IBM Software Group
Enterprise Networking and Transformation Solutions (ENTS)

Technical Review Meeting:
SNA Modernization & 3745 Elimination

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IBM Systems

Agenda

1. **An introduction to SNA modernization**
2. **Network Infrastructure Modernization: SNA Architectural Level**
3. **Modernizing a Subarea Environment: CCL Highlights**
4. **Modernizing an APPN Environment: EE Highlights**
5. **Your Configuration & Migration Goals**
6. **Discussion of 3745 Migration Alternatives**

An Introduction to SNA Modernization

Information based on:

"A Structured Approach to Modernizing the SNA Environment from a System z Perspective", SG24-7334, a Redbook planned to be made available early 4Q2006

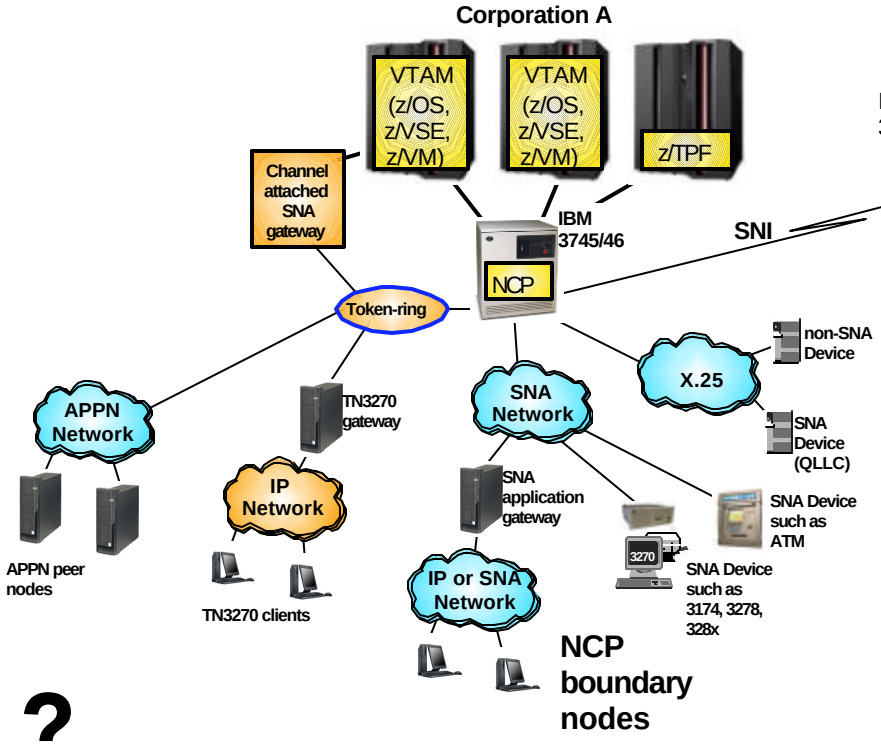
SNA modernization is about preserving SNA applications, not replacing them

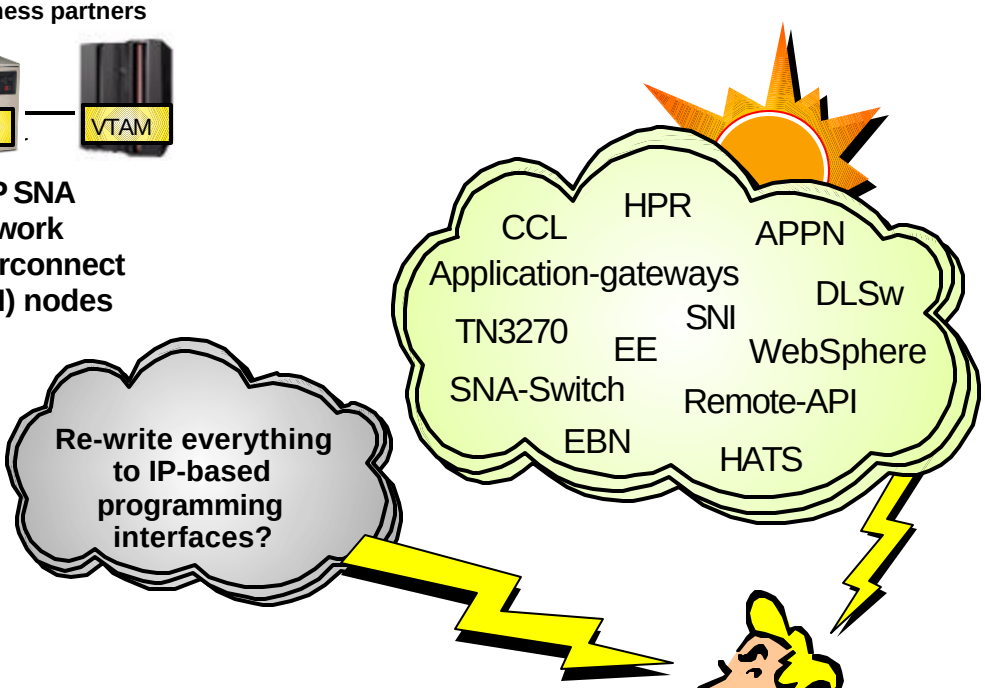
- **Analysts estimate that 200 billion lines of COBOL code exist today**
  - 5 billion lines are added each year
  - Similar inventory of PL/I code
- **The typical mainframe customer has:**
  - 30M lines of COBOL code
  - Worth $600M
  - Automating 100,000 business processes
- **Any mainframe customer**
  - Banking, Insurance, Government, Manufacturing, Travel and Transportation, Distribution and Retail, Media and Utilities, Healthcare Industries
- **A majority (70-80% according to some studies) of these existing applications are terminal-acces based**

Consultants estimate it costs 5 times more to rewrite a business function than to re-use existing code

Modernizing SNA is not about re-writing or throwing away SNA applications. It is about preserving core SNA business applications in an IP-based network infrastructure and it is about enabling re-use of those applications in new end-user environments in an application-transparent manner.

SNA networks and SNA applications in 2006 and beyond - what are the questions that need to be addressed?





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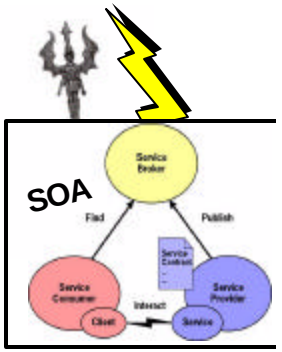
How do I modernize my SNA environment and maintain reliable and cost-efficient access to mainframe core SNA business applications and business partners with an aging SNA networking infrastructure?

- IBM 3705, 3720, 3725, and 3745/46 Communication Controller
- Token-ring technology in general
- ESCON channel-attached SNA controllers from various vendors (including Cisco CIP and CPA)
- IBM 2210, 2216, and 2217 Nways Multi-protocol Routers
- AnyNet
- OS/2 and its CS/2 communications component

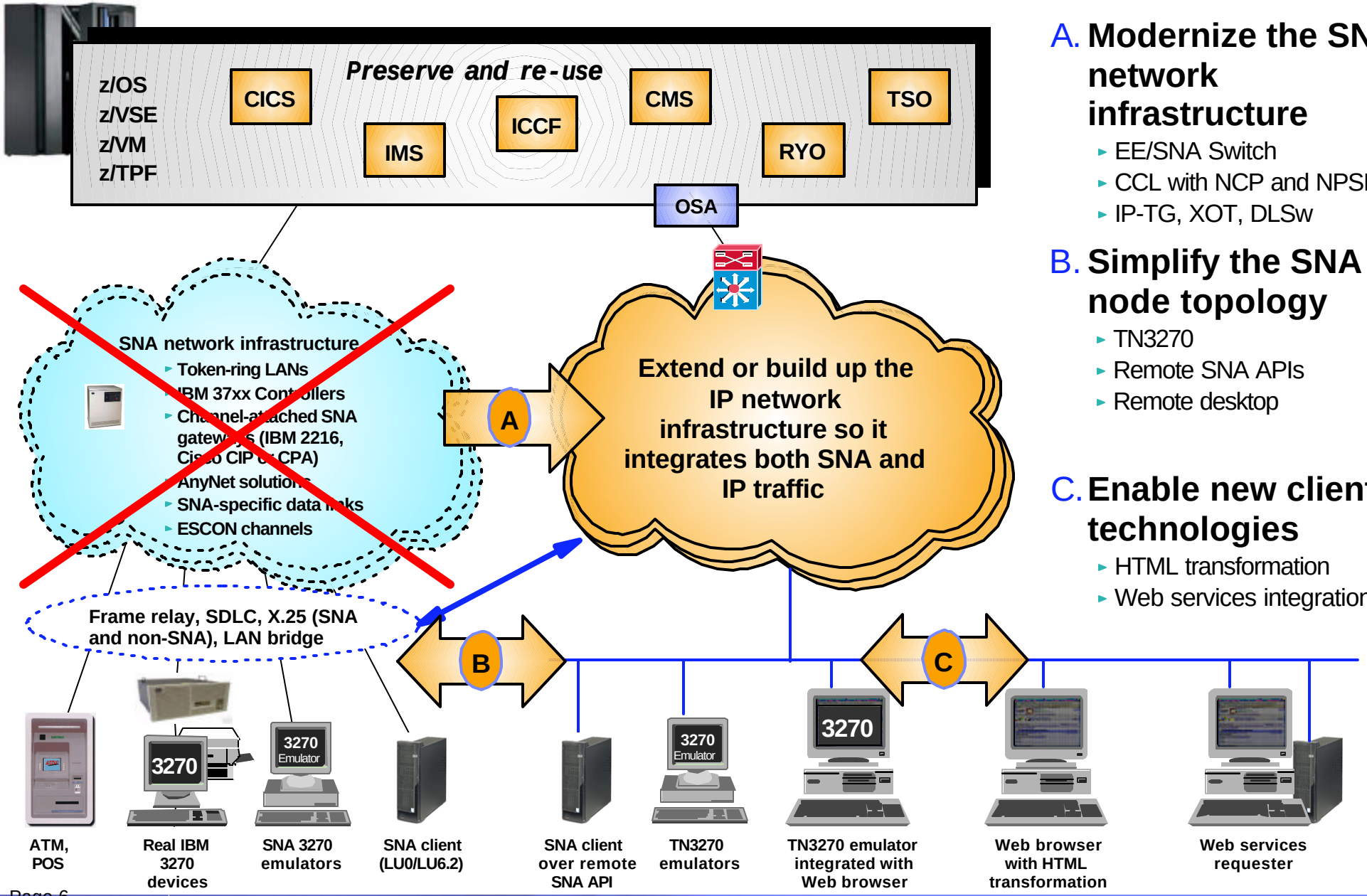
?

How do I protect the investments made in core SNA business applications and re-use those applications from new and emerging end-user environments and integrate them into new application architectures, such as a services-oriented application architecture (SOA)?

- Transforming SNA application data stream to HTTP(S)/HTML to integrate use of SNA mainframe applications in browser-based client environments?
- Exposing SNA applications as Web services, tranforming the SNA application data stream to SOAP/XML and integrating these SNA applications into new business processes composed of Web service elements?



