

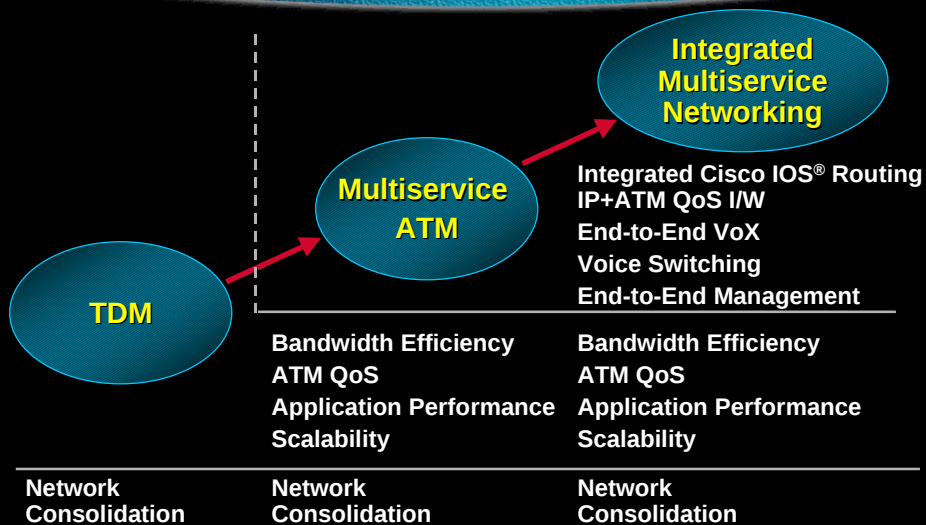


Agenda

- Evolution of Multiservice Networks
- Cisco WAN Switch Value-Add Services
- Cisco IGX™ 8400 Series
- Cisco BPX® 8600 Series
- Cisco MGX™ 8800 Series
- Network Management
- IP+ATM: Enabling New World Services

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WAN Switch Market Evolution



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Current Network Model

Stage I: Rapid Expansion of Separate Networks
and Introduction of Value-Added Services

SMDS IP FR ATM Voice X.25

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New World Forces = New Opportunities

Worldwide Deregulation
and Competition



IP Everywhere



**Service
Providers**



Significant
Growth
Opportunities

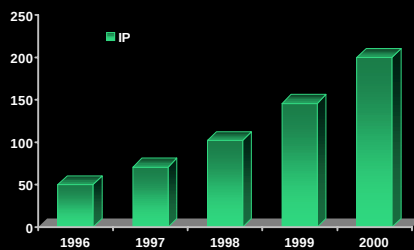


Increased Demand for
Services and Bandwidth

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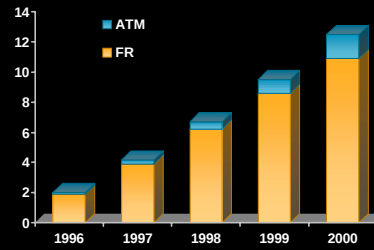
Balancing the Service Portfolio

**IP User Growth
(Millions)**



Emerging Service Opportunity

**Frame/ATM Service
Revenues (\$Billions)**



Today's Revenues

Source: Vertical Systems, IDC, Zona Research, Literature Searches, Team Analysis

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New Requirements Driving Network Evolution

Stage I: Rapid Expansion of Separate Networks and Introduction of Value-Added Services

SMDS IP FR ATM Voice X.25

Stage II: Multiservice Data Networks Integrate IP, FR, ATM, CE

Multiservice Data

Voice

Stage III: PSTN Voice Migrated to Data Networks

21st Century Carrier Infrastructure

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Intelligent Quality of Service Management

Connection Routing Management

Connection Admission Control (CAC)
Routes Connection via Optimal Path
Rerouting Prioritization
Reroutes via Optimal Path

Bandwidth Management

ABR/ForeSight for ATM and FR
Compression and VAD for Voice
Repetitive Pattern Suppression for Data

Dynamic Buffer Management

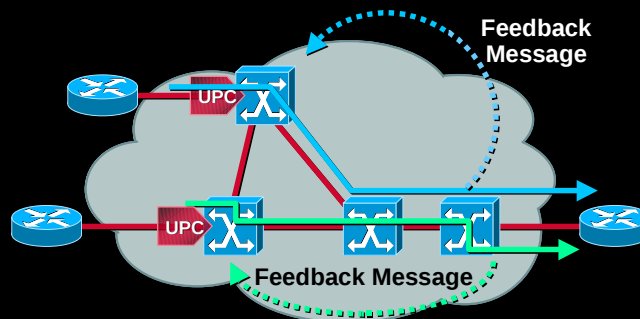
Large Buffering
Up to 1 Million Cells Per ATM Module
100,000 Buffer Per FR Module
Dynamic Buffer Allocation and Scaling

Class of Service Management

Standards-Based Policing
Per VC Queuing at Ingress
Per VC Rate Scheduling
Multiple CoS Queuing on Trunks
Egress Queuing

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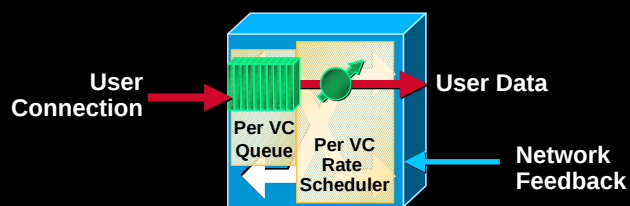
Optimized Bandwidth Management Closed Loop Congestion Avoidance



- **Highest application throughput; lowest latency; most efficient bandwidth utilization**
- Per VC rate-based closed loop congestion avoidance
- Fairly allocates available resources
- For ATM, Frame Relay and frame forwarding services

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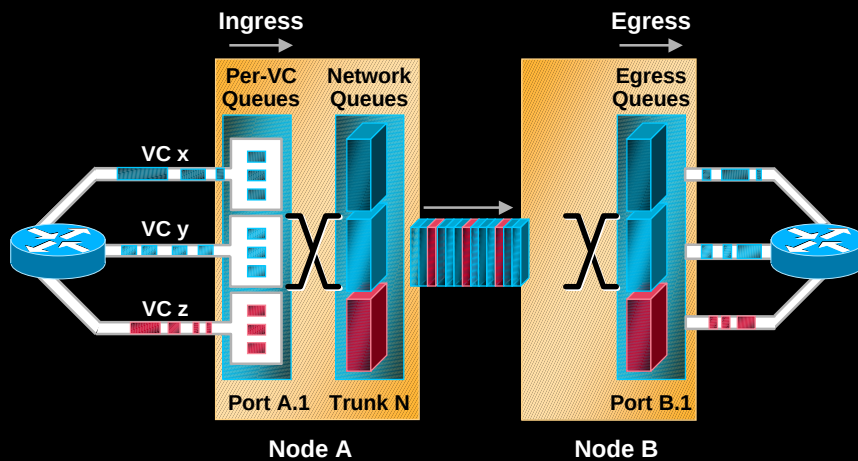
Class of Service Management Per VC Rate Scheduling



- Intelligent admission policy into the network
- Optimal architectural framework for implementation of advanced traffic management feedback
- Admission rate adjusted down if congestion indication is received
- Admission rate adjusted up if no congestion indication

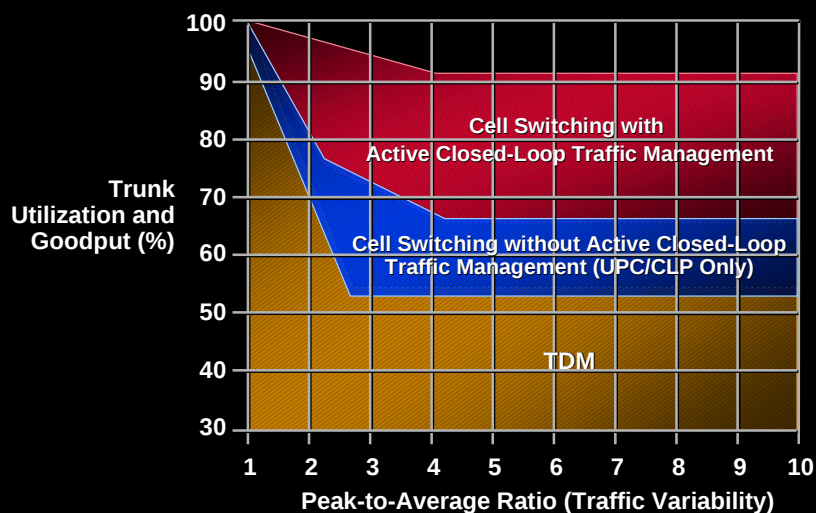
www.cisco.com

Class of Service Management Multiple Class of Service Queues



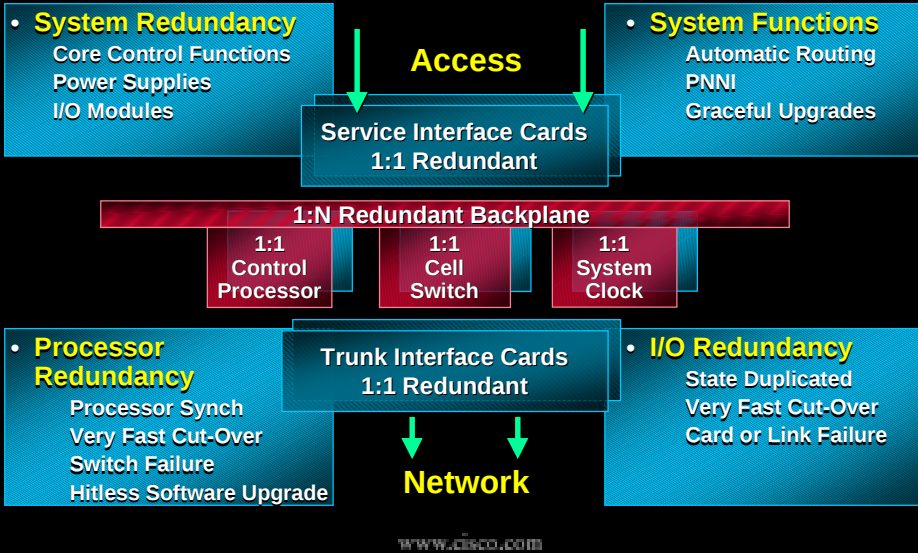
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Advanced Traffic Management Enables 95% Trunk Loading

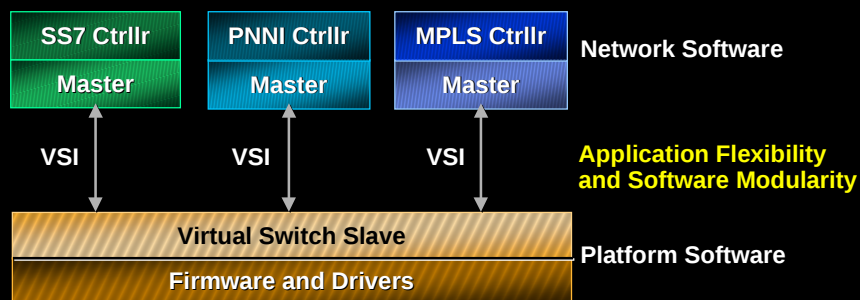


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Carrier Class Reliability for Mission-Critical Traffic



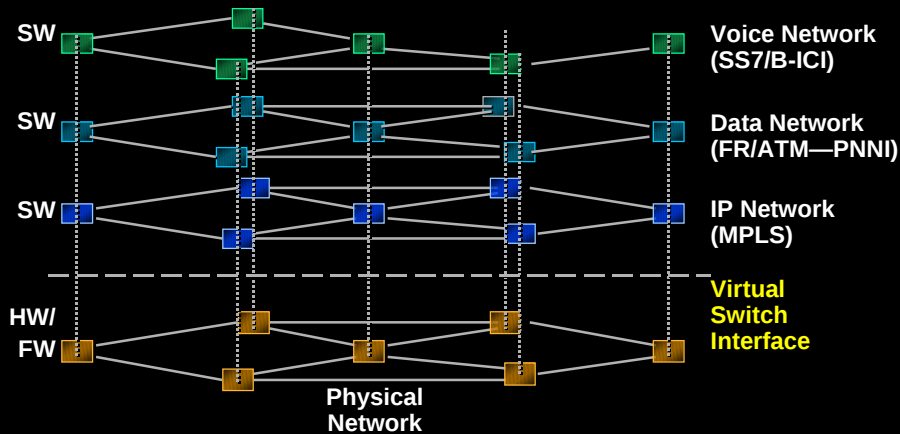
Virtual Switch Interface Single Network—Multiple Controllers



