Introduction to Systems Network Architecture (SNA) on z/OS

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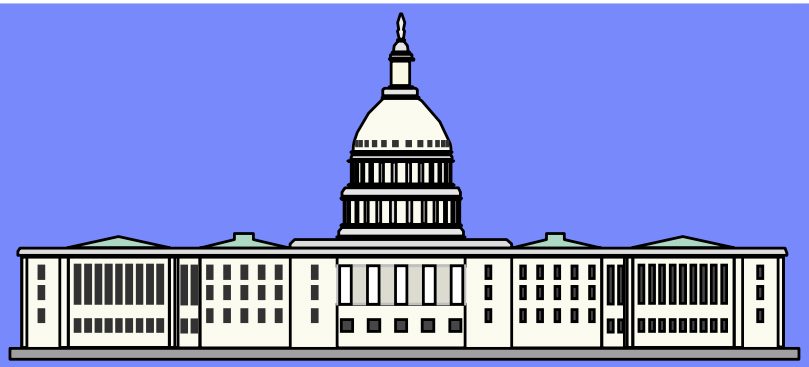

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Agenda

- z/OS Communications Server – History
- Systems Network Architecture (SNA)
- SNA Subarea
- SNA Advanced Peer-to-Peer Networking (APPN)
- Additional SNA Features and Summary
- More Information

Disclaimer

- This is a very high level presentation that attempts to introduce some basic SNA concepts and show some comparisons between SNA and TCP/IP on z/OS.
- There are several different configurations to migrate from subarea to APPN.
  - Interchange Node
  - Migration Data Host
  - Composite Network Node
  - Low-entry Networking Node
- This presentation does not cover those migration options.

z/OS Communications Server - History

What is Communications Server?

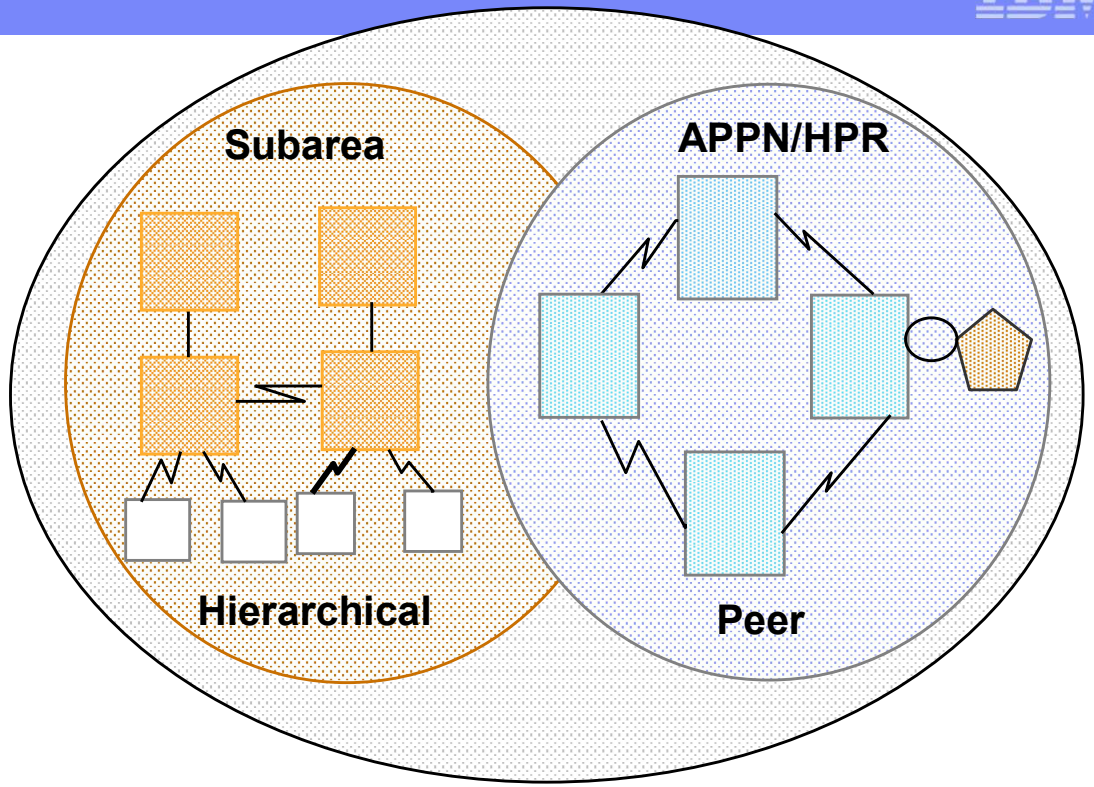
- The Communications Server name was used for products running on different platforms:
  - Z Systems, pSeries, xSeries, or OEM
- Communications Server is currently provided for:
  - z/OS and Linux
- With z/OS, Communications Server is a base element (part of the operating system):
  - Consists of TCP/IP and SNA Services (VTAM)
- With non-Z System, generally thought of as a Gateway product:
  - Operating systems already have a TCP/IP stack and Communications Server provides an SNA stack

