Why Migrate to SNA Switching Services?

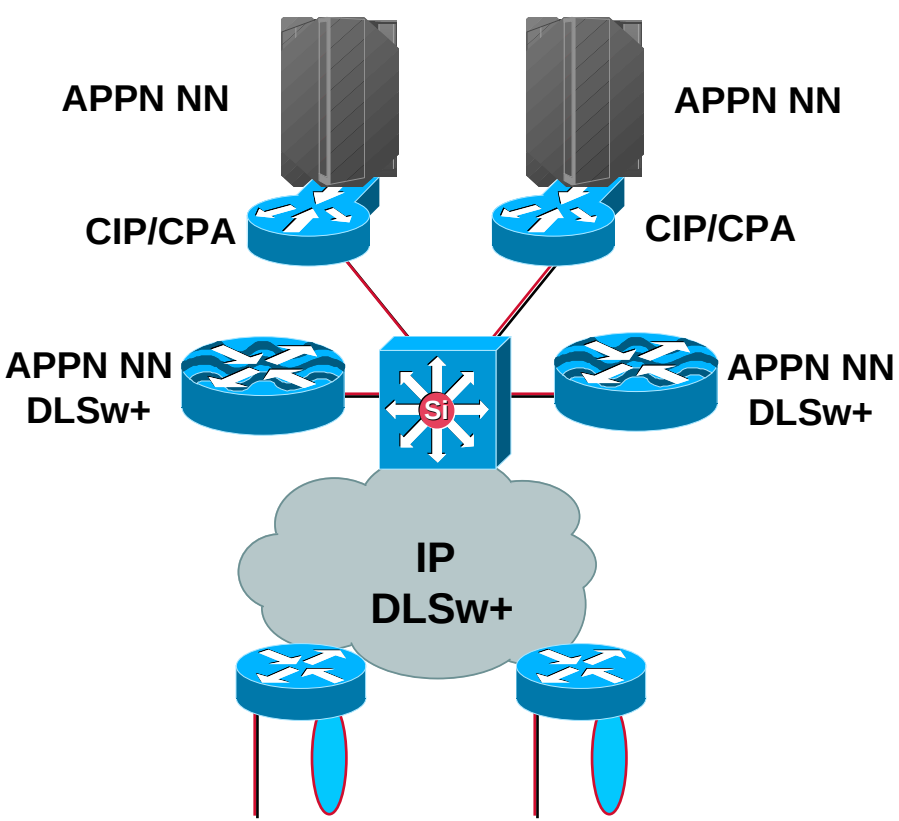
Agenda

- Old Cisco APPN problems and challenges
- How new Cisco APPN (SNASw) addresses these problems and challenges
- Cisco SNASw network migration models

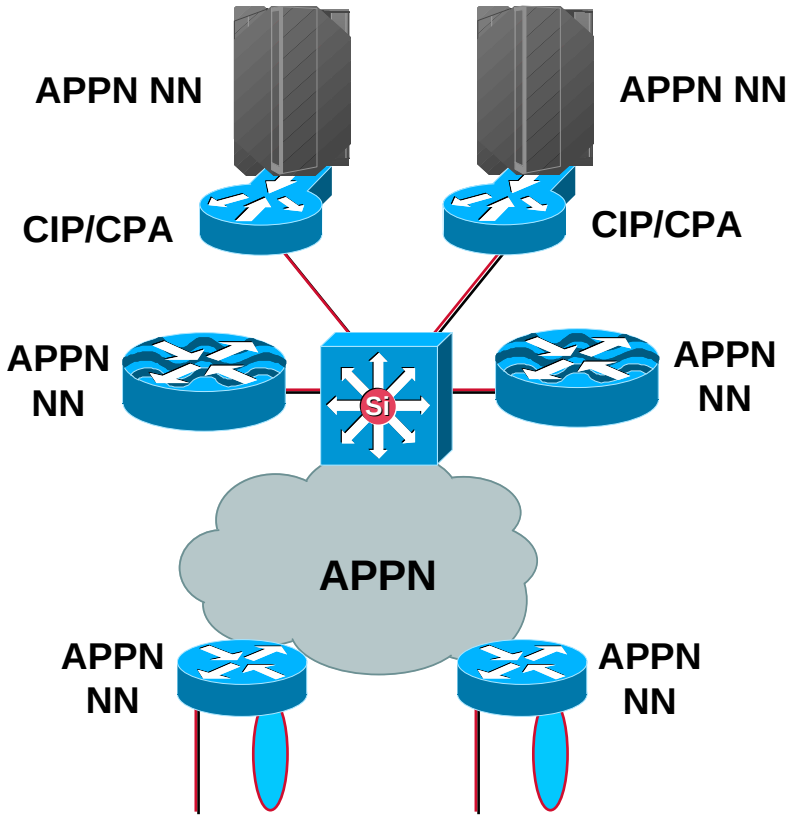
Why Do Cisco Customers Implement APPN?

- Transition subarea SNA into a routable architecture
- Retain SNA session routing when FEPs are being replaced with Cisco CIP/CPA
- Provide support for IBM Parallel Sysplex and MultiNode Persistent Sessions (MNPS)
- Reduce the change management overhead of subarea SNA
- Support distributed client/server processing by enabling APPN peer-to-peer communications

What Have Cisco APPN Networks Looked Like until Today?



- 90%—DLSw+ on backbone, APPN in data center



- 10%—Native APPN across the backbone

Issues with Original APPN Architecture

- APPN transport (LLC/SDLC) in the network is inconsistent with today's IP-based corporate intranet
- But APPN is required to route between multiple SNA application hosts
- APPN NN topologies are very resource intensive and difficult to scale
- APPN networks have been extremely complex to design and configure

Cisco's First Generation (G1) APPN at a Glance

- Shipping since 1995
- More than 8000 G1 APPN routers in production networks today
- Primarily a data center solution
- Based on the original IBM APPN NN architectural model

Old APPN Challenges / What We've Learned

- **Extensive broadcast directory search traffic occurs with APPN NN deployments**
- **Poor serviceability, network management, and diagnostic capabilities**
- **Made configuration, design, and operation needlessly complex**
- **Significant HPR network congestion issues due to problems with original ARB flow control algorithm**

Challenge: Broadcast Directory Traffic

- Encountered by almost every production APPN NN network
- Results in unpredictable broadcast search storms causing network instability
- Inhibits APPN network growth and scale
- Exacerbated by customers deploying cascaded APPN NNs, which was standard practice with original APPN architecture

Challenge: Serviceability Issues

- Messages not descriptive enough
- Traces difficult to obtain (often require outboard analyzer to capture traces)
- Cisco IOS debugs were impossible to analyze and diagnose without Cisco TAC and development assistance

