Communications Server z/OS V1R5 and V1R6 Technical Update

SNI and SNA Gateway Scenarios without 374X Hardware

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IBM Statement of Direction Update on SNA support in 2004

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It is IBM's intent to support VTAM7 in z/OS7 Communications Server for the foreseeable future. Customers have a substantial investment in 3270 and SNA applications. We continue to support and enhance VTAM's capabilities while integrating it with new technologies. IBM has no plans at this time to discontinue SNA support in z/OS Communications Server. As of June 2004, customers can, for selected SNA workloads, use Communications Server products for Linux, Linux on IBM eServer zSeries, Microsoft Windows7, and AIX7 to replace some of the old SNA infrastructure components, such as the IBM 3745/46 or other channel-attached SNA controllers. z/OS Communications Server can replace some SNA Network Interconnect (SNI) workloads using Enterprise Extender and Extended Border Node functions.

It is IBM's intent to introduce an additional solution in 2005 that uses NCP (Network Control Program) software running within Linux on zSeries. The intent is to provide a migration path for customers who use traditional SNA (including SNA Network Interconnect (SNI)) to communicate with their business partners. This solution can allow them to continue using traditional SNA without a dependency on IBM 3745 and 3746 Communications Controller hardware.

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SNA: dead or alive?

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- SNA Applications: Over a trillion lines of customer written application code based on CICS, IMS, and DB2
- 70% of all business data still accessed via SNA applications
- Numerous market factors including the continued convergence of enterprise networks onto IP technologies, and the withdrawal of the venerable 3745 from marketing, have led to a very rapid adoption of Enterprise Extender as a key component of SNA application access strategy amongst the IBM customer set.

SNA applications are very much alive!

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SNA/IP integration strategy objectives

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- ✓ **Preserve investment in the SNA application portfolio for the "natural" lifetime of those SNA applications.**
  - ➢ Preserve the ability to access those SNA applications using traditional end-user technologies such as an IBM 3270 terminal interface or SNA-based client/server program-to-program communication.
  - ➢ Enable reuse of those same SNA applications from an emerging e-Business environment through various forms of Web-enabling technologies.
    - • User interface transformation through technologies such as Host Access Transformation Services.
    - • e-Business application integration through various forms of WebSphere Application Server connector technologies.
- ✓ **Help reduce cost of owning and operating an enterprise networking infrastructure.**
  - ➢ Remove business dependency on SNA networking technology that is no longer strategic or is nearing end of life.
    - • IBM 3745/46 Communication Controller (no longer marketed by IBM)
    - • Token-ring technology (products rapidly being withdrawn in general)
    - • ESCON7 channel-attached SNA controllers of various types (ESCON channel chips no longer manufactured)
    - • AnyNet7 technology (z/OS V1R7 is last z/OS release to support AnyNet on z/OS)
    - • OS/27 (End of Service announced for 2006)
  - ➢ Help reduce software licenses and maintenance costs associated with multiprotocol wide area networking and related management software.
  - ➢ Reduce dependency on SNA wide area network technology skills.
  - ➢ Be able to move forward with SNA to IP migration without dependency on business partner progress or lack thereof with respect to SNA to IP migration activities.
- ✓ **Help improve return on investments in the enterprise networking infrastructure by consolidating all wide area network traffic to an IP-based networking technology.**
  - ➢ Focus on establishing a highly available, scalable, and secure IP-based networking infrastructure.
  - ➢ Reduce overall networking infrastructure complexity.
  - ➢ Consolidate the SNA networking environment into the zSeries box(es) or as a minimum into the data center.

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SNA/IP integration elements

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- A multi-step approach:
  - Consolidate intranet **SNA 3270** traffic (LU1/SCS, LU2, LU3/DSC) into the data center:
    - Using TN3270 client software (PCOM, HOD, OEM) on the user workstation connecting to a TN3270 server in the data center, which could be z/OS or Linux on zSeries
    - Using standard Web browser on the user workstation connecting to WebSphere Application Server Host Access Transformation Services on a server node in the data center, which could be z/OS or Linux on zSeries

  - Move **middleware** communication off SNA where applicable. DB2 DRDA, MQ, etc. can be migrated to native IP communication without impact on database or messaging applications.

  - For remaining **SNA Client/Server applications** in the branches/remote locations (LU0, LU6.2), use one of the following technologies to transport the SNA data over an IP network:
    - Enterprise Extender to transport native SNA flows over an IP network from the branch and into the data center. EE can in the branch be deployed on the workstation or on an EE gateway in the branch. In the data center, EE can be deployed on an EE gateway, such as CS Linux, or on z/OS itself.
    - Use a remote SNA API technology to ship Windows and Linux SNA application calls over an IP network to an SNA API server running on CS Linux in the data center.

  - Move IBM 3745/46-based **business partner communication** to Enterprise Extender technology or to the new IBM Communication Controller for Linux on zSeries (SOD: 2005).

  - Migrate OS/2-based SNA branch server applications to Linux and use either the EE technology or the remote API technology to traverse the IP wide area network.

  - To the extent supported, move remaining native SNA communication coming in through an IBM 3745/46 to the new IBM Communication Controller for Linux on zSeries using the SNA boundary functions.

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SNA/IP integration without changing SNA applications - a transformation is needed somewhere!

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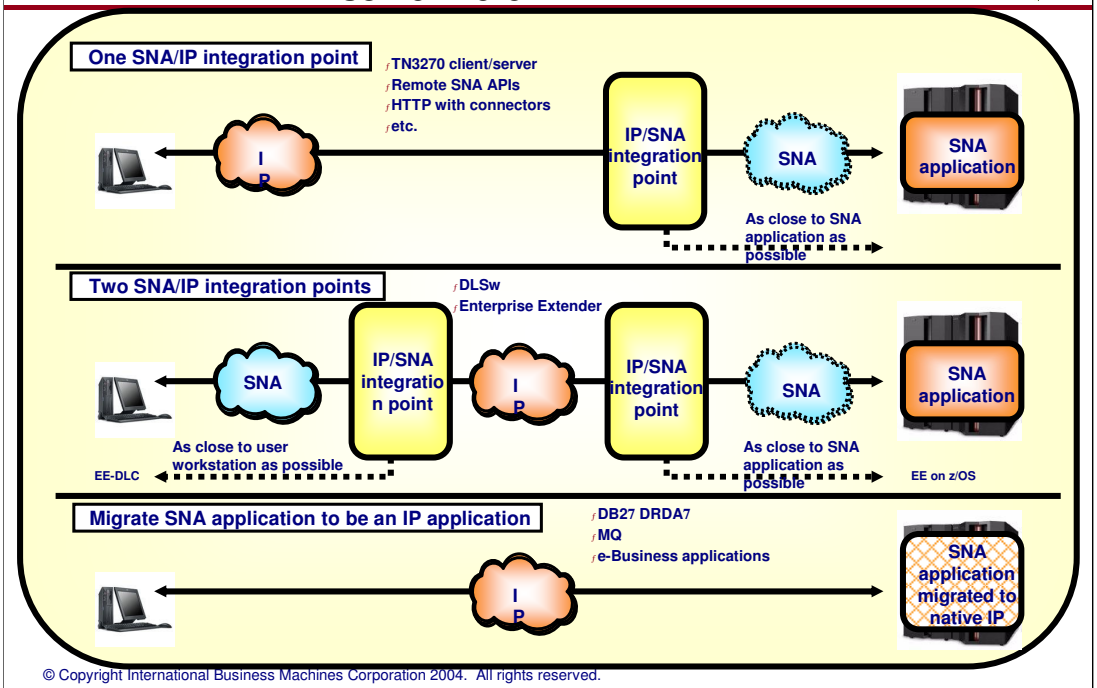

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Key points about Enterprise Extender

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- Enterprise Extender is based on the latest SNA architecture - High Performance Routing (HPR)
  - Includes all the dynamics of Advanced Peer to Peer Networking (APPN)
    - Dynamic SNA resource and topology discovery
  - Includes all the performance and availability aspects of HPR
    - Non-disruptive SNA path switches - SNA sessions survive HPR link failures if an alternate path is available or when the original link recovers
  - EE is HPR over IP and looks at the underlying IP network as a single HPR link
    - Benefits of IP network high-availability features:
      - Redundant network equipment and paths
      - Dynamic recovery from IP topology changes
      - QoS based routing with IP QoS derived from SNA Class Of Service (COS)
  - To be an EE node, that node also needs to have both APPN and HPR enabled
- EE may be deployed in an internal network using two base topologies
  - EE pushed to the edge of the network - IP end-to-end
    - On z/OS - allowing IP traffic to enter/leave z/OS over OSA-Express adapters using QDIO or using HiperSockets between LPARs on a zSeries
    - On the workstation using EE-DLC (Data Link Control) features of products such as IBM Personal Communications or Communications Server for Windows or Linux
  - EE deployed on gateways in the network - simple to implement
    - EE gateways can be deployed in the branch on CS Windows, CS Linux, CS AIX, or SNA Switch
    - EE gateways can be deployed in the data center on the same platforms as in the branch or directly on zSeries using either z/OS or CS Linux on zSeries acting as gateways to other zSeries operating systems
      - An EE gateway on zSeries allows network flows between the zSeries and the network to be IP based