Communications Server History

- Systems Network Architecture (SNA) 1970s
  - 1974 IBM announced SNA
    - VTAM (Virtual Telecommunications Access Method) is the mainframe SNA software product
      - Supported on z/OS (MVS), zVM, VSE
    - NCP (Network Control Program) was the front-end SNA software product
- TCP/IP 1980s and 1990s
  - 1970s ARPANET protocol suite
    - Later developed into the Internet
  - 1983 first Berkeley Software Distribution (BSD) of TCP/IP
  - 1980s TCP/IP ported from VM to MVS
- Communications Server for z/OS
  - 1996 TCP/IP and VTAM combined into a single product
  - TCP/IP and VTAM have both been continuously enhanced

Systems Network Architecture (SNA)

What is SNA?

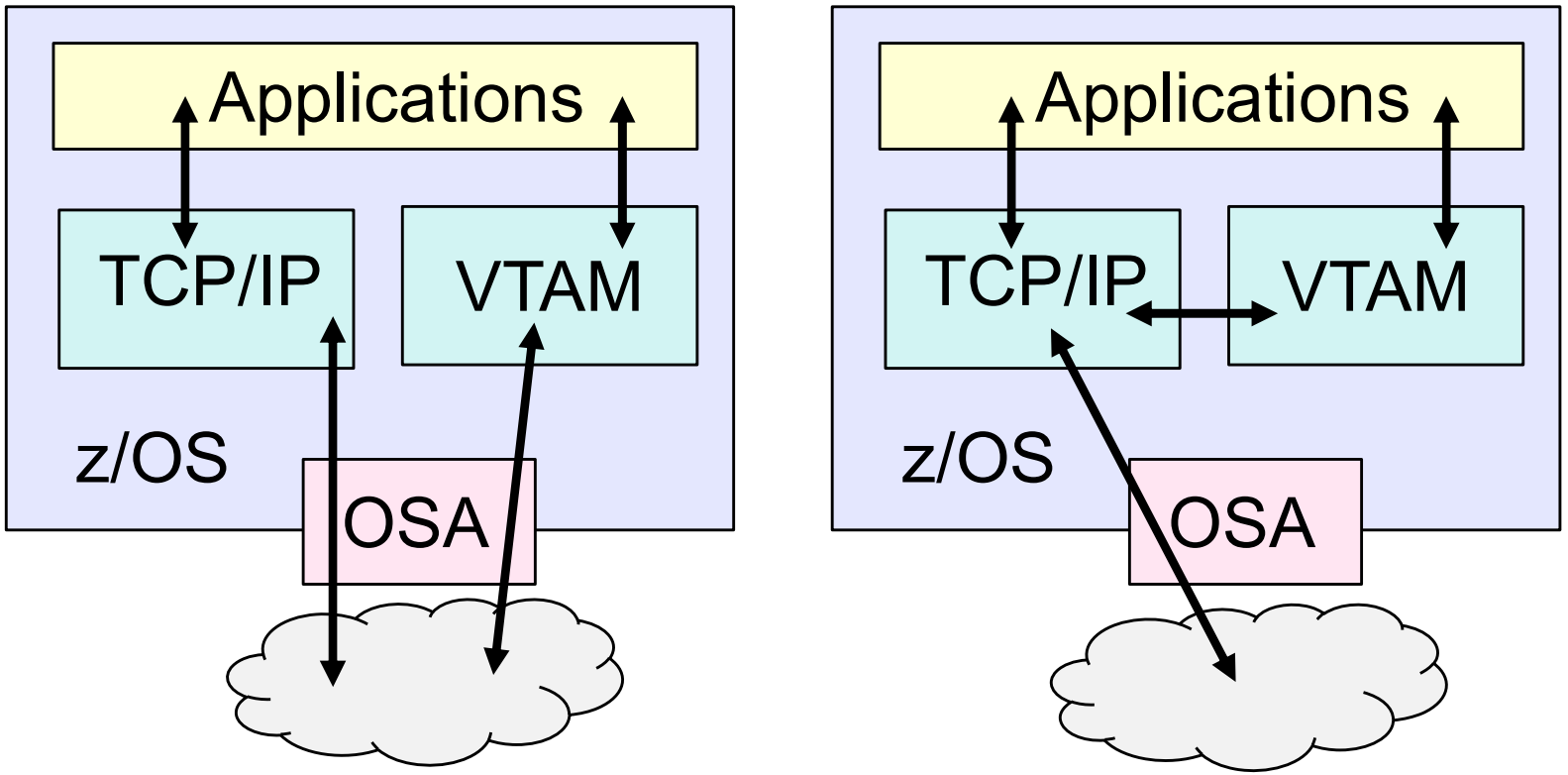


- Systems Network Architecture (SNA) originally consisted of subarea protocols
  - A hierarchical environment where peripheral nodes require the services of a VTAM subarea node to communicate with other nodes.
  - Requires NCP and static definitions.
