Enabling Application Specific QoS on a Converged Network

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Agenda

- Application QoS and Where MPLS Can Facilitate
- Application QoS Issues on a Converged Network
- Providing Application QoS with MPLS
- MPLS Deployment Considerations
- Summary

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The Premise for Application QoS

- Legacy and new applications require highly available service with network specific QoS
- Virtualization ensures separation of services, yet each service needs its own treatment:
  - Traditional IP QoS (delay, bandwidth, loss, etc)
  - New QoS (deterministic traffic engineering)
  - Availability (network resilience)
  - Security (privacy, separation)
- MPLS supports both standards-based and unique solutions in these three critical areas
- Without attention to network service quality, no converged network can meet business goals

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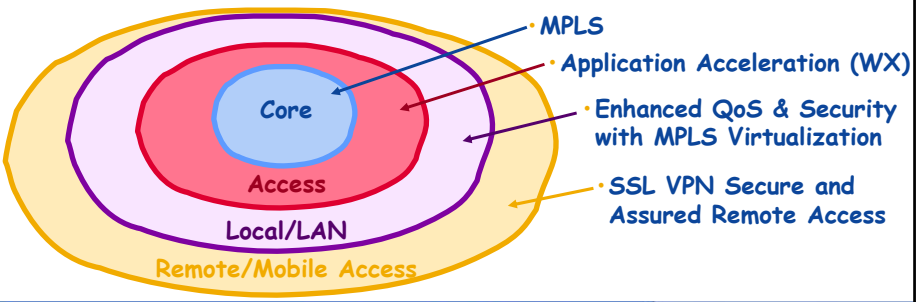
Where is MPLS Appropriate?

- MPLS is primarily applicable in WAN or Network Core Architectures
- MPLS may also be applicable in Campus environments
  - Campus networks often appear as very large segmented LAN environments with high bandwidth needs
- MPLS is a part of the Enterprise Infranet vision architecture



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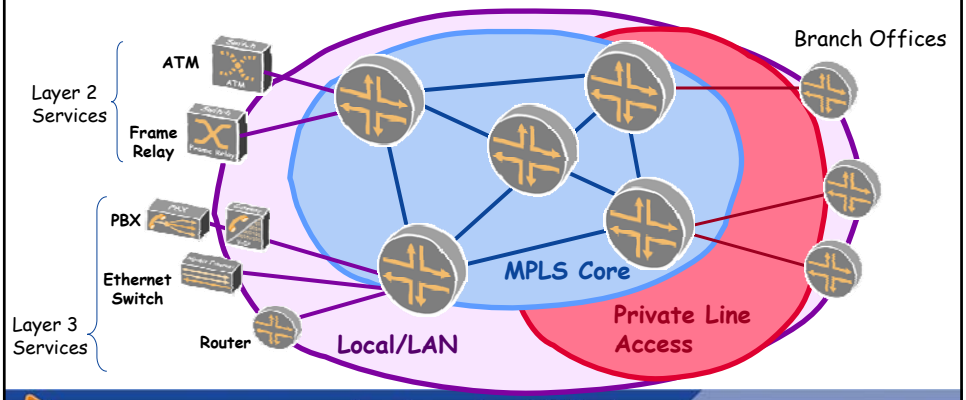
"Build" MPLS - Deployments

- Enterprise owns and manages the MPLS core or WAN
  - Private line access may be used to connect remote branch offices to the enterprise core
  - While there may be ATM, FR, Voice, and IP at the edge and in the LAN, all services are emulated and transported over a converged core/WAN



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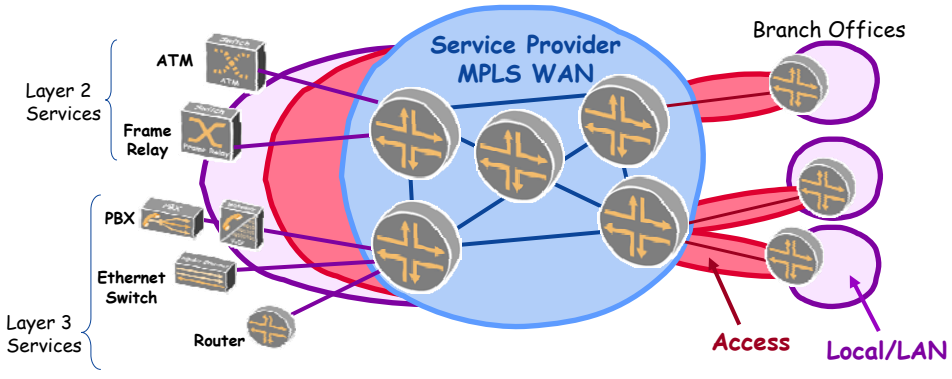
"Buy" MPLS - Deployments

- The WAN is outsourced to a Service Provider's MPLS-based offering
- All sites are connected across the WAN with committed SLAs for the applications supported