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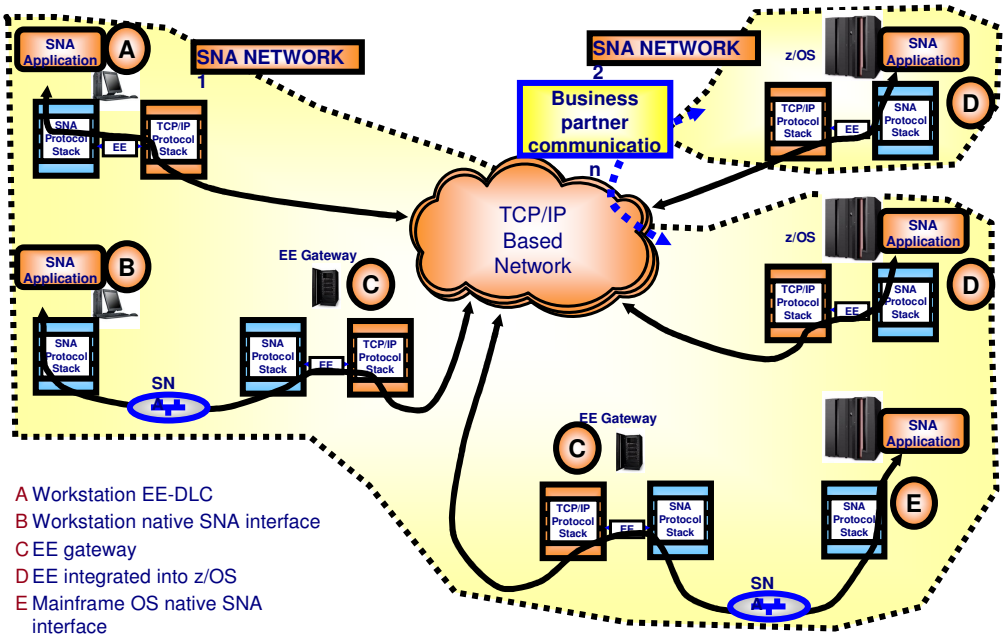
Enterprise Extender - Topology principles



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Key points about Enterprise Extender - continued

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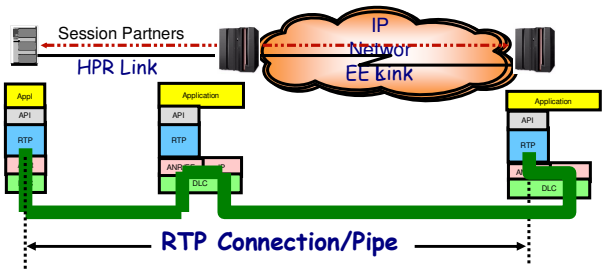
- EE can be used to implement business partner communication based on the APPN Extended Border Node (EBN) function
  - SNA over IP end-to-end with z/OS business partners
- EE offers a one-stop solution for SNA/IP integration that supports both branch and business partner communication and offers the opportunity for use of IP network flows end-to-end
- Use of EE requires no changes to SNA applications
- Network infrastructure is native IP, which allows the router infrastructure to maximize router efficiency - no need for routers to perform functions beyond native IP routing
- Use of EE can reduce the APPN network complexity by collapsing the APPN Network Node (NN) topology into the data center
  - Minimizes the effect of APPN network searches



Why doesn't all installations use EE on z/OS?

- Requires APPN and HPR enablement of the z/OS environment
- EE uses UDP packets and that causes problems for firewall administrators
- EE requires coordinated actions by both end-points
  - Issue for business to business communication

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Two basic models for SNA/IP integration point on zSeries

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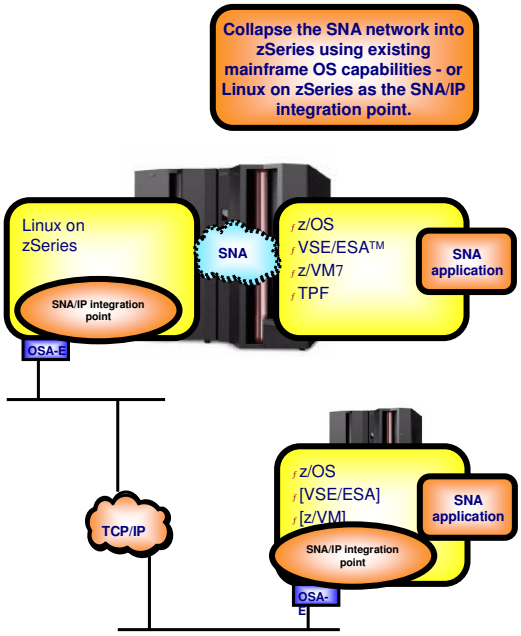
Linux on zSeries SNA/IP integration technologies:

- ✓Communications Server for Linux (CS Linux) on zSeries ***(available now!)***
- ✓Communication Controller for Linux (CCL) on zSeries ***(planned availability 2005!)***
- ✓The WebSphere Application Server environment ***(available now!)***
  - ƒHost Access Transformation Services
  - ƒConnectors

You may end up mixing and matching - using some SNA/IP integration technologies inside your existing zSeries operating system environment and others inside Linux on zSeries

The Linux on zSeries operating system image may be on the same zSeries as your existing zSeries operating system, or it may be on another zSeries that has some kind of SNA network connectivity:

- ✓CTC/MPC
- ✓Shared SNA LAN



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The z/OS environment

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Why place the SNA/IP integration point on z/OS?

- ✓Functions
  - Functionally most rich TN3270 server on the market
  - Supports both SNA subarea-based (SNI) and EE-based (EBN) business partner connectivity
- ✓Performance
  - No extra "hops"
  - IP traffic over high-speed OSA-Express interfaces
  - High-performance same-OS interfaces between the IP and SNA side of the integration point
- ✓Capacity/Scalability/Availability
  - Both the SNA and TCP/IP environments on z/OS are based on and use the z/OS Sysplex technologies
  - A single TN3270 server can service up to 128,000 TN3270 clients
- ✓Simplification
  - All functions are incorporated into one single operating system environment
  - The SNA network is collapsed to reside inside the z/OS Sysplex environment or the z/OS systems in the data center(s)
- ✓Disaster recovery
  - Disaster recovery planning from a network connectivity point of view is significantly simplified if all network access to z/OS is based on TCP/IP - dynamic movement of IP addresses to move functions from one site to another site
- ✓Security
  - IP to z/OS allows use of IP-based security functions that will secure network data all the way into z/OS

If you have the choice, choose z/OS!

Why not place the SNA/IP integration point on z/OS?

- ×Lack of z/OS SNA skills
  - EE requires z/OS to be APPN-enabled
  - TN3270 server on z/OS requires different z/OS SNA configuration definitions than non-z/OS resident TN3270 servers do
  - EE business partner connectivity requires APPN multiple network connectivity (EBN and session management)
- ×Lack of z/OS TCP/IP skills
  - An SNA/IP integration point on z/OS requires TCP/IP to be functional on z/OS
- ×Cost of z/OS MIPS (CP and software charges) versus IFL engines

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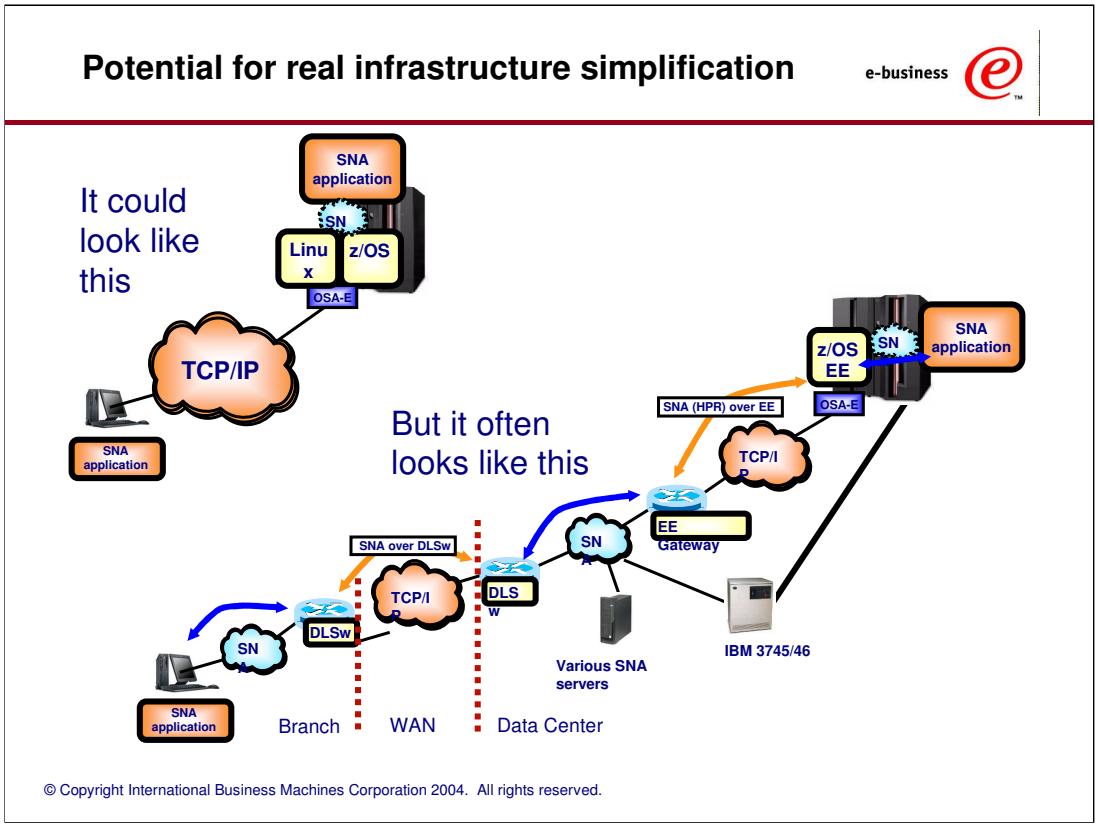


Many customers have invested in DLSw technology that carries SNA traffic from their remote location into the data center.