- Allows multiple, diverse services to be operated on same platform
- Allows performance to be scaled by adding more controllers
- Each controller sees its own independent virtual switch
- Each controller can be upgraded independently
- No requirement for master to master communications

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Virtual Network Model



Virtual Topology May Be Different from Physical

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VSI Summary

- VSI allows an external controller to control the switch, i.e., to establish connections through the switch fabric
- VSI “insulates” switch software running mission-critical traffic (FR/ATM PVCs) from new applications that may require frequent software upgrades (upgrade controller software thus adding new features without upgrading sw)
- VSI allows multiple controllers: MPLS controllers, PNNI, AutoRoute, to control a switch
- Controllers are optimized for the service to be delivered
- VSI manages resource allocation so that controllers are completely independent and each service receives the QoS required
- VSI allows independent overlay networks on a common ATM infrastructure

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Cisco IGX 8400 Series Product Update

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Agenda: Cisco IGX 8400

- **Cisco IGX 8400 Multiservice WAN Switch**
- New Additions to the Cisco IGX 8400 Series and the Service Expansion Shelf
- Services and Service Interfaces
- Software Update
- Applications: TDM Replacement and Voice Integration

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Cisco IGX 8400 Multiservice WAN Switch

Multiband Architecture (1.2 Gbps)

ATM Adaptation and Switching

Multiservice Design

Advanced Traffic Management

Bandwidth Efficiency

High-Availability Design

Proven Technology/Software



Cisco IGX 8410—8 Slot Chassis

Cisco IGX 8420—16 Slot Chassis

Cisco IGX 8430—32 Slot Chassis

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Agenda: Cisco IGX 8400

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SES Extends the Cisco IGX 8400 Product Family

IP+ATM Integration

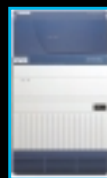
Cisco IGX 8410/8420/8430

+

Service Expansion Shelf

=

Seamless Extension
of Existing Cisco IGX 8400
Networks



Cisco IGX
8410
+
SES



Cisco IGX
8420
+
SES

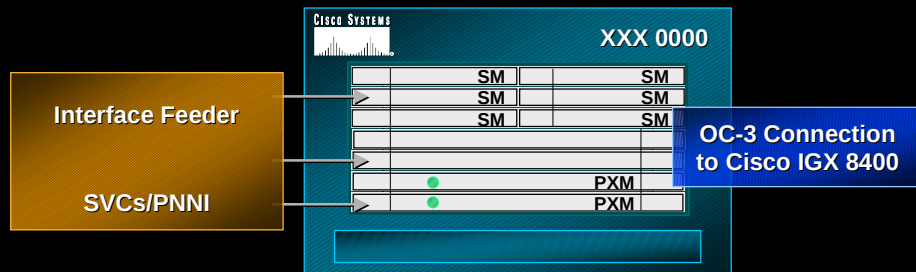


Cisco IGX
8430
+
SES

=
IGX 8450 Bundle!

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SES Architecture and Interfaces



- PNNI/SVC controller for Cisco IGX
- 80 additional ports using Cisco MGX service modules
- Frame Relay/ATM, (8T1/E1)
- High-speed Frame Relay (HSSI, T3/E3, CT3)
- AAL1 circuit emulation—(T1/E1, T3/E3)

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Cisco IGX 8410/20/30 or 8440/50/60?

Immediate Network Requirement

TDM Replacement and
Seamless Upgrade Path

Cisco MGX Modules, PNNI
and
Large-Scale Networking

Cisco IGX 8410/20/30
Add SES
Later if Needed

Cisco IGX 8450

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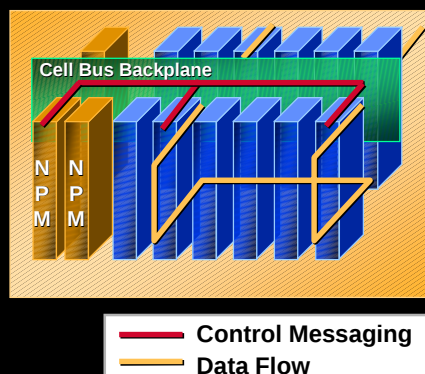
Agenda: Cisco IGX 8400

- Cisco IGX 8400 Multiservice WAN Switch
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- **Architecture, Services, and Service Interfaces**
- Software Update
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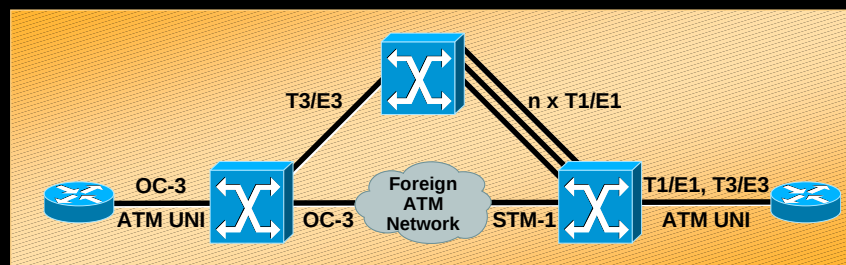
Cisco IGX 8400 Architecture

- **Processor module(s)**
 - Node management and control
 - Connection routing and rerouting
 - Clocking
 - Interface module management
 - Statistics collection
- **Trunk module(s)**
 - Interfaces to other switching nodes
- **Service module(s)**
 - Interfaces to customer equipment



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ATM Services



- High-performance, high-density, standards-based ATM services (4/8 port T1/E1, 3/6 port T3/E3, 2/4 OC-3/STM-1 per module)
- ABR to Cisco routers and LAN/campus ATM switches

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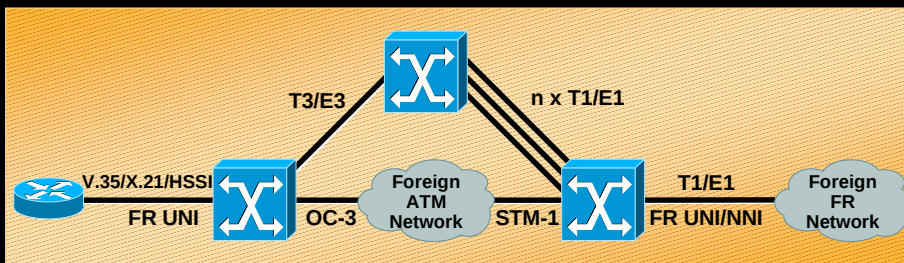
Universal Switch Module (UXM)

- Cisco IGX ATM interface module—ASIC-based design
- 4/8 port T1/E1, 3/6 port T3/E3, 2/4 port OC-3/STM-1/STM-1e UNI/NNI or trunk interface
- Full ABR support (EFCI, ER, VS/VD)
- 128K cell buffers per UXM module
- Inverse multiplexing over ATM (IMA) for n x T1/E1 trunking
- Y-cable redundancy with hot-standby



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Frame Relay Services

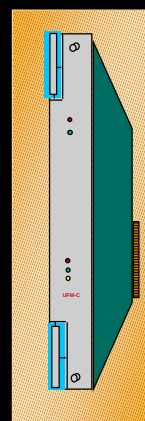


- High-performance, high-density, standards-based Frame Relay services (T3/E3, CT3, T1/E1, X.21, V.35, HSSI, RS-232)
- Frame Relay to ATM interworking (SIW, NIW)
- Per VC queuing and rate scheduling, and closed loop congestion avoidance (ForeSight/ABR)
- Traffic management (CLLM) and Autoconfig (E-LMI) to Cisco routers
- Frame forwarding for frame-based data services (SNA, X.25)

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Frame Relay Service Interfaces

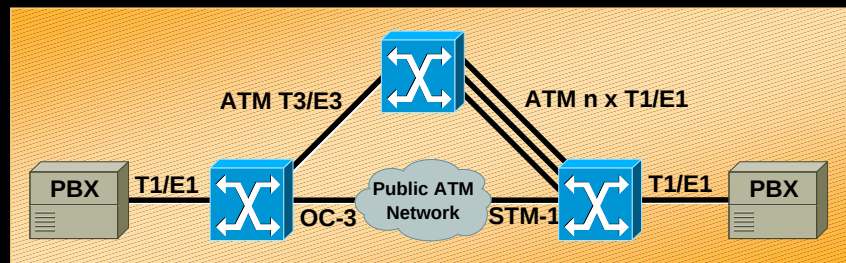
- **UFM-U**
 - 12-port X.21/V.35 (up to 10 Mbps port speed)
 - 4-port HSSI (up to 16 Mbps port speed)
 - CLLM e-LMI
- **UFM-C**
 - 4 or 8-port T1/E1 module
 - 256 logical interfaces
 - FF CLLM e-LMI
- **FRSM**
 - 8-port T1 E1
 - 2-port HSSI



UFM-C/U
FRSM

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Voice Transport Services

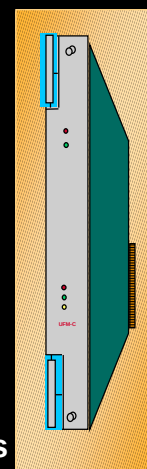


- Standards-based compression, silence suppression, and integrated echo cancellation offers a scalable solution for tie line replacement
- ATM guarantees low delay and jitter for voice packets multiplexed with data packets
- 1 and 2-port T1/E1 digital voice (CAS and CCS)

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Voice Service Interfaces (UVM)

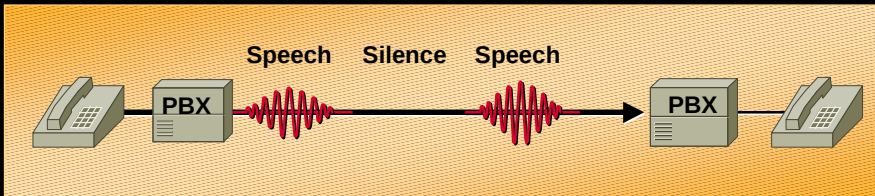
- 2-port T1/E1/J1 per module
- CAS and CCS signaling support
- Standards-based voice compression per channel
 - Up to 32 channels with 32 Kbps, 24 Kbps ADPCM
 - Up to 16 channels with 16 Kbps LD-CELP (G.728)
 - Up to 16 channels with 8 Kbps CS-ACELP (G.729)
 - Up to 32 channels with 8 Kbps CS-ACELP (G.729A)
- Voice Activity Detection (VAD)
- On-board echo cancellation
- Fax/modem detection—Fax Relay at 9.6 Kbps
- Voice switching support



UVM

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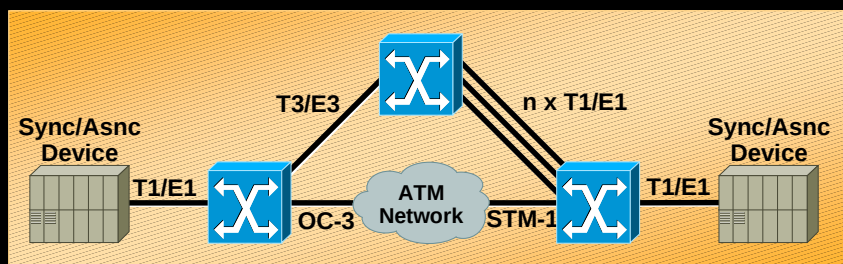
Optimized Bandwidth Management Minimizing Network Bandwidth for Voice



- **Voice compression**
32, 24, 16 Kbps ADPCM, 16 Kbps LD-CELP, 8 Kbps CS-ACELP
D-channel compression
- **Silence suppression**
No cells generated for silence
- **Fax Relay**
Using 9.6 Kbps of bandwidth for group 3 fax

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Circuit Data Interfaces: Native Transport for Legacy Services

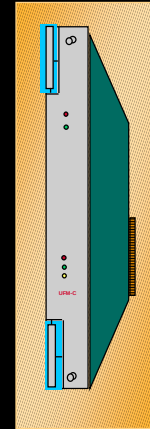


- High-density circuit data modules for video conferencing, SNA, synch/asynch, etc.
- Cell switching ensures low delay and low variability in delay → guaranteed service levels
- RS-232, RS-449, V.35, X.21, etc

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Circuit Data Service Interfaces

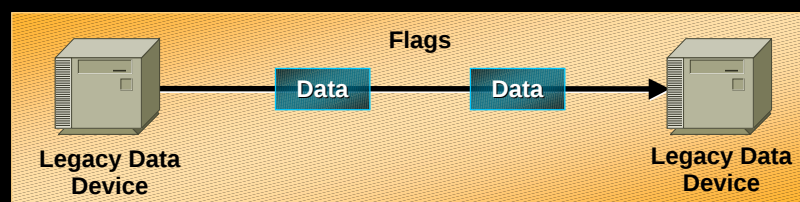
- Sync/async circuit data interfaces (HDM/LDM)
 - 1.2 Kbps to 1.344 Mbps
- Repetitive Pattern Suppression (RPS) increases bandwidth efficiency
- On-demand connections increase bandwidth efficiency
 - Time-of-day, day-of-month, month-of-year
 - Lead triggered
- T1/E1 circuit emulation (CVM-TT, CESM)
- Direct replacement of leased lines or TDM networks



HDM/LDM
CVM-TT
CESM

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Optimized Bandwidth Management Compressing Repetitive Patterns for Legacy Data



- Repetitive pattern suppression
 - No cells generated/transmitted for repetitive patterns—patterns get regenerated at receiving end
 - Example: SDLC/HDLC information frames have multiple flags {7E(H)} between each frame; why send those flags on the trunks?