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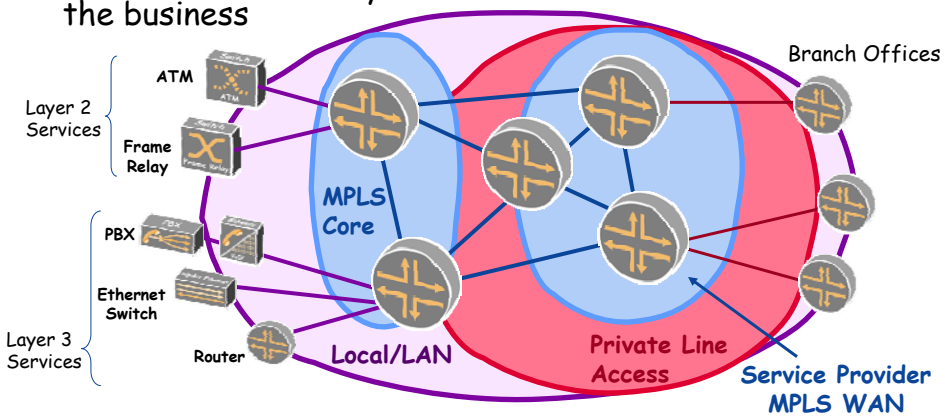
"Hybrid" MPLS - Deployments

- Hybrid combines "Private" and "Public" MPLS-based offerings for enterprise wide reach
- Enables build and buy model where each is beneficial for the business



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Application QoS is Much More Than IP QoS

- The User Quality Experience Includes:
  - Appropriate performance characteristics
  - Reliability and resiliency of the network
  - Availability of network resources
  - Packet performance with CoS considerations per application
  - Security for applications and users
- For Network Managers a Quality Experience Includes:
  - Ease in configuration
  - Configuration rollback with ease in trouble isolation and correction
  - Scale in platform to minimize frequent upgrade requirements

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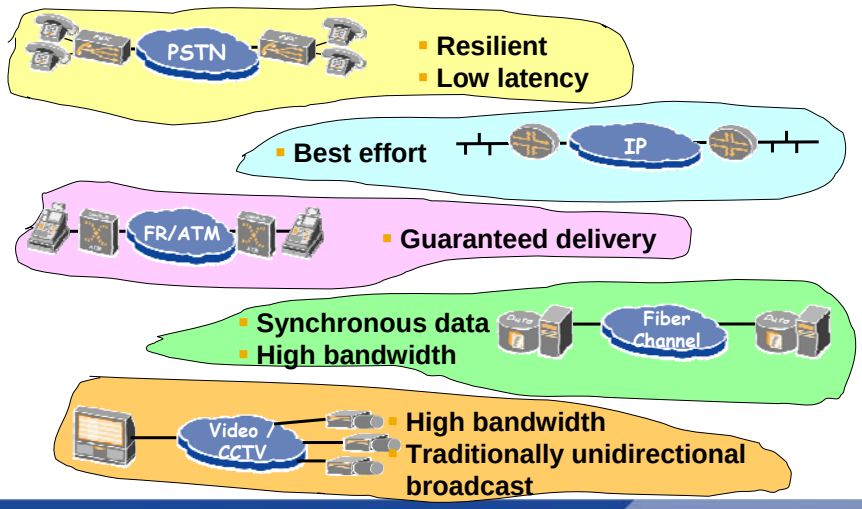
Traffic Separation and Engineering

The Old Fashion Way…before MPLS



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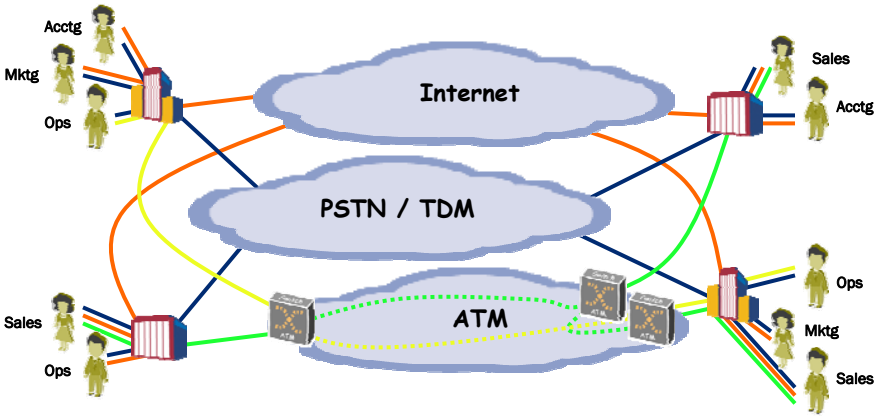
Network Separation is End-to-End



- Networks are Separate in the Enterprise and Across the WAN and Public Networks
- Each network supports a dedicated set of applications

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Old World Meets New World

Established business processes depend on older applications

- TDM voice, ATM, frame, HDLC, X.25, SNA need ongoing support in enterprise WANs

Enterprises are deploying Next-Gen apps for greater productivity

- Voice, video, and other real-time services
- Interactive, client/server, ERP
- Internet Web services are enabling the extended and dynamic enterprise

This "old + new" situation requires support for many different services

- File serving, VoIP, Telnet, Internet Access

Tom, do you think people will remember I invented MPLS?

