APPN™ Network Design Considerations

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Nodes, Functions and Products

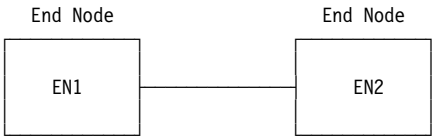
	APPN		
Functions	**NN**	**EN**	**LEN**
T2.1 Node	Yes	Yes	Yes
Support of Independent LUs (ILUs)	Yes	Yes	Yes
Support of Dependent LUs (DLUs)	Yes	Yes	Yes
Edge of Network only	No	Yes	Yes
Directory Services for other Nodes	Yes	No	No
Route Selection Services	Yes	No	No
CP–CP Sessions	Yes	Opt	No
Topology Data Base	Yes	No/part.	No
Intermediate Session Routing (ISR)	Yes	No	No

Products	**NN**	**EN**	**LEN**
AS/400	Yes	Yes	Yes
S/36 with APPN feature	Yes	No	No
S/36 without APPN feature	No	No	Yes
S/38	No	No	Yes
S/1	No	No	Yes
PC with APPC/PC	No	No	Yes
PC with NS/DOS	No	No	Yes
PS/2 with OS/2 CM 1.3	No	No	Yes
PS/2 with OS/2 CM 1.3 + NS/2	Yes	Yes	Yes
PS/2 with OS/2 2.0 + CM/2	Yes	Yes	Yes
3174 with Config supp. C	Yes	No	No
RISC/6000	Yes *1	Yes *1	Yes
DPPX/370	Yes	Yes	No
TPF	No	No	Yes
VTAM/NCP (pre APPN) *2	No	No	Yes
VTAM/NCP (APPN) *3	Yes	Yes	Yes

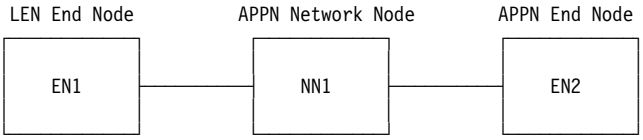
Notes:

*1 – supported with AIX SNA Server/6000 V2.1
*2 – at VTAM V3 and NCP V6R1 level or lower
*3 – at VTAM V4R1 and NCP V6R2 level or higher

Simple Configurations



- Two isolated End Nodes
- May be two LEN nodes as well



- NN needed for intermediate routing
- APPN protocols between NN1 and EN2

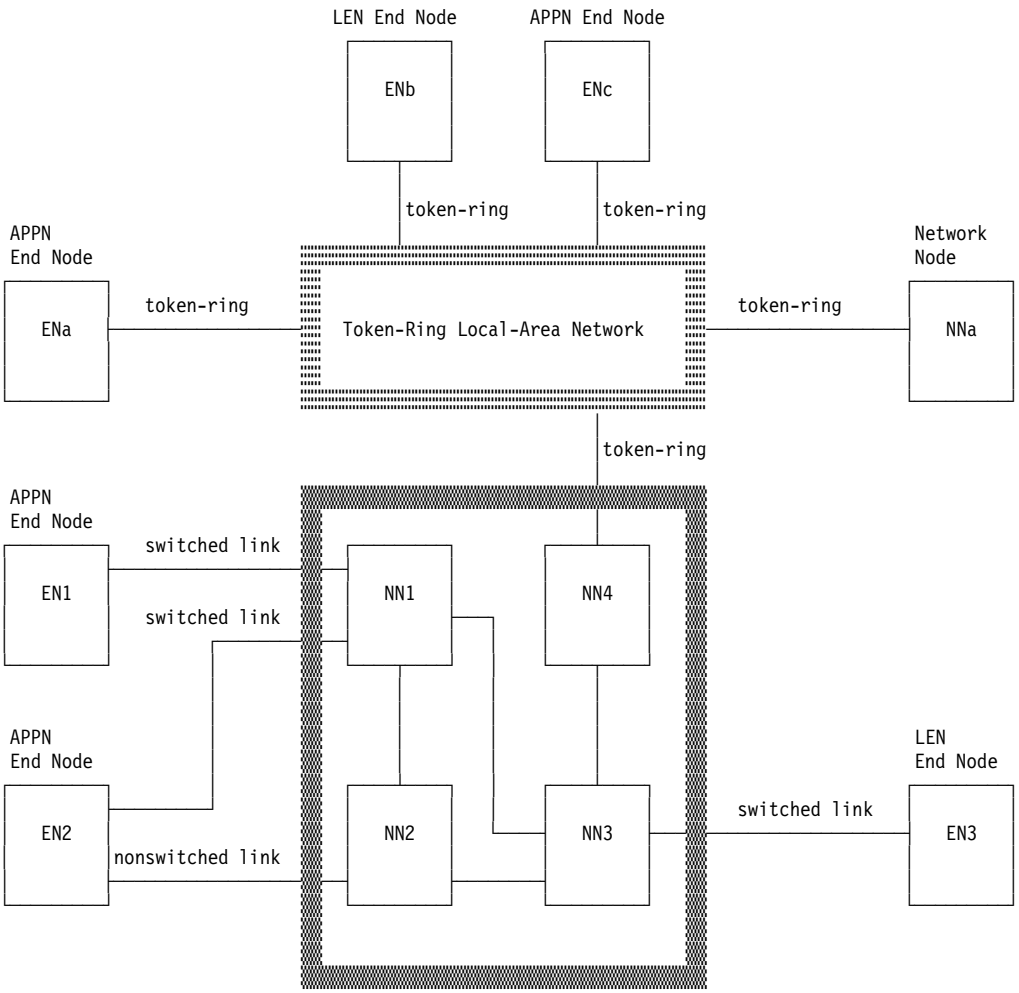
  for registering of resources and locate requests

Notes:

The first figure shows the simplest configuration, where no intermediate session routing is necessary. This configuration may consist of any combination of nodes. LEN-LEN, EN-LEN, EN-NN, etc...

In the second configuration a Network Node is needed for intermediate session routing. Since EN2 has CP-CP session capability it may use APPN protocols to register its resources (LUs) with the Network Node NN1. Since EN1 is only a LEN node, it cannot have a CP-CP session with NN1 and cannot utilize the dynamic registration function for EN1 resources.

