Welcome to Today's Seminar!

- Welcome to this exciting, informative session on Internet VPNs and the QoS Difference
- Keynote speakers
  - Eric Zines, Sr Market Analyst, TeleChoice
  - Ashley Stephenson, Chairman, Xedia Corp.
- At the end of this session, your questions will be answered by this panel of industry experts

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Predictable Performance: The Case for VPN Quality of Service

Eric Zines
Sr. Consultant
TeleChoice, Inc.

Eric Zines - Sr. Consultant, TeleChoice, Inc.

- Introduction to VPNs
- The Performance Question
- QoS and VPNs
- Next Steps

A Few Definitions

- **VPN** - “A private communications network existing within a shared or public network platform…often the Internet”
- **Quality of Service (QoS)** - Performance parameters associated with a transmission system
- **Class of Service (CoS)** - Subgrouping of customers by rates, features, or access to resources

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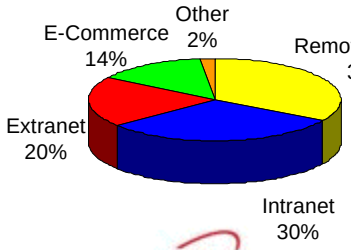
4 VPN Applications

- Remote Access VPNs
- Site-to-Site (Intranet) VPNs
- Extranet VPNs
- E-Commerce



Source: TeleChoice, Inc.

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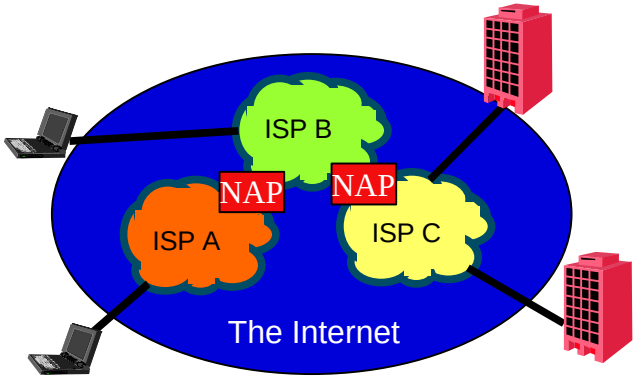
Internet VPNs: The QoS Difference

Internet VPNs



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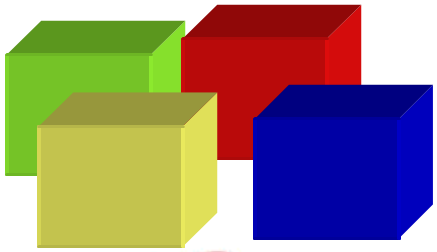
INTERNET VPNS: THE QoS DIFFERENCE

The VPN Foundation

- Performance and Scalability
- Security
- Management and Administration
- Access Coverage



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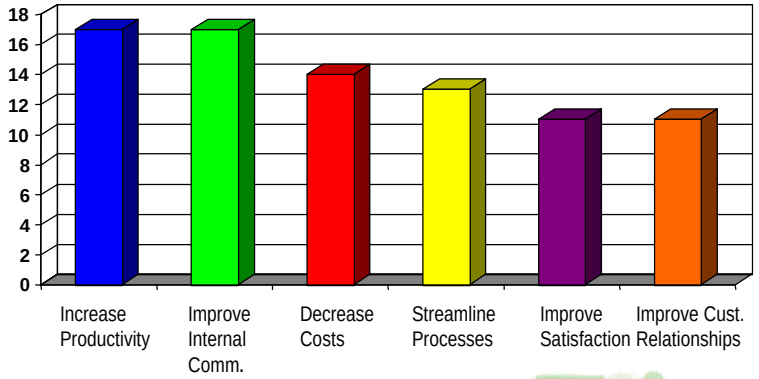
VPN Goals



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INTERNET VPNS: THE QoS DIFFERENCE

6 VPN Drivers

- Growth and popularity of IP
- Need to streamline processes and cut time to market
- Demand for inter-company communications
- Explosion of business travel, telecommuting and nomadic workers
- Need for International networks
- Increasingly distributed computing environments

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Internet VPNs: The QoS Difference

6 Key VPN Benefits

- Ubiquity - It's everywhere
- Network Simplicity - A single protocol to manage
- User Simplicity - Convenient, easy to use connectivity tools
- Openness - Standards-Based Extranets
- Cost Savings - It *should* cost less
- Scalability - With predictable costs

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Internet VPNs: The QoS Difference

VPN Savings Summary

- Remote Access Savings…30%-70%
- Savings Over Frame Relay…20%-60%
- Savings Over Private Lines…50%-70%
- International Private Lines…90%+