Drops off the SNA traffic on an SNA network (typically a Token-ring for connectivity to an IBM 3745/46)

On that same SNA network, may be various types of SNA gateway servers, such as "distributed" TN3270 servers

Some customers connect to the mainframe OS via the IBM 3745/46

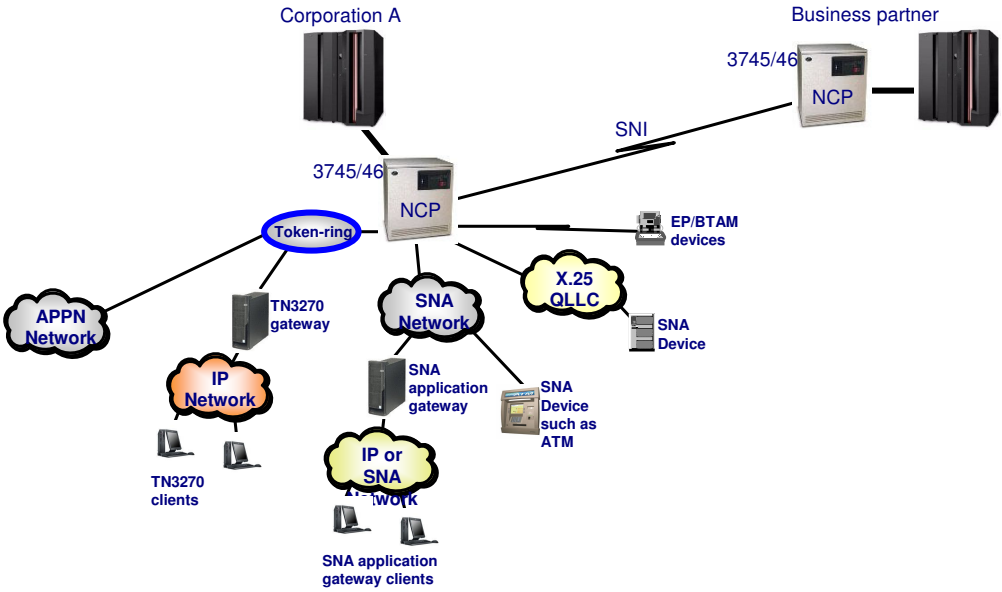
Can be optimized with EE access to z/OS or a CS Linux EE gateway to z/VM and VSE/ESA

Potentially an opportunity for the CCL using NCP boundary functions

Some customers connect to z/OS via an Enterprise Extender gateway (typically a Cisco SNA Switch, but could also be a CS Linux or CS AIX node)

This is generally an acceptable setup

Traditional SNA wide area networking infrastructure



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(May 2004): Communications Server for Linux on zSeries - available now - reduces IBM 3745/46 dependency

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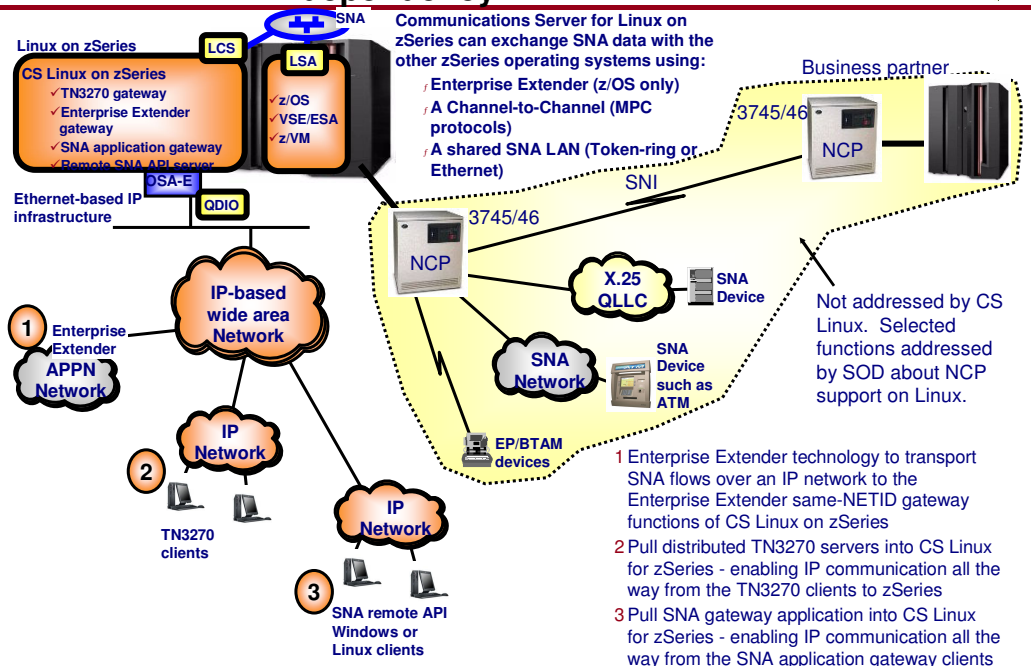

1 Enterprise Extender technology to transport SNA flows over an IP network to the Enterprise Extender same-NETID gateway functions of CS Linux on zSeries

2 Pull distributed TN3270 servers into CS Linux for zSeries - enabling IP communication all the way from the TN3270 clients to zSeries

3 Pull SNA gateway application into CS Linux for zSeries - enabling IP communication all the way from the SNA application gateway clients to zSeries

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IBM Communications Server for Linux on zSeries program product number 5724-I34

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- **Advanced Peer-to-Peer Networking (APPN) support**
  - APPN End Node (EN) or APPN Network Node (NN) support
  - Uses Dependent LU Requester (DLUR) for dependent LU access over an APPN network
- **High Performance Routing (HPR) including Enterprise Extender (EE, a.k.a.. HPR over IP)**
- **Branch Extender (BX) support**
  - Allows for APPN network topology simplification
- **SNA API support**
  - CPI-C and APPC APIs for both dependent and independent LU6.2 - including extensions for both Java and C
  - Java Host Access APIs
  - LUA APIs (Request Unit Interface (RUI) and Session Level Interface (SLI)) for dependent LU functions (LU types 0, 1, 2, and 3)
  - Remote SNA client/server APIs
  - APPC application suite (AFTP, APING, AREXEC, ATELL, ACOPY, and ANAME)
- **TN3270E server**
  - Including SSL with client authentication and Express Logon support
  - Telnet redirector - allows Telnet port mapping and/or Telnet passthru from SSL to non-SSL
- **Administration**
  - Motif-based administration (GUI interface)
  - Network Operator Facility (NOF) APIs for programmed administration
  - Internationalization
  - 31-bit and 64-bit support
  - Runs on both RedHat and SuSE
- **Network attachments for SNA**
  - Enterprise Extender (HPR over IP)
  - (V)CTC using MPC channel protocols (Linux as a PUT2.1)
  - Native SNA over shared LAN (Ethernet or Token-Ring)

Available since May 2004

CS Linux is also offered in an Intel Linux version: 5724-I33

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CS Linux on zSeries - overview of options for SNA connectivity to z/OS, z/VM, and VSE/ESA

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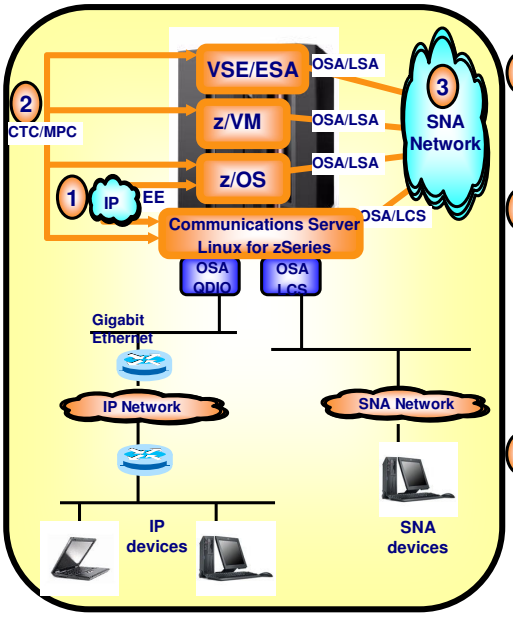