Basic APPN Network

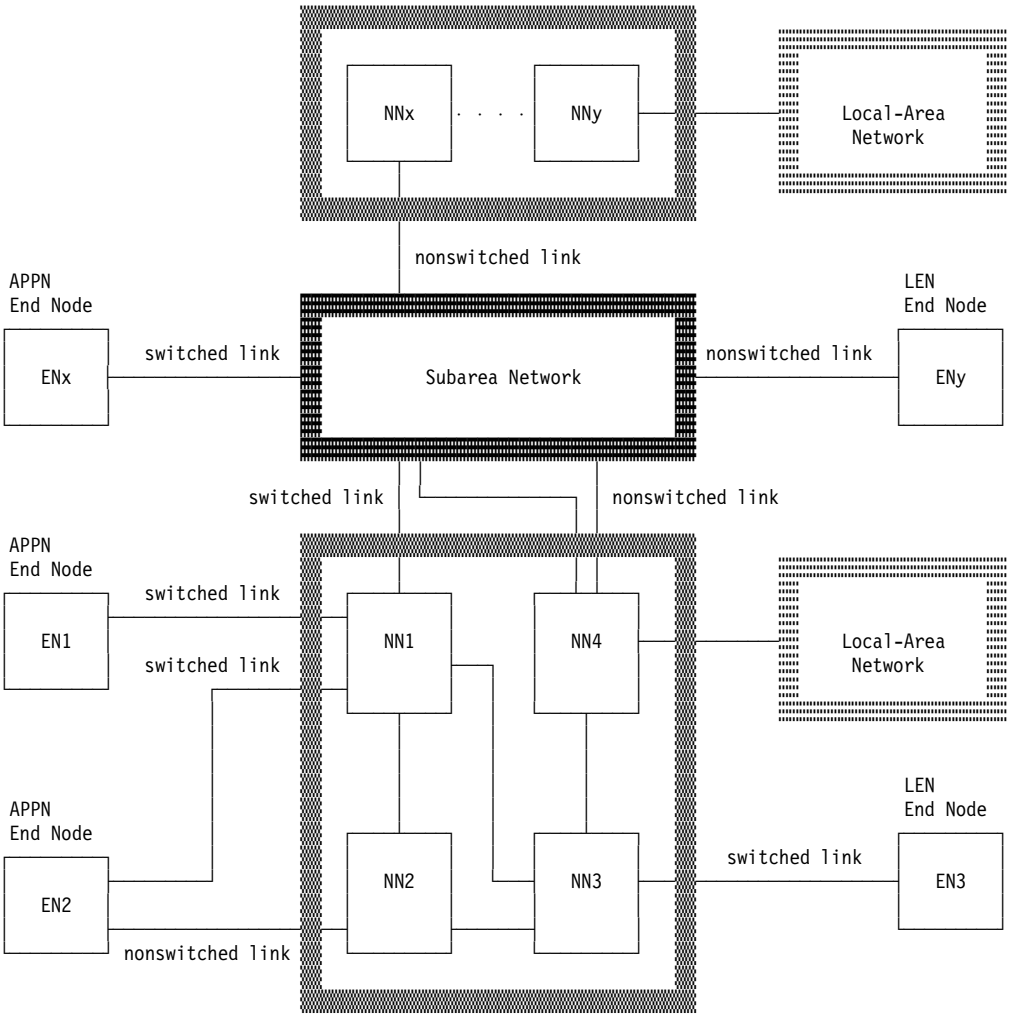


Notes:

The data between nonadjacent nodes passes through the network nodes on its way to the session endpoint, using a function called *intermediate session routing*. Each intermediate network node maintains awareness of all sessions traversing it, just as a boundary node in a subarea network does. Indeed, in both cases, a *session connector* exists in the APPN network node and subarea boundary node for each traversing active session. The session between two endpoints consists of *session stages*, each stage delimited by a half-session and an intermediate session connector, or by two session connectors, depending on the number of intermediate nodes with session awareness.

The devices attached to the LAN may use *Connection Network* definitions to enable NNa to calculate the most direct route between ENa and ENc. This is the direct connection between the two LAN adapters. If no connection network (also called virtual routing node) would be defined, the calculated route for ENa and ENc would go through NNa (sending data twice on the tokenring).

APPN Attachment to Subarea Network (LEN)

