "Change Number of Sessions (CNOS)" on page 79.

2.1.2.4 OS/2 Extended Services Communications Manager End Node Configuration (.NDF File)

The .NDF file for the end node PS2MGE is defined in Figure 33. PS2MGE uses RALYAS4B as its network node server.

```

DEFINE_LOCAL_CP  FQ_CP_NAME(USIBMRA.PS2MGE  )
                  DESCRIPTION(PS/2 End Node)
                  CP_ALIAS(PS2MGE  )
                  NAU_ADDRESS(INDEPENDENT_LU)
                  NODE_TYPE(EN)                                1
                  NODE_ID(X'32280')
                  HOST_FP_SUPPORT(YES);

DEFINE_LOGICAL_LINK  LINK_NAME(LINK0001)
                    ADJACENT_NODE_TYPE(NN)
                    PREFERRED_NN_SERVER(YES)                    2
                    DLC_NAME(IBMTRNET)
                    ADAPTER_NUMBER(0)
                    DESTINATION_ADDRESS(X'400010020002')
                    CP_CP_SESSION_SUPPORT(YES)
                    ACTIVATE_AT_STARTUP(YES)
                    LIMITED_RESOURCE(NO)
                    LINK_STATION_ROLE(USE_ADAPTER_DEFINITION)
                    SOLICIT_SSCP_SESSION(NO)
                    EFFECTIVE_CAPACITY(USE_ADAPTER_DEFINITION)
                    COST_PER_CONNECT_TIME(USE_ADAPTER_DEFINITION)
                    COST_PER_BYTE(USE_ADAPTER_DEFINITION)
                    SECURITY(USE_ADAPTER_DEFINITION)
                    PROPAGATION_DELAY(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_1(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_2(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_3(USE_ADAPTER_DEFINITION);

DEFINE_PARTNER_LU  FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4B  )
                  DESCRIPTION(RALYAS4B - AS/400 B {E20})
                  PARTNER_LU_ALIAS(RALYAS4B)
                  PARTNER_LU_UNINTERPRETED_NAME(RALYAS4B)
                  MAX_MC_LL_SEND_SIZE(32767)
                  CONV_SECURITY_VERIFICATION(NO)
                  PARALLEL_SESSION_SUPPORT(YES);

DEFINE_MODE  MODE_NAME(QPCSUPP  )
            COS_NAME(#CONNECT)
            DEFAULT_RU_SIZE(NO)
            MAX_RU_SIZE_UPPER_BOUND(1024)
            RECEIVE_PACING_WINDOW(4)
            MAX_NEGOTIABLE_SESSION_LIMIT(32767)
            PLU_MODE_SESSION_LIMIT(64)
            MIN_CONWINNERS_SOURCE(0);

```

Figure 33 (Part 1 of 2). PS2MGE Defined as an End Node with Network Node Server RALYAS4B


```

DEFINE_DEFAULTS IMPLICIT_INBOUND_PLU_SUPPORT(YES)
                  DEFAULT_MODE_NAME(BLANK)
                  MAX_MC_LL_SEND_SIZE(32767)
                  DIRECTORY_FOR_INBOUND_ATTACHES(*)
                  DEFAULT_TP_OPERATION(NONQUEUED_AM_STARTED)
                  DEFAULT_TP_PROGRAM_TYPE(BACKGROUND)
                  DEFAULT_TP_CONV_SECURITY_RQD(NO)
                  MAX_HELD_ALERTS(10);

CNOS  LOCAL_LU_ALIAS(PS2MGE )
      FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4B )
      MODE_NAME(QPCSUPP )
      SET_NEGOTIABLE(NO)
      PLU_MODE_SESSION_LIMIT(64)
      MIN_CONWINNERS_SOURCE(64)
      MIN_CONWINNERS_TARGET(0)
      AUTO_ACTIVATE(0);

```

Figure 33 (Part 2 of 2). PS2MGE Defined as an End Node with Network Node Server RALYAS4B

1 The DEFINE_LOCAL_CP verb specifies NODE_TYPE(EN), which means that the local PS/2, PS2MGE, is an end node.

2 The DEFINE_LOGICAL_LINK verb defines the link to RALYAS4B (CP=RALYAS4B) and specifies PREFERRED_NN_SERVER(YES), which means that RALYAS4B is the network node server for PS2MGE.

2.1.2.5 OS/2 Extended Services Communications Manager 5250 Workstation Feature Profile Configuration

The configuration panels for the Extended Services 5250 Workstation feature are included here in Figure 34 on page 32 for reference. The APPC partner LU alias used in the 5250 Terminal/Printer Session Assignments links these definitions to the partner LU definitions in Figure 28 on page 25.

```

5250 Work Station Feature Configuration

* 1. Terminal profiles...
* 2. Printer profiles...
  3. Specify APPC LU alias...
* 4. Session assignments

-----
|                               Specify APPC LU Alias                               |
| APPC LU alias . . . . . [PS2MGE ] |
| Enter  Esc Cancel  F1 Help  F4 List |
|-----|

```

Figure 34. 5250 Workstation Feature Profile Configuration - APPC LU Alias

```

5250 Session Selection

Session Number      Session Type

  1...              Terminal
* 2...              Terminal
* 3...              Terminal
* 4...              Not Configured
* 5...              Not Configured

-----
|                               5250 Terminal/Printer Session Assignments                               |
| 5250 Work Station Feature profile name . . . . . [M1 ] |
| APPC Partner LU alias. . . . . [RALYAS4B] |
| APPC Mode name . . . . . [QPCSUPP ] |
| Short session ID . . . . . [E] |
| Enter  Esc Cancel  F1 Help  F4 List |
|-----|

```

Figure 35 (Part 1 of 2). 5250 Workstation Feature Profile Configuration - Session Assignment

5250 Session Selection	
Session Number	Session Type
* 1...	Terminal
2...	Terminal
* 3...	Terminal
* 4...	Not Configured
* 5...	Not Configured

5250 Terminal/Printer Session Assignments	
5250 Work Station Feature profile name	[M1]
APPC Partner LU alias.	[RALYAS4A]
APPC Mode name	[QPCSUPP]
Short session ID	[F]
Enter Esc Cancel F1 Help F4 List	

Figure 35 (Part 2 of 2). 5250 Workstation Feature Profile Configuration - Session Assignment. This figure shows the session assignments for the first two 5250 sessions, one with RALYAS4A and one with RALYAS4B. There is a third 5250 session, not shown, that is identical to the first except its short session ID is G.

As an aside, another application which uses the partner LU alias is OS/2 PC Support/400. The key parameters from a communications point of view are the partner LU alias from Figure 28 on page 25 and PC location name that is equivalent to the local node alias name in Figure 20 on page 22. The PC support installation screen that shows these key parameters is shown below in Figure 36 on page 34.

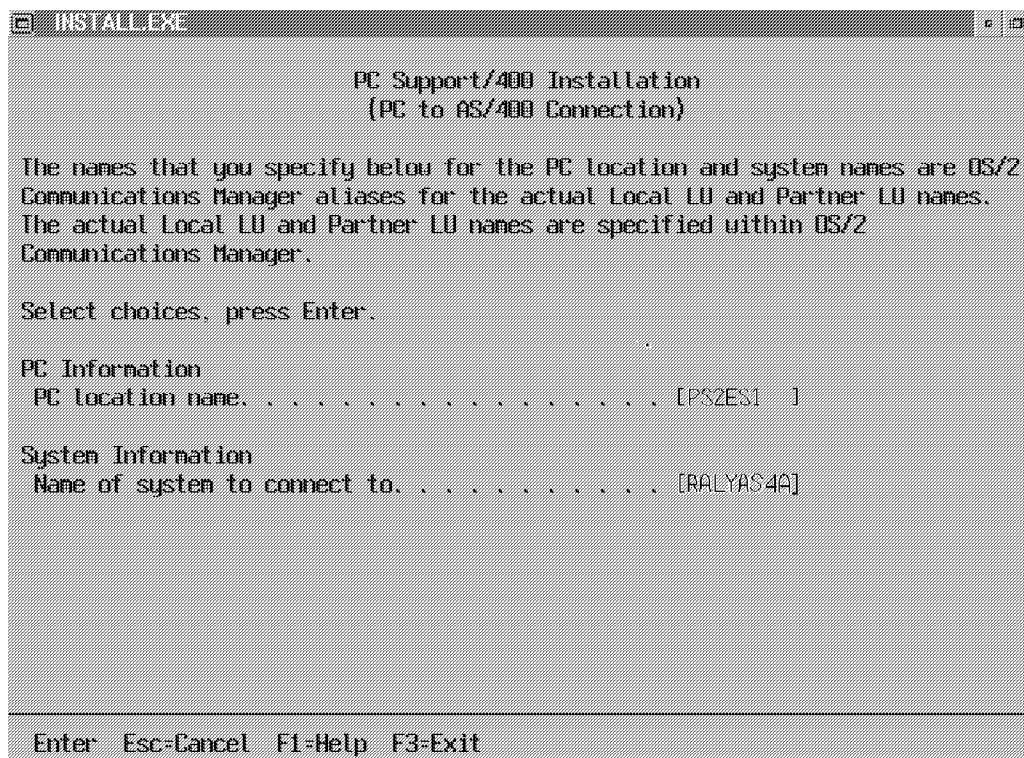


Figure 36. Install OS/2 PC Support - Define Connection

2.1.3 RALYAS4B (NN) to ES (NN) to ES (EN) and PCAT (LEN)

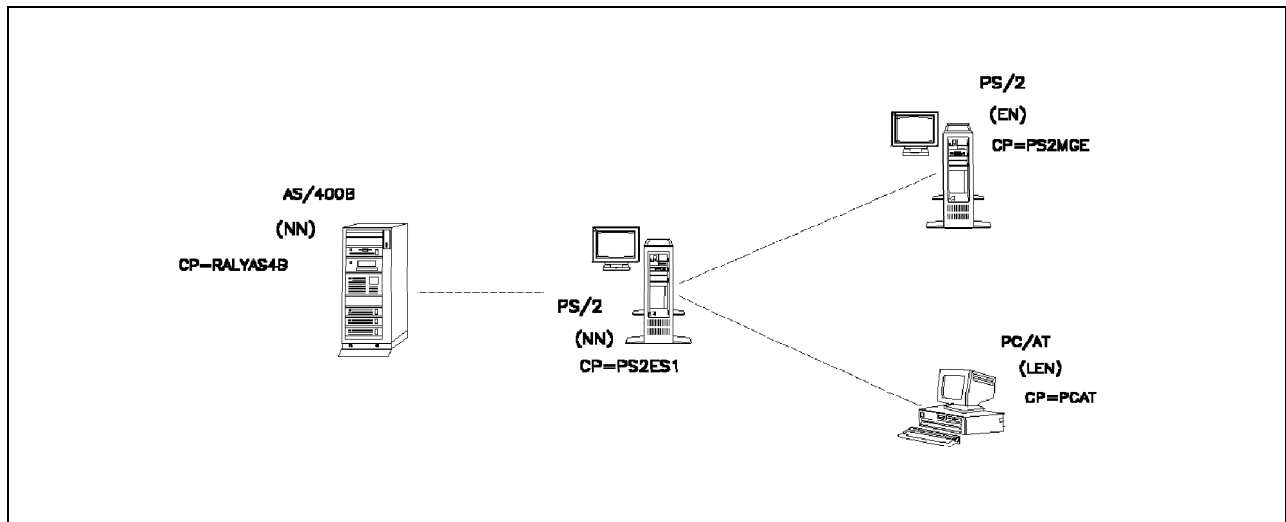


Figure 37. RALYAS4B (NN) to ES (NN) to ES (EN) and PCAT (LEN)

Now we introduce an additional LEN end node into the network. We change the network node server for the end node PS2MGE from RALYAS4B to PS2ES1. The network node with CP name PS2ES1 remains adjacent to RALYAS4B. We define the PCAT to be a LEN end node in the *domain* of the PS2ES1 network node. (An APPN domain includes a network node and its adjacent APPN LEN and end nodes.)

We will show only the changed definitions for PS2ES1 and the CONFIG.PCS file used for the PCAT. See Figure 38 on page 36, Figure 39 on page 36, and Figure 40 on page 37, respectively.

The definitions for PS2MGE are changed so that the LINK0001 is now directed to PS2ES1 by changing the links destination token-ring address. We do not show that configuration file. The AS/400 definition is the same as previously configured.

For more information on how to configure the PCAT for DOS PC Support/400, please refer to the IBM manual *PC Support/400 DOS Installation and Administration Guide*.

We will now add two more links to the network node PS2ES1 for the end node PS2MGE and the LEN end node PCAT. Figure 38 on page 36 summarizes these additions to PS2ES1's configuration.

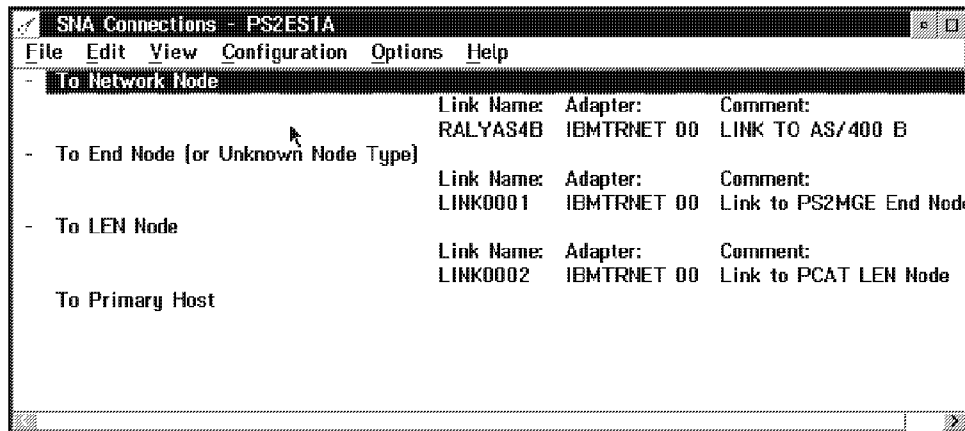


Figure 38. The Final Configuration for PS2ES1 with Three Links Defined

Although PS2ES1 is an NN, we must still define partner LUs for sessions originating from PS2ES1. The reason for this is that our application will be 5250 WSF, and requires that a partner LU alias is defined. This will be the same for any PC application using Communications Manager.

The partner LU alias is linked to the network-qualified LU name before a session is established by CM using our partner LU definitions. So we define partner LU's for RALYAS4A now.

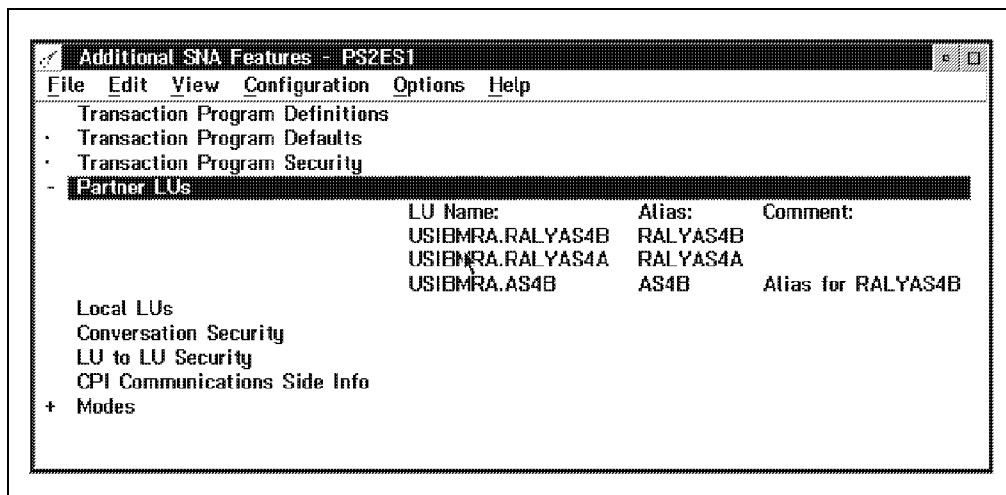


Figure 39. Partner LU Definitions for PS2ES1

We have defined a partner LU name of AS4B. When an LU in PS2ES1 attempts to establish a session to LU AS4B, the PS2ES1 will first send a broadcast search to locate the LU. The search request will reach CP RALYAS4B where AS4B is defined as a local location in its local location list (*WRKCFGL *APPNLCL*). RALYAS4B will respond positively to the search request, and a session may then be established.

In the PCAT CONFIG.PCS file, which is shown in Figure 40 on page 37, we have specified that a session be established with AS4B. Although we request the NN services of PS2ES1 to find LU AS4B, this LU need not be defined at PS2ES1. Partner LUs need not be defined for intermediate sessions through Communications Manager.

```
SFLR 1,I,QIWSFLR,RALYAS4B 1
RTLN USIBMRA.PCAT 2
RTYP ITRN 3
TRLI AS4B,400030010025 4
TRLI RALYAS4B,400010020002 5
```

Figure 40. The CONFIG.PCS File Used on the PCAT. Two Partner LUs are configured to be in RALYAS4B. One Partner LU, AS4B, is via PS2ES1. The other, RALYAS4B, is accessed directly across the token-ring LAN.

1 This entry establishes the I drive session with RALYAS4B directly across the token-ring LAN connection. The token-ring LAN address we specify is that of the RALYAS4B. 5

2 This entry specifies the network-qualified local LU name of the PCAT.

3 This entry specifies that the router type for this PC is token-ring. That is, PC Support/400 sessions will be established via the token-ring adapter on the PCAT.

4 This entry specifies the token-ring address for the partner LU RAS4B. Since we may not know the token-ring LAN adapter address for the location AS4B, we specify the token-ring LAN address of PS2ES1. This is the way we specify that the PCAT use the NN services of PS2ES1 in searching for partner LUs.

We could specify the token-ring address of PS2ES1 for all partner LUs; then we do not need to know any other token-ring addresses. This could mean a significant reduction in workload if a large number of nodes are on the token-ring LAN.

5 AS4B is, in fact, a location name at RALYAS4B (defined using WRKCFGL *APPNLCL) and we could just as easily have bypassed PS2ES1 by specifying the token-ring address of AS400B. In this entry, we do just that.

2.1.4 A Multinetwork Connectivity Scenario

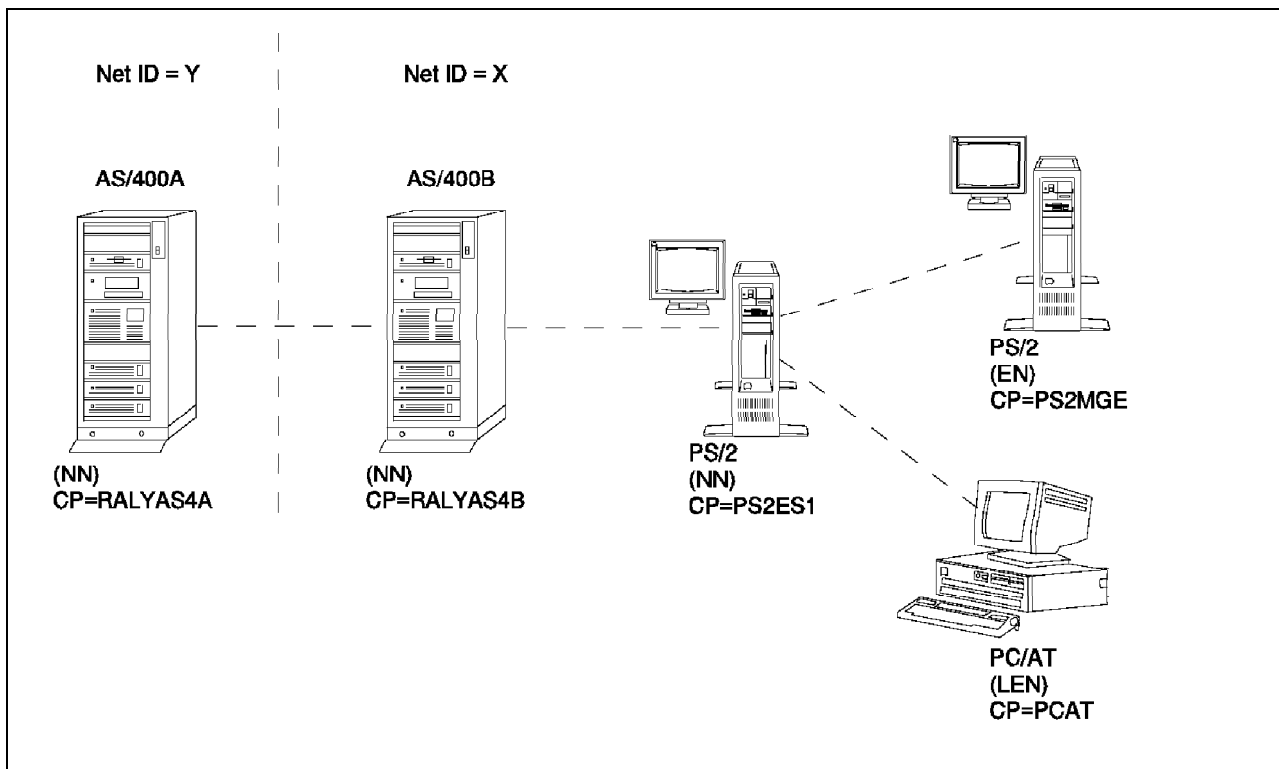


Figure 41. RALYAS4A (NN) to RALYAS4B (NN) to ES (NN) to ES (EN) and PCAT (LEN)

The network we define here is identical to that defined in the previous section, except for the addition of the RALYAS4A to the network. The intention is to explore more fully the capabilities, limitations, and considerations of the APPN multinetwork connectivity between these nodes. The areas we highlight for consideration are as follows:

- Mechanisms of the Multinetwork Connectivity
- Benefits and restrictions of the Multinetwork Connectivity
- Configuration requirements for the Multinetwork Connectivity
- Security implications of Multinetwork Connectivity
- Topology and routing differences of a Multinetwork Scenario

In order to make these considerations, we begin with each node having the same net ID, USIBMRA, and we change the net IDs as follows:

AS400A From USIBMRA to USIBMRAY; call it network Y

AS400B From USIBMRA to USIBMRA X; call it network X

PS2ES1 From USIBMRA to USIBMRA X; call it network X

PS2MGE From USIBMRA to USIBMRA X; call it network X

PCAT From USIBMRA to USIBMRA X; call it network X

2.1.4.1 Mechanisms of the Multinetwork Connectivity

Consider the two networks we have introduced into this scenario. On XID exchange, RALYAS4A and RALYAS4B negotiate as to who will play the role of peripheral border node and will play the role of the end node. Based on the lower network qualified CPNAME Y.AS400A and X.AS400B, RALYAS4B provides the end node function between networks Y and X. On XID exchange with NNs in network X, in this case PS2ES1, RALYAS4B will present itself as an NN. To the NN in network Y, here RALYAS4A, RALYAS4B will present an EN image. In addition, at CP capabilities exchange, RALYAS4B will indicate that it is capable of receiving an APPN locate search request from its NN server in network Y.

The end node image of a peripheral border node does not register its LUs with the NN server. Moreover, the EN image in the PBN *is capable* of receiving a search request for all LUs residing in the network from its network node server. The NN server cannot automatically respond positively to a search request for an LU residing in the network represented by the PBN (it, in fact, doesn't know what LUs reside in the adjacent Network). Instead, the NN server will send a search request to its EN image of the adjacent PBN to determine whether a particular LU resides in the other network.

Please consider two possibilities for processing search requests between networks:

1. RALYAS4B receives a search request from an LU in network X for an LU in network Y. The following search occurs:
 - a. RALYAS4B is an NN in network X. When it receives the search request, it propagates the request to other nodes in network X.
 - b. In addition, since RALYAS4B can utilize the network node services of RALYAS4A in network Y, and because the target LU has a net ID of Y, it propagates the search to RALYAS4A.
 - c. RALYAS4A further propagates the search throughout network Y. It receives a positive response from within network Y and may then forward the positive response on to the end node image of RALYAS4B in network X and includes the routing information.
 - d. RALYAS4B may now positively respond to the search request from the search originator in network X.
 - e. The originating CP then calculates the best route to RALYAS4B and forwards the BIND there, believing that the LU resides at RALYAS4B.
 - f. The peripheral border node function within RALYAS4B will forward the BIND to its NN server, RALYAS4A in network Y, and includes the routing information received in step c.
2. RALYAS4B receives a search request from an LU in network Y for an LU in network X. The following process occurs:
 - a. RALYAS4B appears as an EN with RALYAS4A as its network node server. Recall that it is capable of receiving an APPN Locate search form its NN server doesn't register its LUs with its NN server.

Thus, on receiving any search request, RALYAS4A must, before responding, check whether the LU resides at the EN, RALYAS4B. RALYAS4A, therefore, forwards the request on to RALYAS4B.
 - b. Since RALYAS4B is also an NN in network X, it can now propagate the search request through network X.

- c. Assume that RALYAS4B receives a positive response to the search request. It will then positively respond to its NN server, RALYAS4A.
- d. RALYAS4A, in turn, positively responds to the original search request, forwarding the positive response to the originating LU on behalf of its EN, RALYAS4B.
- e. The originating network node CP of the OLU (origin LU) will then calculate the best route to RALYAS4B, believing the LU to reside there, and send the BIND. The BIND will flow through network Y to RALYAS4B.
- f. RALYAS4B will calculate the optimal route through network X and send the BIND to the DLU (destination LU).

2.1.4.2 Benefits and Restrictions of the Multinetwork Connectivity

The multinetwork connectivity provides the key benefit of communicating between different networks while, at the same time, enabling the APPN search functionality and maintaining isolation of network topology information. To paraphrase: the two networks remain distinct entities as is required for connectivity between corporations. However, they have the benefits of full APPN functionality.

Another possible benefit of the multinetwork connectivity is the ability to split large networks and subnets have different net IDs so that topology information flows may be isolated to specific portions of the network and not propagated around the entire network. Remember, however, that only LUs in adjacent networks may establish sessions.

That is a similar concern for network resources that introduces a restriction to the multinetwork connectivity. As mentioned previously, when connecting different networks via a peripheral border node, it is not possible to establish a session across more than one adjacent network. That is, it is not possible to establish a session from network Y, through network X, to network Z.

2.1.4.3 Configuration Requirements for the Multinetwork Connectivity

Consider briefly the case where a third network, Z, is included in the scenario by changing the network IDs of PS2ES1, PS2MGE, and PCAT to USIBMRAZ.

Every LU in network Z would be able to communicate to every LU in network X but would not be able to communicate to any LU in network Y. Recall that there is no border node function for ES, CM/2 or 3174 APPN. OS/400 V2R1 and up support peripheral border node and VTAM V4.2 supports extended border node with fall-back to PBN if adjacent is NN as PBN. However, only one network node in adjacent networks need provide the border node function. In this case, the AS/400 would provide the border node function for the multinetwork connectivity. The ES/1 will, however, require CSD WR01002 to support connectivity to a border node. CM/2 requires V 1.11. The same is true for connectivity between any two APPN NNs, for example, an AS/400 NN with V2R1 communicating with an AS/400 NN with V1R3. In this case, the V1R3 AS/400 NN requires PTF MF02822. Note that every NN in both networks has to support Locate flows with border nodes.

Apart from the PTF requirements just mentioned, there are no other special configuration requirements when connecting two APPN networks via a peripheral border node.

There are, of course, some changes which need to be made to split a single APPN network into two separate networks. In this example, it is necessary to change the LCLNETID on the AS/400s. In addition, the corresponding net ID parameter in the APPC control unit descriptions must be changed. For the ES nodes, it is necessary to change the FQ_CP_NAME verb in the DEFINE_LOCAL_CP statement to specify the new net ID. In the PCAT, the net ID change should be made in the RTLN parameter of the CONFIG.PCS file.

In the case where one network is split into two, when establishing sessions to LUs in what is now a different network, it is, of course, necessary to specify the new net ID in which the LU resides. For pass-through, it is easy to change the net ID by prompting the STRPASTHR command and overriding the default. Of course, the new net ID could be hard-coded into a program that issues the STRPASTHR command. Similarly for SNADS, the net ID must be changed as appropriate.

2.1.4.4 Security Implications for Multinetwork Connectivity

The AS/400 peripheral border node function does provide isolation of network topology information. However, the full functionality of APPN search and routing function is available for any LUs in adjacent networks. If there are LUs that need to be protected from incorrect access by LUs in another network, then there are three levels of security which may be utilized:

- Location security

The identity of other systems in the network may be verified by password at session establishment time. In an APPN network, location passwords may be specified for those pairs of locations which are to have end-to-end sessions between them. If one location attempts to establish a session with another location, but does not specify a correct password, then the session is rejected.

- User ID security

The identity and rights of users to commands on their local system and remote systems may be verified at sign-on time.

- Resource security

User access to particular resources, such as confidential databases, may be controlled on a system basis.

For more information on security in an APPN network, please refer to *AS/400 APPN User's Guide* and to *AS/400 APPC Programmer's Guide*.

2.1.4.5 Topology and Routing Considerations for a Multinetwork Scenario

We now highlight two key topology and routing considerations for a multinetworking scenario:

1. Topology Information

When two network nodes in different networks establish CP-CP sessions, both or one of them need to support the peripheral border node function. If both support the peripheral border node function, then as previously mentioned, only one will take the role of the border node. The only current example of this scenario is with AS/400s at V2R1 and VTAM 4.2. In this case, the two network nodes are able to negotiate about which node will play the end node function while, initially, they know that they are both network nodes. VTAM will not negotiate but always play EN to a PBN.

If only one of the nodes supports the border node function, for example, if one of the NNs is an AS/400 with V1R3 and PTF MF02045, or later, then the node supporting the PBN function indicates to the other node that it is an EN. Thus, the border node will appear in the local topology database of the adjacent network node server as an EN, not an NN.

Other NNs in the respective networks will have information in their topology databases as if there were no other networks adjoining. Only the border node is "aware" of another network. Its NN server is, in fact, in the adjacent network. The border node, thus, uses its NN server to perform internetwork searches.

2. Session Routing

When viewing session routing information, that is when using DSPAPPNINF *SSN to display the RSCV, only nodes in the local network will be seen. The reason for this is that the routes through the respective networks are calculated separately and not propagated into the adjacent network. Only the border node is "aware" that it is capable of propagating a BIND into an adjacent network; that information is not carried in the RSCV. Please refer to 2.1.4.1, "Mechanisms of the Multinetwork Connectivity" on page 39 for a detailed description of how the border node function works in conjunction with RSCV processing.

2.1.5 AS/400, ES, CM/2, (and PCAT) in a Connection Network

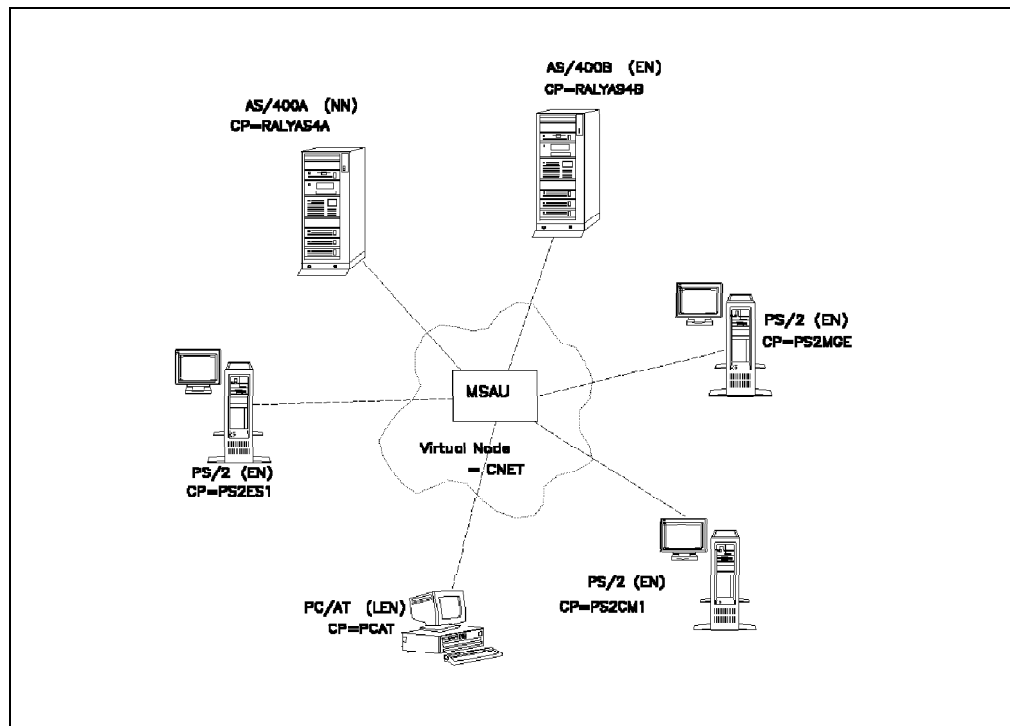


Figure 42. AS/400, ES, (and PCAT) in a Connection Network. Although PCAT (LEN) is included in this figure, it is, in fact, not participating in the connection network which is available only for ENs and NNs.

Here we have the final version of our network; call it CNET. The key consideration now is enabling any-to-any connectivity without the requirement of defining all token-ring addresses on the token-ring in every node.

Simultaneously, the any-to-any connectivity should not rely on one of the network nodes to provide all of the session routing across the token-ring LAN.

A *connection Network* provides a means of defining attachments over a shared-access transport facility, such as a token-ring LAN, without having to define, in all systems, all of the nodes that can be accessed across the facility, and reduces the number of link station definitions and CP-CP sessions, establishing sessions when needed.

A connection network offers benefit even for APPN network nodes. The CN eliminates definition, topology, and the number of sessions which would need to be maintained. The only requirement for CP-CP sessions is that you need a spanning tree between NNs. With an end node and a network node server, the EN or NN can report to its network node server the fact that it is connected to a *virtual node*, the token-ring. It also reports DLC information such as the token-ring MAC and SAP address. As a consequence, the network node server is automatically updated with information about how to access the EN or NN directly across the token-ring LAN.

If all ENs on a token-ring LAN register with their NN server, which may in fact be the only NN server in the network, then information is known about all nodes in the network. Thus, if an EN requests session-establishment support from its NN server, then the server can calculate a route directly across the token-ring LAN to the end point of the requested session, not via the NN server.

In the final version of our network, we have only a single network node, RALYAS4A, four end nodes and a LEN end node. Note, however, that although the PCAT LEN end node resides on the same token-ring LAN as the other nodes, it has no mechanism by which to define its connectivity to the connection network. Connection network is a feature of APPN nodes who need CP-CP sessions, and the PCAT, therefore, cannot participate. All of the other nodes can communicate directly with each other, and yet the NN-EN connections and the CN connection (model control unit) need be defined.

Definitions are required on each node in the connection network in order to indicate that they, indeed, have a token-ring connection to the virtual node. Moreover, since the only network node is now RALYAS4A, all of the end nodes must define RALYAS4A as their network node server.

2.1.5.1 AS/400 Requirements for Connection Network

In order to define connection network on the AS/400, a model APPC control unit is required to be configured. Figure 43 on page 44 shows the control unit, CNET, configured in order to enable a connection network for RALYAS4B. RALYAS4B is an EN while RALYAS4A is its NN server.

1 Specify a model control unit with the MDLCTL(*YES) parameter. In addition, AUTOCRTCTL(*YES) must be specified in the token-ring line description. If your token-ring-attached PUs are automatically created, then AUTOCRTCTL(*YES) has already been specified in your line description.

2 The ADPTADR parameter must point to the network node server unless the local node is a network node. In this case, RALYAS4B's NN server is RALYAS4A. The network attributes must also be changed to specify RALYAS4B as an EN and RALYAS4A as its NN server.

3 The connection network may be conceived of as a virtual node which is given the name CNET. This name must match the name that all other nodes in the connection network use when defining their link to the connection network.

The model control unit description on the network Node Server, RALYAS4A, is required to be the same; except that there is no remote token-ring address specified for the ADPTADR parameter.

Display Controller Description		RALYAS4B
		01/28/93 21:11:52
Controller description	CNET	
Option	*BASIC	
Category of controller	*APPC	
Link type	*LAN	
Online at IPL	*YES	
Character code	*EBCDIC	
Maximum frame size	16393	
Remote network identifier	*NETATR	
Initial connection	*DIAL	
Switched disconnect	*YES	
Data link role	*NEG	
LAN remote adapter address	400010020001	2
LAN DSAP	04	
LAN SSAP	04	
Text	*BLANK	
-----Switched Lines-----		
L31TR		
Controller description	CNET	
Option	*APPN	
Category of controller	*APPC	
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*NETNODE	
APPN transmission group number	*CALC	
APPN minimum switched status	*VRYONPND	
Model controller description	*YES	1
Connection Network Network ID	USIBMRA	
Connection network CP	CNET	3
Control owner	*USER	
F3=Exit F11=Display keywords F12=Cancel		

Figure 43. Connection Network Control Unit Definition

2.1.5.2 ES/1 Requirements for Connection Network

In order to enable the connection network for the PS/2s with ES, the DEFINE_CONNECTION_NETWORK verb must be added to the .NDF file of each. Connection network configuration is not supported in the PM configuration interface and, thus, the file must be directly edited. The file used for PS2MGE is shown in Figure 44 on page 45.

1 The name given to the connection network virtual routing node is CNET, the same as for the AS/400. The very same DEFINE_CONNECTION_NETWORK verb statement must be inserted into the .NDF files for each of the other ESs in the connection network.

2 Notice that the DEFINE_CONNECTION_NETWORK does not contain a token-ring address. ES uses the DEFINE_LOGICAL_LINK verb to determine the token-ring address of its network node server.

```

DEFINE_LOCAL_CP FQ_CP_NAME(USIBMRA.PS2MGE )
                DESCRIPTION(PS/2 End Node)
                CP_ALIAS(PS2MGE )
                NAU_ADDRESS(INDEPENDENT_LU)
                NODE_TYPE(EN)
                NODE_ID(X'32280')
                HOST_FP_SUPPORT(YES);

DEFINE_CONNECTION_NETWORK FQ_CN_NAME(USIBMRA.CNET )      1
                        ADAPTER_INFO( DLC_NAME(IBMTRNET)
                        ADAPTER_NUMBER(0));

DEFINE_LOGICAL_LINK LINK_NAME(LINK0001)
                    ADJACENT_NODE_TYPE(NN)
                    PREFERRED_NN_SERVER(YES)              2
                    DLC_NAME(IBMTRNET)
                    ADAPTER_NUMBER(0)
                    DESTINATION_ADDRESS(X'400010020002')  2
                    CP_CP_SESSION_SUPPORT(YES)
                    ACTIVATE_AT_STARTUP(YES)
                    LIMITED_RESOURCE(NO)
                    LINK_STATION_ROLE(USE_ADAPTER_DEFINITION)
                    SOLICIT_SSCP_SESSION(NO)
                    EFFECTIVE_CAPACITY(USE_ADAPTER_DEFINITION)
                    COST_PER_CONNECT_TIME(USE_ADAPTER_DEFINITION)
                    COST_PER_BYTE(USE_ADAPTER_DEFINITION)
                    SECURITY(USE_ADAPTER_DEFINITION)
                    PROPAGATION_DELAY(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_1(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_2(USE_ADAPTER_DEFINITION)
                    USER_DEFINED_3(USE_ADAPTER_DEFINITION);

DEFINE_PARTNER_LU FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4B )
                 DESCRIPTION(RALYAS4B - AS/400 B {E20})
                 PARTNER_LU_ALIAS(RALYAS4B)
                 PARTNER_LU_UNINTERPRETED_NAME(RALYAS4B)
                 MAX_MC_LL_SEND_SIZE(32767)
                 CONV_SECURITY_VERIFICATION(NO)
                 PARALLEL_SESSION_SUPPORT(YES);

DEFINE_PARTNER_LU FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4A )
                 DESCRIPTION(RALYAS4A - AS/400 A {E50})
                 PARTNER_LU_ALIAS(RALYAS4A)
                 PARTNER_LU_UNINTERPRETED_NAME(RALYAS4A)
                 MAX_MC_LL_SEND_SIZE(32767)
                 CONV_SECURITY_VERIFICATION(NO)
                 PARALLEL_SESSION_SUPPORT(YES);

```

Figure 44 (Part 1 of 2). The ES Configuration for Connection Network on PS2MGE

```

DEFINE_MODE  MODE_NAME(QPCSUPP )
              COS_NAME(#CONNECT)
              DEFAULT_RU_SIZE(NO)
              MAX_RU_SIZE_UPPER_BOUND(1024)
              RECEIVE_PACING_WINDOW(4)
              MAX_NEGOTIABLE_SESSION_LIMIT(32767)
              PLU_MODE_SESSION_LIMIT(64)
              MIN_CONWINNERS_SOURCE(0);

DEFINE_DEFAULTS  IMPLICIT_INBOUND_PLU_SUPPORT(YES)
                  DEFAULT_MODE_NAME(BLANK)
                  MAX_MC_LL_SEND_SIZE(32767)
                  DIRECTORY_FOR_INBOUND_ATTACHES(*)
                  DEFAULT_TP_OPERATION(NONQUEUED_AM_STARTED)
                  DEFAULT_TP_PROGRAM_TYPE(BACKGROUND)
                  DEFAULT_TP_CONV_SECURITY_RQD(NO)
                  MAX_HELD_ALERTS(10);

CNOS  LOCAL_LU_ALIAS(PS2MGE )
       FQ_PARTNER_LU_NAME(USIBMRA.RALYAS4A )
       MODE_NAME(QPCSUPP )
       SET_NEGOTIABLE(NO)
       PLU_MODE_SESSION_LIMIT(64)
       MIN_CONWINNERS_SOURCE(64)
       MIN_CONWINNERS_TARGET(0)
       AUTO_ACTIVATE(0);

```

Figure 44 (Part 2 of 2). The ES Configuration for Connection Network on PS2MGE

2.1.5.3 CM/2 Requirements for Connection Network

Unlike OS/2 ES 1.0, Communications Manager/2 configuration can be achieved using Presentation Manager screens only. There is no need to edit .NDF files, although the .NDF file is still used by CM/2. Communications Manager/2 requires that LAPS (LAN Adapter and Protocol Support) be installed on the PS/2 prior to the Communications Manager/2 installation if a LAN is to be used by Communications Manager/2.

If one of the following products has been installed on your machine, then it is likely an acceptable version of LAPS should be available.

- IBM Extended Services for OS/2
- IBM TCP/IP for OS/2
- IBM LAN Server (or IBM LAN Requester)
- Network Transport Services/2 (NTS/2)

The LAPS configuration process is identical to that described in 2.1.2.1, "OS/2 Extended Services Communications Manager LAN Configuration" on page 12.

The following screens show the definition of PS2CM2. This process is started by either:

- Selecting the **Communications Manager Setup** icon from the Communications Manager folder on the OS/2 desktop.

or

- Selecting the **Communications Manager Setup** icon as a step during the CM/2 installation process.

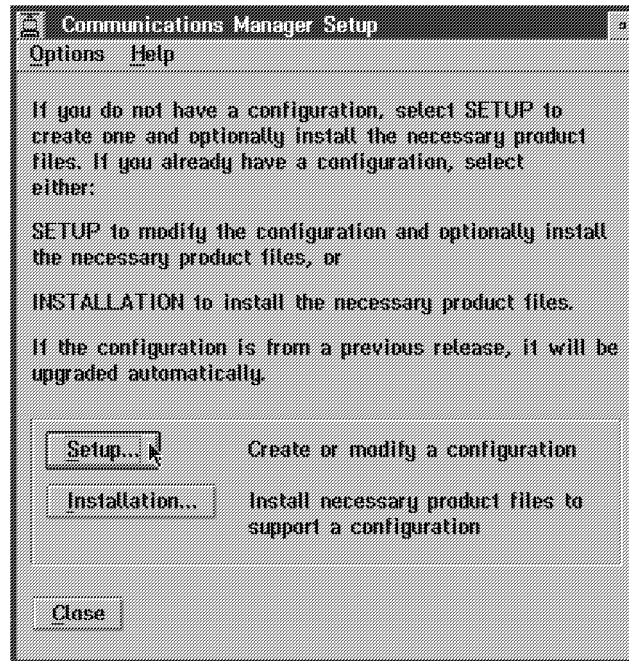


Figure 45. CM/2 Communications Manager Setup

Select the **Setup Option** as indicated by the mouse pointer in Figure 45 on page 47 to continue.

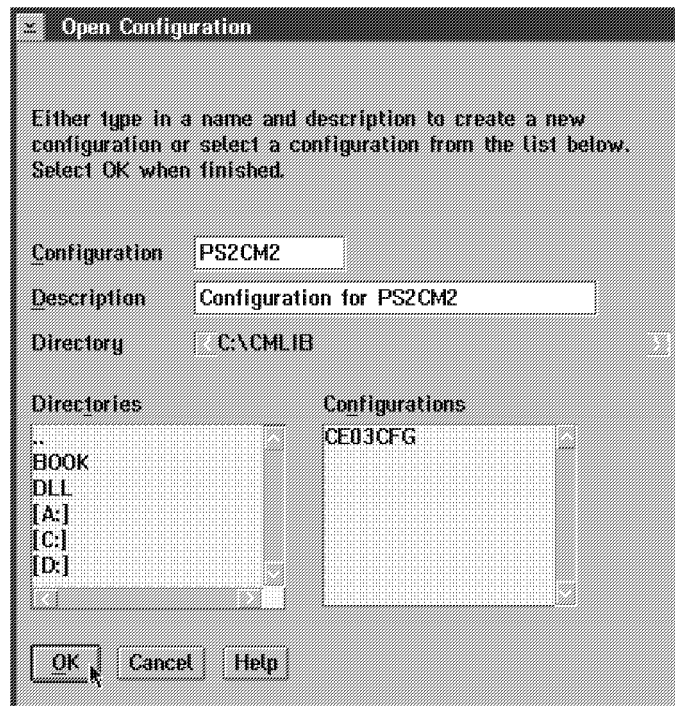


Figure 46. CM/2 Chose Configuration File Name

Chose an appropriate name for the CM/2 configuration files. In this case we use the name **PS2CM2**.

Select the **OK** option, as indicated by the mouse pointer in Figure 46 on page 47, to continue.

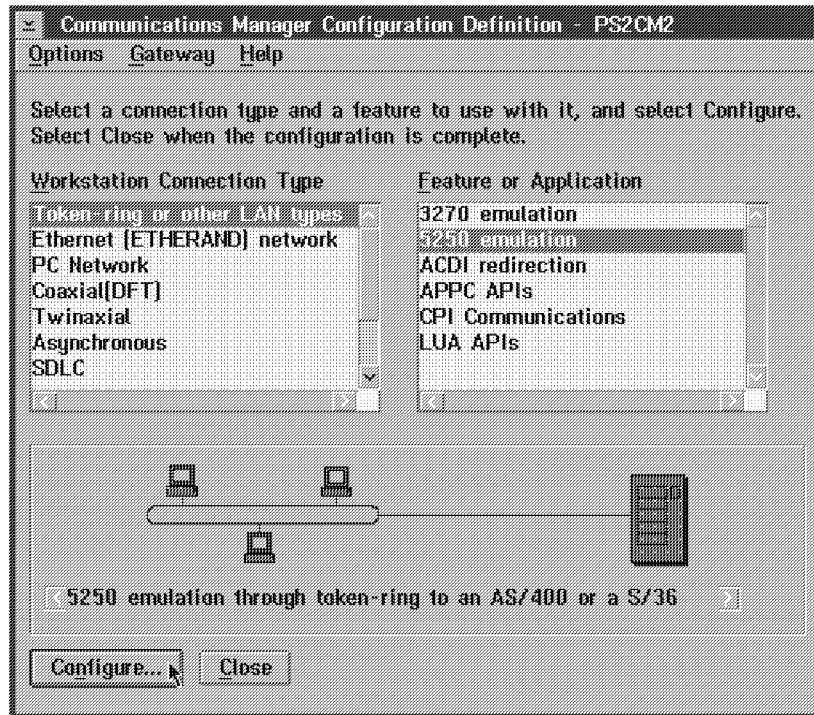


Figure 47. CM/2 Communications Manager Definition

- Select the **Workstation Connection Type**.
- Select the **Feature or Application** as shown in Figure 47 on page 48.
- Select **Configure**, as indicated by the mouse pointer, to continue.

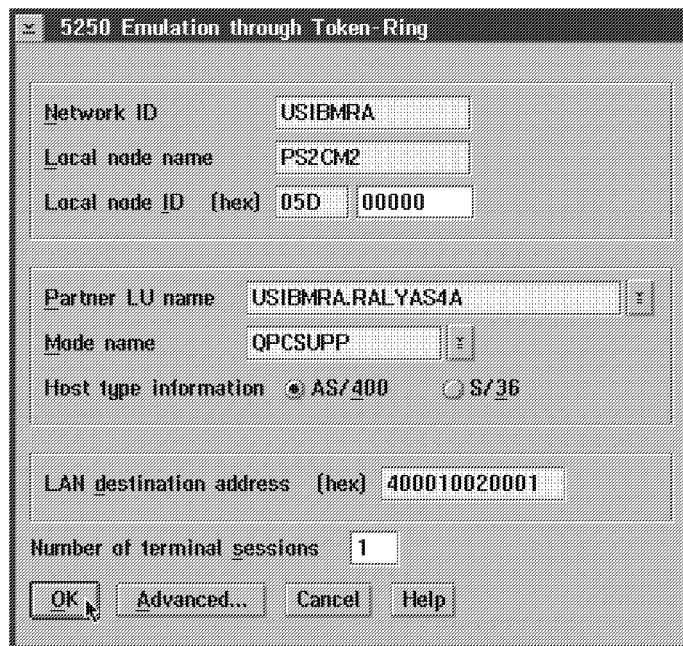


Figure 48. CM/2 5250 Emulation Through Token-Ring LAN

Here we define the characteristics of this system. The net ID and local node name, which become the network-qualified LU or location name of this PS/2, are added here. The partner LU Name and mode name for 5250 Emulation

are added here along with the LAN destination address of the AS/400 we wish to connect to. We could end this setup at this point by selecting OK as indicated in Figure 48 on page 48. This would create a configuration for a token-ring connection to a single AS/400, with 1 or more sessions.

By now, the reader will probably be so familiar with OS/2, Extended Services installations, and the functions/possibilities of APPN, that the question "What happens if I select the **Advanced** option ?" will be irrepressible. Recognizing this, we will continue with the Advanced configuration.

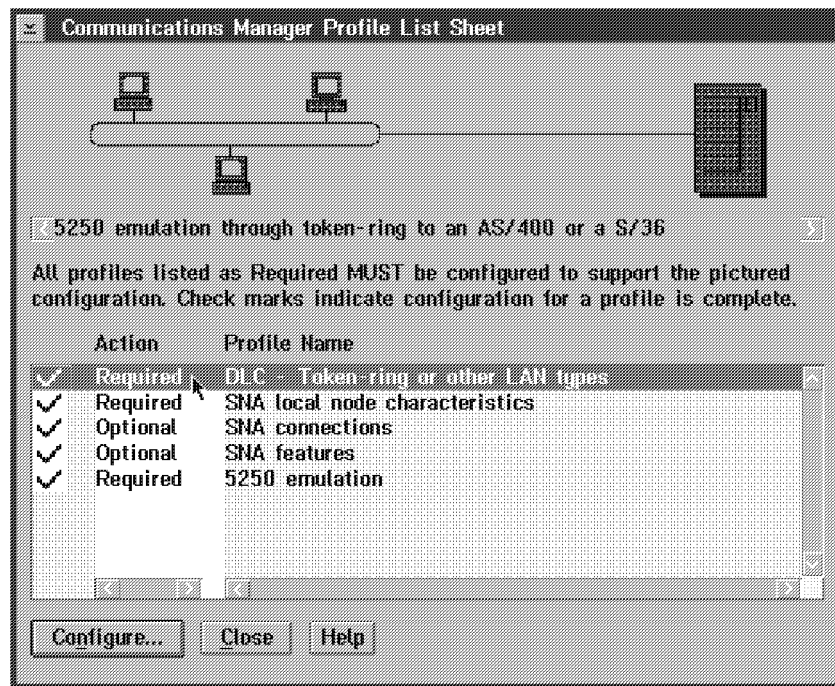


Figure 49. Communications Manager Profile List Sheet - Select DLC

We will select each of the options in Figure 49 on page 49 in turn, starting with DLC. Select **DLC-token-ring LAN and other LAN types**, as indicated by the mouse pointer, and then select **Configure** to continue.

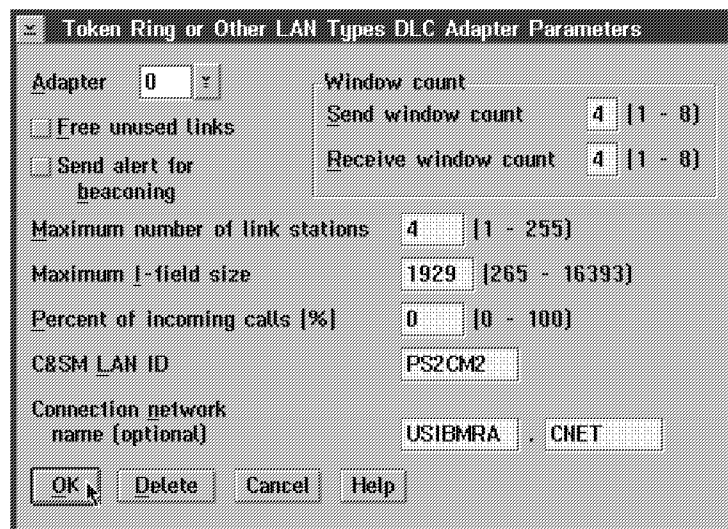


Figure 50. DLC Adapter Parameters

The default parameters here are acceptable for most installations. Note that we have defined the connection network CNET. Select **OK**, as indicated by the mouse pointer, to continue.

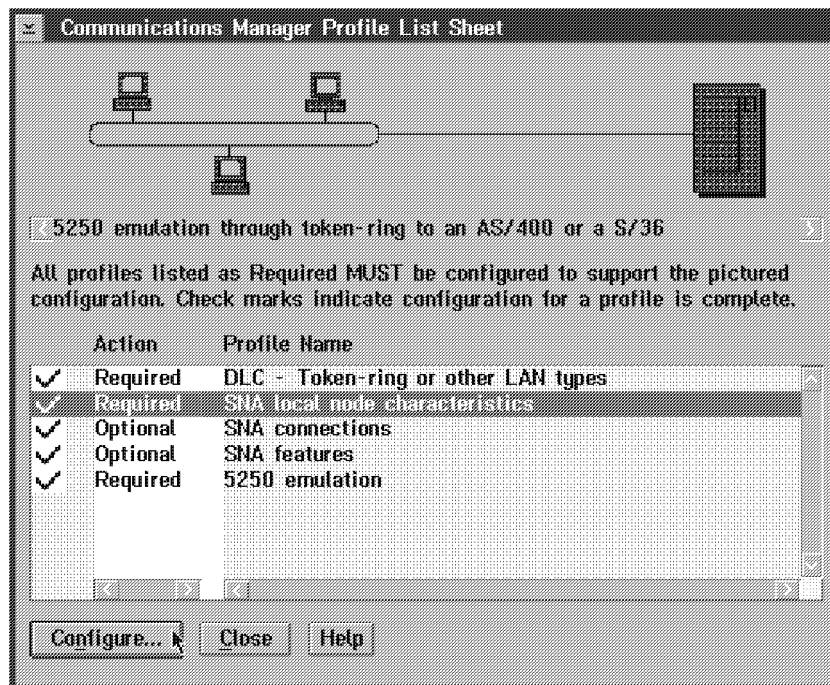


Figure 51. Communications Manager Profile List Sheet - Select SNA Local Node Characteristics

Select **SNA local node characteristics** and then **Configure**, as indicated by the mouse pointer in Figure 51 on page 50, to continue.

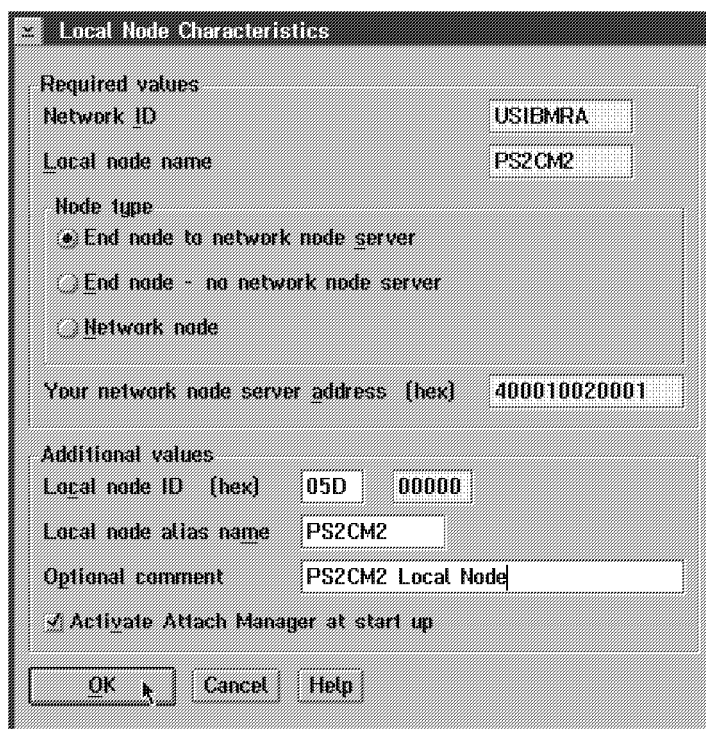


Figure 52. CM/2 Local Node Characteristics

Here, we define the local node name and net ID, plus the local node alias name used by applications such as 5250 WSF. We have changed the default local node alias, of 5250LU, to a more appropriate value, **PS2CM2**.

Select **OK**, as indicated by the mouse pointer in Figure 52 on page 50, to continue. This screen is the same as the Extended Services screen of the same name.

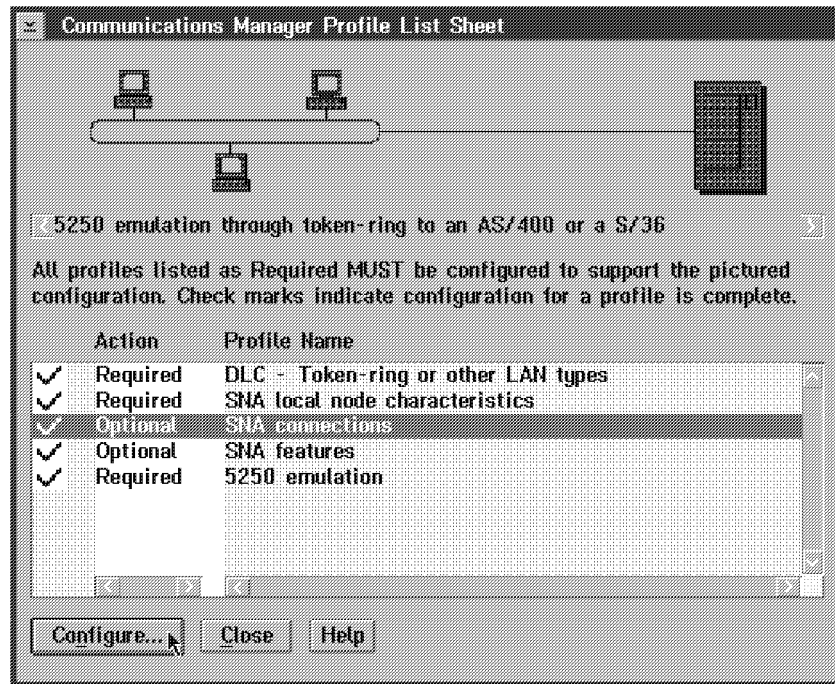


Figure 53. CM/2 SNA Connections

Select **SNA Connections** and then **OK**, as indicated by the mouse pointer in Figure 53, to continue.



Figure 54. CM/2 Connections List

Figure 54 on page 51 to Figure 57 on page 53 show the definition of RALYAS4A as a network node. This link is already defined here, as we defined a link to the network node server in Figure 52 on page 50.

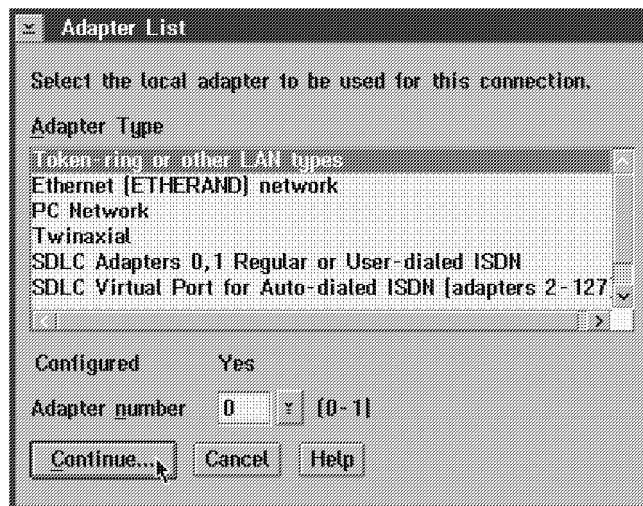


Figure 55. CM/2 Adapter List

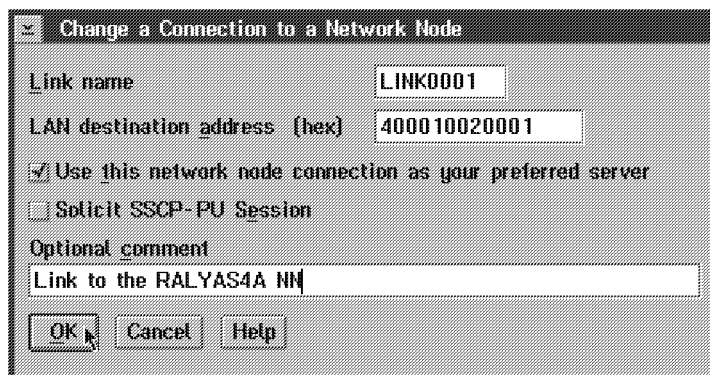


Figure 56. CM/2 Connection to a Network Node



Figure 57. CM/2 Connection List

Having reviewed the definition of the link to RALYAS4A, we can proceed with the definition of our SNA features.

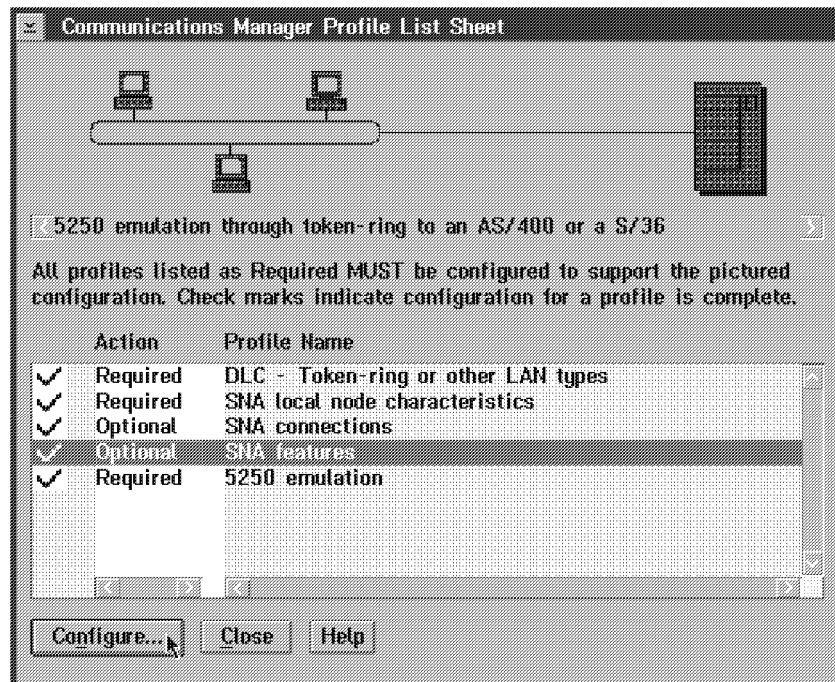


Figure 58. CM/2 SNA Features

Here in Figure 58, we define the SNA features. This is similar to the CM Additional SNA Features window of the OS/2 Extended Services Communications Manager installation. Select **SNA features** and then **Configure**, as indicated by the mouse pointer in Figure 58 on page 53, to continue.

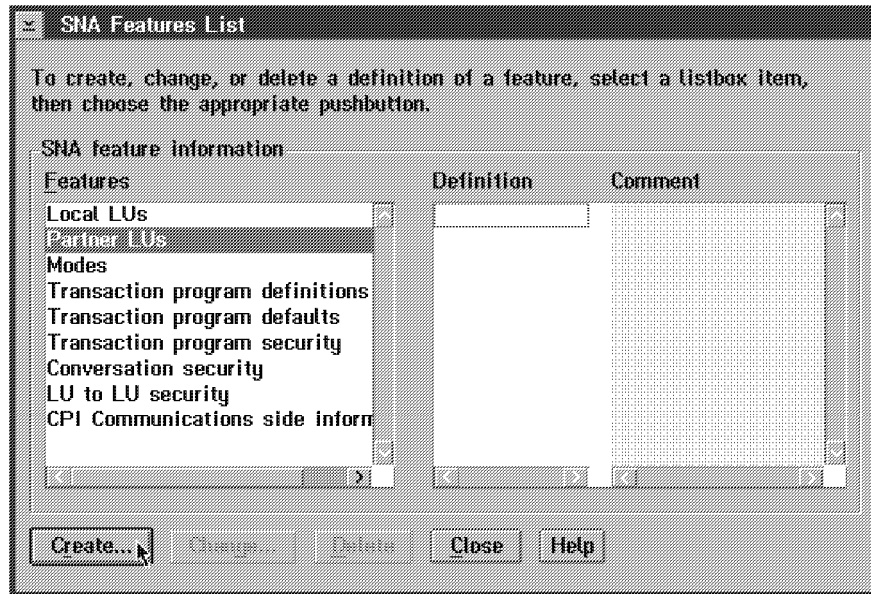


Figure 59. SNA Feature List - Select Partner LU

Here we have deleted the partner LU which was created automatically by the Communications Manager configuration, 5250PLU. We will now create partner LUs for our sessions with RALYAS4A and RALYAS4B with more meaningful names. Select **Create** in Figure 59 on page 54, to continue.

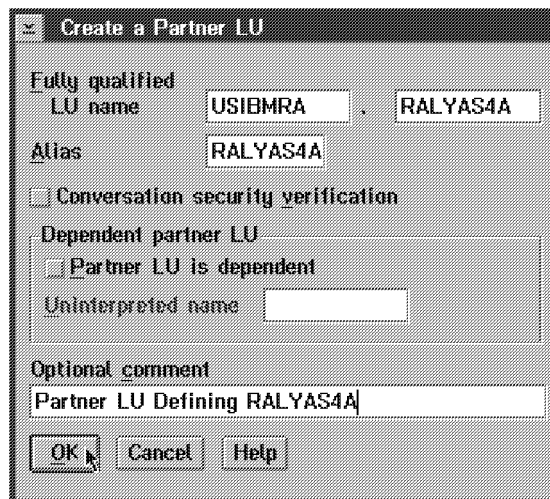


Figure 60. CM/2 Create a Partner LU

Create the partner LU that will define RALYAS4A and select **OK** to continue, as indicated in Figure 60 on page 54 above.

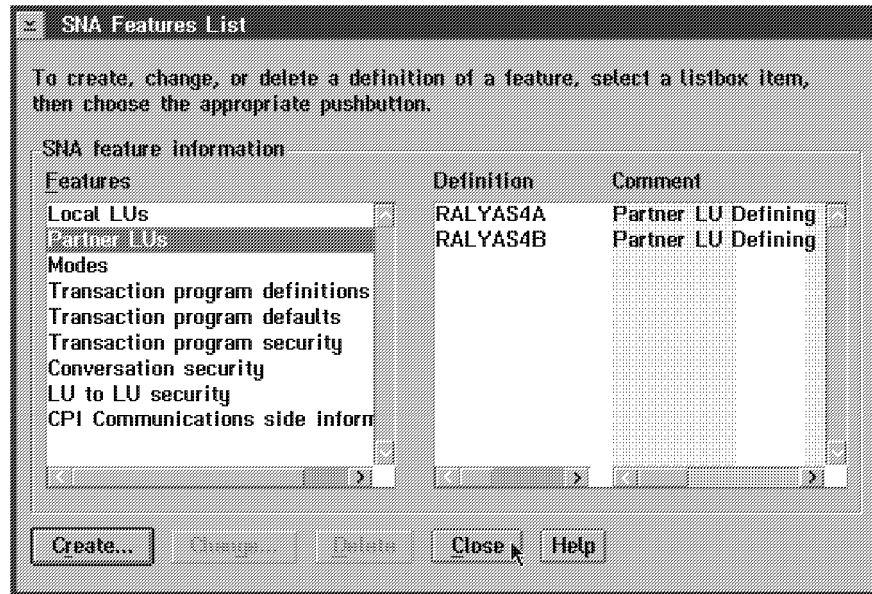


Figure 61. SNA Feature List - Partner LUs Defined

Notice we have repeated the last 2 steps to define a partner LU for RALYAS4B also. Select **Close**, as indicated in Figure 61 on page 55, to continue.

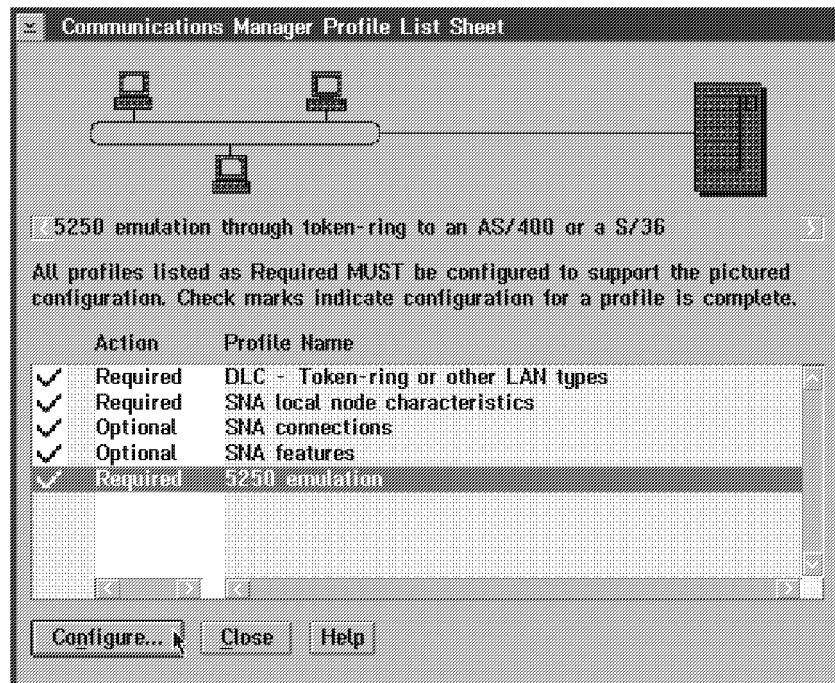


Figure 62. CM/2 5250 Emulation

The remaining step in our configuration is to define the 5250 emulation sessions. Select **5250 emulation** and then **Configure**, as indicated in Figure 62 on page 55, to continue.

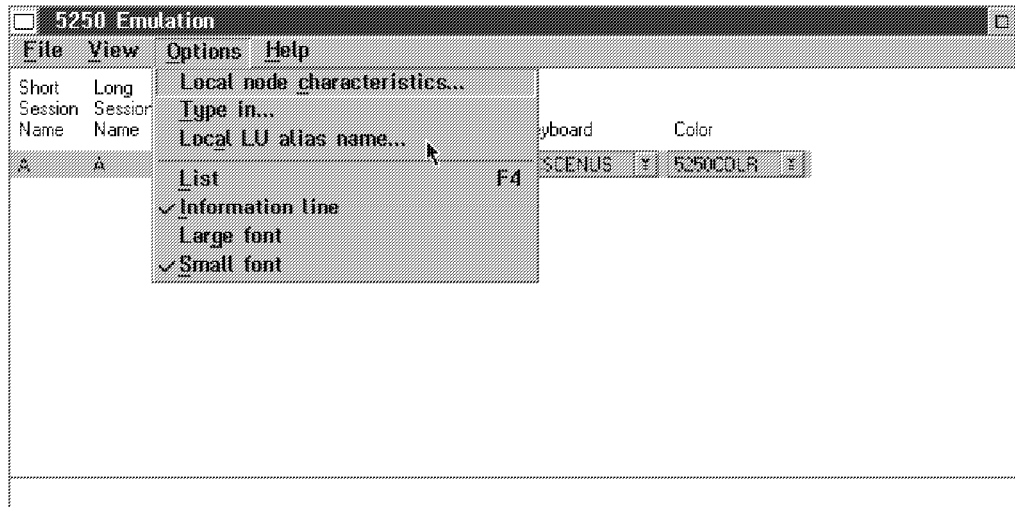


Figure 63. CM/2 5250 Emulation Define Local LU Alias Name

We must select the local LU alias name that will be used for this PS/2 in the 5250 emulation sessions. This can be found by selecting the **Options** and **Local LU alias name**. It is important to change this from the default value to the alias we specified in Figure 52 on page 50.

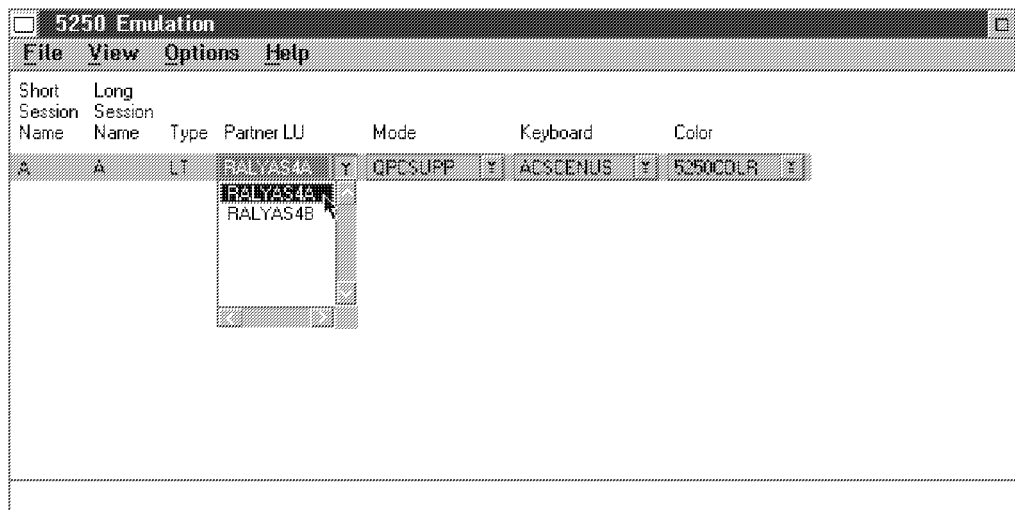


Figure 64. CM/2 5250 Emulation Select Partner LU - RALYAS4A

In Figure 64 on page 56 we see that the partner LU for this session is selected.

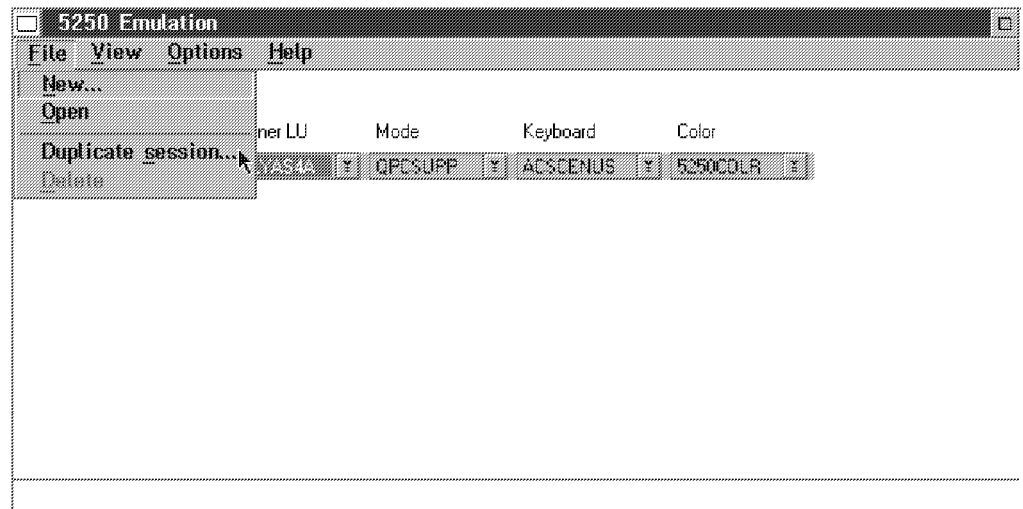


Figure 65. CM/2 5250 Emulation Select Duplicate Session

In Figure 65 on page 57 and Figure 66 on page 57 below, we duplicate this session, so there are now two 5250 sessions to the system RALYAS4A.

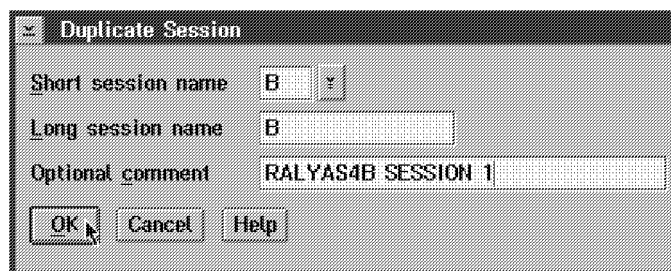


Figure 66. CM/2 5250 Emulation Duplicate Session

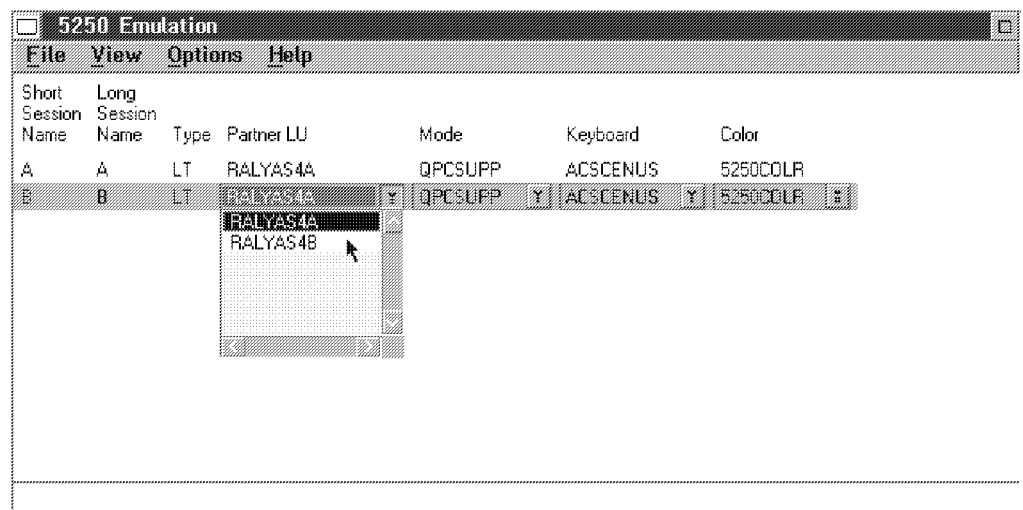
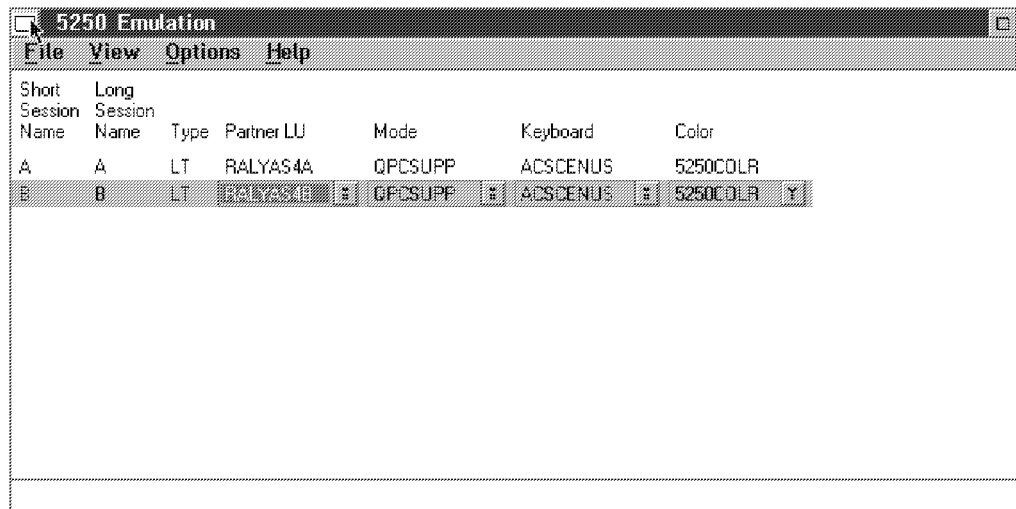


Figure 67. CM/2 5250 Emulation Select Partner LU - RALYAS4B

In Figure 67 on page 57 the partner LU is changed so the second 5250 session will be with the system RALYAS4B.



The screenshot shows a window titled "5250 Emulation" with a menu bar (File, View, Options, Help) and a table of session configurations. The table has columns for Short Session Name, Long Session Name, Type, Partner LU, Mode, Keyboard, and Color. Two sessions are listed: Session A and Session B. Session B is highlighted with a grey background.

Short Session Name	Long Session Name	Type	Partner LU	Mode	Keyboard	Color
A	A	LT	RALYAS4A	QPCSUPP	ACSCENUS	5250COLR
B	B	LT	RALYAS4B	QPCSUPP	ACSCENUS	5250COLR

Figure 68. CM/2 5250 Emulation Sessions

Figure 68 on page 58 shows the final 5250 emulation configuration with one 5250 session to each AS/400 system.

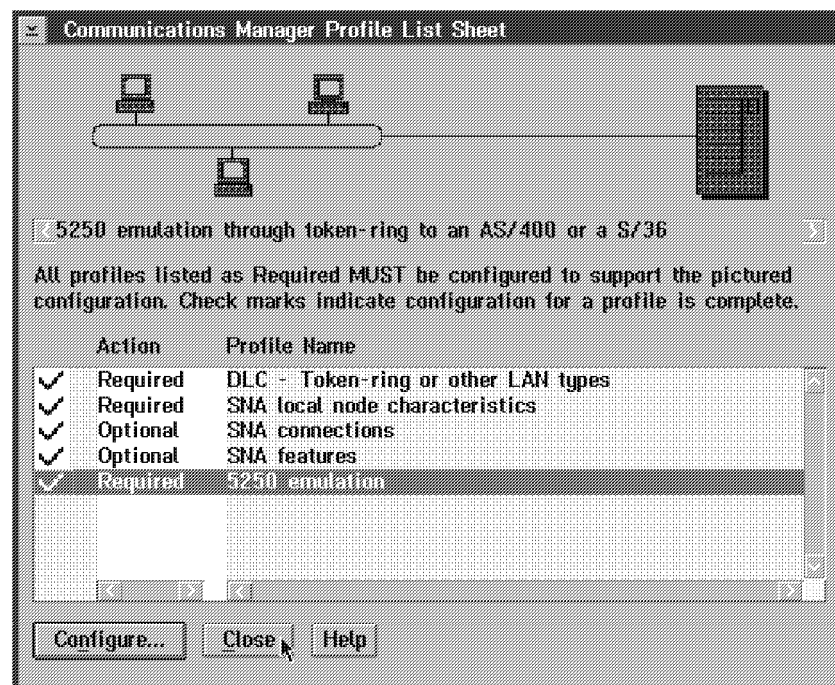


Figure 69. CM/2 Close Profile List Sheet

In Figure 69 on page 58, we **Close** the Communications Manager Profile List Sheet.

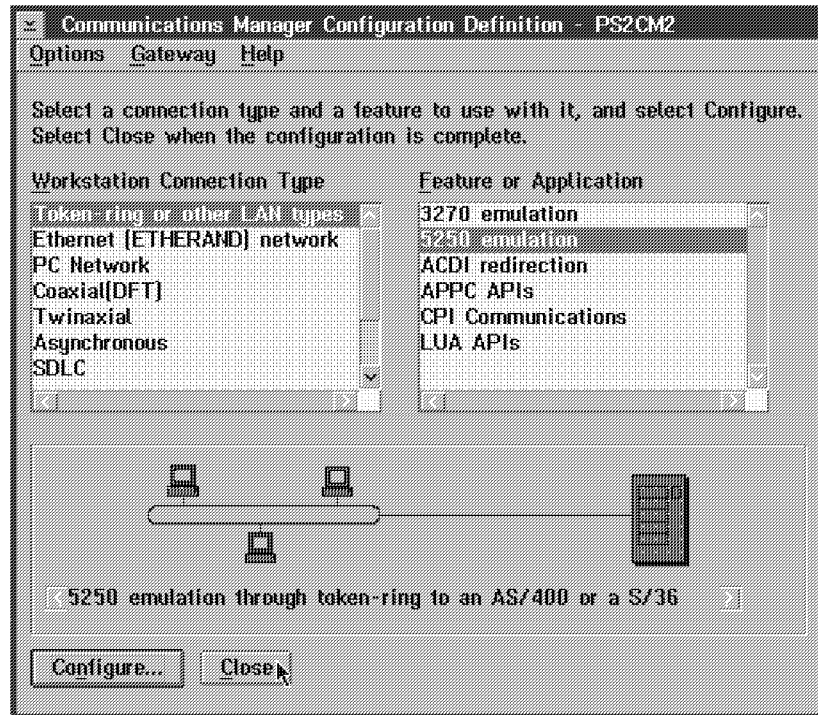


Figure 70. CM/2 Close Configuration Definition

In Figure 70 on page 59, we **Close** the Communications Manager Configuration Definition.



Figure 71. CM/2 Verification

Figure 71 on page 59 shows that the validation process takes place automatically as part of the exit process.

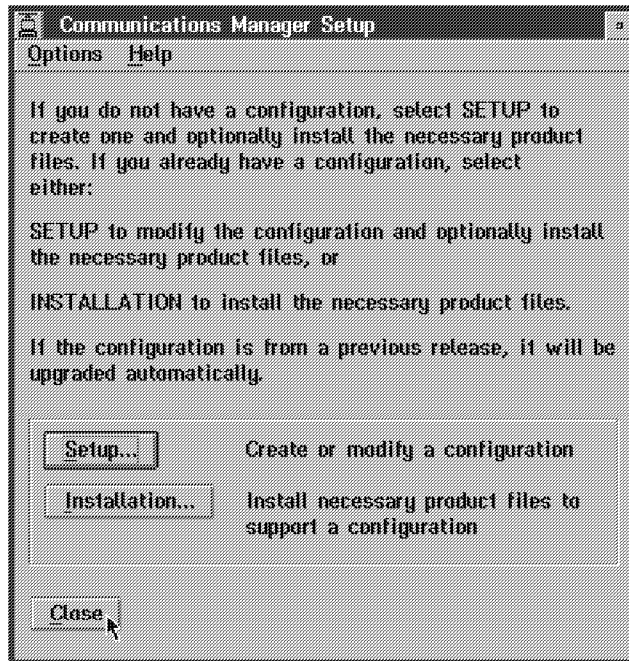


Figure 72. CM/2 Close Setup

In Figure 72 on page 60 we can now **Close** the Communications Manager Setup and shut down and restart our system. CM/2 will establish a connection with RALYAS4A. Using the connection network, a link will also be defined by the system for the connection to RALYAS4B. These links will be used for the 5250 emulation sessions we have defined.

2.2 Trace and Flow Analysis

An easy way to set up communications is to follow configuration examples. However, when the example has been followed and communication still fails, problem determination may depend upon a more detailed understanding of what is occurring across the communications line. The best way to form such an understanding is by looking at a trace and, for APPN, by looking at the respective APPN databases in each node.

In this section, we explore the available information of the traces and flows from the example network we have just set up. We attempt, as much as possible, to link what can be seen in the trace with the corresponding configuration definitions.

2.2.1 RALYAS4A (NN) to RALYAS4B (NN)

The first scenario we consider is the most basic: RALYAS4A and RALYAS4B as network nodes as in the scenario defined in 2.1.1, "RALYAS4A (NN) to RALYAS4B (NN)" on page 7. Please see Figure 73 on page 61.

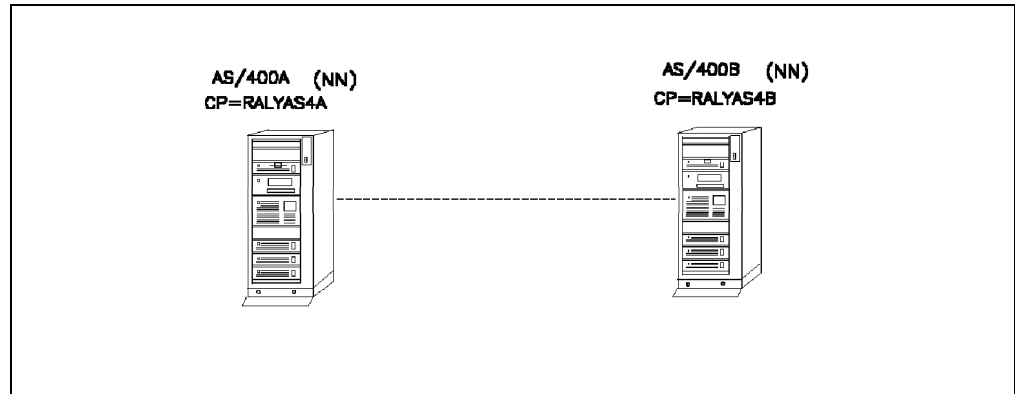


Figure 73. RALYAS4A (NN) to RALYAS4B (NN)

By looking at this basic scenario, we can discuss the bulk of the essential concepts and later expand by looking at other more complex scenarios. In this scenario, we:

- Examine topology and directory database information on the AS/400
- Discuss the SNA frame and reading an SNA trace
- Examine the APPN BIND
- Discuss adaptive pacing
- Examine CP-CP session initiation
- Discuss session-limit negotiation

2.2.1.1 AS/400 APPN Topology and Directory Databases

We begin by looking at the APPN databases in our AS/400s. There is a single command with which to look at APPN information: *DSPAPPNINF*. The options on this command determine what APPN information to look at:

1. The **TOPOLOGY* option displays APPN topology information (topology database).
2. The **LCLNODE* option displays APPN directory information (directory database).
3. The **SSN* option displays APPN session information.

Our RALYAS4A and RALYAS4B machines are often used for APPN testing in the ITSO Raleigh Center. Consequently, the directory and topology databases have a large number of entries. In order to see flows of topology updates in our traces, it is necessary to clean up the topology databases. One method of cleaning up the topology databases is to change the *nodetype* parameter in the network attributes of each AS/400 to **endnode* and, then, back again to **netnode*. This process clears the topology database because an end node's topology database does not contain information about network nodes and links between them. Thus, in the transformation from a network node to an end node, this topology information is cleared. The other method of clearing the topology database is to change the local net ID control point name in network attributes.

Topology Database Information: To check the topology information in RALYAS4A, we use the *DSPAPPNINF *TOPOLOGY *ALL* command to show the details of the topology database. The kind of information in RALYAS4B is, at this point, identical to that in RALYAS4A.

```

                                Display Nodes
                                System:  RALYAS4A
Position to  . . . . .          Control point
Network ID  . . . . .
Type options, press Enter.
5=Display link destination nodes

Control  Network  Node  Routing  Route Addition  Valid Routing
Opt  Point  ID     Type  Congestion  Resistance  Information
RALYAS4A  USIBMRA  *NN  Low        128        Yes        1

                                Bottom
F3=Exit  F5=Refresh  F6=Print information  F12=Cancel

```

Figure 74. AS/400 Screen Resulting from the DSPAPPNINF *TOPOLOGY *ALL Command

1 The only entry in RALYAS4A's topology database is for itself. At the time this screen is displayed, there are no links active and the topology database has just been cleared by the above method. If option 5 is taken from this screen to *display link destination nodes*, then we see that no link destinations exist; none have been activated since the topology database was cleared. Once links have been activated for the first time, any information gathered subsequently will remain in the topology database whether or not the link is active, and, in fact, whether or not the other nodes still exist in the network. There is of course no difference, from an APPN node's perspective, between a non-existent node and one which has never been activated.

To see information about which nodes in the topology database are currently active, the command *DSPAPPNINF *TOPOLOGY *ACTIVE* is used instead of the *DSPAPPNINF *TOPOLOGY *ALL*. In our case, there are no entries shown since RALYAS4A is not yet actively communicating with another node.

Directory Database Information: Next we look at the directory information in each node. It is possible to have directory information about local locations (local LUs) or about remote locations (remote or partner LUs). The command to use is *DSPAPPNINF *LCLNODE*. The following screen shows the local locations of RALYAS4A. These are the LU names to which RALYAS4A will positively respond if a search request is received by another node.

Display Local Locations		
		System: RALYAS4A
Local control point	:	RALYAS4A
Local network ID	:	USIBMRA
Position to	:	
Location	Type of Entry	2
AS4A	Home	
RALYAS4A	Cached	
RA0TNNB0	Home	
RA0TNNB1	Home	
RA0TNNB2	Home	
RA0TNNB3	Home	
T4A09L00	Home	
		Bottom
F3=Exit	F5=Refresh	F6=Print information F12=Cancel

Figure 75. AS/400 Screen Resulting from the DSPAPPNINF *LCLNODE Command

2 There are three types of location or LU entries in the directory database:

- LUs which have been entered on the local, or *home*, node. These include alternative location names for the local node or remote nodes.
- LUs which have been discovered by a previous search request and stored, or *cached*, in the local directory database.
- LUs which have been *registered* at an NN by ENs in its domain.

The screen above, taken from RALYAS4A, shows only the local LUs for RALYAS4A. They are mostly home location entries. These home entries have been entered into RALYAS4A's directory database via the local configuration list, using the *WRKCFGL *APPNLCL* command. The local CP, RALYAS4A, will respond positively to any search request for these local LUs. These entries remained in the directory database when the node type was changed to EN and back to NN. Unlike the topology database, an EN's directory database contains the same kind of information as an NN's (see note).

Note: An EN does not cache locations discovered during search processing like an NN does.

The entry for RALYAS4A reflects the fact that the CP name of the local node is automatically also an LU name. When the CP is defined for the local node, an entry for the LU name RALYAS4A is also cached in the local directory database.

Session Information: The final type of APPN information available is session information. Sessions may originate, end, or be routed through the local node.

The command is *DSPAPPNINF *SSN*, and there are options which may be used to specify whether the session information is for intermediate or end point sessions that are currently active, inactive or either. Some of the information available with this command is:

- A session's route through the network
- A session's formatted BIND

- A session's error data

For more information on the DSPAPPNINF command please refer to the *Communication: Advanced Peer-to-Peer Networking V2.2 Guide*, SC41-8188.

2.2.1.2 Reading an SNA Trace

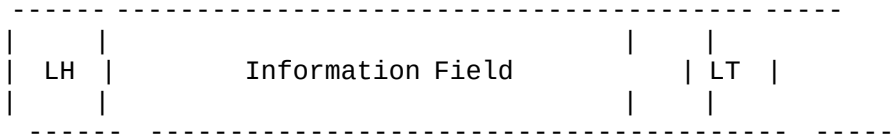
The traces we show in this section are taken from RALYAS4A. We have segmented the trace into four logical sections:

1. XID exchange
2. Session establishment including APPN flows
3. A search request with negative response
4. A search request with positive response

The first segment of the trace includes the Data Link Control information since XID exchange occurs at this level of SNA. However, for the remaining three portions of the trace, we show only the SNA information. This SNA information is formatted to some degree by the AS/400. It separates out the key portions of the SNA frame and translates any hexadecimal characters into displayable characters or replaces them by a point (.).

The information presented in an SNA trace will vary depending on the trace facility used to capture it. Some facilities, such as the AS/400 communications trace facility, automatically strip-off some of the DLC, while others present everything transmitted. The first difficulty to be encountered in reading an SNA trace may, then, simply be identifying what parts of the frame are present. Thus, before proceeding, we will pause briefly to examine the basic structure of an SNA frame. A knowledge of this structure makes it possible to, at least, determine what kind of information you are looking at in an SNA trace.

A frame is the basic unit for information exchange via SNA. It provides a defined format by which the information may be exchanged. An SNA frame has the following generic format:



LH = Link Header
LT = Link Trailer

Figure 76. Generic SNA Frame

The Link Trailer: A link trailer carries only the flag at the end and, before the flag, a Frame Checking Sequence (FCS) field. The FCS carries information generated by a calculation performed at the sending node on the information in the frame being sent. By performing the same calculation, the receiver can determine whether or not the frame has been received correctly.

The Link Header: The link header may be broken into three smaller segments.

1. Flag

The flag is one byte long. Every SNA frame begins and ends with the same flag: always X'7E'. Most trace facilities these days will, at least, separate the frames for you by looking for these bytes, that is a bit string of B'01111110'. In fact, a more likely bit string is B'011111101111110' which indicates the end of one frame and the beginning of another (since the last '0' of the first frame and the beginning of the next frame may be shared).

2. Address field

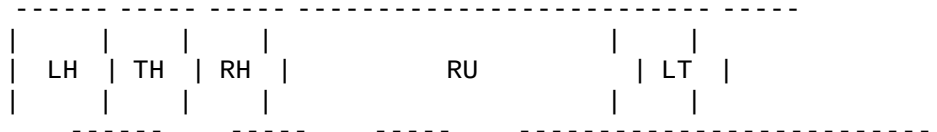
The second segment of the LH carries addressing information and is one byte long.

3. Control field

The third segment carries control information and may be one byte (for modulo 8) or two bytes long (for modulo 128). The control field represents a DLC command. The DLC commands provide the link-level housekeeping at a low level. For example, link initialization or disconnection establishes whether there will be one control byte or two (modulo 8 or 128 - modulo 8 allows 7 frames to be sent without a response, modulo 128 allows 127 frames to be sent), or rejects a frame if it is not received correctly and so on. For a list of the DLC commands please refer to the *SNA Formats Manual*, GA27-3136.

Some DLC commands carry other information which is contained in the information field. For example, a frame reject carries with it information about why a particular SNA frame was rejected. Another example is that of an XID frame. A control field of X'AF' or X'BF' indicates that the DLC command is an XID. The information in the I-field of an XID frame is used in order for APPN or LEN end nodes to recognize each other. We discuss the information exchanged at XID in conjunction with the first section of the trace.

The Information Field (TH,RH,RU): If the SDLC command indicates that higher-level SNA information is present in the I field, then the frame may now be interpreted to look as follows (the information field may be broken into three segments):



LH = Link Header
LT = Link Trailer
TH = Transmission Header
RH = Request or Response Header
RU = Request or Response Unit

Figure 77. SDLC Frame

Having come this far in our examination of the SNA frame, it may or may not be comforting to know that most of what has been discussed so far is usually interpreted by contemporary trace facilities. The DLC trace we show later, in fact, interprets all of this information for us. We don't see the LT or the LH in our trace. However, this is not always the case, and a basic understanding of how to separate out an SNA frame is valuable. Having the SNA formats manual mentioned above is essential.

In order to interpret the higher-level information contained in the I field, that is the TH, RH and RU, it is helpful to first locate the TH. The Transmission Header (TH) follows immediately after the data link control (DLC) information and, for APPN or LEN end nodes is a FID2; the first hexadecimal character or half-byte of a TH is X'2'.

A TH for a FID2 is six bytes (12 half bytes or hexadecimal characters) in length. Immediately following the TH is the request header (RH) which is three bytes in length. Following the RH is the request or response unit (RU). The RU can contain SNA commands, a sense code in case of negative response, or user data. In particular, the RU is where most of the APPN information is found and will be of most interest to us in this section.

Note: Numbering for bytes and bits of an SNA frame begins with "0". The first byte is byte zero, the second byte is byte one and so on. Similarly, the first bit of a byte (which, by the way, is the left hand bit of the byte) is bit zero. Bit zero is the high-order bit, that is, it has a value of 8. Bit one has a value of 4, bit two a value of 2 and bit three a value of 1.

We now look at the XID exchange which occurs between two AS/400 network nodes. The trace shown in Figure 78 on page 67 is taken from RALYAS4B. Specifying "Format SNA data only" as "N" gives us the DLC information shown. In the trace shown in Figure 79 on page 70, "Format SNA data only" is specified as "Y". The DLC information is then omitted, and the SNA information presented in a more formatted manner.

COMMUNICATIONS TRACE	Title: XID3	01/05/93 14:51:13	Page:	1
Trace Description	XID3			
Configuration object	L31TR			
Type	1	1=Line, 2=Network Interface		
Object protocol	TRN			
Start date/Time	01/05/93 14:47:15			
End date/Time	01/05/93 14:49:54			
Bytes collected	21321			
Buffer size	4	1=128K, 2=256K, 3=2048K 4=4096K, 5=6144K, 6=8192K		
Data direction	3	1=Sent, 2=Received, 3=Both		
Stop on buffer full	N	Y=Yes, N=No		
Number of bytes to trace				
Beginning bytes	*CALC	Value, *CALC		
Ending bytes	*CALC	Value, *CALC		
Controller name	RALYAS4A	*ALL, name		
Data representation	2	1=ASCII, 2=EBCDIC		
Format SNA data only	N	Y=Yes, N=No		
Format RR, RNR commands	N	Y=Yes, N=No		
Format TCP/IP data only	N	Y=Yes, N=No		
Format UI data only	N	Y=Yes, N=No		
Format MAC data only	N	Y=Yes, N=No		
Format Broadcast data	Y	Y=Yes, N=No		
COMMUNICATIONS TRACE	Title: XID3	01/05/93 14:51:13	Page:	2
Record Number	Number of record in trace buffer (decimal)			
S/R	S=Sent R=Received M=Modem Change			
Data Length	Amount of data in record (decimal)			
Record Status	Status of record			
Record Timer	Time stamp (Seconds, 100 millisecond resolution, decimal). Range is 0 to 6553.5 seconds			
Data Type	EBCDIC data, ASCII data or Blank=Unknown			
Controller name	Name of controller associated with record			
Command	Command/Response information			
Number sent	Count of records sent			
Number received	Count of records received			
Poll/Final	ON=Poll for Commands, Final for Responses			
Destination MAC Address	Physical address of destination			
Source MAC Address	Physical address of source			
DSAP	Destination Service Access Point (Logical address of destination)			
SSAP	Source Service Access Point (Logical address of source)			
Frame Format	LLC (Logical Link Control) or MAC (Media Access Control)			
Commands/Responses:				
I	Information			
RR	Receive Ready			
RNR	Receive Not Ready			
REJ	Reject			
UI	Unnumbered Information			
UA	Unnumbered Acknowledgment			
DISC	Disconnect/Request Disconnect			
TEST	Test			
SIM	Set Initialization Mode			
FRMR	Frame Reject			
DM	Disconnected Mode			
XID	Exchange ID			
SABME	Set Asynchronous Balanced Mode Extended			
*****	Command/Response Not Valid			

Figure 78 (Part 1 of 2). DLC Trace up to CP-CP Session Establishment

COMMUNICATIONS TRACE				Title: XID3		01/05/93 14:51:13		Page:					
Record Number	S/R	Data Length	Record Timer	Data Type	Controller Name	Destination MAC Address	Source MAC Address	Frame Format	Command	Number Sent	Number Received	Poll Final	DSAP SSAP
131	S	0	877.9	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	XID			OFF	04 04
132	R	0	877.9	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 05
133	R	80	877.9	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 04
Data . . . : 3250056150780000000A000000000000000010B700007CA0000000007000E *.&./&.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F6C5F5F0F1F0F0F0F1F5F0F7F846050580000000 *6E50100015078.....													
134	S	80	878.0	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	XID			OFF	04 04
Data . . . : 3250056155330000800A08000000000001010B700007CA0000000007000E *.&./&.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C21017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F4C5F2F0F1F0F0F0F1F5F5F3F346050580000000 *4E20100015533.....													
135	R	80	878.0	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 05
Data . . . : 325005615078000000F6C8000000000015010B700007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F6C5F5F0F1F0F0F0F1F5F0F7F846050580150000 *6E50100015078.....													
136	S	80	878.3	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	XID			OFF	04 05
Data . . . : 3250056155330000800A08000000000001010B700007CA0000000007000E *.&./&.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C21017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F4C5F2F0F1F0F0F0F1F5F5F3F346050580000000 *4E20100015533.....													
137	R	80	878.3	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 04
Data . . . : 325005615078000000F6C8000000000015010B700007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F6C5F5F0F1F0F0F0F1F5F0F7F846050580150000 *6E50100015078.....													
138	S	80	878.4	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	XID			OFF	04 04
Data . . . : 325005615533000080F6C8000000000001010B700007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C21017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F4C5F2F0F1F0F0F0F1F5F5F3F346050580010000 *4E20100015533.....													
139	R	80	878.4	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 05
Data . . . : 325005615078000000F6C8000000000015010B400007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F6C5F5F0F1F0F0F0F1F5F0F7F846050580150000 *6E50100015078.....													
140	S	80	878.7	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	XID			OFF	04 05
Data . . . : 325005615533000080F6C800000000001010B500007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F4C5F2F0F1F0F0F0F1F5F5F3F346050580010000 *4E20100015533.....													
141	R	80	878.7	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	XID			OFF	04 04
Data . . . : 325005615078000000F6C80000000000010B400007CA0000000007000E *.&./&....6H.....													
11F4E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C11017F1161101130011F9F4F0 *.4USIBMRA.RALYAS4A...1.....940*													
F6C5F5F0F1F0F0F0F1F5F0F7F846050580150000 *6E50100015078.....													
142	S	0	878.7	EBCDIC	RALYAS4A	400010020001	400010020002	LLC	SABME			OFF	04 04
143	R	0	878.7	EBCDIC	RALYAS4A	400010020002	400010020001	LLC	UA			OFF	04 05

Figure 78 (Part 2 of 2). DLC Trace up to CP-CP Session Establishment

The DLC plays an important role for type APPN or LEN end nodes and, in particular, for APPN nodes. As already mentioned, the DLC which flows between AS/400s when control units are activated, that is when a connection is requested, includes addressing information (token-ring addressing information in our case) and XID exchange.

2.2.1.3 The Null XID

A null XID is an XID frame without an information (I) field. The first XID exchange we see, in frames 131 and 132 of the trace, is a *null XID*. Null XID is sent in order to determine the kind of exchange identification of which the other node is capable. APPN or LEN end nodes conform to an XID3 format. An APPN or LEN end node, on receipt of an null XID, will respond with an XID3, declaring its APPN node ability.

Note: We have omitted from the trace the test frames which each of the nodes send in order to establish initial knowledge of the presence of other nodes in the network. Recall also that an X'AF' or X'BF' in the control field of the LH indicates that the frame is an XID frame. However, we do not see these values since the AS/400 has interpreted them for us.

2.2.1.4 The XID3

For APPN or LEN end nodes, the XID format is 3 (XID3). The XID3 indicates, among other things, whether CP-CP sessions are required or supported by each of the nodes. The successful link activation causes each node or *control point (CP)* to initiate a CP-CP session with the other CP by sending a BIND. CP-CP sessions are always initiated in pairs, in order to enable APPN information to flow quickly across the session over which the sending CP has control. This session is referred to as that CP's *contention winner* session. The session over which a CP has no control is referred to as the *contention loser* session.

Frame 133 shows an XID3 being received by RALYAS4B. The two half-bytes of byte 0, X'32' indicate, respectively, that the XID format is 3 and that the sending node is a node type 2. Byte 1 is the length of the XID frame and is followed by the node ID. The node ID includes the block ID of 3 half-bytes (nibbles) length and the ID number of 5 nibbles length. For the AS/400, the block ID is always 056. The XID carries within its bit sequence information about, for example, the APPN node type of the sending node (byte 9, bit 1), its requirement for ACTPU or not (byte 9, bit 0) and its CP-CP session support and requirements (byte 9 bits 2 and 3). Please refer to a current version of the *SNA Formats Manual*, GA27-3136, for a more detailed explanation of the information carried in the bits of an XID3 frame.

Also contained in the XID3 is its *exchange state*. The *exchange state indicator* is carried in bits 4 and 5 of byte 9. The data in the AS/400 trace is presented to us in hexadecimal format. In many situations it is not necessary to decode this further, since the SNA Formats Manual will describe certain whole or half bytes in hexadecimal. Frame 133 byte 0, X'32' indicates an XID type 3 and node type 2 is one example. Sometimes more detail can be found by expanding the hexadecimal values given in the trace to a binary value. The binary system is the one used by computers at their lowest level to perform calculations. The only available units are 0 and 1. The binary system uses base 2. Let's look at byte 9; in hexadecimal byte 9 is X'0A'. If we convert this to binary it becomes B'00001010'. The bits 4 and 5 show the exchange state. There are two XID phases or states, prenegotiation (B'10') and negotiation-proceeding (B'01'), which are indicated by these bits. The early XID3 exchanges are known as the *prenegotiation XID3* exchanges. Information exchanged at this time include an EN's requirement for NN services and the CP names are exchanged. Later XID3 exchanges are known as *negotiation-proceeding XID3* exchanges.