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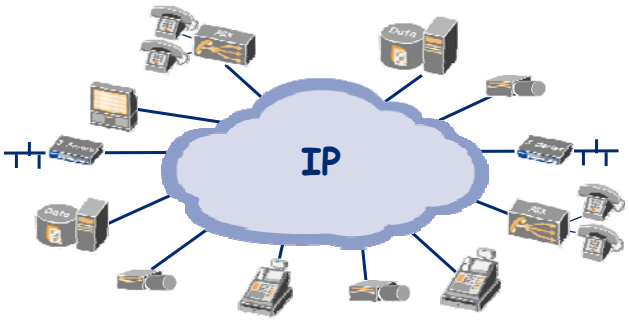
The Goal is to Converge over IP



…but, IP lacks application specific requirements to support:

- Real-time failure re-routing
- Granular traffic engineering
- Security through separation
- Application specific QoS
- Guaranteed delivery
- Enhanced performance

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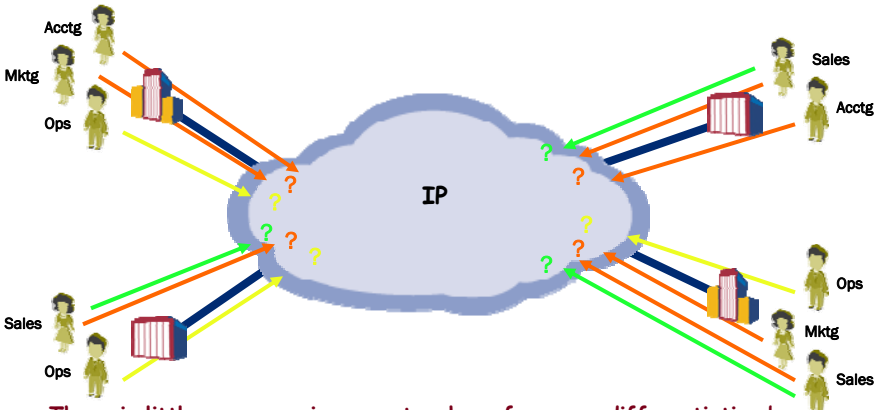
…And from the User Group Perspective



- There is little or no service or network performance differentiation by user or group
- There's increased user vulnerability from attacks within and external to the organization
- Applications and users which were once protected through network separation are now place at greater risk within a converged IP network

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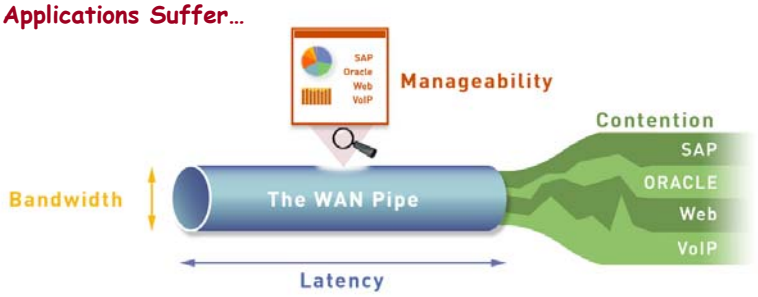
Convergence to IP Introduces New Problems

And Applications Suffer…



Problems emerge that IP QOS cannot address…sacrificing application performance

- More rich content
- Lower-priority applications slow down critical ones
- Protocol chattiness
- Inability to understand application and WAN performance

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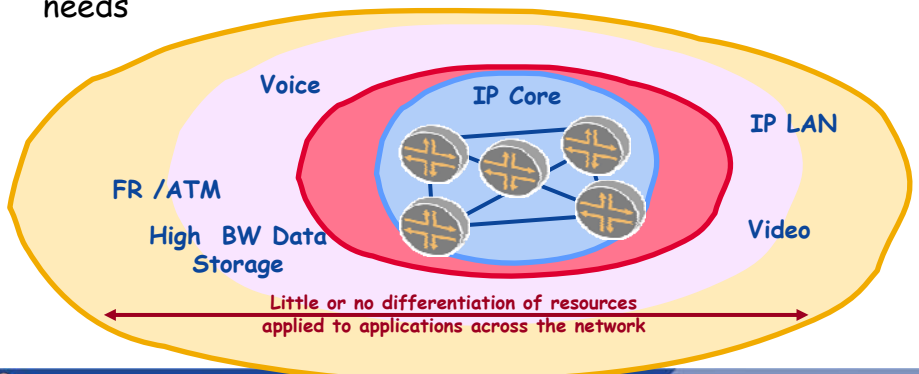
Policy Management with IP

