



IBM Software Group

# SNA Modernization and IBM Communication Controller for Linux

Chuck Gardiner,  
Research Triangle Park,  
North Carolina, USA  
[cgardine@us.ibm.com](mailto:cgardine@us.ibm.com)



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# Abbreviations

Acronym	Explanation
AHHC	APPN Host-to-Host Channel
ADS	Application Data Structure
ANNC	APPN Node-to-Node Communication
ANR	Automatic Network Routing
APPC	Advanced Program-to-Program Communication
APPN	Advanced Peer-to-Peer Networking
BMS	Basic Mapping Support (CICS component)
BN	Border Node
BTT	Branch Transformation Toolkit
BX	Branch eXtender node
CCL	Communication Controller for Linux (IBM 3745 software emulator)
CDLC	Channel Data Link Control (mainframe channel protocol)
CDS	Central Directory Server
CICS	Customer Information Control System (a transaction manager)
CMC	Communications Management Configuration
CNN	Composite Network Node (an APPN NN composed of a VTAM and one or more NCPs)
COS	Class of Service
CP	Control Point
CPI-C	Common Programming Interface for Communications (LU6.2 programming interface)
CSL	Communications Server for Linux
CTG	CICS Transaction Gateway
CWS	CICS Web Support
DLC	Data Link Control
DLSw	Data Link Switching (SNA subarea and APPN/ISR encapsulation over TCP connections)
DRDA	Distributed Relational Data Access
EBN	Extended Border Node (gateway between two APPN networks - APPN equivalent of SNI)
EE	Enterprise Extender (also known as HPR over IP)
EJB	Enterprise Java Bean
EN	End Node
GR	Generic Resources
HATS	Host Access Transformation Services (SNA 3270/HTML transformation)

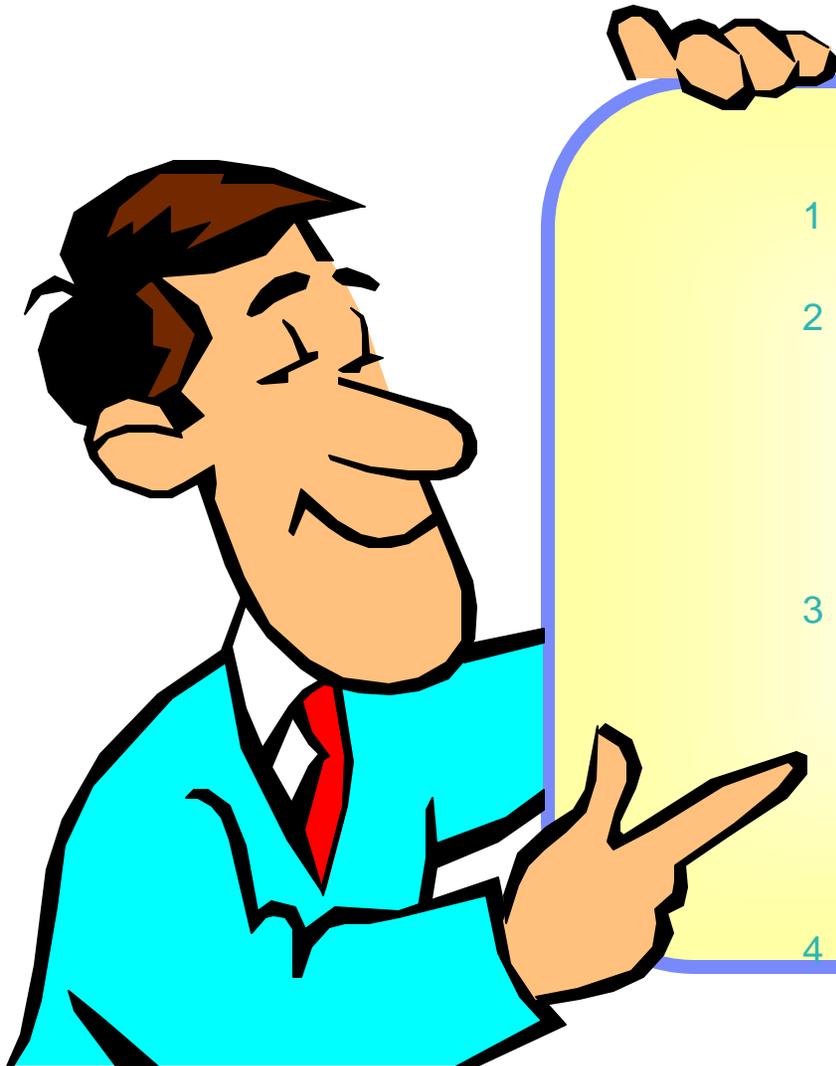
Acronym	Explanation
HPR	High Performance Routing
HTML	Hyper Text Markup Language (tag language for Web pages)
HTTP	Hyper Text Transfer Protocol (application protocol between Web browser and Web server)
ICN	Interchange Node (SNA node that routes between APPN and SNA subarea)
ILU	Independent Logical Unit
IMS	Information Management System (z/OS transaction and database manager)
INN	Intermediate Network Node
IP-TG	Internet Protocol Transmission Group (NCP INN/SNI encapsulation over an IP network between two CCL NCPs)
IP	Internet Protocol
ISR	Intermediate Session Routing
J2C	J2EE Connector Architecture
LLC2	Logical Link Control type 2 (SNA traffic on a LAN)
MAE	Multi-Access Enclosure
MDH	Migration Data Host (a combined SNA subarea node and APPN EN)
MFS	Message Formatting Services (IMS component)
MID	Message Input Descriptor (IMS MFS input ADS)
MNPS	Multi-Node-Persistence Sessions
MOD	Message Output Descriptor (IMS MFS output ADS)
MPC	Multipath Channel (mainframe channel protocol)
MPC+	HPDT Multipath Channel (mainframe channel protocol)
MPP	Message Processing Program (transaction program in IMS)
MPR	Message Processing Region
NCP	Network Control Program
NN	Network Node
NNP	(950) Network Node Processor
NNS	Network Node Server
NPSI	NCP Packet Switching Interface (X,25 connectivity support for an NCP)
OTMA	Open Transaction Manager Access
RTP	Rapid Transport Protocol (the transport protocol layer in HPR)



## Abbreviations (continued)

Acronym	Explanation
RUI	Request Unit Interface (an SNA programming interface)
RYO	Roll Your Own (home-written solution)
SDP	Software Development Platform
SFF	Service Flow Feature (CICS Web services infrastructure)
SNA	Systems Network Architecture
SNI	SNA Network Interconnect (SNA subarea-based business partner communication)
SOA	Services Oriented Architecture
SOAP	Simple Object Access Method
SSCP	System Services Control Point (PU Type 5 in an SNA subarea network)
TG	Transmission Group
VTAM	Virtual Telecommunications Access Method
WAS	WebSphere Application Server
WMQ	WebSphere Message Queuing
WSADIE	WebSphere Application Developer Integration Edition
WTS	Windows Terminal Services (split GUI technology)
XML	Extensible Markup Language
XOT	X.25 Over TCP/IP (encapsulate X.25 packets over a TCP connection)

# Agenda



- 1 An introduction to SNA modernization
- 2 SNA Network Infrastructure Modernization
  - a Modernizing an SNA Subarea Environment
  - b Modernizing an SNA APPN Infrastructure
- 3 Modernizing SNA Application Access
  - a. SNA Network Infrastructure Simplification - Preserving Existing SNA Clients
  - b. Enabling Use of New Client Technologies
- 4 Summary and Contact Information

# An Introduction to SNA Modernization



# SNA modernization is about preserving SNA applications, not replacing them

➤ **Analysts estimate that 200 billion lines of COBOL code exist today**

- f 5 billion lines are added each year
- f Similar inventory of PL/I code

➤ **The typical mainframe customer has:**

- f 30M lines of COBOL code
- f Worth \$600M
- f Automating 100,000 business processes

➤ **Any mainframe customer**

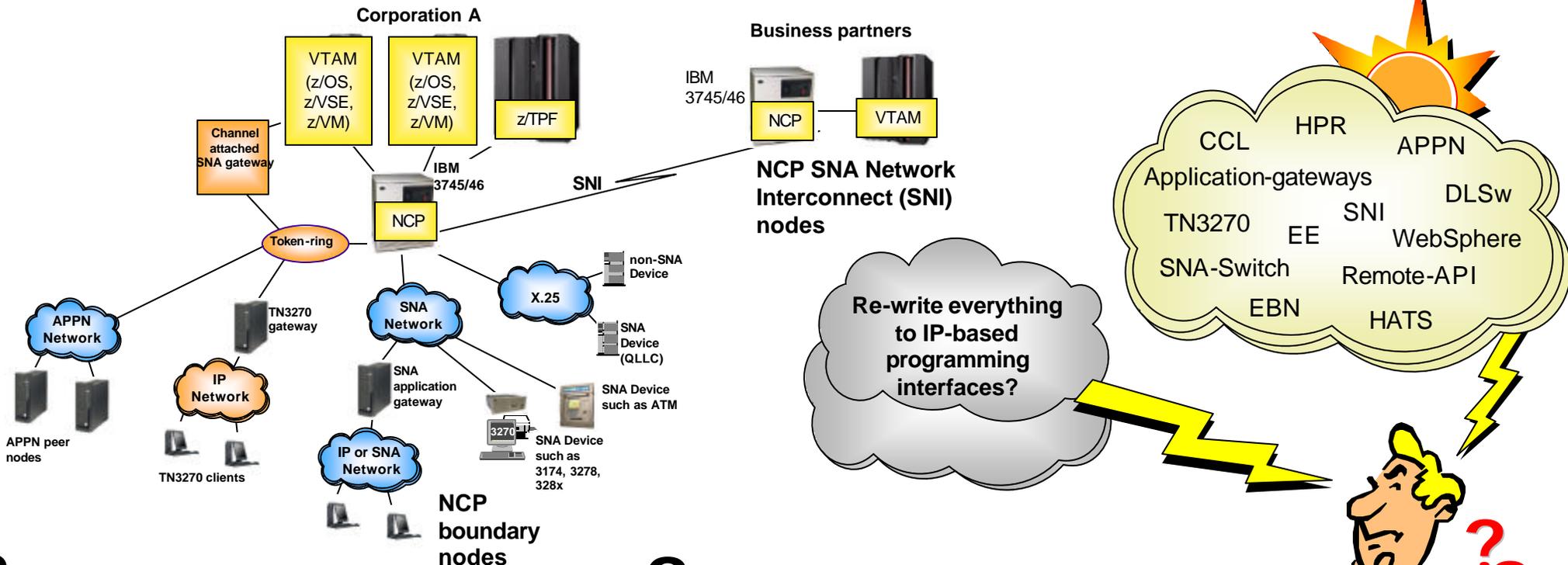
- f Banking, Insurance, Government, Manufacturing, Travel and Transportation, Distribution and Retail, Media and Utilities, Healthcare Industries

➤ **A majority (70-80% according to some studies) of these existing applications are terminal-access 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?

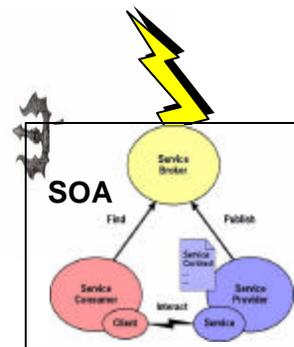


? How do I modernize my SNA environment and maintain reliable and cost-efficient access to mainframe core SNA business applications and business partners with an aging SNA networking infrastructure?