Frames 142 and 143 show SABME and UA being exchanged, indicating that the two nodes have established a link connection, and are now ready to continue communicating at higher levels of SNA. With that as introduction, let's now examine some traces containing higher-level SNA information.

```

COMMUNICATIONS TRACE      Title: TRA CE OF NN TO NN
01/05/93 14:50:09      Page: 1
Trace Description . . . . . NN to NN Session Establishment
Configuration object . . . . . L31TR
Type . . . . . 1      1=Line, 2=Network Interface
Object protocol . . . . . TRN
Start date/Time . . . . . 01/05/93 14:47:15
End date/Time . . . . . 01/05/93 14:49:54
Bytes collected . . . . . 21321
Buffer size . . . . . 4      1=128K, 2=256K, 3=2048K
                                4=4096K, 5=6144K, 6=8192K
Data direction . . . . . 3      1=Sent, 2=Received, 3=Both
Stop on buffer full . . . . . N      Y=Yes, N=No
Number of bytes to trace
Beginning bytes . . . . . *CALC      Value, *CALC
Ending bytes . . . . . *CALC      Value, *CALC
Controller name . . . . . RALYAS4A      *ALL, name
Data representation . . . . . 2      1=ASCII, 2=EBCDIC
Format SNA data only . . . . . Y      Y=Yes, N=No
Format RR, RNR commands . . . . . N      Y=Yes, N=No
Format TCP/IP data only . . . . . N      Y=Yes, N=No
Format UI data only . . . . . N      Y=Yes, N=No
Format MAC data only . . . . . N      Y=Yes, N=No
Format Broadcast data . . . . . Y      Y=Yes, N=No
COMMUNICATIONS TRACE      Title: TRACE OF NN TO NN      01/05/93 14:50:09
Record Number . . . . . Number of record in trace buffer (decimal)
S/R . . . . . S=Sent R=Received M=Modem Change
Controller name . . . . . Name of controller associated with record
Data Type . . . . . EBCDIC data, ASCII data or Blank=Unknown
SNA Data . . . . . TH, RH and RU for record
TH . . . . . Transmission Header
RH . . . . . Request/Response Header
RU . . . . . Request/Response Unit
TH Parameter Descriptions:
FID . . . . . Format Identification
MPF . . . . . Mapping Field (segment of Basic Information
Unit (BIU) - ONLY, FIRST, MIDDLE, LAST)
OAF . . . . . Origination Address Field
DAF . . . . . Destination Address Field
SNF . . . . . Sequence Number Field
DCF . . . . . Data Count Field
LA . . . . . Local Address
ODAI . . . . . OAF-DAF Assignor Indicator
EFI . . . . . Expedited Flow Indicator
LU . . . . . Logical Unit
SSCP . . . . . System Services Control Point
PU . . . . . Physical Unit
RH Parameter Descriptions:
REQ . . . . . Request
RSP . . . . . Response
RH Category Descriptions:
NC . . . . . Network Control
SC . . . . . Session Control
DFC . . . . . Data Flow Control
NC . . . . . Network Control
FMD . . . . . Function Management Data
FMH . . . . . Function Management Header
RH Indicators:
FI . . . . . Format Indicator
SDI . . . . . Sense Data Included Indicator
BCI . . . . . Begin Chain Indicator
ECI . . . . . End Chain Indicator
DR1 . . . . . Definite Response 1 Indicator
DR2 . . . . . Definite Response 2 Indicator
ERI . . . . . Exception Response Indicator
RTI . . . . . Response Type Indicator
QRI . . . . . Queued Response Indicator
EBI . . . . . End Bracket Indicator
CDI . . . . . Change Direction Indicator
PI . . . . . Pacing Indicator
BBI . . . . . Begin Bracket Indicator
CSI . . . . . Code Selection Indicator
EDI . . . . . Enciphered Data Indicator
PDI . . . . . Padded Data Indicator
CEBI . . . . . Conditional End Bracket Indicator
RLWI . . . . . Request Larger Window Indicator

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Page: 2

Figure 79 (Part 1 of 4). SNA Formatted Trace of AS/400 to AS/400 APPN Traffic

COMMUNICATIONS TRACE				Title: TRACE OF NN TO NN	01/05/93 14:50:09	Page:
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
150	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI		
			RU Command	: BIND		
			RU Data	: 31001307B0B051B300787868687070602000000000000000023000010E4E2 *.....GFFG..... C9C2D4D9C14BD9C1D3E8C1E2F4C126000802C3D7E2E5C3D4C70903017820 *IBMRA.RALYAS4A....CPSVCMG... E03700004D1104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C10010E4E2C9C2D4 *....(..USIBMRA.RALYAS4A..USI D9C14BD9C1D3E8C1E2F4C26019F64B0D2BC89E105D10E4E2C9C2D4D9C14B *RA.RALYAS4B-.6...H...).USIBMR D9C1D3E8C1E2F4C12C090407C3D7E2E5C3D4C7 *RALYAS4A....CPSVCMG *		
153	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=00, OAF'=01, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000001 *.... *		
161	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1		
			RU Command	: BIND		
			RU Data	: 31001307B0B051B3008086868000006020000000000000000230000001F00 *.....FF..... 0802C3D7E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *..CPSVCMG....USIBMRA.RALYAS 00006019F64B0D2BC89E105D10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1 *..-6...H...).USIBMRA.RALYAS4A		
163	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('0B9520'X) REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI		
			RU Command	: FMH- 5=110502FF0003D000000422F0F0F1000000 *.....}....001... *		
			RU Data	: 000C12C100000014F6840000 *...A....6D.. *		
167	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI		
			RU Command	: BIND		
			RU Data	: 31001307B0B051B300787868687070602000000000000000023000010E4E2 *.....GFFG..... C9C2D4D9C14BD9C1D3E8C1E2F4C226000802C3D7E2E5C3D4C7090301782E *IBMRA.RALYAS4B....CPSVCMG... FC4F4000041104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20010E4E2C9C2D4 *.. ...USIBMRA.RALYAS4B..USI D9C14BD9C1D3E8C1E2F4C16019F64B0D2EC89E1EA410E4E2C9C2D4D9C14B *RA.RALYAS4A-.6...H...U.USIBMR D9C1D3E8C1E2F4C22C090407C3D7E2E5C3D4C7 *RALYAS4B....CPSVCMG *		
169	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=00, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000001 *.... *		
170	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1		
			RU Command	: BIND		
			RU Data	: 31001307B0B051B3008086868000006020000000000000000230000001F00 *.....FF..... 0802C3D7E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1 *..CPSVCMG....USIBMRA.RALYAS 00006019F64B0D2EC89E1EA410E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *..-6...H...U.USIBMRA.RALYAS4A		
173	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000002 *.... *		
175	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0001 RH : ('0B9520'X) REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI		
			RU Command	: FMH- 5=110502FF0003D000000422F0F0F1000000 *.....}....001... *		
			RU Data	: 000C12C100000012F6840000 *...A....6D.. *		
177	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000002 *.... *		
178	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0001 RH : ('039501'X) REQ FMD, BCI, ECI, DR1, ERI, RLWI, PI, CEBI		
			RU Data	: 000C12C100000014F6840000 *...A....6D.. *		
181	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000002 *.... *		
187	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('039501'X) REQ FMD, BCI, ECI, DR1, ERI, RLWI, PI, CEBI		
			RU Data	: 000C12C100000012F6840000 *...A....6D.. *		
189	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI		
			RU Data	: 000002 *.... *		
191	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0002 RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI		
			RU Command	: FMH- 5=110502FF0003D000000422F0F0F4000000 *.....}....004... *		
			RU Data	: 005C12C20A800000001500000012154410E4E2C9C2D4D9C14BD9C1D3E8C1 *..*..B.....USIBMRA.R E2F4C100000C450A80000000280003300174615800110E4E2C9C2D4D9C1 *S4A.....USIBM 4BD9C1D3E8C1E2F4C2001647000000108076000000000000000014C0080 *..RALYAS4B.....< 8080 *..		

Figure 79 (Part 2 of 4). SNA Formatted Trace of AS/400 to AS/400 APPN Traffic

195	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI		
		RU Data		: 000002	*...		*
197	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI	ODAI=0, DAF'=01, OAF'=01, SNF'=0002		
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.....}....004...		*
		RU Data		: 005C12C20A800000001700000014154410E4E2C9C2D4D9C14BD9C1D3E8C1 E2F4C200000C450A80000000280003300174615800110E4E2C9C2D4D9C1 4BD9C1D3E8C1E2F4C1001647000000E80760000000000000014C0080 8080	*..B.....USIBMRA.RALY *S4B.....USIBMRA *..RALYAS4A.....<..*		
199	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=0, DAF'=01, OAF'=01, SNF'=0000, EFI		
		RU Data		: 000002	*...		*
201	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI	ODAI=1, DAF'=01, OAF'=01, SNF'=0003		
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.....}....004...		*
		RU Data		: 005012C20A800000001600000015154410E4E2C9C2D4D9C14BD9C1D3E8C1 E2F4C20000174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1001647 0000000E8076000000000000000014C00808080	*..B.....USIBMRA.RALY *S4B.....USIBMRA.RALYAS4A... *.....<.....*		
203	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI	ODAI=0, DAF'=01, OAF'=01, SNF'=0003		
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.....}....004...		*
		RU Data		: 005012C20A800000001800000017154410E4E2C9C2D4D9C14BD9C1D3E8C1 E2F4C10000174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2001647 00000010807600000000000000000014C00808080	*..B.....USIBMRA.RALY *S4A.....USIBMRA.RALYAS4B... *.....<.....*		
223	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI	ODAI=0, DAF'=02, OAF'=01, SNF'=0000, EFI		
		RU Command		: BIND			
		RU Data		: 31001307B0B051B300787868687070602000000000000009023000010E4E2 C9C2D4D9C14BD9C1D3E8C1E2F4C227000902E2D5C1E2E5C3D4C709030178 2F0E3200006B1104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20010E4E2C9C2 D4D9C14BD9C1D3E8C1E2F4C16019F64B0D2EC89E1EA510E4E2C9C2D4D9C1 4BD9C1D3E8C1E2F4C22C0A04087BC3D6D5D5C3E32B1901011746158001 10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C100	*.....GFFG.....U *IBMRA.RALYAS4B....SNASVCMG.... *.....USIBMRA.RALYAS4B..USIB* *MRA.RALYAS4A-.6...H..V.USIBMRA* *..RALYAS4B...#CONNECT.....*		
225	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=0, DAF'=01, OAF'=00, SNF'=0000, EFI		
		RU Data		: 000001	*...		*
226	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('EB8000'X) RSP SC, FI, DR1	ODAI=0, DAF'=01, OAF'=02, SNF'=0000, EFI		
		RU Command		: BIND			
		RU Data		: 31001307B0B051B30080868680000060200000000000009023000002000 0902E2D5C1E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 C100006019F64B0D2EC89E1EA510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 2B190101174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C100	*.....FF..... *..SNASVCMG....USIBMRA.RALYAS4* *A...-6...H..V.USIBMRA.RALYAS4B* *.....USIBMRA.RALYAS4A.		
231	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('0B9520'X) REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI	ODAI=0, DAF'=02, OAF'=01, SNF'=0001		
		RU Command		: FMH- 5=0C0502FF0003D0000000206F1	*.....}....1		*
		RU Data		: 001912100200000000000000000040004000840404040404040	*.....		*
233	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=0, DAF'=01, OAF'=02, SNF'=0000, EFI		
		RU Data		: 000002	*...		*
237	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('039501'X) REQ FMD, BCI, ECI, DR1, ERI, RLWI, PI, CEBI	ODAI=0, DAF'=01, OAF'=02, SNF'=0001		
		RU Data		: 001912100A000000000000000040004000840404040404040	*.....		*
239	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI	ODAI=1, DAF'=01, OAF'=02, SNF'=0000, EFI		
		RU Command		: BIND			
		RU Data		: 31001307B0B051B3007878B8B87070602000000000000009023000010E4E2 C9C2D4D9C14BD9C1D3E8C1E2F4C127000902404040404040404009030178 2102A74000B91104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C10010E4E2C9C2 D4D9C14BD9C1D3E8C1E2F4C26019F64B0D2BC89E105E10E4E2C9C2D4D9C1 4BD9C1D3E8C1E2F4C12C0A01087BC3D6D5D5C3E32B1901011746158001 10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C200	*.....G..G.....U *IBMRA.RALYAS4A.... *..X...USIBMRA.RALYAS4A..USIB* *MRA.RALYAS4B-.6...H..IBMRA* *..RALYAS4A...#CONNECT.....*		
241	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=0, DAF'=02, OAF'=01, SNF'=0000, EFI		
		RU Data		: 000002	*...		*
243	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI	ODAI=0, DAF'=00, OAF'=01, SNF'=0000, EFI		
		RU Data		: 000001	*...		*
247	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('EB8000'X) RSP SC, FI, DR1	ODAI=1, DAF'=01, OAF'=02, SNF'=0000, EFI		
		RU Command		: BIND			
		RU Data		: 31001307B0B051B3008088880000060200000000000009023000002000 0902404040404040400203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 C200006019F64B0D2BC89E105E10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1 2B190101174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C200	*.....HH..... *..USIBMRA.RALYAS4* *B...-6...H..IBMRA.RALYAS4A* *.....USIBMRA.RALYAS4B.		

Figure 79 (Part 3 of 4). SNA Formatted Trace of AS/400 to AS/400 APPN Traffic

Figure 79 (Part 4 of 4). SNA Formatted Trace of AS/400 to AS/400 APPN Traffic

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2.2.1.5 The BIND

In frames 150 and 167 of the trace, we see each CP requesting CP-CP sessions with the other. In frame 150, AS400B, with CP name RALYAS4B, receives a request to establish a session, a BIND request, from AS400A with CP name RALYAS4A. A BIND carries a set of rules for a session. Once the rules are agreed upon, then the session is bound. In frame 167, RALYAS4B sends a BIND request to RALYAS4A. We will take a close look at the first BIND request.

Note: It would be instructional if, for the following discussion, you have the *SNA Formats Manual*, GA27-3136 available to which to refer.

Frame 150

Request Header (RH) : X'6B8100' 12

Formatted RH : REQ SC, FI, BCI, ECI, DR1, PI

```
BIND : 31001307|B0B051B3078786868707|0602|00000000000000090230000|10E4E2
      1                2                3 U S
      C9C2D4D9C14BD9C1D3E8C1E2F4C1|2600|0802|C3D7E2E5C3D4C7|0903|017820
      I B M R A . R A L Y A S 4 A 4 5 C P S V C M G
      E03700004D|1104|E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1|00|10E4E2C9C2D4
      6 U S I B M R A . R A L Y A S 4 A 7 U S I B M
      D9C14BD9C1D3E8C1E2F4C2|6019|F64B0D2BC89E105D|10E4E2C9C2D4D9C14B
      R A . R A L Y A S 4 B 8 9 10 U S I B M R A .
      D9C1D3E8C1E2F4C1|2C090407C3D7E2E5C3D4C7
      R A L Y A S 4 A 11 C P S V C M G
```

We use the symbol '|' in order to separate portions of the BIND.

1 The first byte, byte 0, of the RU, X'31', indicates that it is a BIND. Please refer to the *SNA Formats Manual*, for a list of the SNA commands which may be indicated by different hexadecimal values in the first byte or in the first three bytes of the RU.

12 We need to refer back to the first bit in the first byte of the RH to see whether the BIND command is a *request* for BIND or a *response* to a BIND request. In frame 150 of the trace, the first half-byte of the RH is a 6, which is binary 0110 and thus bit zero is 0. We have a BIND request. We need not examine the RH in our trace, however, since it has already been formatted by the AS/400. The characters REQ in the formatted trace indicate that the RU that follows is a request unit and, thus, that this is a BIND request. Similarly, for example, the characters PI at the end of the formatted RH indicate that the pacing indicator is set on. The pacing indicator bit is the last bit in the second byte of the RH. We will speak a little more about pacing later.

1 The second byte, byte 1, of the BIND request unit indicates whether the BIND is negotiable or not. The fact that the second half byte is zero indicates that it is negotiable. Thus, the two nodes may negotiate on the session rules before the session is bound.

1 Bytes 2 and 3 of the BIND will always be X'1307' for LU 6.2 binds. They indicate the Transmission Services (TS) and Function Management (FM) profiles that will be used in the session. TS Profile 7 and FM profile X'13' are always used for LU 6.2. Thus, in fact, the first 4 bytes of an LU 6.2 BIND are always the same; X'31001307'.

Many of the bytes which follow represent the rules by which each of the nodes will communicate across this particular session. 2 As an example, bytes 14 and 15 indicate the LU type for the session. Here, it is LU 6.2. 3 Also included is the primary LU name field. This field is always present since it gives the LU name from which the BIND is received. Its position is determined by the length of other information before it. In this BIND, it starts on byte 28. The byte preceding this, byte 27, indicates the length of the primary LU name. In this case the length is X'10', that is 16, the length of the network-qualified primary LU name "USIBMRA.RALYAS4A".

For more information on these details, please refer to the *SNA Formats*, GA27-3136.

4 Immediately following the primary LU name field comes any user data. The X'26' indicates the length of the user data and the X'00' indicates that structured subfields or control vectors are present within this user data. Structured subfields are not present at any particular position in the BIND, but are rather signaled by a hexadecimal key preceding it. We now look at some examples of the structured subfields in our BIND.

5 The first user data we see is the mode name. The X'02' control vector specifies the mode name. The X'08' value preceding the mode name indicates that the subfield's length is eight characters. Notice that the mode name specified is CPSVCMG. This is the reserved mode name used for establishing CP-CP sessions. It is useful to know about this mode since you can easily identify the presence of CP-CP sessions by checking if the mode CPSVCMG is active. On an AS/400, this mode should be active with two sessions started and it should be attached to the device description with local and remote locations as the respective CP names. If the device has been automatically created, then this device has the same name as the remote CP.

6 The next user data we point out is the user-data subfield given by the X'04' key; preceded by its length X'11'. This is the network-qualified primary LU name, "USIBMRA.RALYAS4A".

We see this now for the second time. Later, in the extended portion of the BIND 10 , we will see it for a third time. The reason for what appears to be redundancy is the result of three different architectures merging:

1. The first appearance of the LU name is the primary LU field (byte 28 here), used for subarea search. Originally, it was not network-qualified. Now, it's network-qualified.
2. The User Data subfield X'04' is used during the session setup phase to identify the session partner.
3. The third occurrence, in the FQPCID (see 8 below), is the network-qualified CP name of the BIND sender, not necessarily the primary LU name. This was added as part of the APPN architecture development.

Usually you will see all fields with the same value, especially if they are sent by or to an AS/400. Typically the AS/400 will only have one LU and its name will be the same as the CP name. But this is not always the case. It is possible for the AS/400 to have multiple LUs, so that the CP name of the BIND sender (3 above) and the primary LU name (2 above) are different. Moreover, the primary LU name field (1 above) is usually the same as the name given in the X'04' subfield.

However, it is possible for it to be changed as it travels through the subarea (with SNI, for example), and, thus, be a different value.

7 The next field we discuss after the user data is the secondary LU field. The X'10' vector indicates the length, 16 bytes, of the name of the secondary LU, "USIBMRA.RALYAS4B".

When establishing APPN sessions, however, an extended BIND is used since there is more information which may be sent in an APPN BIND. An extended BIND is signified by the fact that byte 7, bit 6, of the BIND is turned on. The extended BIND begins after the network-qualified secondary LU field, and is flagged by an X'60' vector 8. This vector is the fully qualified Procedure Correlation Identifier (FQPCID) control vector. The FQPCID is used to uniquely identify a session which flows via many nodes in a network. The first two bytes, 0 and 1, of the FQPCID vector is the vector header. Bytes 2 to 9 are the unique FQPCID value 9. From byte 11 of the FQPCID vector comes, preceded by its length in byte 10, the network-qualified CP name of the node initiating the session setup procedure 10. The last control vector in this BIND is the Class Of Service (COS) control vector 11 (flagged by the X'2C'). The COS name specified for CP-CP sessions is CPSVCMG.

2.2.1.6 Pacing

APPN nodes may use *adaptive pacing*. Adaptive pacing is a means by which nodes can tell each other how much data they are capable of receiving. They do this by sending each other a pacing message whenever necessary.

Frame 153 is a pacing message. It indicates the number of requests that may be sent to RALYAS4B at a time; this number is referred to as the *window size*. A pacing message is identified by the RH being coded as X'830100'. Following the RH is a 3-byte RU. The last byte of the RU indicates the window size. In frame 153, RALYAS4B sets the window size it is capable of receiving. In frame 169, RALYAS4A sets its window size. The window sizes may be changed at any time during the session depending on buffer or other requirements at either node.

2.2.1.7 CP-CP Session Initiation

In frames 161 and 170, respectively, BIND responses are exchanged. Thus, the rules have been agreed upon for the two CP-CP sessions and they are activated. The two CPs are now able to inform each other about relevant APPN information (for example CP-capabilities). This CP-CP session is only available for APPN information. We will later see in the trace another BIND being agreed upon for a user session, in that case Display Station Pass-Through.

Note: Because there are two sessions established, the frame ordering in the trace may not be easy to follow. For example, frame 161 shows RALYAS4B's response to the BIND request from RALYAS4A. Thus, it is possible for information to flow on this session before RALYAS4B has sent its BIND request to RALYAS4A. Indeed, RALYAS4B receives another request in frame 163 before it sends the BIND request in frame 167.

The first APPN information exchanged between the nodes is their capabilities as CPs (for example, whether they are end nodes or network nodes).

Each CP requests the CP capabilities of the other across the CP-CP session which they begin their contention winner session. Frame 163 of the trace shows such a request for the CP capabilities of RALYAS4B. Below, we format frame 163 further and look more closely at it.

Frame 163

Request Header (RH) : X'0B9520'

Formatted RH : REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI

APPC ATTACH : 1105|02FF|0003D00000|0422F0F0F1|000000
(FMH-5) 1 2 3

CP Capabilities : 000C12C1000000014F6840000
(GDS Variable) 4

We know that this frame is a request because byte 0, bit 0 of the RH is off. The formatted trace also indicates that it is a request by using the characters "REQ". Following REQ in the formatted RH are the characters "FMD". These characters indicate that the RU will contain function management (FM) data. APPN makes liberal use of function management data. In particular, the *function management header type 5 (FMH-5)*, along with *GDS variables (see below)*, are keys to the APPN architecture. The FMH-5 carries an LU 6.2 ATTACH. When an allocate, or in AS/400 terms an EVOKE, is issued by an APPC program, the ATTACH carries the transaction program name to be started at the remote system. Thus, we see the reason why APPC is a prerequisite for using APPN.

The previous RHs in the trace indicated that the following RU would contain session control (SC) data since sessions were being started. For more information on the specific meaning of bits in the RH, please refer to the *SNA Formats*, GA27-3136.

1 The first byte of the FMH-5 indicates its length (here 11 bytes). The second byte indicates the fact that it is an FMH type 5.

2 The next two bytes are the command code for an ATTACH.

3 By referring to the *SNA Formats Manual*, GA27-3136, it can be determined where the application name is specified in the ATTACH. Its position varies depending on what information is present or absent. In this ATTACH, the application name is X'22F0F0F1', an SNA service transaction program (STP) with an explicit meaning. With a user APPC program, the application name will be whatever is specified by the user. Here, the SNA-defined program with name X'22F0F0F1' will be started in the node which receives the ATTACH.

The transaction program (TP) X'22F0F0F1', once started by a remote CP, will send the CP capabilities of the local CP to the requesting CP. Thus, this frame shows CP RALYAS4A requesting from CP RALYAS4B its CP capabilities.

4 There is more information in this frame, however. After the FMH-5 ATTACH, comes another chunk of data. It is a GDS variable. APPN uses the ATTACH to start the appropriate application, as already mentioned, and GDS variables to carry the information. In this frame then, RALYAS4A both requests the CP capabilities of CP RALYAS4B and also sends information about its own CP capabilities. It uses the X'12C1' GDS variable to carry the CP capabilities information. Looking more closely at the GDS variable in this frame, we see its length in the first two bytes. Until we read further into the frame, we don't know yet what it is. The next two bytes specify the type of GDS variable we have. We, thus, know that it is a GDS variable and the type is X'12C1'. An X'12C1' is

defined in SNA as a CP capabilities GDS variable. The remaining bits act as support indicators thus describing the capabilities of the CP. For example, byte 8 bits 0, 1 and 2 indicate the node type. In this frame, these bits are set to "111" (byte 8 is X'F') meaning that the CP is a network node. If these bits were set to "100" then this would indicate that the CP was an end node. There are four capabilities exchanged here and we will not discuss them in detail.

Note: Recall that the node type is actually communicated earlier than at the CP_CAPS exchange; it occurs at XID3 exchange. The node type specified in the X'12C1' variable is, in fact, not used.

In frame 187 now, we see RALYAS4B respond to the CP capabilities request of RALYAS4A. Notice that there is no ATTACH required since RALYAS4B itself was attached by the partner program on CP RALYAS4B. Notice also that the GDS variable sent is identical to that sent by RALYAS4A. The two CPs have the same capabilities. In particular, they are both network nodes.

In frame 175, we see RALYAS4B requesting the CP capabilities of RALYAS4A. In fact, the CPs exchange their capabilities twice, once for each CP-CP session established. The partner CP is not considered to be enabled unless the local CP has received the partner's CP capabilities on the conwinner session. RALYAS4A responds in frame 178.

2.2.1.8 Topology Database Updates

In frame 191 we see another ATTACH and another GDS variable type. This is used for exchange topology information. The program allocated by the ATTACH is X'22F0F0F4' and the GDS variable type is X'12C2'. RALYAS4A is now allocating the RECEIVE_TDU_TP (topology database update program) in RALYAS4B and is sending a *topology database update (TDU)*. RALYAS4A is informing RALYAS4B about all of the topology information in its topology data base. We know from our earlier discussion that each CP currently only knows about itself. Let's investigate frame 191 more closely.

Frame 191

ATTACH : 1105|02FF|0003D0000000422F0F0F4000000
(FMH-5)

```

TDU  : 005C|12C2|0A80|00000015000000012|1544|10E4E2C9C2D4D9C14BD9C1D3E8C1
          1      6              2      U S I B M R A . R A L Y A

          E2F4C10000|0C45|0A80|0000000280003300|1746|1580|0110E4E2C9C2D4D9C1
          S 4 A      3              4      U S I B M R A

          4BD9C1D3E8C1E2F4C200|1647|00000010807600000000000000000014C0080
          . R A L Y A S 4 B      5

          8080

```

1 The GDS variable type is X'12C2' which is the topology database update (TDU) GDS variable. Within this variable we find the following control vectors or subfields: 2 The Mode Descriptor control vector (X'44'), flags the beginning of information about a particular node. All subfields which follow are assumed to contain information about this node. That is until another X'44' is received. Here there is only one node known to RALYAS4A, which is itself, so there is only one X'44'. 3 The Node Characteristics control vector X'45', carries the CP capabilities of the node specified in the X'44' control vector. The capabilities

encoded here match those found in the network attributes of the CP. 4 The TG Descriptor control vector X'46' carries the transmission group (TG) information. In this case, RALYAS4A has a single TG to RALYAS4B. Inside the X'46' vector is a TG Descriptor subfield (X'80'). The first two bytes of the X'80' subfield indicate its length and type. The next byte, byte 2, shows the TG number for this link, 01 in this case. Byte 3 is the length (X'10'=16) of the CP at the other end of TG 01, "USIBMRA.RALYAS4B". 5 The TG Characteristics control vector (X'47'), carries the link characteristics for this TG (TG 01, in this case). These characteristics will match those specified in the line description.

All of this information is sent from RALYAS4A to RALYAS4B in this TDU. RALYAS4A had this information in its database after extracting it from the line description and network attributes. Now, every time a new node is added to the network, a TDU will flow from this new node, as we see in the frame just described. In addition, the node receiving the TDU, the adjacent node, will update its own topology database and forward the TDU to any adjacent CPs. In this way, the TDU is propagated around the network. In order to avoid the TDU being propagated indefinitely, it is assigned a Flow-Reduction Sequence Number (FRSN) per TDU and Resource Sequence Number (RSN) per Node Characteristics TDU control Vector (X'45').

The FRSN is flagged in the TDU by a Flow-Reduction Sequence Number control vector (X'80') 6 . This vector is not to be confused with the Node Type and Status Node Characteristics subfield X'80' which is carried inside the Node Characteristics TDU control vector (X'45'). The FRSN always appears first in a TDU and is checked by the adjacent network node on receipt. If a node is temporally disconnected, when it is reconnected it can send on the CP-CP sessions, the FRSN of the last TDU it received, and only be updated on changes after that last FRSN. The Resource Sequence Number (RSN) is associated with the current information about each node and TG in the network topology database; this RSN is assigned by the network node that "owns" the particular resource. The use of RSNs in Node Characteristics TDU control vectors and the network topology database allows a network node to determine whether resource information has been received before. A Node Characteristics (X'45') TDU control vector is discarded and not rebroadcast if the RSN in the Node Characteristics TDU VC is equal to the RSN in the topology database and the information in the TDU is the same as in its database, preventing endless retransmission of resource information.

Frame 203 shows RALYAS4B forwarding this TDU to its adjacent nodes. Note that in the forwarded TDU there is no CP capability information. This information is only passed to the adjacent node and is not propagated.

Similarly, frame 197 shows RALYAS4B sending a TDU informing RALYAS4A about itself. In frame 201 RALYAS4A forwards this TDU to its adjacent nodes, in this case RALYAS4B. RALYAS4B, as the originator of this TDU, will ignore it and stop any further propagation.

2.2.1.9 Change Number of Sessions (CNOS)

So far, we've seen in the trace, CP-CP session establishment, and CP capabilities exchange. Next comes another BIND. This time there is only one session established. The session is still not our user pass-through session. It is an SNA session established in order to negotiate the session limits of our user session.

From previous discussion about the BIND we know that the control vector X'02', in the user data portion of the BIND, flags the beginning of the mode name used for the session. By translating the hexadecimal characters occurring after the X'02', we see that the session bound in frames 223 and 226 uses the mode SNASVCMG. Actually, the formatted portion of the trace also includes these translated hexadecimal characters. Thus, it is easy to see what the mode name is.

In order to negotiate the session limits of the user session, the session established with mode SNASVCMG is used to run the *change number of sessions* (CNOS) application. CNOS is a process of negotiation for session limits. The process is carried out over the SNASVCMG session using CNOS transaction programs to converse.

Below is frame 231.

Frame 231

```
ATTACH      : 0C0502FF0003D00000|0206F1
(FMH-5)                                1

CNOS        : 0019|1210|0200000000000080004000400|08|40404040404040
(GDS Variable)      2                                3
```

We see RALYAS4B send an ATTACH which carries the TP name X'06F1' 1 . Please refer to previous discussion about the ATTACH or to the *SNA Formats*, GA27-3136 for more information on the format of the ATTACH.

The TP X'06F1' is an SNA-defined Transaction Program (TP) name for CNOS. RALYAS4B allocates the CNOS application in RALYAS4A. The CNOS applications in each CP send negotiation information in the CNOS GDS variable X'1210'. 2

The CNOS GDS variable contains the mode name, here 3 , eight blank characters, (the hexadecimal representation of a "blank" is X'40') and other information, such as who is responsible for deactivating the user session, the maximum number of source and target sessions allowed between the partner LUs, whether this is a request or a reply to a CNOS request, and, in a reply, whether, in fact, negotiation is necessary.

Frame 231 shows a request for CNOS negotiation; byte 4, bits 4 to 7 of the GDS variable indicate that it is a request. Frame 237 is a reply and byte 5 tells us that no negotiation was required; this will be the case if the mode names match at each CP. The mode in this case is the IBM default mode "BLANK" which, as can be seen here, has a mode name of eight blank characters. This can be seen in bytes 17 to 24 of the RU data field. A current version of *SNA Formats Manual*, GA27-3136 is required in order to determine the format of the GDS variables. Now, we are in a position to establish our user session.

2.2.1.10 Display Station Pass-Through

Frames 249 and 254 show the user session being established. It is a request from RALYAS4B which initiates the session.

Frame 262 shows RALYAS4B allocating the X'30F0F0F5' program on RALYAS4A, Display Station Pass-Through, and sending the Workstation Display Pass-Through X'12A0' GDS variable. The X'1240' vector is buried in the data and

can be found in bytes 10 and 11 of frame 262. The X'12A0' GDS variable carries such information as the local LU name, the display type, and user profile initiating the pass-through.

Frame 267 is a positive response, including the X'12A0' vector with information about the virtual device used for the pass-through session.

Frames 274 shows the sign-on screen being sent from RALYAS4A to RALYAS4B. The user on RALYAS4B now has access to applications on RALYAS4A.

2.2.1.11 Topology and Directory Databases Revisited

Now that we have established CP-CP sessions and established user sessions between RALYAS4A and RALYAS4B, we will look at how the APPN databases have changed.

The DSPAPPNINF *TOPOLOGY command shows that RALYAS4A is now "aware" of two network nodes in the network, itself as before, and RALYAS4B.

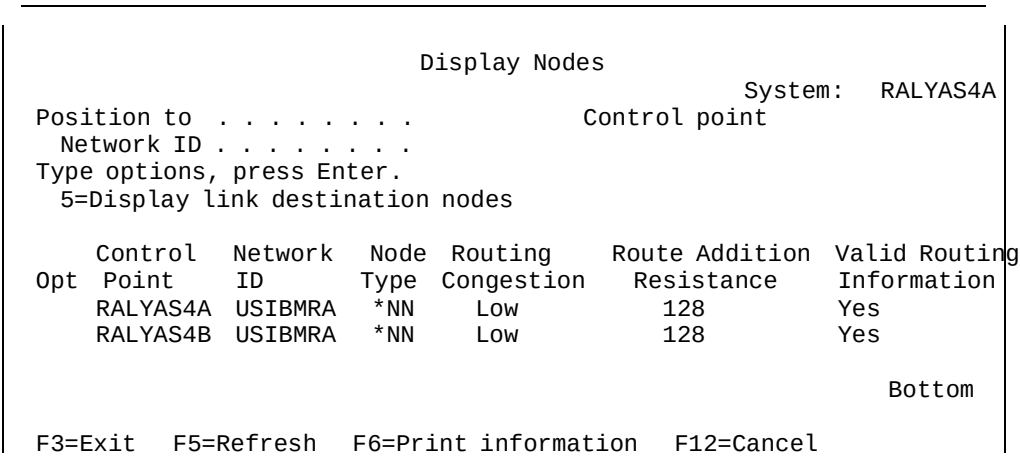


Figure 80. AS/400 Screen Resulting from the DSPAPPNINF *TOPOLOGY *ALL Command

The DSPAPPNINF *LCLNODE command shows that local locations have not changed for RALYAS4A. We did not add any new local "nicknames" (LUs). We do not show that screen again, but pressing **function key 11** gives us the next screen. It shows again the remote CP, RALYAS4B. This time, however, we're looking at the CP's LU name as shown in the directory database. It is, of course, the same as the CP name we see in the topology database in the previous screen.

```

                                Display Remote Control Points
                                System:  RALYAS4A
Local control point . . . . . :  RALYAS4A
Local network ID . . . . . :  USIBMRA
Position to . . . . . Control point
Network ID . . . . .
Type options, press Enter.
5=Display locations
Opt   Control Point   Network ID   Node Type
      RALYAS4B       USIBMRA       *NN

                                Bottom
F3=Exit  F12=Cancel  F19=Left  F20=Right  F24=More keys

```

Figure 81. Display Remote Control Points Screen

Option 5 now shows the location names at the remote CP, RALYAS4B. Now we see any LU names for the remote CP residing in the local directory database. These names will not reside in the local topology database since they are not CP names. When the session was established with AS4B, search processing took place as discussed previously, and RALYAS4A learned that AS4B was an LU in the domain of, or alternative location name for, RALYAS4B. RALYAS4A stored (cached) this information in its directory database, so that next time a session is requested with AS4B, there is no need to broadcast a search request to all CPs. Rather, a directed search may be sent to RALYAS4B just to check that AS4B remains an LU in the domain of CP RALYAS4B. The next screen shows this entry.

```

                                Display Locations
                                System:  RALYAS4A
Remote control point . . . . . :  RALYAS4B
Remote control point network ID . . . . . :  USIBMRA
Position to . . . . . Location
Network ID . . . . .
Location   Network ID   Type of Entry
AS4B      USIBMRA      Cached
RALYAS4B  USIBMRA      Cached

                                Bottom
Press Enter to continue.
F3=Exit  F5=Refresh  F6=Print information  F11=Sort by type of entry
F12=Cancel

```

Figure 82. Display Locations Screen

Next we use the DSPAPPNINF *SSN command to display the sessions for which RALYAS4A has been a session end point. Since all sessions we tested were initiated from the same interactive job on RALYAS4A, there is only a single job to describe the two sessions which were established. As can be seen from the next screen, the display we used was DSP02.

```

Display APPN Jobs
System: RALYAS4A
Type options, press Enter.
  5=Display session PCIDs
Opt   Job      User      Number
      DSP02    MEBELING  035356
Bottom
F3=Exit  F12=Cancel  F19=Left  F20=Right  F24=More keys

```

Figure 83. AS/400 Screen Resulting from the DSPAPPNINF *SSN Command

If we take **option 5** from this screen, then the FQPCIDs for each of the sessions we started is shown. The FQPCID uniquely identifies a session throughout its life in the network.

```

Display Session PCIDs
System: RALYAS4A
Job: DSP09      User: QSECOFR      Number: 013785
Type options, press Enter.
  5=Display route  8=Display formatted BIND  9=Display error data...
Control Network
Opt  PCID      Point ID      Mode      Status
      F64B0D2EC89E1EA6  RALYAS4B  USIBMRA  BLANK      Ended
F3=Exit  F12=Cancel  F19=Left  F20=Right  F24=More keys

```

Figure 84. AS/400 Display Session PCIDs Screen

From this screen, **option 5** allows us to see the route taken by the session. In our case, it is the trivial case of a single hop.

```

Display Route
System: RALYAS4A
PCID . . . . . : F64B0D2EC89E1EA6
Control point . . . . . : RALYAS4B
Network ID . . . . . : USIBMRA
Hop   Control   Network   TG
      Point    ID       Number
  1   RALYAS4B  USIBMRA  1
F3=Exit  F6=Print information  F12=Cancel

```

Figure 85. Display Route Screen

Alternatively, we could have taken option 8 to see the fully formatted BIND. The BIND shown below is the one for the pass-through session to AS4B. Compare the information shown in this formatted BIND with that discussed earlier. It's much easier to read this way.

An additional tool to use, if there is an error on a session, is option 9 for error information from the Display Session PCIDs screen. The data shown by taking this option includes any sense data found in an UNBIND. It will also show the entire UNBIND frame (an UNBIND is a frame sent to a session). A session must have been established and the status of the session must be "Failed" in order to use this option. The status of the sessions shown in Figure 84 on page 83 is "Ended". Thus, there is no error information available to us by taking option 9.

With the trace and formatted APPN information like this, there is a large amount of information available for performing problem analysis.

Display Formatted BIND	
PCID	F64B0D2EC89E1EA6
Control point	RALYAS4B
Network ID	USIBMRA
BIND type	Negotiable
FM profile (hex)	13
TS profile (hex)	07
FM usage (hex):	
Primary protocols	B0
Secondary protocols	B0
Common protocols	51B3
TS usage (hex)	038388888303
PS profile (hex)	06
PS usage (hex)	0200000000000000902300
Cryptography options (hex)	00
Primary NS LU name:	
LU name	RALYAS4B
Network ID	USIBMRA
User data fields:	
Unformatted data (hex)	
Mode name	BLANK
Session instance ID (hex)	01782F145BC00016
PLU network name:	
LU name	RALYAS4B
Network ID	USIBMRA
SLU network name:	
LU name	
Network ID	
Random data (hex)	
Enciphered data (hex)	
URC (hex)	
Secondary NS LU name:	
LU name	RALYAS4A
Network ID	USIBMRA
Transmission priority	Medium
Class of service	#CONNECT

Figure 86. Display Formatted BIND Screen

2.2.2 RALYAS4A (NN) to RALYAS4B (NN) to ES (NN) and ES (EN) and PCAT(LEN)

The case of two network nodes is the simplest case for APPN flows. We now examine a more detailed case. It is a slightly modified version of a scenario built earlier in this chapter.

When building the scenario in section 2.1.3, “RALYAS4B (NN) to ES (NN) to ES (EN) and PCAT (LEN)” on page 35 and section 2.1.4, “A Multinetwork Connectivity Scenario” on page 38, our intention was largely to consider OS/2 Extended Services (ES) configuration requirements. Thus, we made PS2ES1 the network node server for the ES end node, PS2MGE.

In this section, however, we are interested in examining the APPN flows between the nodes. We modify slightly our scenario of 2.1.4, “A Multinetwork Connectivity Scenario” on page 38 by making RALYAS4B the network node server for the Extended Services (EN). We have included also, a new partner LU for the end node PS2MGE, ALISON. We will use this LU to examine a failing directory search request.

The network we will now consider is shown in Figure 87.

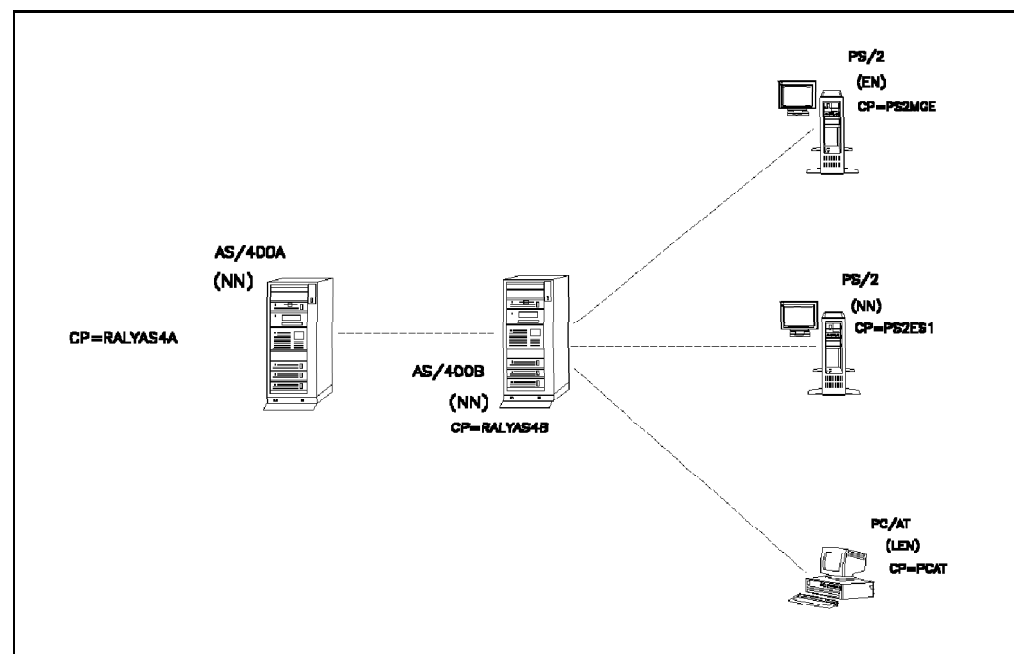


Figure 87. RALYAS4A (NN) to RALYAS4B (NN) to ES (NN) and ES (EN) and PCAT (LEN)

We can view the flows from the perspective of the network node RALYAS4B, that is, run the trace on RALYAS4B. From this vantage point, having already examined how the two AS/400s inform each other of their APPN information, it is possible to further:

- Examine the ES network node (PS2ES1) introducing itself to its adjacent network node, RALYAS4B
- Examine the process of RALYAS4B forwarding the newly learned information about PS2ES1 to RALYAS4A
- Discuss the process by which the end node (PS2MGE) registers its local LUs with its network node server, RALYAS4B

- Discuss the lack of such LU registering from the LEN end node, PCAT
- Examine the APPN search request process for the EN, PS2MGE
- Examine the APPN search request process for the LEN end node, PCAT

The first trace that we consider shows the NN, PS2ES1, joining the network. We have omitted DLC information from the trace and edited out the pacing and RR frames.

2.2.2.1 A Network Node Joining the APPN Network

COMMUNICATIONS TRACE				Title: 3RD NETNODE JOINS NW	01/16/93 00:01:06	Page: 4
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
73	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0001, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI RU Command : BIND RU Data : 31001307B0B050B301808686800106020000000000000102300000EE4E2 *.....&...FF..... C9C2D4D9C14BD7E2F2C5E2F124000802C3D7E2E5C3D4C709030168FF1734 *IBMRA.PS2ES1...CPSVCMG.... 68FF170F04E4E2C9C2D4D9C14BD7E2F2C5E2F10010E4E2C9C2D4D9C14BD9 *...USIBMRA.PS2ES1...USIBMRA C1D3E8C1E2F4C26017F19F3DC81057BD030EE4E2C9C2D4D9C14BD7E2F2C5 *ALYAS4B-.1..H....USIBMRA.PS E2F12C090407C3D7E2E5C3D4C7 *S1...CPSVCMG *		
75	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=00, SNF'=0000, EFI RH : ('830100'X) RSP FMD, PI RU Data : 000001 *...		
77	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0005 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D000000422F0F0F4000000 *.....}....004... RU Data : 004E12C20A800000000400000003154410E4E2C9C2D4D9C14BD9C1D3E8C1 *+.B.....USIBMRA.R E2F4C2000015461380150EE4E2C9C2D4D9C14BD7E2F2C5E2F10016470000 *S4B.....USIBMRA.PS2ES1... 000280760000000000000000014C00808080 *.....<..... *		
79	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0005 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D000000422F0F0F4000000 *.....}....004... RU Data : 004E12C20A800000000700000006154410E4E2C9C2D4D9C14BD9C1D3E8C1 *+.B.....USIBMRA.R E2F4C2000015461380150EE4E2C9C2D4D9C14BD7E2F2C5E2F10016470000 *S4B.....USIBMRA.PS2ES1... 000280760000000000000000014C00808080 *.....<..... *		
81	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI RU Command : BIND RU Data : 31001307B0B051B307878686807060200000000000009023000010E4E2 *.....GFFG..... C9C2D4D9C14BD9C1D3E8C1E2F4C226000802C3D7E2E5C3D4C7090301853C *IBMRA.RALYAS4B...CPSVCMG... D38A4000471104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2000EE4E2C9C2D4 *L. USIBMRA.RALYAS4B..USI D9C14BD7E2F2C5E2F16019F64B0D2EC8A359B210E4E2C9C2D4D9C14BD9C1 *RA.PS2ES1-.6...HT...USIBMRA. D3E8C1E2F4C22C090407C3D7E2E5C3D4C7 *LYAS4B...CPSVCMG *		
84	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=01, SNF'=0001, EFI RH : ('EB8000'X) RSP SC, FI, DR1 RU Command : BIND RU Data : 31001307B0B050B3008086868000060200000000000009023000001F00 *.....&...FF..... 0802C3D7E2E5C3D4C70203020F05E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *..CPSVCMG.....USIBMRA.RALYAS 00006017F19F3DC81057BD030EE4E2C9C2D4D9C14BD7E2F2C5E2F1 *...-1..H....USIBMRA.PS2ES1 RH : ('EB8000'X) RSP SC, FI, DR1		
85	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1 RU Command : BIND RU Data : 31001307B0B050B3008086868000060200000000000001023000001D00 *.....&...FF..... 0802C3D7E2E5C3D4C70203020F05E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *..CPSVCMG.....USIBMRA.PS2ES1 6019F64B0D2EC8A359B210E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *-.6...HT....USIBMRA.RALYAS4B		
87	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0001 RH : ('0B9120'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, CDI RU Command : FMH- 5=300502FF0003D000000422F0F0F100170EE4E2C9C2D4D9C1 *.....}....001...USIBMRA 4BD7E2F2C5E2F1A6E5D3FBD6FE00010808001FB43168FF17 *.PS2ES1WVL.O..... * RU Data : 000C12C100000000E6800000 *...A....W... *		
90	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('0B9520'X) REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI RU Command : FMH- 5=110502FF0003D000000422F0F0F1000000 *.....}....001... RU Data : 000C12C100000000F6840000 *...A....6D.. *		
94	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('039101'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI RU Data : 000C12C100000000E6800000 *...A....W... *		
99	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=01, SNF'=0001 RH : ('039101'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI RU Data : 000C12C100000000F6840000 *...A....6D.. *		

Figure 88 (Part 1 of 2). SNA Formatted Trace of a Third NN Joining the Network

103	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only	ODAI=0, DAF'=01, OAF'=02, SNF'=0002		
				RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI			
		RU Command		: FMH- 5=300502FF0003D0000000422F0F0F400170EE4E2C9C2D4D9C1	*.}	004...	USIBMRA
				4BD7E2F2C5E2F1A6E5D3FA861400010808001FB44068FF17	*.PS2ES1WVL.F.		*
		RU Data		: 005A12C20A80000000030000000013440EE4E2C9C2D4D9C14BD7E2F2C5E2	*.!.B.		USIBMRA.PS2E
				F100000C450A800000000280003300174615801510E4E2C9C2D4D9C14BD9	*1.		USIBMRA.R*
				C1D3E8C1E2F4C200164700000000807500000000000000014C00808080	*ALYAS4B.		<....*
109	S	PS2ES1	EBCDIC	TH : FID=2, MPF=First	ODAI=1, DAF'=01, OAF'=01, SNF'=0002		
				RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI			
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.}	004...	*
		RU Data		: 010212C20A800000000500000000154410E4E2C9C2D4D9C14BD9C1D3E8C1	*.!.B.		USIBMRA.RALY
				E2F4C100000C450A800000000280003300174615800110E4E2C9C2D4D9C1	*S4A.		USIBMRA*
				4BD9C1D3E8C1E2F4C200164700000002807600000000000000014C0080	*.RALYAS4B.		<....*
				8080174615801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2001647000000	*. USIBMRA.RALYAS4B.		*
				08007600000000000000000014C00808080154410E4E2C9C2D4D9C14BD9C1	*. USIBMRA.RALYAS4B.		*
				D3E8C1E2F4C200000C450A80000000028000330015461380150EE4E2C9C2	*LYAS4B.		USIB*
				D4D9C14BD7E2F2C5E2F10016470000000280760000000000000014C00	*MRA.PS2ES1.		<....*
				808080174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C10016470000	*. USIBMRA.RALYAS4A.		*
				0002807600000000	*.		*
111	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Last	ODAI=1, DAF'=01, OAF'=01, SNF'=0002		
		RU Data		: 00000000014C00808080	*.<....		*
115	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only	ODAI=1, DAF'=01, OAF'=01, SNF'=0003		
				RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI			
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.}	004...	*
		RU Data		: 005A12C20A800000000600000000513440EE4E2C9C2D4D9C14BD7E2F2C5E2	*.!.B.		USIBMRA.PS2E
				F100000C450A800000000280003300174615801510E4E2C9C2D4D9C14BD9	*1.		USIBMRA.R*
				C1D3E8C1E2F4C200164700000000807500000000000000014C00808080	*ALYAS4B.		<....*
117	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only	ODAI=0, DAF'=01, OAF'=01, SNF'=0006		
				RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI			
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.}	004...	*
		RU Data		: 005A12C20A800000000600000000413440EE4E2C9C2D4D9C14BD7E2F2C5E2	*.!.B.		USIBMRA.PS2E
				F100000C450A800000000280003300174615801510E4E2C9C2D4D9C14BD9	*1.		USIBMRA.R*
				C1D3E8C1E2F4C200164700000000807500000000000000014C00808080	*ALYAS4B.		<....*
121	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only	ODAI=1, DAF'=01, OAF'=01, SNF'=0006		
				RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI			
		RU Command		: FMH- 5=110502FF0003D0000000422F0F0F4000000	*.}	004...	*
		RU Data		: 005A12C20A80000000080000000713440EE4E2C9C2D4D9C14BD7E2F2C5E2	*.!.B.		USIBMRA.PS2E
				F100000C450A800000000280003300174615801510E4E2C9C2D4D9C14BD9	*1.		USIBMRA.R*
				C1D3E8C1E2F4C200164700000000807500000000000000014C00808080	*ALYAS4B.		<....*

Figure 88 (Part 2 of 2). SNA Formatted Trace of a Third NN Joining the Network

In this trace we see the effect of a third network node joining the network. Much of this trace we are now familiar with, the establishment of CP-CP sessions and exchange of CP capabilities (Frames 73 to 99). In frame 103 we see PS2ES1 send a TDU to RALYAS4B; this is not unlike those we have discussed before. Let us look more closely at Frame 109.

Frame 109

Attach : 1105|02FF|0003D00000|0422F0F0F4|000000

TDU : 0102|12C2|0A80000000050000000015|4410E4E2C9C2D4D9C14BD9C1D3
USIBMRA.RALYA

E2F4C10000|0C450A800000000280003300|174615800110E4E2C9C2D4D9
S4A USIBMRA

4BD9C1D3E8C1E2F4C200|1647000000028076000000000000000014C008
.RALYAS4B

8080|174615801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C200|16470000
USIBMRA.RALYAS4B

08007600000000000000000014C00808080|154410E4E2C9C2D4D9C14BD9C
USIBMRA.RA

D3E8C1E2F4C200000C450A800000000280003300|15461380150EE4E2C9C
LYAS4B USIB

D4D9C14BD7E2F2C5E2F100|16**47**00000000280760000000000000000014
M R A . P S 2 E S 1

808080|17**46**15800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C100|16**47**
U S I B M R A . R A L Y A S 4 A

0002807600000000

X'12C2' is the GDS variable which carries a Topology Database Update (TDU). All of the significant subfields have been highlighted. Notice that each Node Descriptor control vector **X'44'** carries a CP name. Following the **X'44'** comes a Node Characteristics (**X'45'**) control vector which carries node information about the CP. Following the **X'45'** vector comes a TG Descriptor (**X'46'**) control vector and a TG Characteristics (**X'47'**) control vector for each TG associated with the CP. We can see the topology of the network, as RALYAS4B knows it, by reading this TDU. We can see that RALYAS4A has one link to RALYAS4B, and RALYAS4B has two links, one to RALYAS4A and one to PS2ES1.

RALYAS4B does not send this TDU to the entire network since most of this information is new only to PS2ES1. RALYAS4B sends the smaller TDU, in frame 117, to the rest of the network informing the other nodes that PS2ES1 has now joined the network.

After the TDUs have been exchanged, each of the three network nodes have an image of the network and are ready to utilize the functions of APPN in establishing user sessions. In particular, PS2ES1, an ES NN, now has the network information and APPN capabilities to enable it to find LUs not defined to itself and calculate the best route for a session for that LU.

We now compare this capability with that of the end node (EN). The next trace shows the end node, PS2MGE, joining the network.

2.2.2.2 An End Node Joining the APPN Network

COMMUNICATIONS TRACE				Title: END NODE JOINS NETWK	01/25/93 00:41:56	Page:
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
182	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0001, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI RU Command : BIND RU Data : 31001307B0B050B301808686800106020000000000000102300000EE4E2 *.....&...FF.....U C9C2D4D9C14BD7E2F2D4C7C524000802C3D7E2E5C3D4C70903014FDA1C12 *IBMRA.PS2MGE...CPSVCMG... ...* 4FDA1C0F04E4E2C9C2D4D9C14BD7E2F2D4C7C50010E4E2C9C2D4D9C14BD9 * ...USIBMRA.PS2MGE...USIBMRA.R* C1D3E8C1E2F4C26017CCBF3A7AECF406580EE4E2C9C2D4D9C14BD7E2F2D4 *ALYAS4B-....:4...USIBMRA.PS2M* C7C52C090407C3D7E2E5C3D4C7 *GE...CPSVCMG *		
188	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=01, SNF'=0001, EFI RH : ('EB8000'X) RSP SC, FI, DR1 RU Command : BIND RU Data : 31001307B0B050B3008086868000060200000000000009023000001F00 *.....&...FF..... 0802C3D7E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *..CPSVCMG...USIBMRA.RALYAS4B* 00006017CCBF3A7AECF406580EE4E2C9C2D4D9C14BD7E2F2D4C7C5 *...:4...USIBMRA.PS2MGE *		
190	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0001 RH : ('0B9120'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, CDI RU Command : FMH- 5=300502FF0003D000000422F0F0F100170EE4E2C9C2D4D9C1 *.....}....001...USIBMRA 4BD7E2F2D4C7C5A6F1AE685D570001080EE027A60F4FDA1C *..PS2MGEW1..).W. .. * RU Data : 000C12C10000000082800000 *...A...B...		
194	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=01, SNF'=0001 RH : ('039101'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI RU Data : 000C12C100000000F6840000 *...A....6D.. *		
197	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI RU Command : BIND RU Data : 31001307B0B051B3078786868707060200000000000009023000010E4E2 *.....GFFG.....U C9C2D4D9C14BD9C1D3E8C1E2F4C226000802C3D7E2E5C3D4C70903019095 *IBMRA.RALYAS4B...CPSVCMG...N* D2D30000D11104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2000EE4E2C9C2D4 *KL..J..USIBMRA.RALYAS4B..USIBM* D9C14BD7E2F2D4C7C56019F64B0D2EC8AED1DB10E4E2C9C2D4D9C14BD9C1 *RA.PS2MGE-.6...H.J..USIBMRA.RA* D3E8C1E2F4C22C090407C3D7E2E5C3D4C7 *LYAS4B...CPSVCMG *		
202	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1 RU Command : BIND RU Data : 31001307B0B050B3008086868000060200000000000001023000001D00 *.....&...FF..... 0802C3D7E2E5C3D4C70203020F05E4E2C9C2D4D9C14BD7E2F2D4C7C50000 *..CPSVCMG...USIBMRA.PS2MGE..* 6019F64B0D2EC8AED1DB10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2 *-..6...H.J..USIBMRA.RALYAS4B *		
204	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('0B9520'X) REQ FMD, FI, BCI, ECI, DR1, ERI, RLWI, PI, CDI RU Command : FMH- 5=110502FF0003D000000422F0F0F1000000 *.....}....001... RU Data : 000C12C100000000F6840000 *...A....6D.. *		
208	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('039101'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI RU Data : 000C12C10000000082800000 *...A...B...		
212	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0002 RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI RU Command : FMH- 5=110502FF0003D000000422F0F0F3000000 *.....}....003... RU Data : 004112CA038080128200F3E4E2C9C2D4D9C14BD7E2F2D4C7C5143C00F6E4 *.....B.3USIBMRA.PS2MGE...6 E2C9C2D4D9C14BD9C1D3E8C1E2F4C2143D00F3E4E2C9C2D4D9C14BD9C1D3 *SIBMRA.RALYAS4B...3USIBMRA.RAL* E8C1E2F4C2002112C500000100000008E2D5C1E2E5C3D4C700000C2C0408 *YAS4B...E.....SNASVCMG.....* E2D5C1E2E5C3D4C7002712C480000000001B60F64B0D2EC8AED1DC10E4E2 *SNASVCMG...D.....-6...H.J..US* C9C2D4D9C14BD9C1D3E8C1E2F4C2038200 *IBMRA.RALYAS4B.B. *		
216	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0002 RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI RU Command : FMH- 5=300502FF0003D000000422F0F0F300170EE4E2C9C2D4D9C1 *.....}....003...USIBMRA 4BD7E2F2D4C7C5A6F1AE6A4CF2000108080017A6254FDA1C *..PS2MGEW1..<2.....W. .. * RU Data : 002712C440000000001B60F64B0D2EC8AED1DC10E4E2C9C2D4D9C14BD9C1 *...D.....-6...H.J..USIBMRA.R D3E8C1E2F4C2038200002B12CB038080123C00F4E4E2C9C2D4D9C14BD7E2 *LYAS4B.B.....4USIBMRA.PS* F2D4C7C5123D00F3E4E2C9C2D4D9C14BD7E2F2D4C7C500AD12C500000100 *2MGE...3USIBMRA.PS2MGE...E...* 000008E2D5C1E2E5C3D4C700000C2C0408E2D5C1E2E5C3D4C71C46118001 *...SNASVCMG...SNASVCMG...* 0CE4E2C9C2D4D9C14BC3D5C5E38009824000000322800416470000000090 *USIBMRA.CNET..B.....* 750000000000000000014C00808080174615801510E4E2C9C2D4D9C14BD9 *.....<.....USIBMRA.R* C1D3E8C1E2F4C2001647000000008075000000000000000014C00808080 *ALYAS4B.....<.....* 174615801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20016470000000080 *.....USIBMRA.RALYAS4B.....* 7500000000000000000014C00808080 *.....<.....*		

Figure 89 (Part 1 of 3). SNA Formatted Trace of an End Node Joining the Network

```

220 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=02, OAF'=01, SNF'=0000, EFI
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B051B3078786868707060200000000000000023400010E4E2 *.....GFFG.....
      C9C2D4D9C14BD9C1D3E8C1E2F4C227000902E2D5C1E2E5C3D4C709030190 *IBMRA..RALYAS4B...SNASVCMG..
      95D33F4000321104E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2000EE4E2C9C2 *NL...USIBMRA..RALYAS4B...US
      D4D9C14BD7E2F2D4C7C56019F64B0D2EC8AED1DC10E4E2C9C2D4D9C14BD9 *MRA.PS2MGE-.6...H.J..USIBMRA
      C1D3E8C1E2F4C22C0A04087BC3D6D5D5C5C3E32B17010115461380150EE4 *ALYAS4B....#CONNECT.....
      E2C9C2D4D9C14BD7E2F2D4C7C500 *SIBMRA.PS2MGE.
224 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=02, SNF'=0000, EFI
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B050B30080868680000602000000000000010234000001E00 *.....&...FF.....
      0902E2D5C1E2E5C3D4C70203020F05E4E2C9C2D4D9C14BD7E2F2D4C7C500 *..SNASVCMG....USIBMRA..PS2MG
      006019F64B0D2EC8AED1DC10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C22B17 *-..6...H.J..USIBMRA..RALYAS4B
      010115461380150EE4E2C9C2D4D9C14BD7E2F2D4C7C500 *.....USIBMRA.PS2MGE.
226 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=02, OAF'=01, SNF'=0001
      RU Command . . . . : FMH- 5=110502FF0003D0000400423F0F0F1000000 *.....}.001...
      RH : ('0A9500'X) REQ FMD, FI, BCI, DR1, ERI, RLWI, PI
228 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=02, SNF'=0000, EFI
      RU Data . . . . . : 000002 *...
230 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=02, OAF'=01, SNF'=0002
      RU Data . . . . . : 008B1310003D13111B810901E4E2C9C2D4D9C10A02D9C1D3E8C1E2F4C206 *.....A..USIBMRA..RALYA
      0323F0F1F119820901E4E2C9C2D4D9C10802D7E2F2D4C7C5060323F0F1F1 *..011.B...USIBMRA..PS2MGE...0
      059000E000002E154915010901E4E2C9C2D4D9C10A02D9C1D3E8C1E2F4C2 *.....USIBMRA..RALYAS
      060423F0F1F1F0F020000000607C9011900242C07E9001C1212001880F002 *..011.....I.....Z.....
      E11221060123F0F3F104020000021002110212 *.....031.....
232 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=02, SNF'=8000
      RU Data . . . . . : No RU data
236 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=02, OAF'=01, SNF'=0003
      RU Command . . . . : BIS
      RU Data . . . . . : 70
238 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=02, SNF'=0001
      RU Command . . . . : BIS
      RU Data . . . . . : 70
240 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=02, OAF'=01, SNF'=0000, EFI
      RU Command . . . . : UNBIND
      RU Data . . . . . : 3201000000006019F64B0D2EC8AED1DC10E4E2C9C2D4D9C14BD9C1D3E8C1 *.....-..6...H.J..USIBMRA..R
      E2F4C2 *S4B
244 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=02, SNF'=0000, EFI
      RU Command . . . . : UNBIND
      RU Data . . . . . : 32
246 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0003
      RU Command . . . . : FMH- 5=300502FF0003D000000422F0F0F300170EE4E2C9C2D4D9C1 *.....}....003...USIBMRA
      4BD7E2F2D4C7C5A6F1AE6A4CF20001080EE027A62F4FDA1C *..PS2MGEW1..<2.....W.|..
      RU Data . . . . . : 002212C48000000001960CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2 *..D.....4...USIBMR
      F2D4C7C5003F12CA038080123C00F4E4E2C9C2D4D9C14BD7E2F2D4C7C512 *2MGE.....4USIBMRA..PS2MG
      3D00F3E4E2C9C2D4D9C14BD7E2F2D4C7C5148200F3E4E2C9C2D4D9C14BD9 *..3USIBMRA..PS2MGE..B..3USIBMRA
      C1D3E8C1E2F4C1008012C500000100000008E2D5C1E2E5C3D4C700001C46 *ALYAS4A...E.....SNASVCMG..
      1180010CE4E2C9C2D4D9C14BC3D5C5E38009824000000322800416470000 *AS4A...3USIBMRA..RALYAS4A...E
      000090750000000000000000014C00808080174615801510E4E2C9C2D4D9 *.....USIB
      C14BD9C1D3E8C1E2F4C200164700000000807500000000000000014C00 *A..RALYAS4B.....
      8080800C2C0408E2D5C1E2E5C3D4C7 *.....SNASVCMG
250 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0003
      RU Command . . . . : FMH- 5=110502FF0003D000000422F0F0F3000000 *.....}....003...
      RU Data . . . . . : 002512C440000000001960CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2 *..D.....4...USIBMR/
      F2D4C7C5038200002F12CB038080143C00F6E4E2C9C2D4D9C14BD9C1D3E8 *2MGE..B.....6USIBMRA..RA
      C1E2F4C1143D00F3E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1004B12C50000 *AS4A...3USIBMRA..RALYAS4A...E
      0100000008E2D5C1E2E5C3D4C700002A2B0200174615801510E4E2C9C2D4 *.....SNASVCMG.....USI
      D9C14BD9C1D3E8C1E2F4C2000F460D800108D9C1D3E8C1E2F4C1000C2C04 *RA..RALYAS4B.....RALYAS4A..
      08E2D5C1E2E5C3D4C7 *..SNASVCMG
252 R PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=02, SNF'=0002, EFI
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B050B301808686800106020000000000000102300000EE4E2 *.....&...FF.....
      C9C2D4D9C14BD7E2F2D4C7C525000902E2D5C1E2E5C3D4C70903014FDA1C *IBMRA..PS2MGE...SNASVCMG...|
      334FDA1C0F04E4E2C9C2D4D9C14BD7E2F2D4C7C50010E4E2C9C2D4D9C14B *|.USIBMRA..PS2MGE..USIBMR
      D9C1D3E8C1E2F4C16017CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2F2 *RALYAS4A-....4...USIBMR..P
      D4C7C52C0A0408E2D5C1E2E5C3D4C72B280201174615801510E4E2C9C2D4 *MGE...SNASVCMG.....USI
      D9C14BD9C1D3E8C1E2F4C2000F460D800108D9C1D3E8C1E2F4C100

```

Figure 89 (Part 2 of 3). SNA Formatted Trace of an End Node Joining the Network

```

256 S RALYAS4A EBCDIC TH : FID=2, MPF=Only ODAI=0, DAF'=04, OAF'=01, SNF'=0002, EFI
      RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B050B301808686800106020000000000000102340000EE4E2 *.....&...FF.....U
                          C9C2D4D9C14BD7E2F2D4C7C525000902E2D5C1E2E5C3D4C70903014FDA1C *IBMRA.PS2MGE...SNASVCMG...|.
                          334FDA1C0F04E4E2C9C2D4D9C14BD7E2F2D4C7C50010E4E2C9C2D4D9C14B *|.USIBMRA.PS2MGE..USIBMRA.*
                          D9C1D3E8C1E2F4C16017CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2F2 *RALYAS4A-.....4...USIBMRA.PS2*
                          D4C7C52C0A0408E2D5C1E2E5C3D4C72B280202174615801510E4E2C9C2D4 *MGE...SNASVCMG.....USIBM*
                          D9C14BD9C1D3E8C1E2F4C2000F460D800108D9C1D3E8C1E2F4C100 *RA.RALYAS4B.....RALYAS4A.*
263 R RALYAS4A EBCDIC TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=04, SNF'=0002, EFI
      RH : ('EB8000'X) RSP SC, FI, DR1
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B050B30080868680000602000000000000090234000002000 *.....&...FF.....
                          0902E2D5C1E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 *..SNASVCMG...USIBMRA.RALYAS4*
                          C100006017CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2F2D4C7C52B28 *A-.....4...USIBMRA.PS2MGE..
                          0202174615801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2000F460D8001 *.....USIBMRA.RALYAS4B.....
                          08D9C1D3E8C1E2F4C100 *..RALYAS4A.*
266 S PS2MGE EBCDIC TH : FID=2, MPF=Only ODAI=0, DAF'=02, OAF'=02, SNF'=0002, EFI
      RH : ('EB8000'X) RSP SC, FI, DR1
      RU Command . . . . : BIND
      RU Data . . . . . : 31001307B0B050B30080868680000602000000000000090234000002000 *.....&...FF.....
                          0902E2D5C1E2E5C3D4C70203021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 *..SNASVCMG...USIBMRA.RALYAS4*
                          C100006017CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E2F2D4C7C52B28 *A-.....4...USIBMRA.PS2MGE..
                          0202174615801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2000F460D8001 *.....USIBMRA.RALYAS4B.....
                          08D9C1D3E8C1E2F4C100 *..RALYAS4A.*

```

Figure 89 (Part 3 of 3). SNA Formatted Trace of an End Node Joining the Network

The first thing to notice about this trace is that the formatted portions contain the CPSVCMG mode name. In the same way as an NN, the EN may establish CP-CP sessions and exchange CP capabilities. Here, the CP-CP sessions are established between the PS/2 EN, PS2MGE, and its NN server, RALYAS4B, in frames 182 to 208. Try to determine where we can see this. In particular, try to identify where each node indicates its node type (bits 0, 1, and 2 of byte 8 in the X'12C1' GDS variable are set to 100 for ENs and 111 for NNs).

Note: The node type is actually communicated earlier than at the CP_CAPS exchange. It is first communicated at XID3 exchange. The node type specified in the X'12C1' variable is in fact not used. In frame 212 we see the RALYAS4B send a search request to the End Node PS2MGE and receive a response in 216. This is done to confirm the location of the LU PS2MGE for the SNASVCMG session, established in frames 220 through 244. Let us examine this request and the response more closely.

2.2.2.3 Directory Search Request - Remote Location Found

Frame 212 shows RALYAS4B sending a search request out to CP PS2MGE. The FMH-5 carries the TP name X'22F0F0F3', which is the transaction program to accept network searches. This program will be started at PS2MGE so that it can then accept the search request from RALYAS4B. The GDS information which is sent with the ATTACH represents the search request or *Locate search*. A Locate search request must contain three GDS variables:

- A Find (X'12CA') 1
- A CD-Initiate (X'12C5') 2
- A Locate (X'12C4') 3

By looking through the Attach RU data in frame 212, it is possible to find each of these vectors; we may identify it as a locate search request. Below is frame 212 with some extra formatting and highlighting.

Frame 212

Attach : 1105|02FF|0003D00000|0422F0F0F3|000000

```
Find   : 0041|12CA|038080|128200F3E4E2C9C2D4D9C14BD7E2F2D4C7C5143C00F6E
          1          U S I B M R A . P S 2 M G E          U
          E2C9C2D4D9C14BD9C1D3E8C1E2F4C2143D00F3E4E2C9C2D4D9C14BD9C1D3
          S I B M R A . R A L Y A S 4 B          U S I B M R A . R A L

          E8C1E2F4C20021|12C5|00000100000008E2D5C1E2E5C3D4C700000C2C0408
          Y A S 4 B          2          S N A S V C M G

          E2D5C1E2E5C3D4C70027|12C4|80000000001B60F64B0D2EC8AED1DC10E4E2
          S N A S V C M G          3          4          U S

          C9C2D4D9C14BD9C1D3E8C1E2F4C2038200
          I B M R A . R A L Y A S 4 B
```

1 The Find (X'12CA') GDS variable describes the search argument for the search. The search argument is carried in the X'82' vector of the X'12CA' GDS variable; here it is USIBMRA.PS2MGE. It also contains other vectors, X'3C' and X'3D', which describe the search origin CP and LU names, respectively.

2 The Cross-Domain (CD) Initiate (X'12C5') GDS variable contains session initiation parameters required for the LU-LU session to be initiated.

3 The Locate (X'12C4') GDS variable carries search request and reply information between the origin and destination CPs. It carries the Fully Qualified Procedure Correlation ID (X'60') control vector 4, which uniquely identifies a search throughout its life across the network. This vector is also used to carry the routing information returned in a positive search response from a network node. This routing information is carried in a *Route Selection Control Vector* (RSCV) (X'2B') control vector. This can be seen in the reply, frame 216. The locate variable may also carry sense data (X'35' control vector) in a search response in the case of locate errors.

A *Locate search reply* can indicate success or failure of the search, meaning whether or not the search argument has been located. It may contain the following three GDS variables:

- A Locate (X'12C4'), with a bit to indicate the fact that it is a reply rather than a search
If the resource is found then the locate may include an X'35' vector with sense data, if there were other errors in the locate. If the resource is not found then the locate must include an X'35' vector with extended sense data.
- A CD-Initiate (X'12C5') if the LU is found
- A Found (X'12CB') if the LU is found

Frame 216 shows PS2MGE replying to the search request from RALYAS4B.

Frame 216

```
Attach : 3005|02FF|0003D00000|0422F0F0F3|00170EE4E2C9C2D4D9C1
          U S I B M R A

          4BD7E2F2D4C7C5A6F1AE6A4CF2000108080017A6254FDA1C
```

. P S 2 M G E

Locate : 0027|**12C4**|40000000001B60F64B0D2EC8AED1DC10E4E2C9C2D4D9C14BD9C1
1 U S I B M R A . R A

D3E8C1E2F4C2038200002B|**12CB**|038080|123C00F4E4E2C9C2D4D9C14BD7E2
L Y A S 4 B 2 U S I B M R A . P S

F2D4C7C5|123D00F3E4E2C9C2D4D9C14BD7E2F2D4C7C500AD|**12C5**|00000100
2 M G E U S I B M R A . P S 2 M G E 3

000008E2D5C1E2E5C3D4C700000C**2C**0408E2D5C1E2E5C3D4C71C**46**118001
S N A S V C M G S N A S V C M G

0CE4E2C9C2D4D9C14BC3D5C5E3800982**4000000322800**416**47**00000000090
U S I B M R A . C N E T

750000000000000000014C0080808017**46**15801510E4E2C9C2D4D9C14BD9
U S I B M R A . R

C1D3E8C1E2F4C20016**47**00000000080750000000000000000014C00808080
A L Y A S 4 B

17**46**15801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20016**47**00000000080
U S I B M R A . R A L Y A S 4 B

750000000000000000014C00808080

Both the Found 2 and the CD-Initiate 3 GDS variables are found in this locate search reply 1 .

The X'3C' control vector in the Found GDS variable describes the destination CP name, while the X'3D' control vector describes the destination directory entry for the LU name, if it is not the same as the CP name. These two vectors perform the complementary role in the Found GDS variable as they did in the Find GDS variable. Notice that within the X'12C5' GDS variable, however, we find some X'46' and X'47' control vectors. These are TG descriptor control vectors that allow the EN to inform the NN of TGs (links), which the EN has active, and about which the NN may not, otherwise, be aware.

Now, suppose the EN, PS2MGE, was to establish a session with a node adjacent to PS2MGE, other than RALYAS4B, to take a trivial example. Suppose also that this node may be reached via RALYAS4B but that there are numerous hops in between and some slow links. Then RALYAS4B, PS2MGE's NN server, would, from the information which PS2MGE has just sent (its endpoint TG information carried in the X'46' control vector), be able to calculate the optimum route for the session, direct to the adjacent node, rather than establishing it via the NN server. If PS2MGE was a LEN end node or did not support CP-CP sessions, then it would not be able to send network searches, nor would it be able to inform its NN server of its endpoint TGs. This is the case for the LEN end node, PCAT. It would send a BIND to its NN server and always establish sessions via it, despite the fact that there may be an optimal route.

As an aside, and we discuss this fact in greater detail in section 5.4, "Trace and Flow Analysis" on page 200, consider the X'46' control vector that carries information about the EN's connection to the node CNET. Recall that CNET is the

name of the connection network to which PS2MGE has previously been attached. Within the X'46' control vector, an X'82' subfield carries the ENs token-ring address. This is how an NN server gains knowledge about its ENs connection to a connection network. Please don't confuse the X'82' control vector or subfield; within an X'46' control vector and within an X'12CA' GDS variable. The latter contains the search argument for a locate search request while the former contains the token-ring address of the EN used in conjunction with the connection network.

Now back to the trace. Frames 220 and 226 show SNASVCMG sessions being established from RALYAS4B to PS2MGE. In frame 226 and 230 we see a request from RALYAS4B to PS2MGE to identify its management services capabilities, characterized by X'1310' GDS variable. Note also that the RU command has been separated from its RU data by an adaptive pacing RU. Frame 232 is PS2MGE's response.

In frames 240 to 244 we see a end request (UNBIND) for the SNASVCMG session initiated by RALYAS4A.

Frames 246 and 250 show RALYAS4B receiving a Locate search request from PS2MGE and sending a positive response. Note that via the end node Locate search request CDINIT (X'12C5') GDS variable, the end node informs its network node server of all the TGs it has available. It does this in its Locate search request because the network node server will calculate the optimal route and include the RSCV in its reply. Within the RSCV is the node order via which the BIND should flow and, finally, in a X'2C' control vector, the COS name used for the session. You can see these at the end of the formatted data in frame 250. These frames have been reformatted and highlighted below.

Frame 246

```
Attach : 3005|02FF|0003D00000|0422F0F0F3|00170EE4E2C9C2D4D9C1
        4BD7E2F2D4C7C5A6F1AE6A4CF20001080EE027A62F4FDA1C

Find   : 0022|12C4|80000000001960CCBF3A7AEFF406580EE4E2C9C2D4D9C14BD7E
        U S I B M R A . P S
        F2D4C7C5003F|12CA|038080123C00F4E4E2C9C2D4D9C14BD7E2F2D4C7C512
        2 M G E U S I B M R A . P S 2 M G E
        3D00F3E4E2C9C2D4D9C14BD7E2F2D4C7C5148200F3E4E2C9C2D4D9C14BD9
        U S I B M R A . P S 2 M G E U S I B M R A . R
        C1D3E8C1E2F4C10080|12C5|00000100000008E2D5C1E2E5C3D4C700001C46
        A L Y A S 4 A S N A S V C M G
        1180010CE4E2C9C2D4D9C14BC3D5C5E38009824000000322800416470000
        U S I B M R A . C N E T
        0000907500000000000000000014C00808080174615801510E4E2C9C2D4D9
        U S I B M R
        C14BD9C1D3E8C1E2F4C2001647000000008075000000000000000014C00
        A . R A L Y A S 4 B
```

8080800C2C0408E2D5C1E2E5C3D4C7
S N A S V C M G

Frame 250

Attach : 1105|02FF|0003D00000|0422F0F0F3|000000

Locate : 0025|**12C4**|40000000001960CCBF3A7AEFF4065**80**EE4E2C9C2D4D9C14BD7E2
U S I B M R A . P S

F2D4C7C5038200002F|**12CB**|038080143C00F6E4E2C9C2D4D9C14BD9C1D3E8
2 M G E U S I B M R A . R A L Y

C1E2F4C1143D00F3E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C1004B|**12C5**0000
A S 4 A U S I B M R A . R A L Y A S 4 A

0100000008E2D5C1E2E5C3D4C700002A**2B**0200174615801510E4E2C9C2D4
S N A S V C M G U S I B M

D9C14BD9C1D3E8C1E2F4C2000F460D800108D9C1D3E8C1E2F4C1000C2C04
R A . R A L Y A S 4 B R A L Y A S 4 A

08E2D5C1E2E5C3D4C7
S N A S V C M G

In frames 252 to 266 we see the BINDs for the SNASVCMG sessions. These are followed by the user sessions, which are not of interest here.

2.2.2.4 Directory Search Request - Remote Location Not Found

We will now examine a later section of the same trace where PS2MGE requests a session with the location ALISON and the search is unsuccessful.

COMMUNICATIONS TRACE				Title: END NODE JOINS NETWK	01/25/93 00:41:56	Page: 4
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
571	R	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0005 RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI RU Command : FMH- 5=300502FF0003D0000000422F0F0F300170EE4E2C9C2D4D9C1 4BD7E2F2D4C7C5A6F1AE6A4CF2000108861017A6574FDA1C RU Data : 002212C480000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C5003D12CA038080123C00F4E4E2C9C2D4D9C14BD7E2F2D4C7C512 3D00F3E4E2C9C2D4D9C14BD7E2F2D4C7C5128200F3E4E2C9C2D4D9C14BC1 D3C9E2D6D5008012C500000100000008E2D5C1E2E5C3D4C700001C461180 010CE4E2C9C2D4D9C14BC3D5C5E380098240000003228004164700000000 9075000000000000000014C00808080174615801510E4E2C9C2D4D9C14B D9C1D3E8C1E2F4C2001647000000008075000000000000000014C008080 800C2C0408E2D5C1E2E5C3D4C7 *.....}....003...USIBMRA *.PS2MGEW1...<2...F..W. ... *...D.....:34...USIBM *2MGE.....4USIBMRA.PS2MG *..3USIBMRA.PS2MGE..B.3USIBMRA *LISON...E.....SNASVCMG.... *..USIBMRA.CNET..B..... *.....<.....USIBM *RALYAS4B.....<.. *.....SNASVCMG		
575	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=01, SNF'=0007 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D0000000422F0F0F3000000 RU Data : 002812C480000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C50382000380FF005112CA038080143C00F6E4E2C9C2D4D9C14BD9 C1D3E8C1E2F4C2123C00F4E4E2C9C2D4D9C14BD7E2F2D4C7C5123D00F3E4 E2C9C2D4D9C14BD7E2F2D4C7C5128200F3E4E2C9C2D4D9C14BC1D3C9E2D6 D5002112C500000100000008E2D5C1E2E5C3D4C700000C2C0408E2D5C1E2 E5C3D4C7 *.....}....003... *...D.....:34...USIBM *2MGE.B.....6USIBMRA *ALYAS4B...4USIBMRA.PS2MGE... *SIBMRA.PS2MGE..B.3USIBMRA.ALI *N...E.....SNASVCMG.....SN		
577	S	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0005 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D0000000422F0F0F3000000 RU Data : 002812C480000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C50382000380FF005112CA038080143C00F6E4E2C9C2D4D9C14BD9 C1D3E8C1E2F4C2123C00F4E4E2C9C2D4D9C14BD7E2F2D4C7C5123D00F3E4 E2C9C2D4D9C14BD7E2F2D4C7C5128200F3E4E2C9C2D4D9C14BC1D3C9E2D6 D5002112C500000100000008E2D5C1E2E5C3D4C700000C2C0408E2D5C1E2 E5C3D4C7 *.....}....003... *...D.....:34...USIBM *2MGE.B.....6USIBMRA *ALYAS4B...4USIBMRA.PS2MGE... *SIBMRA.PS2MGE..B.3USIBMRA.ALI *N...E.....SNASVCMG.....SN		
579	R	PS2ES1	EBCDIC	TH : FID=2, MPF=Only ODAI=0, DAF'=01, OAF'=02, SNF'=0004 RH : ('0B9181'X) REQ FMD, FI, BCI, ECI, DR1, ERI, PI, BBI, CEBI RU Command : FMH- 5=300502FF0003D0000000422F0F0F300170EE4E2C9C2D4D9C1 4BD7E2F2C5E2F1A6F12C20B471000108E418DFB41A1A41C RU Data : 003F12C440000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C50382001A3508400007900212C40EE4E2C9C2D4D9C14BD7E2F2C5 E2F100 *.....}....003...USIBMRA *.PS2ES1W1.....U.....U. *...D.....:34...USIBM *2MGE.B.....D...USIBMRA.PS		
580	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0007 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D0000000422F0F0F3000000 RU Data : 004112C440000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C50382001C35084000078D0212C410E4E2C9C2D4D9C14BD9C1D3E8 C1E2F4C100 *.....}....003... *...D.....:34...USIBM *2MGE.B.....D...USIBMRA.RA *AS4A.		
585	S	PS2MGE	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0005 RH : ('0B9081'X) REQ FMD, FI, BCI, ECI, DR1, ERI, BBI, CEBI RU Command : FMH- 5=110502FF0003D0000000422F0F0F3000000 RU Data : 004112C440000000001960CCBF3A7AF3F406580EE4E2C9C2D4D9C14BD7E2 F2D4C7C50382001C35084000078D0212C510E4E2C9C2D4D9C14BD9C1D3E8 C1E2F4C200 *.....}....003... *...D.....:34...USIBM *2MGE.B.....E...USIBMRA.RA *AS4B.		

Figure 90. SNA Trace of Search for LU "ALISON" with Negative Response

In this trace, we see the Locate request, frame 571. We can see, by the combination of X'12C4', X'12CA' and X'12C5' GDS variables, that the frame carries a locate search request. These variables may be interpreted as described in section 2.2.1, "RALYAS4A (NN) to RALYAS4B (NN)" on page 60. The LU, for which the search is initiated, is contained within the X'82' control vector of the X'12CA' GDS variable. In this case, it is ALISON. We see in frames 575 and 577, RALYAS4B sends a broadcast search to the network in order to find the LU ALISON which PS2MGE has just requested it to find. The network, in our case, constitutes RALYAS4A and PS2ES1. Notice that, in generating the broadcast search, RALYAS4B has propagated the search request from PS2MGE but not included the endpoint TG vectors with the search request since they are only important for its own route calculation purposes. In frames 579 and 580, we receive search responses from the other nodes in the network. Try to identify the

negative response and the associated sense data (it's carried in the X'35' control vector of the X'12C4' GDS variable on a negative response).

Frame 585 shows the negative response flowing back to PS2MGE.

In the same way as the EN is able to send its endpoint TG information to its NN server, it can also register its local LU resources with its NN server. An X'12C3' GDS variable is used for the EN to register its LUs. We do not see the X'12C3' GDS variable appear in this trace since we have not defined alternate LUs to reside in PS2MGE.

A LEN end node does not have the ability to register its local LU resources with its NN server. This fact means that any LU residing within a LEN end node must be defined at its NNS. A key example of having to define all LUs residing within a LEN end node is when an SNA host acts as a LEN end node in an APPN network and, at the same time, provides routing support for the APPN or LEN end node BIND, through the subarea, to another APPN or LEN end node on the other side of the subarea. In this case, all LUs which are intended to communicate via the subarea need be defined. *Wildcard routing* was introduced in order to alleviate large amounts of definitional work in this case. We consider the routing of data through subarea networks in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235. The next trace considered is that of a LEN end node joining the network.

2.2.2.5 A LEN End Node Joining the APPN Network

COMMUNICATIONS TRACE				Title: LEN JOINS NWK.	01/11/93 01:19:36	Page: 4
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
60	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8000'X) REQ SC, FI, BCI, ECI, DR1		
				RU Command : BIND		
				RU Data : 31001307B0B0D1B10100F5F58001060200000000000001023000010E4E2 *.....J...55..... C9C2D4D9C14BD7C3C1E34040404021000902E2D5C1E2E5C3D4C703030001 *IBMRA.PCAT\$NASVCMG... 1104E4E2C9C2D4D9C14BD7C3C1E3404040400008D9C1D3E8C1E2F4C2 *..USIBMRA.PCAT ..RALLYAS4B		
62	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1		
				RU Command : BIND		
				RU Data : 31001307B0B051B10107F5F587010602000000000000090234000002100 *.....55G..... 0902E2D5C1E2E5C3D4C703030001105E4E2C9C2D4D9C14BD9C1D3E8C1E2 *..\$NASVCMG.....USIBMRA.RALY F4C20000 *4B.. *		
64	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('0A9100'X) REQ FMD, FI, BCI, DR1, ERI, PI		
				RU Command : FMH- 5=0F0502FF0003D000000206F1000000 *.....}....1... *		
66	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0002 RH : ('019020'X) REQ FMD, ECI, DR1, ERI, CDI		
				RU Data : 001812100200000000002000200000007D8D7C3E2E4D7D7 *.....CPCSUPP		
68	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000 RH : ('830100'X) RSP FMD, PI		
				No RU data		
72	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('039101'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI		
				RU Data : 001812100A0400000000200016000A0007D8D7C3E2E4D7D7 *.....CPCSUPP		
74	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('830100'X) RSP FMD, PI		
				No RU data		
75	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8000'X) REQ SC, FI, BCI, ECI, DR1		
				RU Command : UNBIND		
				RU Data : 320F *		
78	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1		
				RU Command : UNBIND		
				RU Data : 32 *		
80	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('6B8000'X) REQ SC, FI, BCI, ECI, DR1		
				RU Command : BIND		
				RU Data : 31001307B0B0D1B10100F5F58001060200000000000001023000010E4E2 *.....J...55..... C9C2D4D9C14BD7C3C1E34040404020000802D8D7C3E2E4D7D70303000211 *IBMRA.PCAT QPCSUPP... 04E4E2C9C2D4D9C14BD7C3C1E3404040400008D9C1D3E8C1E2F4C2 *..USIBMRA.PCAT ..RALLYAS4B		
82	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI RH : ('EB8000'X) RSP SC, FI, DR1		
				RU Command : BIND		
				RU Data : 31001307B0B051B10107F5F587010602000000000000090234000002000 *.....55G..... 0802D8D7C3E2E4D7D7030300021105E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 *..QPCSUPP.....USIBMRA.RALYA C20000 *B.. *		
84	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('0A9100'X) REQ FMD, FI, BCI, DR1, ERI, PI		
				RU Command : FMH- 5=250502FF0003D000000407F0F0F1140902D4C5C2C5D3C9D5 *.....}....001... MEBELIN		
				C70901D3D6D5C7C8C1E4D30000 *G..LONGHAUL.. *		
86	R	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0002 RH : ('019020'X) REQ FMD, ECI, DR1, ERI, CDI		
				RU Data : 000AD001000100041041 *..}..... *		
87	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0000 RH : ('830100'X) RSP FMD, PI		
				No RU data		
90	S	PCAT	EBCDIC	TH : FID=2, MPF=Only ODAI=1, DAF'=01, OAF'=01, SNF'=0001 RH : ('039120'X) REQ FMD, BCI, ECI, DR1, ERI, PI, CDI		
				RU Data : 000AD003000100041443 *..}..... *		

Figure 91 (Part 1 of 2). SNA Formatted Trace of Session Establishment for a LEN End Node

COMMUNICATIONS TRACE				Title: LEN JOINS NWK.	01/11/93 01:19:36	Page: 6
Record Number	S/R	Controller Name	Data Type	SNA Data: TH, RH, RU		
92	R	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('830100'X) RSP FMD, PI No RU data	ODAI=1, DAF'=01, OAF'=01, SNF'=0001	
93	R	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('4B9001'X) REQ DFC, FI, BCI, ECI, DR1, ERI, CEBI	ODAI=1, DAF'=01, OAF'=01, SNF'=0003	
			RU Command	LUSTAT		
			RU Data	0400060000	*	*
96	R	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('6B8000'X) REQ SC, FI, BCI, ECI, DR1	ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI	
			RU Command	UNBIND		
			RU Data	320F	* . .	*
98	S	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('EB8000'X) RSP SC, FI, DR1	ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI	
			RU Command	UNBIND		
			RU Data	32	* .	*
100	R	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('6B8000'X) REQ SC, FI, BCI, ECI, DR1	ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI	
			RU Command	BIND		
			RU Data	31001307B0B0D1B10100F5F58001060200000000000001023000010E4E2 C9C2D4D9C14BD7C3C1E34040404021000902E2D5C1E2E5C3D4C703030003 1104E4E2C9C2D4D9C14BD7C3C1E3404040400008D9C1D3E8C1E2F4C1 F64B0D2EC8A3595C10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20E11F4E4E2 C9C2D4D9C14BD7C3C1E3404040402B2F0202164614801510E4E2C9C2D4D9 C14BD9C1D3E8C1E2F4C2174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2 F4C1002C0A0408E2D5C1E2E5C3D4C7 * J 55 U *IBMRA.PCAT \$NASVCMG * USIBMRA.PCAT RALYAS4A *		
102	S	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('6B8100'X) REQ SC, FI, BCI, ECI, DR1, PI	ODAI=0, DAF'=05, OAF'=01, SNF'=0000, EFI	
			RU Command	BIND		
			RU Data	31001307B0B051B30180F5F58001060200000000000001023400010E4E2 C9C2D4D9C14BD7C3C1E34040404021000902E2D5C1E2E5C3D4C703030003 1104E4E2C9C2D4D9C14BD7C3C1E3404040400008D9C1D3E8C1E2F4C16019 F64B0D2EC8A3595C10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C20E11F4E4E2 C9C2D4D9C14BD7C3C1E3404040402B2F0202164614801510E4E2C9C2D4D9 C14BD9C1D3E8C1E2F4C2174615800110E4E2C9C2D4D9C14BD9C1D3E8C1E2 F4C1002C0A0408E2D5C1E2E5C3D4C7 *4A \$NASVCMG * USIBMRA.PCAT \$NASVCMG * USIBMRA.PCAT RALYAS4A *6 HT USIBMRA RALYAS4 *IBMRA.PCAT USIBMRA *A.RALYAS4B USIBMRA.RALYAS* * \$NASVCMG		
105	R	RALYAS4A	EBCDIC	TH : FID=2, MPF=Only RH : ('EB8000'X) RSP SC, FI, DR1	ODAI=0, DAF'=01, OAF'=05, SNF'=0000, EFI	
			RU Command	BIND		
			RU Data	31001307B0B051B30080F5F58000060200000000000009023400002100 0902E2D5C1E2E5C3D4C7030300031105E4E2C9C2D4D9C14BD9C1D3E8C1E2 F4C100006019F64B0D2EC8A3595C10E4E2C9C2D4D9C14BD9C1D3E8C1E2F4 C22B2F0202164614801510E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C2174615 800110E4E2C9C2D4D9C14BD9C1D3E8C1E2F4C100 * USIBMRA.RALYAS4A * \$NASVCMG USIBMRA.RALYAS* * \$NASVCMG USIBMRA.RALYAS* *4A HT USIBMRA.RALYA *B USIBMRA RALYAS4B * USIBMRA.RALYAS4A		
108	S	PCAT	EBCDIC	TH : FID=2, MPF=Only RH : ('EB8000'X) RSP SC, FI, DR1	ODAI=1, DAF'=01, OAF'=01, SNF'=0000, EFI	
			RU Command	BIND		
			RU Data	31001307B0B051B1013FF5F5BF01060200000000000009023400002100 0902E2D5C1E2E5C3D4C7030300031105E4E2C9C2D4D9C14BD9C1D3E8C1E2 F4C10000 *4A . .		

Figure 91 (Part 2 of 2). SNA Formatted Trace of Session Establishment for a LEN End Node

The first frame we see coming from the LEN end node is a BIND request for a SNASVCMG session. No CP-CP sessions are established nor are CP_CAPS requested and sent. We know that we are considering a LEN end node. The next frames through to frame 72 show the BIND response and then CNOS being run across the session.

Frames 80 and 82 show a user session being requested and established using the mode QPCSUPP. Frames 84 through 93 are not of interest to us here. They show ordinary PC Support setup. Frames 96 and 98 show the normal UNBINDing of the SNASVCMG session. There is nothing new in any of these flows. We include them in order to highlight the lack of CP-CP sessions. Similarly absent are any APPN constructs carried within X'12Cx' GDS variables, for example, the X'12C3' LU registration of an EN with its NN server or the X'12C4'/X'12C5'/X'12CA' search request. This is a crucial difference between an APPN and a LEN end node.

Consider the request for an SNASVCMG session shown in frame 100. PCAT requests a session with RALYAS4A by sending the BIND request to RALYAS4B. In frame 102, RALYAS4B forwards the BIND request onto RALYAS4A. Frames

105 and 108 see the response come back to RALYAS4A and flow to PCAT. RALYAS4B here is acting as a NN server for the LEN end node. It does provide search processing for unknown LUs and best-route calculation. However, the best route calculation is from itself; it has already received the BIND from PCAT and so can't tell the LEN end node where to send it. It can only send the BIND further. This limitation could be an issue in a network where there are two routes from the LEN end node to the desired LU and the longer route is via the NN server. In this case, the session traffic will always flow via the longer route since the session must be established via the NN server. We have omitted the remainder of the trace as it is of little interest to us here.

Chapter 3. The 5394 Remote Control Unit

In this chapter, we intend to:

- Describe the IBM 5394 T2.1 Node Support RPQ (8Q0775) functions and their relevance for the AS/400 and subarea connectivity.
- Provide configuration examples in connecting the 5394 to the network built in the previous chapter. In doing so, we consider both intelligent and non-intelligent terminal connection via the 5394.

In a later chapter we consider the same connection via a subarea network.

3.1 5394 Overview

The 5394 is a remote workstation controller for AS/400s. The IBM 5394 T2.1 Node Support RPQ is a microcode enhancement for the 5394 that allows it to connect to an AS/400 as a node type 2.1 either directly or through a subarea network. OS/400 V2R1M1 is required on the AS/400 in order to support the IBM 5394 T2.1 Node Support RPQ.

The IBM 5394 T2.1 Node Support RPQ supports a single independent LU used for management of dependent workstations (DWSs - displays and printers). This LU supports multiple parallel sessions and can send or receive BINDs. No dependent LUs are supported by the IBM 5394 T2.1 Node Support RPQ. See 3.1.1, "Dependent Workstation Support."

For independent workstations (IWSs and PCs with PC Support) connected to a 5394 with the IBM 5394 T2.1 Node Support RPQ, the LUs are contained in the IWSs and the IBM 5394 T2.1 Node Support RPQ simply passes through all LU-LU traffic for the IWS LUs. See 3.1.2, "Independent Workstation Support" on page 104.

3.1.1 Dependent Workstation Support

AS/400 support for DWSs is maintained using the 5250 data stream commands and SNA LU 4/7 commands. These commands are encapsulated in LU 6.2 headers to transport them through the subarea network. The LU 6.2 support provided is a closed implementation, the purpose of which is to support this encapsulation. No additional LU 6.2 support is provided.

The IBM 5394 T2.1 Node Support RPQ implements a single LU with parallel sessions for the support of all attached DWSs. One controller session is always established and is used for maintenance information, statistics, product information, and microcode upgrade. In addition, there is one session established per DWS.

The BIND for the controller session is sent by the IBM 5394, and the BINDs for the DWS sessions are sent by the AS/400.

3.1.2 Independent Workstation Support

An IWS communicates with the AS/400 through multiple LU 6.2 sessions. The IBM 5394 T2.1 Node Support RPQ supports this communication by acting as a pass-through controller.

The IWS pass-through function tracks the status of the LU 6.2 sessions established by the IWS, passes LU-LU data between the target AS/400 and the IWS, and performs session cleanup when sessions are ended abnormally.

The number of sessions an IWS can establish is determined by the following:

- Each IWS is limited to a maximum of 32 sessions.
- The total number of IWS sessions that the IBM 5394 T2.1 Node Support RPQ supports for all IWSs attached to it is 256.
- Each IWS is guaranteed a minimum of 10 sessions.

IWSs may establish sessions with any AS/400 connected to the SNA subarea network (assuming the IWS and the AS/400 are properly configured). The IBM 5394 T2.1 Node Support RPQ does not require that the IWSs establish sessions with only the AS/400 handling the controller and DWS sessions.

3.2 Installation and Configuration

The following software and hardware are needed:

- The 5394 Type 2.1 RPQ 8Q0775 (a new IBM 5394 system diskette and the *5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775 Supplement*, SC30-3531).
- Your AS/400 must be upgraded to allow communication with the IBM 5394 T2.1 Node Support RPQ. This upgrade is part of OS/400 Version 2 Release 1 (Modification Level 1).
- For the attachment of the IBM 5394 T2.1 Node Support RPQ to the SNA subarea network, a minimum level of VTAM and NCP support is required: VTAM Version 3 Release 2, NCP Version 4 Release 3 for the 3725 controller, NCP Version 5 Release 2 for the 3720 and 3745 controllers.
- If the serial number of your IBM 5394 is below 23-55000, or XX-XXXXBE, then a memory upgrade is required; the 5394 previously had a memory of only 512Kb, and 1Mb is necessary for the RPQ.

For installation details, please refer to the *IBM 5394 Remote Control Unit Maintenance Library, Maintenance Analysis Procedures, Maintenance Information, Parts Catalog Release 1.0*, SY27-0311-00.

3.2.1 Supported IBM 5394 Remote Control Units

The IBM 5394 T2.1 Node Support RPQ supports the IBM 5394 Remote Control Units shown in the following table.

Table 2. Models Supporting the RPQ				
Models Supported	Devices Supported	EIA 232 Support	V.35 Support	X.21
01A	4	Y	Y	N
01B	16	Y	Y	N
01C	16	Y	Y	N
02A	4	N	N	Y
02B	16	N	N	Y

3.2.2 Configuration

There are two phases to the configuration of the 5394 PU type 2.1 attachment: the 5394 configuration documented below and the AS/400 configuration described in 3.2.2.2, "AS/400 Configuration" on page 107. For details of the connection for a 5394 directly to an SNA subarea, please refer to 7.6, "5394 to AS/400 via a Subarea Network" on page 357.

3.2.2.1 IBM 5394 T2.1 Node Support RPQ Configuration

The steps to configure the 5394 controller are described in the *IBM 5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775 Supplement*, SC30-3531. Below is a summary taken from this book. For more details, particularly for error messages, please refer to the above document.

- Step 1. Make sure the 5394 control unit power is set to off (O).
- Step 2. Make sure the Test switch on the 5394 operator panel is set to on.
- Step 3. Make sure that the write-protect tab on the system diskette is closed (not write-protected). Insert the system diskette in the diskette drive.
- Step 4. Set the control unit power switch to on (I) and wait for the Ready indicator to appear.

If the Ready indicator does not appear, refer to Problem Determination Procedures in the *IBM 5394 Remote Control Unit User's Guide*.

- Step 5. Power-on the workstation you are using to configure the IBM 5394.

When the system available indicator appears on the screen, press the Test Request key sequence to display the configuration screen. Refer to the *IBM 5394 Remote Control Unit User's Guide* for the correct key sequence for your keyboard. If a blinking 4- or 6-digit system reference code (SRC) appears on the screen, press the Error Reset key and repeat this step. If the SRC still appears, see Chapter 6 in the *IBM 5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775 Supplement*, SC30-3531.

- Step 6. Configuration screen 1 appears.

The upper portion of the screen shows the configuration of the currently powered-on workstations on the three ports.

The lower portion of the screen contains the operator input fields with current values (default values if configuring for the first time).

If the configuration screen does not appear, set the control unit power switch to off (O) and repeat steps 1 through 6. If the configuration screen still does not appear, see Chapter 6 in the *IBM 5394 Remote*

	0	1	2	3	4	5	6
0/	D	.	.	.	.	.	.
1/	.	.	.	.	.	.	.
2/	.	.	.	.	.	.	.

1	2	3	7
AA-> 0	BB-> 2	CC-> 00-00000	8-> 3C 0
1-> 00	2-> 01	3-> 0 0 0 0 0 0	6
4	5	8	10-> 0A 06
			9
			P-> _ _

Figure 92. Configuration of the 5394, Screen 1

The following descriptions will help you to fill in the fields:

1 Communication Mode setting: 0=SDLC, only value supported.

2 Operating Mode setting: 2=LEN mode; the IBM 5394 T2.1 Node Support RPQ is actually seen as a LEN end node by the other nodes in the network, and this value is, therefore, preset and unremovable.

3 Plant of manufacture of the IBM 5394 (subfields 1-2) and its serial number (subfields 3-7) which you can find on the front of the IBM 5394. Use the Cursor Up and Cursor Down keys to scroll through the possible values.

4 Keyboard code setting: 00=U.S. English.

5 SDLC station address, chosen between 00 and FF (hexadecimal values). Must match AS/400 APPC or host controller parameter.

6 Modem information:

Nonswitched line (0) compulsory.

Half-duplex (0) or duplex (1).

Multipoint (0) or point-to-point communication line (1).

NRZI (0) or NRZ (1) SDLC transmission coding option.

DTR (0) or CDSTL (1).

Leading pad (transmitted by the control unit) not required (0) or required (1).

Local loopback not supported (0) or supported (1).

7 Field not currently supported.

8 Retry count and retry interval used by the IBM 5394 T2.1 Node Support RPQ to re-establish a logical connection with the AS/400. Choose the first value between 00 and FF (0 -> 255 retries) and the

second value between 01 and 3C (10 seconds to 10 minutes with 10 seconds intervals). The defaults are 0A (10 retries) and 06 (1 minute).

9 Port address (0, 1 or 2) and station address (0 to 6) of a printer for configuration screen printing. By default, the first available printer powered on is selected.

After completing all the entries, press the Enter key to start Screen 1 error checking. If an error code is displayed, then please refer to Chapter 6 in the *IBM 5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775 Supplement, SC30-3531*. Correct the error and repeat steps 1 and 2 until no error is displayed. Press the Enter key to proceed to Screen 2.

	1		2
11->	_____	12->	_____
13->	_____	14->	BLANK_____
15->	_____	16->	_____
	5		6
			P-> _ _

Figure 93. Configuration of the 5394, Screen 2

1 The network ID of the 5394.

2 The logical unit (LU) name of the 5394.

The 5394 LU name must match the RMTLOCNAME specified on the AS/400 remote workstation controller definition for the 5394. If this name does not match the CP name specified in the RMTCPNAME parameter of the 5394 APPC controller definition, then a remote location list entry is required on the AS/400.

3 The control point (CP) name of the 5394.

This is a unique name by which the 5394 may be known in the network. It does not imply any CP-CP capabilities. Either the CP name or the previous 5394 customization parameter, LU name, must match the RMTCPNAME parameter specified on the AS/400 APPC controller description for the 5394.

4 The mode name used by the 5394 for APPC sessions. The default is BLANK.

5 The network ID of the AS/400.

Note: This is an optional field. If you leave it blank, the 5394 assumes that the AS/400 is attached to the same network as the 5394.

6 LU name (location name or nickname) of the AS/400. See 3.2.2.2, “AS/400 Configuration” for more information.

3.2.2.2 AS/400 Configuration

The steps to configure the 5394 PU T2.1 attachment on the AS/400 are as follows:

- Step 1. Configure a line to the network containing the 5394 (CRTLINSDLC command).

- Step 2. Configure an AS/400 APPC controller description (CRTCTLAPPC) which describes the 5394. The T2.1 Node Support RPQ allows for a 5394 to establish a session with an AS/400 via an SNA subarea or via other APPN nodes. Thus, only an adjacent AS/400 need create an APPC controller description for the 5394. A non-adjacent AS/400 will naturally require either an APPC or host controller description for a host connection, or an APPC controller description for adjacent APPN node connection.

Assuming then, that the AS/400 is adjacent to the 5394, the APPC controller description contains:

- RMTNETID matching the network ID defined in the 5394
- RMTCPNAME matching the CP name defined in the 5394
- STNADR matching the SDLC station address defined in the 5394
- APPN(*YES)
- NODETYPE as *LENNODE, since the 5394 acts as a LEN end node in the network

- Step 3. Add a remote location list entry to the AS/400. If the LU name matches the CP name specified in the APPC control unit parameter, RMTCPNAME, and the AS/400 is adjacent to the 5394, then no location list entry is required. However, if the LU name does not match the RMTCPNAME parameter or the 5394 is not adjacent to the AS/400, and there is an APPN or subarea network in between, then the remote location list entry must be added. Use the WRKCFGL *APPNRMT command.

For this remote configuration list entry, you need to specify:

- As RMTLOCNAME, the 5394 LU name defined in the 5394, configuration screen 2, field 12.
- As LCLLOCNAME, the AS/400 local location name defined in the 5394 configuration screen 2, field 16.
- As RMTNETID, the network ID of the remote location defined in the 5394 configuration screen 2, field 11.
 - For the case when the 5394 is adjacent to the local AS/400:
As RMTCPNAME and CP network ID, the CP name and network ID of the 5394 as defined in the 5394 configuration screen 2, fields 13 and 11, and also defined in the APPC controller described above.
 - For the case when the 5394 is not adjacent to the local AS/400:
As RMTCPNAME and CP network ID, the CP name and network ID of the AS/400 to which the 5394 is attached or the host via which the session is to be established.

When establishing a session via the subarea, note that in addition, the AS/400 and 5394 LU names must be defined as LU names within NCP.

- Step 4. The APPC device description will be automatically configured, or it can be configured manually, for naming purposes. The automatic creation gives the device the 5394 LU name.

- Step 5. Configure a 5394 controller description (CRTCTLRWS command) with a link type of *NONE (rather than SDLC) and a location name matching the location name customized on the 5394 controller.

Below are specific points which are important for 5394 Remote Workstation Controller description.

CTLD	Controller description name,
TYPE	Controller type - 5394,
MODEL	Controller Model - 1 or 2,
LINKTYPE	Link Type - *NONE. This special value is new for 5394 T2.1 Node Support RPQ.
RMTLOCNAME	This is a new parameter, created for the IBM 5394 T2.1 Node Support RPQ. It must match the location name defined in configuration screen 2 on the 5394 controller.
LCLLOCNAME	This is a new parameter, created for the IBM 5394 T2.1 Node Support RPQ. It is the local location name of the AS/400. The special value *NETATR is allowed, meaning that use will be made of the location name specified in the network attributes. The value should match the value found by looking at configuration screen 2 on the 5394 controller.

Please refer to to the *AS/400 Communications User's Guide*, (SC21-9590) for a complete description of the parameters and their meanings.

- Step 6. Configure a device description for each dependent workstation attached to the 5394 (CRTDEVDSPP/CRTDEVPRTP commands). This is exactly what had to be done previously for directly-attached 5394s. A difference is, however, that devices attached to *NONE 5394 controllers will have their MAXLENRU parameters overridden to be *CALC.

3.3 Connecting a 5394 to the Branch Network

In this section, we describe two scenarios:

- In the first scenario we consider the attachment of a DWS to an AS/400 via a 5394 with the IBM 5394 T2.1 Node Support RPQ.
- In the second scenario we consider the attachment of the DWS from scenario 1 and the additional attachment of a PC/AT with PC Support to our 5394 with the IBM 5394 T2.1 Node Support RPQ.

The part of the network that we consider looks as shown in Figure 94.

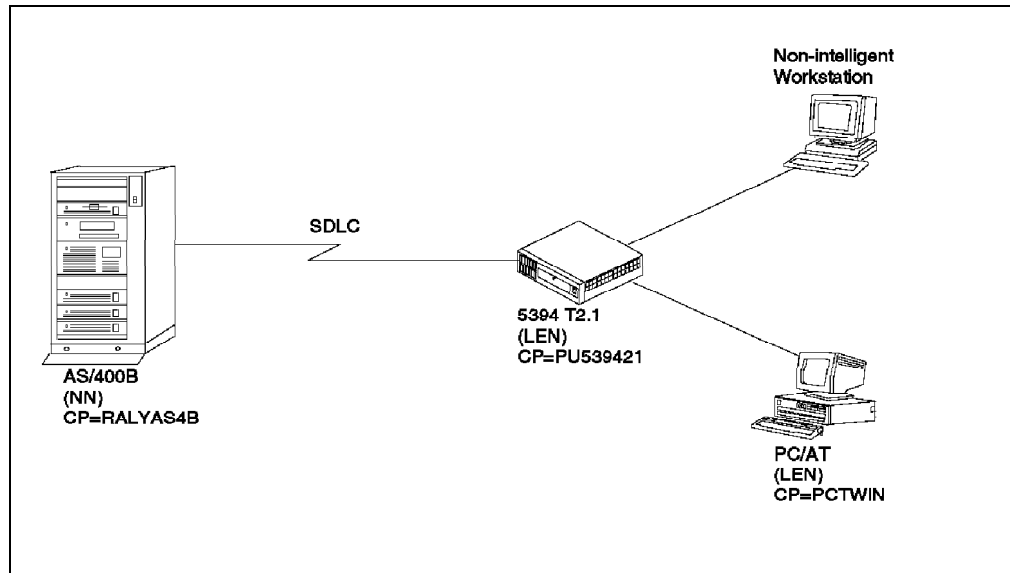


Figure 94. Connection of 5394 PU T2.1 to the Branch Network

Before describing the configuration examples of each of our two scenarios with the T2.1 Node Support RPQ, we pause briefly to overview the configuration objects required both with and without the T2.1 Node Support RPQ. Without the IBM 5394 T2.1 Node Support RPQ, the following configurations are required for DWS and IWS attachment.

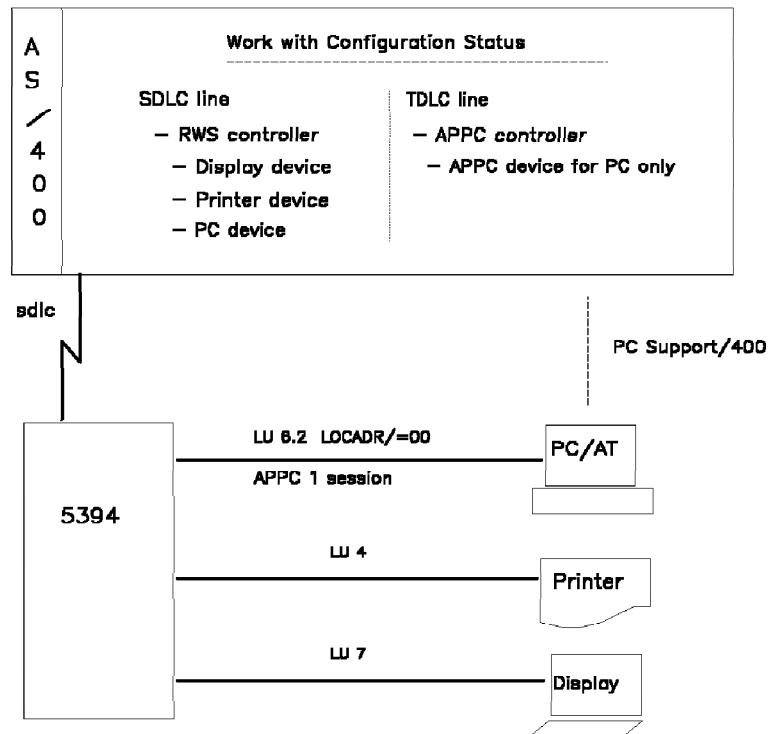


Figure 95. Configuration of 5394 Attachment Before IBM 5394 T2.1 Node Support RPQ

With the IBM 5394 T2.1 Node Support RPQ, the remote workstation controller is no longer related to the SDLC line; whereas, the APPC controller has exchanged its TDLC line attachment for the SDLC line attachment.

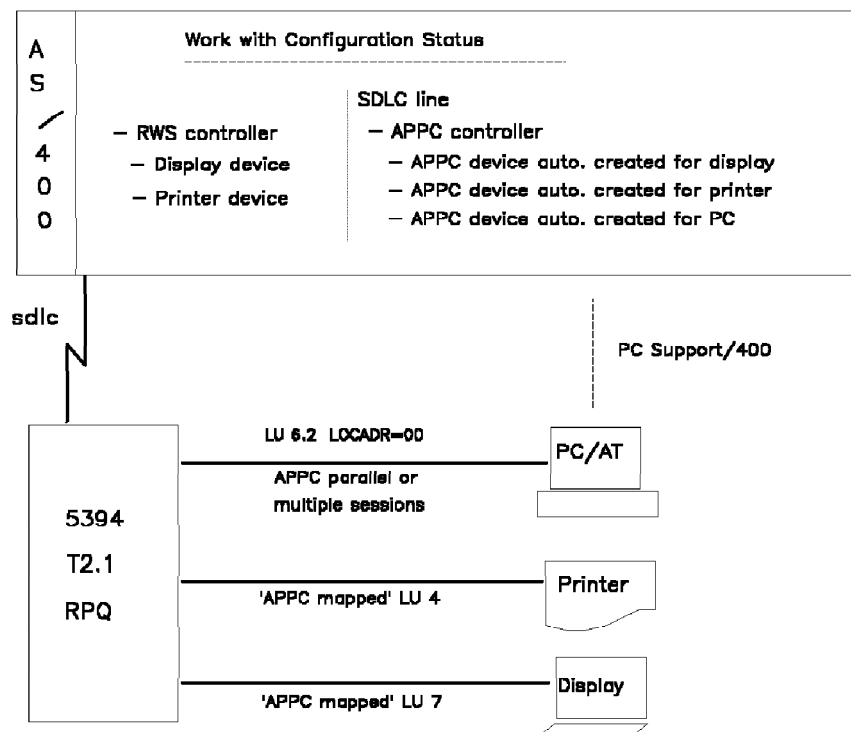


Figure 96. Configuration of IBM 5394 T2.1 Node Support RPQ Attachment

3.3.1 Attachment of a Dependent Workstation

In this scenario, we describe the standard attachment of a remote dependent workstation (DWS) to an AS/400 through the 5394 T2.1 Node Support RPQ.

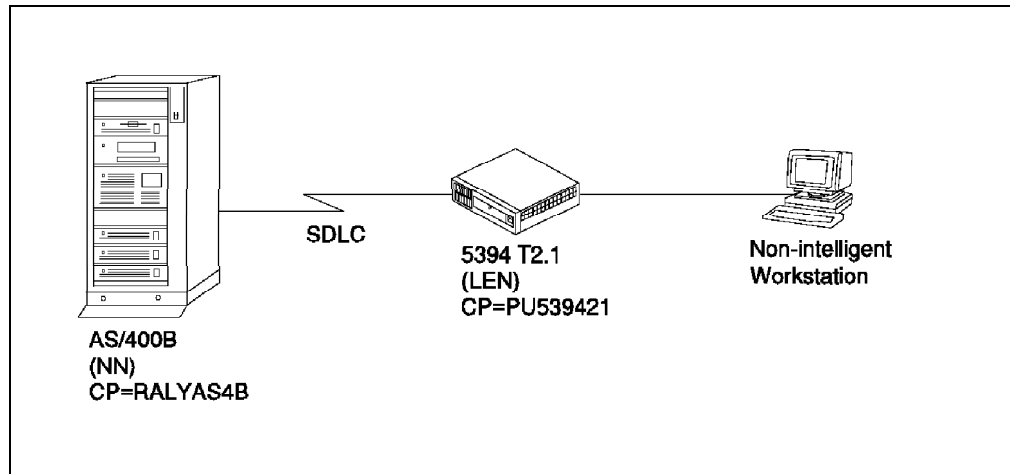


Figure 97. First Scenario for IBM 5394 T2.1 Node Support RPQ Attachment

3.3.1.1 5394 Customization

Figure 98 below and Figure 99 on page 113 show the 5394 customization performed.

	0	1	2	3	4	5	6
0/ D	.	.	.	.	.	.	.
1/ .	.	.	.	.	.	.	.
2/ .	.	.	.	.	.	.	.

AA-> 0 BB-> 2 CC-> 23-12898
 1-> 00 2-> 01 3-> 0 0 1 0 0 1 0 8-> 3C 0
 10-> 0A 06

P-> _ _

Figure 98. Configuration of Our 5394 in Scenario 1, Screen 1

1		2
11-> USIBMRA_	12-> PU539421	13-> PU539421
15-> USIBMRA_	16-> RALYAS4B	14-> QPCSUPP_
5		6
P-> _ _		

Figure 99. Configuration of the 5394, Screen 2

1 The network ID of the 5394. In this case, the 5394 is directly-attached to the AS/400 and, thus, we give it the same network as the AS/400B. It does not need to be the same name.

2 The logical unit (LU) name of the 5394. We give it the same name as the CP name and, thus, there is no need to add a remote location list entry at the AS/400.

3 The control point (CP) name of the 5394.

4 The mode name used by the 5394 for APPC sessions. The default is BLANK. We use QPCSUPP, which is known by every system in our network. It is, of course, the standard AS/400 mode for PC Support.

5 The AS/400's network ID. Here the AS/400B has USIBMRA as its local network ID in its Network Attributes.

6 The LU name (location name or nickname) of the AS/400. This name must either be the CP name of AS/400B or be one of its APPN local location list entries.

It's worth noticing here that, provided a subarea or APPN network is already in place, we can specify in field 16 any LU name which resides in the network. Thus, DWSs, that is AS/400 terminals, may now have access to applications residing on any AS/400 in the network simply by changing this field in the 5394 customization. Notice also that all DWSs must access the same AS/400 and only a single AS/400 at a time. If concurrent access to multiple AS/400s is required then an IWS is required.

3.3.1.2 AS/400 Configuration

Figure 100 on page 114 shows the SDLC line description required for the AS/400 to connect to the 5394. In Figure 101 on page 114, we present the required APPC control unit description. Recall that the APPC device is automatically created during session establishment.

Display Line Description		06/12/91	RALYAS4B
Line description	L539421		
Option	*BASIC		
Category of line	*SDLC		
Resource names	LIN021		
Online at IPL	*YES		
Data link role	*NEG		
Physical interface	*RS232V24		
Connection type	*NONSWTPP		
Switched network backup	*NO		
Exchange identifier	05615533		
NRZI data encoding	*YES		
Maximum controllers	1		
Clocking	*MODEM		
Line speed	9600		
Modem type supported	*NORMAL		
Autoanswer type	*DTR		
Maximum frame size	521		
Error threshold level	*OFF		
Duplex	*HALF		
Modulus	8		
Text	line SDLC for 5394 PU Type 2.1		

Figure 100. SDLC Line Description - Line between AS/400 and Adjacent 5394

Display Controller Description		06/12/91	RALYAS4B
Controller description	C539421		
Option	*BASIC		
Category of controller	*APPC		
Link type	*SDLC		
Online at IPL	*YES		
Switched connection	*NO		
Switched network backup	*NO		
Attached nonswitched line	L539421		
Character code	*EBCDIC		
Maximum frame size	521		
Remote network identifier	USIBMRA		
Remote control point	PU539421		
Data link role	*NEG		
Station address	01		
APPN-capable	*YES		
APPN CP session support	*NO		
APPN node type	*LENNODE		
APPN transmission group number	1		

Figure 101. APPC Controller Description for 5394 Adjacent to AS/400

Varying-on the line causes it to contact the modem and go ACTIVE. The APPC controller remains in the VARY ON PENDING state since no session has yet been requested.

```

Work with Configuration Status                                RALYAS4B
06/12/91
Position to . . . . . Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status ...

Opt Description      Status      -----Job-----
  L539421          ACTIVE
  C539421          VARY ON PENDING

```

Figure 102. Status of SDLC Line and APPC Controller Before 5394 Activation

Next, we show the remote workstation controller and display device definitions.

```

Display Controller Description
Controller description . . . . . : CTLD          CRWS539421
Option . . . . . : OPTION          *ALL
Category of controller . . . . . :              *RWS
Controller type . . . . . : TYPE          5394
Controller model . . . . . : MODEL        1
Link type . . . . . : LINKTYPE         *NONE
Online at IPL . . . . . : ONLINE        *YES
Remote location . . . . . : RMTLOCNAME    PU539421
Local location . . . . . : LCLLOCNAME    RALYAS4B
Remote network identifier . . . . . : RMTNETID  USIBMRA
Text . . . . . : TEXT          Remote workstation ctrl for
5394 T2.1
Attached devices . . . . . : DEV
-----Attached Devices-----
RWS539421
Device wait timer . . . . . : DEFWAITTMR  120
Allocation retry timer . . . . . : ALCRTYTMR  180
Recovery limits . . . . . : CMNRCYLMT
  Count limit . . . . . :              2
  Time interval . . . . . :              5

```

Figure 103. Remote Workstation Controller Definition

Display Device Description		
Device description	DEVD	RWS539421
Option	OPTION	*ALL
Category of device		*DSP
Device class	DEVCLS	*RMT
Device type	TYPE	5292
Device model	MODEL	1
Local location address	LOCADR	00
Online at IPL	ONLINE	*YES
Attached controller	CTL	CRWS539421
Drop line at signoff	DROP	*NO
Character identifier	CHRID	*SYSVAL
Allow blinking cursor	ALWBLN	*YES
Print device	PRTDEV	*SYSVAL
Output queue	OUTQ	*DEV
Printer file	PRTFILE	QSYSPRT
Library		*LIBL
Maximum length of request unit . . .	MAXLENRU	*CALC
Text	TEXT	display description of conso

for 5394 T2.1 Node Support RPQ Device

Figure 104. Remote Workstation Definition

The vary-on operation on the remote workstation controller makes it ready to exchange information with the 5394. The data that will be exchanged is 5250 data carried within the APPC session.

Work with Configuration Status			RALYAS4B
			06/12/91
Position to	Starting characters		
Type options, press Enter.			
1=Vary on 2=Vary off 5=Work with job 8=Work with description			
9=Display mode status ...			
Opt	Description	Status	-----Job-----
	CRWS539421	VARY ON PENDING	
	RWS539421	VARY ON PENDING	

Figure 105. Status of RWS Controller and RWS Device Before 5394 Activation

Next, the 5394 is switched on and a BIND request is sent by the 5394 for the 5394 controller session used for maintenance information and so on. The device for this session is automatically created on the AS/400 and given the LU name of the 5394, PU539421. The AS/400 then sends a BIND request for the DWS session enabling it to exchange user data with AS/400B.

Figure 106 on page 117 shows the description of the automatically created APPC device with the same name as the 5394 LU. Figure 107 on page 117 shows the status of the APPC controller and automatically-created device descriptions, once the sessions have been established.

Display Device Description		06/12/91	RALYAS4B
Device description	PU539421		
Option	*BASIC		
Category of device	*APPC		
Remote location	PU539421		
Online at IPL	*NO		
Local location	RALYAS4B		
Remote network identifier	*NETATR		
Attached controller	C539421		
Message queue	QSYSOPR		
Library	*LIBL		
Local location address	00		
APPN-capable	*YES		
Single session:			
Single session capable	*NO		
Text	AUTOMATICALLY CREATED BY QLUS		
-----Mode-----			
*NETATR			

Figure 106. Description of Automatically Created APPC Device for a DWS

Work with Configuration Status		06/12/91	RALYAS4B
Position to	Starting characters		
Type options, press Enter.			
1=Vary on 2=Vary off 5=Work with job 8=Work with description			
9=Display mode status ...			
Opt	Description	Status	-----Job-----
	L539421	ACTIVE	
	C539421	ACTIVE	
	PU539421	ACTIVE	
	QPCSUPP	ACTIVE/TARGET	PU539421 QUSER 006366

Figure 107. Automatic Creation of APPC Device for a DWS

Notice that, although we mentioned that two sessions are established between the AS/400 and 5394 (one controller session and one per DWS), only one session is visible beneath the automatically created APPC device, PU539421, displayed in Figure 107.

The 5394 control unit management session is not visible. The reason that this session is not visible is that this session is started below the machine interface (MI). On the other hand, the information for the WRKCFGSTS display is taken from APPC control blocks residing above the MI. It is possible to see the 5394 controller session via the DSPAPPNINF command.

By looking at the mode status (type 9 in front of the APPC device on WRKCFGSTS screen), we can confirm that there are actually two user sessions running on the same logical link. As is usual with LU 6.2 sessions, an SNA services mode and a user mode have been started at the AS/400. The QPCSUPP mode indicates that two sessions have, indeed, been started and that one is a source session and the other a target session.

Display Mode Status							System: RALYAS4B
Device : PU539421							
Device status : ACTIVE							
Type options, press Enter.							
5=Display details							
Mode -----Conversations-----							
Opt	Mode	Status	Total	Source	Target	Detached	
	SNASVCMG	Started	0	0	0	0	
	QPCSUPP	Started	2	1	1	0	
							Bottom
F3=Exit F5=Refresh F11=Display sessions F12=Cancel							

Figure 108. Modes Status and Number of Sessions Started in Scenario 1

A communications entry had to be added to the subsystem that we were using for communications, QCMN. In particular, with the standard communications entry in QCMN, the default user is specified as *NONE. This specification caused an SNA sense code of 080F6051, Access security information invalid. The partner LU rejected the user ID or password received on an incoming Attach. Thus, we removed the default communications entry and added the following entry which includes a default user profile. We used this entry for all further testing of the IBM 5394 T2.1 Node Support RPQ.

Display Remote Location Name Entries						System: RALYAS4B
Subsystem description: QCMN		Status:	ACTIVE			
Remote	Job		Default		Max	
Location	Mode	Description	Library	User	Active	
PU539421	QPCSUPP	*USRPRF		QUSER	*NOMAX	
Press Enter to continue.						Bottom
F3=Exit F12=Cancel						

Figure 109. Remote Location Entry Added to QCMN Subsystem for VTAM 5394 LU Recognition

3.3.2 Attachment of an Intelligent Workstation

In this scenario, we attach a PC/AT with a twinax cable to our IBM 5394 T2.1 Node Support RPQ.

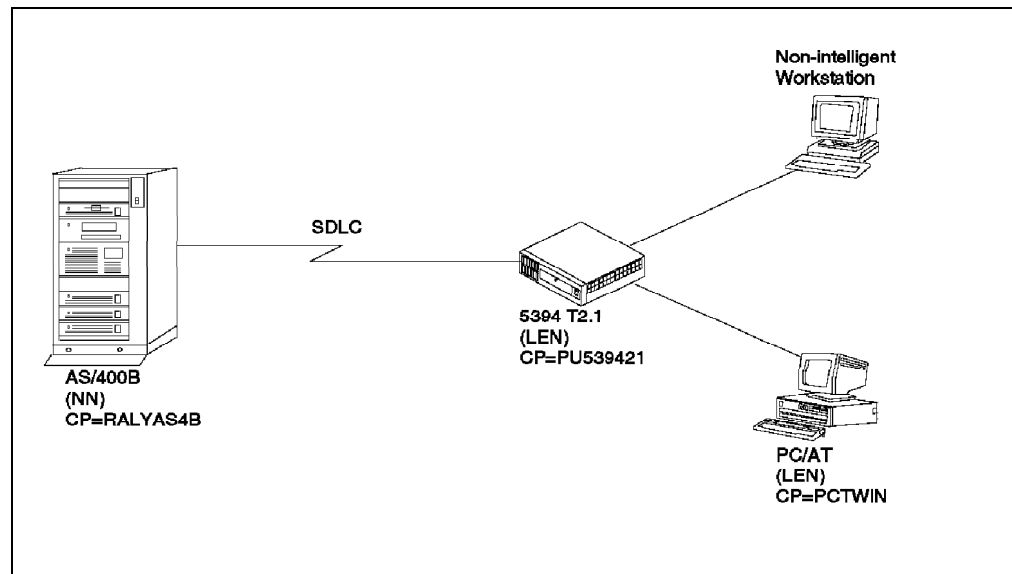


Figure 110. Second Scenario for IBM 5394 T2.1 Node Support RPQ Attachment

Figure 111 shows the CONFIG.PCS file needed for enabling a 5250 WSF session with AS400B.

```
SFLR 1,I,QIWSFLR,RALYAS4B
RTLN USIBMRA.PCTWIN 1
RTYP 5250
EMLI RALYAS4B,1
```

Figure 111. The CONFIG.PCS File Used on the PC/AT

1 Specifies the network qualified local LU name of the PC/AT. We called it PCTWIN.

The IBM T2.1 Node Support RPQ provides a pass-through function for the BIND initiated from the PC with PC Support. Thus, the AS/400 sees all PC Support sessions established via the 5394 as if they are LUs within the 5394. Thus, when these PC Support sessions are established, the AS/400 automatically creates an appropriate APPC device description and attaches it to the 5394 APPC control unit description.

Figure 112 on page 120 shows the configuration status after the PC Support sessions are started from the IWS. Figure 113 on page 120 shows the PCTWIN device description which is automatically created.

```

Work with Configuration Status                                RALYAS4B
                                06/12/91
Position to . . . . . Starting characters

Type options, press Enter.
  1=Vary on  2=Vary off  5=Work with job  8=Work with description
  9=Display mode status ...

