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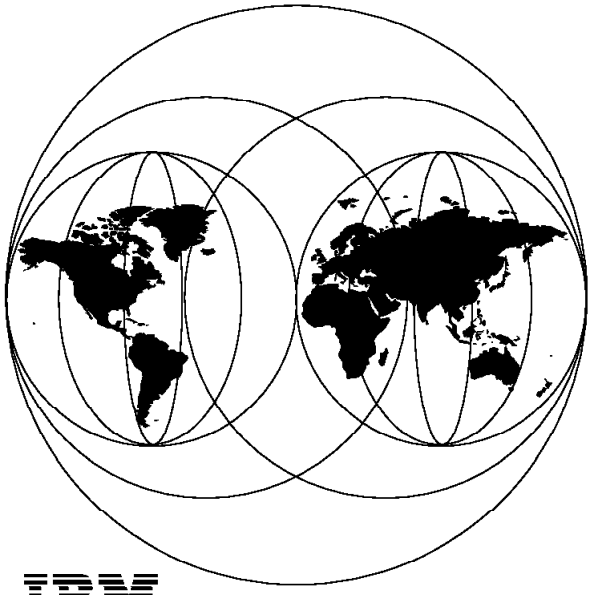
IBM VTAM APPN Handbook

June 1996



IBM

International Technical Support Organization
Raleigh Center

SG24-4823-00

International Technical Support Organization

IBM VTAM APPN Handbook

June 1996

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix A, “Special Notices” on page 55.

First Edition (June 1996)

This edition applies to Version 4 Release 3 of ACF/VTAM, Program Number 5695-117 for use with the MVS operating system.

Comments may be addressed to:
IBM Corporation, International Technical Support Organization
Dept. HZ8 Building 678
P.O. Box 12195
Research Triangle Park, NC 27709-2195

Contents

Preface

This publication is intended for VTAM system programmers who are using APPN in their network environment. It is a quick reference to assist the system programmer in finding information about the APPN environment. There is a brief summary of the VTAM APPN functions, requirements and start options to implement those functions, and commands that are useful in determining if these functions are implemented and working.

Brief information is also provided about other IBM products that you may have in your network that also support these functions. The list of products is not necessarily complete, but is comprised of those which we have installed here at the ITSO with APPN implemented in their configurations.

How This Redbook Is Organized

This redbook contains 63 pages. It is organized as follows:

- Chapter 1, “VTAM APPN Node Types”

  This chapter provides an overview of the APPN node types VTAM supports and the necessary VTAM start options to define the node type.

- Chapter 2, “APPN Control Point and CP-CP Sessions”

  This chapter provides an overview of the APPN control point and CP-to-CP sessions.

- Chapter 3, “VTAM APPN Start Options”

  This chapter provides an overview of the VTAM start options that affect VTAM APPN operation.

- Chapter 4, “VTAM APPN Commands”

  This chapter provides an overview of VTAM commands that affect APPN operation. This is not a complete command reference but provides the experienced VTAM user with a reference for the new commands and new command parameters useful for an APPN environment.

- Chapter 5, “Directory Services”

  This chapter provides an overview of the VTAM APPN directory functions. It gives an overview of VTAM start options that affect directory functions and briefly describes the central directory server function. Information about resource searches in a combined APPN/subarea network is also covered.

- Chapter 6, “VTAM Topology and Routing”

This chapter provides an overview of the VTAM APPN topology and routing functions including class-of-service and VTAM parameters that affect route calculation and selection.

- Chapter 7, “Connecting APPN Nodes over a Subarea Network (VRTG)”

  This chapter provides an overview of the VTAM virtual route-based transmission groups (VR-based TGs) which allow APPN connectivity over a subarea network.

- Chapter 8, “Connection Network”

  This chapter provides an overview of the APPN connection network function and the VTAM requirements to implement it.

- Chapter 9, “Cross Network Connections”

  This chapter provides an overview of the VTAM APPN border node support. the VTAM requirements to implement it.

- Chapter 10, “Dependent LU Requester/Server (DLUR/DLUS)”

  This chapter provides an overview of the APPN dependent LU server (DLUS) support provided by VTAM for dependent LU requesters (DLURs). The DLUR/DLUS function allows dependent LUs in a network to communicate over an APPN network.

- Chapter 11, “High Performance Routing (HPR)”

  This chapter provides an overview of the high performance routing (HPR) feature and the support provided by VTAM. HPR is an extension to APPN which improves the existing APPN routing mechanism.

- Chapter 12, “APPN Implementations”

  This chapter provides an overview of other IBM products available that provide APPN functions. This is not necessarily a complete list but simply a guide to other products that may exist in a network and the APPN functions they provide.

- Chapter 13, “VTAM APPN Migration Example”

  This chapter provides an overview of a simple migration of VTAM subarea nodes to APPN.

The Team That Wrote This Redbook

This redbook was produced by a specialist from the Systems Management and Networking ITSO Center, Raleigh.

Carla Sadtler is a Senior ITSO Specialist at the Systems Management and Networking ITSO Center, Raleigh. She provides host and network system

support for the ITSO lab environment. She also provides the Raleigh ITSO Center with network connectivity and Lotus support. In addition she produces redbooks on overall network connectivity. Before joining the ITSO 11 years ago, Carla worked in the Raleigh Branch Office as a program support representative.

Thanks to the following people for their invaluable contributions to this project:

Jose Boo Sanchez
Systems Management and Networking ITSO Center, Raleigh

Juan Rodriquez
Systems Management and Networking ITSO Center, Raleigh

Mick Lugton
Systems Management and Networking ITSO Center, Raleigh

Mohammed Shabani
Systems Management and Networking ITSO Center, Raleigh

Comments Welcome

We want our redbooks to be as helpful as possible. Should you have any comments about this or other redbooks, please send us a note at the following address:

redbook@vnet.ibm.com

Your comments are important to us!

Chapter 1. VTAM APPN Node Types

VTAM can play many roles in APPN and subarea networks. The combination of start options you specify determine how VTAM will act in a network.

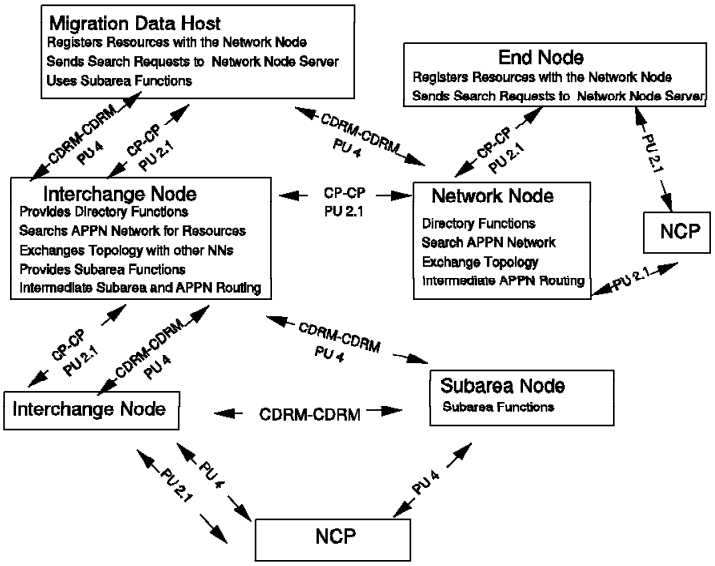


Figure 1. VTAM Network Node Types

Network Node (NN): An APPN node that provides directory and routing services for its end nodes and intermediate routing services for sessions crossing it.

Interchange Node (ICN): VTAM that has both subarea and APPN capabilities.

Migration Data Host: A VTAM host that combines the function on an APPN end node and a subarea data host. It is on the border of the APPN and subarea networks, performing no intermediate routing but using both networks for connectivity.

End Node (EN): An APPN node that establishes a CP-CP session with a network node and relies on that network node server for directory and route selection services. A VTAM EN can define a list of possible network node servers in a network node server list and can establish a link to multiple

network nodes, but can only establish a CP-CP session with one network node at a time.

LEN Node: A type 2.1 node that can function in an APPN or subarea environment. It does not establish a CP-CP session with a network node, nor an SSCP-SSCP session with a subarea node. LEN nodes look like peripheral devices to subarea nodes. LEN nodes can communicate with each other without the services of an SSCP.

Composite Node: A VTAM ICN and any NCPs it owns form a composite node. NCP does not act alone as an APPN node but is considered a part of the VTAM APPN node that owns it. If APPN connections are to be supported from the NCP, the NCP must be at release 6.2 or higher.

Table 1. VTAM Start Options and Node Types

Node Type	VTAM Start Options	APPN Functions	Subarea Functions	NCP Ownership	CDRM, PATH, ADJSSCP needed
Subarea	HOSTSA=	none	yes	yes	yes
Network Node (NN)	NODETYPE=NN	network node	none	no	no
Interchange Node (ICN)	HOSTSA= NODETYPE=NN	network node	yes	yes, NCP/VTAM become a composite node	yes, for subarea connections
Migration Data Host	HOSTSA= NODETYPE=EN	end node	data host only	no	yes, for subarea connections
End Node	NODETYPE=EN	end node	no	no	no

Note: A VTAM APPN node cannot activate or own resources in an NCP. It can establish a 2.1 connection with the NCP allowing it to connect to APPN nodes via the NCP. NCP must be at 6.2 or later to support APPN links.

Chapter 2. APPN Control Point and CP-CP Sessions

Each APPN node has a control point (CP) that manages the node and its resources. The CP communicates to other CPs in the network via a CP-to-CP session. This session is an LU 6.2 session between two CPs using the CPSVCMG logmode. Failure to have CPSVCMG in the default logmode table can cause a sense code 08210002. This is sometimes seen in networks migrating to APPN with back-level VTAM nodes in the network.

2.1.1.1 CPNAME

For a VTAM host, the VTAM SSCPNAME also becomes its CPNAME when APPN is enabled. CPNAME and PU name should be unique in the network and different from each other.

Table 2. CP Name Definitions

Product	**CP Name Definition**
VTAM	SSCPNAME start option
Communications Server for OS/2 Warp V4	Local node name (defined in local node characteristics)
AS/400	Controller description
Communications Server for AIX	CP Name in control point profile
6611, MPNP V1.4	Control point name on APPN Routing panel
3174	Question 511, control point name on common SNA panel

2.1.1.2 Displaying VTAM CP-to-CP Sessions

Use the VTAM topology display command to determine if the host has a CP-CP session with another node.

```
D NET,TOPO,ID=cpname
```

```
NCCF                    N E T V I E W    RAKAN SADTLER  08/09/95 13:43
* RAKAN    D NET,TOPO,ID=WTR0510I
  RAKAN    IST097I  DISPLAY  ACCEPTED
' RAKAN
IST350I  DISPLAY TYPE = TOPOLOGY
IST1295I  CP NAME           NODETYPE ROUTERES CONGESTION  CP-CP WEIGHT
IST1296I  USIBMRA.WTR0510I  EN       *NA*     ***NA***    YES   *NA*
IST314I  END
```

Figure 2. VTAM Topology Display Showing CP-CP Sessions. The CP-CP field in IST1296I shows whether a CP-CP session exists.

Note: A display (D NET,ID=node) of a PU or a VTAM host will only show if it has CP-CP capability, not if it has a CP-CP session.