- High priority and low priority applications contend for shared resources
- Applications are susceptible from other users and applications on the converged network.
- Limited policy support based on application or user group needs



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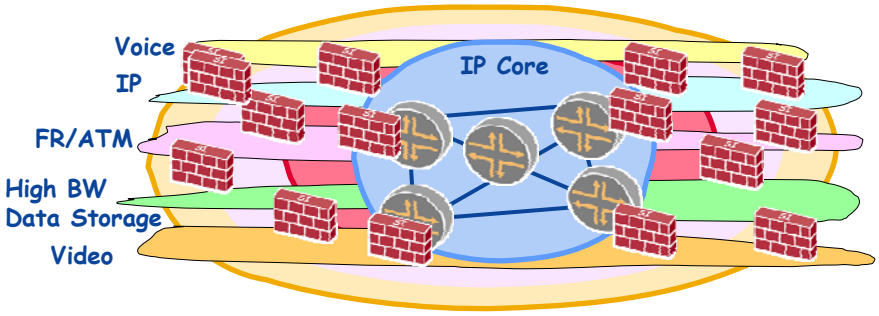
Policy Management with FW Policy and IP QoS

- Coarse IP QoS is applied to support application requirements and resource utilization
- Firewalls proliferate to "separate" applications and enforce policy
  - Enforced policy does not scale well and is costly to implement



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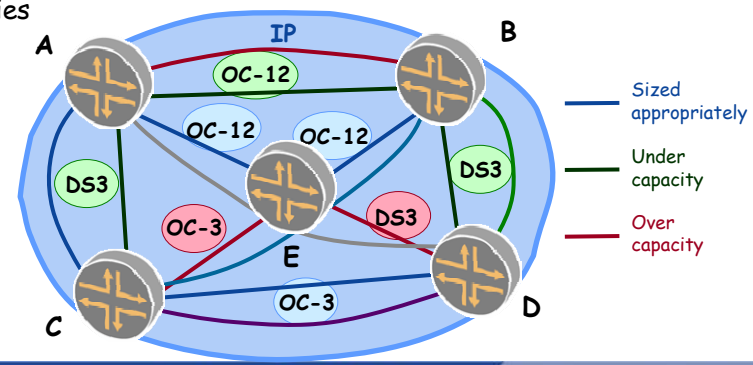
Quality Degrades on Congested Links

Example:

- Analysis shows:
  - Link CE needs to be upgraded to OC-12
  - Link ED needs to be upgraded to OC-3
  - Although links AB, AC, and BD are under capacity, re-sizing them to OC-3 and multi-T1 respectively would not provide sufficient capacities



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Basic Network Design - Planning

- Use MPLS to virtualize, consolidate, and simplify management of the network
  - Segment the network, enhance security and performance on an application or user group basis MPLS virtualization
  - Consolidate the core while preserving the investment of legacy ATM, FR, Voice, and data within the enterprise
  - Simplify management with a consolidated IP-based core that enables traffic engineering and "dynamic" new service provisioning
- Lower cost and improve performance
  - Network convergence to reduce networks, access and equipment
  - Traffic Engineering to switch traffic onto least cost paths and to reduce total WAN transport cost
  - MPLS VPNs with CoS optimized for the applications and users

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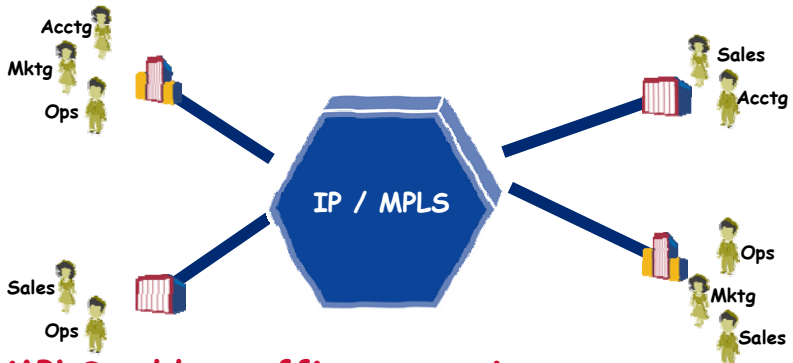
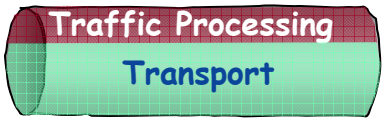
An Efficient Converged Network