Opt  Description      Status      -----Job-----
    L539421          ACTIVE
    C539421          ACTIVE
    PU539421          ACTIVE
    QPCSUPP          ACTIVE/TARGET      PU539421  QUSER      006367
    PCTWIN           ACTIVE
    QPCSUPP          ACTIVE/TARGET      QXFSESV  QSECOFR    006370
    QPCSUPP          ACTIVE/TARGET      PCTWIN   QSECOFR    006371

```

Figure 112. Automatic Creation of APPC Devices for PC/AT Named PCTWIN

```

Display Device Description                                RALYAS4B
                                06/12/91
Device description . . . . . : PCTWIN
Option . . . . . : *BASIC
Category of device . . . . . : *APPC

Remote location . . . . . : PCTWIN
Online at IPL . . . . . : *NO
Local location . . . . . : RALYAS4B
Remote network identifier . . . . . : *NETATR
Attached controller . . . . . : C539421
Message queue . . . . . : QSYSOPR
Library . . . . . : *LIBL
Local location address . . . . . : 00

-----Mode-----
*NETATR

```

Figure 113. Description of Automatically Created APPC Device for PC/AT

We can confirm, by looking at the mode status on each of the two APPC devices, that there are two user sessions for the DWS: one source and one target as before. Additionally, beneath the PCTWIN device there are now two sessions for the IWS. Notice that there are two target sessions and no source sessions. The IWS sends the BINDs to the AS/400 and, therefore, there are no AS/400 source sessions.

Display Mode Status							System: RALYAS4B
Device : PU539421							
Device status : ACTIVE							
Type options, press Enter.							
5=Display details							
	Mode	-----Conversations-----					
Opt	Mode	Status	Total	Source	Target	Detached	
	SNASVCMG	Started	0	0	0	0	
	QPCSUPP	Started	2	1	1	0	
							Bottom
F3=Exit F5=Refresh F11=Display sessions F12=Cancel							

Figure 114. Modes Status and Number of Sessions Started in Scenario 2

Display Mode Status							System: RALYAS4B
Device : PCTWIN							
Device status : ACTIVE							
Type options, press Enter.							
5=Display details							
	Mode	-----Conversations-----					
Opt	Mode	Status	Total	Source	Target	Detached	
	SNASVCMG	Started	0	0	0	0	
	QPCSUPP	Started	2	0	2	0	
							Bottom
F3=Exit F5=Refresh F11=Display sessions F12=Cancel							

Figure 115. Modes Status and Number of Sessions Started in Scenario 2

3.3.3 Schema of Matching Parameters

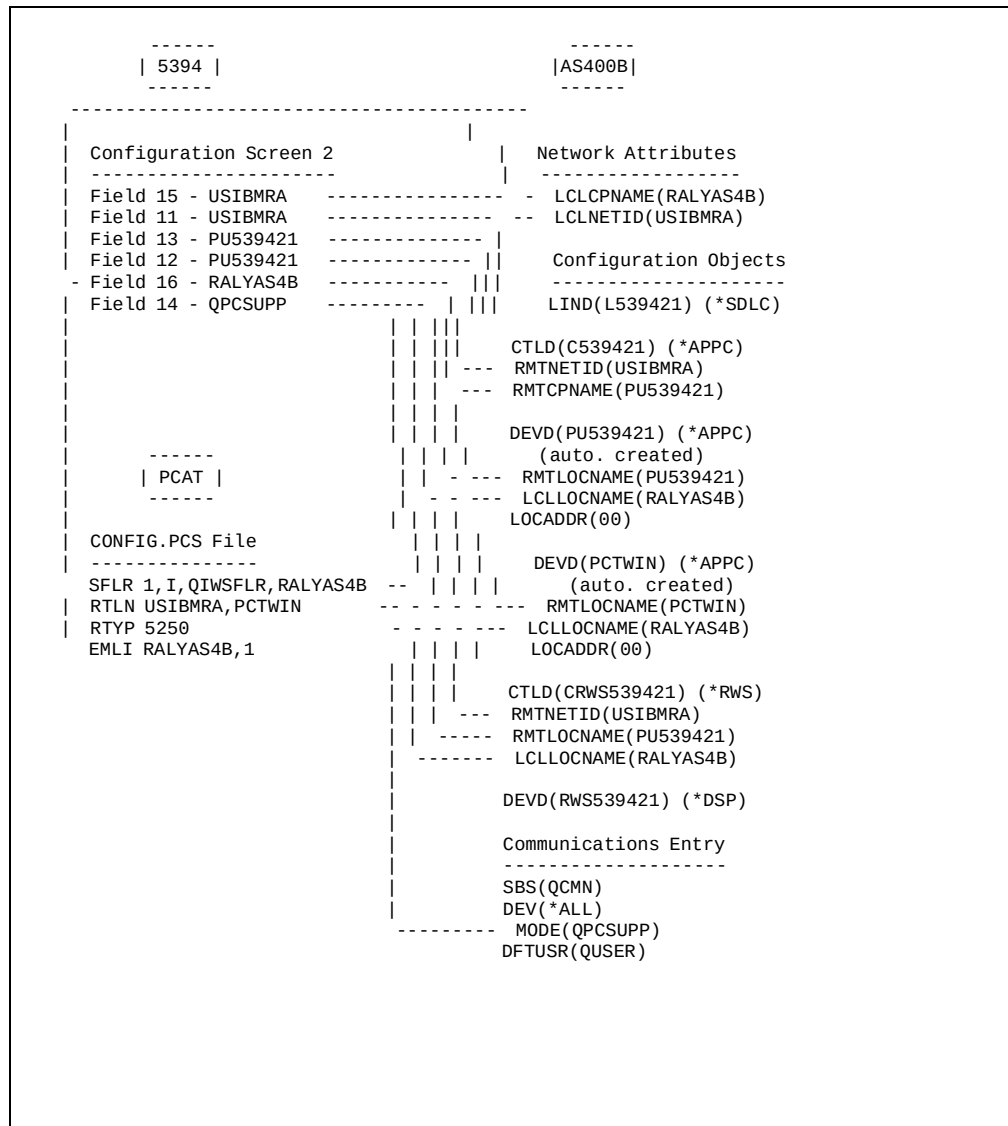


Figure 116. Matching Parameters for 5394, PC/AT and AS/400 Parameters

Chapter 4. The 5494 Remote Control Unit

In this chapter the following will be covered:

- An overview of the 5494 Remote Control Unit, its functions, and the extra function available by using the 5494 ASN RPQ.
- Configuration examples for attachment of the 5494 to the AS/400 without using the 5494 ASN RPQ. These will not be covered in detail as they are already well documented in *5494 and OS/2 Extended Services: Connecting Remote User Groups to AS/400s*.
- Configuration examples for using the 5494 ASN RPQ to connect the AS/400 and 5494 via a PS/2 gateway or a second 5494. Connection via a subarea network will be covered in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235 and Chapter 8, "APPN VTAM" on page 387.

Note: The regular microcode allows connectivity only with AS/400s. The 5494 ASN RPQ, allowing XID definition, can be connected to any other PU type 2.1 or LEN end nodes, though only a connection with an SNA subarea is officially supported. All other examples mentioned here are documented AS IS and are not officially supported.

4.1 5494 Overview

The 5494 is a remote workstation controller for the AS/400 and is available in two models:

- Model 001 manages the operation of up to 28 twinaxially attached workstations communicating with an AS/400 over a WAN. This communication is handled through an SNA physical unit (PU) type 2.1 connection. Release 2.0 allows the operation of up to 56 twinax devices using a Twinax Expansion feature.
- Model 002, in addition to the functions of the Model 001, allows communication over a token-ring network. A maximum of 40 links can be established in this way. Release 2.0 allows communications with up to 80 token-ring attached IWSs via a Token-Ring Upgrade Kit.

The level of PU type 2.1 support the 5494 provides is a low-entry networking node (LEN). The 5494 does not support CP-CP sessions, nor APPN end node or network node functions, but is able to act as an intermediate node for downstream-requested sessions with an upstream AS/400 host. The 5494 implements independent type 6.2 logical units (LU 6.2) only; LU4/7 sessions will be encapsulated in LU 6.2 headers.

4.1.1 Dependent Workstation Support

The 5494 supports a single independent LU for management of all DWSs (twinaxially attached displays and printers). This LU supports multiple parallel sessions. One controller session is always established and is used for maintenance information, statistics, product information, and microcode upgrades. In addition, there is one session established per DWS.

The BIND for the controller session is sent by the 5494, and the BINDs for the DWS sessions are sent by the AS/400. The DWSs attached to a 5494 may

establish sessions with an adjacently linked AS/400, or if that AS/400 is part of an APPN network, then the 5494 may establish sessions with any other AS/400 in the network. However, because there is only one LU 6.2 session per 5494 controller, all attached DWSs must communicate with the same AS/400.

4.1.2 Independent Workstation Support

An IWS communicates with the AS/400 through multiple LU 6.2 sessions. The 5494 supports this communication by acting as a pass-through controller.

The IWS pass-through function tracks the status of the LU 6.2 sessions established by the IWS, passes LU-LU data between the target AS/400 and the IWS, and performs session cleanup when sessions are ended abnormally.

The number of sessions an IWS can establish is determined by the following:

- The maximum number of links is 40 (80 for Release 2.0).
- Each IWS has a maximum of 32 sessions.
- The total number of IWS sessions for a 5494 is limited to 640 (1280 for Release 2.0).
- The mode description that is used.

The 5494 will accept BINDs initiated by the downstream IWS and pass them through to the upstream-linked AS/400. It will not, however, pass through BINDs from the upstream AS/400 to the downstream IWSs or to other devices from other downstream 5494s. Only 5294, Release 2 supports host-initiated BINDs to IWSs.

Note: Configuration of the 5494 was carried out using the 5494 Utility Program in stand-alone mode. For more details on configuration methods, refer to the 5494 manuals or *5494 and OS/2 Extended Services: Connecting Remote User Groups to AS/400s*.

4.2 5494 Configuration Examples

In this section we will consider two simple scenarios:

1. SDLC attachment of the 5494 to the AS/400, using the 5494 as a token-ring gateway.
2. Token-ring attachment of the 5494 to the AS/400, including using IWSs to communicate with more than one AS/400.

4.2.1 Attaching the 5494 to the AS/400 via an SDLC Gateway

Our scenario was configured as per the following diagram:

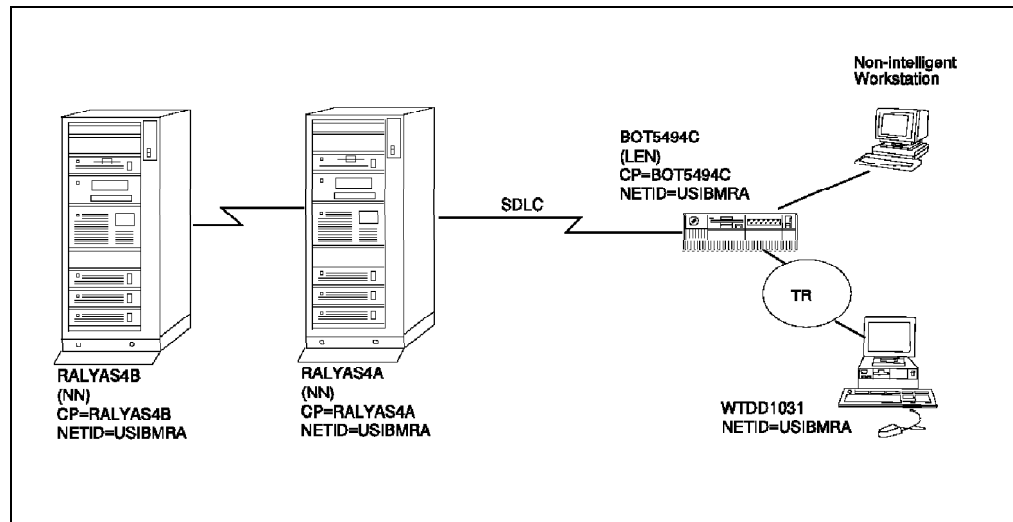


Figure 117. 5494 Attached via SDLC Line

4.2.1.1 5494 Configuration

As mentioned previously, configuration was done via the 5494 Utility Program R1.1 in stand-alone mode.

After the IBM logo screen, the main menu is displayed. Choose **Configuration**:

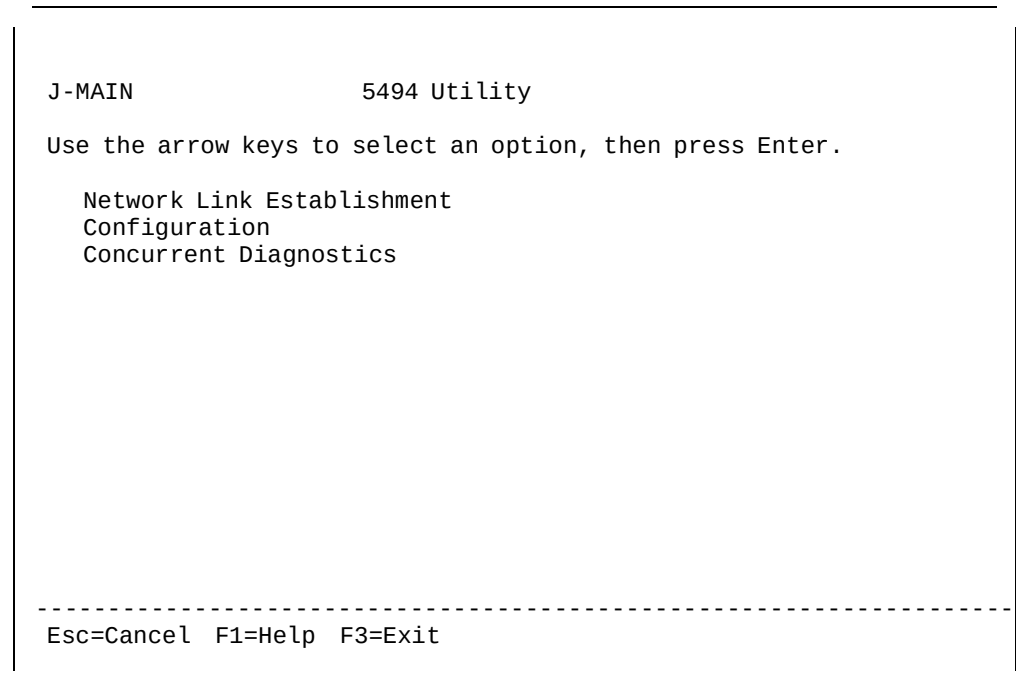


Figure 118. 5494 Utility Program Main Menu

We must first configure the connection to the AS/400:

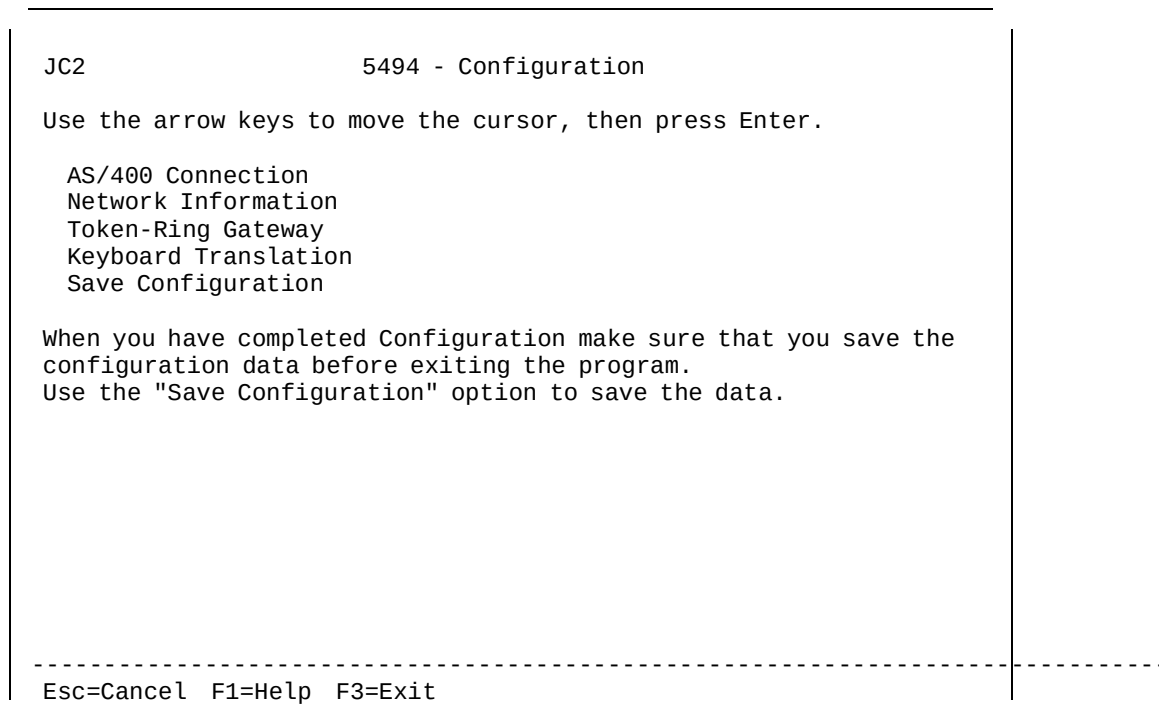


Figure 119. 5494 Utility Program Configuration Menu

Selecting the AS/400 Connection type, in this case SDLC, brings us to the SDLC configuration panels:

JC2-2-1 5494 - Configuration - AS/400 Connection - SDLC		More
Fill in the fields and use the spacebar to make selections, then press F6. Press Enter to verify the data.		
5494 SDLC Station Address (Hex)		[01]
Line Type	Leased Switched/Manual-Dial Switched/(V.25 bis)	
Line Facility	Half-Duplex Full-Duplex	
Connection Type	Multipoint Point-to-Point	
Data Encoding	NRZI NRZ	
Connection Method	DTR CDSTL	
Send Leading Pad	No Yes	
Local Loopback Support	No Yes	
V.25 bis Auto-Dial Connection Timeout in Seconds [60]		End

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 120. Configuring the 5494 for an SDLC Connection

All the parameters selected above should match the AS/400 SDLC line description.

Returning to the main configuration screen, we then configure information about the network:

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRA]	
5494 LU Name	[BOT5494C]	1
5494 CP Name	[BOT5494C]	1
Default Mode Name	[QRMTWSC]	2
5494 Connection Number	[	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[00]-[00000]	3
H1 AS/400 System 1		
AS/400 LU Name	[RALYAS4A]	
AS/400 Network Name	[USIBMRA]	
5494 Network Name	[USIBMRA]	
Mode Name	[QRMTWSC]	
AS/400 Connection Number	[	
	]	

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 121. Configuring the 5494 Network Information

Notes:

- 1 For simplicity, the 5494 CP and LU names were kept the same. If, however, it is necessary to have an LU name which is different from the CP name, then an entry in the Remote Location List of the AS/400 would be needed.
- 2 The mode description QRMTWSC is an IBM-supplied one, with parameters tailored to match the 5494s capabilities.
- 3 In normal use, this can be any sequence of numbers with the exception that the first two digits cannot be "XI", as this combination is reserved for the RPQ 8Q0932 for attachment to a Subarea Network.

As the 5494 will be acting as a gateway for downstream IWSs, we must configure the token-ring gateway function:

JC2-3 5494 - Configuration - Token-Ring Gateway

Fill in the fields and use the spacebar to make selection,
then press F6. Press Enter to verify the data.

Token-Ring Gateway Support No
Yes

Token-Ring Address (Hex) [400054940002]

SAP [04]

Response Timer (T1) [1]

Inactive Timer (Ti) [30]

Receive Acknowledgment Timer (T2) [30]

Retry Count (N2) [8]

Maximum Out (TW) [2]

Maximum In (N3) [1]

Esc=Cancel F1=Help F3=Exit F6=Return

Figure 122. Configuring the 5494 for a Token-Ring Gateway

With the exception of the token-ring address, all values used above were the defaults. The 5494 configuration is now complete, and the save configuration option is used to save the file as 5494CONF.DAT before transferring the information to the 5494:

JC2-5

5494- Configuration - Save Configuration

To save the configuration data press Enter.

Save Configuration File

Configuration File Name:
[A:\5494CONF.DAT]

Following are current configuration selections:

Communication Protocol	SDLC
Token-Ring Gateway	Yes

Esc=Cancel F1=Help F3=Exit

Figure 123. Saving the Configuration Information

4.2.1.2 IWS Configuration - Token-ring Connection

For this example, an IWS running the Communications Manager component of Extended Services 1.0 was connected via the token-ring network.

The IWS was configured to connect via the 5494 to RALYAS4A, and then onwards within the APPN network to RALYAS4B.

Upon entering Communications Manager Configuration, we are presented with the following screen:

Verify	Exit	F1 Help

Communication Configuration Menu		
Configuration file name : 54941		
Configuration file status :		
Verification required		
Press F10 to go to the action bar or select the type of profile you want to configure.		
* 1. Workstation profile (and auto-start options)... * 2. Asynchronous feature profiles * 3. 3270 feature profiles * 4. SNA feature profiles * 5. Server-Requester Programming Interface (SRPI) profiles * 6. LAN Adapter and Protocol Support * 7. 5250 Work Station Feature profiles * 8. X.25 feature profiles * 9. Configuration file utilities		

Figure 124. Communications Manager Main Configuration Menu

The first thing to configure is option 6: **LAN Adapter and Protocol Support**. In our case, we select an **IBM token-ring adapter** and **IBM IEEE 802.2** support.

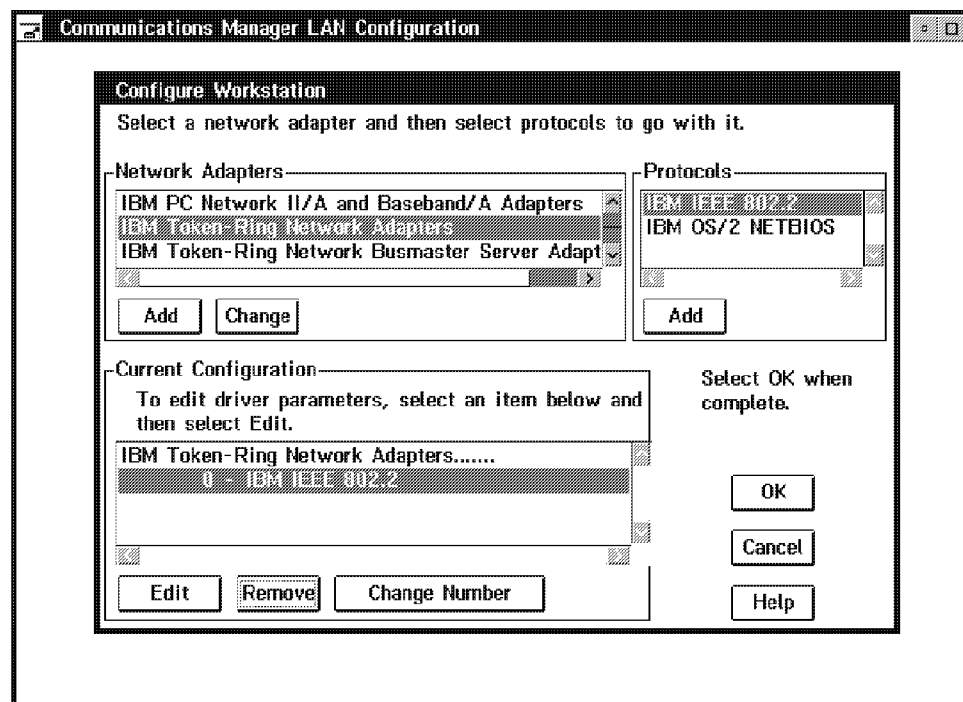


Figure 125. Configuring LAN Adapter and Protocol Support

The next thing to configure is option 4: **SNA features profiles**. In our case the DLC profile is for token-ring on adapter 00:

SNA Feature Configuration	
Data Link Control (DLC) profiles...	
* SNA network definitions...	
* SNA gateway profiles...	
* SNA LUA profiles...	

Esc Cancel F1 Help F3 Exit	

Figure 126. DLC Configuration (1)

SNA Feature Configuration	
Data Link Control (DLC) profiles...	
* SNA network definitions...	
* -----	
*	DLC Types
* 1. SDLC...	
* 2. IBM PC Network...	
3. Token-Ring or Other LAN type...	
* 4. Twinaxial...	
* 5. X.25...	
* 6. ETHERAND Network...	

Esc Cancel F1 Help	

Figure 127. DLC Configuration (2)

SNA Feature Configuration	
Data Link Control (DLC) profiles...	
* SNA network definitions...	
* -----	
*	DLC Types
* 1. SDLC...	-----
* 2. IBM PC N	DLC Adapters and Operations
3. Token-Ri	
* 4. Twinaxia	Use the spacebar to select.
* 5. X.25...	
* 6. ETHERAND	Number Adapter 0
	* Adapter 1
	Operation. Display
	* Change
	* Create
	* Delete

	Enter Esc Cancel F1 Help

Figure 128. DLC Configuration (3)

Display IBM Token-Ring Network DLC Adapter Profile	
Adapter number	: 0
Load DLC	: Yes
Maximum number of link stations.	: 4
Percent of incoming calls.	: 0 %
Free unused link	: No
Congestion tolerance	: 80 %
Maximum RU size.	: 512 bytes
Send window count.	: 2
Receive window count	: 1
C&SM LAN ID.	: WTDD1031
Send alert for beaconing	: No

Esc Cancel F1 Help	

Figure 129. DLC Configuration (4)

Now we must configure the network definitions, starting with the characteristics of the local node. Selecting **SNA Network Definitions** brings us to the following screen:

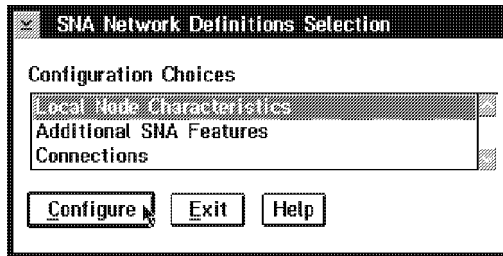


Figure 130. SNA Network Definitions Main Menu

Selecting **Local Node Characteristics** allows us to configure information about the local system:

Figure 131. Configuring the Local Node Characteristics

The PS/2 is now configured as local node WTDD1031 in network USIBMRA. The local node ID is optional and represents the exchange ID of the PS/2.

Returning to the Network Definitions menu, we select **Additional SNA Features** to define the LUs that we will be using:

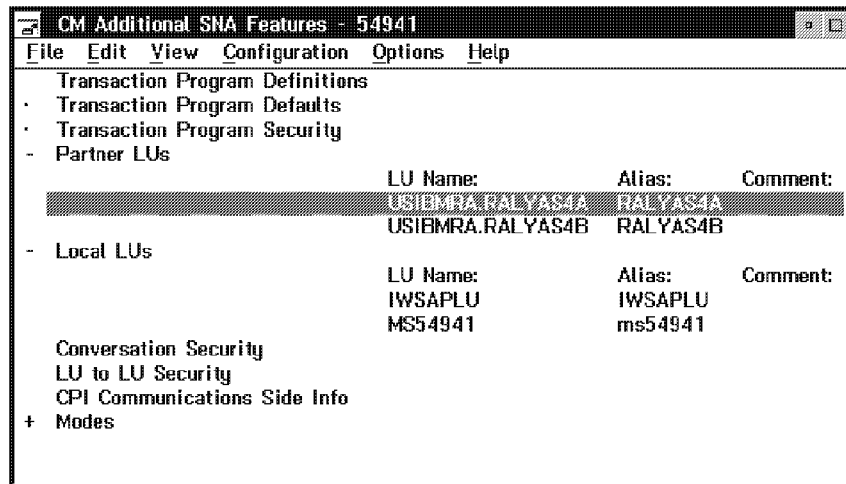


Figure 132. Configuring LUs. The LU IWSAPLU is used for configuring the 5494 interactively and is not relevant to this scenario.

We will be connecting to RALYAS4A and RALYAS4B, so we define a Partner LU for each of them. In addition, we define the local systems LU to be MS54941.

After saving this information, we configure the connection, in this case to a peer node:

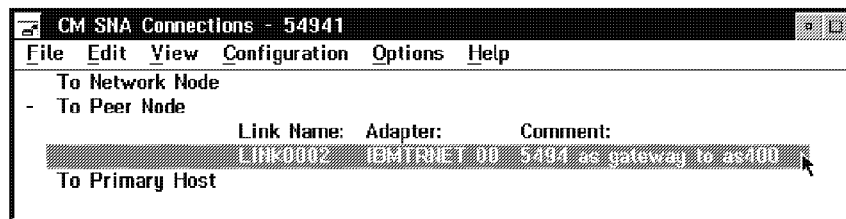


Figure 133. Configuring the Link to the 5494

Double clicking on **To Peer Node** allows us to configure a link to the 5494. First we must select the adapter that will be used:

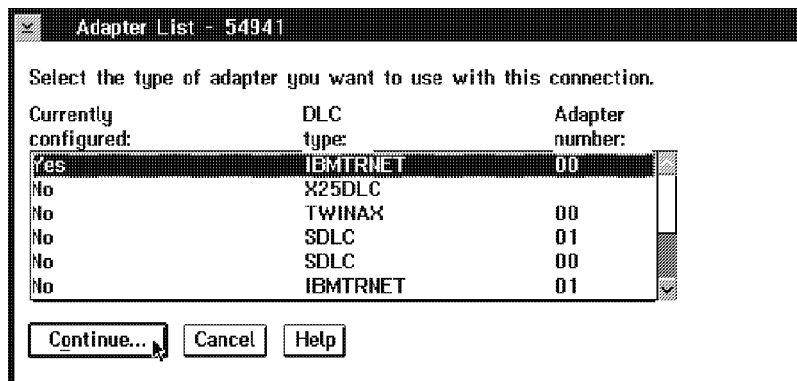


Figure 134. Choosing the Adapter for LINK0002

Then we add details about the link. Here we add the network ID, node name, and adapter address of the adjacent 5494:

Changing a Connection to a To Peer Node - 54941

Link name:

Partner network ID: (Required for partner LU definition)

Partner node name: (Required for partner LU definition)

LAN destination address:

Comment: (Optional)

Figure 135. Configuring the Link

Configuration of the SNA Network is now complete. We return to the main configuration screen and select **5250 Work Station Feature Profiles** to configure our session information:

5250 Work Station Feature Configuration

- * 1. Terminal profiles...
- * 2. Printer profiles...
- * 3. Specify APPC LU alias...
- 4. Session assignments

Esc Cancel F1 Help F3 Exit

Figure 136. 5250 Work Station Feature Configuration Menu

5250 Session Selection	
Session Number	Session Type
1...	Terminal
* 2...	Terminal
* 3...	Terminal
* 4...	Not Configured
* 5...	Not Configured

Esc Cancel F1 Help F3 Exit

Figure 137. Configuring 5250 Sessions

Sessions 1 and 2 are defined for RALYAS4A:

5250 Session Selection	
Session Number	Session Type
1...	Terminal
* 2...	Terminal
* 3...	Terminal
* 4...	Not Configured
* 5...	Not Configured

5250 Terminal/Printer Session Assignments	
5250 Work Station Feature profile name	[5250D1]
APPC Partner LU alias.	[RALYAS4A]
APPC Mode name	[QPCSUPP]
Short session ID	[F]

Enter Esc Cancel F1 Help F4 List

Figure 138. Configuring 5250 Session 1. Session 2 is identical.

Session 3 is defined for RALYAS4B:

5250 Session Selection	
Session Number	Session Type
* 1...	Terminal
* 2...	Terminal
3...	Terminal
* 4...	Not Configured
* 5...	Not Configured

5250 Terminal/Printer Session Assignments	
5250 Work Station Feature profile name	[5250D1]
APPC Partner LU alias.	[RALYAS4B]
APPC Mode name	[QPCSUPP]
Short session ID	[H]
Enter Esc Cancel F1 Help F4 List	

Figure 139. Configuring 5250 Session 3

4.2.1.3 AS/400 Configuration

Where possible, we allowed the AS/400s to autocreate objects that were needed. However, some objects still need to be created manually.

The first object that needs to be created is the SDLC line description.

Display Line Description	
Line description	BOT5494LIN
Option	*BASIC
Category of line	*SDLC
Resource names	LIN062
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP 1
Switched network backup	*NO
Exchange identifier	05615078 2
NRZI data encoding	*YES 1
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*HALF
Autoanswer type	*DTR 1
Maximum frame size	521 3
Error threshold level	*OFF
Duplex	*FULL 1
Modulus	8
Text	LIN081 Line to Bottom 5494

Figure 140. SDLC Line Description for 5494 Connection

Notes:

- 1 These parameters should match the parameters on the 5494 configuration screens.
- 2 This exchange ID was generated by the AS/400.
- 3 The maximum frame size on the *target* AS/400 should always be 521.

Attached to this line will be the APPC Controller and APPC Device:

Display Controller Description	
Controller description	BOT5494CTL
Option	*BASIC
Category of controller	*APPC
Link type	*SDLC
Online at IPL	*YES
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	BOT5494LIN
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	*NETATR
Remote control point	BOT5494C 1
Exchange identifier	073000C1 2
Data link role	*NEG
Station address	C1
Text	APPC Controller for Bottom 5494
APPN-capable	*YES
APPN CP session support	*NO 3
APPN node type	*LENNODE
APPN transmission group number	1
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 141. APPC Controller for 5494 Connection

Notes:

- 1 The CP name of the 5494.
- 2 The first three digits of the exchange ID (073) are the block ID of the 5494. The remaining digits should be '000' followed by the station address of the 5494.
- 3 As a LEN end node, the 5494 does not support CP-CP sessions.

Display Device Description	
Device description	BOT5494DEV
Option	*BASIC
Category of device	*APPC
Automatically created	NO
Remote location	BOT5494C 1
Online at IPL	*YES
Local location	*NETATR
Remote network identifier	*NETATR
Attached controller	BOT5494CTL
Message queue	QSYSOPR
Library	*LIBL
Local location address	00 2
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	APPC Device for Bottom 5494

Figure 142. APPC Device for 5494 Connection

Notes:

1 The LU name of the 5494.

2 The location address should be "00" for an independent LU.

For DWSs, a remote workstation controller and devices have to be created with linktype *NONE and the remote location name of the 5494 LU:

Display Controller Description	
Controller description	BOT5494RWS
Option	*BASIC
Category of controller	*RWS
Controller type	5494
Controller model	2
Link type	*NONE
Online at IPL	*YES
Remote location	BOT5494C
Local location	*NETATR
Remote network identifier	USIBMRA
Text	RWS Controller for Bottom 5494 -

Figure 143. Remote Workstation Controller for the 5494

Display Device Description	
Device description	BOT5494DSP
Option	*BASIC
Category of device	*DSP
Device class	*RMT
Device type	3487
Device model	HC
Local location address	00
Online at IPL	*YES
Attached controller	BOT5494RWS
Drop line at signoff	*NO
Character identifier	*SYSVAL
Allow blinking cursor	*YES
Print device	*SYSVAL
Output queue	*DEV
Printer file	QSYSPRT
Library	*LIBL
Maximum length of request unit . . .	*CALC
Workstation customizing object . . .	*NONE
Text	3487 - 00 - Bottom 5494

Figure 144. Description for a 3487 Attached to the 5494

Routing to other AS/400s

When using APPN to route sessions from the 5494 through the AS/400 to other systems, remember that the frame size on the *target* AS/400's controller must be set to 521. In our case, this meant restricting the token-ring controller connecting AS/400s A and B to a frame size of 521. 5494 Release 2.0 allows RU with 1.024 bytes.

4.2.2 Attaching the 5494 to the AS/400 via the Token-ring Network

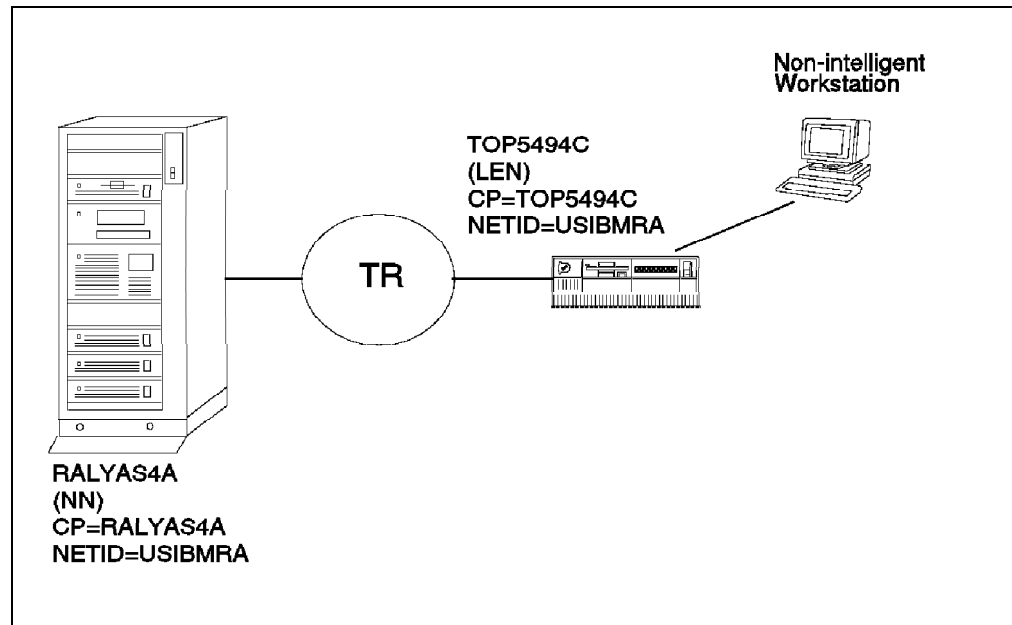


Figure 145. Token-Ring Attached 5494

For this scenario we used the token-ring line description L41TR which was already created on the AS/400 and is documented in Figure 3 on page 8.

This line description has Autocreate Controller set to *YES, so we allowed the AS/400 controller and device to be created during XID exchange.

4.2.2.1 5494 Configuration

Using the Utility Program, select AS/400 Connection, and this time choose token-ring as the connection protocol. The following screen is displayed:

JC2-2-4 5494 - Configuration - AS/400 Connection - Token Ring	
	More
Fill in the fields, then press F6. Press Enter to verify the data.	
5494 SAP (Hex)	[04]
Response Timer (T1)	[1]
Inactive Timer (Ti)	[30]
Receiver Acknowledgment Timer (T2)	[30]
Retry Count (N2)	[8]
H1 AS/400 System 1	
AS/400 SAP (Hex)	[04]
Maximum Out (TW)	[2]
Maximum In (N3)	[1]
H2 AS/400 System 2	
AS/400 SAP (Hex)	[04]
Maximum Out (TW)	[2]
Maximum In (N3)	[1]
H3 AS/400 System 3	

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down	

Figure 146. Configuring the 5494 for Token-Ring Connection to the AS/400

All the values used above were the defaults. The "response timer (T1) is defaulted to 1. This is acceptable in more circumstances, but if you have a large network between the 5494 and the AS/400, you will have to increase that value.

Returning to the main configuration menu, we then configure information about the network:

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRA]	
5494 LU Name	[TOP5494C]	
5494 CP Name	[TOP5494C]	
Default Mode Name	[QRMTWSC]	
5494 Connection Number	[400054940001]	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[00]-[00000]	
H1 AS/400 System 1		
AS/400 LU Name	[RALYAS4A]	
AS/400 Network Name	[USIBMRA]	
5494 Network Name	[USIBMRA]	
Mode Name	[QRMTWSC]	
AS/400 Connection Number		
[400020010001		]

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 147. 5494 Network Information. Note that this time we configure token-ring adapter addresses.

A connection to only one AS/400 was configured on the above screen. It is possible to define up to four AS/400s with which the 5494 will communicate, though not simultaneously. To communicate with another AS/400, the 5494 operator has to end communications with one AS/400 and re-establish them with another.

Configuration of the 5494 is now complete, and the data can be saved by taking the Save Configuration option from the main menu.

4.2.2.2 AS/400 Configuration

The APPC controller and device were autoconfigured by the system:

Display Controller Description		
Controller description	TOP5494C	
Option	*BASIC	
Category of controller	*APPC	
Link type	*LAN	
Online at IPL	*NO	
Character code	*EBCDIC	
Maximum frame size	16393	
Remote network identifier	USIBMRA	
Remote control point	TOP5494C	1
Initial connection	*DIAL	
Dial initiation	*LINKTYPE	
Switched disconnect	*YES	
Data link role	*NEG	
LAN remote adapter address	400054940001	2
LAN DSAP	04	
LAN SSAP	04	
Text	AUTOMATICALLY CREATED BY QLU5	

Figure 148. APPC Controller for the 5494

Notes:

- 1 The CP name of the 5494.
- 2 The token-ring address of the 5494.

Display Device Description		
Device description	TOP5494C	
Option	*BASIC	
Category of device	*APPC	
Automatically created	YES	
Remote location	TOP5494C	1
Online at IPL	*NO	
Local location	RALYAS4A	
Remote network identifier	*NETATR	
Attached controller	BOT5494CTL	
Message queue	QSYSOPR	
Library	*LIBL	
Local location address	00	
APPN-capable	*YES	
Single session:		
Single session capable	*NO	
Press Enter to continue		
F3=Exit F11=Display keywords F12=Cancel		

Figure 149. APPC Device for the 5494

Note:

- 1 The LU name of the 5494.

A remote workstation controller and devices will not be autocreated and must be created manually. The controller should have a linktype of *NONE and the remote location name should be the name of the 5494's LU.

Display Controller Description	
Controller description	CTL5494RWS
Option	*BASIC
Category of controller	*RWS
Controller type	5494
Controller model	2
Link type	*NONE
Online at IPL	*YES
Remote location	TOP5494C
Local location	*NETATR
Remote network identifier	USIBMRA
Text	5494 Remote Workstation Controller
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 150. Remote Workstation Controller for the 5494

Display Device Description	
Device description	TESTC
Option	*BASIC
Category of device	*DSP
Device class	*RMT
Device type	3487
Device model	HC
Local location address	01
Online at IPL	*YES
Attached controller	CTL5494RWS
Drop line at signoff	*NO
Character identifier	*SYSVAL
Allow blinking cursor	*YES
Print device	*SYSVAL
Output queue	*DEV
Printer file	QSYSPRT
Library	*LIBL
Maximum length of request unit . . .	*CALC
Workstation customizing object . . .	*NONE
Text	*BLANK
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 151. Device Description for a Screen Attached to the 5494

4.3 5494 Configuration using RPQ 8Q0932 for Attachment to Other Nodes

In this section we will consider the following scenarios:

- A 5494 connecting to an AS/400 via a PS/2 network node acting as a gateway
- A 5494 connecting to an AS/400 via another 5494

Connecting the 5494 to a subarea network will be considered in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235 and Chapter 8, "APPN VTAM" on page 387.

4.3.1 Overview of the 5494 ASN RPQ

5494 ASN RPQ is a licensed internal code enhancement feature for the 5494 Remote Control Unit. This enhancement allows the 5494 to communicate with an AS/400 through an SNA subarea network. Thus, a target AS/400 system can communicate with remote dependent workstations (DWSS) or independent workstations (IWSs) attached to the 5494. The 5494 ASN RPQ provides support for both DWSS and IWSs through a twinaxial link and IWSs attached through a token-ring to the 5494. The 5494 Release 2.0 now officially supports attachment to PS/2 NNs and 3174 NNs.

The 5494 ASN RPQ provides the following benefits:

- The 5494 ASN RPQ accesses AS/400 systems that are not attached directly as the adjacent node and where the adjacent node is not another AS/400 system. This not only allows attachment through an SNA Subarea Network, but also allows a 5494 to act as a gateway for other 5494s (with IWSs only attached). In this way, networks may not need to be redesigned in order to add more AS/400 terminals.
- Line costs may be reduced because the 5494 ASN RPQ eliminates the need for a dedicated communication line from the 5494 to the AS/400 system. The 5494 can share a line already in place with other systems.
- The 5494 ASN RPQ supports network user verification by the network. This support is provided by allowing the user to configure the ID number portion of the exchange station identification (XID) transmitted by the 5494.

4.3.2 5494 to AS/400 via PS/2 NN Gateway

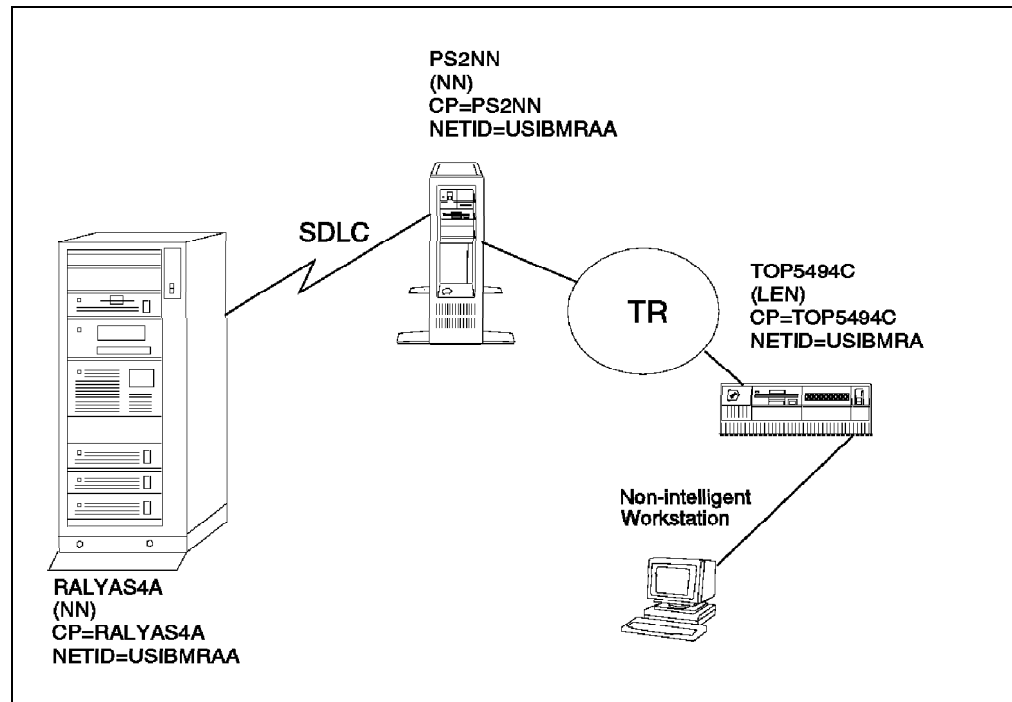


Figure 152. Connecting the 5494 via a PS/2 Network Node

We will first consider the scenario above, where a 5494 is connected to a PS/2 network node acting as the network node with the AS/400, where all three nodes are in the same network. Later, we will discuss the implications of having more than one network ID.

4.3.2.1 5494 Configuration

As a LEN node, the 5494 views all resources as residing on its adjacent node, in this case PS2NN. Therefore, the 5494 was configured with an AS/400 connection type of token-ring, and the AS/400's token-ring address was the address of the adjacent node PS2NN. The AS/400's fully qualified LU name does not change:

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRA]	
5494 LU Name	[TOP5494C]	1
5494 CP Name	[TOP5494C]	1
Default Mode Name	[QRMTWSC]	
5494 Connection Number	[400054940001]	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[XI] - [05494]	2
H1 AS/400 System 1		
AS/400 LU Name	[RALYAS4A]	
AS/400 Network Name	[USIBMRAA]	
5494 Network Name	[USIBMRA]	
Mode Name	[QRMTWSC]	
AS/400 Connection Number		
[400030010025		3

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 153. Configuring the 5494 to Connect via the PS/2 Network Node

Notes:

1 For simplicity, the 5494 CP and LU names were kept the same. If, however, it is necessary to have an LU name which is different from the CP name, then an entry in the Remote Location List of the AS/400 would be needed.

2 If support for network user verification is desired, the serial number should be "XI-hhhhh", where h represents a valid hexadecimal digit. The 5494 inserts the last five characters into the ID number field of the XID transmitted by the 5494. If these characters are not valid hexadecimal digits, an error code appears on the operator panel and on the attached DWSs when the 5494 is powered in normal mode. If the first two characters are not "XI", then the 5494 ASN RPQ sends an XID with an ID number of "000xx", where xx is the station address (x'00' for token-ring). Without the 5494 ASN RPQ, the 5494 always sends an XID in the latter format.

3 The token-ring address of the adjacent node PS2NN.

4.3.2.2 AS/400 Configuration

An SDLC line was created for the connection to PS2NN:

Display Line Description	
Line description	PS2NN062
Option	*BASIC
Category of line	*SDLC
Resource names	LIN062
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	05615078
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*FULL
Modulus	8
Text	SDLC line to PS/2 NN
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 154. SDLC Line Description for Connection to PS/2 Network Node

An APPC Controller was attached to this line:

Display Controller Description	
Controller description	PS2NN062
Option	*BASIC
Category of controller	*APPC
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	PS2NN062
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRAA
Remote control point	PS2NN
Exchange identifier	05D00000
Data link role	*NEG
Station address	01
Text	CTL FOR PS2NN GATEWAY PS/2
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 155. APPC Controller for the 5494

The APPC devices were allowed to autocreate at connection time:

Display Device Description	
Device description	PS2NN
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	PS2NN
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	PS2NN062
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 156. APPC Device for the PS/2 Network Node

Display Device Description	
Device description	TOP5494C
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	TOP5494C
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	PS2NN062
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 157. APPC Device for the 5494

A remote workstation controller was created as per Figure 150 on page 147.

4.3.2.3 PS/2 Network Node Configuration

The first parameters to be configured are the characteristics of the PS/2 network node itself. This is done through the Local Node Characteristics item on the SNA Network Definitions menu of the SNA Features Profiles.

Local Node Characteristics - PSNN5494

Required Features

Network ID: USIBMRAA

Local node name: PS2NN

Node type:

- ☐ End Node to Network Node Server
- ☐ End Node - No Network Node Server
- ☒ Network Node

Optional Features

Local node ID: 05D 00000 (Hex)

Local node alias name: PS2NN

Comment: PS/2 Network Node

☒ Activate Attach Manager at start up

Save and Return Cancel Help

Figure 158. Local Node Characteristics of the PS/2 Network Node

On this screen we configure the network that the PS/2 resides on, the local node name (in other words, the control point name), and the type of APPN node. It is also possible to specify a unique exchange ID for network user verification, though for our purposes this was left at X'00000' (05D is always the block ID of a PS/2 running Communications Manager). The combination of network ID, CP name, and exchange (or node) ID is used when the AS/400 selects or creates an APPC controller.

In Additional SNA Features, we can define local LUs for any emulation sessions in use on the PS/2 itself. We can also define Partner LUs, again only if local emulation is needed. If the PS2NN is being used purely as a network node, then it is not necessary to specify these.

In the Connections menu, we define links to other systems in our network. It is not necessary to define a link to the 5494, as the network node will create one when the 5494 contacts it. We do, however, have to create an SDLC link to the AS/400 network node. Double clicking on To Network Node allows us to create this. First we specify the adapter that we are going to use:

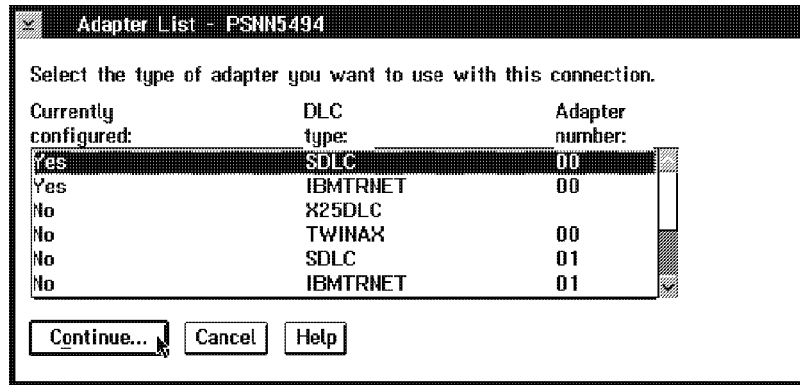


Figure 159. Configuring the SDLC Adapter for Connection to the AS/400

Then we give the link a name. The system will supply a default of LINK0001 upwards if no name is specified:

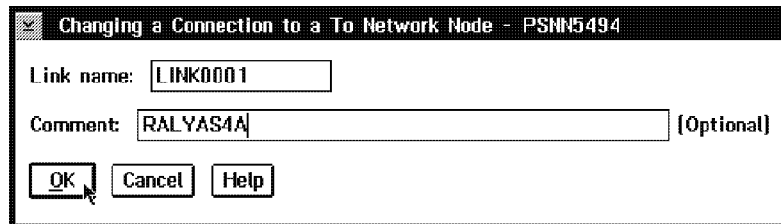


Figure 160. Configuring the Link to the AS/400

If a meaningful name is required for the 5494 connection, then a link can be created by selecting To End Node (or Unknown Node Type) or To LEN Node. If the former is chosen, then the PS/2 will determine the type of connection at XID exchange time (it is also highly recommended that you use this method when several net IDs are in use). This time, the token-ing adapter is chosen:

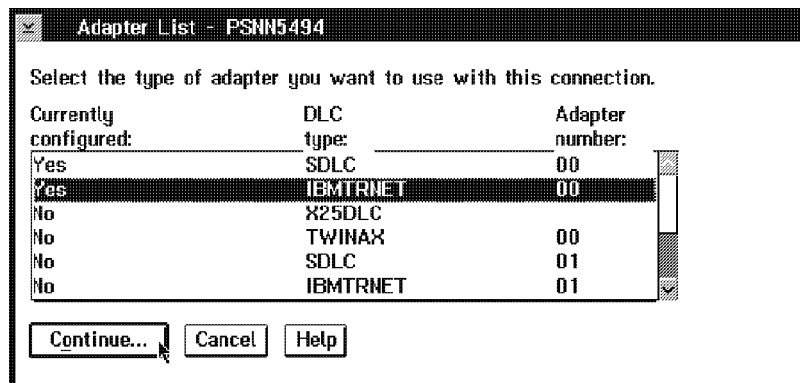


Figure 161. Configuring the Token-Ring Adapter for Connection to the 5494

The adapter address of the 5494 must then be specified:

Changing a Connection to a To End Node (or Unknown Node Type) - PSNN!

Link name:

LAN destination address:

Comment: [Optional]

Figure 162. Adding the 5494 Token-Ring Adapter Address

The configuration of the PS/2 is now complete. After verification of the configuration and restarting Communications Manager, we can take a look at the logical links that are active on the PS/2:

Link Name	Partner Network ID	Partner Name	Partner Type	Active Sessions	Link Status
@AAAAAAA	USIBMRAA	RAK	Learn	0	Pending Active
LINK0001	USIBMRAA	RALYAS4A	NN	7	Active
LINK0002			Learn	0	Inactive

Figure 163. Logical Link Status. @AAAAAAA is an example of an autocreated link.

As can be seen, the link to the AS/400 is active with seven sessions (five emulation and two CP-CP sessions). The link that was defined as the 5494 (LINK0002) is inactive. If we power on the 5494, the PS/2 will discover the nature of the link:

Link Name	Partner Network ID	Partner Name	Partner Type	Active Sessions	Link Status
@AAAAAAA	USIBMRAA	RAK	Learn	0	Pending Active
LINK0001	USIBMRAA	RALYAS4A	NN	10	Active
LINK0002	USIBMRAA	TOP5494C	LEN	3	Active

Figure 164. Logical Link Status after Activation of the 5494

The PS/2 now shows the CP name and net ID of the 5494, and recognizes it as a LEN connection. There are three sessions active (one controller and two screens), and these sessions are also active on the AS/400 link. The link @AAAAAAA is an autocreated link which is not relevant to this scenario.

If we look at the AS/400, we will see that the APPC device TOP5494C has been autocreated and is active.

Work with Configuration Status						RALYAS4A
						02/03/93 20:27:22
Position to _____ Starting characters						
Type options, press Enter.						
1=Vary on 2=Vary off 5=Work with job 8=Work with description						
9=Display Mode status ...						
Opt	Description	Status	-----Job-----			
—	PS2NN062	ACTIVE				
—	PS2NN062	ACTIVE				
—	PS2NN	ACTIVE				
—	TOP5494C	ACTIVE				
—	QRMTWSC	ACTIVE/TARGET	TOP5494C	SMYTH	036210	
Parameters or command						
===> _____						
F3=Exit F4=Prompt F12=Cancel F23=More options F24=More keys_						

Figure 165. WRKCFGSTS Screen for Line PS2NN062

By looking at the mode status (type 9 in front of the APPC device on the WRKCFGSTS screen), we can confirm that there are two user sessions running on the same logical link. As is usual with LU 6.2 sessions, an SNA services mode and a user node have been started at the AS/400. The QRMTWSC mode indicates that three sessions have, indeed, been started and that two are source sessions and the other a target session.

Display Mode Status						System: RALYAS4A
Device : TOP5494C						
Device status : ACTIVE						
Type options, press Enter.						
5=Display details						
Opt	Mode	Mode Status	-----Conversations-----			
—	SNASVCMG	Started	Total	Source	Target	Detached
—	QRMTWSC	Started	0	0	0	0
—			3	2	1	0
F3=Exit F5=Refresh F11=Display sessions F12=Cancel						Bottom

Figure 166. Mode Status of Device TOP5494C

4.3.2.4 Using Multiple Network Names

The scenario above used one network ID for all three nodes. We repeated the tests using different combinations of network IDs and the results were as follows:

1. ***PS/2 and AS/400 in Network USIBMRAA, 5494 in Network USIBMRA***

This scenario worked in exactly the same way as before. As is the case with LEN end node connections, the 5494 will pass BIND requests to its adjacent node and network-qualified LU names are not checked. It then becomes the responsibility of the adjacent node to locate the requested resource. The adjacent node, in our case PS2NN, will use APPN directory services to locate the destination LU and forward the BIND to RALYAS4A.

2. ***AS/400 in USIBMRAA, PS/2 and 5494 in USIBMRA***

This will work providing the PS/2 is configured correctly. When the AS/400 and PS/2 enter XID negotiation, the AS/400 will recognize that the PS/2 is a network node for a different network, and that the PS/2 doesn't support the (peripheral) border node function (bit 4 of byte 10 in the XID is '0'). As a result, the AS/400 will act as a border node, and present an end node image to the PS/2.

If the link to the AS/400 is already configured as a network node then the link will fail. The AS/400 will present an end node image to the PS/2, but the PS/2, expecting to see a network node, will not accept it. The link should, therefore, be created as an End Node (or Unknown Node Type) as in Figure 162 on page 155.

3. ***All Three Nodes in Different Networks***

We used the following network names:

- AS/400: USIBMRAA
- PS/2NN: USIBMRA
- 5494: USIBMRAX

The 5494 was able to make a connection to the AS/400, as the PS/2 was capable of forwarding the BIND for the controller session. However, as the AS/400 network node adopts the border node role in this scenario, and presents itself to the PS/2 as an end node, it will only send locate requests to the PS/2 for LUs that reside in the PS/2s native network. As a result, the AS/400 is unable to locate LUs in network USIBMRAX, and cannot send BINDs to the DWSs attached to the 5494.

Although DWSs can never become active in the above scenario, the same is not true for IWSs. As an IWS sends the BIND for its sessions to the AS/400, we were able to establish sessions on these IWSs across three network IDs.

4.3.3 5494 to AS/400 using Another 5494 as a Gateway

With the normal 5494 microcode, the 5494 will only exchange XIDs with an AS/400. However, with the announcement of the 5494 ASN RPQ, this limitation is now removed and the 5494 can receive an XID from any adjacent APPN node. As a result of this, it is now possible to locate 5494s downstream of other 5494s within the following guidelines:

Downstream 5494s will only support IWSs. As mentioned earlier, the 5494 will accept BINDs initiated downstream and pass them through to the upstream-linked AS/400. However, as a LEN end node, it does not have the capability of registering resources, and cannot, therefore, pass BINDs for downstream LUs.

As a result, the gateway 5494 will pass the BIND for the downstream 5494 controller session to the AS/400, but will not pass BINDs for the DWSs issued from the AS/400. As an IWS sends a BIND to the AS/400, it is capable of establishing a session.

The maximum number of links that a 5494 gateway will support is 40, the maximum number of sessions is 640, and the 5494 gateway guarantees 10 sessions per link. For example, 20 downstream 5494s would have a minimum of 10 sessions each, and the rest ($640 - 20 \times 10 = 440$ sessions) will be allowed per request between the 20 downstream 5494s, with a maximum of 32 sessions per 5494.

Note: The 5494 Release 2.0 allows 80 links with a maximum of 1280 sessions.

In this way, the 5494 can act both as a gateway and as a terminal server for twinax-attached IWSs on a token-ring network.

Our test scenario was set up as shown in the following diagram:

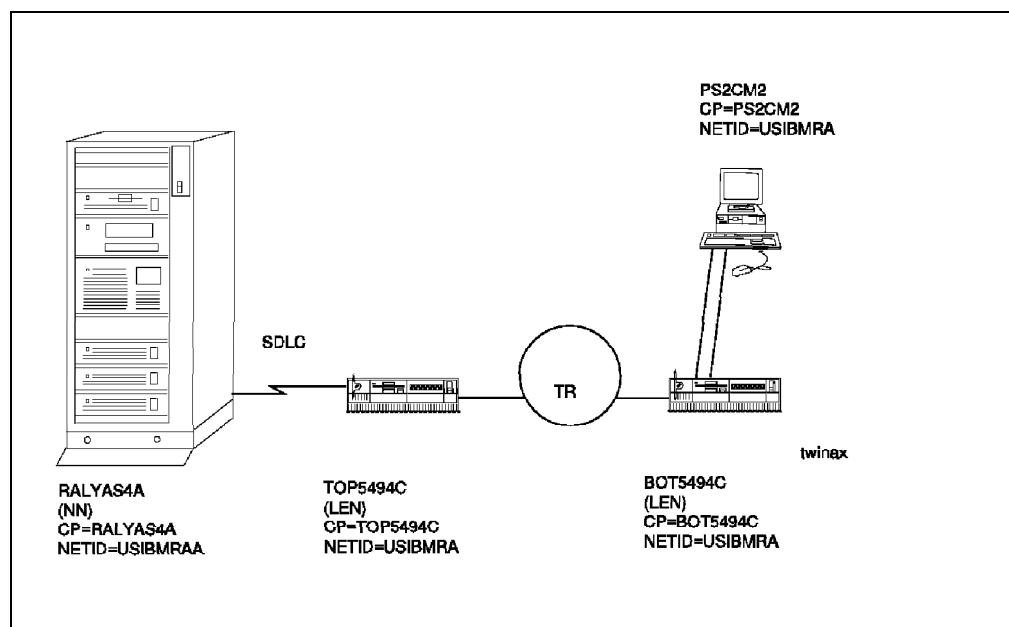


Figure 167. Connecting Multiple 5494s

4.3.3.1 5494 Configuration - Gateway

The configuration of the SDLC gateway was identical to the configuration used in 4.2.1, "Attaching the 5494 to the AS/400 via an SDLC Gateway" on page 124, with two exceptions:

1. The 5494 ASN RPQ was used in place of the normal 5494 system disk.
2. The serial number parameter was changed in order to provide a unique XID. See Figure 153 on page 150 for more details on this.

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name [USIBMRA]		
5494 LU Name [BOT5494C]		
5494 CP Name [BOT5494C]		
Default Mode Name [QRMTWSC]		
5494 Connection Number []		
Logical Connection:		
Retry Counter [10]		
Retry Interval [6]		
Serial Number [XI] - [05494]		
H1 AS/400 System 1		
AS/400 LU Name [RALYAS4A]		
AS/400 Network Name [USIBMRA]		
5494 Network Name [USIBMRA]		
Mode Name [QRMTWSC]		
AS/400 Connection Number		
[]		

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 168. 5494 Network Information Configuration

4.3.3.2 5494 Configuration - Downstream Controller

As with the gateway 5494, minimal change is needed to the standard token-ring 5494 configuration described previously in order to connect the 5494 through the gateway 5494. The changes were as follows:

1. The 5494 ASN RPQ was used in place of the normal 5494 system disk.
2. The serial number parameter was changed in order to provide a unique XID. See Figure 153 on page 150 for more details on this.
3. While the network qualified LU name of the destination AS/400 remained the same, the connection number was changed to the token-ring address of the adjacent upstream 5494.

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRA]	
5494 LU Name	[TOP5494C]	
5494 CP Name	[TOP5494C]	
Default Mode Name	[QRMTWSC]	
5494 Connection Number	[400054940001]	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[XI] - [15494]	
H1 AS/400 System 1		
AS/400 LU Name	[RALYAS4A]	
AS/400 Network Name	[USIBMRA]	
5494 Network Name	[USIBMRA]	
Mode Name	[QRMTWSC]	
AS/400 Connection Number		
[400054940002		]

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 169. Network Information Configuration for the Downstream 5494

4.3.3.3 IWS Configuration

A PS/2 running Communications Manager/2 was attached via twinax to the downstream 5494.

CM/2 is completely icon-driven, and configuration is done through the Communications Manager Setup icon (expand the CM - Icon View):

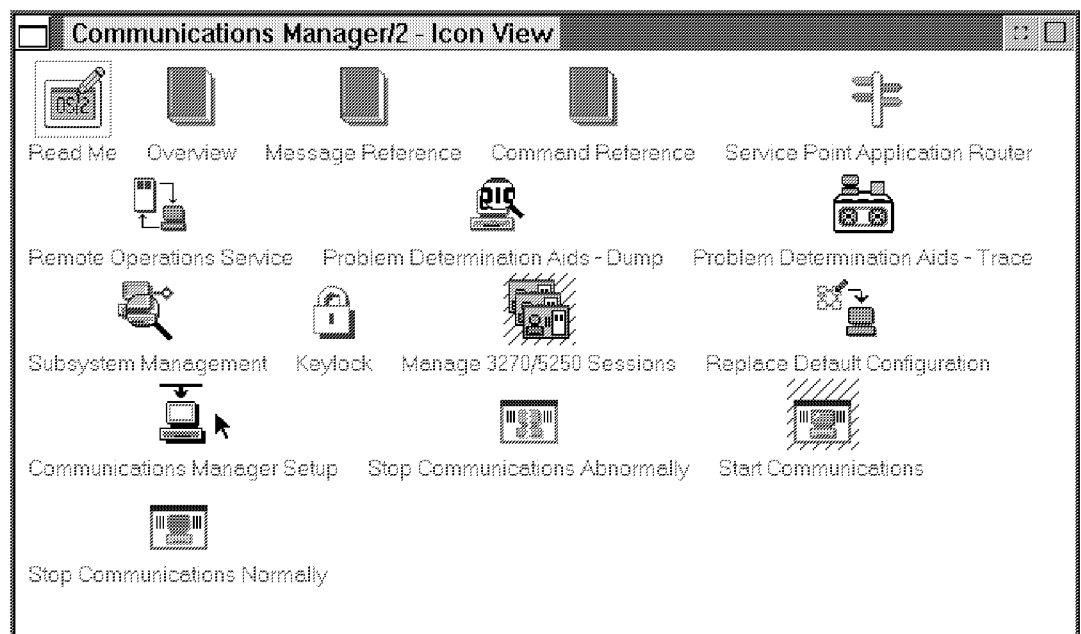


Figure 170. CM/2 Main Menu

We choose **Communication Manager Setup** to create our configuration and click on **CM2TWX**.

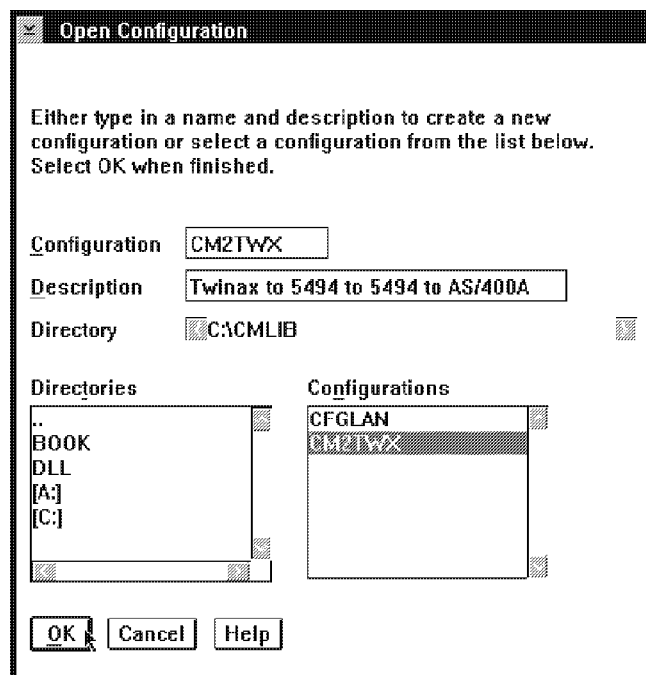


Figure 171. CM/2 Open Configuration Screen

Our connection shall be twinaxial, and the feature (obviously) is 5250 emulation.

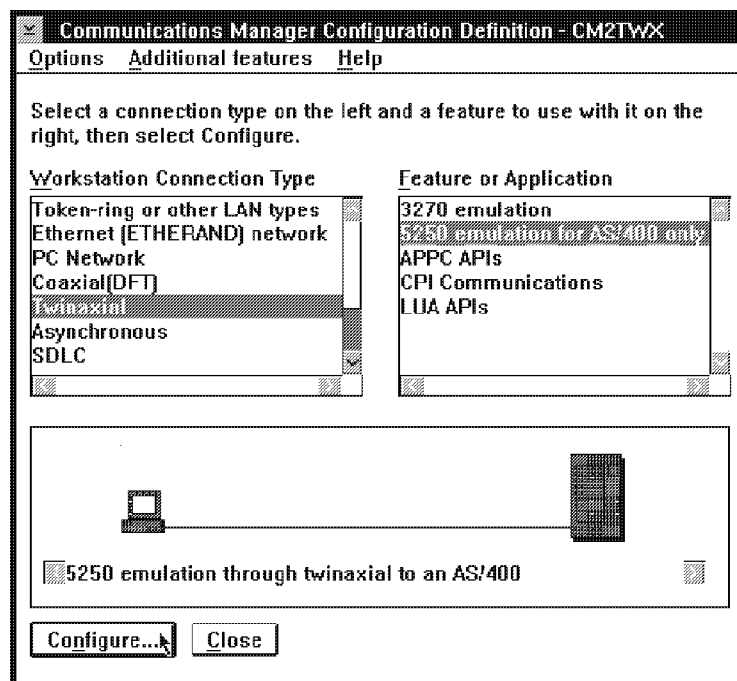


Figure 172. Selecting the Connection Type

Click on **Configure**. The following screen is displayed:

5250 Emulation through Twinaxial for AS/400

Network ID: USIBMRA

Local node name: PS2CM2

Local node ID (hex): 05D 32295

Partner LU name: USIBMRA.RALYAS4A

Mode name: QPCSUPP

Controller address: 3 (0 - 6)

Number of sessions: 2

OK Advanced... Cancel Help

Figure 173. Entering Local and Partner LUs

This is all that is needed to configure the connection to the AS/400.

4.3.3.4 AS/400 Configuration

There are no special considerations for implementing this configuration on the AS/400. The 5494 gateway configuration was identical to the configuration used in 4.2.1, “Attaching the 5494 to the AS/400 via an SDLC Gateway” on page 124. When the downstream 5494 is switched on, the gateway 5494 will forward the BIND and an APPC device for the downstream 5494 will be created on the SDLC line:

```

                                Display Device Description
Device description . . . . . : TOP5494C01
Option . . . . . : *BASIC
Category of device . . . . . : *APPC

Automatically created . . . . . : YES
Remote location . . . . . : TOP5494C
Online at IPL . . . . . : *NO
Local location . . . . . : RALYAS4A
Remote network identifier . . . . . : *NETATR
Attached controller . . . . . : BOT5494CTL
Message queue . . . . . : QSYSOPR
  Library . . . . . : *LIBL
Local location address . . . . . : 00
APPN-capable . . . . . : *YES
Single session:
  Single session capable . . . . . : *NO

Press Enter to continue

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 174. Autoconfigured APPC Device for Downstream 5494

In addition, when the twinaxially attached IWS, PS2CM2, sends its BIND, another APPC device is created:

Display Device Description	
Device description	PS2CM2
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	PS2CM2
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	BOT5494CTL
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 175. Autoconfigured APPC Device for IWS Attached to Downstream 5494

Chapter 5. Including a 3174 APPN Node in the Branch Network

In this chapter, we intend to:

- Position the role of a 3174 within an APPN network.
- Further expand the APPN network which has been built in the previous four chapters by including a 3174 with Configuration Support C as an APPN node in its own right.
- Consider the enhanced APPN capabilities of Configuration Support C 3.0.
- Provide a trace and flow analysis of the 3174 acting as a network node server in a connection network.

5.1 Considerations for a 3174 in an APPN Network

A 3174 with Configuration Support C may adopt a quite different role than has previously been expected for a 3174 cluster controller. In particular, it may deal solely with APPC traffic in an APPN network, independently of the host. This is precisely the role which we will, in this chapter, impose upon our 3174-11L (a channel-attached 3174) by adding it to the network built in the previous chapters. Later in this chapter, we will consider a 3174-13R with Configuration Support C 3.0 and SDLC attached to an AS/400 as a NN.

Note: All versions of Configuration Support C will support an APPN network on a token-ring LAN link. This is the environment explored in the first part of this chapter. Configuration Support C Version 3.0, considered in the final section, will support an APPN network, and CP-CP sessions over an SDLC, X.25, token-ring, and channel connection.

A far more practical role for the 3174-11L is to both participate in the APPN network and, at the same time, also have connectivity to the host. This connectivity to the host may be either via a direct connection (channel, SDLC or token-ring adapter) or via some other node in the APPN network. Furthermore, it should provide the possibility for either dependent communications to the subarea or independent communications to or through it. We will further explore this role for our 3174 and the combination of dependent and independent traffic through the subarea in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235.

In the subarea-independent, APPN-only network we are currently building, we consider independent communications only. It is possible to establish 3270 sessions between the AS/400 and 3174. We consider these cases further in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235.

The role of a 3174 in an APPN network is as an NN only. It cannot be an EN or a LEN end node. Therefore, the key reason for its use is likely to be as a network node server for other APPN or LEN nodes on the token-ring, particularly, token-ring-attached DOS or OS/2 PCs.

A 3174 may also be used as a network node server for its own coax-attached DOS PCs using the *IBM 3174 Workstation Peer Communications Support Program Version 1.0 (WPCSP)*. The coax-attached DOS PC may use other nodes in the APPN network as their NN server if desired. WPCSP enables coax-attached DOS

PS/2s or PCs to appear as if they are attached directly to a token-ring LAN. In this chapter, we will show examples of coax-attached PS/2s being defined to the 3174 as LEN end nodes. Please refer to 5.2.2, "The IBM 3174 Workstation Peer Communications Support Program" on page 178 for a discussion on the WPCSP Program.

PS/2s which use OS/2 Extended Services or Communications Manager/2 may also use the 3174 Peer Communication Feature. We include an ES example in this chapter.

5.2 Connecting a 3174 to the Branch Network (CS-C1.0, C2.0 & C3.0)

In adding a 3174 to the remote APPN branch we have been constructing, there are some 3174 definitional requirements to discuss. The other nodes in our network, however, require no special definitions in consideration of the 3174. It is simply another APPN network node in the network with another CP name. Thus, we discuss first the 3174 customization for its inclusion in the APPN network we have been building. We then discuss the Workstation Peer Communications Support Program (WPCSP) and examine the use of APPN from a 3174-connected PS/2 to RALYAS4A and RALYAS4B. The remote branch network built in this chapter is as shown in Figure 176.

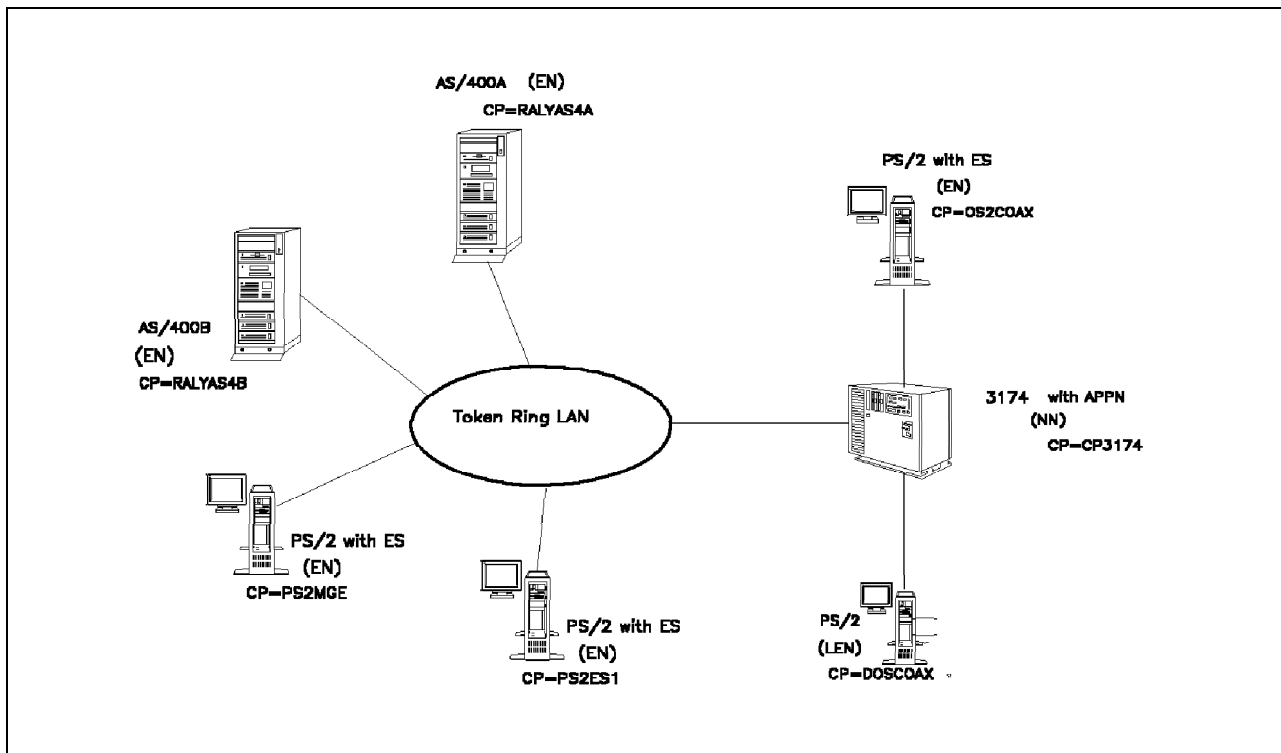


Figure 176. 3174 APPN Node in a Branch Network

5.2.1 Customizing the 3174 for APPN

Customization is the process of tailoring the 3174 Licensed Internal Code (LIC) to meet your unique requirements. This chapter provides guidance on customizing the 3174 for APPN functions. For a detailed description of each customizing question, please refer to *Configuration Support C Planning Guide*.

APPN customization in the 3174 requires questions to be answered or options to be selected in each of the following customization screens:

- Customization Entry panel
- Local SNA panel
- Common SNA panel
- APPN Node Definition panel
- Network Resource panel (topology database)
- Associated LUs panel (directory database)
- Class Of Service (COS) Definition panel
- Mode/COS Correlation panel

In order to customize the 3174, it is advisable to refer to the *3174 Controller Utilities Guide Configuration Support C*. However, if the 3174 has been previously customized with *Configuration Support C Planning Guide* then the following basic instructions may be used in order to further customize it for APPN:

1. Turn on the 3174.
2. At the front panel of the 3174, simultaneously press:
 - Alt 1
 - IML
3. Release the IML key. A 31 appears in the display.
4. Release the Alt 1 key. A 40 appears.
5. At the front panel keypad, type 0340 and press Enter.

This procedure begins the 3174 customization process using the hard disk. If you are using diskettes, then type 0140 or 0240 depending on the diskette drive in which you place the customization diskette. Now wait.

The first screen which appears on the customization console is the Master Menu. See Figure 177 on page 168.

Master Menu

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Select Option; press ENTER

Option	Description
1	Customize the Control Disk
2	Merge DSL
3	Copy Files
4	Diagnostics
5	Microcode Upgrade
6	Central Site Customizing
7	Media Management
K	Identify Customizing Keyboard

Select ==>

Press PF12 to File, PF3 to Quit, or Select another Option

PF: 3=Quit 4=Default 7=Back 8=Fwd 9=Check 12=File

Figure 177. Master Menu Panel

From this menu, option 1 shows another panel which enables the specification of which disk to customize. In our case, we choose the hard disk on that screen by placing a 3 in the control disk field. We do not show this screen here.

The next screen which appears on the customization console is the Customization Control Disk Menu. See Figure 178 on page 169.

```

_____ Customize Control Disk Menu _____

Select Option; press ENTER

Option      Description

   1        Configure
   2        Define Devices
   3        Merge RPQs
   4        Modify Keyboards
   5        Define AEA
   6        Define APPN Node
   7        Define COS
   8        Define 3174-PEER

Select ==>
Press PF12 to File, PF3 to Quit, or Select another Option
PF: 3=Quit   4=Default   7=Back   8=Fwd   9=Check   12=File

```

Figure 178. Customization Entry Panel

Options 1, 6 and 7 are of interest for APPN. Taking option 1 and scrolling forward once gives access to the screen in Figure 179.

```

_____ Local (SNA) _____
                                           LOCL

104 - 40      105 - 46      108 - 23N6233   110 - 1 0000   116 - 2_ __
121 - 01      123 - 0       125 - 00000000   126 - 00000000  127 - 2 4
132 - 0 0 0 0  136 - 1 0 0 1  137 - 0 0 0 0   138 - 0
141 - A       150 - 1 0      165 - 0       166 - A       168 - 0
173 - 00000000 175 - 000000   179 - 0 0 0    190 - 00
213 - 1       215 - 00000   220 - 3
222 - 1       223 - 10      224 - 2       225 - 4
240 - 0       241 - 0      242 - 1

PF: 3=Quit   4=Default   7=Back   8=Fwd

```

Figure 179. Local SNA Panel

We do not consider the subarea connection of the 3174 until later. However, it is worthwhile pointing out here that your answer to question 242 determines whether a connection with a PU type 2.0 or a PU type 2.1 (APPN node) can be establish with the host. Here we answer with a 1 (PU type 2.1 or APPN node) and save some re-customization time later. Other questions on this panel are not related to APPN. By scrolling forward, we come to the common SNA panels as shown in Figure 180 and Figure 181 on page 171.

Common SNA 40/LOCL

500 - 0 1 501 - USIBMRA_ 502 - _____

APPN Support Fields:

2 510 - 1 3 511 - CP3174__ 4 512 - CNET_____

PF: 3=Quit 4=Default 7=Back 8=Fwd 9=RtnH

Figure 180. Common SNA Panel One

Common SNA		40/LOCL
5	900 - 4000 3174 0001 04	905 - 1 908 -IBMLAN____
	911 - 0	
PF: 3=Quit 4=Default 7=Back 8=Fwd 9=RtnH		

Figure 181. Common SNA Panel Two

The Common SNA customization panel is the entry point to APPN definitions.

1 Question 501 allows the network ID of the 3174 to be specified. In this example, we use the same net ID as specified for other nodes in the branch network built in Chapter 2, "AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network" on page 5.

2 Specify in question 510 whether APPN will be used (1) or not (0).

3 Specify in question 511 the Control Point (CP) name of the 3174.

4 Question 512 allows the connection network to be defined. The name specified here is the name of the virtual node for the connection network. Here, we specify CNET to be the virtual node to match the virtual node name specified by the other nodes in our branch network. See 2.1.5.2, "ES/1 Requirements for Connection Network" on page 44 for discussion of *connection network*.

Since the 3174 may only act as a network node, it is defined as the network node server in our connection network, CNET. Then, all other nodes in the network may act as end nodes being serviced by the 3174 and all sessions between nodes connected to the virtual node CNET may then be routed directly across the token-ring.

5 The token-ring address of the 3174 is specified here.

Exiting back to the main menu and taking option 6 causes the panel in Figure 182 on page 172 to be displayed. Subsequent panels are displayed by scrolling forward.

APPN Node Definition

1

610 SESSIONS - 1

2

611 NODES/LINKS - 1

3

612 WILDCARD - 0

PF: 3=Quit

4=Default

8=Fwd

Figure 182. APPN Node Definition Panel

1 Question 610: APPN Sessions

This response indicates the number of LU 6.2 intermediate sessions which may be activated through the 3174. Valid responses are:

- 1 = up to 225 sessions (default response)
- 2 = up to 500 sessions
- 3 = up to 750 sessions
- 4 = up to 1000 sessions

Your response is used to:

- Allocate the 3174 storage when the 3174 NN is initially loaded. Since APPN sessions are dynamically set up, and dependent upon resources (buffers, control blocks, links) available at session initiation, this value may not always be achieved.
- Determine the total amount of storage required for the 3174.

2 Question 611: APPN Nodes/Links

This response indicates the number of PU type 2.1 links supported by the 3174. Valid responses are:

- 1 = up to 20 nodes/links (default response)
- 2 = up to 75 nodes/links
- 3 = up to 150 nodes/links
- 4 = up to 255 nodes/links

Your response is used to:

- Allocate the 3174 storage when the 3174 NN is initially loaded. Since PU type 2.1 links are dynamically activated as required, and dependent upon resources (control blocks and ports) available at link establishment, this value may not always be achieved.
- Determine the total amount of storage required for the 3174.

3 Question 612: APPN Wildcard Option

This response indicates whether the 3174 APPN NN currently being customized holds the wildcard for the APPN network in which it is participating. Valid responses are:

0 = No (default response)

1 = Yes

Only one network node in an APPN network may hold the wildcard since this node will respond positively to a search request for any LU. Usually, the node holding the wildcard is the network node which is used for routing sessions through the subarea. This node must then be adjacent to the host.

Since there is no CP-CP session between a network node and its adjacent host node (a LEN end node), then all LUs, in and beyond the subarea, must be defined at the network node. The key reason for the wildcard option is to reduce the amount of definition required.

If the wildcard option is taken here, be sure that no other node in the network also has it specified; otherwise, unpredictable results may occur.

Storage Requirements: You must also pay attention to storage requirements. For example, the defaults to questions 610=1 and 611=1 (225 sessions, 20 links) require 968 kb of additional storage.

Selection of 650, 651, and 652=1 (Peer, Bridge, LAN Mgr) places an additional requirement of 250 kilobytes storage. Table 3 is a matrix of possible responses for the above panel. It shows the amount of storage which must be added in addition to that required for base and other feature functions.

Table 3. Sessions/Nodes Storage Requirements (Bytes)				
	Q 611=1 (20)	Q 611=2 (75)	Q 611=3 (150)	Q 611=4 (225)
Q 610=1 (225)	968	1188	1666	1966
Q 610=2 (500)	1408	1628	2106	2406
Q 610=3 (750)	1808	2028	2506	2806
Q 610=4 (1000)	2208	2428	2906	3206

Network Resources								001 of 240
	CPNAME	NODE TYPE (1-3)	LUs* (X)	DLC TYPE** (1)	ADDRESS**			
	1	2	2	3	4			
1	RALYAS4B	2	—	1	4000	1002	0002	04
2	RALYAS4A	2	—	1	4000	1002	0001	04
3	PS2ES1	2	—	1	4000	3001	0025	04
4	ESCOAX	2	—	1	4000	3174	1992	04
5	DOSCOAX	1	—	1	4000	3174	3992	04
6		—	—	—				
7		—	—	—				
8		—	—	—				
9		—	—	—				

* - Enter 'X' to define Associated LUs where required.
 ** - Specify only for connect initiation from this 3174.

PF: 3=Quit 4=Default 7=Back 8=Fwd 10=PageBk 11=PageFwd

Figure 183. Links to Adjacent Nodes

1 The network resources panel provides, first, the capability for defining any APPN nodes which are to be considered as adjacent nodes to the 3174 being customized.

The 3174 is capable of dynamically learning about the existence of nodes which contact it across the token-ring. This capability is analogous to the dynamic controller description creation on the AS/400. If, for example, an AS/400 and a 3174 are to establish CP-CP sessions, only one of the CPs need define the other. Either an AS/400 APPC controller description is created for the 3174 or the AS/400 is defined in the 3174 network resources panel. Notice that we define no NNs to the 3174. See the description for 2. The 3174 (CP=CP3174) will, in our network, perform the role of network node server to all nodes in the CNET connection network. Since the adjacent nodes have been defined at the 3174, an APPC controller need not be created on the AS/400. It will be automatically created.

Note: At the time of testing, there was a limitation with the automatic CP definition on the 3174. The limitation relates to a CP which is already defined in the 3174 gateway definitions as a downstream PU. The auto-creation of that CP definition does not occur. In this case, both the AS/400 and the 3174 must define the adjacent CP over which CP-CP sessions will be established.

2 Specify here whether the node being defined is either a LEN end node (1), an end node (2), or a network node (3).

3 There is no need to define LUs for APPN end nodes or network nodes. The network node LUs are discovered dynamically by APPN and the end node LUs are registered with the network node after CP-CP sessions establishment. If an X is entered here, then the panel shown in Figure 184 on page 175 will later be shown. We have only a single LEN end node being defined and, thus, define LUs for only this node.

4 The DLC type must be token-ring (1). APPN support is currently confined to token-ring for configuration support C 2.0. Configuration support C 3.0 has no such limitation and will be discussed separately.

5 Specify here the token-ring address of the node to which the 3174 will initiate contact.

		Associated LUs					001 of 004
	CPNAME	LUNAME	LUNAME	LUNAME	LUNAME	SERVING NN	
1	1	DOSCOAX	DOSCOAX			CP3174	
PF: 3=Quit 4=Default 7=Back 8=Fwd 10=PageBk 11=PageFwd							

Figure 184. LU Definition to Directory

1 Bear in mind that if a serving NN, that is, the NN server for the LEN end node, is not specified then the 3174 NN is used by default. However, another NN can be defined to serve the 3174-attached LEN end node.

_____ COS Definition _____

Enter the number of the COS Definition and the number of the definition to be used as a model.

COS Definition Number - ____ Model Definition Number - ____
 (1-14) (0-14)

-----Definition Numbers-----

0. Clear Definition	
1. #BATCH__	8. _____
2. #BATCHSC	9. _____
3. #INTER__	10. _____
4. #INTERSC	11. _____
5. #CONNECT	12. _____
6. _____	13. _____
7. _____	14. _____

When using models 1-5, IBM-supplied defaults will always be invoked.

PF: 3=Quit 8=Fwd

Figure 185. COS Definition

A class of service (COS) is a table which contains definitions of the "weight" which particular node and link characteristics are given when calculating a route through the network. Characteristics with a lower weight are considered to be more desirable for route selection. A COS is specified at session establishment time and used by a network node in order to determine the optimal route through an APPN network according to the definitions given in the COS. All classes of service which may be used by sessions for which the 3174 performs route selection calculation must be defined here. Route selection calculation may be performed for sessions originating at the 3174 or for sessions from nodes for which the 3174 provides NN services. If a session is requested specifying a COS which is not defined at the 3174, then route selection cannot be performed and the request will fail. The COS entries listed here appear by default. Every current IBM implementation of APPN includes these default COS entries. However, if other COS entries have been created to match some unique route selection requirement, they must also be specified in this panel.

Mode/COS Correlation					
Mode Name	#	COS Name	Mode Name	#	COS Name
#BATCH__	_	#BATCH__	_____	_	_____
#BATCHSC	_	#BATCHSC	_____	_	_____
#INTER__	_	#INTER__	_____	_	_____
#INTERSC	_	#INTERSC	_____	_	_____
BLANK	_	#CONNECT	_____	_	_____
1		QPCSUPP_			#CONNECT
_____	_	_____	_____	_	_____

Define Mode/COS pairs. To specify IBM-supplied COS names, place 1-5 in the #-column. 1=#BATCH 2=#BATCHSC 3=#INTER 4=#INTERSC 5=#CONNECT

PF: 3=Quit 4=Default 7=Back 8=Fwd

Figure 186. Mode/COS Correlation

A class of service is specified at session establishment by actually specifying a mode. A mode implies a set of characteristics, one of which is the COS, to be associated with the session.

Thus, every node name specified on the screen in Figure 185 on page 176 must be correlated with a COS name in Figure 186. Otherwise, the COS cannot be found by reference to the Mode.

In our case, we use the QPCSUPP mode for 5250 WSF sessions. Since QPCSUPP is not an APPN-architected mode, it does not appear by default. We must specify it in the Mode/COS Correlation panel and associate it with a class of service. On the AS/400, QPCSUPP is IBM-supplied and linked by default to the APPN-architected COS #CONNECT. We, too, will link QPCSUPP to #CONNECT.

1 Therefore, we specify this entry. Otherwise, session negotiation will fail if the mode QPCSUPP is used, even if the 3174 is only performing intermediate session routing.

The two SNA-reserved modes, SNASVCMG and CPSVCMG, are defined internally to the 3174 and need not be defined here.

It's possible to add or modify a COS table during the 3174 customization process. However, the 3174 will prevent modification to the IBM-supplied COS tables by re-inserting default values during IML.

5.2.2 The IBM 3174 Workstation Peer Communications Support Program

The IBM 3174 Workstation Peer Communications Support Program (WPCSP) is a DOS program that runs in PCs or PS/2s which are coax-connected to the 3174. The program number for WPCSP is 5799-PHL. In conjunction with the 3174 peer communications LIC feature, available in Configuration Support C or as an RPQ (#8Q0718) for Configuration Support B, it provides the capability for these PCs to appear as if they are directly attached to the token-ring LAN.

The 3174 microcode feature provides a virtual token-ring connection and the WPCSP provides appropriate device drivers to interface to that virtual token-ring LAN connection. The Peer Communication LIC feature is supported by the WPCSP program in DOS PCs. In an OS/2 PC, this support is included in both Communications Manager/2 and OS/2 Extended Services.

Logically, the connectivity may be pictured as follows:

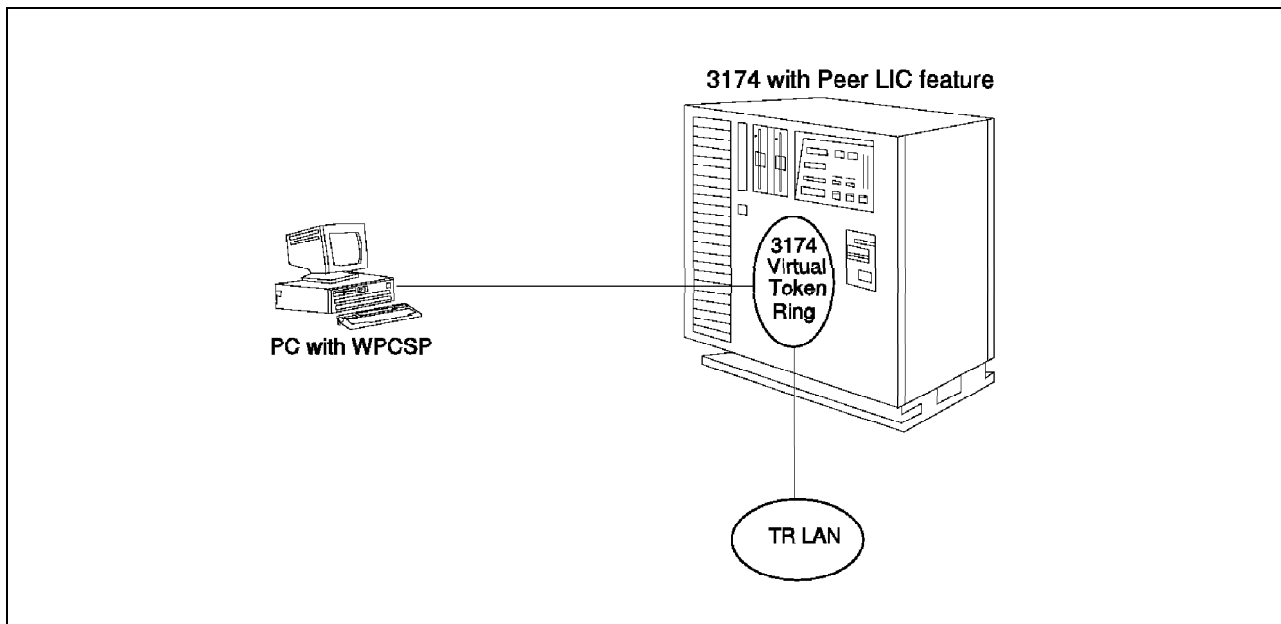


Figure 187. The 3174 Virtual Token-Ring

Consequently, a PC which is coax-attached to the 3174 is logically equivalent to any PC which is token-ring LAN-attached to the 3174. Provided the 3174 has been configured appropriately, its network node services may, in particular, be used by either coax-attached PCs or by LAN-attached PCs.

Consideration is now given to the configuration requirements to enable a coax-attached PS/2 to communicate, using DOS PC Support to RALYAS4A and RALYAS4B, across the network already built in previous chapters.

5.2.2.1 AS/400 Configuration

In terms of AS/400 configuration, we are finished before we begin. We already have our token-ring line description on the AS/400. Furthermore, the line description specifies AUTOCRTCTL(*YES) and, therefore, an incoming connection request will automatically create an APPC controller description for our PS/2 with PC Support.

5.2.2.2 3174 Customization for the Peer Communications Function

We have already customized the 3174 for APPN. In doing so, we specified in the Network resources panel that DOSCOAX, a coax-attached DOS-based PS/2, is a LEN end node. We also specify its token-ring address in that panel. However, until the 3174 is customized for the peer function, DOSCOAX cannot be reached at its token-ring address. Prior to peer customization, the 3174 can only recognize DOSCOAX as a coax-connected device. Recall, also, that the 3174 implementation of APPN is only supported across a token-ring. Thus, without appropriate peer customization on the 3174, DOSCOAX cannot be a part of the APPN network.

Option 8 from the Customization Control Disk Menu allows for peer customization. We show this panel in Figure 188, below:

3174-Peer Definition			
3174-Peer Support			
1	650 - Y	3174-Peer Support	(Y,N)
3174-Peer Options			
2	651 - Y	Bridge Support	(Y,N)
	652 - N	LAN Manager Support	(Y,N)
	653 - Y	3174-Peer Online Test Updates	(Y,N)
3174-Peer Station Parameters			
3	660 - 4000 3001 91 PN	3174-Peer Port Address Range	(0000 00 - FFFF FF)
	661 - 05	Percentage of Discard Threshold	(00 - 99)
PF: 3=Quit 4=Default 8=Fwd			

Figure 188. Peer Definition Panel

1 Question 650 allows the specification of the peer support. With specification of the peer function comes the capability for coax-connected DOS PCs or PS/2s on the 3174 to communicate with each other via an internal token-ring LAN segment within the 3174.

2 Question 651 allows the specification of token-ring bridge support for the 3174. If specified as Y then the 3174 internal token-ring is capable of being bridged to other token-rings as if by a token-ring bridge. The 3174 provides a link from the internal LAN segment to the external LAN segment, where the token-ring adapter on the 3174 is connected. Thus, the coax-attached PCs are now capable of communicating via token-ring to any other token-ring-attached device external to the 3174.

3 The first 10 characters of the token-ring address for all of the coax-attached devices is specified. The last two characters, shown on the customization screen as PN, are defaulted for each specific device to its 3174 port number. Thus, in this case, a device on port 02 will have a default token-ring address of 400030019102. The address may be overridden in each PC by specifying a different value in the CONFIG.SYS file. However, the value used in the CONFIG.SYS file must be outside of the range of decimal 00-63. These values are reserved for use by workstations on corresponding port addresses. For example, the value 02 can only be used by the PC coax-attached to port 02 on the 3174. If the token-ring address is overridden in the CONFIG.PCS file of the PC on port 02 then the only valid values used must be out of the range 400030019100 to 400030019163.

5.2.2.3 PS/2 PC Support Configuration

The following products are required on the PS/2 :

- DOS 3.3 or 4.1
- IBM 3174 Workstation Peer Communication Support Program Version 1.0 (WPCSP) - 5799-PHL
- DOS PC Support/400

The 3174 WPCSP is provided on one PC diskette. One of the files provided, DXMINFO.DOC, is an extension to the user's guide. For more information regarding specific configuration requirements, please refer to this guide.

The diskette contains four driver files which need to be added in the CONFIG.SYS of the PS/2. These files are:

- DXMA0MOD.SYS, an interrupt arbitrator
- DXMA1MOD.SYS, the software interface to the adapter
- DXML1MOD.SYS, providing the IEEE 802.2 program support
- DXMT0MOD.SYS, providing NetBIOS application programs with a program interface to the adapter support device drivers

After having installed the WPCSP product in the C:\WPCSP directory of the PS/2, the CONFIG.SYS is changed as follows :

```

DEVICE=C:\WPCSP\DXMA0MOD.SYS
DEVICE=C:\WPCSP\DXMA1MOD.SYS
DEVICE=C:\WPCSP\DXML1MOD.SYS 400031743992 1
DEVICE=C:\WPCSP\DXMT0MOD.SYS
BREAK=ON
BUFFERS=20
FILES=40
DEVICE=C:\PCS\EIMPCS.SYS 2
DEVICE=C:\PCS\ECYDDX.SYS 2

```

Figure 189. CONFIG.SYS file for DOSCOAX

1 Here we have overridden the PC token-ring address.

2 These two drivers are used by PC Support/400 for shared folder support. They are automatically placed in the CONFIG.SYS by the DOS INSTALL procedure of PC Support/400.

Since DOSCOAX now appears as a LAN-attached LEN end node in an APPN network, there are two options for establishing a PC Support session with RALYAS4A and RALYAS4B. First, the token-ring address for both RALYAS4A and RALYAS4B may be specified in the CONFIG.PCS file. Thus, DOSCOAX would communicate via the 3174 internal token-ring LAN and bridge to the AS/400s directly on the token-ring LAN. Second, the token-ring address of the 3174 may be specified in the CONFIG.PCS file. In this latter case, the 3174 provides the network node services for the coax-connected PS/2 in order to route the PC Support session to the AS/400s. The CONFIG.PCS file used to establish 5250 WSF to each of RALYAS4A and RALYAS4B directly across the token-ring is shown in Figure 190. The CONFIG.PCS file used to establish 5250 WSF to each of RALYAS4A and RALYAS4B by utilizing the NN services of the 3174 is shown in Figure 191.

```
SFLR 1,I,,RALYAS4B
TRLI RALYAS4B,400010020002
TRLI RALYAS4A,400010020001
RTLN APPN.DOSCOAX
RTYP ITRN
UPDT I:\QIWSFL2,C:\PCS,S,,,PC SUPPORT/400
FTYP 2
```

Figure 190. CONFIG.PCS File Used to Establish Direct 5250 WSF to RALYAS4A and RALYAS4B

```
SFLR 1,I,,RALYAS4B
TRLI RALYAS4B,400031740001
ADRS RALYAS4A,RALYAS4B
RTLN USIBMRA.DOSCOAX
RTYP ITRN
UPDT I:\QIWSFL2,C:\PCS,S,,,PC SUPPORT/400
FTYP 2
```

Figure 191. CONFIG.PCS File Used to Establish 5250 WSF to AS/400 by Utilizing 3174 NN Services

1 Recall that the 3174 token-ring address is specified in question 900 of the Common Network panel. Sessions established to RALYAS4B are done by use of the NN services of the 3174 whose token-ring address is specified here.

2 Sessions established to RALYAS4A are re-established by use of the NN services of CP3174 at token-ring address 400031740001.

3 The net ID of the PC needs to be changed to match that of the 3174. The reason for this requirement is that the current APPN implementation on 3174 does not support attachment of downstream APPN or LEN nodes with a different net ID. This limitation has ramifications when attempting to connect a 3174 and an AS/400 with different net IDs. Even if the AS/400 supports the border node function, the AS/400 and 3174 cannot, at the time of testing for this document, establish CP-CP sessions if they have different net IDs.

5.2.2.4 Schema of Matching Parameters

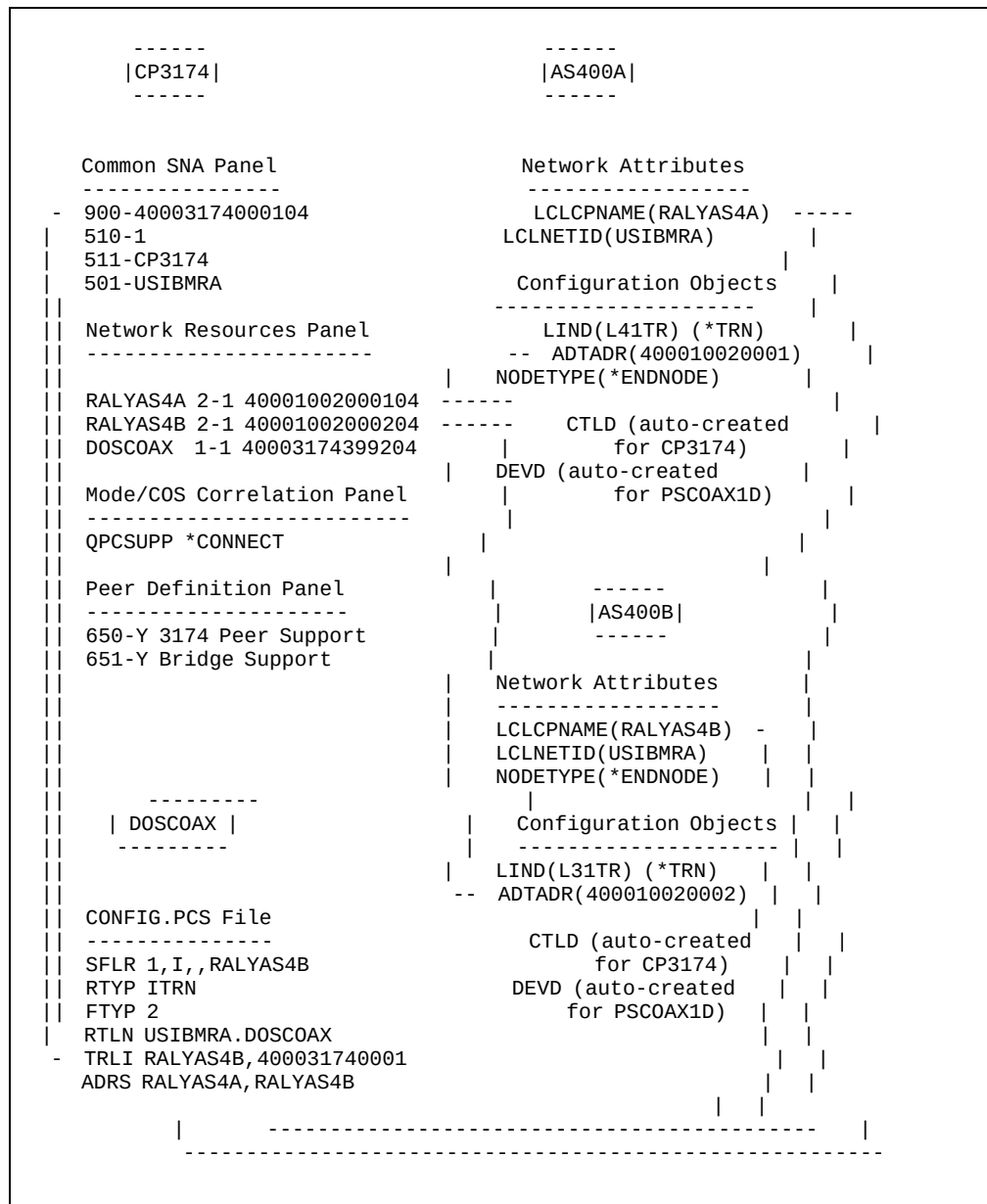


Figure 192. Matching Parameters for DOSCOAX to AS/400s via CP3174

5.3 Connecting a 3174 to the Branch Network (CS-C3.0 Only)

In this scenario, we will add the 3174 to our branch network via an SDLC link. While it has always been possible to support a 3174 on a downstream SDLC or X.25 link to the AS/400, it has not, up to now, been possible to support a CP-CP session with this 3174. To examine these changes more closely, we will leave our familiar CNET network for the moment. The network implemented in this section is shown in Figure 193 on page 183.

Here we will create an SDLC line and APPC controller description for the AS/400, with an SNA Pass-Through device for CP3174's 3270 session. SNA Pass-Through will be discussed more fully in Chapter 7, "Remote Branch Networks Connected

through an SNA Subarea (No APPN VTAM),” and is not discussed further here. Similarly, an additional 3174 remote workstation controller (RWS) description is defined for each system attached to CP3174 which requires 3270 sessions with RALYAS4A (or an S/390 host attached to RALYAS4A). This includes CP31742, RALYAS4B, ESCOAX, and DOSCOAX.

The objective of this section is to show the configuration for SDLC-attachment of a 3174 acting as a network node to an AS/400. The configuration parameters for CP31742, RALYAS4B, ESCOAX, and DOSCOAX are referenced in this section, but will generally, not be discussed in detail. The detailed configuration for these systems are identical to those found in 5.2, “Connecting a 3174 to the Branch Network (CS-C1.0, C2.0 & C3.0)” on page 166.

The 3174 provides PU type 2.1 or APPN support only for the token-ring gateway and does not provide APPN intermediate session routing (ISR) for the other 3174s downstream to it and using the 3174 gateway functions. This means that as RALYAS4A views CP3174, and 3270 connections for systems which lie beyond CP3174 (downstream), each system will appear as a unique SDLC station address, defined in the question 940: Ring Address Assignment, and will have a corresponding AS/400 RWS controller description. These controller descriptions will be used for 3270-type sessions only. All APPC sessions, like PC support functions or AS/400 DSPT, will appear to RALYAS4A as devices under the controller description for CP3174. APPC sessions use the 3174's APPN routing functions to connect to RALYAS4A.

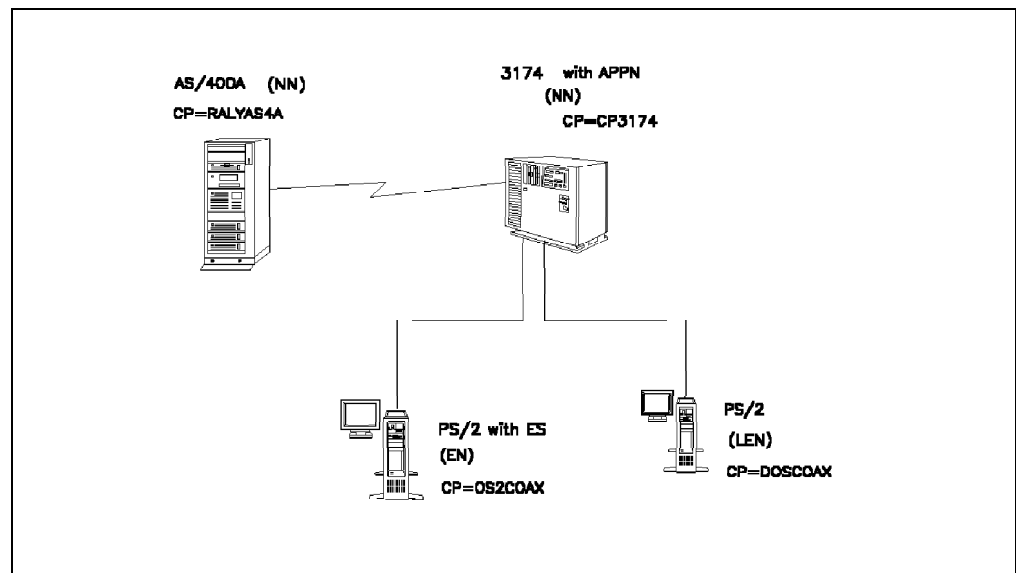


Figure 193. The Environment Built in This Section - 3174 SDLC to Branch

5.3.1 CP3174 Sessions (SDLC Attached-APPN Capable)

Figure 194 on page 184 through Figure 204 on page 190 show the 3174 configuration panels for CP3174. These are similar to those we have discussed earlier except here the 3174 is a 3174-11R, a control unit attached to the AS/400 via communications lines using the SDLC communications protocol. The host for the 3174, in this instance, is an AS/400, RALYAS4A.

You may notice some of these screens are slightly different in their appearance from those in the previous section. The prompt is:

Select Test; press ENTER ==>

PF: 3=Quit 8=Fwd 12=Test Menu

This prompt, which appears in one form or another at the bottom of all the screens which follow, indicates that these screens are those shown when the 3174 test facility is used to display a 3174's active configuration. The 3174 test function is discussed further in 5.3.4, "The 3174 Test Function" on page 197.

Model / Attach

098 -

099 - 3174 11R ITSC RALEIGH TR GW C30

100 - 11R

101 - 2

Select Test; press ENTER ==>

PF: 3=Quit 8=Fwd 12=Test Menu

Figure 194. 3174 Configuration Support C3.0 Customization (SDL-Attached) Panel

SDLC				
104 - C1	105 - C8	108 - 23N6503	110 - 1 0000	116 - 2_ _
121 - 01	123 - 0	125 - 00000000	126 - 00000000	127 - 0 0
132 - 0 0 0 0	136 - 1 0 0 1	137 - 0 0 0 0	138 - 0	
141 - A	150 - 1 0	165 - 1	166 - A	168 - 0
173 - 00000000	175 - 000000	179 - 0 0 0	190 - 00	
213 - 1	215 - 00000	220 - 0		
310 - 0	313 - 1	317 - 0	318 - 0	340 - 1
365 - 0	370 - 1			
Select Test; press ENTER ==>				
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu				

Figure 195. 3174 Configuration Support C3.0 Customization (SDLC-Attached) SDLC

The responses to questions 104 and 105 now indicate the range of SDLC polling addresses that this control unit will use. In Figure 179 on page 169 these questions specify the channel address range in the local channel-attached 3174. It is not possible to channel-attach a 3174 to an AS/400.

Common SNA		
500 - 0	501 - USIBMRAA	502 - CP3174__
APPN Support Fields:		
510 - 1	511 - CP3174__	512 - CNET__
Select Test; press ENTER ==>		
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu		

Figure 196. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Common SNA Panel

Common Network		
900 - 4000 3174 0002 04	905 - 1	908 - IBMLAN
911 - 0	912 - 00	
Select Test; press ENTER ==>		
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu		

Figure 197. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Common Network Panel

_____ 940: Ring Address Assignment _____

S	Ring Address	SAP	T	S	Ring Address	SAP	T
C1	4000 3174 0002	04		C3	4000 3174 2992	04	0
C2	4000 3174 1992	04	0	C5	4000 3174 4992	04	0
C4	4000 3174 3992	04	0	C7	4000 3174 6992	04	0
C6	4000 3174 5992	04	0				
C8	4000 3174 0003	04	1				

Select Test; press ENTER ==>

PF: 3=Quit 7=Back 8=Fwd 12=Test Menu

Figure 198. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Ring Address Assignment Panel

_____ 3174-Peer Definition _____

3174-Peer Support

650 - Y 3174-Peer Support Y,N

3174-Peer Options

651 - Y Bridge Support Y,N

652 - Y LAN Manager Support Y,N

653 - Y 3174-Peer Online Test Updates Y,N

3174-Peer Station Parameters

660 - 4000 0000 11 PN 3174-Peer Port Address Range 0000 00 - FFFF FF

661 - 05 Percentage of Discard Threshold 00 - 99

Select Test; press ENTER ==>

PF: 3=Quit 8=Fwd 12=Test Menu

Figure 199. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Peer Definition Panel

3174-Peer Bridge Profile

670 - 1	Bridge Number	0-F
671 - BB3	Token-Ring Segment Number	001-FFF
672 - 001	3174-Peer Segment Number	001-FFF
673 - 7	Token-Ring Hop Count	1-7
674 - Y	Frame Forwarding Active	Y,N,W
675 - 0010	Bridge Performance Threshold	0000-9999
	Frames Discarded Per 10,000	
676 - 02 00	Logging Interval	00-99 Hours 00-59 Minutes
677 - 010	Alert Threshold	000-255

Select Test; press ENTER ==>

PF: 3=Quit 7=Back 8=Fwd 12=Test Menu

Figure 200. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Bridge Profile Panel

APPN Node Definition

610 SESSIONS - 1	611 NODES/LINKS - 1
612 WILDCARD - 0	613 HOST LINK - 1A

Select Test; press ENTER ==>

PF: 3=Quit 8=Fwd 12=Test Menu

Figure 201. 3174 Configuration Support C3.0 Customization (SDLC-Attached) APPN Node Definition Panel

The major change with CS-3.0 is the addition of Question 613 in the APPN Node Definition panel. Question 613 defines an APPN-capable host link, in this scenario the primary host link 1A is to be used. Notice the downstream APPN definitions (Figure 202 on page 189) for the token-ring LAN-attached systems remain almost the same as those in Figure 183 on page 174. The exception is

RALYAS4A's definition, and note the new DLC Type **2**. for SDLC, and no token-ring LAN address is defined.

Network Resources									
	CPNAME	NODE 1-4	TYPE	LUs X	DLC TYPE 1-3	ADDRESS			
1	ESCOAX__	2		—	1	4000	3174	1992	04
2	PS2ES1__	3		—	1	4000	3001	0025	04
3	RALYAS4A	3		—	2				
4	DOSCOAX_	1		X	1	4000	3174	3992	08

Select Test; press ENTER ==>

PF: 3=Quit 7=Back 12=Test Menu

Figure 202. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Network Resources Panel

Mode/COS Correlation					
Mode Name	#	COS Name	Mode Name	#	COS Name
#BATCH__	—	#BATCH__	M2SDLCQ_	—	#CONNECT
#BATCHSC	—	#BATCHSC	SD82____	—	#CONNECT
#INTER__	—	#INTER__	QPCSUPP_	—	#CONNECT
#INTERSC	—	#INTERSC	_____	—	_____
BLANK	—	#CONNECT	_____	—	_____
_____	—	_____	_____	—	_____
_____	—	_____	_____	—	_____

Select Test; press ENTER ==>

PF: 3=Quit 7=Back 12=Test Menu

Figure 203. 3174 Configuration Support C3.0 Customization (SDLC-Attached) Mode/COS Correlation Panel

_____ COS Definition _____

Enter the number of the COS Definition.

COS Definition Number - ____

-----Definition Numbers-----

1. #BATCH__	8. _____
2. #BATCHSC	9. _____
3. #INTER__	10. _____
4. #INTERSC	11. _____
5. #CONNECT	12. _____
6. _____	13. _____
7. _____	14. _____

Select Test; press ENTER ==>

PF: 3=Quit 8=Fwd 12=Test Menu

Figure 204. 3174 Configuration Support C3.0 Customization (SDLC-Attached) COS Definition Panel

5.3.2 AS/400 Definitions (SDLC-attached 3174)

On RALYAS4A we define CP3174 as an SDLC-attached APPC controller. See Figure 205 to Figure 207 on page 193 for AS/400 line, controller, and devices definitions.

Display Line Description		RALYAS4A	
		01/26/93	16:49:02
Line description	: CP3174LIN		
Option	: *BASIC		
Category of line	: *SDLC		
Resource names	: LIN062		
Online at IPL	: *NO		
Data link role	: *NEG		
Physical interface	: *RS232V24		
Connection type	: *NONSWTPP		
Switched network backup	: *NO		
Exchange identifier	: 0569406A		
NRZI data encoding	: *YES		
Maximum controllers	: 1		
Clocking	: *MODEM		
Line speed	: 9600		
Modem type supported	: *NORMAL		
Modem data rate select	: *FULL		
Autoanswer type	: *DTR		
Autoanswer type	: *DTR		
Maximum frame size	: 521		
Error threshold level	: *OFF		
Duplex	: *HALF		
Modulus	: 8		
Text	: SDLC Line to CP3174		
-----Attached Nonswitched Controllers-----			
CP3174S			

Figure 205. SDLC Line Definition for CP3174

Display Controller Description		RALYAS4A
		01/26/93 11:40:30
Controller description	CP3174S	
Option	*BASIC	
Category of controller	*APPC	
Link type	*SDLC	
Online at IPL	*NO	
Switched connection	*NO	
Switched network backup	*NO	
Attached nonswitched line	CP3174LIN	
Character code	*EBCDIC	
Maximum frame size	521	
Remote network identifier	APPN	
Remote control point	CP3174	
Exchange identifier	01700000	
Data link role	*NEG	
Station address	C1	
Text	Controller description for CP3174 (SDLC)	
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*NETNODE	
APPN transmission group number	*CALC	
Autodelete device	*NO	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	
Recovery limits:		
Count limit	2	
Time interval	5	

Figure 206. 3174 APPC Controller Definition (SDLC-Attached)

The device description is included here for completeness only, SNA Pass-Through is discussed in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235.

Display Device Description		RALYAS4A	
		02/01/93	10:10:10
Device description	CP31743270		
Option	*BASIC		
Category of device	*DSP		
Device class	*SNPT		
Device type	3278		
Device model	0		
Local location address	02		
Online at IPL	*YES		
Attached controller	CP3174S		
Keyboard language type	USB		
Print device	*SYSVAL		
Output queue	*DEV		
Printer file	QSYSPRT		
Library	*LIBL		
Activation timer	170		
Inactivity timer	*NOMAX		
SNA pass-through device desc	RA9T0507		
SNA pass-through group name	*NONE		
Host signon/logon command	*NONE		
Text	SNPT Device for CP3174		

Figure 207. SNA Pass-Through Device Definition for CP3174 3270 Display

5.3.3 CP3174, RALYAS4B, DOSCOAX, and ESCOAX92 Sessions

The configuration or customization of CP3174, RALYAS4B, DOSCOAX, and ESCOAX is similar to that described in 7.5, “3174 as Gateway from a Branch Network to a Subarea Network” on page 346 for CP3174, RALYAS4A, DOSCOAX, and ESCOAX, where the 3174 is used as a gateway to a S/390 Host. In our scenario here, we replace the S/390 Host with RALYAS4A.

We do need to do some further definition on RALYAS4A. As stated earlier each of these downstream systems which requires 3270 sessions with RALYAS4A (or some, as yet undefined, S/390 host attached to RALYAS4A) will require a RWS controller description. Each of the RWS controllers will use the station address which is mapped to the real controller's token-ring LAN address in question 940, Figure 198 on page 187. The real controller could be another AS/400, a PS/2 or a 3174. Each display session on the real controller will also require a 3270 device description or SNA Pass-Through device description. This applies to devices or controllers requiring 3270 sessions only. The configuration seen in 7.2.8, “CP31742 Sessions” on page 288 is similar, though the link type discussed is LAN and not SDLC, as it is here.

Figure 208 on page 194 shows the 3174 RWS controller description for ESCOAX which has a token-ring LAN address of 400031741992. This token-ring LAN address, is mapped to the SDLC station address of C2 by CP3174, see Figure 198 on page 187.

APPC sessions, that is 5250 emulation sessions, will be automatically defined by RALYAS4A under the CP3174S controller, as they are required.

Display Controller Description		26/04/93 23	RALYAS4A
Controller description	:	ESCOAXS	
Option	:	*BASIC	
Category of controller	:	*RWS	
Controller type	:	3174	
Controller model	:	0	
Link type	:	*SDLC	
Online at IPL	:	*YES	
Switched connection	:	*NO	
Switched network backup	:	*NO	
Attached nonswitched line	:	CP3174LIN	
Character code	:	*EBCDIC	
Maximum frame size	:	265	
Exchange identifier	:	01700000	
SSCP identifier	:	050000000000	
Station address	:	C2	
Text	:	*BLANK	
Device wait timer	:	120	
SDLC poll priority	:	*NO	
SDLC poll limit	:	0	
SDLC out limit	:	*POLLLMT	
SDLC connect poll retry	:	*NOMAX	
SDLC NDM poll timer	:	*CALC	
Recovery limits:			
Count limit	:	2	
Time interval	:	5	

Figure 208. 3174 Controller Description for ESCOAX - via CP3174 SDLC

A 3270 device must also be defined for this controller for each 3270 session which is required by ESCOAX. These devices may either be SNA Pass-Through devices, like Figure 207 on page 193, or conventional 3270 devices like, that shown below in Figure 209.

Display Device Description		RALYAS4A
		02/02/93 15:10:10
Device description	: ESCOAXD1	
Option	: *BASIC	
Category of device	: *DSP	
Device class	: *RMT	
Device type	: 3278	
Device model	: 0	
Local location address	: 02	
Online at IPL	: *YES	
Attached controller	: ESCOAXS	
Keyboard language type	: USB	
Drop line at signoff	: *YES	
Print device	: *SYSVAL	
Output queue	: *DEV	
Printer file	: QSYSPRT	
Library	: *LIBL	
Maximum length of request unit . . .	: *CALC	
Text	: Device for Coax attached PC to CP	

Figure 209. 3270 Device Description for ESCOAX - via CP3174 SDLC

5.3.3.1 Schema of Matching Parameters

```

-----
|CP3174|
-----
Model/Attach
-----
101-2 SDLC

SDLC
----
104-C1
215-00000
117-26-00 002 (Port Assignment)

Common SNA Panel
-----
500-0
501-USIBMRAA
510-1
511-CP3174

Network Resources Panel
-----
ESCOAX 2-1 40003174199204
PS2ES1 3-1 40003001002504
RALYAS4A 3-2
DOSCOAX 1-1 40003174399204

Mode/COS Correlation Panel
-----
QPCSUPP *CONNECT

Peer Definition Panel
-----
650-Y 3174 Peer Support
651-Y Bridge Support

-----
|DOSCOAX|
-----

CONFIG.PCS File
-----
SFLR 1,I,,RALYAS4B
RTYP ITRN
FTYP 2
RTLN USIBMRA.DOSCOAX
TRLI RALYAS4B,400031740001
ADRS RALYAS4A,RALYAS4B

-----
|AS400A|
-----

Network Attributes
-----
LCLCPNAME(RALYAS4A)
LCLNETID(USIBMRAA)

Configuration Objects
-----
LIND(CP3174LIN)
OPTION(*SDLC)
EXCHID(0569406A)

CTLD(CP3174AS)
LINKTYPE(*SDLC)
NSWLINLST(CP3174LIN)
EXCHID(01700000)
STNADR(C1)
APPN(*YES)
CPCP(*YES)
NODETYPE(*NETNODE)

DEVD (auto-created
for APPC Devices)

DEVD(CP31743270)
DEVCLS(*SNPT)
DEVTYPE(3278)
DEVMOD(0)
LOCADR(02)

-----
|ESCOAX 3270|
-----

CTLD(ESCOAXS)
CTLTTYPE(3174)
EXCHID(01700000)
STNADR(C2)

DEVD(ESCOAXD1)
DEVTYPE(3278)
DEVMOD(0)
LOCADR(02)

```

Figure 210. Matching Parameters for RALYAS4A to 3174 Network Node (SDLC)

5.3.4 The 3174 Test Function

The 3174 has the ability to display, online, the current configuration, and perform certain tests. This function is available on all levels of 3174 configuration support, however, some of the options available may change from release to release. Shown in Figure 211 to Figure 214 are a selection of test panels for CS-C3.0.