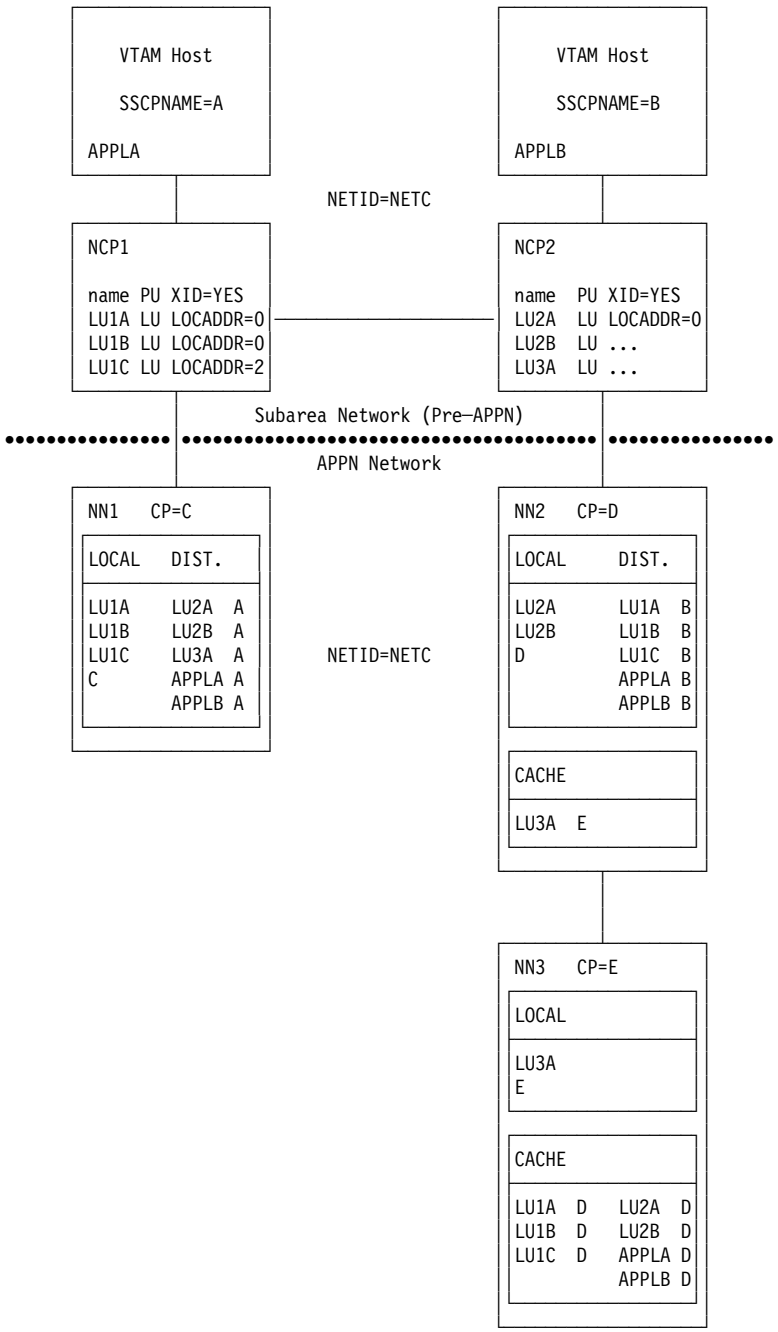


Notes:

If an APPN network is attached to a subarea network by LEN connections (this was the only possibility before VTAM V4R1 and NCP V6R2), the subarea network appears to attached APPN nodes as a single LEN node. Since LEN nodes do not have a CP-CP session capability, they cannot register their resources with the attached Network Node server. This again means that there is a higher manual definition effort necessary to make resources known in the network.

As soon as no LEN nodes are in the network anymore, no node needs to define resources that are located in other nodes. All these **resources will be found dynamically** within the network. Therefore it is strongly recommended to migrate LEN nodes to EN or NN whenever possible. (Note that NS/DOS currently still implements a LEN node only and that the RS/6000 announced that it will support EN and NN).

Definition of T2.1 Resources (LEN)

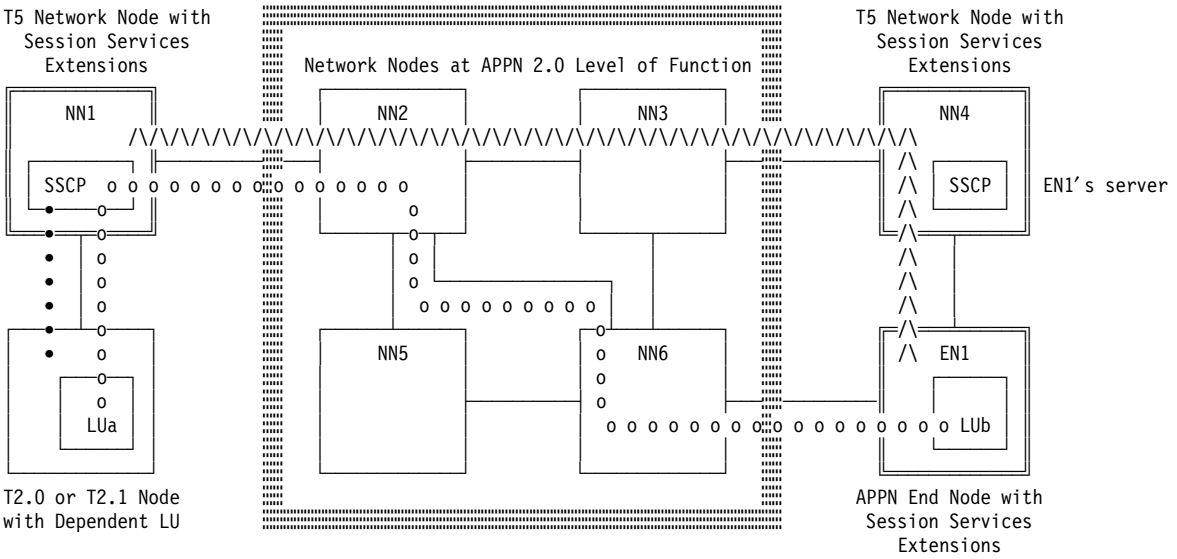


Notes:

Because VTAM before V4R1 and NCP before V6R2 are LEN node implementations they cannot communicate via CP-CP sessions to the NNs in the APPN network, to register their LUs. These LUs have therefore to be manually defined in the remote directory of the attached NN (either by full name or with wildcard entries).

LEN nodes cannot see beyond their adjacent nodes. Therefore all the nodes behind (and including) the adjacent node are seen as one (big) LEN node. E.g. NCP2 sees only one (combined) T2.1 node downstream which contains all LUs of NN2 and NN3 (LU2A, LU2B and LU3A). An ACTPU can therefore only be sent to NN2 and not to NN3. Therefore NN3 cannot contain any dependent LUs. All LUs in NN3 must be independent. The NN2 sees the subarea network and NN1 as one (and only one) T2.1 LEN node. No CP-CP session is possible between NN2 and NN1. Similarly NN1 sees the subarea network and NN2 and NN3 as a single LEN end node.

Session Services Extensions



Key:
/\/\/\ Path of Locate search and session initiation protocols
o o o Path of LU-LU session
●●●●●● SSCP-PU and SSCP-LU sessions