Table 3. CP-CP Session Display

Product	**CP-CP Session Display**
VTAM	D NET,TOPO,ID=cpname
Communications Server for OS/2 Warp	Using Subsystem Management Choose Details, SNA Subsystem Display LU 6.2 sessions CPSVCMG logmode indicates a CP-CP session
AS/400	Display Mode Status for node *DSPMODSTS DEV(nodename) Display Sessions CPSVCMG logmode indicates a CP-CP session
Communications Server for AIX	Smitty SNA Manage SNA Resources Display LU 6.2 sessions CPSVCMG logmode indicates a CP-CP session
6611 MPNP	Use the control panel or a MIB browser to display the APPN Topology Group MIBs MIB Variable =ibmappnNnAdjNodeCpCpSessStatus
3174	Online Test 17 - APPN Tests Option 2 - Display Adjacent Nodes

2.1.1.3 VTAM CP-CP Connectivity

CP-CP sessions are established over PU 2.1 connections. In the case of host channel-to-channel connections this means the connection must be an APPN host-to-host channel (AHHC) connection or a VRTG connection. If you receive a sense code 08420000 trying to activate a CP-CP session between two VTAM APPN nodes check to make sure you have a PU 2.1 session between them, or a CDRM-CDRM session with VRTG allowed.

Chapter 3. VTAM APPN Start Options

The following table is a list of VTAM start options that affect the APPN functions in VTAM. Those parameters marked dynamic can be changed during VTAM operation with the F NET,VTAMOPTS command.

Table 4 (Page 1 of 3). VTAM Start Options for APPN

Start Parameter	Usage	Dynamic
APPNCOS	APPN class of service definitions to be used if a requested COS cannot be found in the APPN COS database.	Y
BN	Border node support.	
BNDYN	Determines what border nodes are dynamically added to the adjacent cluster routing list.	Y
BNORD	Defines the order in which cross-subnet searches are performed.	Y
CDRDYN	Dynamic CDRSC support. CDRDYN should be coded YES to enable CP-CP sessions. Without this support a CDRSC for each CP-CP session partner would need to be coded.	Y
CDSERVR	Specifies if this node acts as a central directory server.	
CDSREFER	Determines how many of the nearest central directory servers are used for LOCATE searches and central resource registration.	Y
CONNTYPE	Determines if PU 2.1 connections are attempted as APPN or LEN nodes. If a search for an LU fails even though it is available, check the CONNTYPE value for the requesting LU. If CONNTYPE=APPN but there is no CP-CP session with the host, the search may fail with a sense code 087D0001.	Y
CPCDRSC	Determines whether VTAM can dynamically create CDRSCs to represent destination LEN CP independent LUs.	Y
CPCP	CP-CP session support. Must be coded to allow CP-CP sessions to be established or overridden at the PU level for APPN session support.	Y
DIRSIZE	Maximum number of dynamic APPN resources stored in the VTAM directory services database.	Y
DIRTIME	Amount of time an APPN resource remains in the directory services database if unused.	Y
DYNADJCP	Determines if adjacent CP minor nodes are created dynamically (placed in ISTADJCP). If specified as NO, an ADJCP definition must be created for each CP-CP session partner. DYNADJCP can be overridden at the link level.	
DYNLU	Although not an APPN only option, DYNLU=YES should be specified to allow dynamic CDRSCs to be created, either as a start option at the adjacent link station PU level. DYNLU controls they dynamic definition of independent LUs including LEN CPs when they are the originating LU.	

Table 4 (Page 2 of 3). VTAM Start Options for APPN

Start Parameter	Usage	Dynamic
HPR	Determines level of HPR support.	
HPRPST	Maximum time VTAM tries a path switch before ending a connection when HPR=RTP.	Y
INITDB	Determines loading of directory and topology databases when VTAM is started.	
IOPURGE	Interval after which outstanding I/O requests are purged. This includes APPN search requests and HPR route setup requests.	Y
NODETYPE	Combined with HOSTSA determines APPN function capability.	
NUMTREES	Limits number of routing trees in the topology and routing services tree cache.	Y
RESUSAGE	Determines how many times a node or TG is used during route selection before routing trees will be reconstructed to use alternate routes.	Y
ROUTERES	Route addition resistance value. Used to give this node a relative advantage or disadvantage over other nodes as an intermediate route.	Y
SECLVLCP	Session-level security specification for LU 6.2 involving a CP.	
SNVC	Max number of networks this border node will search for a resource.	Y
SORDER	Controls the order networks are searched when a network request is received from the subarea network (that is, APPN, subarea, or a combination defined by ADJSSCP tables).	Y
SRCHRED	Specifies search reduction for resources found unreachable. Used in conjunction with SRCOUNT and SRTIMER. Affects both subarea and APPN.	Y
SRCOUNT	Specifies number of search requests to limit before searching for the resource again.	Y
SRTIMER	Specifies amount of time to wait to conduct a search for a resource already found to be unreachable.	Y
SSEARCH	Determines whether the subarea network is searched when a request is received from the APPN network. Failure to specify this correctly can cause a sense code 08400007 if a request is for an APPN resource that is only reachable through the subarea network.	Y
VERIFYCP	Determines whether LU-LU session-level verification is performed during activation of LU 6.2 sessions involving CPs. You must coordinate the activation of this parameter with the customization of the security product (that is, RACF) or VTAM will get an OPEN ACB error for CP at activation time and will not come up.	
VFYRED	Specifies whether resource verification reduction is allowed for LU 6.2 applications using APPCCMD API.	Y

Table 4 (Page 3 of 3). VTAM Start Options for APPN

Start Parameter	Usage	Dynamic
VFYREDTI	Max time a resource's location is not verified during session setup.	Y
VRTG	Determines whether to request virtual routing transmission group connections when SSCP-SSCP sessions are established. This allows subarea connections to be used for APPN traffic.	Y
VRTGCPCP	Support for CP-CP sessions over VRTG.	Y

Notes: D NET,VTAMOPTS,FUNCTION=APPNCHAR can be used to display the value of the VTAM start options affecting the APPN network.

Chapter 4. VTAM APPN Commands

The following commands and operands are useful for APPN operation and diagnostics. They are not complete. Please see *VTAM Operation* for a complete list of options and the syntax.

4.1.1.1 APPN Operands for VTAM Modify Commands

Table 5. VTAM Modify Command APPN Operands

Modify Command	APPN-Related Optional Parameters	Use
F NET,CHKPT	TYPE=ALL | DIR | TOPO	Checkpoint the specified data set.
F NET,DIRECTRY,UPDATE,ID=node	CPNAME=new | (new,old), NETSRVR=server	Change ownership of network resources.
F NET,DIRECTRY,DELETE,ID=node		Delete a resource from the directory database.
F NET,TRACE,ID=node TYPE= GPT | IO | BUF | STATE	IDTYPE=RESOURCE | SSCP | CP	CP specifies tracing for the CP whose ID is *node*. RESOURCE specifies tracing for any resource with ID *node*.
F NET,TRACE,ID=node, TYPE=STATE	OPTION=ADJCP	Starts tracing for adjacent CPs.
F NET,RESOURCE,ID=node	SRCOUNT=number_searchs SRTIMER=number_seconds SRCLEAR=YES REGISTER=CDSERVR | NETSRVR | NO	Change APPN-related parameters for a resource. Many other non-APPN related parameters can also be specified.
F NET,TGP,TGPNAME=profile, ID=adjlink_station| ID=cpname,TGN=tg_number		Change the transmission group profile associated with a connection.
F NET,TOPO,ID=cpname	TYPE=FORCE	Delete a node from the topology database.
F NET,TOPO, ORIG=cpname DEST=cpname, TGN=tg_number	TYPE=FORCE	Delete a transmission group from the topology database.
F NET,VTAMOPTS	(Table 4 on page 5).	Change start options.

4.1.1.2 APPN Operands for VTAM Vary Commands

Table 6. VTAM VARY Command APPN Operands

Vary Command	**APPN-Related Optional Parameters**	**Use**
V NET,ACT,ID=adj_link_station | pu 2.1_nonswitched_line_name	CPCP=YES | NO HPR=YES | NO	Activate a connection and specify if it supports CP-CP sessions and HPR.
V NET,ACT,ID=cdrsc	IDTYPE=RESOURCE | CP	Activate a resource. IDTYPE indicates whether to activate the CP or if RESOURCE is specified whether to activate a CP and CDRM by that name if both exist.
V NET,ACT,ID=cdrmname	IDTYPE=RESOURCE | SSCP VRTGCPCP=YES | NO	Activate a CDRM (SSCP) or a CDRM and CP (RESOURCE) and specify whether to allow CP-CP sessions with this CP over a VRTG connection.
V NET,INACT,ID=cdrsc	IDTYPE=CP	Inactivate a cdrsc. IDTYPE=CP specifies to inact only a CP by this name.
V NET,INACT,ID=dlur		Deactivate a dependent LU requester.
V NET,INACT,ID=dlurpu		Deactivate a PU supported by a DLUR

4.1.1.3 APPN Operands for VTAM Display Commands

Table 7 (Page 1 of 2). VTAM Display Command APPN Operands

Display Command	APPN-Related Optional Parameters	Use
D NET,ADJCLUST	NETID=destination network SCOPE=ONLY | ALL	Display the adjacent cluster routing tables used for APPN searches.
D NET,ADJCP,ID=adjacent_CP	SCOPE=ONLY | ALL	Display an adjacent CP and its connections. Note that a CP at the other end of an RTP connection is considered adjacent.
D NET,BNCOSMAP	NETID=destination network SCOPE=ONLY | ALL	Display border node class-of-service mapping.
D NET,DIRECTRY,ID=resource	SCOPE=ONLY | ALL | NSEARCH	Display a resource in the directory. NSEARCH will cause a network (subarea and APPN) search to be performed returning all instances in the local domain and the first instance in another domain.
D NET,DIRECTRY,ID=*.resource	MAX=number_to_display	Display a resource in any network. Default for MAX is the DSPLYDEF start option.
D NET,DLURS		Display dependent LU requesters that have a CPSVRMGR session with the host.
D NET,ID=resource	IDTYPE=RESOURCE | CP | DIRECTRY (note 2) NETID=cdrsc_network SCOPE=ONLY | ACT | ACTONLY | CONCT | INACT| INACTONLY | ALL | PENDING | RESET	Display a resource.
D NET,ID=*.resource	IDTYPE=RESOURCE | DIRECTRY SCOPE=ONLY | ACT | ACTONLY | CONCT | INACT| INACTONLY | ALL | PENDING | RESET MAX=1 | number_to_display	Display a resource in any network.
D NET,ID=ISTADJCP,E		Display dynamic adjacent CPs.
D NET,ID=ISTRTPMN,E		Display HPR RTP connections.
D NET,NETSRVR	SCOPE=ALL | ONLY	Display network node server. Issued at end node or migration data host.