Challenge: Configuration, Design, and Operation Complexity

- APPN NN deployments resulted in extensive Cisco router configuration efforts
- APPN CP names and BTU sizes had to be manually determined and defined for each node
- Designing large-scale APPN networks became complex and challenging
- APPN networks became extremely difficult to implement, manage, and troubleshoot

Challenge: HPR Flow Control Issues

- Learned of these issues in last 12-24 months as customers began to test/implement APPN HPR and original ARB flow control algorithm (ARB1) over IP networks
- Symptoms: slow ramp up, lack of fairness, over-reaction to losses, unpredictable throughput
- Had effectively curbed production use of Cisco HPR ARB on shipping releases
- APPN Implementers Workshop (AIW) recognized the issues and developed solutions (Fall ’98)

APPN Network Node Limitations

1.0 Chapter 1. The Large APPN Network Problem

Large APPN networks have problems with:

- The number of NNs
- Excess network control traffic
- Extra unnecessary switched hops
- The limitations of Border Node in a multi-link environment:
  - Class of Service route selection
  - Unintelligent directory searching

Source: AIW APPN Branch Extender Architecture Reference, Document Number: SV40-0129-01, 10/01/98

APPN Customer Needs, Wants and Desires

- Simplified configuration
- Turnkey operation
- Minimize points of failure
- Avoid excessive SNA routing
- Seamless IP integration
- Code stability
- Smart value-add features

Cisco's Second Generation APPN Goals

- Integrate APPN seamlessly into the IP network infrastructure
- Provide necessary SNA application routing functionality
- Improve APPN network scalability
- Reduce APPN complexity
  - Simplify network design
  - Reduce configuration requirements
- Improve manageability of APPN networks

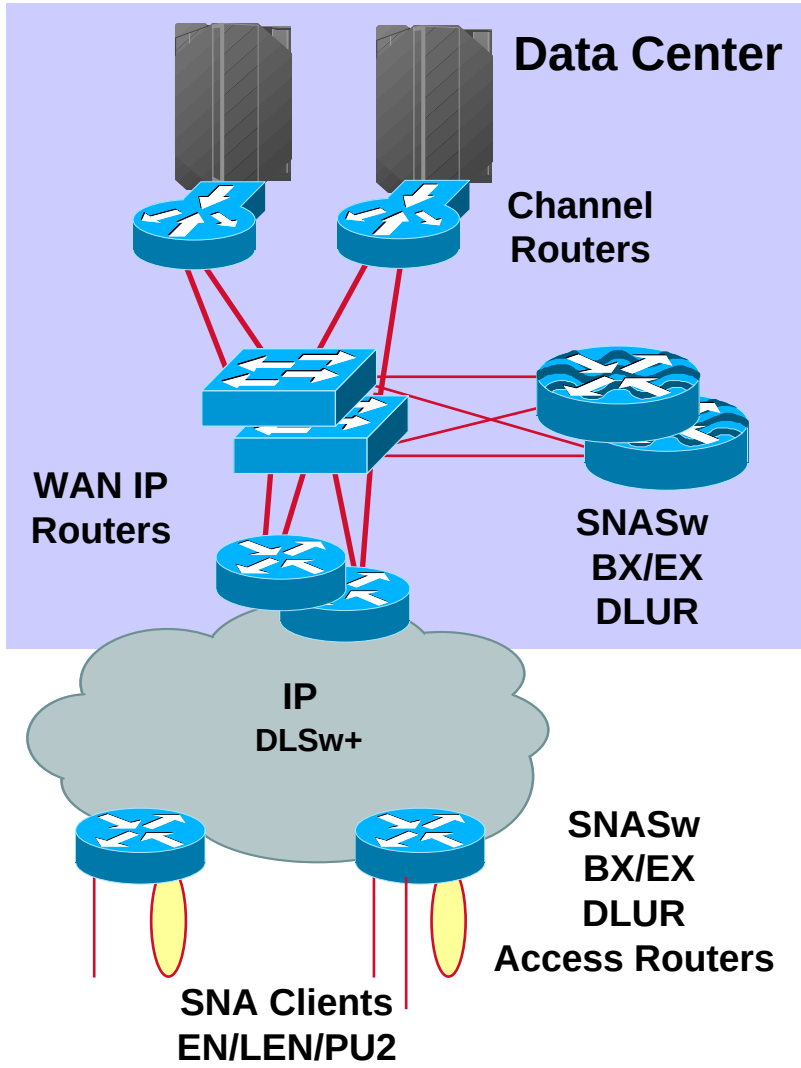
Current State of Cisco's APPN Products

- **Cisco is discontinuing G1 APPN NN in Cisco IOS Release 12.1* because of architectural complexity, scaling limitations, and manageability problems**
- **These problems lead to destabilized networks, limited implementation choices, and dissatisfied customers**
- **Cisco has replaced APPN NN with a new G2 APPN stack—SNASw**
- **SNASw was architected for scalability, designed for simplicity, and implemented with manageability as a main objective**

*** End of Engineering for Cisco IOS Release 12.0 is October 15, 2001**

What Is Cisco SNASw?