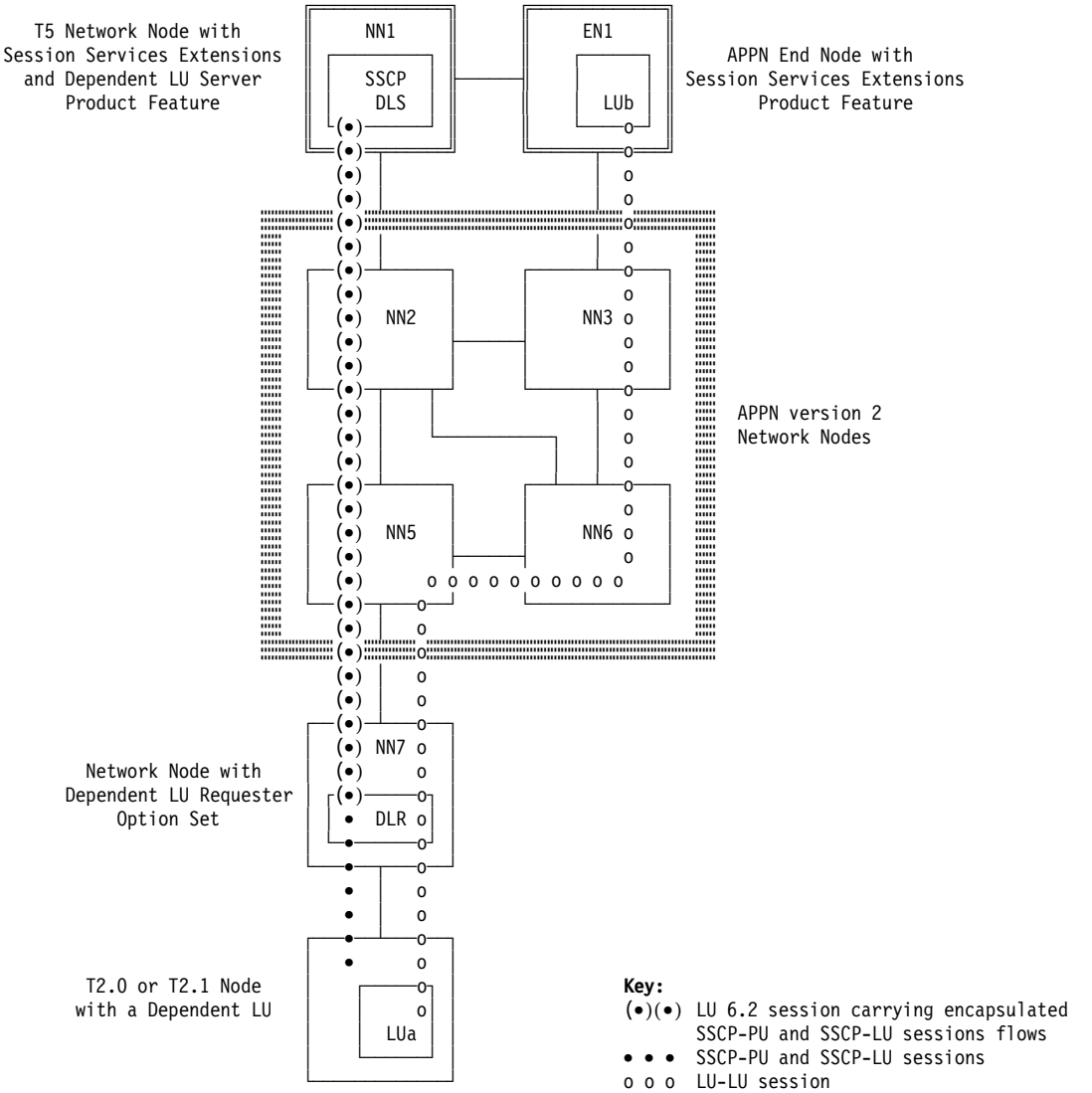
Notes:

APPN network nodes may provide intermediate session routing for LU-LU sessions between dependent LUs, if the dependent LUs are in, or adjacent to, a subarea boundary node through which SSCP services are provided.

Session Services Extensions

APPN end nodes and network nodes may optionally support some session services extensions. These extensions allow LU-LU sessions between dependent LUs to be set up across an APPN network using APPN protocols. These protocols are transparent to ordinary intermediate network nodes. A network node on the path between two network nodes that support session services extensions may find itself routing dependent LU-LU session traffic between a primary LU (PLU) and secondary LU (SLU). (SSCP-PU and SSCP-LU traffic to a dependent SLU still requires that the subarea boundary node through which SSCP services are provided be adjacent to the T2.0 or T2.1 node where the affected dependent SLU resides—a temporary restriction of current APPN architecture.) An APPN end node supporting session services extensions requires a network node server that also supports the extensions, in order to make use of any of the functions. These new protocols support existing application programs′ invocation of functions that have been available in subarea networks, such as third-party-initiated sessions, SLU-initiated sessions, queuing for partner LU availability, monitoring session limits, automatic logon, requesting that an LU release a session, and session-status notification.

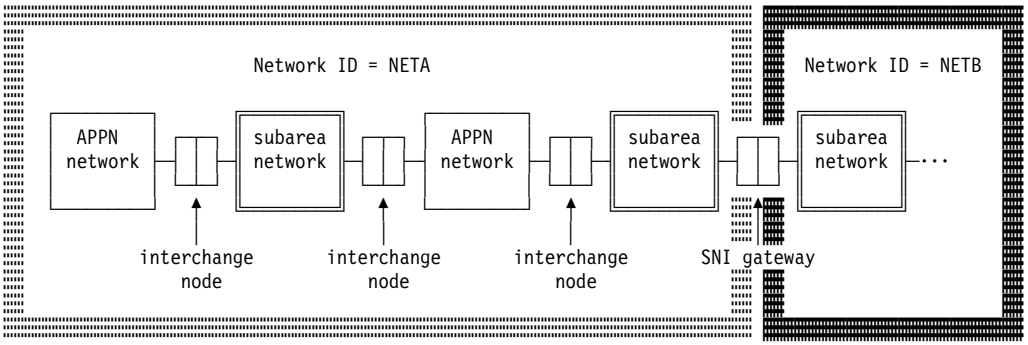
Dependent LU Server/Requester



Notes:

APPN network nodes provide intermediate session routing for LU-LU sessions between dependent LUs that are not adjacent to a node where SSCP services are provided, if the node where the SSCP resides supports the *dependent LU server* product feature and the dependent LU is either in or adjacent to a node supporting the *dependent LU requester* option set.