3174 Test Menu 1TEST		
Test	Description	page 1 of 2
0	Terminal check	
1	Display event logs and response time log	
2	Display configuration panels	
3	3270 device status information	
4	Reset logs and cable errors	
5	Display vital data	
6	Display Control Areas	
7	Color convergence	
8	Extended functions and program symbols	
9	LAN tests	
10	Port wrap tests	
11,p	Trace control ap=passworda	
12	Asynchronous emulation adapter tests	
A,n	Alert to Host ID n n=1A-1H,2A-2D,3A-3D	
D,n,m	Dump device on port n, HG m n=0-31 m=26-27	
Select Test; press ENTER ==>		
PF: 3=Quit 8=Fwd		

Figure 211. 3174 Test Menu Page 1 of 2

3174 Test Menu 1TEST		
Test	Description	page 2 of 2
13	Enterprise Systems CONNecTion ESCON* Adapter Tests	
14	3174 Operator Functions	
15	Display 3270 Host Status Summary	
16	Integrated Services Digital Network ISDN Tests	
17	Advanced Peer to Peer Networking APPN Tests	
Select Test; press ENTER ==>		
PF: 3=Quit 7=Back		

Figure 212. 3174 Test Menu Page 2 of 2

By choosing option 17 in Figure 212, we are able to perform tests on the status of our APPN links. See Figure 213.

APPN Test Menu	
Option	Description
1	Display Node Status
2	Display Adjacent Nodes
3,N.C	Display Link Status N.C = NETID.CPNAME
4,X	Display Session Status X = Status Type; P=Pending, A=Active, T=Terminating
5,P.N.C	Display Pending Session Route P.N.C. = PCID.NETID.CPNAME
6	Display Active Locate Requests
NOTE: The Link Status Test can also be run by executing the Adjacent Nodes Test and selecting a LINK ID. The Pending Session Route Test can also be run by executing the Session Status Test and selecting a SESSION NUMBER. PCID, net ID, and CPNAME parameters are case sensitive. To go directly to other tests, enter: /Test,Option Select Option; press ENTER ==> PF: 3=Quit 12=Test Menu	

Figure 213. 3174 APPN Test Menu

Option 2 in Figure 213 often proves to be most useful in determining the status of our APPN links. See Figure 214.

Adjacent Nodes							
LINKID	NETID	CPNAME	Type	Status	State	Num Sess	CP-CP
1	USIBMRAA	RALYAS4A	NN	OPEN	08	0	YES
2	USIBMRAA	ESCOAX92	EN	CLOSED	01	0	NO
9	USIBMRAA	PS2ES1	NN	CLOSED	01	0	NO
10	USIBMRAA	DOSCOAX	LN	CLOSED	01	0	NA
To go directly to other tests, enter: /Test,Option Select Option; press ENTER ==> 4729-Enter the LINKID to run Link Status Test PF: 3=Quit 5=Refresh 12=Test Menu							

Figure 214. 3174 APPN Test Menu - Adjacent Nodes

Here we can see that at the time of this display, our only active link is to the AS/400, RALYAS4A. We can also note that RALYAS4A is a network node and

there are, currently, no user sessions active with RALYAS4A. There are links defined for end node ESCOAX92, for the network node PS2ES1, and for the LEN node DOSCOAX, none of which, currently, have active sessions.

If you require more information about the capabilities of the 3174 Test panels, then consult the *3174 Customer Problem Determination* manual for the level of 3174 Configuration Support being used.

5.4 Trace and Flow Analysis

The intention in this section is to illustrate a useful role for a 3174 APPN node in a token-ring network with other APPN nodes. In doing so, we also illustrate the flows within a connection network. Please refer to 2.1.5.2, “ES/1 Requirements for Connection Network” on page 44 for an introduction to a connection network.

One of the keys to a connection network is that each node defined as an EN may utilize the same NN server and inform that NN server that it is connected to the token-ring. These nodes must also inform the NN server of their token-ring addresses. When an EN then requests that the NN server calculate a route to another EN, the NN server has the information available to calculate a route directly from EN to EN rather than via the NN server.

5.4.1 RALYAS4A (EN) to RALYAS4B (EN) and CP3174 (NN) in a Connection Network

In this scenario, we again establish a session from RALYAS4A to RALYAS4B. However, this time, these nodes are ENs which have not been defined to each other. They each utilize the network node services of CP3174 and have defined their respective connections to a connection network, CNET. The token-ring addresses of each of the nodes are:

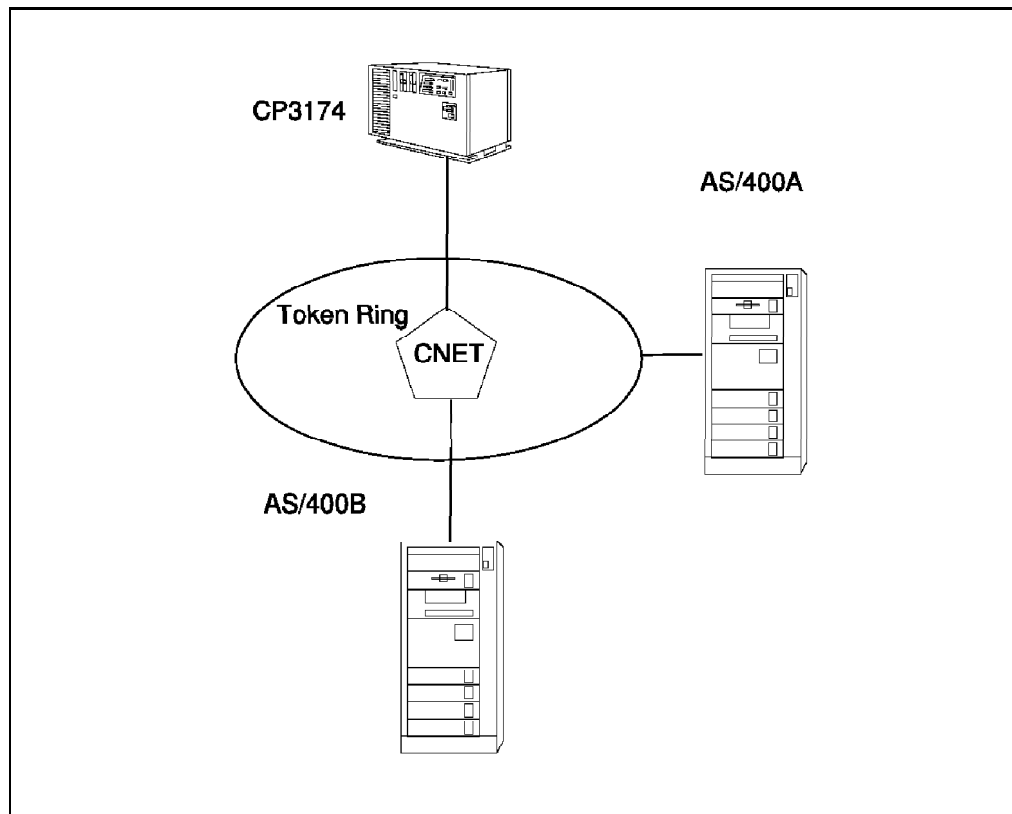


Figure 215. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

- AS/400A (CP=RALYAS4A) - 400010020001
- RALYAS4B (CP=RALYAS4B) - 400010020002
- CP3174 (CP=CP3174) - 400031740002

Note: In order to enable an AS/400 and 3174 to communicate via a connection network, a PTF is required on the AS/400. The PTF number is MF02480.

Previously, we have considered the key APPN constructs within session establishment (see 2.2.1, “RALYAS4A (NN) to RALYAS4B (NN)” on page 60 and 2.2.2, “RALYAS4A (NN) to RALYAS4B (NN) to ES (NN) and ES (EN) and PCAT(LEN)” on page 85). In this section, we again view these constructs and consider some more. In particular, we examine the APPN connection network mechanisms by which an EN may provide appropriate token-ring DLC information to an NN server. We do assume a knowledge of the discussion carried out in 2.2.1, “RALYAS4A (NN) to RALYAS4B (NN)” on page 60 and 2.2.2, “RALYAS4A (NN) to RALYAS4B (NN) to ES (NN) and ES (EN) and PCAT(LEN)” on page 85.

The trace tool used here is the IBM Token-Ring Network 16/4 Trace and Performance Program. This tool allows us to see in a single trace any flow across the token-ring. You will notice that this trace facility does not strip the entire link header away from the SNA frame (as the AS/400 DLC trace does). In particular, it leaves the DLC command to be seen in the data. The discussion on reading an SNA trace, from 2.2.1.2, “Reading an SNA Trace” on page 64, may, thus, be more necessary here than it has been previously with the higher level AS/400 trace. Our discussion begins after the trace which is presented in Figure 216.

```

Frame number. . . . . 163          Time stamp . . . . .19:28:08.21
Destination address . 400010020001   Source address . . 400031740001

I frame N(s)=0 N(r)=0 P/F=0

04 04 00 00 2F 00 00 02-00 01 6B 81 00 31 00 13  .......,a....
07 B0 B0 50 B3 07 87 87-87 87 07 06 02 00 00 00  ...&..gggg.....
00 00 00 00 00 23 00 00-0E E4 E2 C9 C2 D4 D9 C1  .......USIBMRA
4B C3 D7 F3 F1 F7 F4 24-00 08 02 C3 D7 E2 E5 C3  .CP3174....CPSVC
D4 C7 09 03 01 00 00 00-00 00 00 01 0F 04 E4 E2  MG.....US
C9 C2 D4 D9 C1 4B C3 D7-F3 F1 F7 F4 00 10 E4 E2  IBMRA.CP3174..US
C9 C2 D4 D9 C1 4B D9 C1-D3 E8 C1 E2 F4 C1 60 17  IBMRA.RALYAS4A-.
EE 4B 8B FF 34 3A 89 40-0E E4 E2 C9 C2 D4 D9 C1  ....i .USIBMRA
4B C3 D7 F3 F1 F7 F4 2C-0A 04 08 C3 D7 E2 E5 C3  .CP3174....CPSVC
D4 C7 00                                     MG.

```

Figure 216. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

We begin our examination of the trace after link establishment between the 3174 and each of the AS/400s has been performed. That is, we omit the TEST, null XID and XID3, SABME and UA frames from the trace. Please refer to 2.2.1.3, “The Null XID” on page 68 and 2.2.1.4, “The XID3” on page 69 for a discussion on link establishment between APPN nodes. We also omit RR and pacing frames.

The simplest way to identify the important information in this trace is to first find the TH. For APPN and LEN nodes, the TH begins with a 2 and is 6 bytes long. We highlight the TH in frame 163 as a landmark. After the TH comes the 3-byte RH followed by the RU. The first byte of the RU indicates that we have a BIND. The first bit of the RH being set off indicates that it is a request. We know that the BIND request comes from CP3174 by looking at the Source address field in the trace. Without analyzing the BIND, we can see that the BIND request is for a CP-CP session. The formatted information to the right shows the CPSVCMG mode in lines 4 and 5. This mode is an SNA-reserved mode used for CP-CP sessions.

```

Frame number. . . . . 175          Time stamp . . . . .19:28:10.21
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=1 N(r)=1 P/F=0

04 04 02 02 2D 00 01 01-00 00 6B 81 00 31 00 13      .....a....
07 B0 B0 51 B3 07 87 86-86 87 07 06 02 00 00 00      .....gffg.....
00 00 00 00 90 23 00 00-10 E4 E2 C9 C2 D4 D9 C1      .....USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C1 26 00 08 02 C3 D7 E2      .RALYAS4A....CPS
E5 C3 D4 C7 09 03 01 D1-7D 99 45 00 00 DB 11 04      VCMG...J'r.....
E4 E2 C9 C2 D4 D9 C1 4B-D9 C1 D3 E8 C1 E2 F4 C1      USIBMRA.RALYAS4A
00 0E E4 E2 C9 C2 D4 D9-C1 4B C3 D7 F3 F1 F7 F4      ..USIBMRA.CP3174
60 19 F6 4B 0D 2B C5 F7-A7 1C 10 E4 E2 C9 C2 D4      -.6...E7x..USIBM
D9 C1 4B D9 C1 D3 E8 C1-E2 F4 C1 2C 09 04 07 C3      RA.RALYAS4A....C
D7 E2 E5 C3 D4 C7                                     PSVCMG

```

Figure 217. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frame 175 shows AS/400A sending a BIND request for CP-CP session to CP3174. This time we highlight the RH as our landmark.

```

Frame number. . . . . 177          Time stamp . . . . .19:28:10.21
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=2 N(r)=1 P/F=0

04 04 04 02 2F 00 02 00-00 01 EB 80 00 31 00 13  .....
07 B0 B0 50 B3 00 80 86-86 80 00 06 02 00 00 00  ...&...ff.....
00 00 00 00 90 23 00 00-00 1F 00 08 02 C3 D7 E2  .....CPS
E5 C3 D4 C7 02 03 02 11-05 E4 E2 C9 C2 D4 D9 C1  VCMG.....USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C1 00 00 60 17 EE 4B 8B  .RALYAS4A...-....
FF 34 3A 89 40 0E E4 E2-C9 C2 D4 D9 C1 4B C3 D7  ...i .USIBMRA.CP
F3 F1 F7 F4                                     3174

Frame number. . . . . 179          Time stamp . . . . .19:28:10.27
Destination address . 400010020001    Source address . . 400031740001

I frame N(s)=1 N(r)=3 P/F=0

04 04 02 06 2D 00 01 01-00 00 EB 80 00 31 00 13  .....
07 B0 B0 50 B3 00 80 86-86 80 00 06 02 00 00 00  ...&...ff.....
00 00 00 00 00 23 00 00-00 1D 00 08 02 C3 D7 E2  .....CPS
E5 C3 D4 C7 02 03 02 0F-05 E4 E2 C9 C2 D4 D9 C1  VCMG.....USIBMRA
4B C3 D7 F3 F1 F7 F4 00-00 60 19 F6 4B 0D 2B C5  .CP3174...-6...E
F7 A7 1C 10 E4 E2 C9 C2-D4 D9 C1 4B D9 C1 D3 E8  7x..USIBMRA.RALY
C1 E2 F4 C1                                     AS4A

```

Figure 218. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

In frames 177 and 179, we see positive responses to the requests for CP-CP sessions. Bit 3 of the third half-byte of the RH being set off (the half-byte is 8) indicates that the response is positive.

```

Frame number. . . . . 180          Time stamp . . . . .19:28:10.27
Destination address . 400010020001    Source address . . 400031740001

I frame N(s)=2 N(r)=3 P/F=0

04 04 04 06 2E 00 00 02-00 01 0B 91 20 11 05 02 .....j....
FF 00 03 D0 00 00 04 22-F0 F0 F1 00 00 00 00 0C .....001....
12 C1 00 00 00 00 F6 80-00 00                .A....6...

Frame number. . . . . 185          Time stamp . . . . .19:28:10.27
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=3 N(r)=4 P/F=0

04 04 06 08 2C 00 01 01-00 01 0B 95 20 11 05 02 .....n....
FF 00 03 D0 00 00 04 22-F0 F0 F1 00 00 00 00 0C .....001....
12 C1 00 00 00 00 80 84-00 00                .A.....d..

```

Figure 219. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frames 180 and 185 show the 3174 and AS/400A mutually requesting the other's CP capabilities and also sending their own CP capabilities. The X'110502FF' indicates an FMH-5 with an APPC Attach and the program to be attached is the SNA service transaction program X'22F0F0F1', which is the program that sends CP capabilities. This portion of frames 180 and 185, therefore, represents the request for CP capabilities. The X'12C1' is the identifier for the CP capabilities GDS variable. APPN nodes use this GDS variable to send their CP capabilities to another node. An example of information which is sent by each CP is its node type. Given that the key field uses bytes 2 and 3 of the GDS variable, notice that byte 8, bits 0, 1, and 2, are B'111' for frame 180 and B'100' for frame 185. This indicates that the sender in frame 180 (CP3174) is an NN and that the sender in frame 185 (AS/400A) is an EN.

```

Frame number. . . . . 188          Time stamp . . . . .19:28:10.27
Destination address . 400010020001    Source address . . 400031740001

I frame N(s)=5 N(r)=4 P/F=0

04 04 0A 08 2C 00 01 01-00 01 03 91 01 00 0C 12 .....j....
C1 00 00 00 00 F6 80 00-00                      A....6...

Frame number. . . . . 193          Time stamp . . . . .19:28:10.32
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=5 N(r)=6 P/F=0

04 04 0A 0C 2E 00 02 00-00 01 03 95 01 00 0C 12 .....n....
C1 00 00 00 00 80 84 00-00                      A.....d..

```

Figure 220. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frame 188 shows CP3174's response to AS/400A's request for CP capabilities. It responds by (again) sending the CP capabilities (X'12C1') GDS variable. Frame 193 similarly shows AS/400A sending its CP_CAPS to CP3174. Now each of the CPs has received the other's CP capabilities on their conwinner session. It is at this point that CP-CP sessions are ready to be used for flows of APPN information.

```

Frame number. . . . . 196          Time stamp . . . . .19:28:10.38
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=7 N(r)=7 P/F=0

04 04 0E 0E 2C 00 01 01-00 02 0B A1 81 11 05 02 .....a....
FF 00 03 D0 00 40 04 22-F0 F0 F2 00 00 00 00 55 .....002.....
12 C3 03 80 10 13 3D 00-F3 E4 E2 C9 C2 D4 D9 C1 .C.....3USIBMRA
4B C1 D3 C9 E2 D6 D5 C5-13 3D 00 F3 E4 E2 C9 C2 .ALISONE...3USIB
D4 D9 C1 4B D9 C1 F9 E3-F4 F0 F0 14 3D 00 F3 E4 MRA.RA9T400...3U
E2 C9 C2 D4 D9 C1 4B D9-C1 F9 E3 D5 D5 C1 F0 14 SIBMRA.RA9TNNAG.
3D 00 F3 E4 E2 C9 C2 D4-D9 C1 4B D9 C1 D3 E8 C1 ..3USIBMRA.RALYA
E2 F4 C1                      S4A

```

Figure 221. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frame 196 shows AS/400A registering its LU resources with its NN server, CP3174. LU resource registering enables the NN to be aware of the presence of an LU in a CP for which it is providing NN services, without that LU being defined at the NN. The NN still forwards the search to the EN so that the EN can supply its TG vectors.

The GDS variable which carries the registered LUs is flagged by the X'12C3' identifier. Frame 196 also carries an FMH-5 ATTACH for the X'22F0F0F2' SNA service transaction program. This TP at the NN receives the EN's request to register resources.

You can see, by looking at the formatted data, that three LUs are registered: ALISONE, RA9T400 and RA9TNNA0. These LUs are contained in the directory database of the AS/400. That is, they have been previously added to the local location list of AS/400A.

```

Frame number. . . . . 199          Time stamp . . . . .19:28:10.38
Destination address . 400010020002   Source address . . 400031740001

I frame N(s)=0 N(r)=0 P/F=0

04 04 00 00 2F 00 00 02-00 02 6B 81 00 31 00 13   ..... ,a....
07 B0 B0 50 B3 07 87 87-87 87 07 06 02 00 00 00   ...&..gggg.....
00 00 00 00 00 23 00 00-0E E4 E2 C9 C2 D4 D9 C1   .....USIBMRA
4B C3 D7 F3 F1 F7 F4 24-00 08 02 C3 D7 E2 E5 C3   .CP3174....CPSVC
D4 C7 09 03 01 00 00 00-00 00 00 02 0F 04 E4 E2   MG.....US
C9 C2 D4 D9 C1 4B C3 D7-F3 F1 F7 F4 00 10 E4 E2   IBMRA.CP3174..US
C9 C2 D4 D9 C1 4B D9 C1-D3 E8 C1 E2 F4 C2 60 17   IBMRA.RALYAS4B-.
EE 4B 8B FF 34 3A 89 41-0E E4 E2 C9 C2 D4 D9 C1   .....i..USIBMRA
4B C3 D7 F3 F1 F7 F4 2C-0A 04 08 C3 D7 E2 E5 C3   .CP3174....CPSVC
D4 C7 00                                           MG.

```

Figure 222. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frames 199 to 234 show the same process for RALYAS4B as just described for AS/400A. We leave these sections of the trace unhighlighted. As an exercise, try to identify the key constructs.

```

Frame number. . . . . 211          Time stamp . . . . .19:28:15.43
Destination address . 400031740001   Source address . . 400010020002

I frame N(s)=1 N(r)=1 P/F=0

04 04 02 02 2D 00 01 01-00 00 6B 81 00 31 00 13   ..... ,a....
07 B0 B0 51 B3 07 87 86-86 87 07 06 02 00 00 00   .....gffg.....
00 00 00 00 90 23 00 00-10 E4 E2 C9 C2 D4 D9 C1   .....USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C2 26 00 08 02 C3 D7 E2   .RALYAS4B....CPS
E5 C3 D4 C7 09 03 01 D1-7D 31 4D 40 00 05 11 04   VCMG...J'.( ....
E4 E2 C9 C2 D4 D9 C1 4B-D9 C1 D3 E8 C1 E2 F4 C2   USIBMRA.RALYAS4B
00 0E E4 E2 C9 C2 D4 D9-C1 4B C3 D7 F3 F1 F7 F4   ..USIBMRA.CP3174
60 19 F6 4B 0D 2E C5 F7-A8 5A 10 E4 E2 C9 C2 D4   -.6...E7y!.USIBM
D9 C1 4B D9 C1 D3 E8 C1-E2 F4 C2 2C 09 04 07 C3   RA.RALYAS4B....C
D7 E2 E5 C3 D4 C7                               PSVCMG

```

Figure 223. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network


```

Frame number. . . . . 213          Time stamp . . . . .19:28:15.43
Destination address . 400010020002    Source address . . 400031740001

I frame N(s)=1 N(r)=2 P/F=0

04 04 02 04 2D 00 01 01-00 00 EB 80 00 31 00 13  .....
07 B0 B0 50 B3 00 80 86-86 80 00 06 02 00 00 00  ...&...ff.....
00 00 00 00 00 23 00 00-00 1D 00 08 02 C3 D7 E2  .....CPS
E5 C3 D4 C7 02 03 02 0F-05 E4 E2 C9 C2 D4 D9 C1  VCMG.....USIBMRA
4B C3 D7 F3 F1 F7 F4 00-00 60 19 F6 4B 0D 2E C5  .CP3174...-.6....E
F7 A8 5A 10 E4 E2 C9 C2-D4 D9 C1 4B D9 C1 D3 E8  7y!.USIBMRA.RALY
C1 E2 F4 C2                                     AS4B

Frame number. . . . . 214          Time stamp . . . . .19:28:15.43
Destination address . 400031740001    Source address . . 400010020002

I frame N(s)=2 N(r)=1 P/F=0

04 04 04 02 2F 00 02 00-00 02 EB 80 00 31 00 13  .....
07 B0 B0 50 B3 00 80 86-86 80 00 06 02 00 00 00  ...&...ff.....
00 00 00 00 90 23 00 00-00 1F 00 08 02 C3 D7 E2  .....CPS
E5 C3 D4 C7 02 03 02 11-05 E4 E2 C9 C2 D4 D9 C1  VCMG.....USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C2 00 00 60 17 EE 4B 8B  .RALYAS4B...-....
FF 34 3A 89 41 0E E4 E2-C9 C2 D4 D9 C1 4B C3 D7  ...i..USIBMRA.CP
F3 F1 F7 F4                                     3174

Frame number. . . . . 218          Time stamp . . . . .19:28:15.49
Destination address . 400010020002    Source address . . 400031740001

I frame N(s)=3 N(r)=3 P/F=0

04 04 06 06 2E 00 00 02-00 01 0B 91 20 11 05 02  .....j....
FF 00 03 D0 00 00 04 22-F0 F0 F1 00 00 00 00 0C  .....001.....
12 C1 00 00 00 00 F6 80-00 00                      .A....6...

Frame number. . . . . 221          Time stamp . . . . .19:28:15.49
Destination address . 400031740001    Source address . . 400010020002

I frame N(s)=3 N(r)=4 P/F=0

04 04 06 08 2C 00 01 01-00 01 0B 95 20 11 05 02  .....n....
FF 00 03 D0 00 00 04 22-F0 F0 F1 00 00 00 00 0C  .....001.....
12 C1 00 00 00 00 80 84-00 00                      .A.....d..

```

Figure 224. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

```

Frame number. . . . . 224          Time stamp . . . . .19:28:15.49
Destination address . 400010020002    Source address . . 400031740001

I frame N(s)=5 N(r)=4 P/F=0

04 04 0A 08 2C 00 01 01-00 01 03 91 01 00 0C 12  ....j....
C1 00 00 00 00 F6 80 00-00                A....6...

Frame number. . . . . 231          Time stamp . . . . .19:28:15.82
Destination address . 400031740001    Source address . . 400010020002

I frame N(s)=6 N(r)=6 P/F=0

04 04 0C 0C 2E 00 02 00-00 01 03 95 01 00 0C 12  ....n....
C1 00 00 00 00 80 84 00-00                A.....d..

Frame number. . . . . 234          Time stamp . . . . .19:28:15.82
Destination address . 400031740001    Source address . . 400010020002

I frame N(s)=7 N(r)=6 P/F=0

04 04 0E 0C 2C 00 01 01-00 02 0B A1 81 11 05 02  ....a....
FF 00 03 D0 00 40 04 22-F0 F0 F2 00 00 00 00 B0  ....002....
12 C3 03 80 10 10 3D 00-F3 E4 E2 C9 C2 D4 D9 C1  .C.....3USIBMRA
4B C1 E2 F4 C2 14 3D 00-F3 E4 E2 C9 C2 D4 D9 C1  .AS4B...3USIBMRA
4B C1 E2 F4 C2 D9 C1 C9-E3 12 3D 00 F3 E4 E2 C9  .AS4BRAIT...3USI
C2 D4 D9 C1 4B C1 E2 F4-F0 F0 C2 14 3D 00 F3 E4  BMRA.AS400B...3U
E2 C9 C2 D4 D9 C1 4B C1-E2 F4 F0 F0 C2 C1 F1 13  SIBMRA.AS400BA1.
3D 00 F3 E4 E2 C9 C2 D4-D9 C1 4B C1 E2 F9 F4 F0  ..3USIBMRA.AS940
F4 C2 13 3D 00 F3 E4 E2-C9 C2 D4 D9 C1 4B D9 C1  4B...3USIBMRA.RA
F9 D5 D5 C2 F0 14 3D 00-F3 E4 E2 C9 C2 D4 D9 C1  9NNB0...3USIBMRA
4B D9 C1 F9 E3 D5 D5 C2-F0 11 3D 00 F3 E4 E2 C9  .RA9TNNB0...3USI
C2 D4 D9 C1 4B D9 C5 D4-D3 E4 14 3D 00 F3 E4 E2  BMRA.REMLU...3US
C9 C2 D4 D9 C1 4B D9 C1-D3 E8 C1 E2 F4 C2        IBMRA.RALYAS4B

```

Figure 225. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

```

Frame number. . . . . 263          Time stamp . . . . .19:28:41.65
Destination address . 400031740001    Source address . . 400010020001

I frame N(s)=8 N(r)=9 P/F=0

04 04 10 12 2C 00 01 01-00 03 0B 90 81 11 05 02 .....a...
FF 00 03 D0 00 00 04 22-F0 F0 F3 00 00 00 00 55 .....003....
12 CA 03 80 80 14 82 00-F3 E4 E2 C9 C2 D4 D9 C1 .....b.3USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C2 12 3C 00 F6 E4 E2 C9 .RALYAS4B...6USI
C2 D4 D9 C1 4B C3 D7 F3-F1 F7 F4 14 3C 00 F4 E4 BMRA.CP3174...4U
E2 C9 C2 D4 D9 C1 4B D9-C1 D3 E8 C1 E2 F4 C1 14 SIBMRA.RALYAS4A.
3D 00 F3 E4 E2 C9 C2 D4-D9 C1 4B D9 C1 D3 E8 C1 ..3USIBMRA.RALYA
E2 F4 C1 00 7E 12 C5 00-00 01 00 00 00 08 40 40 S4A.=.E.....
40 40 40 40 40 40 00 00-0C 2C 01 08 7B C3 D6 D5 .....#CON
D5 C5 C3 E3 1C 46 11 80-01 0C E4 E2 C9 C2 D4 D9 NECT.....USIMR
C1 4B C3 D5 C5 E3 80 09-82 40 00 10 02 00 01 04 A.CNET..b .....
16 47 00 00 00 02 90 76-00 00 00 00 00 00 00 .....
01 4C 00 80 80 80 15 46-13 80 15 0E E4 E2 C9 C2 .<.....USIB
D4 D9 C1 4B C3 D7 F3 F1-F7 F4 00 16 47 00 00 00 MRA .CP3174.....
06 80 76 00 00 00 00 00-00 00 00 01 4C 00 80 80 .....<...
80 00 27 12 C4 80 00 00-00 00 1B 60 F6 4B 0D 2B ....D.....-6...
C5 F7 A7 1D 10 E4 E2 C9-C2 D4 D9 C1 4B D9 C1 D3 E7x..USIBMRA.RAL
E8 C1 E2 F4 C1 03 82 00                                YAS4A.b.

```

Figure 226. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frame 263 shows RALYAS4A sending a search request for RALYAS4B to CP3174. The Find (X'12CA'), Cross-Domain Initiate (X'12C5') and Locate (X'12C4') GDS variables make up the locate search request. For more information on these variables and the following discussion, please refer to 2.2.1, "RALYAS4A (NN) to RALYAS4B (NN)" on page 60. The TG Descriptor (X'46') control vector may be included in the Cross-Domain Initiate (X'12C5') GDS variable. It is the TG descriptor control vector and contains information about the EN's TGs (links). The EN, thus, informs its NN server about other links about which the NN server may not be aware. The TG Descriptor (X'46') control vector appears in a pair with the TG Characteristics (X'47') control vector which carries the characteristics of the TGs. In frame 263 then, AS/400A is informing CP3174 of its links; in particular, it informs CP3174 of its link to the token-ring virtual node, CNET. Within the TG Descriptor (X'46') control vector, notice the subfield beginning with X'0982'. The X'09' indicates the length of the DLC Signaling Information (X'82') subfield which has been introduced for a connection network and carries the token-ring address of AS/400A.

```

Frame number. . . . . 265          Time stamp . . . . .19:28:41.71
Destination address . 400010020002    Source address . . 400031740001

I frame N(s)=9 N(r)=8 P/F=0

04 04 12 10 2E 00 00 02-00 02 0B 91 81 11 05 02  .....ja...
FF 00 03 D0 00 00 04 22-F0 F0 F3 00 00 00 00 24  .....003....
12 C4 80 00 00 00 00 00 1B-60 F6 4B 0D 2B C5 F7 A7  .D.....-6...E7x
1D 10 E4 E2 C9 C2 D4 D9-C1 4B D9 C1 D3 E8 C1 E2  ..USIBMRA.RALYAS
F4 C1 00 55 12 CA 03 80-80 14 82 00 F3 E4 E2 C9  4A.....b.3USI
C2 D4 D9 C1 4B D9 C1 D3-E8 C1 E2 F4 C2 12 3C 00  BMRA.RALYAS4B...
F6 E4 E2 C9 C2 D4 D9 C1-4B C3 D7 F3 F1 F7 F4 14  6USIBMRA.CP3174.
3C 00 F4 E4 E2 C9 C2 D4-D9 C1 4B D9 C1 D3 E8 C1  ..4USIBMRA.RALYA
E2 F4 C1 14 3D 00 F3 E4-E2 C9 C2 D4 D9 C1 4B D9  S4A...3USIBMRA.R
C1 D3 E8 C1 E2 F4 C1 00-21 12 C5 00 00 01 00 00  ALYAS4A...E....
00 08 40 40 40 40 40 40-40 40 00 00 0C 2C 01 08  ..      .....
7B C3 D6 D5 D5 C5 C3 E3                                #CONNECT

```

Figure 227. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

In frame 265, we see CP3174 providing NN services for AS/400A. After receiving a search request from AS/400A, CP3174 will either query a central directory or (if none exists) send a broadcast search to the network, if it doesn't know the LU's location, or forward the search request to the CP owning the LU, if it is known by CP3174, to check that it still resides at that location. In this case, CP3174 knows the location of RALYAS4B and forwards the search request directly to RALYAS4B.

```

Frame number. . . . . 269          Time stamp . . . . .19:28:41.76
Destination address . 400031740001   Source address . . 400010020002

I frame N(s)=9 N(r)=10 P/F=0

04 04 12 14 2C 00 01 01-00 03 0B 90 81 11 05 02 .....a...
FF 00 03 D0 00 00 04 22-F0 F0 F3 00 00 00 00 27 .....003....
12 C4 40 00 00 00 00 00 1B-60 F6 4B 0D 2B C5 F7 A7 .D .....-6...E7x
1D 10 E4 E2 C9 C2 D4 D9-C1 4B D9 C1 D3 E8 C1 E2 ..USIBMRA.RALYAS
F4 C1 03 82 00 00 41 12-CB 03 80 80 12 3C 00 F6 4A.b.....6
E4 E2 C9 C2 D4 D9 C1 4B-C3 D7 F3 F1 F7 F4 14 3C USIBMRA.CP3174..
00 F4 E4 E2 C9 C2 D4 D9-C1 4B D9 C1 D3 E8 C1 E2 .4USIBMRA.RALYAS
F4 C2 14 3D 00 F3 E4 E2-C9 C2 D4 D9 C1 4B D9 C1 4B...3USIBMRA.RA
D3 E8 C1 E2 F4 C2 00 72-12 C5 00 00 01 00 00 00 LYAS4B...E.....
08 40 40 40 40 40 40 40-40 00 00 1C 46 11 80 01 .....
0C E4 E2 C9 C2 D4 D9 C1-4B C3 D5 C5 E3 80 09 82 .USIBMRA.CNET..b
40 00 10 02 00 02 04 16-47 00 00 00 02 90 76 00 .....
00 00 00 00 00 00 00 01-4C 00 80 80 80 15 46 13 .....<.....
80 15 0E E4 E2 C9 C2 D4-D9 C1 4B C3 D7 F3 F1 F7 ...USIBMRA.CP317
F4 00 16 47 00 00 00 06-80 76 00 00 00 00 00 00 4.....
00 00 01 4C 00 80 80 80 ...<....

```

Figure 228. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

Frame 269 shows RALYAS4B responding to the search request with a FOUND. The Locate (X'12C4'), Found (X'12CB') and Cross-Domaine Initiate (X'12C5') GDS variables make up the Found. RALYAS4B also returns to its NN server, CP3174, information about its link with the token ring, CNET, and its token-ring address. Recall that this information is carried in the DLC Signaling Information (X'82') subfield of the TG Descriptor (X'46') included in the Cross-Domaine Initiate (X'12C5') GDS variable; we've highlighted it.

CP3174 now has more complete information about the network. It is now in a position to calculate what we know to be the optimum route from RALYAS4A to RALYAS4B. Without the information sent by the ENs about their respective endpoint TGs, the optimum route which CP3174 would have calculated would have been a route via itself. Now its optimum route calculation includes the fact that each of the AS/400s is connected to the virtual node CNET. Thus, in frame 271, we see CP3174 as NN server for AS/400A, forwarding the Found to AS/400A and appending a route selection control vector (RSCV) specifying the optimum route for AS/400A to RALYAS4B. The RSCV control vector, flagged by the Route Selection X'2B' control vector specifies that the RALYAS4A should establish a session with RALYAS4B via CNET. If CNET was a real NN then it would provide intermediate session routing of the session between RALYAS4A and RALYAS4B. In this case, however, the DLC Signaling Information (X'82') subfield of the TG Descriptor (X'46') included in the Cross-Domaine Initiate (X'12C5') GDS variable tells AS/400 where to forward the BIND.

```

Frame number. . . . . 271          Time stamp . . . . .19:28:41.82
Destination address . 400010020001    Source address . . 400031740001

I frame N(s)=9 N(r)=9 P/F=0

04 04 12 12 2E 00 00 02-00 02 0B 91 81 11 05 02      .....ja...
FF 00 03 D0 00 00 04 22-F0 F0 F3 00 00 00 00 24      .....003....
12 C4 00 00 00 80 00 1B-60 F6 4B 0D 2B C5 F7 A7      .D .....-6...E7x
1D 10 E4 E2 C9 C2 D4 D9-C1 4B D9 C1 D3 E8 C1 E2      ..USIBMRA.RALYAS
F4 C1 00 41 12 CB 03 80-80 12 3C 00 F6 E4 E2 C9      4A.....6USI
C2 D4 D9 C1 4B C3 D7 F3-F1 F7 F4 14 3C 00 F4 E4      BMRA.CP3174...4U
E2 C9 C2 D4 D9 C1 4B D9-C1 D3 E8 C1 E2 F4 C2 14      SIBMRA.RALYAS4B.
3D 00 F3 E4 E2 C9 C2 D4-D9 C1 4B D9 C1 D3 E8 C1      ..3USIBMRA.RALYA
E2 F4 C2 00 50 12 C5 00-00 01 00 00 00 08 40 40      S4B.&.E.....
40 40 40 40 40 40 00 00-0C 2C 01 08 7B C3 D6 D5      .....#CON
D5 C5 C3 E3 2F 2B 02 00-13 46 11 80 01 0C E4 E2      NECT.....US
C9 C2 D4 D9 C1 4B C3 D5-C5 E3 80 18 46 0D 80 01      IBMRA.CNET.....
08 D9 C1 D3 E8 C1 E2 F4-C2 80 09 82 40 00 10 02      .RALYAS4B..b ...
00 02 04                                          ...

```

Figure 229. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

```

Frame number. . . . . 292          Time stamp . . . . .19:28:45.98
Destination address . 400010020002    Source address . . 400010020001

I frame N(s)=0 N(r)=0 P/F=0

04 04 00 00 2F 00 01 01-00 00 6B 81 00 31 00 13      ..... ,a....
07 B0 B0 51 B3 07 87 86-86 87 07 06 02 00 00 00      .....gffg.....
00 00 00 00 90 23 40 00-10 E4 E2 C9 C2 D4 D9 C1      ..... ..USIBMRA
4B D9 C1 D3 E8 C1 E2 F4-C1 27 00 09 02 E2 D5 C1      .RALYAS4A....SNA
E2 E5 C3 D4 C7 09 03 01-D1 7D BB 57 40 00 31 11      SVCMG...J'....
04 E4 E2 C9 C2 D4 D9 C1-4B D9 C1 D3 E8 C1 E2 F4      .USIBMRA.RALYAS4
C1 00 10 E4 E2 C9 C2 D4-D9 C1 4B D9 C1 D3 E8 C1      A..USIBMRA.RALYA
E2 F4 C2 60 19 F6 4B 0D-2B C5 F7 A7 1D 10 E4 E2      S4B-.6...E7x..US
C9 C2 D4 D9 C1 4B D9 C1-D3 E8 C1 E2 F4 C1 2C 0A      IBMRA.RALYAS4A..
04 08 7B C3 D6 D5 D5 C5-C3 E3 2B 2D 02 02 13 46      ..#CONNECT.....
11 80 01 0C E4 E2 C9 C2-D4 D9 C1 4B C3 D5 C5 E3      ....USIBMRA.CNET
80 18 46 0D 80 01 08 D9-C1 D3 E8 C1 E2 F4 C2 80      .....RALYAS4B.
09 82 40 00 10 02 00 02-04                        .b.....

```

Figure 230. CP3174 as NN Server for RALYAS4A to RALYAS4B in a Connection Network

In frame 292, we see AS/400A forward the BIND request for the SNASVCMG session directly to RALYAS4B. The RSCV has been highlighted. It does not include CP3174 which is now out of the picture. The remainder of the trace shows the same constructs as discussed in 2.2, “Trace and Flow Analysis” on page 60.

Chapter 6. The RISC System/6000

In this chapter we will explore the connection capabilities of the RISC/6000* as a LEN end node using SNA Services.

6.1 Using SNA Services/6000 for a LEN Connection

In this section we will explore the use of SNA Services/6000 to allow the RS/6000 to participate as a LEN end node in an APPN network. It is our intention to show the configuration steps necessary to configure an LU 6.2 connection between the systems covered in this chapter. As there are numerous products available which utilize SNA Services/6000, we will not be giving details on configuring these products. However, for the record, all connections created in this chapter were tested using the AIX 5250 Emulation portion of the AIX Connection Program/6000.

6.1.1 Overview of SNA Services Configuration

AIX SNA Services/6000 is comprised of:

- A set of background processes.
- AIX Operating System device drivers that run under the control of the System Resource Controller (SRC). The SRC, in turn, provides all services to transfer data over the network. To provide these services the SRC requests information from the profile and data management components to define the characteristics of connections and attachments on the network.

AIX SNA Services/6000 keeps all network information in structured files called profiles. It stores the profiles as database files that are controlled by system data management routines. These profiles are kept in the directory `/usr/lpp/sna/objrepos`. The profiles required for an LU 6.2 connection are detailed in Figure 231 on page 214.

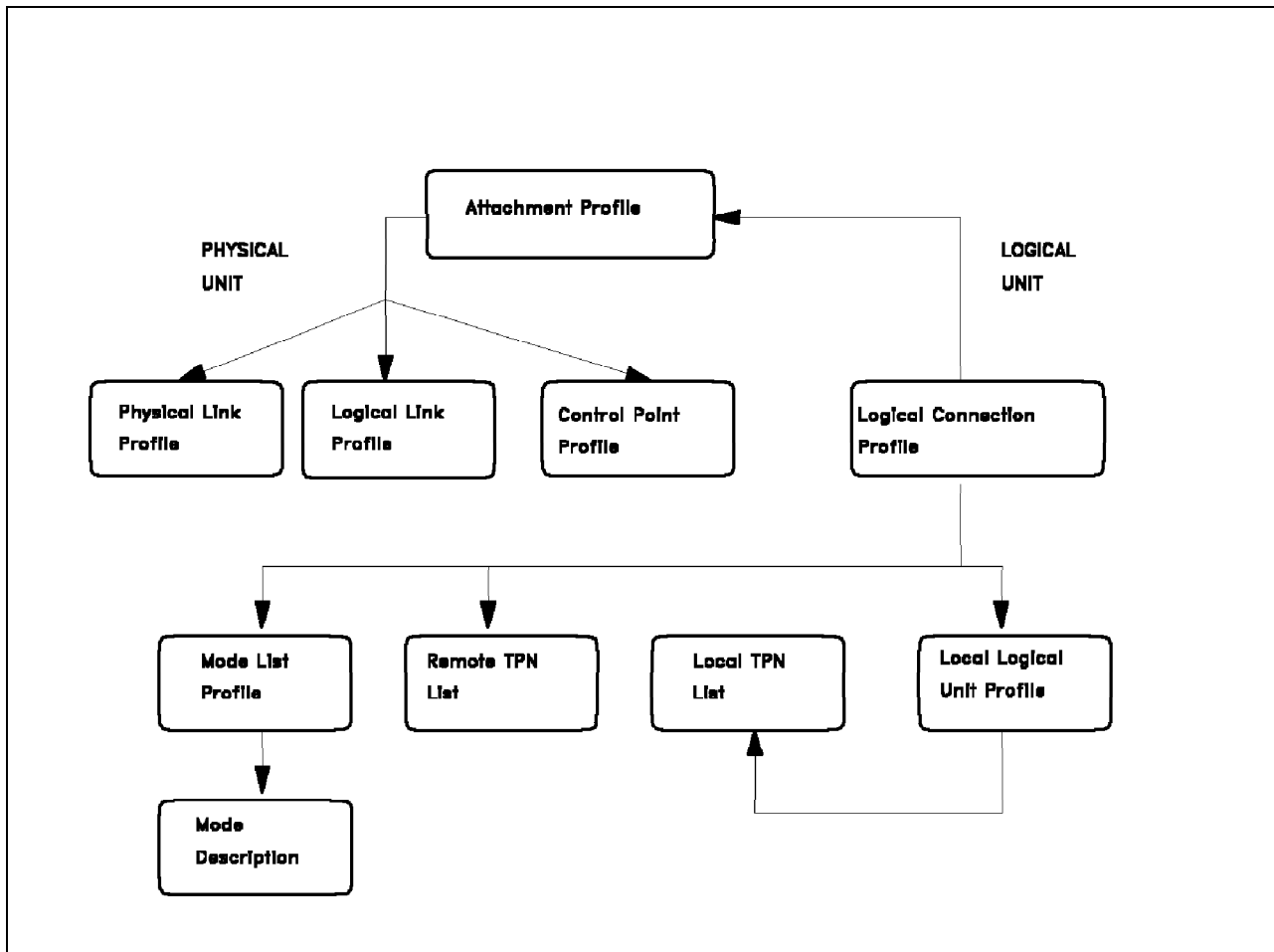


Figure 231. Configuration Objects Required for an LU 6.2 Connection

Notes:

Attachment: Together with the profiles below, this describes the characteristics of the network link. It includes pointers to the following profiles:

- Control point
- Logical link
- Physical link

Control Point: This describes the characteristics of the physical unit (PU) associated with the local system. The same control point profile can be used with many attachment profiles. Only the name of the profile is needed for a leased line.

Logical Link: This describes the characteristics of the link protocol used on the network. Only one logical link protocol exists for an attachment. The same logical link profile can be used with many attachment profiles.

Physical Link: This describes the characteristics of the physical link provided by the network.

Logical Connection: This profile describes each LU-LU session.

Local Logical Unit: This describes the network-qualified LU name of the local system. The same LU profile can be used with many connection profiles.

TPN Lists: These describe the characteristics of the local and remote transaction programs.

Mode and Mode lists: These describe a mode. Multiple modes can be added to a mode list. Modes used by SNA, such as SNASVCMMSG and CPSVCMMSG, do not need to be added to these lists.

6.1.2 RS/6000 to AS/400

We begin by building a simple scenario where we connect an RS/6000 to an AS/400 over a token-ring network as shown in the following diagram:

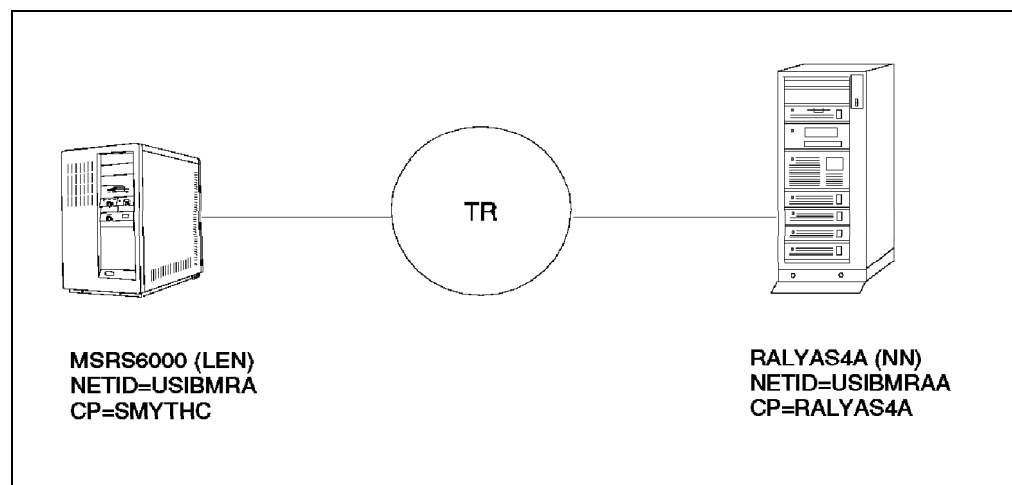


Figure 232. Simple Connectivity Scenario

There is a facility within SNA Services called Quickly configure an LU 6.2 connection. In order to give a more detailed overview of the configuration process, we do not use this. However, references to any differences between normal and quick configuration will be made where appropriate.

6.1.2.1 RS/6000 Configuration

We begin our configuration by creating an attachment profile (the equivalent of a PU), which provides details of the token-ring link which we shall use. Using the fastpath **smit sna**, we select, in order:

1. Select Configure SNA Profiles.
2. Select Advanced SNA configuration.
3. Select Physical Units.
4. Select Token-ring.
5. Select Token-ring attachment.

Please refer to Figure 233 on page 216 for details.

Note: Remember when giving names to profiles that the RS/6000 is case-sensitive.

Change / Show SNA Token Ring Attachment Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTH		
NEW PROFILE name	[]		
CONTROL POINT profile name	[SMYTH]		
LOGICAL LINK profile name	[SMYTH]		
PHYSICAL LINK profile name	[SMYTH]		
STOP ATTACHMENT on inactivity?	no		
If yes, inactivity TIMEOUT (0-10 minutes)	[0]		
LU address REGISTRATION?	no		
If yes, LU address REGISTRATION PROFILE name	[LDEFAULT]		
CALL type	call		1
If listen,			
AUTO-LISTEN?	no		
MINIMUM SAP address (hex 04-ec)	[04]		
MAXIMUM SAP address (hex 04-ec)	[EC]		
If call, ACCESS ROUTING	link_address		2
If link-name, REMOTE LINK name	[]		
If link-address,			
Remote LINK address	[400010020001]		2
Remote SAP address (hex 04-ec)	[04]		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 233. Token-Ring Attachment Profile

Notes:

- 1 As we will be initiating communications, we select call as our call type.
- 2 The token-ring address of the AS/400.

We then configure information about the logical link being used:

Change / Show SNA Token Ring Logical Link Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTH		
NEW PROFILE name	[]		
TRANSMIT window count (1-127)	[10]		
DYNAMIC window increment (1-127)	[1]		
RETRANSMIT count (1-30)	[8]		
RECEIVE window count (1-127)	[127]		
RING ACCESS priority	0		
DROP LINK on inactivity?	yes		
INACTIVITY timeout (1-120 seconds)	[120]		
RESPONSE timeout (1-40, 500 msec intervals)	[2]		
ACKNOWLEDGE timeout (1-40, 500 msec intervals)	[1]		
FORCE DISCONNECT timeout (1-600 seconds)	[120]		
DEFINITION of maximum I-FIELD size	user_defined		
If user-defined, max. I-FIELD SIZE (265-30729)	[265] 1		
TRACE link?	no .		
If yes, TRACE SIZE	short		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 234. Token-Ring Logical Link Profile

Note:

- 1 For this example, with only one token-ring link, we could specify a large I-field size. However, in subsequent configurations, we found that we needed to specify an I-field size of 265.

Next we configure the physical link profile. Here we specify the token-ring device that we will use:

Change / Show SNA Token Ring Physical Link Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
CURRENT profile name		[Entry Fields]	
NEW PROFILE name		SMYTH	
DATALINK device name		[]	
LOCAL LINK name		[tok0]	
Maximum number of LOGICAL LINKS (1-255)		[SMYTH]	
Local SAP address (hex 04-ec)		[32]	
		[04]	
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 235. Token-Ring Physical Link Profile

The above screens define the PU that we will be using. Next, we move on to the information about the local node. We start with information about the local control point:

Change / Show SNA Control Point Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
CURRENT profile name		[Entry Fields]	
NEW PROFILE name		SMYTH	
XID node ID		[]	
NETWORK name		[07100000]	
CONTROL POINT name		[USIBMRAA]	
		[SMYTHC]	
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 236. Control Point Profile

Here we have configured the network-qualified CP name of the RS/6000, and have left the node ID at "00000" to indicate that we are not verifying network user

access beyond the normal checking of net ID and CP name at link establishment. Note also the control point name of SMYTHC. This name was generated when we used the quickly configure option of SNA services. This option always creates a CP name of xxxC, where xxx is the name of the configuration. Care should be taken when using this option with certain configurations, as the different LU and CP names created by the quickly configure feature may necessitate an entry in the AS/400s remote location list. This method also defaults to single-session capability, and the Mode, QPCSUPP, will also need to be altered.

Next we must configure the LU 6.2 connection. We first configure the Local LU Profile. Here we specify the fully qualified LU name of the RS/6000.

Change / Show SNA LU6.2 Local LU Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
CURRENT profile name		[Entry Fields]	
NEW PROFILE name		SMYTH	
TPN LIST profile name		[]	
NETWORK name		[TDEFAULT]	
Local LU NAME		[USIBMRAA]	
INDEPENDENT LU?		[MSRS6000]	
		yes	
If no,			
Local LU ADDRESS (1-255)		[1]	
SSCP ID		[*]	
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 237. LU6.2 Local LU Profile

We have now completed the configuration of our attachment profile and have an entry point into the APPN network. Using this attachment, we can utilize the locate facilities of our adjacent node to create the connections that we need. In this simple case we will create one connection for RALYAS4A. We select LU 6.2 Logical Connection.

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTH		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH]		
LOCAL LU profile name	[SMYTH]		
NETWORK name	[USIBMRAA] 1		
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[RALYAS4A]		
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended 2		
If extended, SESSION CONCURRENCY	parallel 2		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 238. LU6.2 Logical Connection Profile

Notes:

- 1 This is the name of the **target** network. This, together with the remote LU name, makes up the network-qualified LU name of the remote system.
- 2 The default is for single session, which is not desirable in our case.

We must create a mode, and place this mode in a mode list. Here we are using the standard AS/400 Mode QPCSUPP.

Change / Show SNA LU6.2 Mode Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
CURRENT profile name		[Entry Fields]	
NEW PROFILE name		QPCSUPP	
MODE name		[]	
Maximum number of SESSIONS (1-999)		[QPCSUPP]	
Minimum contention WINNERS (0-499)		[64]	
Minimum contention LOSERS (0-500)		[64]	
RECEIVE pacing (0-63)		[0]	
SEND pacing (0-63)		[7]	
Maximum RU SIZE (256,288,...,3840)		[7]	
RECOVERY level		[3840]	
		no_reconnect	
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 239. LU6.2 Mode Profile

Change SNA LU6.2 Mode List Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]		[Entry Fields]	
CURRENT profile name		QPCSUPP	
NEW PROFILE name		[]	
DELETE profile names from list (F4 to list)			
Add profile names to list:			
Name 1		[QPCSUPP]	
Name 2		[]	
Name 3		[]	
Name 4		[]	
Name 5		[]	
Name 6		[]	
Name 7		[]	
Name 8		[]	
Name 9		[]	
Name 10		[]	
[MORE...53]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 240. LU6.2 Mode List Profile

We also need to have local and remote transaction profiles. We used the defaults of TDEFAULT and RDEFAULT as shown in Figure 241 on page 222 and Figure 242 on page 222, and added them to their respective TPN lists.

Change / Show SNA LU6.2 TPN Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	TDEFAULT		
NEW PROFILE name	[]		
Transaction program name is in HEXADECIMAL?	no		
TRANSACTION program name	[tpn]		
PIP data?	no		
If yes, SUBFIELDS (0-99)	[0]		
CONVERSATION type	basic		
RECOVERY level	no_reconnect		
SYNC level	none		
Full PATH to TPN executable	[/usr/lpp/sna]		
MULTIPLE INSTANCES supported?	no		
User ID	[0]		
SERVER synonym name	[TDEFAULT]		
RESTART action	once		
COMMUNICATION type	signals		
If IPC, communication IPC queue key	[0]		
Standard INPUT file/device	[/dev/null]		
Standard OUTPUT file/device	[/dev/console]		
Standard ERROR file/device	[/dev/console]		
SECURITY Required	none		
If access,			
RESOURCE SECURITY ACCESS LIST profile	[RSRCDEFAULT]		
(If no name entered, /etc/passwd used)			
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 241. LU6.2 Local TPN Default Profile

Change / Show SNA LU6.2 RTPN Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
	[Entry Fields]		
CURRENT profile name	RDEFAULT		
NEW PROFILE name	[]		
RTPN name is in HEXADECIMAL?	no		
RTPN name	[rtpn]		
PIP data?	no		
CONVERSATION type	basic		
RECOVERY level	no_reconnect		
SYNC level	none		
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 242. LU6.2 Remote TPN Default Profile

6.1.3 AS/400 Configuration

We created a controller on token-ring line L41TR for the RS/6000.

Display Controller Description	
Controller description	MSRS6000
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*NO
Active switched line	L41TR
Character code	*EBCDIC
Maximum frame size	3489
Remote network identifier	USIBMRAA
Remote control point	SMYTHC
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	10005AA88793
LAN DSAP	04
LAN SSAP	04
Text	RS/6000 Controller

Figure 243. Token-Ring Controller Description for the RS/6000

In our configuration examples we do not use the option on the RS/6000 to configure our LU 6.2 sessions with security. As a result we needed to add a remote location name entry to the subsystem QCMN on the AS/400 for the RS/6000. This was because we were using the Mode QPCSUPP, which is designed for the PC Support/400 router and, therefore, has a communications entry with a default user of *NONE. Using the CL command ADDCMNE, we added the following remote location name entry. As our emulator also sent the user ID of the RS/6000 when establishing a session, we also had to create a user profile on the AS/400 for the user ROOT.

Display Remote Location Name Entries					
Subsystem description: QCMN			Status: ACTIVE	System: RALYAS4A	
Remote Location	Mode	Job Description	Library	Default User	Max Active
MSRS6000	QPCSUPP	*USRPRF		QUSER	*NOMAX

Figure 244. Remote Location Name Entry for the RS/6000

If security is used, then the above entry is not necessary.

6.1.3.1 Activation of the Link

Activation of the link was achieved on the RS/6000 by:

1. Starting the SNA subsystem. This can be done in several ways:
 - Through the SMIT (Systems Management Interface Tool) interface
 - By using the */etc/rc.sna* file to automatically start the SNA subsystem when we IPL the RS/6000
 - By issuing the AIX command `startsrc -s 'sna'` from the command line
2. Starting the relevant attachment
3. Starting the relevant connection
4. Starting our emulator

Upon initiating a 5250 connection from the RS/6000, the following APPC device was created on controller MSRS6000:

Display Device Description	
Device description	MSRS6000
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	MSRS6000
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	MSRS6000
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLU5

Figure 245. APPC Device for RS/6000 Autocreated by AS/400

6.1.4 RS/6000 to AS/400 via a PS/2 Network Node

In this section we describe the steps necessary to allow the RS/6000 to enter the APPN network via a PS/2 acting as a network node. Please refer to Figure 246 for an overview of the scenario.

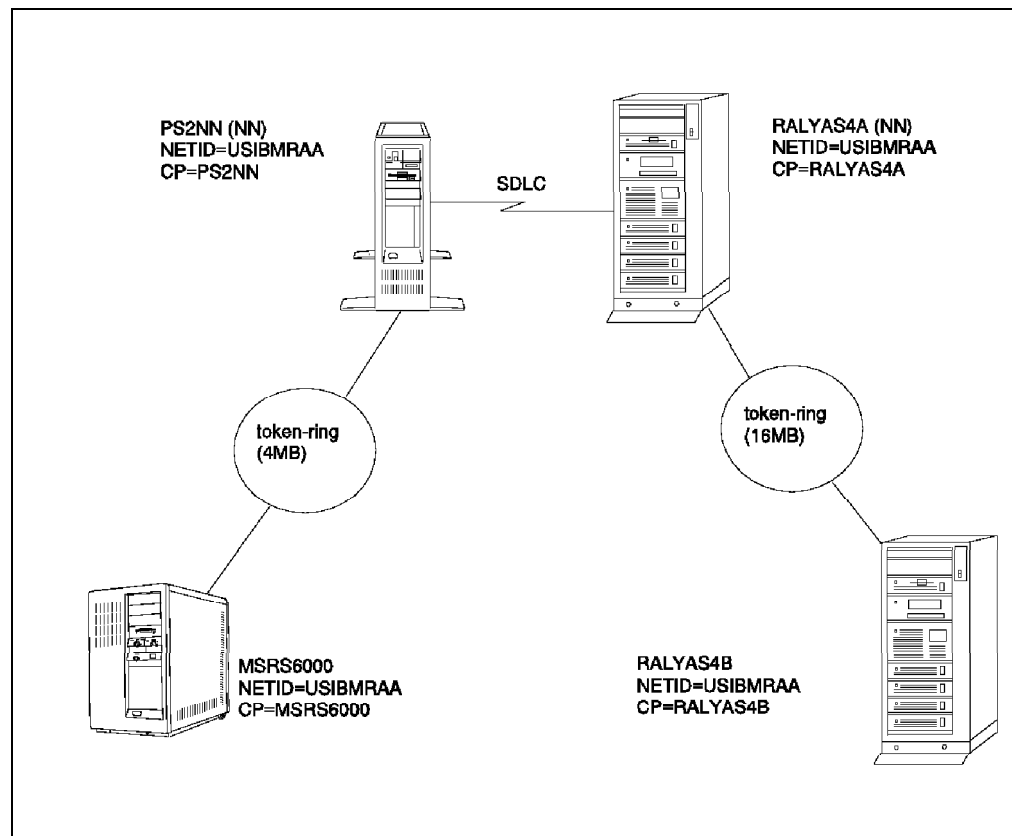


Figure 246. RS/6000 to AS/400 via PS/2 NN

6.1.4.1 RS/6000 Configuration

We took the attachment profile SMYTH as detailed in 6.1.2, "RS/6000 to AS/400" on page 215 and altered the token-ring address to point to the new adjacent node PS2NN.

Change / Show SNA Token Ring Attachment Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]		[Entry Fields]	
CURRENT profile name		SMYTH	
NEW PROFILE name		[]	
CONTROL POINT profile name		[SMYTH]	
LOGICAL LINK profile name		[SMYTH]	
PHYSICAL LINK profile name		[SMYTH]	
STOP ATTACHMENT on inactivity?		no	
If yes, inactivity TIMEOUT (0-10 minutes)		[0]	
LU address REGISTRATION?		no	
If yes, LU address REGISTRATION PROFILE name		[LDEFAULT]	
CALL type		call	
If listen,			
AUTO-LISTEN?		no	
MINIMUM SAP address (hex 04-ec)		[04]	
MAXIMUM SAP address (hex 04-ec)		[EC]	
If call, ACCESS ROUTING		link_address	
If link-name, REMOTE LINK name		[]	
If link-address,			
Remote LINK address		[400030010025]	1
Remote SAP address (hex 04-ec)		[04]	
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 247. Token-Ring Attachment Profile

Note:

- 1 The token-ring address of the adjacent PS/2

We also altered the control point profile and changed the control point name to MSRS6000.

Change / Show SNA Control Point Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
		[Entry Fields]	
CURRENT profile name		SMYTH	
NEW PROFILE name		[]	
XID node ID		[07100000]	
NETWORK name		[USIBMRAA]	
CONTROL POINT name		[MSRS6000]	
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 248. Control Point Profile

The only other change that was necessary to the attachment profile was to the I-field size in the Token-ring Logical Link Profile. This had to be changed to 265 in order for the connection to be made.

The connection profile for RALYAS4A as detailed in 6.1.2, "RS/6000 to AS/400" on page 215 did not change. This time, however, we added a second connection, to RALYAS4B, using the PS/2 and RALYAS4A as intermediate nodes. This connection was defined as follows:

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTHB		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH] 1		
LOCAL LU profile name	[SMYTH] 1		
NETWORK name	[USIBMRAA] 2		
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[RALYAS4B]		
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended 3		
If extended, SESSION CONCURRENCY	parallel 3		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 249. Token-Ring LU6.2 Logical Connection Profile for RALYAS4B

Notes:

- 1 As can be seen, this connection uses the existing local LU profile and attachment to the PS/2 network node.
- 2 This is the name of the **target** network. This, together with the remote LU name, makes up the network-qualified LU name of the remote system. See 6.1.4.5, "Using Multiple Network IDs in this Scenario" on page 233 for remote network name considerations.
- 3 The default is for single session, which is not desirable in our case.

6.1.4.2 PS/2 Configuration

To configure our PS/2 as a network node, we used the Communications Manager component of Extended Services 1.0.

The Data Link Control definition for the SDLC line, and the Mode description QPCSUPP were already created on our machine for a previous configuration (please refer to Figure 30 on page 26 and Figure 18 on page 20 for details)

We used the SNA Networks Definition menu to configure the information about the local node.

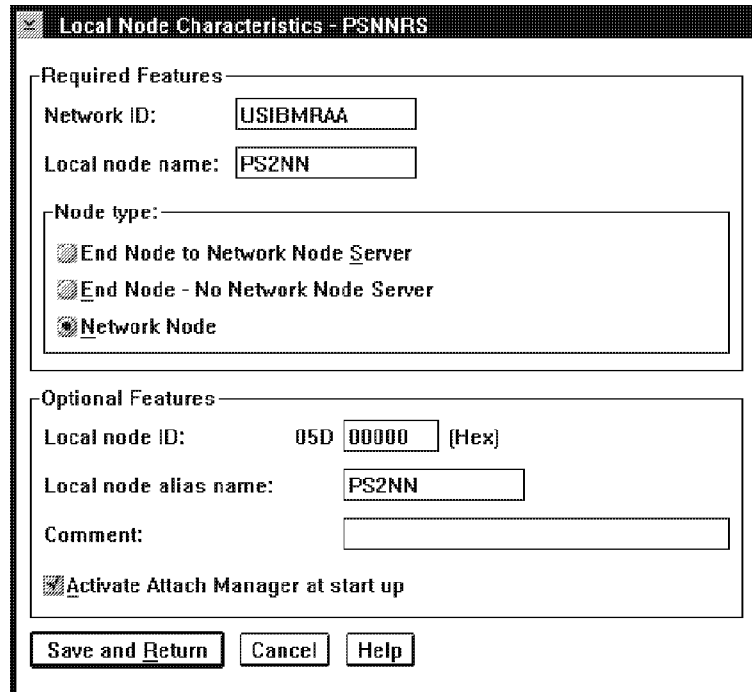


Figure 250. Local Node Characteristics of the PS/2 Network Node

We then created connections via token-ring to the RS/6000, and via SDLC to the AS/400.

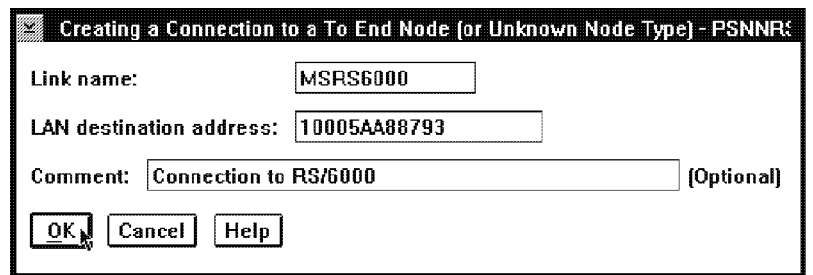


Figure 251. Creating a Link to the RS/6000

Changing a Connection to a To Network Node - PSNNRS

Link name: MSAS400A

Comment: RALYAS4A [Optional]

OK Cancel Help

Figure 252. Creating a Link to the AS/400

6.1.4.3 AS/400 Configuration

We created an SDLC line and APPC controller for the PS/2 network node.

Display Line Description	
Line description	PS2NN062
Option	*BASIC
Category of line	*SDLC
Resource names	LIN062
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	05615078
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*FULL
Modulus	8
Text	SDLC line to PS/2 NN

Figure 253. SDLC Line to PS/2 Network Node

Display Controller Description	
Controller description	PS2NN062
Option	*BASIC
Category of controller	*APPC
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	PS2NN062
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRAA
Remote control point	PS2NN
Exchange identifier	05D00000
Data link role	*NEG
Station address	01
Text	CTL FOR PS2NN GATEWAY PS/2

Figure 254. APPC Controller for PS/2 Network Node

APPN-capable	*YES
APPN CP session support	*YES
APPN node type	*NETNODE
APPN transmission group number	1
Autodelete device	1440
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 255. APPN Capabilities of PS/2 Controller

We also configured a link between the two AS/400s on the second token-ring. As is normal for token-ring connections, we only had to create one APPC controller for the connection.

Display Controller Description	
Controller description	RALYAS4B16
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*YES
Active switched line	LINTR16MEG
Character code	*EBCDIC
Maximum frame size	16393
Remote network identifier	USIBMRAA
Remote control point	RALYAS4B
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	400010020004
LAN DSAP	04
LAN SSAP	04
Text	APPC ctl for RALYAS4B

Figure 256. Controller for AS/400 A to AS/400 B Connection

As we were not using the security option on the RS/6000, we also had to have a remote location name entry in the QCMN subsystem. See Figure 244 on page 223 for details.

6.1.4.4 Activating the Link

Note: We used the /etc/rc.sna file to automatically start the SNA subsystem when we power on the RS/6000. If this is not used, then it is necessary to start the subsystem before any attachments can be activated.

On the RS/6000, we activated the SMYTH attachment and connection, and issued the command to start our emulation session with RALYAS4A. When the attachment is started, the RS/6000 exchanges XIDs with the PS/2, the PS/2 learns the nature of the link, and the link becomes active.

SNA Logical Link Management					
Display		Change status		Options	
Link		Partner	Partner	Active	Link
Name	Network ID	Name	Type	Sessions	Status
@AAAAAAA	USIBMRAA	RAK	LEN	3	Active
MSAS400A	USIBMRAA	RALYAS4A	NN	6	Active
MSRS6000			Learn	0	Pending Active

Figure 257. Logical Link Status when Created

SNA Logical Link Management					
Display Change status Options Help					
Link Name	Partner Network ID	Partner Name	Partner Type	Active Sessions	Link Status
@AAAAAAA	USIBMRA	RAK	LEN	3	Active
MSAS400A	USIBMRAA	RALYAS4A	NN	7	Active
MSRS6000	USIBMRAA	MSRS6000	LEN	1	Active

Figure 258. Logical Link after RS/6000 Connection is Started

The PS/2 forwards the BIND for the RALYAS4A session to RALYAS4A, where an APPC device is created and activated on the PS/2 controller.

Display Device Description	
Device description	MSRS6000
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	MSRS6000
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	PS2NN062
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 259. APPC Device for RS/6000 Autocreated on RALYAS4A

```

Work with Configuration Status

Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display Mode status ...

Opt  Description          Status          -----Job-----
___  PS2NN062             ACTIVE
___  PS2NN062             ACTIVE
___  PS2NN                ACTIVE
___  PS2NNLU              ACTIVE
___  MSRS600000           ACTIVE
___  QPCSUPP              ACTIVE/TARGET      MSRS6000000  ROOT

Parameters or command
===> _____

F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys

```

Figure 260. WRKCFGSTS Screen Showing Active Device for RS/6000

6.1.4.5 Using Multiple Network IDs in this Scenario

During the course of our tests, we used several combinations of network names for the nodes in our scenario. We found no difficulty in routing sessions through the PS/2 to the adjacent AS/400, RALYAS4A. The same was not true, however, for sessions to the non-adjacent node RALYAS4B. Limitations were placed on us by the ability of the PS/2 to participate in a network in which the border node function was used. If we changed the network name of RALYAS4B to one that was alphabetically lower than RALYAS4A, then we could establish a session. This was because RALYAS4B would assume the border node role, and present an image of an end node to RALYAS4A.

If, however, the network name of RALYAS4B was changed to one that was alphabetically higher than that of RALYAS4A, then the connection would fail. The difference was that, in this case, it was RALYAS4A who presented the End Node image, thus creating two logical networks. In this case, the PS/2 would receive the correct tail vector in the locate found from RALYAS4A, but would not understand it. The problem is that the PS/2 has to support part of the APPN function set 1013 (interoperability with peripheral border node), which is only available with Communications Manager/2 V1.11.

The PS/2 was the only machine to cause this problem. When we replaced it with a VTAM network node, the scenario worked perfectly.

Chapter 7. Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)

The advent of VTAM 3.2, along with the announcement of the AS/400 with APPN, heralded the beginnings of APPN connectivity via an SNA subarea network. In this chapter we will investigate options for an APPN network which is connected to a conventional VTAM subarea network. The configuration examples in this chapter will use VTAM Version 4 Release 1. Most scenarios are equally relevant to VTAM 3.2 and associated NCPs; on occasions where there are special considerations for VTAM 3.2 users, they will be specifically noted.

This chapter will consider subarea connectivity only. In APPN terms, VTAM acts as a LEN end node. VTAM Version 4 Release 1 will act as a pure subarea node, or LEN end node if the NODETYPE and CPCP parameters are omitted from the VTAM start list. In the following chapter we will consider further implementations of VTAM Version 4 Release 1, including its APPN network and end node capabilities.

LEN connectivity requires that VTAM submit to the possibility of accepting a BIND from an independent LU at an APPN or LEN end node. VTAM must then forward the BIND to the target LU specified in the BIND in order to allow the session to be established. After session establishment, VTAM has no further part to play, as conversations are routed directly through the subarea network over the session established between the origin and destination independent LUs.

The AS/400 may be an APPN network node. It is also capable of routing BINDs from other nodes in an APPN network to the subarea. Not only is it possible for APPN nodes to communicate via the subarea network but, also, entire APPN networks can use the AS/400's wildcard capabilities to pass session requests to, and through, the subarea network.

The announcement of APPN for the 3174 and for the PS/2 has given rise to a number of options for connecting remote APPN networks via a subarea network. These options provide a degree of flexibility. They also provide a possibly increased complexity with associated issues and questions. It is the primary intention in this chapter to address some of these issues and questions by:

- Discussing the options available for connecting remote APPN networks, call them branches, via a subarea network.
- Highlighting the relative benefits and limitations of each of these options.
- Providing configuration details of each option, using SDLC leased line, token-ring, and X.25 connections.
- Discussing further the implications of connecting different corporations with different network IDs. That is Non-Native Network Connection (NNNC) in relation to subarea connectivity. NNNC is available as a PTF for VTAM Version 3 Release 3, and is included in later releases.
- Discussing the VTAM 4.1 function of dynamic PU and independent LU creation.
- Providing an analysis of trace and flow mechanisms building on the discussion from previous chapters.

- Discussing and providing a configuration example for 5394, 5494, and RISC/6000 to AS/400 connectivity via a subarea network.

7.1 Subarea Considerations - Connectivity Options

When an APPN network is connected to a subarea network, the subarea is considered to be a single, albeit large, LEN end node. Any LU with which communications is desired within the subarea network must be defined in the adjacent network node either specifically (by using an AS/400 Remote Location List entry) or by defining a wildcard. Moreover, any LU residing within an APPN network beyond the subarea is considered to reside within the host LEN end node. Thus, any LUs beyond the host network to which communications may be desired must be defined in the network node adjacent to the host in the same manner as an LU residing within the subarea.

Since a PS/2, a 3174 and an AS/400 can all be APPN network nodes, they are all capable of routing session traffic through a subarea network. That is to say, an LU in the same network may request a session with an LU in or beyond the subarea network and the PS/2, 3174 or AS/400 can route the BIND to the host. VTAM can then route the BIND to the appropriate LU destination using the cross domain routing facility. This is done using the network nodes wildcard support.

Wildcard support will permit one network node within an APPN network to respond positively to search requests for locations which do not lie within the bounds of its APPN network. The network node holding the wildcard will then forward any session request to the control point in its APPN wildcard entry. In our case the control point will be RAP, our VTAM host. The implementation of the wildcard is product specific, and will be discussed further in the following sections of this chapter.

There are four key APPN connectivity options available to enable independent communications from one remote branch, through a subarea network, to another remote branch. These options are:

- AS/400 acting as a gateway from the branch network to the subarea network
- OS/2 Extended Services acting as a gateway from the branch network to the subarea network
- 3174 with Configuration Support C acting as a gateway from the branch network to the subarea network

We consider these options in this chapter. In addition, we also consider connection of a 5394, 5494 and RISC/6000 to an AS/400 via a subarea network. The 5494 is also capable, in a limited sense, of acting as a gateway to the subarea. A 5494 can support APPC sessions for devices which *initiate* APPC sessions in or beyond the subarea.

Note: The term gateway used in the above context implies only that the node acting as gateway to the subarea has the direct telecommunications link to the subarea. And that, any sessions to be routed to or through the subarea must first be routed through the gateway node in the remote branch network. There is no special gateway function or software implied by this term. We will explicitly describe all software and function utilized by any node in our network.

A key element in our considerations for each of these options is the ability to simultaneously perform independent and dependent communications.

The remote branch defined in the previous chapters will provide the basis for our testing. The final version of that network implemented the Connection network capability. The virtual node representing the connection network was named CNET. We have re-moulded CNET a little in this chapter for illustrative purposes.

In this chapter we do not consider or utilize the Connection network. However, we keep the name CNET for our remote branch network. In addition, we have removed RALYAS4B from CNET and included it with another PS/2 into a different network. We call this new network VNET and give it a network ID of USIBMRAB. We have also included a second 3174 with CP name of CP31742 in CNET (we explain why in 7.2.5, “CP3174 Sessions” on page 277). Lastly, CNET has been given a different network ID of USIBMRAA. We test the connection between these two networks via an SNA subarea network. The SNA subarea network has been named SUBNET which has a net ID of USIBMRA.

In particular, we consider each of the cases where the AS/400, the 3174 and the PS/2, in turn, have a direct telecommunications link to the subarea network. In each case, the other nodes, which do not have a direct telecommunications link, perform communications via the node which does.

With each of the three networks having been given different net IDs, the inference is that the two remote networks, CNET and VNET, be considered as remote branches of different corporations. The host may be seen as the central location from yet another corporation, or perhaps IBM Information Network (IIN*).

Considering different net IDs in this way provides a mechanism by which the implications of NNNC may be explored. Naturally, it is possible to deduce the more specific case of having the same net ID for each node from the more general case of different net IDs. Any limitations discussed for different net IDs is done so in the context of whether those limitations also exist when net IDs are the same.

The complete environment built in this chapter is described in Figure 261 on page 238.

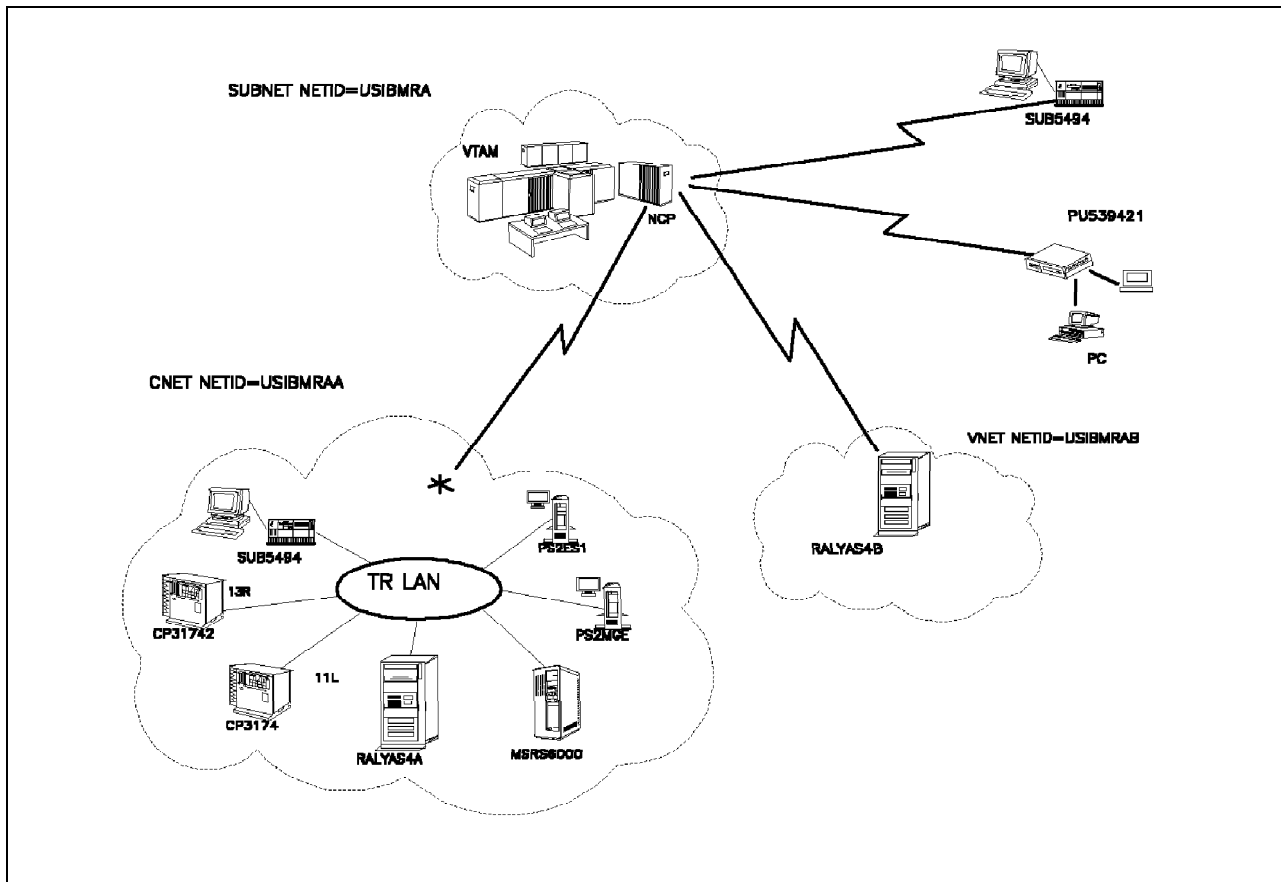


Figure 261. The Three-Network Subarea Environment. The telecommunications link from SUBNET to CNET is alternately connected to RALYAS4A, PS2ES1 and CP3174.

In Figure 261, the subarea network has been called SUBNET, with net ID USIBMRA, the two remote branches have been called CNET, with net ID USIBMRAA, and VNET, with net ID USIBMRAB, respectively. The names given are primarily for reference purposes. The name SUBNET does not exist in any definitions. CNET is the name of the Connection network created in 2.1.5.2, "ES/1 Requirements for Connection Network" on page 44. VNET is the name given to the remote network on the right of the subarea. In our testing, the direct telecommunications link to CNET is alternately attached to each of RALYAS4A, CP3174 and PS2ES1. The direct telecommunications link to VNET is always attached to RALYAS4B. Consideration is also given to the attachment of a 5394 and 5494 via the subarea network.

The specific scenarios considered from the above environment are:

1. CNET via RALYAS4A to SUBNET to VNET
2. CNET via CP3174 to SUBNET to VNET
3. CNET via PS2ES1 to SUBNET to VNET
4. VNET to SUBNET to PU539421
5. VNET to SUBNET to SUB5494
6. VNET to SUBNET to MSRS6000 (not shown above)

7.1.1 Considerations for Multiple Network IDs in a Subarea Network

We considered, in 2.1.1.2, “Multinetwork Connectivity” on page 10, the APPN peripheral border node function which is available for the AS/400. Prior to border node support, it was possible to connect network nodes in different networks by defining each as a LEN node. In this case, the APPN capabilities between networks is limited. When considering connectivity via a subarea network, there are two further possibilities for allowing multinetwork connectivity. Along with the previously discussed LEN connection and peripheral border node function, the possibilities are:

1. VTAM Non-Native Network Connectivity (NNNC)
2. VTAM systems network interconnection (SNI)
3. AS/400 LEN connection between network nodes
4. AS/400 multinetworking capability or peripheral border node

There are some restrictions involving the interconnection of different APPN networks, different subarea networks, and combinations of different APPN and subarea networks. The key reason for these restrictions is to prevent a search which never stops.

Consider a search that fails in NETWORK1 and then gets sent to NETWORK2 where it fails and gets sent to NETWORK1 and so on. The network may too easily become consumed and be unable to recover unless every node is powered down at the same time. APPN prevents this situation from occurring through the use of FQPCID caching.

From the three possible means of enabling multinetwork connectivity, there are a number of alternatives which may be examined. Consider four generic networks. By definition, each network has a different network ID, NETWORK1 through NETWORK4. In the following discussion, we explain the alternatives by making specific assumptions about these generic networks.

Note: The following discussion excludes 3174. At the time of testing for this document, the 3174 is not capable of establishing CP-CP sessions with any node having a different net ID than its own.

7.1.1.1 The End Node Connection to a Network Node Server

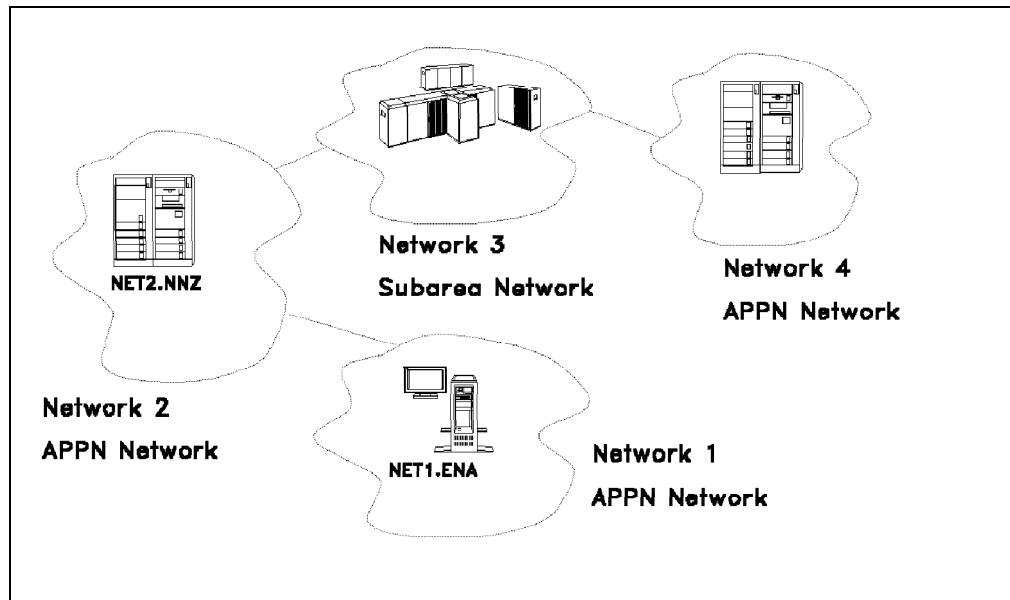


Figure 262. End Node Connection to Network Node Server

Assume that:

- NETWORK1, NETWORK2, and NETWORK4 are APPN networks.
- NETWORK3 is a subarea network with the Non-Native Network Connection (NNNC).

Note: For VTAM before V3.4 the NNNC PTF must be applied (see *Announcement Letter, VTAM Non-Native Network Connection PTFs*, for more information about NNNC).

- There is an end node in NETWORK1 named NET1.ENA and NET1.ENA is NOT connected to a network node server in NETWORK1 (for example, NET1.ENA does NOT have CP-CP sessions with a network node in NETWORK1).
- There is a network node in NETWORK2 named NET2.NNZ.

Given these assumptions, NET1.ENA can link to NET2.NNZ and make NET2.NNZ its network node server. Because the NN server is in a different network, the other control points in NETWORK1 are not able to establish sessions to NET1.ENA. In Communications Manager the DEFINE_LOGICAL_LINK verb, within the .NDF file, would specify ADJACENT_NODE_TYPE(NN) and CP_CP_SESSION_SUPPORT(YES). On the AS/400, the APPC controller description would specify NODETYPE(*NETNODE) and CPSSN(*YES). NET1.ENA would register its LUs with NET2.NNZ. An LU in NET1.ENA would be able to reach any LU in NETWORK2 and vice versa.

An LU in NET1.ENA would not, however, be able to reach an LU in NETWORK3 or beyond. Similarly, an LU in NETWORK3 or beyond would not be able to reach an LU in NET1.ENA.

The NNNC function allows the subarea to use LEN definitions and connect to a network with a different network ID. However, it does *not* allow you to cascade networks. If a BIND flows from NETWORK2 into the NETWORK3 subarea, VTAM will check the network ID of the network-qualified primary LU name. If it does not match the network ID of the node connected to the subarea, the BIND will be

rejected. In addition, session requests that are originated in the subarea or routed through the subarea will be unable to reach into NETWORK2 unless the network ID of the network-qualified secondary LU name is NETWORK2.

In this alternative, a BIND that originates from an LU in NET1.ENA will carry a network ID of NETWORK1 on the primary LU network-qualified name and it will be rejected in NETWORK3. Also, there is no way in VTAM to define an LU location where the network ID of the LU is NETWORK1 and the LU location is through NETWORK2. Therefore, an LU in NET1.ENA would be unable to reach an LU in NETWORK3 and beyond and vice versa.

7.1.1.2 The LEN Connection Between Network Nodes

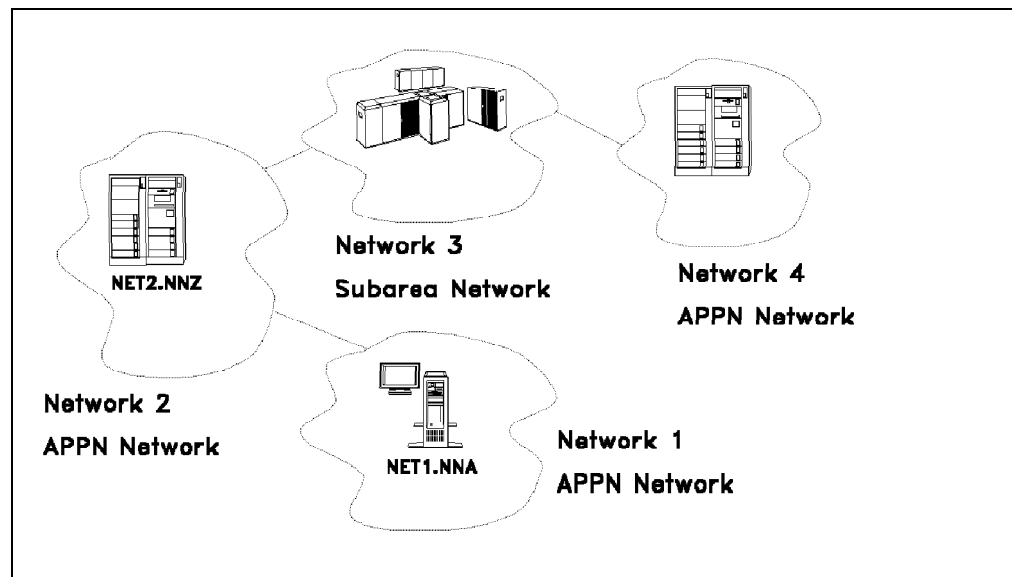


Figure 263. LEN Connection Between Network Nodes

Assume that:

- NETWORK1, NETWORK2, and NETWORK4 are APPN networks.
- NETWORK3 is a subarea network.
- There is a network node in NETWORK1 named NET1.NNA.
- There is a network node in NETWORK2 named NET2.NNZ.

Given these assumptions, it is possible for NET1.NNA to link to NET2.NNZ using a LEN connection. In OS/2 Extended Services, the DEFINE_LOGICAL_LINK verb would specify ADJACENT_NODE_TYPE(LEN) and CP_CP_SESSION_SUPPORT(NO). On the AS/400, the APPC controller description would specify NODETYPE(*LENNODE) and CPSSN(*NO).

Since there are no CP-CP sessions between the network nodes, search requests between them are not possible. In NET1.NNA, the location of the LUs in NET2.NNZ and beyond must be defined. In NET2.NNZ, the location of the LUs in NET1.NNA must be defined. In both cases, it is possible to define the locations either explicitly or by careful use of wildcards.

The wildcard provides a mechanism for a network node adjacent to a LEN end node to route BIND requests for LUs which are unknown to the APPN network to

the LEN host. An example of such a wildcard is the *ANY entry in the AS/400s Remote Location List, see Figure 294 on page 272.

When the LU locations have been defined as described above, any LU in NETWORK1 will be able to reach any LU in NET2.NNZ. Similarly, any LU in NETWORK2 will be able to reach any LU in NET1.NNA. Notice the restrictions in this case. The LUs in NETWORK1 would *not* be able to reach past NET2.NNZ to other LUs in NETWORK2 and LUs in NETWORK2 would *not* be able to reach past NET1.NNA to other LUs in NETWORK1.

Also, for the same reasons as those given in alternative 1 above, the LUs in NETWORK3 and beyond are completely out of reach of the LUs in NETWORK1, even if NET2.NNZ is directly connected to NETWORK3.

The APPN architecture defines a far superior approach to multiple network connectivity. We describe that option next.

7.1.1.3 The Peripheral Border Node Connection Between Network Nodes

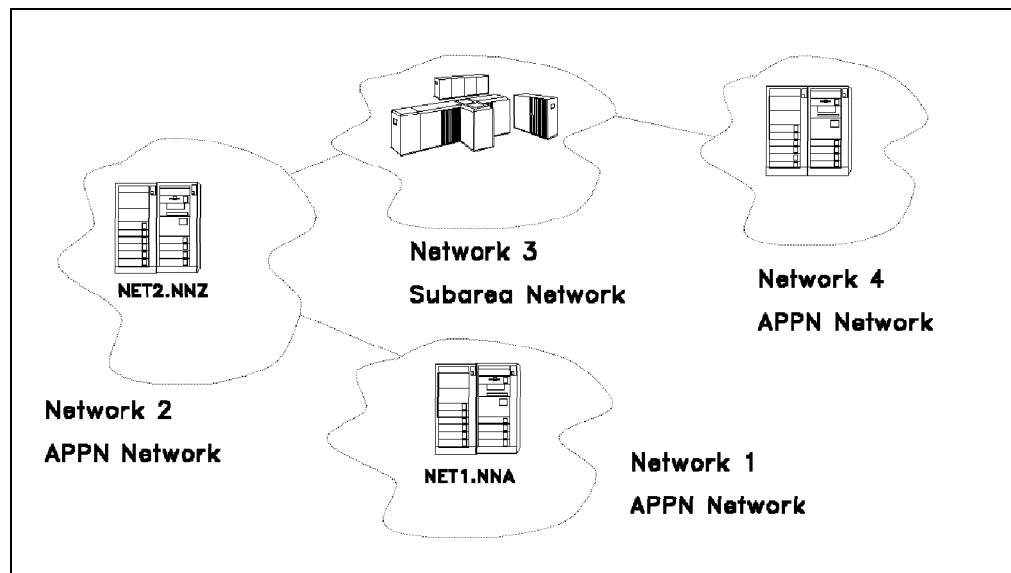


Figure 264. APPN Border Node Connection Between Network Node

Assume that:

- NETWORK1, NETWORK2, and NETWORK4 are APPN networks.
- NETWORK3 is a subarea network.
- There is a network node in NETWORK1 named NET1.NNA.
- There is a network node in NETWORK2 named NET2.NNZ.
- Either NET1.NNA or NET2.NNZ is a peripheral border node. This option does not have to be in both nodes, just one of them.

Then given these assumptions, NET1.NNA can link to NET2.NNZ and establish CP-CP sessions. When the connection is established, the peripheral border node would negotiate itself to appear as an end node that supports a search, with its network node server being the network node of the adjacent network. Of

course, if both nodes were peripheral border nodes, the negotiation logic would force exactly one node to appear as an end node.

Since searches can pass over the CP-CP session between NET1.NNA and NET2.NNZ, any LU in NETWORK1 can reach any LU in NETWORK2 and vice versa. No LU location definitions are required.

Assume that a search request for an LU in NETWORK1 is received by NET2.NNZ. It knows of NET1.NNA as an end node which supports a search request. Thus, NETWORK.NNZ will forward the search request to NET1.NNA which will take on its role as a network node in NETWORK1 and propagate the request in NETWORK1. Once a search reply is obtained, NET1.NNA will forward it to NET2.NNZ; the search reply will then be returned to the initiator with appropriate routing information and the BIND will then be established.

However, there are restrictions to the peripheral border node support: it makes it possible to connect adjacent networks only. To illustrate, assume that NET2.NNZ has the multinetwork connectivity option. If the LU search originates in NETWORK1, NET2.NNZ will not forward the search to NETWORK2 unless NETWORK2 is the network ID of the LU to be found. Similarly, if the LU search originates in NETWORK2, NET2.NNZ will not forward the search to NETWORK1 unless NETWORK1 is the network ID of the LU to be found.

Assume now, there is a network node NETWORK2.NNO and a network node NETWORK4.NNP, one of which is a peripheral border node. Furthermore, assume there is a direct connection between them. Now, any LU in NETWORK1 can reach any LU in NETWORK2 and vice versa. In addition, any LU in NETWORK4 can reach any LU in NETWORK2 and vice versa. However, because the multinetwork capability enables only adjacent networks to connect, no LU in NETWORK1 can reach an LU in NETWORK4 and vice versa. To overcome this restriction, make all of the APPN networks adjacent by establishing at least one NN-NN connection between all networks, or use extended border node.

Of course, for the same reasons as those given in alternative 1 above, the LUs in NETWORK3 and beyond are completely out of reach of the LUs in NETWORK1.

7.1.1.4 LEN Connections to a Subarea Joining APPN Networks

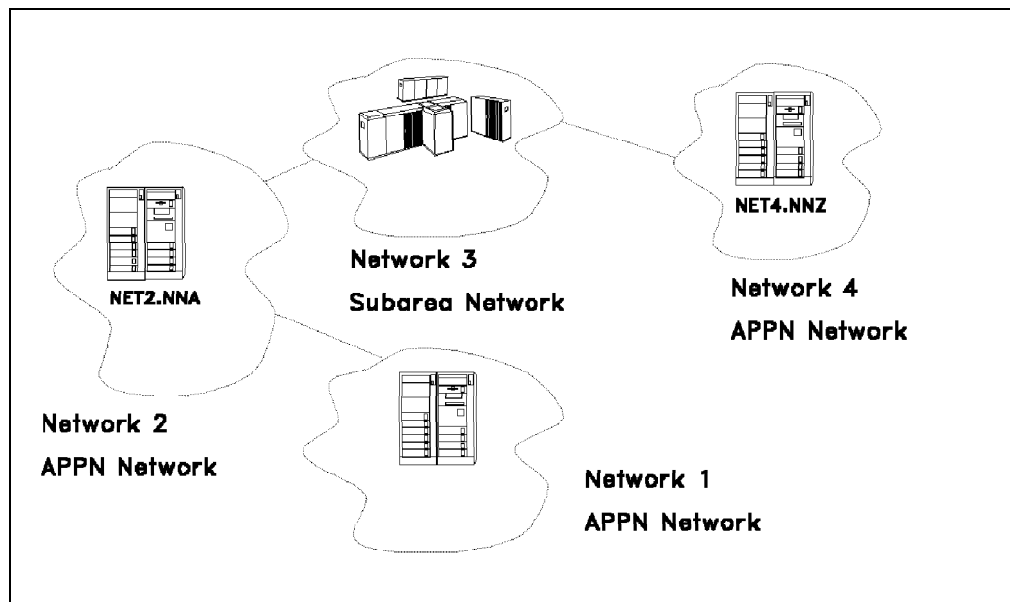


Figure 265. LEN Connections to Subarea

Assume that:

- NETWORK1, NETWORK2, and NETWORK4 are APPN networks.
- NETWORK3 is a subarea network.
- There is a network node in NETWORK2 named NET2.NNA that is linked to the NETWORK3 subarea.
- There is a network node in NETWORK4 named NET4.NNZ that is linked to the NETWORK3 subarea.

Since VTAM V3R4 does not support CP-CP sessions, the connections between the network nodes and the subarea are LEN connections. Since there is no way to search for an LU across a LEN connection, we must define some LU locations.

First, consider NET2.NNA. In this network node, you would have to define any LU in NETWORK3 or NETWORK4 (that needs to be reached) as if the LU were located in the node at the other end of the NET2.NNA subarea connection, but specifying its true network-qualified name. In reality, this requirement relates to specifying that the subarea connection is the next hop in the route to the LU. When the target LU moves from one node to another, the definitions in NET2.NNA need not be changed. Moreover, it is possible to define the LU locations using wildcards. Wildcards reduce the definition work on the network nodes adjacent to the host dramatically.

The same analysis applies to NET4.NNZ. Here, you would have to define any LU in NETWORK2 or NETWORK3 as if the LU were located in the node at the other end of the NET4.NNZ subarea connection, specifying its true network-qualified name.

Now consider the subarea definitions. One choice would be to explicitly define any LU in NETWORK3 as if the LU were located in NETWORK3.NNA and to define any LU in NETWORK4 as if the LU were located in NET4.NNZ. Unfortunately, VTAM does not have a wildcard option for LEN connections to simplify this task.

However, as will be discussed later in this chapter, VTAM 4.1 can dynamically create independent originating LU definitions.

VTAM 4.1 has the ability to accept a BIND from an LU that has not been explicitly defined and will dynamically create a CDRSC definition for that LU. From that point on, if any other LU attempts to reach the dynamically added LU, VTAM will know how to route the BIND. Further discussion is provided on this capability in the next section.

Once the LU locations have been defined correctly:

- Any LU in NETWORK2 can reach any LU in NETWORK3 or NETWORK4.
- Any LU in NETWORK3 can reach any LU in NETWORK2 or NETWORK4.
- Any LU in NETWORK4 can reach any LU in NETWORK2 or NETWORK3.

Of course, for the same reasons as those given in alternative 1 above, the LUs in NETWORK3 and beyond are completely out of reach of the LUs in NETWORK1.

7.1.1.5 SNI Connections Between Subareas

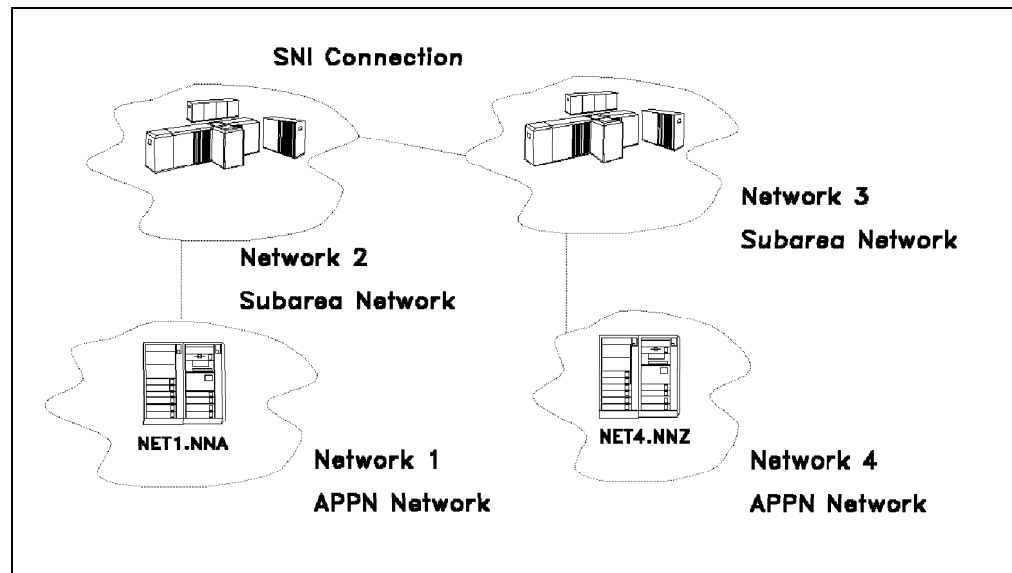


Figure 266. SNI Connections Between Subareas

Assume that:

- NETWORK1 and NETWORK4 are APPN networks.
- NETWORK2 and NETWORK3 are subarea networks.
- There is an SNI connection between NETWORK2 and NETWORK3.
- There is a network node in NETWORK1 named NET1.NNA that is linked to the NETWORK2 subarea.
- There is a network node in NETWORK4 named NET4.NNZ that is linked to the NETWORK3 subarea.

As in alternative 4 above, the connections between the network nodes and the subareas are LEN connections. Since there is no way to search for an LU across a LEN connection, we must define some LU locations.

Using the same procedures outlined in alternative 4 above,

- In NET1.NNA you would define any LU that needs to be reached in NETWORK2, NETWORK3, or NETWORK4 as if the LU were located in the node at the other end of the NET1.NNA subarea connection using the target LU's true network-qualified name.
- In the NETWORK2 subarea, you would define any LU that needs to be reached in NETWORK1 as if the LU were located in NET1.NNA.
- In the NETWORK3 subarea, you would define any LU that needs to be reached in NETWORK4 as if the LU were located in NET4.NNZ.
- In NET4.NNZ you would define any LU that needs to be reached in NETWORK1, NETWORK2, or NETWORK3 as if the LU were located in the node at the other end of the NET4.NNZ subarea connection using the target LU's true network-qualified name.

Wildcards can be used in network nodes and dynamic LU definitions can be used in the VTAMs.

Once the LU locations have been defined correctly, with the help of SNI between the two subarea networks:

- Any LU in NETWORK1 can reach any LU in NETWORK2, NETWORK3 or NETWORK4.
- Any LU in NETWORK2 can reach any LU in NETWORK1, NETWORK3 or NETWORK4.
- Any LU in NETWORK3 can reach any LU in NETWORK1, NETWORK2 or NETWORK4.
- Any LU in NETWORK4 can reach any LU in NETWORK1, NETWORK2 or NETWORK3.

7.1.1.6 Casual Connections Between Subareas

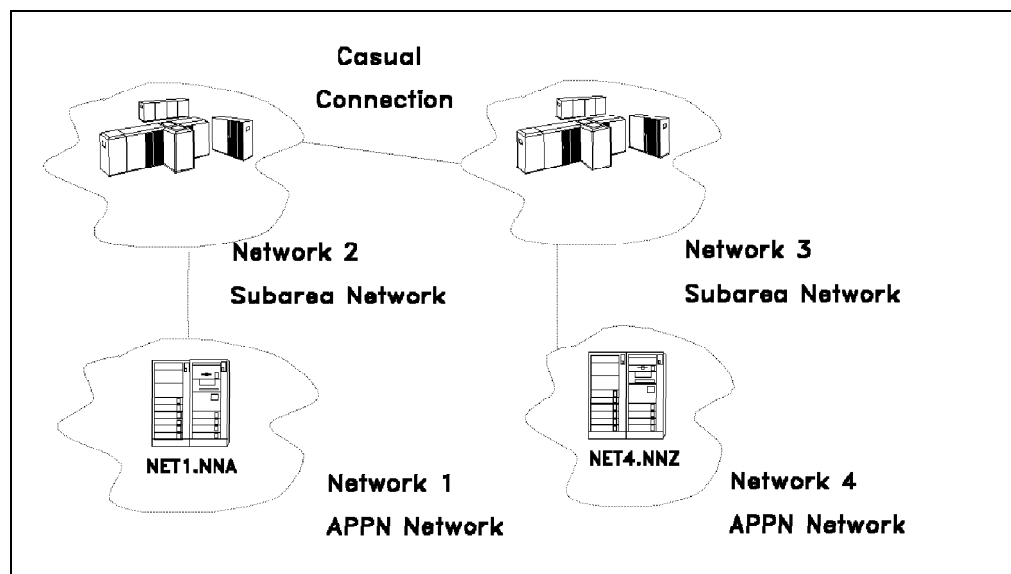


Figure 267. T2.1 Casual Connections Between Subareas

Assume that:

- NETWORK1 and NETWORK4 are APPN networks.

- NETWORK2 and NETWORK3 are subarea networks.
- There is no SNI connection between NETWORK2 and NETWORK3 but rather there is a T2.1 casual connection between them.
- There is a network node in NETWORK1 named NET1.NNA that is linked to the NETWORK2 subarea.
- There is a network node in NETWORK4 named NET4.NNZ that is linked to the NETWORK3 subarea.

The only difference between this alternative and alternative 5 is the absence of SNI. Unlike SNI, casual connection of Type 4 nodes restricts LU-LU sessions to the two net IDs, NETWORK2 and NETWORK3. Thus, NETWORK1 and NETWORK4 are completely out of each other's reach. Moreover, NETWORK1 can only communicate with NETWORK2 and NETWORK4 can only communicate with NETWORK3.

7.1.2 Host Definition Considerations

Before discussing the definitions required at the host, we will first look briefly at the way definitions may be performed. This discussion is intended to provide a basic understanding of the means by which VTAM/NCP definitions are created.

VTAM is the telecommunications access method for the host. NCP is the network control program for the host's communications controller: a 3745, 3720, 3725 or 3705.

Communication definitions for both NCP and VTAM are performed in a data set at the host. For our testing, the host operating system is MVS and, thus, the definitions are performed in a data set, named RISC.VTAMLST. The suffix VTAMLST must be used for communication definitions and the prefix may be whatever is desired.

VTAM definitions are required for *all* SNA communications with which the host is involved, whether it be for local devices or remote. NCP definitions are only required if the communications requires the services of a network controller. For example, NCP definitions are not required if the communications is performed to a channel-attached 3174 with local 3270 devices.

NCP definitions are performed in a single data set which is known as an *NCP major node*. Many NCP major nodes may be defined for any one network controller, but only one may be used by VTAM for the network controller at any time. The major node we use for testing in this chapter is named RA9NCPI in RISC.VTAMLST on our test system. It is more common in a production environment for this dataset to be named SYS1.VTAMLST.

An NCP major node contains both NCP and VTAM parameters. In particular, it contains as the upstream definition:

- An NCP BUILD macro which defines the characteristics of the local NCP
- PCCU and HOST macros which include definitions for the VTAM hosts with which the local NCP may communicate via channel to them

The downstream definitions include:

- The GROUP macro enabling the definition of physical characteristics for a group of lines

- The LINE macro in order to define the physical port out of which a particular line will communicate
- The PU and LU macros defining downstream nodes and devices

The last parameter type is for intermediate networking nodes, that is, NCPs communicating with each other:

- PATH statements included in order to define the paths which may be taken through a network and the physical links which must be crossed for any logical link to a remote node

At NCP generation, the NCP parameters are used to create an NCP module which is loaded into the 37x5 when the NCP is started. When the NCP is started, the VTAM parameters from that NCP major node are also enabled.

In addition, however, there are also VTAM-specific definitions which relate only to the local VTAM. These are included in a *VTAM start list*. The start list includes parameters which define the SSCP name and the net ID of the local host. These definitions are activated at VTAM startup.

There are other types of major nodes in addition to NCP major nodes. These major nodes are coded in a separate data set from the NCP major node and include a VBUILD macro instead of an NCP BUILD macro. An additional *TYPE* parameter on the VBUILD statement further determines the type of major node which is being defined. Examples of these major nodes are:

- Switched major node
TYPE=SWNET for switched lines including token-ring
- A CDRSC major node
TYPE=CDRSC for cross-domain definitions

The name *subarea* is used to refer to a node containing an NCP or a VTAM. The VTAM subarea and the NCP subareas which are owned by that VTAM make up a *domain*. A domain includes only a single VTAM but may include multiple NCPs. With VTAM Version 3 Release 4 and later, CDRSC definitions are also used to define independent LUs.
- A local major node
TYPE=LOCAL for channel-attached cluster controllers such as 3174s

7.1.3 VTAM Dynamic Creation of Originating LUs

All tests in this chapter are performed using VTAM 4.1. For a detailed overview of the new functions in VTAM 4.1, please refer to the *VTAM 4.1 Planning Guide*.

In particular, VTAM 4.1 offers the capability of dynamically creating definitions for originating independent LUs (ILUs or OLUs) which request a session. This capability has been support by VTAM since VTAM Version 3.4.

The dynamic ILU creation support is an extension of the existing capability of VTAM to dynamically create cross-domain resources. Thus, the ILUs are seen as cross-domain resources. ILUs which are dynamically created by VTAM are placed in a cross-domain resource major node with the name ISTCDRDY. ILUs which are predefined are copied into a different cross-domain resource major node, ISTPDILU.

The support of dynamic independent OLU creation may be controlled through the use of a parameter definable for the entire node or for a connection.

The dynamic definition support is defaulted for the entire VTAM 4.1 node by a VTAM start option. This start option indicates whether or not the node must pre-define *all* ILUs or whether the originating ILUs may be dynamically created.

The parameter is:

DYNLU=YES/NO

The node default may be overridden on a PU basis. The identical parameter to that in the start option is then coded on the PU macro. Any major node type which supports independent LU definitions will also support this parameter on the PU macro.

In this chapter, we use a VTAM start list with the *DYNLU* parameter coded as *YES*. More discussion is provided for the usage of dynamic OLU creation for independent LUs throughout the chapter.

7.2 AS/400 as Gateway from a Branch Network to a Subarea

We now begin to examine the alternatives for connecting remote APPN networks via an SNA subarea network. The first alternative which we consider is with an AS/400 acting as the gateway to the subarea from our remote network, USIBMRAA. That is, with a direct telecommunications link to the subarea.

The key question in this section is, whether LUs in each of the AS/400, PS/2 and 3174 nodes can *simultaneously*:

1. Use the APPN function in the AS/400 in order to route *independent* session traffic through the subarea to USIBMRAB, for example, DSPT, ODF, PC Support/400 or any other APPC application.
2. Use the AS/400 SNA Pass-Through function to route *dependent* traffic to the host. In this case, 3270 emulation is the dependent traffic tested.

We examine this alternative by considering the sessions described in the following diagram, Figure 268 on page 250.

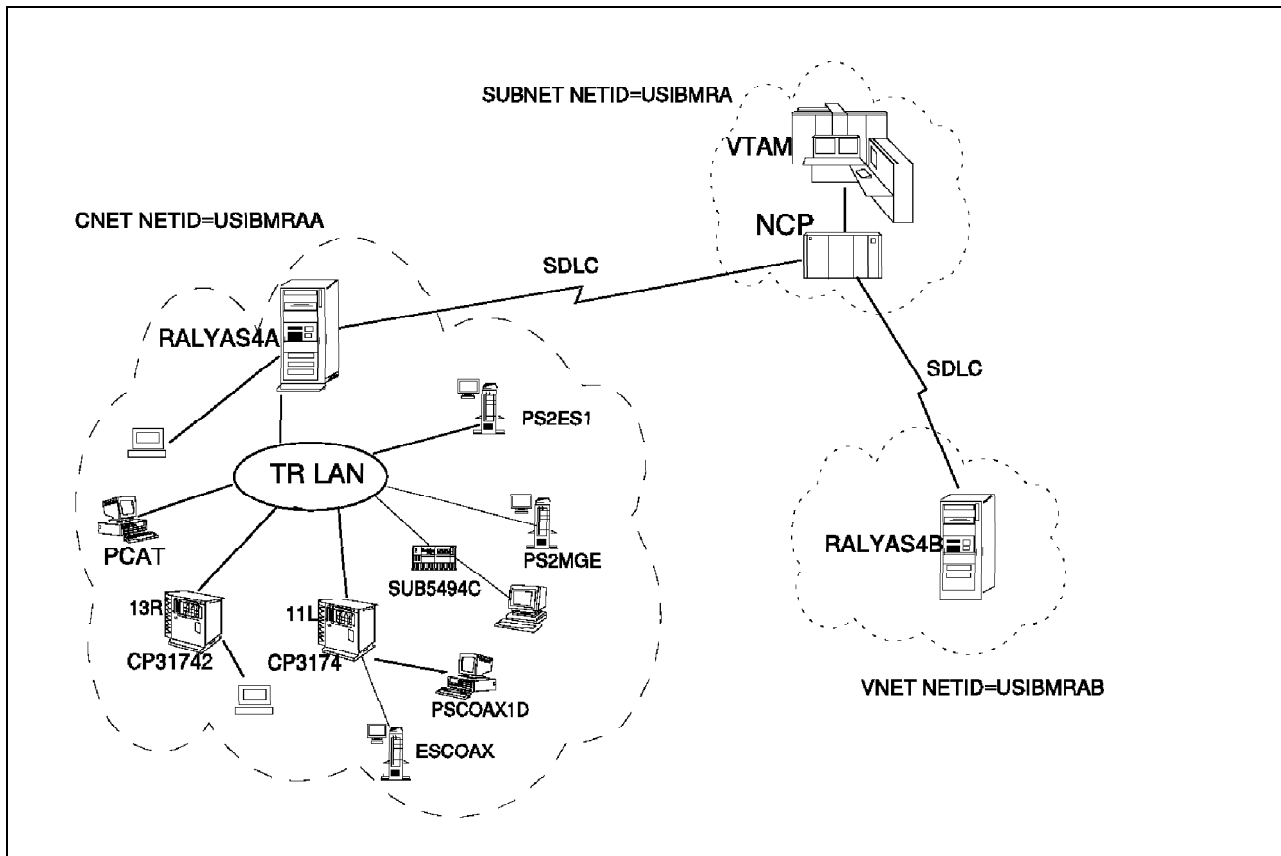


Figure 268. The Communications Environment Established in This Section

An AS/400, RALYAS4A, provides the gateway from the remote network USIBMRAA to the subarea network, USIBMRA. Sessions are established and configuration requirements examined for each node, in turn, as follows:

- RALYAS4A sessions
 1. 3270 emulation to host
 2. Display Station Pass-Through (DSPT) to RALYAS4B
- PS2ES1 sessions
 1. 5250 WSF to RALYAS4A and RALYAS4B
 2. 3270 emulation to host
- CP3174 sessions
 1. 3270 session to host
 2. Coax-connected PC running DOS 5250 WSF to RALYAS4A and RALYAS4B
 3. Coax-connected PS/2 with OS/2 Extended Services 1.0
- CP31742 sessions
 1. 3270 session to AS/400, then 3270 emulation to VTAM host
 2. CP-CP sessions with RALYAS4A
 3. 3270 session to VTAM host via AS/400 SNA Pass-Through
- PCAT sessions

1. 3270 emulation to host
2. DOS 5250 WSF to RALYAS4A and RALYAS4B

7.2.1 RALYAS4A Sessions

We consider dependent and independent sessions from RALYAS4A as follows:

1. 3270 Emulation to the host

First, the AS/400 and the host must each define the fact that there is an SDLC link between them.

On the AS/400, the required line description is shown in Figure 269 below:

Display Line Description		RALYAS4A	
		01/26/93	12:56:47
Line description	RA9L005		
Option	*BASIC		
Category of line	*SDLC		
Resource names	LIN082		
Online at IPL	*NO		
Data link role	*NEG		
Physical interface	*RS232V24		
Connection type	*NONSWTPP		
Switched network backup	*NO		
Exchange identifier	0569406A		
NRZI data encoding	*YES		
Maximum controllers	1		
Clocking	*MODEM		
Line speed	9600		
Modem type supported	*NORMAL		
Modem data rate select	*FULL		
Autoanswer type	*DTR		
Maximum frame size	521		
Error threshold level	*OFF		
Duplex	*HALF		
Modulus	8		
Text	SDLC Line to SUBNET		=RA9L005
-----Attached Nonswitched Controllers-----			
RA9P05			

Figure 269. SDLC Line Definition for RALYAS4A to USIBMRA

We now look at the host definitions required to define the physical link to RALYAS4A. Since the link being defined is an SDLC link, it must go via a communications controller, in our case a 3745. Therefore, an NCP major node definition is required. We do not include the entire major node definition, but present only those portions which are relevant to our discussion.

The required GROUP macro and LINE macros for RALYAS4A are shown in Figure 271 on page 253.

In addition to the GROUP and LINE macros, we include the NCP BUILD macro which defines the characteristics of the NCP we are using for our SDLC link to the host. This definition is shown in Figure 270 on page 252.

```

*****
*****
*      BUILD MACRO - NCP/CONTROLLER INFORMATION      *
*****
      BUILD BFRS=(240),          NCP BUFFER SIZE          *
      ADDSESS=300,          ALLOCATED SESSION CONTROL BLOCKS T2.1 *
      AUXADDR=300,          EXTRA ADDR. FOR ILU ACT AS PLU  T2.1 *
      MEMSIZE=4M,          4M TO USE                      *
      BRANCH=8000,          BRANCH TRACE ENTRIES          *
      CATRACE=(YES,100),      CHANNEL ADAPTER TRACE        *
      CWALL=26,             MIN. BUFFERS BEFORE SLOWDOWN    *
      DSABLTO=6.5,          *                               *
      ENABLTO=6.5,          IBM 386X REQUIRE 6.5 AS MINIMUM *
      ERLIMIT=16,          *                               *
      LTRACE=4,             SIT FOR 4 LINES                *
      LOADLIB=NCPLoad,      NCP LOAD MODULE LIBRARY        *
      MAXSSCP=8,            8 SSCP'S CAN ACTIVATE THIS NCP *
      MAXSESS=5000,         MAX NUMBER OF SESSIONS FOR ILU *
      MLTGORDR=MLTGPR1,      *                               *
      MODEL=3745-61A,       3745 COMMUNICATION CONTROLLER  *
      NAMTAB=100,           MAX NUMBER SSCP, NETWORKS, CP T2.1 *
      NETID=USIBMRA,        REQUIRED                        *
      NPA=(YES,DR),         *                               *
      NEWNAME=RA9NCPI,      NAME OF THIS LOAD MODULE        *
      NUMHSAS=8,            8 HOSTS MAY COMMUNICATE CONCURRENTLY*
      PUNAME=RA6NCP9,       NAME OF THIS PU                *
      SUBAREA=06,           SUBAREA ADDRESS = 06           *
      TGBXTRA=6,            IN CASE WE NEED MORE PATHS     *
      TRACE=(YES,64),       64 ADDRESS-TRACE ENTRIES      *
      TRANSFR=22,           FOR 5000-BYTE PIU              *
      TYPGEN=NCP,           NCP ONLY                       *
      TYP SYS=MVS,          MVS OPERATING SYSTEM           *
      USGTIER=5,            NCP USAGE TIER                 *
      VERSION=V6R2F        NDF VERSION INDICATOR          *
*****
*      DYNAMIC RECONFIGURATION POOL SPACE CONTROLLED BY VTAM      *
*****
DRPOOLPU PUDRPOOL NUMBER=100      CAN ADD 100 PUS          *
*
DRPOOLLU LUDRPOOL NUMTYP1=200,     RESERVE 200 LUS ON PU.T1 PUS *
      NUMTYP2=500,                 RESERVE 500 LUS ON PU.T2 PUS *
      NUMILU=200                   NO. OF INDEPENDENT LUS        *
*

```

Figure 270. NCP Definitions for Subarea 25 Named RA9NCPI

```

*****
*          GROUP MACRO SPECIFICATIONS FOR LEASED   SDLC LINES          *
*****
RA9AS400 GROUP LNCTL=SDLC,          SYNCHRONOUS DATA LINK
          DUPLEX=FULL,          REQUEST TO SEND ALWAYS UP
          DIAL=NO,
          NRZI=YES,
          REPLYTO=1,          1 SECOND FOR SDLC
          RETRIES=(7,4,5),    7 RETRY PER SECOND FOR 5 TIMES
          TYPE=NCP          NCP ONLY
*****
*          LINE MACRO SPECIFICATION   SDLC LINK 005 FOR AS/400        *
*****
RA9L005 LINE ADDRESS=(005,HALF), HDX LEASED LINE
          ANS=CONTINUE,      DON'T BREAK CROSS DOMAIN SESSIONS
          NPACOLL=YES,
          ISTATUS=ACTIVE,
          CLOCKNG=EXT,      MODEM PROVIDES THE CLOCKING #####
          DUPLEX=(FULL),    REQUEST TO SEND ALWAYS UP
          MAXPU=9,          ALLOW NO MORE THAN 9 PUS ON LINE
          SERVLIM=10,
          SPEED=9600,      NPA AND SCANNER USE      #####
          SRT=(, 64)
*          NGFTXT='AS/400/A'
*****
*          SERVICE MACRO SPECIFICATION FOR SDLC (LINE 005)          *
*****
          SERVICE ORDER=(RA9P05), MAXLIST=9

```

Figure 271. NCP Definitions for SDLC Group and Line used By AS/400 Link 005 to AS/400 A

Now that the physical link definitions have been made on RALYAS4A and the host, the physical units (PUs) which will communicate across the link must be defined.