MPLS adds traffic processing

- Security
- Enhanced Quality of Service (QoS)
- Application intelligence



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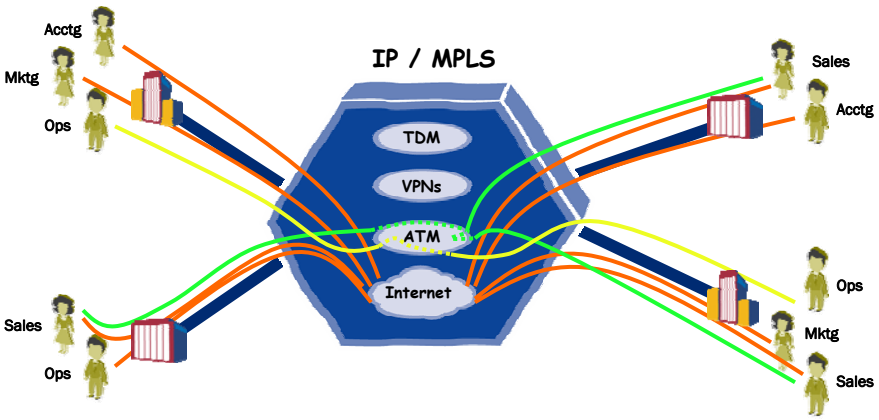
Application QoS within a Converged Network



The solution for Application QoS is to build virtual application and user group networks within a common converged IP core or WAN

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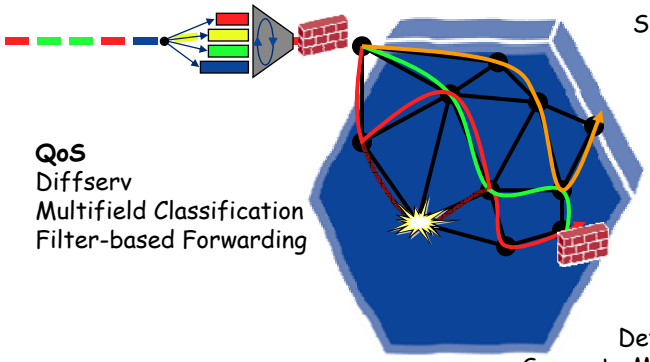
MPLS Application QoS Mechanisms

Determinism / Planning
Traffic Engineering
DS-TE

Availability
Fast Reroute
Secondary Paths
Fast IGPs
BFD



QoS
Diffserv
Multifield Classification
Filter-based Forwarding

Security
Policing
Firewalls
Monitoring
Policy Application
Deterministic Routing
Separate MPLS paths or VPNs

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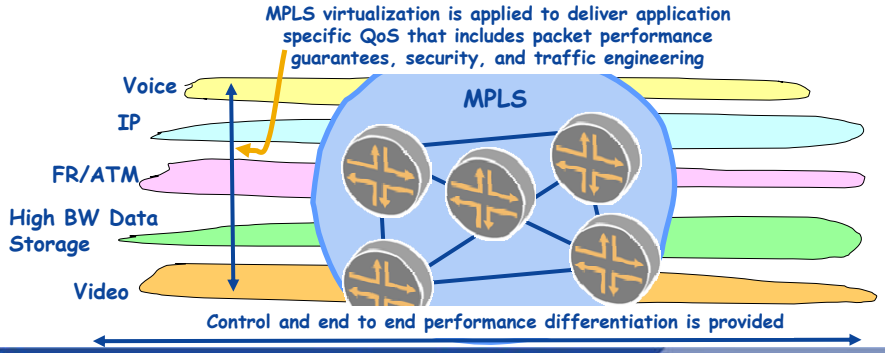
Traffic Separation and Engineering

With the Benefits of MPLS

- Existing services are tunneled through the core/WAN
- Services, equipment, and investments are preserved in the LAN and user environment
- Easy to add a new service, department, or network



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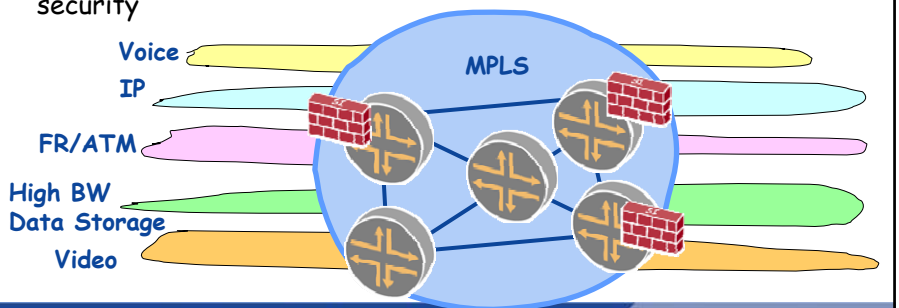
Policy Consolidation with MPLS

- MPLS virtualization provides separation of applications on different VPNs
- Granular QoS is tuned for each application support layer 2 and layer 3 services
- Policy is consolidated and managed per application and/or user groups
  - Firewalls consolidation reduces cost and complexity of network security