Table 7 (Page 2 of 2). VTAM Display Command APPN Operands

Display Command	APPN-Related Optional Parameters	Use
D NET,RSCLIST,ID=* | resource	IDTYPE=* | ADJCPS | ADJCPSEG | TRLSEG EXCLUDE=name or pattern MAX=number_to_display SCOPE=ALL | ACT | ACTONLY | CONCT | INACT| INACTONLY | PENDING | RESET	Display resources whose names match a pattern. IDTYPE covers many more areas, only APPN types are listed here. Depending on the VTAM DSPLYWLD start option, wildcard values can be used for the resource name.
D NET,SATOAPPN		Display the subarea-to-APPN class-of-service mapping table.
D NET,TGPS	ID=tgprofile_name MAX=number_to_display	Display transmission group profiles. MAX defaults to DSPLYDEF start option.
D NET,TOPO,LIST=SUMMARY		Topology summary display.
D NET,TOPO,ID=cpname	LIST=ALL APPNCOS=cos_name	Display topology for a specific node.
D NET,TOPO,ID=cpname, LIST=ADJ	APPNCOS=cos_name	Display topology for an adjacent node.
D NET,TOPO,LIST=BN | CDSERVR | EN | ICN | NN | VN	ID=cpname APPNCOS=cos_name	Display topology for specific node types.
D NET,ORIG=cpname	DEST=cpname TGN=tgnumber APPNCOS=cos_name	Display topology for specific TGs. Specify the DEST or TGN or both.
D NET,TRL	MAX=number_to_display TRLE=trl_entry_name	Display transport resource list. MAX defaults to DSPLYDEF start option.
D NET,VTAMOPTS	FORMAT=CURRENT | COMPLETE | MODIFIED OPTION=* | vtam option FUNCTION=APPNCHAR	Display VTAM start options. There are many options for FUNCTION. APPNCHAR is specifically for start options that affect APPN.

Note: E is the abbreviation for SCOPE=ALL, N for SCOPE=ONLY. Many commands default to SCOPE=ONLY. Specifying E will give much more information.

Chapter 5. Directory Services

Directory services in each APPN node performs searches for a resource in the network. It maintains a directory database built from resource registrations, network search results, and resource definitions.

VTAM keeps the directory database in storage. Network nodes and ICN nodes can define checkpoint databases for the directory to be used for initialization during VTAM restart. Checkpointing requires data sets defined in the VTAM procedure as DSDB1, DSDB2, and DSDBCTRL. Checkpoints are taken during a VTAM HALT, HALT QUICK, or when an F NET,CHKPT command is issued.

A network node provides directory services to the LUs it serves and is referred to as the LU's network node server.

VTAM can perform central directory services in an APPN network, reducing the amount of searches required to locate a resource.

5.1.1.1 VTAM Definitions

Table 8. Directory Services VTAM Start Options

VTAM Option	Use
CDSERVR=NO|YES	Defines if this node is a central directory server.
CDSREFER=1| number_of_CDSs	Determines how many of the nearest CDSs are used for searches and central resource registration.
DIRTIME=8D| time	Amount of time before deleting an unused resource from the directory database.
DIRSIZE=0| number	Number of dynamic APPN resources kept in directory database before deleting the oldest resources.
INITDB=ALL|DIR|TOPO|NONE	Load the directory database at initialization time from checkpoint data sets.
SORDER=SUBAREA|APPN|ADJSSCP	Determines which network is searched first.
SSEARCH=YES|NO	Determines whether to search the subarea network for requests coming in from the APPN network.

Table 9. Directory Services Resource Registration. VTAM REGISTER definitions determine when and where a resource is registered. The underlined parameter is the default.

Resource Registration		
Node Type	**VTAM Definition**	**Operand**
Application	VBUILD TYPE=APPL APPL ACBNAME=	REGISTER=CDSERVR|NETSRVR|NO
	APPL ACBNAME=TSO	REGISTER=CDSERVR|NETSRVR |NO
	APPL ACBNAME=TSO0001	REGISTER=NO|CDSERVR|NETSRVR
Independent LU Cross Domain Resource	VBUILD TYPE=CDRSC CDRSC	REGISTER=NO|CDSERVR|NETSRVR
local non-SNA	LBUILD LOCAL	REGISTER=NETSRVR|CDSERVR|NO
LU Group	VBUILD TYPE=LUGROUP LUGROUP	REGISTER=NETSRVR|CDSERVR|NO
local SNA	VBUILD TYPE=LOCAL LU LOCADDR>0	REGISTER=NETSRVR|CDSERVR|NO
	LU LOCADDR=0	REGISTER=NO|CDSERVR|NETSRVR
Model	VBUILD TYPE=LOCAL LU LOCADDR>0	REGISTER=NETSRVR|CDSERVR|NO
	LU LOCADDR=0	REGISTER=NO|CDSERVR|NETSRVR
NCP	LU LOCADDR>0	REGISTER=NETSRVR|CDSERVR|NO
	LU LOCADDR=0	REGISTER=NO|CDSERVR|NETSRVR
Switched Major Node	VBUILD TYPE=SWNET LU LOCADDR>0	REGISTER=NETSRVR|CDSERVR|NO
	LU LOCADDR=0	REGISTER=NO|CDSERVR|NETSRVR

Table 10. Directory Services Search Control. The parameters in this table affect the way VTAM searches for APPN resources.

VTAM Definition Type	Parameters	Use
VTAM Start Option	CDSREFER=1| number_of_CDSs	Determines how many of the nearest CDSs are used for searches and central resource registration.
APPN Cross Domain Resource VBUILD TYPE=CDRSC	NETSRVR=network_node_server CPNAME=cpname ALSLIST=ISTAPNPU	Specifies the owning CP, network node server, and APPN as the adjacent link station.
Network Node Server List VBUILD TYPE=NETSRVR	VBUILD TYPE=NETSRVR ORDER=FIRST|NEXT netsrvr NETID=netid SLUINIT=REQ|OPT	For end nodes to define a list of potential network node servers and to specify which to try as a NNS first.
Adjacent Cluster Routing Definitions VBUILD TYPE=ADJCLUST	netid NETWORK BNDYN=FULL|LIMITED|NONE NETID=netid cpname NEXTCP CPNAME=cpname SNVC=subnetwork_list_count	Defines which adjacent subnetworks VTAM should search.

Note:

1. LEN nodes cannot participate in APPN searches; therefore their LUs cannot be found in an APPN search. A CDRSC definition with REGISTER specified would make this resource available.

5.1.1.2 Adding a Central Directory Server to the Network

A central directory server maintains location information about the resources throughout the network. One or more central directory servers can be used to reduce the number of broadcasts in a network.

When a central directory server exists in the network, all network nodes will register their end nodes to the central server. When a network node is searching for a resource it passes the request to a central directory server. If the central server does not know the resource, it will ask other central directory servers and then issue a broadcast if necessary.

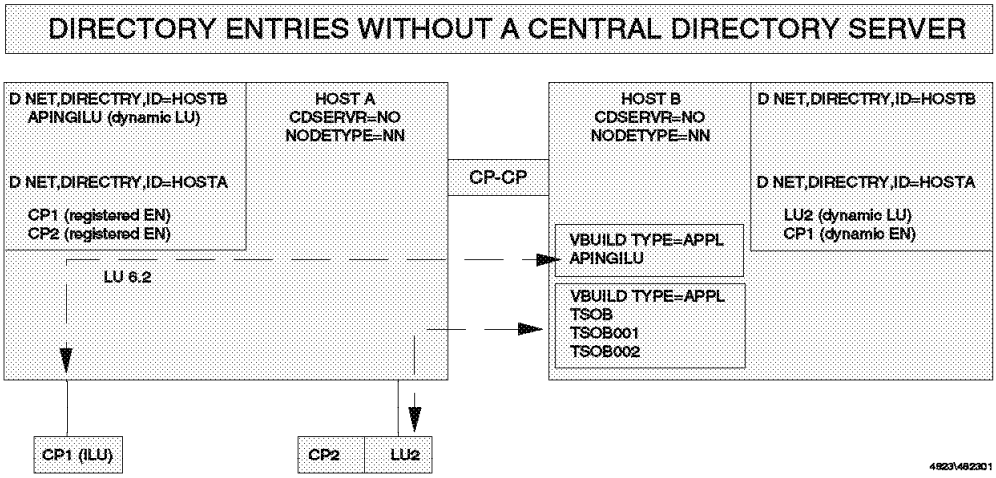


Figure 3. Network Node Directory Registration. This configuration shows two VTAM network nodes, HOSTA and HOSTB. Neither is a central directory server. Each host is aware of the end nodes attached to it. HOSTA has directory entries for CP1 and CP2 when they become active in the network. When a cross-domain session is started (that is, between CP1 and APINGILU) each host network node updates its directory to show the cross-domain resource. HOSTA becomes aware of APINGILU and HOSTB learns of CP1.

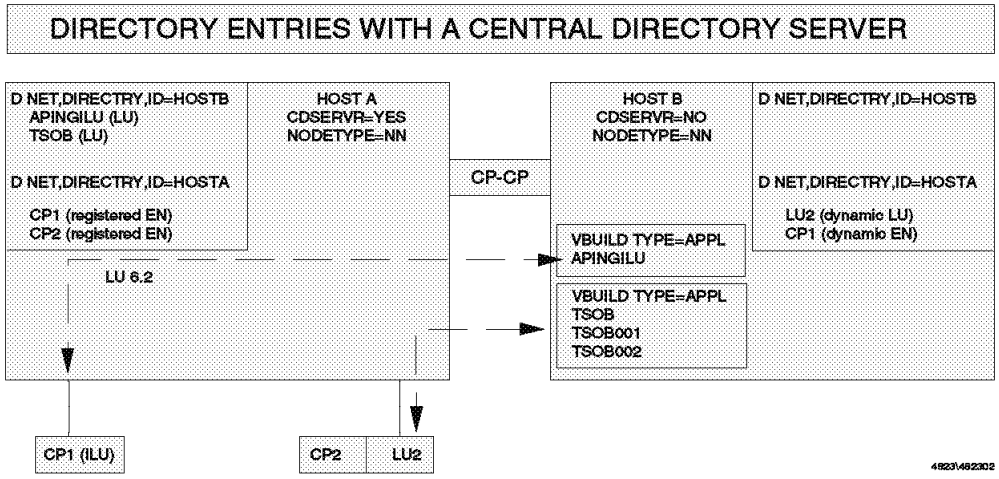


Figure 4. Central Directory Services Registration. In this configuration HOSTA is the CDS for the APPN network. Each host will have directory entries for the end nodes it serves. The CDS will also have entries for resources belonging to network nodes that are registered to the CDS. In this example, the LUs on HOSTB are automatically registered with HOSTA and do not have to be searched for.

Figure 5 on page 17 shows how a central directory server reduces the amount of broadcasts needed to find a resource. During a search for a

resource, a network node will issue a broadcast unless there is a central directory server in the network. If one or more CDSs exist, the network nodes do not broadcast. Only central directory servers will issue the broadcast, and only after they have checked for that resource in other the central directory servers in the network.