- Advanced Peer to Peer networking (APPN) introduced mid 1980s
  - A peer-to-peer environment that does not require NCP and provides dynamic definitions of some local connections.
- High Performance Routing (HPR) introduced in 1990s
  - Additional functions on top of APPN
  - Non-disruptive session switching
  - Adaptive Rate Based Flow/Congestion Control
  - Enterprise Extender (HPR over UDP) introduced in 1999

SNA Viability

- SNA is a legacy networking protocol, but it is still in wide use and support is still required.
  - Large amount of all business data is still accessed using SNA applications

SNA Subarea and Advanced Peer-to-Peer Networking (APPN)

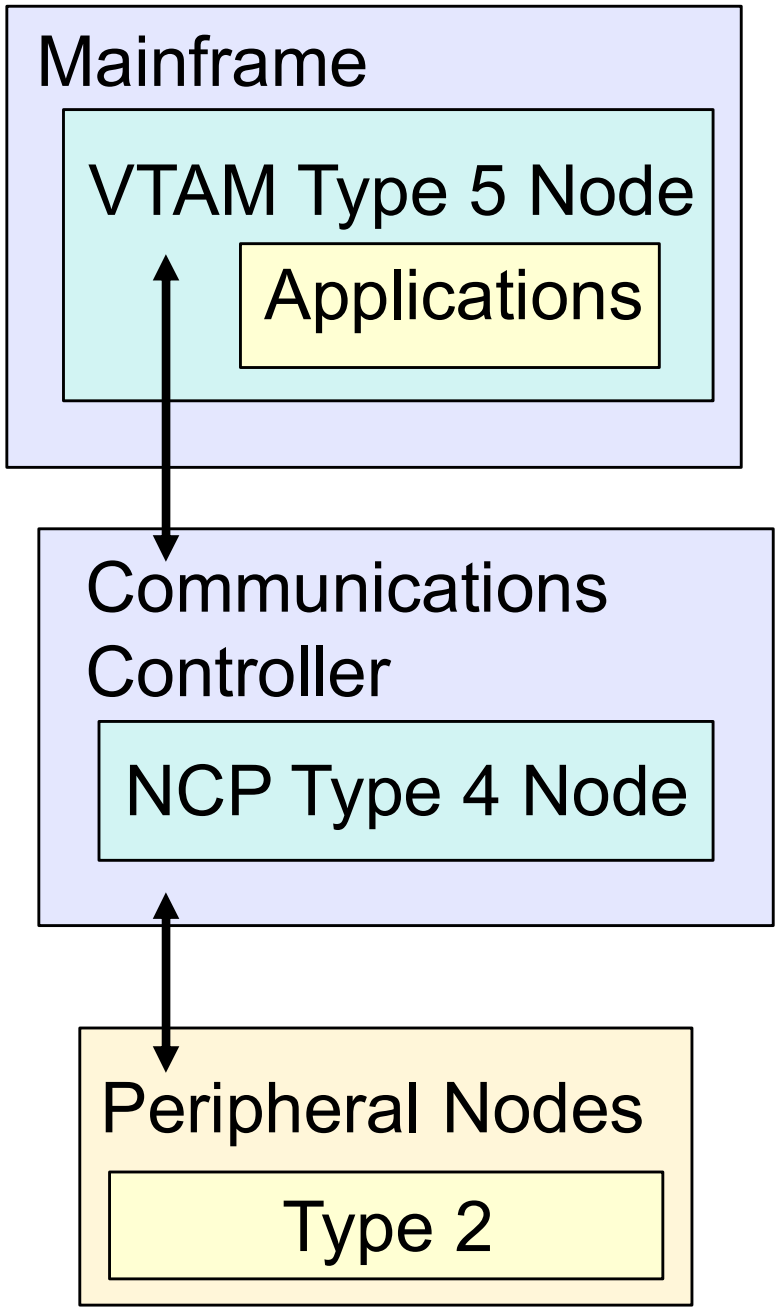


- z/OS applications are written to use TCP/IP or VTAM for network communication with their partners.
  - VTAM originally sent SNA data across the network.
  - Today VTAM sends all communication to TCP/IP which encapsulates SNA in UDP (User Datagram Protocol) using Enterprise Extender (EE).