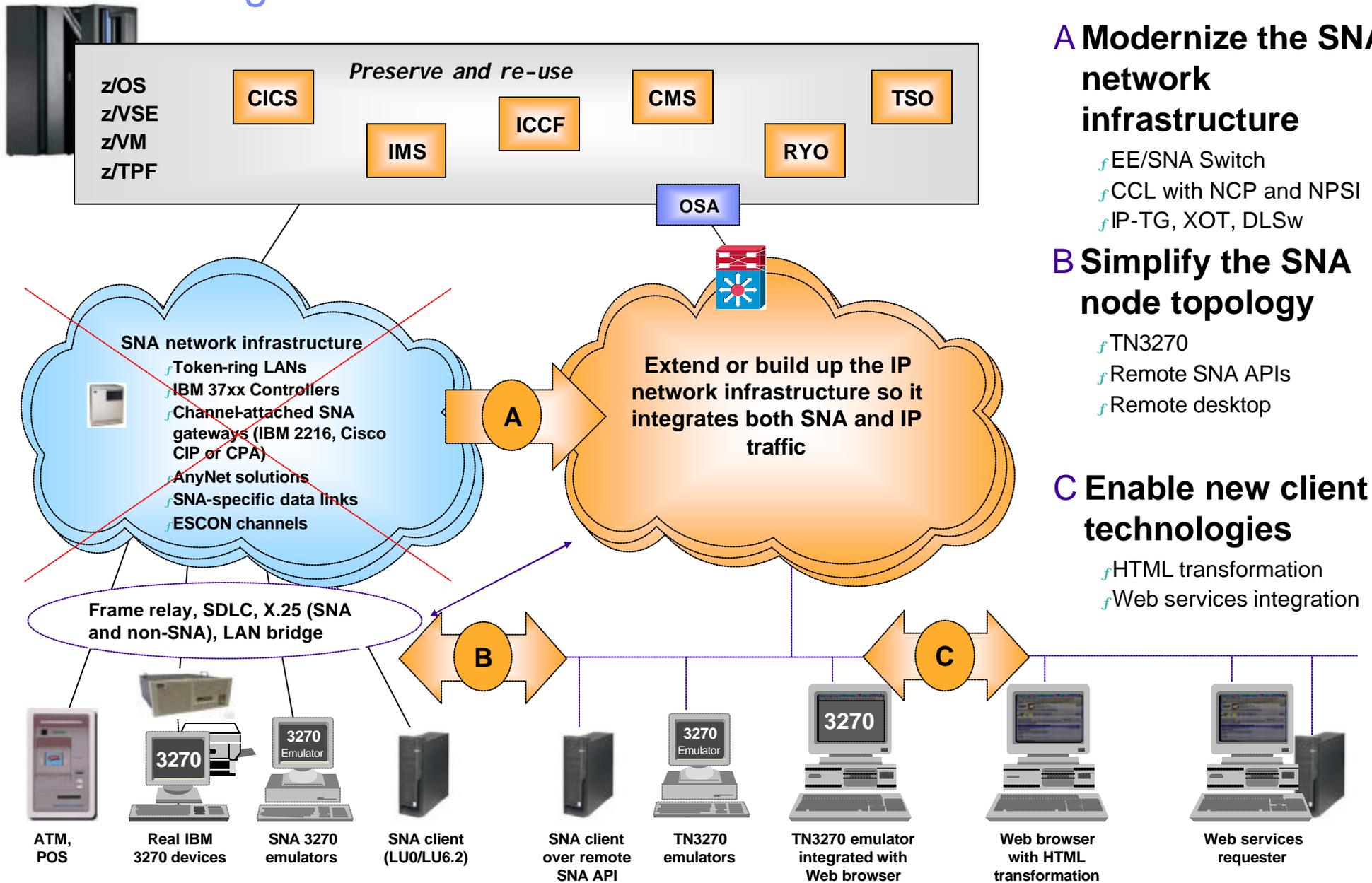
- f IBM 3705, 3720, 3725, and 3745/46 Communication Controller
- f Token-ring technology in general
- f ESCON channel-attached SNA controllers from various vendors (including Cisco CIP and CPA)
- f IBM 2210, 2216, and 2217 Nways Multi-protocol Routers
- f AnyNet
- f OS/2 and its CS/2 communications component

? 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)?

- f Transforming SNA application data stream to HTTP(S)/HTML to integrate use of SNA mainframe applications in browser-based client environments?
- f Exposing SNA applications as Web services, transforming 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

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

## B Simplify the SNA node topology

- ƒ TN3270
- ƒ Remote SNA APIs
- ƒ Remote desktop

## C Enable new client technologies

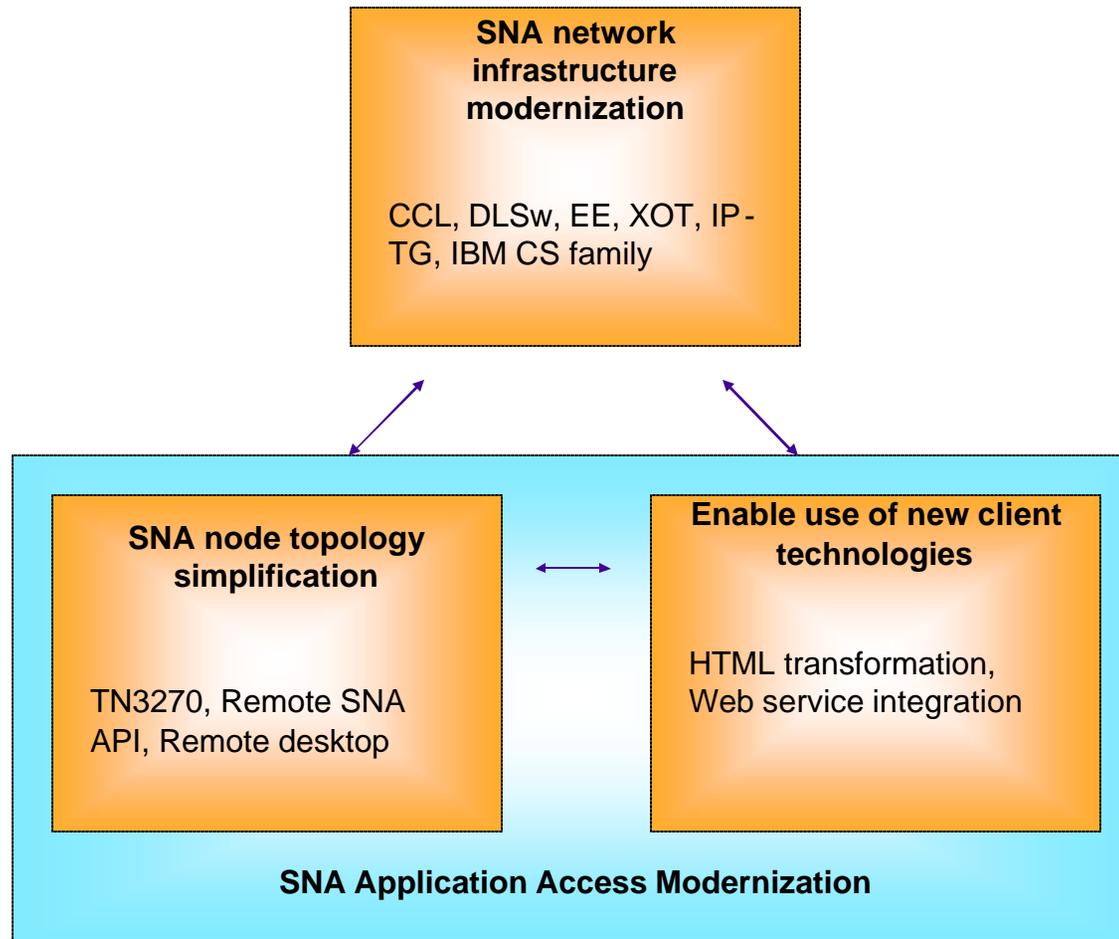
- ƒ HTML transformation
- ƒ Web services integration

## 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**
- 3 Using a Web browser as the client - transforming SNA data stream to HTTP(S)/HTML
  - 4 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:**
- 5 IBM 3705, 3720, 3725, and 3745/46 Communication Controller hardware
  - 6 IBM 2210, 2216, and 2217 Nways Multi-protocol Routers
  - 7 IBM AnyNet software technology in general
  - 8 OEM ESCON channel-attached SNA gateways, such as Cisco CIP and Cisco CPA
  - 9 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.**

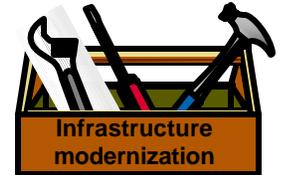
# SNA modernization technology introduction

## ➤ SNA network infrastructure modernization

ƒ 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.

ƒ 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

ƒ Preserve existing SNA end-user interfaces and SNA client functions while providing means to remove SNA protocol stacks on workstations and branch servers, consolidating SNA protocol stacks into the data center.

ƒ 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

ƒ Provide ways for re-using existing SNA server applications from new client environments, such as a Web browser or a Web service requester.

ƒ 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



# The SNA architecture level aspect of SNA modernization

## ➤ The three SNA architecture levels:

### ƒ **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

### ƒ **Advanced Peer to Peer Networking** (APPN) with the original Intermediate Session Routing (ISR) routing protocol

### ƒ **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

## ➤ If your SNA mainframe environment today is SNA subarea

- ƒ 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
- ƒ 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

## ➤ If your SNA mainframe environment today is APPN-enabled

- ƒ You can use HPR over IP to modernize the SNA APPN infrastructure and to integrate your APPN traffic with your IP network

## ➤ Often it is both

- ƒ 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

**You can meet most of the SNA modernization objectives with both an SNA subarea environment and an APPN environment, but the technologies you will choose, especially for network infrastructure modernization, will vary somewhat based on which SNA architecture level you decide to move forward with.**

# Modernizing an SNA Subarea Environment



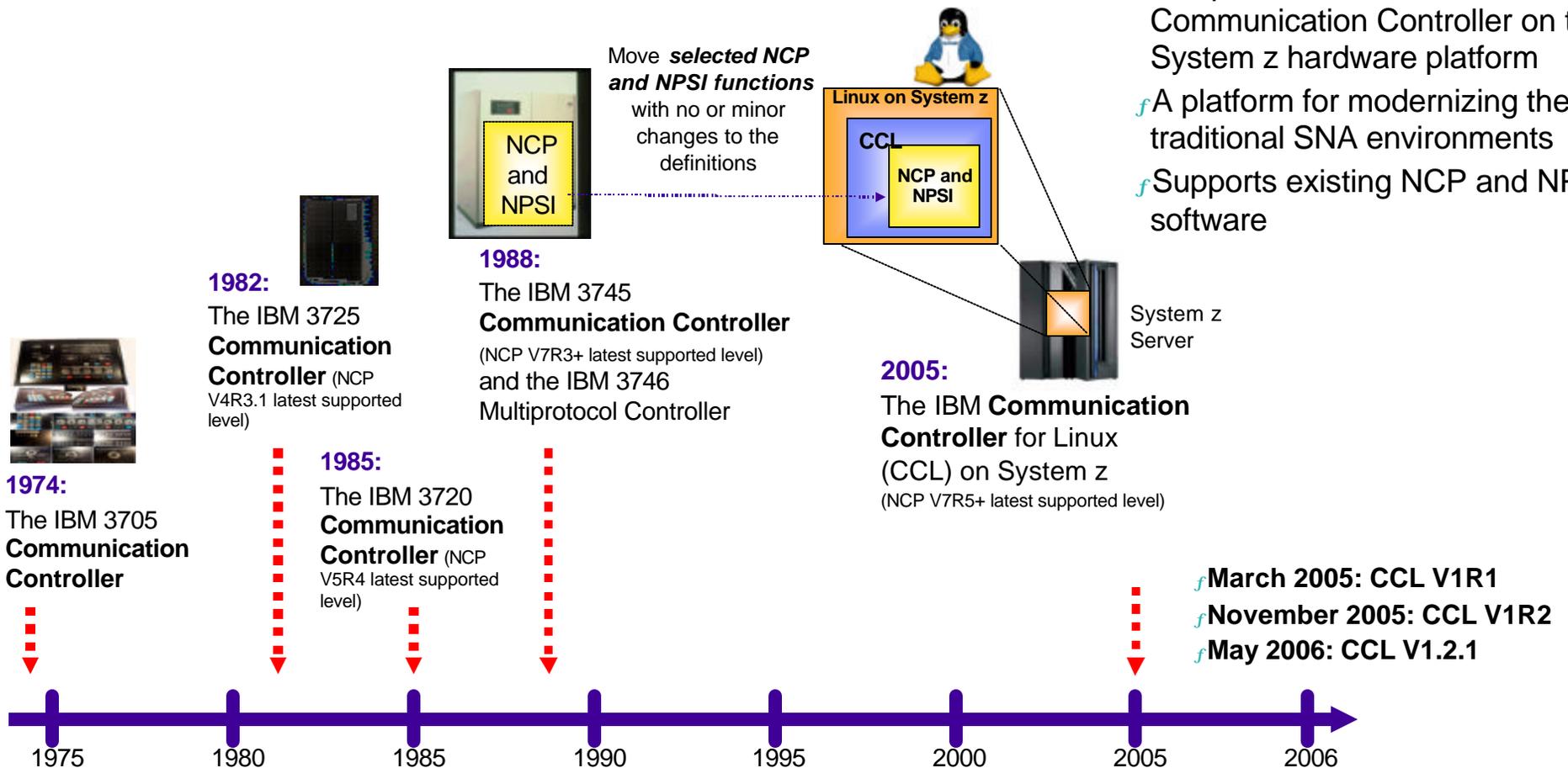
# IBM Communication Controllers - the foundation of SNA application access to the IBM mainframe since 1974