A high-level view of SNA modernization



A. Modernize the SNA network infrastructure

- EE/SNA Switch
- CCL with NCP and NPSI
- IP-TG, XOT, DLSw

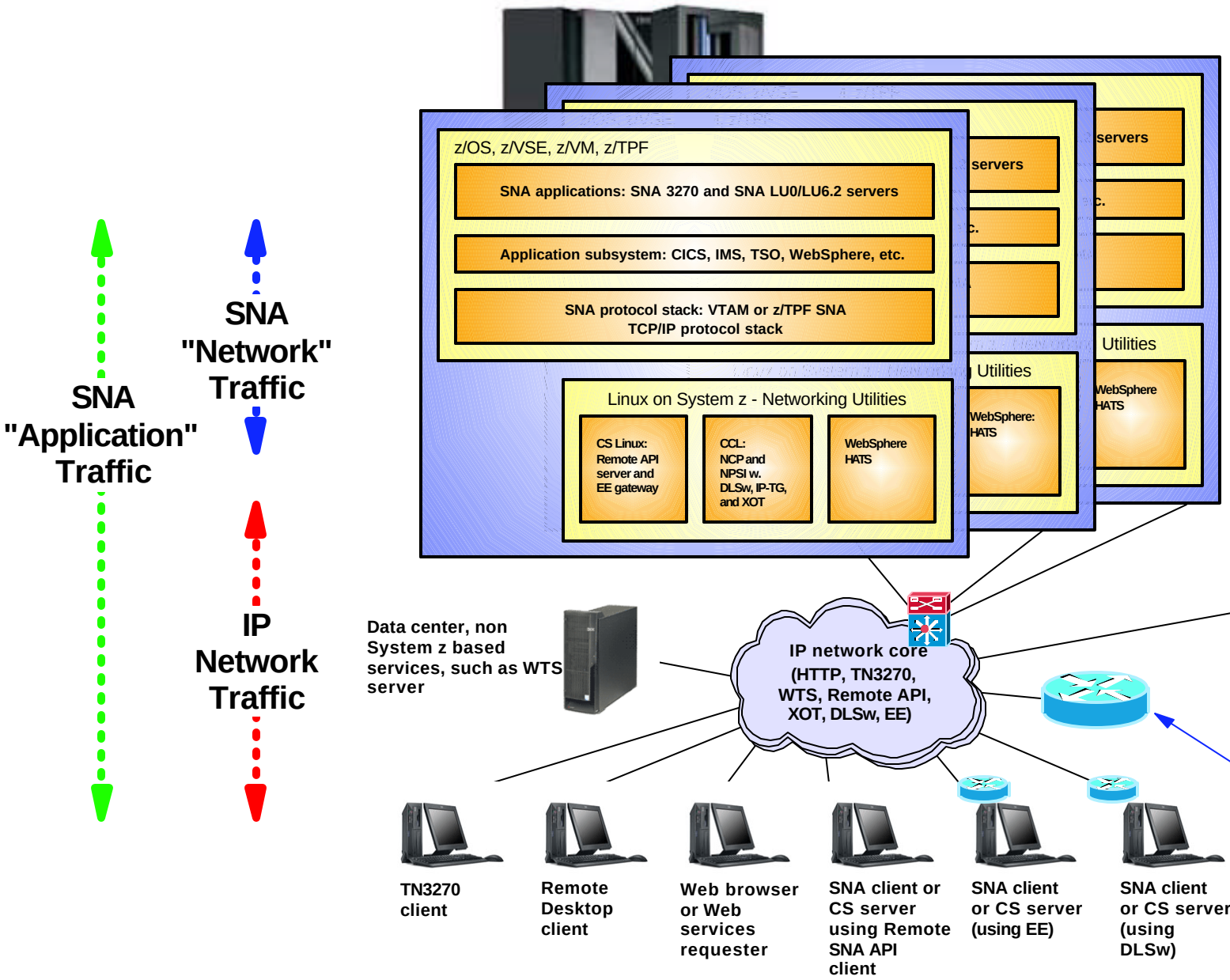
B. Simplify the SNA node topology

- TN3270
- Remote SNA APIs
- Remote desktop

C. Enable new client technologies

- HTML transformation
- Web services integration

SNA without an SNA wide area network



- SNA application traffic across the IP-based enterprise network infrastructure.
- SNA network traffic consolidated into the data center on a few SNA-specific link types, such as MPC+ channels, XCF messaging, or the data center LAN environment.

Overall SNA modernization objectives

A. **Continued use of SNA core business applications and the way these applications are accessed:**
   1. SNA 3270 applications - real 3270 devices and through various forms of 3270 emulation
   2. SNA client/server applications - including user-written SNA LU0/LU6.2 client/server applications

B. **Provide opportunity for modernizing and simplifying the application portfolio by integrating access to SNA applications with a browser-based workstation technology and an overall application infrastructure that is based on a Services Oriented Architecture**
   1. Using a Web browser as the client - transforming SNA data stream to HTTP(S)/HTML
   2. Exposing and accessing SNA applications as Web services - transforming SNA data stream to SOAP/XML

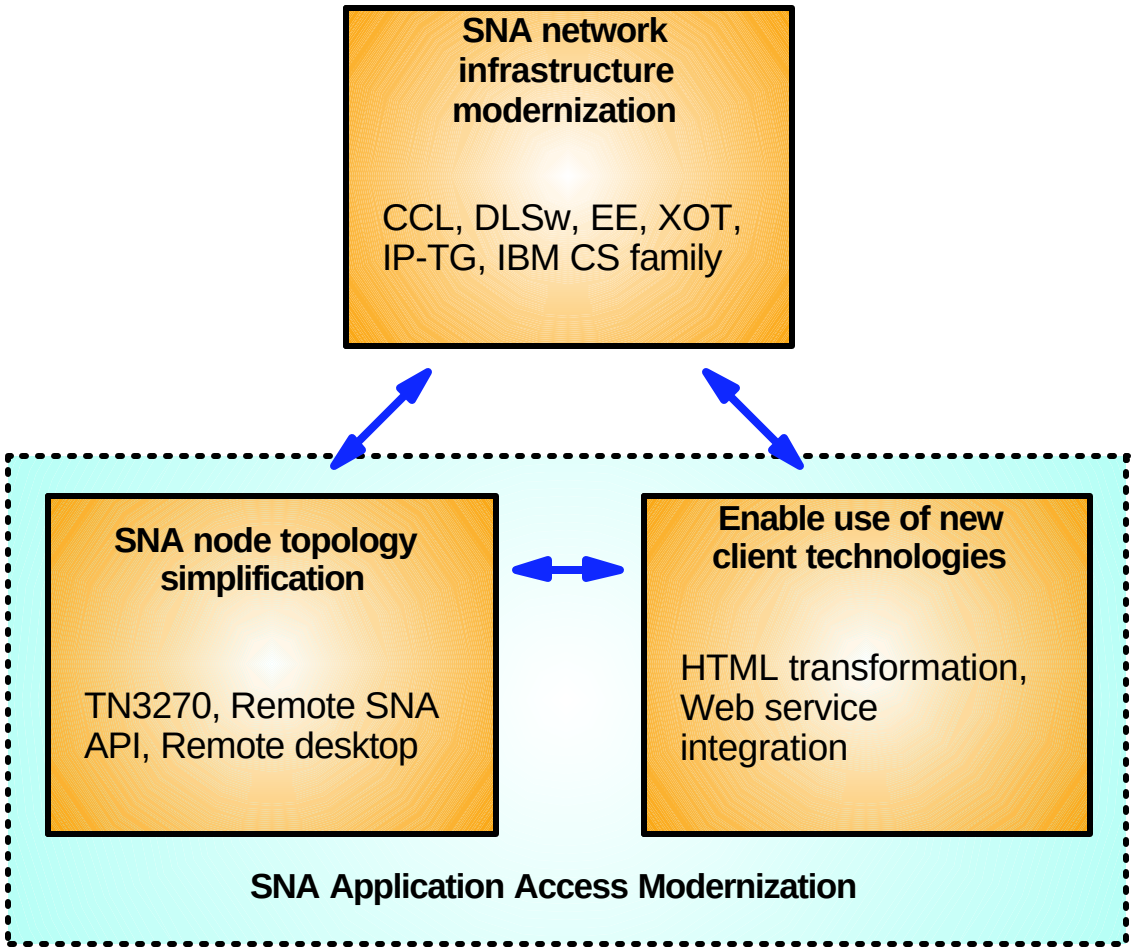
C. **Help remove dependence on an outdated SNA networking infrastructure:**
   1. IBM 3705, 3720, 3725, and 3745/46 Communication Controller hardware
   2. IBM 2210, 2216, and 2217 Nways Multi-protocol Routers
   3. IBM AnyNet software technology in general
   4. OEM ESCON channel-attached SNA gateways, such as Cisco CIP and Cisco CPA
   5. Token-ring LAN technology in general

D. **Help reduce the overall cost of the enterprise networking environment by simplifying the enterprise networking infrastructure so both SNA-based and IP-based application services share a common high-capacity, scalable, reliable, and secure IP-based transport network that provides both enterprise-wide connectivity and inter-enterprise connectivity**

E. **Assist in reducing the need for SNA skills requirements in the overall enterprise network**

Structuring SNA modernization activities

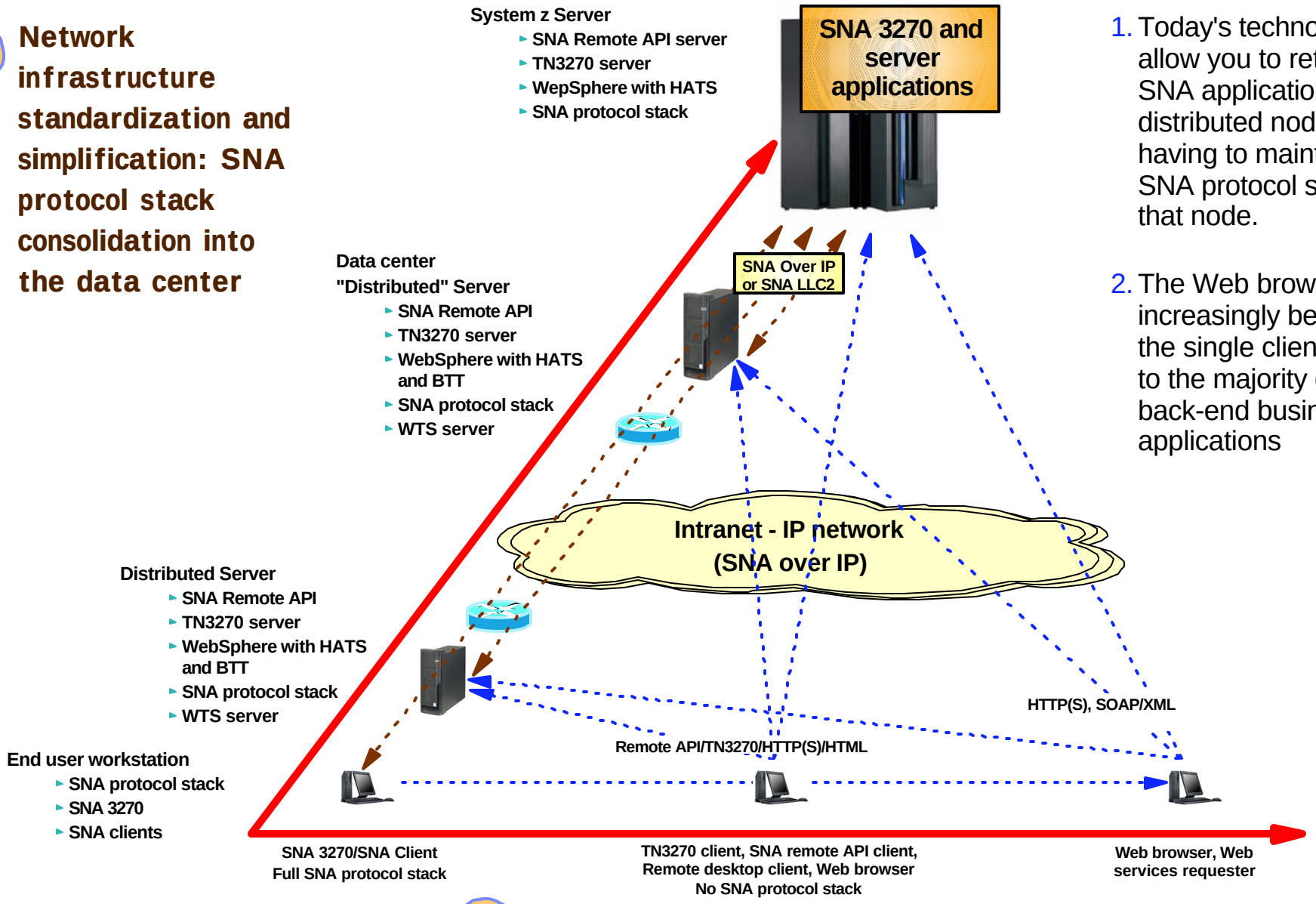
The three groups of SNA modernization activities are distinct groups of activities, yet very much related:



- **SNA network infrastructure modernization**
  - Updating the SNA network infrastructure to remove dependence on outdated SNA-specific hardware technologies - instead using a state-of-the art network technology that is based on a shared high-speed, secure, reliable, and highly available IP-based network topology for transporting both SNA and IP application traffic end-to-end.
- **SNA application access modernization**
  - Enabling continued use of both SNA client and server applications in their current form over a modernized network infrastructure, while at the same time allowing access to SNA-based server applications to be integrated into new client environments such as a Web browser, and into modern application environments, such as those based on a Services Oriented Architecture (SOA).
- **Do remember that by starting with SNA application access modernization, one implicitly reduces the amount of SNA infrastructure to modernize, but the overall modernization project will involve more people and may take significantly longer time.**

Two dimensions impacting SNA application access modernization

1 Network infrastructure standardization and simplification: SNA protocol stack consolidation into the data center



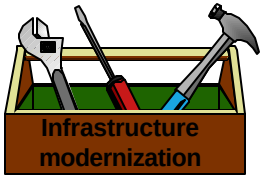
1. Today's technologies allow you to retain an SNA application on a distributed node, but not having to maintain a full SNA protocol stack on that node.
2. The Web browser is increasingly becoming the single client interface to the majority of back-end business applications