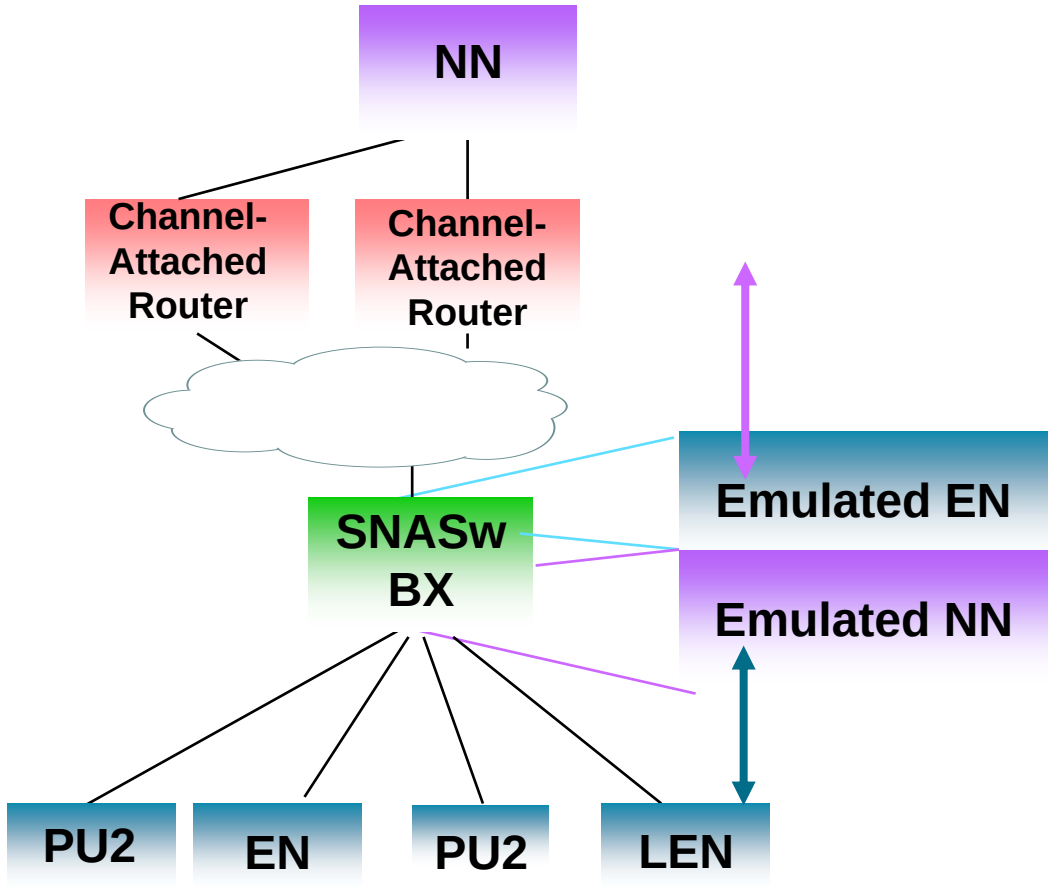
- Cisco's G2 APPN support in Cisco IOS
- Branch Extender (BX) provides SNA routing while optimizing network scalability
- Enterprise Extender (EX) supports SNA over IP using HPR/IP over UDP (RFC 2353)
- DLUR support for dependent SNA device connections (PU2.0)
- Significant usability and network management enhancements
- Simplified router configuration requirements



What Is SNASw Branch Extender Support?

- BX looks like an EN to upstream VTAM NNs
- BX looks like an NN to downstream devices

Broadcast traffic does not traverse the WAN, resulting in enhanced network scalability

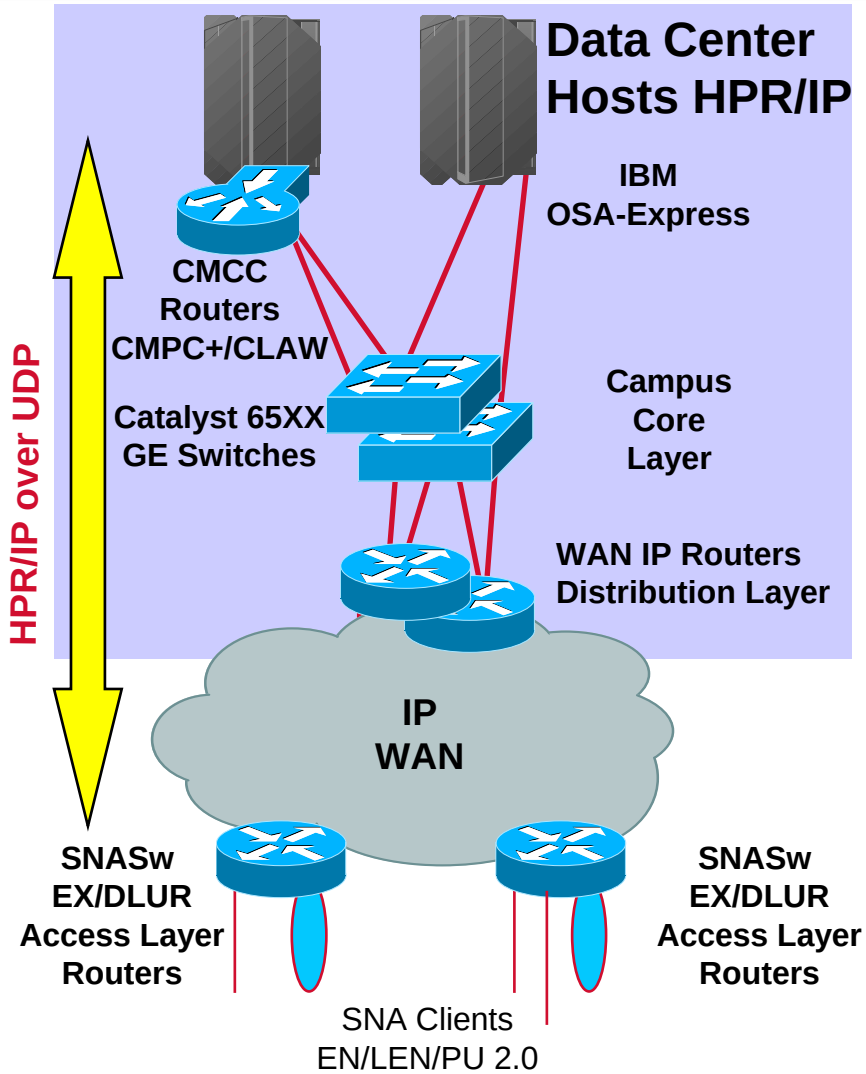


When to Use SNASw Branch Extender

- Reduce number of APPN NNs (VTAM only) allowing customers that installed old Cisco APPN to scale
- Retain SNA session routing when FEPs are replaced with CIP/CPA
- Support existing subarea SNA boundary function (DLUR/DLUS)
- Host VTAM is APPN enabled but is not HPR/IP capable yet
- OS releases before OS/CS/390 V2R7
- Existing DLSw+ network in place

What Is SNASw Enterprise Extender Support?

- HPR/IP over UDP
- Layer 3 IP routing end to end
  - SNA nodes have IP addresses
  - Utilizes IP routing algorithms
- Layer 4 HPR for reliability
  - HPR provides end-to-end flow, error, and segmentation control
  - Automatically maps SNA COS to IP precedence bits, preserving SNA traffic prioritization (QoS)
- Provides nondisruptive rerouting around link failures



When to Use SNASw Enterprise Extender

- IP native transport from enterprise server (S/390) to remote branch is desired goal
- IP backbone/data center
- Support nondisruptive SNA sessions
- Upgrading Cisco branch routers to support SNA, multiservice (data/voice/video), and IP QoS
- Migrating from Token Ring to high-speed campus LAN
  - Fast Ethernet (10/100) using CIP/CPA and CLAW or CMPC+
  - Gigabit Ethernet using Catalyst 65XX switch and OSA-Express NIC (IBM G5 mainframe or higher)
- VTAM is APPN HPR/IP and OS/CS/390 V2R7 and higher