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- SNA between Linux for zSeries and other zSeries operating systems:

1 Enterprise Extender (HPR over IP)
- For upstream to z/OS only
- Dependent LUs: Linux DLUR - z/OS DLUS
- Can use any IP-based connectivity between Linux and z/OS - including HiperSockets

2 APPN Host to Host (AHHC/ANNC over MPC)
- Connectivity: CTC MPC channel
- For upstream to z/OS, z/VM, and VSE/ESA
- Both endpoints must be defined as PU Type 2.1 nodes - may mean APPN-enabling z/OS, z/VM, and VSE/ESA, if not already done (z/VM and VSE/ESA as APPN NNs)
- Dependent LUs: Linux DLUR - z/OS, z/VM, and VSE/ESA DLUS

3 SNA LAN (APPN, LEN, or Peripheral)
- Connectivity: Linux OSA LCS via shared LAN to OSA LSA
- For upstream to z/OS, z/VM, and VSE/ESA
- Linux attachment via LCS device driver and enhanced OSA Express microcode (zSeries only)
- z/OS, z/VM, and VSE/ESA attachment via standard OSA LSA device driver
- PUs may be PU Type 2.0 or 2.1

3270: one step further - CS for Linux on zSeries and IBM's Host Access Transformation Services

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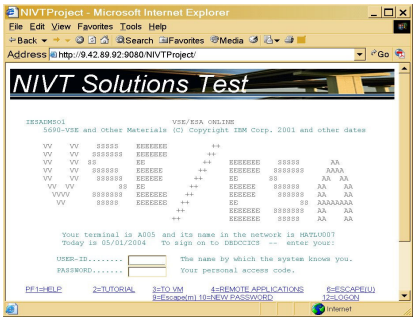


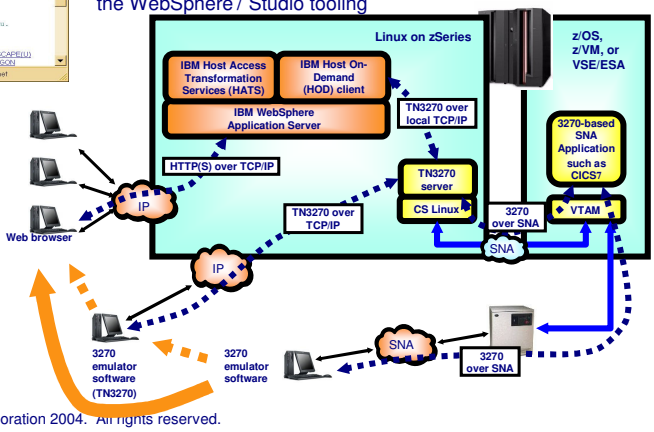
- Universal workstation client: Web browser
  - Basically all platforms with a Web browser are supported
- No 3270 emulator software (fat client or down-loaded) on workstation
- Only HTTP/HTTPS over IP between workstation and WebSphere Application Server
  - Simplifies firewall setup
- No changes to existing mainframe SNA 3270 applications
- User interface can remain 3270-like, or it can be transformed using the WebSphere7 Studio tooling

Network infrastructure simplification
- IP network access from end user to mainframe
- SNA network collapsed into zSeries

Scalability
- Vertical scaling through zSeries 64-bit storage support and powerful parallel CPU engines
- Horisontal scaling through z/VM technologies

Availability
- zSeries hardware availability
- Multiple parallel virtual environments can be deployed

Security
- Security-rich internal network connectivity between Linux and the mainframe operating systems
- Encryption/decryption of HTTPS connections done with zSeries IFL engines and hardware crypto support



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Linux for zSeries as same NETID Enterprise Extender gateway to z/OS, z/VM, and VSE/ESA

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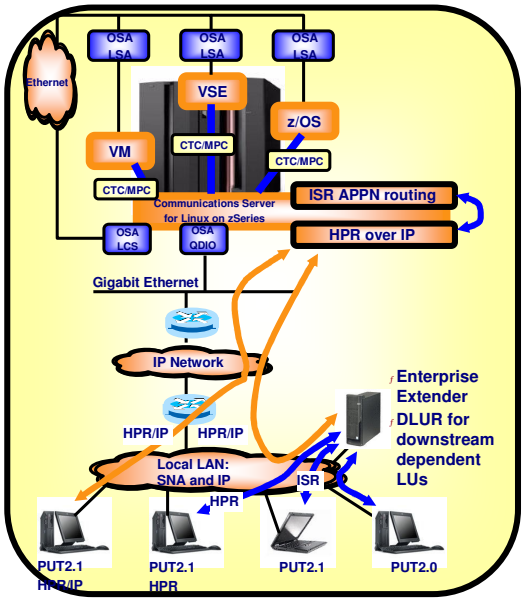

- Linux for zSeries can act as an Enterprise Extender gateway to other zSeries operating systems that do not support, or are not configured for EE
- SNA traffic reduced to branch LAN and zSeries
  - Reduced dependency on IBM 3745/46, CIP, or Token-ring hardware
  - Common WAN IP infrastructure
- Network connectivity to zSeries via Gigabit Ethernet and QDIO
- For full set of functions, zSeries operating systems must be APPN enabled
  - ISR APPN routing over:
    - –a CTC MPC link
    - –OSA LCS via shared LAN to OSA LSA
  - HPR routing over IP (to z/OS only)
- LEN connectivity over a shared LAN provides some limited capabilities (predefined resources)
- All immediate downstream and upstream nodes must be within the same SNA NETID
  - CS Linux does not support APPN boundary functions or session services extensions

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Remote API Client/Server technology

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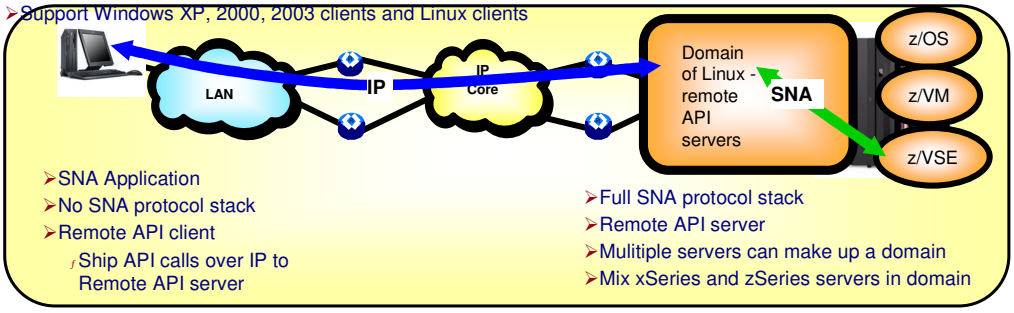
- The remote SNA API support allows SNA application programs to reside on nodes that don't implement a full SNA protocol stack.
- The SNA API calls are intercepted by a shim layer that ships the calls over a TCP connection to a Remote API server where the actual SNA API calls are executed.
- This technology provides a solution for SNA application programs that must remain in remote locations - without requiring SNA protocol stacks on those remote nodes.
  - Removing the need for SNA stack configuration skills, management, and operations procedures outside the data center where the remote SNA API servers may be collapsed
- This technology also provides built-in availability and load-balancing to a pool (domain) of Remote API servers
  - A Remote API client is not limited to use a single Remote API server
  - Pools of LUs can be shared across servers on a Domain.
  - Servers can be configured to back up each other
- There is no charge for installing the Remote API client - usage is covered by per-user server charge
- Support Windows XP, 2000, 2003 clients and Linux clients



- SNA Application
- No SNA protocol stack
- Remote API client
  - Ship API calls over IP to Remote API server

- Full SNA protocol stack
- Remote API server
- Mulitiple servers can make up a domain
- Mix xSeries and zSeries servers in domain

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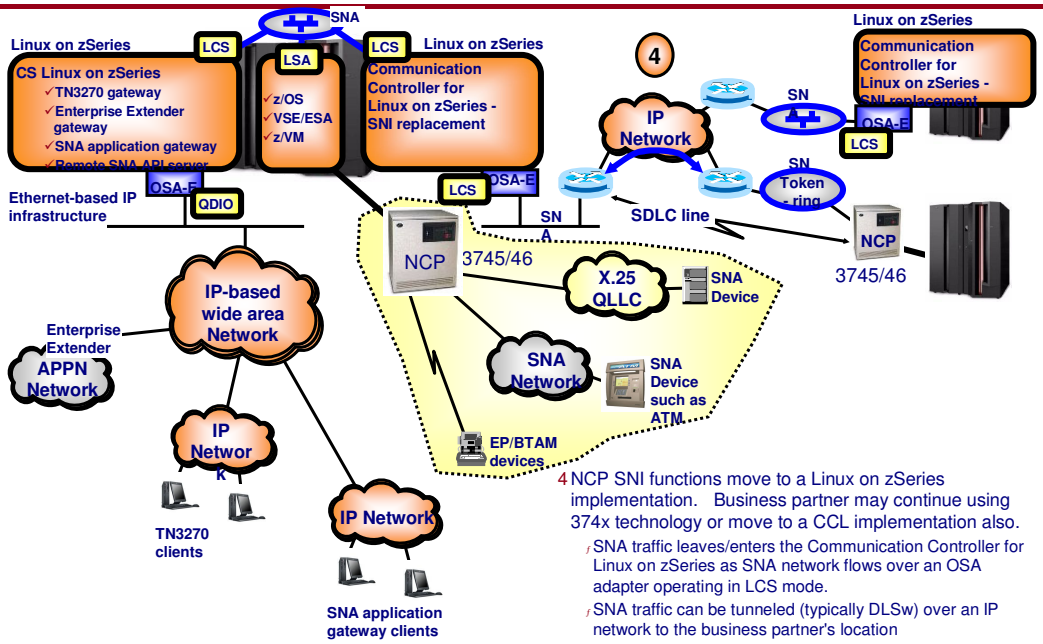
(Planned 2005): Communication Controller for Linux Phase 1 - SNI replacement



4 NCP SNI functions move to a Linux on zSeries implementation. Business partner may continue using 374x technology or move to a CCL implementation also.