2 Client standardization and simplification

SNA modernization technology introduction

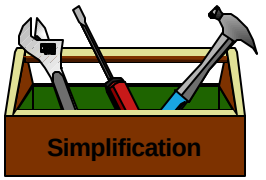
SNA network infrastructure modernization

- Primary objective is to remove dependency on old SNA-specific hardware, merge SNA and IP traffic over a common IP-based network, while preserving the existing full-function SNA end-user interfaces/functions and SNA node infrastructure in the branch and the data center.
- Technologies of primary interest:
  - APPN with High Performance Routing over IP (Enterprise Extender (EE))
  - Next-generation communication controller (Communication Controller for Linux (CCL))
  - Data Link Switching (DLSw)
  - IP Transmission Group (IP-TG)
  - X.25 over TCP/IP (XOT)



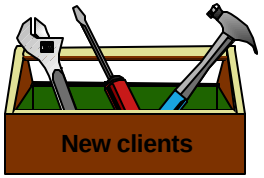
SNA node topology simplification

- Preserve existing SNA end-user interfaces and SNA client functions while at the same time providing means to remove SNA protocol stacks on workstations and branch servers, consolidating SNA protocol stacks into the data center.
- Technologies of primary interest:
  - Telnet 5250 and 3270 (TN5250 and TN3270)
  - Remote SNA API for desktop or remote server applications (split stack)
  - X-Windows or Windows Remote Desktop and Terminal Services (split GUI)



Enable use of existing SNA applications from new client technologies

- Provide ways for re-using existing SNA server applications from new client environments, such as a Web browser or a Web service requester.
- Technologies of primary interest:
  - SNA data stream to HTTP(S)/HTML transformation for use from a Web browser
  - Expose SNA applications as Web services and transform SNA data stream to SOAP/XML for use from a Web service requester and for integration into new business process workflows



SNA Network Infrastructure Modernization:
SNA Architecture Level

The SNA architecture level aspect of SNA modernization

The three SNA architecture levels:

- ***Subarea SNA*** (also sometimes referred to as traditional SNA or hierarchical SNA)
  - This is where you find an NCP along with the typical boundary functions and SNA network interconnect (SNI) functions to SNA business partners
- ***Advanced Peer to Peer Networking*** (APPN) with the original Intermediate Session Routing (ISR) routing protocol
- ***APPN with High Performance Routing*** (HPR)
  - HPR may use various types of network technologies, of which one is an entire IP network - known as HPR over IP or more commonly as Enterprise Extender

Modernizing if your SNA mainframe environment today is SNA subarea

- You can keep that subarea environment including SNI business partner communication - modernizing the SNA subarea infrastructure using CCL, DLSw, IP-TG, and XOT technologies to integrate SNA subarea traffic with your IP network
- Or you can migrate from an SNA subarea environment to an APPN environment before you start looking at how to integrate your APPN traffic with your IP network

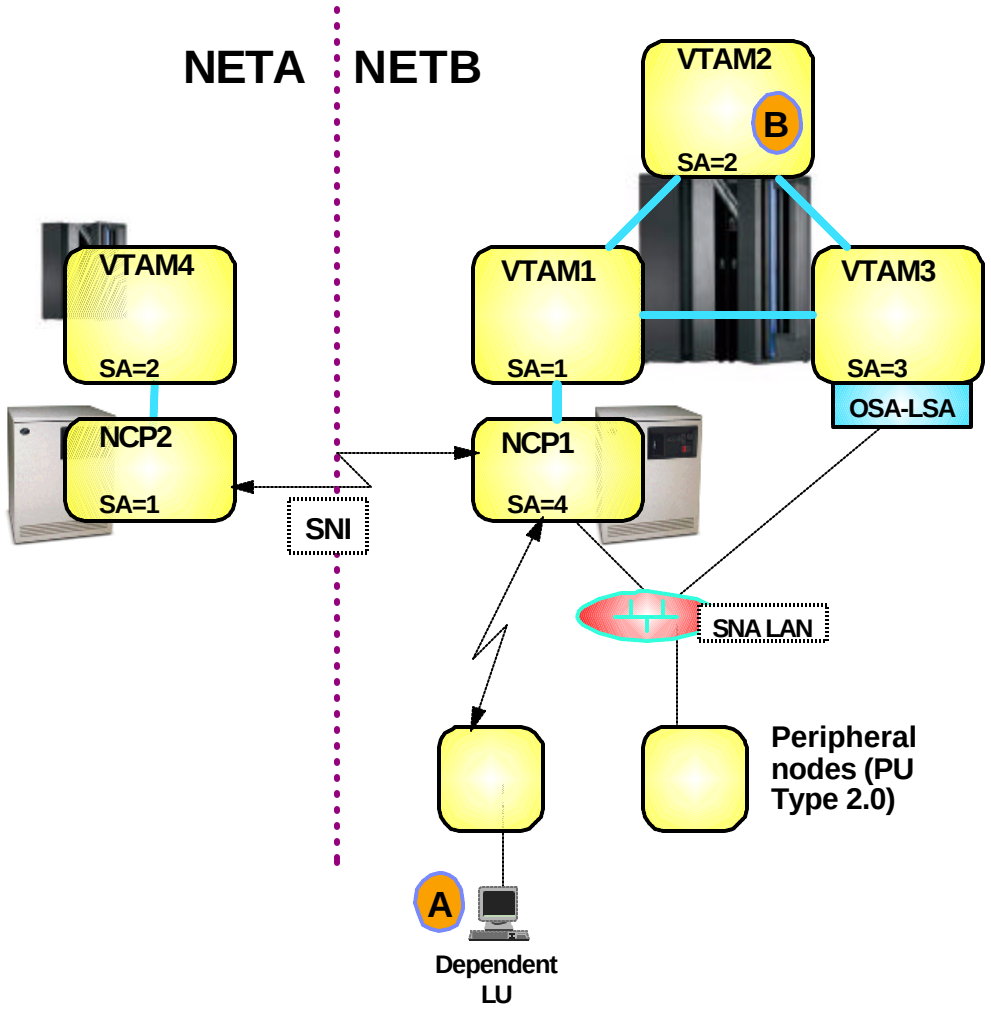
Modernizing if your SNA mainframe environment today is APPN-enabled

- You may be able to use HPR over IP (EE) to modernize the SNA APPN infrastructure and to integrate your APPN traffic with your IP network

Often it is both

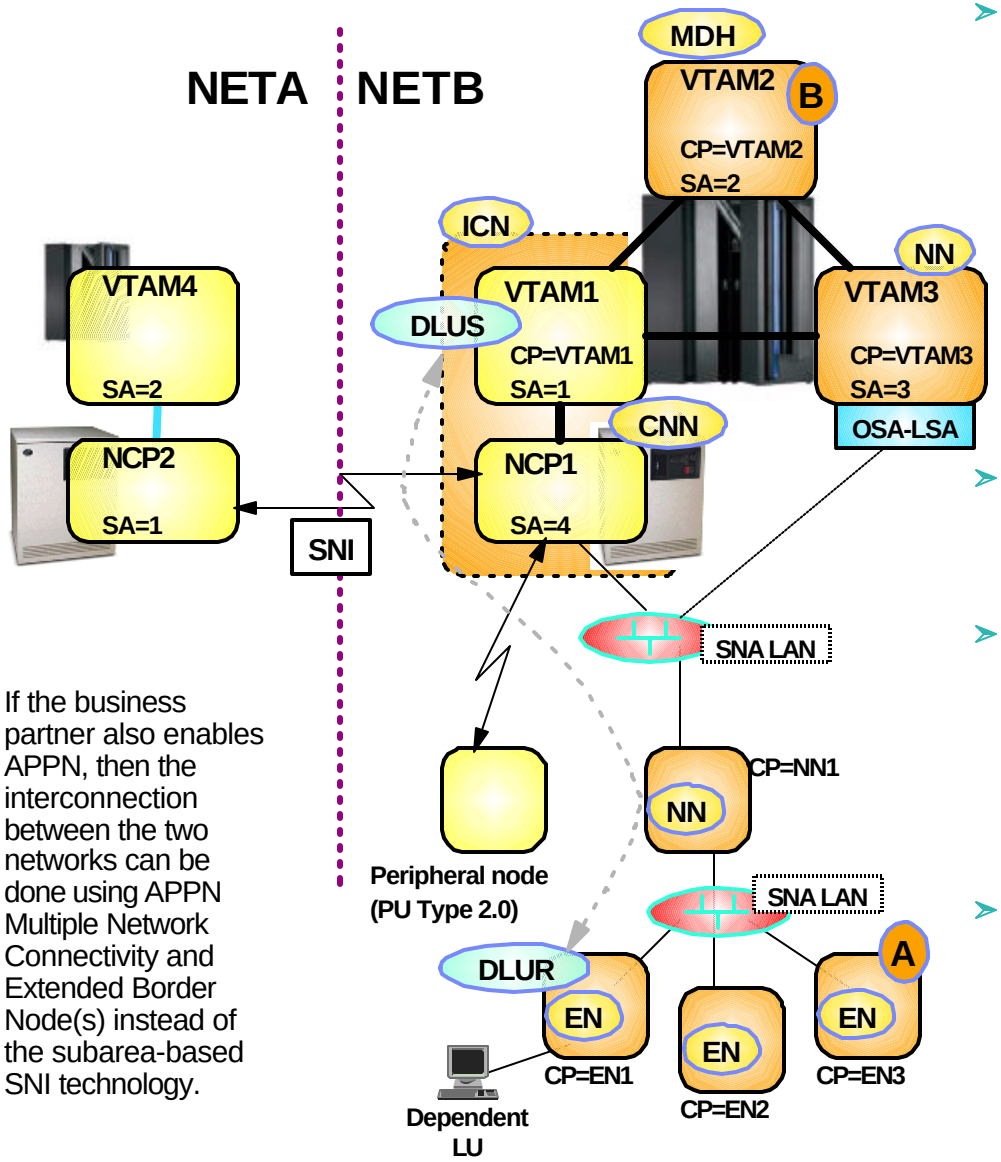
- Even with APPN enabled and use of APPN connectivity to the bulk of your SNA nodes, you may still have some SNA subarea connectivity to handle also, such as SNI connections to business partners

SNA tutorial - SNA subarea networking



- SNA nodes are either subarea nodes (VTAM, NCP) or peripheral nodes.
- All resources (nodes, links, paths) in an SNA network (a NETID) must be defined on each subarea node for it to be able to establish sessions through the SNA subarea network:
  - For application B on SA=2 to establish sessions with an SNA Logical Unit A that belongs to an SNA peripheral node attached to the NCP in SA=4, the network topology between SA=2 and SA=4 must be defined on SA=2 and the LU name A must be defined as owned by VTAM1.
- All possible session paths (routes between subarea nodes) must be predefined on all the subarea nodes.
  - The dreaded SNA path tables
- Worked fine for a relatively static, hierarchical network environment.
- If A and B are in session with each other over the link between SA=1 and SA=2 and that link fails, the SNA session between A and B will break.
  - A new session can be set up via alternate links.
- Different SNA subarea networks can be interconnected using SNA Network Interconnection (SNI) functions.