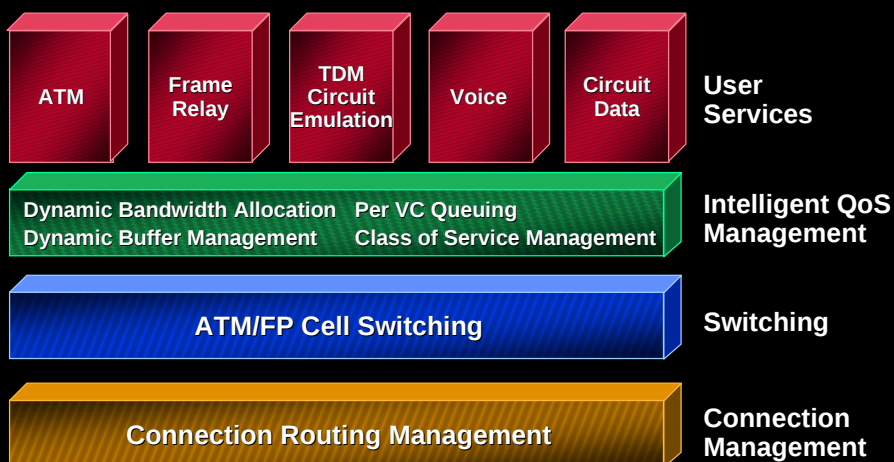
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Agenda: Cisco IGX 8400

- Cisco IGX 8400 Multiservice WAN Switch
- New Additions to the Cisco IGX 8400 Series and the Service Expansion Shelf
- Architecture, Services, and Service Interfaces
- **Software Update**
- Applications: TDM Replacement and Voice Integration

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Cisco IGX 8400 Software Architecture



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Cisco IGX 8400 Release 9.1/9.2 Highlights **Available Now!**

- **UXM—Universal Switch Module**
 - T1/E1, T3/E3, OC-3/STM-1 ATM
 - T1/E1 IMA Trunking (incl. Feeder trunks)
 - ATM-F T.M. 4.0 (ABR)
 - Ports and Trunks on 1 module
 - Virtual Trunking (VP- and VC-based)
- **UVM—Universal Voice Module**
 - G.729 and G.729a 8kbps voice
 - Fax relay
 - H.320 Idle Code Suppression
- **SES—Service Expansion Shelf**
- **Traffic shaping**

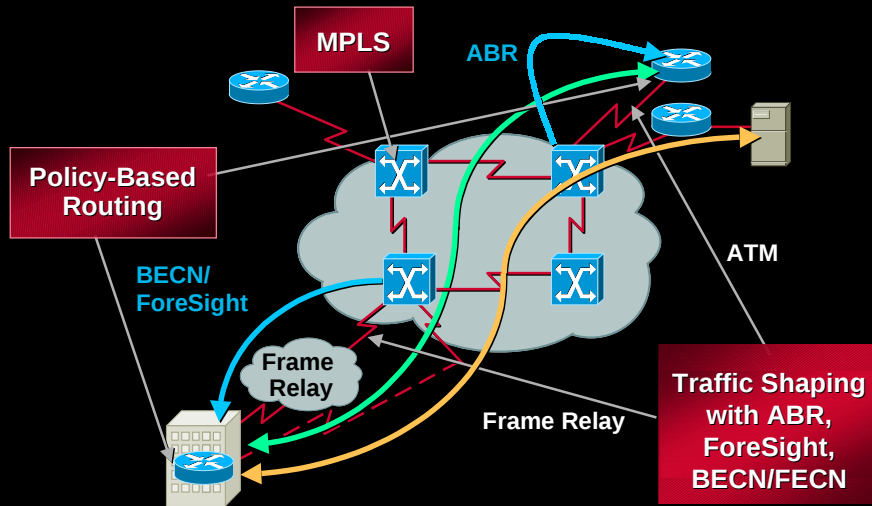
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Cisco IGX 8400 Release 9.3 Highlights

- **UXM IMA ports for UNI connectivity**
- **Priority bumping**
- **MPLS using VSI and 7200 LSC**
- **ILMI and E-LMI enhancements**
- **LAN NMS (CiscoWorks) integration**
- **PNNI**

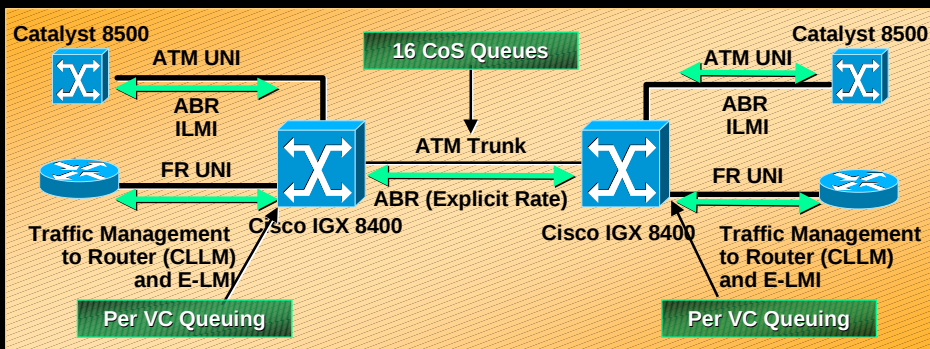
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Enabling End-to-End QoS



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TM Enhancement: Integrating the WAN with the LAN



- Traffic management extension from the WAN backbone to the LAN—ABR for ATM, ForeSight for Frame Relay
- Automatic configuration of Cisco routers (E-LMI on the Frame Relay interface)
- NMS integration

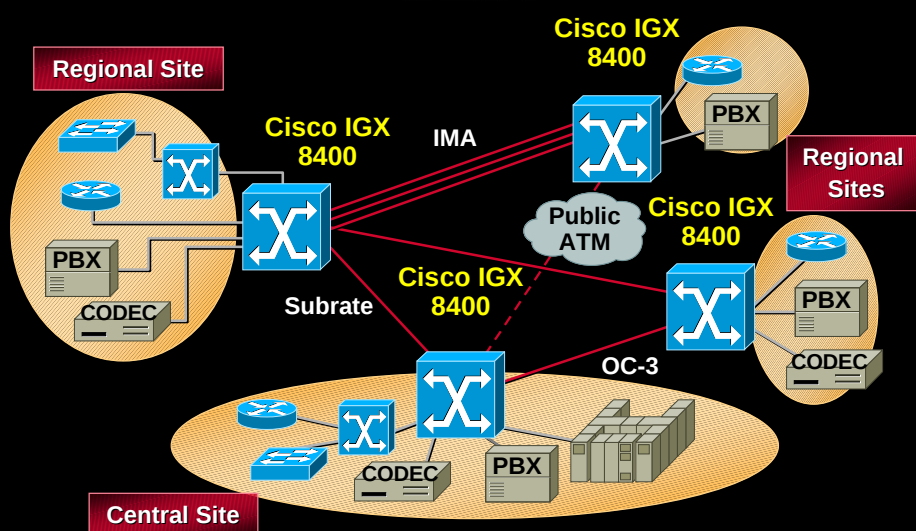
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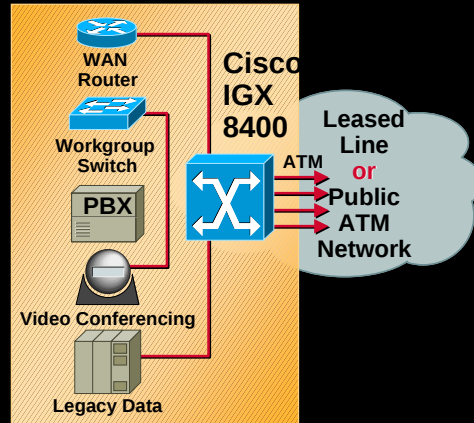
TDM Replacement



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Value Propositions for TDM Replacement

- Integrate separate networks
- Increase bandwidth efficiency and reduce cost
- Guaranteed performance and multi-service QoS
- LAN/WAN integration
- Carrier-class resiliency
- Full access—backbone interworking
- MPLS



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Cisco IGX 8400 Differentiators for TDM Replacement

• Intelligent QoS Management

Bandwidth Management
(TM4.0/ABR, ForeSight)
16 Classes of
Service Management
128k Buffers Per Module

• LAN/WAN Interworking

Automatic Configuration of Cisco
Router Frame Relay
Frame Relay (ForeSight) and ATM
(ABR) Traffic Management
Extension to Cisco Routers
and LAN/Campus ATM Switches

• Carrier-Class Reliability

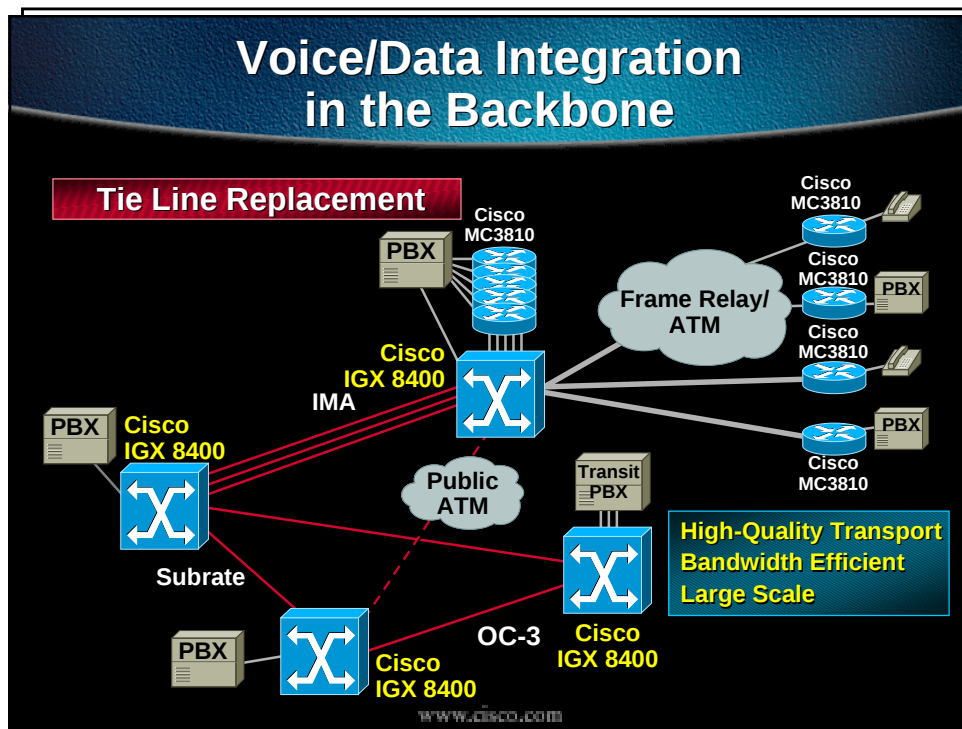
100 ms Hot-Standby Switchovers
Node-by-Node Graceful Upgrades
Hitless Processor Switchover