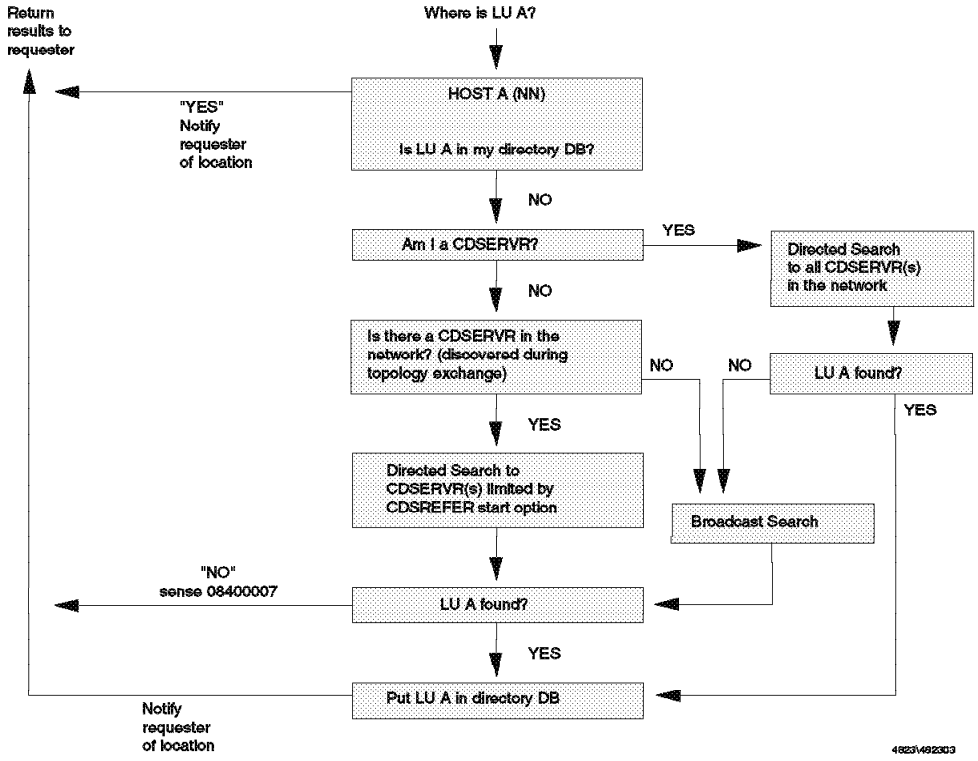


Figure 5. VTAM APPN Search Logic

To find out if there is a central directory server in the network, display the topology database. The following figure shows a display showing that two CDSERVRs are in the network.

```
 D NET,TOPO,LIST=CDSERVR IST097I  DISPLAY  ACCEPTED
IST350I  DISPLAY TYPE = TOPOLOGY
IST1295I  CP NAME          NODETYPE ROUTERES CONGESTION  CP-CP WEIGHT
IST1296I  USIBMRA.RAK      NN       128      NONE        *NA*  *NA*
IST1296I  USIBMRA.RA1      NN       128      NONE        YES   *NA*
IST314I  END
```

5.1.1.3 Searches in a Subarea and APPN Mixed Environment

When you have a mixture of subarea and APPN nodes you should determine how you want resource searches carried out and in what order networks should be searched.

Table 11. VTAM Start Options That Affect Resource Location Searches

Option	Affect
SORDER=SUBAREA|APPN|ADJSSCP	Determines which network is searched first. A combination of subarea and APPN nodes may be mixed in the search order by specifying SORDER=ADJSSCP and adding the designation for the APPN network (ISTAPNCP) in the adjacent SSCP table.
SSEARCH=YES|NO	Determines whether to search the subarea network for requests coming in from the APPN network.

Figure 6 illustrates a network search for a resource. ISTAPNCP represents the APPN network. In this case, SORDER=SUBAREA, so the APPN network is searched last. The search failed.

```
IST663I  IPS SRC    REQUEST TO   ISTAPNCP RECEIVED, SENSE=087D0001
IST664I  REAL  OLU=USIBMRA.RA6TNCS1    REAL  DLU=USIBMRA.RAIATC3
IST889I  SID = F8D3D1649E51A521
IST894I  ADJSSCPS TRIED  FAILURE SENSE   ADJSSCPS TRIED  FAILURE SENSE
IST895I     RAI             087D0001        RA1             087D0001
IST895I     RA3             087D0001        RAB             087D0001
IST895I     RAP             087D0001        RAG             08420000
IST895I     RA39            087D0001        RA36            087D0001
IST895I     RA2             08420000        RAH             08060023
IST895I     RAS             08420000        ISTAPNCP        08400007
IST314I  END
```

Figure 6. VTAM Failed Search, Subarea Followed by APPN

A mixture of subarea and APPN nodes can be searched by adding the APPN network representation (ISTAPNCP) to the adjacent SSCP table and specifying SORDER=ADJSSCP. Figure 7 shows an example where this was done.

```
                VBUILD TYPE=ADJSSCP
RAK      ADJCDRM
RAI      ADJCDRM
ISTAPNCP ADJCDRM
RA36     ADJCDRM
```

Figure 7. Combined Subarea and APPN Search Definition

5.1.1.4 How Do I Know Where a Resource Is?

By displaying the directory for a resource using SCOPE=NSEARCH, you can determine where a resource is.

```
   D NET,DIRECTRY,ID=USIBMSC.SC36N,SCOPE=NSEARCH
IST350I  DISPLAY TYPE = NETWORK SEARCH
IST1427I  NAME = USIBMSC.SC36N      FOUND TYPE = OWNER
IST1184I  CPNAME = USIBMSC.SC36M     - NETSRVR = USIBMRA.RAK
IST314I  END
```

Chapter 6. VTAM Topology and Routing

Each network node maintains a network topology database containing information on all transmission groups (TGs) between all network nodes (not end nodes). VTAM end nodes and network nodes maintain a local topology database describing their own PU 2.1 connections. The topology databases are in memory only. SYS1.TRSDB is required for topology database checkpoint functions (NN network topology only).

The topology database can be queried by using the D NET,TOPO command.

6.1.1.1 Route Calculation and Class of Service

VTAM routing services chooses session routes by their weight. The route with the lowest weight is the most preferred. The weight of the route is the sum of the weights of each node and TG in the route. IBM defaults will generally cause the route with the least number of nodes and transmission groups (TGs) to be chosen (to have the lowest weight).

Routes for APPN sessions can be influenced by coding parameters specifying TG characteristics on VTAM and NCP node definitions. These, or their defaults, are compared to a user class of service table pointed to by the logmode entry or to the IBM default class of service table, COSAPPN.

Weight is determined by comparing the characteristics of the node or TG to the NODEROW or LINEROW statements of the class-of-service table. The WEIGHT specified on the first matching row (compared in order specified by NUMBER) is the weight assigned to this node or TG. Since the first match is taken it is best to code the rows from least to highest weight. See Figure 8 on page 23 for an example of a class-of-service table.

If an endpoint of the TG is a virtual routing node, the weight is divided by two.

Table 12. Class of Service Route Selection Parameters. These can be used to define transmission group characteristics and to influence route selection.

VTAM Definition	CAPACITY	COSTBYTE	COSTTIME	PDELAY	SECURITY	UPARM1/2/3	PRIORITY	NUMBER	WEIGHT	CONGEST	ROUTERS	TGP (note 2)
APPNCOS (note 1)	L	L	L	L	L	L	X	L N	L N	N	N	
VTAM Start Option											X	
Transmission Group Profile (note 2)	X	X	X	X	X	X						
NCP LINE/PU	X	X	X	X	X	X						X
CDRM (VRTG=YES)	X	X	X	X	X	X						X
XCA (VNNAME VNGROUP)	X	X	X	X	X	X						X
Local SNA PU	X	X	X	X	X	X						X
Model PU	X	X	X	X	X	X						X
Switched Major Node	X	X	X	X	X	X						X

Notes:

1. L - Parameter coded on the LINEROW statement, describing transmission group characteristics.

   N - Parameter coded on the NODEROW statement, describing node characteristics.

   See Figure 8 on page 23 for an example of APPNCOS coding.

2. A transmission group profile can be coded to define a set of TG characteristics. To define a node as having these characteristics the profile can be pointed to by coding TGP= on the node definition.

6.1.1.2 IBM APPNCOS Definitions

IBM ships default APPNCOS definitions with VTAM with the member name COSAPPN. This member should be included in the VTAMLST library but does not need to be included in ATCCONxx. (Failure to have the COSAPPN member in VTAMLST can cause a sense code 80140002.) If user APPNCOS entries are coded in a separate VTAMLST member they should be activated with the VARY ACT command or put in ATCCONxx.

The IBM default logmode table ISTINCLM specifies an APPNCOS entry from the default class-of-service table (COSAPPN) for each logmode.

```
#INTER   APPNCOS  PRIORITY=HIGH            transmission priority      17300000
         LINEROW  WEIGHT=30,               line row weight           *17400000
               NUMBER=1,                   line row number           *17450000
               UPARM1=(0,255),             user defined char 1       *17500000
               UPARM2=(0,255),             user defined char 2       *17550000
               UPARM3=(0,255),             user defined char 3       *17600000
               CAPACITY=(4M,MAXIMUM),      line speed                *17650000
               COSTTIME=(0,0),             cost per connect time     *17700000
               COSTBYTE=(0,0),             cost per byte transmitted *17750000
               PDELAY=(MINIMUM,NEGLIGIB),  propagation delay         *17800000
               SECURITY=(UNSECURE,MAXIMUM) security level for TG      17850000
         NODEROW  NUMBER=1,                node row number           *17900000
               WEIGHT=5,                   node row weight           *17950000
               CONGEST=(LOW,LOW),          congestion                *18000000
               ROUTERES=(0,31)             route addition resistance  18050000
         LINEROW  WEIGHT=60,               line row weight           *18100000
               NUMBER=2,                   line row number           *18150000
               UPARM1=(0,255),             user defined char 1       *18200000
               UPARM2=(0,255),             user defined char 2       *18250000
               UPARM3=(0,255),             user defined char 3       *18300000
               CAPACITY=(56000,MAXIMUM),   line speed                *18350000
               COSTTIME=(0,0),             cost per connect time     *18400000
               COSTBYTE=(0,0),             cost per byte transmitted *18450000
               PDELAY=(MINIMUM,TERRESTR),  propagation delay         *18500000
               SECURITY=(UNSECURE,MAXIMUM) security level for TG      18550000
         NODEROW  NUMBER=2,                node row number           *18600000
               WEIGHT=10,                  node row weight           *18650000
               CONGEST=(LOW,LOW),          congestion                *18700000
               ROUTERES=(0,63)             route addition resistance  18750000
                ..                                                    18800000
                ..                                                    18800000
```

Figure 8. APPNCOS Example Coding

6.1.1.3 Choosing an APPN Class of Service

A class of service for an APPN session can be determined in several ways. Table 13 lists VTAM definitions and tables that are used. Figure 9 on page 25 shows the decision process.

Table 13. APPN Class of Service Definitions

Definition Type	MACRO	Description
logmode table	`MODEENT APPNCOS=appn_cosname`	If APPNCOS is coded, this is the COS name chosen.
	`MODEENT COS=appn_cosname`	If APPNCOS is not coded but COS is and an APPNCOS entry by that name exists, it is chosen.
Subarea to APPN COS mapping table	`VBUILD TYPE=SATOAPPN` `sa_cos MAPSTO COS=appn_cosname`	Maps subarea COS names to APPN COS names for sessions coming from a subarea network.
VTAM start option	APPNCOS	COS name to use when the requested COS name can not be found.
APPN to Subarea COS mapping table	`VBUILD TYPE=APPNTOSA` `appn_cos MAPSTO COS=sa_cos`	Controls the subarea class of service used when an APPN session crosses a subarea network (VRTG).
Border Node COS Mapping Definitions	`VBUILD TYPE=BNCOSMAP` `cos1 MAPSTO COS=native_cos`	Controls COS mapping across border nodes. If there is no mapping provided or the COS name coming in is not defined in the network, the APPNCOS start option determines the class of service used.