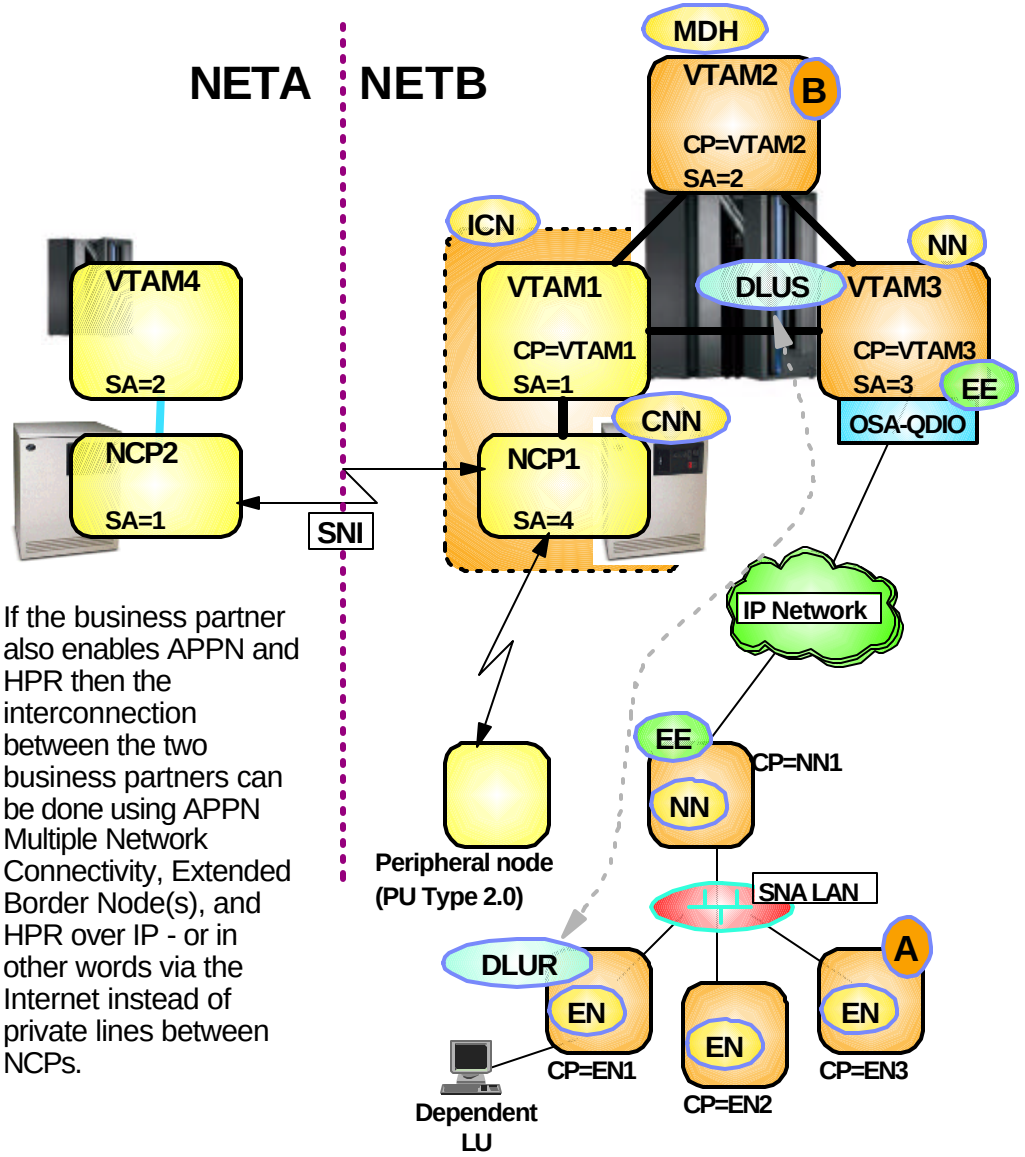
SNA tutorial - SNA Advanced Peer to Peer Networking (APPN)



If the business partner also enables APPN, then the interconnection between the two networks can be done using APPN Multiple Network Connectivity and Extended Border Node(s) instead of the subarea-based SNI technology.

- SNA subarea and APPN networking may interact and some nodes may be both APPN node types and subarea node types.
  - NN: Network Node
  - EN: End Node
  - ICN: Inter Change Node (can control session setup between the SNA subarea network and the APPN network)
  - EBN: Extended Border Node (controls session setup between two APPN networks)
  - CNN: Composite Network Node (An APPN NN that is comprised of a VTAM and one or more NCPs)
  - MDH: Migration Data Host (An EN that is also a subarea node)
- Non-subarea adjacent dependent LU access through an APPN network uses Dependent LU Requester/Server technology (DLUR/DLUS)
- Session paths are computed dynamically in an APPN network and need not be predefined.
  - When Application A on EN1 wants to talk to Application B on VTAM2, directory information locally and on NN1 will be searched - if not found, a search will flow to the other NNs in the APPN network and the location of and how to reach B will be identified and returned to EN1.
- If A and B are in session with each other over the link between VTAM2 and VTAM1 and that link fails, the SNA session between A and B will still break.
  - A new session can then be established between A and B by going via VTAM3 (as long as VTAM3 is an NN)

SNA tutorial - SNA High Performance Routing (HPR)



If the business partner also enables APPN and HPR then the interconnection between the two business partners can be done using APPN Multiple Network Connectivity, Extended Border Node(s), and HPR over IP - or in other words via the Internet instead of private lines between NCPs.

- HPR is an extension to APPN, so an HPR environment inherits all the characteristics of APPN.
- If A and B are in session with each other over the link between VTAM2 and VTAM3 and that link fails, the SNA session between A and B will no longer break as long as the links between VTAM2, VTAM1, and VTAM3 are HPR links, such as XCF or MPC+ channels.
  - When the link breaks, HPR will make a non-disruptive path switch and switch the session to go between VTAM2, via VTAM1, to VTAM3 and then further on via NN1 to EN3.
- An extension to HPR is to use an IP network as an HPR link - this is known as HPR over IP (HPR/IP) or more generally as Enterprise Extender (EE)
  - HPR looks at the entire IP network - regardless of the size of that IP network - as a single HPR link
  - If topology in the IP network changes, it is up to the IP infrastructure to recover from that change and reroute IP packets via alternate routes
  - With EE enabled on z/OS, SNA traffic leaves and enters z/OS as IP packets, which means SNA/HPR/EE traffic can benefit from OSA-Express QDIO high-capacity network adapters such as Gigabit Ethernet and HiperSockets connectivity

If my SNA network is subarea today, should I migrate to APPN before integrating SNA traffic with my IP network?

- **APPN is much more advanced than SNA subarea and requires less administrative "maintenance":**
  - LUs can be found dynamically anywhere in the APPN network - Directory Services
  - Route selection is done dynamically and includes dynamic changes to the network topology - Topology and Routing Services (TRS)
  - Provides intermediate session routing (ISR) - Traffic between two nodes may pass through one or more intermediate APPN nodes
  - APPN with HPR provides non-disruptive path switch in case of link failures
  - Reduces system definitions - Logical units and control points need be defined only on owning node, and routes are dynamically determined at session setup time

- **An APPN migration is not overly complex, but does require some new SNA skills and planning:**
  - Skill development
  - Migration planning
  - Updating SNA network management software and procedures

- **If business partner SNI connectivity is to be replaced by EE/EBN:**
  - Business partner coordination of changes at both end points
  - If EE is to be used between business partners, firewall traversal needs to be addressed

- **APPN may use more resources than SNA subarea:**
  - For VTAM that may mean higher CPU and memory costs
  - For an SNA network, that may mean more bandwidth used for APPN control flows

APPN/HPR is the most functionally rich SNA architecture level and is the generally preferred level for SNA networks today. But if the existing SNA infrastructure is based on an SNA subarea architecture level and is considered to provide an adequate level of service, a migration to APPN/HPR may not be necessary or may require skills that are not readily available.

Modernizing an SNA Subarea Environment:
CCL Highlights

IBM Communication Controllers - the foundation of SNA application access to the IBM mainframe since 1974

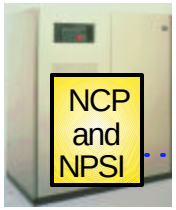
In an SNA subarea environment, an NCP is a key component

- ***For SNA boundary functions***
- ***For SNA business partner connectivity (SNI)***
- ***In combination with NPSI: for non-SNA X.25 access***

1974:
The IBM 3705 **Communication Controller**

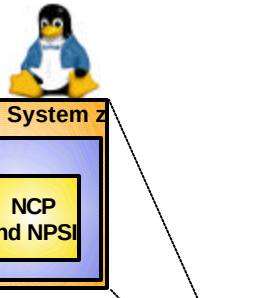
1982:
The IBM 3725 **Communication Controller** (NCP V4R3.1 latest supported level)

1985:
The IBM 3720 **Communication Controller** (NCP V5R4 latest supported level)



1988:
The IBM 3745 **Communication Controller**
(NCP V7R3+ latest supported level)
and the IBM 3746 Multiprotocol Controller

Move ***selected NCP and NPSI functions*** with no or minor changes to the definitions



System z Server

2005:
The IBM **Communication Controller** for Linux (CCL) on System z
(NCP V7R5+ latest supported level)

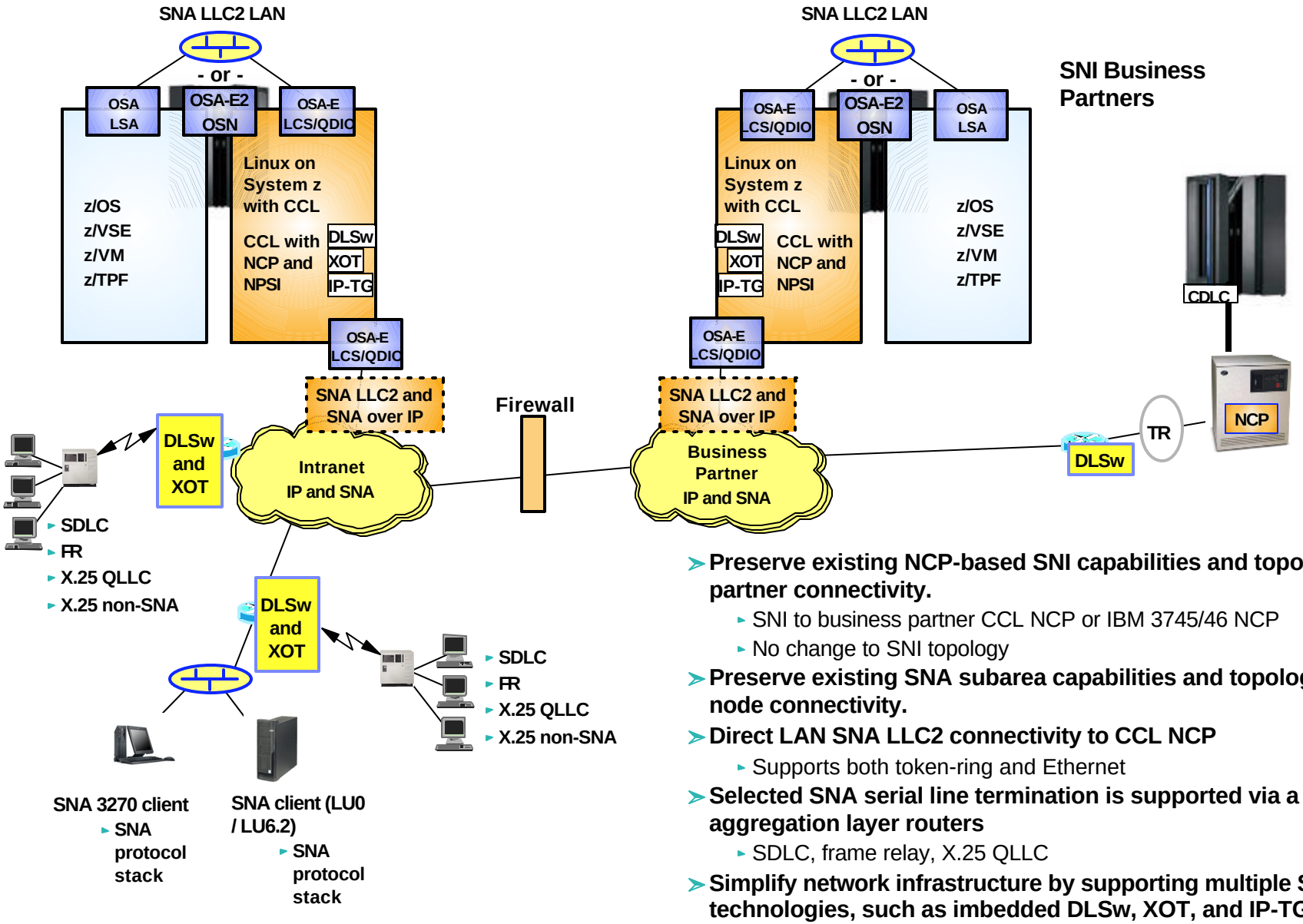
- **March 2005: CCL V1R1**
- **November 2005: CCL V1R2**
- **May 2006: CCL V1.2.1**

1975 1980 1985 1990 1995 2000 2005 2006

What is CCL?