• End-to-End Network Management

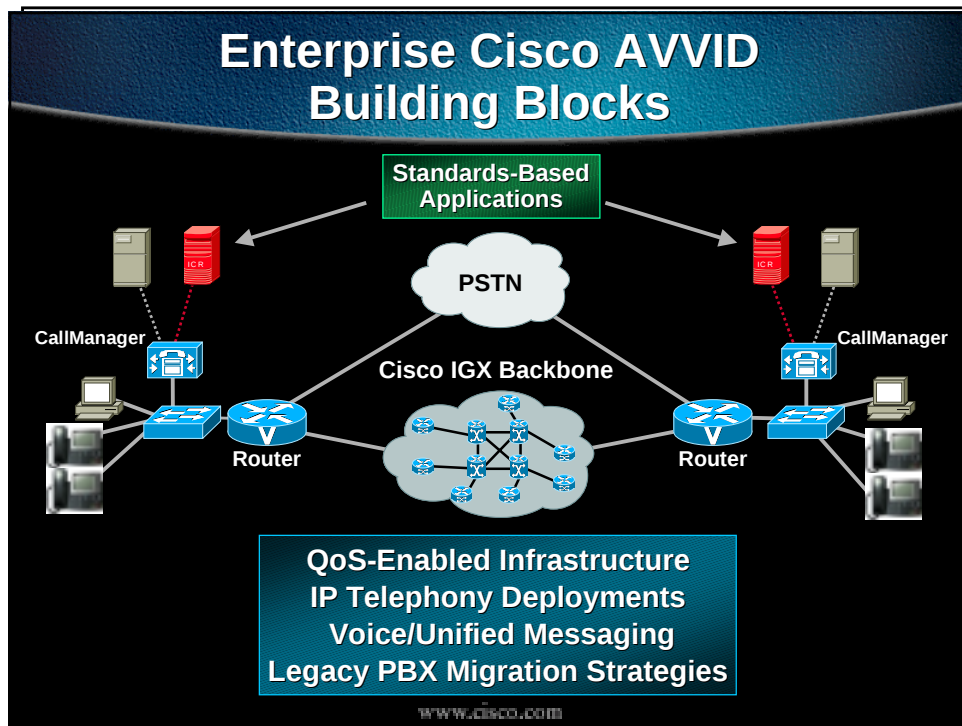
Easy-to-Use Connection
Management
CiscoView
Cisco Infocenter

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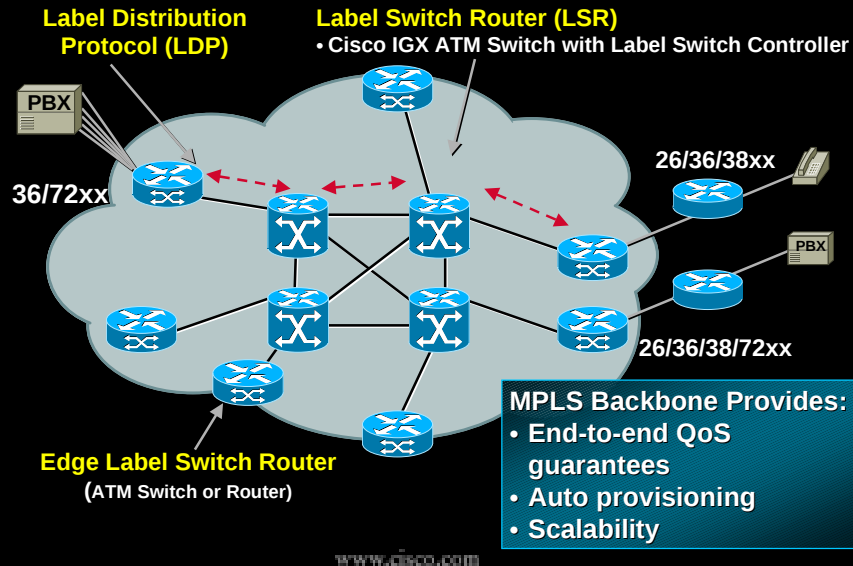
Voice/Data Integration in the Backbone



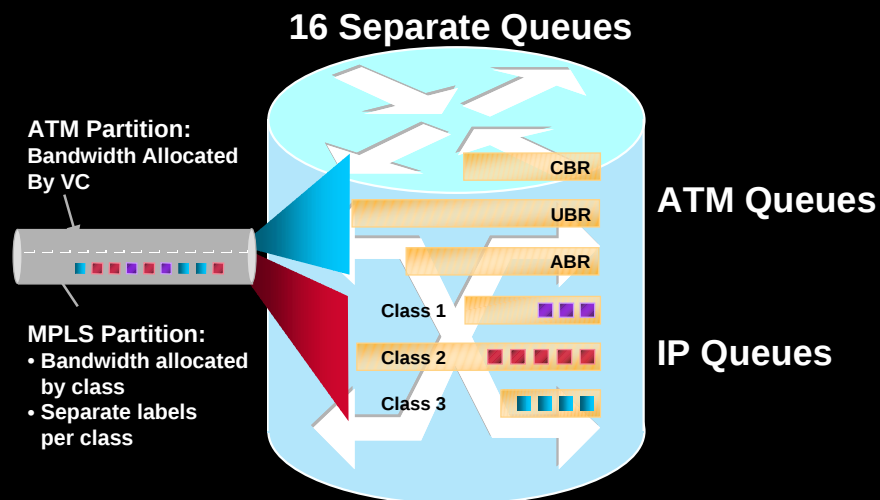
Enterprise Cisco AVVID Building Blocks



Layer 3 Voice/Data Integration over an Cisco IGX MPLS Backbone



IP Awareness in an Cisco IGX MPLS Switch



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- Cisco MGX 8800 Series
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The Cisco BPX 8600 Series Multiservice Switch

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Cisco BPX 8600 Series: BPX 8620, BPX 8650, BPX 8680

- Extending Cisco's global WAN leadership in:
 - Scale, density and price
 - IP integration
 - Cisco product integration and interoperability
 - Reliability, Availability, Serviceability (RAS)
 - Service diversity and feature richness
 - Virtual switch interface
 - Service expansion shelf (PNNI, MPLS)
 - VISM/voice switching controller



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Agenda: Cisco BPX 8600

- **Cisco BPX 8620**
 - Architecture and service modules**
- Cisco BPX 8650 IP+ATM MPLS switch/router
- Cisco BPX 8680 Service Node and Cisco MGX concentrators
- Cisco BPX 8680 Service Node Evolution
 - The Service Expansion Shelf
- Software update and new feature set
 - Release 9.2
 - Release 9.3

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Cisco BPX 8620 Wide Area Switch

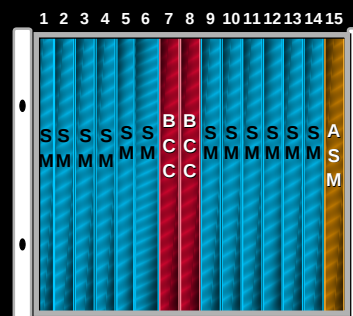
- Scalable multigigabit (9.6 or 19.2 Gbps) ATM switch
- Industry-leading traffic management
- Flexible multiservice platform
- Designed for highest-service availability
- Open architecture and network management concept
- Conforms to CCITT, ANSI, ETSI and ATM forum standards and specs
- 12 slots for ATM service I/O modules
- E3/T3, OC-3c/STM-1, OC-12c/STM-4



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Cisco BPX 8620 Architectural Highlights

- Switching capacity: 19.2 Gbps peak; 9.6 Gbps fully non blocking
- 15 card slots per shelf
- Common equipment with 1:1 redundancy option
- Two slots for processor modules
- Mid-plane design
- Line module approach (all cabling from rear)
- Port and trunk interface modules with 1:1 redundancy option, APS available for optical interfaces
- Extensive diagnostic testing capabilities
- Hot-swappable cards

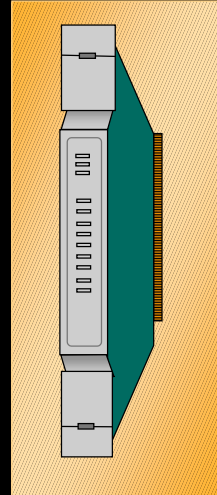


BCC—Broadband Controller Card
SM—Service Module (BXM)
ASM—Alarm Status Monitor

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BXM: ATM Service Module

- Standards-based UNI/NNI services
- VPC or VCC connections
CBR, VBR, UBR, ABR
- Interface type and densities
 - T3/E3 8 or 12 ports per card
 - OC-3/STM-1 4 or 8 ports per card
 - OC-12/STM-4 1 or 2 ports per card
- Up to 32 “virtual ports” per module
- Dynamic VC buffer management
 - Up to 1,000,000 cells buffering
 - Per VC EPD, CLP, and EFCI thresholds
 - Per VC scheduling
- Cell and frame-based policing/UPC
 - Two (F)GCRA policers and one shaper per VC
- Up to 32k connections per card



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Agenda: Cisco BPX 8600

- Cisco BPX 8620
Architecture and Service Modules
- **Cisco BPX 8650 IP+ATM MPLS Switch/Router**
- Cisco BPX 8680 Service Node and
Cisco MGX Concentrators
- Cisco BPX 8680 Service Node Evolution
The Service Expansion Shelf
- Software Update and New Feature Set
 - Release 9.2
 - Release 9.3

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MPLS on Cisco BPX 8650 and 8680-IP: In Production Networks Today!

- Allows dynamic IP switching over ATM fabric
- Single platform supports full range of IP+ATM services at the edge
- Represents >35% of total Cisco BPX 8600 series bookings

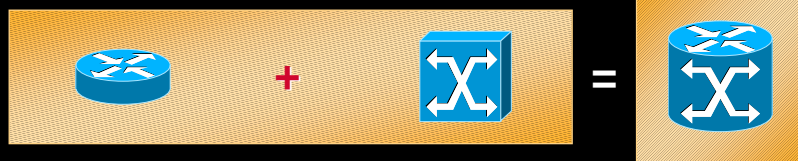
Upgrade available for any
Cisco BPX 8600 ever shipped

**World's Leading
ATM Switch**



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Cisco BPX 8650 IP+ATM MPLS Switch/Router



Cisco 7204 Router
AC or DC Power
NPE-200 w/64MB Ram
ATM Port Adapter
Cisco IOS Software
Label Switch Controller S/W
Cisco BPX Hardware
Rack Mount Kit

**Cisco BPX ATM
Switch**
AC or DC Power
BCC-4
BXM-155-4 or -8
9.1 Software
Fiber Optic Cable

**Cisco BPX
8650 IP+ATM
MPLS Switch
Router**

www.cisco.com

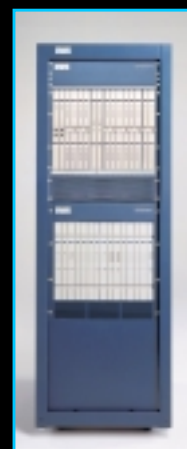
Agenda: Cisco BPX 8600

- Cisco BPX 8620
Architecture and Service Modules
- Cisco BPX 8650 IP+ATM MPLS Switch/Router
- **Cisco BPX 8680 Service Node and Cisco MGX Concentrators**
- Cisco BPX 8680 Service Node Evolution
The Service Expansion Shelf
- Software Update and New Feature Set
Release 9.1
Release 9.2

www.cisco.com

Cisco BPX 8680 Universal Service Node

- Optimized to scale the edge at very large sites:
Supports up to 16,000+ DS1s
- Leverages Cisco MGX technology
Investment protection of service interfaces
High-density interfaces lower cost per port
- Integrated Cisco IOS and MPLS for IP+ATM services



www.cisco.com

Cisco MGX 8220 Concentrator: Services Flexibility

- 300 Mbps multiservice edge Concentrator that adapts multiple traffic types to ATM using standards-based interworking
- Provides a wide range of interfaces types
- Advanced redundancy scheme
 - Common equipment is 1:1 hot standby
 - T1/E1 service modules are 1:N redundant
 - All cards are hot swappable
- Leverages DACS infrastructure with bulk distribution
 - FR, ATM, and CE services from CT3 ports