- SNA traffic leaves/enters the Communication Controller for Linux on zSeries as SNA network flows over an OSA adapter operating in LCS mode.
- SNA traffic can be tunneled (typically DLSw) over an IP network to the business partner's location
- An SDLC line from the business partner's 37xx can be terminated in a local router

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(Planned 2005): Communication Controller for Linux Phase 1 - Selected NCP boundary functions

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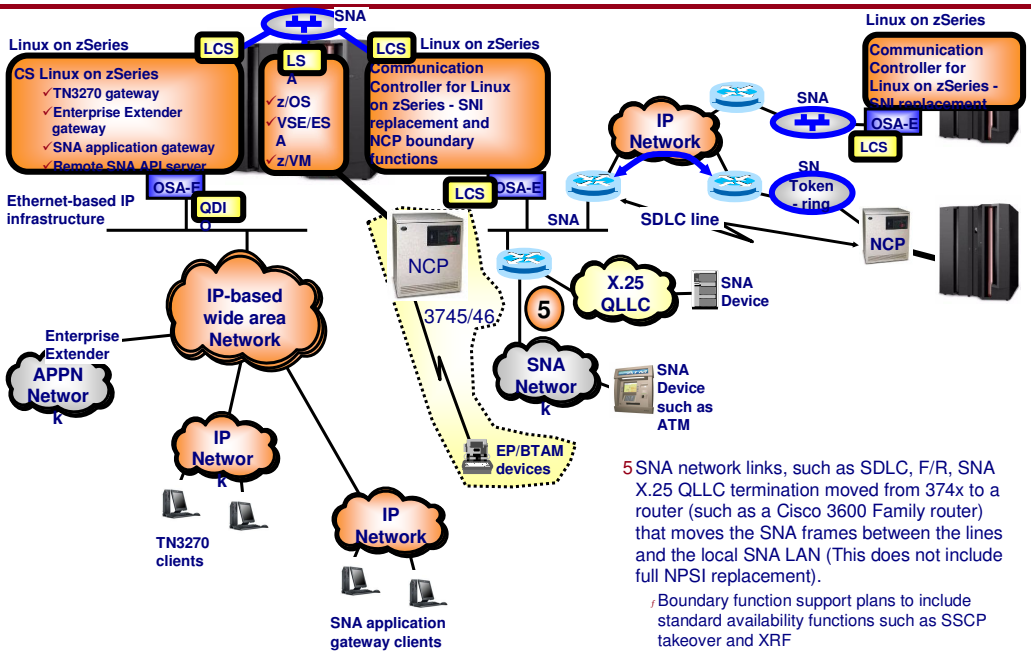

5 SNA network links, such as SDLC, F/R, SNA X.25 QLLC termination moved from 374x to a router (such as a Cisco 3600 Family router) that moves the SNA frames between the lines and the local SNA LAN (This does not include full NPSI replacement).

- Boundary function support plans to include standard availability functions such as SSCP takeover and XRF

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(Planned 2005): Communication Controller for Linux (CCL) Phase 2 - SNI to CCL partner over IP

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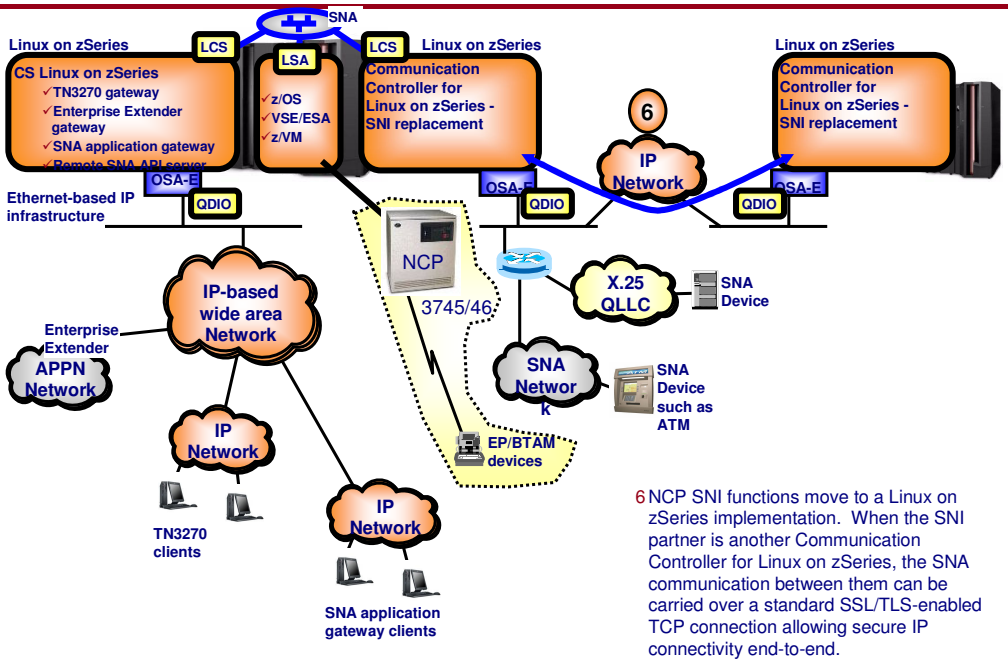

6 NCP SNI functions move to a Linux on zSeries implementation. When the SNI partner is another Communication Controller for Linux on zSeries, the SNA communication between them can be carried over a standard SSL/TLS-enabled TCP connection allowing secure IP connectivity end-to-end.

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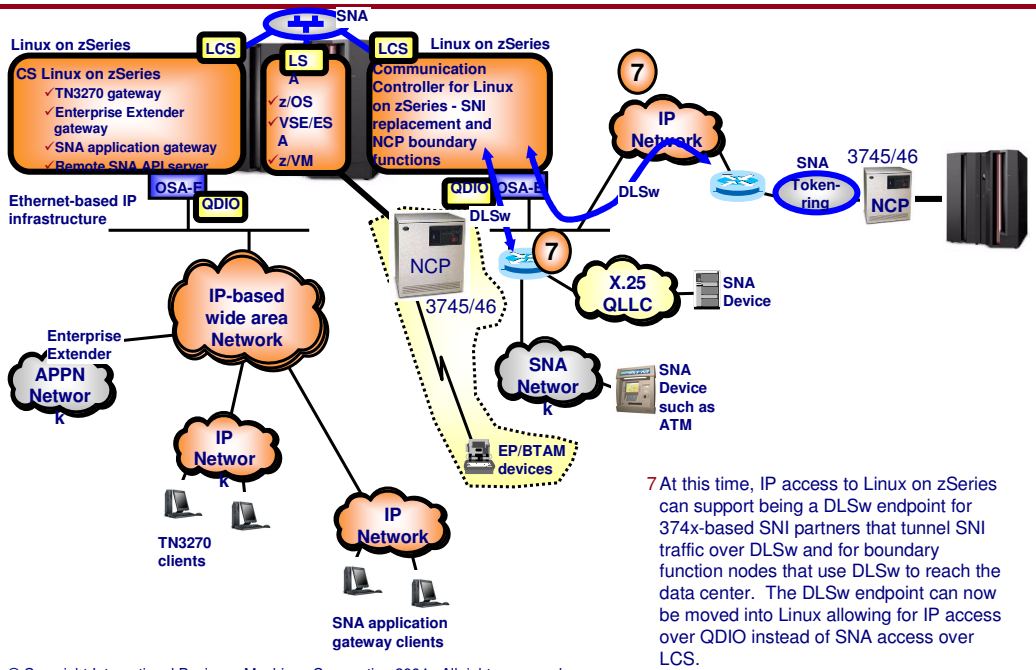
(Planned 2005): Communication Controller for Linux Phase 2 - DLSw endpoint support



7 At this time, IP access to Linux on zSeries can support being a DLSw endpoint for 374x-based SNI partners that tunnel SNI traffic over DLSw and for boundary function nodes that use DLSw to reach the data center. The DLSw endpoint can now be moved into Linux allowing for IP access over QDIO instead of SNA access over LCS.