- The next generation IBM Communication Controller for the majority of SNA workloads
- A mainframe software solution that provides a virtualized Communication Controller on the System z hardware platform
- A platform for modernizing the traditional SNA environments
- Supports existing NCP and NPSI software

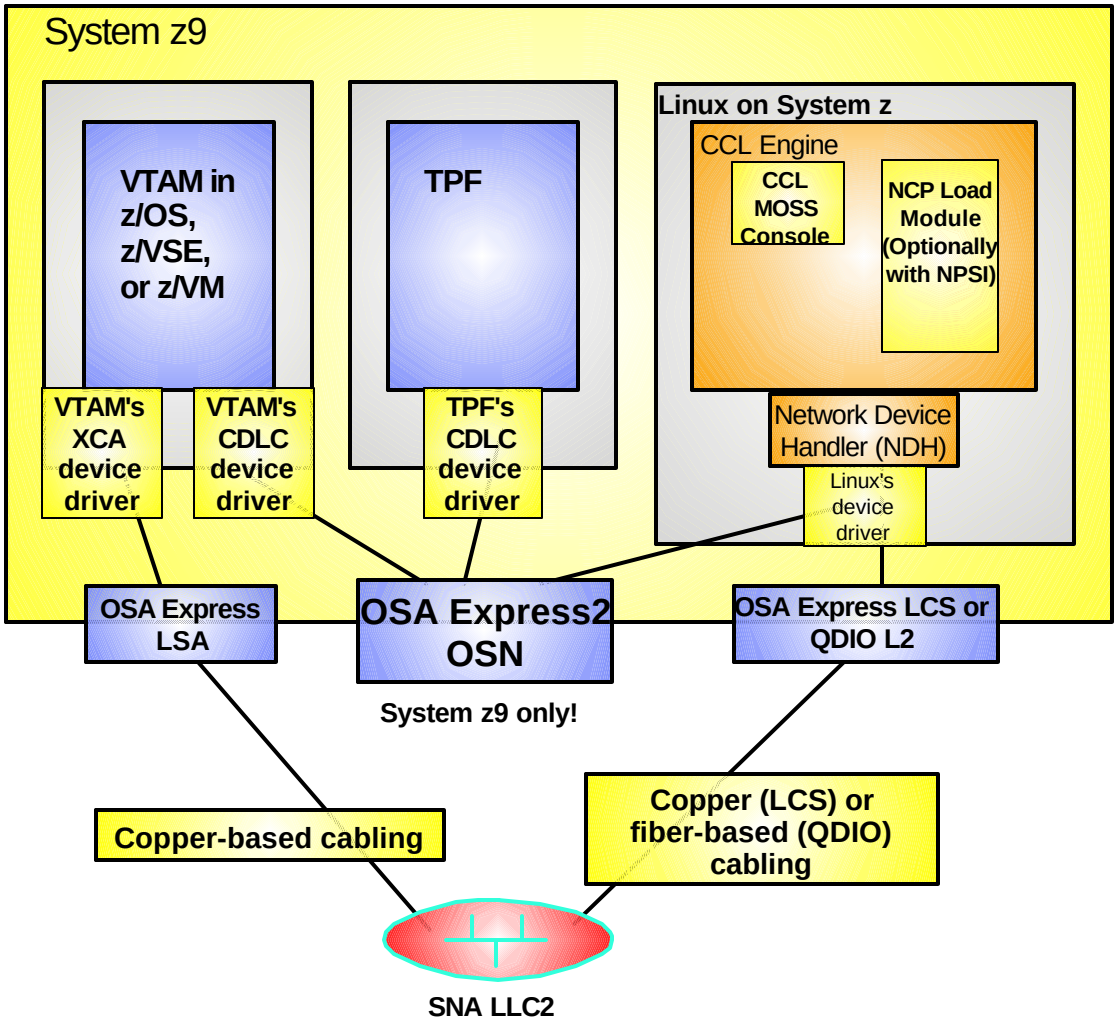
CCL - the newest IBM Communication Controller - NCP and NPSI



Please note that z/TPF does not support OSA LSA connectivity. z/TPF supports OSN connectivity to CCL only.

- **Preserve existing NCP-based SNI capabilities and topology for business partner connectivity.**
  - SNI to business partner CCL NCP or IBM 3745/46 NCP
  - No change to SNI topology
- **Preserve existing SNA subarea capabilities and topology for peripheral node connectivity.**
- **Direct LAN SNA LLC2 connectivity to CCL NCP**
  - Supports both token-ring and Ethernet
- **Selected SNA serial line termination is supported via a network aggregation layer routers**
  - SDLC, frame relay, X.25 QLLC
- **Simplify network infrastructure by supporting multiple SNA over IP technologies, such as imbedded DLSw, XOT, and IP-TG**
- **Preserves existing network operations and management**

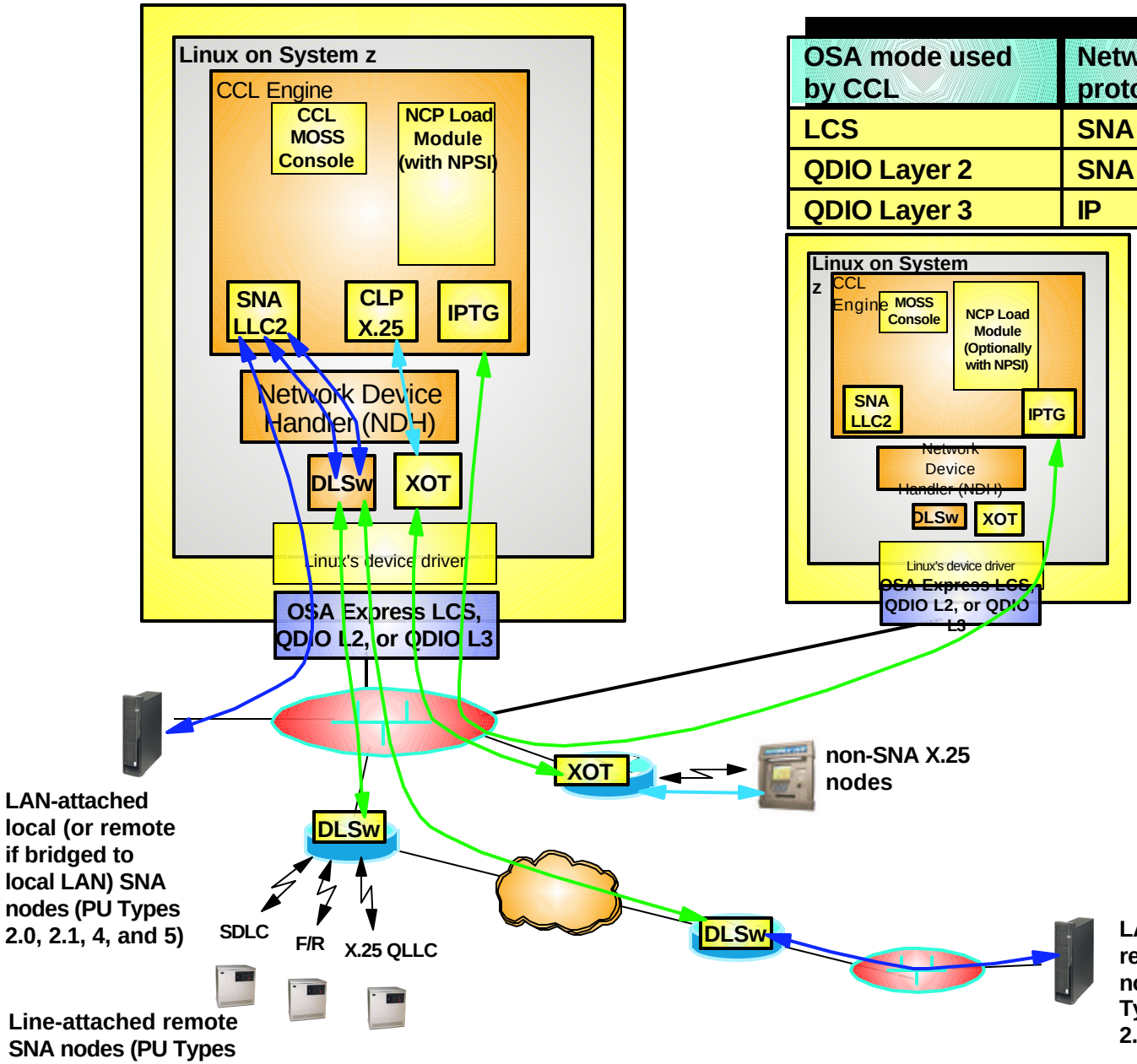
CCL and VTAM/TPF connectivity summary



- **VTAM connects to a CCL NCP using one of two technologies:**
  - Over a LAN to which VTAM connects using an OSA port in LSA mode and Linux over an OSA port in LCS or QETH mode (QDIO Layer 2).
  - If VTAM and CCL reside on the same System z9, they can connect via a shared OSA-E2 port operating in OSA for NCP (OSN) mode.
    - Both VTAM, TPF, and the NCP see this connectivity as an ESCON channel over which the usual CDLC channel protocol is used.
- **TPF supports the OSN connectivity option only.**
- **No SNA subarea topology changes - VTAM is still a PU Type 5 and the NCP is a PU Type 4**
  - In most cases no changes to SNA subarea pathing definitions
- **When OSN connectivity is used, there are no changes to VTAM definitions or VTAM operations procedures.**
- **When LAN connectivity is used, there may be minor changes to VTAM definitions and VTAM operations procedures.**
- **In most cases no changes to NetView definitions and operations.**

Note: The OSN technology is available on System z9 hardware only.

CCL and down-stream connectivity summary

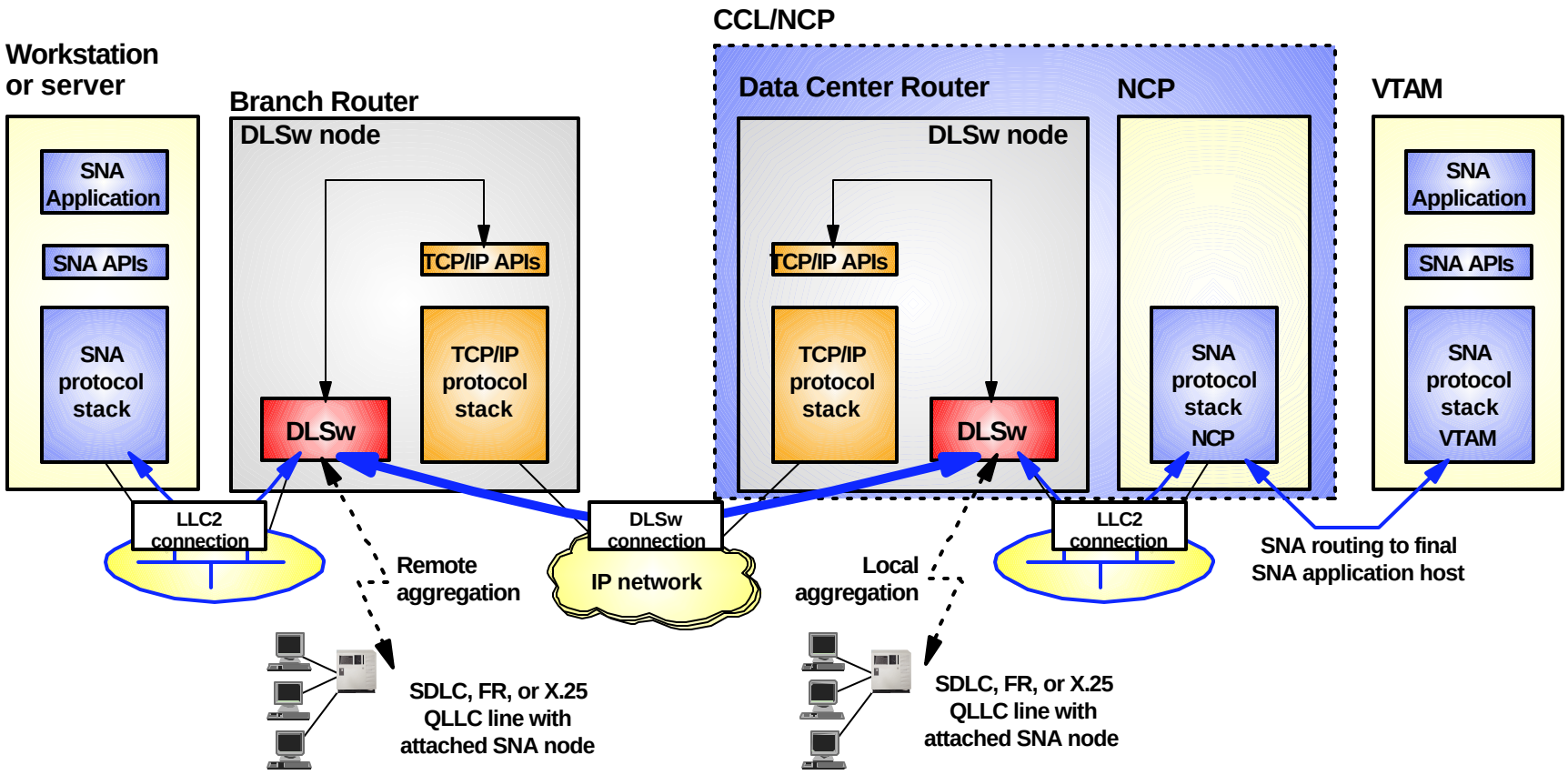


OSA mode used by CCL	Networking protocols	Cabling
LCS	SNA LLC2 and IP	Copper, RJ45
QDIO Layer 2	SNA LLC2 and IP	Fiber or copper
QDIO Layer 3	IP	Fiber or copper

- **SNA LLC2**
  - SNA protocol data units (PDUs) in native frames on the LAN
- **DLSw**
  - SNA Subarea and/or APPN ISR PDUs encapsulated in a TCP connection
  - Local DLSw refers to serial line termination a PDU switching to a LAN
- **XOT**
  - X.25 packets encapsulated in a TCP connection
- **IPTG**
  - SNA INN/SNI PDUs encapsulated in a TCP connection

The NCP sees all down-stream resources (except X.25) as though they were Token-ring attached - NCP TIC2 or TIC3 line address.