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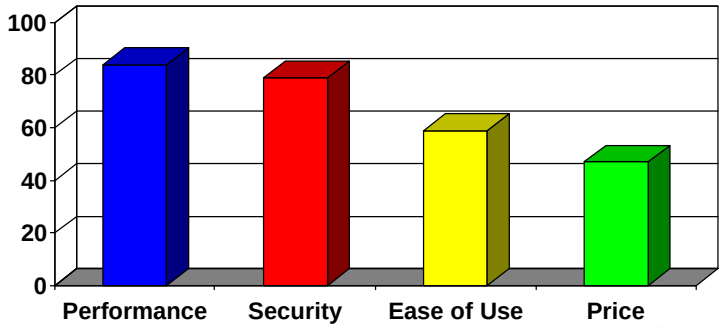
INTERNET VPNS: THE QoS DIFFERENCE

Customer VPN Concerns

Percentage of VPN Active Buyers Ranking Features as 'Very Important'



Source: TeleChoice, Inc.

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Internet VPNs: The QoS Difference

VPN Performance Goals

- Mission Critical Application Support
- Utilization Awareness
- Granular QoS by:
  - User
  - Application
  - Time/Date
- “Absolute QoS”
- Scalable for the Future

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Performance Issues

- IP is designed for “best-effort” traffic treatment
- Applications are designed to be greedy
- Access bandwidth is still a scarce commodity
- Particularly difficult across SP boundaries and NAPs
- Granular mechanisms are needed

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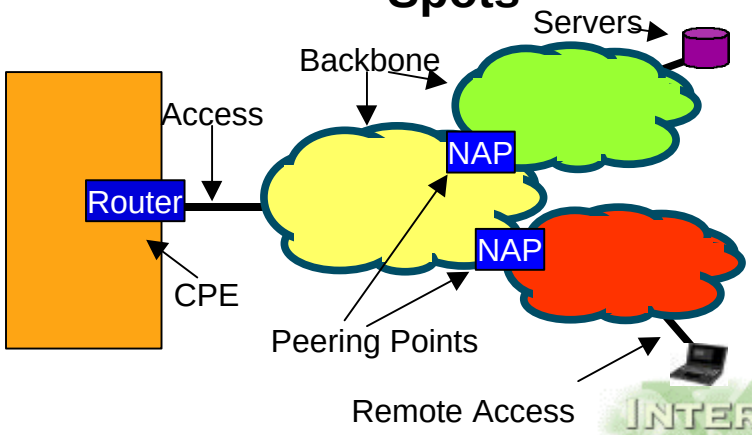
Performance Issues - Trouble Spots



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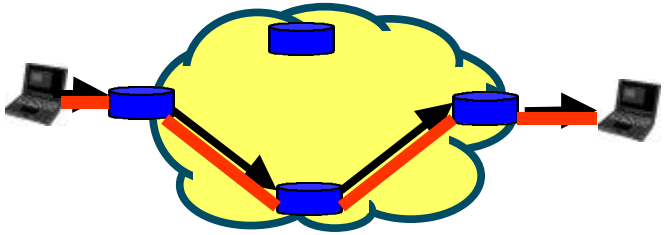
QoS/CoS Efforts and Standards

- Resource Reservation Protocol (RSVP)
- Differentiated Services (DiffServ)
- Multi-Protocol Label Switching (MPLS)

Resource Reservation Protocol (RSVP RFC's 2205 -2209)



- Resource reservation set-up protocol designed for integrated services
- Hosts may request a "quality of service" for application flows
- Works at the transport layer

RSVP - Issues

- RSVP was designed to support delay sensitive apps…not fix the Internet
- Transport Layer - processor intensive for core routers
- Requires SP backbone upgrade
- IPSec encrypts the transport header (RFC 2207)
- Lack of applications support
- Leads to inefficient bandwidth usage (voice)

Differentiated Services (DiffServ - RFC's 2474 & 2475)

- Simple method for providing classes of service in IP traffic
- Makes use of IPv4 ToS octet or the IPv6 Traffic Class octet
- Classifications describe "per-hop" behavior
- Service providers can offer multiple "classes" each with different SLAs

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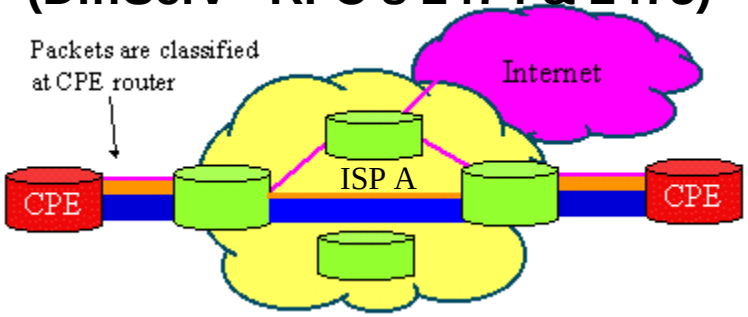
Differentiated Services (DiffServ - RFC's 2474 & 2475)