Frame Relay
ATM
FUNI
Circuit Emulation
HDLC Transparent

www.cisco.com

Cisco MGX 8220 Service Modules

- **Frame Relay Interfaces**
 - FRSM 8-port T1/E1 FR/FUNI/FF (PPP, SMDS, X.25)
 - Channelized (nxDS0) and unchannelized (T1/E1)
 - FRSM 2-port DS3 FR/FUNI/FF(PPP, SMDS, X.25)
 - Clear channel T3 and channelized down to DS1 and DS0 level
 - FRSM 4-port HSSI/X.21 FR/FUNI/FF(PPP, SMDS, X.25)
- **ATM Interfaces**
 - AUSM 8-port T1/E1 ATM/IMA (ATM inverse muxing)
- **Circuit Emulation Interfaces**
 - CESM 8-port T1/E1 circuit emulation
 - Structured and unstructured, SRTS and adaptive clocking
 - CESM 1-port T3 circuit emulation
 - SRTS and adaptive clocking

www.cisco.com

Cisco MGX 8800 “Universal Chassis”

- DS0 to OC-48c interfaces
- Scalable switch architecture
Optimized for low-cost entry and high-throughput switching
- Flexible narrowband/broadband form factor
- Integrated Cisco IOS Layer 3 routing and MPLS/tag
- Carrier-class reliability
SONET/SDH APS
1:N service module redundancy

“Future Proof the Edge”



www.cisco.com

Cisco MGX High Port and Connection Densities Reduce Costs

256 PVCs

8-Port T1/E1
IMATM

*4-Port T1/E1 CESM:
Unchannelized

*4-Port T1/E1 AUSM

*4-Port T1/E1 FRSM:
Fractional and
Channelized

1000 PVCs

8-Port T1/E1
Channelized CESM

8-Port T1/E1 AUSM

8-port T1/E1 FRSM:
Fractional and
Channelized

FRSM-HS1:
HSSI, X.21

Up to 4000 PVCs

FRSM-HS2 (8220
and 8800)
2T3/E3, CT3 (8800 Only)

T3/E3 CESM UDT
(8800 Only)

Voice Service
Module (8800 Only)

*4-Port Cards Supported on Cisco MGX 8220 Only

www.cisco.com

Cisco BPX 8600 Scalable Architecture

- **Managed as a single switching node**
- **Unprecedented scalability**
Up to 16 concentrator shelves
- **Narrowband services**
- **Broadband services**
- **MPLS**



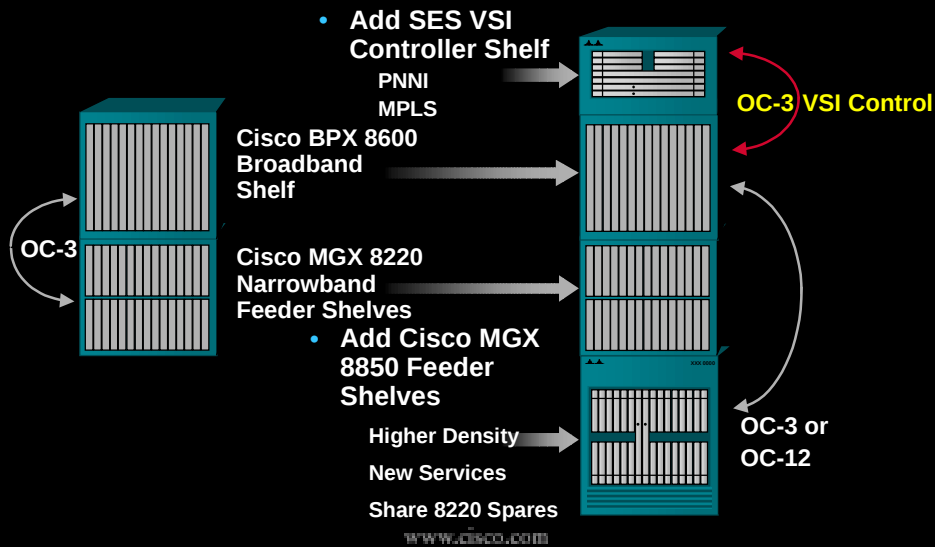
www.cisco.com

Agenda: Cisco BPX 8600

- **Cisco BPX 8620**
Architecture and Service Modules
- **Cisco BPX 8650 IP+ATM MPLS Switch/Router**
- **Cisco BPX 8680 Service Node and Cisco MGX Concentrators**
- **Cisco BPX 8680 Service Node Evolution**
The Service Expansion Shelf
- **Software Update and New Feature Set**
Release 9.2
Release 9.3

www.cisco.com

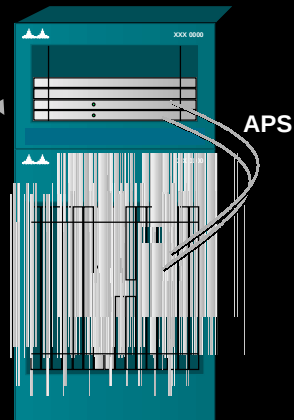
Cisco BPX Service Node Evolution



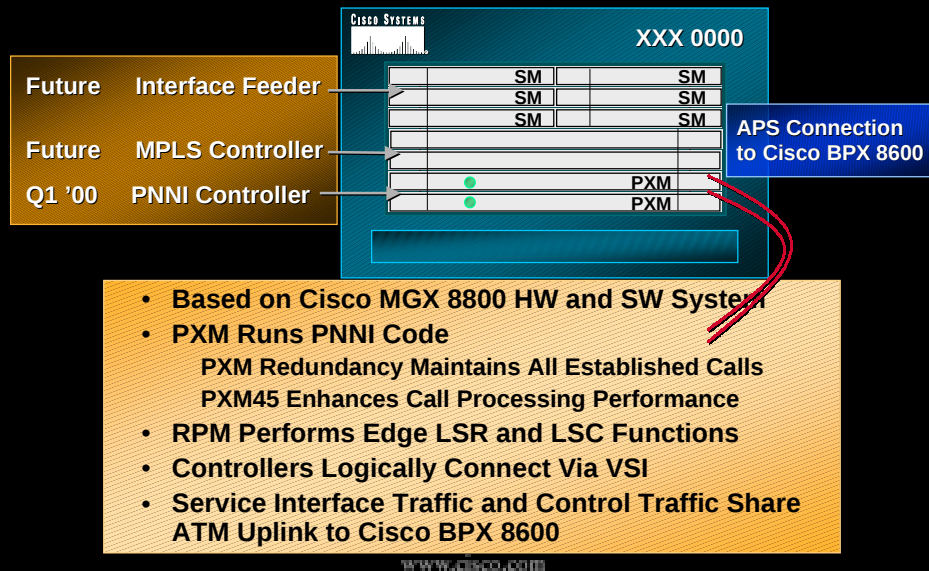
Cisco BPX Service Expansion Shelf (SES) Enables New Applications

- Integrated controller in Cisco BPX service node
- Integrated network management
- Integrated, simultaneous support for PNNI and MPLS (future)
- Scalable performance
- Contains both redundant controllers
- Completely hitless PNNI controller operation

Service Expansion Shelf (SES)
Integrated PNNI/MPLS Controller



SES Details and Applications



Agenda: Cisco BPX 8600

- Cisco BPX 8620
 - Architecture and Service Modules
- Cisco BPX 8650 IP+ATM MPLS Switch/Router
- Cisco BPX 8680 Service Node and Cisco MGX Concentrators
- Cisco BPX 8680 Service Node Evolution
 - The Service Expansion Shelf
- **Software Update and New Feature Set**
 - Release 9.2**
 - Release 9.3**

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Cisco BPX8600/Cisco MGX 8220 Features

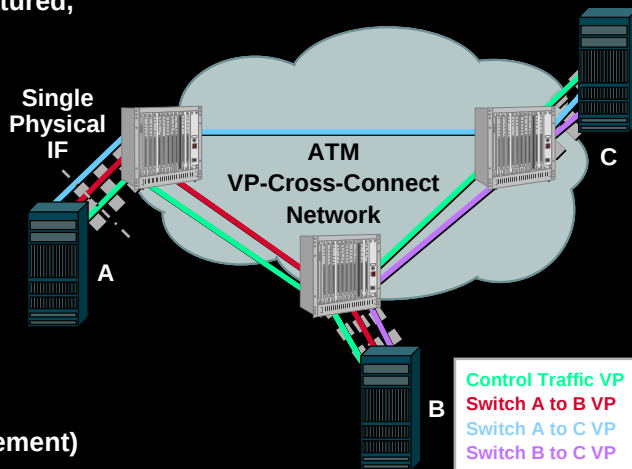
Release 9.2—Available Now

- Virtual Trunking on BXM
- Ports/Trunks Config on BXM
- APS (SONET/SDH Redundancy)
- Enhanced BXM Statistics
- ILMI Scale Enhancement
- Reconfigure Trunk/Port Params w/o Outage
- RAS Projects
- FRSM-HS2
- Standards-compliant IMA
- BXM Enhanced Cards (Higher Connectivity Density, Shaping Granularity)
- VBR-RT and VBR-nRT
- 16k Terminated PVCs
- MPLS QoS
- MPLS VPNs
- Multiple VSI Partitions—MPLS + PNNI
- BXM Frame-based Policing

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Virtual Trunking

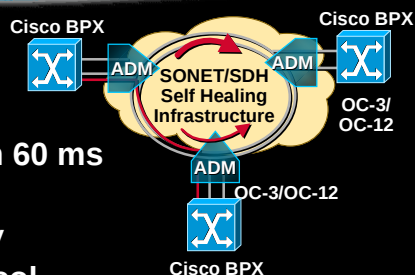
- Allows for fully featured, single-point-of management private network implementation over VP-cross-connect ATM infrastructure
- Expands service capabilities of infrastructure by providing easy-to-manage service switch functions (i.e., traffic management)



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APS Feature Overview

- SONET and SDH standards based
- APS switchover criteria: within 60 ms
 - 10ms switch initiation
 - 50ms switch-over service recovery
- Use K1, K2 APS in-band protocol
 - K1: denotes protection switch action request
 - K2: protection initiation (mode of operation): linear APS
- APS supported on BXM-155 and BXM-622, both 1:1 and 1+1
- Support for SMF and long reach back cards
- Bellcore GR-253, ITU-T G.783 with Annex B



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BXM APS Configuration Options

1+1



- FC and BC 1+1 Protected
- Protection for Fiber Cut and Card Failure
- New Paired BC

1:1

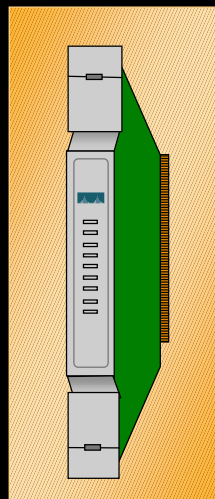


- 1:1 Protection Against Fiber Cut

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BXM Enhanced Cards

- **Higher connection density**
32k conns per card with R9.2;
60k in future release
- **Larger buffers—up to 1 million cells per card**
- **Improved traffic shaping granularity**
- **ABR support for non-AAL5 traffic**
- **Future support for VC-merge for MPLS traffic**



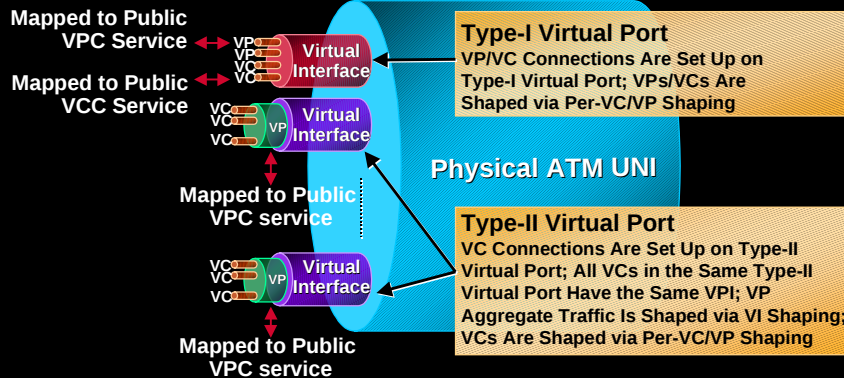
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Cisco BPX 8600 Features Release 9.3