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Retain pure SNA subarea environment

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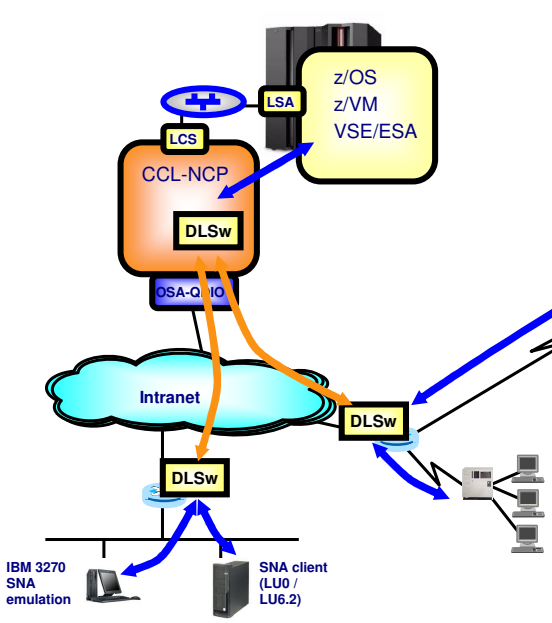

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Benefits:

- ✓Minimal changes to VTAM and NCP definitions
- ✓SNI connectivity continues unchanged to business partners
- ✓Existing line-attached remote SNA equipment continues to operate as today

Disadvantages:

- ×DLSw router infrastructure needs to be implemented (if not already there)
- ×No exploitation of modern SNA capabilities as available in APPN/HPR

Retain SNA subarea environment in mainframe OS

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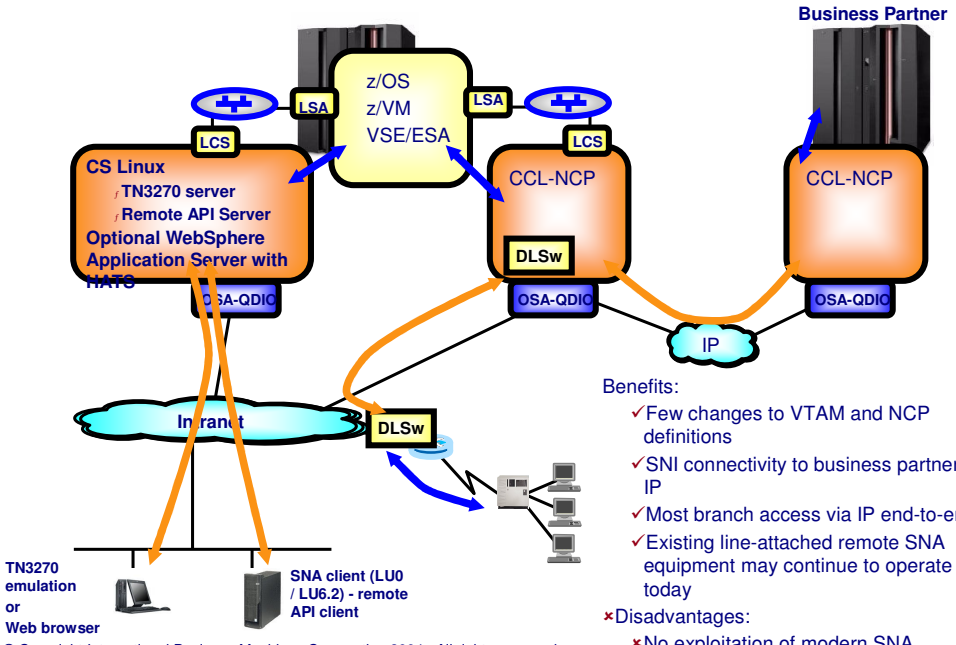

Benefits:

- ✓Few changes to VTAM and NCP definitions
- ✓SNI connectivity to business partner via IP
- ✓Most branch access via IP end-to-end
- ✓Existing line-attached remote SNA equipment may continue to operate as today

×Disadvantages:

- ×No exploitation of modern SNA capabilities as available in APPN/HPR

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Exploit SNA APPN/HPR technologies in the z/OS environment

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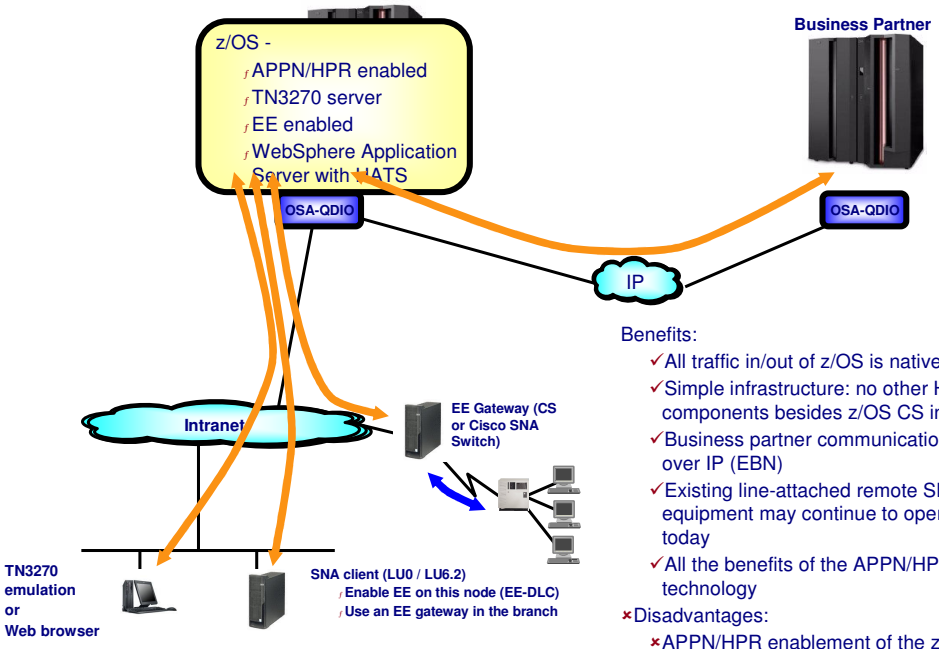

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Benefits:

- ✓All traffic in/out of z/OS is native IP
- ✓Simple infrastructure: no other HW/SW components besides z/OS CS involved
- ✓Business partner communication via HPR over IP (EBN)
- ✓Existing line-attached remote SNA equipment may continue to operate as today
- ✓All the benefits of the APPN/HPR technology

×Disadvantages:

- ×APPN/HPR enablement of the z/OS environment

Exploit SNA APPN/HPR technologies for the z/VM and VSE/ESA environments

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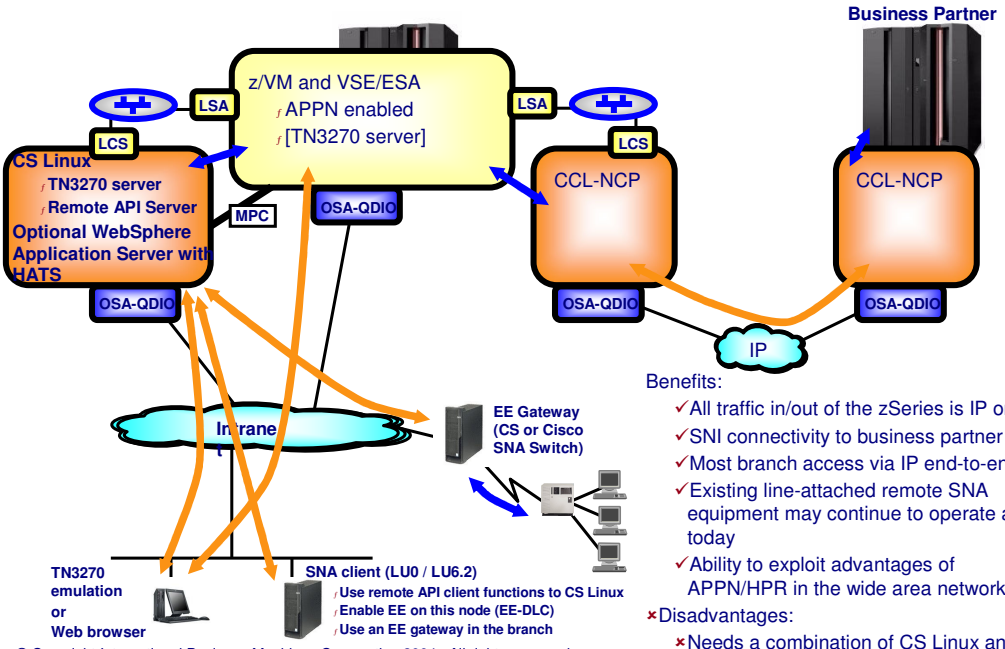

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Benefits:

- ✓All traffic in/out of the zSeries is IP only
- ✓SNI connectivity to business partner via IP
- ✓Most branch access via IP end-to-end
- ✓Existing line-attached remote SNA equipment may continue to operate as today
- ✓Ability to exploit advantages of APPN/HPR in the wide area network

×Disadvantages:

- ×Needs a combination of CS Linux and CCL to accomplish full set of functions

Subarea SNA connectivity overview for Communication Controller for Linux on zSeries - Phase 2