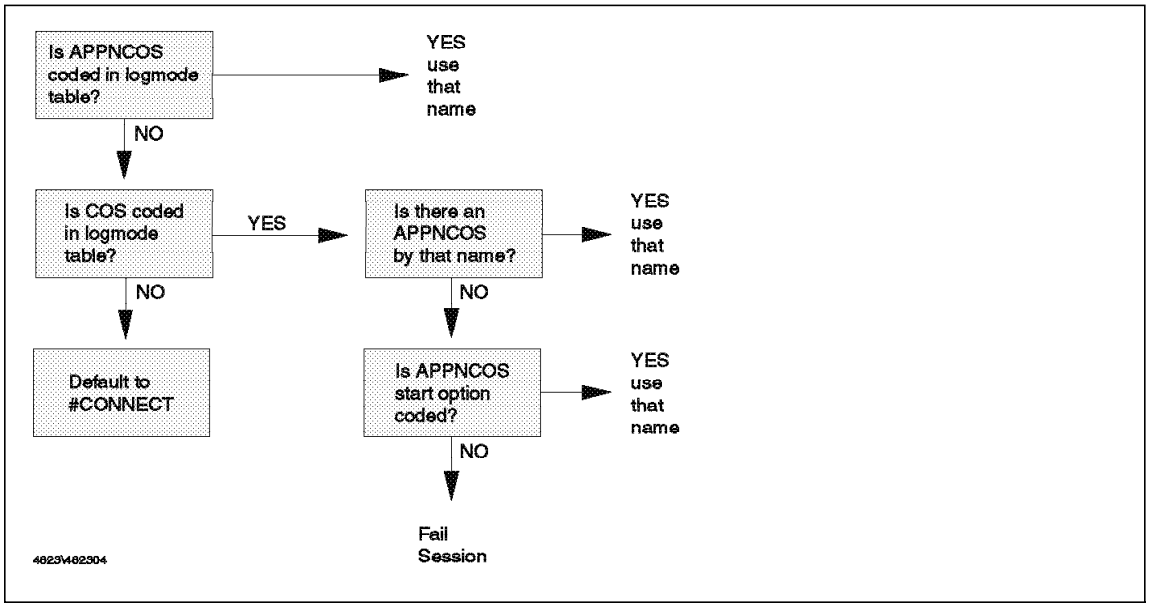


Figure 9. APPN Class of Service Decision Tree

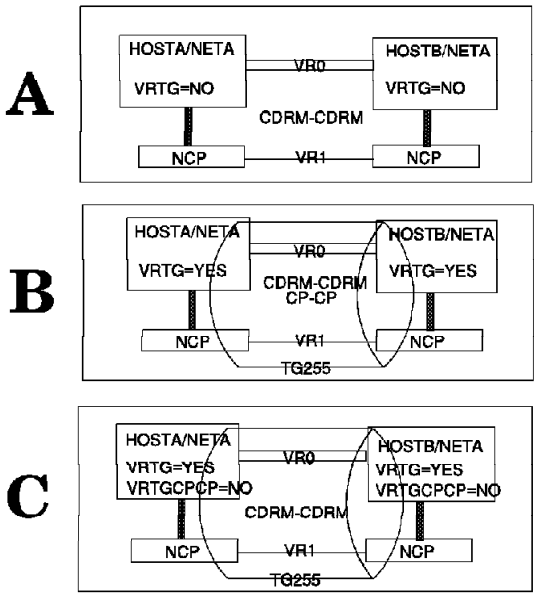
6.1.1.4 Topology and Routing Services Control Options

Other parameters that can affect topology and routing services are:

- RESUSAGE start option - Determines how many times a resource is used in route selection before it is considered overused.
- NUMTREES start option - Controls storage used by topology cache by limiting the number of routing trees retained in storage.
- INITDB start option - Controls whether the topology database is loaded at VTAM start.
- TOPO= on PU definitions - Controls notification of TG characteristics and status to topology and routing services. This is only relevant for switched major nodes. All other APPN PUs will have a value of CONNECT for TOPO, indicating that topology services is notified about the connection characteristics and status. For a switched major node TOPO can specify that the connection topology is not to be reported (TOPO=NONE) or that the connection is treated as auto-active with a connection cost override (TOPO=connection_cost).
- TGN - Controls the TGN number chosen or can specify parallel TG capability.
- DYNMODTB start option - To associate user logmode tables with dynamically defined CDRSCs

Chapter 7. Connecting APPN Nodes over a Subarea Network (VRTG)

A VR-based TG connects two APPN-capable VTAM nodes through a subarea network and allows them to act as APPN peers.



(A) Without VRTG, only a subarea connection is possible over the CTC as defined.

(B) With VRTG, the subarea CDRM connections are activated, then the APPN CP-CP session is established over the VRTG.

(C) VRTGCPCP=NO restricts the usage of the VRTG so no CP-CP sessions are established over it.

7.1.1.1 VTAM Definitions

Table 14. VTAM Parameters for VRTG

Definition Type	Parameters	Use
VTAM Start Options	VRTG=YES (in both VTAMs) VRTGCPCP=YES	VRTG determines if a VRTG session is requested when SSCP-SSCP sessions are established. VRTGCPCP determines whether CP-CP are permitted over VRTGs.
CDRM definition for adjacent VTAM	VRTG=YES VRTGCPCP=YES TGP=tgpname UPARM1=128 |uservalue UPARM2=128 |uservalue UPARM3=128 |uservalue	VRTG and VRTG can be specified at the CDRM level. The default is the value of the start options. TGP can be specified if you don't want default transmission group profile for the VRTG.

7.1.1.2 Requirements

- CTC connections between VTAMs can be CTC or MPC, but not AHHC since the subarea connection is the first/primary connection and AHHC does not support subarea. (CTC and MPC do not support APPN but this does not matter since the connection is subarea.)
- Both VTAMs must support subarea and APPN.
- VRTGs are given a transmission group number of 255.
- CDRM-CDRM session between the two end VTAMs must exist.
- If a VRTG lies anywhere in the path of an APPN session, the subarea network path structure must be complete from end to end. Check this if you get sense code 80130004.
- Only one VRTG between two nodes is allowed but the VRTG can span more than one subarea VR.
- VRTGs cannot cross network boundaries.
- Two consecutive VRTGs can be used to connect two hosts but is not recommended.

7.1.1.3 How Do I Know If It Is Working?

```
CNMS8012 OUTPUT FROM  D NET,TOPO,LIST=ALL,ID=RA39   LINE 1
IST097I  DISPLAY  ACCEPTED
IST350I  DISPLAY TYPE = TOPOLOGY
IST1295I  CP NAME           NODETYPE ROUTERES CONGESTION  CP-CP WEIGHT
IST1296I  USIBMRA.RA39      NN       128      NONE        YES   *NA*
IST1297I                    ICN/MDH  CDSERVR  RSN         HPR
IST1298I                    YES      NO       134         ANR
IST1223I                    BN       NATIVE
IST1224I                    NO       YES
IST1299I  TRANSMISSION GROUPS ORIGINATING AT CP USIBMRA.RA39
IST1357I                                                 CPCP
IST1300I  DESTINATION CP    TGN      STATUS   TGTYPE      VALUE WEIGHT
IST1301I  USIBMRA.RAK       21       INOP     INTERM      YES   *NA*
IST1301I  USIBMRA.RAB       255      OPER     INTERM VRTG YES   *NA
IST1301I  USIBMRA.RAK       255      OPER     INTERM VRTG YES   *NA
IST1301I  USIBMRA.RAI       255      OPER     INTERM VRTG YES   *NA*
IST1301I  USIBMRA.RAP       255      OPER     INTERM VRTG YES   *NA*
IST314I  END
```

To determine what VRTG connections exist from a CDRM (CP), display the topology for that CP. In this display, RA39 has CP-CP, CDRM-CDRM, and VRTG connections with RAB, RAK, RAI, and RAP. For these CPs the display (IST1301I) shows an operational connection that supports intermediate routing and VRTG. The TGN is 255 (all VRTGs have TGN of 255). The CPCP VALUE column indicates that CP-CP sessions are supported (VRTGCPCP=YES). It does not show whether or not CP-CP sessions exist. IST1296I shows whether a CP-CP session exists to the CP.

Chapter 8. Connection Network

A connection network is the act of two APPN nodes communicating over a shared transport facility (for example, LAN) even though they have no direct connectivity defined. They do this by defining a connection to a virtual node in the connection network. This greatly reduces the need for definitions since each node only needs to define the virtual node, not each node it wants to communicate with. It reduces the connection path between the two nodes.

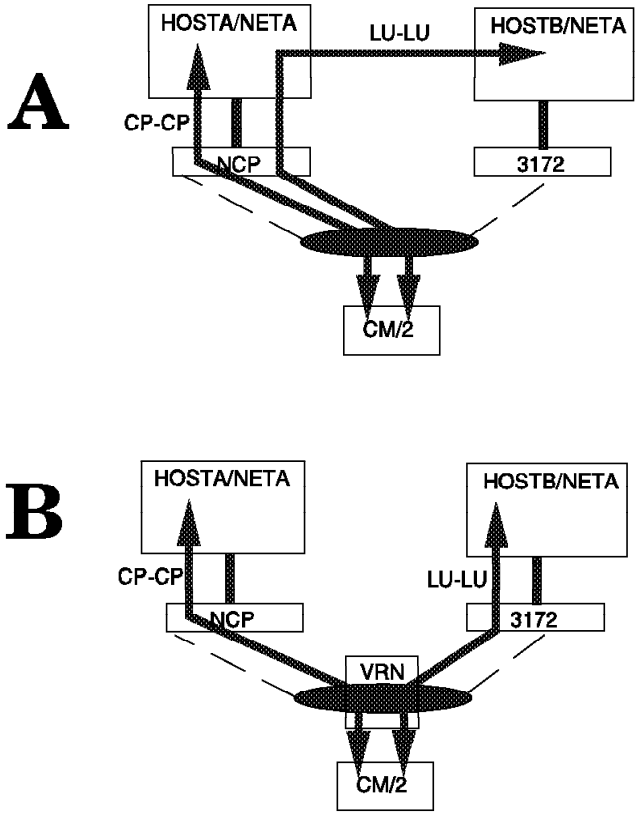


Figure 10. Connection Network. Host A is the network node server for the CM/2 machine.

(A) LU-LU session route without a connection network.

(B) LU-LU session route with a connection network.

Notes:

1. Routes traversing a virtual node cannot be used for CP-CP sessions.
2. Connection network cannot be used for connectivity across network boundaries.

Table 15. Definitions for Connection Network

VTAM Definition	Required Parameters
VTAM XCA major node	VBUILD TYPE=XCA PORT VNNAME=connection_network_name VNGROUP=vngroup vngroup GROUP DIAL=YES DYNPU=YES DYNPUPFX=dynpu_prefix
NCP major node	**GROUP ECLTYPE=PHYSICAL** **LINE VNNAME=**connection network name **VNGROUP=**vngroup vngroup **GROUP ECLTYPE=LOGICAL** **DIAL=YES** **DYNPU=YES**
VTAM Adjacent CP	**VBUILD TYPE=ADJCP** cpname **ADJCP VN=YES**

Note: Parameters such as CAPACITY, COSTBYTE, and other transmission group parameters may be specified for a connection network definition.