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

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

## ➤ What is CCL?

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



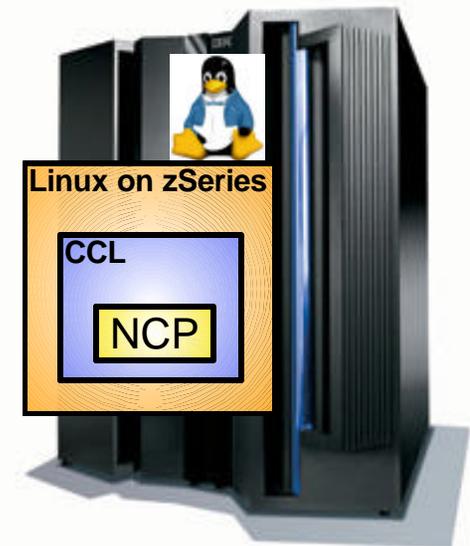
# CCL – the newest IBM Communication Controller features

## ➤ Continued NCP and NPSI support

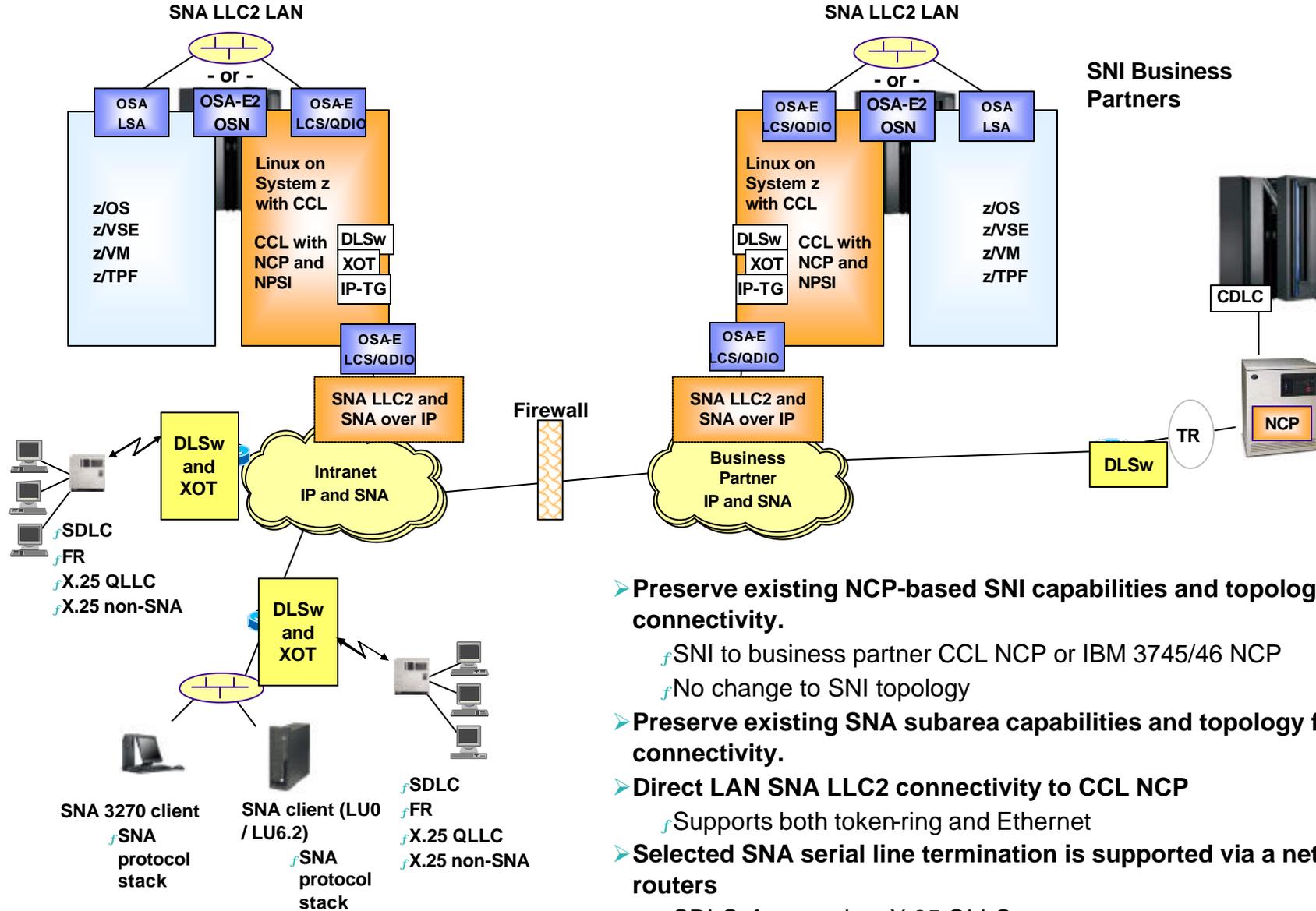
- ▶ SNI, INN, BNN, XRF, NRF, SSCP Takeover/Giveback, Duplicate TIC
- ▶ Preserved operations through VTAM commands, CCL MOSS console
- ▶ Preserved network management and tuning support through Tivoli NetView for z/OS, NTuneMON, etc.

## ➤ New Features

- ▶ 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
- ▶ Opportunities for consolidation



# CCL – NCP and NPSI connectivity



**SNI Business Partners**

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

# SNA over IP technologies

- **Data Link Switching (DLSw)**
  - ▶ **DLSw is a technology that switches SNA link level frames over an IP network imbedded in TCP connections between two DLSw endpoints**
    - Each DLSw endpoint terminates the SNA LLC2 connections
      - To avoid wide area network latency and performance impact on local LLC2 timers
      - To avoid wasting wide area network resources on polling
    - **DLSw uses one or two TCP connections between the two DLSw nodes when connecting over an IP network**
  
- **X.25 over TCP/IP (XOT)\***
  - ▶ **XOT is an open standard and defined in RFC 1613 "Cisco Systems X.25 over TCP (XOT)".**
  - ▶ **Encapsulates X.25 packets over a TCP/IP network.**
    - Supported by various router vendors - including Cisco
  
- **IPTG**
  - ▶ **CCL NCP to CCL NCP only - supports INN and SNI links**
  - ▶ **Uses a single TCP connection, with preconfigured port number, per INN/SNI link**
    - Can be secured using STUNNEL or IPsec
  - ▶ **Only supports subarea flows - no APPN ISR/HPR flows**

**\*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)**

# Modernizing an SNA APPN Infrastructure



## A select set of APPN-based technologies of special interest

### ➤ **Transport SNA over an IP network**

- ƒ High Performance Routing over IP - Enterprise Extender
- ƒ 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**

- ƒ An NCP may still be used even if VTAM is defined as an APPN node
- ƒ In VTAM if VTAM is attached to the network via an OSA LSA port
- ƒ 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**

- ƒ Branch Extender (BX, BEX, or BrNN) node technology

### ➤ **Control the amount of APPN transmission group definitions in an APPN network**

- ƒ Connection network technology - Virtual Routing Node (VRN)

### ➤ **APPN-based business partner connectivity**

- ƒ Extended Border Node (EBN) node technology
- ƒ Physical connectivity may be IP if EE is used at both business partner locations



# APPN routing protocol support overview

## ➤ There are three levels of routing protocols for APPN nodes

### f APPN/ISR routing

- Each APPN node has awareness of all sessions that send data through the node, uses storage on each NN 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)
- All APPN nodes are supposed to support APPN/ISR routing over one or more physical link types
- z/VM VTAM and z/VSE VTAM only support ISR routing

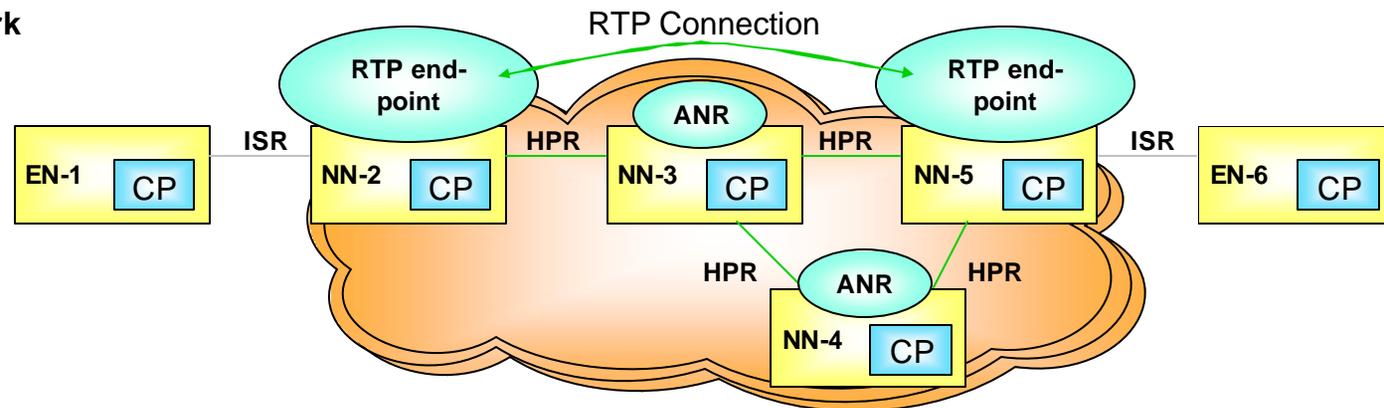
### f APPN/HPR routing

- 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
- If a link fails, HPR is able to non-disruptively re-route the data over another route - if one exists
- HPR routing may be end-to-end, if the endpoints support it, and also may 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
- z/OS VTAM, z/TPF, CS Linux (System z, Intel, and Power), CS Windows, CS AIX, i5/OS, OS/400, Microsoft Host Integration Server (HIS) 2004, PCOMM, and Cisco SNA Switch

### f APPN/HPR over IP routing (EE)

- z/OS, CS Linux (System z, Intel, and Power), CS Windows, CS/AIX, i5/OS, Microsoft HIS 2004, PCOMM, and Cisco SNA Switch all support EE
- z/VM VTAM, z/VSE VTAM, z/TPF, and OS/400 do not support EE