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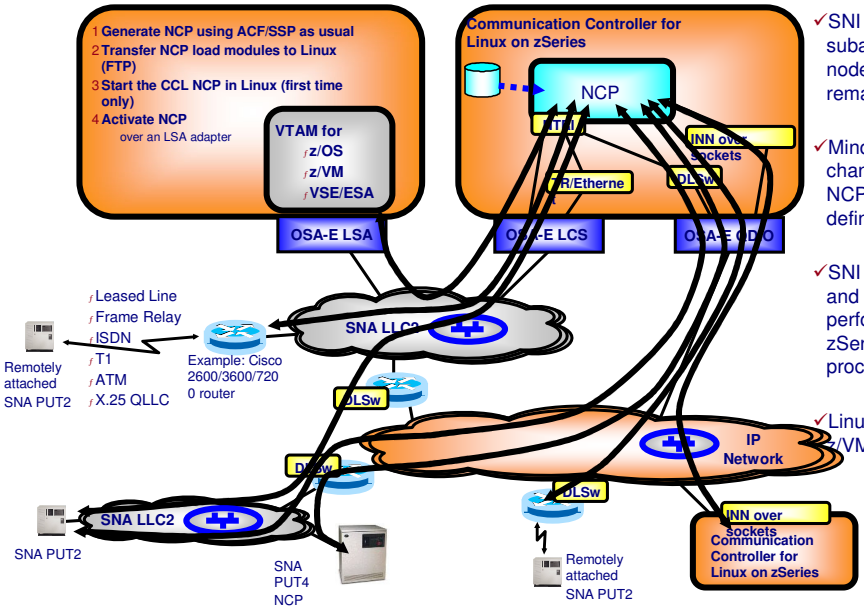

- ✓SNI and SNA subarea boundary node functions (BNN) remain NCP functions
- ✓Minor configuration changes to existing NCP and VTAM definitions
- ✓SNI gateway NCP and BNN functions performed using zSeries IFL processors
- ✓Linux in LPAR or as a z/VM guest

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OSA port usage
Sharing ports between CCL and VTAM

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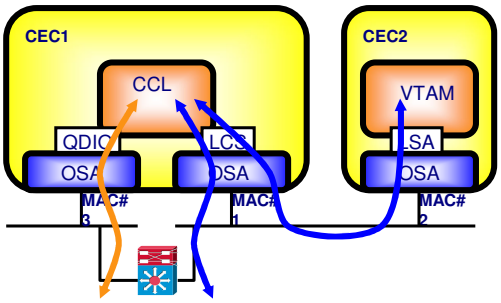
- OSA has special support that allows IP packets between two LPARs that share an LCS or a QDIO adapter to loop back to the destination LPAR without going out over the actual LAN infrastructure.
- That support does not exist for LSA (SNA).
  - OSA LSA Token-ring and ATM allow packets to same MAC as where they came from (looping the frame out on the network and then back in)
  - OSA LSA ethernet doesn't allow that
- When the LAN type is ethernet then VTAM and CCL cannot share the same OSA port if they are to communicate with each other
  - VTAM must have one LSA port and CCL another LCS port onto the same LAN
    - Can be two separate adapters or the two ports on a two-port OSA-express adapter

The CCL LCS OSA adapter can be used for both SNA and IP communication in/out of the CCL Linux environment, but typically IP would be going over a QDIO adapter.



The VTAM owning OS and the CCL owning Linux OS may both reside in a single CEC or be split between two CECs as long as there is LAN connectivity between them.

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Availability

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VTAM availability

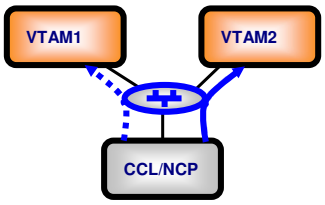
- SSCP takeover functions will work as today

Susbsystem availability

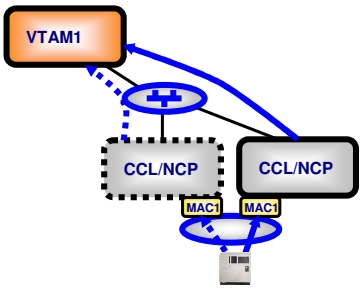
- Extended Recovery Facility (XRF) will work as today

CCL/NCP availability

- Redundant CCL/NCPs with duplicate TR MAC addresses



Switch ownership of resources from VTAM1 to VTAM2



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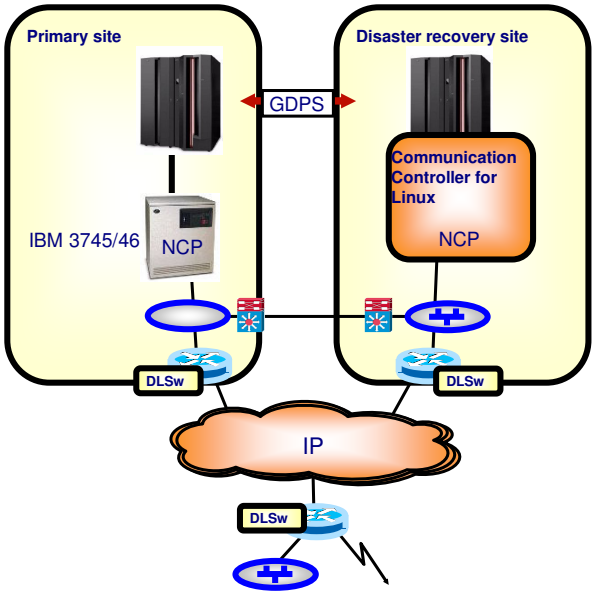
Disaster recovery site establishment



- For installations currently investing in DR sites, IBM 3745/46 redundancy poses some challenges.
- An alternative in many cases to installing spare IBM 3745/46 hardware will be to use Communication Controller for Linux running the DR NCP in the DR site.
- For LAN attached connections, a switch to the DR site can be done using layer-2 bridging of SNA flows, or using DLSw to redirect the traffic to the DR site.
- If physical serial lines are attached to the IBM 3745/46, they need as usual to be manually switched to the DR site where they then can be terminated in a DLSw router

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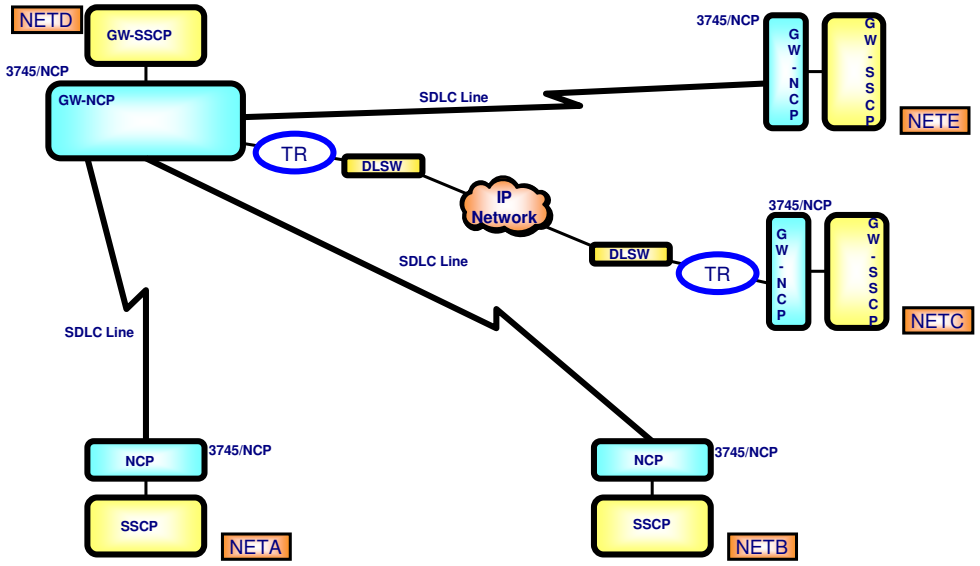
Sample SNI connectivity view today



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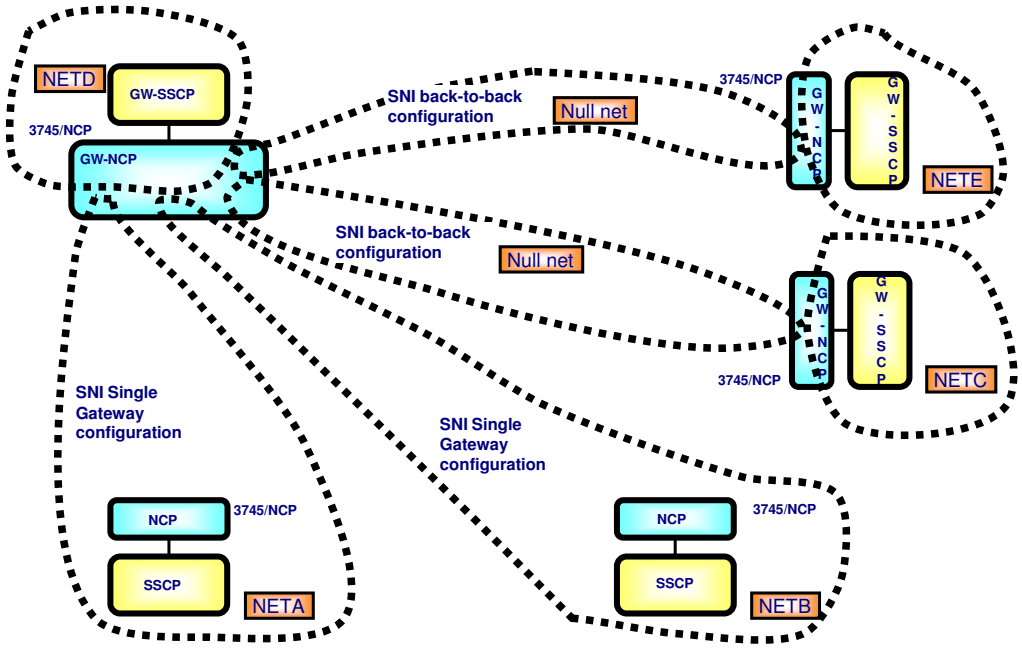
Sample SNI topology view today