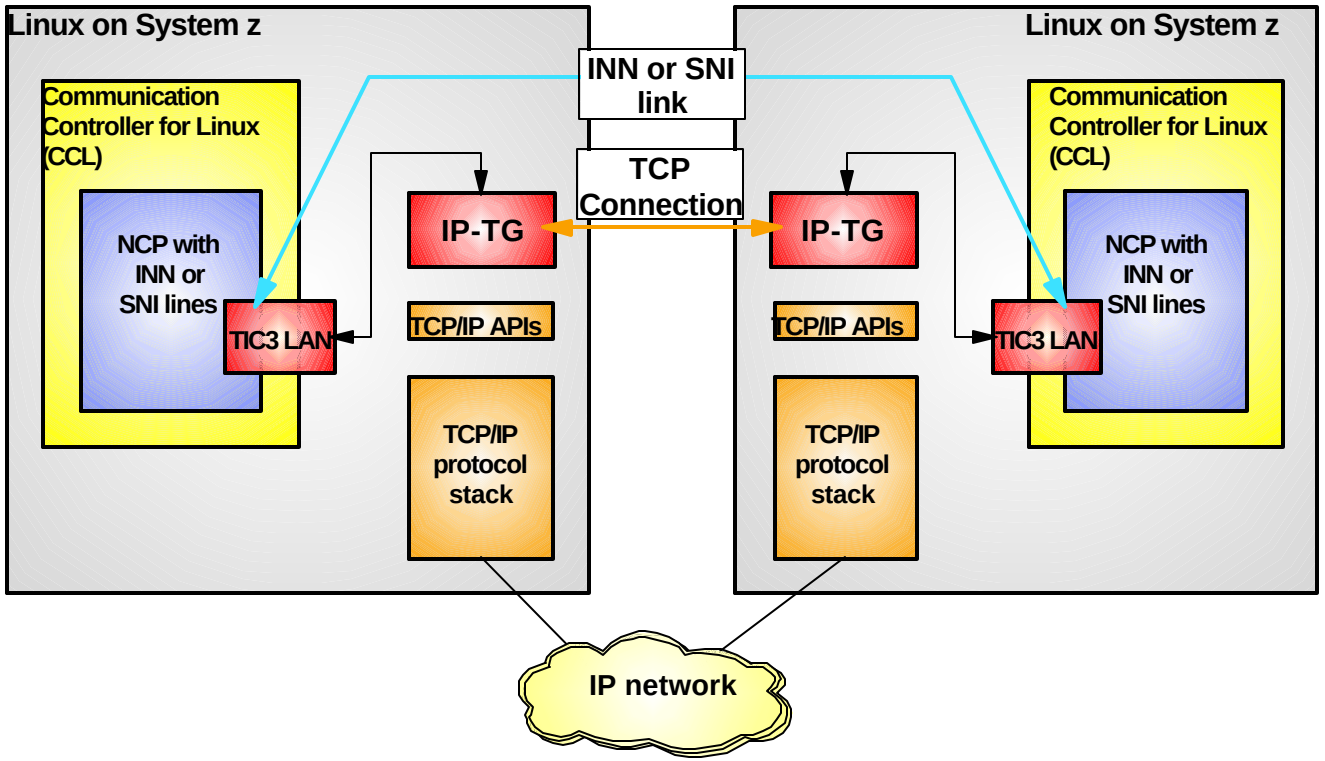
Transporting SNA subarea traffic over an IP network - DLSw



- **Data Link Switching (DLSw) is a technology that switches SNA link level frames over an IP network imbedded in TCP connections between two DLSw endpoints**
- **DLSw uses one or two TCP connections between the two DLSw nodes when connecting over an IP network**
- **DLSw supports SNA subarea flows and APPN/ISR - but not APPN/HPR routing**
- **DLSw does not support SNA Class Of Service priorities over the IP network**
- **DLSw is incompatible with MLTG and does not support MLTG topologies between NCPs (INN or SNI)**
- **Typical use scenario is for remote SNA node access to data center and for serial line (SDLC) aggregation**
- **CCL V1.2.1 can be a DLSw endpoint - terminating DLSw connections inside CCL**
  - No local aggregation by CCL DLSw (no direct serial line attachment to CCL)

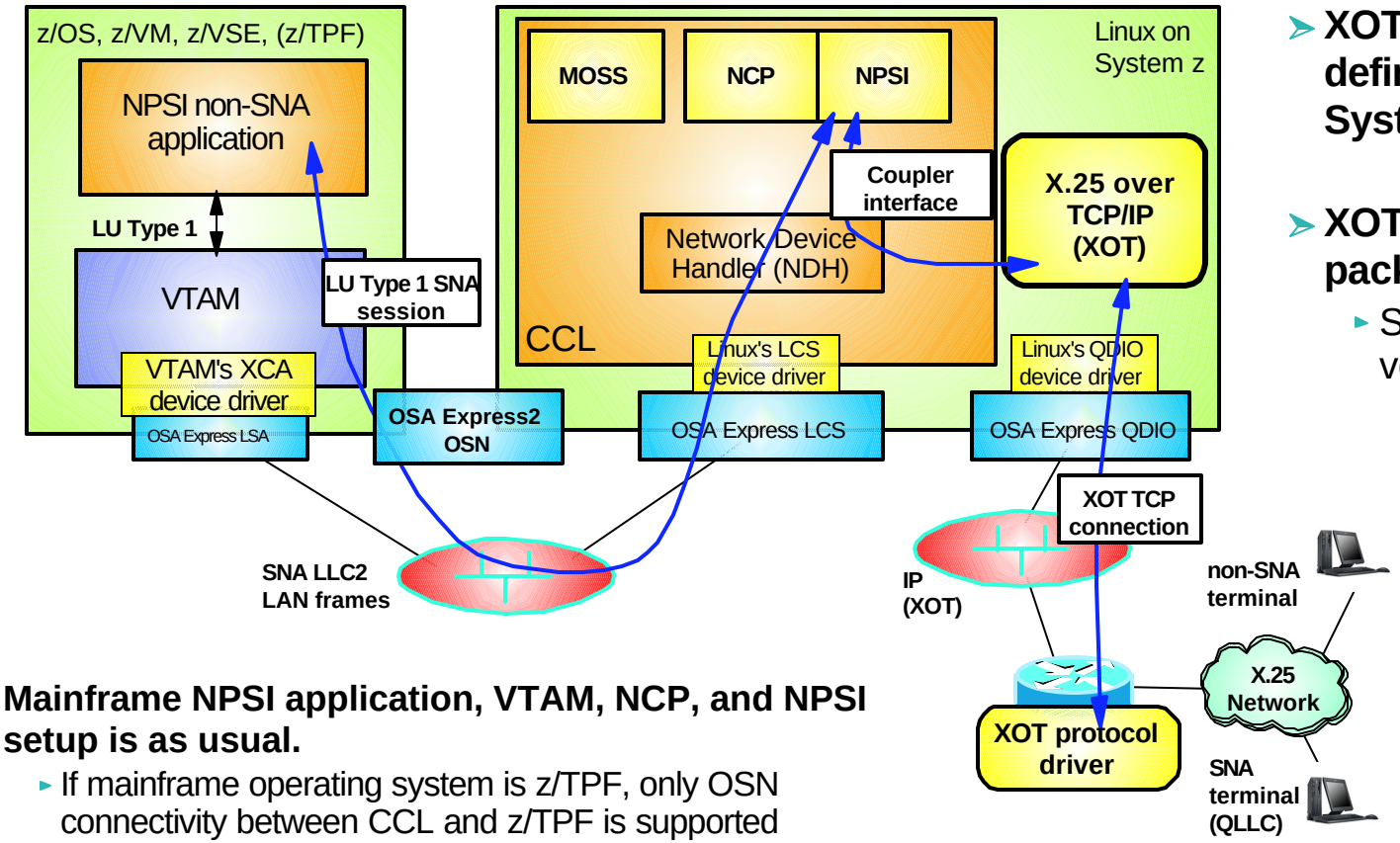
Transporting CCL/NCP to CCL/NCP (INN or SNI) traffic over an IP network - IP Transmission Group

- **CCL NCP to CCL NCP only - supports INN and SNI links**
- **Uses a single TCP connection per INN/SNI link**
- **Preconfigured TCP port number**
- **The TCP connection can be secured using STUNNEL (SSH) or IPSec**
- **IP-TG only support subarea flows - no APPN ISR/HPR flows**



- **Simple IP end-to-end technology for SNI links**
- **Since TCP is used and TCP port number is pre-configured, firewall administration is easier than with EE**
- **Low-overhead technology that offers very high throughput rates**

Transporting non-SNA X.25 access to CCL/NPSI over an IP Network - X.25 over TCP



- **XOT is an open standard and defined in RFC 1613 "Cisco Systems X.25 over TCP (XOT)".**
- **XOT is used to encapsulate X.25 packets over a TCP/IP network.**
  - Supported by various router vendors - including Cisco

XOT with CCL enables continued use of NPSI-based applications and X.25 connectvity to the System z platform via an XOT router.

- **Mainframe NPSI application, VTAM, NCP, and NPSI setup is as usual.**
  - If mainframe operating system is z/TPF, only OSN connectivity between CCL and z/TPF is supported
- **NPSI processing remains offloaded from the mainframe OS environment.**
- **Physical connectivity to X.25 network is via an aggregation layer router.**
  - Connectivity between aggregation layer router and NPSI is via an X.25 Over TCP/IP (XOT) TCP connection (IP network flows).
- **Interface between NPSI and local XOT protocol component is the same as NPSI uses today when communicating over X.25 adapters in an IBM 3746 unit - the Coupler interface.**
- **X.25 over TCP/IP for CCL will be a separate software product that is needed in conjunction with CCL for X.25 connectivity to NPSI (Statement Of Direction as of August 2006)**

CCL is not a complete replacement for the IBM 3745/46

CCL Functional Overview Matrix	CCL V1.2.1 supports	CCL V1.2.1 support of serial lines via an aggregation layer router	CCL V1.2.1 does not support
Software	NCP (V7R5 and above) and compatible levels of NRF SSP, NTuneMON, NetView, and NPM continue to work as they have in the past NCP Packet Switching Interface (NPSI)		Other IBM 3745 software products: XI/NSF, EP, NTO, NSI, MERVA, and TPNS Functions provided by the IBM 3746 MAE or NNP (most of these functions can be migrated to CS Linux on System z) NCP-based IP routing (migrate to standard Linux-based IP routing)
Physical network interfaces	SNA LLC2 (LAN) access to OSA token-ring and Ethernet LAN NCP TIC2 or TIC3 LAN interfaces via OSA LCS or OSA QETH (QDIO layer-2) CDLC channel connectivity through shared OSA-E2 on System z9 IP-TG for direct IP connectivity between two CCL NCPs XOT for x.25 connectivity DLSw for DLSw termination in Linux for System z	SDLC, frame relay, X.25 QLLC, and ISDN serial line interfaces are not supported directly by CCL, but are supported via an aggregation layer router X.25 circuits are not supported directly by CCL, but are via an aggregation layer router that uses the XOT protocol to transport the X.25 packets to/from NPSI running in CCL	BSC, ALC, Start/Stop

CCL is more than just an IBM 3745 emulator

- **Expanded LAN technology support to include high speed Ethernet**
  - Token ring LAN and ESCON technology may be replaced
- **LAN interface virtualization support (via QDIO layer 2 and DLSw)**
- **Support of SNA over IP technology endpoints in System z**
  - DLSw
  - XOT
  - IP-TG
- **IP-based security for IP-based CCL connectivity**
  - IPSEC/VPN for DLSw, XOT
  - IPSEC/VPN or SSH Tunnelling for IP-TG
- **Inherited System z availability features**
- **Expanded network management opportunities**
- **Significant improvements in transactional throughput and response times (up to 8 times faster)**
- **Opportunities for consolidation (4-5 70% utilized 3745-31A NCPs fit on one System z9 IFL)**