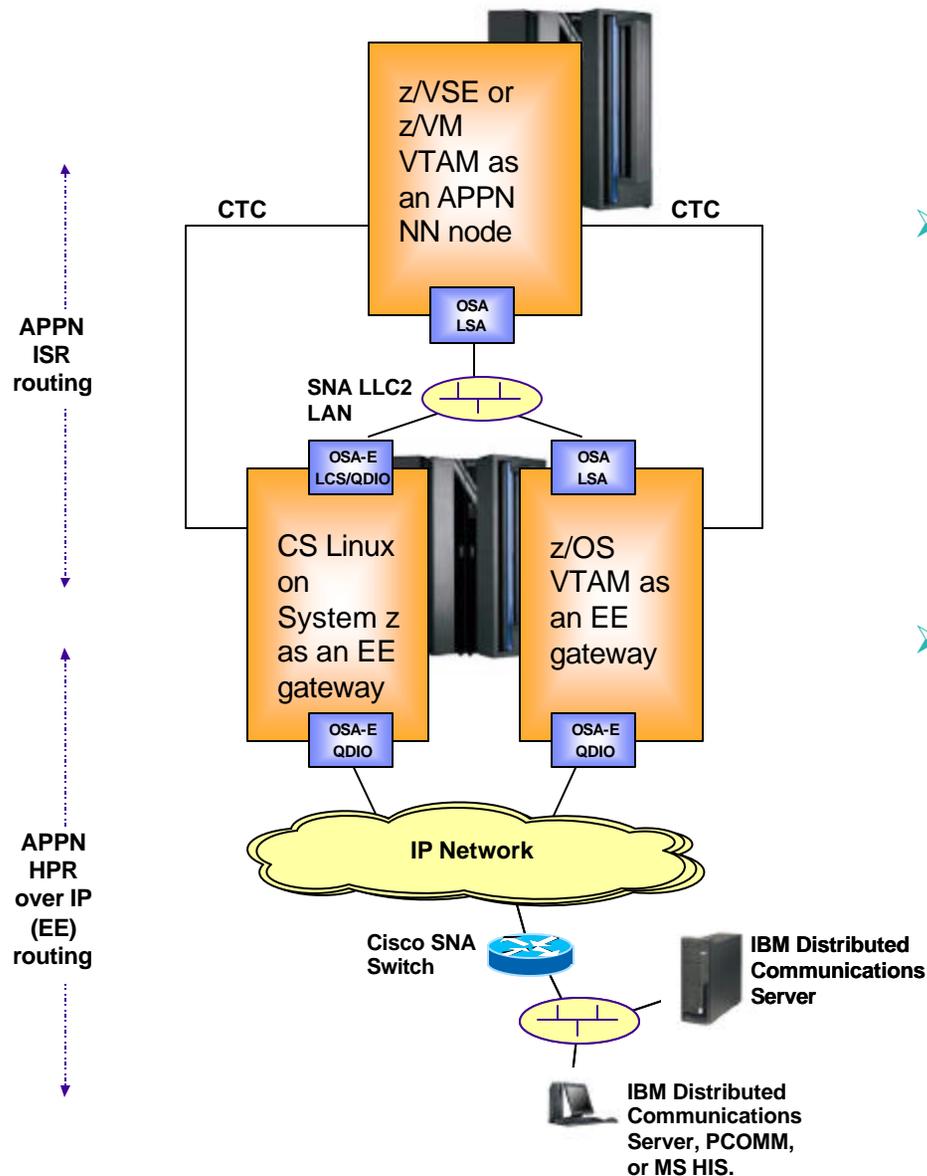
## ➤ You can mix and match in an APPN network



## Enterprise Extender characteristics

- **EE is APPN HPR routing over an IP network**
  - f To the IP network, EE looks like a UDP application
  - f To the APPN network, EE looks like an HPR link
- **Dependent LU access via DLUR/DLUS services**
  - f 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**
  - f 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**
  - f 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
  - f 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**
  - f But not with SSL/TLS - SSL/TLS is TCP only
- **Business partner connectivity through EE/EBN**

# How can you use EE with z/VSE and z/VM VTAM?



## ➤ VTAM on z/VSE and z/VM does support being configured as an APPN node

ƒ VTAM on z/VSE and z/VM also supports APPN ISR routing, but not HPR routing.

## ➤ If you need to connect z/VSE or z/VM as APPN nodes into an HPR or an HPR over IP (EE) infrastructure, you need an HPR/ISR gateway:

ƒ Can be VTAM on z/OS

ƒ Can be IBM Communications Server for Linux on System z  
 – Can also be IBM CS for Linux on a non-System z platform as long as there is SNA (APPN ISR routing) connectivity between that node and System z (could be via a shared LAN)

## ➤ If CS Linux is used, then the following requirements need to be met:

ƒ z/VSE and z/VM need to be in the same APPN NET ID as CS Linux

– CS Linux cannot act as an APPN border node

– z/OS can, in which case z/VSE and z/VM could be in a different SNA NET ID from z/OS

ƒ z/VSE and z/VM should be APPN network nodes

– It is strongly recommended that VTAM end nodes use VTAM network node servers

# 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 network 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

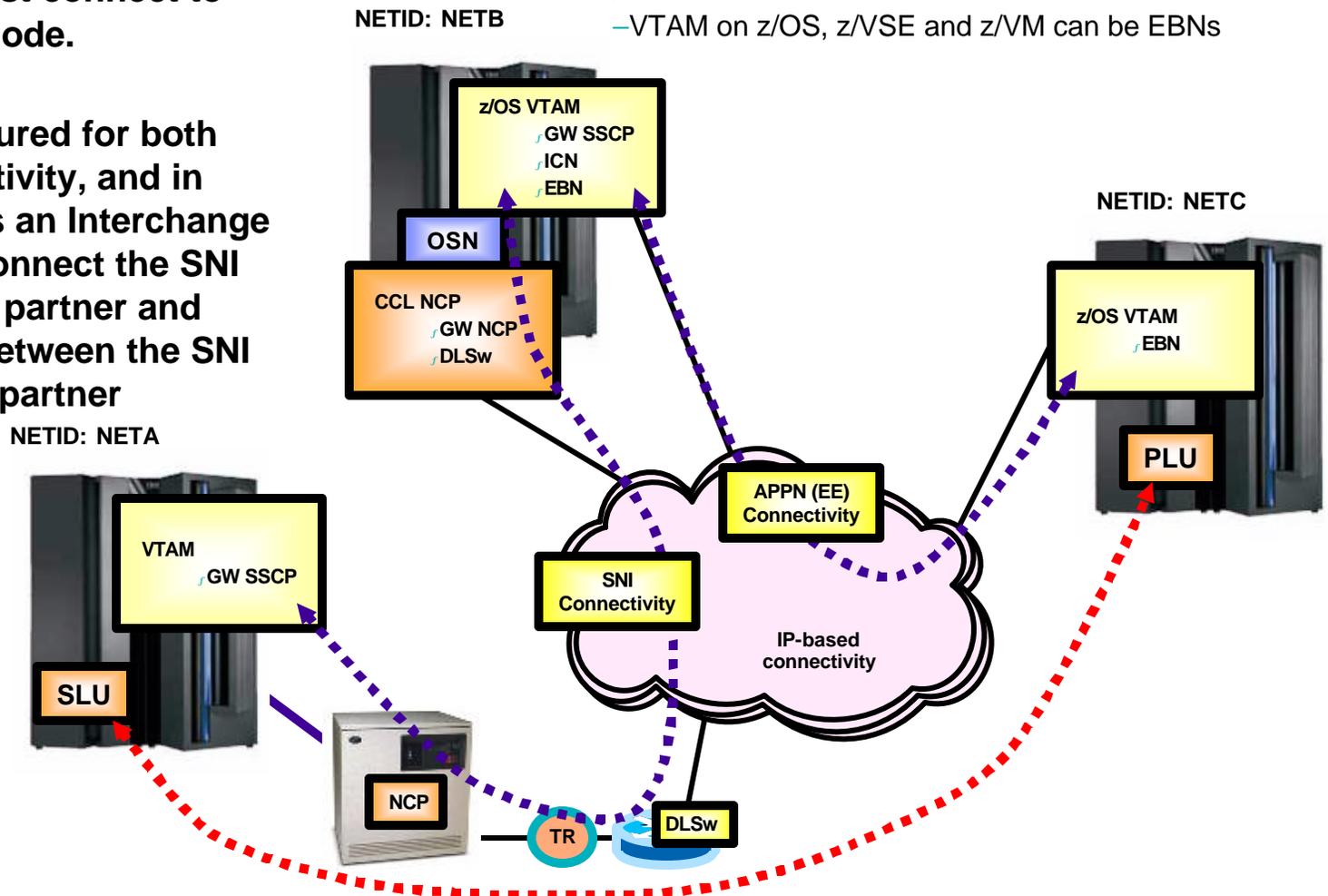
↳ NETA LUs can establish sessions with NETC LUs via NETB

➤ 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



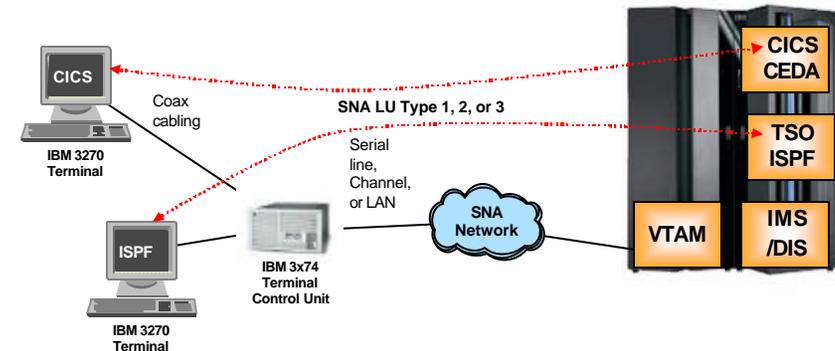
# Modernizing SNA Application Access



# An SNA application view of SNA modernization

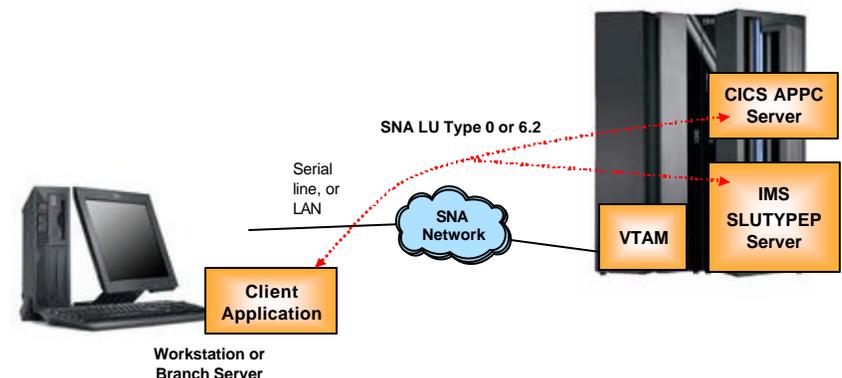
## ➤ SNA 3270 applications

- f It is the "server" part we need to preserve
  - CICS or IMS transactions (BMS/MFS)
  - TSO, NetView, etc.
- f Client environments
  - Traditional 3270 screen interface
    - SNA emulators or real IBM 3270 devices
    - SNA network infrastructure modernization focus
    - TN3270 emulators (fat clients and on-demand clients)
  - Web browser via HTTP(S)/HTML
  - Web services requester