SNA Subarea

Subarea Domain

- VTAM Domain consists of VTAMs and the devices that they own.
  - All VTAMs and NCPs have unique subarea numbers.
  - Every Device attached to VTAM and NCP have an Element Address.
- VTAM is a Type 5 Node
  - They own and control NCP Type 4 Nodes and Peripheral Nodes that attach to them.
  - They handle session initiation and search requests for resources.
- NCP is a Type 4 Node
  - Channel attached to the mainframe.
  - They provide different types of attachments for Perifpheral Nodes.
    - SDLC, Token Ring, Ethernet, X.25, etc.
- Peripheral Nodes
  - Require their owning VTAM to communicate with other nodes in the network.



Subarea Paths

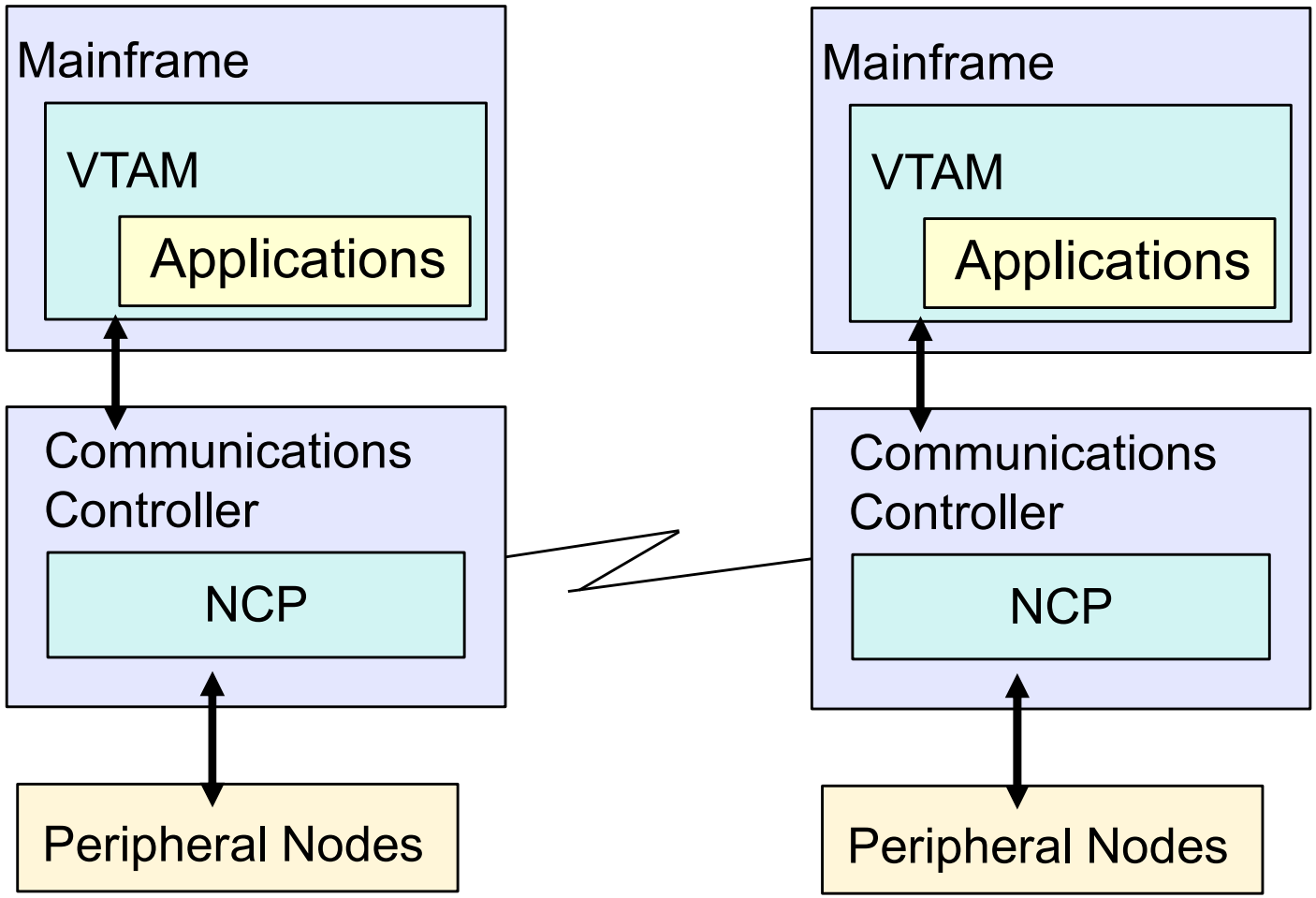
- All devices are statically defined to their VTAM owner.
- Links define the attachments between different devices.
  - Channel connections between VTAMs.
  - Channel connections to NCPs.
  - SDLC, Token Ring, Ethernet, X.25, etc.
- Transmission Groups (TGs) group like links together.
- Explicit Routes (ERs) are groups of TGs in one direction between endpoints.
  - A matching ER is required in the other direction of the same path.
- Virtual Routes (VRs) specify the two one way ERs to create a route-trip path.
- Each path definition statement gives the end destination point of the path. The ER gives the TG and subarea number for the next hop on the path. The association of the VR number with the ER within the path definition connects the individual hops together into a complete path from one end point to the other.