Modernizing an SNA APPN Environment:
EE Highlights

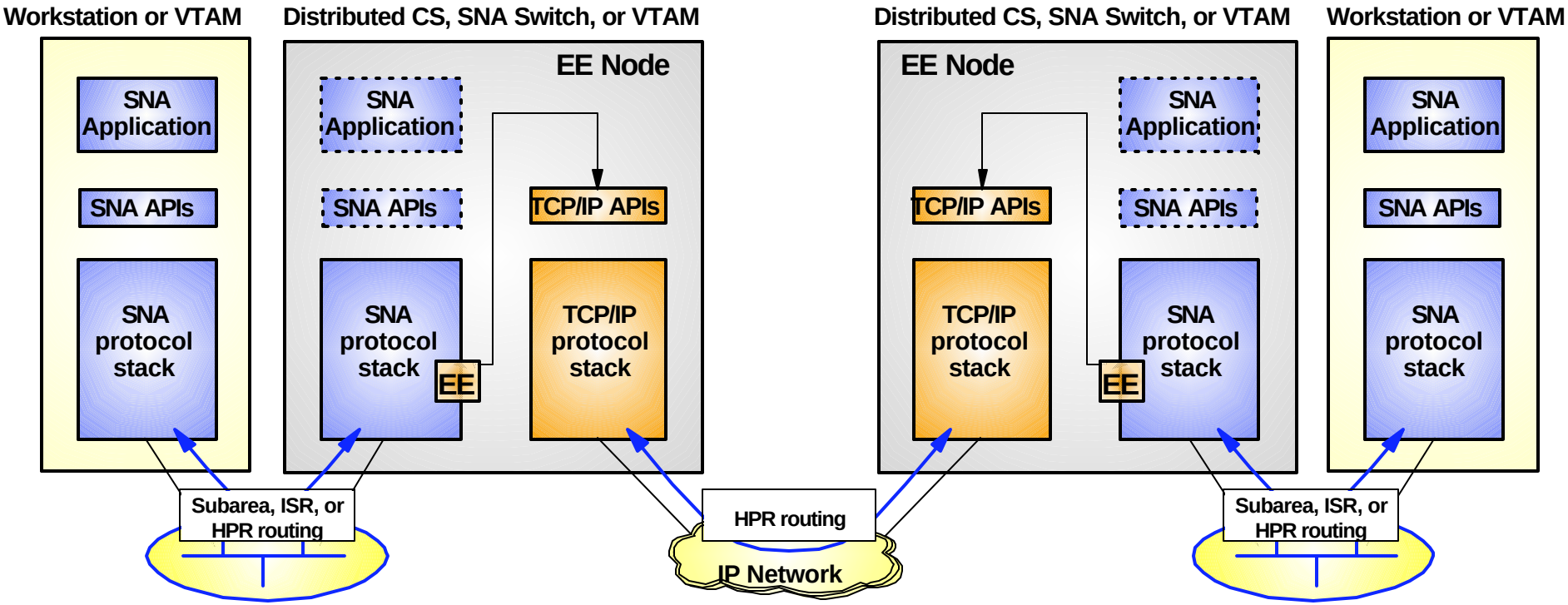
A select set of APPN-based technologies of special interest

- **Transport SNA over an IP network**
  - High Performance Routing over IP - Enterprise Extender
  - Some of the more common EE endpoints:
    - z/OS
    - Cisco SNA Switch
    - IBM Communications Server for Windows
    - IBM Communications Server for AIX
    - IBM Communications Server for Linux on Intel, Power, and System z
    - IBM's Personal Communication (PCOMM)
    - Microsoft Host Integration Server 2004
    - IBM i5/OS
- **Support for SNA boundary functions in an APPN network**
  - An NCP may still be used even if VTAM is defined as an APPN node
  - In VTAM if VTAM is attached to the network via an OSA LSA port
  - On any APPN node that supports being a Dependent LU Requester (DLUR) node
- **Control the size of the APPN network in terms of the number of APPN network nodes**
  - Branch Extender (BX, BEX, or BrNN) node technology
- **Control the amount of APPN transmission group definitions in an APPN network**
  - Connection network technology - Virtual Routing Node (VRN)
- **APPN-based business partner connectivity**
  - Extended Border Node (EBN) node technology
  - Physical connectivity may be IP if EE is used at both business partner locations

APPN routing protocol review: ISR and HPR

- **Intermediate Session Routing (ISR) is the base APPN routing technology**
  - Each APPN node has awareness of all sessions that send data through the node
    - Storage requirements on the NNs on the session path
  - If a link fails, all sessions that use that link are terminated and the endpoints (the LUs) are notified of the broken session (UNBIND processing)
- **High Performance Routing (HPR) is an extension to the APPN architecture**
  - APPN/HPR nodes on the session path have no session awareness
  - If a link fails, HPR is able to re-route the data over another route - if one exists
    - This re-route (also known as path switch) is non-disruptive to sessions that use the failed route
  - The two endpoints of the HPR route are known as the Rapid Transport Protocol (RTP) endpoints or just the HPR pipe endpoints
    - Intermediate nodes between the two RTP endpoints perform Automatic Network Routing (ANR) forwarding of SNA session data without session awareness
  - HPR routing may be end-to-end if the endpoints support it
  - HPR may also be used on intermediate sections of the full end-to-end path
    - A session may start using ISR routing and then switch to an HPR "pipe" between two APPN nodes that are capable of HPR routing, and then switch back to ISR routing for the final part of the path
- **HPR routing may be used over**
  - A LAN
  - A mainframe channel (ESCON or FICON) operating in MPC+ mode
  - An XCF (Cross Coupling Facility) link between z/OS systems in a z/OS Sysplex
  - An IP network (Enterprise Extender)

Transporting APPN/HPR data over an IP network: Enterprise Extender (EE)

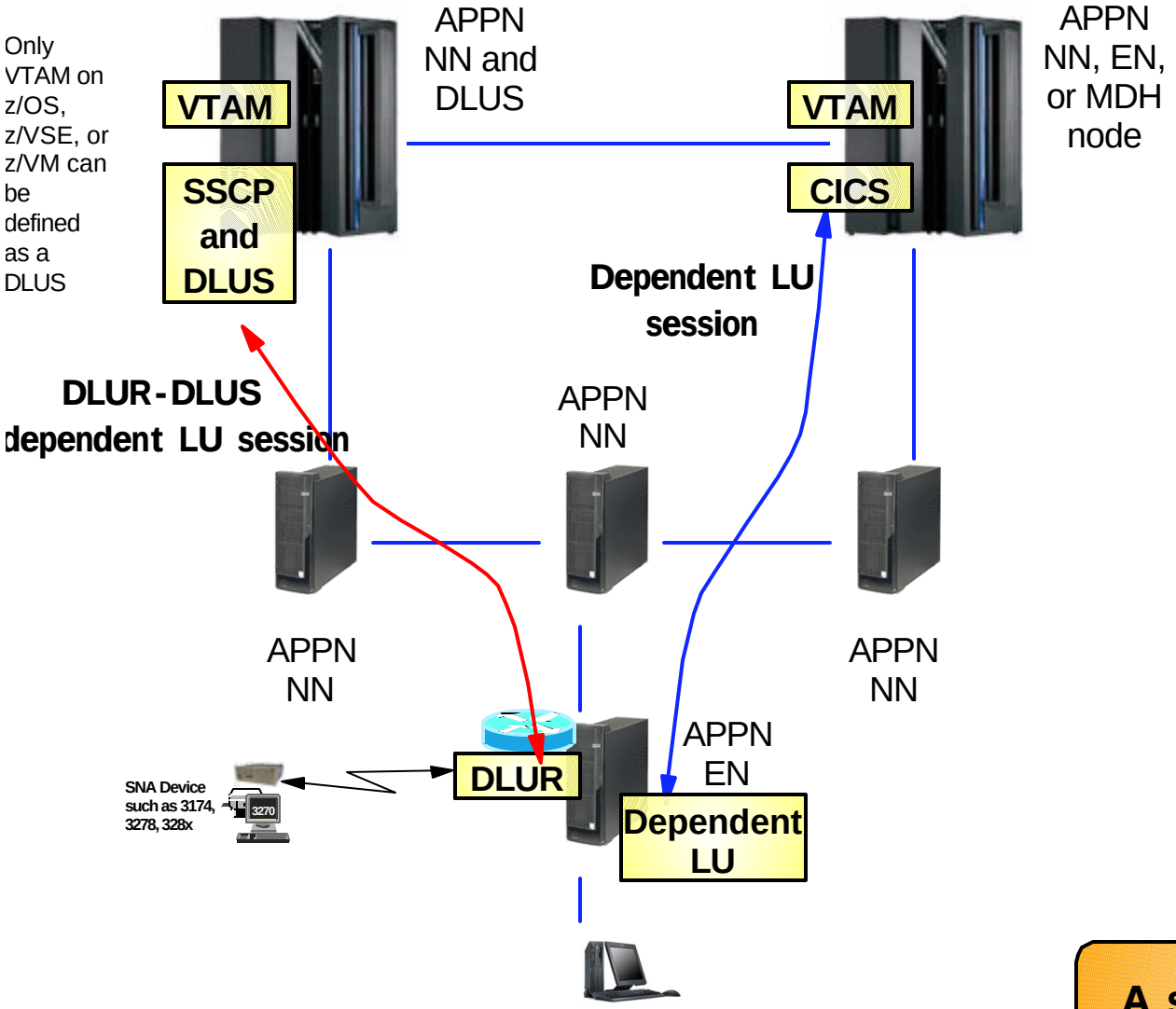


- Uses latest SNA architecture enhancements
- True IP end-to-end technology
- Conceptually simple (HPR over IP using UDP transport protocols)
- Covers both branch access and business partner connectivity
- Be aware of IP firewalls

Enterprise Extender characteristics

- **EE is APPN HPR routing over an IP network**
  - To the IP network, EE looks like a UDP application
  - To the APPN network, EE looks like an HPR link
- **Dependent LU access via DLUR/DLUS services**
  - Subarea SNA traffic (dependent LUs) is based on the normal APPN DLUR/DLUS functions
- **The SNA traffic is sent as UDP datagrams over the IP network, each EE endpoint using 5 UDP port numbers**
  - Firewalls can be an issue, especially between business partners
- **EE can be implemented on the SNA application hosts, or on APPN nodes that act as EE gateways**
- **Main EE nodes are z/OS, CS/Linux, CS/AIX, CS/Windows, and Cisco SNA Switch**
  - Some EE nodes implement an EE-DLC connectivity function without being full APPN node capable - an example is Microsoft's Host Integration Server that cannot be a network node, and Cisco SNA Switch that can be a Branch Extender node only
  - i5/OS (iSeries) added EE support to i5/OS V5R4 in February 2006
- **Since EE is HPR over IP, EE traffic inherits all the APPN/HPR characteristics including non-disruptive path switch**
- **EE traffic can be secured using IPSec**
  - But not with SSL/TLS - SSL/TLS is TCP only
- **Business partner connectivity through EE/EBN**