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Sample SNI and EE connectivity tomorrow

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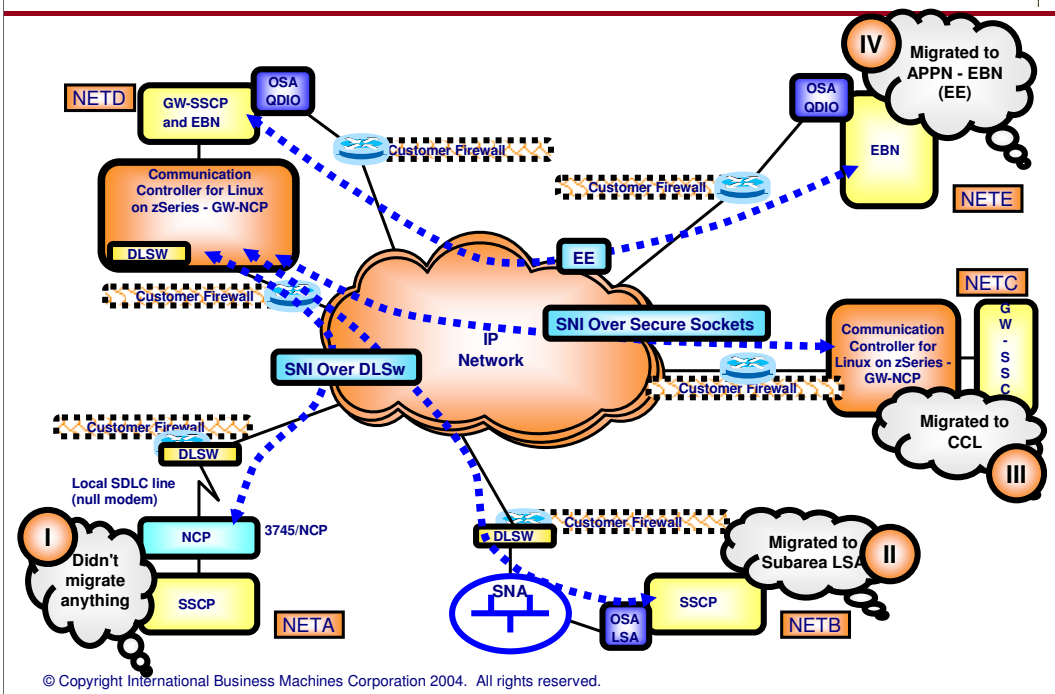

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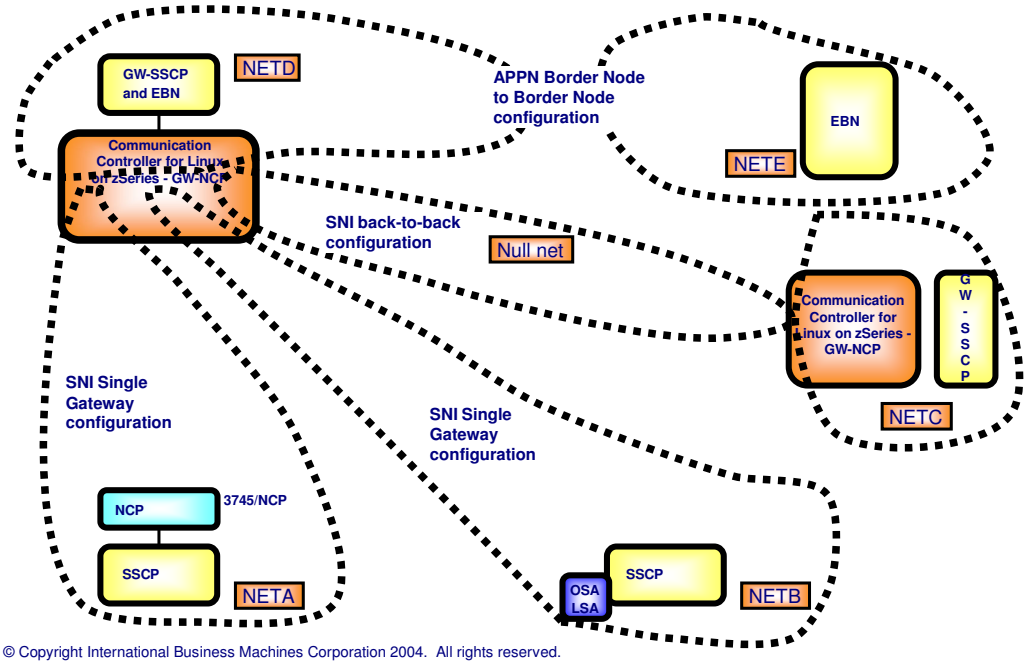
Sample SNI and EE topology view tomorrow



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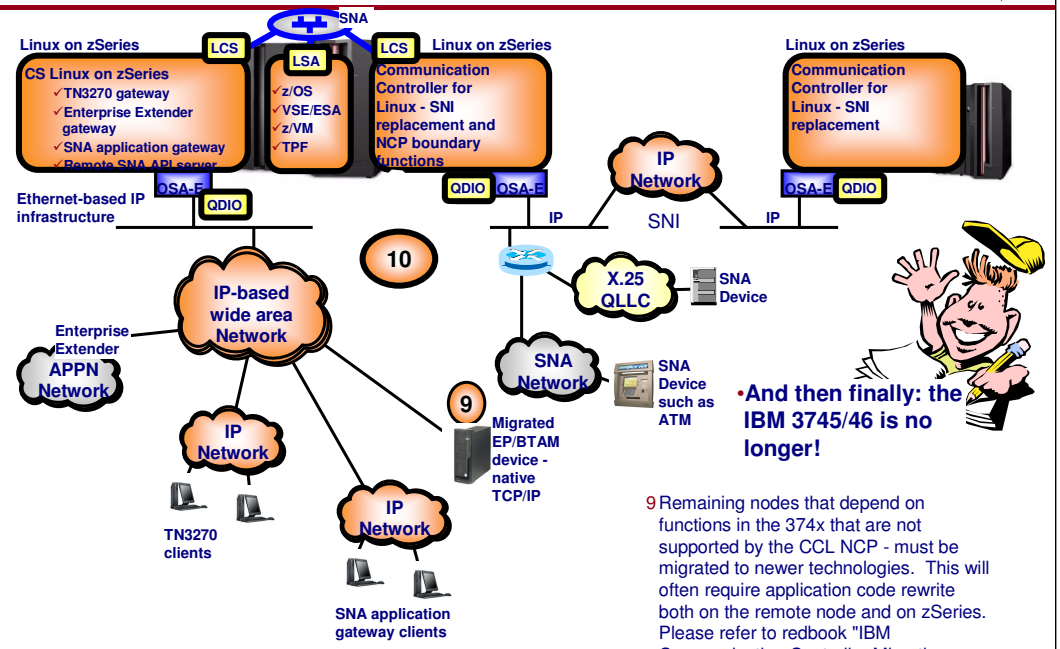
Migrate remaining 374x-dependent nodes to newer technologies



- **And then finally: the IBM 3745/46 is no longer!**

9 Remaining nodes that depend on functions in the 374x that are not supported by the CCL NCP - must be migrated to newer technologies. This will often require application code rewrite both on the remote node and on zSeries. Please refer to redbook "IBM Communication Controller Migration Guide", SG24-6298 for assistance in this area.

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Summary

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- ✓**Preserve use of existing SNA applications**
  - IBM 3270 access
  - SNA Client/Server
  - SNA subarea business partner communication (SNI)
- ✓**Replacement technology for selected IBM 3745/46 NCP functions will be provided by IBM**
  - No need to migrate off SNA subarea technology
- ✓**Linux on zSeries is an important component in an SNA to IP migration strategy**
  - Skills in Linux on zSeries need to be established
- ✓**With the existing and planned IBM provided technologies, CS for Linux on zSeries and Communication Controller for Linux on zSeries, it will be possible to define an SNA to IP network migration plan that can support:**
  - Collapsing the physical SNA network to the zSeries or the data center
  - Achieving full independence of SNA wide area network hardware and software components
  - Removing needs for maintaining an SNA wide area network component skills base

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