- | | |
|---|--|
| <ul style="list-style-type: none"> • Network Scalability • BXM to BXM-E Hitless Conn Density Upgrade (9.3.0) • VSI • 3 VSI Partitions (to Allow Hot Redundancy of MPLS Controller) (9.3.0) • VSI Controller MIB on Cisco BPX (9.3.0) • VSI Controller QoS Expansion (9.3.y) • Per-Qbin Line Stats (9.3.0) • RAS • Separate Abort Log for Critical and Non-critical Errors (9.3.0) • Control Traffic Shaping (9.3.0) • Upgrade Protection by Auto Disabling Stats (9.3.0) | <ul style="list-style-type: none"> • ATM Feature Enhancements • Priority Bumping • Virtual Port/Hierarchical Traffic Shaping (9.3.x) • F4 to F5 OAM Flow Mapping (9.3.z) • FBTC Auto-sense (9.3.z) • Less than 50 cps PCR and SCR (9.3.0) • Advanced IP • VC Merge (9.3.y) |
|---|--|

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Virtual Port/Hierarchical Traffic Shaping



- Support both Type-I and Type-II Virtual Ports on the same physical ATM UNI for greater economy
 - (Type I) Support up to 256 VPs/VCs per Type-I Virtual Port by using only one VI
 - (Type II) Use one VI resource to support a hierarchically shaped VP (up to 31 Type-II Virtual Ports per physical UNI)

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Agenda

- Evolution of Multiservice Networks
- Cisco WAN Switch Value-Add Services
- Cisco IGX 8400 Series
- Cisco BPX 8600 Series
- **Cisco MGX 8800 Series**
- Network Management
- IP+ATM: Enabling New World Services

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The Cisco MGX 8800 Series Multiservice ATM Switch

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Future-Proofing the Edge with “Universal Chassis”

- DS0 to OC-48c/STM-16
- Scalable switch architecture
 - Optimized for low-cost entry and high-throughput switching
 - 1.2 Gbps to 45 Gbps in a single chassis
- Flexible form factor
- Carrier-class reliability
 - SONET/SDH APS
 - 1:1 and 1:N equipment redundancy
 - Hitless switchovers and upgrades

Cisco MGX 8850



www.cisco.com

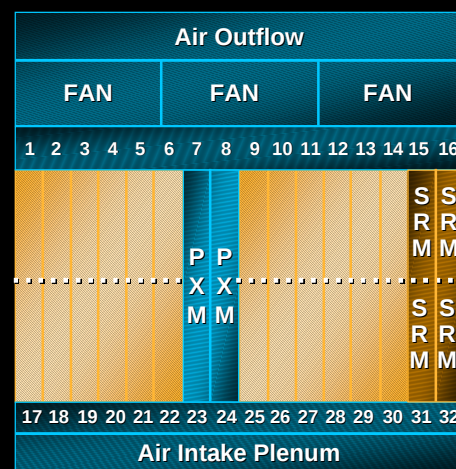
Agenda: Cisco MGX 8800

- **Hardware Architecture**
- Software Architecture
- Layer 2 Data Services and Service Modules
- Layer 3 Data Services and Service Modules
- Packet Voice Services and Service Modules

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Cisco MGX 8850 Chassis and Slot Configuration

- Up to 24 single height SM service modules
- Up to 12 double height service modules
- Slots 15, 16, 31, 32 are reserved for service resource modules
- Field removable midrail dividers enable easy upgrade from single height to double height service modules

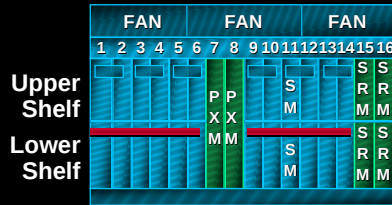


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Multiband Midplane Consolidates Network Edge Functionality

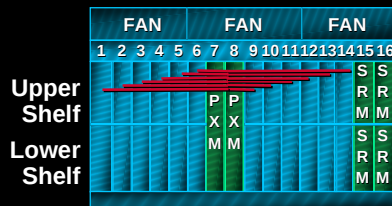
Narrowband

- Multiple Cell Buses
- 2.2 Gbps Optimized for Aggregating Narrowband Services
- Enables Compatibility with Cisco MGX 8220 SMs



Broadband

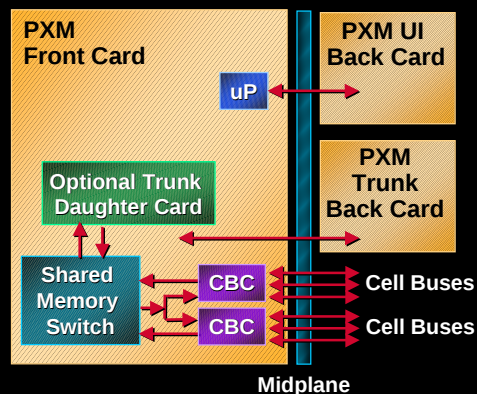
- Multiple Serial Lines
- Fully Synchronized
- 45 Gbps Optimized for Aggregating Broadband Services



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Cisco MGX 8800 Switch Architecture PXM1

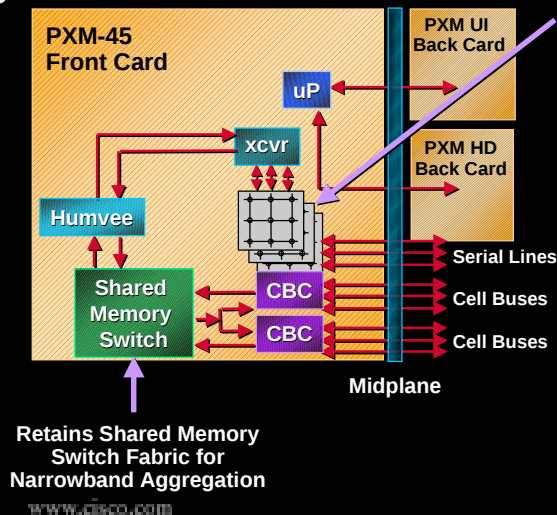
- 1.2 Gbps non-blocking capacity
 - R4700/200 MHz MIPS CPU
 - Cell bus control and arbitration
 - 1:1 Hot standby redundancy
 - 1 GB hard disk
 - Stratum 4E clocking
- Utilizes 2.2 Gbps cell bus
- Trunk daughter cards
 - 2-port T3 or E3
 - 4-port OC-3c/STM-1
 - 1-port OC-12c/STM-4
 - SONET/SDH APS



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Cisco MGX 8800 Switch Architecture **PXM45**

- 45 Gbps non-blocking crosspoint switch
- Virtual output buffering
- R5000 series MIPS CPU
- Cell bus control and arbitration
- Crosspoint control and arbitration
- Bridging between cell bus and serial lines
- 1:1 Hot standby redundancy
- 4 GB hard disk
- Stratum 3 clocking

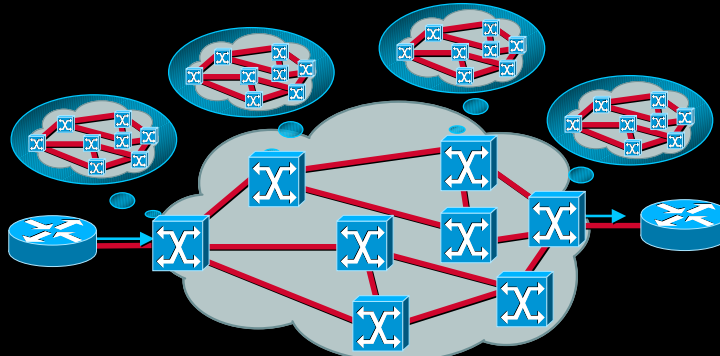


Agenda: Cisco MGX 8800

- Hardware Architecture
- **Software Architecture**
- Layer 2 Data Services and Service Modules
- Layer 3 Data Services and Service Modules
- Packet Voice Services and Service Modules

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PNNI SVC/S-PVC Routing

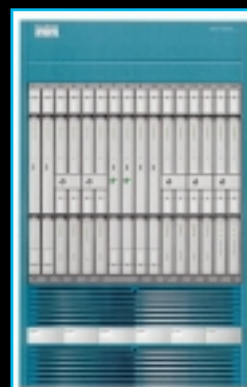


- ATM standard connection routing and fast rerouting mechanism
- Facilitates interworking
- Enhancements to improve carrier class performance (e.g., AINI)

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PNNI in Cisco MGX 8850 R2.0

- Software integrated on PXM45 controller
- Hot Redundancy (calls stable on switchover)
- Virtual Switch Interface (VSI)
- Configuration of SPVCs/SPVPs via CWM GUI
- 250 calls per second
Future plans for 1,000's of calls per second with distributed call processing
- 50,000 connections per node (100–500K future)
- PNNI 1.0 single peer group, enhanced IISF
- ILMI 4.0 (addr reg, VPI/VCI bit control)
- Standard debug and trace tools



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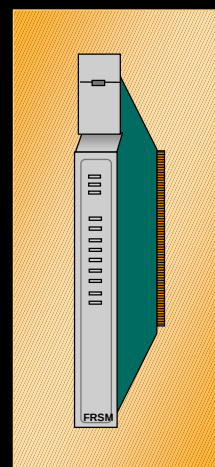
Agenda: Cisco MGX 8800

- Hardware Architecture
- Software Architecture
- **Layer 2 Data Services and Service Modules**
- Layer 3 Data Services and Service Modules
- Packet Voice Services and Service Modules

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Frame Relay Services Frame Service Modules (FRSM)

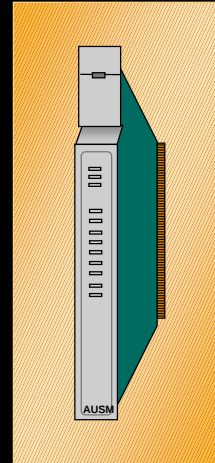
- **Full frame functionality**
 - Standards-based FR UNI, NNI, and FUNI
 - Frame Relay to ATM network and service interworking
 - Frame forwarding for HDLC, PPP transport
 - Traffic management and enhanced LMI to Cisco routers
 - BERT
- **High-density interfaces on single-height form factor (up to 24 per chassis)**
 - 2x CT3 ports
 - 2x HSSI ports
 - 2x T3/E3
 - 8x T1/E1 (channelized/unchannelized)
 - 4x V.35
- **1:N redundancy**



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Narrowband ATM Services ATM User Service Module (AUSM)

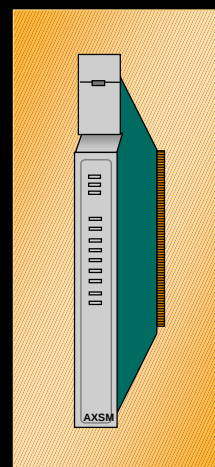
- **Full ATM functionality**
 - T1/E1 ATM UNI, NNI
 - n x T1/E1 ATM UNI (IMA)
 - Multiple IMA groups per module
 - All ATM service categories, including CBR, VBR, UBR, and ABR
 - ILMI, OAM cells
 - BERT
- **High port and connection density**
 - 8 T1/E1 ports per module/192 per chassis
 - 1000 connections per card
- **1:N redundancy**



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Broadband ATM Services ATM Switch Service Module (AXSM)

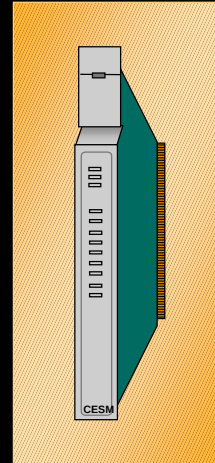
- **Full ATM functionality**
 - All ATM service categories, including CBR, VBR, UBR, and ABR
 - Virtual output queues
 - PVC, SVC, S-PVC
 - 1M cells of buffering, 128K connections
 - ILMI, OAM cells, ATM UNI 3.0, 3.1, 4.0
- **High port density**
 - 16x T3/E3 ports --> 192/node
 - 16x OC-3c/STM-1 ports --> 192/node
 - 4x OC-12c/STM-4 ports --> 48/node
 - 1x OC-48c/STM-16 port --> 12/node
- **1:1 redundancy**