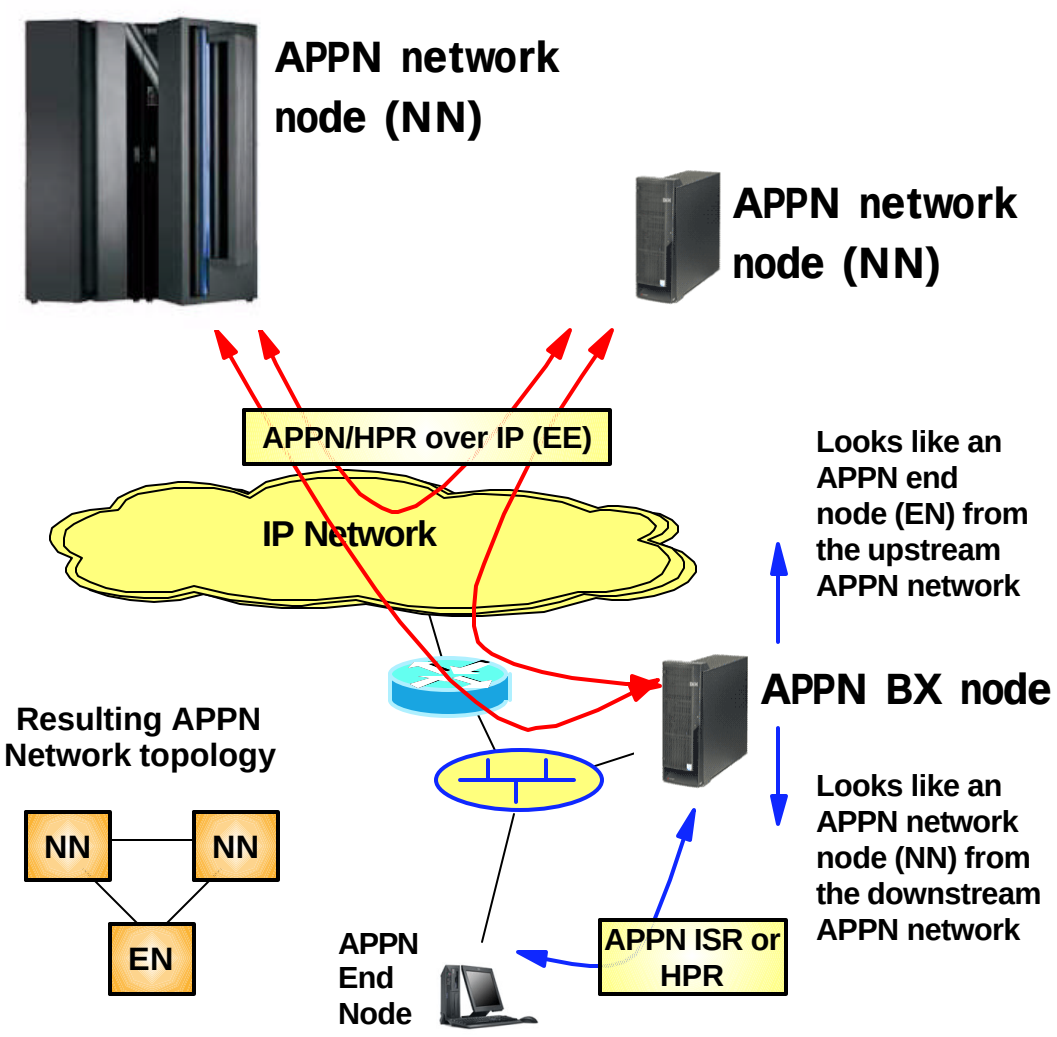
Dependent LU support via DLUR-DLUS in an APPN network



- **The DLUR function may reside on one of IBM's distributed Communications Servers**
  - CS Windows
  - CS Linux for Intel, Power, and System z
  - CS/AIX
  - PCOMM
- **Or on other vendors' APPN-capable nodes**
  - Cisco SNA Switch as an example
- **Some platforms support serial line termination, which in combination with DLUR allows for support of downstream, serial-line attacted SNA peripheral nodes with dependent LUs in an APPN network**
  - Cisco routers
  - IBM CS Windows, AIX, and Linux on Intel
    - SDLC and X.25 QLLC

A simple way to integrate dependent LUs in an APPN topology

Branch Extender - simplifying APPN network node topology in large APPN networks

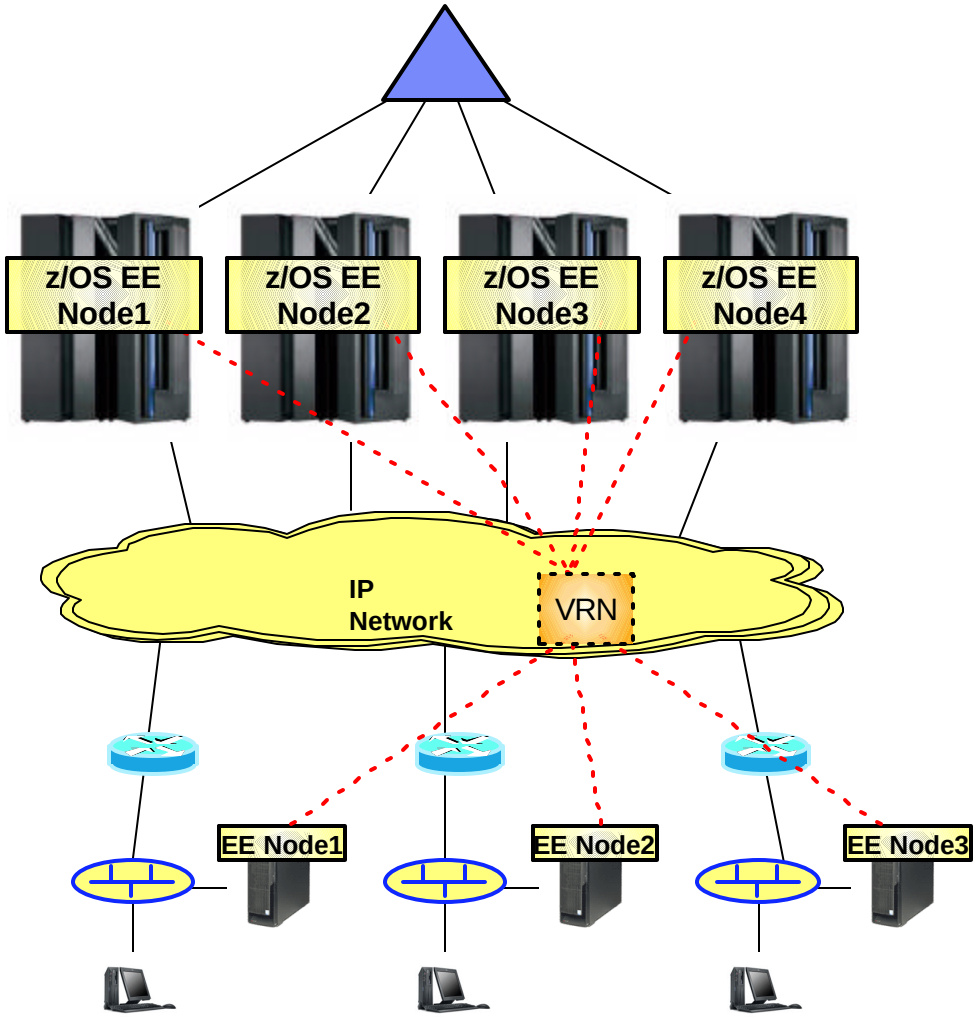


- **You generally want to keep the number of APPN network nodes under control**
  - Broadcast searches are sent to all NNs in an APPN network and can become an issue if NNs are connected over slow/low-capacity network links
  - Network topology updates are exchanged between all NNs
- **Branch Extender nodes connected to the data center over EE, allow you to consolidate APPN NNs into the data center**
- **Most commonly used nodes that support being a Branch Extender**
  - IBM CS Linux (Intel, Power, and System z)
  - IBM CS Windows
  - IBM CS AIX
  - i5/OS
  - Cisco SNA Switch

Note: Dependent LUs on the downstream EN are not supported over HPR-only links to the BX (such as EE)

Note: A DLUR node cannot be located downstream from a BX node!

Simplifying link definitions in large EE networks - APPN connection network technology works over IP networks

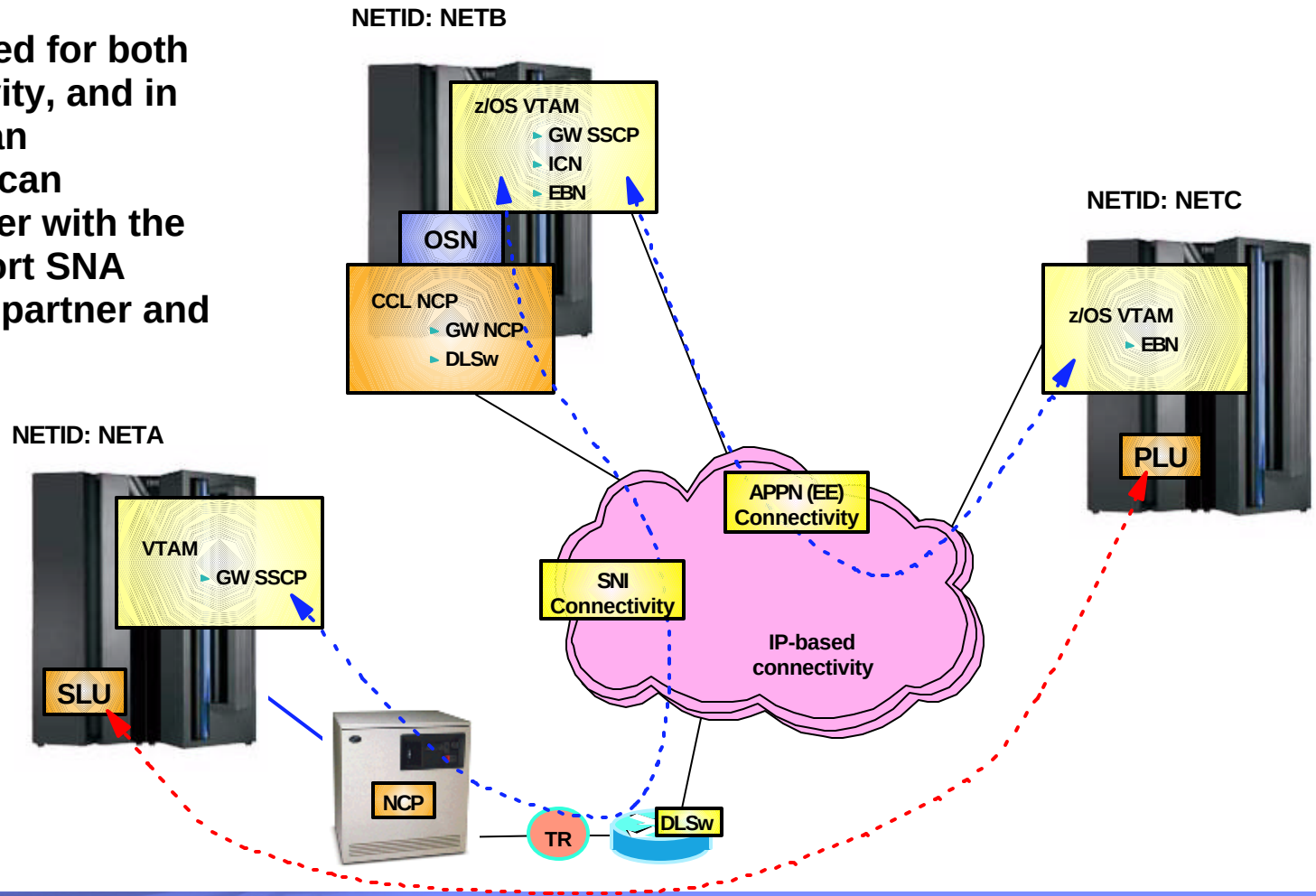


- **Local connection network:**
  - Does not cross network boundaries
- **Global connection network**
  - May cross network boundaries

- **A connection network is an APPN technology that reduces the need for predefining APPN links between nodes that are connected to a shared access transport facility (SATF), of which a LAN is the most typical example.**
- **Connection networks can also be used with EE, where the full IP network can be viewed as a single SATF network.**
- **In this example topology, all EE nodes can send EE packets directly to each other without defining links to all the other nodes.**
  - Please note that in a connection network topology, each node still needs some pre-defined links for selected CP-CP sessions.
- **Generally the combination of EE with connection network technology is recommended with the objective of reducing the amount of link definitions that are required and to allow EE endpoint to endpoint communication to flow directly between the associated IP endpoints.**

SNI and APPN multiple network connectivity (EBN connectivity)

- **An SNI gateway must connect to another SNA subarea node.**
- **An EE/EBN endpoint must connect to another APPN node.**
- **If a z/OS VTAM is configured for both EE/EBN and SNI connectivity, and in addition is configured as an Interchange Node (ICN), it can interconnect the SNI partner with the EE/EBN partner and support SNA sessions between the SNI partner and the EE/EBN partner**
  - NETA LUs can establish sessions with NETC LUs via NETB
- **APPN multiple network connectivity**
  - APPN's alternative to SNI for SNA connectivity between different APPN NET IDs
  - Implemented via Extended Border Node (EBN)
    - VTAM on z/OS, z/VSE and z/VM can be EBNs



Select set of APPN node capabilities

	z/OS VTAM	z/VSE VTAM	z/VM VTAM	z/TPF	NCP	CS Linux	CS AIX	PCOMM	i5/OS	CS Windows	Cisco SNA Switch
NN	y	y	y			y	y		y	y	
EN	y	y	y	y		y	y	y	y	y	
BX						y	y		y	y	y
MDH	y	y	y	(y)							
ICN	y	y	y								
EBN	y	y	y								
DLUR						y	y	y	y	y	y
DLUS	y	y	y								
CDS	y	y	y								
RTP end point	y			y		y	y	y	y	y	y
ANR router	y				y	y	y		y	y	y
HPR over IP (EE)	y					y	y	y	y	y	y

Your Configuration & Migration Goals

Discussion of 3745 Migration Alternatives

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