Old Cisco APPN NN versus SNASw Comparison

Old Cisco APPN	SNASw
Full Routing Services	Works with VTAM to Provide Routing Services
HPR Network Support over IP: DLSw+	HPR Network Support over IP: DLSw+, EX
More than 100 Configuration Commands and Operands	Approximately 30 Commands and Operands
Broadcast Traffic Grows as Number of Routers Increases	Broadcast Traffic Is Significantly Reduced

APPN NN versus SNASw Branch Extender

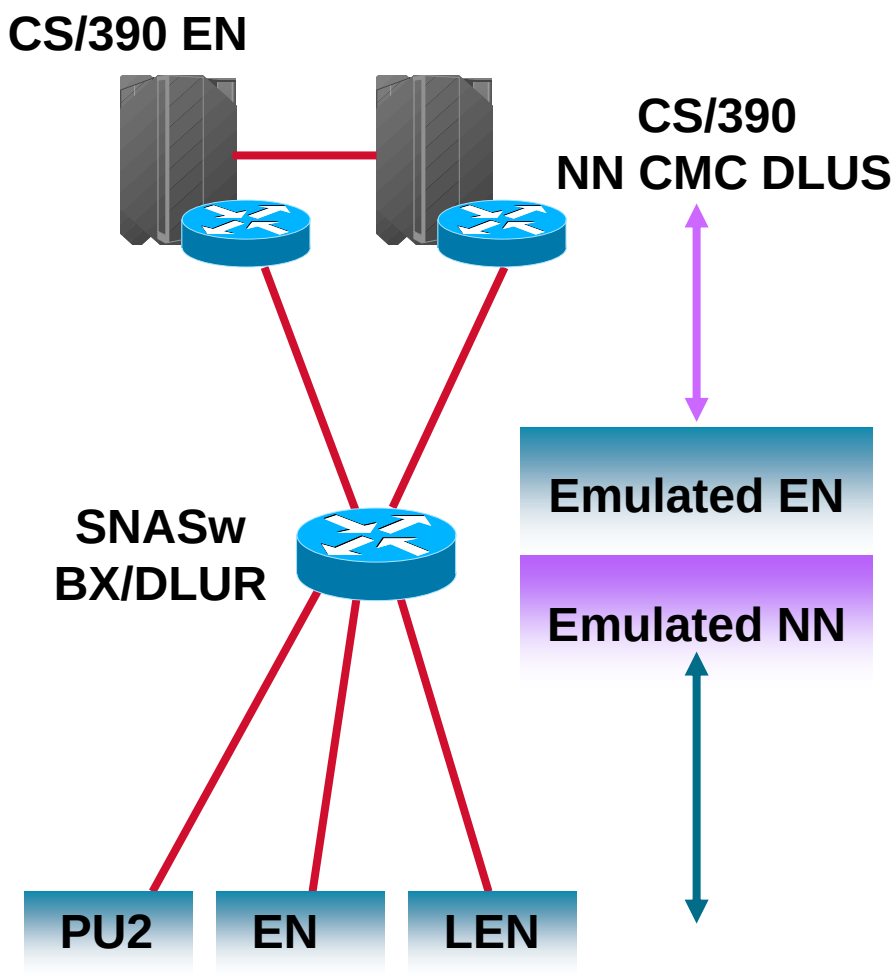
> **The most NNs I know of that were in a single NETID was (a bank) who had approximately 400. Why anyone would consider this many NNs now that BX and EE are possibilities escapes me. (This customer) has been operating much better ever since most of the NNs were changed to use BX.**

IBM Senior APPN Designer, October 2000

This network is moving to BX with IBM and Cisco's direction because they found they were unable to continue to grow as their business required

SNASw Eliminates Broadcasts Broadcast Directory Traffic

- SNASw BX appears as an EN to VTAM and provides NN services to downstream APPN devices
- No longer implements full APPN NN routing
- Eliminates cascaded APPN NN networks which don't scale and have a history of failing
- *Enables one level of SNA routing and significantly reduces broadcast traffic*



SNASw Provides Enhanced Serviceability

- Data-link control tracing
- Sniffer-compatible trace facilities
- Console message archiving
  - Enhanced PD messages with retrievable logs
  - Unattended problem diagnosis capability
- Comprehensive SNMP APPN MIB support
  - APPN MIB (RFC 2455)
  - APPN-Trap-MIB (RFC 2456)
  - APPN DLUR MIB (RFC 2232)
- Support for CiscoWorks Blue SNA View and Maps

SNASw Reduces Configuration, Design & Operation Complexity

- By limiting NN to VTAM host, significantly fewer configuration commands are required
- To improve usability, SNASw automatically generates node (CP) names and SNA BTU size
- Reducing number of APPN NNs greatly simplifies APPN network design
- Commands have been rewritten to make configuration simpler to perform and APPN networks easier to troubleshoot

SNASw Simplifies Configuration Requirements

APPN NN

```
appn control-point NETA.R4700B01
dlus NETA.SJMVS3
dlur
complete
!
appn port SRB rsrb
rsrb-virtual-station 4000.5555.6666 54 1 53
complete
!
appn port TOK1 TokenRing1
complete
!
appn link-station SJMVS3
port SRB
lan-dest-address 4000.1234.0001
retry-limit infinite
complete
```