On the AS/400, a PU definition to represent the host at the other side of the SDLC link is required. The means by which a PU definition is made on the AS/400 is by creating a *Controller Description*. There are different creation commands for a controller description depending on the kind of PU being defined.

This definition is shown in Figure 272 on page 254. 1 Notice that, in this case, we use the *CRTCTLHOST* command indicating that it is a PU Type 2.0 or Type 2.1 with which we will be communicating. 2 For SDLC communications, the station address must match that specified at the host in the PU ADDR parameter.

Display Controller Description			RALYAS4A
			01/26/93 13:46:09
Controller description	RA9P05		
Option	*BASIC		
Category of controller	*HOST	1	
Link type	*SDLC		
Online at IPL	*NO		
Switched connection	*NO		
Switched network backup	*NO		
Attached nonswitched line	RA9L005		
Character code	*EBCDIC		
Maximum frame size	521		
Remote network identifier	USIBMRA		
Remote control point	RAP		
SSCP identifier	050000000000		
Local exchange identifier	*LIND		
Station address	01	2	
Recontact on vary off	*YES		
Text	Controller description for USIBMRA		
APPN-capable	*YES		
APPN CP session support	*NO		
APPN node type	*LENNODE		
APPN transmission group number	*CALC		
Autodelete device	1440		
User-defined 1	*LIND		
User-defined 2	*LIND		
User-defined 3	*LIND		
Recovery limits:			
Count limit	2		
Time interval	5		

Figure 272. Host Controller Definition for RALYAS4A to USIBMRA

At the host, a PU macro must be specified for each PU with which communications is to be established across the SDLC link. In this case, there is only a single PU, RALYAS4A. The PU definition is shown in Figure 273 on page 255. 3 The PU ADDR=01 matches the SDLC station address for the control unit description on the AS/400.

4 XID=YES is perhaps the key parameter in this PU definition. It is also present in Figure 279 on page 260, the PU definition for RALYAS4B. The XID=YES parameter is required for PU type 2.1 definitions. It indicates to VTAM that the PU being defined is capable of sending and receiving an XID3 frame. XID3 negotiation is a process by which two APPN nodes exchange information about their node type and support. In particular, they indicate their support for sending or receiving a BIND.

The XID=YES parameter indicates to the host that it must be prepared to receive a BIND from this PU. The VTAM startup XNETALS=YES is also required.

If our plan here was to use this link for dependent communications only, we need not include this parameter, or we could include XID=NO.

5 The DYNLU=YES parameter indicates that originating independent LUs will be dynamically created by VTAM. In fact, it need not be coded here in the PU macro since we have already coded it in the VTAM start list.

If, on the other hand, we wanted to indicate that dynamic LU creation was not supported for this PU, it could be coded here as DYNLU=NO. This

coding would override, for this PU only, the DYNLU=YES coded on a node-wide basis in the VTAM start list.

6 Also included in Figure 273 is the LU definition for a dependent LU-LU session which will be established between the RALYAS4A and the host. We have included only the dependent LU used for the 3270 emulation which we are considering in this section. RA9T0501 has a LOCADDR=1 and is, thus, appropriate for dependent communications, such as 3270 emulation (LOCADDR=0 is reserved for use with independent communications). Its LU definition on the RALYAS4A must be defined with LOCADDR=1 and is given by the device description RA9T0501. It has been given the same name for ease of identification, see 8 in Figure 275 on page 256. This device description is created on the AS/400 by using the CRTDEVDHST command.

7 RA9T0507 is a dependent LU definition for an SNA Pass-Through session that will be discussed later in this chapter. Notice it is identical to 6 .

Dynamic LU definition is a function first introduced in VTAM 3.4 and enables independent LUs that originate sessions through the subarea to be dynamically created. In this case, we must define the LU since it is for dependent communications.

```

*****
*      PU AND LU DEFINITIONS OF RALYAS4A TO SUPPORT DEPENDENT
*      AND INDEPENDENT LUS
*****
RA9P05  PU ADDR=01,  3          AS/400 SDLC ADDRESS          *
          MAXDATA=265,          MAXIMUM FRAME SIZE          *
          MAXOUT=7,             MAX SDLC FRAMES BEFORE RESPONSE *
          PACING=0,             PACING SET BY BIND IMAGE      *
          PASSLIM=8,
          PUTYPE=2,
          RETRIES=( , 4, 5),      7 RETRY PER SECOND FOR 5 TIMES *
          XID=YES,  4            FOR T2.1 PU                  *
          DYNLU=YES,  5          DYNAMIC LU                    *
          DISCNT=(NO),           (V) VTAM                      *
          MODETAB=MTGS3X,        (V) VTAM                      *
          ISTATUS=ACTIVE,        (V) VTAM                      *
          SSCPFM=USSSCS,        (V) VTAM                      *
          USSTAB=US327X,        (V) VTAM                      *
          VPACING=0              (V) VTAM                      *
*      STATOPT='AS/400 A'
*****
RA9T0501 LU LOCADDR=1,  6        3270 EMULATION              *
          MODETAB=MTGS3X,
          USSTAB=US327X,
          DLOGMOD=EM3277,
          ISTATUS=ACTIVE
RA9T0507 LU LOCADDR=7,  7        3270 SNA Pass Through      *
          MODETAB=MTGS3X,
          USSTAB=US327X,
          DLOGMOD=EM3277,
          ISTATUS=ACTIVE

```

Figure 273. NCP PU and LU Definitions for RALYAS4A

Some readers may not be familiar with the concept of mode tables and mode table entries. A mode entry, within a mode table, describes to VTAM

or VTAM applications the characteristics of the LU (or terminal) which it will own, in the case of a dependent LU, or perform services for, in the case of an independent LU. For the benefit of those unfamiliar with mode table entries we include Figure 274 to show the mode entries used in this publication.

*-----		
EM3277	MODEENT LOGMODE=EM3277,	X
	FMPROF=X'03',TSPROF=X'03',	X
	PRIPROT=X'B1',SECPROT=X'90',	X
	COMPROT=X'3080',	X
	RUSIZES=X'A8A8',	X
	PSERVIC=X'020000000000000000000200'	
*-----		
EM3278	MODEENT LOGMODE=EM3278,	X
	FMPROF=X'03',TSPROF=X'03',	X
	PRIPROT=X'B1',SECPROT=X'90',	X
	COMPROT=X'3080',	X
	RUSIZES=X'87C7',	X
	PSERVIC=X'020000000000000000000200'	
*-----		
QPCSUPP	MODEENT LOGMODE=QPCSUPP	
*-----		

Figure 274. Mode Table Entries used in this Publication

The mode entry for QPCSUPP does not require any further definition in the mode table, as VTAM applications will not use this mode. In this publication, the mode QPCSUPP is used only by independent LUs whose sessions pass-through VTAM. It is important to ensure that the Class-of-Service (COS) #CONNECT used by the mode QPCSUPP, is included in VTAM's COS table. If other modes are used for independent communication, to or through the VTAM subarea network, then those modes and their COS entries must be defined to VTAM as well.

Figure 275 shows the 3270 device description that will be used for 3270 emulation with the VTAM host.

Display Device Description		RALYAS4A
		01/26/93 14:20:57
Device description	RA9T0501	
Option	*BASIC	
Category of device	*HOST	
Local location address	01 8	
Remote location	RA9T0501	
Online at IPL	*YES	
Attached controller	RA9P05	
Application type	*EML	
Maximum length of request unit . . .	*CALC	
Emulated device	3278	
Emulated keyboard	*LOWER	
Emulated numeric lock	*NO	
Emulation work station	*ANY	
Text	3270 EMULATION DEVICE ADDRS=02	

Figure 275. 3270 Emulation Device Definition for RALYAS4A to SUBNET

At this point, it is now possible to use the command STREML3270 RA9P05 to start a 3270 session from RALYAS4A to the host.

2. *DSPT to RALYAS4B*

We have already defined a link from the host to RALYAS4A. In order to enable pass-through from RALYAS4A to RALYAS4B via the host, a link must also be defined from the host to RALYAS4B. These definitions for both the AS/400 and the host are shown in Figure 276 and Figure 277 on page 258.

Display Line Description		RALYAS4B	
		01/26/93	14:39:46
Line description	RA9L015		
Option	*BASIC		
Category of line	*SDLC		
Resource names	LIN011		
Online at IPL	*NO		
Data link role	*NEG		
Physical interface	*RS232V24		
Connection type	*NONSWTPP		
Switched network backup	*NO		
Exchange identifier	05615533		
NRZI data encoding	*YES		
Maximum controllers	1		
Clocking	*MODEM		
Line speed	9600		
Modem type supported	*NORMAL		
Modem data rate select	*FULL		
Autoanswer type	*DTR		
Maximum frame size	521		
Error threshold level	*OFF		
Duplex	*FULL		
Modulus	8		
Text	SDLC Line to Subarea 09		
-----Attached Nonswitched Controllers-----			
RA9P015			

Figure 276. SDLC Line Definition for RALYAS4B to SUBNET

```

*****
*           LINE MACRO SPECIFICATION           SDLC LINK 135 FOR AS/400 B
*****

RA9L015  LINE ADDRESS=(015,HALF),  HDX LEASED LINE          *
        ANS=CONTINUE,           DON'T BREAK CROSS DOMAIN SESSIONS *
        NPACOLL=YES,                                     *
        ISTATUS=ACTIVE,                                           *
        CLOCKNG=EXT,           EXTERNAL CLOCKING                *
        DUPLEX=(FULL),         REQUEST TO SEND ALWAYS UP        *
        MAXPU=9,               ALLOW NO MORE THAN 9 PUS ON LINE  *
        SERVLIM=10,                                           *
        SPEED=9600,           NPA AND SCANNER USE      #####   *
        SRT=(, 64)
        NGFTXT='AS/400/B'
*****
*           SERVICE MACRO SPECIFICATION FOR SDLC (LINE 135)
*****
1      SERVICE ORDER=(RA9P015), MAXLIST=9

```

Figure 277. NCP Definitions for SDLC Link 135 to RALYAS4B

1 The service order on a link indicates the order of polling for the PUs on that link. It is given here, but is not meaningful, since there is only a single PU to service. The service macro is no longer needed for PU-to-PU links.

Next, we define the PU and controller description. Again, they are similarly defined as for RALYAS4A and are given in Figure 278 on page 259 (the RALYAS4B control unit description) and Figure 279 on page 260 (the host PU macro).

Display Controller Description		RALYAS4B
		01/26/93 14:51:25
Controller description	RA9P015	
Option	*BASIC	
Category of controller	*HOST	
Link type	*SDLC	
Online at IPL	*NO	
Switched connection	*NO	
Switched network backup	*NO	
Attached nonswitched line	RA9L015	
Character code	*EBCDIC	
Maximum frame size	521	
Remote network identifier	USIBMRA	
Remote control point	RAP	
Local exchange identifier	*LIND	
Station address	01	
Recontact on vary off	*YES	
Text	Controller Description for SUBNET	
APPN-capable	*YES	
APPN CP session support	*NO	
APPN node type	*LENNODE	
APPN transmission group number	*CALC	
Autodelete device	*NO	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	
Recovery limits:		
Count limit	2	
Time interval	5	

Figure 278. AS/400 Host Controller Description for RALYAS4B to SUBNET

```

*****
*      PU AND LU DEFINITIONS OF RALYAS4B TO SUPPORT DEPENDENT
*      AND INDEPENDENT LUS
*****
RA9P015  PU ADDR=01,          AS/400 SDLC ADDRESS
          MAXDATA=265,        MAXIMUM FRAME SIZE
          MAXOUT=7,           MAX SDLC FRAMES BEFORE RESPONSE
          PACING=0,           PACING SET BY BIND IMAGE
          PASSLIM=8,
          PUTYPE=2,
          RETRIES=(, 4, 5),    7 RETRY PER SECOND FOR 5 TIMES
          XID=YES,            FOR T2.1 PU
          DYNLU=YES,          DYNAMIC LU
          DISCNT=(NO),        (V) VTAM
          MODETAB=MTGS3X,     (V) VTAM
          ISTATUS=ACTIVE,     (V) VTAM
          SSCPFM=USSSCS,      (V) VTAM
          USSTAB=US327X,      (V) VTAM
          VPACING=0,          (V) VTAM
*      STATOPT='AS/400 B'
RA9T1500 LU LOCADDR=0, 2      INDEPENDENT LU
          MODETAB=MTGS3X,
          DLOGMOD=MODS361,
          ISTATUS=ACTIVE
RA9T1501 LU LOCADDR=1,        3270 EMULATION
          MODETAB=MTGS3X,
          USSTAB=US327X,
          DLOGMOD=EM3277,
          ISTATUS=ACTIVE

```

Figure 279. NCP, PU, and LU Definitions for RALYAS4B

2 Included in Figure 279, are also the host LU definitions for RALYAS4B. Notice that an additional LU has been included under the PU definition for RALYAS4B. This LU is an independent LU; it has LOCADDR=0. This LU will become the destination LU for the DSPT session from RALYAS4A to RALYAS4B.

The support for dynamic creation of independent LUs does not extend to destination LUs (DLUs). It makes sense that VTAM can let in an LU which knocks on its door but cannot find the door of an LU which is not already defined to it. However, since there is no definitional difference between originating and destination independent LUs, an automatically created originating LU may be subsequently used as a destination LU.

However, to avoid a large amount of unwanted LUs being kept, VTAM will delete the automatically created LU, on a regular basis. The maximum amount of time a dynamically created LU will remain in existence is a few minutes. Thus, LUs which are likely to be used frequently as destination LUs should be explicitly defined. Correspondingly, we define the LU RA9T1500 since it is to be the destination LU in our tests.

Another option exists; VTAM provides a Session Management Exit (SME). By providing a customized routine for this exit, it is possible to dynamically indicate which link station should be used to reach a destination LU. For further discussion of dynamic DLU creation for independent LUs, please refer to the *VTAM 4.1 Planning Guide*.

Independent LUs may also be predefined as cross-domain resources (CDRSC) in their own cross-domain resource (CDRSC) major node. This is the option which is preferred by most VTAM system programmers. We note it here for completeness. In the interests of simplicity, we have defined our independent LUs in our NCP generation.

Recall now, that we have not defined an independent LU for RALYAS4A. For our testing, we consider RALYAS4A to be the initiating node for the pass-through session. We have only to check that dynamic OLU creation is specified in the VTAM start list, on the PU macro or, as in our case, both and then allow VTAM to create our originating independent LU dynamically.

A device description need not be created for an independent LU-LU session from RALYAS4A to RALYAS4B since AS/400 APPN creates independent devices automatically on session establishment, both on the source and target AS/400s. However, RALYAS4A must know where to forward the BIND. Thus, if no device description is created, we need a way to define these LUs on RALYAS4A. The *AS/400 remote location list* allows remote locations (or remote LUs) to be defined. To a network node, the host is seen as a LEN end node and any LU beyond the host is seen as an LU residing at the host LEN end node. The remote location definitions are shown in Figure 280 on page 262.

These definitions are only needed here because there is no CP-CP session capability provided with a LEN connection. In this case the network node will pass the BIND to the LEN end node, but can do little more than hope that the LEN end node will know what is to be done with it. If no such LU definition can be found within the LEN end node (subarea, in this case) the BIND will fail.

3 Defines the DLU name, RA9T1500, on RALYAS4B which is also defined at the host. (It must also be defined in the Local Location List of RALYAS4B. Please refer to Figure 282 on page 263.)

4 Indicates the network in which the DLU is located, USIBMRAB. Notice that it is different from the local net ID of USIBMRAA and from the host net ID of USIBMRA. VTAM NNNC provides the functionality to support this configuration of different net IDs. Note that, if the subarea contained two VTAMs, each with a different net ID, for example, USIBMRAA and USIBMRAB, the AS/400 would not be able to establish sessions. Please refer to 7.1.1.1, "The End Node Connection to a Network Node Server" on page 240.

5 Defines the OLU which will be used for the OLU-RA9T1500 session pairing. Whenever a session is established from RALYAS4A to DLU RA9T1500 on RALYAS4B, the OLU must be RA9TNNA0. If another OLU, including the CP name, is desired then it, too, must be entered here as a local location entry for RA9T1500.

6 We define to RALYAS4A that RA9T1500 is an LU residing in the host subarea (with CP name RAP, the SSCP name in the host VTAM start list, and net ID USIBMRA).

```

                                Display Configuration List
                                                                RALYAS4A
                                                                01/27/93 21:59:08

Configuration list . . . . . : QAPPNRMT
Configuration list type . . . . : *APPNRMT
Text . . . . . : Remote Location List

-----APPN Remote Locations-----

      Remote      Remote      Control
Remote  Network  Local  Control  Point  Secure
Location ID  Location Point  Net ID  Loc
RA9T1500 USIBMRAB RA9TNNA0 RAP  USIBMRA  *NO

      3          4          5          6

```

Figure 280. Remote Location List on RALYAS4A

If there are many LUs to be defined as residing in the host, then the wildcard option may be used. The wildcard option provides a mechanism by which the APPN node adjacent to the host will always reply positively to a search request from another node in its APPN network. The APPN node holding the wildcard indicates in its response whether it is responding to an explicit LU match or a wildcard match. Provided that there are no other explicit responses to the search request, then the OLU will send the BIND to the network node with the wildcard which will, in turn, forward the BIND appropriately. The purpose of the wildcard is so that DLUs in or beyond the subarea need not all be defined at the network node adjacent to the host.

Previously, VTAM had no such relief from ILU definition. All ILUs residing in APPN networks to which LU 6.2 sessions should be routed had to be defined at the host.

Since the introduction of VTAM 3.4, the workload in defining ILUs is significantly reduced. Since VTAM will automatically create our originating LU dynamically, we may specify any arbitrary name as the OLU for an OLU-DLU session pairing. This function is powerful. It means that any OLU residing in an APPN network connected to the subarea can, without being defined to VTAM, initiate a session with any other independent DLU in the network provided that DLU is appropriately defined to VTAM. These OLUs could include a large number of PS/2s using their CP name as the OLU name, for example.

With power comes concern for security. Thus, it is possible to restrict usage of a particular DLU to an authorized list of PUs. The VTAM start list parameter which enables this security mechanism is:

ALSREQ=YES/NO

If this parameter is coded as NO then, at session request, the PU over which the OLU makes the request must appear in the default Adjacent Link Station (ALS) list for the independent DLU. The ALS list is defined on the LU macro by the parameter:

ALLIST={PUNAME1, . . . , PUNAMEn}

In this example, we chose, in keeping with the ITSO Raleigh naming standards, the OLU name RA9TNNA0. Since this is not the local CP name, we must inform RALYAS4A that this is a local location, or local LU, residing within it. We do this by using the *AS/400 Local Location List* as shown in Figure 281 on page 263. This requirement remains despite the fact that we

have already specified, in the Remote Location List shown in Figure 280, RA9TNNA0 as the local LU partner for RA9T1500.

9 The OLU name is defined for RALYAS4A.

```

                                Display Configuration List                                RALYAS4A
                                                                01/27/93 22:10:18
Configuration list . . . . . : QAPPNLCL
Configuration list type . . . . . : *APPNLCL
Text . . . . . : APPN Local Location List

-----APPN Local Locations-----
Local
Location Text
RA9TNNA0 Local LU name 9

-----APPN Local Locations-----
Local
Location Text

```

Figure 281. Local Location List on RALYAS4A

Similarly, the DLU name RA9T1500 must be defined at RALYAS4B in its Local Location List, see Figure 282.

```

                                Display Configuration List                                RALYAS4A
                                                                01/27/93 22:15:02
Configuration list . . . . . : QAPPNLCL
Configuration list type . . . . . : *APPNLCL
Text . . . . . : APPN Local Location List

-----APPN Local Locations-----
Local
Location Text
RA9T1500 Local LU name

-----APPN Local Locations-----
Local
Location Text

```

Figure 282. Local Location List on RALYAS4B

It is now possible to establish a DSPT session from RALYAS4A to RALYAS4B via SUBNET. Moreover, remember that the ILU RA9TNNA0 was not defined and has been created dynamically by VTAM when the session has been established. Now, by providing the appropriate remote configuration list entries on RALYAS4B, as they were for RALYAS4A, a session in the reverse direction may also be established for the same LU-LU pairing.

To start the session from RA9TNNA0 to RA9T1500, the STRPASTHR command shown in Figure 283 on page 264 may be used.

10 Notice that the remote network ID cannot be allowed to default to the local network ID since RALYAS4B is in a different network. If the default of *LOC were taken, then no route to the specified remote location would be found.

```

                                Start Pass-Through (STRPASTHR)

Type choices, press Enter.

Remote location . . . . . RMTLOCNAME  > RA9T1500
Virtual controller . . . . . VRTCTL      *NONE
Virtual display device . . . . . VRTDEV    *NONE
                                + for more values
Mode . . . . . MODE                      QPCSUPP
Local location . . . . . LCLLOCNAME      RA9TNNA0
Remote network identifier . . . . . RMTNETID  USIBMRA8    10
System request program . . . . . SRQ10PGM    *SRQMNU
Library . . . . .

```

Figure 283. AS/400 STRPASTHR Command

Having issued the *STRPASTHR* command, the appropriate device descriptions are automatically created on each of the AS/400s. The session status display on the RALYAS4B is shown in Figure 284. Notice that the device description has been attached to the host controller description.

```

                                Work with Configuration Status                                RALYAS4B
                                                                                          01/27/93 22:13:19
Position to . . . . . Starting characters

Type options, press Enter.
 1=Vary on  2=Vary off  5=Work with job  8=Work with description
 9=Display mode status ...

Opt  Description      Status      -----Job-----
   11  RA9L015        ACTIVE
      RA9P015        ACTIVE
      RA9TNNA0        ACTIVE
      QPCSUPP        ACTIVE/TARGET      RA9TNNA0  QUSER      006127

Parameters or command
===>
F3=Exit  F4=Prompt  F11=Display types  F12=Cancel  F23=More options
F24=More keys

```

Figure 284. Communications Status Display on RALYAS4B

We chose, in keeping with ITSO Raleigh naming conventions, RA9TNNA0 as our OLU name for this session. It was dynamically defined by VTAM and placed in the CDRSC major node ISTCDRDY. Figure 285 on page 265 is a NetView* display of this node after the session has been established. Notice that RA9TNNA0 is active and in session 10.

```

NCCF      N E T V I E W      RAPAN MEBELIN 01/26/93 15:26:43
C RAPAN   DISPLAY NET,ID=ISTCDRDY,SCOPE=ALL
  RAPAN   IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I   NAME = ISTCDRDY      , TYPE = CDRSC SEGMENT
IST486I   STATUS= ACTIV      , DESIRED STATE= ACTIV
IST478I   CDRSCS:
IST483I   RA9TNNA0 ACT/S---Y, CDRM = RAP      , NETID = USIBMRAA 10
IST314I   END

```

Figure 285. NetView Display of the ISTCDRDY Major Node

In addition to the dynamic definition of RA9TNNA0 in the CDRSC major node ISTCDRDY, the pre-defined LU definition for RA9T1500 is copied into another CDRSC major node ISTPDILU. We show the NetView display of this major node before the session has been established in Figure 286.

```

C RAPAN   DISPLAY NET,ID=ISTPDILU,SCOPE=ALL
  RAPAN   IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I   NAME = ISTPDILU      , TYPE = CDRSC SEGMENT
IST486I   STATUS= ACTIV      , DESIRED STATE= ACTIV
IST478I   CDRSCS:
IST483I   RA9T1500 ACTIV      , CDRM = ***NA***
IST314I   END

```

Figure 286. NetView Display of the ISTPDILU Major Node

7.2.2 Schema of Matching Parameters

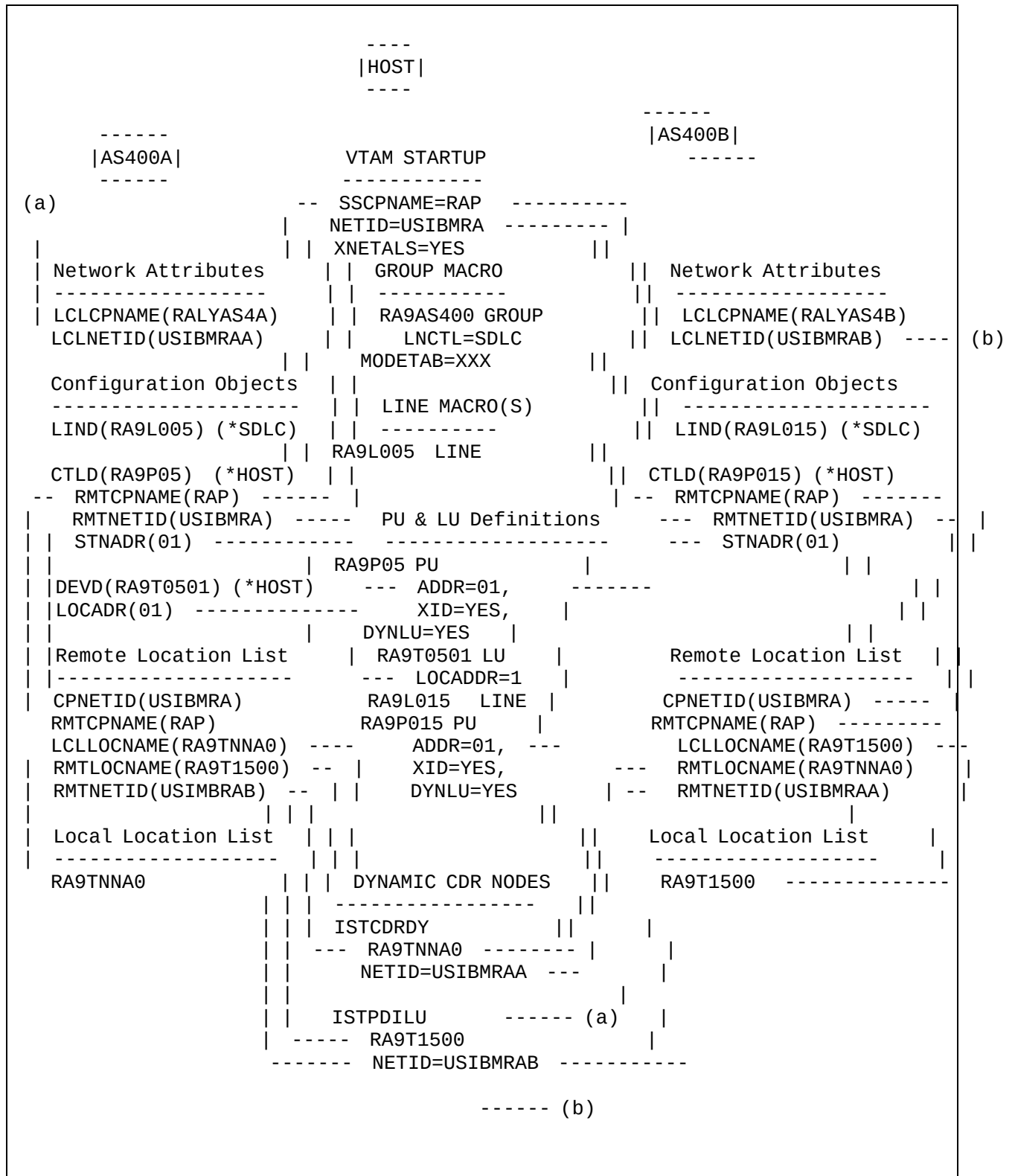


Figure 287. Matching Parameters for RALYAS4A to RALYAS4B via a Subarea

7.2.3 PS2ES1 Sessions

We should, by now, be reasonably familiar with the OS/2 Extended Services Communications Manager configuration process for SNA Features and 5250 WSF. We now expand our PS2ES1 configuration to include 3270 sessions with the SUBNET host which is upstream from the AS/400, RALYAS4A. The SNA Pass-Through facility of OS/400 Version 2 Release 2 will be used for these 3270 sessions.

The introduction of SNA Pass-Through to the AS/400 allows us to, concurrently, support independent and dependent communications with a single downstream device. More importantly it allows 3270 devices downstream from the AS/400 to have 3270 sessions with a 3270 host which is upstream from the AS/400 without you having to first sign on to the AS/400 and issue a STREML3270 command.

For a more comprehensive discussion AS/400 SNA Pass-Through refer to *AS/400 SNA Pass-Through Communications Definitions and Examples*, GG24-3919 .

The PS2ES1 configuration has changed slightly from our example in 2.1.2, "RALYAS4B (NN) to OS/2 Extended Services (NN) and OS/2 Extended Services (EN)" on page 11. We now have a link with RALYAS4A instead of RALYAS4B. Our 5250 WSF and LAN configuration does not change and will not be shown again here. The SNA network definitions which have changed are summarized in Figure 288 to Figure 290 on page 268.

Local Node Characteristics - PS2ES1A

Required Features

Network ID: USIBMRAA

Local node name: PS2ES1

Node type:

- ☐ End Node to Network Node Server
- ☐ End Node - No Network Node Server
- ☒ Network Node

Your network node server address:

Optional Features

Local node ID: 05D 10025 (Hex)

Local node alias name: PS2ES1

Comment: PS2ES1 - Network Node

☒ Activate Attach Manager at start up

Save and Return Cancel Help

Figure 288. PS2ES1 SNA Network Definitions - Local Node Characteristics

PS2ES1 now uses the same network ID as RALYAS4A. It is now a node in the network USIBMRAA. We chose to do this because OS/2 Extended Services does not support border node function and will not allow CP-CP sessions with another network node if it has a different network ID.

The CP name of the PS/2 used here will become the originating LU name for the LU-LU session to RALYAS4B. If the level of VTAM is lower than VTAM 3.4 and, therefore, does not support dynamic LU definition, then this name must match an the name of an independent LU under the PU definition for RALYAS4A. Since we are using VTAM 4.1 and have the VTAM keyword DYNLU=YES in our PU definition for the RALYAS4A PU, RA9P05, this resource will be dynamically defined by VTAM.

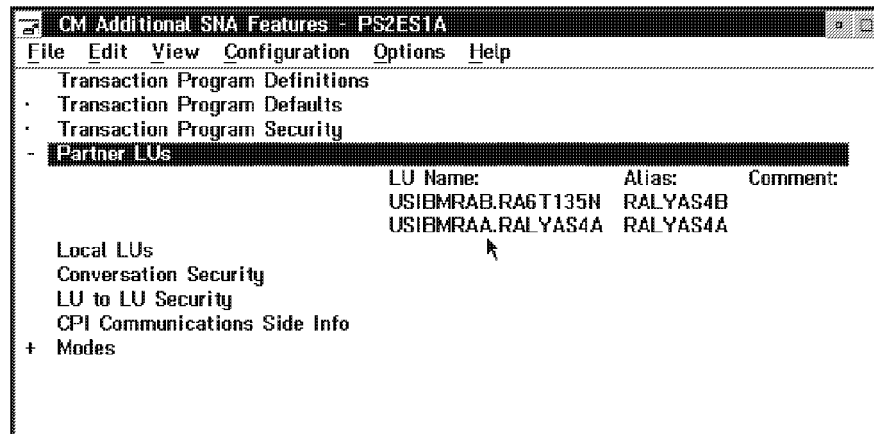


Figure 289. PS2ES1 Additional SNA Features - Partner LUs

Although PS2ES1 is a network node, we must still define partner LUs for sessions originating from PS2ES1. The application used here is 5250 WSF which knows the aliases, RALYAS4A and RALYAS4B. The partner LU definition provides the logical connection between the partner LU alias and the network-qualified LU name.

The partner LUs have been changed to reflect the new, network-qualified destination LU names, Figure 289. The independent LU, RA9T150N, is used for sessions with RALYAS4B.

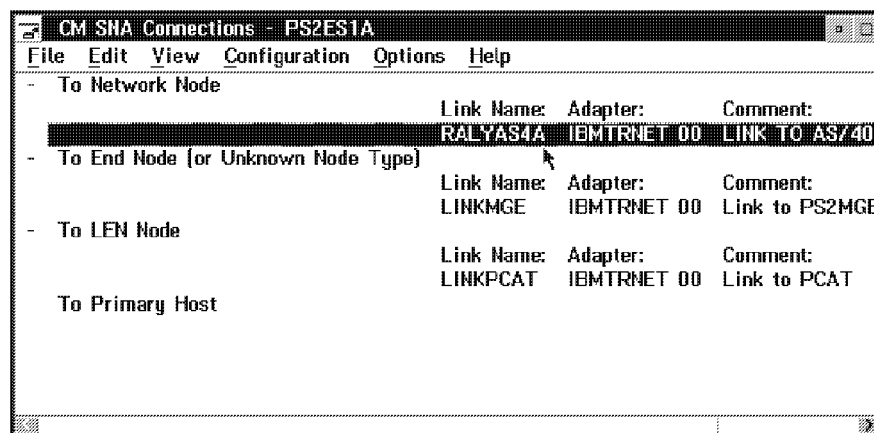


Figure 290. PS2ES1 SNA Connections - Link to RALYAS4A

The link definition to network node has been changed so that the LAN destination address is that of RALYAS4A. We have also changed the link name to reflect this new destination. The links to the LEN end node PCAT, and the end node PS2MGE remain unchanged from our example in 2.1.2, "RALYAS4B (NN) to OS/2 Extended Services (NN) and OS/2 Extended Services (EN)" on page 11. It is possible to define connections to other network nodes here if required. At this

point, it is possible to establish a connection with RALYAS4A and with the LU RA9T1500 on RALYAS4B. RALYAS4A will route the BIND request for RA9T1500 to SUBNET using its remote location list. As in our previous PS2ES1 example, an APPC controller and device is automatically created on RALYAS4A. See Figure 291 and Figure 292 on page 270.

Display Controller Description		RALYAS4A
		02/01/93 09:32:10
Controller description	PS2ES1	
Option	*BASIC	
Category of controller	*APPC	
Link type	*LAN	
Online at IPL	*NO	
Active switched line	L41TR	
Character code	*EBCDIC	
Maximum frame size	16393	
Remote network identifier	USIBMRAA	
Remote control point	PS2ES1	
Initial connection	*DIAL	
Dial initiation	*LINKTYPE	
Switched disconnect	*YES	
Data link role	*NEG	
LAN remote adapter address	400030010025	
LAN DSAP	04	
LAN SSAP	04	
Text	AUTOMATICALLY CREATED BY QLUS	
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*CALC	
APPN transmission group number	*CALC	
APPN minimum switched status	*VRYONPND	
Autodelete device	1440	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	
Model controller description	*NO	
Control owner	*SYS	

Figure 291. Controller Description for PS2ES1 - Automatically Created on RALYAS4A

Display Device Description		RALYAS4A	
		02/01/93	10:10:12
Device description	PS2ES1		
Option	*BASIC		
Category of device	*APPC		
Automatically created	YES		
Remote location	PS2ES1		
Online at IPL	*NO		
Local location	RALYAS4A		
Remote network identifier	*NETATR		
Attached controller	PS2ES1		
Message queue	QSYSOPR		
Library	*LIBL		
Local location address	00		
APPN-capable	*YES		
Single session:			
Single session capable	*NO		
Text	AUTOMATICALLY CREATED BY QLUS		

Figure 292. Device Description for PS2ES1 - Automatically Created on RALYAS4A

Session establishment to RALYAS4A is the same in 2.1.2, “RALYAS4B (NN) to OS/2 Extended Services (NN) and OS/2 Extended Services (EN)” on page 11, and will not be discussed further here. The session establishment to RALYAS4B is different and uses RALYAS4A as a gateway to the VTAM subarea network and VTAM, in turn, routes our BIND request to RALYAS4B. As already mentioned, PS2ES1 is the originating LU (OLU). Whatever name we define as the OLU need not be defined to VTAM if dynamic LU definition is permitted, as it is in our case. The destination LU (DLU) must be an independent LU already defined to VTAM. We could use the independent LU already defined as our DLU. However, in order to introduce the usefulness of wildcards in the network node adjacent to the subarea, we have added another independent LU 1. The AS/400 controller description we created in Figure 278 on page 259 remains unchanged.


```

*****
*      PU AND LU DEFINITIONS OF RALYAS4B TO SUPPORT DEPENDENT
*      AND INDEPENDENT LUS
*****
RA9P015  PU ADDR=01,          AS/400 SDLC ADDRESS          *
          MAXDATA=265,        MAXIMUM FRAME SIZE          *
          MAXOUT=7,           MAX SDLC FRAMES BEFORE RESPONSE *
          PACING=0,            PACING SET BY BIND IMAGE      *
          PASSLIM=8,                                     *
          PUTYPE=2,                                     *
          RETRIES=(,4,5),      7 RETRY PER SECOND FOR 5 TIMES *
          XID=YES,             FOR T2.1 PU                  *
          DYNLU=YES,           DYNAMIC LU                   *
          DISCNT=(NO),         (V) VTAM                     *
          MODETAB=MTGS3X,      (V) VTAM                     *
          ISTATUS=ACTIVE,      (V) VTAM                     *
          SSCPFM=USSSCS,       (V) VTAM                     *
          USSTAB=US327X,       (V) VTAM                     *
          VPACING=0            (V) VTAM                     *
*      STATOPT='AS/400 B'
RA9T1500 LU LOCADDR=0,        INDEPENDENT LU                *
          MODETAB=MTGS3X,      *
          DLOGMOD=MODS361,     *
          ISTATUS=ACTIVE      *
RA9T150N LU LOCADDR=0, 1      INDEPENDENT LU                *
          MODETAB=MTGS3X,      *
          DLOGMOD=MODS361,     *
          ISTATUS=ACTIVE      *
RA9T1501 LU LOCADDR=1,        3270 EMULATION                *
          MODETAB=MTGS3X,      *
          USSTAB=US327X,       *
          DLOGMOD=EM3277,     *
          ISTATUS=ACTIVE

```

Figure 293. NCP Definitions for RALYAS4B via SDLC Link 015

Since AS/400A is the network node adjacent to the subarea network, the DLU must either be explicitly defined in its remote location list or a wildcard must be specified. If a large number of LUs require access from USIBMRAA via AS/400A, via USIBMRA to USIBMRAB or beyond, then it may be a wise idea to define the wildcard entry. We do this in Figure 294 on page 272.

2 We have deleted the previous Remote Location List entry for RA9T1500 and added the *ANY entry for the wildcard.

3 Notice that there is no remote network ID associated with the wildcard entry. The BIND will be forwarded from AS/400A with the appropriate DLU network-qualified name as specified by the originating LU.

4 The BIND will be forwarded to the CP with the name RAP. This is the host SSCP name and matches the RMTCPNAME parameter specified in the host control unit description created previously on RALYAS4A.

```

Display Configuration List
RALLYAS4A
02/01/93 11:05:35

Configuration list . . . . . : QAPPNRMT
Configuration list type . . . . : *APPNRMT
Text . . . . . : APPN Remote Location List

-----APPN Remote Locations-----
Remote      Remote      Remote      Control
Location    Network    Location    Point      Point      Secure
*ANY        USIBMRAB    RALLYAS4A   RAP        USIBMRA    *NO
2           3           4

```

Figure 294. Remote Location List on AS/400A

The final requirement is that, again, RALLYAS4B must be instructed to accept a BIND for the DLU we specify, in this case RA9T150N. An entry for RA9T150N must be added in the Local Location List of RALLYAS4B. Please refer to Figure 295. Notice in particular, that both the DLU with which we now wish to communicate and the previous DLU for communications from AS/400A are specified amongst the local location names. There are also a number of other local location names. RALLYAS4B will respond positively to an APPN search request to any one of these LU names and will accept a BIND from any PU specifying any OLU-DLU session pairing, provided the DLU is amongst the names in this list. As discussed in Chapter 2, "AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network" on page 5, for independent communications across a token-ring, the PU, or controller description, need not be defined provided we have AUTOCRTCTL(*YES) in the line description.

```

Display Configuration List
RALLYAS4B
02/01/93 11:14:12

Configuration list . . . . . : QAPPNLCL
Configuration list type . . . . : *APPNLCL
Text . . . . . : APPN local location list

-----APPN Local Locations-----
Local
Location Text
AS4B      Token-Ring LU
RALLYAS4B Token-Ring LU
RA9T1500  SDLC with subarea 9
RA9T150N  SDLC with subarea 9

-----APPN Local Locations-----
Local
Location Text

```

Figure 295. Local Configuration List on RALLYAS4B

7.2.3.1 3270 Emulation to the Host

Next we configure the 3270 dependent LUs for PS2ES1 and the 3270 component of communications manager. As stated earlier we will use SNA Pass-Through on RALYAS4A to provide a 3270 gateway function for PS2ES1. We have previously defined a single LU at the host for dependent communications, RA9T0507. See 1 Figure 296 or Figure 273 on page 255. Its LU partner on RALYAS4A is given by the device description RA9T0507 also, with local location address 7, see 2 . Of course, since these are dependent LUs, if we want more than one LU2 session, then we must define an LU and device definition for every one. See Figure 297.

RA9T0507 LU LOCADDR=7, 1	3270 SNA Pass Through	*
MODETAB=MTGS3X,		*
USSTAB=US327X,		*
DLOGMOD=EM3277,		*
ISTATUS=ACTIVE		

Figure 296. NCP LU Definitions for AS/400A SNA Pass-Through LU

Display Device Description		RALYAS4A
		02/01/93 15:01:23
Device description	RA9T0507	
Option	*BASIC	
Category of device	*SNPT	
Local location address	07 2	
SNA pass-through class	*UP	
Online at IPL	*NO	
Attached controller	RA9P05	
Activation timer	170	
SNA pass-through device desc	PS2ES13270 3	
SNA pass-through group name	*NONE	
Text	SNA PT DEV UPSTREAM DEFINITION	

Figure 297. SNA Pass-Through Device Definition for AS/400A Upstream to SUBNET

3 The SNA Pass-Through device description is initially configured as *NONE. The device description PS2ES13270 is added later by OS/400.

This, so far, represents only half of the required definitions, the two LUs, (RA9T0507 x 2) from the upstream half to the SNA Pass-Through session. Next we must configure the downstream LU pair for PS2ES1. We have already had a controller definition automatically defined on RALYAS4A for PS2ES1, see Figure 291 on page 269. We now simply add a device description to represent the downstream 3270 dependent LU for PS2ES1. As for all dependent LUs or device descriptions, they must be defined manually, and this is no exception.

As an aside, it is not necessary to have PS2ES1's controller description defined automatically by RALYAS4A. You may chose to define it using the CRTCTLAPPC command. This is a requirement where the link to the AS/400 is via SDLC, ASCII workstation controller, or in some X.25 instances.

Display Device Description			RALYAS4A
			02/01/93 15:14:08
Device description	:	PS2ES13270	
Option	:	*BASIC	
Category of device	:	*DSP	
Device class	:	*SNPT	
Device type	:	3278	
Device model	:	0	
Local location address	:	02 6	
Online at IPL	:	*YES	
Attached controller	:	PS2ES1	
Keyboard language type	:	USB	
Print device	:	*SYSVAL	
Output queue	:	*DEV	
Printer file	:	QSYSPRT	
Library	:	*LIBL	
Activation timer	:	170	
Inactivity timer	:	*NOMAX	
SNA Pass-Through device desc	:	RA9T0507 4	
SNA Pass-Through group name	:	*NONE	
Host signon/logon command	:	'LOGON APPLID(NVAS)' 5	
Text	:	SNPT Device for PS2ES1	

Figure 298. SNA Pass-Through Device Definition for AS/400A Downstream to PS2ES1

4 RA9T0507 is the name of the upstream SNA Pass-Through device that will be used by this downstream device.

5 LOGON APPLID(NVAS) is the logon command for the host application that our PS2ES1 3270 session will use. It is often better to use this rather than rely on the USSTAB welcome message. The USSTAB message is sent by the host when the AS/400 upstream SNA Pass-Through device first establishes a connection with VTAM. The logon command, included here, will ensure the PS2ES1 user is presented with the correct application screen. In this case, the signon screen for our host application, NetView Access, will be presented.

The final component requires that Communications Manager be configured for 3270 communication over the token-ring.

6 The LU address of the device description must match the LU address of the Communications Manager logical 3270 terminal. See 6 in Figure 300 on page 275.

This is done from the OS/2 Extended Services Communications Manager Main Menu:

1. Select **Advanced**
2. Select **Configuration**
3. Select **3270 Configuration Profile**
4. Select **Token-ring or other LAN Type**
5. Select **Connection**

This will present you with the screen in Figure 299 on page 275.

Create/Change 3270 Profile	
1. Connection...	Token-Ring or Other LAN type Configured

Specify Link Information	
Use the spacebar to select.	
Adapter number	Adapter 0 * Adapter 1
Destination address. [400010020001]	
Note: For ETHERAND, the address format may need to be reversed. Press F1 for more information.	

Enter Esc Cancel F1 Help	

Figure 299. Communications Manager 3270 LAN Configuration - Connection

6. Configure the Session, Figure 300.

Create/Change 3270 Logical Terminal Session Profile	
Use the spacebar to select.	
Session number.	: 1
Session ID/LU Name.	[A]
Comment	
[	]
Short session ID.	[A]
AT keyboard profile name.	[ACS3ATUS]
Enhanced keyboard profile name.	[ACS3ENUS]
Presentation space size	
25 x 80 (3278/79 mod 2)	* 44 x 80 (3278/79 mod 4)
* 33 x 80 (3278/79 mod 3)	* 28 x 132 (3278/79 mod 5)
* Other...	
Data transfer buffer size override (Kb)	[0]
LU local address (NAU hex address).	[02]
Unsupported control codes	
Display hyphens	* Error codes
Activate presentation space print	
Yes	* No

Enter Esc Cancel F1 Help F4 List	

Figure 300. Communications Manager 3270 Terminal Configuration

7. The configuration file must now be saved and verified, before it can used, as usual.

Note: If we had not chosen to use SNA Pass-Through for this connection from PS2ES1 to the RALYAS4A, and used 3270 Emulation on the AS/400 instead, we would have defined PS2ES1 to RALYAS4B as though it were a 3174 remote control unit using the command CRTCTLRWS. This would mean we could not have simultaneously supported the 5250 sessions with RALYAS4A or RALYAS4B as these sessions would require an APPC controller.

The AS/400 does not allow two control unit descriptions to be varied on concurrently when they specify the same destination service access point (DSAP) address and the same source service access point (SSAP) address for a specific token-ring address. It does however, provide the possibility to change the DSAP or SSAP so that multiple control unit descriptions may be varied on concurrently. See the DSAP and SSAP addresses in Figure 291 on page 269.

Unfortunately, neither Communications Manager/2 nor OS/2 Extended Services allow a different DSAP or SSAP to be defined; both DSAP and SSAP must be 04. Thus, although it is possible to specify a different DSAP at the AS/400, the PS/2 can't use this number as its SSAP.

On the other hand, the PS/2 has no problem specifying the same remote adapter address to be used for both dependent and independent communications. Thus, there is usually no need to change SAP addresses.

Having said all that, the limitation is probably not a real one since it is most likely that users will require 5250 WSF instead of 3270 emulation in order to establish the session to the AS/400. Any 3270 emulation requirements are better served using SNA Pass-Through.

Interestingly, DOS PC Support allows different SAP addresses to be specified in the CONFIG.PCS. Thus, it is possible to enable both 5250 WSF and 3270 emulation when using DOS. Furthermore, a 3174 also provides the possibility to change SAP addresses and, thus, provides the capability to communicate concurrently with the AS/400 using both dependent and independent sessions. We examine these possibilities further when considering our 3174 and PC AT attachments.

7.2.4 3174 Sessions

In the same way as for the PS/2, it is possible for a 3174-attached device to use RALYAS4A as a gateway for 3270 emulation. There are two options:

1. We can use the downstream 3174 support and upstream 3270 emulation of the AS/400 utilizing the AS/400 pipeline facility to provide somewhat transparent access to SUBNET through the AS/400. This is the most appropriate option if users of non-programmable terminals attached to the 3174 require access to AS/400 applications.
2. The concurrent APPC/APPN and SNA Pass-Through support used in 7.2.3, "PS2ES1 Sessions" on page 267 may be used here with the 3174. This is the best option if no AS/400 applications are required by the users of non-programmable terminals.

We will explore both of these scenarios in the course of the next three sections.

7.2.5 CP3174 Sessions

We consider dependent and independent communications from the 3174-11L APPN node (CP3174) as follows:

7.2.5.1 CP31742 3270 Session to the Host

Here we can use the downstream 3174 support and upstream 3270 emulation of the AS/400 with the AS/400 pipeline facility to provide a gateway for 3270 emulation. We use the LU-LU pairing RA9T0501 (VTAM Host LU) - RA9T0501 (AS/400 Device) to support the LU2 traffic from the 3174. And again, if we wish to have more than a single session up to the host, then we need more LU definitions.

However, CP3174, the 3174 which we customized in 5.2.1, "Customizing the 3174 for APPN" on page 167 is a Model 11L. It is channel-attached and considers the channel, not the token-ring, to be upstream. Since the 3174 can only initiate 3270 sessions to an upstream node, the 3174 11L, therefore, cannot initiate 3270 sessions across the token-ring. Which means that, since in this scenario RALYAS4A is the 3174's gateway to the host, there is no way for an LU2 session to be established to the host.

There are two solutions:

1. Use a 3174 Model X3R

Some models of 3174 do support 3270 sessions via the token-ring adapter. That is, they consider the token-ring connection to be an upstream connection. These are the X3R models. Thus, for this reason, we introduce a second 3174 into our USIBMRAA network: a 3174-13R with a CP name of CP31742. We consider communications from this 3174 in 7.2.8, "CP31742 Sessions" on page 288. First, however, we consider use of the 3174-11L in conjunction with the WPCSP.

2. Use the 3174 Workstation Peer Communications Support Feature

Both DOS and OS/2 workstations are capable of using this feature to attach to the 3174 over a standard 3270 coaxial cable.

DOS or OS/2 PS/2s are capable of using *The Workstation Peer Communications Support Feature* allow these workstations to make use of a virtual LAN within the 3174. PS/2 applications are configured as though they are attached to a real token-ring LAN. The 3174's internal virtual token-ring LAN may then be bridged to the real token-ring LAN. This is transparent to the PS/2's applications.

7.2.6 DOS PS/2 using Workstation Peer Communications Support Program (WPCSP)

A DOS PS/2 using the DOS Workstation Peer Communications Support Program (WPCSP) with 3270 emulation, may establish an LU2 session to the AS/400. These PS/2s also have access to the host, via the AS/400, in the same way as our PS/2 with ES1 had access. The WPCSP does not provide host access for non-programmable terminals since it is not possible to load them with the WPCSP device drivers.

From an AS/400 perspective, definitions for a coax-attached PS/2 with 3270 emulation and WPCSP are the same as for any PS/2 with 3270 emulation; a 3174 control unit description and 3278 device description are required. These are shown in Figure 301 on page 278 and Figure 302 on page 279, respectively.

Display Controller Description		RALYAS4A
		02/02/93 15:45:22
Controller description	CP3270	
Option	*BASIC	
Category of controller	*RWS	
Controller type	3174	
Controller model	0	
Link type	*LAN	
Online at IPL	*YES	
Active switched line	L41TR	
Character code	*EBCDIC	
Maximum frame size	1994	
SSCP identifier	050000000000	
Initial connection	*DIAL	
LAN remote adapter address	400031743992	
LAN DSAP	04	
LAN SSAP	04	
Text	Coax attached PC to CP3174	
-----Switched Lines-----		
L41TR		
Device wait timer	120	
LAN frame retry	10	
LAN connection retry	10	
LAN response timer	10	
LAN connection timer	70	
LAN acknowledgement timer	1	
LAN inactivity timer	100	
LAN acknowledgement frequency	1	
LAN max outstanding frames	2	
LAN access priority	0	
LAN window step	*NONE	
Recovery limits:		
Count limit	2	
Time interval	5	

Figure 301. AS/400 Remote 3174 Control Unit Description for DOSCOAX

Display Device Description		RALYAS4A
		02/02/93 15:46:25
Device description	CP3270D1	
Option	*BASIC	
Category of device	*DSP	
Device class	*RMT	
Device type	3278	
Device model	0	
Local location address	02	1
Online at IPL	*YES	
Attached controller	CP3270	
Keyboard language type	USB	
Drop line at signoff	*YES	
Print device	*SYSVAL	
Output queue	*DEV	
Printer file	QSYSPRT	
Library	*LIBL	
Maximum length of request unit . . .	*CALC	
Text	Device for Coax attached PC to CP3174	

Figure 302. Device Description for the PS/2 with 3270 Emulation

1 The LU address of the downstream 3270 device

The 3270 emulation configuration on the coax-connected PS/2 is shown from Figure 303 to Figure 307 on page 281.

In these figures, the screens through which the PC3270 emulation Version 2 configuration utility progresses are shown. After these screens have been filled, the utility creates a batch file which may be used to initiate the 3270 emulation.

Choose Configuration	
Press F10 to change choice.	
Type of configuration	Network station
Advanced link options	No
Multiple adapter cards for host communication	
Specifying SNA/Non-SNA parameters	
Non-default settings for adapter cards	
X.25 connection	
Use Extended/Expanded Memory	No

Figure 303. 3270 Emulation Configuration for Coax-Connected PS/2 Part 1

Attachment Types		
Fill in the fields.		
Total number of sessions for:		
Distributed Function Terminal (DFT)	0	
LAN via 802.2 protocol	0	
LAN via NetBIOS	0	
3174 Peer Communication	1	1
Synchronous Data Link Control (SDLC)	0	
Asynchronous Data Link Control (ASYNCH)	0	

Figure 304. 3270 Emulation Configuration for Coax-Connected PS/2 Part 2

1 Here we indicate that there is to be a single 3270 emulation session possible: a single dependent LU. Moreover, it will be established across the coax connection to the 3174, using 3174 Peer Communication.

3174 Peer Communication		
Fill in the fields.		
Link name	lan1	
Destination address . . .	400010020001	2
Physical Unit ID	00000	
Block ID	061	
PIU size	2048	3

Figure 305. 3270 Emulation Configuration for Coax-Connected PS/2 Part 3

2 The Destination address indicates the token-ring address of the node to which we will perform 3270 emulation. In our case, we wish to establish a session to RALYAS4A with token-ring address 400010020001.

3 The PIU size is the size of the information field in the frame. Any user data is sent in this part of the SNA frame. The PIU size equals the RU size plus the TH and RH size. The PIU size is important. If it is too small, then the PC may have problems receiving the welcome screen when emulation is started to the host. We originally set the PIU size at 256. We could start 3270 emulation to the AS/400. However, starting 3270 emulation from the AS/400 emulation session was unsuccessful because the RU size was too small for the host welcome message.

Network Station Options			
Press F10 to change choice.			
Logical terminal			
ID	Link name	Screen size	
a	lan1	24 x 80	4
Name of definition file for keyboard, color and alarm . . .			

Figure 306. 3270 Emulation Configuration for Coax-Connected PS/2 Part 4

4 We define a logical unit ID to the 3270 session. The link name must match the link name specified in the previous screen; which, in turn, specifies the token-ring address of the node to which 3270 emulation is to be established. The next screen is the final screen before the configuration utility prompts you to save the configuration.

Keyboard and Code Pages	
Press F10 to change choice.	
Country	U.S. (English)
PC code page . . .	437
Host code page . .	037
Keyboard type . . .	Enhanced

Figure 307. 3270 Emulation Configuration for Coax-Connected PS/2 Part 5

There are also some definitions required on the 3174. It must be customized for the peer support. Please refer to 5.2.2, "The IBM 3174 Workstation Peer Communications Support Program" on page 178 for more details on 3174 customization for peer support.

5250 WSF sessions to RALYAS4A and RALYAS4B

Here we extend the definitions we made in 5.2.2, “The IBM 3174 Workstation Peer Communications Support Program” on page 178:

- First, the RALYAS4B now resides in another network and it can only be reached by being routed through the subarea.
- Second, we consider the requirements for enabling 5250 and 3270 sessions to run concurrently in the PS/2.

We already have the LINE, PU and two independent LUs for RALYAS4B, our destination node, defined at the host. Please refer to Figure 278 on page 259 and Figure 293 on page 271, respectively. The SDLC line definition and host controller description for RALYAS4A are shown in Figure 269 on page 251 and Figure 272 on page 254, respectively.

The coax-connected PS/2, DOSCOAX, used here is the same one as was used in 5.2.2, “The IBM 3174 Workstation Peer Communications Support Program” on page 178. Figure 191 on page 181 shows the CONFIG.PCS file we used in that chapter. We modify this file and show the definitions in Figure 308.

```
SFLR 1,I,,RALYAS4A
TRLI RALYAS4A,400010020001      1
ADRS RA9T1500,RALYAS4A
TRSS 08                          3
RTLN USIBMRAA.DOSCOAX          2
RTYP ITRN
UPDT I:\QIWSFL2,C:\PCS,S,,,PC SUPPORT/400
FTYP 2
```

Figure 308. CONFIG.PCS File for DOSCOAX

1 This is the token-ring address at which to begin searching for the requested LU. We have the choice of using the 3174 or the AS/400. Here, we will use the AS/400 address. We consider the case where we specify the 3174 token-ring address in 7.5, “3174 as Gateway from a Branch Network to a Subarea Network” on page 346.

2 The net ID of this LEN end node must be the same as RALYAS4A. This restriction is due to the fact that the host NNNC support only allows for the net ID of the adjacent network to be different from that of the host. Giving DOSCOAX another net ID would violate this restriction and the session would be rejected by VTAM.

Note: The AS/400, OS/2 Extended Services and Communications Manager do support LEN end nodes with different net IDs; the 3174 currently does not.

3 In order to initiate both 3270 emulation and PC Support across the same token-ring adapter on the same DOS-based PS/2, we need to specify two different source service access points (SSAPs). SAPs provide different logical addresses, or sub-addresses, for the same physical address. The default source SAP is 04 as is the default destination SAP (DSAP).

For this reason we need to change the SSAP for PC Support and give it a value of 08 (SSAP and DSAP have to be hexadecimal values between 00 and FF which

are multiples of 04). In order to change the SSAP address, DOS PC Support provides the TRSS instruction.

This instruction causes PC Support to send an identification address 400031743992 08 in place of 400031743992 04 to each node with which it has a session and, thus, the 3270 emulation and PC Support each have a unique address.

In the same context, we also need to make a change in the CONFIG.SYS created in section 5.2.2, "The IBM 3174 Workstation Peer Communications Support Program" on page 178.

```
DEVICE=C:\WPCSP\DXMA0MOD.SYS
DEVICE=C:\WPCSP\DXMA1MOD.SYS
DEVICE=C:\WPCSP\DXML1MOD.SYS 400031743992
DEVICE=C:\WPCSP\DXMT0MOD.SYS ES=3 EST=3      4
BREAK=ON
BUFFERS=20
FILES=40
DEVICE=C:\PCS\EIMPCS.SYS
DEVICE=C:\PCS\ECYDDX.SYS
```

Figure 309. CONFIG.SYS File for DOSCOAX

Unless otherwise specified, the NetBIOS interface opens the adapter at load time (IPL of the PS/2) with defaults. The default number of SAPs requested by NetBIOS at load time is 1.

4 Specifying these parameters on the DXMT0MOD.SYS driver indicates to NetBIOS that it should open the adapter at load time as follows:

- *ES=3* indicates additional SAPs requested by the NetBIOS driver when it opens the adapter.
- *EST=3* indicates additional link stations requested by the NetBIOS driver when it opens the adapter.

On starting PC Support, DOSCOAX requests a session to each of the DLUs, RA9T1500 and RALYAS4A, at token-ring address 400010020001. The RALYAS4A, in fact, finds both DLUs at its local CP. The first DLU, RALYAS4A, is its own CP name. RA9T1500 matches with the explicit Remote Location List entry for RA9T1500 (the destination LU) which must be specified at RALYAS4A. Please see Figure 310 on page 285. The AS/400 will autcreate a controller description for its session with the PS/2; the controller description will specify a DSAP = 08 in pointing to the PS/2 token-ring LAN address. Furthermore, it will forward the BIND it receives from DOSCOAX to the host, which in turn, forwards it to RALYAS4B.

Note: Both PC Support and 3270 emulation use the same hotkey back to DOS. This conflict causes one of the emulation programs to drop out. In order to avoid the conflict, re-define the *ALT - ESC* for PC Support using the *CFGWSF.EXE*.

7.2.6.1 Network ID Considerations for LEN End Nodes

An APPN EN or NN always sends a BIND with a network-qualified destination LU name. The PS/2 DOSCOAX is a LEN end node, however. Whether or not a LEN end node sends a network-qualified LU name is dependent on the application. In the case of a PS/2 or PC running DOS 5250 WSF, the destination LU specified in the BIND is not network qualified.

The way in which unqualified DLU names are handled by APPN nodes is dependent on the particular product's implementation of APPN. The three implementations of APPN NN considered in this book handle an unqualified DLU name differently:

- AS/400

AS/400 assumes that the unqualified DLU name is in its own network. In order to find a directory match for this DLU, the AS/400 requires a Remote Location List entry with the destination LU qualified to be in the AS/400 local network. Please refer to Figure 310 on page 285. This is a strange requirement since the DLU is, in fact, in a different network on the other side of the subarea.

Next, the AS/400 then forwards the BIND to the subarea with an *unqualified DLU* name. This fact is key, since VTAM is able to process an unqualified LU name and will search for an LU match with *any* network ID. The first match it finds will be assumed to be the DLU. It is necessary then that all LUs in all communicating networks have unique LU names. Otherwise, a session may be established to an LU in the wrong network. There is no better way to handle this situation unless the application can specify the network with which it wishes to communicate.

Note that the wildcard is not sufficient for the AS/400 to find a match for the unqualified LU name. The directory entry must be explicit and specify the AS/400's network ID.

- 3174

3174, with wildcard, finds a match in the unqualified DLU name. It then assumes that the net ID must be that of the host. (The 3174 wildcard option assumes that the LU resides in the primary host on the primary link.) The 3174 then forwards the BIND to the subarea *qualifying the DLU* with the subarea's net ID; this is a key difference from the AS/400. Unless the net ID of the subarea matches the net ID of the network where the DLU resides, then the session initiation fails since a match is not found for the network-qualified DLU.

- OS/2 Extended Services and Communications Manager

OS/2 Extended Services, like the 3174 but unlike the AS/400, finds a match for the unqualified LU in its wildcard entry. It, like the AS/400 but unlike the 3174, assumes that the unqualified DLU resides in its network. It, thus, forwards the BIND to the subarea *qualifying the DLU* with its own net ID. Again, the session initiation fails unless the net ID of the network in which the DLU resides is the same as that of the network in which the PS/2 with OS/2 Extended Services resides.

What is the fate then of our LEN end node, DOSCOAX? It can use the NN services of RALYAS4A to establish a session to RALYAS4B via the subarea provided either:

- The RALYAS4A has an entry in the Remote Location List as shown in Figure 310 on page 285.

```

Display Configuration List
Configuration list . . . . . : QAPNRMT
Configuration list type . . . . . : *APPNRMT
Text . . . . . : APPN Remote Location List

-----APPN Remote Locations-----
Remote      Remote      Remote      Control
Network     Local      Control    Point      Secure
Location ID  Location Point  Net ID     Loc
RA9T1500    USIBMRAA  RA9TNNA0   RAP        USIBMRA    *NO

```

Figure 310. RALYAS4A Remote LU Lost with Explicit Entry for RA9T1500

- The net IDs are the same in CNET, VNET, and SUBNET.

7.2.7 OS/2 Extended Services Coax Attach - Peer Support Feature

Like the DOS PC in 7.2.6, “DOS PS/2 using Workstation Peer Communications Support Program (WPCSP)” on page 277, OS/2 Extended Services and Communications Manager PS/2s are also capable of utilizing the 3174 Peer Support Feature. From an AS/400 perspective, the OS/2 Extended Services PS/2 will appear as though it was a LAN-attached device, and its configuration is very similar to that of PS2ES1 in 7.2.3, “PS2ES1 Sessions” on page 267. The major difference is the LAN adapter which is used (see Figure 311).

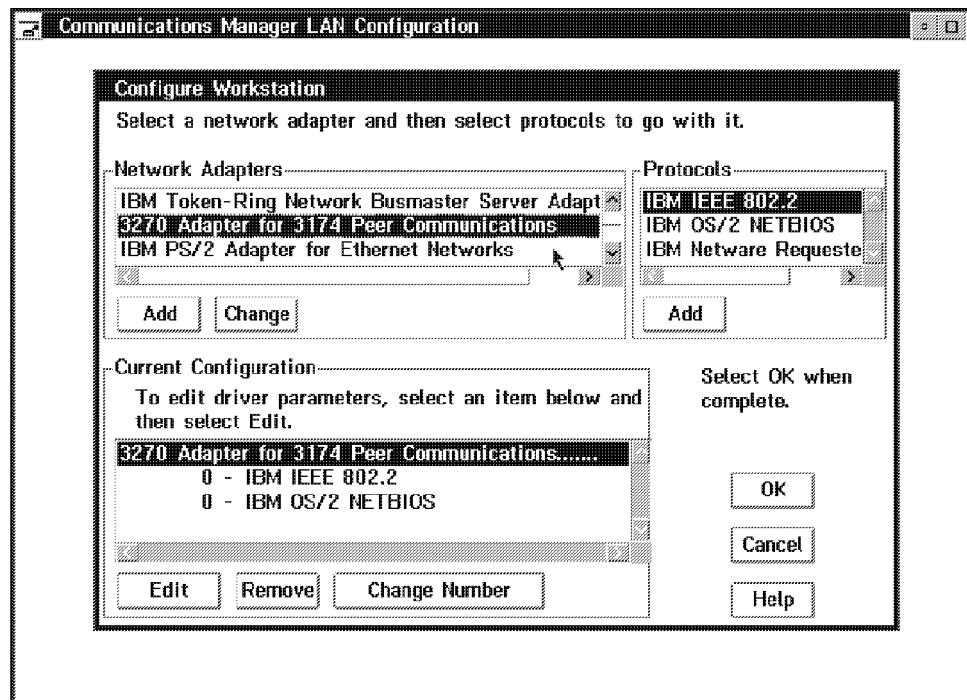


Figure 311. OS/2 Extended Services COAX Peer Support Feature - LAN Adapter

Parameters for 3270 Adapter for 3174 Peer Communications
 Edit the parameters as needed.

Network adapter address	400031741992
Maximum number of queued transmits	12

OK Cancel Range Help

Figure 312. OS/2 Extended Services COAX Peer Support Feature - Configure LAN Adapter

Local Node Characteristics - ESCOAXA

Required Features

Network ID: USIBMRAA

Local node name: ESCOAX92

Node type:

☒ End Node to Network Node Server
☐ End Node - No Network Node Server
☐ Network Node

Your network node server address: 40001002D001

Optional Features

Local node ID: 05D 00000 (Hex)

Local node alias name: ESCOAX92

Comment: COAX Attached End Node

☒ Activate Attach Manager at start up

Save and Return Cancel Help

Figure 313. OS/2 Extended Services COAX - SNA Local

CM Additional SNA Features - ESCOAXA

File Edit View Configuration Options Help

Transaction Program Definitions

- Transaction Program Defaults
- Transaction Program Security
- Partner LUs**

LU Name:	Alias:	Comment:
USIBMRAA.RALYAS4A	RALYAS4A	
USIBMRAA.RA9T0500	RALYAS4B	
- Local LUs
- Conversation Security
- LU to LU Security
- CPI Communications Side Info
- + Modes

Figure 314. OS/2 Extended Services COAX - SNA Partner LU Configuration

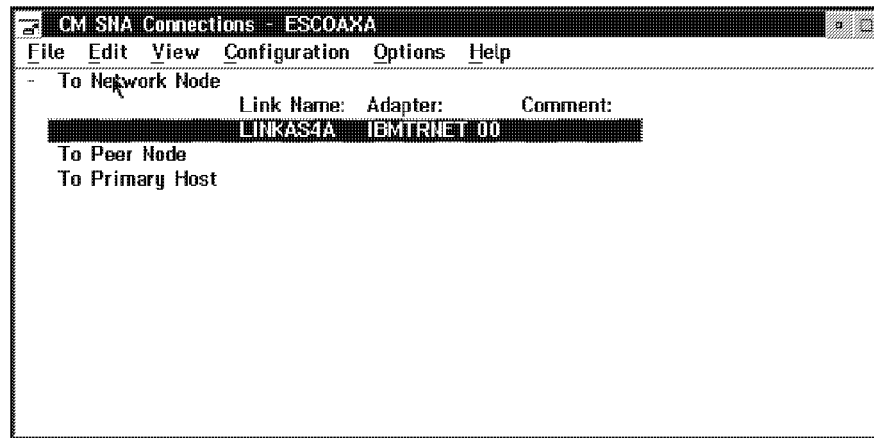


Figure 315. OS/2 Extended Services COAX - SNA Links Configuration

```

                                Display Controller Description                                RALYAS4A
                                                                02/03/93 11:44:32
Controller description . . . . . : ESCOAX92
Option . . . . . : *BASIC
Category of controller . . . . . : *APPC

Link type . . . . . : *LAN
Online at IPL . . . . . : *NO
Active switched line . . . . . : L41TR
Character code . . . . . : *EBCDIC
Maximum frame size . . . . . : 16393
Remote network identifier . . . . : USIBMRAA
Remote control point . . . . . : ESCOAX92
Initial connection . . . . . : *DIAL
Dial initiation . . . . . : *LINKTYPE
Switched disconnect . . . . . : *YES
Data link role . . . . . : *NEG
LAN remote adapter address . . . . : 400031741992
LAN DSAP . . . . . : 04
LAN SSAP . . . . . : 04
Text . . . . . : AUTOMATICALLY CREATED BY QLUS

-----Switched Lines-----
L41TR

APPN-capable . . . . . : *YES
APPN CP session support . . . . . : *YES
APPN node type . . . . . : *CALC
APPN transmission group number . . : *CALC
APPN minimum switched status . . . : *VRYONPND
Autodelete device . . . . . : 1440
User-defined 1 . . . . . : *LIND
User-defined 2 . . . . . : *LIND
User-defined 3 . . . . . : *LIND
Model controller description . . . : *NO
Control owner . . . . . : *SYS

```

Figure 316. AS/400 APPC Controller Description for the ESCOAX92

Display Device Description		RALYAS4A	
		02/03/93	11:50:09
Device description	ESCOAX021		
Option	*BASIC		
Category of device	*DSP		
Device class	*SNPT		
Device type	3278		
Device model	0		
Local location address	02	1	
Online at IPL	*NO		
Attached controller	ESCOAX92		
Keyboard language type	USB		
Print device	*SYSVAL		
Output queue	*DEV		
Printer file	QSYSPRT		
Library	*LIBL		
Activation timer	170		
Inactivity timer	*NOMAX		
SNA pass-through device desc	RA9T0507		
SNA pass-through group name	*NONE		
Host signon/logon command	*NONE		
Text	Downstream SNPT device for ESCOAX92		

Figure 317. Downstream Device Description for ESCOAX92 using SNA Pass-Through

7.2.8 CP31742 Sessions

The CP31742 is a 3174-13R. It is capable of supporting 3270 sessions upstream across the token-ring adapter. We consider dependent and independent communications from CP31742 as follows:

- 3270 session to the host using 3270 Emulation

In order to establish a 3270 session from the 3174-13R to the host, a session must first be established to the AS/400 acting as gateway to the subarea. On RALYAS4A, this entails configuration of a downstream 3174 control unit and device. We show these definitions in Figure 318 on page 289 and Figure 319 on page 290.

Display Controller Description		RALYAS4A
		07/17/91 16:17:12
Controller description	CP3270B	
Option	*BASIC	
Category of controller	*RWS	
Controller type	3174	
Controller model	0	
Link type	*LAN	
Online at IPL	*YES	
Active switched line	L41TR	
Character code	*EBCDIC	
Maximum frame size	1994	
SSCP identifier	050000000000	
Initial connection	*DIAL	
LAN remote adapter address	400031740002	
LAN DSAP	04	
LAN SSAP	08 1	
Text	3174-13R downstream	
-----Switched Lines-----		
L41TR		

Figure 318. Remote Workstation Controller on RALYAS4A

1 Notice that the SSAP of the RALYAS4A is specified as 08. The reason for this specification is so that the APPC control unit, which we define for CP-CP session establishment, can use an SSAP of 04. The SSAP 08 must also be available on the token-ring line description for SNA. Please see Figure 3 on page 8.

Note: It is noteworthy that it is currently possible to establish concurrent dependent and independent sessions with the 3174 downstream of the AS/400. That is, it is possible for the 3174 to concurrently establish 3270 and APPC sessions upstream to the AS/400. Moreover, the AS/400 may then act as gateway to route these sessions to or through the subarea. Recall that, since it is not possible in Communications Manager to specify different SAP addresses on the same token-ring address, it is not currently possible to perform this concurrent dependent and independent sessions with an OS/2 PS/2 downstream of an AS/400.

Display Device Description		RALYAS4A	
		07/17/91	16:27:13
Device description	CP3270B		
Option	*BASIC		
Category of device	*DSP		
Device class	*RMT		
Device type	3278		
Device model	0		
Local location address	02		
Online at IPL	*YES		
Attached controller	CP3270B		
Keyboard language type	USB		
Drop line at signoff	*YES		
Print device	*SYSVAL		
Output queue	*DEV		
Printer file	QSYSPRT		
Library	*LIBL		
Maximum length of request unit . . .	*CALC		
Text	Device for CP31742		

Figure 319. Remote Display Device for RALYAS4A

The 3174 must be customized so that the RALYAS4A is seen as a host. In our case, we customize it so that RALYAS4A is primary host on the primary link, in fact the only host. We do not consider in detail the 3174 customization. In particular, we do not go through the 3174 customization for individual LUs. Clearly, there needs to be an LU defined with an address matching the local location address defined in the downstream 3270 device description at the AS/400; this was defined in Figure 319 to be 02. For more information, please refer to *3174 Configuration Support C Planning Guide*.

However, in Figure 320 on page 291, we do show the token-ring network panel in which we define the RALYAS4A as primary link primary host. Here, we wish to point out the SAP addresses given for each token-ring address.

Token-Ring Network			
106 - 4000 3174 0002 04 1	107 - 4000 1002 0001 08 2	108 - 23N6503	
110 - 1 0000	116 - 2_ _		
121 - 01	123 - 0	125 - 00000000	126 - 00000000 127 - 2 2
132 - 0 0 0 0	136 - 1 0 0 1	137 - 0 0 0 0	138 - 0
141 - A	165 - 0	166 - A	168 - 0
173 - 00000000	175 -	179 - 0 0 0	
213 - 1	215 - 00000	220 - 3	
382 - 2042	383 - 2	384 - 0	
385 - LAN317	386 - 1		
Select Test; press ENTER ==>			
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu			

Figure 320. Token-Ring Network Definition CP31742 using 3270 Emulation

1 and 2 specify the token-ring addresses of the 3174 and RALYAS4A, respectively. Notice in 2 that we have specified a SAP address on the RALYAS4A of 08; this is the RALYAS4A SSAP. It matches the SSAP specified on the AS/400 control unit description.

Once a 3270 session is established to RALYAS4A, then AS/400 3270 emulation (STREML3270) may be used in order to start a session to the host. Please refer to 7.2.1, "RALYAS4A Sessions" on page 251 for configuration requirements.

- CP-CP sessions to RALYAS4A

In order to establish CP-CP sessions between RALYAS4A and CP31742, either the AS/400 must define an APPC control unit description or the 3174 must define the AS/400 in its APPN node definition panel. The customization of the 13R and 11L are identical for APPN. Thus, for details on this customization, please refer to 5.2.1, "Customizing the 3174 for APPN" on page 167.

Once a CP-CP session is established between CP31742 and RALYAS4A, independent sessions may flow between them and, in particular, up to the host via RALYAS4A acting as gateway.

- 3270 session to the host using SNA Pass-Through

If it is not a requirement that users of non-programmable terminals attached to CP31742 have access to AS/400 applications, then the use of SNA Pass-Through is most appropriate.

When using SNA Pass-Through we must configure an APPC controller on the AS/400. This controller will be used to support both dependent and independent sessions; unlike the previous example where a separate controller description was required for each type of protocol, necessitating

the definition of two LAN service access points. As stated earlier only one controller need be defined here, as shown in Figure 321 on page 292.

Display Controller Description		RALYAS4A
		02/02/93 20:28:49
Controller description	CP31742	
Option	*BASIC	
Category of controller	*APPC	
Link type	*LAN	
Online at IPL	*NO	
Active switched line	L41TR	
Character code	*EBCDIC	
Maximum frame size	16393	
Remote network identifier	*NETATR	
Remote control point	CP31742	
Initial connection	*DIAL	
Dial initiation	*LINKTYPE	
Switched disconnect	*NO	
Data link role	*NEG	
LAN remote adapter address	400031740002	
LAN DSAP	04	
LAN SSAP	04	
Text	3174 NN - using SNPT	
-----Switched Lines-----		
L41TR		
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*NETNODE	
APPN transmission group number	*CALC	
APPN minimum switched status	*VRYON	
Autodelete device	1440	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	
Model controller description	*NO	
Control owner	*USER	

Figure 321. APPC Controller on RALYAS4A for CP31742 Using SNA Pass-Through

There is no need to create an APPC device as it will be automatically created when the CP31742 establishes CP-CP sessions with RALYAS4A. We do need to define a downstream SNA Pass-Through device for each dependent LU that is configured on the 3174. Figure 322 on page 293 is one such dependent LU.

Display Device Description		RALYAS4A
		02/02/93 22:15:12
Device description	CP3174202	
Option	*BASIC	
Category of device	*DSP	
Device class	*SNPT	
Device type	3278	
Device model	0	
Local location address	02	
Online at IPL	*NO	
Attached controller	CP31742	
Keyboard language type	USB	
Print device	*SYSVAL	
Output queue	*DEV	
Printer file	QSYSPRT	
Library	*LIBL	
Activation timer	170	
Inactivity timer	*NOMAX	
SNA pass-through device desc	RA9T0507	
SNA pass-through group name	*NONE	
Host signon/logon command	*NONE	
Text	SNPT Downstream Device for CP31742	

Figure 322. SNA Pass-Through Downstream Device for CP31742

The upstream device we have used here again is RA9T0507, from Figure 297 on page 273. In a real configuration for each pair of downstream SNA Pass-Through LUs there must be a corresponding pair of upstream SNA Pass-Through LUs.

_____ Token-Ring Network _____			
106 - 4000 3174 0002 04 1	107 - 4000 1002 0001 04 2	108 - 23N6503	
110 - 1 0000	116 - 2_ _		
121 - 01	123 - 0	125 - 00000000	126 - 00000000 127 - 2 2
132 - 0 0 0 0	136 - 1 0 0 1	137 - 0 0 0 0	138 - 0
141 - A	165 - 0	166 - A	168 - 0
173 - 00000000	175 -	179 - 0 0 0	
213 - 1	215 - 00000	220 - 3	
382 - 2042	383 - 2	384 - 0	
385 - LAN317	386 - 1		
Select Test; press ENTER ==>			
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu			

Figure 323. Token-Ring Network Definition CP31742 Using SNA Pass-Through

1 and 2 again specify the token-ring addresses of the 3174 and RALYAS4A, respectively. Notice in 2 that this time it is not necessary to

specify a different SAP. This is because only one controller is required; there is no need to distinguish between dependent and independent sessions.

7.2.9 PC AT Sessions

We include this section for completeness. However, in considering the communications from a PS/2 running DOS WSF and coax-attached to a 3174, we have, indeed, already considered the communications from PCAT. WPCSP causes the coax-attached PC to appear like any other PC on the token-ring LAN. Because of this we will avoid duplication and no longer consider PCAT in our examples. Keep in mind, however, that statements made regarding the PC coax-attached to the 3174 will also apply to any PC on the token-ring LAN.

7.2.10 RISC/6000 Sessions

In this section we connect the RISC/6000 to AS/400 B through two intermediate network nodes, namely AS/400 A and VTAM, without using CP-CP sessions. Please refer to Figure 324 for an overview of this scenario.

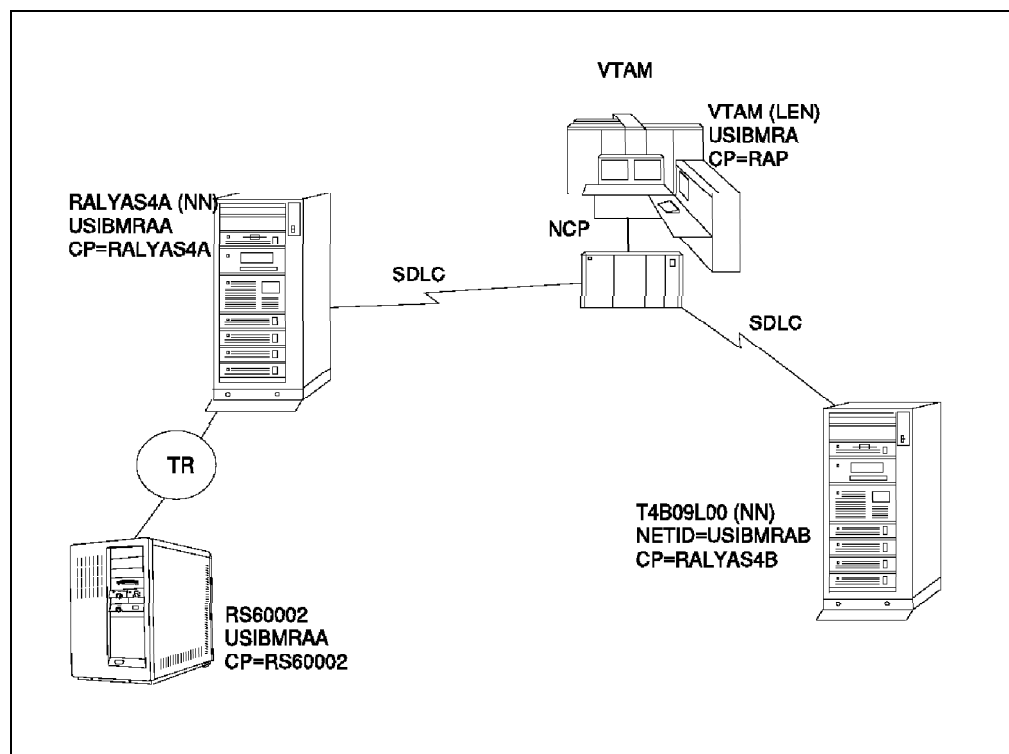


Figure 324. RISC/6000 to AS/400 B LEN Connection Through AS/400 A and VTAM

As can be seen from the diagram, we are using three network names here, with each intermediate node in a different network. This will work for LEN connections, but be aware that using the network nodes will restrict the network to two net IDs.

7.2.10.1 RISC/6000 Configuration

We took the SMYTH configuration created in Chapter 6, "The RISC System/6000" on page 213 (Figure 233 on page 216 through Figure 242 on page 222), and altered the following items:

- Control Point and Local LU Profiles. Net ID changed to USIBMRAA.
- Control Point Profile. CP name changed to RS60002.

- Local LU Profile. Local LU name changed to RS60002.

We then created a Logical Connection for AS/400 B.

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTHB		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH]		
LOCAL LU profile name	[SMYTH]		
NETWORK name	[USIBMRAB] 1		
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[T4B09L00] 2		
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended 3		
If extended, SESSION CONCURRENCY	parallel 3		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 325. LU 6.2 Logical Connection Profile

Notes:

- 1 This is the net ID of the **target** network. This, together with the remote LU name, makes up the network-qualified LU name of the remote system.
- 2 This LU must exist both in VTAM and in the Local Location List of the target AS/400.
- 3 The default is for a single session, which is not desirable in our case.

7.2.10.2 AS/400 Configuration - Intermediate AS/400

For our host connection on AS/400 A, we used the line, RA9L005, and host controller, RA9P05.

Display Line Description	
Line description	RA9L005
Option	*BASIC
Category of line	*SDLC
Resource names	LIN082
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	0569406A
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*HALF
Modulus	8
Text	SDLC Line to SA09

Figure 326. AS/400 A SDLC Line to Host

Display Controller Description	
Controller description	RA9P05
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L005
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
SSCP identifier	050000000000
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	HOST CTL SA09

Figure 327. Host Controller for AS/400 A

Display Controller Description	
Controller description	RA9P05
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*NO
APPN node type	*LENNODE
APPN transmission group number . . .	*CALC
Autodelete device	1440
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 328. APPN Capabilities of Host Controller

The token-ring connection to the RISC/6000 used the line L41TR described in Figure 3 on page 8. We allowed the AS/400 to autocreate configuration objects for the RISC/6000 at XID exchange time.

As we are not using CP-CP sessions here, we had to tell the AS/400 where to send the RISC/6000s BIND for AS/400 B. This was done by adding an entry in the Remote Location List.

Display Configuration List	
Configuration list	QAPPNRMT
Configuration list type	*APPNRMT
Text	
-----APPN Remote Locations-----	
Remote	Remote Control
Network	Control Point
Local	Secure
Location ID	Location Point Net ID Loc
T4B09L00	USIBMRAB RS60002 RAP USIBMRA *NO

Figure 329. Remote Location List Entry to Route RISC/6000 LUs to Host

7.2.10.3 AS/400 Configuration - Target AS/400

Our host connection on AS/400 B was through the line, RA9L015, and host controller, RA9P015.

Display Line Description	
Line description	RA9L015
Option	*BASIC
Category of line	*SDLC
Resource names	LIN011
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	05615533
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*FULL
Modulus	8
Text	SDLC Line to Subarea 06

Figure 330. SDLC Line for AS/400 B

Display Controller Description	
Controller description	RA9P015
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L015
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	Controller Description for RAP

Figure 331. Host Controller for AS/400 B

Display Controller Description	
Controller description	RA9P015
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*NO
APPN node type	*LENNODE
APPN transmission group number . . .	*CALC
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 332. APPN Capabilities of the Host Controller on AS/400 B

7.2.10.4 Host Configuration

Our connection to AS/400 A was through the line, RA9L005, and PU, RA9P05.

```

RA9L005  LINE ADDRESS=(005, HALF),  HDX LEASED LINE          *
          ANS=CONTINUE,          DON'T BREAK CROSS DOMAIN SESSIONS *
          NPACOLL=YES,                                     *
          ISTATUS=ACTIVE,                                           *
          CLOCKNG=EXT,          MODEM  PROVIDES THE CLOCKING ##### *
          DUPLEX=(FULL),          REQUEST TO SEND ALWAYS UP        *
          MAXPU=9,              ALLOW NO MORE THAN 9 PUS ON LINE    *
          SERVLIM=10,                                           *
          SPEED=9600,          NPA AND SCANNER USE                ##### *
          SRT=(, 64)
*          NGFTXT='AS/400/A'
*****
*          SERVICE MACRO SPECIFICATION FOR SDLC (LINE 005)          *
*****
          SERVICE ORDER=(RA9P05), MAXLIST=9
*****
*          PU AND LU DEFINITIONS OF AS/400A TO SUPPORT DEPENDENT
*          AND INDEPENDENT LUS
*****
RA9P05  PU  ADDR=01,                                           *
          DATMODE=FULL,                                         *
          PUTYPE=2,                                             *
          CONNTYPE=LEN,                                         *
          XID=YES
*          STATOPT='CONNECTION TO AS4A'

```

Figure 333. Host Line and PU for AS/400 A

For the connection to AS/400 B, we used the line, RA9L015, and PU, RA9P015. The line was identical to the one detailed in Figure 333. For this connection, however, we need to create an independent LU for the RISC/6000 remote LU of T4B09L00.

```

RA9P015  PU  ADDR=01,
          DATMODE=FULL,
          PUTYPE=2,
          CONNTYPE=LEN,
          XID=YES
*          STATOPT='LEN CONNECTION TO PS/2'
      ADD T0=RA9P015
T4B09L00 LU  RESSCB=4,
          MODETAB=MTGS3X,
          LOCADDR=0
*          STATOPT='INDEPENDENT LU'

```

Figure 334. PU and Independent LU Definition for AS/400 B

7.2.10.5 Activation of the Link

We varied on lines and controllers on the AS/400s and the host. Then we started the RISC/6000s SNA subsystem and the SMYTH attachment. This caused the RISC/6000 to exchange XIDs with its adjacent node, in our case RALYAS4A, and an APPC controller to be created.

Display Controller Description	
Controller description	RS60002
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*NO
Active switched line	L41TR
Character code	*EBCDIC
Maximum frame size	16393
Remote network identifier	USIBMRA
Remote control point	RS60002
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	10005AA87023
LAN DSAP	04
LAN SSAP	04
Text	AUTOMATICALLY CREATED BY QLU

Figure 335. APPC Device Created for RS60002 on AS/400 A

We then activated the SMYTHB connection, causing a BIND to be sent to the intermediate AS/400, RALYAS4A. RALYAS4A accepted the BIND and created an APPC device.

Display Device Description	
Device description	RS60002
Option	*BASIC
Category of device	*APPC
Automatically created	NO
Remote location	RS60002
Online at IPL	*YES
Local location	*NETATR
Remote network identifier	*NETATR
Attached controller	RS60002
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 336. APPC Device Autocreated on RALYAS4A

In accordance with the entry in RALYAS4A's Remote Location List, the BIND is forwarded to VTAM, which creates a dynamic LU for RS60002, and forwards the BIND to RALYAS4B.

```

NAME = USIBMRAA.RS60002 , TYPE = CDRSC
STATUS= ACT/S---Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=SNASVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED , SLU ENABLED , SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
ALSLIST = RA9P05
DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000001, SESSION REQUESTS = 0000000000
SESSIONS:
ADJACENT LINK STATION = RA9P05
NAME STATUS SID SEND RECV VR TP NETID
T4B09L00 ACTIV-S F64B0D31C8EFCCD7 USIBMRAA
END

```

Figure 337. Status of Dynamic LU for RS60002 on Host

The target AS/400 received the BIND, autocreated an APPC device, and the connection became active.

Display Device Description	
Device description	RS60002
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	RS60002
Online at IPL	*NO
Local location	T4B09L00
Remote network identifier	USIBMRAA
Attached controller	RA9P015
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 338. APPC Device Autocreated on Host Controller of Target AS/400

7.3 AS/400A (NN) via a Subarea to AS/400B (NN) (with Different Net IDs)

The intention in this section is to illustrate the PU type 2.1 flows between AS/400s connected via a subarea. All of the AS/400s are defined as NNs and have different network IDs, both from each other and the subarea.

In order to illustrate PU type 2.1 flow through the subarea from one APPN network to another, we now discuss two traces. The traces are taken on RALYAS4A and RALYAS4B, respectively. They show a session, initiated from AS/400A (in network A with Net ID=USIBMRAA) to AS/400B (in network B with net ID=USIBMRAB) via the subarea (network C with net ID=USIBMRA).

7.3.1 Trace and Flow Analysis

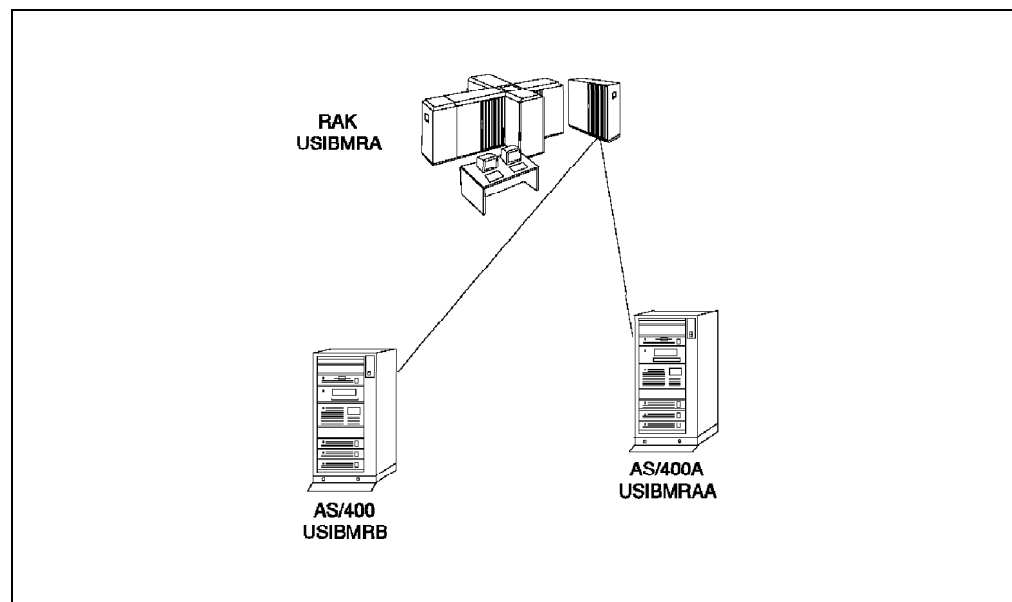


Figure 339. Subarea Network

We have re-numbered the traces so that it is easier to see where the two match; it also makes discussion somewhat easier. Frame 1, for example, in each of the traces, shows one of the AS/400s sending a BIND request and the other receiving it. The request is for an SNASVCMG session. This request has flowed from RALYAS4A via the subarea to RALYAS4B. You can see by looking at the formatted portion of frame 1, that the originating LU is USIBMRAA.RA9TNNA0 and the destination LU is USIBMRAA.RA9T1500. Recall that only the destination LU needed to be defined at the host with VTAM 4.1 installed. Notice that the net ID of these LUs is different from each other and from the subarea net ID of USIBMRA. VTAM 4.1 supports different net IDs for adjacent nodes natively while VTAM 3.3 requires the NNC PTF. The support for three net IDs, as shown here, is only available where LEN connections are used with VTAM 4.1.

Frames 3 to 5 show CNOS being run. Frames 7 through 14 show a user session being established and pass-through being started.

Frames 16 and 18 show another user session request. Notice that this time it is established from RALYAS4B to RALYAS4A and that no CNOS was required for establishment of sessions subsequent to the first.

The two traces we have shown are identical to what would be seen if two AS/400s established sessions as LEN end nodes. In fact, the two AS/400s are effectively reduced to LEN end nodes, since the host provides routing of extended BINDs but does not allow the flow of APPN traffic. However, there are clear differences between two LENS communicating directly and via a subarea network. We have omitted the XID3 exchange which each of the nodes performed in establishing link connection with the host. We have also suppressed any dependent LU flows. For example, if there are dependent LUs also defined to the host, then you will see them in your trace.

Figure 340 (Part 1 of 2). Trace AS/400 A to Subarea RAP

Figure 340 (Part 2 of 2). Trace AS/400 A to Subarea RAP

Figure 341 (Part 1 of 2). Trace AS/400 B to Subarea RAP

7.4 PS/2 as Gateway from a Branch Network to a Subarea Network

The second alternative which is considered for our remote network, USIBMRAA, is a OS/2 Communication Manager acting as gateway to the subarea network. In the two examples, PS2ES1 or CM2GWNN have a direct link to the subarea network.

In a similar way to the previous section, the key question here is whether LUs in the AS/400, PS/2 and 3174 nodes can *simultaneously*:

- Use the APPN function in the PS/2 in order to route *independent* session traffic through the subarea to USIBMRAA, for example, DSPT, ODF, PC Support/400 or any other APPC application.
- Use the PS/2 Communications Manager 3270 gateway function to route *dependent* traffic to the host. In this case, 3270 emulation is the dependent traffic tested.

We examine this alternative by considering the sessions described in the following diagram:

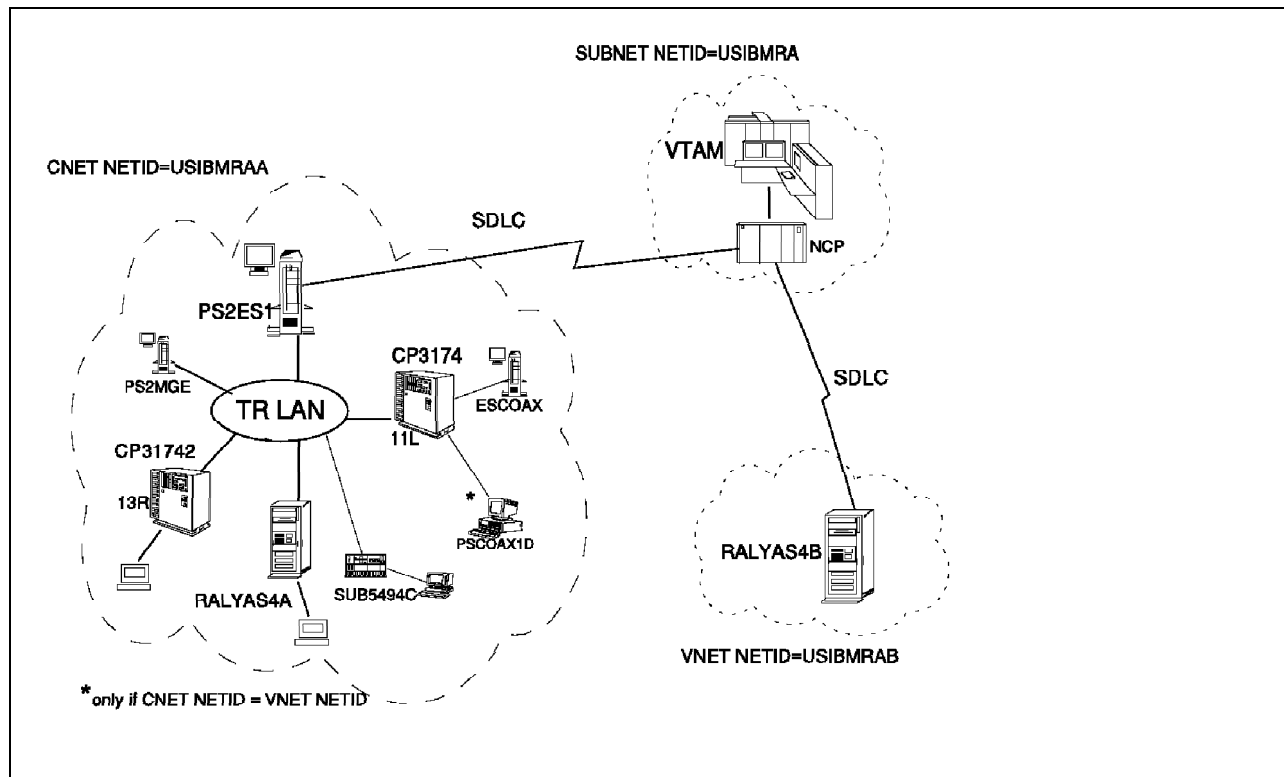


Figure 342. The PS/2 Gateway to the Subarea Environment

With a OS/2 Communication Manager acting as gateway from our USIBMRAA remote network to the subarea, sessions are established and configuration requirements examined for each node, in turn, as follows:

- RALYAS4A
 1. 3270 emulation to host
 2. Display Station Pass-Through (DSPT) to RALYAS4B
- PS2ES1

- 1. 3270 emulation to host
- 2. 5250 WSF to RALYAS4A and RALYAS4B
- CP3174
 - 1. 3270 session to host
 - 2. Coax-connected PC running DOS 5250 WSF to RALYAS4A and RALYAS4B
- CP31742
 - 1. 3270 session to host
 - 2. CP-CP sessions with PS2ES1 or CM2GWNN

Thus far, we have shown, in a step-by-step manner, the definitions required in order to establish the independent and dependent sessions we are considering. Such an approach may be of value for instructive purposes in this document. However, it is not necessarily the best manner in which to plan network definition. It is not convenient, for example, to have to re-generate NCP along each step of the way to creating the required definitions. From this point, we intend to discuss the required definitions in a less separate manner.

Moreover, the configuration process on the PS/2 for independent and dependent communications is quite separate within OS/2 Extended Services or Communications Manager/2. Since, in this section, the PS/2 acts as gateway from USIBMRAA to the subarea network, it is also the focal point for our definitions. We will maintain a strict logical separation in discussion between dependent and independent communications.

7.4.1 OS/2 Extended Services Example

7.4.1.1 Dependent Sessions

The OS/2 Extended Services is now providing the gateway to the subarea network from USIBMRAA. Establishing an LU2 session from RALYAS4A and the 3174 to the host requires that PS2ES1 be configured for the 3270 gateway function.

The 3270 gateway function of Communications Manager provides the gateway sessions via *LU mapping*. Only a single PU definition is required in the host. When the PS/2 gateway and the host connect, the gateway responds to the ACTPU from the host and to the ACTLU for all the downstream LUs so that all sessions are activated. However, the gateway also indicates that the LUs are not in a state to support a session, such as a screen which is powered off.

When the downstream user requests a 3270 session, in the 3270 gateway, a free session is allocated and a NOTIFY is sent to SSCP to indicate it's now able to act as SLU.

When the downstream LU wishes to establish a session with the host, it sends a LOGON request, which will flow via the gateway and up to the host as usual. The host will then send the BIND to the gateway LU in response to the LOGON request.

We include the CM configuration in Figure 344 on page 312 to Figure 348 on page 314. We configure first the SDLC Data Link Control (DLC) Profile. Here we

prepare the SDLC Adapter for SNA communications. Figure 343 on page 311 shows the necessary configuration options. To get to this screen:

1. From Communications Manager Main Menu, select **Advanced**.
2. Then after an appropriate configuration file has been selected, select **4. SNA Feature Profiles**.
3. Select **Data Link Control (DLC) Profiles**.
4. Select **SDLC**.

The SDLC adapter may now be configured for SNA communications. See Figure 343.

Display SDLC DLC Adapter Profile	
Adapter number	: 0
Load DLC	: Yes
Free unused link	: Yes
Maximum RU size	: 0256 bytes
Send window count	: 4
Receive window count	: 4
Line type	:
Non-switched	
Data set ready timeout	: 5 minutes
Link station role	:
Negotiable	
Local station address (in hex)	: 01
XID repoll count	: 100
Non-XID repoll count	: 7
Line mode	:
Line turnaround required	
NRZI	: Yes
Modem rate	:
full speed	

Esc=Cancel F1=Help	

Figure 343. PS2ES1 SNA Data Link Control (DLC) Profile Configuration

Having prepared the SDLC adapter we may now configure the 3270 gateway to use the SDLC adapter. You can:

1. Select **SNA Feature Profiles**.
2. Select **SNA Gateway Profiles**.
3. Select **Host Connection**, which will present us with Figure 344 on page 312 and Figure 345 on page 312.

Display SNA Gateway Host Connection Profile (1 of 2)	
DLC type	:
SDLC	
Adapter/directory entry.	: 0
Destination address.	:
Permanent connection	: Yes
Auto-logoff timeout (minutes).	: 999

Esc=Cancel F1=Help F8=Forward	

Figure 344. PS2ES1 3270 Gateway Configuration - Connection Profile Part 1

Display SNA Gateway Host Connection Profile (2 of 2)		
Pool Class	LU Address Range	Auto-logoff
1	04 - 0A 1	No

Esc=Cancel F1=Help F7=Backward		

Figure 345. PS2ES1 3270 Gateway Configuration - Connection Profile Part 2

Notice here we specify the range of LU addresses on the 3270 host that will be used as a pool of LUs for this gateway. As requests for host 3270 LUs are received from devices downstream of PS2ES1, the gateway function will allocate the next available LU from this address range to the requestor.

Next we define the workstation LU Profiles; these represent the downstream devices that will be using the gateway function of PS2ES1. Select **Workstation LU** from the **SNA Gateway Profiles** screen. A workstation LU profile must be defined for each LU on each downstream device. An example is included in Figure 346 on page 313. Here we show the remote workstation LU for the LU with local location address of 02. This is the location address which has been configured on the 3174 in the port assignment panel. Take care this LU address is specified here in hexadecimal, **not** decimal as it is on the first 3174 port assignment panel and in VTAM definitions. See Figure 345 1 and Figure 349 on page 315.

In our tests we have created one remote workstation LU for a downstream 3270 device for RALYAS4A, ESCOAX92, and DOSCOAX. These are not shown here as they are identical, except for the CP names and destination address of the downstream PUs.

Display SNA Gateway Workstation LU Profile	
LU name at workstation.	: AS400LU2
Comment	:
gateway workstation LU Profile FOR AS/400 A	
CP name of workstation.	: RALYAS4A
LU pooling.	:
Pooled	
LU pool class	: 1
Auto-logout	:
LU local address	:
at host (hex)	:
LU local address	:
at workstation (hex).	: 02
DLC type.	:
Token-Ring or Other LAN type	
Adapter/directory entry	: 0
Destination address	: 400010020001

Esc=Cancel F1=Help	

Figure 346. PS2ES1 3270 Gateway Configuration - Remote Workstation LU Profile

Figure 347 on page 314 and Figure 348 on page 314 show the configuration of the 3270 sessions for PS2ES1 itself. Notice in Figure 345 on page 312 that the range of LUs in pool class 1 starts at 06. This allows us to define the LU addresses 02 to 05 for use by the 3270 emulation on PS2ES1. These screens are found by:

1. Selecting **Advanced** from Communications Manager Main Menu.
2. Then after an appropriate configuration file has been selected, selecting **4. 3270 Feature Profiles**.
3. Selecting **2 SDLC**.
4. The connection and session can then be configured as shown in Figure 347 on page 314 and Figure 348 on page 314.

Display 3270 Profile	
1. Connection...	SDLC
2. Session 1...	A Terminal
3. Session 2...	Not Configured
4. Session 3...	Not Configured
5. Session 4...	Not Configured
6. Session 5...	Not Configured

Esc=Cancel F1=Help F3=Exit

Figure 347. PS2ES1 3270 Feature Configuration - Connection Profile

Display 3270 Profile	
1. Connection...	SDLC

Display SDLC Connection Profile	
Adapter number. : 0	
Esc=Cancel F1=Help	

Figure 348. PS2ES1 3270 Feature Configuration - Session Profile

As mentioned previously, the CM 3270 gateway function requires only a single PU to be defined at the host for the PS/2. The line, PU and LU definitions are given in Figure 349 on page 315.

```

*****
RA9L014 LINE ADDRESS=(014,FULL),  TRANSMIT AND RECEIVE ADDRESSES  *
      CLOCKNG=EXT,                                     *
      OWNER=RAP,           (V) VTAM                        *
      DUPLEX=(FULL),      REQUEST TO SEND ALWAYS UP        *
      SPEED=(9600)        LINE SPEED IS 9600 BPS
*      NGFTXT='PS/2'
*****
*      SERVICE MACRO SPECIFICATION FOR SDLC (LINE 014)      *
*****
      SERVICE ORDER=(RA9P14),
      MAXLIST=9
*****
*      PS2ES1 GATEWAY INDEPENDENT AND DEPENDENT SUPPORT    *
*****
RA9P14  PU ADDR=01,
      DATMODE=FULL,
      PUTYPE=2,
      XID=YES
      DYNLU=YES
*      STATOPT='PS2ES1'
*****
RA9T1402 LU LOCADDR=02,          3270 EMULATION FOR GATEWAY USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE
RA9T1403 LU LOCADDR=03,          3270 EMULATION FOR GATEWAY USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE
RA9T1404 LU LOCADDR=04,          3270 EMULATION FOR POOL USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE
RA9T1405 LU LOCADDR=05,          3270 EMULATION FOR POOL USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE
RA9T1406 LU LOCADDR=06,          3270 EMULATION FOR POOL USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE
RA9T1407 LU LOCADDR=07,          3270 EMULATION FOR POOL USE
      MODETAB=MTGS3X,
      USSTAB=US327X,
      DLOGMOD=EM3277,
      ISTATUS=ACTIVE

```

Figure 349 (Part 1 of 2). NCP Definition of the SDLC Line, PU and LUs for PS2ES1

RA9T1408 LU	LOCADDR=08, MODETAB=MTGS3X, USSTAB=US327X, DLOGMOD=EM3277, ISTATUS=ACTIVE	3270 EMULATION FOR POOL USE
RA9T1409 LU	LOCADDR=09, MODETAB=MTGS3X, USSTAB=US327X, DLOGMOD=EM3277, ISTATUS=ACTIVE	3270 EMULATION FOR POOL USE
RA9T1410 LU	LOCADDR=10, MODETAB=MTGS3X, USSTAB=US327X, DLOGMOD=EM3277, ISTATUS=ACTIVE	3270 EMULATION FOR POOL USE

Figure 349 (Part 2 of 2). NCP Definition of the SDLC Line, PU and LUs for PS2ES1

Notice that there are no independent LUs (ILUs) defined. We are only considering 3270 emulation and, thus, need no independent LUs. In fact, considering independent sessions for a moment, it is worth noting that here they are not required since we assume that all sessions will originate from USIBMRAA. Recall that originating ILUs need not be defined in VTAM 4.1. ILU definitions will be required for the RALYAS4B ILU since it will be the destination LU.

With the PS/2 configured as a 3270 gateway, it may now appear to the AS/400 and 3174s as an upstream host. Thus, at the AS/400, it remains only to define the required host controller and 3270 device descriptions. The host control unit, as previously discussed, supports both dependent (here 3270 emulation) and independent communications to the host. See Figure 350 on page 317 below and Figure 351 on page 318.

Display Controller Description		RALYAS4A	
		02/04/93	14:00:05
Controller description	PS2ES1GW		
Option	*BASIC		
Category of controller	*HOST		
Link type	*LAN		
Online at IPL	*YES		
Active switched line	L41TR		
Character code	*EBCDIC		
Maximum frame size	16393		
Remote network identifier	USIBMRAA		
Remote control point	PS2ES1	3	
Initial connection	*DIAL		
Switched disconnect	*NO		
LAN remote adapter address	400030010025		
LAN DSAP	04		
LAN SSAP	04		
Text	Ctl for 3270 EM via ES Gateway		
-----Switched Lines-----			
L41TR			
APPN-capable	*YES		
APPN CP session support	*YES		
APPN node type	*NETNODE		
APPN transmission group number	1		
APPN minimum switched status	*VRYONPND		

Figure 350. Host Controller Description for RALYAS4A to the PS/2 3270 Gateway

3 The remote control point is the control point name of the PS/2 gateway. There are some considerations to be made here. Since the PS/2 with CM is a PU type 2.1 or APPN node, it may now send an XID3 even if it is establishing only LU2 communications.

The AS/400 checks this XID3 and ensures that the control point name which is sent with it matches the control point name in the controller description.

If the host controller description for the gateway PS/2 is varied off at the time when the gateway comes up, then, across the token-ring, the AS/400 will automatically create an APPC controller to match the XID3 which is received. It will also create an appropriate APPC device and establish CP-CP sessions.

When an attempt is then made to vary on the host controller for the PS/2 gateway, it is unsuccessful, since it points to the same token-ring address as the APPC controller which was automatically created. Ensuring that the host controller is varied on at system startup may avoid this conflict. Alternatively, it is easy to delete the APPC controller which is automatically created. It is not needed anyway since the host controller will support both host and APPC device descriptions. The host control unit must provide this support if it is to simultaneously support dependent and independent communications to the same upstream node.

The host device definition we used for 3270 emulation through the CM 3270 gateway is similar to that which is shown in Figure 346 on page 313.

Display Device Description		RALYAS4A	
		02/04/93	14:13:28
Device description	PS2ES1GW02		
Option	*BASIC		
Category of device	*HOST		
Local location address	02	4	
Remote location	VTAM02	5	
Online at IPL	*YES		
Attached controller	PS2ES1GW		
Application type	*EML		
Maximum length of request unit . . .	*CALC		
Emulated device	3278		
Emulated keyboard	*UPPER		
Emulated numeric lock	*NO		
Emulation work station	*ANY		
Text	Device for 3270 EML via PS2ES1		

Figure 351. AS/400 Host Device Description for an LU2 Session via the PS2 3270 Gateway

4 The LU address of the AS/400 device is a hexadecimal value which must match the local LU address defined in the SNA gateway workstation profile on PS2ES1 for this session, see Figure 346 on page 313.

5 This is a symbolic name. It must, however, be unique. We have used the name VTAM02 because of the local LU address. In our example, Figure 275 on page 256, we used the VTAM name to ensure uniqueness. This is not appropriate here as the VTAM LU we are assigned will depend on which host LU is the next available in the PS2ES1 gateway's LU pool.

For the PS/2s, DOSCOAX and ESCOAX92, coax-connected to CP3174 the definitions are the same as those used previously for 3270 emulation with the RALYAS4A as gateway, except of course the LAN destination address for each of these changes from RALYAS4A's to PS2ES1's address. Please see Figure 303 on page 279 through Figure 307 on page 281 for DOSCOAX, also Figure 299 on page 275 and Figure 300 on page 275 for ESCOAX.

For the non-intelligent terminal attached to CP31742, apart from the token-ring address, the definitions are the same as for 3270 sessions to the RALYAS4A. Again, we do not show the 3174 customization. However, clearly an LU must be customized with address 02 to match the CM definition. We do show the token-ring network panel in Figure 352 on page 319. It shows the token-ring address for the PS/2 in question 107. Notice that we have a SAP of 04 instead of 08 used for the AS/400.

Token-Ring Network			
106 - 4000 3174 0002 04	107 - 4000 3001 0025 04	108 - 23N6503	
110 - 1 0000	116 - 2_ _		
121 - 01	123 - 0	125 - 00000000	126 - 00000000 127 - 2 2
132 - 0 0 0 0	136 - 1 0 0 1	137 - 0 0 0 0	138 - 0
141 - A	165 - 0	166 - A	168 - 0
173 - 00000000	175 -	179 - 0 0 0	
213 - 1	215 - 00000	220 - 3	
382 - 2042	383 - 2	384 - 0	
385 - LAN317	386 - 1		
Select Test; press ENTER ==>			
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu			

Figure 352. Token-Ring Network Definition - CP31742

7.4.1.2 Independent Sessions

Consider, first, the host definitions. It is the focal point in the connection between the remote networks, USIBMRAA and USIBMRAB. The link to RALYAS4B, which has the direct telecommunications line for USIBMRAB, has been defined in a previous section and will not change. To see the definitions for RALYAS4B and the host, respectively, please refer to Figure 276 on page 257, through Figure 279 on page 260.

The host dependent LU definitions for the connection to PS2ES1 have just been shown in Figure 349 on page 315. In Figure 353 on page 320, we show the Communications Manager configuration required in order to establish independent communications through the subarea and to the other nodes in the APPN network, USIBMRAA. Because we want to define PS2ES1 as the node in the network, USIBMRAA, which holds the wildcard entry, we must edit the .NDF file. The wildcard has the same effect as having a remote location entry of *ANY in the AS/400, see Figure 294 on page 272. Take care that only one node in the APPN network has a wildcard or *ANY in the Remote Location List entry. Because PS2ES1 will now hold the wildcard, we remove the *ANY entry in Figure 294 on page 272.

```

DEFINE_LOCAL_CP  FQ_CP_NAME(USIBMRA.PS2ES1  )  1
                DESCRIPTION(PS2ES1 - network node)
                CP_ALIAS(PS2ES1  )
                NAU_ADDRESS(INDEPENDENT_LU)
                NODE_TYPE(NN)                2
                NODE_ID(X'10025')
                HOST_FP_SUPPORT(NO);

DEFINE_LOGICAL_LINK  LINK_NAME(RALYAS4A)  3
                DESCRIPTION(LINK TO AS/400 A)
                ADJACENT_NODE_TYPE(NN)
                PREFERRED_NN_SERVER(NO)
                DLC_NAME(IBMTRNET)
                ADAPTER_NUMBER(0)
                DESTINATION_ADDRESS(X'400010020001')
                CP_CP_SESSION_SUPPORT(YES)
                ACTIVATE_AT_STARTUP(YES)
                LIMITED_RESOURCE(NO)
                LINK_STATION_ROLE(USE_ADAPTER_DEFINITION)
                SOLICIT_SSCP_SESSION(NO)
                EFFECTIVE_CAPACITY(USE_ADAPTER_DEFINITION)
                COST_PER_CONNECT_TIME(USE_ADAPTER_DEFINITION)
                COST_PER_BYTE(USE_ADAPTER_DEFINITION)
                SECURITY(USE_ADAPTER_DEFINITION)
                PROPAGATION_DELAY(USE_ADAPTER_DEFINITION)
                USER_DEFINED_1(USE_ADAPTER_DEFINITION)
                USER_DEFINED_2(USE_ADAPTER_DEFINITION)
                USER_DEFINED_3(USE_ADAPTER_DEFINITION);

DEFINE_LOGICAL_LINK  LINK_NAME(LINKVTAM)  4
                DESCRIPTION(Link to HOST - adjacent LEN)
                FQ_ADJACENT_CP_NAME(USIBMRA.RAP)  5
                ADJACENT_NODE_TYPE(LEN)  6
                DLC_NAME(SDLC  )
                ADAPTER_NUMBER(0)
                CP_CP_SESSION_SUPPORT(NO)  7
                ACTIVATE_AT_STARTUP(YES)
                LIMITED_RESOURCE(USE_ADAPTER_DEFINITION)
                LINK_STATION_ROLE(USE_ADAPTER_DEFINITION)
                SOLICIT_SSCP_SESSION(NO)
                EFFECTIVE_CAPACITY(USE_ADAPTER_DEFINITION)
                COST_PER_CONNECT_TIME(USE_ADAPTER_DEFINITION)
                COST_PER_BYTE(USE_ADAPTER_DEFINITION)
                SECURITY(USE_ADAPTER_DEFINITION)
                PROPAGATION_DELAY(USE_ADAPTER_DEFINITION)
                USER_DEFINED_1(USE_ADAPTER_DEFINITION)
                USER_DEFINED_2(USE_ADAPTER_DEFINITION)
                USER_DEFINED_3(USE_ADAPTER_DEFINITION);

```

Figure 353 (Part 1 of 2). .NDF File for PS2ES1 Acting as Gateway from CNET to the Subarea

```

DEFINE_PARTNER_LU  FQ_PARTNER_LU_NAME(USIBMRAA.RALYAS4A)
                    DESCRIPTION(PLU USIBMRAA.RALYAS4A)
                    PARTNER_LU_ALIAS(RALYAS4A)
                    MAX_MC_LL_SEND_SIZE(32767)
                    CONV_SECURITY_VERIFICATION(NO)
                    PARALLEL_SESSION_SUPPORT(YES);

DEFINE_PARTNER_LU  FQ_PARTNER_LU_NAME(USIBMRAB.RA9T1500)      8
                    DESCRIPTION(PLU USIBMRAA.RALYAS4B)
                    PARTNER_LU_ALIAS(RALYAS4B)
                    MAX_MC_LL_SEND_SIZE(32767)
                    CONV_SECURITY_VERIFICATION(NO)
                    PARALLEL_SESSION_SUPPORT(YES);

DEFINE_PARTNER_LU_LOCATION WILDCARD_ENTRY(FULL)              9
                    DESCRIPTION(WILD CARD - unknown LLUs sent to host)
                    FQ_OWNING_CP_NAME(USIBMRA.RAP)
                    LOCAL_NODE_NN_SERVER(YES);

DEFINE_MODE  MODE_NAME(QPCSUPP )
            COS_NAME(#CONNECT)
            DEFAULT_RU_SIZE(YES)
            RECEIVE_PACING_WINDOW(8)
            MAX_NEGOTIABLE_SESSION_LIMIT(32767)
            PLU_MODE_SESSION_LIMIT(32)
            MIN_CONWINNERS_SOURCE(0);

DEFINE_DEFAULTS  IMPLICIT_INBOUND_PLU_SUPPORT(NO)
                DESCRIPTION(Defaults)
                DEFAULT_MODE_NAME(BLANK)
                MAX_MC_LL_SEND_SIZE(32767)
                DIRECTORY_FOR_INBOUND_ATTACHES(*)
                DEFAULT_TP_OPERATION(NONQUEUED_AM_STARTED)
                DEFAULT_TP_PROGRAM_TYPE(BACKGROUND)
                DEFAULT_TP_CONV_SECURITY_RQD(NO)
                MAX_HELD_ALERTS(10);

START_ATTACH_MANAGER;

```

Figure 353 (Part 2 of 2). .NDF File for PS2ES1 Acting as Gateway from CNET to the Subarea

1 The local CP name is USIBMRAA.PS2ES1. Since we do not plan to have PS2ES1 as a destination LU, we need not define the LU name PS2ES1 at the host. As an OLU, PS2ES1 will be dynamically defined in VTAM.

2 The local CP is defined as a network node. PS2ES1 must be a network node; otherwise, it will not be able to route session requests from other nodes in its network. Moreover, it will not be able to route session requests from the host to appropriate nodes in its network.