Subarea Sessions

- Physical Unit (PU)
  - Every node has a PU
- Logical Unit (LU)
  - Every node has an LU
  - An LU-LU session is required for two applications or devices to communicate.
  - Each LU-LU session has a logon mode table entry that specifies subarea Class of Service (COS) that contains a list of pairs of VRs and transmission priorities.
- Subrea VTAM System Services Control Point (SSCP)
  - Manages resources that it owns
  - Coordinates the initiation and termination of sessions between separate nodes within its domain or across domains in cooperation with other SSCPs
  - Performs recovery when communication fails between network components
- Session Types
  - SSCP-SSCP
  - SSCP-PU
  - SSCP-LU
  - LU-LU
- Peripheral Nodes use low-entry networking (LEN) when communicating to VTAM.

SNA Network Interconnect (SNI)

- Multiple Domains in a Subarea Network
- Cross Network resources use SNI



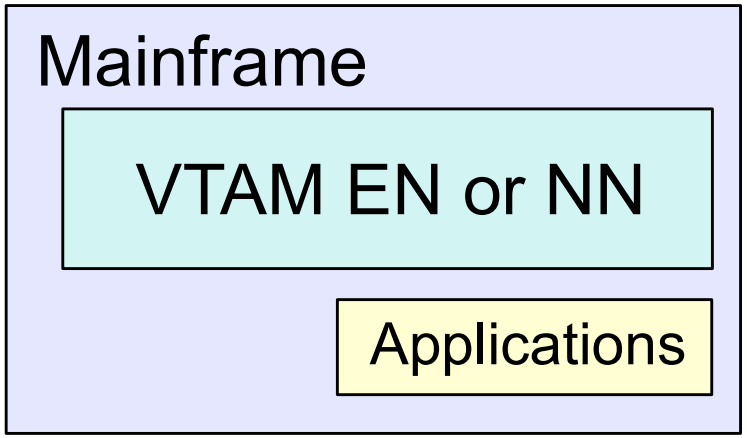
SNA Model Definitions

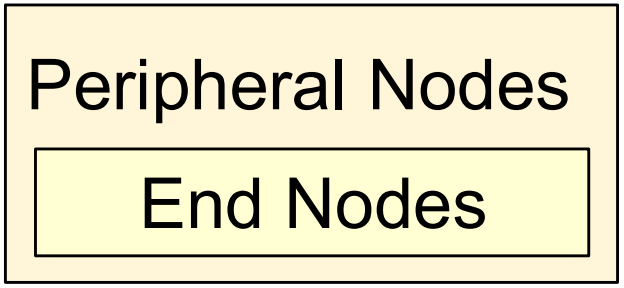
- Many different VTAM definitions support Model definitions that describe characteristics that dynamically create “clone” definitions.
- While this does provide some amount of “dynamic” definition, there is no true dynamic learning of resources by Subarea VTAM.
- There is no automatic failover of session routes due to link failures in Subarea networks.