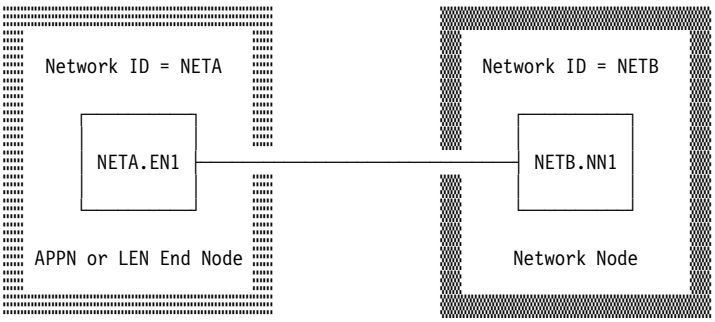
Interchange Nodes connecting Subarea and APPN

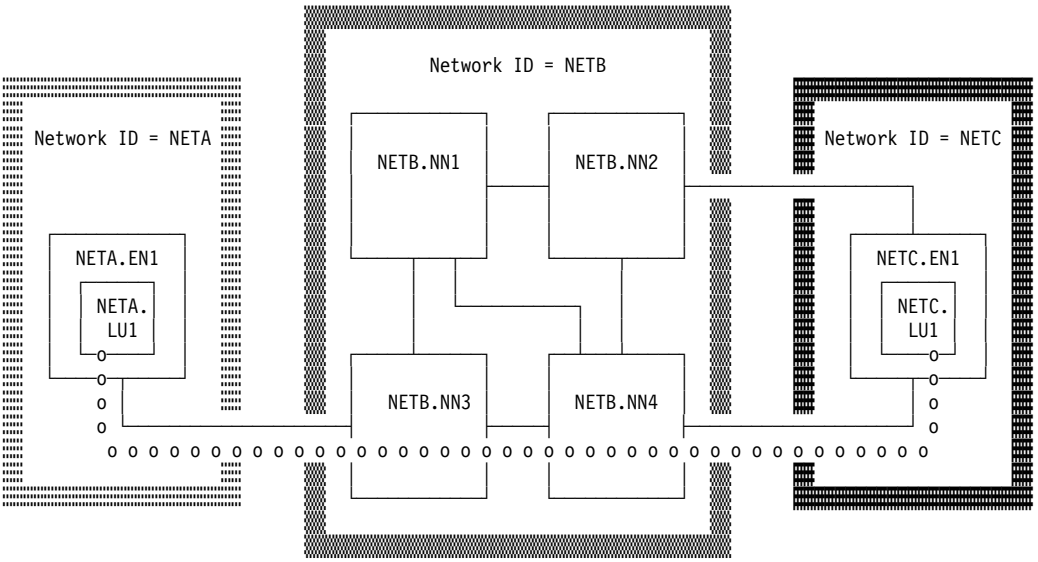


Notes:

An interchange node permits the use of APPN Locate search protocols to establish LU-LU sessions across arbitrarily-connected APPN and subarea networks, with no restrictions on where the session endpoints are located. For example, one LU may be in a subarea network and its partner LU in an APPN network; or both LUs may be in different APPN networks; or both LUs may be in different subarea networks. This avoids the system definition needed in a subarea boundary node and improves the dynamics of the mixed network environment. An interchange node permits session establishment across any combination of APPN and subarea networks, including SNA network interconnection (SNI) gateways. While the network shown in this figure may appear unusual, it illustrates a key design point of the interchange node to permit migration of an existing subarea network to APPN on a node-by-node, link-by-link basis without a need for network-wide coordination. This figure depicts an intermediate step in this migration.

Nonnative Network Attachments





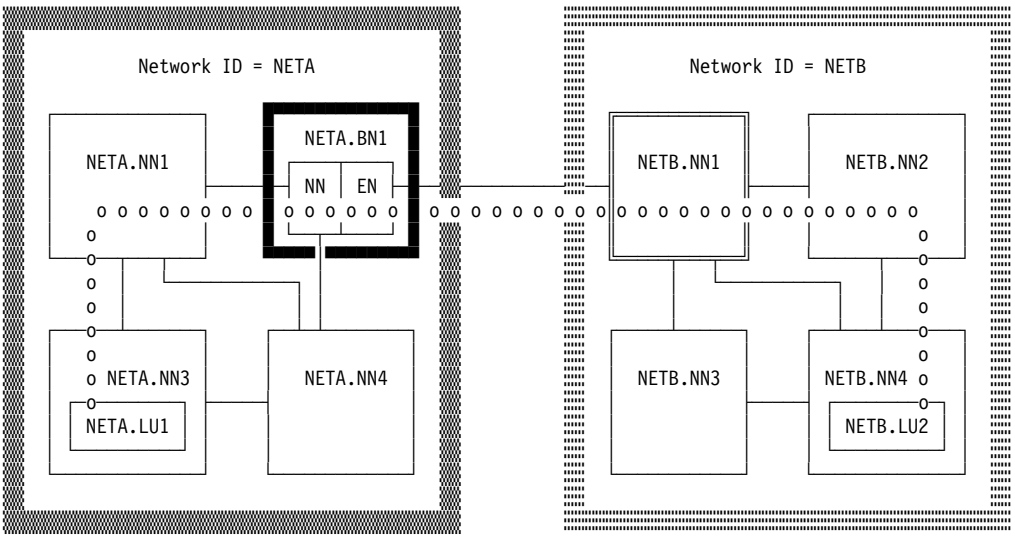
Key: o o o Path of cross-network LU-LU session

Notes:

An end node may connect to a network node server with a different network ID from its own, a capability allowing an end node to dial into different APPN networks as needed. Such an attachment is called a *nonnative* attachment. The previous figures illustrate such a nonnative attachment.

Because all network nodes support these nonnative attachments to end nodes, end nodes with different network IDs can establish LU-LU sessions through APPN networks to which both are nonnatively attached.

Peripheral Border Node



Key:

o o o Path of cross-network LU-LU session through a peripheral border node

Peripheral border node

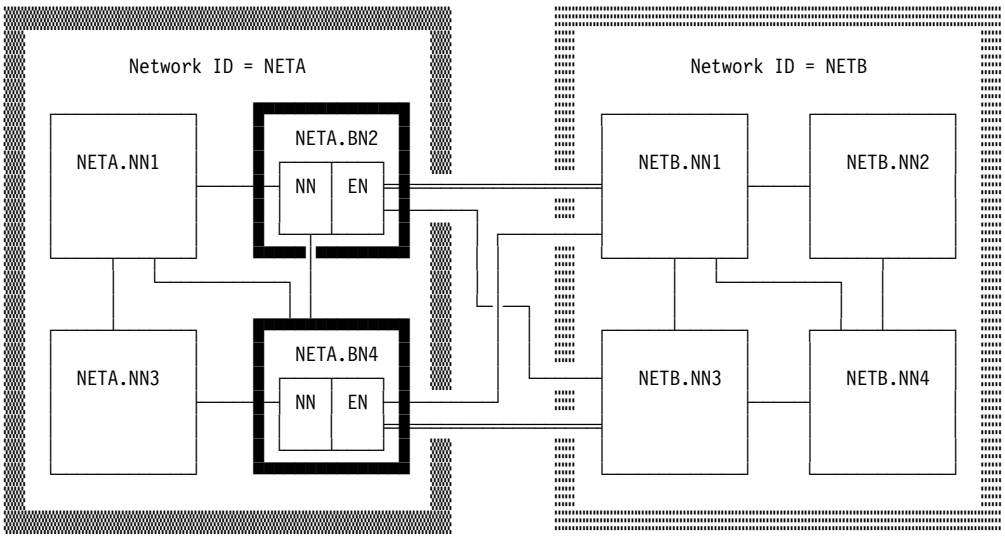
Network node with function set 1013 (Interoperability with Peripheral Border Node)