3 Here we define a link to the adjacent network node, RALYAS4A, as this is a node for which we have a partner LU. We define only one link: to RALYAS4A. We, thus, rely on the other nodes, for example, CP31742, DOSCOAX and CP3174 to initiate the link with PS2ES1. Please refer to 5.2.1, "Customizing the 3174 for APPN" on page 167 for information on 3174 customization for APPN, if further

explanation of the 3174 configuration is required. Alternatively we could define links to each of the other nodes in USIBMRAA, but there seems little need to do this. These direct connections would entail the addition of a `DEFINE_LOGICAL_LINK` statement in the .NDF file or a link in the Communications Manager SNA connections. As Communications Manager supports the dynamic definition of links, if any node defines a link to PS2ES1 and there is not one in existence, PS2ES1 will create one.

4 Of course, the link to the host must be defined. The host's CP name and network ID are USIBMRA.RAP 5 as defined in the VTAM start list. The host is a LEN end node 6 and, therefore, cannot support CP-CP sessions 7 .

8 Notice that one of the partner LU names we use is the independent LU already defined in the host for RALYAS4B. Thus, we need no more LU definitions at the host for RALYAS4B unless we wish to specify other destination LUs.

The PS2ES1 CP is, with these partner LU definitions, capable of establishing its 5250 WSF session to RALYAS4B and RALYAS4A. No further definitions are required in order to establish these sessions.

9 The wildcard entry indicates that PS2ES1 holds the wildcard for the USIBMRAA network. It will route any session request for an unknown ILU up to USIBMRA.RAP. We must ensure that no other node in the network is also defined to hold the wildcard. We must, therefore, remove it from the RALYAS4A remote configuration list.

The links to each of the remote networks are in place and the gateways have appropriate definitions. We have re-configured the PS2ES1 Communications Manager definitions to take on the gateway role and given it the wildcard instead of RALYAS4A. Nothing else need be changed from our configurations where RALYAS4A took the gateway role.

However, as discussed in 7.2.6.1, "Network ID Considerations for LEN End Nodes" on page 284, it is not possible to establish a DOS 5250 WSF session from DOSCOAX to RALYAS4B via the subarea, when OS/2 Extended Services performs the gateway role. The only way to allow this session to be established is to make the net ID of USIBMRA (the APPN network on the other side of the subarea) the same as USIBMRAA (the APPN network on the same side of the subarea as the LEN end node). They may, in fact, be different from the net ID of the subarea. Please refer to 7.2.6.1, "Network ID Considerations for LEN End Nodes" on page 284 for more information.

7.4.2 OS/2 Communications Manager/2 Example

In the following section, we are going to show the PS/2 OS/2 gateway running the Communications Manager/2. The two examples have the same functions but use a different configuration technique.

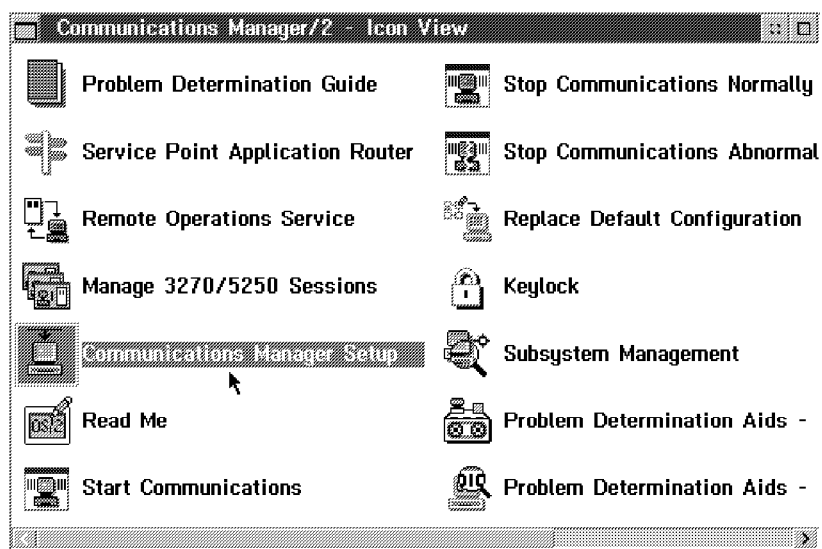


Figure 354. Communications Manager/2 - Icon View

To configure the CM/2 gateway and the network node functions, from the Communications Manager/2 window:

- Click on **Communications Manager Setup**



Figure 355. Communications Manager Setup

From the **Communications Manager/2 Setup** window:

- Click on **Setup**

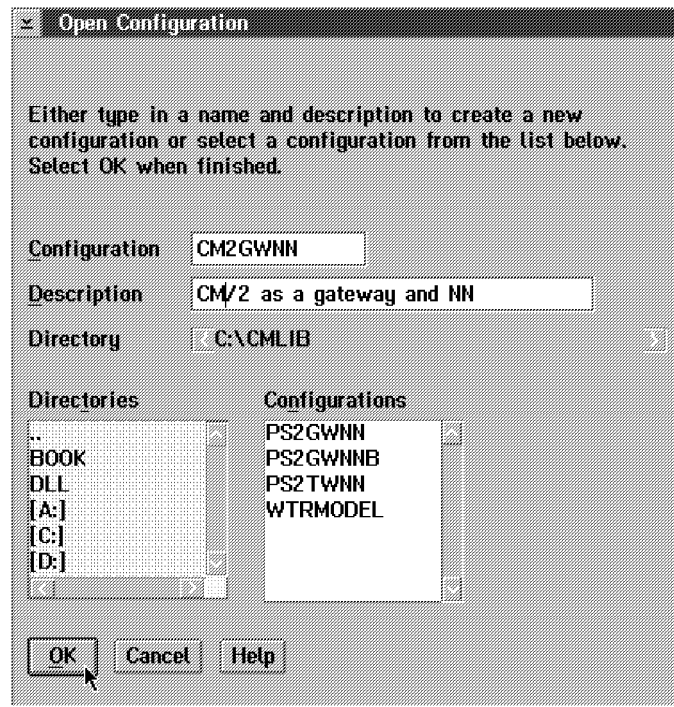


Figure 356. Open Configuration window

From the **Open Configuration** window:

- Type a new Configuration name, a Description, and
- Click on **OK**

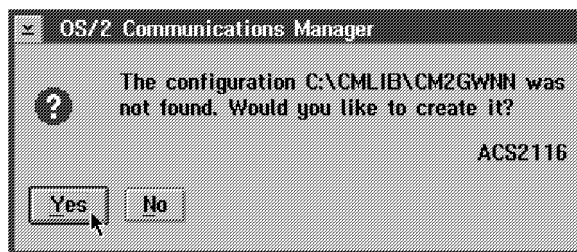


Figure 357. OS/2 Communications Manager

From the **OS/2 Communications Manager** window:

- Confirm that you want to create a new configuration by
- Clicking on **YES**

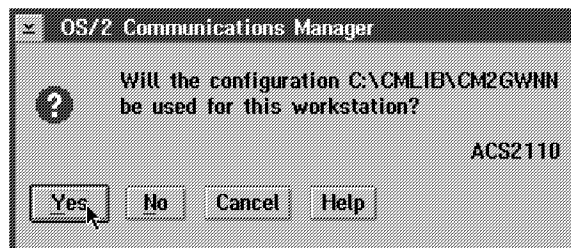


Figure 358. OS/2 Communications Manager

From the **OS/2 Communications Manager** window:

- Confirm that your configuration will be used for this WS by
- Clicking on **YES**

7.4.2.1 Dependent LUs Definition

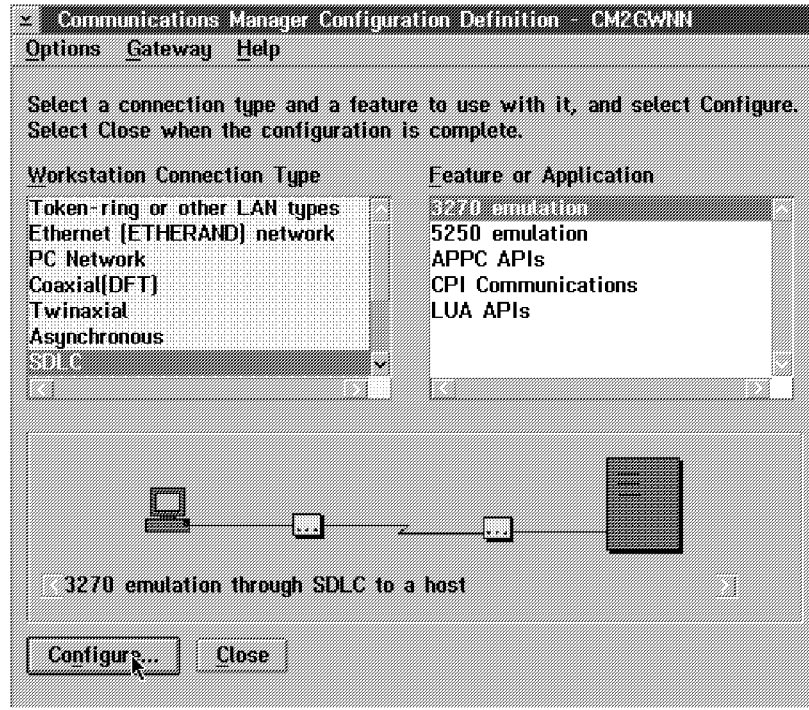


Figure 359. Communications Manager Configuration Definition

From the **OS/2 Communications Manager Configuration Definition** window:

- Select **SDLC**
- Select **3270 emulation**, and
- Click on **Configure**

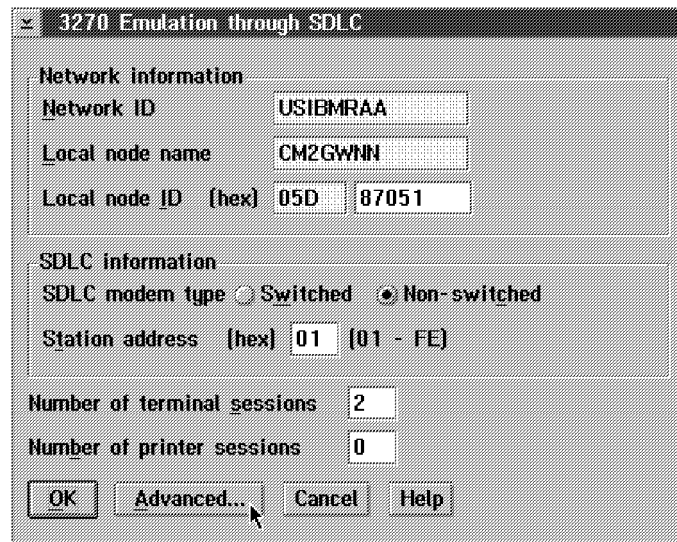


Figure 360. 3270 Emulation Through SDLC

From the **3270 Emulation Through SDLC** window:

- Type in the **Network ID**
- Type in the **Local node name**
- Type in the **Local node ID**
- Select **Non-switched**
- Type in the **Station address**
- Type in the **Number of terminal sessions** you want to configure
- Type in the **Number of printer sessions** you want to configure, and
- Click on **OK**

With the previous definition, we defined the CM/2 as a end node. For our example, we need to define the CM/2 as a network node. Figure 361 to Figure 362 on page 327 show how to modify the node definition.

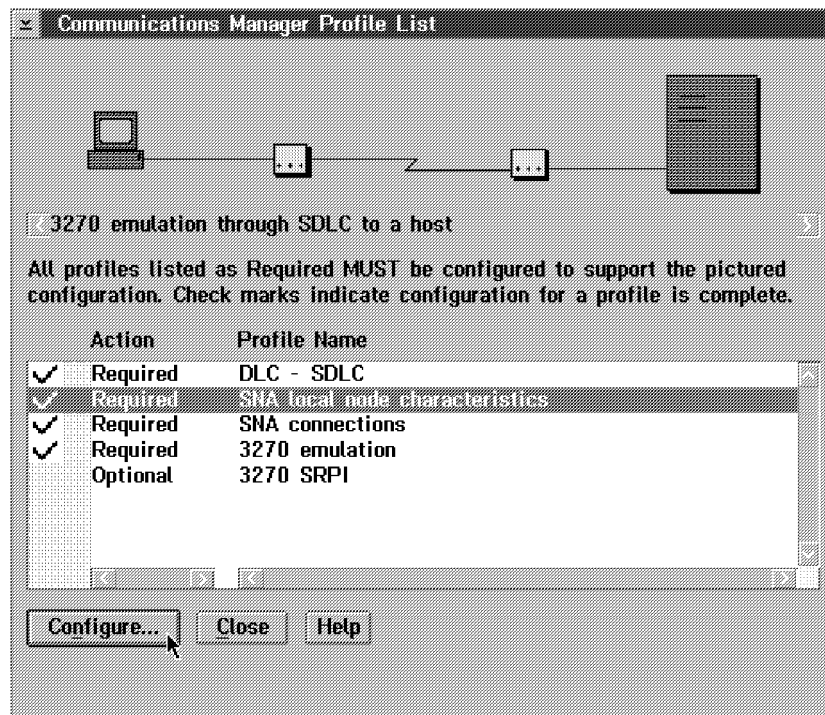


Figure 361. Communications Manager Profile List

From the **OS/2 Communications Manager Profile List** window:

- Select **SNA local node characteristics**, and
- Click on **Configure**

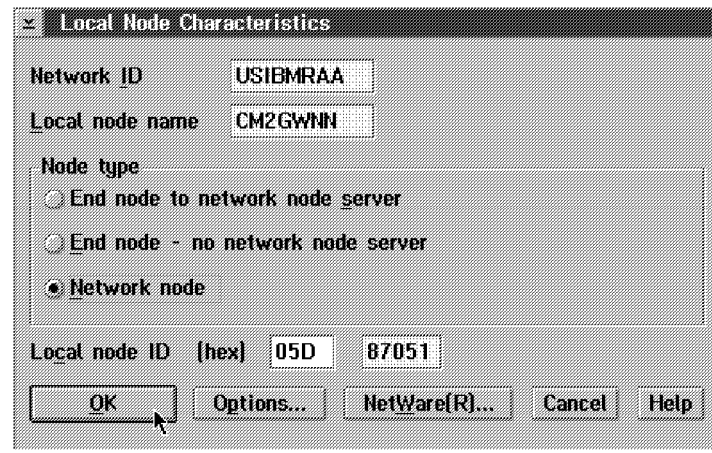


Figure 362. Local Node Characteristics

From the **Local Node Characteristics** window:

- Select **Network node**, and
- Click on **OK**

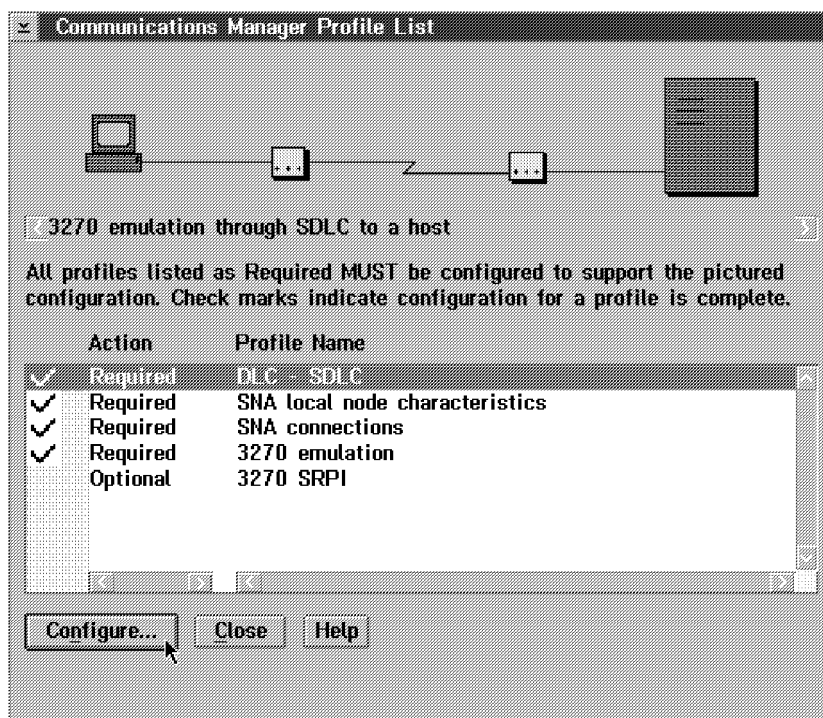


Figure 363. Communication Manager Profile List

To check the SDLC definitions, from the **Communications Manager Profile List** window:

- Select **DLC - SDLC**, and
- Click on **Configure**

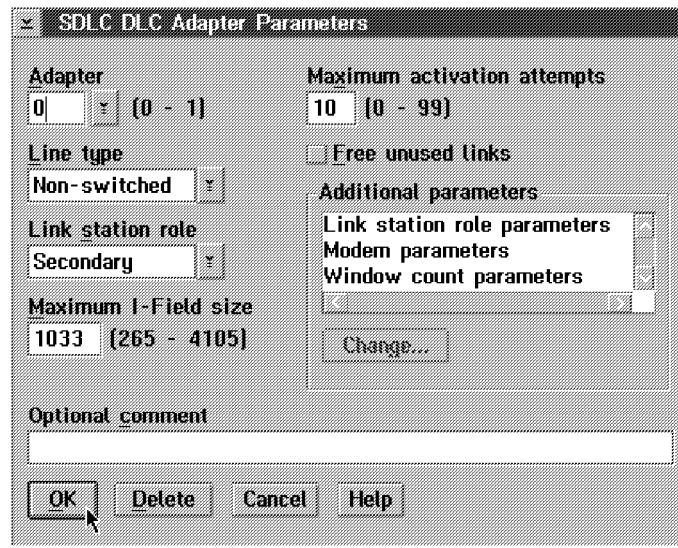


Figure 364. SDLC DLC Adapter Parameters

From the **SDLC DLC Adapter Parameters** window:

- Unselect **Free unused links**, and
- Click on **OK**

7.4.2.2 Independent LUs Definition

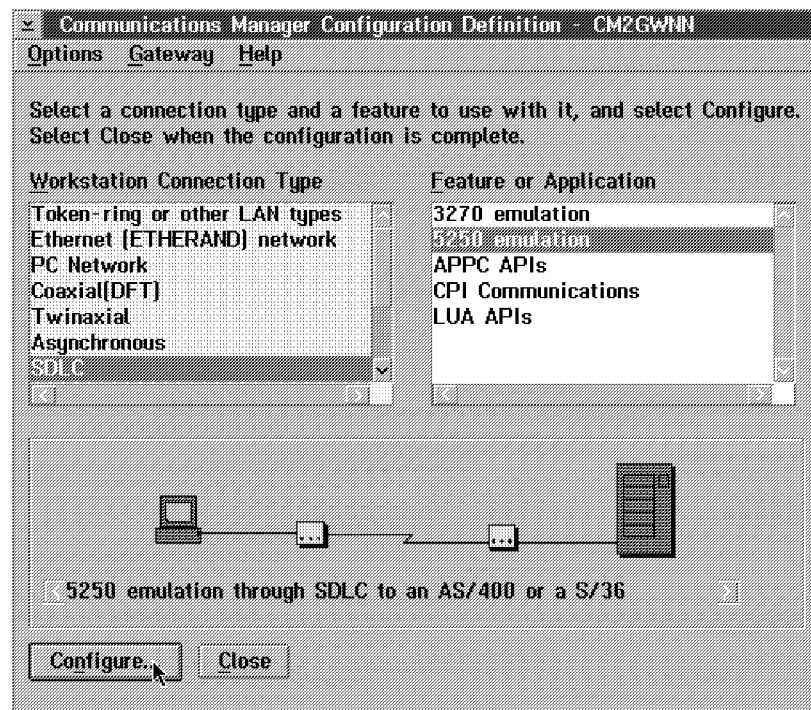


Figure 365. Communications Manager Configuration Definition - CM2GWNN

From the **OS/2 Communications Manager Configuration Definition** window:

- Select **SDLC**
- Select **5250 emulation**, and

- Select **Configure**

5250 Emulation through SDLC

Network information

Network ID: USIBMRAA

Local node name: CM2GWNN

Local node ID (hex): 05D 87051

5250 information

Partner LU name: USIBMRAA.RALYAS4B

Mode name: QPCSUPP

Host type information: ☒ AS/400 ☐ S/36

SDLC information

SDLC modem type: ☐ Switched ☒ Non-switched

Station address (hex): 01 (01 - FE)

Number of terminal sessions: 2

Number of printer sessions: 0

OK Advanced... Cancel Help

Figure 366. 5250 Emulation through SDLC

From the **5250 Emulation Through SDLC** window:

- Type in the **Partner LU name**
- Type in the **Mode name** used for the sessions
- Type in the **Number of terminal sessions** you want to configure
- Type in the **Number of printer sessions** you want to configure, and
- Select **OK**

Remember that the Network ID, Local node name, Local node ID, SDLC modem type, and the station address have already been defined in the 3270 emulation definition step.

7.4.2.3 Dependent LU Definitions for Downstream Devices

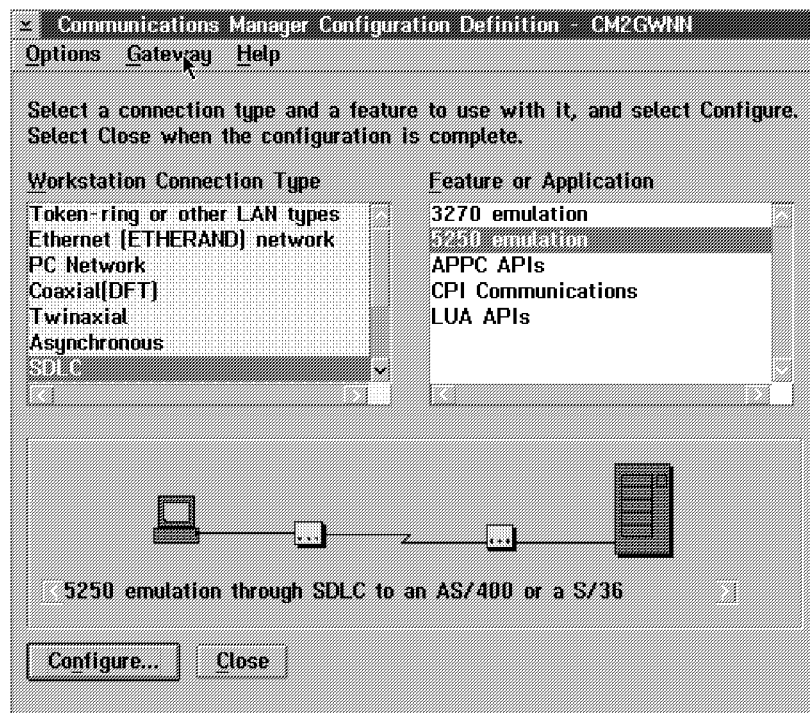


Figure 367. Communications Manager Configuration Definition - CM2GWNN

From the **Communication Manager Configuration Definition** window:

- Click on **Gateway**

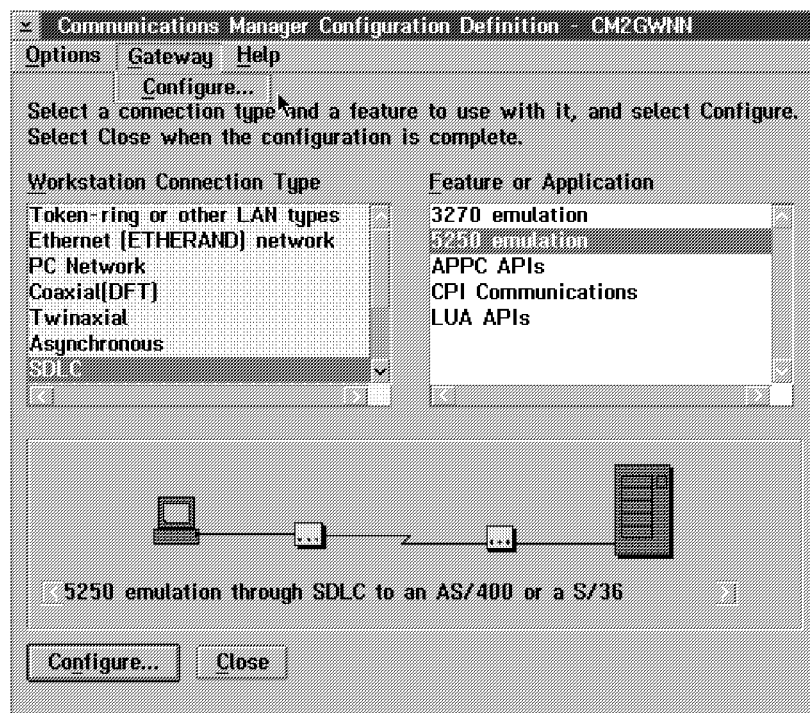


Figure 368. Communications Manager Configuration Definition - CM2GWNN

From the **Communication Manager Configuration Definition** window:

- Click on **Configure**

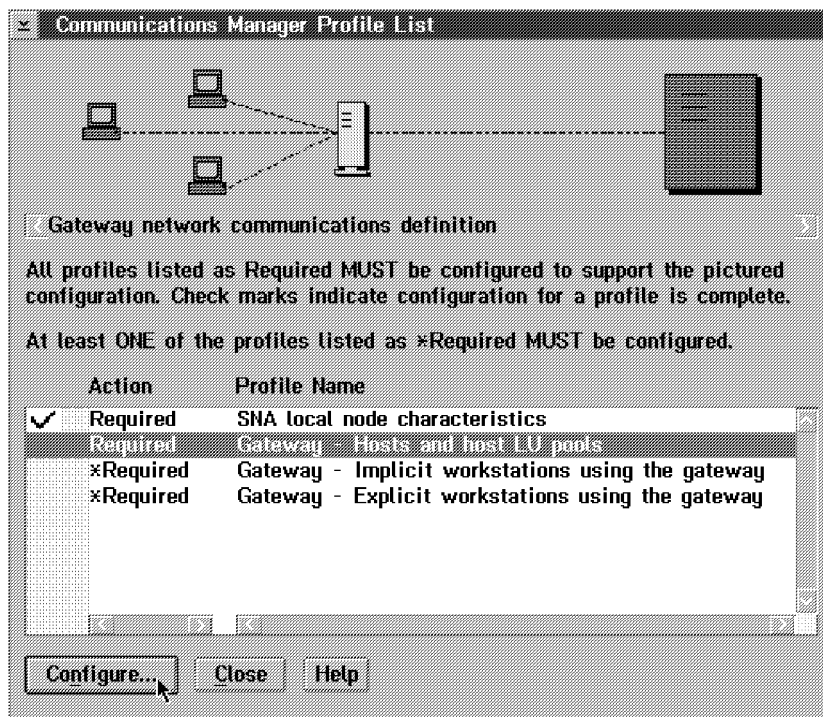


Figure 369. Communications Manager Profile List

From the **Communication Manager Profile List** window:

- Check the Host link out by selecting **Gateway and Host LU pools**, and
- Click on **Configure**

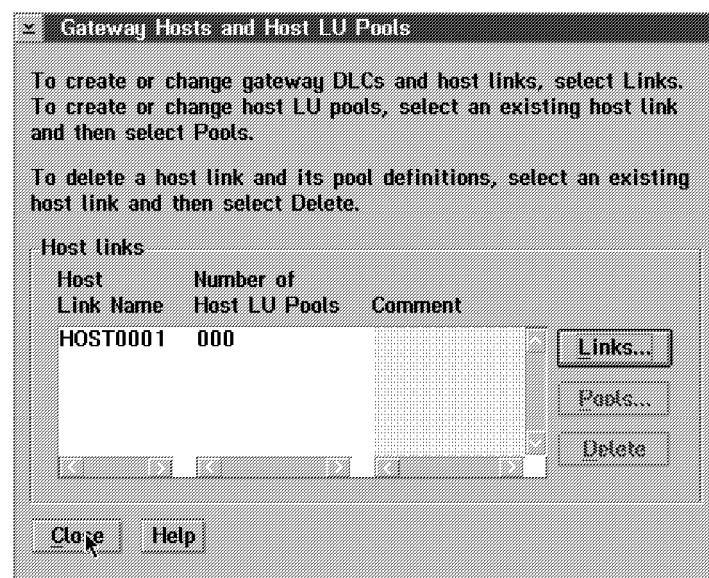


Figure 370. Gateway Hosts and Host LU Pools

Remember that the Host link has been defined during the 3270 emulation definition, so to leave this window:

- Click on **Close**

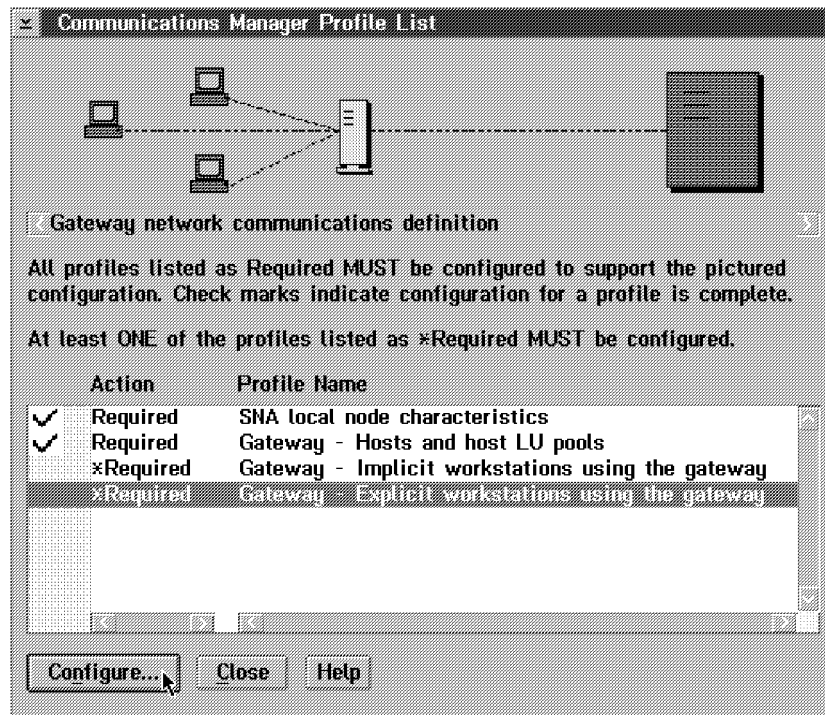


Figure 371. Communications Manager Profile List

Now to define the downstream LUs, using the gateway, from the **Communication Manager Profile List** window:

- Select **Gateway - Explicit workstations using the gateway**, and
- Click on **Configure**

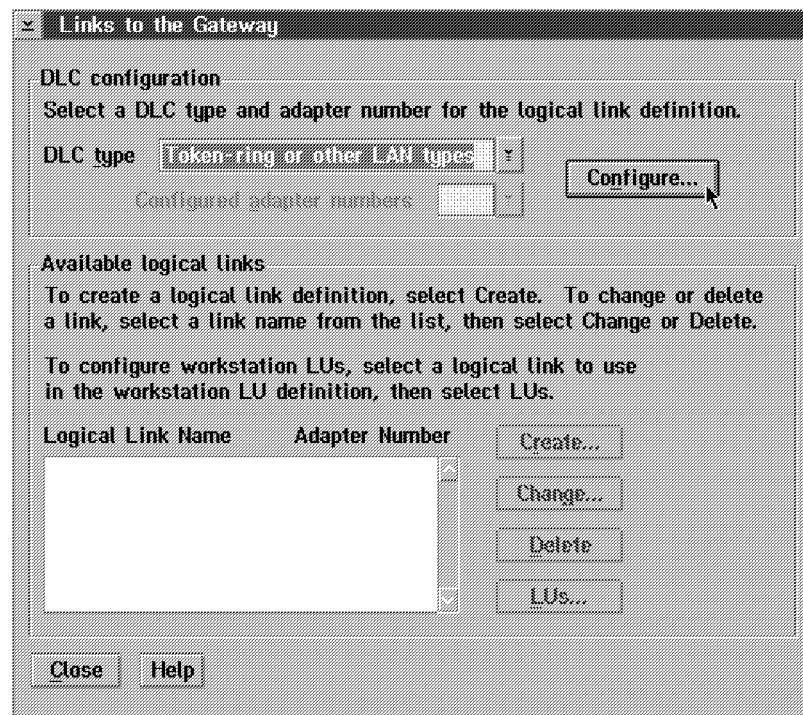


Figure 372. Links to the Gateway

From the **Links to the Gateway** window:

- Select the DLC type **Token-Ring or other LAN Types**, and
- Click on **Configure**

Token Ring or Other LAN Types DLC Adapter Parameters

Adapter

☐ Free unused links

☐ Send alert for beaconing

Window count

Send window count [1 - 8]

Receive window count [1 - 8]

Maximum link stations [1 - 255]

Maximum activation attempts [0 - 99]

Maximum I-field size [265 - 16393]

Percent of incoming calls [%] [0 - 100]

Link establishment retransmission count [1 - 127]

Retransmission threshold [1 - 127]

Local sap (hex) [04 - 9C]

C&SM LAN ID

Connection network name (optional)

Figure 373. Token-Ring or Other Types DLC Adapter Parameters

- Change the required values, and
- Click on **OK**

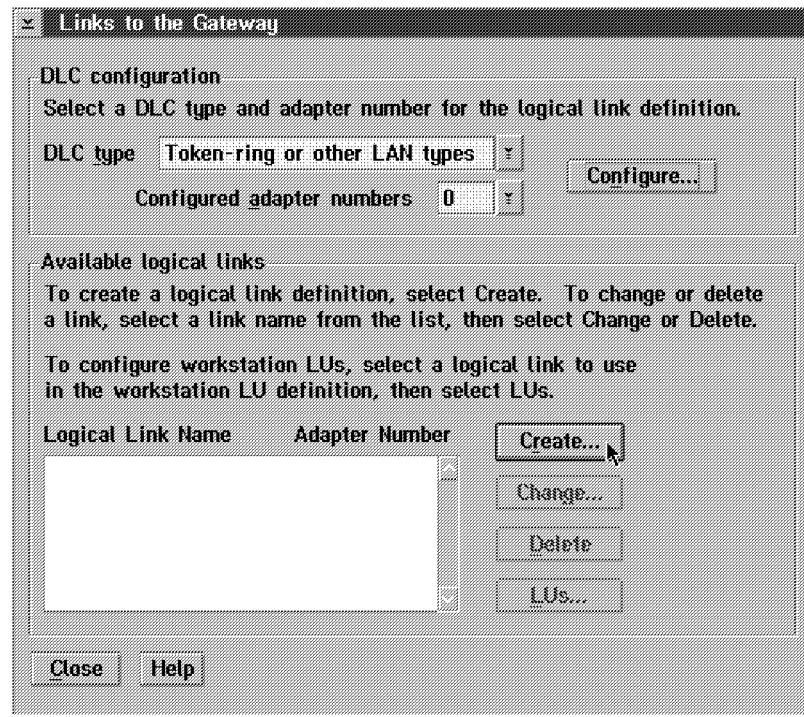


Figure 374. Links to the Gateway

From the **Links to the Gateway** window:

- Click on **Create** to define a new link to a downstream workstation

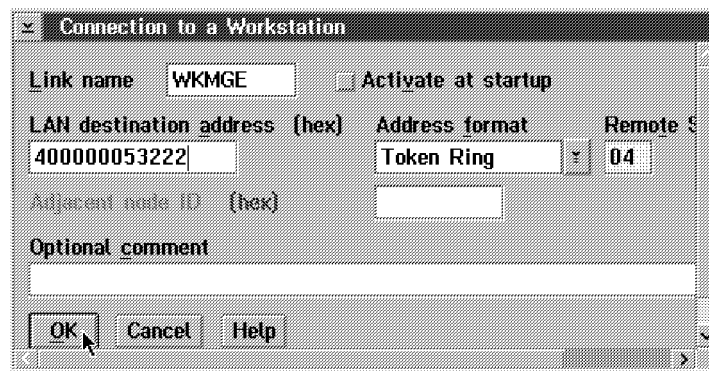


Figure 375. Connection to a Workstation

From the **Connection to a Workstation** window:

- Enter a **Link Name**
- Enter a **LAN destination address**, and
- Click on **OK**

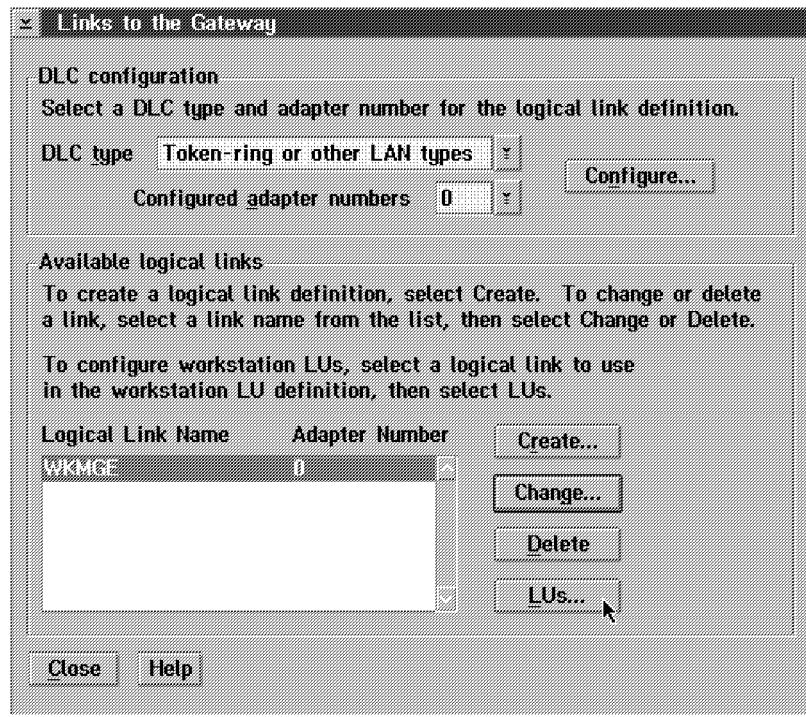


Figure 376. Links to the Gateway

From the **Links to the Gateway** window:

- Select the Logical Link Name **WKMGE**, and
- Click on **LUs..** to add LUs to the downstream link.

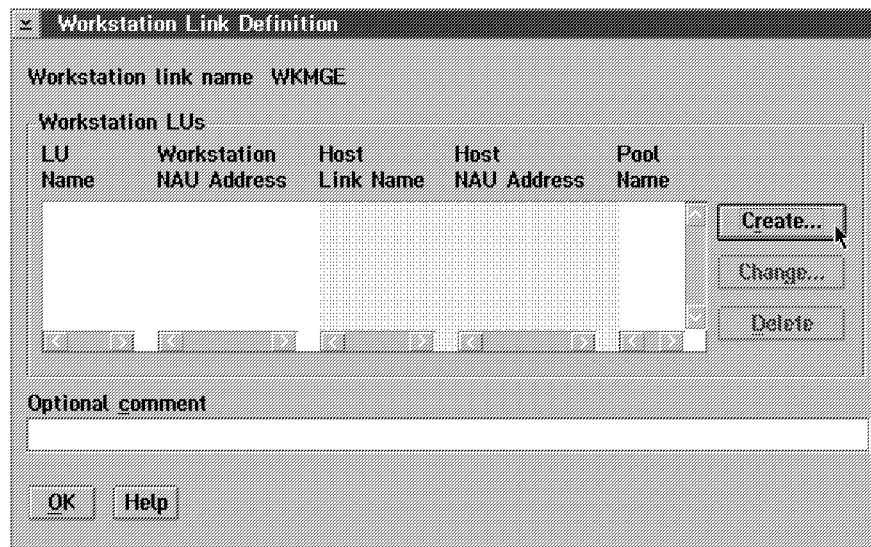
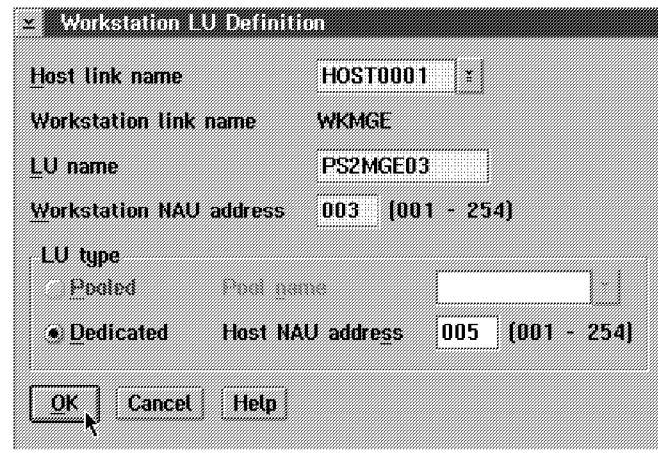


Figure 377. Workstation Link Definition

From the **Workstation Link Definition** window:

- Click on **Create**



Workstation LU Definition

Host link name: HOST0001

Workstation link name: WKMGE

LU name: PS2MGE03

Workstation NAU address: 003 (001 - 254)

LU type:

☐ Pooled Pool name:

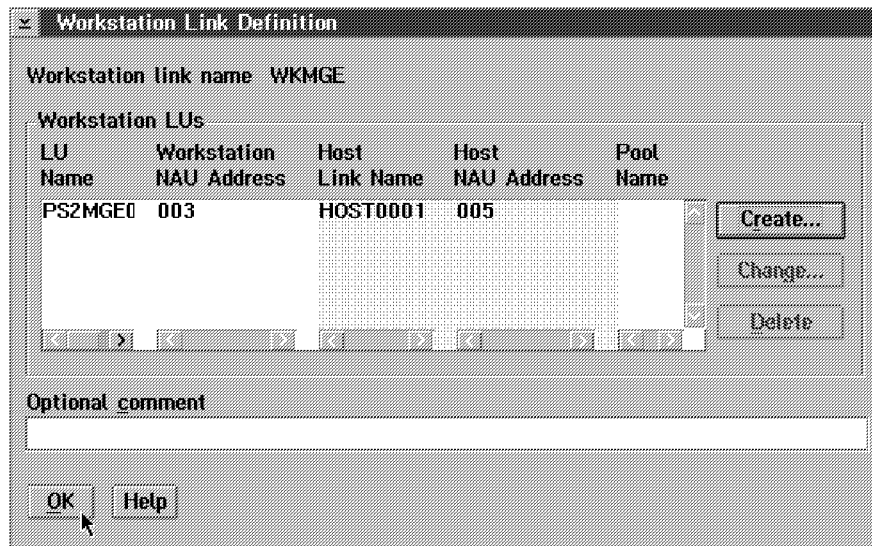
☒ Dedicated Host NAU address: 005 (001 - 254)

OK Cancel Help

Figure 378. Workstation LU Definition

From the **Workstation LU Definition** window:

- Enter a **LU name**
- Enter a **Workstation NAU address** (Downstream LU address)
- Select **Dedicated**
- Enter a **Host NAU address** (NCP LU address)
- Click on **OK**



Workstation Link Definition

Workstation link name: WKMGE

LU Name	Workstation NAU Address	Host Link Name	Host NAU Address	Pool Name
PS2MGE0	003	HOST0001	005	

Create... Change... Delete

Optional comment

OK Help

Figure 379. Workstation Link Definition

From the **Workstation Link Definition** window:

- Click on **OK** to go back to the previous window

7.4.2.4 Gateway Definition for the Downstream AS/400

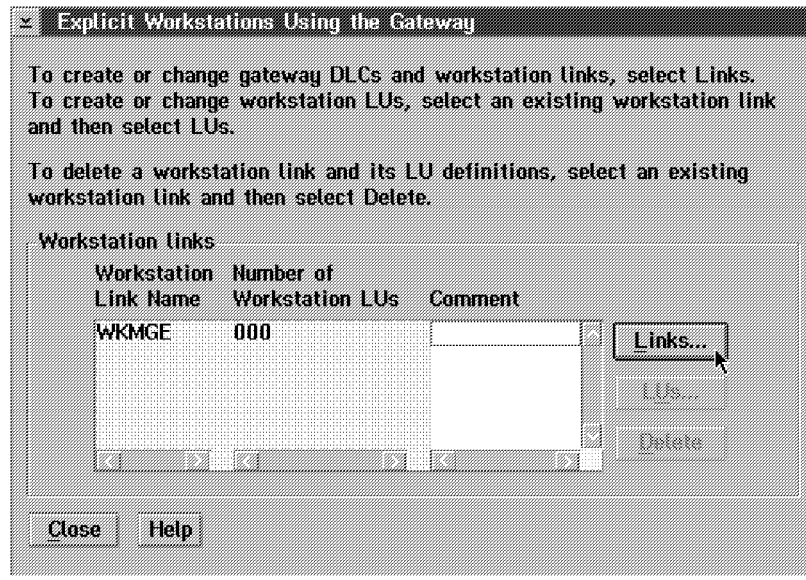


Figure 380. Explicit Workstations Using the Gateway

From the **Explicit Workstations Using the gateway** window:

- Click on **Link**

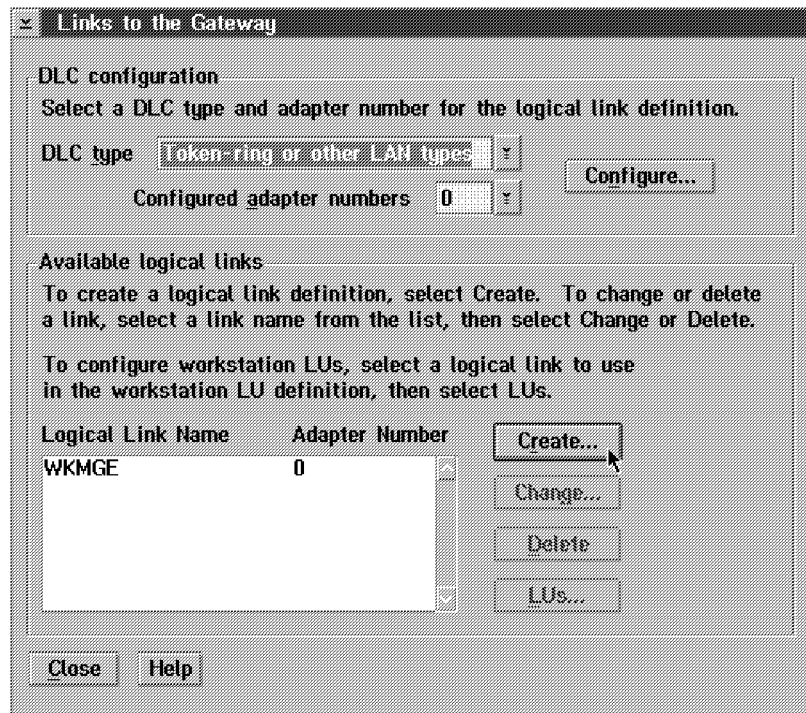


Figure 381. Links to the Gateway

From the **Links to the Gateway** window:

- Click on **Create** to define a new link to a downstream workstation

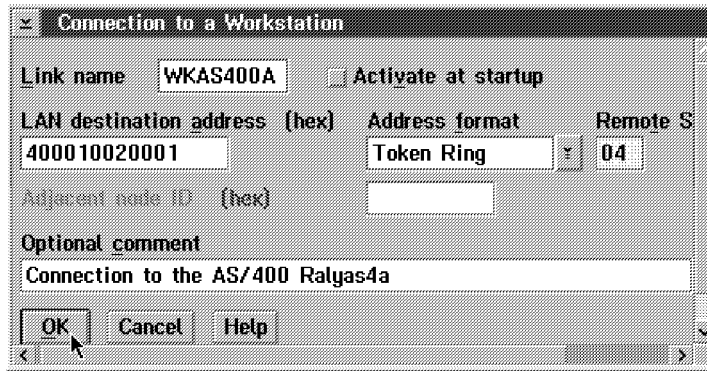


Figure 382. Connection to a Workstation

From the **Connection to a Workstation** window:

- Enter a **Link Name**
- Enter a **LAN destination address**, and
- Click on **OK**

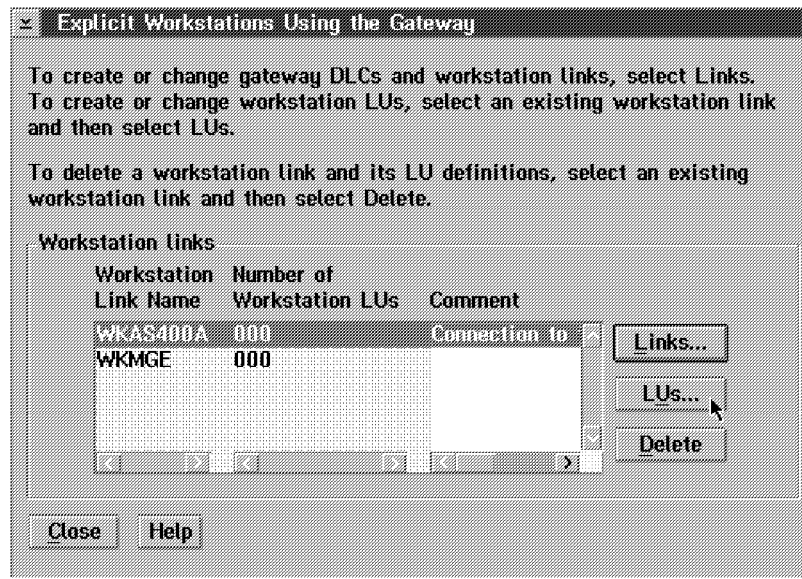


Figure 383. Explicit Workstations Using the Gateway

From the **Explicit Workstations Using the Gateway** window:

- Select the Workstation Link Name **WKMGE**, and
- Click on **LUs..** to add LUs to the downstream link.

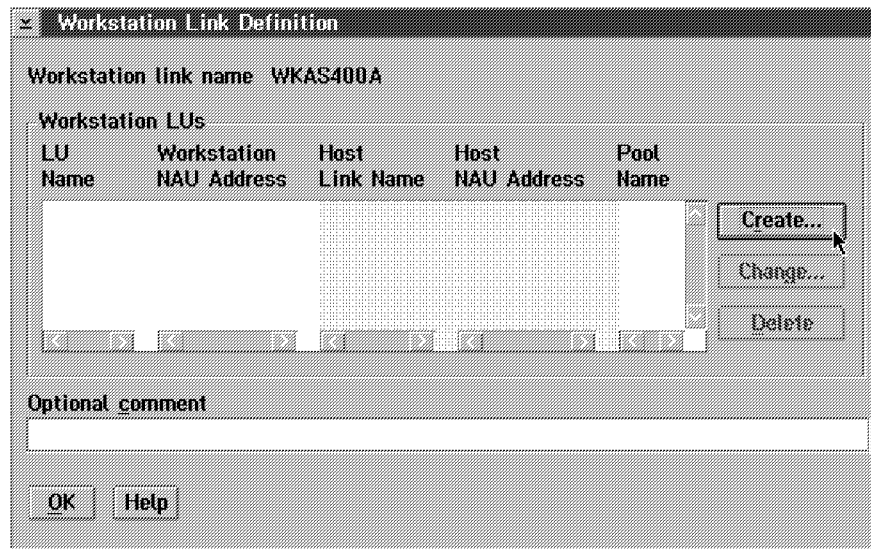


Figure 384. Workstation Link Definition

From the **Workstation Link Definition** window:

- Click on **Create** to define a new link to a downstream workstation

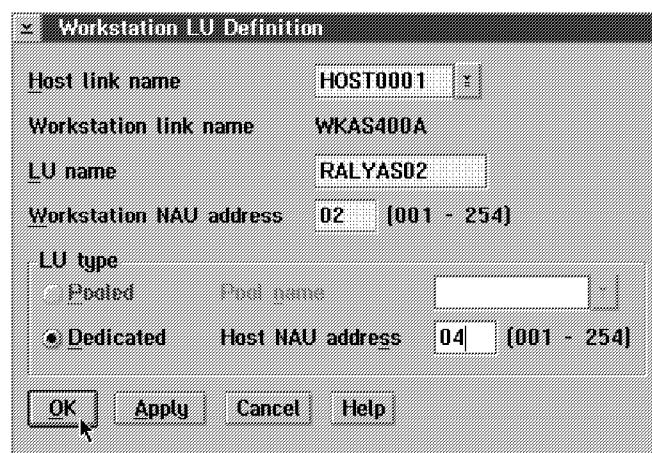


Figure 385. Workstation LU Definitions

From the **Workstation LU Definition** window:

- Enter a **LU name**
- Enter a **Workstation NAU address** (Downstream LU address)
- Select **Dedicated**
- Enter a **Host NAU address** (NCP LU address)
- Click on **OK**

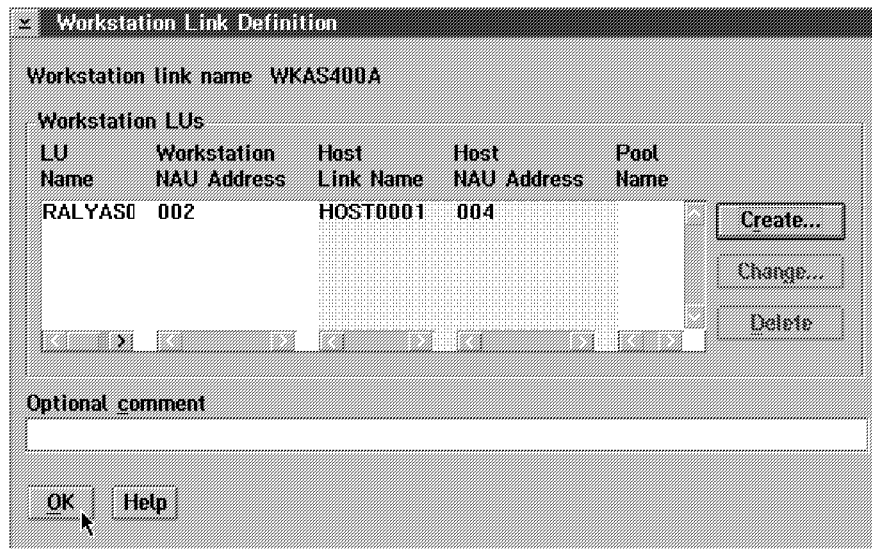


Figure 386. Workstation Link Definition

From the **Workstation Link Definition** window:

- Click on **OK** to go back to the previous window

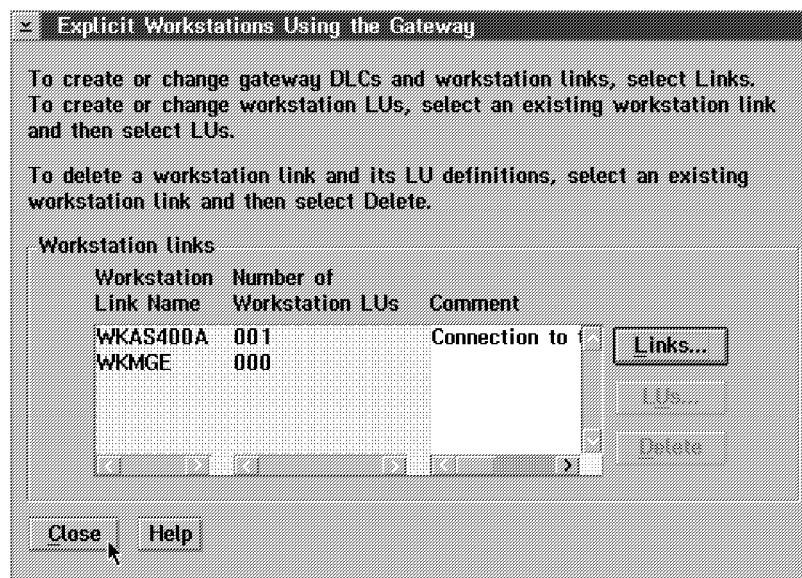


Figure 387. Explicit Workstations Using the Gateway

- Click on **Close** until you exit the CM/2 setup program.

7.4.3 RISC/6000 Sessions

In this section we connect the RISC/6000 to a PS/2 network node which has a LEN connection to our host system. We then use this connection to make contact with RALYAS4B. Please refer to Figure 388 for an overview of this scenario.

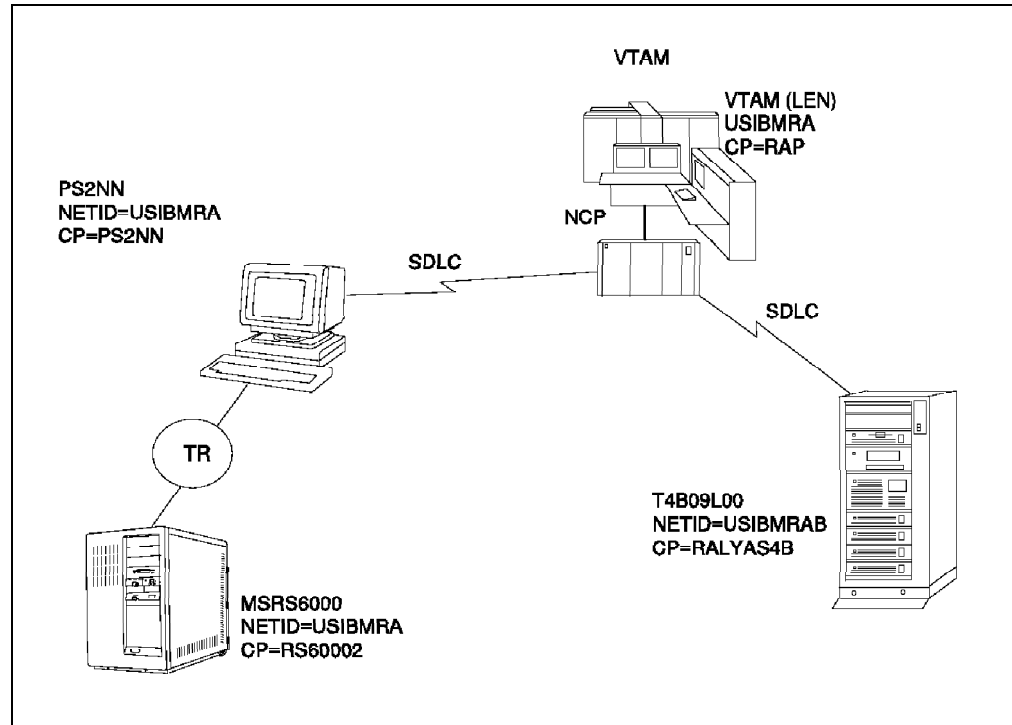


Figure 388. RISC/6000 to AS/400 via PS/2 and VTAM

7.4.3.1 RISC/6000 Configuration

We took the SMYTH configuration created in Chapter 6, "The RISC System/6000" on page 213 (Figure 233 on page 216 through Figure 242 on page 222), and altered the following items:

- Token-ring attachment profile. Link address changed to 400030010025, the PS2NN's token-ring address.
- Control point and Local LU Profiles. Network name changed to USIBMRA.
- Control Point Profile. CP name changed to RS60002.
- Local LU Profile. Local LU name changed to RS60002.

We then created a Logical Connection for AS/400 B.

Change / Show SNA LU6.2 Logical Connection Profile	
Type or select values in entry fields. Press Enter AFTER making all desired changes.	
[TOP]	[Entry
Fields]	
CURRENT profile name	SMYTHB
NEW PROFILE name	[]
ATTACHMENT profile name	[SMYTH]
LOCAL LU profile name	[SMYTH]
NETWORK name	[USIBMRAB]
STOP CONNECTION on inactivity?	no
If yes, TIMEOUT (0-10 minutes)	[0]
REMOTE LU name	[T4B09L00]
SECURITY Accepted	none
If conversation or already_verified,	
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]
(If no name entered, /etc/passwd used)	
REMOTE TPN LIST profile name	[RDEFAULT]
MODE LIST profile name	[QPCSUPP]
INTERFACE type	extended
If extended, SESSION CONCURRENCY	parallel
Node VERIFICATION?	no
[BOTTOM]	
F1=Help	F2=Refresh
F5=Undo	F6=Command
F9=Shell	F10=Exit
F3=Cancel	F7=Edit
	F8=Image
	Enter=Do

Figure 389. LU6.2 Logical Connection Profile

On the PS/2 we add a new link for the RISC/6000.

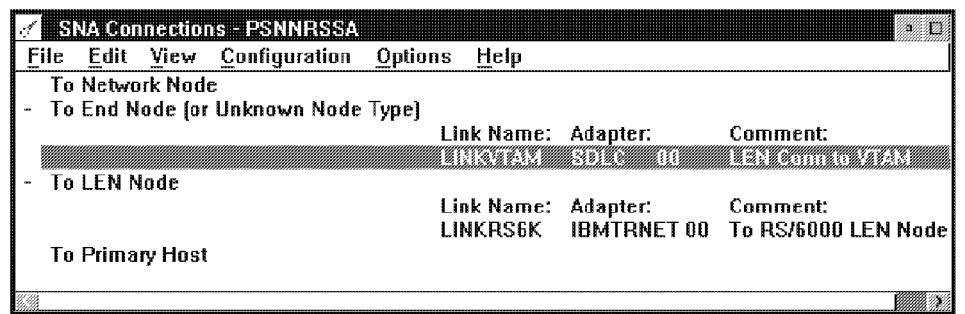


Figure 390. The Links to VTAM and RISC/6000. For more information on Communications Manager configuration refer to Chapter 2, "AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network" on page 5.

As the connection to VTAM did not use CP-CP sessions, we had to manually edit the .NDF file for this configuration in order to add a wildcard entry which would send all unknown BIND requests to the host. Please refer to Chapter 2, "AS/400s, PS/2s with Communications Manager and DOS PCs with PC Support/400 in a Branch Network" on page 5 for more details on editing the .NDF file. We added the following statements:


```

DEFINE_PARTNER_LU_LOCATION WILDCARD_ENTRY(FULL)
      DESCRIPTION(WILDCARD - ALL UNKNOWN ILUS TO RAP)
      FQ_OWNING_CP_NAME(USIBMRA.RAP)
      LOCAL_NODE_NN_SERVER(NO)

```

Figure 391. .NDF File Wildcard Entry

7.4.3.2 Host Configuration

For the AS/400 connection we used the line, RA9L015, and PU, RA9P015.

```

RA9L015  LINE ADDRESS=(015,HALF),  HDX LEASED LINE          *
      ANS=CONTINUE,          DON'T BREAK CROSS DOMAIN SESSIONS *
      NPACOLL=YES,                                     *
      ISTATUS=ACTIVE,                                     *
      CLOCKNG=EXT,          MODEM CLOCKING                *
      DUPLEX=(FULL),          REQUEST TO SEND ALWAYS UP    *
      MAXPU=9,          ALLOW NO MORE THAN 9 PUS ON LINE   *
      SERVLIM=10,                                     *
      SPEED=9600,          NPA AND SCANNER USE          ##### *
      SRT=(, 64)
*      NGFTXT='AS/400/B'

```

Figure 392. Host Line to AS/400 B

```

RA9P015  PU  ADDR=01,                                     *
      DATMODE=FULL,                                     *
      PUTYPE=2,                                         *
      CONNTYPE=LEN,                                     *
      XID=YES
*      STATOPT='LEN CONNECTION TO PS/2'
      ADD TO=RA9P015
T4B09L00 LU  RESSCB=4,                                     *
      MODETAB=MTGS3X,                                     *
      LOCADDR=0
*      STATOPT='INDEPENDENT LU'

```

Figure 393. Host PU and LU Definition for RALYAS4B Connection

Note that here we create an independent LU for RALYAS4B.

The connection to the PS/2 used the line, RA9L005, and PU, RA9P05 as follows:

```

RA9L005  LINE ADDRESS=(005,HALF),  HDX LEASED LINE
          ANS=CONTINUE,             DON'T BREAK CROSS DOMAIN SESSIONS
          NPACOLL=YES,
          ISTATUS=ACTIVE,
          CLOCKNG=EXT,              MODEM PROVIDES THE CLOCKING #####
          DUPLEX=(FULL),            REQUEST TO SEND ALWAYS UP
          MAXPU=9,                  ALLOW NO MORE THAN 9 PUS ON LINE
          SERVLIM=10,
          SPEED=9600,               NPA AND SCANNER USE #####
          SRT=(, 64)
*          NGFTXT='AS/400/A'

```

Figure 394. Host Line to PS/2

```

RA9P05   PU  ADDR=01,
          DATMODE=FULL,
          PUTYPE=2,
          CONNTYPE=LEN,
          XID=YES
*          STATOPT='CONNECTION TO PS/2'

```

Figure 395. Host PU for PS/2

7.4.3.3 AS/400 Configuration

Minimal configuration was necessary on the target AS/400. We used the line, RA9L015, and controller, RA9P015, described previously in Figure 276 on page 257 and Figure 278 on page 259. We did, however, have to add a Local Location List entry for the LU name that the RISC/6000 was trying to reach.

```

                                Display Configuration List

Configuration list . . . . . : QAPPNLCL
Configuration list type . . . . : *APPNLCL
Text . . . . . :

-----APPN Local Locations-----
Local
Location Text
AS4B      Alias for L31TR
RA9T1500  Alias for RA6L0135
T4B09L00  Alias for RA9L015

```

Figure 396. Local Location List on AS/400 B

7.4.3.4 Activating the Link

We varied on the host lines and PUs and the AS/400 line and controller. Next we started Communications Manager on the PS/2. The link was established to the host as follows:

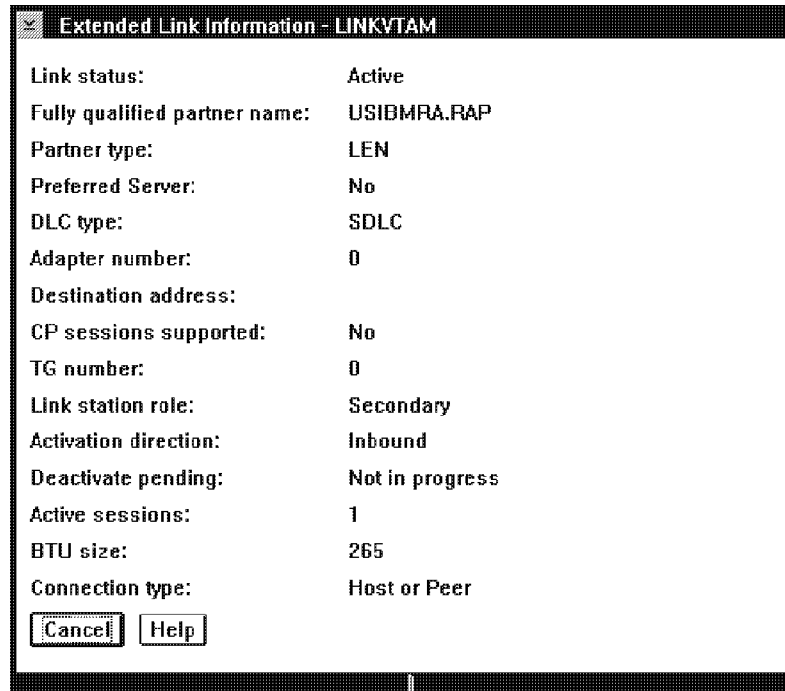


Figure 397. Characteristics of the PS/2 Host Link When Activated

Next, we started the RISC/6000s SNA subsystem and started the SMYTH attachment. XIDs were exchanged between the PS/2 and RISC/6000 and the link became active.

SNA Logical Link Management					
Display Change status Options Help					
Partner					
Link Name	Network ID	Partner Name	Partner Type	Active Sessions	Link Status
LINKR66K	USIBMRA	MSR6000	LEN	0	Active
LINKVTAM	USIBMRA	RAP	LEN	2	Active

Figure 398. Status of the Links on the PS/2 after Activating the RISC/6000

We, then, started the RISC/6000 connection profile SMYTHB, causing a BIND to be sent to the PS/2. The PS/2 forwarded this BIND to the host, where a dynamic LU was created for RS60002.

```

DISPLAY NET,ID=RS60002,SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = USIBMRA.RS60002 , TYPE = CDRSC
STATUS= ACT/S----Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=SNASVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = RA9P05
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000001, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P05
NAME      STATUS      SID      SEND RECV VR TP NETID
T4B09L00 ACTIV-S      C81F5D05EF53076E      USIBMRAB
END

```

Figure 399. Dynamic LU Created for RS60002

The AS/400, receiving the BIND, created an APPC device on the host controller, and the link became active.

Display Device Description	
Device description	RS6000200
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	RS60002
Online at IPL	*NO
Local location	T4B09L00
Remote network identifier	USIBMRA
Attached controller	RA9P015
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 400. APPC Device Autocreated on AS/400 Host Controller

7.5 3174 as Gateway from a Branch Network to a Subarea Network

The third alternative that is considered for our remote network, USIBMRAA, is with a 3174 acting as gateway to the subarea. In this example, CP3174 has the direct link to the subarea.

Following from the previous section, the key question in this section is whether LUs in the AS/400, PS/2 and 3174 nodes can *simultaneously*:

1. Use the APPN function in the 3174 in order to route *independent* session traffic through the subarea to USIBMRAB. For example, DSPT, ODF, PC Support/400 or any other APPC application.
2. Use the 3174 gateway function to route *dependent* traffic to the host. In this case, 3270 emulation is the dependent traffic tested.

In this section, however, we deviate slightly from our stated scenario. Instead of using an SDLC line to connect our 3174, we use a channel attachment.

The concepts are identical for the two cases. The only difference lies in the fact that a VTAM local major node definition is required and no NCP definitions are required.

The intention in using the channel-attached 3174 is to illustrate a different perspective for attachment of an APPN network to the host. In particular, it need not be via a 3725 or 3745, but may, in fact, be via a local 3174. USIBMRAA in this scenario may still be considered as a remote branch. The concepts do not change. However, instead of the NCP definitions, we include the VTAM local major node definitions.

We examine this alternative by considering the sessions described in the following diagram:

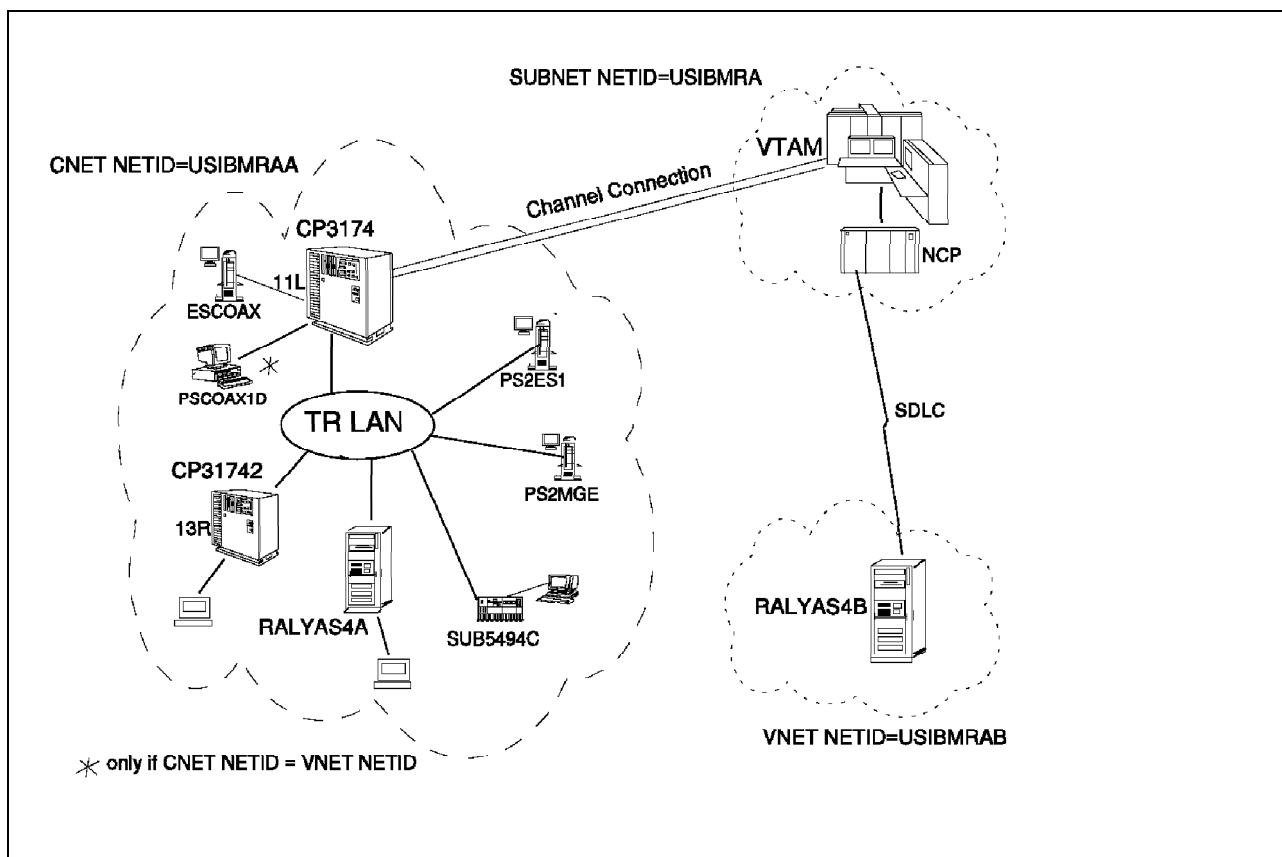


Figure 401. The Communications Environment Established in This Section

With a 3174 acting as a gateway from our now local CNET network to the subarea, sessions are established and configuration requirements examined for each node, in turn, as follows:

- RALYAS4A
 1. 3270 emulation to host
 2. Display Station Pass-Through (DSPT) to RALYAS4B
- CP31742
 1. 3270 session to host
 2. CP-CP sessions to CP3174
- PS2ES1
 1. 3270 emulation to host
 2. 5250 WSF to RALYAS4A and RALYAS4B
- CP3174
 1. 3270 session to host
 2. Coax-connected PC running DOS 5250 WSF to RALYAS4A and RALYAS4B

In this section, we no longer maintain the separation of configuration for dependent and independent communications. We, thus, show configurations for all sessions established, dependent and independent, on a node-by-node basis.

7.5.1 Host Definitions

At the host, definitions are required for the 3174 and for the RALYAS4B. The RALYAS4B is connected directly via an SDLC leased line as previously. Please see Figure 279 on page 260 for the NCP major node definition of the RALYAS4B PU and LUs. The GROUP and LINE definitions for RALYAS4B may be found in Figure 271 on page 253 and Figure 277 on page 258, respectively.

As mentioned previously, since the 3174 is connected by channel directly to VTAM, there is no NCP major node definition required. Rather, a local major node is required for the 3174. Please see Figure 402 on page 349.

* -----			
* LOCAL 3174-11L DEFINITIONS FOR TYPE 2.1		4/14/92	*
* -----			
LOC1121 VBUILD TYPE=LOCAL			
RAPPE40	PU	CUADDR=E40, PUTYPE=2, MAXBFRU=10,	*
1		MODETAB=AMODETAB, DLOGMOD=M2SDLCQ, USSTAB=US327X,	*
		XID=YES, DYNLU=YES, CONNTYPE=LEN,	*
		VPACING=0, LUGROUP=GROUP1, LUSEED=RAPT40##	
* -----			
RAPT4002	LU	LOCADDR=2	
RAPT4003	LU	LOCADDR=3	
RAPT4004	LU	LOCADDR=4	
* -----			
* DEFINITIONS FOR CP31742 DOWNSTREAM			*
* -----			
RAPPE41	PU	CUADDR=E41, ISTATUS=ACTIVE, PUTYPE=2, MAXBFRU=10,	*
2		MODETAB=AMODETAB, DLOGMOD=M2SDLCQ, USSTAB=US327X,	*
		VPACING=0, SECNET=YES	
RAPT4102	LU	LOCADDR=2	
RAPT4103	LU	LOCADDR=3	
* -----			
* DEFINITIONS FOR PS2ES1 DOWNSTREAM			*
* -----			
RAPPE45	PU	CUADDR=E45, PUTYPE=2, MAXBFRU=10,	*
3		MODETAB=AMODETAB, DLOGMOD=M2SDLCQ, USSTAB=US327X,	*
		ISTATUS=ACTIVE,	*
		VPACING=0, SECNET=YES	
* -----			
RAPT4502	LU	LOCADDR=2	
RAPT4503	LU	LOCADDR=3	
RAPT4504	LU	LOCADDR=4	
RAPT4505	LU	LOCADDR=5	
* -----			
* DEFINITIONS FOR RALYAS4A DOWNSTREAM			*
* -----			
RAPPE46	PU	CUADDR=E46, PUTYPE=2, MAXBFRU=10,	*
4		SECNET=NO, ISTATUS=ACTIVE, VPACING=1,	*
		MODETAB=MTGS3X, DLOGMOD=EM3277, USSTAB=US327X,	*
		PACING=2	
* -----			
RAPT4602	LU	LOCADDR=2	
RAPT4603	LU	LOCADDR=3	

Figure 402. Local Major Node for 3174 and Downstream PU type 2.0 and 2.1

The 3174 gateway function is handled differently from the gateway function in Communications Manager (CM). The CM gateway function is performed according to LU mapping through the gateway. Thus, only a single PU is defined at the host, that of the gateway. Any session to be established to a node via the gateway will have an LU definition at the host as if it resides beneath the gateway PU. Please refer to Figure 349 on page 315 to see the host definitions for the CM gateway.

By contrast, the 3174 performs the gateway function by providing PU mapping through the gateway for dependent LUs only. The host will send an ACTPU and ACTLU request to each PU downstream of the 3174 for the dependent LU

sessions, and each PU will handle its own ACTPU and ACTLU responses. Therefore, when a 3174 is used as a gateway for downstream PUs, each of these PUs must also be defined in the 3174 major node. In this scenario, we need a host PU definition for the gateway 3174 1 , for the downstream CP31742 2 , PS2ES1 3 , and RALYAS4A 4 .

Notice also that we have not defined any independent LUs. They will be dynamically defined by VTAM 4.1. Notice also the dynamic LU definition will occur only on the 3174's PU. In this way the 3174 APPN function handles independent LU session routing in the same manner as our other wildcard holders, RALYAS4A and PS2ES1.

A further point of interest is that VTAM 4.1 supports dynamic dependent LU definition for certain devices. Currently, Personal Communications/3270 Version 3.0 and 3174 Configuration Support C 2.0 support this function. The parameters LUGROUP and LUSEED in 1 enable this function. This is not supported by the AS/400.

7.5.2 RALYAS4B Definitions

Please refer to Figure 276 on page 257, Figure 278 on page 259, and Figure 282 on page 263, for these definitions.

7.5.3 3174 Definitions

For simultaneously dependent sessions and independent sessions, the 3174 requires gateway and APPN definitions. The gateway definitions for RALYAS4A, CP31742, and PS2ES1 are shown in Figure 403.

_____ 940: Ring Address Assignment _____							
S	Ring Address	SAP	T	S	Ring Address	SAP	T
40	4000 3174 0001	04					
41	4000 3174 0002	04	1	42	4000 3174 0003	04	
43	4000 3174 1992	04	0	44	4000 3174 3992	04	0
45	4000 3001 0025	04	0	46	4000 1002 0001	04	0
Select Test; press ENTER ==>							
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu							

Figure 403. Downstream PU Definition - Ring Address Assignment

We considered 3174 customization for APPN in 5.2.1, “Customizing the 3174 for APPN” on page 167. Here we tailor the customization shown in that section.

Common SNA				
500 - 0	1	501 - USIBMRAA	502 - _____	
APPN Support Fields:				
510 - 1		511 - CP3174__	512 - CNET__	
PF: 3=Quit 4=Default 7=Back 8=Fwd 9=RtnH				

Figure 404. Common SNA Panel

1 The network ID of the 3174 is now USIBMRAA.

Since the 3174 now has the direct link to the host, it should now hold the wildcard for the network. Since only a single wildcard should exist in an APPN network, we take the wildcard away from the previous holder, PS2ES1, by removing the wildcard entry from its .NDF file. Please refer to the Figure 353 on page 320 to see the .NDF file definition with the wildcard entry indicated by 9 .

2 In Figure 405 on page 352, we specify that the 3174 holds the wildcard. The wildcard definition in the 3174 serves two purposes. First, the 3174 assumes that any unknown destination LU from a BIND should be routed to the host. If the 3174 is channel-attached then it routes the request via its channel. If not, it routes it to the primary host on the primary link.

Second, the wildcard specification is a sufficient APPN definition for the host. There is no need to further define the host as a LEN node in the *Network Resources* screen shown in Figure 406 on page 353. For a 3174 APPN using a host LEN connection, a wildcard specification is mandatory. All LUs to which communications may be required can then be specified in the same way as for the LEN end node, DOSCOAX, in Figure 407 on page 353.

APPN Node Definition		
610 SESSIONS - 1	611 NODES/LINKS - 1	
2 612 WILDCARD - 1		
PF: 3=Quit 4=Default 8=Fwd		

Figure 405. APPN Node Definition Panel

In the panel shown in Figure 406 on page 353, we define the adjacent nodes to this 3174. As mentioned in 5.2.1, “Customizing the 3174 for APPN” on page 167, the 3174 can dynamically learn about CPs which call into it, whether they be ENs or NNs. However, this function was not available if the CP which called in was also defined as a downstream PU in the 3174 gateway definitions. In this scenario, PS2ES1, CP31742 and RALYAS4A are defined in the 3174 gateway definitions and we must define them here 3, as we wish to make use of the 3174’s APPN capabilities.

4 The node type for RALYAS4A and PS2ES1 is 3, signifying that they are network nodes.

5 Since DOSCOAX is a LEN end node (node type = 1), we must specify what LUs reside there since they cannot be dynamically learned via APPN search mechanisms (because there are no CP-CP sessions possible with a LEN end node). We place an X in Figure 406 on page 353, and specify the LU name in Figure 407 on page 353.

Recall that, in our scenario, DOSCOAX is capable of establishing dependent sessions to the host or independent sessions to RALYAS4A. It is not possible for DOSCOAX to establish independent sessions to RALYAS4B. This limitation is described in 7.2.6.1, “Network ID Considerations for LEN End Nodes” on page 284. The only means by which DOSCOAX can establish sessions to RALYAS4B, in the network on the other side of the subarea, is if that network has the same net ID as the subarea.

With CP3174 having a direct attachment to the host, DOSCOAX can use DFT 3270 emulation on its 3270 adapter to the 3174 or continue to utilize 3270 emulation and WPCSP across the 3174’s internal token-ring network.

Network Resources							
	CPNAME	NODE TYPE (1-3)	LUs* (X)	DLC TYPE** (1)	ADDRESS**		
		3		4	5		
1	RALYAS4A	3	—	1	4000	1002	0001 04
2	PS2ES1	3	—	1	4000	3001	0025 04
3	DOSCOAX	1	X	1	4000	3174	3992 04
4	CP31742	3	—	1	4000	3174	0002 04
5	ESCOAX	2	—	1	4000	3174	1992 04
6	_____	—	—	—	_____	_____	_____
7	_____	—	—	—	_____	_____	_____
8	_____	—	—	—	_____	_____	_____

* - Enter 'X' to define Associated LUs where required.
 ** - Specify only for connect initiation from this 3174.

PF: 3=Quit 4=Default 7=Back 8=Fwd 10=PageBk 11=PageFwd

Figure 406. Network Resources Panel

Associated LUs						001 of 004
	CPNAME	LUNAME	LUNAME	LUNAME	LUNAME	SERVING NN
5	1 DOSCOAX	DOSCOAX	_____	_____	_____	CP3174

PF: 3=Quit 4=Default 7=Back 8=Fwd 10=PageBk 11=PageFwd

Figure 407. LU Directory Entry Panel

7.5.4 Coax-Attached DOS Workstation

These remain the same as before except the token-ring LAN address is changed to that of CP3174.

7.5.5 Coax-Attached PS/2 with OS/2 Extended Services 1.0

These remain the same as before except the token-ring LAN address is changed to that of CP3174.

7.5.6 RALYAS4A Definitions

In the same way as when a PS/2 provided the gateway to the host, a Host Controller Description is required on the RALYAS4A when the 3174 provides the gateway to the host. The host controller description supports both independent and dependent communications. Please see Figure 408.

```

                                Display Controller Description
                                02/04/93 19:52:14 RALYAS4A
Controller description . . . . . : HOST3174
Option . . . . . : *BASIC
Category of controller . . . . . : *HOST

Link type . . . . . : *LAN
Online at IPL . . . . . : *YES
Active switched line . . . . . : L41TR
Character code . . . . . : *EBCDIC
Maximum frame size . . . . . : 16393
Remote network identifier . . . . : *NETATR
Remote control point . . . . . : CP3174
Initial connection . . . . . : *DIAL
Switched disconnect . . . . . : *NO
LAN remote adapter address . . . . : 400031740001
LAN DSAP . . . . . : 04
LAN SSAP . . . . . : 04

Text . . . . . : Host Controller Definition for CP3174

-----Switched Lines-----
L41TR

APPN-capable . . . . . : *YES
APPN CP session support . . . . . : *YES
APPN node type . . . . . : *NETNODE
APPN transmission group number . . : 1
APPN minimum switched status . . . : *VRYONPND
```

Figure 408. Host Controller Description at RALYAS4A for CP3174

1 For 3270 emulation, a host device description must also be created as in Figure 409 on page 355. The Local location address must match the LU ADDR specified at the host. Recall that the 3174 provides only PU address mapping and no LU mapping. Thus, the LU addresses must match, unlike the case for CM as the gateway, where CM provides the LU address mapping.

2 The remote location name specified for the dependent LU device description must not be the CP name of any CPs in the same network to which a CP-CP session may be required. Otherwise, because of a name conflict, the appropriate APPC device for the CP-CP session will not be able to be created. In particular,

in this case, since both dependent and independent communications flow through the same 3174, it may seem reasonable to attempt to give the remote location name as the CP name of the 3174. Don't do it.

Display Device Description		RALYAS4A	
		07/03/91	20:55:11
Device description	HOST3174D1		
Option	*BASIC		
Category of device	*HOST		
Local location address	02	1	
Remote location	HOST3174	2	
Online at IPL	*YES		
Attached controller	HOST3174		
Application type	*EML		
Maximum length of request unit . . .	*CALC		
Emulated device	3278		
Emulated keyboard	*UPPER		
Emulated numeric lock	*NO		
Emulation work station	*ANY		
Text	3270 Emulation Device		

Figure 409. Host Device Description on RALYAS4A

We don't need to define a remote configuration list entry for RALYAS4A. In order to establish sessions to LUs, the locations of which are not defined at RALYAS4A, we rely on the APPN search process. The CP3174 holds the wildcard and will positively respond to any search. RALYAS4A may then forward the BIND to CP3174 and have it routed through the host to the appropriate location. The only requirement is that the destination LU be defined at the host and that the destination node, in this case RALYAS4B, have the defined destination LU name entered in its local location list.

7.5.7 CP31742 Definitions

Figure 410 shows the token-ring network panel at the 3174-13R. This panel is where the token-ring address of the 3174-11L is specified. Along with port address assignments and APPN customization as described in 5.2.1, “Customizing the 3174 for APPN” on page 167, this is sufficient to support both dependent communications through the CP3174 gateway to the host and independent communications via the subarea to RALYAS4B.

Token-Ring Network			
106 - 4000 3174 0002 04	107 - 4000 3001 0025 04	108 - 23N6503	
110 - 1 0000	116 - 2_ _		
121 - 01	123 - 0	125 - 00000000	126 - 00000000 127 - 2 2
132 - 0 0 0 0	136 - 1 0 0 1	137 - 0 0 0 0	138 - 0
141 - A	165 - 0	166 - A	168 - 0
173 - 00000000	175 -	179 - 0 0 0	
213 - 1	215 - 00000	220 - 3	
382 - 2042	383 - 2	384 - 0	
385 - LAN317	386 - 1		
Select Test; press ENTER ==>			
PF: 3=Quit 7=Back 8=Fwd 12=Test Menu			

Figure 410. Token-Ring Network Definition - CP31742

7.5.8 PS/2 Definitions

At PS2ES1, definitions are required in CM for the 3270 session, and for the 5250 WSF sessions. These definitions are identical to those in 7.2.3, “PS2ES1 Sessions” on page 267, except the token-ring LAN address, given in Figure 300 on page 275 and in the link definition of Figure 290 on page 268, becomes that of the 3174, 400031740001.

There is no need to define a link to the 3174 as this link will be automatically defined by PS2ES1 when it is contacted by CP3174. CP3174 will contact PS2ES1 because we have specified its CP name and token-ring LAN address in CP3174's APPN configuration, Figure 406 on page 353. PS2ES1 is to establish sessions to RALYAS4A directly using the previously defined link to RALYAS4A. It is also able to establish a session to RALYAS4B via the 3174 and then, utilizing the wildcard in the 3174, through the subarea. The CP name PS2ES1, will be dynamically defined by VTAM 4.1.

7.6 5394 to AS/400 via a Subarea Network

The 5394 T2.1 Node Support RPQ enables terminals and printers, and PCs with PC Support, to communicate with the AS/400 host system through an SNA subarea network. The T2.1 Node Support provided in the IBM 5394 T2.1 Node Support RPQ, together with the OS/400 V2R1M1 and the VTAM/NCP PU type 2.1 support, makes this communication possible.

In this section, we describe configuration details for both an AS/400 screen and a PC with PC Support attached to the 5394 in order to establish sessions with RALYAS4B via the subarea. Please refer to Figure 411.

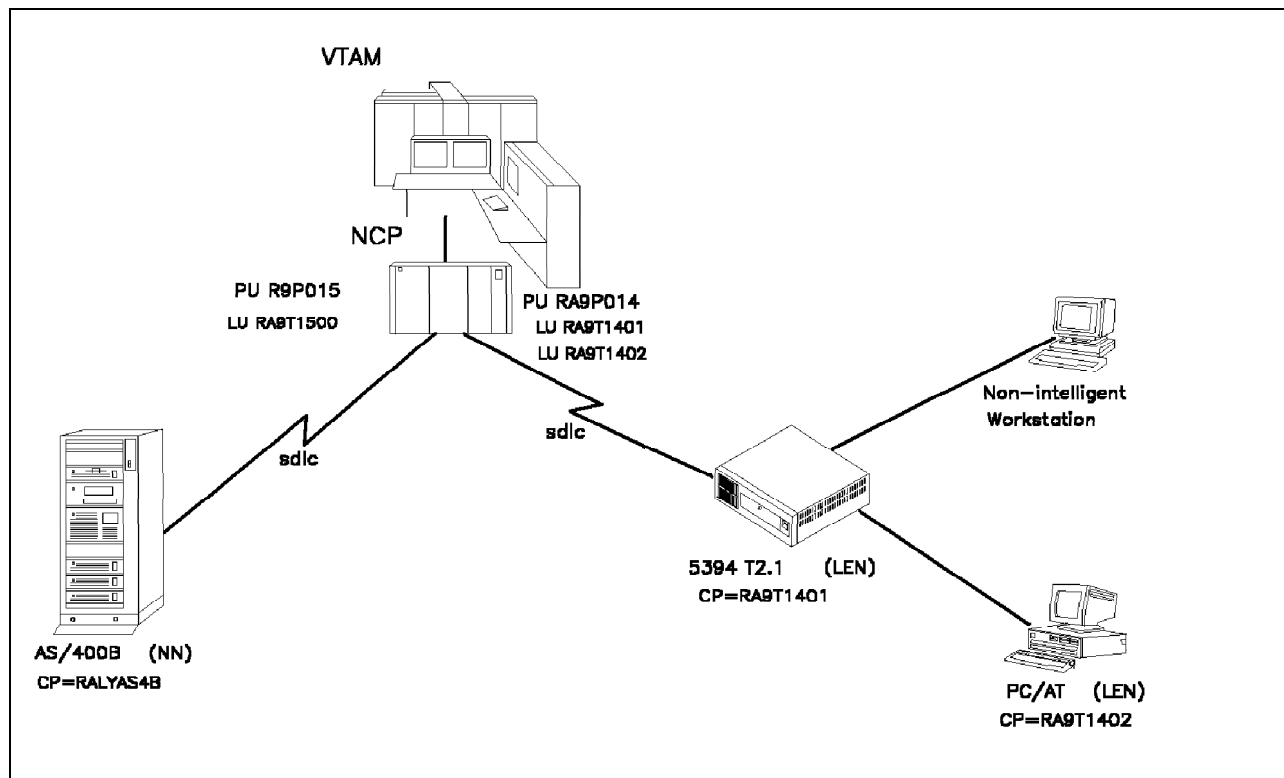


Figure 411. Connection of 5394 T2.1 to RALYAS4B Through a Subarea Network

7.6.1 5394 Configuration

Figure 412 on page 358 and Figure 413 on page 358 show the 5394 customization.

	0	1	2	3	4	5	6
0/	D	.	.	.	.	.	.
1/	.	.	.	.	.	.	.
2/	.	.	.	.	.	.	.

AA-> 0 BB-> 2 CC-> 23-12898
 1-> 00 2-> 01 3-> 0 0 1 0 0 1 0 8-> 3C 0
 10-> 0A 06

P-> _ _

Figure 412. Configuration of the 5394, Screen 1

11-> USIBMRA_	12-> RA9T1401	13-> RA9T1401	14-> QPCSUPP_
15-> USIBMRA_	16-> RA9T1500		

P-> _ _

Figure 413. Configuration of the 5394, Screen 2

1 The name of the network (net ID) to which the 5394 is directly attached. In this case, the 5394 is attached to the AS/400 through the subarea network. Thus, we use the subarea's net ID.

2 The logical unit (LU) name of the 5394. Here, we made the 5394 LU name the same as its CP name 3. It could, however, be different. This name must be added to RALYAS4B's Remote Location List as if it resides within the host LEN end node.

3 The control point (CP) name of the 5394. This is a unique name by which the 5394 may be known throughout the network. It does not suggest any CP-CP session capability.

4 The Mode name used by the 5394 for APPC sessions. The default is BLANK. Since we are planning to use PC Support, then we use the QPCSUPP mode. QPCSUPP must be defined in your mode table at the host, in addition to existing at the AS/400.

5 The AS/400's net ID. This is an optional field. If you leave it blank, the 5394 assumes that the AS/400 is attached to the same network as the 5394. In our case, however, since the host and the AS/400 are in different networks, we must explicitly specify the AS/400's net ID, USIBMRA.

6 The LU name, or local location name, of the AS/400. This name may be the AS/400 CP name or any other local location name defined for RALYAS4B in its local configuration list. The command to use to work with this list is WRKCFGL *APPNLCL. Here we use RA9T1500 since we have previously defined it at the host. We could have used the RALYAS4B CP name, RALYAS4B, as destination LU name. However, this name would then need to be defined as an independent LU at the host.

It's worth noticing here that, provided a subarea or APPN network is already in place, we can specify in field 16 any LU name which resides in the network. Thus, DWSs, that is AS/400 terminals, may now have access to applications residing on any AS/400 in the network simply by changing this field in the 5394 customization. (Assuming that the remote workstation control unit for the 5394 exists at the target AS/400.) Notice also that all DWSs must access the same AS/400 and only a single AS/400 at a time. If concurrent access to multiple AS/400s is required, then an IWS is also required.

7.6.2 AS/400 Configuration

We show again, in Figure 414 below and Figure 415 on page 360, respectively, the SDLC line definition and host control unit definition for the AS/400 connection to the subarea.

Display Line Description		
Line description	LIND	LINRAP
Option	OPTION	*ALL
Category of line		*SDLC
Resource names	RSRCNAME	LIN021
Online at IPL	ONLINE	*YES
Data link role	ROLE	*NEG
Physical interface	INTERFACE	*RS232V24
Connection type	CNN	*NONSWTPP
Switched network backup	SNBU	*NO
Exchange identifier	EXCHID	05615533
NRZI data encoding	NRZI	*YES
Maximum controllers	MAXCTL	1
Clocking	CLOCK	*MODEM
Line speed	LINESPEED	9600
Modem type supported	MODEM	*NORMAL
Modem data rate select	MODEMRATE	*FULL
Autoanswer type	AUTOANSTYP	*DTR
Maximum frame size	MAXFRAME	521
Error threshold level	THRESHOLD	*OFF
Duplex	DUPLEX	*FULL
Modulus	MODULUS	8
Text	TEXT	SDLC Line to Subarea 20
Attached nonswitch controllers . . .	CTL	
-----Attached Nonswitched Controllers-----		
CTLRAP		

Figure 414. SDLC Line Description for RALYAS4A to the Subarea Network

```

Display Controller Description
Controller description . . . . . : CTLD      CTLRAP
Option . . . . . : OPTION    *ALL
Category of controller . . . . . :          *HOST
Link type . . . . . : LINKTYPE *SDLC
Online at IPL . . . . . : ONLINE  *YES
Switched connection . . . . . : SWITCHED *NO
Switched network backup . . . . . : SNBU   *NO
Attached nonswitched line . . . . . : LINE   LINRAP
Character code . . . . . : CODE     *EBCDIC
Maximum frame size . . . . . : MAXFRAME 521
Remote network identifier . . . . . : RMTNETID USIBMRA
Remote control point . . . . . : RMTCPNAME RAP
Station address . . . . . : STNADR  01
Recontact on vary off . . . . . : RECONTACT *YES
Text . . . . . : TEXT      Controller Desc.for RAP
Attached devices . . . . . : DEV
-----Attached Devices-----
(No devices attached)
APPN-capable . . . . . : APPN      *YES
APPN CP session support . . . . . : CPSSN  *NO
APPN node type . . . . . : NODETYPE *LENNODE
APPN transmission group number . . : TMSGRPNBR 1
Recovery limits . . . . . : CMNRCYLMT
  Count limit . . . . . :          2
  Time interval . . . . . :          5

```

Figure 415. Host Controller Description for RALYAS4A to the Subarea Network

In addition to the HOST controller description, a remote workstation controller is required for the 5250 protocol which is encapsulated in APPC and transmitted to the 5394 via the LU 6.2 session.

```

Display Controller Description
Controller description . . . . . : CTLD      CRW539421
Option . . . . . : OPTION    *ALL
Category of controller . . . . . :          *RWS
Controller type . . . . . : TYPE     5394
Controller model . . . . . : MODEL    1
Link type . . . . . : LINKTYPE  *NONE
Online at IPL . . . . . : ONLINE  *YES
Remote location . . . . . : RMTLOCNAME RA9T1401
Local location . . . . . : LCLLOCNAME RA9T1500
Remote network identifier . . . . . : RMTNETID USIBMRA
Text . . . . . : TEXT      Rmt Wrkstn for 5394 T2.1
Attached devices . . . . . : DEV
-----Attached Devices-----
RWS539421

```

Figure 416. Remote Workstation Controller Definition for 5394 T2.1 Attached to RAP

The remote workstation controller has been changed to include some new entries, as explained in 3.2.2.2, “AS/400 Configuration” on page 107. Notice that the local LU name and remote LU name match those defined in the 5394 customization.

As for any 5394 definition, a device description is also required.

Display Device Description		
Device description	DEVD	RWS539421
Option	OPTION	*ALL
Category of device		*DSP
Device class	DEVCLS	*RMT
Device type	TYPE	5292
Device model	MODEL	1
Local location address	LOCADR	00
Online at IPL	ONLINE	*YES
Attached controller	CTL	CRWS539421
Drop line at signoff	DROP	*NO
Character identifier	CHRID	*SYSVAL
Allow blinking cursor	ALWBLN	*YES
Print device	PRTDEV	*SYSVAL
Output queue	OUTQ	*DEV
Printer file	PRTFILE	QSYSVRT
Library		*LIBL
Maximum length of request unit . . .	MAXLENRU	*CALC
Text	TEXT	5394 Non-Intelligent wrkstn

Figure 417. Remote Workstation Definition Non-IWS

All that remains to be defined on the AS/400 are any remote and local LU names which we may have used. Here, we show that RA9T1401 is in the remote location list and RA9T1500 is in the local location list.

Display Configuration List		RALYAS4B
		01/27/93 22:10:05
Configuration list	QAPPNLCL	
Configuration list type	*APPNLCL	
Text	APPN local location list	
-----APPN Local Locations-----		-----APPN Local Locations-----
Local	Local	
Location Text	Location Text	
RA9T1500	Local LU name	
		Bottom
Press Enter to continue.		
F3=Exit F12=Cancel F17=Position to		

Figure 418. Local Location List at RALYAS4B

```

                                Display Configuration List
                                06/19/91 18:55:24 RALYAS4B
Configuration list . . . . . : QAPNRMT
Configuration list type . . . . : *APPNRMT
Text . . . . . : APPN remote location list
-----APPN Remote Locations-----
      Remote      Remote      Control
Remote  Network  Local  Control  Point  Secure
Location ID    Location Point   Net ID   Loc
RA9T1401 USIBMRA RA9T1500 RAP     USIBMRA  *NO
                                Bottom
Press Enter to continue.
F3=Exit  F11=Display session information  F12=Cancel  F17=Position to

```

Figure 419. Remote Location List at RALYAS4B

Note: At the time of testing, we were working with pre-release code for the 5394 T2.1 Node Support RPQ. There was, in fact, an additional consideration which may not be required when the code is released in OS/400 V2R1M1. A communications entry was required to be added to the subsystem which we were using for communications, QCMN. In particular, with the standard communications entry in QCMN, the default user is specified as *NONE. This specification caused an SNA sense code of 080F6051 "Access security information invalid." The partner LU rejected the user ID or password received on an incoming attach. Thus, we removed the default communications entry and added the following entry which includes a default user profile.

```

                                Display Remote Location Name Entries
                                System: RALYAS4B
Subsystem description: QCMN      Status: ACTIVE
Remote               Job        Default      Max
Location            Mode        Description   Library     User        Active
RA9T1401            QPCSUPP    *USRPRF     QUSER       QUSER       *NOMAX
                                Bottom
Press Enter to continue.
F3=Exit  F12=Cancel

```

Figure 420. Remote Location Entry Added to QCMN Subsystem for VTAM 5394 LU Recognition

7.6.3 PC Support Configuration

Below is the CONFIG.PCS file needed for enabling a 5250 WSF session with RALYAS4B through the subarea:

```
SFLR 1,I,QIWSFLR,RA9T1500 1
RTLN USIBMRA.RA9T1402 2
RTYP 5250 3
EMLI RA9T1500,1 4
```

Figure 421. The CONFIG.PCS File Used on the PC/AT in This Scenario

1 The location name for RALYAS4B known by VTAM and the 5394 is RA9T1500. The I drive session will be established with the LU, RA9T1500, at RALYAS4B.

2 Specifies the network-qualified local LU name of the PCAT. We did not need to define an LU to VTAM as it will be dynamically defined at session initiation. Note also there is no remote location list entry for this LU on RALYAS4B; this is not needed as sessions are always established from the PS/2 to the AS/400.

3 Specifies that the router type for this PC is 5250.

4 Specifies that the emulation is run with the partner LU, RA9T1500, on RALYAS4B.

7.6.4 Host Configuration

The required host definitions for the 5394 T2.1 Node Support RPQ connection are shown in Figure 422. Please refer to Figure 277 on page 258, and Figure 279 on page 260, respectively, for the required NCP LINE and PU/LU definitions for RALYAS4B.

```

*****
*          LINE MACRO SPECIFICATION          SDLC LINK 014  5394 2.1 SUPPORT
*****
RA9L014  LINE ADDRESS=(014,FULL),  TRANSMIT AND RECEIVE ADDRESSES      *
          CLOCKNG=EXT,                      NPA*
          OWNER=RAP,                        (V) VTAM                      *
          DUPLEX=(FULL),                    REQUEST TO SEND ALWAYS UP    *
          SPEED=(4800)                      LINE SPEED IS 4800 BPS
*
          NGFTXT='5394'
*****
*          SERVICE MACRO SPECIFICATION FOR SDLC (LINE 014)
*****
          SERVICE ORDER=(RA9p014),
          MAXLIST=9
*****
*          5394 TYPE 2.1 NODE SUPPORT
*****
RA9P014  PU ADDR=01,
          DATMODE=FULL,
          PUTYPE=2,
          DYNLU=YES,
          XID=YES
*
          STATOPT='5394'
*****
RA9T1401 LU RESSCB=4,                      INDEPENDENT LU
          LOCADDR=0,
          MODETAB=MTGS3X
*
          STATOPT='INDEPENDENT LU'

```

Figure 422. NCP Definitions for 5394 via SDLC Link 14

Because we have given our LUs the same name, only a single APPC device is created on the AS/400 and all of the LU-LU sessions use this device description as their session endpoint. The device description is shown in Figure 423 on page 365 and the configuration status for the device is shown in Figure 424 on page 365.

Display Device Description		
Device description	DEVD	RA9T1401
Option	OPTION	*ALL
Category of device		*APPC
Remote location	RMTLOCNAME	RA9T1401
Online at IPL	ONLINE	*NO
Local location	LCLLOCNAME	RA9T1500
Remote network identifier	RMTNETID	USIBMRA
Attached controller	CTL	CTLRAP
Message queue	MSGQ	QSYSOPR
Library		*LIBL
Local location address	LOCADR	00
APPN-capable	APPN	*YES
Single session	SNGSSN	
Single session capable		*NO
Text	TEXT	AUTOMATICALLY CREATED BY QLU
Mode	MODE	
-----Mode-----		
*NETATR		

Figure 423. Description of Automatically Created APPC Device for 5394's WS

```

Work with Configuration Status
                                RALYAS4B
                                06/19/91 18:14:48
Position to . . . . .           Starting characters
Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display Mode status ...
Opt Description      Status      -----Job-----
LINRAP              ACTIVE
CTLRAP              ACTIVE
RA9T1401            ACTIVE
QPCSUPP             ACTIVE/TARGET      RA9T1401      QUSER      006689
QPCSUPP             ACTIVE/TARGET      QXFSEV      QSECOFR      006643
QPCSUPP             ACTIVE/TARGET      RA9T1401      QSECOFR      006644

```

Figure 424. Automatic Creation of an APPC Device, and 5250 Emulation Sessions

By looking at the mode status (type 9 in front of the APPC device on WRKCFGSTS screen), we find out that there are actually four sessions running on the same logical link. Recall from 3.1.1, "Dependent Workstation Support" on page 103, that the invisible session is a controller session used for maintenance information and so on, and the first visible session is for the active AS/400 workstation, enabling it to exchange user data with RALYAS4B. Since we gave the PC location the same name as the 5394 LU, its I drive and WSF sessions occur under the same APPC device as the DWS sessions.

```

                                System:  RALYAS4B
Device . . . . . :  RA9T1401
Device status . . . . . :  ACTIVE
Type options, press Enter.
    5=Display details
        Mode
Opt  Mode      Status      Total  Source  Target  Detached
   SNASVCMG    Started         0       0       0       0
   QPCSUPP     Started         4       1       3       0
                                Bottom
F3=Exit  F5=Refresh  F11=Display sessions  F12=Cancel

```

Figure 425. Modes Status and Number of Sessions Started under APPC Device

7.7 AS/400 to 5494 via a Subarea Network

RPQ 8Q0932 for attachment to a Subarea Network must be used for any subarea attachment. This RPQ is a licensed internal code enhancement feature for the 5494 Remote Control Unit. This enhancement allows the 5494 to communicate with an AS/400 through an SNA subarea network. Thus, a target AS/400 system can communicate with remote dependent workstations (DWSs) or independent workstations (IWSs) attached to the 5494. The 5494 ASN RPQ provides support for both DWSs and IWSs through a twinaxial link and IWSs attached through a token-ring to the 5494.

The target AS/400 system must be running Operating System/400 (OS/400) Version 2 Release 1 Modification 1 or higher. OS/400 Version 2 Release 2 is required for new workstation and controller functions supported in 5494 Release 1.1. In addition, a minimum level of VTAM and NCP support is required for the attachment of the LEN end nodes to the SNA subarea network. This support was added to:

- VTAM Version 3 Release 2
- NCP Version 4 Release 3 for the 3725 controller
- NCP Version 5 Release 2 for the 3720 and 3745 controllers

The 5494 ASN RPQ provides the following benefits:

- The 5494 ASN RPQ accesses AS/400 systems that are not attached directly as the adjacent node and where the adjacent node is not another AS/400 system. This not only allows attachment through an SNA subarea network, but also allows a 5494 to act as a gateway for other 5494s (with IWSs only attached).
- When you are attached to a subarea network, your network management is enhanced because the communication link between the 5494 and the LEN-BF is visible to NetView. NetView is also aware of all sessions between the 5494 and the AS/400 system.
- Line costs may be reduced because the 5494 ASN RPQ eliminates the need for a dedicated communication line from the 5494 to the AS/400 system. The 5494 can share a line to the subarea network with other systems.
- The 5494 ASN RPQ supports network user verification by the network. This support is provided by allowing you to configure the ID number portion of the exchange station identification (XID) transmitted by the 5494.

Our scenario was set up as per the following diagram:

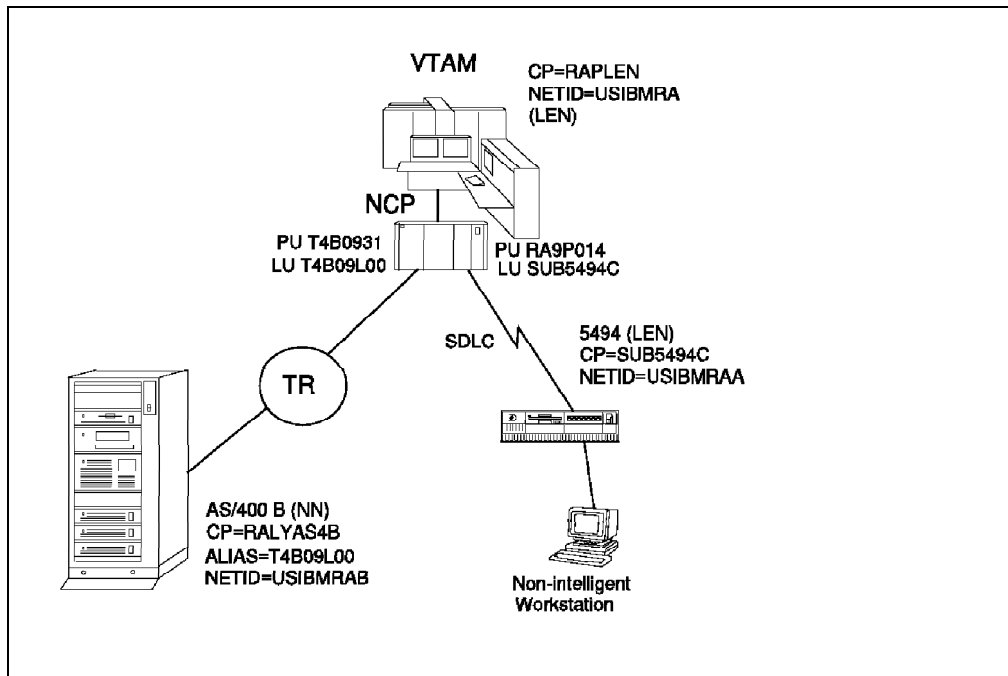


Figure 426. 5494 Scenario

Note that in the above diagram three different network IDs are being used. This is not an issue, as all connections are LEN connections, but care must be taken when using APPN nodes. The implications of network IDs are discussed more fully in the next chapter.

7.7.1.1 5494 Configuration

The 5494 was first configured for an SDLC connection to the host. For more information on 5494 configuration, see Chapter 4, “The 5494 Remote Control Unit” on page 123.

JC2-2-1 5494 - Configuration - AS/400 Connection - SDLC		-
Fill in the fields and use the spacebar to make selections, then press F6. Press Enter to verify the data.		
5494 SDLC Station Address (Hex)		[01]
Line Type	Leased Switched/Manual-Dial Switched/(V.25 bis)	
Line Facility	Half-Duplex Full-Duplex	
Connection Type	Multipoint Point-to-Point	
Data Encoding	NRZI NRZ	
Connection Method	DTR CDSTL	
Send Leading Pad	No Yes	
Local Loopback Support	No Yes	
V.25 bis Auto-Dial Connection Timeout in Seconds	[60]	End

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 427. Configuring the 5494 for an SDLC Connection

Next, the network information must be defined:

JC2-1	5494 - Configuration - Network Information	More -
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRAA]	
5494 LU Name	[SUB5494C]	1
5494 CP Name	[SUB5494C]	1
Default Mode Name	[QPCSUPP]	2
5494 Connection Number	[	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[XI]-[15494]	3
H1 AS/400 System 1		
AS/400 LU Name	[T4B09L00]	4
AS/400 Network Name	[USIBMRAA]	
5494 Network Name	[USIBMRAA]	
Mode Name	[QPCSUPP]	
AS/400 Connection Number	[	
	]	

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 428. Configuring the 5494 Network Information

Notes:

- 1 In previous configurations the CP and LU names were kept the same in order to remove the need for a Remote Location List entry. In this case, however, an entry is needed whether the CP and LU names are the same or different. See Figure 434 on page 373 for details.
- 2 The mode, QPCSUPP, was used in place of the normal 5494 mode, QRMTWSC, because it was already defined at the host.
- 3 If support for network user verification is required, the serial number should be "XI-hhhhh", where h represents a valid hexadecimal digit. The 5494 inserts the last five characters into the ID number field of the XID transmitted by the 5494. If the first two characters are not "XI", then the 5494 ASN RPQ sends an XID with an ID number of "000xx", where xx is the station address. Without the 5494 ASN RPQ, the 5494 always sends an XID in the latter format.
- 4 This LU name must be specified in the Local Location List of the AS/400.

7.7.1.2 AS/400 configuration

In the 5394 configuration we used SDLC to connect to the host. This time we shall connect via the token-ring network. The host controller, T4B0931, was used for this scenario.

Display Controller Description	
Controller description	T4B0931
Option	*BASIC
Category of controller	*HOST
Link type	*LAN
Online at IPL	*NO
Character code	*EBCDIC
Maximum frame size	2057
Remote network identifier	USIBMRA
Remote control point	RAPLEN
Local exchange identifier	*LIND
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*NO
LAN remote adapter address	400001091000
LAN DSAP	04
LAN SSAP	04
Text	Token-Ring CTL to SA09
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 429. AS/400 Host Controller Description

Display Controller Description	
Controller description	T4B0931
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*NO
APPN node type	*LENNODE
APPN transmission group number	*CALC
APPN minimum switched status	*VRYON
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 430. APPN Capabilities of the Host Controller. As this is a LEN Connection, there will be no CP-CP sessions.

In addition to the host controller, a remote workstation controller is required for the DWSs attached to the 5494.

Display Controller Description	
Controller description	SUB5494RWS
Option	*BASIC
Category of controller	*RWS
Controller type	5494
Controller model	2
Link type	*NONE
Online at IPL	*YES
Remote location	SUB5494C
Local location	T4B09L00
Remote network identifier	USIBMRAA
Text	RWS for 5494 via subarea
Press Enter to continue.	
F3=Exit F11=Display keywords F12=Cancel	

Figure 431. Remote Workstation Controller for 5494

Attached to this controller will be remote device descriptions.

Display Device Description	
Device description	TEST1
Option	*BASIC
Category of device	*DSP
Device class	*RMT
Device type	3487
Device model	HC
Local location address	00
Online at IPL	*YES
Attached controller	SUB5494RWS
Drop line at signoff	*NO
Character identifier	*SYSVAL
Allow blinking cursor	*YES
Print device	*SYSVAL
Output queue	*DEV
Printer file	QSYSPRT
Library	*LIBL
Maximum length of request unit . . .	*CALC
Workstation customizing object . . .	*NONE
Text	*BLANK
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 432. Device Description for 3487 Attached to 5494

As mentioned earlier, we must also define both Local and Remote Location Lists in the AS/400. Using the WRKCFGL command, we add the following:

```

Display Configuration List

Configuration list . . . . . : QAPPNRMT
Configuration list type . . . . : *APPNRMT
Text . . . . . :

-----APPN Remote Locations-----
Remote      Remote      Remote      Control
Location    Network    Local      Control    Point      Secure
ID          Location    Point      Net ID     Loc
SUB5494C   USIBMRAA   T4B09L00   RAPLEN     USIBMRA    *NO

Press Enter to continue.

F3=Exit  F11=Display session information  F12=Cancel  F17=Position to

```

Figure 433. APPN Remote Location List for AS/400 B

```

Display Configuration List

Configuration list . . . . . : QAPPNLCL
Configuration list type . . . . : *APPNLCL
Text . . . . . :

-----APPN Local Locations-----
Local
Location Text
AS4B      Alias for L31TR
RA9T1500  Alias for RA6L0135
T4B09L00  Alias for SW4B0931

-----APPN Local Locations-----
Local
Location Text

Press Enter to continue.

F3=Exit  F12=Cancel  F17=Position to

```

Figure 434. AS/400 Local Location List for AS/400 B

7.7.1.3 Host Configuration

An SDLC line was created for the 5494 connection. This line, RA9L014, was identical to the line, RA9L015, described in Figure 277 on page 258. The PU definition is shown in Figure 435 on page 374.

```

*****
*          LINE MACRO SPECIFICATION          SDLC LINK 014 FOR 5494
*****
RA9P014  PU  ADDR=01,                      *
          DATMODE=FULL,                     *
          ISTATUS=ACTIVE,                   *
          MODETAB=MTGS3X,                   *
          PUTYPE=2,                         *
          CONNTYPE=LEN,                     *
          XID=YES,                         *
          DYNLU=YES
*          STATOPT='5494'

SUB5494C LU  RESSCB=4,                      *      INDEPENDENT LU
          MODETAB=MTGS3X,                   *
          ISTATUS=ACTIVE,                   *
          LOCADDR=0
*          STATOPT='INDEPENDENT LU'

```

Figure 435. NCP Definitions for 5494 via SDLC

Note that, in the above screen, we also created an LU for the 5494.

Next, we created a switched major node definition for the token-ring connection, with a PU and Independent LU for AS/400 B.

```

SW5494  VBUILD MAXGRP=5,                      REQUIRED      X
          MAXNO=12,                          REQUIRED      X
          TYPE=SWNET                          REQUIRED
**
*-----PU AND LU'S DEFINITION FOR AS/400 SYSTEM      9406  ----
T4B0931 PU  ADDR=01,                      COULD BE ANYTHING (NOT USED)      X
          MAXDATA=265,                      AS/400 SYSTEM                      X
          IDBLK=056,                        AS/400  ID BLOCK NUMBER          X
          IDNUM=09404,                      IDNUM OF AS/400 9404            X
          DISCNT=NO,                        X
          MAXOUT=7,                          X
          MAXPATH=2,                        X
          CPNAME=RALYAS4B,                  X
          CONNTYPE=LEN,                     X
          PUTYPE=2,                          X
          PASSLIM=7,                        X
          DYNLU=YES,                        X
          ISTATUS=ACTIVE

**
T4B0931 PATH DIALNO=0004400010020002, TO AS/400 9404      X
          GRPNM=EG09P01,                    FROM TIC 2 SA9                    X
          GID=1,                            X
          PID=2,                            X
          USE=YES                            INITIALLY ACTIVE

**
*-----INDEPENDENT LU-----
T4B09L00 LU  LOCADDR=0, MODETAB=MTGS3X,                      X
          DLOGMOD=MODS361, ISTATUS=ACTIVE

```

Figure 436. Switched Major Node for AS/400 B

When the 5494 sends its XID to the AS/400, an APPC device is automatically created.

Display Device Description	
Device description	SUB5494C
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	SUB5494C
Online at IPL	*NO
Local location	T4B09L00
Remote network identifier	USIBMRAA
Attached controller	T4B0931
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Press Enter to continue	
F3=Exit F11=Display keywords F12=Cancel	

Figure 437. Autoconfigured APPC Device for SUB5494C

7.8 RISC/6000 to AS/400 via Subarea Network

In this scenario we connect the RISC/6000 to AS/400 B through VTAM without using the network node capabilities of VTAM. Please refer to Figure 438 for an overview of this scenario.

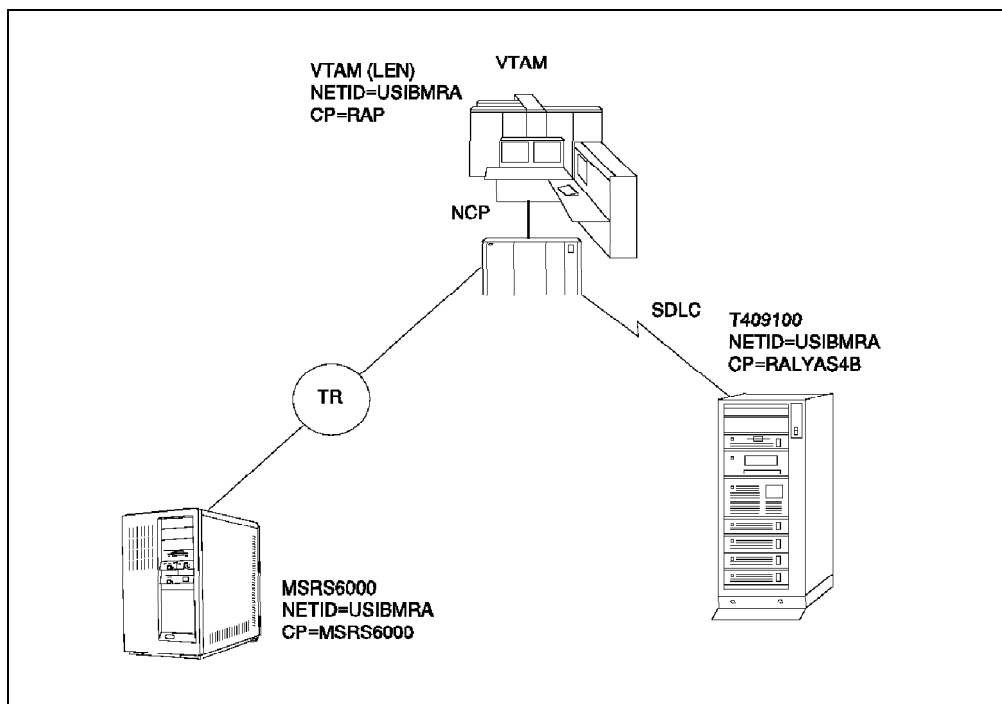


Figure 438. RISC/6000 to AS/400 via VTAM LEN Connection

7.8.1.1 RISC/6000 Configuration

We used the logical link, physical link, control point, mode, and transaction program profiles created in Chapter 6, "The RISC System/6000" on page 213. We altered the Local LU profile to give us the same net ID as VTAM, and changed the token-ring attachment profile so that it pointed to the TIC of our host 3745.