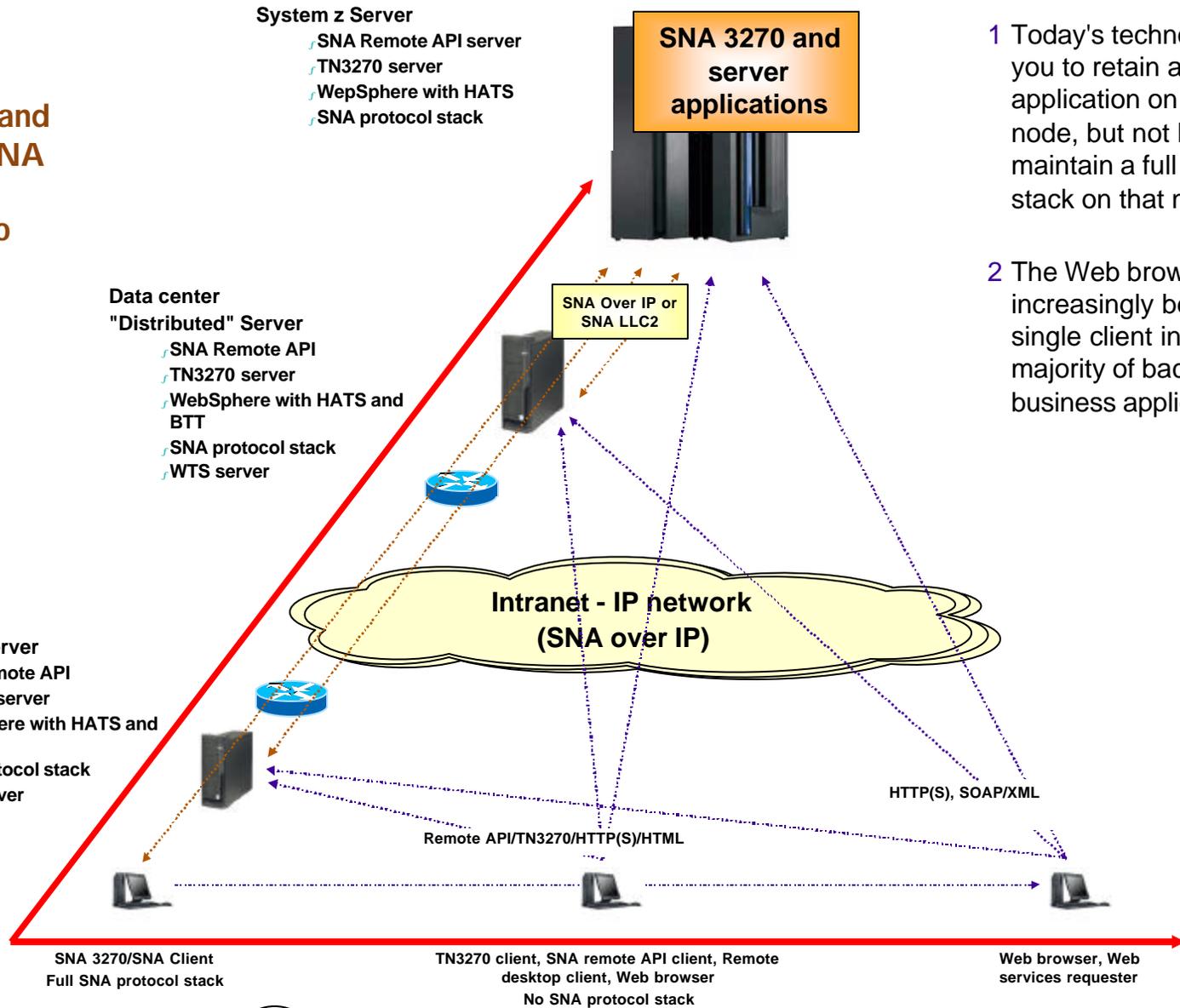
## ➤ SNA LU0/LU6.2 client/server applications

- f The "server" part:
  - CICS or IMS transactions
  - APPC/MVS, etc.
- f Client environments
  - User-written client
    - Preserve SNA client where it runs
    - SNA network infrastructure modernization focus
    - SNA node simplification focus (Remote SNA API technology)
  - Web browser via HTTP(S)/HTML
    - New "presentation" logic in HTTP server
  - Web services requester
    - New "presentation" logic in Web service wrapper



# 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

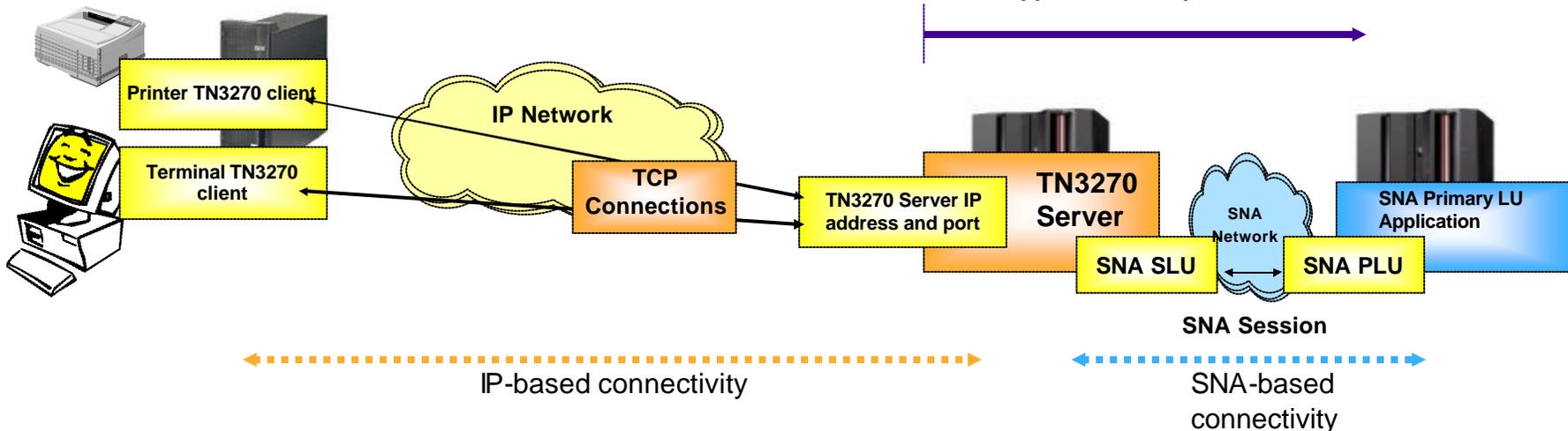
**SNA Node Topology  
Simplification - Preserving  
Existing SNA Client Interfaces**

# TN3270

- **Switching from SNA to TN3270 will in most cases remove a considerable portion of your SNA wide area network traffic.**
  - ƒ Along with that, it will remove the need for maintaining (and modernizing) an SNA network infrastructure between the end-user locations and the TN3270 server location.
  - ƒ TN3270 also removes the need for a full SNA protocol stack on the workstations - helping to consolidate SNA to the data center
- **Switching from SNA to TN3270 connectivity preserves the end-user interface - it is transparent to the end user and it is transparent to the 3270-based mainframe subsystems and applications (TSO, CICS, IMS, etc.).**
  - ƒ With one potential exception: some EHLLAPI programs may have issues with the switch
- **A TN3270 server infrastructure is often the base for further SNA 3270 application access modernization steps:**
  - ƒ SNA 3270/HTML transformation and Web-services integration.
- **With the recent withdrawal from marketing of some of the frequently used non-System z TN3270 solutions, this may be a good time to reconsider the location of the TN3270 service.**

Given that the majority of SNA network traffic in most cases is IBM 3270 traffic, replacing SNA-based 3270 access with IP-based TN3270 access and placing the TN3270 server in the data center can make a big reduction in the amount of SNA-based wide area network traffic that still exists in an enterprise.

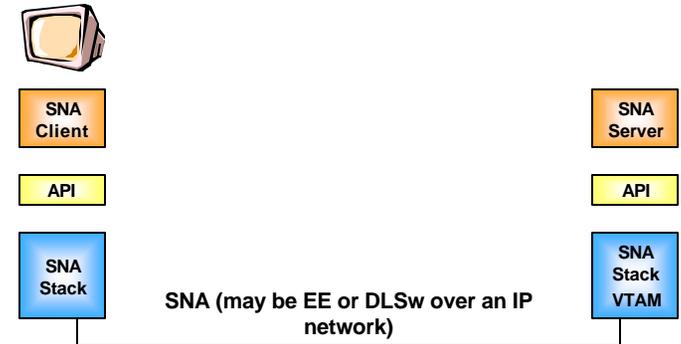
In the data center, as close to SNA applications as possible



# What about SNA LU0 or LU6.2 clients on workstations or branch servers? TN3270 does not address those!

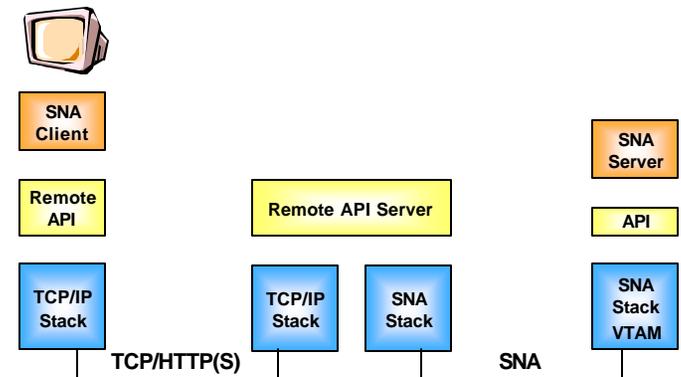
## A Preserve the SNA protocol stack and SNA client application on the workstation - transport SNA traffic over an IP network using EE or DLSw

- Retain existing SNA node topology, but address modernization through SNA network infrastructure modernization



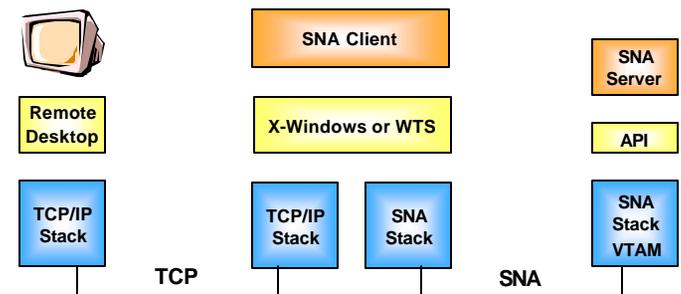
## B Preserve the SNA client application on the workstation, but collapse the SNA protocol stack into the data center using IBM's remote SNA API technology (also known as "split stack")

- Remove SNA protocol stack on SNA client node, consolidating SNA protocol stacks onto servers and/or into the data center



## C Preserve the GUI interface on the workstation, but collapse the SNA application and the SNA protocol stack into the data center using Microsoft's Windows Terminal Server technology or an X-Windows technology (also known as "split GUI")

- Move SNA client to a server (remote or in the data center)
- If the server is remote, then combine with split stack technology for further consolidation of SNA protocol stacks into data center SNA remote API servers



# Remote SNA API overview

➤ **Supports both dependent and independent LUs**

- ↳ For independent LUs that includes support for outbound attach requests
- ↳ Might be used for SNA 3270 emulation, where a migration to TN3270 isn't possible due to EHLLAPI issues
- ↳ IBM PCOMM can be configured to be an SNA 3270 emulator using the remote SNA API

➤ **Remote API servers can be configured in a server pool for load-balancing and availability**