SNA Advanced Peer-to-Peer Networking (APPN)

End Nodes and Network Nodes

- VTAM is defined as an End Node (EN) or Network Node (NN)
- All non-VTAM devices and applications are ENs
  - ENs can define a NN as their Network Node Server (NNS)
- VTAM Domain consists of ENs and their NNSs
- Control Point (CP)
  - Every node has a CP
  - Activates and deactivates resources (similar to SSCP function in subarea)
  - Routes cross-domain requests
  - Maintains dynamic network topology in NNs

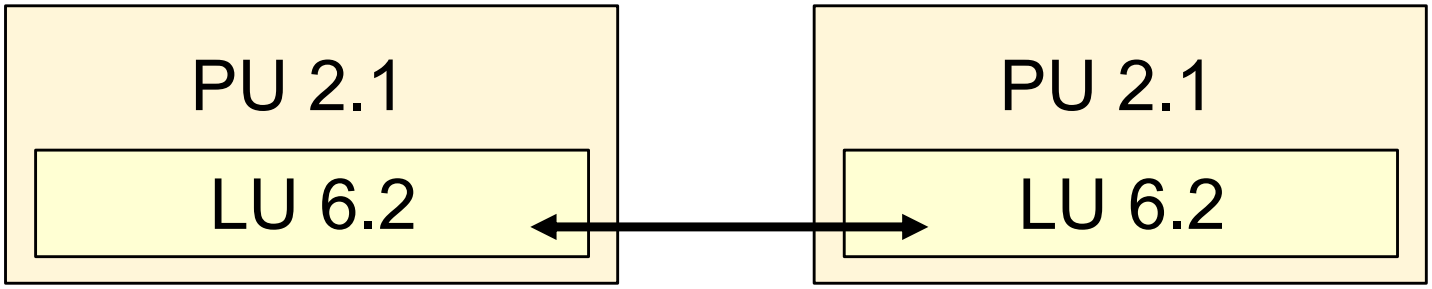




Control Point to Control Point Sessions

- EN has CP-CP session to its NNS
- NN has CP-CP session to ENs and other NNs
- Network Node (NN)
  - Provides dynamic session routing
- End Node (EN)
  - Dynamically registers its resources with its NNS
- Links must be defined to the nodes that own them, but routes over other links and TGs between NNs are learned by NNs dynamically.
- APPN Class of Service (COS) defines characteristics of a route for a session.
  - Unlike the COS for the subarea network, where the COS is actually a list of VRs that are acceptable for a particular COS, APPN COS specifies the types of routes that are acceptable for a Class of Service.
  - The route that an NN selects is the current least-weight (or best) route from the node containing the origin LU to the node containing the destination LU.

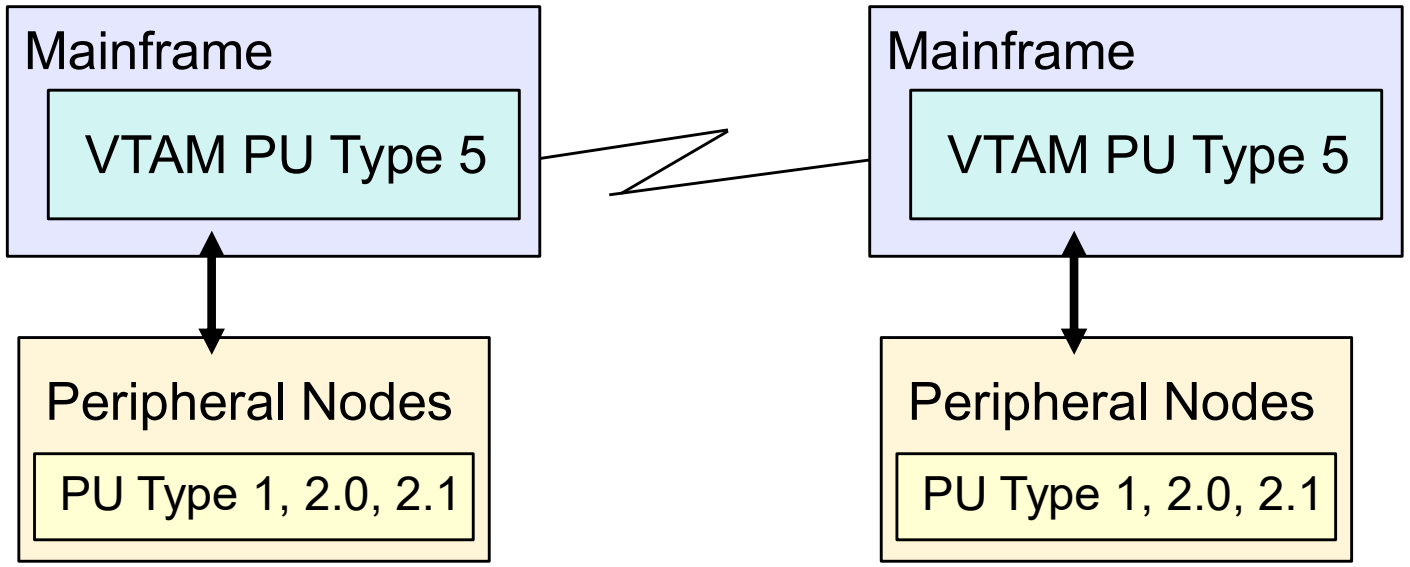
Independent LUs Do Not “Need” VTAM



- PU 2.1 devices with LU 6.2 support may bring up sessions to each other without VTAM