Change / Show SNA Token-Ring Attachment Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]			[Entry Fields]
CURRENT profile name			SMYTH
NEW PROFILE name			[]
CONTROL POINT profile name			[SMYTH]
LOGICAL LINK profile name			[SMYTH]
PHYSICAL LINK profile name			[SMYTH]
STOP ATTACHMENT on inactivity?			no
If yes, inactivity TIMEOUT (0-10 minutes)			[0]
LU address REGISTRATION?			no
If yes, LU address REGISTRATION PROFILE name			[LDEFAULT]
CALL type			call
If listen,			
AUTO-LISTEN?			no
MINIMUM SAP address (hex 04-ec)			[04]
MAXIMUM SAP address (hex 04-ec)			[EC]
If call, ACCESS ROUTING			link_address
If link-name, REMOTE LINK name			[]
If link-address,			
Remote LINK address			[400010090000] 1
Remote SAP address (hex 04-ec)			[04]
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 439. Token-Ring Attachment Profile

Note:

- 1 The token-ring address of the host

Change / Show SNA LU6.2 Local LU Profile															
Type or select values in entry fields. Press Enter AFTER making all desired changes.															
CURRENT profile name		[Entry Fields]													
NEW PROFILE name		SMYTH													
TPN LIST profile name		[]													
NETWORK name		[TDEFAULT]													
Local LU NAME		[USIBMRA] 1													
INDEPENDENT LU?		[MSRS6000] 1													
If no,		yes													
Local LU ADDRESS (1-255)		[1]													
SSCP ID		[*]													
<table border="0"> <tr> <td>F1=Help</td> <td>F2=Refresh</td> <td>F3=Cancel</td> <td>F4=List</td> </tr> <tr> <td>F5=Undo</td> <td>F6=Command</td> <td>F7=Edit</td> <td>F8=Image</td> </tr> <tr> <td>F9=Shell</td> <td>F10=Exit</td> <td>Enter=Do</td> <td></td> </tr> </table>				F1=Help	F2=Refresh	F3=Cancel	F4=List	F5=Undo	F6=Command	F7=Edit	F8=Image	F9=Shell	F10=Exit	Enter=Do	
F1=Help	F2=Refresh	F3=Cancel	F4=List												
F5=Undo	F6=Command	F7=Edit	F8=Image												
F9=Shell	F10=Exit	Enter=Do													

Figure 440. LU6.2 Local LU Profile

Note:

- 1 This is the fully qualified LU name of the RISC/6000.

We then created a logical connection to RALYAS4B. As we were using LEN connections, we needed to have an LU defined at each intermediate node in our network. We chose the LU name T4B09L00.

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTH		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH]		
LOCAL LU profile name	[SMYTH]		
NETWORK name	[USIBMRA]	1	
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[T4B09L00]	2	
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended		
If extended, SESSION CONCURRENCY	parallel		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 441. LU6.2 Logical Connection Profile

Notes:

- 1 This is the name of the **target** network. Together with the remote LU name, this makes up the network-qualified name of the target LU.
- 2 This is the name of the LU to be selected on RALYAS4B, and the name of the LU created in VTAM. This entry must exist in the Local Location List of that system. If LU 6.2 applications that send BINDs from the AS/400 to the RISC/6000 are to be used, then an entry in the Remote Location List would also be required.

7.8.1.2 Host Configuration

We created a switched major node for our token-ring connection to the RS/6000.

```

*****
*
*          RS/6000 IN A TOKEN-RING NETWORK
*
*****
SWRS6000 VBUILD MAXGRP=5,          REQUIRED
          MAXNO=12,          REQUIRED
          TYPE=SWNET          REQUIRED
**
* -----PU AND LU'S DEFINITION FOR RS/6000 SYSTEM -----
**
RS6000  PU   ADDR=01,          COULD BE ANYTHING (NOT USED)
          MAXDATA=265,        RS6000 SYSTEM
          IDBLK=071,          RS/6000  ID BLOCK NUMBER
          IDNUM=00000,        IDNUM OF RS6000
          DISCNT=NO,          X
          MAXOUT=7,          X
          MAXPATH=2,          X
          CPNAME=MSRS6000,    X
          PACING=(7,1),       X
          VPACING=8,          X
          PUTYPE=2,           X
          PASSLIM=7,          X
          ISTATUS=ACTIVE
**
TR13A40A PATH DIALNO=000410005AA88793, TO RS6000 1
          GRPNM=EG13L01,      FROM TIC 2
          GID=1,              X
          PID=2,              X
          USE=YES              INITIALLY ACTIVE
**

```

Figure 442. Switched Major Node for RISC/6000

The AS/400 connection was through the line, RA9L015, and PU, RA9P015. Because we are using the Dynamic LU definition facility available in VTAM V3R4 onwards, it is not necessary to create the ILU. For downlevel VTAM releases, an ILU definition would be required. Also, if the CP name and LU name are different, then a Local Location List entry will be necessary on the AS/400 even if CP-CP sessions are used.

```

RA9L015  LINE ADDRESS=(015,HALF),  HDX LEASED LINE          *
          ANS=CONTINUE,             DON'T BREAK CROSS DOMAIN SESSIONS *
          NPACOLL=YES,
          ISTATUS=ACTIVE,
          CLOCKNG=EXT,             MODEM CLOCKING          *
          DUPLEX=(FULL),          REQUEST TO SEND ALWAYS UP *
          MAXPU=9,                ALLOW NO MORE THAN 9 PUS ON LINE *
          SERVLIM=10,
          SPEED=9600,             NPA AND SCANNER USE      ##### *
          SRT=(, 64)
*          NGFTXT='AS/400/A'
*****
*          SERVICE MACRO SPECIFICATION FOR SDLC (LINE 000)          *
*****
          SERVICE ORDER=(RA9P015), MAXLIST=9
*****
RA9P015  PU  ADDR=01,
          DATMODE=FULL,
          PUTYPE=2,
          CONNTYPE=LEN,
          XID=YES
*          STATOPT='LEN CONNECTION TO AS/400 B'
*****
T4B09L00 LU  RESSCB=4,
          MODETAB=MTGS3X,
          LOCADDR=0
*          STATOPT='INDEPENDENT LU'
*****

```

Figure 443. Line and PU for the AS/400. Note that here we create an LU for AS/400 B.

7.8.1.3 AS/400 Configuration

We used the line, RA9L015, and controller, RA9P015, for the host attachment.

Display Line Description	
Line description	RA9L015
Option	*BASIC
Category of line	*SDLC
Resource names	LIN011
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	05615533
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*FULL
Modulus	8
Text	SDLC Line to Subarea 09

Figure 444. Line Description for Host Connection

Display Controller Description	
Controller description	RA9P015
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L015
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	*BLANK

Figure 445. Controller Description for Host Connection

Display Controller Description	
Controller description	RA9P015
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*NO
APPN node type	*LENNODE
APPN transmission group number . . .	*CALC
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 446. APPN Capabilities of Host Controller

We also added the relevant entries to the Local Location List. A Remote Location List was not required because our RISC/6000 application initiated the sessions by sending the BIND from the RISC/6000 to the AS/400. If the AS/400 was to initiate a session with the RISC/6000, then a Remote Location List entry would be required.

Display Configuration List	
Configuration list	QAPPNLCL
Configuration list type	*APPNLCL
Text	
-----APPN Local Locations-----	
Local	
Location	Text
AS4B	Alias for L31TR
RA9T1500	Alias for RA6L0135
T4B09L00	Alias for RISC/6000

Figure 447. Local Location List

7.8.1.4 Activating the Link

We activated the host lines and switched major node, varied on the AS/400 host connection, and started the RISC/6000 attachment. This caused the RS/6000 to exchange XIDs with the host and the host PU to be activated.

DISPLAY NET,ID=RS6000,SCOPE=ALL	
IST097I DISPLAY ACCEPTED	
NAME = RS6000	, TYPE = PU_T2.1
STATUS= ACTIV	, DESIRED STATE= ACTIV
CP NAME = MSRS6000,	CP NETID = USIBMRA , DYNAMIC LU = YES
SWITCHED SNA MAJOR NODE = SWRS6K	
LINE NAME = J0009013,	LINE GROUP = EG09L00 , MAJNOD = RA9NCPJ
I/O TRACE = OFF, BUFFER TRACE = OFF	
NO LOGICAL UNITS EXIST	

Figure 448. Active Host PU

We then activated the logical connection, causing a BIND to be sent from the RISC/6000 to the AS/400 (see: Chapter 6, “The RISC System/6000” on page 213 for details on activating the link on the RISC/6000). The host dynamically creates an LU for the RISC/6000.

```

DISPLAY NET,ID=RS6000,SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = RS6000          , TYPE = PU_T2.1
STATUS= ACTIV--L--, DESIRED STATE= ACTIV
  CP NAME = MSRS6000, CP NETID = USIBMRA , DYNAMIC LU = YES
SWITCHED SNA MAJOR NODE = SWRS6K
LINE NAME = J0009013, LINE GROUP = EG09L00 , MAJNOD = RA9NCPJ
I/O TRACE = OFF, BUFFER TRACE = OFF
LOGICAL UNITS:
MSRS6000 ACT/S----Y
END

```

Figure 449. Host PU, This Time with Dynamic LU Created

The host then forwards this BIND to the AS/400, which creates an APPC device for the remote location on the host controller.

Display Device Description	
Device description	MSRS6000
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	MSRS6000
Online at IPL	*NO
Local location	T4B09L00
Remote network identifier	*NETATR
Attached controller	RA9P015
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLU5

Figure 450. APPC Device for RISC/6000

Looking at the status of the device on the AS/400, we see that it is active and that our emulator session is in use.

```

Work with Configuration Status

Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status ...

Opt  Description      Status      -----Job-----
___  RA9L015          ACTIVE
___  RA9P015          ACTIVE
___  RAP              ACTIVE
___  RALYAS4A00       ACTIVE
___  MSRS6000         ACTIVE
___  QPCSUPP          ACTIVE/TARGET      MSRS6000      ROOT

```

Figure 451. WRKCFGSTS on AS/400

We can also see the sessions being routed through the host by looking at the LUs for the RISC/6000 and AS/400.

```

NAME = USIBMRA.T4B09L00 , TYPE = CDRSC
STATUS= ACT/S      , DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=MTGS3X  USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=***NA*** USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC  MAJOR NODE = ISTPDILU
  ALSLIST = RA9P015
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P015
NAME      STATUS      SID      SEND RECV VR TP NETID
MSRS6000  ACTIV-P     F88F016423C8C9BA      USIBMRA
MSRS6000  ACTIV-P     F88F016423C8C9B9      USIBMRA
END

```

Figure 452. Status of AS/400 LU on the Host

```

NAME = USIBMRA.MSRS6000 , TYPE = CDRSC
STATUS= ACT/S---Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=SNASVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = RS6000
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RS6000
NAME      STATUS      SID      SEND RECV VR TP NETID
T4B09L00 ACTIV-S      F88F016423C8C9BA      USIBMRA
T4B09L00 ACTIV-S      F88F016423C8C9B9      USIBMRA

```

Figure 453. Status of RISC/6000 LU on Host

Chapter 8. APPN VTAM

VTAM Version 4 Release 1 and NCP Version 6 Release 2 have finally introduced VTAM as a full member of the APPN community. In this chapter we will explore the implications of this change through a number of connectivity scenarios.

Note: The PTF MF03938 must be applied to AS/400 with OS/400 Version 2 Release 2 to allow the AS/400 to operate with VTAM Version 4 Release 1.

8.1 Migration Considerations for VTAM Version 4 Release 1

VTAM Version 4 Release 1 may be customized to act as one of four types of host.

1. Subarea node

In this scenario the VTAM Version 4 Release 1 start options **NODETYPE** and **CPCP** are omitted from the VTAM start list. The resulting VTAM is a pure subarea node, and can only support APPN LEN node connections. The LEN support is the same as that provided in VTAM V3R4 and VTAM V3R4.1.

This is the environment which was used in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235.

2. Interchange node

An interchange node or ICN, is a network node also defined with a subarea number. The ICN will translate APPN session setup flows to subarea session setup flows, and subarea session setup flows to APPN session setup flows. The ICN can act as a network node server for attached end nodes, will support topology database updates, and search requests from other network nodes.

This is the VTAM node type that is used for the test environments in this chapter.

The VTAM start options **NODETYPE**, **CPCP**, and **SUBAREA** are coded in the VTAM start list.

3. Migration data host

The migration data host or MDH, is an end node with subarea capability. The MDH cannot own or activate an NCP and does not allow itself to be searched by the APPN broadcast searches. The MDH requires an attached network node to provide directory services for broadcast searches.

The VTAM start options **NODETYPE**, **CPCP**, and **SUBAREA** are coded in the VTAM start list. In this case, **NODETYPE=EN** is coded.

4. Network node or end node only

VTAM Version 4 Release 1 may also be customized to act as a (pure) end node or network node. As a pure network node or end node, VTAM will support neither SSCP-SSCP sessions nor FID4 connections to other VTAMs. It is not able to own or activate an NCP and has no subarea number defined.

The VTAM start options **NODETYPE** and **CPCP** are coded in the VTAM start list. In this case, the **SUBAREA** option is omitted.

In this chapter we will consider only the VTAM interchange node. We will revisit the scenarios explored in Chapter 7, “Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)” on page 235 and discuss the configuration changes and implications of the migration to a VTAM ICN.

In addition to this, we will examine some more general configuration examples which include VTAM as a network node, AS/400, PS/2, RS/6000, and 5494 control units.

8.2 VTAM Version 4 Release 1 as a Subarea Node Only

This is the scenario we explored in Chapter 7, “Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)” on page 235. The key feature here is that VTAM 4.1 in this mode operates in the same manner as VTAM 3.4 and VTAM 3.4.1. The VTAM start options that limit VTAMs function in this case are NODETYPE and CPCP, which are omitted from the VTAM start up list.

8.3 LEN Connection to VTAM ICN

Let us first examine the VTAM start options which have been set in this scenario; in fact, we use the same options for all the scenarios in this chapter. The task of displaying the VTAM options is made relatively simple using the VTAM command, D NET,VTAMOPTS. See Figure 454. This command was introduced with VTAM V4 R1.

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/10/93 10:32:10
* RAPAN    D NET,VTAMOPTS
  RAPAN    IST097I  DISPLAY  ACCEPTED
' RAPAN
IST1188I  ACF/VTAM* V4R1   STARTED AT 07:04:27 ON 03/10/93
IST1349I  COMPONENT ID IS 5695-11701-201
IST1348I  VTAM STARTED AS INTERCHANGE NODE
IST1189I  ALSREQ  = NO                      APPNCOS  = NONE
IST1189I  ASIRFMSG = OLUSSCP                  ASYDE    = TERM
IST1189I  BSCMDRS = (STATS, INOPS)           BSCTMOUT = 286
IST1189I  CACHETI  = 8                      CDRSCTI   = 480S
IST1189I  CDSERVR  = NO                      CINDXSIZ  = 4080
IST1189I  CMPVTAM  = 0                      COLD      = YES
IST1189I  CONFIG   = P0                      CONNTYPE  = APPN   1
IST1189I  CPCP     = YES  2                  CSALIMIT  = NOLIMIT
IST1189I  CSA24    = NOLIMIT                 DATEFORM  = MDY
IST1189I  DIRSIZE  = 0                      DIRTIME   = 691200S
IST1189I  DLRTCB   = 32                      DYNADJCP  = YES
IST1189I  DYNASSCP = YES                     DYNLU     = YES   3
IST1189I  ENCRYPTN  = NO                     ESIRFMSG  = ALLSSCP
IST1189I  FSIRFMSG = OLUSSCP                 GWSSCP    = YES
IST1189I  HNTSIZE  = 4080                   HOSTPU    = ISTPUS25
???
```

Figure 454 (Part 1 of 2). Display VTAM Start Options - VTAM Interchange Node

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/10/93 10:33:20
' RAPAN
IST1188I ACF/VTAM V4R1   STARTED AT 07:04:27 ON 03/10/93
IST1189I HOSTSA  = 25  4                                HOTIOTRM = 0
IST1189I HSRTSIZE = 9973                                INITDB  = ALL
IST1189I INOPDUMP = OFF                                IOINT   = 0
IST1189I IOMSGLIM = 2147483647                          IOPURGE = 0
IST1189I MAINTLVL = *BLANKS*                            MAXLURU = 6144
IST1189I MAXSSCPs = 10                                  MAXSUBA = 15
IST1189I MIHTMOUT = 1800                                MSGLEVEL = V4R1
IST1189I MSGMOD   = NO                                  MXSAWBUF = 10000
IST1189I MXSSCPRU = 4096                                MXSUBNUM = 511
IST1189I NCPBUFsz = 512                                NETID    = USIBMRA  5
IST1189I NMVTLOG  = NPDA                                NODELST  = *BLANKS*
IST1189I NODETYPE = NN  6                                NQNMODE  = NAME
IST1189I NUMTREES = 100                                OSRTSIZE = 43
IST1189I PDTRCBUF = 2                                  PIUMAXDS = 200
IST1189I PLUALMSG = NOSUPP                             PPOLOG   = YES
IST1189I PSSTRACE = NORB                                RESUSAGE = 100
IST1189I RESWGHT  = 0                                  ROUTERES = 128
IST1189I SAWMAXDS = 100                                SAWMXQPK = 0
???
```

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/10/93 10:34:05
' RAPAN
IST1188I ACF/VTAM V4R1   STARTED AT 07:04:27 ON 03/10/93
IST1189I SDLCMDRS = (STATS,INOPS)                      SECLVLCP = ***NA***
IST1189I SIRFMSG  = ALLSSCP                             SLUALMSG = NOSUPP
IST1189I SNAPREQ  = 1000                                SONLIM   = (60,30)
IST1189I SORDER   = APPN                                SSCPDYN  = YES
IST1189I SSCPID   = 25                                  SSCPNAME = RAP  7
IST1189I SSCPORD  = PRIORITY                            SSDTMOUT = 30
IST1189I SSEARCH  = YES                                SUPP     = NOSUP
IST1189I TNSTAT   = CNSL,TIME=60                       TRANSLAT = (0,1,2,3,4,5,6,7)
IST1189I USSTAB   = *BLANKS*                            VERIFYCP = NONE
IST1189I VTAMEAS  = 32001                                WARM     = NO
IST1189I XNETALS  = YES
IST314I  END
```

Figure 454 (Part 2 of 2). Display VTAM Start Options - VTAM Interchange Node

Some of the VTAM start options of particular interest to us are:

- 1 The default setting for the CONNTYPE option, the type of connection, is APPN. This is similar to setting the APPN node type parameter in an AS/400 controller description to *CALC.

CONNTYPE could also have been set to LEN. This may be a more appropriate value if the majority of connections to the subarea are to remain LEN connections. Each connection which will support APPN can then have the CONNTYPE=APPN coded on the PU Macro.
- 2 Control-point-to-control-point (CP-CP) sessions are supported by VTAM. As discussed in 8.1, "Migration Considerations for VTAM Version 4 Release 1" on page 387, this is one of the VTAM start options that determines the type of host that VTAM will become. NODETYPE and SA, below, are the other key options.

- 3 Dynamic LU creation support is the default for this system.
- 4 The host subarea number is 25, this indicates that traditional subarea connections are still supported and the VTAM subarea number is 25.
- 5 The VTAM host has a net ID of USIBMRA.
- 6 VTAM will act as a network node.
- 7 The CP name for this system is RAP.

Logically, one of the first steps in a migration from a pure subarea VTAM to an APPN capable VTAM would be to enable the VTAM APPN function and confirm that all existing LEN type connections still function as LEN connections. Here we continue to use a LEN connection from the VTAM subarea to the gateway systems described in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235. It is not necessary to make any change to the gateway nodes described in Chapter 7, "Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)" on page 235. We must, however, include the parameter **CONNTYPE=LEN**, on the VTAM PU MACRO for each gateway system. This ensures that LEN connection types will be used on these links. The line and LU definitions can remain unchanged. In Figure 455, we see the same PU macro as Figure 273 on page 255, which now includes the CONNTYPE parameter, as an example.

```

*****
*      PU AND LU DEFINITIONS OF RALYAS4A TO SUPPORT DEPENDENT
*      AND INDEPENDENT LUS
*****
RA9P05  PU ADDR=01,              AS/400 SDLC ADDRESS      *
          MAXDATA=265,           MAXIMUM FRAME SIZE      *
          MAXOUT=7,              MAX SDLC FRAMES BEFORE RESPONSE *
          PACING=0,              PACING SET BY BIND IMAGE    *
          PASSLIM=8,                                     *
          PUTYPE=2,                                     *
          RETRIES=(,4,5),        7 RETRY PER SECOND FOR 5 TIMES *
          XID=YES,              FOR T2.1 PU                *
          DYNLU=YES,            DYNAMIC LU                  *
          CONNTYPE=LEN,          LEN CONNECTION             *
          DISCNT=(NO),           (V) VTAM                   *
          MODETAB=MTGS3X,        (V) VTAM                   *
          ISTATUS=ACTIVE,        (V) VTAM                   *
          SSCPFM=USSSCS,         (V) VTAM                   *
          USSTAB=US327X,         (V) VTAM                   *
          VPACING=0,             (V) VTAM                   *
*      STATOPT='AS/400 A'
*****
RA9T0501 LU LOCADDR=1,          3270 EMULATION            *
          MODETAB=MTGS3X,                                     *
          USSTAB=US327X,                                     *
          DLOGMOD=EM3277,                                     *
          ISTATUS=ACTIVE
RA9T0507 LU LOCADDR=7,          3270 SNA Pass Through    *
          MODETAB=MTGS3X,                                     *
          USSTAB=US327X,                                     *
          DLOGMOD=EM3277,                                     *
          ISTATUS=ACTIVE

```

Figure 455. NCP PU and LU Definitions for RALYAS4A including CONNTYPE (SDLC Link)

The controller definition on RALYAS4A, to which this is a partner, remains the same as in Chapter 6. It has been reproduced here, for convenience, in Figure 456 on page 391.

Display Controller Description		RALYAS4A
		01/26/93 13:46:09
Controller description	RA9P05	
Option	*BASIC	
Category of controller	*HOST	
Link type	*SDLC	
Online at IPL	*NO	
Switched connection	*NO	
Switched network backup	*NO	
Attached nonswitched line	RA9L005	
Character code	*EBCDIC	
Maximum frame size	521	
Remote network identifier	USIBMRA	
Remote control point	RAP	
SSCP identifier	050000000000	
Local exchange identifier	*LIND	
Station address	01	
Recontact on vary off	*YES	
Text	Controller description for SUBNET	
APPN-capable	*YES	
APPN CP session support	*NO	
APPN node type	*LENNODE	
APPN transmission group number . . .	*CALC	
Autodelete device	1440	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	
Recovery limits:		
Count limit	2	
Time interval	5	

Figure 456. Host Controller Definition for RALYAS4A to SUBNET

All other configurations in Chapter 7, “Remote Branch Networks Connected through an SNA Subarea (No APPN VTAM)” on page 235 need not be changed, with the exception of any node that has a direct physical connection to the VTAM host. In these cases the PU macro must be changed, as it has been in Figure 455 on page 390, to include the CONNTYPE=LEN statement.

If this parameter is omitted, the XID exchange process will fail. VTAM will assume that the AS/400 is capable of supporting parallel transmission groups (TGs) over this link because the AS/400 will identify itself initially as an end node. The AS/400 will reject the XID, as parallel TGs are not supported when the APPN node type is *LENNODE, as it is in Figure 456. An alternative would be to configure the AS/400 controller description as APPN node type *ENDNODE with APPN CP session support *NO, and set the CONNTYPE parameter to APPN. In our scenario setting CONNTYPE to APPN and omitting it produce the same result, as the default is APPN.

8.4 VTAM 4.1 with APPN Network Node Function

In this section we could simply remove the CONNTYPE=LEN option from our existing PU definitions. This would allow VTAM to participate in the networks, USIBMRAA and USIBMRA, as a network node. It would also be necessary to change the AS/400 controller descriptions to indicate that the VTAM host is now a network node. Similarly the definitions we created for our PS/2 with OS/2 Extended Services 1.0 gateway would be changed. We would need to remove the link **To Primary Host** and replace it with a link **To Network Node**.

In order to provide illustration of another connection type, we will replace the SDLC link we used for our host connection from USIBMRAA to USIBMRA with a token-ring LAN connection. Our new network is shown in Figure 457.

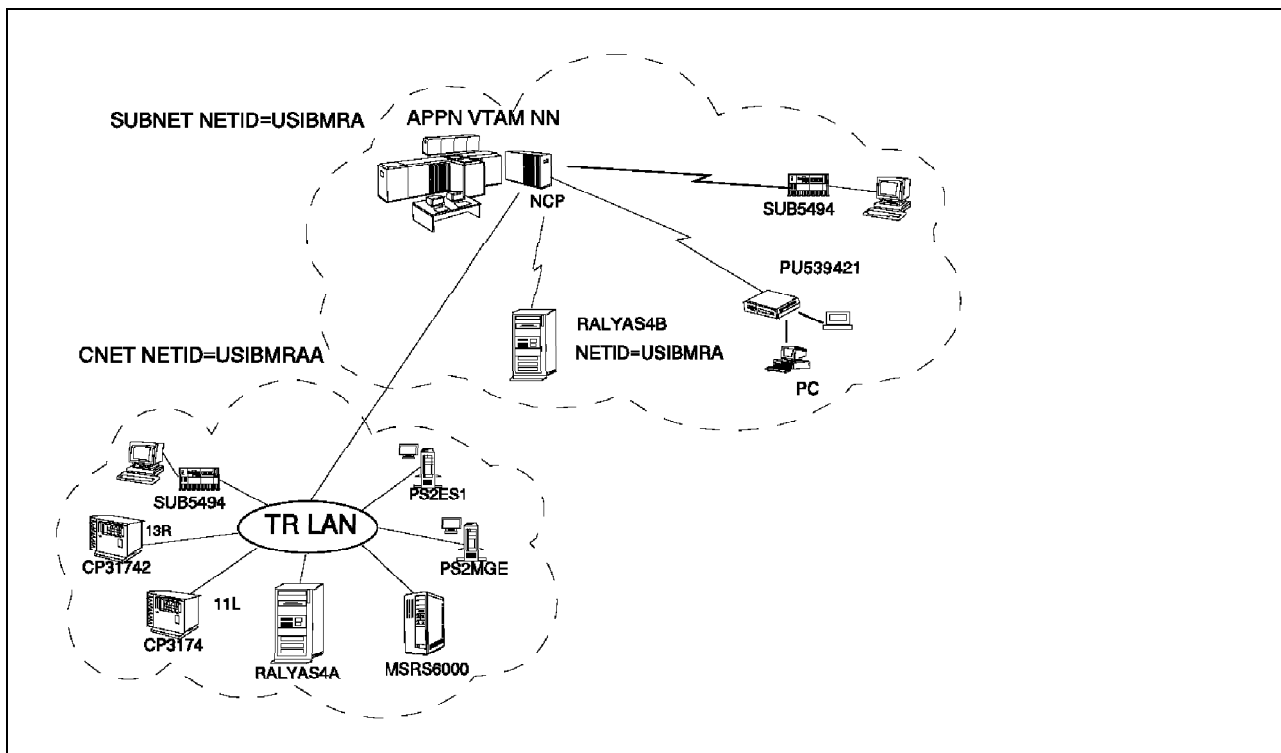


Figure 457. The Two-Network Environment Built in this Chapter. The SDLC telecommunications link from SUBNET to CNET is replaced with a token-ring LAN connection.

To accommodate the token-ring link, we must first define a Group and Line statement for the token-ring LAN interface coupler (TIC) in the 3745/NCP; this can be seen in Figure 458 on page 393.

```

*****
EG09P01  GROUP ADAPTER=TIC2,
          ECLTYPE=(PHYSICAL, ANY),
          SPEED=9600,
          MAXTSL=2044,
          TYPE=NCP,
          DIAL=NO,
          LNCTL=SDLC,
          LEVEL2=ECLNARL2,
          LEVEL3=ECLNARL3,
          LEVEL5=NCP,
          TIMER=(ECLNART1, , ECLNART2, ECLNART3),
          XI0=(ECLNARXL, ECLNARXS, ECLNARXI, ECLNARXK),
          USERID=(5668854, ECLRBDT, NORECMS, , ECLNMVT),
          MAXPU=1,
          NPACOLL=NO,
          PUTYPE=1,
          PUDR=NO,
          COMPTAD=YES,
          COMPSWP=YES,
          COMPOWN=YES
*
EL091089 LINE ADDRESS=(1089, FULL),
          ISTATUS=ACTIVE,
          PORTADD=1,
          LOCADD=400001091000,  TIC TOKEN-RING ADDR.
          TRSPEED=4,           NCP DFLT IS TIC1, TRSPEED=16
          RCVBUFC=4095,
          UACB=(X$P2AX, X$P2AR)
*          STATOPT='NTRI TIC1'
*
EP091089 PU ADDR=01,
          INNPORT=YES,
          ANS=CONTINUE
*          STATOPT='NTRI TIC1'
*
EU091089 LU ISTATUS=INACTIVE,
          LOCADDR=0
*          STATOPT='NTRI TIC1'

```

Figure 458. NCP Group and Line Definitions for the Token-Ring Link

The second requirement is the creation of a switched major node for RALYAS4A, PS2ES1, CP31742 and SUB5495. These are identical with two exceptions:

1. 31742 was coded with the dynamic dependent LU capability as discussed with Figure 402 on page 349.
2. SUB5494 had no dependent LUs coded.

Here we show the switched major node definition for RALYAS4A.

```

*****
*          AS/400 IN A TOKEN-RING NETWORK          *
*          AS/400-RALAS4A LINE 41 (L41TR)          *
*****
SWAS400A VBUILD MAXGRP=5,          REQUIRED          X
          MAXNO=12,          REQUIRED          X
          TYPE=SWNET          REQUIRED
*
*-----PU AND LU'S DEFINITION FOR AS/400 SYSTEM 9406 ----
T4A0941 PU  ADDR=01,          COULD BE ANYTHING (NOT USED) X
          MAXDATA=265,          AS/400 SYSTEM          X
          DISCNT=NO,          X
          MAXOUT=7,          X
          MAXPATH=2,          X
          CPNAME=RALYAS4A,          X
          PACING=(1,1, FIXED),          X
          VPACING=(2,2, FIXED),          X
          PUTYPE=2,          X
          PASSLIM=7,          X
          DYNLU=YES,          X
          ISTATUS=ACTIVE
**
T4A0941 PATH DIALNO=0004400010020001, TO AS/400 9406 X
          GRPNM=EG09P01,          FROM TIC 2 SA9          X
          GID=1,          X
          PID=2,          X
          USE=YES          INITIALY ACTIVE
**
*-----INDEPENDENT LU-----
* NO INDEPENDENT LU DEFINITIONS ARE REQUIRED
*-----3270 EMULATION-----
T4A09L02 LU  LOCADDR=2, MODETAB=MTGS3X, USSTAB=US327X, X
          DLOGMOD=EM3278, ISTATUS=ACTIVE
T4A09L07 LU  LOCADDR=7, MODETAB=MTGS3X, USSTAB=US327X, X
          DLOGMOD=EM3278, ISTATUS=ACTIVE

```

Figure 459. NCP Group and Line Definitions for the Token-Ring Link

Figure 460 on page 395 shows the AS/400 controller description which corresponds to Figure 459.

Display Controller Description		RALYAS4A
		03/11/93 15:41:28
Controller description	T4A0941	
Option	*BASIC	
Category of controller	*HOST	
Link type	*LAN	
Online at IPL	*NO	
Character code	*EBCDIC	
Maximum frame size	2057	
Remote network identifier	USIBMRA	
Remote control point	RAP	
Local exchange identifier	*LIND	
Initial connection	*DIAL	
Dial initiation	*LINKTYPE	
Switched disconnect	*NO	
LAN remote adapter address	400001091000	
LAN DSAP	04	
LAN SSAP	04	
Text	Token-Ring CTL to SA09	
APPN-capable	*YES	
APPN CP session support	*YES	
APPN node type	*NETNODE	
APPN transmission group number	*CALC	
APPN minimum switched status	*VRYON	
Autodelete device	*NO	
User-defined 1	*LIND	
User-defined 2	*LIND	
User-defined 3	*LIND	

Figure 460. RALYAS4A Controller for the VTAM Host Token-Ring Link

The host 3270 device and SNA Pass-Through devices for RALYAS4A are identical to Figure 275 on page 256 and Figure 296 on page 273, except for the name of their *Attached controller*.

When this configuration is activated an XID negotiation will take place, CP-CP sessions will start, topology database update will occur and user sessions may flow across the link. In addition to this, because the CP-CP sessions exist the VTAM host is now capable of issuing, accepting and responding to APPN search requests. There are four main implications here for AS/400 users:

1. It is essential that any independent LUs that have previously been defined in VTAM for the AS/400 or downstream devices be removed from their CDRSC (and NCP definition, if they were defined there). This is necessary to avoid duplicate responses to an APPN search.

NCCF	NETVIEW	RAPAN MEBELIN	03/19/93 08:57:
* RAPAN	V NET, INACT, ID=RA9T0500, DELETE=YES	1	
RAPAN	IST097I VARY ACCEPTED		
RAPAN	IST1133I RA9T0500	IS NOW INACTIVE, TYPE = CDRSC	
* RAPAN	D NET, ID=RA9T0500	2	
RAPAN	IST453I ID PARAMETER VALUE INVALID		

Figure 461. Delete CDRSC (Independent LUs). The First command 1 deletes the CDRSC, the second 2 shows an attempt to display the now deleted resource, RA9T0500.

2. It is now possible to request a session with an APPN node attached to a VTAM host, using its CP name as the DLU. This is something that has always been possible between AS/400s. For example in our network, see Figure 457 on page 392, we can now issue the following command on RALYAS4A.

Start Pass-Through (STRPASTHR)

Type choices, press Enter.

Remote location RMTLOCNAME > RALYAS4B

Virtual controller VRTCTL *NONE

Virtual display device VRTDEV *NONE

+ for more values

Mode MODE QPCSUPP

Local location LCLLOCNAME *NETATR

Remote network identifier . . . RMTNETID USIBMRA 1

System request program *SRQMNU *SRQMNU

Library

Figure 462. AS/400 STRPASTHR Command - Through an APPN VTAM System

3. The peripheral border node function, as it is currently implemented in the AS/400, will only permit sessions between adjacent net ID networks. It will not support a session to a system with third net ID without a direct link to it. Because of this we have changed the net ID of RALYAS4B to USIBMRA, as you may have noticed in Figure 457 on page 392.

It is possible to concurrently support a LEN and APPN connection between the AS/400 and VTAM over a single physical link. This would require two host PU and AS/400 controller descriptions; one for an APPN capable and one for a LEN connection. The only qualifier being that the AS/400 controller definition for the LEN connection must use a dummy CP name 1 for the host link and the remote location list entry for the system with the third net ID must point to this dummy CP name. In this scenario, the LEN connection will be used only for sessions with the third network, which must also use a LEN connection to the host. The APPN-capable link will be used for all sessions between the first two networks.

Included in Figure 463 on page 397 and Figure 464 on page 398 are the token-ring LAN LEN controller and switched major node descriptions. These are used in conjunction with the APPN-capable pair in Figure 459 on page 394 and Figure 460 on page 395.

In this scenario the second switched major node/controller pair use a different LAN SSAP 3 and the AS/400 controller uses a Local exchange identifier 2 .

Display Controller Description		RALYAS4A	
		03/16/93	18:29:14
Controller description	T4A8941		
Option	*BASIC		
Category of controller	*HOST		
Link type	*LAN		
Online at IPL	*NO		
Active switched line	L41TR		
Character code	*EBCDIC		
Maximum frame size	2057		
Remote network identifier	USIBMRA		
Remote control point	RAPLEN	1	
Local exchange identifier	05694061	2	
Initial connection	*DIAL		
Dial initiation	*LINKTYPE		
Switched disconnect	*NO		
LAN remote adapter address	400001091000		
LAN DSAP	04		
LAN SSAP	08	3	
Text	TR CTL to SA09 using SAP 08		
APPN-capable	*YES		
APPN CP session support	*NO		
APPN node type	*LENNODE		
APPN transmission group number	*CALC		
APPN minimum switched status	*VRYON		
Autodelete device	*NO		
User-defined 1	*LIND		
User-defined 2	*LIND		
User-defined 3	*LIND		

Figure 463. AS/400 Controller Description - LEN Connection Token-Ring

```

*****
*          AS/400 IN A TOKEN-RING NETWORK          *
*          AS/400-RALAS4A LINE 41 (L41TR)          *
*****
SWAS400A VBUILD MAXGRP=5,          REQUIRED          X
          MAXNO=12,          REQUIRED          X
          TYPE=SWNET          REQUIRED
**
*-----PU AND LU'S DEFINITION FOR AS/400 SYSTEM  9406  ----
**
T4A8941 PU  ADDR=01,          COULD BE ANYTHING (NOT USED)  X
          MAXDATA=265,          AS/400 SYSTEM          X
          DISCNT=NO,          X
          IDBLK=056,          2          AS/400 ID BLOCK NUMBER  X
          IDNUM=94061,          2          IDNUM OF AS/400 9406  X
          MAXOUT=7,          X
          MAXPATH=2,          X
          CONNTYPE=LEN,          X
          PACING=(1,1,FIXED),          X
          VPACING=(2,2,FIXED),          X
          PUTYPE=2,          X
          PASSLIM=7,          X
          DYNLU=YES,          X
          ISTATUS=ACTIVE
**
          3
T4A8941 PATH DIALNO=0008400010020001, TO AS/400 9406  X
          GRPNM=EG09P01,          FROM TIC 2 SA9          X
          GID=1,          X
          PID=2,          X
          USE=YES          INITIALLY ACTIVE
**
*-----INDEPENDENT LU-----
T4A89L00 LU  LOCADDR=0,MODETAB=MTGS3X,          X
          DLOGMOD=MODS361,ISTATUS=ACTIVE

```

Figure 464. VTAM Switched Major Node - LEN Connection Token-Ring

```

Display Configuration List          RALYAS4A
                                03/16/93 18:39:53
Configuration list . . . . . : QAPPNRMT
Configuration list type . . . . : *APPNRMT
Text . . . . . :

-----APPN Remote Locations-----
Remote      Remote      Remote      Control
Location    Network    Local      Control    Point    Secure
Location ID    Location Point    Net ID    Loc
*ANY        USIBMRAB  RA9TNNA0  RAPLEN    USIBMRA  *NO

```

Figure 465. Remote Location List - LEN Connection

The configuration for another type of link would be similar, for an SDLC connection the two links would be identified by separate polling addresses, for an X.25 link separate virtual circuits would be used to separate the PU/Controller pairs.

- It is no longer necessary to define remote location list entries for a link to a VTAM network node where CP-CP sessions are supported. The exception being where three networks are connected, Any existing entries which were

used to point to the VTAM CP may now be removed. The APPN search and route selection process will be able to locate these LUs and determine the most appropriate route a session should take to the remote LU.

5. It is still necessary to define a local location list entry in the AS/400 if it is to be known by an LU or location name other than the CP name.

8.4.1 Trace and Flow Analysis - AS/400 Peripheral Border Node

We will take a few moments now to look closely at the peripheral border node function implemented in the AS/400. The following two traces show XID and CP capabilities exchange between RALYAS4A and the VTAM network node RAP. These traces also give us an opportunity to examine a formatted token-ring LAN trace.

COMMUNICATIONS TRACE	Title: BORDER NODE XID VTAM	03/14/93 00:02:20	Page: 1
Trace Description	BORDER NODE XID VTAM		
Configuration object	L41TR		
Type	1	1=Line, 2=Network Interface	
Object protocol	TRN		
Start date/Time	03/13/93 23:55:11		
End date/Time	03/14/93 00:01:29		
Bytes collected	81633		
Buffer size	3	1=128K, 2=256K, 3=2048K 4=4096K, 5=6144K, 6=8192K	
Data direction	3	1=Sent, 2=Received, 3=Both	
Stop on buffer full	N	Y=Yes, N=No	
Number of bytes to trace			
Beginning bytes	*CALC	Value, *CALC	
Ending bytes	*CALC	Value, *CALC	
Controller name	T4A0941	*ALL, name	
Data representation	2	1=ASCII, 2=EBCDIC	
Format SNA data only	N	Y=Yes, N=No	
Format RR, RNR commands	N	Y=Yes, N=No	
Format TCP/IP data only	N	Y=Yes, N=No	
Format UI data only	N	Y=Yes, N=No	
Format MAC data only	N	Y=Yes, N=No	
Format Broadcast data	Y	Y=Yes, N=No	
Record Number	Number of record in trace buffer (decimal)		
S/R	S=Sent R=Received M=Modem Change		
Data Length	Amount of data in record (decimal)		
Record Status	Status of record		
Record Timer	Time stamp (Seconds, 100 millisecond resolution, decimal). Range is 0 to 6553.5 seconds		
Data Type	EBCDIC data, ASCII data or Blank=Unknown		
Controller name	Name of controller associated with record		
Command	Command/Response information		
Number sent	Count of records sent		
Number received	Count of records received		
Poll/Final	ON=Poll for Commands, Final for Responses		
Destination MAC Address	Physical address of destination		
Source MAC Address	Physical address of source		
DSAP	Destination Service Access Point (Logical address of destination)		
SSAP	Source Service Access Point (Logical address of source)		
Frame Format	LLC (Logical Link Control) or MAC (Media Access Control)		
Commands/Responses:			
I	Information		
RR	Receive Ready		
RNR	Receive Not Ready		
REJ	Reject		
UI	Unnumbered Information		
UA	Unnumbered Acknowledgment		
DISC	Disconnect/Request Disconnect		
TEST	Test		
SIM	Set Initialization Mode		
FRMR	Frame Reject		
DM	Disconnected Mode		
XID	Exchange ID		
SABME	Set Asynchronous Balanced Mode Extended		
*****	Command/Response Not Valid		

Figure 466 (Part 1 of 2). Trace AS/400 Peripheral Border Node XID Exchange

Figure 466 (Part 2 of 2). Trace AS/400 Peripheral Border Node XID Exchange

Frame 422 shows the final XID sent by RAP to RALYAS4A. Recall that the first two half bytes of the XID indicate the format of the XID and the node type of its sender. In this case, we have an X'3' - format 3 followed by X'4' - subarea node (T4 or T5). This is followed by the length of the XID, block number and ID

number. Further on, in bytes 8 and 9 we see the characteristics of the XID sender X'10F7'. X'10F7' when expressed in binary is B'00010000**1111**0111'. The bits 9, 10 and 11, indicate the sender is a network node, which provides CP services and supports CP-CP sessions on this TG.

From the fourth bit of the next byte, byte 10 (X'41'), we see also that border node function is not supported by the sender, the VTAM network node.

In frame 423 we see the RALYAS4A send its final XID. Here bytes 8 and 9 are X'10F7' or B'0000 0000**0011**0110'. Again from bits 9, 10, and 11 we can see the AS/400 stating it is not a network node, it does not request or provide control point services (topology database exchange), but it will support CP-CP sessions. In the latter part of the XID exchange frame, we also see the network-qualified CP name of each system.

We know that RALYAS4A is a network node, and that it is capable of supporting CP services. Yet here it is presenting an end node image to the VTAM network node. We will discover more about each node as we examine the CP capabilities exchange.

This brings us to our next trace, Figure 467 on page 402, which shows the dialogue continuing with the CP capabilities exchange. This is made possible as the ground rules for communication have been established with the completion of XID exchange and negotiation.

Note: AS/400s which do not support border node function, that is those with OS/400 Version 1 Release 3 (without the border node PTF MF02045) and earlier, will produce a different trace result. These will commence the XID negotiation process indicating that they are network nodes. This XID will be rejected by a second system (NN) whose network ID is different, unless it supports the border node function.

Figure 467. Trace AS/400 Peripheral Border Node CP Capabilities Exchange

0633800000F40633800000F640633800000F6

From bytes 8 and 9, B'1000001010000100', we are able to confirm the following. The sender, RALYAS4A, is an end node capable of receiving a network search, which does not support TDUs, and supports MS capabilities exchange, parallel CP-CP sessions and CP-CP session activation. This confirms what we learned from our investigation of the final XID exchange. Some additional detail is added about the capabilities of RALYAS4A as presented to the adjacent network node RAP.

The frame also contains the X'33' control vector which gives us yet more information about the types of resources that this node may be searched for. The X'33' control vector is only present when the sender is end node.

We will look briefly now at the VTAM NNS' reply.

Frame 452

Request Header (RH) : X'039101'

Formatted RH : REQ FMD, BCI, ECI, DR1, ERI, PI, CEBI

CP Capabilities : 000C12C100000000F6BE0000

Again the key information about the CP capabilities can be found in bytes 8 and 9, B'1111011010111110'. Here we also confirm what we discovered in the examination with some new information added. We can see, among other things, that the sender is a network node who supports all that the end node does, plus it supports TDUs and the registration and deletion of resources. It will, of course, never be sent or send a TDU from or to RALYAS4A as RALYAS4A has indicated it is neither capable of sending or receiving TDU.

This is, in fact, basically how the peripheral border node function works. By presenting an end node image which does not share topology information, both systems are effectively isolated from topology database updates which propagate within the other's network. At same time they can support APPN search requests over the CP-CP sessions, and consequently are able to find resources in the other's network.

In frames 472 and 475 we see the identical CP capabilities exchange for the second CP-CP session from RAP to RALYAS4A.

8.5 VTAM Version 4 Release 1 APPN Configuration Examples

The following are some general configuration examples which include AS/400, RS/6000, and PS/2 connections to a VTAM network node.

8.5.1 5494 to AS/400 via VTAM APPN

RPQ 8Q0932 for attachment to a Subarea Network must be used for any subarea attachment. This RPQ is a licensed internal code enhancement feature for the 5494 Remote Control Unit. This enhancement allows the 5494 to communicate with an AS/400 through an SNA subarea network. Thus, a target AS/400 system can communicate with remote DWSs or IWSs attached to the 5494. The 5494 ASN RPQ provides support for both IWSs and DWSs through a twinaxial link and IWSs attached through a token-ring to the 5494.

Configuration for this scenario differs in several ways from the 5494 connection to a VTAM LEN node described in the previous chapter. The main differences are:

- We no longer need to create LUs at the host for the adjacent nodes. Instead, we can specify DYNLU=YES and allow them to be autocreated during XID exchange.
- Network IDs become a consideration. In the previous LEN configuration the connection to adjacent nodes had to be defined in each node, so APPN searches were not used. However, in this scenario no more than two network IDs can be used due to limitations of the peripheral border node function implemented in the AS/400.
- If the CP and LU name of the 5494 are the same, then a remote and local location list entry on the AS/400 is no longer required. If they are not the same, then a local location list will be required.

We started building our scenario by connecting a 5494 DWS to RALYAS4A via a VTAM network node. Then, we added another 5494 downstream of the original one, with an IWS twinaxially attached. Please refer to Figure 475 on page 408.

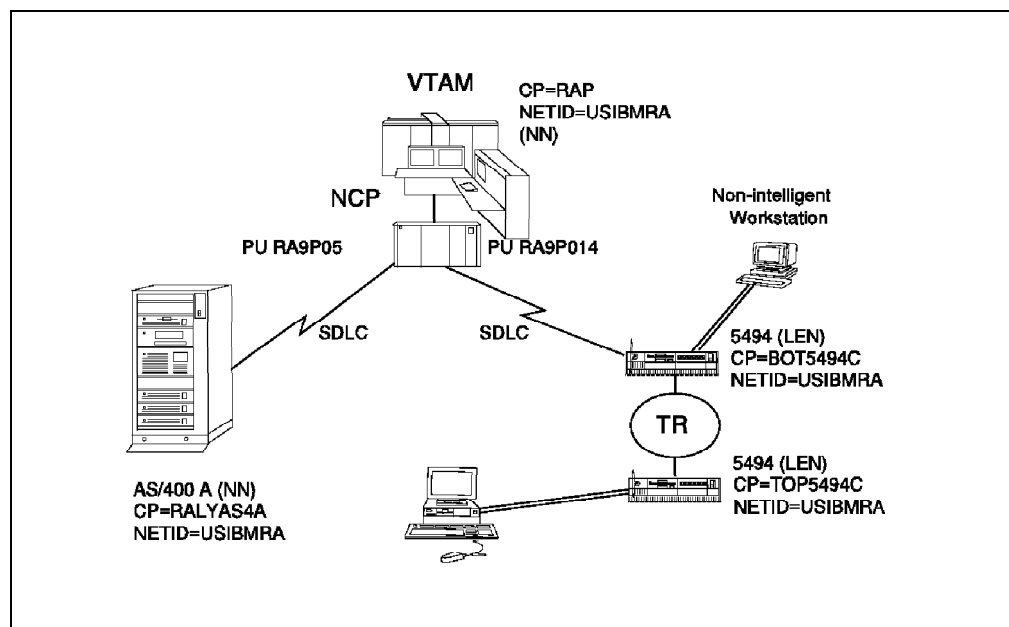


Figure 468. 5494 to AS/400 via VTAM Network Node

8.5.1.1 5494 Configuration

The 5494 was configured using the 5494 Utility Program. For more details on 5494 configuration, please refer to Chapter 4, "The 5494 Remote Control Unit" on page 123. For the AS/400 connection type, SDLC was chosen, and the connection was configured as per the following screen:

JC2-2-1 5494 - Configuration - AS/400 Connection - SDLC		More
Fill in the fields and use the spacebar to make selections, then press F6. Press Enter to verify the data.		
5494 SDLC Station Address (Hex)		[01]
Line Type	Leased Switched/Manual-Dial Switched/(V.25 bis)	
Line Facility	Half-Duplex Full-Duplex	
Connection Type	Multipoint Point-to-Point	
Data Encoding	NRZI NRZ	
Connection Method	DTR CDSTL	
Send Leading Pad	No Yes	
Local Loopback Support	No Yes	
V.25 bis Auto-Dial Connection Timeout in Seconds	[60]	End

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 469. Configuring the 5494 for an SDLC Connection

Information about the network was then configured.

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRA]	
5494 LU Name	[BOT5494C]	1
5494 CP Name	[BOT5494C]	1
Default Mode Name	[QPCSUPP]	2
5494 Connection Number	[]	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[XI]-[05494]	3
H1 AS/400 System 1		
AS/400 LU Name	[RALYAS4A]	
AS/400 Network Name	[USIBMRAA]	
5494 Network Name	[USIBMRA]	
Mode Name	[QPCSUPP]	
AS/400 Connection Number	[]	

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 470. Configuring the 5494 Network Information

Notes:

- 1 For simplicity, the LU and CP name of the 5494 were kept the same. If, however, it is necessary for them to be different, then an entry in the AS/400 remote location list would be necessary.
- 2 The mode QPCSUPP was used instead of the normal 5494 mode of QRMTWSC because it was already defined in the host mode table.
- 3 If support for network user verification is required, the serial number should be "XI-hhhhh" where h represents a valid hexadecimal digit. The 5494 inserts the last five characters into the ID number field of the XID transmitted by the 5494.

This is all the configuration necessary on the 5494.

8.5.1.2 Host Configuration

The 5494 connection used the line RA9L014 and PU RA9P014 as follows:

```

RA9L014  LINE ADDRESS=(014,HALF),  HDX LEASED LINE
          ANS=CONTINUE,             DON'T BREAK CROSS DOMAIN SESSIONS
          NPACOLL=YES,
          ISTATUS=ACTIVE,
          CLOCKNG=EXT,              MODEM CLOCKING
          DUPLEX=(FULL),            REQUEST TO SEND ALWAYS UP
          MAXPU=9,                  ALLOW NO MORE THAN 9 PUS ON LINE
          SERVLIM=10,
          SPEED=9600,              NPA AND SCANNER USE      #####
          SRT=(, 64)
*      NGFTXT='AS/400/A'

```

Figure 471. Host Line Definition for SDLC Line to 5494

```

RA9P014  PU  ADDR=01,
          DATMODE=FULL,
          ISTATUS=ACTIVE,
          MODETAB=MTGS3X,
          PUTYPE=2,
          CONNTYPE=LEN,
          XID=YES,
          DYNLU=YES
*      STATOPT='5494'

```

Figure 472. Host PU Definition for 5494

As mentioned before, we do not need to create ILUs for the 5494 if we specify DYNLU=YES. Note the CONNTYPE specified as LEN.

The AS/400 connection used the line RA9L005 and PU RA9P05. The description for RA9L005 was identical to the line RA9L014 described above. The PU, RA9P05, was configured as follows:

```

RA9P05   PU  ADDR=01,          AS/400 SDLC ADDRESS
          MAXDATA=265,         MAXIMUM FRAME SIZE
          MAXOUT=7,            MAX SDLC FRAMES BEFORE RESPONSE
          PACING=0,            PACING SET BY BIND IMAGE
          PASSLIM=8,
          PUTYPE=2,
          RETRIES=(, 4, 5),     7 RETRY PER SECOND FOR 5 TIMES
          XID=YES,              FOR T2.1 PU
          DYNLU=YES,            DYNAMIC LU
          DISCNT=(NO),          (V) VTAM
          MODETAB=MTGS3X,       (V) VTAM
          ISTATUS=ACTIVE,       (V) VTAM
          SSCPFM=USSSCS,        (V) VTAM
          USSTAB=US327X,        (V) VTAM
          VPACING=0,            (V) VTAM
*      STATOPT='AS/400 A'

```

Figure 473. PU Definition for AS/400 A

We don't need to define ILUs in these configurations as we are using the AS/400 and 5494 CP names as DLU names. If, however, the CP and LU names were not the same, then a local location list entry would be needed.

8.5.1.3 AS/400 Configuration

The SDLC line, RA9L005, was used.

Display Line Description	
Line description	RA9L005
Option	*BASIC
Category of line	*SDLC
Resource names	LIN082
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	0569406A
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*HALF
Modulus	8
Text	SDLC Line to SA09 - RA9NCPI

Figure 474. Line Description for SDLC Line to Host

As the adjacent system is a System/370*, we configured a host controller instead of the normal APPC controller.

Display Controller Description	
Controller description	RA9P05
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L005
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
SSCP identifier	050000000000
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	HOST CTL SA09 - NCP RA9NCPI

Figure 475. Host Controller Description

Controller description	RA9P05
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*YES
APPN node type	*NETNODE
APPN transmission group number . . .	*CALC
Autodelete device	1440
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 476. APPN Capabilities of the Host Controller. As we are communicating with a network node, CP session support is *yes.

A remote workstation controller was created for the DWSs attached to the 5494.

Display Controller Description	
Controller description	CTL5494RWS
Option	*BASIC
Category of controller	*RWS
Controller type	5494
Controller model	2
Link type	*NONE 1
Online at IPL	*YES
Remote location	TOP5494C 2
Local location	*NETATR
Remote network identifier	USIBMRAA 3
Text	5494 Remote Workstation Controller

Figure 477. Remote Workstation Controller for 5494. A 3487 display was attached to this controller.

Notes:

- 1 The link type is always *NONE for a 5494 RWS controller.
- 2 The LU name of the 5494.
- 3 The network ID of the network that the 5494 is in. This, together with the remote location name, makes up the network-qualified LU name of the 5494.

Note, also, that in this scenario it is not necessary to have a remote location list entry in the AS/400.

When the line RA9L005 was activated, VTAM created an LU for RALYAS4A. Similarly, when we IML the 5494, VTAM created an LU for BOT5494C and forwarded its BIND to the AS/400. The AS/400 created an LU (device) for the 5494 on the controller RA9P05, and sent a BIND for the DWS sessions to VTAM. VTAM forwarded this BIND to the 5494 and the DWSs became active.

8.5.2 Adding a Second Downstream 5494

A second 5494 was connected to the first 5494 via token-ring. Please note that there are restrictions to using this configuration; refer to Chapter 4, "The 5494 Remote Control Unit" on page 123 for details of these restrictions.

8.5.2.1 5494 Configuration

The SDLC-attached 5494 was reconfigured to include the token-ring gateway function.

```
JC2-3      5494 - Configuration - Token-Ring Gateway

Fill in the fields and use the spacebar to make selection,
then press F6. Press Enter to verify the data.

Token-Ring Gateway Support . . . . . No
                                     Yes

Token-Ring Address (Hex) . . . . . [400054940001]
SAP . . . . . [04]
Response Timer (T1) . . . . . [1 ]
Inactive Timer (Ti) . . . . . [30]
Receive Acknowledgment Timer (T2) . . . . . [30 ]
Retry Count (N2) . . . . . [8 ]
Maximum Out (TW) . . . . . [2]
Maximum In (N3) . . . . . [1]

-----
Esc  Cancel  F1  Help  F3  Exit  F6  Return
```

Figure 478. Configuring the 5494 for a Token-Ring Gateway

The downstream 5494 was then configured for token-ring attachment to the AS/400 with the following network information:

JC2-1	5494 - Configuration - Network Information	More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name [USIBMRA]		
5494 LU Name [TOP5494C]		
5494 CP Name [TOP5494C]		
Default Mode Name [QPCSUPP]		
5494 Connection Number [400054940002]		
Logical Connection:		
Retry Counter [10]		
Retry Interval [6]		
Serial Number [XI] - [15494]		
H1 AS/400 System 1		
AS/400 LU Name [RALYAS4A]		
AS/400 Network Name [USIBMRAA]		
5494 Network Name [USIBMRA]		
Mode Name [QPCSUPP]		
AS/400 Connection Number		
[400054940001]		

Esc=Cancel F1=Help F3=Exit F6=Return F7=Page Up F8=Page Down		

Figure 479. Network Information for Downstream 5494

This time the 5494 connection number was specified along with the connection number of the AS/400 (which in our case is the token-ring address of the adjacent 5494).

An IWS running Communications Manager/2 was attached to the 5494. Selecting the communications configuration icon, we first chose the connection type, in our case twinax 5250 emulation.

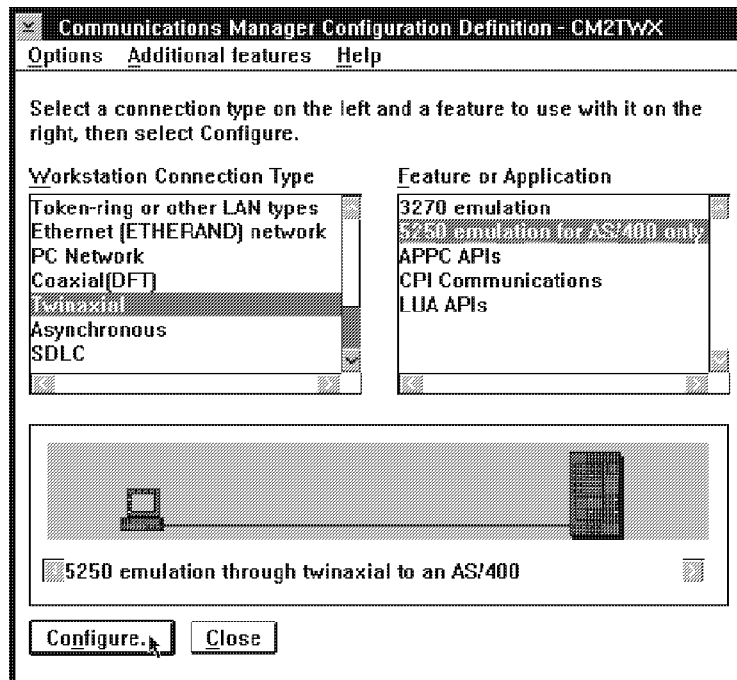


Figure 480. CM/2 Communications Configuration

We, then, entered our local node information, exchange ID information, the fully-qualified LU name of the AS/400, and the mode that we wished to use.

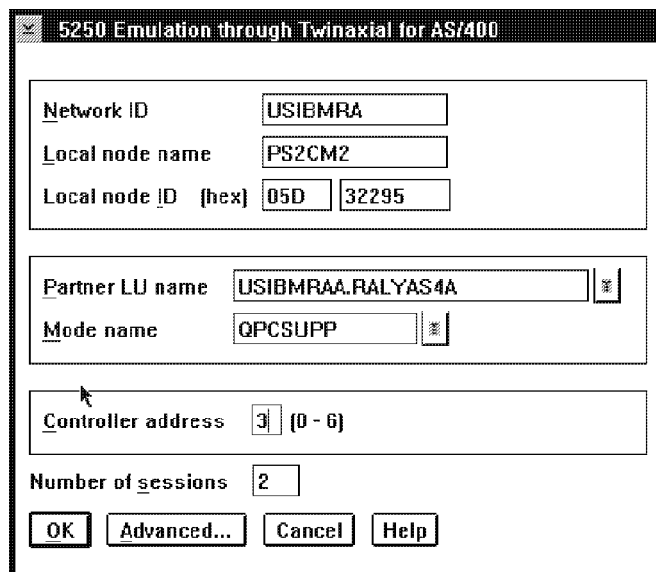


Figure 481. CM/2 Network Information

This is all that is necessary to configure CM/2 for a twinaxial connection. CM/2 will automatically create a link and Partner LU which may be changed if necessary.

Change a Connection to a Peer Node

Link name:

Partner network ID: (Required for partner LU definition)

Partner node name: (Required for partner LU definition)

Optional comment:

Buttons:

Figure 482. Connection Created by CM/2

Change Partner LUs

To add a Partner LU, enter the LU name, alias, and comment. Then select the Add button.

To change a Partner LU, select an LU from the list, change the LU name, alias, and/or comment fields and select the Change button.

To delete a Partner LU, select an LU from the list and select the Delete button.

LU name: Alias:

Dependent partner LU: ☒ Partner LU is dependent

Uninterpreted name:

LU name	Alias
USIBMRAA RALYAS	5250PLU

Buttons:

Figure 483. Partner LU Created by CM/2

Remember!

The 5494 will only pass BINDs upstream to an AS/400. As a result only IWSSs will be able to attach to the downstream 5494.

8.5.3 5494 Sessions

In this section we describe the configuration steps necessary to configure a 5494 which is physically attached to AS/400 A, in order to allow it to communicate, via the APPN VTAM, with AS/400 B. Please refer to Figure 484 for a diagram of this scenario.

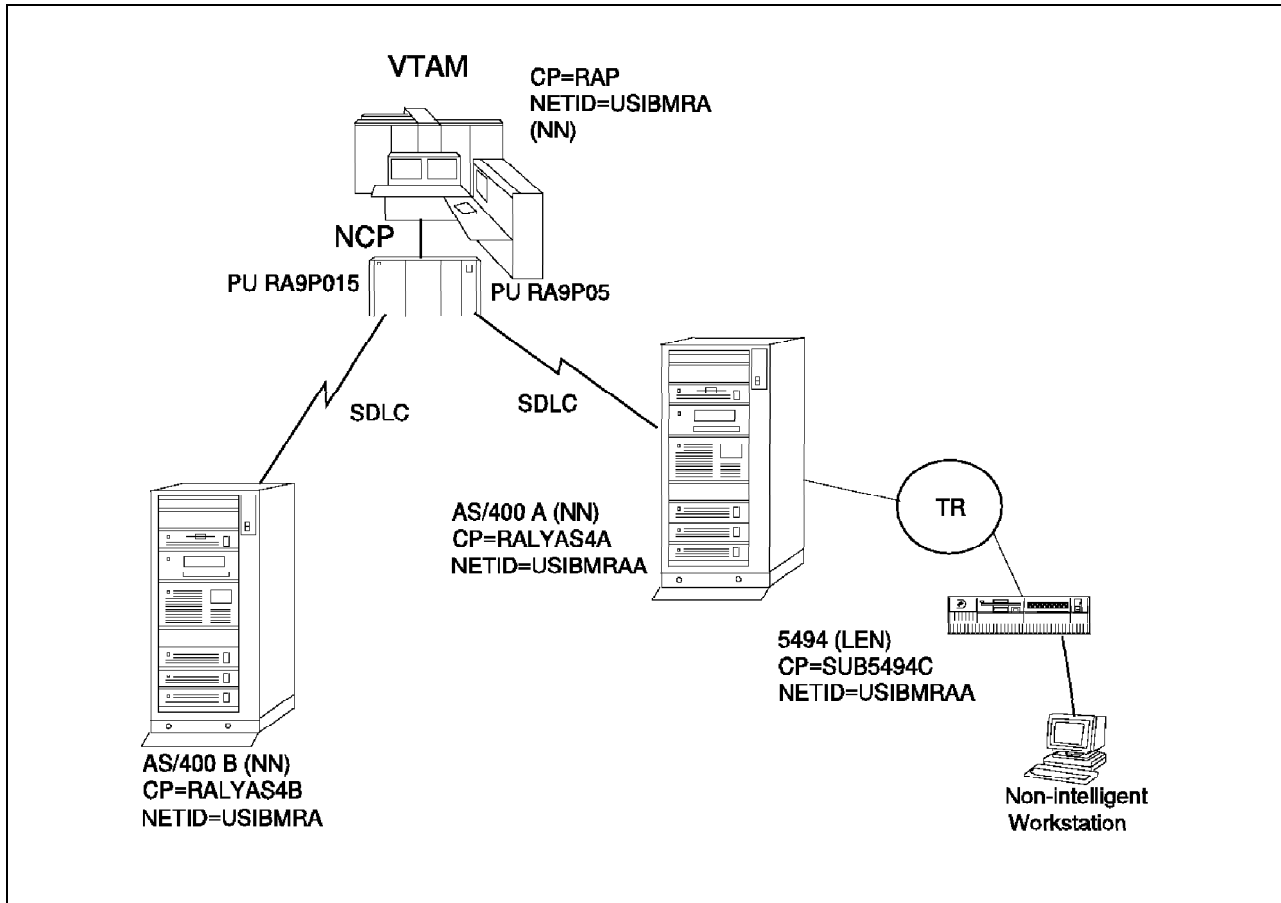


Figure 484. 5494 in an APPN Network

As can be seen in the diagram, the 5494 was physically connected to AS/400 A in network USIBMRAA, but sessions were routed through this AS/400 and the subarea network to AS/400 B in network USIBMRA. Configuration was carried out as follows.

8.5.3.1 5494 Configuration

The 5494 was configured using the 5494 Utility Program and RPQ 8Q0932 for attachment to a Subarea Network to connect via the token-ring network to AS/400 A. For more details on the RPQ 8Q0932 for attachment to a Subarea Network, please refer to 7.7, "AS/400 to 5494 via a Subarea Network" on page 367. For a more detailed description of 5494 configuration, please refer to Chapter 4, "The 5494 Remote Control Unit" on page 123. The network information was set up as follows.

JC2-1 5494 - Configuration - Network Information		More
Fill in the fields, then press F6. Press Enter to verify the data.		
Default Local Network Name	[USIBMRAA]	
5494 LU Name	[SUB5494C]	
5494 CP Name	[SUB5494C]	
Default Mode Name	[QPCSUPP]	
5494 Connection Number	[400054940001]	
Logical Connection:		
Retry Counter	[10]	
Retry Interval	[6]	
Serial Number	[XI] - [25494]	
H1 AS/400 System 1		
AS/400 LU Name	[RALAS4B]	
AS/400 Network Name	[USIBMRA]	
5494 Network Name	[USIBMRAA]	
Mode Name	[QPCSUPP]	
AS/400 Connection Number		
[400010020001		]

Esc Cancel F1 Help F3 Exit F6 Return F7 Page Up F8 Page Down		

Figure 485. 5494 Network Information

8.5.3.2 Configuration of Intermediate AS/400

As the 5494 was connecting to AS/400 A via the token-ring network, we allowed the AS/400 to autocreate the necessary APPC controller.

For our connection to the host, we used the SDLC line RA9L005. To this line we attached the Host controller RA9P05.

Display Controller Description	
Controller description	RA9P05
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L005
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
SSCP identifier	050000000000
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	HOST CTL SA09 - NCP RA9NCPI

Figure 486. Host Controller Definition on AS/400 A

8.5.3.3 Host Definitions

The SDLC line RA9L005 was used for communications between the host and AS/400 A. Attached to this line was the PU RA9P05.

RA9P05	PU ADDR=01,	AS/400 SDLC ADDRESS	*
	MAXDATA=265,	MAXIMUM FRAME SIZE	*
	MAXOUT=7,	MAX SDLC FRAMES BEFORE RESPONSE	*
	PACING=0,	PACING SET BY BIND IMAGE	*
	PASSLIM=8,		*
	PUTYPE=2,		*
	RETRIES=(, 4, 5),	7 RETRY PER SECOND FOR 5 TIMES	*
	XID=YES,	FOR T2.1 PU	*
	DYNLU=YES,	DYNAMIC LU	*
	DISCNT=(NO),	(V) VTAM	*
	MODETAB=MTGS3X,	(V) VTAM	*
	ISTATUS=ACTIVE,	(V) VTAM	*
	SSCPFM=USSSCS,	(V) VTAM	*
	USSTAB=US327X,	(V) VTAM	*
	VPACING=0	(V) VTAM	*
*	STATOPT='AS/400 A'		

Figure 487. Host PU Definition for RALYAS4A

For communication between the host and AS/400 B, line RA9L015 was used. Attached to this line was the PU RA9P015.

RA9P015	PU ADDR=01,	AS/400 SDLC ADDRESS	*
	MAXDATA=265,	MAXIMUM FRAME SIZE	*
	MAXOUT=7,	MAX SDLC FRAMES BEFORE RESPONSE	*
	PACING=0,	PACING SET BY BIND IMAGE	*
	PASSLIM=8,		*
	PUTYPE=2,		*
	RETRIES=(, 4, 5),	7 RETRY PER SECOND FOR 5 TIMES	*
	XID=YES,	FOR T2.1 PU	*
	DYNLU=YES,	DYNAMIC LU	*
	DISCNT=(NO),	(V) VTAM	*
	MODETAB=MTGS3X,	(V) VTAM	*
	ISTATUS=ACTIVE,	(V) VTAM	*
	SSCPFM=USSSCS,	(V) VTAM	*
	USSTAB=US327X,	(V) VTAM	*
	VPACING=0	(V) VTAM	*
*	STATOPT='AS/400 B'		

Figure 488. Host PU Definition for RALYAS4B

In both cases the PUs used the DYNLU=YES option, allowing VTAM to create LUs when needed.

8.5.3.4 AS/400 Configuration - Target AS/400

The SDLC line RA9L015 was used to communicate with the host. Attached to this line was the controller RA9P015.

Display Controller Description	
Controller description	RA9P015
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L015
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	Controller Description for RAP

Figure 489. AS/400 B Host Controller

Controller description	RA9P015
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*YES
APPN node type	*NETNODE
APPN transmission group number	*CALC
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 490. APPN Capabilities of Host Controller

We also created a remote workstation controller for the 5494.

Display Controller Description	
Controller description	SUB5494RWS
Option	*BASIC
Category of controller	*RWS
Controller type	5494
Controller model	2
Link type	*NONE
Online at IPL	*YES
Remote location	SUB5494C
Local location	*NETATR
Remote network identifier	USIBMRAA
Text	*BLANK

Figure 491. Remote Workstation Controller for the 5494. Attached to this controller were two 3487 devices.

8.5.3.5 Activating the Network

We activated all the links and started the 5494. The first object to be created was an APPC controller for the 5494 on AS/400 A's token-ring line.

Display Controller Description	
Controller description	SUB5494C
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*NO
Active switched line	L41TR
Character code	*EBCDIC
Maximum frame size	16393
Remote network identifier	USIBMRAA
Remote control point	SUB5494C
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	400054940001
LAN DSAP	04
LAN SSAP	04
Text	AUTOMATICALLY CREATED BY QLUS

Figure 492. APPC Controller Autocreated on AS/400 A

As this controller was only being used for intermediate sessions, no APPC device was created. As a result, the controller did not go active, but remained in the VARIED ON state.

Work with Configuration Status			
Position to _____ Starting characters			
Type options, press Enter.			
1=Vary on 2=Vary off 5=Work with job 8=Work with description			
9=Display mode status ...			
Opt	Description	Status	Type
—	L41TR	ACTIVE	*LIN
—	SUB5494C	VARIED ON	*CTL

Figure 493. WRKCFGSTS for AS/400 A Token-Ring Connection to RS/6000. Note that the 5494 controller session can not be seen as it operates below the Machine Interface (MI)

However, using the DSPAPPNINF command with parameters *SSN, *INMSSN, we could examine the intermediate sessions on AS/400 A.

```

                                Display Intermediate Sessions
                                System:  A
Number of intermediate sessions . . . . . : 3
Number of sessions in use . . . . . : 3
Controller . . . . . : *ALL

Type options, press Enter.
  5=Display session information  10=Display PIUs
 11=Display pacing information...

                                --Session Origin--
                                Control  Network
Opt  PCID                Point  ID      Mode      Status
---  ---                ---  ---  ---  ---  ---
   1  F64B0D2EC8E0F808  RALYAS4B  USIBMRA  QPCSUPP  In use
   2  F64B0D2EC8E0F807  RALYAS4B  USIBMRA  QPCSUPP  In use
   3  F77B0F9541755B6A  SUB5494C  USIBMRAA  QPCSUPP  In use

```

Figure 494. Intermediate Sessions on AS/400 A

As can be seen above, there are three intermediate sessions in use: one for the 5494 controller originating from the 5494, and two 5250 sessions for the DWs, originating from the AS/400.

Upon examining the host system, we see that VTAM creates a CDRSC for SUB5494C.

```

                                N E T V I E W   RAPAN SMYTH   02/27/93 15:50:42
                                DISPLAY NET,ID=SUB5494C,SCOPE=ALL
                                IST097I  DISPLAY  ACCEPTED

NAME = USIBMRAA.SUB5494C, TYPE = CDRSC
STATUS= ACT/S----Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=***NA*** USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC  MAJOR NODE = ISTCDRDY
CDRM NAME = RAP      , VERIFY OWNER = NO
ALSLIST = ISTAPNPU
DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000003, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P05
NAME      STATUS      SID      SEND RECV VR TP NETID
RALYAS4B  ACTIV-S     F77B0F9541755B6A      USIBMRA
RALYAS4B  ACTIV-P     F64B0D2EC8E0F808      USIBMRA
RALYAS4B  ACTIV-P     F64B0D2EC8E0F807      USIBMRA
NAME = USIBMRAA.SUB5494C, TYPE = CDRSC
-----
NAME = USIBMRAA.SUB5494C, TYPE = DIRECTORY ENTRY
  DIRECTORY ENTRY = DYNAMIC  LU
  CPNAME = USIBMRAA.RALYAS4A - NETSRVR = USIBMRA.RAP
END

```

Figure 495. Dynamically Created Host LU SUB5494C

If we examine the target AS/400, AS/400 B, we see that our 5494 controller has become active, and that an APPC controller for the 5494 was created on RA9P015.

```

Work with Configuration Status
                                02/27/93
Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on  2=Vary off  5=Work with job  8=Work with description
  9=Display Mode status ...

Opt Description      Status      Type
—  RA9L015          ACTIVE      *LIN
—  RA9P015          ACTIVE      *CTL
—  RAP              ACTIVE      *DEV
—  MSRS6000000      ACTIVE      *DEV
—  SUB5494C01       ACTIVE      *DEV
—  QPCSUPP          ACTIVE/TARGET *MOD

```

Figure 496. Status of Host Connection with 5494 Device Autocreated

```

Work with Configuration Status
                                02/27/93
Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on  2=Vary off  5=Work with job  8=Work with description
  9=Display Mode status ...

Opt Description      Status      Type
—  SUB5494RWS       ACTIVE      *CTL
—  TEST1            SIGNON DISPLAY *DEV
—  TEST2            SIGNON DISPLAY *DEV

```

Figure 497. Status of 5494 Remote Workstation Controller

Display Device Description	
Device description	SUB5494C01
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	SUB5494C
Online at IPL	*NO
Local location	RALYAS4B
Remote network identifier	USIBMRAA
Attached controller	RA9P015
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 498. Automatically Created APPC Device for 5494.

8.5.4 RS/6000 (LEN) to VTAM (NN) to AS/400 (NN)

In this scenario we attach the RS/6000 to our VTAM network node via the token-ring network, and then use this connection to reach our AS/400 network. Please refer to Figure 499 for details of this scenario.

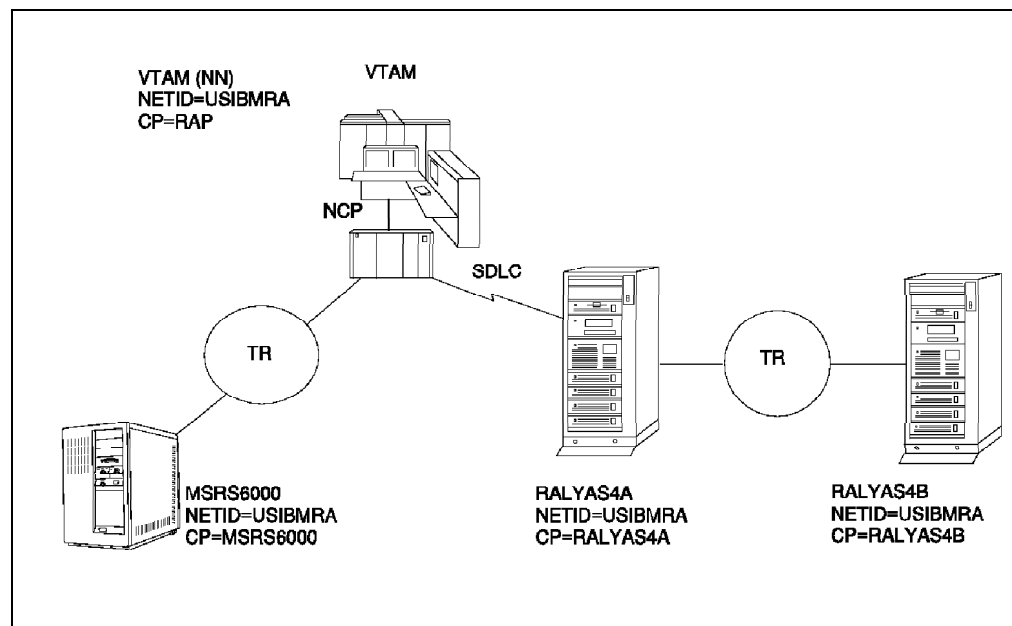


Figure 499. RS/6000 to AS/400 via VTAM

8.5.4.1 RS/6000 Configuration

We used the logical link, physical link, control point, mode, and transaction program profiles created in Chapter 6, "The RISC System/6000" on page 213. We altered the Local LU profile to give us the same net ID as VTAM, and changed the token-ring attachment profile so that it pointed to the TIC of our host 3745. All other configuration parameters stayed the same.

Change / Show SNA Token-Ring Attachment Profile	
Type or select values in entry fields. Press Enter AFTER making all desired changes.	
[TOP]	[Entry Fields]
CURRENT profile name	SMYTH
NEW PROFILE name	[]
CONTROL POINT profile name	[SMYTH]
LOGICAL LINK profile name	[SMYTH]
PHYSICAL LINK profile name	[SMYTH]
STOP ATTACHMENT on inactivity?	no
If yes, inactivity TIMEOUT (0-10 minutes)	[0]
LU address REGISTRATION?	no
If yes, LU address REGISTRATION PROFILE name	[LDEFAULT]
CALL type	call
If listen,	
AUTO-LISTEN?	no
MINIMUM SAP address (hex 04-ec)	[04]
MAXIMUM SAP address (hex 04-ec)	[EC]
If call, ACCESS ROUTING	link_address
If link-name, REMOTE LINK name	[]
If link-address,	
Remote LINK address	[40001090000] 1
Remote SAP address (hex 04-ec)	[04]
[BOTTOM]	

Figure 500. Token-Ring Attachment Profile

Note:

- 1 The token-ring address of the host.

Change / Show SNA LU6.2 Local LU Profile															
Type or select values in entry fields. Press Enter AFTER making all desired changes.															
CURRENT profile name		[Entry Fields]													
NEW PROFILE name		SMYTH													
TPN LIST profile name		[]													
NETWORK name		[TDEFAULT]													
Local LU NAME		[USIBMRA] 1													
INDEPENDENT LU?		[MSRS6000] 1													
If no,		yes													
Local LU ADDRESS (1-255)		[1]													
SSCP ID		[*]													
<table border="0"> <tr> <td>F1=Help</td> <td>F2=Refresh</td> <td>F3=Cancel</td> <td>F4=List</td> </tr> <tr> <td>F5=Undo</td> <td>F6=Command</td> <td>F7=Edit</td> <td>F8=Image</td> </tr> <tr> <td>F9=Shell</td> <td>F10=Exit</td> <td>Enter=Do</td> <td></td> </tr> </table>				F1=Help	F2=Refresh	F3=Cancel	F4=List	F5=Undo	F6=Command	F7=Edit	F8=Image	F9=Shell	F10=Exit	Enter=Do	
F1=Help	F2=Refresh	F3=Cancel	F4=List												
F5=Undo	F6=Command	F7=Edit	F8=Image												
F9=Shell	F10=Exit	Enter=Do													

Figure 501. LU6.2 Local LU Profile

Note:

- 1 This is the network-qualified LU name of the RS/6000.

We then added a second connection profile to our existing attachment for RALYAS4B.

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTH		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH]		
LOCAL LU profile name	[SMYTH]		
NETWORK name	[USIBMRA] 1		
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[RALYAS4B]		
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended		
If extended, SESSION CONCURRENCY	parallel		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 502. LU6.2 Logical Connection Profile

Note:

- 1 This is the name of the **target** network. Together with the remote LU name, this makes up the network-qualified name of the target LU.

8.5.4.2 Host Configuration

We created a switched major node for the RS/6000 token-ring connection.

```

*****
*
*          RS/6000 IN A TOKEN-RING NETWORK          *
*
*****
SWRS6000 VBUILD MAXGRP=5,          REQUIRED          X
          MAXNO=12,          REQUIRED
          TYPE=SWNET          REQUIRED
**
* -----PU AND LU'S DEFINITION FOR RS/6000 SYSTEM -----
**
RS6000  PU   ADDR=01,          COULD BE ANYTHING (NOT USED)  X
          MAXDATA=265,        RS6000 SYSTEM                X
          IDBLK=071,          RS/6000  ID BLOCK NUMBER      X
          IDNUM=00000,        IDNUM OF RS6000               X
          DISCNT=NO,          X
          MAXOUT=7,          X
          MAXPATH=2,         X
          CPNAME=MSRS6000,    X
          PACING=(7,1),       X
          VPACING=8,          X
          PUTYPE=2,           X
          PASSLIM=7,          X
          ISTATUS=ACTIVE
**
TR13A40A PATH DIALNO=000410005AA88793, TO RS6000 1      X
          GRPNM=EG13L01,    FROM TIC 2                  X
          GID=1,            X
          PID=2,            X
          USE=YES          INITIALLY ACTIVE
**

```

Figure 503. Switched Major Node for RS/6000

The AS/400 connection was through the line RA9L005 and PU RA9P05.

```

RA9L005  LINE ADDRESS=(005,HALF),  HDX LEASED LINE          *
        ANS=CONTINUE,          DON'T BREAK CROSS DOMAIN SESSIONS *
        NPACOLL=YES,
        ISTATUS=ACTIVE,
        CLOCKNG=EXT,          MODEM  PROVIDES THE CLOCKING ##### *
        DUPLEX=(FULL),        REQUEST TO SEND ALWAYS UP      *
        MAXPU=9,              ALLOW NO MORE THAN 9 PUS ON LINE *
        SERVLIM=10,
        SPEED=9600,          NPA AND SCANNER USE          ##### *
        SRT=(, 64)
*      NGFTXT='AS/400/A'
*****
*      SERVICE MACRO SPECIFICATION FOR SDLC (LINE 005)          *
*****
        SERVICE ORDER=(RA9P05),MAXLIST=9
*****
*      PU AND LU DEFINITIONS OF AS/400A TO SUPPORT DEPENDENT
*      AND INDEPENDENT LUS
*****
RA9P05  PU ADDR=01,          AS/400 SDLC ADDRESS          *
        MAXDATA=265,          MAXIMUM FRAME SIZE          *
        MAXOUT=7,             MAX SDLC FRAMES BEFORE RESPONSE *
        PACING=0,             PACING SET BY BIND IMAGE      *
        PASSLIM=8,
        PUTYPE=2,
        RETRIES=(, 4, 5),      7 RETRY PER SECOND FOR 5 TIMES *
        XID=YES,              FOR T2.1 PU                  *
        DYNLU=YES,            DYNAMIC LU                    *
        DISCNT=(NO),          (V) VTAM                      *
        MODETAB=MTGS3X,        (V) VTAM                      *
        ISTATUS=ACTIVE,        (V) VTAM                      *
        SSCPFM=USSSCS,         (V) VTAM                      *
        USSTAB=US327X,         (V) VTAM                      *
        VPACING=0              (V) VTAM                      *
*      STATOPT='AS/400 A'
*****

```

Figure 504. Line and PU for the AS/400. Note that we are allowing VTAM to dynamically create an LU for the RS/6000

8.5.4.3 AS/400 Configuration

For our host connection we used the line, RA9L005, and controller, RA9P05, on RALYAS4A as follows:

Display Line Description	
Line description	RA9L005
Option	*BASIC
Category of line	*SDLC
Resource names	LIN082
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	0569406A
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*HALF
Modulus	8
Text	SDLC Line to SA09 - RA9NCPI

Figure 505. Line Description for Host Connection

Display Controller Description	
Controller description	RA9P05
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L005
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
SSCP identifier	050000000000
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	HOST CTL SA09 - NCP RA9NCPI

Figure 506. Controller Description for Host Connection

We also used our token-ring to connect RALYAS4A and RALYAS4B, creating a controller on RALYAS4A for the connection.

Display Controller Description	
Controller description	RALYAS4B16
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*YES
Character code	*EBCDIC
Maximum frame size	16393
Remote network identifier	USIBMRA
Remote control point	RALYAS4B
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	400010020004
LAN DSAP	04
LAN SSAP	04
Text	*BLANK

Figure 507. Token-Ring Controller for RALYAS4B

The only configuration item required on RALYAS4B was the token-ring line description; we allowed all other objects to autocreate.

8.5.4.4 Activation of the Link

We activated the host line and switched major node, and varied on the AS/400 host connection and token-ring connection. We then started the RS/6000 attachment profile, causing the RS/6000 to exchange XIDs with the host, and the switched major node and its PU RS6000 to become active.

```

DISPLAY NET,ID=RS6000,SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = RS6000          , TYPE = PU_T2.1
STATUS= ACTIV--L--, DESIRED STATE= ACTIV
  CP NAME = MSRS6000, CP NETID = USIBMRA , DYNAMIC LU = YES
SWITCHED SNA MAJOR NODE = SWRS6K
LINE NAME = J0009013, LINE GROUP = EG09L00 , MAJNOD = RA9NCPJ
I/O TRACE = OFF, BUFFER TRACE = OFF
LOGICAL UNITS:
MSRS6000 ACT/S----Y
END

```

Figure 508. Active RS/6000 PU on the Host

We then activated the connection to RALYAS4A on the RS/6000, causing a BIND to be sent to the host. The host created an LU for MSRS6000 and forwarded the BIND to RALYAS4A, where a device was created for the RS/6000 on the host controller and the link became active.

```

Work with Configuration Status

Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display Mode status ...

Opt  Description      Status      -----Job-----
___  RA9L005          ACTIVE
___  RA9P05          ACTIVE
___  RAP             ACTIVE
___  MSRS6000        ACTIVE
___  QPCSUPP        ACTIVE/TARGET      MSRS6000      ROOT      037289

```

Figure 509. WRKCFGSTS Screen on RALYAS4A

Display Device Description	
Device description	MSRS6000
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	MSRS6000
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	RA9P05
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 510. Autocreated Device for RS/6000 on RALYAS4A

We then activated our connection to RALYAS4B, and this time the BIND was forwarded to RALYAS4B, where a device was created for the RS/6000 on the token-ring controller for RALYAS4A. This device was identical to the one created on RALYAS4A, with the obvious exception of the attached controller.

```

Work with Configuration Status

Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display Mode status ...

Opt  Description      Status      -----Job-----
---  LINTR16MEG      ACTIVE
---  RALYAS4A00      ACTIVE
---  RALYAS4A02      ACTIVE
---  MSRS6000        ACTIVE
---  QPCSUPP         ACTIVE/TARGET      MSRS6000      ROOT      008762

```

Figure 511. WRKCFGSTS Screen for RALYAS4B

Looking again at AS/400 A, we can see the intermediate sessions for the RS/6000 sessions on AS/400 B.

Display Intermediate Sessions					
					System:
Number of intermediate sessions					2
Number of sessions in use					1
Controller					*ALL
Type options, press Enter.					
5=Display session information 10=Display PIUs					
11=Display pacing information...					
--Session Origin--					
Control Network					
Opt	PCID	Point	ID	Mode	Status
—	F88F016423C8CA5	RAP	USIBMRA	QPCSUPP	In use
—	F88F016423C8CA4	RAP	USIBMRA	SNASVCMG	Active

Figure 512. Intermediate Sessions for RALYAS4B on RALYAS4A

Similarly, we can look at the LU MSRS6000 on the host and see the sessions in use.


```

DISPLAY NET,ID=MSRS6000,SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = USIBMRA.MSRS6000 , TYPE = CDRSC
STATUS= ACT/S----Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=SNASVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = RS6000
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000004, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RS6000
NAME      STATUS      SID      SEND RECV VR TP NETID
RALYAS4B ACTIV-S      F88F016423C8CCA5      USIBMRA
RALYAS4B ACTIV-S      F88F016423C8CCA4      USIBMRA
RALYAS4A ACTIV-S      F88F016423C8CCA3      USIBMRA
RALYAS4A ACTIV-S      F88F016423C8CCA2      USIBMRA
NAME = USIBMRA.MSRS6000 , TYPE = CDRSC

```

Figure 513. Host View of LU MSRS6000

8.5.4.5 Using Multiple Network IDs

In this scenario, we used one network for all nodes. We also successfully tested this scenario with the AS/400s in a second network, USIBMRAA. With the peripheral border node function, two network IDs is the maximum that can be used for a scenario such as this.

8.5.5 RS/6000 (LEN) to AS/400 A (NN) to VTAM (NN) to AS/400 B (NN)

In this section we connect the RS/6000 to AS/400 B through two intermediate network nodes, namely AS/400 A and VTAM. Please refer to Figure 514 for an overview of this scenario.

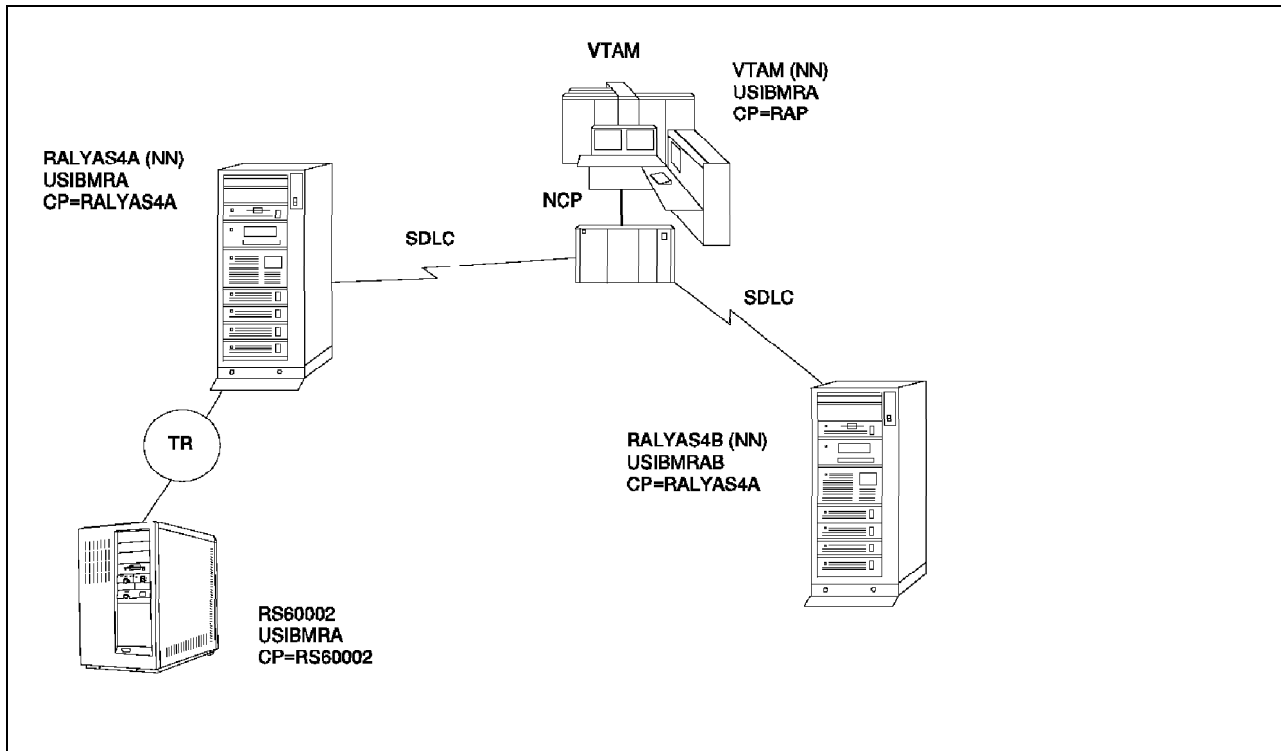


Figure 514. RS/6000 to AS/400 B Through AS/400 A and VTAM

As can be seen from the diagram, we are also using two network names here, with AS/400 B in a different network.

8.5.5.1 RS/6000 Configuration

We took the SMYTH configuration created in Chapter 6, "The RISC System/6000" on page 213 (Figure 233 on page 216 through Figure 242 on page 222), and altered the following items:

- Control Point and Local LU Profiles. Network name changed to USIBMRA.
- Control Point Profile. CP name changed to RS60002.
- Local LU Profile. Local LU name changed to RS60002.

We then created a Logical Connection for AS/400 B.

Change / Show SNA LU6.2 Logical Connection Profile			
Type or select values in entry fields. Press Enter AFTER making all desired changes.			
[TOP]	[Entry Fields]		
CURRENT profile name	SMYTHB		
NEW PROFILE name	[]		
ATTACHMENT profile name	[SMYTH]		
LOCAL LU profile name	[SMYTH]		
NETWORK name	[USIBMRAB] 1		
STOP CONNECTION on inactivity?	no		
If yes, TIMEOUT (0-10 minutes)	[0]		
REMOTE LU name	[RALYAS4B]		
SECURITY Accepted	none		
If conversation or already_verified,			
CONVERSATION SECURITY ACCESS LIST profile	[CONVDEFAULT]		
(If no name entered, /etc/passwd used)			
REMOTE TPN LIST profile name	[RDEFAULT]		
MODE LIST profile name	[QPCSUPP]		
INTERFACE type	extended 2		
If extended, SESSION CONCURRENCY	parallel 2		
Node VERIFICATION?	no		
[BOTTOM]			
F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Undo	F6=Command	F7=Edit	F8=Image
F9=Shell	F10=Exit	Enter=Do	

Figure 515. LU 6.2 Logical Connection Profile

Notes:

- 1 This is the name of the **target** network. This, together with the remote LU name, makes up the network-qualified LU name of the remote system.
- 2 The default is for single session, which is not desirable in our case.

8.5.5.2 AS/400 Configuration

For our host connection on AS/400 A, we used the line, RA9L005, and host controller, RA9P05.

Display Line Description	
Line description	RA9L005
Option	*BASIC
Category of line	*SDLC
Resource names	LIN082
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	0569406A
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*HALF
Modulus	8
Text	SDLC Line to SA09

Figure 516. AS/400 A SDLC Line to Host

Display Controller Description	
Controller description	RA9P05
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L005
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
SSCP identifier	050000000000
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	HOST CTL SA09

Figure 517. Host Controller for AS/400 A

Display Controller Description	
Controller description	RA9P05
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*YES
APPN node type	*NETNODE
APPN transmission group number . . .	*CALC
Autodelete device	1440
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 518. APPN Capabilities of Host Controller

Our host connection on AS/400 B was through the line, RA9L015, and host controller, RA9P015.

Display Line Description	
Line description	RA9L015
Option	*BASIC
Category of line	*SDLC
Resource names	LIN011
Online at IPL	*NO
Data link role	*NEG
Physical interface	*RS232V24
Connection type	*NONSWTPP
Switched network backup	*NO
Exchange identifier	05615533
NRZI data encoding	*YES
Maximum controllers	1
Clocking	*MODEM
Line speed	9600
Modem type supported	*NORMAL
Modem data rate select	*FULL
Autoanswer type	*DTR
Maximum frame size	521
Error threshold level	*OFF
Duplex	*FULL
Modulus	8
Text	SDLC Line to Subarea 06

Figure 519. SDLC Line for AS/400 B

Display Controller Description	
Controller description	RA9P015
Option	*BASIC
Category of controller	*HOST
Link type	*SDLC
Online at IPL	*NO
Switched connection	*NO
Switched network backup	*NO
Attached nonswitched line	RA9L015
Character code	*EBCDIC
Maximum frame size	521
Remote network identifier	USIBMRA
Remote control point	RAP
Local exchange identifier	*LIND
Station address	01
Recontact on vary off	*YES
Text	Controller Description for RAP

Figure 520. Host Controller for AS/400 B

Display Controller Description	
Controller description	RA9P015
Option	*APPN
Category of controller	*HOST
APPN-capable	*YES
APPN CP session support	*YES
APPN node type	*NETNODE
APPN transmission group number	*CALC
Autodelete device	*NO
User-defined 1	*LIND
User-defined 2	*LIND
User-defined 3	*LIND

Figure 521. APPN Capabilities of the Host Controller on AS/400 B

8.5.5.3 Host Configuration

Our connection to AS/400 A was through the line, RA9L005, and PU, RA9P05.

```

RA9L005  LINE ADDRESS=(005,HALF),  HDX LEASED LINE          *
        ANS=CONTINUE,          DON'T BREAK CROSS DOMAIN SESSIONS *
        NPACOLL=YES,
        ISTATUS=ACTIVE,
        CLOCKNG=EXT,          MODEM  PROVIDES THE CLOCKING ##### *
        DUPLEX=(FULL),        REQUEST TO SEND ALWAYS UP      *
        MAXPU=9,              ALLOW NO MORE THAN 9 PUS ON LINE *
        SERVLIM=10,
        SPEED=9600,          NPA AND SCANNER USE      ##### *
        SRT=(, 64)
*        NGFTXT='AS/400/A'
*****
*        SERVICE MACRO SPECIFICATION FOR SDLC (LINE 005)      *
*****
        SERVICE ORDER=(RA9P05),MAXLIST=9
*****
*        PU AND LU DEFINITIONS OF AS/400A TO SUPPORT DEPENDENT
*        AND INDEPENDENT LUS
*****
RA9P05   PU ADDR=01,          AS/400 SDLC ADDRESS          *
        MAXDATA=265,          MAXIMUM FRAME SIZE          *
        MAXOUT=7,             MAX SDLC FRAMES BEFORE RESPONSE *
        PACING=0,             PACING SET BY BIND IMAGE      *
        PASSLIM=8,
        PUTYPE=2,
        RETRIES=(, 4, 5),      7 RETRY PER SECOND FOR 5 TIMES *
        XID=YES,              FOR T2.1 PU                  *
        DYNLU=YES,            DYNAMIC LU                    *
        DISCNT=(NO),          (V) VTAM                     *
        MODETAB=MTGS3X,        (V) VTAM                     *
        ISTATUS=ACTIVE,        (V) VTAM                     *
        SSCPFM=USSSCS,         (V) VTAM                     *
        USSTAB=US327X,         (V) VTAM                     *
        VPACING=0              (V) VTAM                     *
*        STATOPT='AS/400 A'

```

Figure 522. Host Line and PU for AS/400 A

For the connection to AS/400 B, we used the line, RA9L015, and PU, RA9P015. This line and PU were identical to the ones detailed in Figure 522. As with previous examples, we specify DYNLU=YES and allow VTAM to create the necessary LUs.

The token-ring connection to the RS/6000 used the line L41TR described in Figure 3 on page 8. We allowed the AS/400 to autcreate configuration objects for the RS/6000 at XID exchange time.

8.5.5.4 Activation of the Link

We varied on the line and controller on the AS/400 A. VTAM, upon receiving an XID from the AS/400, created a dynamic LU for RALYAS4A.

```

DISPLAY NET, ID=RALYAS4A, SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = USIBMRA.RALYAS4A , TYPE = ADJACENT CP
STATUS= ACT/S---Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=CPSVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED , SLU ENABLED , SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = ISTAPNPU
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P05
NAME      STATUS      SID      SEND RECV VR TP NETID
RAP      ACTIV/CP-S F64B0D2BC8EF02A6 0043 0001 0 0 USIBMRA
RAP      ACTIV/CP-P F88F016424DE6136 0001 0042 0 0 USIBMRA

```

Figure 523. Dynamic CDRSC Created for RALYAS4A with Active CP-CP Sessions

Similarly, an LU was created for RALYAS4B. We also see that VTAM creates a directory entry for RALYAS4B and, because RALYAS4B is in a different network, it adopts the border node role and presents itself to VTAM as an end node.

```

DISPLAY NET, ID=RALYAS4B, SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = USIBMRAB.RALYAS4B, TYPE = ADJACENT CP
STATUS= ACT/S---Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=CPSVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED , SLU ENABLED , SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = ISTAPNPU
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P015
NAME      STATUS      SID      SEND RECV VR TP NETID
RAP      ACTIV/CP-S F64B0D34C8EC2C4B 0043 0001 0 0 USIBMRA
RAP      ACTIV/CP-P F88F016424DE612F 0001 0043 0 0 USIBMRA
-----
NAME = USIBMRAB.RALYAS4B, TYPE = ADJACENT CP
NAME = USIBMRAB.RALYAS4B, TYPE = DIRECTORY ENTRY
  DIRECTORY ENTRY = REGISTERED EN
  CPNAME = USIBMRAB.RALYAS4B - NETSRVR = USIBMRA.RAP
END

```

Figure 524. Dynamic CDRSC for RALYAS4B

The next step was to start the RS/6000s SNA subsystem, and start the attachment profile SMYTH. This caused the RS/6000 to exchange XIDs with its adjacent CP, RALYAS4A, and an APPC controller was created on RALYAS4A.

Display Controller Description	
Controller description	RS60002
Option	*BASIC
Category of controller	*APPC
Link type	*LAN
Online at IPL	*NO
Active switched line	L41TR
Character code	*EBCDIC
Maximum frame size	16393
Remote network identifier	USIBMRA
Remote control point	RS60002
Initial connection	*DIAL
Dial initiation	*LINKTYPE
Switched disconnect	*YES
Data link role	*NEG
LAN remote adapter address	10005AA87023
LAN DSAP	04
LAN SSAP	04
Text	AUTOMATICALLY CREATED BY QLUS

Figure 525. APPC Device for RS60002 Autocreated on AS/400 A

This controller was varied on by the system, but did not yet go active, as we did not yet have an LU-LU session.

The next step was to start the SMYTHB connection. Upon activating this connection, a BIND was sent to AS/400 A, and an APPC device was created.

Display Device Description	
Device description	RS60002
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	RS60002
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	RS60002
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 526. APPC Device for RS60002 Autocreated on AS/400 A

This BIND was forwarded to VTAM, and VTAM dynamically created a CDRSC for the RS/6000.

```

DISPLAY NET, ID=RS60002, SCOPE=ALL
IST097I  DISPLAY  ACCEPTED

NAME = USIBMRA.RS60002 , TYPE = CDRSC
STATUS= ACT/S----Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=***NA*** USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
CDRM NAME = RAP , VERIFY OWNER = NO
  ALSLIST = ISTAPNPU
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000001, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P05
NAME      STATUS      SID      SEND RECV VR TP NETID
RALYAS4B  ACTIV-S      F64B0D2BC8EF02A8      USIBMRA
-----
NAME = USIBMRA.RS60002 , TYPE = DIRECTORY ENTRY
DIRECTORY ENTRY = DYNAMIC LU
CPNAME = USIBMRA.RALYAS4A - NETSRVR = ***NA***
END

```

Figure 527. Dynamic CDRSC created for RS60002

The BIND is then forwarded to RALYAS4B, where an APPC device is created on the host controller and activated.

Display Device Description	
Device description	RS60002
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	RS60002
Online at IPL	*NO
Local location	RALYAS4B
Remote network identifier	USIBMRA
Attached controller	RA9P015
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO

Figure 528. APPC Device Autocreated for RS60002 on RALYAS4Bs Host Controller

Looking again at the dynamic CDRSC created for RALYAS4B, we can now see the RS60002 session.

```
DISPLAY NET, ID=RALYAS4B, SCOPE=ALL
IST097I  DISPLAY  ACCEPTED
```

```
NAME = USIBMRAB.RALYAS4B, TYPE = ADJACENT CP
STATUS= ACT/S----Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=CPSVCMG USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
CDRSC MAJOR NODE = ISTCDRDY
  ALSLIST = ISTAPNPU
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 00000000003, SESSION REQUESTS = 00000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P015
NAME      STATUS      SID      SEND RECV VR TP NETID
RAP      ACTIV/CP-S F64B0D34C8EC2C4B 0046 0001 0 0 USIBMRA
RS60002  ACTIV-P    F64B0D2BC8EF02A8      USIBMRA
RAP      ACTIV/CP-P F88F016424DE612F 0001 0046 0 0 USIBMRA
-----
NAME = USIBMRAB.RALYAS4B, TYPE = ADJACENT CP
NAME = USIBMRAB.RALYAS4B, TYPE = DIRECTORY ENTRY
  DIRECTORY ENTRY = REGISTERED EN
  CPNAME = USIBMRAB.RALYAS4B - NETSRVR = USIBMRA.RAP
END
```

Figure 529. Host LU for RALYAS4B with Active Session for RS60002

8.5.6 RS/6000 (LEN) to PS/2 (NN) to VTAM (NN) to AS/400 (NN)

In this section we connect the RS/6000 using SNA Services/6000 to AS/400 A, via intermediate sessions in a PS/2 network node and VTAM network node. Please refer to Figure 530 for a diagram of this scenario.

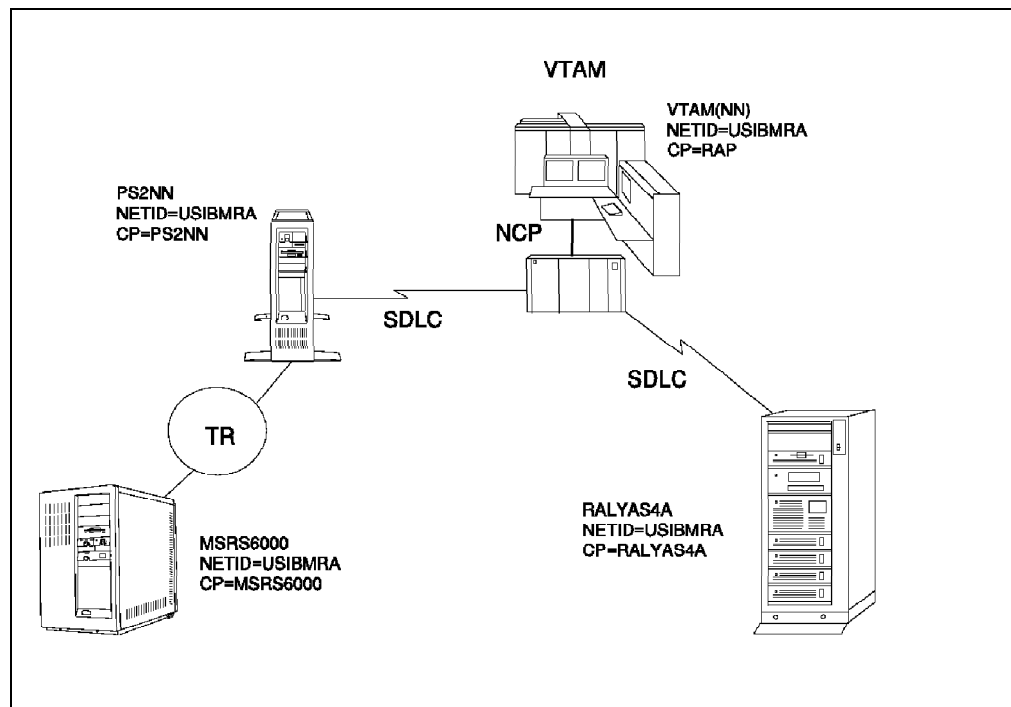


Figure 530. RS/6000 to AS/400 via PS/2 and VTAM Network Nodes

8.5.6.1 RS/6000 Configuration

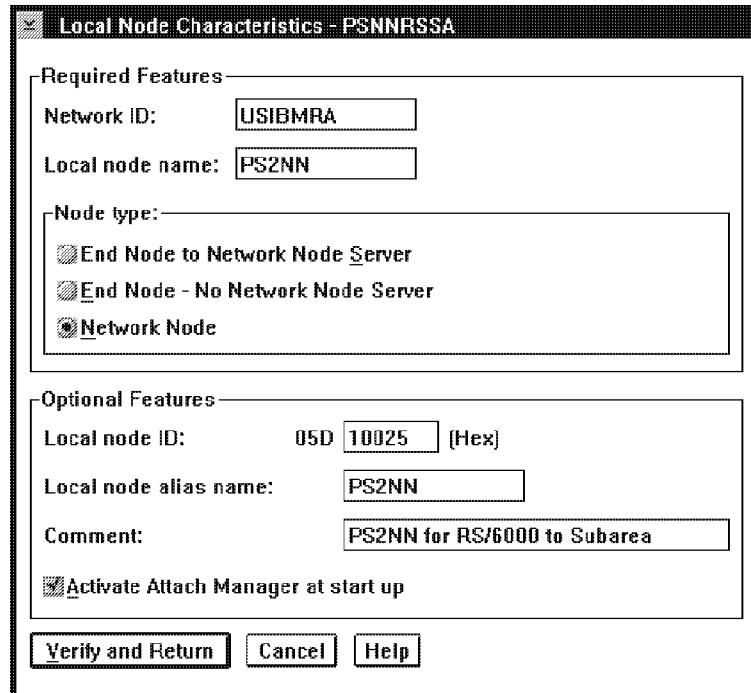
Using the configuration generated in Chapter 6, “The RISC System/6000” on page 213, we made the following changes:

- Attachment Profile. Token-ring address changed to that of PS/2.
- Control Point Profile. New network ID of USIBMRA.
- Local LU Profile. New network ID of USIBMRA.
- Logical Connection. New network ID of USIBMRA.

All other parameters stayed the same.

8.5.6.2 PS/2 Configuration

Using the Communications Manager portion of Extended Services, we configured the PS/2 as a network node. In the SNA features configuration section, we created the following Local Node Characteristics.



Local Node Characteristics - PSNNRSSA

Required Features

Network ID:

Local node name:

Node type:

☐ End Node to Network Node Server
☐ End Node - No Network Node Server
☒ Network Node

Optional Features

Local node ID: 05D (Hex)

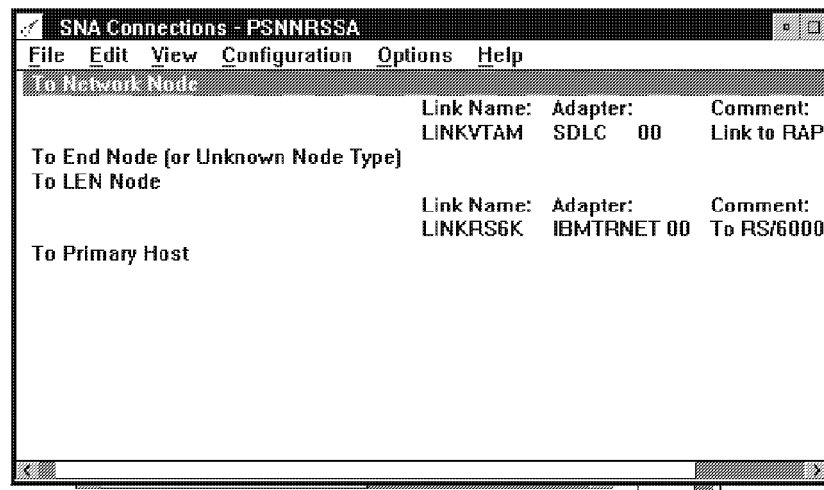
Local node alias name:

Comment:

☒ Activate Attach Manager at start up

Figure 531. Local Node Characteristics of the PS/2 Network Node

Then we created our links. This step is not necessary for the token-ring attached RS/6000, but we wanted to give the link a meaningful name.



SNA Connections - PSNNRSSA

File Edit View Configuration Options Help

To Network Node	Link Name:	Adapter:	Comment:
To End Node (or Unknown Node Type)	LINKVTAM	SDLC 00	Link to RAP
To LEN Node	LINKRS6K	IBMTRNET 00	To RS/6000
To Primary Host			

Figure 532. SNA Connections Screen

8.5.6.3 Host Configuration

The SDLC lines used for the PS/2 and AS/400 were RA9L015 and RA9L005, respectively. To these lines we added the following PUs:

RA9P015	PU	ADDR=01,	AS/400 SDLC ADDRESS	*
		MAXDATA=265,	MAXIMUM FRAME SIZE	*
		MAXOUT=7,	MAX SDLC FRAMES BEFORE RESPONSE	*
		PACING=0,	PACING SET BY BIND IMAGE	*
		PASSLIM=8,		*
		PUTYPE=2,		*
		RETRIES=(, 4, 5),	7 RETRY PER SECOND FOR 5 TIMES	*
		XID=YES,	FOR T2.1 PU	*
		DYNLU=YES,	DYNAMIC LU	*
		DISCNT=(NO),	(V) VTAM	*
		MODETAB=MTGS3X,	(V) VTAM	*
		ISTATUS=ACTIVE,	(V) VTAM	*
		SSCPFM=USSSCS,	(V) VTAM	*
		USSTAB=US327X,	(V) VTAM	*
		VPACING=0	(V) VTAM	*
*		STATOPT='PS/2 NN'		

Figure 533. PU Definition for PS/2 NN

RA9P05	PU	ADDR=01,	AS/400 SDLC ADDRESS	*
		MAXDATA=265,	MAXIMUM FRAME SIZE	*
		MAXOUT=7,	MAX SDLC FRAMES BEFORE RESPONSE	*
		PACING=0,	PACING SET BY BIND IMAGE	*
		PASSLIM=8,		*
		PUTYPE=2,		*
		RETRIES=(, 4, 5),	7 RETRY PER SECOND FOR 5 TIMES	*
		XID=YES,	FOR T2.1 PU	*
		DYNLU=YES,	DYNAMIC LU	*
		DISCNT=(NO),	(V) VTAM	*
		MODETAB=MTGS3X,	(V) VTAM	*
		ISTATUS=ACTIVE,	(V) VTAM	*
		SSCPFM=USSSCS,	(V) VTAM	*
		USSTAB=US327X,	(V) VTAM	*
		VPACING=0	(V) VTAM	*
*		STATOPT='AS/400 A'		

Figure 534. PU Definition for AS/400 A

8.5.6.4 AS/400 Configuration

We used the line, RA9L005, as described in Figure 474 on page 408 and the host controller as described in Figure 475 on page 408.

8.5.6.5 Activation of the Link

We varied on the various host and AS/400 lines and controllers, and started Communications Manager on the PS/2. On the RS/6000, after starting the SNA subsystem, we activated the attachment profile. This causes the RS/6000 to exchange XIDs with the PS/2 NN, and the logical link becomes active.

Changing a Connection to a To LEN Node - PSNNRSSA

Link name:

Partner network ID: (Required for partner LU definition)

Partner node name: (Required for partner LU definition)

LAN destination address:

Comment: (Optional)

Figure 535. Logical Link Status of PS/2 when Contacted by RS/6000

Upon starting our connection profile, a BIND is sent to the PS/2 and forwarded to VTAM. VTAM creates a dynamic CDRSC for MSRS6000 (seen in Figure 536) and forwards the BIND to the AS/400. The AS/400 creates a device for the RS/6000 on RA9P05 and (in our case of 5250 emulation) sends a signon screen to the RS/6000.

```

      N E T V I E W      RAPAN SMYTH      03/04/93 16:38
      DISPLAY NET, ID=MSRS6000, SCOPE=ALL
      IST097I  DISPLAY  ACCEPTED

NAME = USIBMRA.MSRS6000 , TYPE = CDRSC
STATUS= ACT/S---Y, DESIRED STATE= ACTIV
MDLTAB=***NA*** ASLTAB=***NA***
MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
DLOGMOD=***NA*** USS LANGTAB=***NA***
CAPABILITY-PLU ENABLED , SLU ENABLED , SESSION LIMIT NONE
CDRSC   MAJOR NODE = ISTCDRDY
CDRM NAME = RAP      , VERIFY OWNER = NO
  ALSLIST = ISTAPNPU
  DEVICE = ILU/CDRSC
I/O TRACE = OFF, BUFFER TRACE = OFF
ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
SESSIONS:
  ADJACENT LINK STATION = RA9P015
NAME      STATUS      SID      SEND RECV VR TP NETID
RALYAS4A  ACTIV-S      C81F5D05F54DDA1D      USIBMRA
RALYAS4A  ACTIV-S      C81F5D05F44DDA1D      USIBMRA

```

Figure 536. Dynamic CDRSC Created by VTAM for MSRS6000

On the AS/400, the AS/400 creates an APPC device from the BIND information.

Display Device Description	
Device description	MSRS600000
Option	*BASIC
Category of device	*APPC
Automatically created	YES
Remote location	MSRS6000
Online at IPL	*NO
Local location	RALYAS4A
Remote network identifier	*NETATR
Attached controller	RA9P05
Message queue	QSYSOPR
Library	*LIBL
Local location address	00
APPN-capable	*YES
Single session:	
Single session capable	*NO
Text	AUTOMATICALLY CREATED BY QLUS

Figure 537. Device for RS/6000 Autocreated on Host Controller

```

                                Work with Configuration Status
                                03/04/93
Position to . . . . . _____ Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display Mode status ...