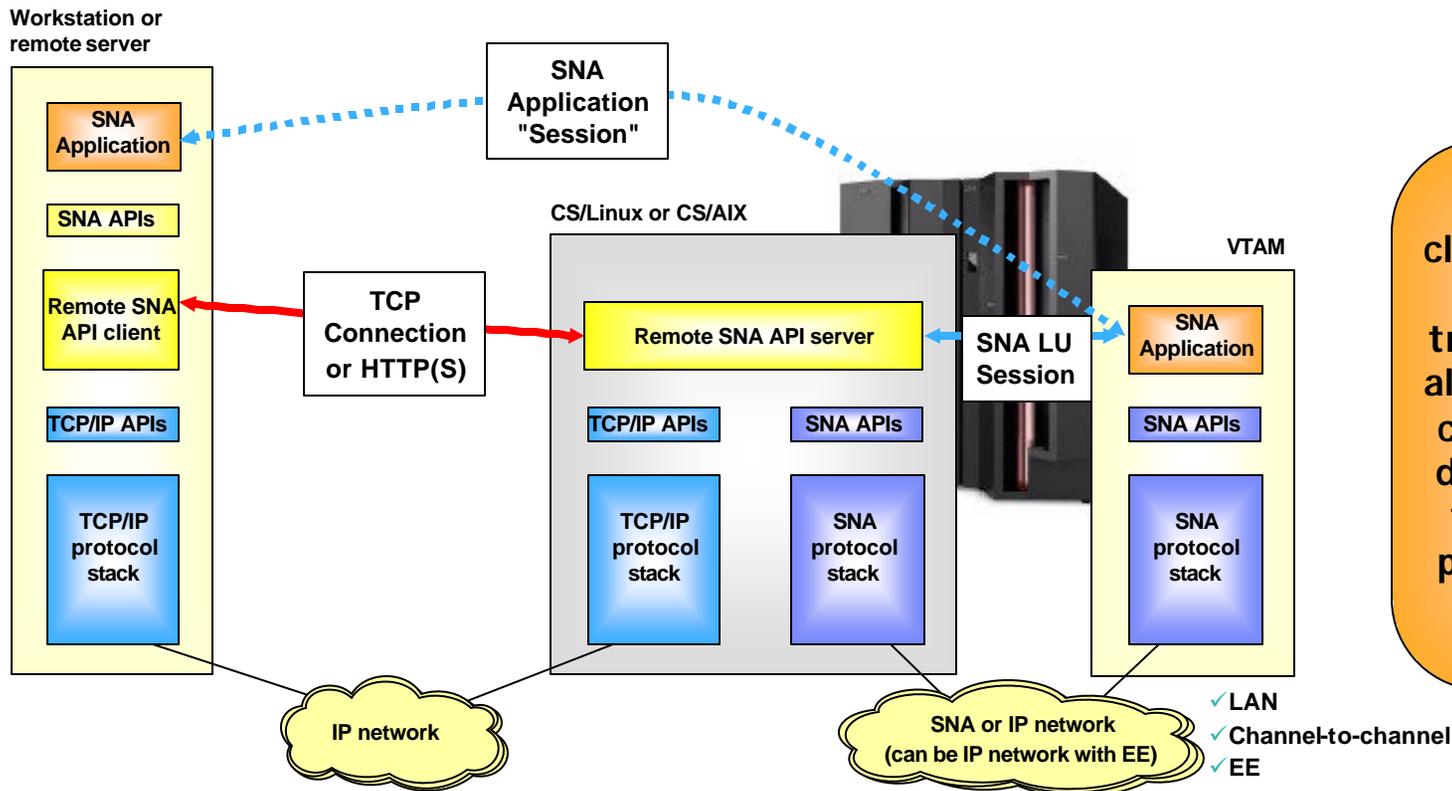
➤ **Two transports between remote API client and remote API server:**

- ↳ Plain TCP connection to remote API server-specific TCP port number
- ↳ HTTP(S) as transport requires WebSphere Application Server on the Remote SNA API server node

➤ **None of the traditional mainframe operating systems have support for being the remote SNA API server.**

➤ **IBM Communications Server for Linux does include support for being the remote SNA API server.**

- ↳ This includes Linux on System z - so a consolidation of the SNA protocol stacks all the way into System z is possible



The remote SNA API client/server technology is a simple, efficient, and transparent technology that allows continued use of SNA clients on workstations and distributed servers without the full footprint of SNA protocol software on those client nodes.

# Enabling Use of New Client Technologies



# Replacing the end-user interface with a Web browser or a Web service requester - transforming the SNA application data stream

## ➤ Stage 1 - Presentation integration (enhancing the user experience):

- ƒ Enabling a Web browser to act as the client for existing SNA applications
  - Transforming the SNA data stream to an HTML data stream over an HTTP(S) connection from a Web browser.
- ƒ For SNA 3270 applications, such transformation can often be done without writing new presentation logic.
  - The transformation can in most cases be rules-driven where the transformation rules are generated by a development toolkit based on the SNA 3270 data stream or, when the transformation is done in CICS or IMS, the unformatted application data structures (ADS).
- ƒ For SNA server applications that are accessed from LU0 or LU6.2 client programs, the transformation normally requires development of some new presentation logic to transform whatever presentation the existing client program did to the new user interface.

## ➤ Stage 2 - Programmatic integration (adapt for enhanced relationships):

- ƒ Enabling SNA applications as Web services
  - Providing a Web service development tooling and runtime technology that can be used to expose SNA application as Web services.
- ƒ For SNA 3270 applications, exposing the SNA 3270 core business application as a Web service is an additional element of the transformation that was discussed above
  - The transformation is extended to also expose the SNA 3270 application as a Web service and transform the SNA 3270 data stream to/from SOAP/XML instead of HTML.
- ƒ For SNA server applications, the transformation again normally requires development of a Web service wrapper component that is aware of the SNA client/server application protocol and knows how to transform the application data stream to/from SOAP/XML.

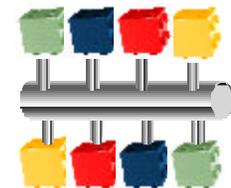
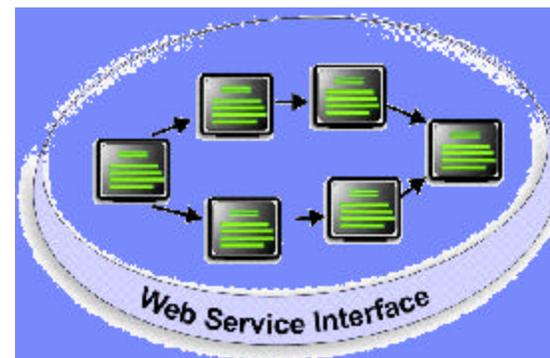
# SNA application access transformation IBM product overview

	SNA 3270 Application			SNA LU0 and SNA LU6.2 Application		
	Subsystem independent	CICS specific	IMS specific	Subsystem independent	CICS specific	IMS specific
<b>Presentation integration - SNA data stream / HTML transformation</b>	Host Access Transformation Services (HATS)	CICS Web Support and 3270 Web bridge, or CTG	IMS MFS Web Enablement	Branch Transformation Toolkit (BTT)	CICS Web support or CTG	IMS MFS Web support
<b>Programmatic integration - Expose SNA core business applications as Web services</b>	Host Access Transformation Services (HATS)	CICS Service Flow Feature and Link3270	IMS MFS Web Services	Branch Transformation Toolkit (BTT)	CICS Service Flow Feature	IMS MFS Web Services

When deciding if you are going to use a subsystem-independent solution or one or more subsystem-dependent solutions to Web-enable your SNA core business applications, you need to analyze much more than just the topology aspects of the two types of solutions. Each of them offers different levels of transformation capabilities, and a detailed analysis of what is required, compared to what is offered by these solutions, in combination with the network topology aspects, will determine which you will use.

# Introduction to IBM Host Access Transformation Services (HATS)

- Transforms 3270 and 5250 traditional screen applications into HTML interfaces
- Combines data from multiple screens, applications and application environments (CICS, IMS, TSO, etc.)
- Screen transformation rules running on IBM WebSphere Application Server
- No software download to clients
  - ƒ A Web browser is all that is needed on user workstations
- Extends terminal applications as Web Services
- Low skills requirement
- Rules-based, highly customizable
- Iterative, Eclipse-based development environment