SNASw

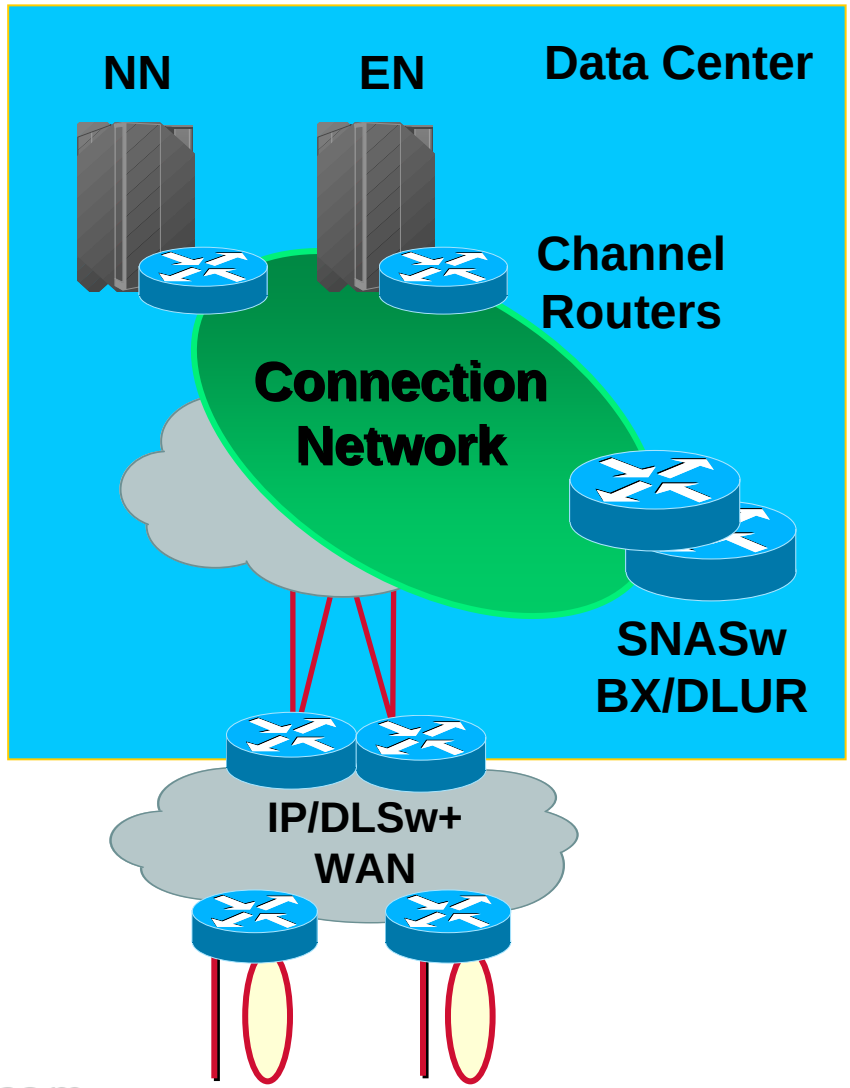
```
snasw cpname NETA.R4700B01

snasw dlus NETA.SJMVS3

snasw port TOK1 TokenRing1
conntype nohpr

snasw port VTOK2 TokenRing2
conntype nohpr

snasw link SJMVS3 port VTOK2 rmac
4000.1234.0001
```

SNASw Provides Enhanced HPR Flow Control Support

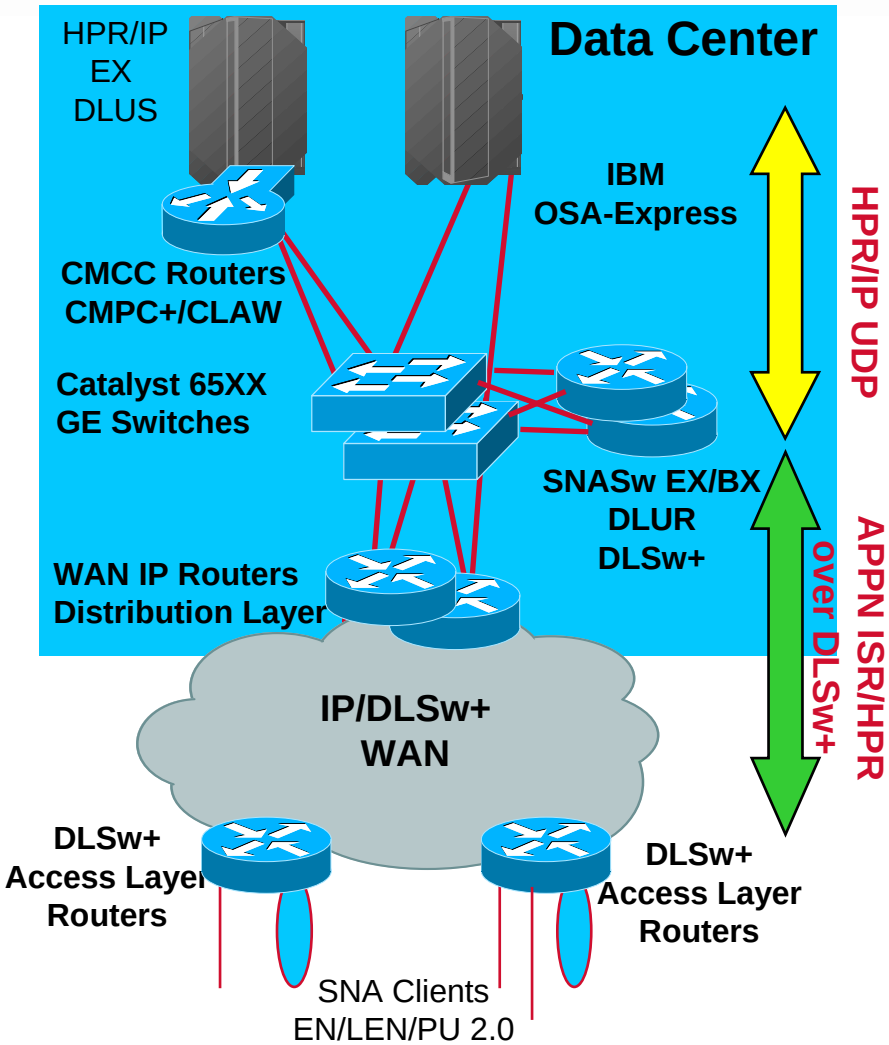
- **SNASw supports new responsive mode ARB (RARB) AIW standard**
  - **Fixes HPR flow control problems with the original ARB AIW standard**
- **Works with current RARB support in CS/390**