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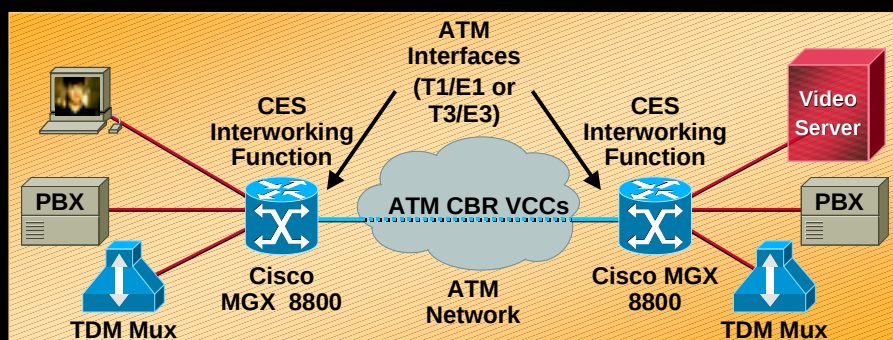
Circuit Emulation Services Circuit Emulation Service Module (CESM)

- **1999 availability**
 - Single-height cards (24 per Cisco MGX 8850)
 - 8 T1/E1 per card (full channelization)
 - 1 T3/E3 per card (unchannelized)
 - 1 for N redundancy, BERT, and channelized T3 with SRM
- **Full CES functionality**
 - AAL1-based DS1/E1, DS3/E3 circuit emulation
 - Structured and unstructured DS1/E1
 - Unstructured DS3/E3
 - Structured DS3 with SRM-3T3
 - Multiple clocking options
 - Synchronous, SRTS, and Adaptive
 - On-hook/off-hook detection
 - For structured DS1/E1



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Cisco MGX 8800 Delivers Circuit Emulation Services for Leased Line Replacement

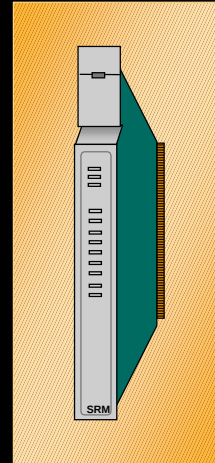


- Replace leased lines for enabling video applications and interconnecting TDM Muxes, PBXs
- Leverage ATM infrastructure

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Service Resource Module (SRM) Provides TDM Interface Support

- **High-density bulk distribution**
Up to 3 T3s per SRM
T1s extracted via C-bit parity
or M-frame format
- **N:1 service module
redundancy**
- **BERT and loopback
commands**
- **1:1 redundancy of SRM**



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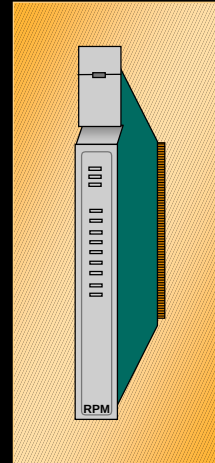
Agenda: Cisco MGX 8800

- **Hardware Architecture**
- **Software Architecture**
- **Layer 2 Data Services
and Service Modules**
- **Layer 3 Data Services
and Service Modules**
- **Packet Voice Services
and Service Modules**

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Cisco IOS Layer 3 Services with Route Processor Module (RPM)

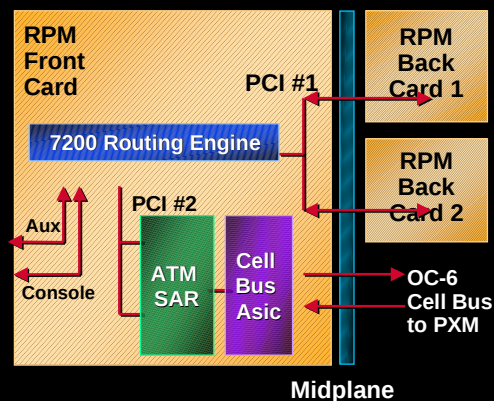
- Full Cisco IOS TM IP Suite
IP (TCP, UDP, IP, ICMP, ARP)
OSPF, IGRP, IS-IS, BGP
PPP over ATM
- MPLS
Label Edge Router (LER)
Label Switch Controller (LSC)



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Modular Layer 3 Architecture Scales with Service Demands

- Cisco 7200-based hardware
Based on NPE 150
ATM Deluxe SAR to cell bus
- Double-height front card
Up to 12 RPMs per chassis
- Single-height back cards
4x Ethernet
1x Fast Ethernet
1x FDDI



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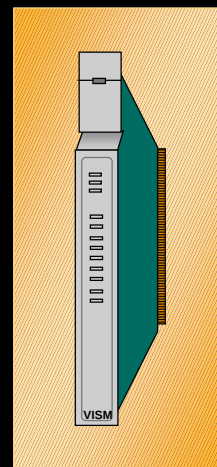
Agenda: Cisco MGX 8800

- Hardware Architecture
- Software Architecture
- Layer 2 Data Services and Service Modules
- Layer 3 Data Services and Service Modules
- **Packet Voice Services and Service Modules**

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Full-Featured Voice Transport Voice Interworking Service Module (VISM)

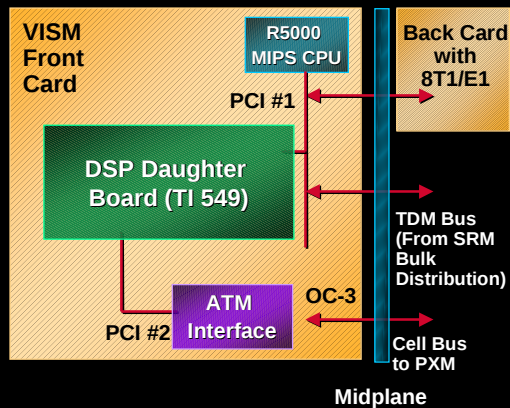
- PCM to packet voice conversion
- Full featured voice processing
 - 32K ADPCM, 16K LDCELP, 8K CS-ACELP
 - VAD and comfort noise generation
 - Programmable 16, 32, 64, 128 ms echo cancellation
 - DTMF/MF detection/generation
- Full voice transport and interworking
 - VoIP and VoATM
 - Voice gateway
- Multiple packetization format
 - Circuit emulation (AAL1)
 - VToA (AAL2)
 - VoIP (RTP in AAL5)
 - VoFR (FR in AAL5)



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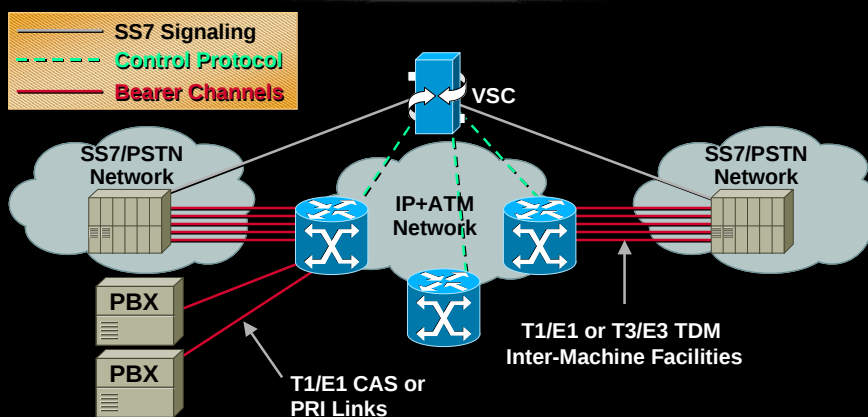
Cisco MGX with VISM Scalable Packet Voice Solution

- **Dynamic DSP allocation**
Basic functionality (ECAN, nxDS0, G.711, tone detection and generation) for all channels
High functionality (ADPCM, CELP) negotiated on demand for a fair proportion of channels
- **High-density aggregation**
8 T1/E1s of PCM voice
192 (256) DS0/card
4608 (6144) DS0/shelf
N x DS0
- **Carrier-class reliability**
1: N redundancy
BERT support via SRM



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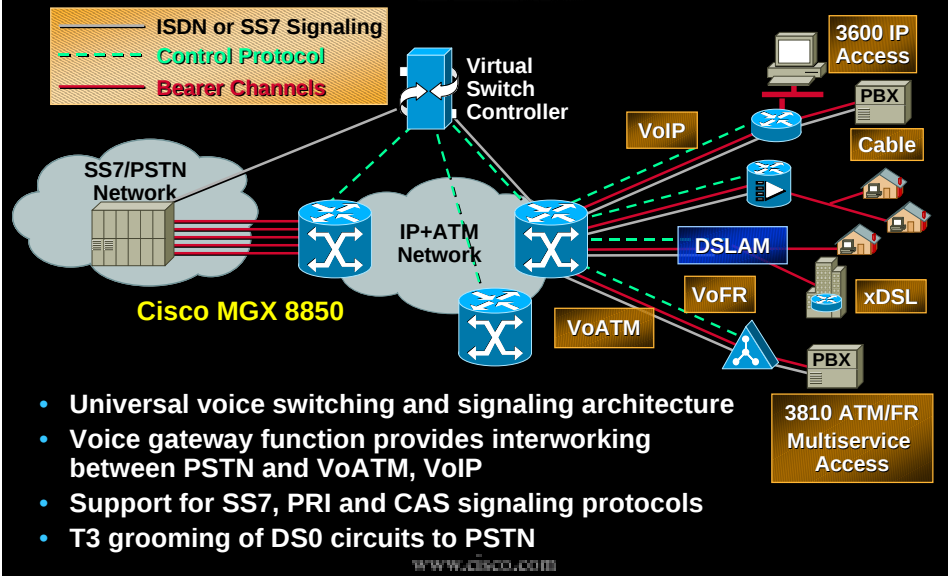
Cisco MGX 8850 with VISM as a Packet Voice Gateway



- Virtual class 4 tandem implementation
- SS7, PRI and CAS signaling protocols
- VoIP and VoATM transport

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Cisco MGX 8850 as a Universal Packet Voice Edge Switch



Agenda

- Evolution of Multiservice Networks
- Cisco WAN Switch Value-Add Services
- Cisco IGX 8400 Series
- Cisco BPX 8600 Series
- Cisco MGX 8800 Series
- **Network Management**
- IP+ATM: Enabling New World Services

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Rapid Multiservice Network Deployment Cisco WAN Manager

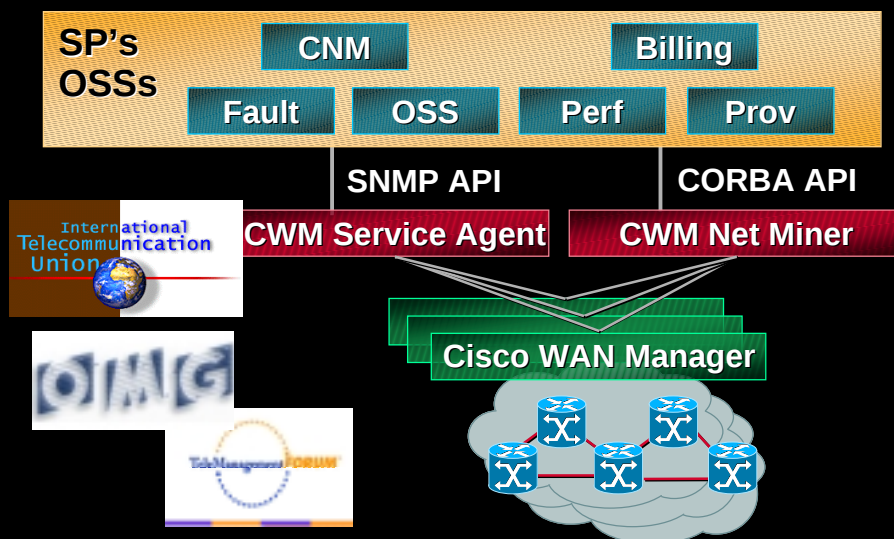


- Modular design and simple GUI for rapid network configuration and provisioning
- Scalable network data collection and robust event reporting mechanism to maintain network availability and performance
- Open APIs (SNMP, CORBA)
- **Java/WEB GUIs**

NEW!!! CWM 10

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TMN Standards, Open APIs ...OSS Integration and Open Development Environment



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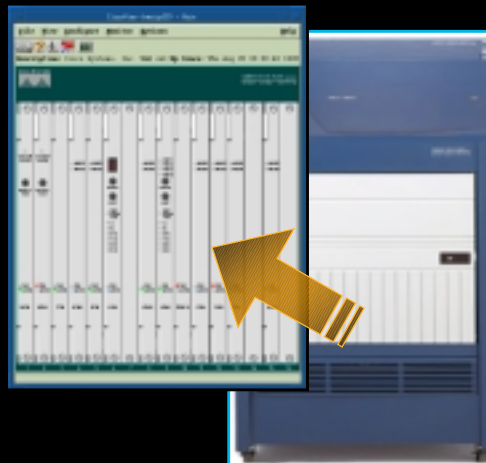
Major Enhancements from CWM 8.4 to 9.2