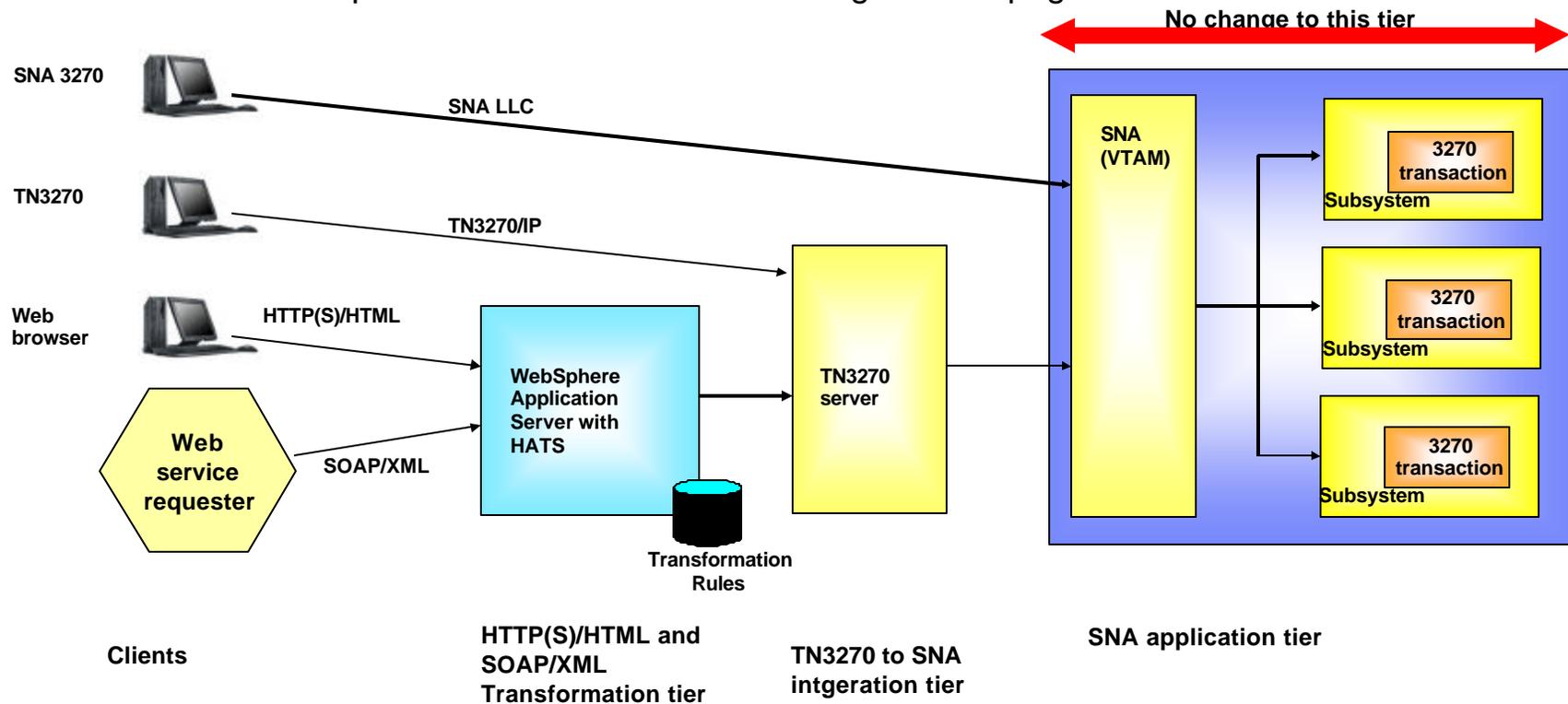


3270 and 5250 Data stream

# SNA 3270 mainframe application - multiple access channels, one mainframe application

## ➤ A technology such as HATS is subsystem independent

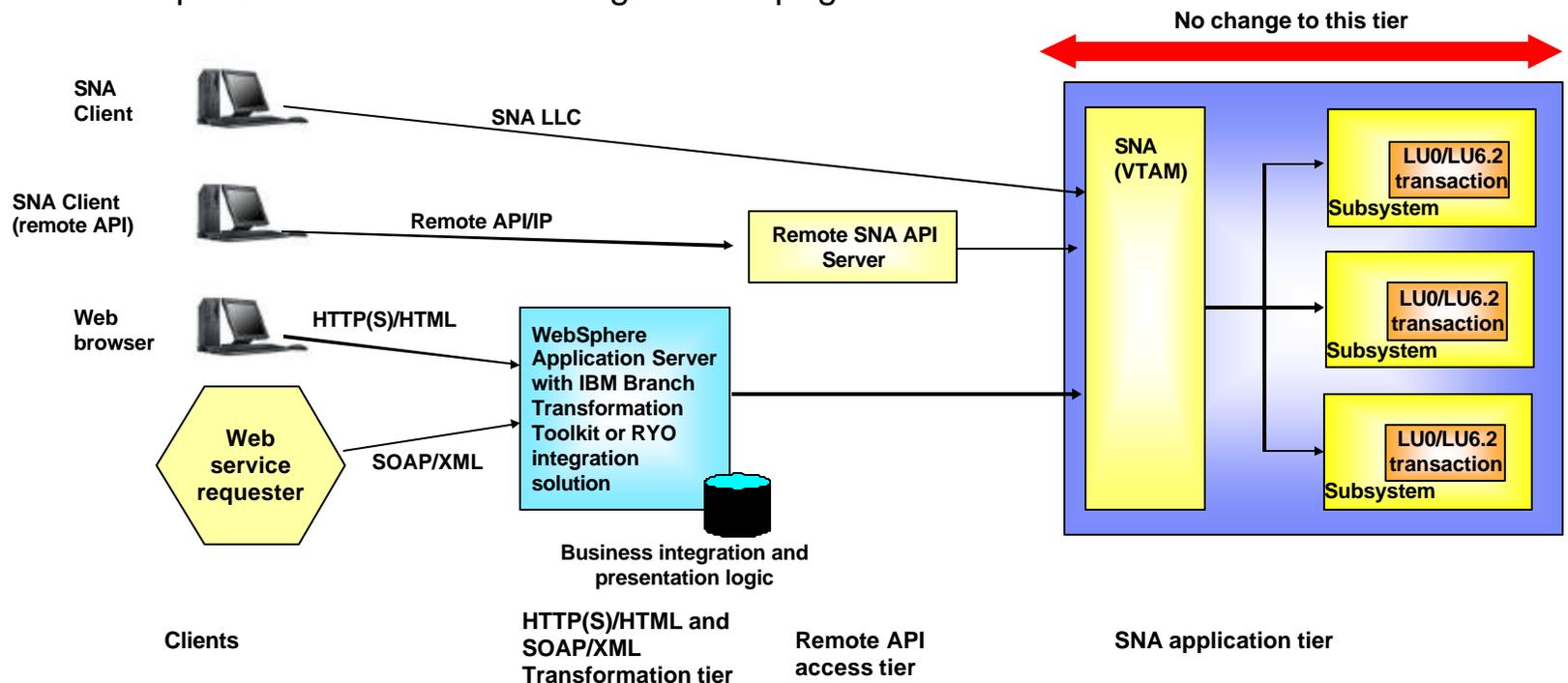
- f Transforms the SNA 3270 data stream
- f No change to the SNA 3270 application, the SNA application subsystem, or the SNA host operating system environment
  - The same SNA 3270 application can be used from traditional 3270 interfaces, such as real SNA 3270 terminals, SNA 3270 emulators, or TN3270 emulators
- f Transform IMS, CICS, TSO, etc. SNA 3270 applications
- f Can combine data from multiple SNA 3270 sessions into a single HTML page or Web service



# SNA LU0/LU6.2 mainframe application - multiple access channels, one mainframe application

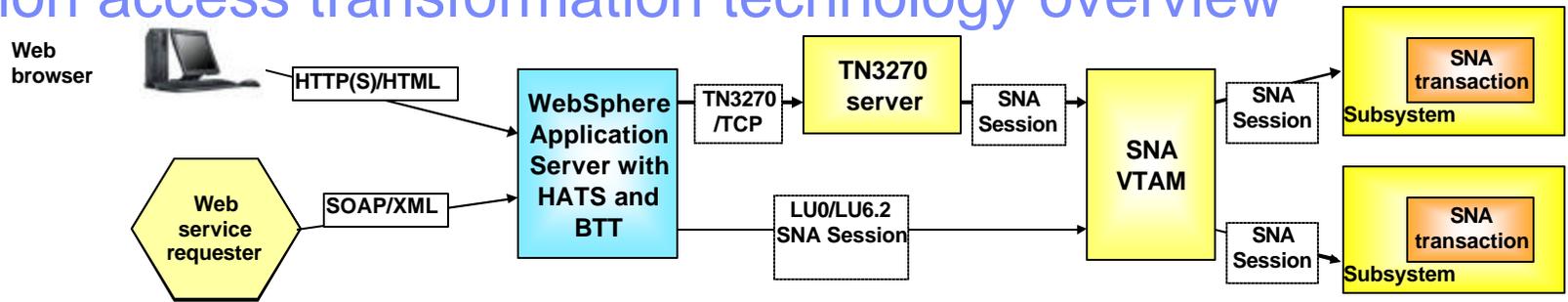
## ➤ A technology such as Branch Transformation Toolkit (BTT) is subsystem independent

- f BTT provides a set of adapters that allow Web applications running in a WebSphere Application Server environment to interface with existing enterprise applications and data.
- f Application logic on WebSphere transforms the application-based data stream
- f No change to the SNA LU0/LU6.2 application, the SNA application subsystem, or the SNA host operating system environment
  - The same SNA LU0/LU6.2 application can be used from SNA clients, or SNA clients that use the remote SNA API technology to traverse an IP network
- f Can be used to transform IMS, CICS, APPC/MVS, etc. SNA applications, supported on Windows, AIX, Linux on Intel
- f Can combine data from multiple SNA sessions into a single HTML page or Web service

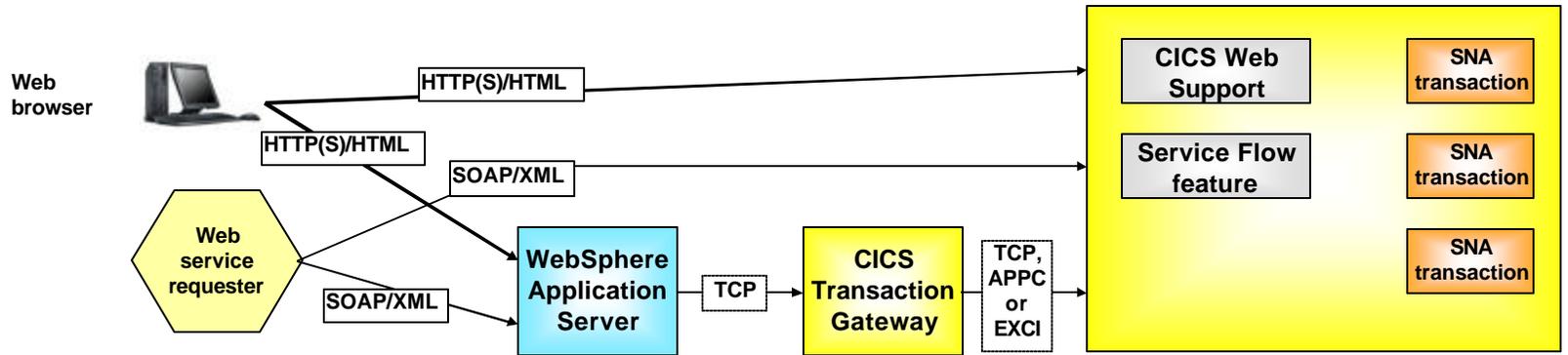


# SNA application access transformation technology overview

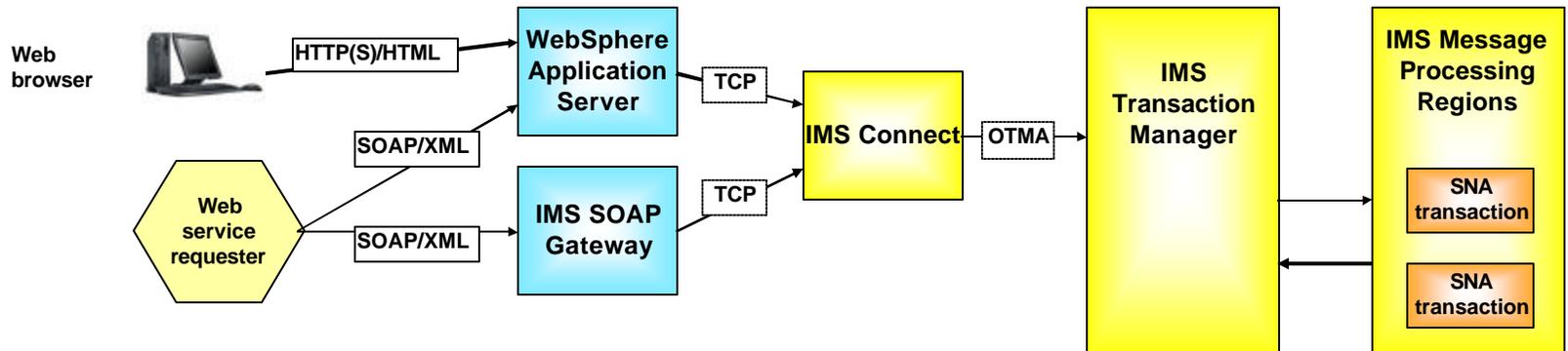
Subsystem independent topology



CICS specific topology

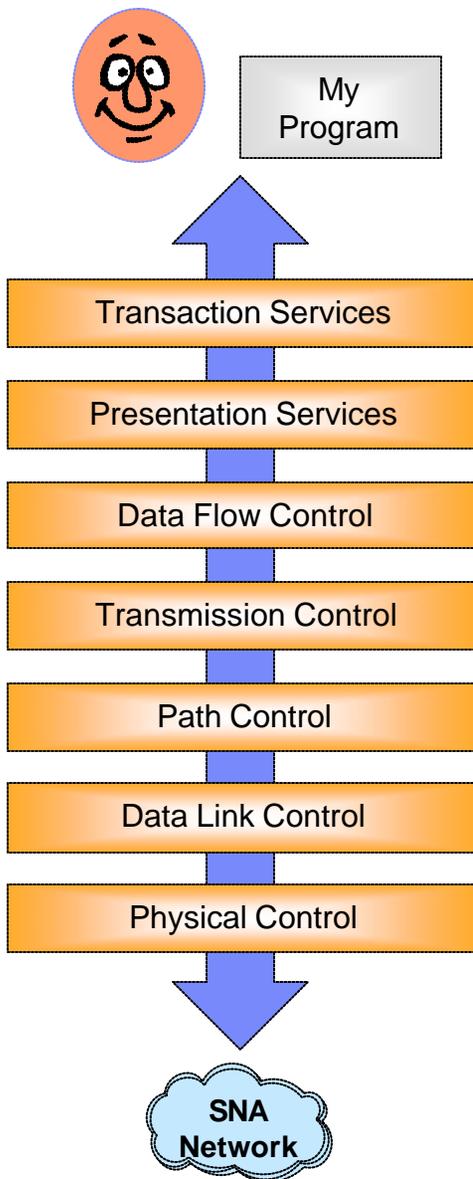


IMS specific topology





## It is all thanks to a good architecture



- **As long as the interface between two SNA architecture layers doesn't change, an underlying layer can be totally redesigned and re-implemented using new technologies and protocols for communication with its partner layer in another SNA node - without any impact to upper layers in the architecture, which ultimately includes the SNA applications.**

f Hardware components can be ripped out and replaced

- IBM 37xx
- Token-ring
- ESCON channels

f New protocols can be deployed

- Enterprise Extender
- DLSw
- XOT
- IP-TG
- Remote SNA API

f New clients can be introduced

- TN3270
- Web browsers
- Web service requesters

**With minimal or no impact to the applications or, in many cases, the application subsystems**

- **SNA was from the beginning built for change**

- **Protecting the investments made in programming skills and applications**

# SNA subarea network infrastructure modernization summary

Objectives		Modernization technologies				
		SNA subarea				APPN
		DLSw	XOT	CCL	IP-TG	EE
Enterprise Transformation Stage		0	0	0	0	0
Retain traditional 3270 screen on WS				(✓)		(✓)
Retain SNA client on WS				(✓)		(✓)
Access SNA 3270 applications from a Web browser with a web look and feel						
Enable as a Web service	SNA 3270 server application					
	SNA LU0 or LU6.2 server application					
Remove dependency on outdated hardware technologies	Token-ring			✓		(✓)
	IBM 3745/46			✓		(✓)
	Channel-attached SNA gateways			✓		(✓)
Share IP network for SNA and IP		✓	✓	(✓)	✓	✓
Consolidate SNA stacks into the data center						
Remove need for SNA						
Comments						