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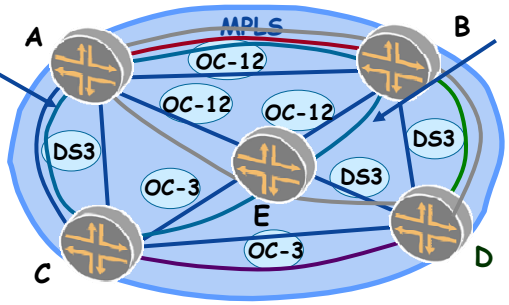
Traffic Engineering for Application QoS

- TE can be applied per VPN to support unique application requirements
- Real-time applications can be switched over low latency and low packet loss routes
- Best effort applications can be engineered to follow long paths, making room for critical and time sensitive applications during peak bandwidth demands without having to over-provision circuits

MPLS-TE switches best effort traffic from B to C over and alternate path (link BAC) to make room for priority traffic



MPLS-TE is used to switch real-time and critical traffic from B to C over the most direct and highest speed link (link BEC)

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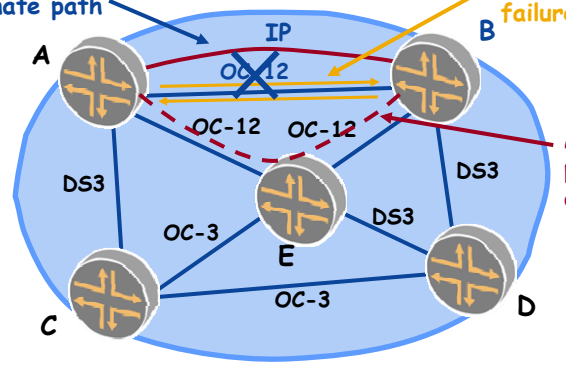
Fast Re-Route (FRR) and Bidirectional Forwarding Detection (BFD)

Supporting real-time traffic requirements

When a failure occurs, BFD and FRR work together to minimize packet loss and automatically switch traffic to the alternate path

BFD monitors links and nodes for early failure detection



MPLS pre-provisioned alternate paths

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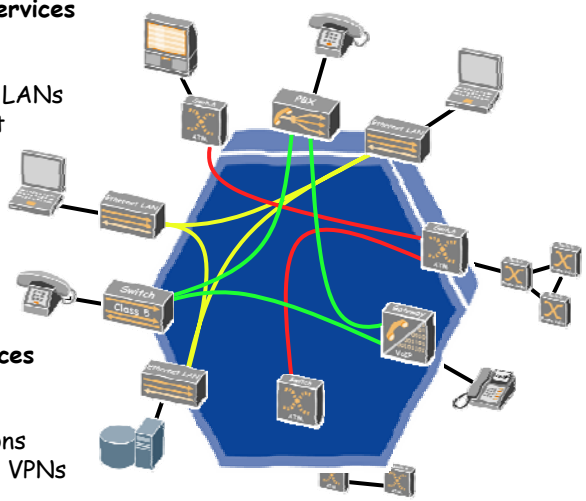
Native Service Environments

Capable of low-cost and flexible reconfiguration and migration

Next Gen Services
IP Routing
L3VPNs
Transparent LANs
P2P Ethernet



Interfaces
ATM
Frame
Ethernet
Serial
Any speed

Legacy Services
TDM
DLSW
PWE3 Solutions
Frame / ATM VPNs

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MPLS Provisioning

- Plan to prevent and design to minimize, detect, and report configuration errors
- Automate the provisioning process where possible
  - Use BGP for dynamic provisioning of MPLS VPNs across the network
- Seek simple versus complex configuration commands
- Demand easy configuration roll-back
- Look for easy of 3rd party application integration with standard APIs

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MPLS Management

- Preemptively plan to detect, troubleshoot and resolve failures
- Deploy solutions that improve your visibility of the network
- Plan to identify and isolate both, silent and non-silent alarms
- Incorporate MPLS-specific tools into your management plan
  - Label Switched Path Ping (LSPing), Bidirectional Forwarding Detection for MPLS LSPs, LSP Traceroute, and ICMP Ping with and without VRF context

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MPLS Solutions for Private Networks Must Have

- Depth of MPLS feature support
  - Full MPLS VPN feature support (L3 VPN, L2 VPN, L2.5 VPN, VPLS)
  - Full MPLS traffic engineering capabilities (COS, traffic engineering, fast re-route)
  - Active industry leaders in definition and development of MPLS
- Breadth of MPLS support across platforms
  - J-series through TX – all have MPLS through JUNOS/JUNOSe
  - Key J-series differentiation vs. competitors without the performance/software to support MPLS in low end platforms
- Carrier Class implementation
  - Hardware, software security, reliability and performance
  - Carrier implementations over past several years

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Depth of MPLS Support

Superior MPLS Scale
LSP and VRF Scale

VPN Flexibility
L3 VPN (2547)
L2 VPN (Kompella)
L2 VPN Interworking
L2 Circuits (Martini)
VPLS

Traffic Engineering and Management
Diffserv-TE
LSP Ingress Policing
LSP Monitoring & Accounting