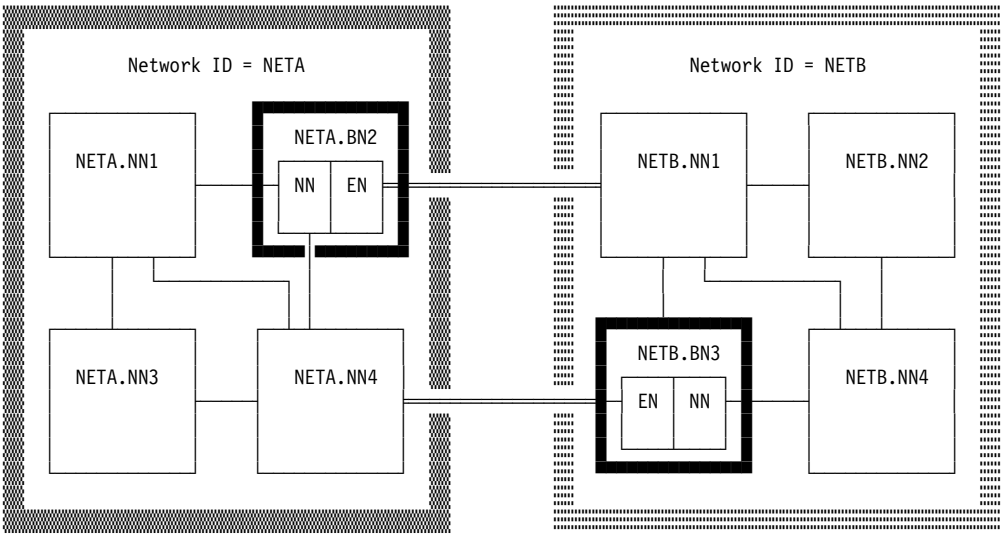
Notes:

Network nodes attach to one another *natively*; i.e., two attached network nodes have the same network ID. APPN networks having different network IDs are said to be *nonnative* with respect to each other. One way nonnative APPN networks can be interconnected is by a peripheral border node.

NETB.NN1 does require function set 1013, because a peripheral border node appears as an APPN end node to any network node to which it is nonnatively attached. Function set 1013 provides support in a network node for the cases where a Peripheral border node is not quite identical to an APPN end node.

Peripheral Border Node (cont.)

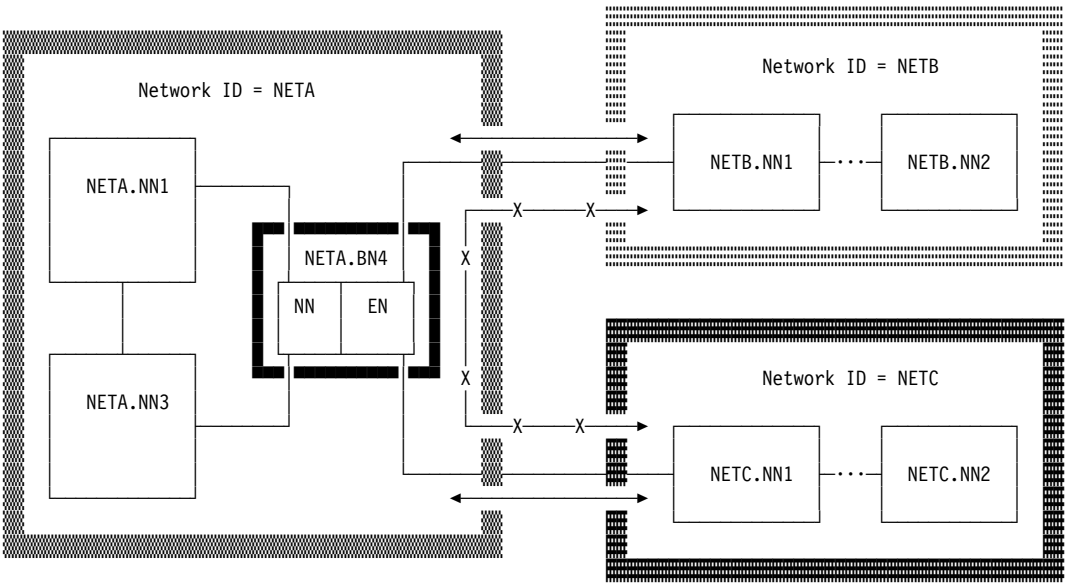




Key:

CP-CP sessions permitted
Peripheral border node

Peripheral Border Node Restrictions

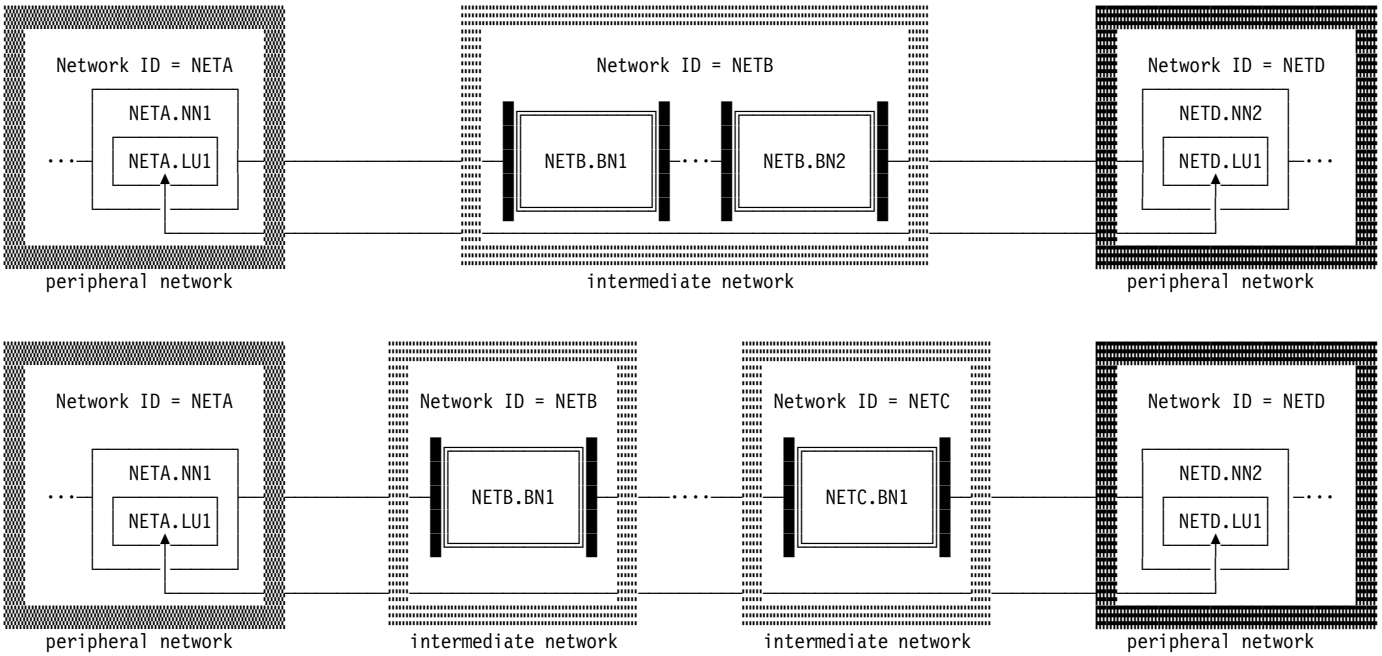


Key: ◄——► Adjacent subnetwork LU-LU sessions permitted
◄—X—► Intermediate network routing not supported

Notes:

A peripheral border node can support a session between pairs of LUs residing in NETA and NETB, and between pairs of LUs residing in NETA and NETC. A peripheral border node **does not support** intermediate network routing between LUs in NETB and NETC. For this kind of function an Extended Border Node is needed.

Extended Border Nodes



Key:

Cross-subnetwork LU-LU session with intermediate network routing by one or more extended border nodes

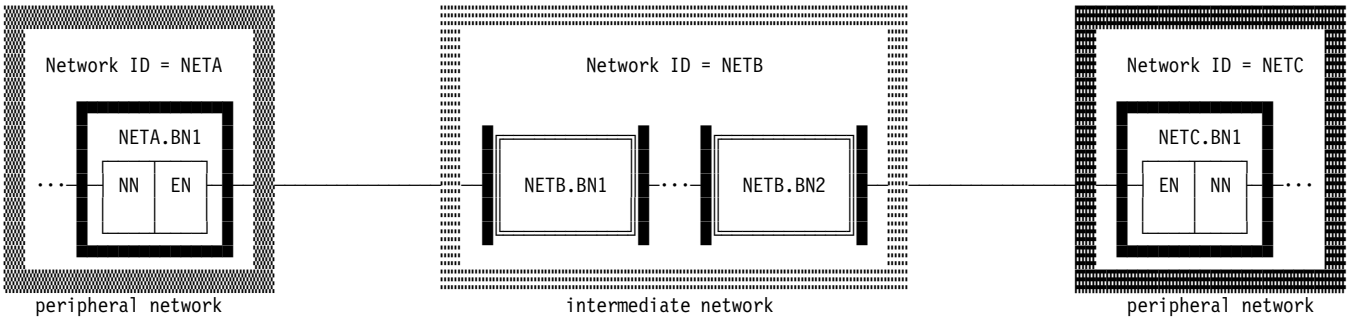
Extended border node

Notes:

Unlike a peripheral border node, an extended border node permits intermediate network routing. It also supports the partitioning of a single NETID subnetwork into isolated topology subnetworks, or *clusters.*

An extended border node permits cascaded network configurations. A network that performs intermediate network routing has at least one extended border node. An APPN network containing an extended border node is called an *intermediate routing network,* or simply *intermediate network.* An APPN network that does not support intermediate network routing is called a *peripheral network.* A network node, peripheral border node, or extended border node in a peripheral network attaches to an extended border node in an intermediate network. A network node attaching a peripheral network to an intermediate network is called a *peripheral network node.* More than one peripheral network may attach to a single extended border node.

Peripheral and Extended Border Nodes

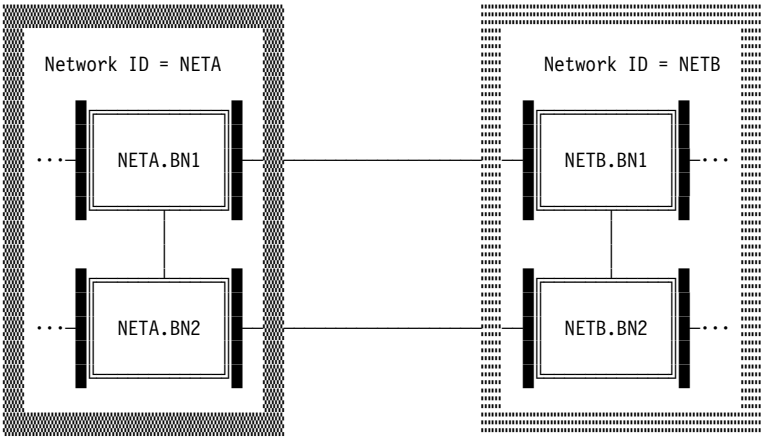


Key:

peripheral border node

extended border node

Parallel Extended Border Nodes



Key:

Extended border node

Notes:

Peripheral Border Node capability is provided by the AS/400 since 1991.
Extended Border Node capabilities will be provided by VTAM V4R2.
Central Directory Server functionality is provided by VTAM V4R1.

Hints and Tips

- ## Use Central Directory Server(s)

  To eliminate most of the broadcast searches.

- ## Decide which nodes should be NNs and which ENs

  If possible, define nodes that are frequently restarted/powered up and down, as End Nodes to avoid in large networks unecessary Topology Updates. Smaller networks (e.g. 50 nodes) should have no problems if all nodes are Network Nodes.

- ## Use ENs rather than LENs

  When a product support LEN and EN capabilities, use preferrably EN to cut down on LU definitions, by letting the LUs being registered automatically via the CP-CP sessions.