Table 16 (Page 1 of 2). Definitions for Connection Network - IBM Products

Product	Connection Network Definition
Communications Server for OS/2 Warp	Connection network name in Token-Ring or Other LAN Types Adapter Parameters screen.
AS/400	AUTOCRTCTL(*YES) on token ring line Define a model control unit - MDLCTL(*YES) LAN Remote Adapter = network node server address if EN, none if NN Controller Description = connection network name Category of controller = APPC Link type = LAN APPN-capable
Communications Server for AIX	Smit SNA Advanced Config Links APPN Connection Network
6611, MPNP V1.4	Connection network name in APPN node level parameters (token-ring and Ethernet ports only).
3174	Question 512: APPN Virtual Node Name on the Common SNA panel.
2217	In the SNA section there is an SNA Connection Network panel page where you specify the connection network name and port.

Table 16 (Page 2 of 2). Definitions for Connection Network - IBM Products	
Product	**Connection Network Definition**
3746 NN	The 3746 network node configuration allows you to specify a connection network name during port configuration.

8.1.1.1 How Do I Know If It Is Working?

When the VTAM major node is activated, a message will be generated from VTAM indicating the connection network has been contacted.

A topology display of the virtual node name (RACONNET) shows the nodetype is VN and TGs between the virtual node and our two hosts.

```
         D NET,TOPO,ID=RACONNET,LIST=ALL
IST097I  DISPLAY  ACCEPTED
IST350I  DISPLAY TYPE = TOPOLOGY
IST1295I  CP NAME           NODETYPE ROUTERES CONGESTION  CP-CP WEIGHT
IST1296I  USIBMRA.RACONNET  VN       128      NONE        *NA*  *NA*
IST1297I                    ICN/MDH  CDSERVR  RSN         HPR
IST1298I                    NO       NO       0           NONE
IST1223I                    BN       NATIVE
IST1224I                    NO       YES
IST1299I  TRANSMISSION GROUPS ORIGINATING AT CP USIBMRA.RACONNET
IST1357I                                                 CPCP
IST1300I  DESTINATION CP    TGN      STATUS   TGTYPE      VALUE WEIGHT
IST1301I  USIBMRA.RAI       21       OPER     INTERM      NO    *NA*
IST1301I  USIBMRA.RAK       21       OPER     INTERM      NO    *NA*
```

Chapter 9. Cross Network Connections

Border node support allows two subnetworks to isolate their topology from each other. The subnetworks can have the same or different NETIDs. They do not exchange topology, but do pass locate requests to other border nodes. This allows full APPN directory and session initiation support across network boundaries. It also allows networks to be subdivided to reduce topology exchange volume.

Peripheral Border Node
A border node connected to a non-border node. It acts as an end node to the host it is connected to in the other network, but as a network node to the nodes in its native network. This is not recommended between two VTAM nodes. This support is for nodes that support interoperability with border nodes (APPN option set 1013).

Extended Border Node
A VTAM border node connected to another VTAM border node. Both hosts are aware of each other as border nodes and implement search redundancy and loop controls.

Table 17. Border Node Functions

Border Node Type	VTAM Start Options -Host A	VTAM Start Options -Host B	Topology Exchange ?	Directory Searched ?
Peripheral	BN=YES	BN=NO	No	Yes
Extended	BN=YES	BN=YES	No	Yes
None	BN=NO	BN=NO	Yes	Yes

Border nodes

- Are network nodes
- Allow cross network connections over channel links using AHHC connections
- Require NCP 7.1 subnetwork boundaries through the NCP
- Are not supported over connection networks
- Allow COS definitions to be inconsistent across boundaries

Table 18. Border Node VTAM Definitions

VTAM Start Option	SNVC=	Maximum networks this border node will search for a resource.
	BNDYN=LIMITED|FULL|NONE	Determines how VTAM dynamically adds nodes to the adjacent cluster routing list.
	BNORD=PRIORITY|DEFINED	Defines the order VTAM will perform cross-network searches.
	BN=YES|NO	Defines whether or not this node is a border node.
Adjacent cluster routing list	VBUILD TYPE=ADJCLUST NETWORK BYDYN NETID NEXTCP CPNAME SNVC	Allows you to define which adjacent subnetworks to search.
Class-of-Service mapping tables	VBUILD TYPE=BNCOSMAP NETWORK NETID= cosname MAPSTO COS=native_cos	Allows mapping of COS names from one network to another.
Adjacent CP	VBUILD TYPE=ADJCP ADJCP NATIVE=	Use NATIVE=NO to force a subnetwork boundary if the NETIDs are the same to eliminate topology exchange between the two nodes.
Local SNA, model, switched major node	PU NATIVE=	Use NATIVE=NO to force a subnetwork boundary if the NETIDs are the same to eliminate topology exchange between the two nodes.

9.1.1.1 How Do I Know If It Is Working?

A topology display of the partner node will not show anything since with border node support there is no topology exchange. A topology display of the native node will show an intercluster link to the non-native node.

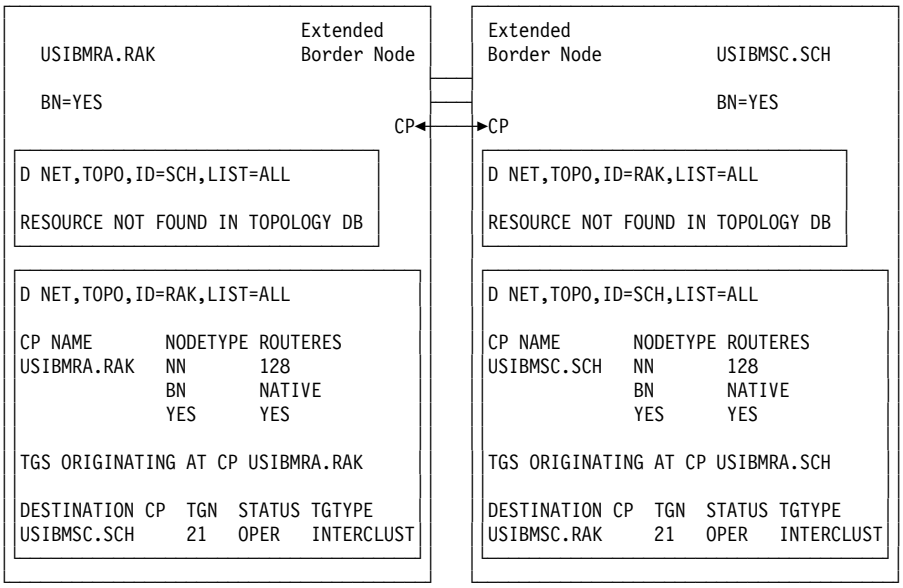


Figure 11. Extended Border Node. A topology display of the native node will show a TGTYPE of INTERCLUST to represent an inter-subnetwork link. The display may show BN as NO even if the node has been defined with border node support. The BN value won't change to yes until the first inter-subnetwork connection and the node is acting like a border node.

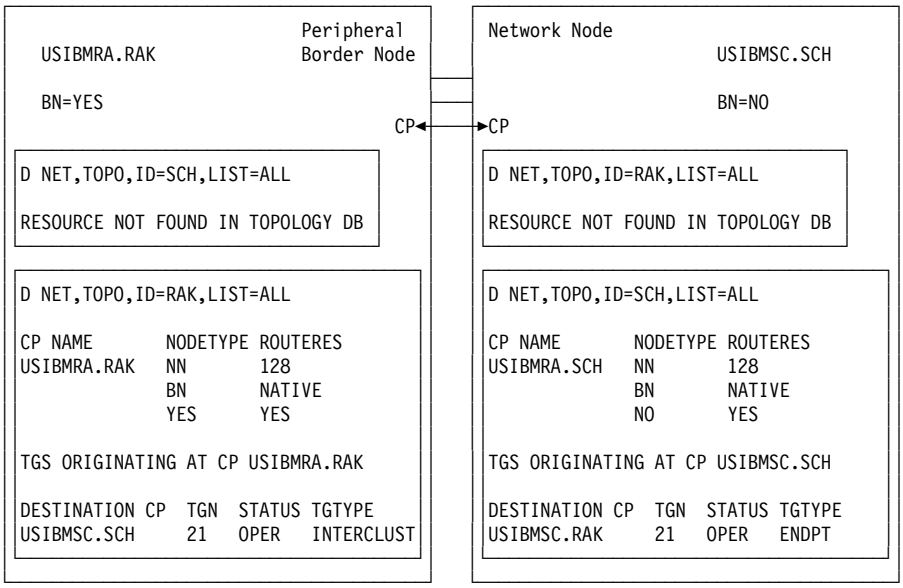


Figure 12. Peripheral Border Node. Network Node RAK will be performing peripheral border node support since SCH has no border node support. SCH sees RAK as an end node. The TGTYPE is ENDPT on SCH. RAK knows this is a border node connection and sees the TGTYPE for SCH as INTERCLUST.

Chapter 10. Dependent LU Requester/Server (DLUR/DLUS)

DLUR/DLUS support provides a way for dependent LUs to be connected to an APPN node and not directly to a subarea node. The session between a dependent LU and its SSCP can now be established even though the LU is not directly connected to the owning VTAM or NCP. The SSCP-LU session is encapsulated in an LU 6.2 pipe and may cross CP or even network boundaries.

Table 19. Definitions for DLUR/DLUS

Definition Type	Parameter	Description
VTAM Switched Major Node	VBUILD TYPE=SWNET,MAXDLUR= PATH DLURNAME=,DLCADDR=	These parameters are only needed if the host will start the session. MAXDLUR can be used to limit the number of dependent LU requesters.

Note: The DLUR will specify the host CPNAME as its DLUS.

Table 20. DLUR/DLUS Product Support

Products providing DLUS	Products providing DLUR
• VTAM 4.2 • VTAM 4.3	• 3174 configuration C5, C6 • 3746-900 • 3746-950 • OS/2 DLUR provided by VTAM 4.2 (requires CM/2 1.11 and service pack WR06150, OS/2 2.0 or higher). DLUR for OS/2 is not provided by VTAM 4.3. • Communications Server for OS/2 Warp • 2217 Nways Multiprotocol Concentrator (MpC) • 3172 HPR Channel Connectivity Program • Personal Communications AS/400 and 3270 V4.1 for OS/2 • Personal Communications AS/400 and 3270 V4.1 for Windows 95 • 6611 MPNP 1.4

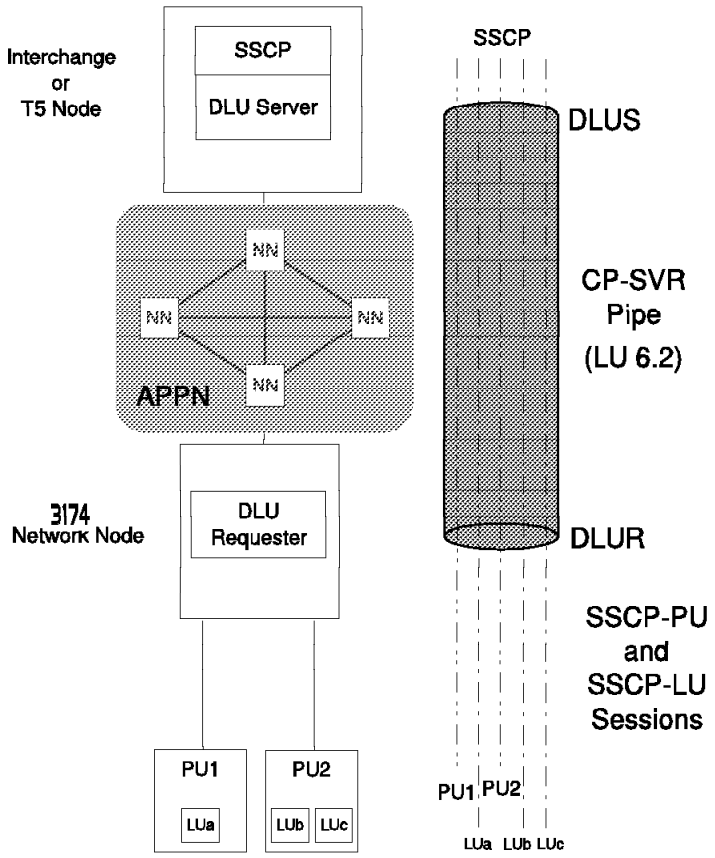


Figure 13. DLUR/DLUS Example

Notes:

1. The DLUS must be a network node.
2. Each DLUS can handle multiple PU/LUs.
3. The LU 6.2 pipe is referred to as the CPSVRMGR session. This session flows over APPN or VRTG links, not over pure subarea links.