## ➤ IBM Communication Controller for Linux on System z:

- f Preserve NCP-based functions
  - SNA boundary functions
  - SNI Network Interconnect (SNI) to SNA business partners who continue to base such connectivity on SNI
- f Migrate from token-ring to Ethernet for SNA LAN connectivity
- f Remove dependence on ESCON channel-attached SNA hardware components

## ➤ DLSw as the main SNA over IP transport technology

- f DLSw endpoint imbedded into CCL Version 1.2.1

## ➤ IP-TG for CCL NCP to NCP - including SNI connectivity to business partners

- f Simple firewall administration - single TCP connection

## ➤ XOT for non-SNA X.25 connectivity to CCL NCP with NPSI

- f Retain mainframe NPSI application topology and support

# APPN network infrastructure modernization summary

Objectives		Modernization technologies				
		SNA subarea				APPN
		DLSw	XOT	CCL	IP-TC	EE
Enterprise Transformation Stage		0	0	0	0	0
Retain traditional 3270 screen on WS				(✓)		(✓)
Retain SNA client on WS				(✓)		(✓)
Access SNA 3270 applications from a Web browser with a web look and feel						
Enable as a Web service	SNA 3270 server application					
	SNA LU0 or LU6.2 server application					
Remove dependency on outdated hardware technologies	Token-ring			✓		(✓)
	IBM 3745/46			✓		(✓)
	Channel-attached SNA gateways			✓		(✓)
Share IP network for SNA and IP		✓	✓	(✓)	✓	✓
Consolidate SNA stacks into the data center						
Remove need for SNA						
Comments						

## ➤ APPN with High Performance Routing over IP (Enterprise Extender)

f SNA traffic integrated with the IP core network

## ➤ DLUR/DLUS support for peripheral nodes

f Support for peripheral nodes with dependent LUs in an APPN network environment - offering an alternative to NCP-based boundary functions in an APPN network

f DLUR nodes are typically not limited to token-ring connectivity, but support SNA over Ethernet

f Some DLUR nodes also support terminating serial SNA lines (SDLC, frame relay, X.25 QLLC) and performing SNA boundary functions for SNA devices connected through such transmission facilities

## ➤ APPN connection network technology

f To keep manual APPN link definitions to a minimum

## ➤ Branch Extender node technology

f To limit the number of APPN network nodes

f Does not support downstream DLUR nodes

## ➤ EE/EBN as SNI replacement

f For business partner connectivity where both partners are APPN/EE enabled

# SNA network infrastructure simplification summary

Objectives		Modernization technologies							
		SNA 3270 applications			SNA Client/Server applications				Rewrite applications to TCP/IP APIs or as Web services
		TN3270 emulation (PCOMM and HOD)	User interface transformation (HATS, IMS, CICS)	Web service and SOA integration (HATS, IMS, CICS)	Remote API	Remote desktop	Web service and SOA integration (BTT, IMS, CICS)	DRDA o. IP	
Enterprise Transformation Stage	0	1	2	0	0	1 and 2	0	0	3
Retain traditional 3270 screen on WS	✓				(✓)				
Retain SNA client on WS				✓	(✓)				
Access SNA 3270 applications from a Web browser with a web look and feel		✓							
Enable as a Web service	SNA 3270 server application		✓						
	SNA LU0 or LU6.2 server application					✓			
Remove dependency on outdated hardware technologies	Token-ring								
	IBM 3745/46								
	Channel-attached SNA gateways								
Share IP network for SNA and IP									
Consolidate SNA stacks into the data center	✓	✓	✓	✓	✓	✓			
Remove need for SNA			(✓)			(✓)	✓	✓	✓
Comments							For DRDA traffic	For MQ traffic	

## ➤ TN3270

- f Preserve 3270 "green screen" user interface
- f Replace SNA 3270 emulation
- f Transport 3270 data stream over a TCP connection
- f Remove remote SNA protocol stack on emulator workstation

## ➤ Remote API

- f Preserve SNA client placement
- f Remove remote SNA protocol stack for SNA clients
- f Transport SNA API calls over TCP or HTTP(S)

## ➤ Remote desktop

- f Consolidate application functions on WTS server
- f In combination with remote API, remove SNA protocol stack on server node (WTS or X-Windows)

# Enable new client technologies - summary

Objectives		Modernization technologies								
		SNA 3270 applications			SNA Client/Server applications					Rewrite applications to TCP/IP APIs or as Web services
		TN3270 emulation (PCOMM and HOD)	User interface transformation (HATS, IMS, CICS)	Web service and SOA integration (HATS, IMS, CICS)	Remote API	Remote desktop	Web service and SOA integration (BTT, IMS, CICS)	ORDA o. IP	MQ o. IP	
Enterprise Transformation Stage	0	1	2	0	0	1 and 2	0	0	3	
Retain traditional 3270 screen on WS	✓				(✓)					
Retain SNA client on WS				✓	(✓)					
Access SNA 3270 applications from a Web browser with a web look and feel		✓								
Enable as a Web service	SNA 3270 server application		✓							
	SNA LU0 or LU6.2 server application					✓				
Remove dependency on outdated hardware technologies	Token-ring									
	IBM 3745/46									
	Channel-attached SNA gateways									
Share IP network for SNA and IP										
Consolidate SNA stacks into the data center	✓	✓	✓	✓	✓	✓				
Remove need for SNA			(✓)			(✓)	✓	✓	✓	
Comments							For ORDA traffic	For MQ traffic		

## ➤ Web browser

- f HTML transformation
- f IBM Host Access Transformation Services
- f IBM Branch Transformation Toolkit
- f CICS Web support
- f IMS Integration Solutions
- f RYO

## ➤ Web service requester

- f SOAP/XML transformation
- f Web services "wrapper"
- f Integrate SNA services into new business processes based on a service-oriented architecture
- f IBM Host Access Transformation Services
- f IBM Branch Transformation Toolkit
- f CICS Service Flow Feature
- f IMS Integration Solutions
- f RYO

## Additional WebSphere Product Resources

- Discover the latest trends in WebSphere Technology and implementation, participate in technically-focused briefings, webcasts and podcasts at:  
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- Learn about the Electronic Service Request (ESR) tool for submitting problems electronically:  
[www.ibm.com/software/support/viewlet/probsub/ESR\\_Overview\\_viewlet\\_swf.html](http://www.ibm.com/software/support/viewlet/probsub/ESR_Overview_viewlet_swf.html)
- Sign up to receive weekly technical My support emails: [www.ibm.com/software/support/einfo.html](http://www.ibm.com/software/support/einfo.html)





# Appendix A

## Reference Material



## Contact - for additional information - etc.....

➤ **For more information on any of the solutions mentioned in this session, please contact:**

- f EMEA: Peter Redman - Peter\_Redman@uk.ibm.com
- f North America: Erika Lewis - erika@us.ibm.com
- f Latin America: Suvas Shah - suvas@us.ibm.com
- f AP: Chuck Gardiner - cgardine@us.ibm.com

➤ **For planning and installation services, contact:**

- f Heather Johnson-Dunnings in IBM SWG Application and Integration Middleware Software e-Server Services - hjd@us.ibm.com

➤ **For technical assistance in the Americas, IBMers can submit a TechExpress through [w3.ibm.com](http://w3.ibm.com) or a question through WWQ&A**

➤ **Information in this session is based on the following Redbook.**

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



## Reference information

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

- f IBM Communication Controller for Linux on System z V1.2.1 Implementation Guide, SG24-7223-00
- f IBM Communication Controller Migration Guide, SG24-6298-02
- f Using IBM WebSphere Host Access Transformation Services V5, SG24-6099-00
- f IBM Branch Transformation Toolkit 5.1 Migration and Usage Guidelines, SG24-7160-00
- f CICS Transaction Gateway for z/OS Version 6.1, SG24-7161-00
- f Revealed! Architecting e-business Access to CICS, SG24-5466-04
- f IMS Connectivity in an On Demand Environment: A Practical Guide to IMS Connectivity, SG24-6794-00
- f Communications Server for z/OS V1R7 TCP/IP Implementation, Volume 1: Base Functions, Connectivity, and Routing, SG24-7169-00
- f Communications Server for z/OS V1R7 TCP/IP Implementation, Volume 2 - Standard Applications, SG24-7170-00
- f Communications Server for z/OS V1R7 TCP/IP, Implementation Volume 3 - High Availability, Scalability, and Performance, SG24-7171-00
- f Communications Server for z/OS V1R7 TCP/IP Implementation, Volume 4: Policy-Based Network Security, SG24-7172-00

➤ **Other sources of information:**

- f HATS Version 6 Information Center: <http://publib.boulder.ibm.com/infocenter/hatshelp/v60/index.jsp>



For more information....



URL	Content
<a href="http://www.ibm.com/servers/eserver/zseries">http://www.ibm.com/servers/eserver/zseries</a>	IBM eServer zSeries Mainframe Servers
<a href="http://www.ibm.com/servers/eserver/zseries/networking">http://www.ibm.com/servers/eserver/zseries/networking</a>	Networking: IBM zSeries Servers
<a href="http://www.ibm.com/servers/eserver/zseries/networking/technology.html">http://www.ibm.com/servers/eserver/zseries/networking/technology.html</a>	IBM Enterprise Servers: Networking Technologies
<a href="http://www.ibm.com/software/network/commserver">http://www.ibm.com/software/network/commserver</a>	Communications Server product overview
<a href="http://www.ibm.com/software/network/commserver/zos/">http://www.ibm.com/software/network/commserver/zos/</a>	z/OS Communications Server
<a href="http://www.ibm.com/software/network/commserver/z_lin/">http://www.ibm.com/software/network/commserver/z_lin/</a>	Communications Server for Linux on zSeries
<a href="http://www.ibm.com/software/network/ccl">http://www.ibm.com/software/network/ccl</a>	Communication Controller for Linux on zSeries
<a href="http://www.ibm.com/software/network/commserver/library">http://www.ibm.com/software/network/commserver/library</a>	Communications Server products - white papers, product documentation, etc.
<a href="http://www.redbooks.ibm.com">http://www.redbooks.ibm.com</a>	ITSO Redbooks
<a href="http://www.ibm.com/software/network/commserver/support">http://www.ibm.com/software/network/commserver/support</a>	Communications Server technical support
<a href="http://www.ibm.com/support/techdocs/">http://www.ibm.com/support/techdocs/</a>	Technical support documentation (techdocs, flashes, presentations, white papers, etc.)
<a href="http://www.rfc-editor.org/rfcsearch.html">http://www.rfc-editor.org/rfcsearch.html</a>	Request For Comments (RFC)