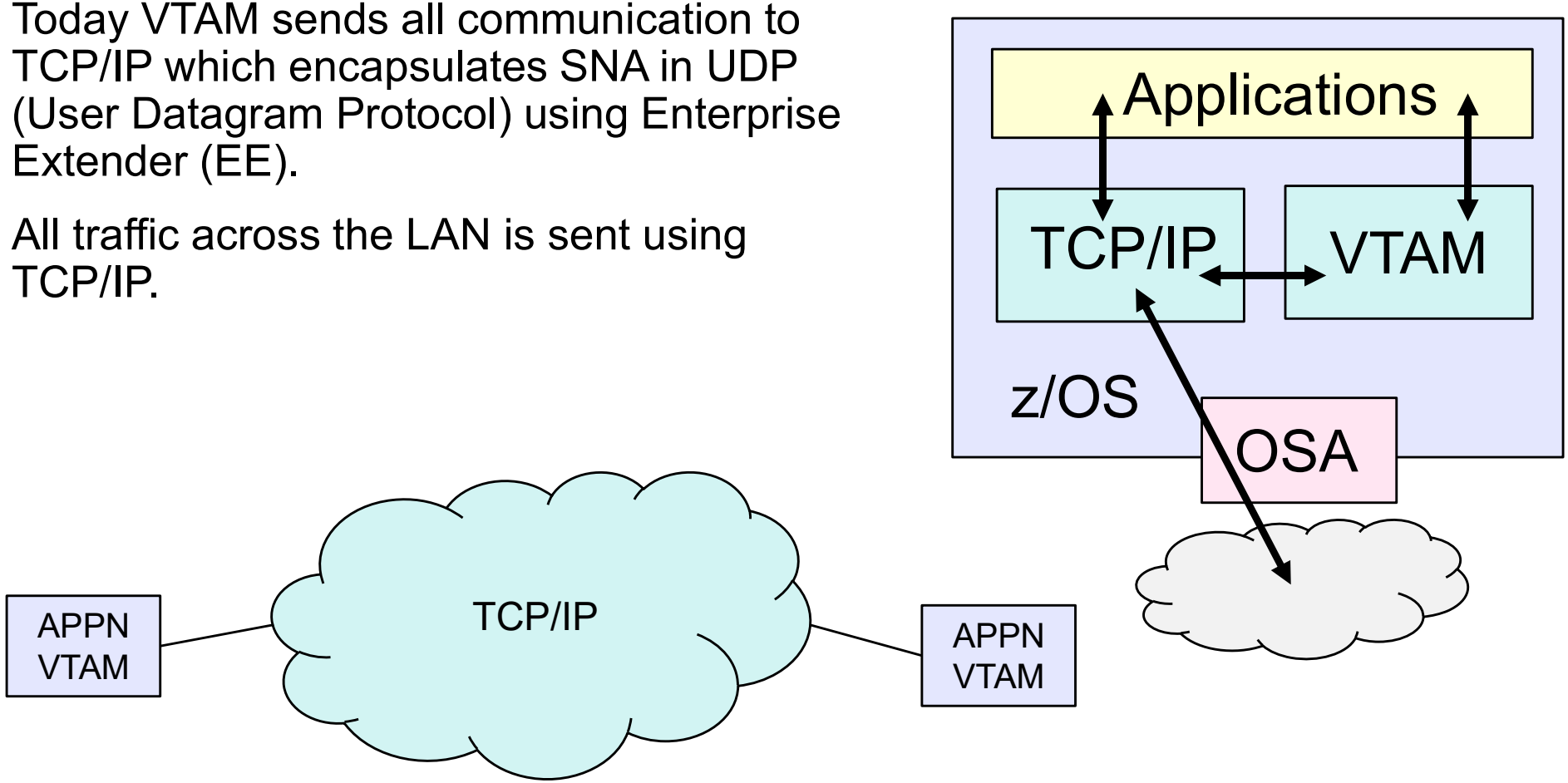
SNA Border Node (BN)

- Cross Network resources use Border Node (BN) and Extended Border Node (EBN)



Enterprise Extender (EE)