Table 21 (Page 1 of 2). DLUR/DLUS Product Definitions

Product	DLUR/DLUS Definition
Communications Server for OS/2 Warp, PCOM 3270 with OS/2 Access Feature	Choose the option to configure any profile or feature. SNA dependent LU server defintions is one of the options.

Table 21 (Page 2 of 2). DLUR/DLUS Product Definitions

Product	DLUR/DLUS Definition
6611, MPNP V1.4	Secondary LUs only are supported over token-ring, Ethernet, and serial frame-relay ports, and pseudo ports using DLSw (including SDLC). DLUR is not supported over PPP ports or IP pseudo ports. For adjacent T2.0 nodes with dependent LUs, set the adjacent node type parameter to PU 2.0 node. For adjacent T2.1 nodes with dependent LUs, set the adjacent node type parameter to APPN end node or unknown node type. The CPNAME of the primary and backup DLUS are defined in the APPN node level parameters.
3174 C5/C6	DLUR services are provided for coax-attached dependent terminals. The CPNAME and network ID of the primary and secondary DLUS host are defined in questions 620-623.
2217	The DLUR/DLUS parameters are in the SNA folder under the DLUS tab. Parameters are DLUS name, activate at startup, local PU name, node identifier, backup DLUS name, and maximum activation attempts.
3746 NN	The 3746 network node configuration option for APPN NN/FP/DLUR allows the DLUS name and retry time to be defined.

10.1.1.1 How Do I Know If It Is Working?

VTAM provides a display command for DLUR nodes. Use this command (Figure 14) to see what DLUR sessions exist.

```
      D NET,DLURS

IST350I  DISPLAY TYPE = DLURS
IST1352I  DLUR NAME          DLUS CONWINNER STATE  DLUS CONLOSER STATE
IST1353I  USIBMRA.CP31743    ACTIVE                ACTIVE
IST314I  END
```

Figure 14. VTAM Display of DLURs. This command will display the DLU requesters.

A VTAM display of a DLUR node (Figure 15) will indicate that sessions are DLUR sessions by showing /DL after the status.

```
      DISPLAY NET,ID=CP31743,SCOPE=ALL

 IST075I  NAME = USIBMRA.CP31743  , TYPE = ADJACENT CP
 IST486I  STATUS= ACT/S----Y, DESIRED STATE= ACTIV
 IST977I  MDLTAB=***NA*** ASLTAB=***NA***
 IST1333I  ADJLIST = ***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 = ISTCDRDY
 IST479I  CDRM NAME = RAI     , VERIFY OWNER = NO
 IST1184I  CPNAME = USIBMRA.CP31743   - NETSRVR = ***NA***
 IST1044I  ALSLIST = ISTAPNPU
 IST082I  DEVTYPE = INDEPENDENT LU / CDRSC
 IST654I  I/O TRACE = OFF, BUFFER TRACE = OFF
 IST171I  ACTIVE SESSIONS = 0000000002, SESSION REQUESTS = 0000000000
 IST206I  SESSIONS:
 IST1081I  ADJACENT LINK STATION = RA9PO5
 IST634I  NAME     STATUS         SID          SEND RECV VR TP NETID
*IST635I  RAI      ACTIV/DL-S EE4B78FF00000003 000E 0000  0  0 USIBMRA
*IST635I  RAI      ACTIV/DL-P F86FE164A634EC37 0000 0012  0  0 USIBMRA
 IST089I  SW31743P TYPE = PHYSICAL UNIT    , ACTIV
 IST924I  -------------------------------------------------------------
 IST075I  NAME = USIBMRA.CP31743  , TYPE = DIRECTORY ENTRY
```

Figure 15. VTAM Display of DLUR a CP. The ACTIV/DL status indicates the session is a CP-SVR session.

10.1.1.2 Note about DLUR Sessions

If you are setting up a DLUR/DLUS environment and experience sense code 0835000D during the BIND, the last 2 bytes of this sense code point to the BIND byte in error. If byte X'0D' (SLU-PLU pacing count) is in error, remember that most NNs require some type of pacing in both directions (PLU-SLU and SLU-PLU) for LU-LU sessions routing through them. If there

is an intermediate NN between the DLUS and DLUR, you must have a non-zero value for the VPACING parameter on the definition for the application (primary LU). The logmode should also have PSNDPAC and SSNDPAC on.

Chapter 11. High Performance Routing (HPR)

High Performance Routing (HPR) is an APPN enhancement that utilizes the more efficient networks and updated connection and routing protocols to increase the performance for data routing and reliability. HPR implements the following functions to provide high-speed data transfer:

Rapid Transport Protocol (RTP) establishes an RTP transport connection between the origin and destination nodes (endpoints). Intermediate nodes are not aware of the session. RTP operates in the nodes that initiate and terminate the HPR connection. RTP provides the following:

- Non-disruptive rerouting around network outages
- Efficient selective retransmission
- End-to-end data integrity and congestion control

Automatic Network Routing (ANR) is a low-level source routing mechanism that minimizes processing cycles and storage necessary for routing packets in intermediate nodes. No intermediate node storage is required to maintain routing tables. All the routing information is stored in the header.

Adaptive Rate-Based (ARB) flow and congestion control adapts the rate at which the sender transmits data into the network based on the receiver's ability to receive and process data. This algorithm is proactive and not reactive to the link state. This promotes high-link utilization and prevents network congestion.

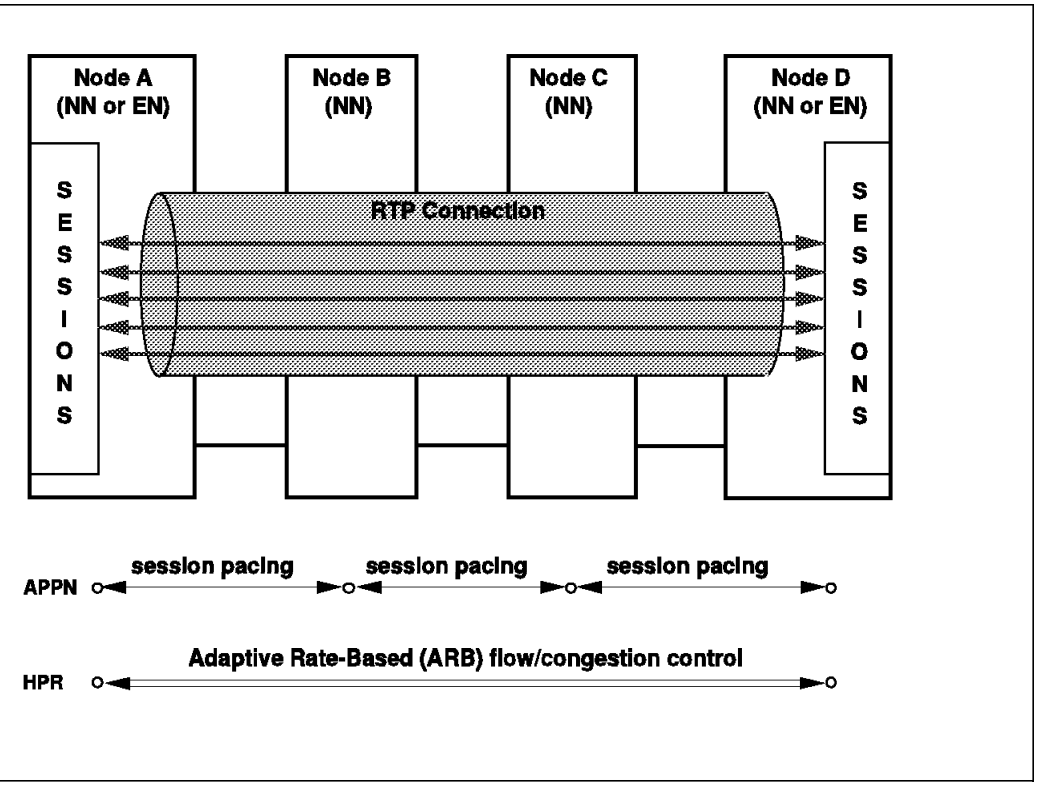


Figure 16. HPR Overview

Using HPR reduces the need for storage and cycles in NCP for APPN routing. It also reduces flow over links by performing error recovery and flow control at endpoints, not each hop in the path. In a VTAM environment, HPR can run over VRTG links and supports connection networks. It is not supported over subnetwork boundaries. NCP must be at V7.3.

Table 22 (Page 1 of 2). VTAM HPR Definitions

VTAM Node Type	Start Option	HPR Start Options Available	HPR on Local SNA, AHHC	HPR on NCP, switched major node PU	HPR on Other Connections
Subarea	HOSTSA=xx	HPR=**NONE**	HPR=**NO**	HPR=**NO**	HPR=**NO**
Network Node	NODETYPE=NN	HPR=ANR|**RTP**|NONE HPRPST= (note 1)	HPR=**YES**|NO (note 2)	N/A	HPR=**NO**
Composite Network Node	NODETYPE=NN HOSTSA=xx	HPR=**ANR**|NONE (note 3)	HPR=**NO**	HPR=**YES**|NO LLERP=**NOTPREF**|REQUIRED	HPR=**NO**

Table 22 (Page 2 of 2). VTAM HPR Definitions

VTAM Node Type	Start Option	HPR Start Options Available	HPR on Local SNA, AHHC	HPR on NCP, switched major node PU	HPR on Other Connections
Migration Data Host	NODETYPE=EN HOSTSA=xx	HPR=**RTP**|NONE HPRPST=	HPR=**YES**|NO	N/A	HPR=**NO**
End Node	NODETYPE=EN	HPR=**RTP**|NONE HPRPST=	HPR=**YES**|NO	N/A	HPR=**NO**

Notes:

1. ANR would limit the support. HPR=RTP provides both RTP and ANR support.
2. HPR defaults to yes if HPR=RTP was specified in the start options. Otherwise HPR defaults to NO on the PU.
3. A composite node (a VTAM ICN and an NCP) provides ANR support through the NCP only.
4. HPRPST specifies maximum time VTAM tries a path switch before ending a connection. HPRPST is only valid if HPR=RTP.
5. LLERP determines whether link-level error recovery procedures for HPR connections are required.

Table 23 (Page 1 of 2). HPR Product Support and Definitions

Product	HPR Definitions
Communications Server for OS/2 Warp, PCOM 3270 with OS/2 Access Feature	HPR support is activated on by clicking on HPR Support while defining additional connection parameters for an SNA connection.
AS/400	ANR support is automatically activated when APPN is enabled.