Opt  Description          Status          -----Job-----
___  RA9L005              ACTIVE
___  RA9P05              ACTIVE
___  RAP                 ACTIVE
___  PS2NNLU             ACTIVE
___  MSRS600000          ACTIVE
___  QPCSUPP             ACTIVE/TARGET      MSRS600000  ROOT

```

Figure 538. WRKCFGSTS Screen on RALYAS4A Showing Status of RS/6000 Device

Appendix A. Advanced Peer-to-Peer Networking Implementations

Several products have implemented Advanced Peer-to-Peer Networking and LEN functions, either as Advanced Peer-to-Peer Networking nodes or as LEN end nodes. This chapter gives a brief overview of the implementation specifics of IBM products providing APPN functions. For an extensive description of Advanced Peer-to-Peer Networking VTAM you should read "APPN VTAM" of *APPN Architecture and Product Implementations Tutorial*. Advanced Peer-to-Peer Networking implementations in other manufacturer's equipment are not covered in this document.

The size of an Advanced Peer-to-Peer Networking network may be limited by restrictions caused by implementations having limited storage and processor capacity. In the following section, we mention some limitations imposed by several Advanced Peer-to-Peer Networking implementations. The values specified are maximum values, but for performance reasons use of lower values may be recommended.

Advanced Peer-to-Peer Networking architecture groups functions into a base set and a number of optional function sets. The numbering of the different functions together with a brief description of each function can be found in "APPN Base and Option Sets" of *APPN Architecture and Product Implementations Tutorial*. In this chapter, each section describing the APPN implementation of a specific product contains a set of figures documenting which functions are implemented in the respective product. The functions are referenced by number only and the support for a specific function is indicated by a shaded box.

Table 4 on page 474, Table 5 on page 476, and Table 6 on page 477 at the end of this chapter, then give an overview of which functions have been implemented on IBM systems. For each of the functions, a reference has been made to the page where more information about the function can be found.

The evolution of SNA will continue and enhancements to Advanced Peer-to-Peer Networking and Advanced Peer-to-Peer Networking implementations will continue to be introduced. You should be aware that this chapter describes current hardware and software.

A.1 AS/400

Advanced Peer-to-Peer Networking functions were available when the first version of the AS/400 was announced in 1988. The core functions had already been implemented in the S/36, the AS/400's predecessor. The AS/400 can be configured as a network node, as an end node, or as a LEN node. Further information can be found in *AS/400 Advanced Peer-to-Peer Networking* or in the *AS/400 Peer-to-Peer Networking Guide*.

Advanced Peer-to-Peer Networking support is part of OS/400, the operating system of the AS/400.

A.1.1 Terminology

The term "location" is used for LU (logical unit).

A remote node is also called a "controller" or "control unit."

A "device" is the representation of a remote location (LU) in the local node.

Wildcard routing is also called "*ANY" routing.

Multinetwork Connectivity

The AS/400 is the first Advanced Peer-to-Peer Networking system to implement border node functions with OS/400 V2.1. This capability is referred to as multinetwork connectivity. The AS/400 has implemented the peripheral border node function, also known as border node release 1.

Congestion

The maximum number of intermediate routing sessions supported by a network node can be defined by the network administrator. Network Nodes are said to be congested if 90% of that number is reached. The node becomes "uncongested," when the actual number of intermediate routing sessions becomes less than 80% of the defined maximum.

A.1.2 System Definitions

The AS/400 can be defined to have multiple local LU names. Local resources have to be defined. Remote LUs need be defined only for:

- LUs in adjacent LEN end nodes
- LUs in adjacent APPN end nodes without CP-CP sessions, if the LU name is different from the CP name
- LUs in adjacent APPN end nodes that do not register and do not allow domain broadcast
- LUs in adjacent unauthorized APPN end nodes
- LUs, for which session security is defined
- Single-session LUs

Controller descriptions for LAN devices can be created automatically; however, their use is limited to independent LUs. Therefore, if an AS/400 connects to VTAM or NCP and dependent LU support is required, the controller and device descriptions need to be entered manually.

A.1.3 Restrictions

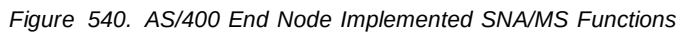
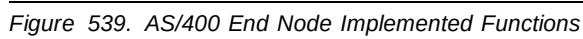
The maximum number of conversations between local and remote transaction programs is 512 per mode. (A mode name is used when an LU starts a session to indicate the required session characteristics.)

The maximum number of sessions routed through an AS/400 network node is 9999.

The maximum number of modes simultaneously in use between local and remote LUs is 14.

The maximum number of “devices” that can be associated with a controller is 254.

The maximum RU length is 16 384 bytes.



A.2 3174 with CS-C Establishment Controller

The Advanced Peer-to-Peer Networking Licensed Internal Code (LIC) adds Advanced Peer-to-Peer Networking network node capabilities to the 3174 with CS-C establishment controller. The Advanced Peer-to-Peer Networking LIC feature is a separately orderable, no-charge feature that requires Configuration Support-C LIC.

The Advanced Peer-to-Peer Networking implementation allows the 3174 with CS-C to be customized as an Advanced Peer-to-Peer Networking network node only. For detailed information, refer to *3174 Planning Guide Configuration Support C*.

The 3174 with CS-C network node supports links to other APPN network nodes, APPN end nodes, and LEN end nodes. Links supported are:

- Connections to APPN network nodes via LAN (token-ring LAN and Ethernet), SDLC, and channel links.
- Connections to APPN end nodes and LEN end nodes via token-ring LAN, coax attachments (Peer/Communications), SDLC, and channel links.

Configuration Support-C R5 LIC adds the Dependent LU Requester Function (option 1067) to the 3174 with CS-C Advanced Peer-to-Peer Networking support which provides a remote boundary function as dependent LUs for locally, coax attached devices. The 3174 with CS-C does not provide the DLUR function for link-attached PUs Type 2.0. The DLUR function requires the Dependent LU Server (option set 1066) function available with VTAM V4R2 for SSCP services. Together, these functions relieve the restriction that PU type 2.0 be directly attached (or bridged, or data link switched, or frame relayed) to the SSCP giving them SSCP services.

Notes:

1. To connect LEN end nodes and APPN end nodes via coax attachment to the 3174 with CS-C network node requires the Peer Communication LIC feature.
2. Advanced Peer-to-Peer Networking network node and end node connections via SDLC and channel links are supported only if the adjacent node is a VTAM or a composite VTAM/NCP node. (Advanced Peer-to-Peer Networking is supported with VTAM in V4R1 and later, here referred to as Advanced Peer-to-Peer Networking VTAM.)
3. LEN connections via SDLC and channel links are supported only if the adjacent node is an AS/400 or a VTAM or a composite VTAM/NCP node. (LEN support for VTAM is introduced with VTAM V3R2, also called LEN VTAM.)

A.2.1 Terminology

In the 3174 with CS-C context, the term “gateway” applies to the 3174 with CS-C LAN (token-ring LAN or Ethernet) gateway feature.

Dependent and independent LU traffic is supported on the same link to an adjacent VTAM Advanced Peer-to-Peer Networking or VTAM LEN end node. If dependent LUs attach to the 3174 with CS-C, an SSCP-PU session is requested when exchanging XIDs during link activation.

The 3174 with CS-C considers “dynamic links” as limited resources. When the number of sessions using a specific link goes to zero, the link is taken down.

The 3174 with CS-C assumes that all end nodes are authorized, meaning:

- Resource registration requests will be accepted from all end nodes within the domain of the 3174 with CS-C network node.
- End node's requests to be included in a domain search for resources not known to the 3174 with CS-C network node, will be granted.

Network Node Characteristic: The 3174 with CS-C network node uses two indicators within the node characteristics to regulate the number of sessions being routed through the network node. When the number of sessions concurrently being routed through the 3174 with CS-C network node reaches the maximum number configured, the 3174 with CS-C network node broadcasts TDUs indicating “intermediate routing resources depleted”; when the number of free buffers falls below a critical level, it broadcasts TDUs indicating “congestion.” Other APPN network nodes will use this information to avoid additional sessions from being routed through the 3174 with CS-C network node.

A.2.2 System Definitions

The 3174 with CS-C does not allow users to enter system definitions through the node operator facility when the 3174 with CS-C is on-line; all definitions must be entered during off-line customization.

A.2.3 Restrictions

The safe/store cache function is supported only if the 3174 with CS-C has a hard file.

When connecting to a (VTAM Advanced Peer-to-Peer Networking or VTAM LEN) APPN node on SDLC and channel links, the 3174 with CS-C is always the secondary station (not negotiable).

The node's “route-addition resistance” is fixed at 128.

The maximum RU size is 8KB.

The maximum number of sessions routed through the 3174 with CS-C network node is 1000.

The maximum number of links supported by the 3174 with CS-C is 255. If a 4Mbps token-ring LAN adapter is used, the limit is 140; when an 8KB frame size is used, then the maximum number of links supported drops to 100.

The maximum number of adjacent network nodes is eight.

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A.3 PS/2

The PS/2 support for LEN end nodes was announced in 1988 and the support for APPN network nodes and APPN end nodes was announced in March, 1991. Originally (OS/2 V1.1, V1.2 and V1.3) LEN end node support was part of OS/2 Extended Edition (EE), which among other things offered Communications Manager support. Advanced Peer-to-Peer Networking support, for APPN network nodes and APPN end nodes, has been introduced with a separate product called Networking Services/2 (NS/2). NS/2 is an extension of the OS/2 V1.3 Communications Manager support. With the introduction of OS/2 V2.0, LEN and Advanced Peer-to-Peer Networking support both have become part of Communications Manager support within OS/2 Extended Services (ES). For detailed information, refer to *Extended Services for OS/2 Information and Planning Guide*.

Networking Services/DOS V1.0 announced in March, 1992, allows DOS workstations to participate, as LEN end nodes, in Advanced Peer-to-Peer Networking as well as in SNA subarea environments.

Note: The following sections cover the Advanced Peer-to-Peer Networking support in OS/2 V2 ES V1.1.

A.3.1 Terminology and Implementation Specifics

During session initiation, an Advanced Peer-to-Peer Networking or LEN end node tries to locate the partner LU within its local directory database and if no information can be found queries its Network Node Server (Advanced Peer-to-Peer Networking end node only). Session initiation will fail if the partner LU cannot be located. However, PS/2 end nodes can define, using a “local wildcard” definition, a **substitute Network Node Server**. The substitute Network Node Server is an adjacent APPN network node with which no CP-CP sessions have been established. If, during session initiation, the partner LU cannot be located locally, the PS/2 end node sends a BIND to the substitute Network Node Server. The substitute Network Node Server then becomes responsible for locating the partner LUs, route calculation, and forwarding the BIND to the destination node. The concept of substitute Network Node Server can be used to define a backup Network Node Server for PS/2 APPN end nodes and provides a means of using wildcard definitions on a PS/2 LEN end node for its local use only.

A.3.1.1 Session Flow Control and Congestion

To manage the flow of data over a network, Communications Manager uses adaptive session-level pacing. The pacing occurs between each pair of adjacent nodes participating in the session route. When the APPC component of the Communications Manager is started, it determines the amount of memory that can be locked, that is, made nonswappable and nonmoveable. Communications Manager then computes 30% of this amount as *available memory*, that is, the memory that can be used to transmit and receive user data. The amount of available memory dictates how the adaptive pacing algorithm is used, as well as determining when the APPN node becomes *congested*.

A.3.2 System Definitions

OS/2 can be defined as a primary, secondary, or negotiable link station.

A.3.3 Restrictions

Only one network node can be specified as server. But, another server can be designated as a substitute server (by using the end node's local wildcard function).

Route-addition resistance is fixed at 128.

The cache directory can hold up to 255 LUs. When more are learned, the oldest ones are discarded. The cache directory is saved to disk after every 20 updates.

Transmission priority is not supported.

A.3.4 Implemented Functions (OS/2)

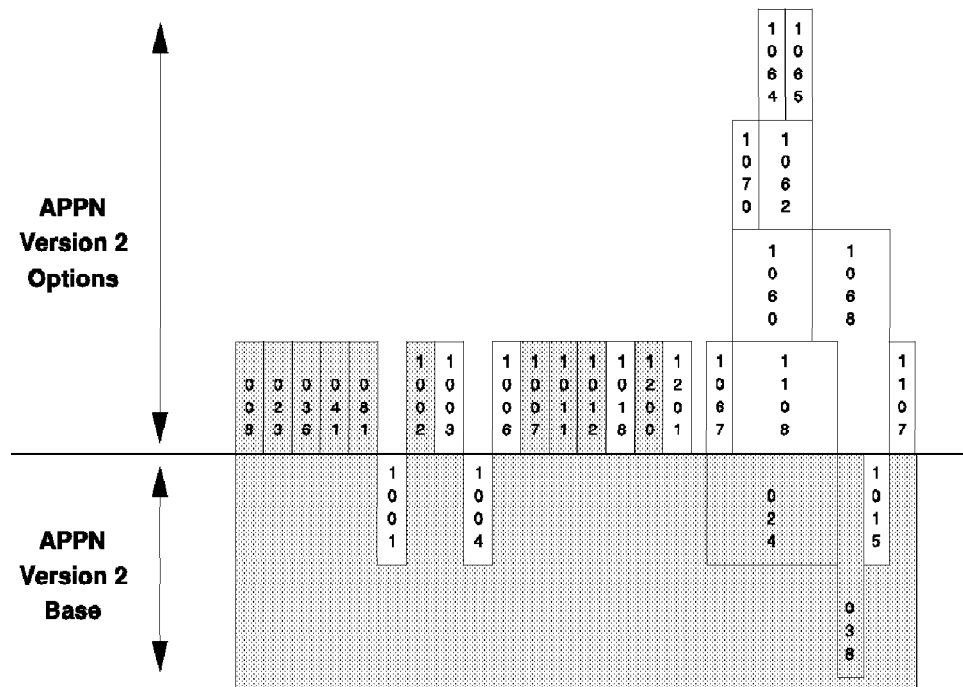


Figure 545. OS/2 End Node Implemented Functions

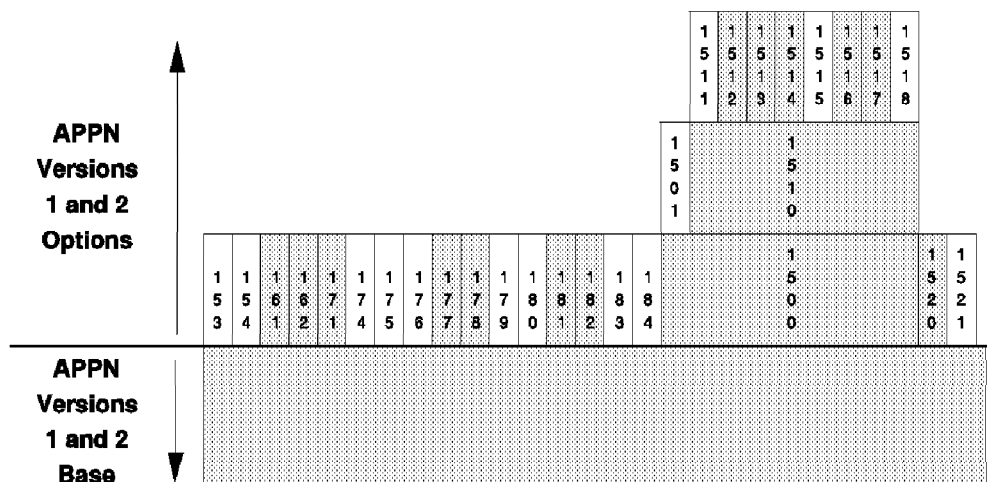


Figure 546. OS/2 End Node Implemented SNA/MS Functions

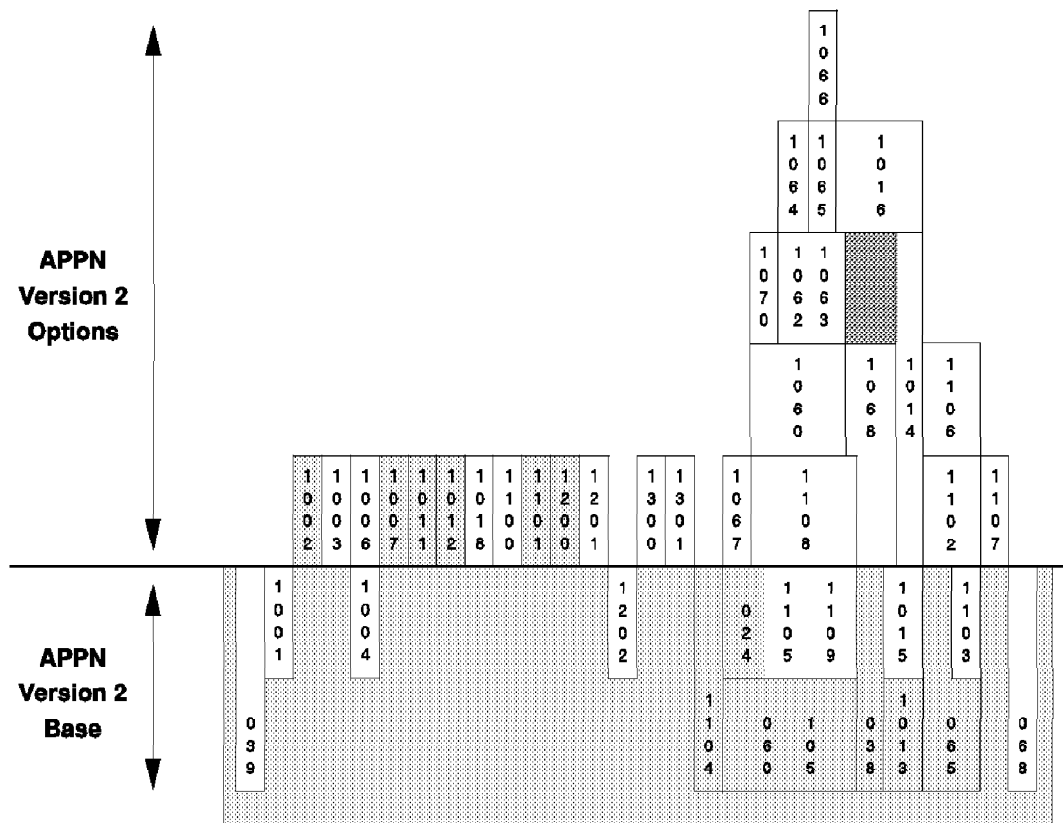


Figure 547. OS/2 Network Node Implemented Functions

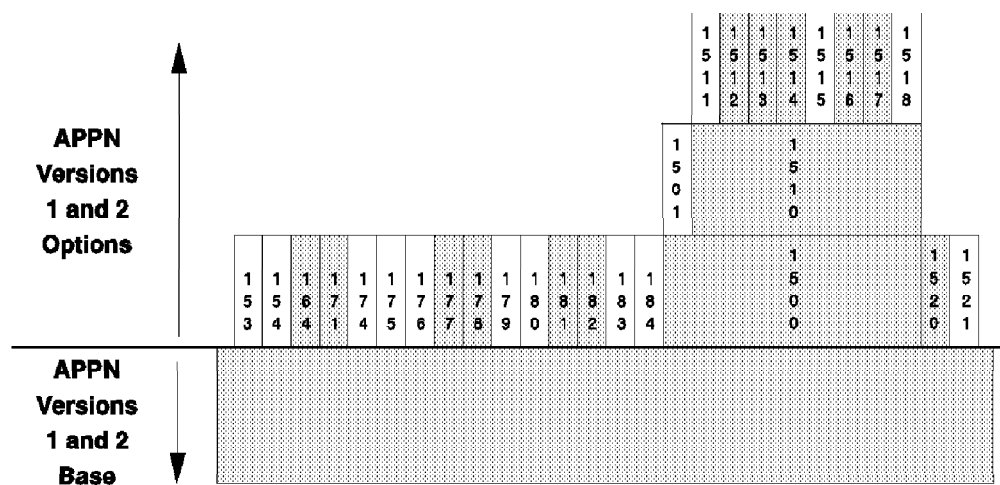


Figure 548. OS/2 Network Node Implemented SNA/MS Functions

A.4 VTAM and NCP

VTAM and NCP announced LEN support in 1987. The bulletin *Enterprise Networking with SNA Type 2.1 Nodes* gives a technical overview of this implementation. VTAM V4R1, announced in March, 1992, allows VTAM and NCP V6R2 to portray itself as an APPN network node; a VTAM that does not own NCPs can also be an APPN end node. VTAM V4R2, will allow VTAM (and NCP) to portray itself as an extended border node.

When referring to the Advanced Peer-to-Peer Networking support introduced with VTAM V4R1 and enhanced with VTAM V4R2, we will use the term Advanced Peer-to-Peer Networking VTAM. We will use the term Advanced Peer-to-Peer Networking VTAM to refer to either VTAM V4R1 or VTAM V4R2 unless a specific release is stated.

Information in this chapter is based on Advanced Peer-to-Peer Networking VTAM. LEN functions have been introduced with VTAM V3.2 and NCP V5R2.1.

Note: The following section gives a very condensed description of Advanced Peer-to-Peer Networking VTAM; a more extensive discussion can be found in "VTAM" chapter of *APPN Architecture and Product Implementations Tutorial*.

A.4.1 Terminology and Implementation Specifics

Advanced Peer-to-Peer Networking VTAM allows host systems to attach to Advanced Peer-to-Peer Networking networks as APPN network nodes, APPN end nodes, or LEN end nodes. The function within VTAM and NCP which allows nonsubarea (or peripheral) nodes to connect is called the VTAM or NCP boundary function.

Advanced Peer-to-Peer Networking VTAM offers extended connectivity in a transparent manner for both Advanced Peer-to-Peer Networking and subarea LUs, without loss of functionality. All LU-LU session capabilities present in a pure subarea or a pure Advanced Peer-to-Peer Networking environment are also supported in a combined APPN/subarea networking environment.

To get full Advanced Peer-to-Peer Networking connectivity requires CP-CP connectivity. Advanced Peer-to-Peer Networking VTAM allows CP-CP sessions to be established between an Advanced Peer-to-Peer Networking VTAM node and any adjacent Advanced Peer-to-Peer Networking node.

For other APPN nodes in an Advanced Peer-to-Peer Networking network, the VTAM/NCP complex is a composite network node or LEN end node; however, internally, subarea protocols are used. VTAM and NCP configured as an APPN network node or LEN end node allow intermediate session routing within the VTAM/NCP complex.

Dynamic Cross-Domain Resource

In VTAM all independent LUs owned by attached Advanced Peer-to-Peer Networking nodes can be either explicitly or dynamically defined. Resources not explicitly defined will, during session establishment, be defined as dynamic cross-domain resources. Dynamic definition of independent LUs owned by adjacent Advanced Peer-to-Peer Networking nodes has been introduced with VTAM V3R4 and NCP V5.4.

Advanced Peer-to-Peer Networking versus Subarea Flows

Within a subarea network, LUs are located using CDINIT or DSRLST requests. The VTAM host (see for example NN1 or NN2 in Figure 549 on page 460) that transforms Advanced Peer-to-Peer Networking requests into subarea requests and vice versa, is called an interchange node (ICN). CDINIT and DSRLST routing in a subarea network can be seen as a sequence of directed searches.

Surrogate Network Node Server

A subarea network may enable session establishment between two disjoint Advanced Peer-to-Peer Networking networks by giving an Advanced Peer-to-Peer Networking network node appearance to either Advanced Peer-to-Peer Networking network; see for example Figure 549. If the ICNs providing the boundary function, NN1 and NN2, are two separate VTAMs between which no CP-CP, only SSCP-SSCP, connectivity exists, then each of the APPN nodes in the “other” Advanced Peer-to-Peer Networking network appears to its APPN endpoint partner as an APPN end node that connects to a *surrogate network server*. For example, NNA “sees” NNB as an ENB connected to the surrogate Network Node Server NN1, and NNB “sees” NNA as an ENA connected to surrogate Network Node Server NN2.

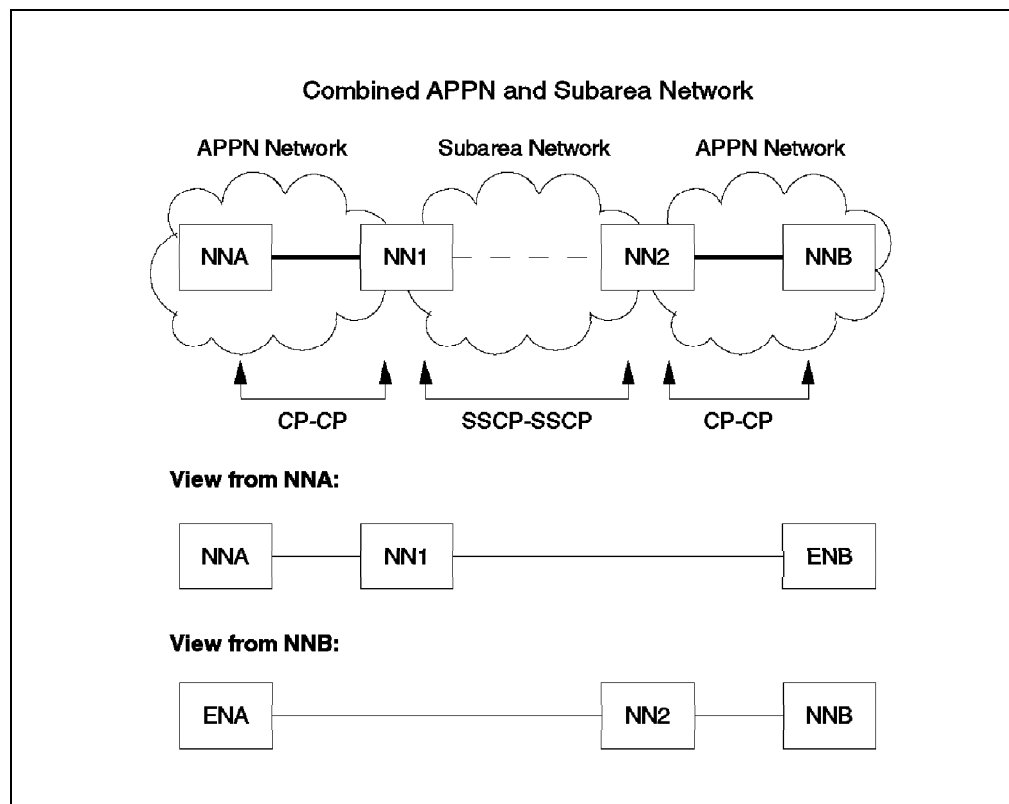


Figure 549. Surrogate Network Node Servers (NN1 and NN2)

Note, that the LUs within the subarea that are owned by different VTAMs from the one providing the boundary function, also appear to reside on an APPN end node.

Transmission Priority and Class of Service

The COS name is obtained from a (VTAM) mode table (MODETAB). The class of service is used to select an operational route and a transmission priority from a list of predefined routes within a COS table (COSTAB). The transmission priority is used within the subarea part of the network (between VTAMs and NCPs) and

optionally on the boundary links to attached APPN nodes. The latter part of a route within a subarea network is often called the *route extension*.

Casual Connection

VTAM may portray itself as an APPN network node, an APPN end node, or a LEN end node; VTAM/NCP may portray itself as a (composite) APPN network node or a LEN end node; A LEN connection between two (VTAM/NCP) composite nodes is called a *casual connection*; each side sees the adjacent side as one LEN end node.

Connection Networks

VTAM V4R1 does not allow the definition of its own attachment to a connection network; however, VTAM V4R1, as a Network Node Server, is able to recognize a connection network and calculate a route through a virtual routing node. This restriction is removed with VTAM V4R2. A VTAM V4R2 APPN network node and APPN end node can now define a TG towards a virtual routing node representing a connection network and activate a TG across the shared-access transport facility when a session is being established.

Adjacent Link Station (ALS) Selection Function

The ALS selection function in the VTAM session management exit can be programmed to select a route to a destination LU when multiple LEN connections exist to an adjacent Advanced Peer-to-Peer Networking network. This is equivalent to selective wildcard routing.

A.4.2 System Definitions

Generally, LUs are defined locally, that is, only once in a subarea network. For LEN connections, LUs have to be defined on both sides. Yet, there are some functions that provide dynamic network access and eliminate the need for multiple definitions.

Self-Defining Independent LUs

When a BIND from a LEN end node enters the subarea network, the OLU can automatically be defined (dynamic CDRSC). This function complements the wildcard search function in Advanced Peer-to-Peer Networking networks. The DLU can be a predefined CDRSC, a dynamic CDRSC, or automatically defined by a VTAM exit.

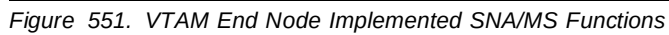
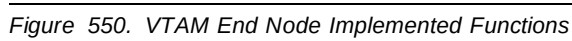
Dynamic Switched Definition Support

Dynamic switched definition support simplifies adding switched devices to the network, including token-ring LAN attached devices, which are treated as switched devices when connected through NCP's or VTAM's boundary function (not through a 3174 gateway). This support is for dependent or independent LUs. For dial-in support, reusable model definitions together with an installation exit routine are used.

A.4.3 Restrictions

Route selection between Advanced Peer-to-Peer Networking networks and subarea networks is not seamless, as independent algorithms apply.

Multiple LEN connections from the Advanced Peer-to-Peer Networking network to the subarea network require at least VTAM V3R4 and NCP V5R4.



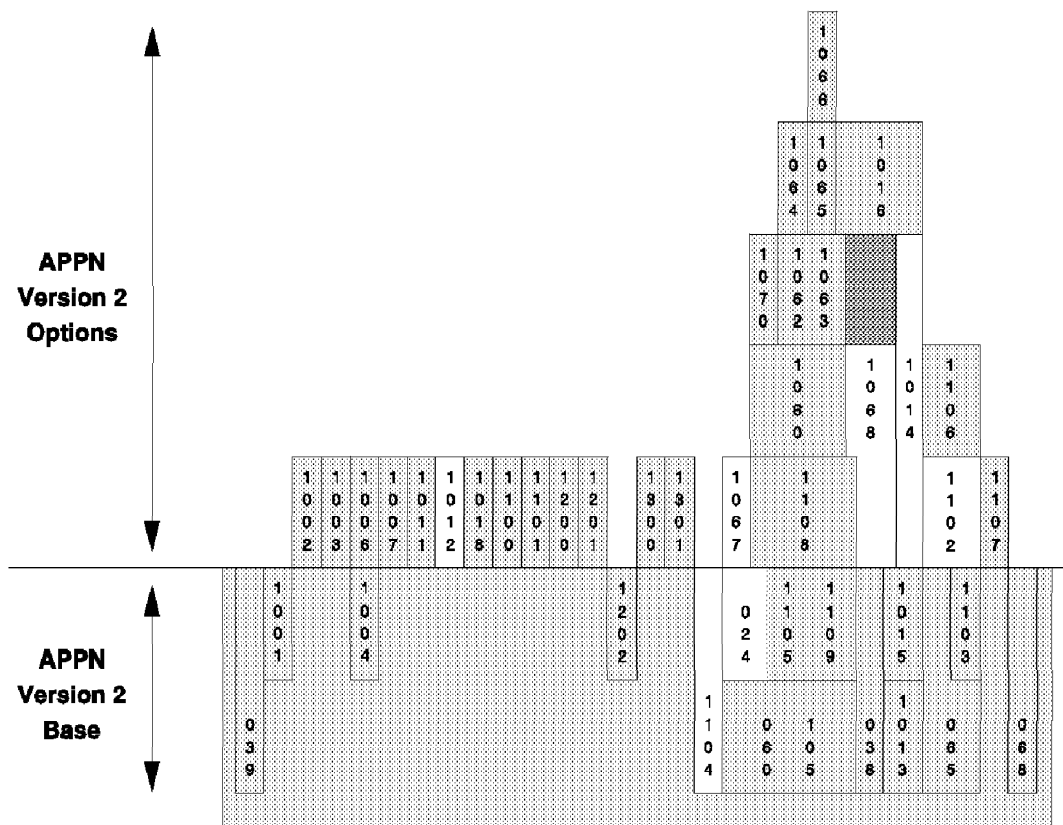


Figure 552. VTAM Network Node Implemented Functions

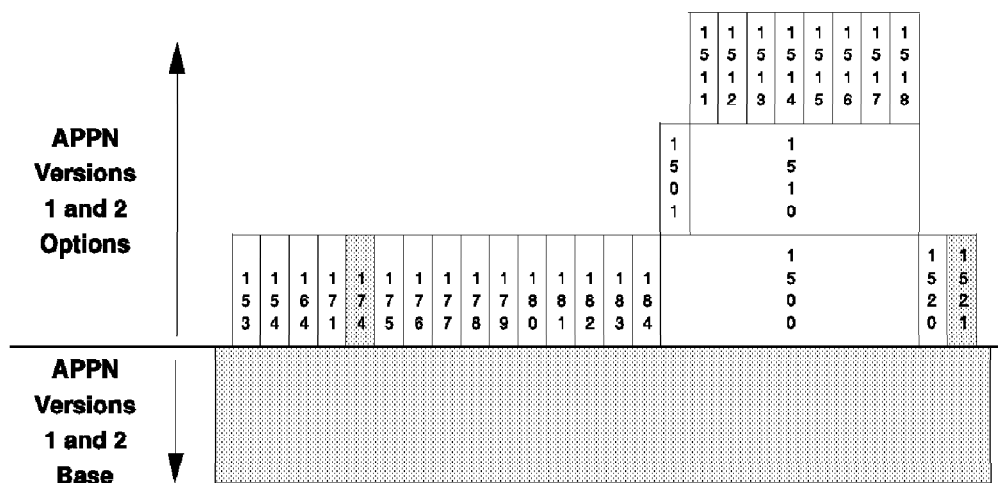


Figure 553. VTAM Network Node Implemented SNA/MS Functions

A.5 AIX SNA Server/6000

AIX SNA Services/6000 V1R2 allowed RISC System/6000s to function as LEN end nodes. AIX SNA Server/6000 V2R1 now provides full APPN support and enables the RISC/6000 workstation to function as a network node or end node in an APPN network.

AIX SNA Server/6000 supports connection networks over token-ring and Ethernet.

A.5.1 Terminology

The term “partner LU” is used for LUs in remote nodes.

The term “calling link station” is used for link stations that initiate activation of a link.

The term “dynamic calling link station” is used for link stations that initiate activation of a link over a connection network.

The term “listening link station” is used for link stations that accept link activation requests from remote link stations.

- A “selective listening link station” accepts a link activation request only from a specific remote link station.
- A “nonselective listening link station” accepts a link activation from any partner link station.
- A “dynamic listening link station” is not explicitly configured.

A.5.2 System Definitions

Configuration information is stored in “profiles” that are maintained in two databases: a working database that contains new or changed profiles, and a committed database that contains verified profiles. Before new or changed profiles can be used to run SNA Server/6000, the entire profile database must be verified with the “update” option specified to place the profiles in the committed database.

To configure a RISC System/6000 workstation, you need to provide information about the node and the local control point, each link to an adjacent node, and the LUs that provide control for sessions with a remote node. In an APPN network, you can use also dynamic resource definition to access resources that have not been configured to SNA Server/6000 (for example, activating dynamic link stations or finding remote LUs that are not configured on the local node).

A.5.3 Restrictions

The maximum number of sessions supported by a node is 5000. This number applies to sessions with local LUs and intermediate sessions (that is, sessions between remote LUs passing through a node).

The maximum number of node entries in the topology database is 65535.

A.6 IBM 6611

The IBM 6611 Network Processor provides a method of interconnecting multiple network types, and sending and receiving a variety of protocols across the interconnected networks. The IBM 6611 is used to route and bridge communications across local area networks (LANs) and wide area networks (WANs). The system control program for the IBM 6611 is the IBM Multiprotocol Network Program (MPNP). With MPNP V1R2 the IBM 6611 can be configured as an APPN network node that supports connections with APPN and LEN nodes. The IBM 6611 cannot act as an APPN end node or LEN end node.

APPN in the IBM 6611 uses data link switching (DLSw) to provide a connection-oriented interface (802.2 LLC type 2) between the APPN component in the IBM 6611 and APPN nodes and LEN end nodes attached to a token-ring LAN or Ethernet LAN. The DLSw function uses bridging to transport SNA frames encapsulated in a MAC sublayer frame to and from LAN-attached nodes served by the IBM 6611 network node.

Across a WAN, the APPN component in the IBM 6611 uses either the remote DLSw function or a direct IP connection to communicate with another IBM 6611 network node. Normally, end nodes serviced by the IBM 6611 network node are connected to a LAN that is locally attached to the IBM 6611. However, the IBM 6611 network node can service an end node that is connected to a LAN on another IBM 6611.

Adjacent nodes need not be defined; the IBM 6611 can be configured to accept connection requests from any adjacent node and establish CP-CP sessions. For security reasons, the IBM 6611 may be configured to accept connection requests only from nodes that are defined as adjacent nodes.

A.6.1 Restrictions

The IBM 6611 implementation of APPN does not provide an application program interface to support user-written LU 6.2 programs.

The IBM 6611 can not define a connection virtual routing node, but supports route calculation for sessions across a connection network.

The IBM 6611 supports up to 255 transmission groups to adjacent nodes. Only one transmission group is permitted, however, between the IBM 6611 and a specific adjacent node; that means, the IBM 6611 does not support parallel transmission groups.

The IBM 6611 does not fully support SNA class of service. It does only service session requests for mode names that map to the architected classes of service. In addition, it calculates least-weight routes based on COS and TG characteristics in accordance with the APPN architecture. However, the IBM 6611 does not provide a method for defining classes of service or TG characteristics for TGs connected to the IBM 6611. TG characteristics are set by internal defaults. Also, the IBM 6611 does not provide transmission priority based on COS.

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A.7 System/36

The System/36 was the first IBM system to implement low-entry networking (LEN) and then APPN functions for peer-to-peer networking. The APPN architecture was developed to satisfy the requirements for peer-to-peer communication of the large number of System/36s installed. The System/36, although still being used in a large number of installations, has the AS/400 as its successor; consequently, new functions are implemented in the AS/400.

A.7.1 Terminology

The term “end node” is used for LEN end nodes.

The term “location” is used for logical units.

The term “local location name” is used for a node's own CP name.

The term “remote system name” is used for the CP name of remote systems.

The term “session group” is used for a logmode entry defining the common characteristics of a group of sessions.

A.7.2 Restrictions

The System/36 cannot be an APPN end node.

The System/36 supports a maximum of 150 network nodes and 600 TGs connecting network nodes in its topology database.

A System/36 network node may concurrently communicate with up to 25 adjacent nodes.

A System/36 network node is able to support up to 50 intermediate sessions passing through the node.

The System/36 supports sessions that cross a maximum of 10 intermediate systems (11 hops); that is, the RSCV is restricted to 11 TG Descriptor control vectors.

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A.8 DPPX/370

Distributed Processing Programming Executive (DPPX) was the first IBM product to implement host-independent SNA peer-to-peer communication. This peer-to-peer communication was implemented using SNA subarea protocols. On a link connecting two adjacent nodes one side acts as a PU T5 and the other side as a PU T4. Although subarea protocols and flows are used, for example for session setup, two DPPX systems cannot directly communicate through a VTAM/NCP subarea network and a DPPX system connects as a PU T2.0 to a VTAM/NCP subarea network. To allow DPPX-attached dependent LUs to access applications in remote DPPX systems the Router application is used that routes the session data through a DPPX subarea network also across multiple systems.

Starting with DPPX/370 R3 the separately orderable DPPX/370 APPC/APPN Feature is available that provides peer-to-peer communication using APPN protocols. A DPPX/370 system can be an APPN network node or end node and supports connection to LEN end nodes. A link can be defined as a “shared link” to concurrently support APPN flows and subarea (PU T2.0 or PU T5) flows.

A.8.1 Terminology

The term “partner CP” is used for CPs on adjacent nodes.

The term “partner LU” is used for LUs in remote nodes.

A.8.2 System Definitions

CPs in adjacent nodes must be defined as partner CPs and cannot be dynamically learned. In an DPPX/370 end node, an adjacent network node's CP must be defined as being the end node's Network Node Server; only one Network Node Server can be defined as Network Node Server and when the connection to it fails a backup Network Node Server cannot dynamically defined. DPPX/370 supports passwords for CP-CP sessions to verify the identity of a partner CP; the password must be specified when defining the partner CP.

The DPPX/370 system supports multiple local LUs. Local LUs must be defined. Partner LUs must be defined for:

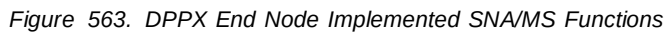
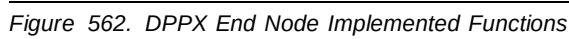
- LUs in adjacent LEN end nodes
- LUs in adjacent end nodes without CP-CP sessions
- LUs, for which session passwords are defined
- Remote LUs to which a session shall be established first

Partner LUs may be dynamically defined in a node for remote LUs that establish a session with a local LU.

A.8.3 Restrictions

DPPX/370 does not support the definition of virtual routing node, that means cannot connect to a connection network, but as a Network Node Server can calculate a route through a connection network for other (non-DPPX/370) nodes that support connection networks.

DPPX/370 does not support transmission priorities.



A.9 Summary of Implemented Functions

Table 4 (Page 1 of 3). Summary of Implemented Base Functions (APPN Version 1)														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
Configuration Services														
001	LEN-level XID3	X	X	X	X	X	X	X	X	X	X	X	X	X
002	All XID3 States	X	X	X	X	X	X	X	X		X	X	X	X
003	Link Station Role Negotiation	X	X	X	X	X	X	X	X	X	X		X	X
006	CP Name on XID3	X	X	X	X	X	X	X	X	X	X	X	X	X
007	TG Number Negotiation	X	X	X	X	X	X	X	X	1	X	X	X	X
008	Multiple TGs	X	X	X	X	X	X	X	X	X	X	X	X	X
010	Single-Link TG	X	X	X	X	X	X	X	X	X	X	X	X	X
Intermediate Session Routing														
011	LFSID Addressing	X	X	X	X	X	X	X	X	X	X	X	X	X
013	Priority Queuing for Transmission	2	2	X	X					X				
Address Space Manager														
020	Extended BIND and UNBIND	X	X	X	X	X	X	X	X	X	X	X	X	X
021	Adaptive Pacing for Independent LU BINDs	3	3	X	X	X	X			X	X	X	X	X
023	Bind Segmenting and Reassembly			X	X	X	X	X	X	X	X	X	X	X
Session Services														
030	CP-CP Sessions	X	X	X	X	X	X	X	X	X	X	X	X	X
031	CP-CP Capabilities Exchange	X	X	X	X	X	X	X	X	X	X	X	X	X
033	FQPCID Generation	X	X	X	X	X	X	X	X	X	X	X	X	X
034	CD-Initiate	X	X	X	X	X	X	X	X	X	X	X	X	X
035	Reconstruct CD-Initiate Reply	X	X	X	X	X	X	X	X	X	X		X	X
036	COS/TPF	X	X	X	X	X	X	X	X	X	X		X	X
037	BIND (ILU=PLU)	X	X	X	X	X	X	X	X	X	X	X	X	X
038	Limited Resource	X	X	X	X	X	X			X		X	X	X
039	BIND without RSCV from Any LEN or APPN Node	X	X	X	X	X	X	X	X	4	X	5	X	X
040	Propagate Unrecognized CVs		X		X		X		X	1	X	6	X	X
041	Session RU Segmenting and Reassembly	X	X	X	X	X	X	X	X	X	X	X	X	X
042	Interleaved Segments	X	X	X	X	X	X	X	X	X	X		X	X
Directory Services														
050	Register EN Resources	X	X	X	X	X	X	X	X	X	X	X	X	X
051	Locate/Find/Found	X	X	X	X	X	X	X	X	X	X	X	X	X
052	Reconstruct GDS Variables for Locate Reply and CD-Initiate Reply	X	X	X	X	X	X	X	X	X	X	X	X	X
053	Participate in Network Searches	X	X	X	X	X	X	X	X	X	X	X	X	X
054	Send Wildcard Reply			X	X	X	X	X	X	X	X	X	X	X
055	Broadcast and Directed Searches	X	X	X	X	X	X	X	X	X	X	X	X	X
056	ENCP Search Control	X	X	X	X	X	X	X	X	X	X	X	X	X
057	Partial Directory Entries			X	X	X	X	X	X	1	X	X		
059	Accept Unqualified LU Name	X	X		X		X		X	X	X	X		X
060	Locate Chains - Locate(keep)	X	X		X		X		X	X		6		
061	Sending Locate to a Gateway		X		X		X		X		X			
062	Cache Resource Locations		X		X		X		X	X	X	X		X
063	Favor Explicit Replies		X		X		X		X	X	X			X
064	Network-Qualified LU Names	X	X	X	X	X	X	X	X	X	X	X	X	X
065	Central Directory Client		X		X		X		8	4	X			
066	Abbreviated Resource Hierarchy		X		X		X			X	X			
068	Authentic Net ID Indicator	X	X						X	1	X	6		
069	DS Support for Domain LEN Resources	7	X		X		X		X	X	X	X		X

Table 4 (Page 2 of 3). Summary of Implemented Base Functions (APPN Version 1)														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
Topology and Routing Services														
070	Process Local Resource Change	X	X	X	X	X	X	X	X	X	X	X	X	X
073	Initial Topology Exchange	X	X		X		X		X	X	X	X		X
074	Flow Reduction Sequence Numbers	X	X		X		X		X	X	X	X		X
075	Resource Sequence Numbers	X	X		X		X		X	X	X	X		X
076	Topology Broadcast		X		X		X		X	X	X	X		X
077	Garbage Collection		X		X		X		X	X	X	X		X
078	Topology Isolation at Net ID Boundaries		X		X		X		8	X	X	X		X
079	Build RSCV		X	X	X	X	X	X	X	X	X	X	X	X
080	Calculate Route Using Connection Networks		X		X		X		X	X	X			X
081	Class-of-Service Manager	X	X	X	X	X	X	X	X	X	X		X	X
082	Route Randomization		X		X		X		X	X	X			
083	Member of Connection Network	9	9	X	X	X	X	X	X	X	X			
084	Select One-Hop Routes		X	X	X		X		X	X	X		X	X
085	Select Network Routes		X		X		X		X	X	X	X		X
Node Operator Command Set														
090	Common Node Operator Command Set	X	X	X	X	X	X	X	X	X		X	X	X
091	Network Node Node Operator Command Set		X		X							X		X
Intermediate Session Routing														
100	Extended/Unextended BIND and UNBIND	X	X		X		X		X	X	X	X		X
101	Fixed Session-Level Pacing	X	X	X	X		X	X	X	X	X	X		X
102	Adaptive Session-Level Pacing	X	X	X	X		X	X	X	X	X	X		X
103	Intermediate Session Segmenting/Reassembly				X		X		X	X	X	X		X
104	Routing BIND and UNBIND	7	X		X		X		X	X	X	X		X
105	Intermediate Session Routing for Dependent LU Sessions	7	X		X		X		8	1	X	X		
106	Intermediate Session Routing for Type 6.2 LU-LU Sessions	7	X		X		X		X	X	X	X		X
Management Services - Multiple-Domain Support														
150	MDS Common Base	10	10	X	X	X	X	X	X	4	X		X	X
151	MDS End Node Support	10		X		X		X					X	
152	MDS Network Node Support		10		X		X		X	4	X			X
Management Services - MS Capabilities														
160	MS_CAPS Base End Node Support	10		X		X		X					X	
161	MS_CAPS Have a Backup or Implicit FP	10	10	X	X	X	X	11	11	4	X			X
163	MS_CAPS Base Network Node Support		10		X		X		X	4	X			X

Table 4 (Page 3 of 3). Summary of Implemented Base Functions (APPN Version 1)														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
Management Services - Entry Point Alerts														
170	EP Alert Base Subset			X	X	X	X	X	X		X		X	X
Miscellaneous														
1104	Topology-Based Directory Nonverify				X		X		X	X	X			
Notes: 1 Not supported by 3174 Configuration Support C1/C2; supported by Configuration Support C3/C4/C5. 2 Supported by NCP's BF only. 3 VTAM will respond to a BIND pacing request received, but will never set the pacing request indicator on a BIND. 4 Not supported by 3174 Configuration Support C1/C2/C3/C4; supported by Configuration Support C5. 5 Not supported in S/36 R5; supported by R6 and R7. 6 Not supported in S/36 R5 and R6; supported by R7. 7 VTAM EN providing LEN attachment. 8 Not supported by AIX SNA Server V2R1; supported by V2R1.1. 9 Not supported by VTAM V4R1; supported by V4R2. 10 Function supported through NetView. 11 Backup Focal Point only.														

Table 5. Summary of Implemented Base Functions APPN Version 2 (Optional for Version 1)														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
024	Adaptive Pacing for Dependent LU BINDs			X	X	X	X			1	X	X		
1001	Secondary-Initiated Non-Activation XID	X	X							X				
1004	Adjacent Node Name Change	X	X	2	2					3				
1013	Interoperability with Peripheral Border Node		X		X		X		5	1		4		
1015	CP-CP Session Activation Enhancements	X	X	X	X									
1103	Retry Referred Search		X						5					
1105	PCID Modifier	X	X											
1109	Surrogate Owner		X							3				
Notes: 1 Not supported by 3174 Configuration Support C1/C2/C3/C4; supported by Configuration Support C5. 2 Not supported by AS/400 V2R1; supported by V2R2. 3 Not supported by 3174 Configuration Support C1/C2; supported by Configuration Support C3/C4/C5. 4 Not supported by S/36 R5 and R6; supported by R7. 5 Not supported by AIX SNA Server/6000 V2R1; supported by V2R1.1.														

Table 6 (Page 1 of 2). Summary of Implemented Optional Functions														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
Management Services - Multiple-Domain Support														
153	MDS High Performance Option													
154	MDS Transport Confirmation Option													
Management Services - MS Capabilities														
162	MS_CAPS Be a Sphere of Control	1		X		X		X						
164	MS_CAPS Have a Subarea FP	2	2		X		X			X		X		X
Management Services - Entry Point Alerts														
171	Problem Diagnosis Data in Alert	1	1	X	X	X	X	X	X		X		X	X
174	Operator-Initiated Alert			X	X					X				
175	Qualified Message Data in Alert			X	X									
176	Self-Defining Message Text			X	X									
177	Subvector in Alert													
177	LAN Alert			X	X	X	X			X			X	X
178	SDLC/LAN LLC Alert			X	X	X	X							X
179	X.21 Alert			X	X									
180	Hybrid Alert													
181	X.25 Alert			X	X	X	X						X	X
182	Held Alert for CPMS			X	X	X	X			X				
183	Resolution Notification Support													
184	Operations Management Support in Alert													
Configuration Services														
1002	Adjacent Link Station Name	X	X	X	X	X	X			X	X	X		
1003	Short-Hold Mode	X	X	X	X									
1006	Dynamic Name Change	X	X							3				
1007	Parallel TGs	X	X	X	X	X	X	X	X	3		X	X	X
CP Capabilities														
1011	Multiple Local LUs	X	X	X	X	X	X	X	X			X	X	X
1012	LU Name = CP Name			X	X	X	X	X	X	X	X	X		
1014	Peripheral Border Node				X									
1016	Extended Border Node		4											
1017	Gateway													
1018	Delete EN Resources Before Registering	X	X											
Dependent LU Support														
1060	Prerequisite for Session Services Extensions	X	X											
1062	Session Services Ext. CP Support	X	X											
1063	Session Services Ext. NNS Support		X											
1064	Session Services Ext. PLU Node Support	X	X											
1065	Session Services Ext. CP(SLU) (SSCP) Support	X	X											
1066	Dependent LU Server		4											
1067	Dependent LU Requester									5				
1068	Non-Persistent CP-CP Sessions													
Cryptography Support														
1070	Session Cryptography	X	X											

Table 6 (Page 2 of 2). Summary of Implemented Optional Functions														
Function		VTAM		AS/400		CM/2		AIX SNA		3174	6611	S/36	DPPX	
		V4R2		V2R2		V1.1		V2R1.1		C5	1.2	R7	R3	
No.	Description	EN	NN	EN	NN	EN	NN	EN	NN	NN	NN	NN	EN	NN
Directory Services														
1100	Safe-Store of Directory Cache		X		X					X				X
1101	Preloaded Directory Cache		X				X			X	X			
1102	EN Authorization							X			X	X		
1106	Central Directory Server		X											
1107	Central Resource Registration (of LUs)	X	X											
1108	Nonverify		6											
Topology and Routing Services														
1200	Tree Caching and TG Caching		X	X	X	X	X		X		X			
1201	Permanent Storage Medium	X	X	X	X								X	X
1202	Safe-Store of Topology DB		X		X									X
Intermediate Session Routing														
1300	Tuning Values for ISR	X	X											
1301	Nonpaced Intermediate Session Traffic	X	X		X				7					X
Management Services - File Services														
1500	File Services Support Base			8	8	9	9	10	10	X				
1501	Network Operator Support for File Services													
Management Services - Change Management														
1510	CM Base			8	8	9	9	10	10	X				
1511	CM Production Only Activate			8	8									
1512	CM Execution Window Timing			8	8	9	9	10	10					
1513	CM Activate Report			8	8	9	9	10	10	X				
1514	CM Alter Active Install			8	8	9	9	10	10					
1515	CM Object Disposition Install													
1516	CM Initiate Command			8	8	9	9	10	10					
1517	CM Cancel Command			8	8	9	9	10	10					
1518	CM Activate Last													
Management Services - Operations Management														
1520	Common Operations Services					X	X							
1521	Operations Management	1	1											
Notes: - Function supported through NetView. - NetView serves as the subarea focal point, but cannot have a subarea focal point using the APPN architecture. Instead, NetView supports using another NetView as a subarea focal point using a proprietary interface. - Not supported by 3174 Configuration Support C1/C2; supported by Configuration Support C3/C4/C5. - Not supported by VTAM V4R1; supported by V4R2. - Not supported by 3174 Configuration Support C1/C2/C3/C4; supported by Configuration Support C5. - Function supported only at NN(OLU). - Receive nonpaced intermediate session traffic only; not supported by AIX SNA Server/6000 V2R1; supported by V2R1.1. - Function supported by Managed System Services/400. - Function supported by NetView DM/2. - Function supported by NetView DM/6000.														

Appendix B. VTAM New Commands

The following commands are available using VTAM Version 4 Release 1.

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 08:50:10
* RAPAN    D NET,TOPO,ID=RAP,LIST=ALL
  RAPAN    IST097I  DISPLAY  ACCEPTED
' RAPAN
IST350I  DISPLAY TYPE = TOPOLOGY
IST1295I  CP NAME                NODETYPE ROUTERES CONGESTION  CP-CP WEIGHT
IST1296I  USIBMRA.RAP            NN      128      NONE      *NA*  *NA*
IST1297I                ICN/MDH  CDSERV  RSN      BASEWEIGHT
IST1298I                YES      NO      0      *NA*
IST1299I  TRANSMISSION GROUPS ORIGINATING AT CP USIBMRA.RAP
IST1357I                CPCP
IST1300I  DESTINATION CP      TGN      STATUS  TGTYPE  VALUE WEIGHT
IST1301I  USIBMRAA.CP3174  21      INOP      INTERM  YES  *NA*
IST1301I  USIBMRAA.RALYAS4A 21      OPER      ENDPT  YES  *NA*
IST314I  END

```

Figure 566. Display VTAM Topology - for the Node RAP

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 08:55:02
* RAPAN    D NET,ID=RA9T0500
  RAPAN    IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I  NAME = RA9T0500          , TYPE = CDRSC
IST486I  STATUS= ACTIV          , DESIRED STATE= ACTIV
IST599I  REAL NAME = ***NA***
IST977I  MDLTAB=***NA*** ASLTAB=***NA***
IST861I  MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
IST934I  DLOGMOD=***NA*** USS LANGTAB=***NA***
IST597I  CAPABILITY-PLU ENABLED , SLU ENABLED , SESSION LIMIT NONE
IST231I  CDRSC  MAJOR NODE = ISTDILU
IST1044I  ALSLIST = RA9P05
IST1131I  DEVICE = ILU/CDRSC
IST654I  I/O TRACE = OFF, BUFFER TRACE = OFF
IST171I  ACTIVE SESSIONS = 0000000000, SESSION REQUESTS = 0000000000
IST314I  END
-----

```

Figure 567. Display VTAM Resource - Display the LU RA9T0500 (CDRSC)

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 08:57:39
* RAPAN    V NET, INACT, ID=RA9T0500, DELETE=YES    1
  RAPAN    IST097I VARY    ACCEPTED
  RAPAN    IST1133I RA9T0500    IS NOW INACTIVE, TYPE = CDRSC
* RAPAN    D NET, ID=RA9T0500    2
  RAPAN    IST453I ID    PARAMETER VALUE INVALID
-----

```

Figure 568. Inactivate and Delete Independent LU RA9T0500 (CDRSC). The first command 1 inactivates (varies off) and deletes the independent LU, RA9T0500. The second 2 is an attempt to display the now deleted LU.

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 09:00:57
* RAPAN    D NET, DIRECTRY, ID=USIBMRAA.RALYAS4A
  RAPAN    IST097I DISPLAY ACCEPTED
  ' RAPAN
IST350I DISPLAY TYPE = DIRECTORY
IST1186I DIRECTORY ENTRY = REGISTERED EN
IST1184I CPNAME = USIBMRAA.RALYAS4A - NETSRVR = USIBMRA.RAP
IST314I END
-----

```

Figure 569. Display the Directory Entry for the CP USIBMRAA.RALYAS4A

```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 09:03:39
* RAPAN    D NET, ID=RALYAS4A
  RAPAN    IST097I DISPLAY ACCEPTED
  ' RAPAN
IST075I NAME = USIBMRAA.RALYAS4A, TYPE = ADJACENT CP
IST486I STATUS= ACT/S---Y, DESIRED STATE= ACTIV
IST977I MDLTAB=***NA*** ASLTAB=***NA***
IST861I MODETAB=***NA*** USSTAB=***NA*** LOGTAB=***NA***
IST934I DLOGMOD=CPSVCMG USS LANGTAB=***NA***
IST597I CAPABILITY-PLU ENABLED ,SLU ENABLED ,SESSION LIMIT NONE
IST231I CDRSC MAJOR NODE = ISTDYRDY
IST1044I ALSLIST = ISTAPNPU
IST1131I DEVICE = ILU/CDRSC
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST171I ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
IST924I -----
IST075I NAME = USIBMRAA.RALYAS4A, TYPE = DIRECTORY ENTRY
IST1186I DIRECTORY ENTRY = REGISTERED EN
IST1184I CPNAME = USIBMRAA.RALYAS4A - NETSRVR = USIBMRA.RAP
IST314I END
-----

```

Figure 570. Display the LU and CP RALYAS4A (RALYAS4A is a Border Node)

```

NCCF                                N E T V I E W    RAPAN MEBELIN  03/19/93 09:06:13
* RAPAN      D NET,ID=T4A8941,SCOPE=ALL
  RAPAN      IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I  NAME = T4A8941              , TYPE = PU_T2.1
IST486I  STATUS= ACTIV              , DESIRED STATE= ACTIV
IST1043I CP NAME = RALYAS4A, CP NETID = USIBMRAA, DYNAMIC LU = YES
IST136I  SWITCHED SNA MAJOR NODE = SWAS4A08
IST081I  LINE NAME = J0009039, LINE GROUP = EG09L01 , MAJNOD = RA9NCPK
IST654I  I/O TRACE = OFF, BUFFER TRACE = OFF
IST355I  LOGICAL UNITS:
IST080I  T4A89L02 CONCT              T4A89L03 CONCT              T4A89L04 CONCT
IST080I  T4A89L05 CONCT              T4A89L06 CONCT              T4A89L07 CONCT
IST080I  T4A89L40 CONCT
IST314I  END
-----

```

Figure 571. Display the PU T4A8941, Token-Ring LEN Connection

```

NCCF                                N E T V I E W    RAPAN MEBELIN  03/19/93 09:14:47
C RAPAN      DISPLAY NET,ID=ISTDSWMN,SCOPE=ALL
  RAPAN      IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I  NAME = ISTDSWMN              , TYPE = SW SNA MAJ NODE
IST486I  STATUS= ACTIV              , DESIRED STATE= ACTIV
IST084I  NETWORK NODES:
IST089I  V15078  TYPE = PHYSICAL UNIT      , ACTIV--LX-
IST089I  V1507802 TYPE = LOGICAL UNIT      , ACTIV---X-
IST089I  V1507803 TYPE = LOGICAL UNIT      , ACTIV---X-
IST089I  V1507804 TYPE = LOGICAL UNIT      , ACTIV---X-
IST089I  V1507805 TYPE = LOGICAL UNIT      , ACTIV---X-
IST314I  END
-----

```

Figure 572. Display the Dynamic Switched Major Node ISTDSWMN

```

NCCF                                N E T V I E W      RAPAN MEBELIN   03/19/93 09:12:52
C RAPAN      DISPLAY NET,ID=V15078,SCOPE=ALL
  RAPAN      IST097I  DISPLAY  ACCEPTED
    ' RAPAN
IST075I  NAME = V15078                      , TYPE = PU_T2.1
IST486I  STATUS= ACTIV--LX-, DESIRED STATE= ACTIV
IST1043I  CP NAME = RALYAS4A, CP NETID = USIBMRAA, DYNAMIC LU = YES
IST1105I  RESOURCE STATUS TGN CP-CP TG CHARACTERISTICS
IST1106I  V15078  AC/R      21 YES    802D00000000000000000017100808080
IST136I  SWITCHED SNA MAJOR NODE = ISTD SWMN
IST081I  LINE NAME = J000903B, LINE GROUP = EG09L01 , MAJNOD = RA9NCPK
IST654I  I/O TRACE = OFF, BUFFER TRACE = OFF
IST355I  LOGICAL UNITS:
IST080I  V1507802 ACTIV---X- V1507803 ACTIV---X- V1507804 ACTIV---X-
IST080I  V1507805 ACTIV---X-
IST080I  RALYAS4A ACT/S----Y
IST314I  END
-----

```

```

NCCF                                N E T V I E W      RAPAN MEBELIN  03/19/93 09:16:28
* RAPAN      ACT SW4A0941
C RAPAN      VARY NET,ACT,ID=SW4A0941
  RAPAN      IST097I  VARY      ACCEPTED
  RAPAN      IST1132I  T4A0941      IS ACTIVE, TYPE = PU_T2
  RAPAN      IST1132I  SW4A0941      IS ACTIVE, TYPE = SW SNA MAJ NODE
-----

```

```

NCCF                      N E T V I E W      RAPAN MEBELIN   03/19/93 09:47:12
C RAPAN      DISPLAY NET,ID=T4A0941,SCOPE=ALL
  RAPAN      IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I  NAME = T4A0941              , TYPE = PU_T2.1
IST486I  STATUS= ACTIV--L--, DESIRED STATE= ACTIV
IST1043I  CP NAME = RALYAS4A, CP NETID = USIBMRAA, DYNAMIC LU = YES
IST1105I  RESOURCE STATUS TGN CP-CP TG CHARACTERISTICS
IST1106I  T4A0941 AC/R      21 YES    802D0000000000000000000017100808080
IST136I  SWITCHED SNA MAJOR NODE = SW4A0941
IST081I  LINE NAME = J000903B, LINE GROUP = EG09L01 , MAJNOD = RA9NCPK
IST654I  I/O TRACE = OFF, BUFFER TRACE = OFF
IST355I  LOGICAL UNITS:
IST080I  T4A09L02 ACTIV          T4A09L03 ACTIV          T4A09L04 ACTIV
IST080I  T4A09L05 ACTIV          T4A09L06 ACTIV          T4A09L07 ACTIV
IST080I  T4A09L40 ACTIV
IST080I  RALYAS4A ACT/S----Y
IST314I  END
-----

```

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```

NCCF                                N E T V I E W    RAPAN MEBELIN 03/19/93 10:04:34
C RAPAN    DISPLAY NET,ID=SW4A0941,SCOPE=ALL
      RAPAN    IST097I  DISPLAY  ACCEPTED
' RAPAN
IST075I  NAME = SW4A0941          , TYPE = SW SNA MAJ NODE
IST486I  STATUS= ACTIV          , DESIRED STATE= ACTIV
IST084I  NETWORK NODES:
IST089I  T4A0941  TYPE = PHYSICAL UNIT      , ACTIV--L--
IST089I  T4A09L02 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L03 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L04 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L05 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L06 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L07 TYPE = LOGICAL UNIT      , ACTIV
IST089I  T4A09L40 TYPE = LOGICAL UNIT      , ACTIV
IST314I  END
-----

```

Figure 576. Display the Pre-defined Token-Ring PU Switched Major Node SW4A0941

Appendix C. APPN Basics

This chapter first introduces the basic terminology used with Advanced Peer-to-Peer Networking and puts it in context without going into detail. This appendix forms the first chapter of *APPN Architecture and Product Implementation Tutorial*, if further detail is required on the APPN Architecture and its implementation then we recommend that you consult this manual.

C.1 LEN Node and Advanced Peer-to-Peer Networking

A network can be very simple, for example, two PS/2s connected by a telephone line, as shown in the figure below.

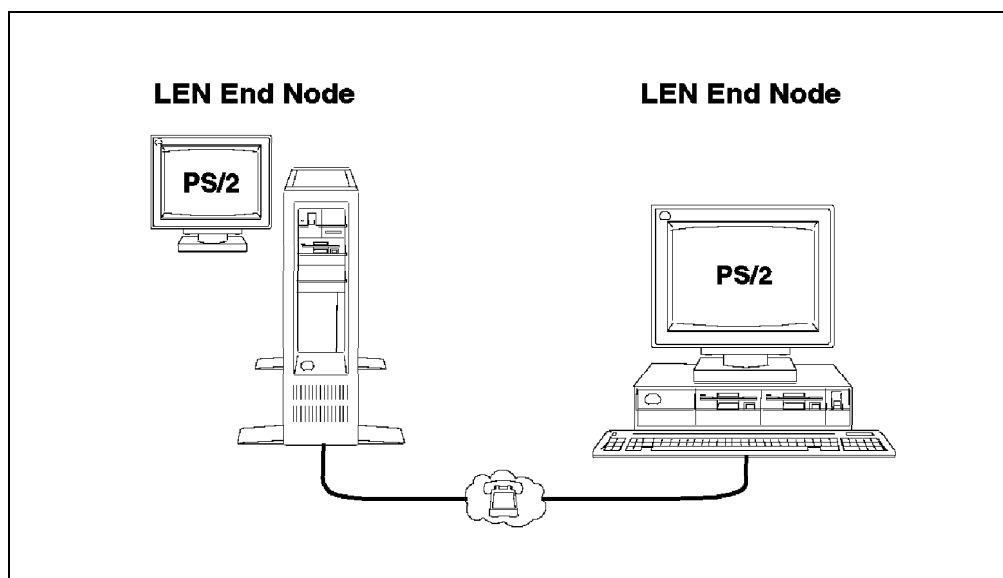


Figure 577. Two PS/2s Forming a LEN Connection

The purpose of connecting these two systems is to exchange data between two end users. An end user could be a person working with this system, a program running on the system, or a printer controlled by the system.

The end user gains access to the network through the logical unit (LU). Before the two LUs are able to exchange data, they must start an LU-LU session. For program-to-program communication, this session would typically be an LU 6.2 session.

In the case above, when the two systems (PS/2s) establish a low-entry networking (LEN) connection, the two connecting systems are known as **LEN end nodes**. Using the architectural terms, the configuration above could be drawn as shown in Figure 578 on page 486.

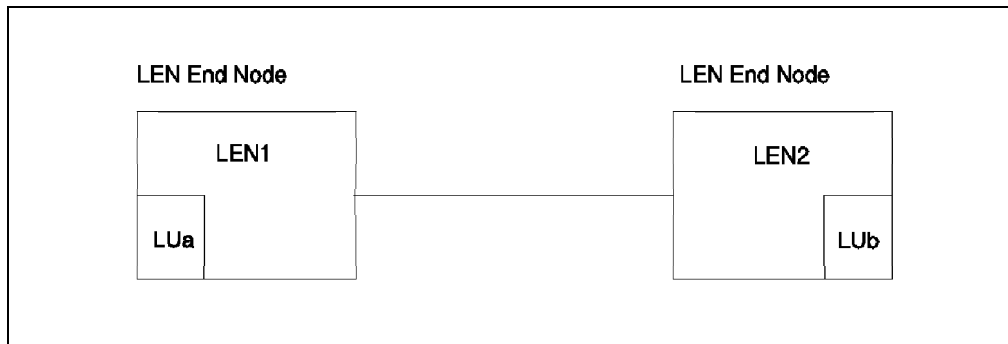


Figure 578. The Basic LEN node Connection

Several systems can be configured as LEN end nodes, such as VTAM and NCP, AS/400 and PS/2. LEN end nodes provide the minimum functions required to:

- Provide a connection between LEN1 and LEN2
- Establish a session between the LUs named LUa and LUb
- Transport data

The relation between LEN end nodes is truly peer-to-peer. Either side may activate a connection or start a session to the partner. It should be noted that according to the architecture, there are only *two* adjacent nodes involved in a LEN node connection. That is, no matter how many nodes are actually in the network, the LEN node connection only recognizes two nodes.

Obviously, there must be functions in addition to LEN node to build a network with more than two nodes. One of these functions is the capability to act as an intermediate node; that is, the node can receive data that is not for itself and can pass it on to the destination node. This principle is shown in Figure 579.

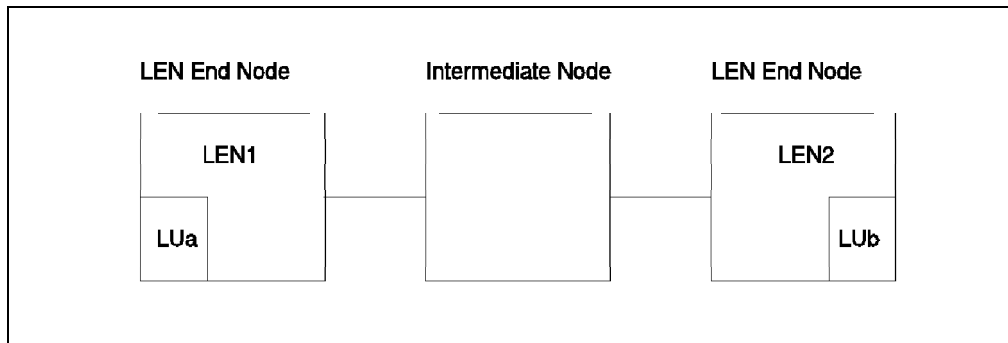


Figure 579. LEN End Nodes Connected to an Intermediate Node

According to the LEN node architecture, the relation between LEN end nodes is always a “two-node peer relationship.” Therefore LUs residing on non-adjacent LEN nodes can only establish sessions and exchange data, because the intermediate node presents itself as a LEN node owning all LUs residing on non-adjacent nodes. As seen from LEN1, the intermediate node is just a normal LEN end node, and LEN2 is not visible at all from LEN1. For LEN1, the LU named LUb seems to be in the intermediate node.

VTAM and NCP support the LEN end node function and also provide intermediate routing between LEN end nodes. Figure 580 on page 487 gives an example of this configuration with VTAM on an ES/3090 as intermediate node.

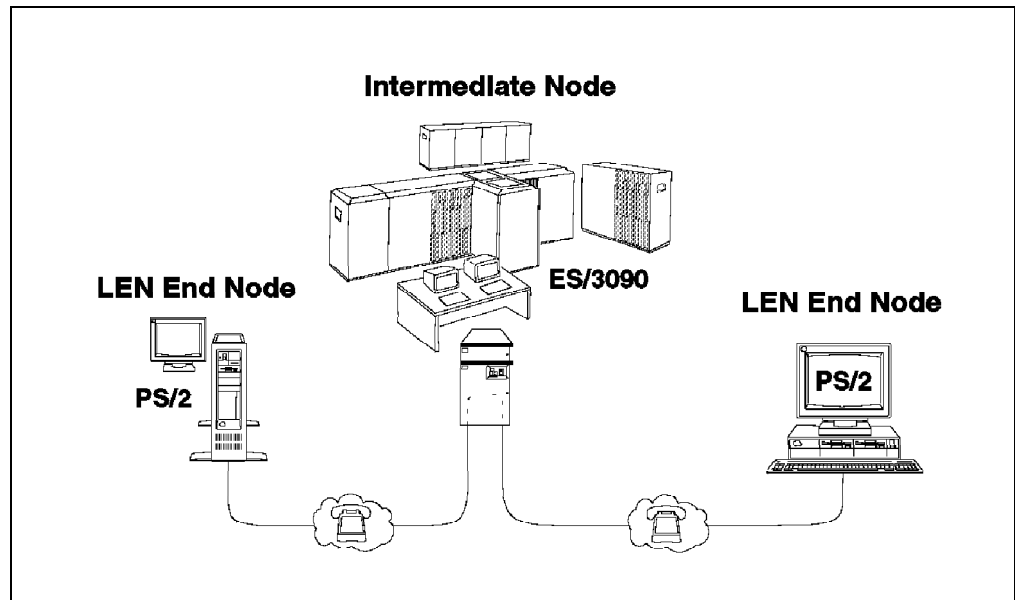


Figure 580. VTAM/NCP Providing the Intermediate Routing Function for LEN End Nodes

The functions of LEN nodes are limited, for example the nodes are not able to exchange topology and configuration data. Additional capabilities are required to reduce the number of definitions and the maintenance effort when building larger networks. For this purpose the Advanced Peer-to-Peer Networking (APPN) architecture has been developed, which has been announced and published as the latest extension to SNA (Systems Network Architecture).

APPN architecture defines two basic node types:

1. **APPN End Node**

The APPN end node is similar to a LEN end node, except that the control point (CP) of the end node exchanges information with the CP in the adjacent network node. The communication over the CP-CP sessions reduces the requirement for network definitions, and thus makes installation and maintenance of the network easier.

2. **APPN Network Node**

The APPN network node has intermediate routing functions and provides network services to either APPN or LEN end nodes which attach to the network node. An APPN network node establishes CP-CP sessions with its adjacent APPN network nodes to exchange network topology and resource information. The CP-CP sessions to adjacent APPN end nodes are optional and are required only for APPN end nodes for which the APPN network node provides network services (such as locating resources in the APPN network).

APPN architecture describes the connection of LEN end nodes to APPN network nodes or APPN end nodes.

Figure 581 on page 488 shows the basic form of an APPN network and gives an example of the services provided by the APPN network node. When LUa requests a session with LUC, the network node will locate the partner LU and assist in establishing the session.

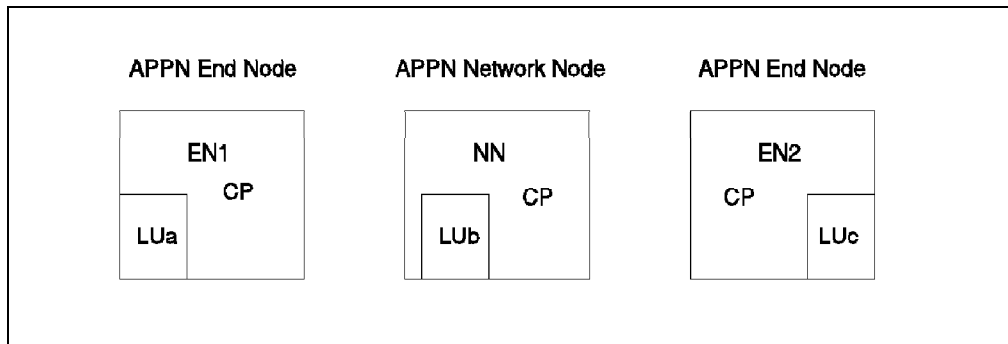


Figure 581. Advanced Peer-to-Peer Networking with Three Nodes

Figure 581 shows the basic form of an APPN network, however, APPN networks can be much more complex. APPN does not limit the number of nodes in an APPN network nor does it explicitly limit the number of intermediate APPN network nodes through which LU-LU sessions are routed. One restriction exists however: the length of the Route Selection control vector (RSCV) describing a physical session path is limited to 255 bytes.

Figure 582 shows a backbone structure of APPN network nodes to which end nodes connect. The Advanced Peer-to-Peer Networking nodes communicate through CP-CP sessions which are established between adjacent nodes. User sessions can be established from any LU to any LU.

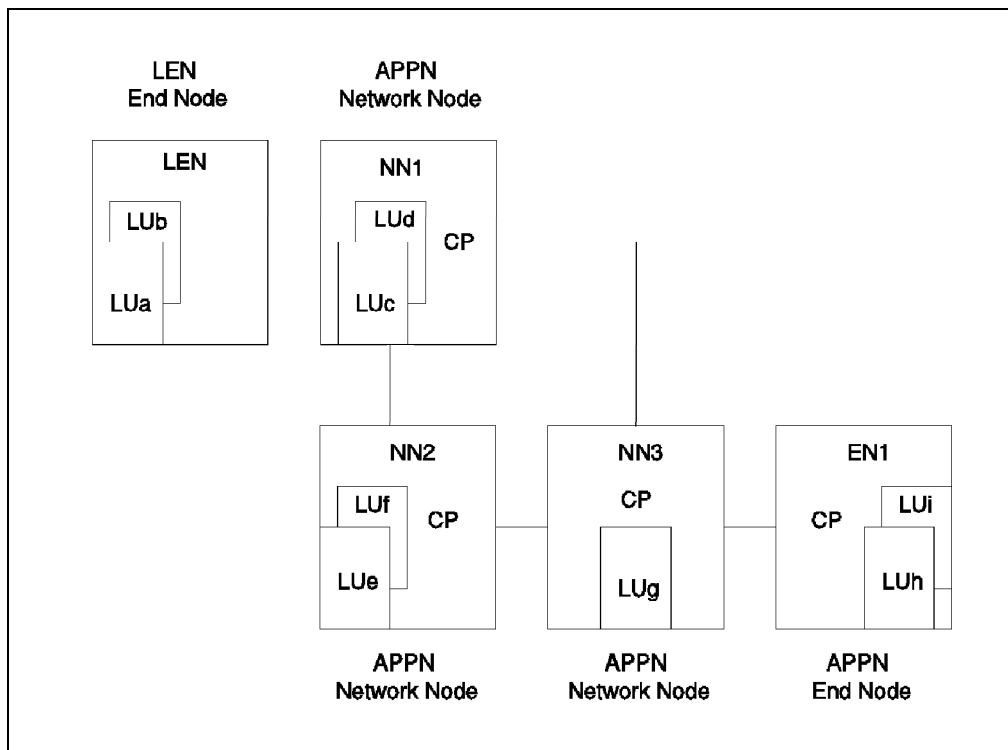


Figure 582. Advanced Peer-to-Peer Networking Network with Different Node Types

While the previous figure showed the architectural node types used in the network, the next picture (Figure 583) shows a variety of products, such as VTAM and NCP, AS/400, PS/2, and 3174 with CS-C, connecting through different link protocols.

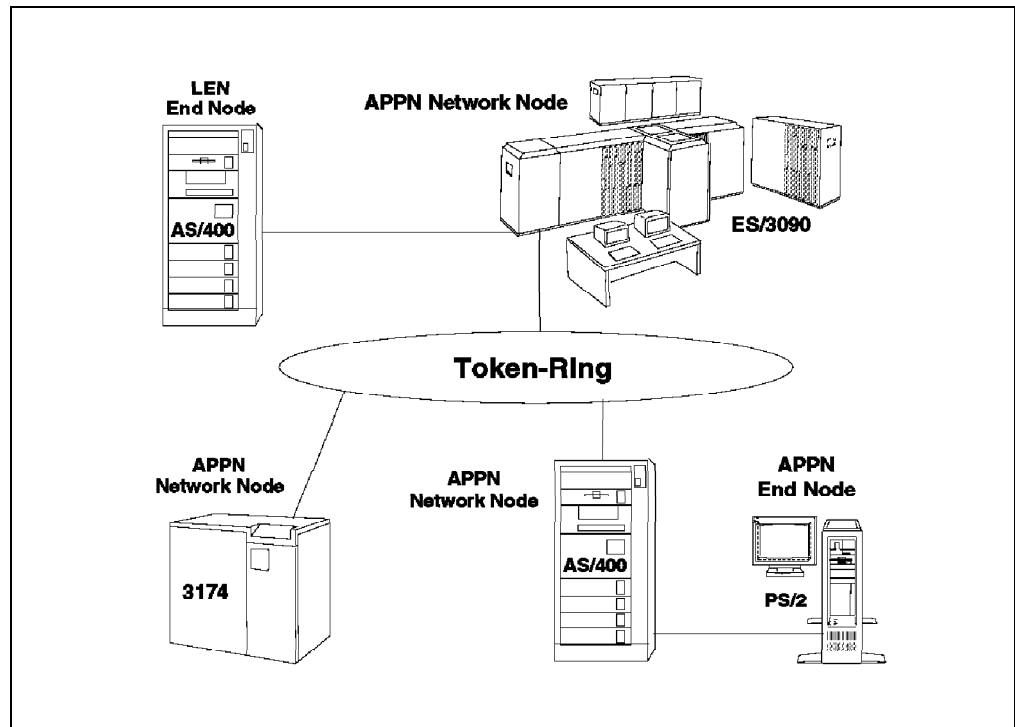


Figure 583. Advanced Peer-to-Peer Networking

Figure 583 depicts a VTAM host, an AS/400, and an 3174 with CS-C configured as APPN network nodes, a PS/2 configured as an APPN end node and a second AS/400 configured as a LEN end node.

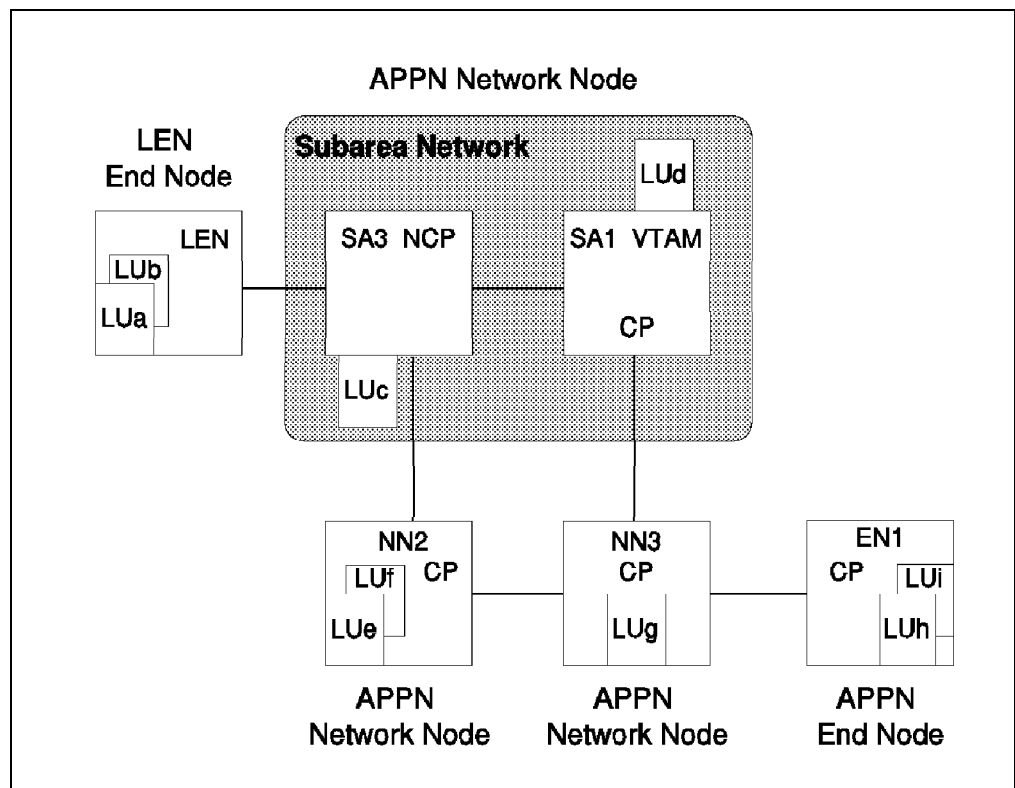


Figure 584. Composite Network Node with APPN Network Node Appearance

Note: A VTAM configured as a network node, together with all its owned NCPs, is called a *composite network node* (CNN). Within the composite network node, subarea protocols are used (see Figure 584) but to the other APPN or LEN nodes the CNN gives the appearance of an APPN network node.

You have seen that the APPN architecture defines several types of nodes and that the CPs of these nodes have different scopes of function. The node types are defined more precisely later in this chapter. The internal implementation of the functions defined by the architecture may be different in different products. Appendix A, “Advanced Peer-to-Peer Networking Implementations” on page 447, will provide details.

C.2 Names

Resource naming is important as it allows end users to start sessions without knowing the exact location of different resources within the network.

C.2.1.1 The Network Accessible Unit

In an APPN network, all components that can establish sessions with one another are called network accessible units. Examples are CPs and LUs. The term NAU was previously used as an abbreviation for “network *addressable* units.” The terminology has changed with Advanced Peer-to-Peer Networking, and now NAUs are represented by names rather than by addresses.

Within an APPN network, the names of network accessible units must be unique. To ensure the uniqueness of names within the network, a consistent naming convention is required. To make the administering of resource names easier, “the network” can be divided into partitions.

C.2.1.2 Network Identifiers

A partition of “the network” may be given a unique network identifier (net ID). Net IDs are 1 to 8 bytes long. The net ID is used throughout SNA, both in the subarea and the Advanced Peer-to-Peer Networking part of a network. Because names of LUs and CPs have to be unique only within the scope of a net ID, they can be assigned and administered independently for each distinct partition of the network.

Registering can help network administrators ensure the uniqueness of the net ID they use. IBM provides a worldwide registry for network IDs; information on the registration process can be obtained from your IBM representative.

IBM-registered net IDs should have an 8-byte name with the following structure:

cc is the country code (according to ISO Standard 3166)
eeee is the enterprise code (unique within a country)
nn is the network suffix code (unique within one enterprise).

C.2.1.3 Network Names

A network name is an identifier of a network resource. Each CP, LU, link, and link station in an SNA network has a network name. The network names are assigned through system definition. In an Advanced Peer-to-Peer Networking node, the system definition is done using the node operator facility (NOF).

C.2.1.4 Network-Qualified Names

A network-qualified name identifies both the resource and the network in which the resource is located. It is a concatenation of the network ID and the network name of the resource, for example, names NETA.LUA and NETB.LUA refer to different entities.

C.3 Addresses

Network addresses uniquely identify a resource throughout the subarea network. Local addresses uniquely identify a session on a link. Advanced Peer-to-Peer Networking uses local addresses. Traditional SNA subarea networking uses local *and* network addresses. Local addresses are used between peripheral nodes and the boundary functions of VTAM and NCP; network addresses are used when routing data between subarea nodes and bear no relation to specific sessions.

The “address” used in an Advanced Peer-to-Peer Networking transmission header is an identifier unique on the given link for a particular session rather than the address of the NAU.

Addresses are used for routing. Routing in an SNA network uses a combination of two things:

- Information carried in the transmission header of the message
- Information stored in the intermediate node.

In an Advanced Peer-to-Peer Networking network, routing information is session oriented. The transmission header carries session identifiers that are locally defined for each pair of adjacent routing nodes and are only *temporarily* assigned. They are assigned at session initiation, and released when the session ends. The session initiation request (BIND) carries routing information about the full session path that determines the sequence of links used from origin to destination. The local session identifier stored in each intermediate node in a session path is contained in a session connector and only kept for the life of the session.

The session identifier is associated with

- A particular session
- A transmission group (link) between two nodes.

Figure 585 on page 492 shows a session between two LUs, LUa and LUb, residing on two non-adjacent APPN end nodes. The session data is routed through two intermediate network nodes. The session can be thought of as a sequence of three session stages or “hops” with a distinct session identifier assigned to each session stage.

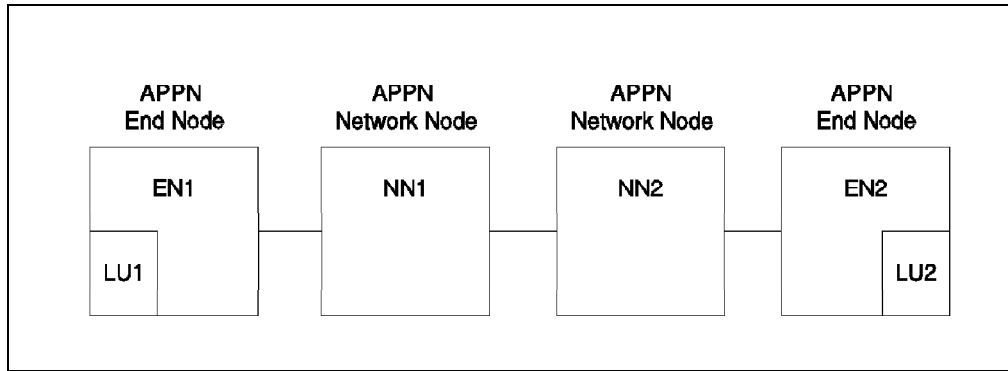


Figure 585. Session with Several Session Stages

Session identifiers vary at different session stages, which is why they are called local-form session identifiers (LFSID). The LFSID is set up during session establishment by the address space manager component of the CP and assigned for the “lifetime” of an LU-LU (or CP-CP) session.

Each session is uniquely identified by a network-unique identifier, the fully qualified procedure correlation ID (FQPCID), described in “Routing in APPN/HPR Networks” of *APPN Architecture and Product Implementations Tutorial*.

C.4 Domains

A domain is an “area of control.” A domain in an Advanced Peer-to-Peer Networking network consists of the control point in a node and the resources controlled by the control point. Consequently, all Advanced Peer-to-Peer Networking networks are multi-domain networks.

Though all Advanced Peer-to-Peer Networking nodes are peers with respect to session initiations and do not rely on other nodes to control their resources, APPN end nodes and LEN end nodes use the services of network nodes. The domain of an APPN end node or LEN end node contains the node's own (local) resources. The domain of an APPN network node contains its local resources *and* the resources of those nodes that use the network node's services. Thus, the domains of the APPN end nodes and LEN end nodes are included in the domains of their respective Network Node Servers.

Note: In traditional subarea networking, a domain is the part of the network managed by a VTAM System Services Control Point (SSCP). Within this document, when using the term domain, we refer to an APPN domain unless explicitly stated otherwise.

C.5 Node Types

Before and after its announcement in 1986 the LEN end node was known by many names. Some of the names for the LEN end node that are found in various publications are:

- LEN end node
- LEN node
- Peer node
- PU type 2.1
- PU 2.1
- SNA PU 2.1
- SNA Type 2.1 node
- Type 2.1
- Node Type 2.1 Function
- etc...

All the names mentioned above are synonyms for *LEN end node*. They all refer to the same function set. With the APPN extensions to SNA, two other types of nodes, *APPN end node* and *APPN network node*, have been introduced.

Because VTAM as an APPN node identifies itself as a T5 node to the APPN network it is no longer valid to use the term *T2.1 node* when referring to an APPN node. Throughout this document we will use the term *APPN or LEN end node* to refer to any of these three types of nodes, and use the term **APPN node** when referring to either an APPN network node or an APPN end node.

C.5.1 APPN Network Node

An APPN network node provides distributed directory and routing services for all LUs that it controls. These LUs may be located on the APPN network node itself or on one of the adjacent LEN node or APPN end nodes for which the APPN network node provides network node services. Jointly, with the other active APPN network nodes, an APPN network node is able to locate all destination LUs known in the network.

A facility known as **central resource registration** allows an APPN network node to register its resources at a central directory server. Once a resource is registered, APPN network nodes can locate the resource by querying the central directory server instead of using a broadcast search, thus improving network search performance during session establishment.

After the LU is located, the APPN network node is able to calculate the route between origin and destination LU according to the required class of service. All network nodes exchange information about the topology of the network. When two adjacent network nodes establish a connection, they exchange information about the network topology as they know it. In turn, each network node broadcasts this network topology information to other, active and adjacent, network nodes with which it has CP-CP sessions.

Alternatively, if the connection between network nodes is deactivated, then each network node broadcasts this change to all other, active and adjacent, network nodes. An APPN network node that is taken out of service will be declared inactive and, after some time, removed from the topology information in all network nodes together with its routing capabilities to other nodes.

The APPN network node is also capable of routing LU-LU sessions through its node from one adjacent node to another adjacent node. This function is called intermediate session routing.

C.5.2 APPN End Node

An APPN end node provides limited directory and routing services for LUs local to it. The APPN end node can select an adjacent APPN network node and request this network node to be its **Network Node Server**. If accepted by the network node, the APPN end node may register its local resources at the Network Node Server. This allows the Network Node Server to intercept Locate search requests for resources that are located on the APPN end node and pass the request on to the APPN end node for verification.

Without a network node server an APPN end node can function as a LEN end node and establish LU-LU sessions with a partner LU in an adjacent APPN or LEN end node.

The APPN end node sends Locate search requests for resources unknown to the APPN end node, to its Network Node Server. The APPN network node uses its distributed directory and routing facilities to locate the LU (via directed, central directory, or broadcast searches) and calculates the optimal route starting at the APPN end node toward the destination LU.

The APPN end node may have active connections to multiple adjacent network nodes; however, only one of these network nodes at a time can act as its Network Node Server. The APPN end node selects its Network Node Server by establishing CP-CP sessions with an adjacent APPN network node.

On APPN network nodes, the APPN end nodes are categorized as either **authorized** or **unauthorized**. An authorized APPN end node may send registration requests to register local network accessible resources at a Network Node Server, a facility known as **end node resource registration**, and may, in addition, request that these resources be registered with the central directory server. If during session establishment a Network Node Server does not know where an LU is located, the Network Node Server queries authorized APPN end nodes within its domain which have indicated they are willing to be queried for unknown resources. Network accessible resources on unauthorized nodes require explicit definition at the Network Node Server as part of its system definition or dynamically by the Network Node Server's operator. To avoid explicitly defining resources of authorized nodes at their Network Node Server, the APPN end node should either register its resources or allow the Network Node Server to query the APPN end node for unknown resources.

An APPN end node can attach to any LEN or APPN node regardless of its network ID.

C.5.3 LEN End Node

A LEN end node provides peer-to-peer connectivity to other LEN end nodes, APPN end nodes, or APPN network nodes. A LEN end node requires that all network accessible resources, either controlled by the LEN end node itself or on other nodes, be defined at the LEN end node. LUs on adjacent nodes need to be defined with the CP name of the adjacent node. LUs on non-adjacent nodes need to be defined with the CP name of an adjacent network node, as LEN end nodes assume that LUs are either local or reside on adjacent nodes.

Unlike APPN end nodes, the LEN end node cannot establish CP-CP sessions with an APPN network node; therefore, a LEN end node cannot register resources at a Network Node Server, nor can it request its Network Node Server to search for a resource, or, to calculate the route between the LEN end node and the node containing a destination resource.

However, indirectly a LEN end node uses the distributed directory and routing services of an adjacent network node by predefining remote LUs, owned by non-adjacent nodes, with the CP name of an adjacent APPN network node. The session activation (BIND) request for that remote LU is sent by the LEN end node to the adjacent network node. The network node, in turn, automatically acts as the LEN end node's Network Node Server, locates the actual destination of the LU, calculates the route to it, and uses this route to send the BIND to its final destination.

A LEN end node can attach to any LEN or APPN node regardless of its network ID.

C.5.4 Other Node Types

In SNA, a node represents an endpoint of a link or a junction common to two or more links in a network. The LEN end node, APPN end node, and APPN network node are endpoints of a link. Each node has a distinct role in an APPN network.

Besides these node types you will find references in the APPN literature to other node types that are either synonyms for nodes as seen from a subarea network, represent a specific junction in the network, or represent an APPN node with additional functions. The following is not a complete list, but merely highlights those found when creating this document:

- Boundary and peripheral node
- Composite node
- Interchange node
- Virtual routing node
- Peripheral border node
- Extended border node

C.5.4.1 Boundary and Peripheral Node

Within traditional subarea SNA, the resources in a domain of a subarea SNA network are controlled through a hierarchical structure. The nodes that play a role in these networks are categorized as subarea and peripheral nodes. An example of such an SNA network is a S/390 type mainframe running VTAM and a 3745 communication controller running the Network Control Program (NCP). Both VTAM and NCP are referred to as subarea nodes. The VTAM subarea node includes the CP function, hereafter called the System Services Control Point (SSCP). Like the APPN CP, the SSCP controls all the resources that are in its domain.

Attached to these subarea nodes, or *boundary nodes*, are the *peripheral nodes*. The peripheral node is either a PU type 2.0 or an APPN or LEN end node. The PU type 2.0 is a traditional hierarchical PU that requires the support of an SSCP to establish sessions. Traditional subarea SNA allowed LEN connections only; CP-CP sessions could not be established between VTAM and the APPN nodes.

With the introduction of APPN VTAM, a VTAM or a composite network node (subarea network consisting of one VTAM and one or more NCPs) is able to

present an APPN image to other APPN nodes. APPN VTAM allows CP-CP sessions with APPN nodes attached to the VTAM or NCP boundary function, to get full APPN connectivity. The term “peripheral” node has lost its value in a network which is truly peer-to-peer.

C.5.4.2 Composite Node

The term *composite node* is used in some publications to represent a group of nodes that appear as **one** APPN or LEN end node to other APPN or LEN end nodes in an APPN network. For example, a subarea network that consists of one VTAM host and one or more NCPs consists of multiple nodes, but when connected to an APPN node, appears as **one** logical APPN or LEN end node

A subarea composite node may appear as either a LEN end node or as an APPN network node. In the former case, the term composite LEN node is used; in the latter case the term composite network node (CNN) is used.

C.5.4.3 Interchange Node

A VTAM host acting as an interchange node (ICN) can be a stand-alone APPN VTAM node or a composite network node. The ICN routes sessions from APPN nodes into and through the subarea network using subarea routing, without exposing the subarea implementation to the APPN part of the network. This is accomplished by making the APPN VTAM node, plus all its owned resources, appear to other nodes as a single APPN network node with multiple connections. At the same time the ICN, and the NCPs it owns, will maintain their subarea appearance to other subarea nodes.

The ICN supports SSCP-SSCP sessions with other VTAM nodes as well as CP-CP sessions with adjacent APPN network nodes and end nodes. This support allows the ICN to use both APPN and subarea data flows to locate LUs and to provide the best route between nodes. APPN session setup protocols, which flow on CP-CP sessions, are converted to the corresponding subarea protocols that flow on SSCP-SSCP sessions, and vice versa.

To an ICN, see for example VTAM1/NCP in Figure 586 on page 497, multiple VTAMs and NCPs may connect using subarea protocols. Session establishment is possible between any LU in the subarea network and any LU in the APPN network. The VTAM host to which APPN nodes attach, or the VTAM host owning the NCPs to which APPN nodes attach, must have implemented APPN VTAM, as it is responsible (as an “interchange node”) for the conversion of subarea to APPN protocols and vice versa; other VTAMs within the subarea network may be backlevel VTAMs. From the viewpoint of the APPN nodes, LUs owned by VTAMs (for example, VTAM2 or VTAM3) other than the VTAM providing the interchange function are considered to reside on APPN end nodes.

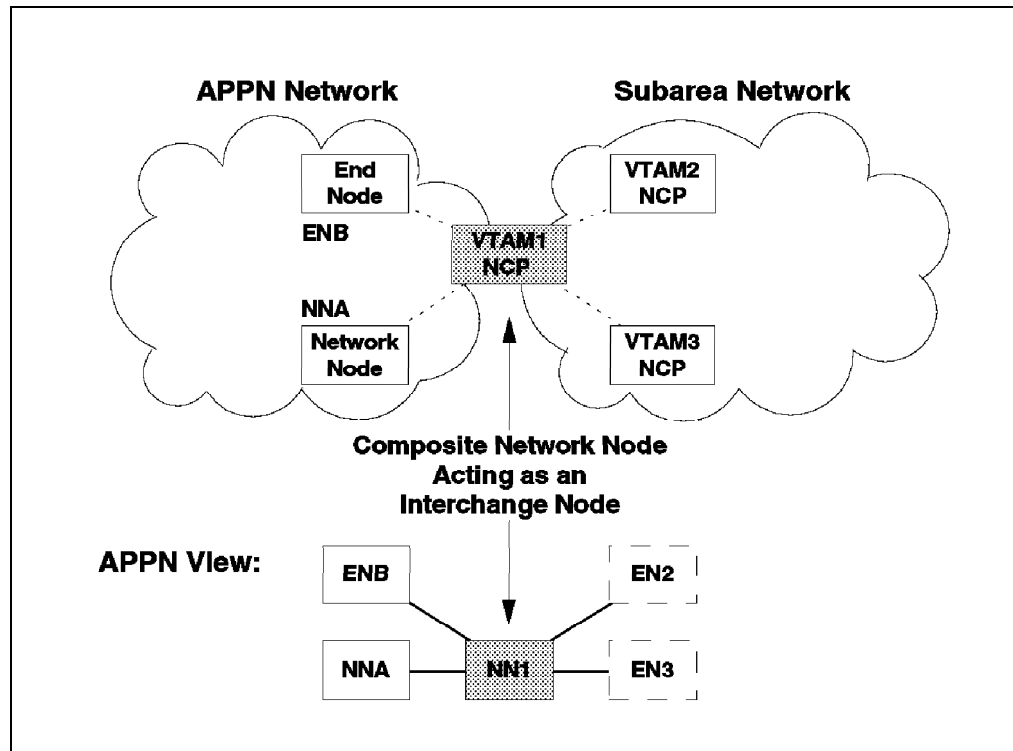


Figure 586. Composite Network Node Acting as an Interchange Node

Note: Figure 586 shows the basic form of connecting APPN and subarea networks using a composite network node acting as an interchange node.

C.5.4.4 Virtual Routing Node

APPN allows APPN nodes to reduce the addressing information stored at each node connected to a shared-access transmission facility (SATF), such as a token-ring LAN, by allowing each node to define a virtual routing node (VRN) to represent its connection to the shared facility and all other nodes similarly configured. The SATF and the set of nodes having defined a connection to a common virtual routing node are said to comprise a **connection network**.

A virtual routing node (VRN) is not a node, but it is a way to define an APPN node's attachment to a shared-access transport facility. It reduces end node definition requirements by relying on the network node server to discover the common connection and supply necessary link-level signaling information as part of the regular Locate search process; LU-LU session data can then be routed directly, without intermediate node routing, between APPN nodes attached to the SATF.

C.5.4.5 Border Node

Base APPN architecture does not allow two adjacent APPN network nodes to connect and establish CP-CP sessions when they do not have the same net ID. The border node is an optional feature of an APPN network node that overcomes this restriction.

A border node can connect to an APPN network node with a different net ID, establish CP-CP sessions with it, and allow session establishment between LUs in different net ID **subnetworks**. Topology information is not passed between the subnetworks. Similarly a border node can also connect to another border node. Two types of border node are defined in the APPN architecture: peripheral

border node and extended border node. (In the previous version of this book these were called Border Node Release 1 and Border Node Release 2, respectively.)

C.5.4.6 Peripheral Border Node

The peripheral border node enables the connection of network nodes with different net IDs and allows session establishment between LUs in different, adjacent, net ID subnetworks.

A peripheral border node provides directory, session setup and route selection services across the boundary between paired subnetworks with different network IDs while isolating each subnetwork from the other network's topology information. This reduces the flow of topology updates and the storage requirements for the network topology database on network nodes in each of the network partitions.

C.5.4.7 Extended Border Node

The extended border node allows the connection of network nodes with different net IDs and session establishment between LUs in different net ID subnetworks that need not be adjacent.

An extended border node provides directory, session setup and route selection services across the boundary between paired or cascaded nonnative net ID subnetworks. An extended border node can also partition a single net ID subnetwork into two or more clusters or topology subnetworks with the same net ID, thus isolating them from the topology of the other.

Appendix D. APPN Route Selection - Some Basics

APPN provides a mechanism for selecting the most appropriate route for a session from one LU or location to another through an APPN network. The process of route selection will for most users remain a mystery, this is appropriate. For most users the default class-of-service tables and system values will produce acceptable performance, however, as we introduce more complex environments which may include parallel transmission groups and multiple paths to our destination, it may be helpful for network designers to have a basic understanding of the APPN route selection process. In this chapter we will consider some of the more important concepts for route selection.

D.1 Parallel Transmission Groups

Multiple connections to the same APPN node are known as parallel transmission groups where each physical connection is a transmission group.

Now that VTAM 4.1 supports CP-CP sessions, the possibility now exists for parallel transmission groups between an AS/400 NN and a VTAM NN. Parallel TGs exist where two or more links are established between two APPN nodes. The links may be over different media and have different characteristics, propagation delay and operation cost and so on. The TG number may be predefined or negotiated by the systems at link activation time. Any integer between 1 and 255 may be used as a TG number; the numbers between 1 and 20 are set aside for predefined TGs. There is no load balancing between links aside from that which occurs as a result of route selection. Once a session has been established over a TG it will continue to use that TG. In the event of a TG (link) failure all sessions using that TG will fail. The major exception to this being CP-CP sessions, which will re-establish automatically over the most appropriate available TG.

When parallel TGs are used, the route selection process becomes an important factor in link utilization. In the following sections, we will examine route selection and COS design.

D.2 Topology and Routing Services

Topology and routing services (TRS) is a component of the control point (CP) which resides in each network node and in a reduced form in APPN End Nodes and LEN Node nodes. In a network node TRS is responsible for maintaining the class of service and for creating and maintaining a copy of the network topology database. The network topology database contains information on network node connections to virtual routing nodes, like our Connection network CNET and other network nodes. TRS is also responsible for maintaining the local topology database. The local topology database contains information involving end nodes, and includes the locations in the AS/400's APPN local location list.

TRS in an end node is responsible for creating and maintaining a class of service database, and for maintaining the local topology database. The local topology database again contains information on connections involving end nodes: EN to EN, EN to VRN, and EN to NN.

When an LU to LU session is requested by the end node's network node Server or the network node itself, the Network Node's Directory services function will be invoked to *locate* the partner LU. We have seen examples of this in Chapter 2. Once the LU has been located, topology and routing services is invoked to select the optimum route through the APPN network to the node owning the partner LU. In a network node TRS will use any information provided by any end node together with the information in the network node's class of service and network topology database to select an end-to-end route.

D.3 Class of Service Database

The class of service database and class of service manager are components of APPN topology and routing services (TRS). They exist in all APPN network nodes and in End Nodes where the class of service/transmission-priority-field (COS/TPF) function is supported. The COS/TPF function is the capability to translate a mode name to a COS name and the associated transmission priority. It is the COS database that holds the information used to calculate the optimal route between an origin LU and a destination LU.

The optimal route is the physical path that most closely matches the transmission requirements for a specific LU-LU session at the time the route is calculated.

The COS database includes:

- List of mode names

Each entry contains a mode name and a pointer to the corresponding COS name.

- List of COS names

Each entry contains a COS definition, which represents one or more sets of acceptable characteristics to which TG characteristics are compared. Each entry also contains the transmission priority and weight index for the COS.

- Weight index structure

The weight index structure allows the actual TG weight for each class of service to be calculated once and stored in the TG's COS weights array. So for any given COS the weight for a TG for that COS may be stored in this array. This reduces the time required by route selection services (RSS), a component of TRS, to select appropriate TGs. If TG weights were not kept in the COS weights array then the RSS would have to compare the weight of every eligible TG against the COS definition each time a route was requested.

Figure 587 on page 501 shows the COS definition for the IBM-supplied COS #INTER. As you can see, it includes a minimum and maximum value for each of the following fields:

- Link speed (effective capacity)
- Cost-per-connect time
- Cost-per-byte
- Security
- Propagation delay

- User-defined Characteristic 1 (not shown on the Figure 587 on page 501, range is 0 to 255 for all entries in this COS, use F11 to display)
- User-defined Characteristic 2 (not shown, see above)
- User-defined Characteristic 3 (not shown, see above)

The COS database also contains a transmission priority for the COS that may be:

- High
- Medium
- Low

APPN distinguishes four transmission priorities, the fourth and highest is network priority. This cannot be specified in a COS, because it is reserved for network control messages and CP-CP sessions.

Display Class-of-Service Description							
							RALYAS4B
							02/09/93 09:32:26
Class-of-service description : #INTER							
Transmission priority : *HIGH							
Text : This COSD is IBM Supplied							
-----Line Information-----							
Line Row	Line Weight		Link Speed	Cost/ Connect	Cost/ Byte	Security for Line	Propagation Delay
1	30	MINIMUM	4M	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	0	0	*MAX	*LAN
2	60	MINIMUM	56000	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	0	0	*MAX	*TELEPHONE
3	90	MINIMUM	56000	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	128	128	*MAX	*TELEPHONE
4	120	MINIMUM	19200	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	0	0	*MAX	*TELEPHONE
5	150	MINIMUM	19200	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	128	128	*MAX	*PKTSWTNET
6	180	MINIMUM	9600	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	0	0	*MAX	*PKTSWTNET
7	210	MINIMUM	9600	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	196	196	*MAX	*MAX
8	240	MINIMUM	*MIN	0	0	*NONSECURE	*MIN
		MAXIMUM	*MAX	255	255	*MAX	*MAX
Press Enter to continue.							
F3=Exit F11=Display user-defined costs F12=Cancel							

Figure 587. Class of Service Description (COS Definition Table) TG Characteristics

The COS database also includes a similar table for node characteristics for:

- Route-addition resistance
- Congestion

Here we again assign a weight for each row/range of values. See Figure 588 on page 502.

Display Class-of-Service Description				RALYAS4B
				02/09/93 09:32:26
Class-of-service description . . . : #INTER				
Transmission priority : *HIGH				
Text : This COSD is IBM Supplied				
-----Node Information-----				
Node Row	Node Weight		Route Addition Resistance	Congestion for Node
1	5	MINIMUM	0	*LOW
		MAXIMUM	31	*LOW
2	10	MINIMUM	0	*LOW
		MAXIMUM	63	*LOW
3	20	MINIMUM	0	*LOW
		MAXIMUM	95	*LOW
4	40	MINIMUM	0	*LOW
		MAXIMUM	127	*LOW
5	60	MINIMUM	0	*LOW
		MAXIMUM	159	*LOW
6	80	MINIMUM	0	*LOW
		MAXIMUM	191	*LOW
7	120	MINIMUM	0	*LOW
		MAXIMUM	223	*HIGH
8	160	MINIMUM	0	*LOW
		MAXIMUM	255	*HIGH

Figure 588. Class of Service Description (COS Definition Table) Node Characteristics

During route calculation, RSS uses the TG characteristics to decide which TGs are acceptable and which are not, for this class of service. A TG is considered acceptable if all the actual TG characteristic values, obtained from the topology database, fall within the range of the required TG characteristics obtained from the COS database.

The TG weight is a quantitative measure of how well the actual TG characteristics satisfy the session requirements specified in the COS definition. So in Figure 587 on page 501, a TG which has a speed of 48 000 bps, a cost per connection and per byte of zero, a propagation delay of telephone connection, is a non-secure link, and all user-defined values of zero, will have a weight of 180. Note that this particular TG also satisfies the conditions for lines seven and eight, the lowest weight is the one which is always assigned to the TG, line six, weight 180. Where more than one line row is satisfied by the actual TG values the smallest weight is chosen.

As mentioned previously, this comparison may be done once and the resulting weight for a given TG stored in the weight index structure.

In a similar manner, a weight is assigned to each intermediate node on the session path from our OLU to DLU. This is based on:

- Route-addition resistance (RAR)

Route-addition resistance is a number assigned in the network attributes of a network node as an indication of how desirable it is to route intermediate sessions through this node. As you can see from Figure 588, the higher the route-addition resistance, the less desirable it is to use that node for intermediate routing.

Note: The RAR of the 3174 and the PS/2 is fixed at 128.

- Congestion

This characteristic is set and reset by the intermediate node based upon one of the following:

- Cycle utilization of the hardware
- Total buffer utilization

When either of these measures crosses a specific threshold then the node is said to be congested. A node is either congested or it is not. A congested node may be used to route intermediate sessions if during the route calculation it is still found to be part of the most desirable route. The node weight for a congested node is high the COS table #INTER, Figure 588 on page 502, so it will not normally be a first choice for intermediate node.

D.4 Route Computation

APPN networks consist of network nodes connected together by TGs known as intermediate routing TGs. Together, these form a backbone structure which supports end nodes which connect to this network. The TGs connecting end nodes to the backbone structure are known as end point TGs.

In an APPN network, a route as defined as a sequence of nodes that represent a path from an origin node to a destination node. To compute the optimum route through the APPN network, the calculating network node requires the following:

1. The *required* route characteristics
2. An understanding of all the resources it has available, TGs and network nodes that could be used in the route

The node calculating the route will then:

1. Exclude all TGs and network nodes which do not meet the required characteristics specified in the COS description for the session, from the route calculation.
2. From the remaining TGs and network nodes calculate all possible routes, and select the optimum. As stated earlier, for a given COS each node and TG will be assigned a weight, the sum of all the TG weights plus the weight of any intermediate nodes will give us the weight of the route. The route with the lowest route weight will be selected as the *optimum* route. This route is also known as the *shortest path*.

Let us look at a simple example of route calculation. We wish to establish a DSPT session from EN 1 to EN 2. NN D is the network node server for EN 1 and EN 2. It is NN D that will perform the route calculation for this session. In Figure 589 on page 504 we have a relatively simple APPN network. In this network we have assumed the following:

- The cost/connect and cost/byte is zero for all links.
- All links are Non-secure.
- All three user-defined characteristics are set to the default of 128.
- The RAR for all nodes is set at 128, (the default for the AS/400), except for the network nodes A and C which have an RAR of 90. The network nodes A and C are large systems and have some excess capacity that could be used for intermediate session routing. The network administrator in this sample network has decided to take advantage of this spare capacity and *encourage*

the network to use these nodes for intermediate session routing where possible.

- None of the network nodes are congested.
- The COS used in this example is #INTER, as shown in Figure 587 on page 501 and Figure 588 on page 502.
- Both end nodes have CP-CP sessions with NN D.

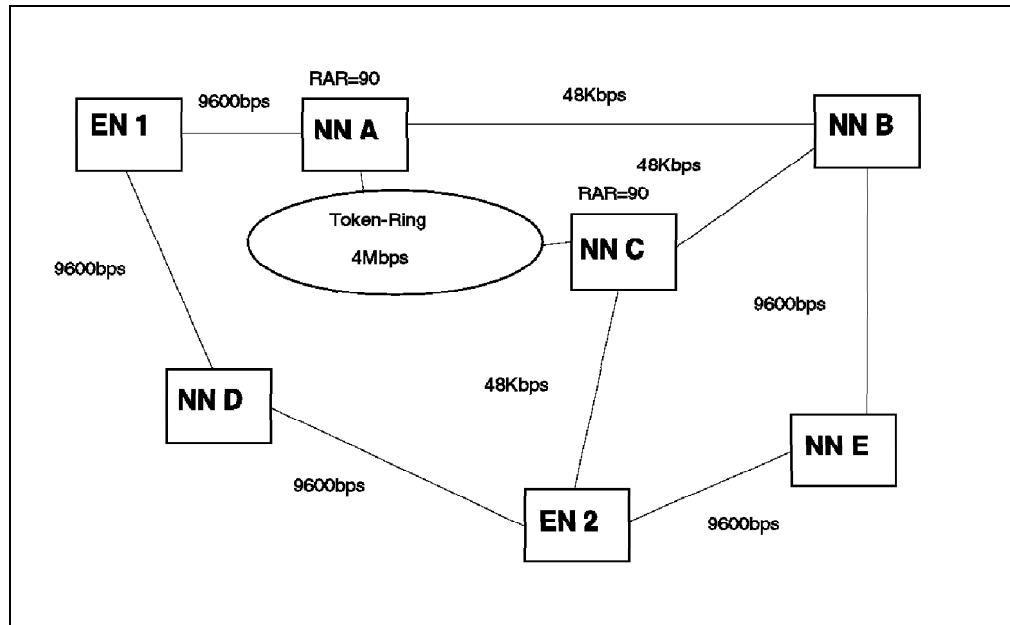


Figure 589. Example APPN Network

In Figure 590 on page 505 we have determined the node and TG using the COS table in Figure 588 on page 502 and Figure 587 on page 501. In doing this we have performed the first two steps in route calculation:

1. We have determined the *required* route characteristics. We require the session to use the class of service #INTER.
2. We have developed an understanding of all the resources that are available. We know the TGs and Network Nodes that we can use in the route from EN1 to EN2.

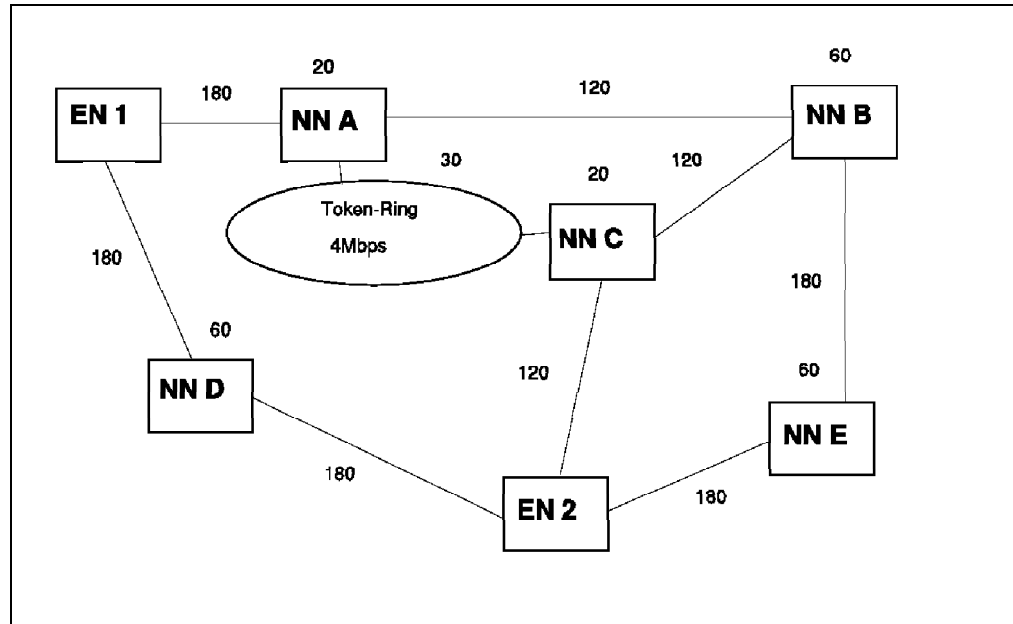


Figure 590. Example APPN Network Showing Node and TG Weights

The next step in route calculation is:

1. Exclude all TGs and network nodes which do not meet the required characteristics specified the class of service #INTER. In this case all nodes and TGs are available to this class of service.
2. From the remaining TGs and network nodes we must calculate all possible routes, and determine the weight of each route. The optimum route will then be selected.

As an example, the route weight from EN 1 to EN 2 via NN D is the sum of the link weights (180 + 180) plus the sum of the intermediate node weights (60). The weight for this route is 420. The remaining routes have been calculated and are shown in Table 7.

Table 7. Route Weights for a Simple Network

Route	Route weight
EN 1 - NN A - NN C - EN 2	370
EN 1 - NN D - EN 2	420
EN 1 - NN A - NN B - NN C - EN 2	640
EN 1 - NN A - NN B - NN E - EN 2	800
EN 1 - NN A - NN C - NN B - NN E - EN 2	850

NN D has now determined the optimum route, which is:

EN 1 - NN A - NN C - EN 2

Notice the optimum route calculated here by NN D for EN 1 does not include itself. This is possible because the NN D has a CP-CP session with EN 1 and is able to forward an RSCV containing the optimum route (EN 1 - NN A - NN C - EN 2) to EN 1. EN 1 can then attach this RSCV to its BIND for the DSPT session with EN 2 and the normal bind response and session establishment process will follow.

Note: A route selection control vector (RSCV) is carried in BINDs, locate requests and replies, and other RUs to describe a route through the network.

The existence of CP-CP sessions between an end node and its network node server is important. If in this example there were no CP-CP session between EN 1 and NN D or if EN 1 was a LEN Node node, NN D would be unable to forward the RSCV to EN 1 and would calculate the optimum route starting from itself (NN D). The resulting *optimum* route would then become:

EN 1 - NN D - EN 2

In an environment where parallel transmission groups are available, route selection will be made using the same process as we discussed above. We will again look at a simple example. See Figure 591.

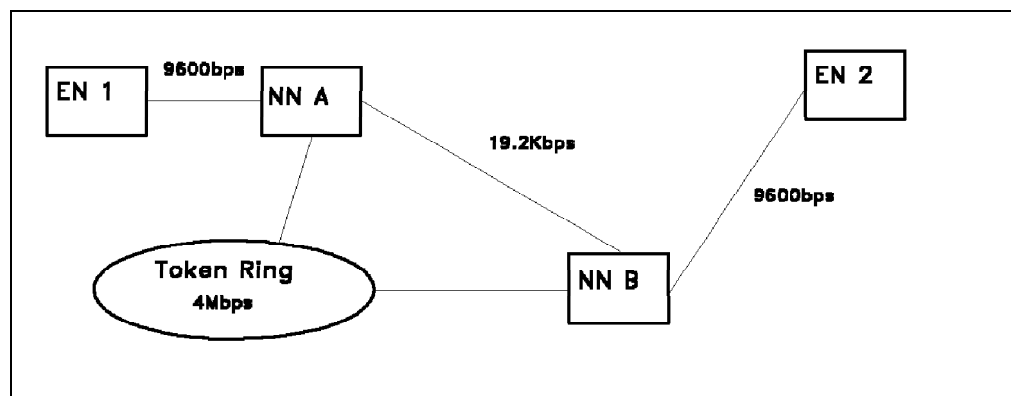


Figure 591. Example APPN Network with Parallel TGs

In this case using the class of service #INTER, the route chosen will flow:

EN 1 - NN A - Token Ring TG - NN B - EN 2

If we were to choose a different COS, SLOWCOS for example, we will get a different result. See Figure 592 on page 507

Display Class-of-Service Description							RALAS4A
							02/11/93 12:12:45
Class-of-service description : SLOWCOS							
Transmission priority : *LOW							
Text : User created COS							
-----Line Information-----							
Line Row	Line Weight	Link Speed	Cost/ Connect	Cost/ Byte	Security for Line	Propagation Delay	
1	30	MINIMUM *MIN	0	0	*NONSECURE	*MIN	
		MAXIMUM 2400	0	0	*MAX	*MAX	
2	60	MINIMUM 2400	0	0	*NONSECURE	*MIN	
		MAXIMUM 9600	0	0	*MAX	*MAX	
3	90	MINIMUM 9600	0	0	*NONSECURE	*MIN	
		MAXIMUM 48000	0	0	*MAX	*MAX	
4	120	MINIMUM 48000	0	0	*NONSECURE	*MIN	
		MAXIMUM 64000	0	0	*MAX	*MAX	
5	150	MINIMUM 64000	0	0	*NONSECURE	*MIN	
		MAXIMUM 4M	0	0	*MAX	*MAX	
6	180	MINIMUM 4M	0	0	*NONSECURE	*MIN	
		MAXIMUM 16M	0	0	*MAX	*MAX	
7	210	MINIMUM 16M	0	0	*NONSECURE	*MIN	
		MAXIMUM *MAX	0	0	*MAX	*MAX	
8	240	MINIMUM *MIN	0	0	*NONSECURE	*MIN	
		MAXIMUM *MAX	0	0	*MAX	*MAX	
Press Enter to continue.							
F3=Exit F11=Display user-defined costs F12=Cancel							

Figure 592. Class of Service Description (COS Definition Table) TG Characteristics for SLOWCOS

In this class of service, the TGs with the lowest speed are always chosen first, because they are given the lowest weight. If this COS were to be used for the example in Figure 591 on page 506, the route which will be chosen is:

EN 1 - NN A - 19.2Kbps TG - NN B - EN 2

We have included the class of service table in Figure 592 to assist us in our understanding of route selection. We do not recommend that this COS be used. Using this COS will result in an *optimal* route which includes the slowest links wherever possible. It is unlikely that this will be the desired result for any application.

Where parallel TGs exist, the route selected will follow the same process as outlined above. The additional TGs will just increase the number of routes which TRS has to select from.

In the special case where two routes have an identical weight, say, the route includes two identical communications links which form parallel TGs in the *optimum* route, then a random choice will be made between the the two possible *optimum* routes.

Abbreviations

ABBREVIATION

MEANING

ALS	Adjacent Link Station
APPC	Advanced Program-to-Program Connectivity
APPN	Advanced Peer-to-Peer Networking
AS/400	Application System/400
CD	Cross-Domain
CDRSC	Cross Domain Resource
CDSTL	Carrier Detect Station To Line
CM	Communications Manager
COS	Class Of Service
CP	Control Point
DCB	Data Control Block
DLC	Data Link Control
DLU	Destination Logical Unit
DSAP	Destination Service Access Point
DSPT	Display Station Pass-Through
DTR	Data Terminal Ready
DWS	Dependent Work Station
FQCPID	Fully Qualified Control Point ID
EN	End Node
FCS	Frame Checking Sequence
FM	Function Manager
FMH	Function Management Header
FRSN	Flow-Reduction Sequence Number
GDS	General Data Stream
HCF	Host Control Facility
HDLC	High-Level Data Link Control
IBM	International Business Machines
ID	Identifier
ILU	Independent Logical Unit
ITSO	International Technical Support Organization
LAN	Local Area Network
LEN	Low-Entry Networking

LH	Link Header
LIC	Licensed Internal Code
LT	Link Trailer
LU	Logical Unit
LUA	Logical Unit Application
MAC	Medium Access Control
NCP	Network Control Program
NN	Network Node
NNNC	Non-Native Network Connectivity
NS/2	Networking Services/2
NRZI	Non-Return to Zero Inverted
ODF	Object Distribution Facility
OLU	Origin Logical Unit
OS/400	Operating System/400
PBN	Peripheral Border Node
PC	Personal Computer
PCID	Procedure Correlation Identifier
PTF	Program Temporary Fix
PU	Physical Unit
RJE	Remote Job Entry
RH	Response Header
RPQ	Request for Price Quotation
RSCV	Route Selection Control Vector
RWS	Remote Work Station
RU	Request or Response Unit
SAA	Systems Application Architecture
SC	Session Control
SDLC	Synchronous Data Link Control
SNA	Systems Network Architecture
SNADS	SNA Distribution Services
SNi	SNA Network Interconnection
SSAP	Source Service Access Point
STP	Service Transaction Program
SRC	System Reference Code
TDLC	Twinaxial Data Link Control
TDU	Topology Database Update

<i>TG</i>	Transmission Group	<i>WPCSP</i>	Workstation Peer Communications Support Program
<i>TH</i>	Transmission Header		
<i>TP</i>	Transaction Program	<i>WS</i>	Work Station
<i>TS</i>	Transmission Services	<i>WSF</i>	Work Station Feature
<i>VTAM</i>	Virtual Telecommunications Access Method	<i>XID</i>	Exchange Identifier

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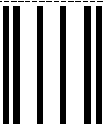
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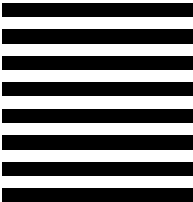
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