- Graphical Device Management (CiscoView) for Entire Product Line—Cisco MGX /BPX/IGX
- Connection Templates
- Performance Summary Reports
- Flexible Security Management with Multi-user Access Profiles
- Improved Network Browser
 - Tree-structure Navigation and More Inventory Details Displayed
- Inclusion of HPUX Platform Support

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Cisco WAN Manager CiscoView for Element Management

- Complete Cisco IGX , BPX, and MGX support
- Common element mgmt across all Cisco devices
- Detailed element views help pinpoint problems quickly
- Simple point-and-click paradigm for configuration
- Graphical real-time monitoring for troubleshooting



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Preview of CWM Release

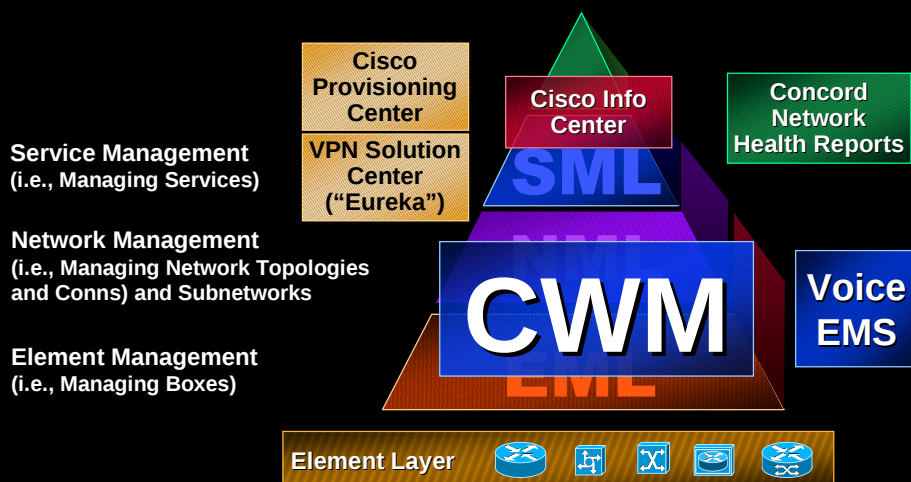
10

- **Brand new front-end**
Java and Web-based user interfaces
- **New client/server architecture**
SCM GUI decoupling
- **Descriptors (e.g., Connection naming)**
- **Improved usability**
Better screen layout, using tree-based navigation and tabs
InstallShield

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WAN Multiservice Management Product Suite

Service Provisioning and Activation ---> Service Assurance ---> Service Reporting



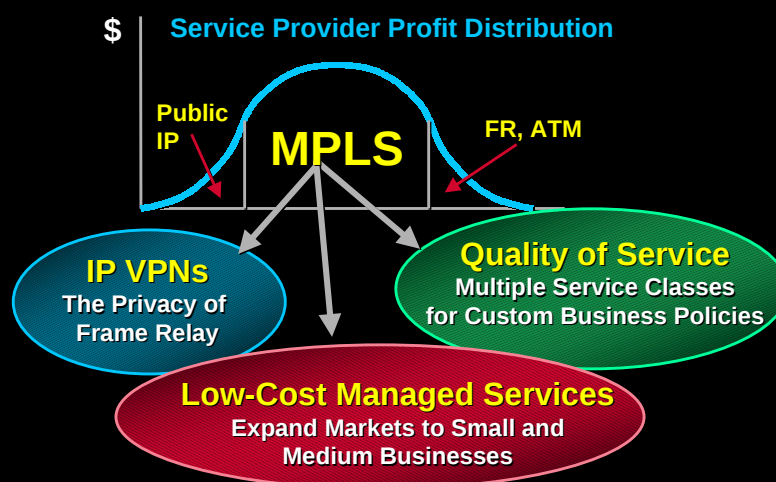
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Agenda

- Evolution of Multiservice Networks
- Cisco WAN Switch Value-Add Services
- Cisco IGX 8400 Series
- Cisco BPX 8600 Series
- Cisco MGX 8800 Series
- Network Management
- **IP+ATM: Enabling New World Services**

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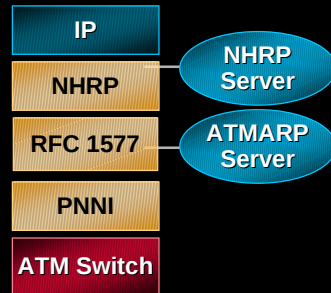
MPLS: The Complete Solution for Business IP Services



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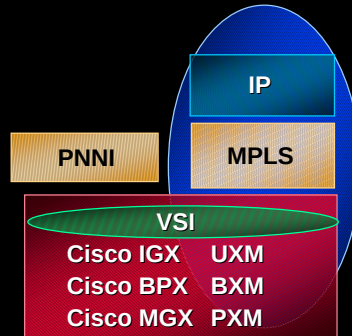
IP+ATM Simplifies IP Delivery

IP over ATM



- Must translate:
IP addressing/routing
To ATM addressing/routing
To ATM switching
- Not IP-aware

IP+ATM



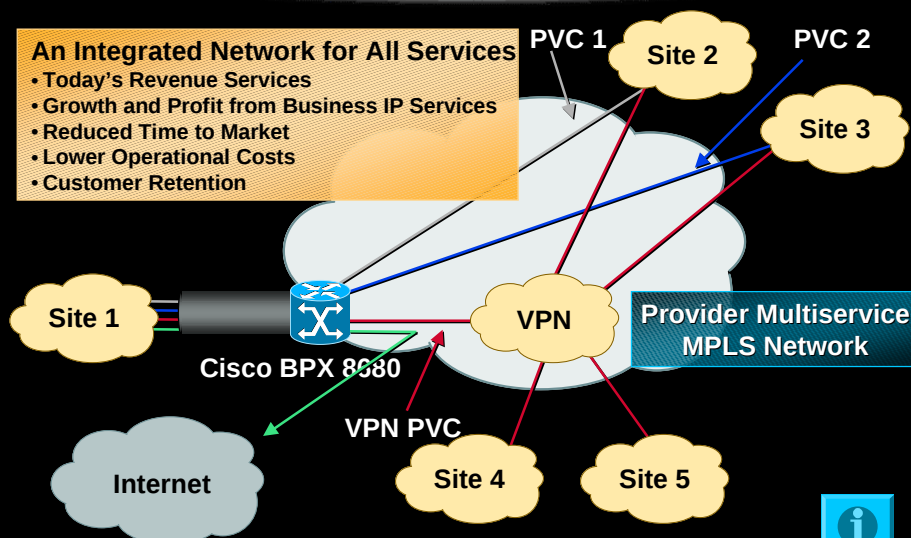
- Directly translate
IP addressing/routing
to ATM switching
- Uses ATM QoS hardware

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IP+ATM: The Best of Both Worlds

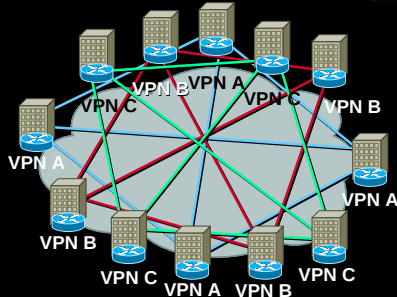
An Integrated Network for All Services

- Today's Revenue Services
- Growth and Profit from Business IP Services
- Reduced Time to Market
- Lower Operational Costs
- Customer Retention

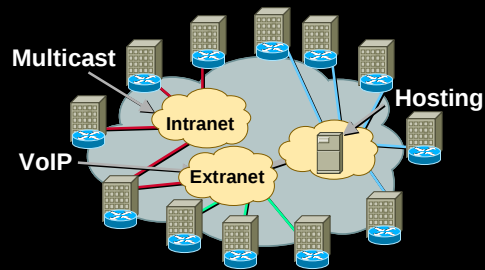


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Emerging Services: IP+ATM VPNs



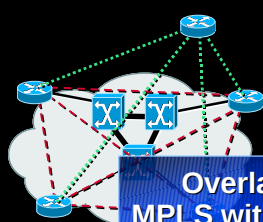
- **Overlay VPN**
 - FR/VC privacy
 - VC-based
 - FR/ATM aware
 - Groups endpoints
 - Complex OAM



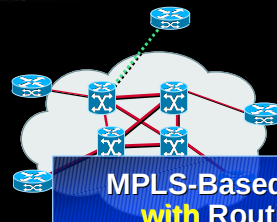
- **MPLS-based VPNs**
 - FR/VC privacy
 - Network-based (subnets)
 - IP and VPN aware
 - Groups users and services
 - Global VPN protocol
 - Simple OAM

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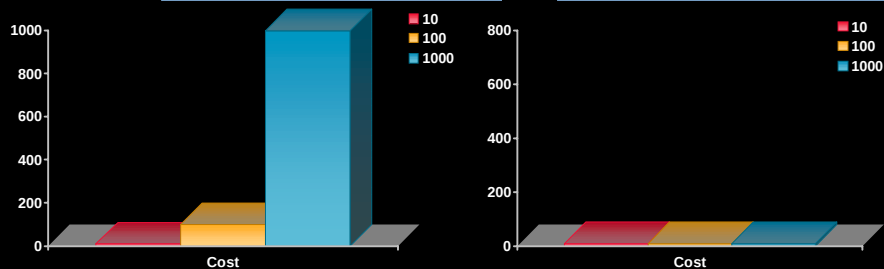
MPLS with Routing Reduces Operational Cost



Overlay VPN or
MPLS without Routing



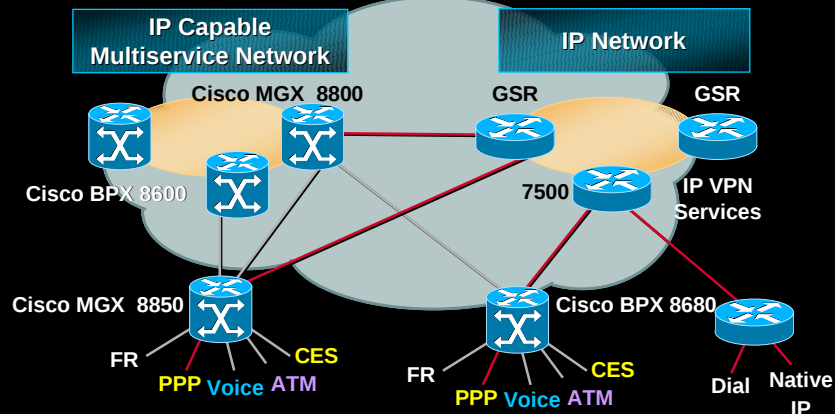
MPLS-Based VPN
with Routing



Cost to Add One Node (by VPN size)

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Integrated Multiservice and IP Networks

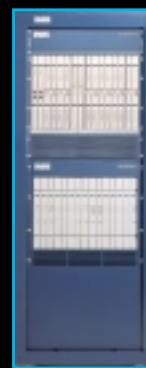


- Integrated IP and ATM-based services
- Integrated aggregation for dial and DSL
- Integrated MPLS enabling IP VPNs

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Integrated IP Services

- Integrated routing "blade"
 - Add-on 7204 router engine for Cisco BPX systems
 - Or slots directly into 8850 chassis
- Cisco 7200 based hardware
 - 7200 NPE routing engine
 - Same IOS image as 7200
- Port adapter back cards
 - Direct LAN attachment
- Fully integrated IP capability
 - MPLS, RIP, OSPF, etc.



Cisco BPX 8680



Cisco MGX 8850

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MPLS on Cisco BPX 8650 and 8680-IP In Production Networks Today!

- Allows dynamic IP switching over ATM fabric
- Single platform supports full range of IP+ATM services at the edge
- Represents >50% of total Cisco BPX 8600 series bookings

Upgrade available for any Cisco BPX 8600 ever shipped

World's Leading
ATM Switch



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Cisco Multiservice Switching Initiatives

- Redefine economics of the carrier infrastructure
- Enable IP services on a multiservice network
- Leverage the packet core for voice
- Deliver integrated voice/data access
- Scale the IP+ATM edge and core

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