Table 23 (Page 2 of 2). HPR Product Support and Definitions

Product	HPR Definitions
6611, MPNP V1.4	ANR and RTP are supported on token-ring, Ethernet, and serial ports configured with frame-relay or PPP. HPR is not supported on SDLC adapters which are only supported using DLSw on pseudo ports. HPR parameters that can be specified include: • Node level – Enable APPN network node – Maximum sessions for HPR connections – RTP inactivity timer – Maximum number of RTP retries – Path switch timer – RTP Inactivity timer – Maximum RTP retries • Port level – HPR support – Local HPR SAP address – Default inactivity timer override (HPR Ti) – Default reply timer override (HPR T1) – Default maximum retransmissions (HPR N2)
2217	ANR and RTP supported on token-ring, Ethernet, and frame-relay links. The HPR default capability for implicit links is defined in the SNA folder, SNA info tab. HPR support is enabled for specific links in the SNA folder, SNA info tab, SNA link definitions.

11.1.1.1 How Do I Know If It Is Working?

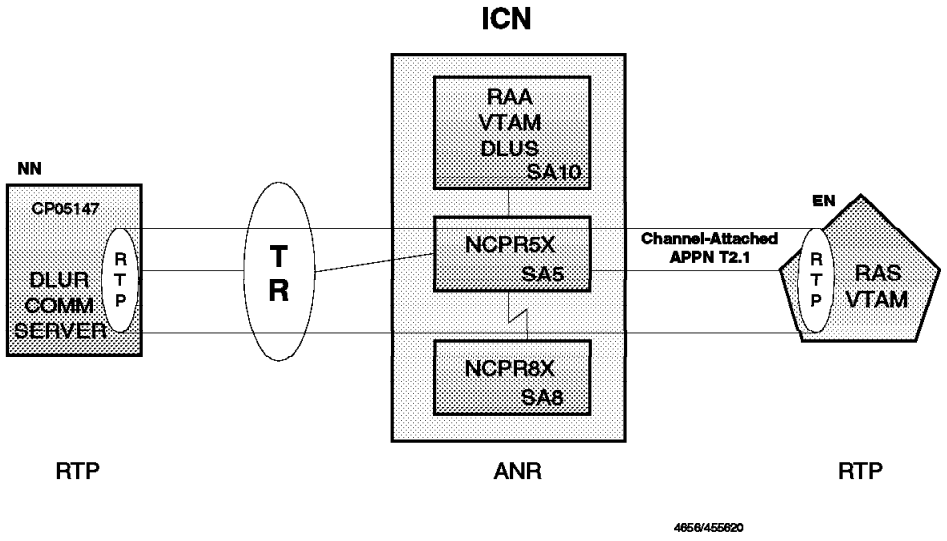


Figure 17. RTP Connection

The RTP major node, ISTRTPMN, and the PUs that represent an RTP can be displayed. If RTP connections exist, you will see them represented with an RTP name starting with CNR and the status of the connection.

```
LOGON
IST1488I  ACTIVATION   FOR RTP CNR00002 AS ACTIVE  PARTNER COMPLETED
D NET,ID=ISTRTPMN,E
IST097I DISPLAY ACCEPTED
IST075I NAME = ISTRTPMN, TYPE = RTP MAJOR NODE 510
IST486I STATUS= ACTIV, DESIRED STATE= ACTIV
IST1486I   RTP NAME   STATE             DESTINATION CP
IST1487I   CNR00002   CONNECTED         USIBMRA.CP05147
IST314I END
```

Figure 18. Display of RTP Major Node from RAS

Dynamic PUs created (CNRxxxx) to represent connection from VTAM to an RTP node can be displayed for more detailed information about an HPR connection.

```
D NET,ID=CNR00002,E
IST097I DISPLAY ACCEPTED
IST075I NAME = CNR00002, TYPE = PU_T2.1 513
IST486I STATUS= ACTIV--LX-, DESIRED STATE= ACTIV
IST1043I CP NAME = CP05147, CP NETID = USIBMRA, DYNAMIC LU = YES
IST933I LOGMODE=***NA***, COS=#CONNECT
IST1476I TCID X'00000002000008B' - REMOTE TCID X'0000000000000127'
IST1481I DESTINATION CP USIBMRA.CP05147 - NCE X'80'
IST1477I ALLOWED DATA FLOW RATE = 58 KBITS/SEC
IST1516I INITIAL DATA FLOW RATE = 58 KBITS/SEC
IST1511I MAXIMUM NETWORK LAYER PACKET SIZE = 2044 BYTES
IST1478I NUMBER OF UNACKNOWLEDGED BUFFERS = 0
IST1479I RTP CONNECTION STATE = CONNECTED
IST1480I RTP END TO END ROUTE
IST1460I TGN  CPNAME             TG TYPE      HPR
IST1461I  21  USIBMRA.RAA        APPN         ANR
IST1461I  21  USIBMRA.CP05147    APPN         RTP
IST231I RTP MAJOR NODE = ISTRTPMN
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST1500I STATE TRACE = OFF
IST355I LOGICAL UNITS:
IST080I W1541702 ACT/S----Y
IST314I END
```

Figure 19. Display of RTP Connection from RAS to CP05147

The following VTAM modify RTP command can be used to cause VTAM to search for a better HPR route and switch a connection to that route if a better one is found.

```
F NET,RTP,ID=CNRxxxxx
```

Chapter 12. APPN Implementations

Table 24 provides a summary of some of the APPN functions supported by product. Please check with your marketing representative if you do not see a product you are interested in and to get the latest information on any product.

Table 24. APPN Node Support

APPN Support	VTAM V4R2	VTAM V4R3	OS/400 V3R1 / V3R6	Com Server for OS/2 Warp V4.0	3174 C6	6611 MPNP V1R4	AIX SNA Server 2.1, Comm Server for AIX V4	3746-900 NN / 3746-950	2217 MPC	PComm AS/400 and 3270
APPN NN	X	X	X	X	X	X	X	X	X	
APPN EN	X	X	X	X			X		X	Win 95, OS/2
Peripheral Border Node	X	X	X							
Extended Border Node	X	X								
Central Directory Server	X	X								
Connection Network Route Calculation	X	X	X	X	X		X		X	
Member of Connection Network	X	X	X	X	X	X	X	X	X	
Dependent LU Requester				X	X	X		X	X	Win 95, OS/2
Dependent LU Server	X	X								
HPR Support		RTP ANR (NCP 7.3)	ANR	RTP ANR		RTP ANR			RTP ANR	RTP (Win 95, OS/2)

Chapter 13. VTAM APPN Migration Example

This example shows a simple migration scenario of a VTAM subarea node to an APPN ICN.

Note: D NET,VTAMOPTS,FUNCTION=APPNCHAR can be used to display the value of the VTAM start options affecting the APPN network.

13.1.1.1 Step 1

Begin to design the APPN network you would like to build by identifying the key hosts in your network. These will be the hosts that will be connected to the most nodes, doing the most session setup and routing, etc. Turn on the APPN function in one or more key hosts.

Table 25. Step 1 in Migration of VTAM Host to APPN

New Start Parameters	Other changes	What you get	What you can do
NODETYPE=NN **CPCP=YES** **SORDER=SUBAREA** **CDRDYN=YES** **CONNTYPE=APPN** **(note 1)** **DYNADJCP=YES** **DYNLU=YES** **SSEARCH=YES**	Copy COSAPPN to VTAMLST from SAMPLIB Add DSDB1, DSDB2, DSDBCTRL, TRSDB datasets to VTAM startup	APPNCOS=NONE BN=NO BNDYN=**NA** BNORD=**NA** CDSERVR=NO CDSREFER=1 DIRSIZE=0 DIRTIME=691200S HPR=ANR INITDB=ALL NUMTREES=100 RESUSAGE=100 ROUTERES=128 SECLVLCP=**NA** SNVC=**NA** VERIFYCP=NONE VRTG=NO VRTGCPCP=YES	An APPN network node with subarea capability. The subarea connectivity is basically unaffected. Peripheral devices such as 3174s, PS/2s, AS/400s, RS/6000s, can connect to this host as an APPN node and will be able to find LUs in the subarea network for session establishment.

Note:

- If CONNTYPE=APPN, a node that uses this host as its network connection and has APPN capabilities but does not establish a CP-CP session with this host may fail in searches for LUs outside of this host. Therefore, it is recommended that users be aware of this and should configure their devices to establish the CP-CP session.

  You may find it useful to specify CONNTYPE=LEN in the start options as a default and specify CONNTYPE=APPN at the PU level if you only have a few APPN nodes in your network.

13.1.1.2 Step 2

- Choose one (or more) hosts to serve as the central directory server.
- Convert the rest of the desired hosts to APPN as in step 1. Connect the APPN hosts through PU 2.1 connections or turn on VRTG connectivity.

APPN sessions over a route that contains a VRTG will have to have a subarea path defined from end to end. If new nodes are involved and you don't want to define the subarea paths for all nodes that may cross these, consider using APPN (2.1) connections in addition to the existing subarea connections.

- Change SORDER to search the APPN network first.
- Review CONNTYPE to determine whether it is better to use LEN or APPN. This could be largely determined by the types of devices you have in the network and what it would involve to reconfigure those devices to use APPN.
- If you only have APPN connectivity between hosts (no subarea), remove the CDRM, CDRSC, ADJSSCP, and PATH definitions for those hosts.

Table 26. Step 2 in Migration of VTAM Host to APPN

Start Parameters	Other changes	What you get	What you can do
CDSERVR=YES **VRTG=YES** **VRTGCPCP=YES** **SORDER=APPN** NODETYPE=NN CPCP=YES CDRDYN=YES CONNTYPE=APPN DYNADJCP=YES SSEARCH=YES		APPNCOS=NONE BN=NO BNDYN=**NA** BNORD=**NA** CDSREFER=1 DIRSIZE=0 DIRTIME=691200S HPR=ANR INITDB=ALL NUMTREES=100 RESUSAGE=100 ROUTERES=128 SECLVLCP=**NA** SNVC=**NA** VERIFYCP=NONE	VTAM hosts will now participate in the APPN network searches. Choosing a central directory server will make these searches more efficient.

13.1.1.3 Step 3

Begin integrating other networks using border node support. If NCP controllers are being used for SNI to other hosts that could be connected over a channel, consider using AHHC connections.

If topology exchange can be significant within the network you are building, border node support can be used to divide it into smaller subnetworks.

Appendix A. Special Notices

This publication is intended for VTAM system programmers who are using APPN in their network environment. It is a quick reference to assist the system programmer in finding information about the APPN environment. Other IBM products that provide functions of interest are mentioned.

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Appendix B. Related Publications

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

B.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “How to Get ITSO Redbooks” on page 59.

- *Subarea Network to APPN Network Migration Experiences*, SG24-4656
- *3174 APPN Implementation Guide Update*, SG24-4171
- *IBM 3174 Establishment Controller/Networking Server Installation Guide*, GG24-3061
- *A Guided Tour of SNA Server/6000 Version 2.1*, GG24-4189
- *The IBM 6611 Network Processor as an SNA/APPN Router*, GG24-4367
- *NCP Version 7 Release 3 New Functions*, SG24-2592
- *IBM 3746 Nways Controller Model 950 and IBM Model 900 APPN Implementation Guide*, GG24-2536
- *AS/400 APPN Configuration Guide*, GG24-4023

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

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