Branch Extender Network Design for Migration

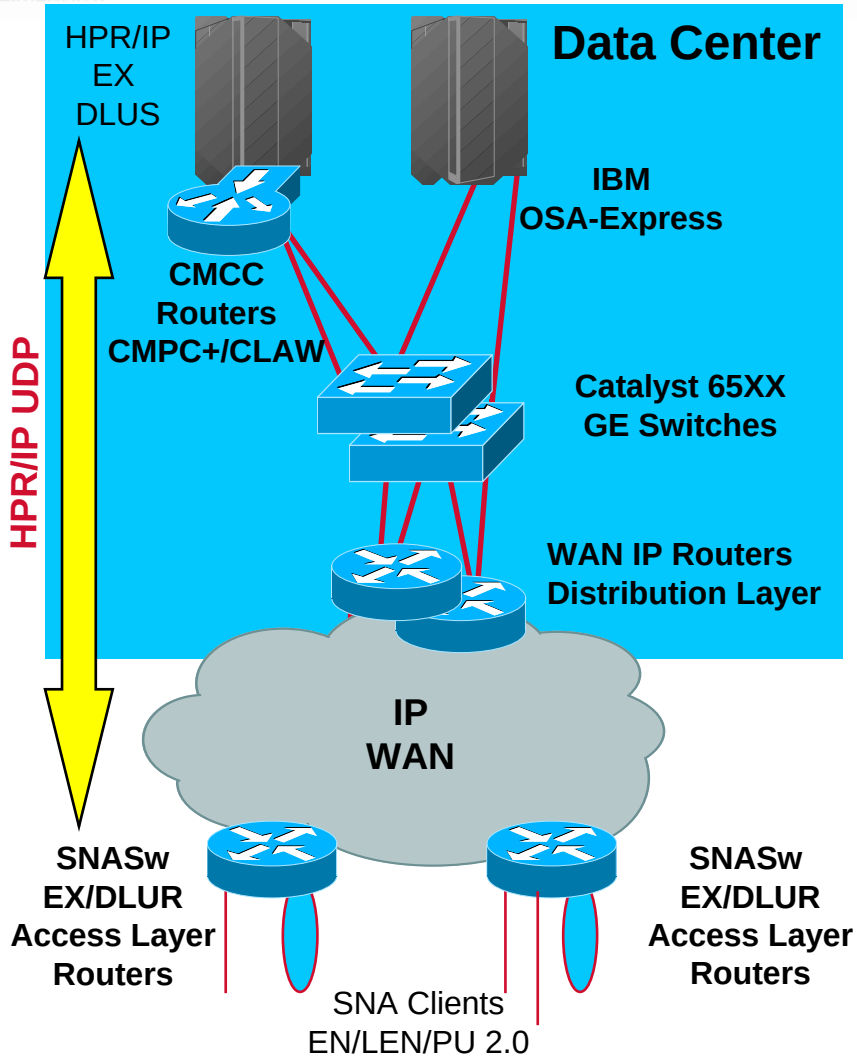
- Single (plus backup) VTAM NN with DLUS
- Other VTAMs are ENs
- Migrate Cisco data center routers from old APPN (NN) to SNASw BX/DLUR
- Channel-attached routers bridge LLC traffic to host
- SNASw BX/DLUR nodes connect to VTAMs using APPN connection network



Enterprise Extender Network Design—2 Options



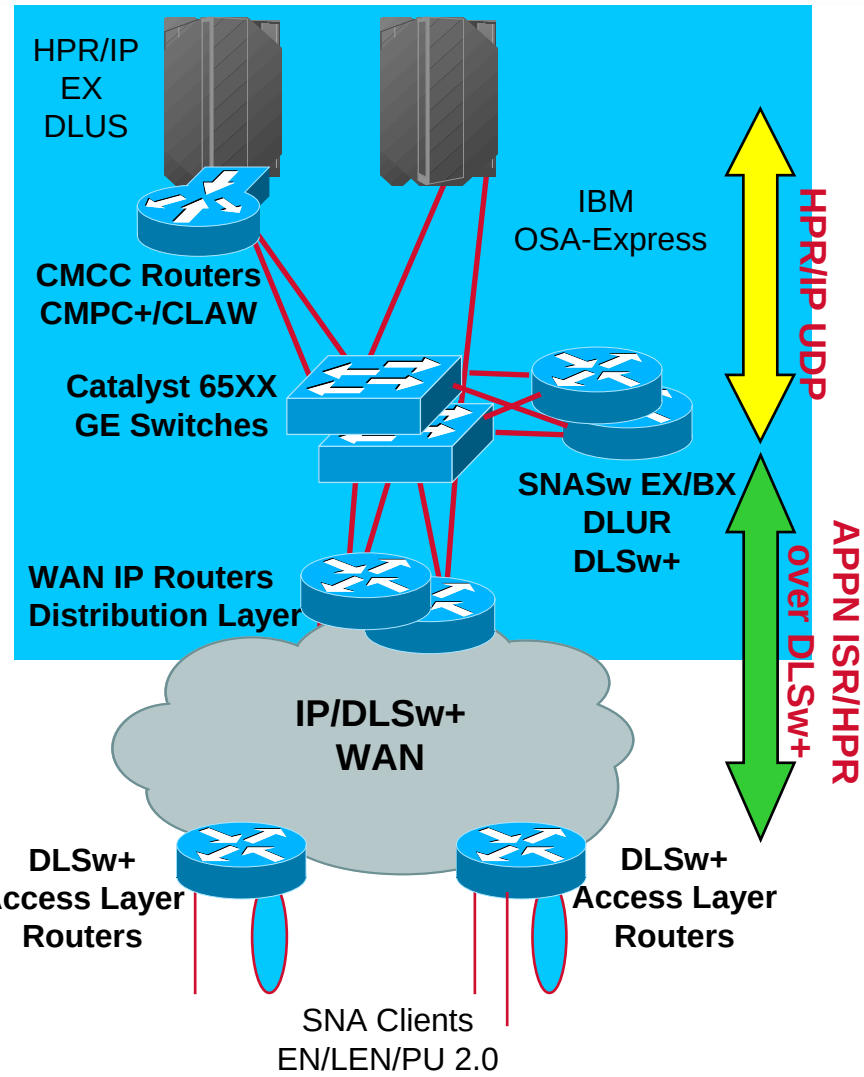
Option 1: DLSw+ to the Branch



Option 2: EX to the Branch

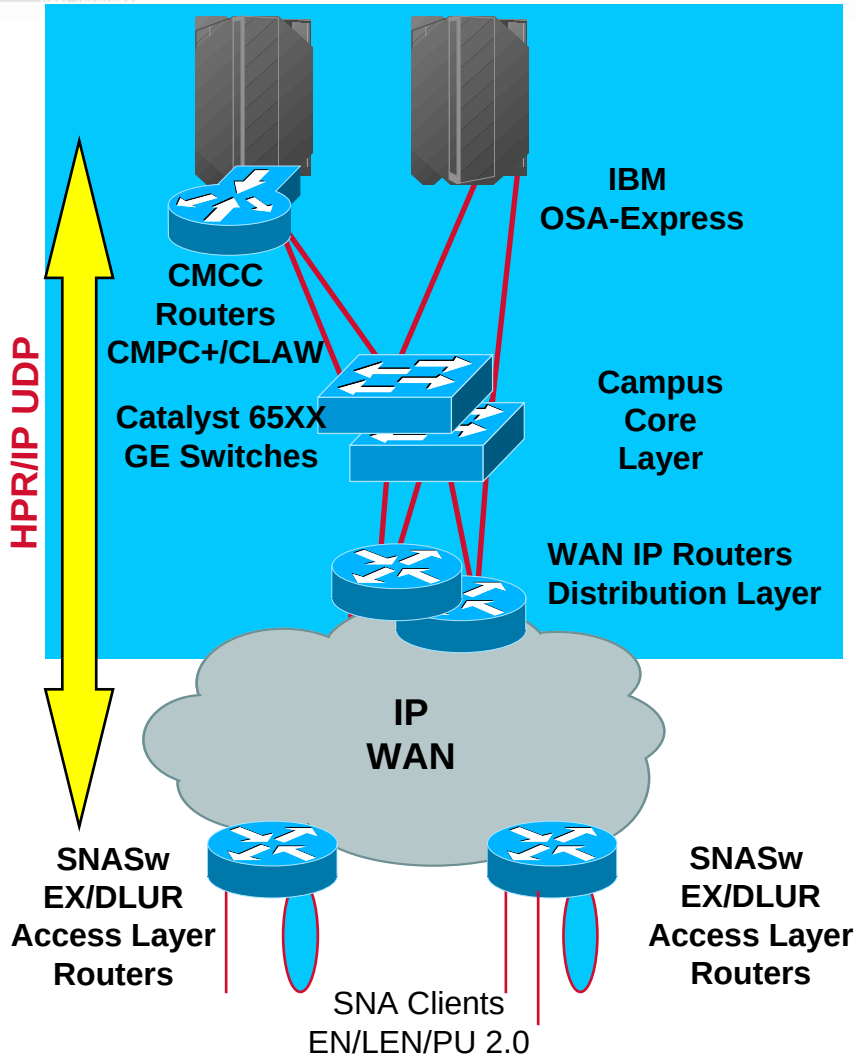
EX Migration Model 1: DLSw+ to the Branch