MPLS Management Options and Flexibility
Detailed statistics
XML interface
Command Commit and Rollback
SNMPv3, CLI, MIB, SSHv2

Failure Detection and Fast Re-route
FRR Link Protection
FRR Link/Node Protection
FRR for VPNs
Bidirectional Forwarding Detection

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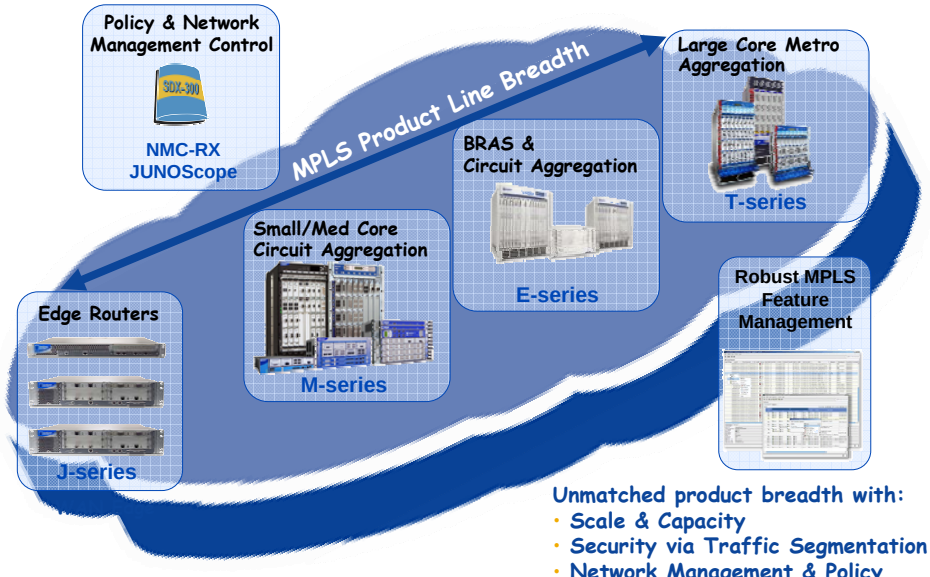
MPLS Breadth Across Products



Unmatched product breadth with:
- Scale & Capacity
- Security via Traffic Segmentation
- Network Management & Policy

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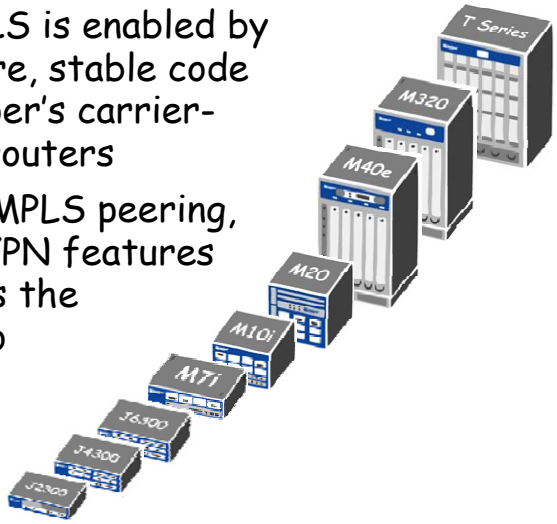
Consistent MPLS Capabilities in All Routers

- Enterprise MPLS is enabled by the same mature, stable code that runs Juniper's carrier-class M and T routers
- Hybrid MPLS, MPLS peering, and advanced VPN features available across the entire portfolio



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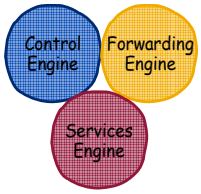
Proven Carrier Class Platforms

SUPOR - Secure, Uptime, Performance, OPEX Routers

strong Security

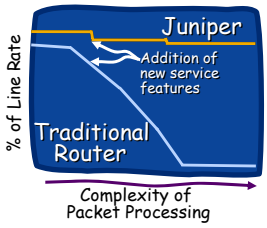


- Modularity for full router control in attack
- Next Gen CLI for fast editing of filters while under attack
- Add many filter terms without degradation

high Uptime

- Minor problems do not lead to system crashes
- Next Gen CLI prevents operator error
- Rescue button on J-series
- Graceful restart and M10i hitless recovery