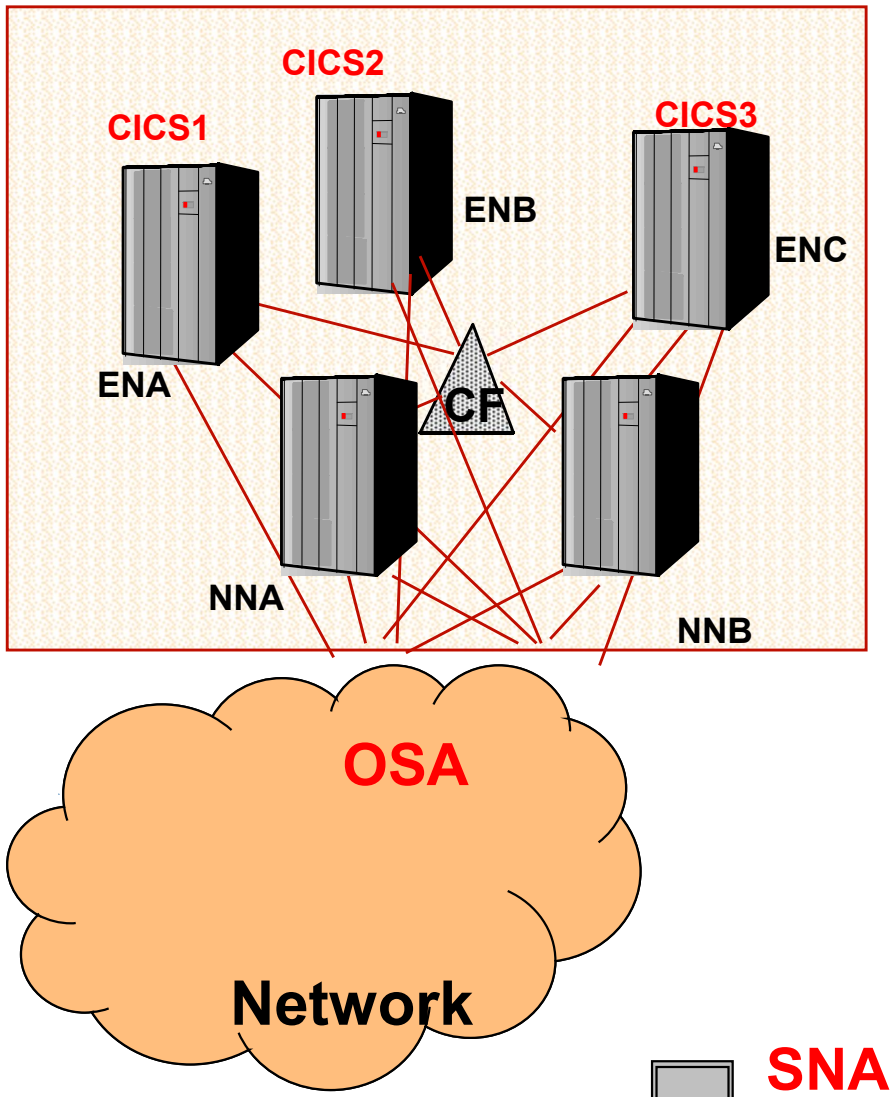
- Today VTAM sends all communication to TCP/IP which encapsulates SNA in UDP (User Datagram Protocol) using Enterprise Extender (EE).
- All traffic across the LAN is sent using TCP/IP.



Additional SNA Features and Summary

SNA Sysplex Functions

- In addition to supporting TCP/IP Sysplex
  - Generic Resources
    - Provides load balancing and availability
    - Users logon to a generic name - VTAM decides which application to use
    - Requires APPN in Sysplex
  - Multinode Persistent Sessions (MNPS)
    - Sessions can continue with application started on another image if current image fails
    - Requires HPR
  - TSO Generic Resources
    - Multiple TSO applications have the same name
  - Dynamic Definition of VTAM-to-VTAM Connections
    - Allows for dynamic establishment of XCF connections between VTAMs



TCP/IP versus SNA

- TCP/IP
  - SYS1.TCPPARMS
    - Relatively fewer definition files
    - Definition files also include unix files
  - Dynamic Routing
  - Sysplex Distributor
    - Supports WLM for load balancing
- SNA
  - SYS1.VTAMLST
    - Relatively greater definition files
  - APPN/HPR
  - Generic Resources
    - Supports WLM for load balancing
- TCP/IP and SNA are combined together into z/OS Communications Server
  - VTAM is required to use TCP/IP
    - VTAM device definitions are required to define TCP/IP Interfaces
  - TCP/IP is required to use VTAM
    - Enterprise Extender is required to communicate using SNA over OSA

More Information

Web Pages

- URLs for Publications
  - https://www.ibm.com/docs/en/zos
  - http://www.redbooks.ibm.com
- IBM Washington Systems Center Technical Sales Support
  - http://www.ibm.com/support/techdocs/

End of Presentation

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