- SNASw EX/DLUR in data center routers to transport SNA over HPR/IP UDP to hosts
- Data center hosts HPR/IP and EX enabled
- Channel-attached routers IP (or IP connection to host using IBM OSA-Express)
- Remaining Cisco WAN network routers IP/DLSw+



EX Migration Model 2: EX to the Branch

- SNASw EX and DLUR deployed in branch routers to convert SNA traffic to IP
- Data center hosts HPR/IP and EX enabled
- Channel-attached routers IP (or IP connection to host using IBM OSA-Express)
- Remaining Cisco network routers IP



Customer Description

- Premier provider of facilities-based and fully integrated local, long distance, international, and Internet services
- Offers virtual private network (VPN) solutions, security, customer care, Web hosting, multicasting, and e-commerce services
- Operates in more than 65 countries worldwide

Customer Data Center Environment

- 40+ LPARs
- 4 geographically separate data centers
- Pre-Oct 1999: 75% of host SNA/APPN traffic on a dedicated DS-3 network infrastructure
- Post-Oct 1999: All host SNA/APPN traffic migrated to a consolidated IP backbone network using HPR/IP and EE

Customer Data Center Migration Timetable

- More than 100 separate networks (pre-1996)
  - Protocols
  - Applications
  - Hardware
  - Lines of business
- IP backbone/APPN NN (PSNA)/DLUR/DLSw (1996/1997)
- EE/SNASw (1999)

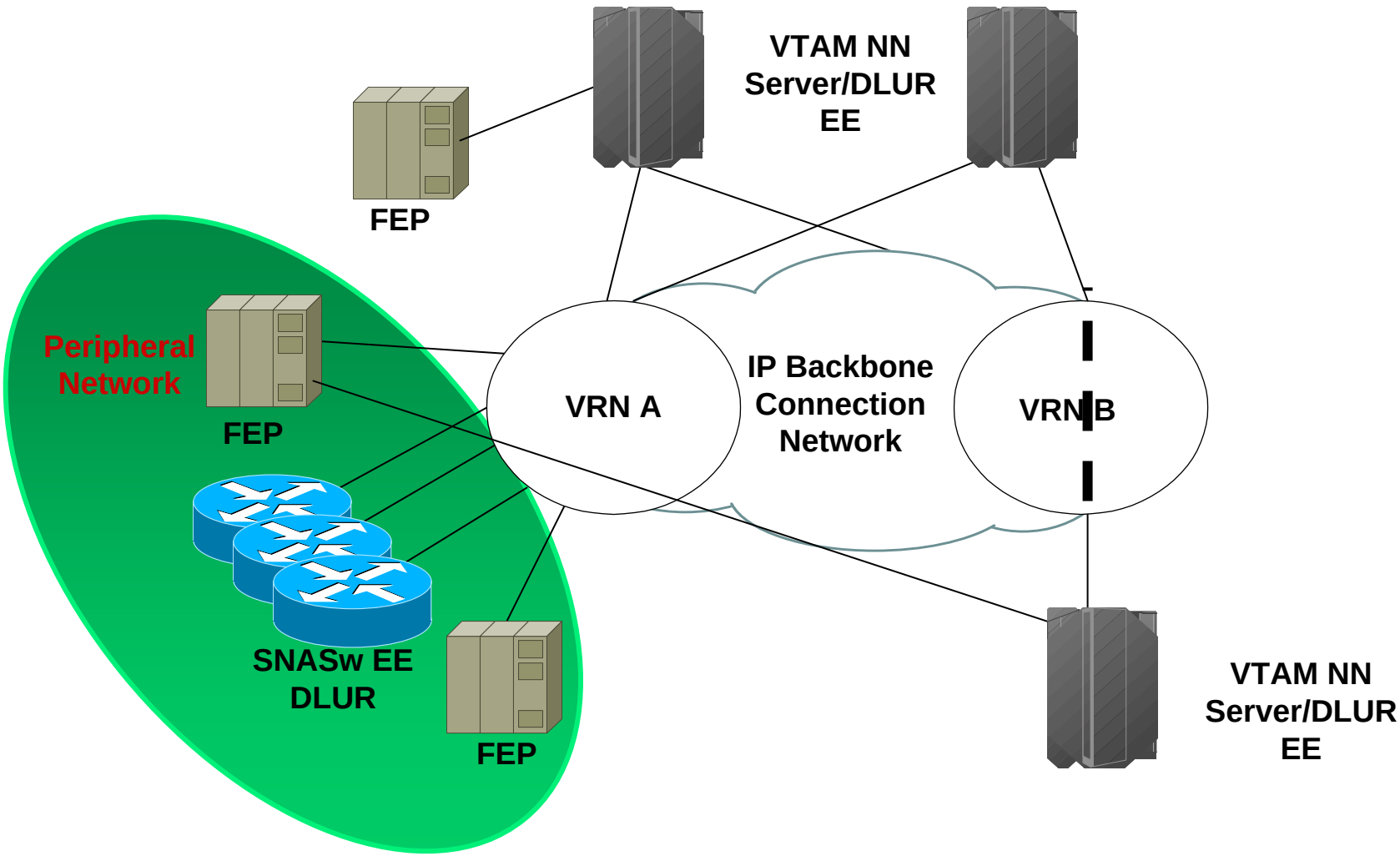
Customer Objectives

- **Improve network availability**
  - **Enable dynamic nondisruptive rerouting of SNA session traffic**
- **Reduce total cost of networking**
  - **Reduce or eliminate DLSw routers between the remote sites and data center mainframes**
  - **Consolidate equipment by reducing the number of DLUR routers at the aggregation locations**
  - **Move the resource-intensive DLSw functions off of the ABR routers to stabilize ABR routers for VOIP**
- **Improve overall network performance**
  - **Exploit efficient, reliable, direct routing to each data center for optimal application access**