- ## Use standard Mode and COS names

  These standard names should satisfy 90% of the installations.
  If you use other names you may need to coordinate these names with other nodes and modify additional tables (e.g. MODE to COS correlation table in 3174).

- ## Use standard COS tables

  The standard entries should satisfy 95% of the installations. Use them until it's clear they do not meet your requirements (e.g. you want to select specific links). Change them only if you know what you are doing.

- ## CP names may be used as normal application LUs

  This would cut down definitions and searches.

- ## Do not use special characters in NETIDs

  E.g. # is not supported in some implementations

Hints and Tips (cont.)

- ## Don't define unnecessarily LAN 'links'

  E.g. on a token ring most implementations allow that only one of the
  two T2.1 nodes involved in XID3 exchange need to define the link with
  the MAC address of the partner. E.g. define the link from the EN to the NN
  and not vice versa, since the NN to EN link will be defined dynamically.
  Utilize also Connection Network definitions, to cut down definitions and traffic.

- ## Don't define anything you do not have to define

  Utilize the full dynamics that APPN offers.

- ## Use APING to check initial connectivity

  Is on CD-ROM 'The Best of APPC, APPN, and CPI-C' (SK2T-2013).

- ## Subscribe to the 'APPC Connection' Newsletters

  Contains good information on APPC and APPN issues. You can subscribe via:
  CompuServ: 76711,370, USIB23NQ at IBMMAIL, or appcnews@vnet.ibm.com
  to receive free copies of the bi-monthly issues.

- ## Use 'Multiplatform APPC Configuration Guide'

  Contains samples and correlations of configuration parameters for:
  OS/2 CM/2, NS/DOS, AS/400, AIX SNA Services/6000, APPC/MVS/VM, CICS, etc.
  To get a free copy ask your SE to fetch the file MPCONFIG PACKAGE from MKTTOOLA.

Bibliography

LU6.2, APPC, CPI-C

GC30-3084 SNA Transaction Programmer's Reference for LU Type 6.2
SC30-3269 Format and Protocol Reference Manual: Architecture Logic for LU 6.2
SC30-3400 VTAM Programming for LU 6.2
SC31-6808 SNA LU 6.2 Reference: Peer Protocols
SC21-9598 AS/400 Communications: APPC APPN User's Guide
S90X-7950 OS/2 Extended Edition APPC Programming Reference
G326-0161 Extended Services for OS/2 Information and Planning Guide
GG22-9105 Advanced Architectured APPC, SNADS, DIA, AND DCAL
GG22-9137 Low Entry Networking and APPC
GG24-3034 Introduction to Programming for APPC/PC
GG24-3297 VTAM APPC API Scenarios and Programming Experiences (flows, samples, traces)
ZZ81-0231 Practical Conversations with APPC (samples, traces)
GG24-3372 Using the Enhanced Connectivity Features of VM/SP R6 (CPI-C sample)
GG24-3482 Program-to-Program Communications in SAA Environments (samples)
GG24-3520 APPC and CPI-C Product Implementations
GG24-3596 MVS/ESA APPC/MVS Technical Presentation Guide
GG24-3768 OS/2 and CICS/ESA: Implementation Example with CPI-C Communications
GG24-3818 APPC Programming Considerations in MVS/ESA and OS/2
GG24-3819 APPC Application Examples in MVS/ESA and OS/2
GG24-3863 APPC/MVS Server Facilities Presentation Guide
GG24-3895 MVS/ESA and CICS/ESA: APPC Programming and Definitions
GG24-3960 APPC Security: MVS/ESA, CICS/ESA, and OS/2
GG66-3224 APPC System Definitions in MVS/ESA and OS/2
G325-0055 The APPC Resource Book (courses, books, appls., dev.tools, etc.)
SK2T-2013 The Best of APPC, APPN, and CPI-C (CD-ROM with source programs)
VMTOOLS   CPICTALK PACKAGE (CPI-C presentation)
VMTOOLS   CPICTRY PACKAGE (CPI-C learning package)
VMTOOLS   CPICRPC PACKAGE (CPI-C samples)
MKTTOOLS APPCINFO PACKAGE (various information on APPC)
MKTTOOLS APPCNEWS PACKAGE (bi-monthly flashes on APPC)
Q&A   GERHONAA05X9 (APPC sample CICS/VSE - REXX under CMS)

Bibliography (cont.)

Type 2.1 node, LEN, APPN, subarea connectivity

LY30-5605 NCP/EP Reference
SC30-3422 APPN Architecture Reference
SC41-8188 AS/400 Communications: APPN Guide
GA27-3918 3174 Planning Guide Config. Support C
GG66-0283 A Technical Overview: VTAM V3R2, NCP V4R3, NCP V5R2
GG24-3121 VTAM V3R2 and NCP V4R3. Planning Guide for New Functions
GG66-3157 A Technical Overview: VTAM V3R3, NCP V5R3
GG24-3491 NCP V5R3 Planning and Migration Guide
GG24-3433 Enterprise Networking with SNA T2.1 Nodes
GG66-0299 SNA T2.1 support
GG24-3364 APPN/SA Networking. Design and Interconnection considerations
GG66-0216 SNA Networks for Small Systems
GG66-3161 Networking with AS/400s in an SNA Network
GG24-3420 AS/400, S/38 and PS/2 as T2.1 Nodes in a Subarea Network
CB11 Advanced SNA Communication Architecture
CB14 VTAM/NCP Technical Update
GG24-3574 VTAM V3R3/NCP V5R3 Implementation Guide
GG24-3569 VTAM V3R4 Planning Guide for New Functions
GG24-3691 VTAM V3R4 Implementation Guide
GG24-3669 APPN Architecture and Product Implementations Tutorial
GG24-3662 NS/2 Installation, Customization, and Operation. APPN for OS/2
GG24-3702 3174 APPN Implementation Guide
GG24-3717 APPN with AS/400, PS/2, 3174 and Subarea Networking
GG24-3816 High-Speed Networking Technology
GG24-3876 Extended Services for OS/2 Communications Manager
GG24-3941 VTAM V4R1 Planning Guide
GG24-4011 VTAM V4R1 Implementation Guide
MKTTOOLA MPCONFIG PACKAGE (Multi-platform APPC Configuration Guide)
MKTTOOLS ADVSNA PACKAGE (presentation of APPC and APPN)