predictable Performance



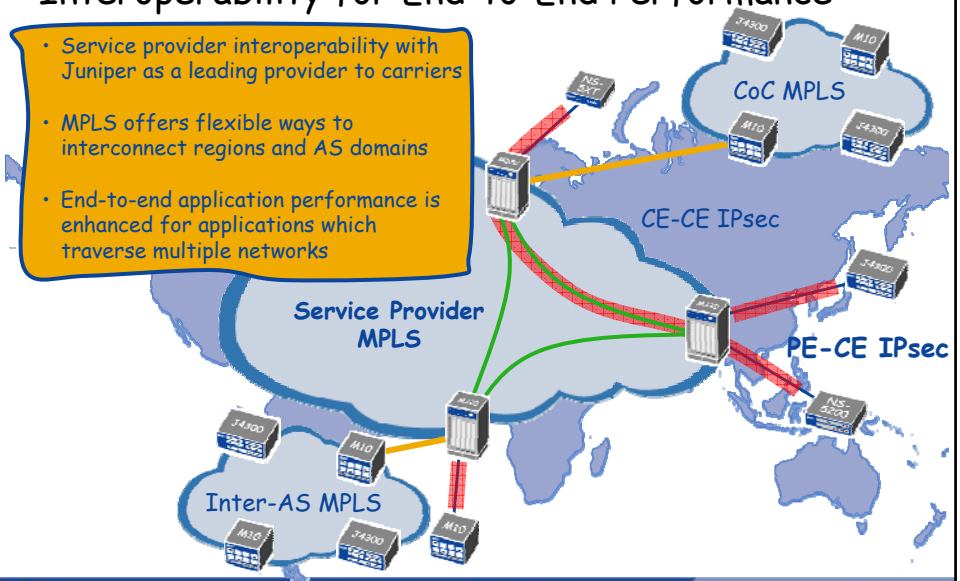
- Predictable performance for voice, video and other time critical apps
- Comprehensive QOS functions to classify, prioritize and schedule traffic

reduced Operations cost

- One software train
- Multiple management tools, including J-Web
- XML-based API
- Restoration features
- Feature licensing
- Interoperability

Carrier Class Implementation Facilitates Interoperability for End-to-End Performance

- Service provider interoperability with Juniper as a leading provider to carriers
- MPLS offers flexible ways to interconnect regions and AS domains
- End-to-end application performance is enhanced for applications which traverse multiple networks



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Application QoS is Enabled for the Enterprise

- Native service environments preserve investments
- Interoperable service provider offerings are available to facilitate the rich application QoS experience
- Enterprise networks are always in flux and MPLS facilitates these transitions
  - Old applications and services phasing out, new ones phasing in
- Support must be both: Generic (e.g. Internet, IP) and Specific (e.g. ATM CES, TDM)
- Juniper Networks MPLS supports specific applications with standards-based, partner, and proprietary solutions

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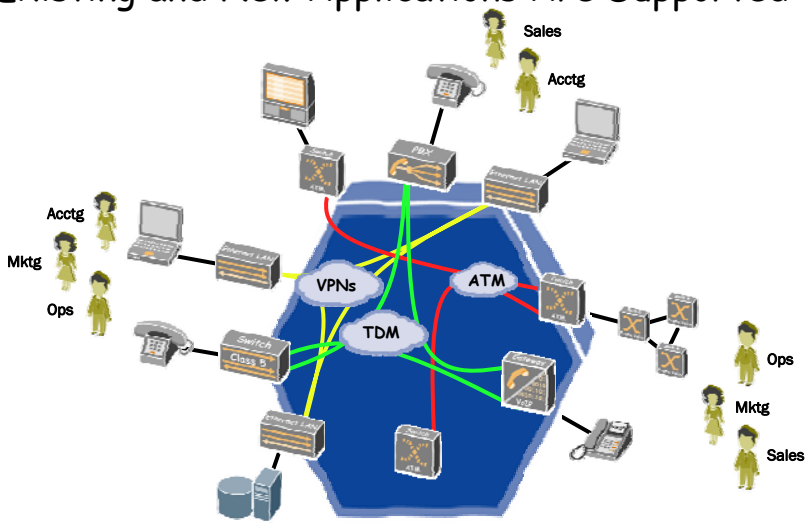
Existing and New Applications Are Supported



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Summary

- MPLS enables application specific QoS on a converged network similar to the way separate and dedicated networks provide QoS
- MPLS virtualization per application provides
  - Packet performance guarantees
  - Enhanced Security through separation
  - Traffic engineering as an application QoS tool
- Key for a successful implementation in the enterprise is:
  - Depth of MPLS features to enable a full set of application QoS capabilities
  - Breadth of feature support across platforms to scale without limitations
  - A carrier-class MPLS implementation for the enterprise
- Interoperability with leading MPLS service providers

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Thank you

Convergence with Virtualization

- More services on fewer networks saves money
  - Convergence *requires* QoS, VPNs, traffic engineering, L1 and 2 support, etc.
- Services never want to be converged
  - Differences in QoS requirements, routing, availability, privacy, regulatory needs
  - Each service should experience its network as custom-built for it
- How can we converge, but not seem to?

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Summary: Benefits of MPLS in the NGN

- Converged networks that "seem" separate
  - One bill for one network infrastructure from your provider, yet many services / apps
  - One network to manage, control, secure, maintain, and regulate
- Each application is assured the experience (security, availability, performance) it requires
- All business applications are supported
  - Legacy or NextGen, critical to best-effort

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