Key Customer Migration Steps

- Migrated mainframe-to-mainframe connections to HPR/IP EE
- Implemented EE connection network (VRN)
- Used SNA COS to map sessions to EE VRN connection network
- Implemented dynamic routing protocol (OSPF) on the IBM S/390 mainframes
- Extended SNASw BX/EE/DLUR to remote branch SNA device connections
- Replaced WAN channel-extended and host-to-host DLSw/RSRB networks with native IP transport

Customer Network after EE Deployment



Customer Benefits

- **Simplified network architecture**
  - **Single IP network right out of the mainframe for both SNA and IP traffic**
- **Saved $9.6M by decommissioning dedicated DS-3 SNA network**
- **Achieved significantly higher data throughput (5x improvement) for batch file transfers**
- **Able to take advantage of higher transmission link speeds**
- **Improved network availability**
- **Simplified network management**

Customer Description

- Customer is a computing provider for savings banks in Germany with 86 regional branch offices
- Network has 3000 routers (mostly Cisco 4700s in the primary network and Cisco 2504s in the secondary network)
- Network base for IP and SNA infrastructure of the public savings banks serviced
- Data centers at 4 geographic locations (Duisburg, Duesseldorf, Cologne/Junkersdorf, and Cologne/ Gremberghoven)
- Customers use AS/400s for file transfer, OS/2 and AIX SNA servers, and SDLC-attached ATM cash machines

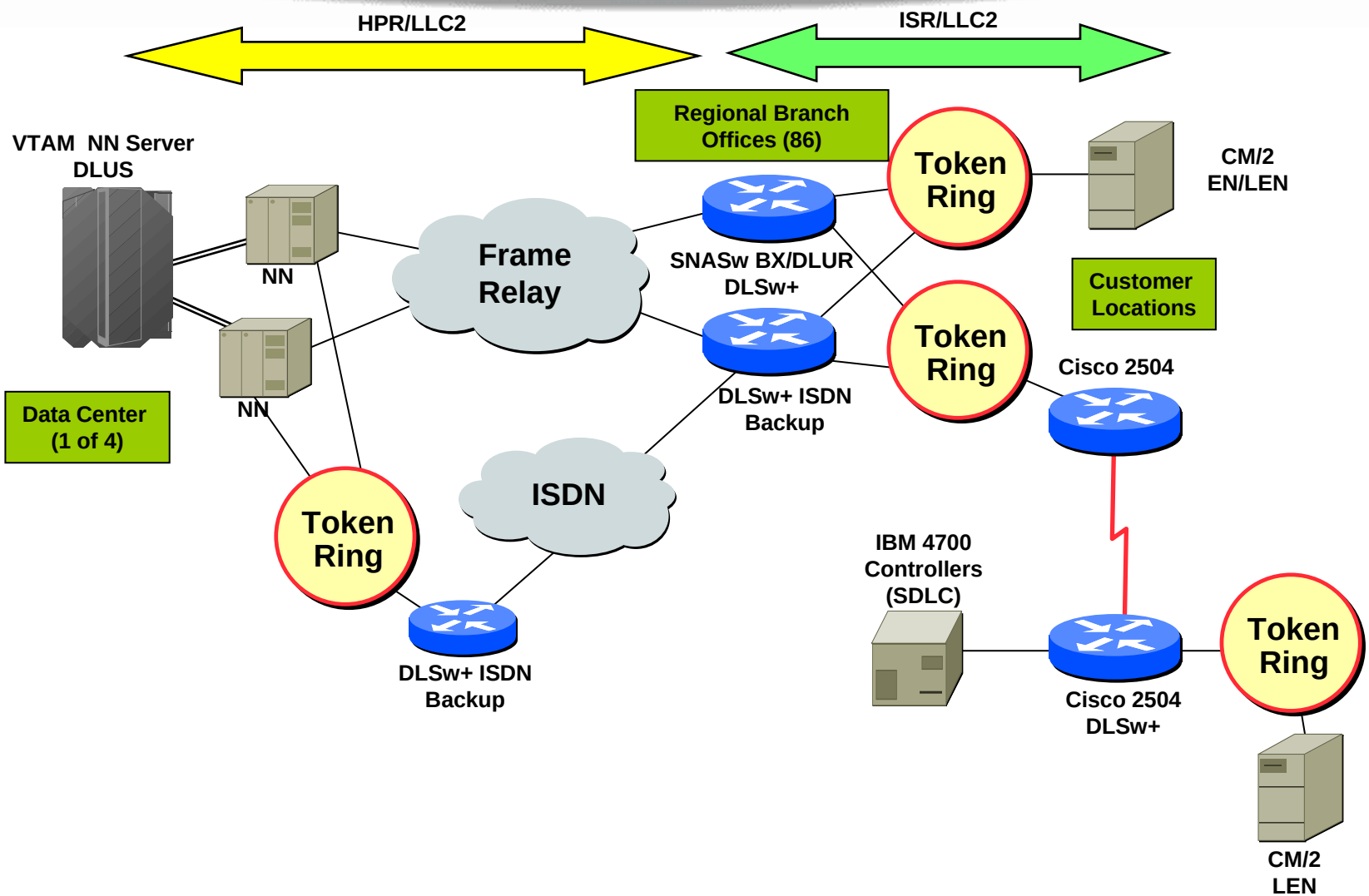
Customer Objectives

- **Improve network stability**
  - **Migrate away from Cisco APPN (PSNA) and IBM 950 NN server because of instability of current APPN NN design**
- **Improve network scalability and performance**
  - **Eliminate APPN broadcast and locate storms**
- **Migrate backbone network between data centers to HPR/IP EE**
- **Migrate 86 remote branch banks to EE**

Key Customer Migration Milestones

- **Phase I: Migrate remote regional banks from APPN NN (PSNA) to SNASw BX/DLUR**
- **Phase II: Migrate backbone data center network (host to host) to HPR/IP EE**
- **Phase III: Migrate remote regional banks from HPR over LLC2 (SNASw BX) to HPR/IP (SNASw EE)**

Phase I: Customer Network after SNASw BX/DLUR Deployment



Summary

The SNASw solution from Cisco:

- Integrates SNA into the IP infrastructure
- Reduces complexity in APPN networks
- Provides a highly scalable solution
- Greatly simplifies APPN network design
- Provides enhanced usability, serviceability, and network management