- DiffServ may be implemented at CPE only to prioritize a customer's own traffic relative to itself
- If the backbone is DiffServ-enabled, traffic may also be classified relative to other customers' traffic

DiffServ

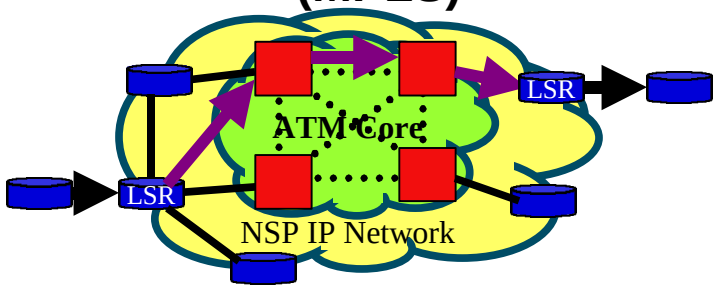
DiffServ Strengths and Weaknesses

- Strengths
  - Complex functions are performed at edge
  - Doesn't *require* SP backbone upgrade
  - Widely supported
- Weaknesses
  - No mechanism for routing around congestion
  - Service definitions have not been standardized

Multi-Protocol Label Switching - (MPLS)

- Combines intelligence of routing with speed of switching
- Maps Layer 3 precedence to Layer 2 QoS techniques (ATM, frame relay)
- Provides a tool for enhanced IP traffic engineering and management

Multi-Protocol Label Switching - (MPLS)



- Label Switching Routers (LSRs) do destination lookup and attach 32-bit MPLS label to packets to identify MPLS Path
- Path selected may be based on QoS rules
- Router lookups are minimized at each hop

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INTERNET VPNS: THE QoS DIFFERENCE

MPLS

MPLS Strengths and Weaknesses

- Strengths
  - Enables sophisticated traffic engineering
  - Employs constraint-based routing to avoid network congestion
  - Supports both frame relay and ATM
  - Simplifies network planning
- Weaknesses
  - Looks to other mechanisms (DiffServ) to define classifications
  - Still relatively new
  - Requires backbone network upgrades

Other Technologies for Improving VPN Performance

- Private Peering
- Content caching
- Load balancing
- Compression
- Hardware-based encryption

QoS/CoS Trends

- DiffServ/MPLS appears to be the leader
- RSVP still has strong support
- Efforts to combine approaches (i.e. RSVP with DiffServ/MPLS)

QoS is CRITICAL to VPNs

- Mission Critical Applications
  - Payroll
  - Order Entry
  - Other Database or Client/Server Apps
- Revenue-Generating Extranet Apps
- Potentially High Volumes of Email
- Next-Generation Services
  - VoIP, Video Conferencing

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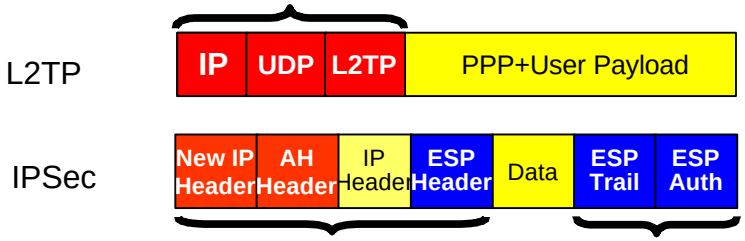
QoS is CRITICAL to VPNs

- Tunneling technologies solve certain problems, but they create overhead



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Internet VPNs: The QoS Difference

Enterprise Benefits

- Apply Bandwidth Where it's Needed
  - By User
  - By Application
  - By Time/Date
- Manage Existing Resources More Efficiently
- Understand the True Performance of Your Network
- Upgrade Only When Necessary

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Today's VPN Service Level Agreements (SLAs)

Common VPN SLA's	
Metric	**SLA**
Availability	95% - 100%
Latency (round trip)	120ms - 150ms
Mean Time To Repair	4 hours to 24 hours
Dial Connect Success	95% - 99%

QoS-Enabled SLAs

- Real or “Absolute” QoS
  - Bandwidth Guarantees
- Class of Service
  - Gold
  - Silver
  - Bronze
- End-to-End Policy-based Networks
- Monitoring, Measuring, and Reporting of Performance Parameters

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Internet VPNs: The QoS Difference

VPNs and QoS…Next Steps

- Start at the Edge…You can do this NOW
- Ask Providers About their QoS Plans
- Ask Providers About Cross-Border SLAs
  - Are they working with other carriers?
  - Are they adhering to standards?

Performance is as Important as Security!

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Internet VPNs - the QoS Difference

Ashley Stephenson
Chairman, Xedia Corporation

Internet VPN Requirements

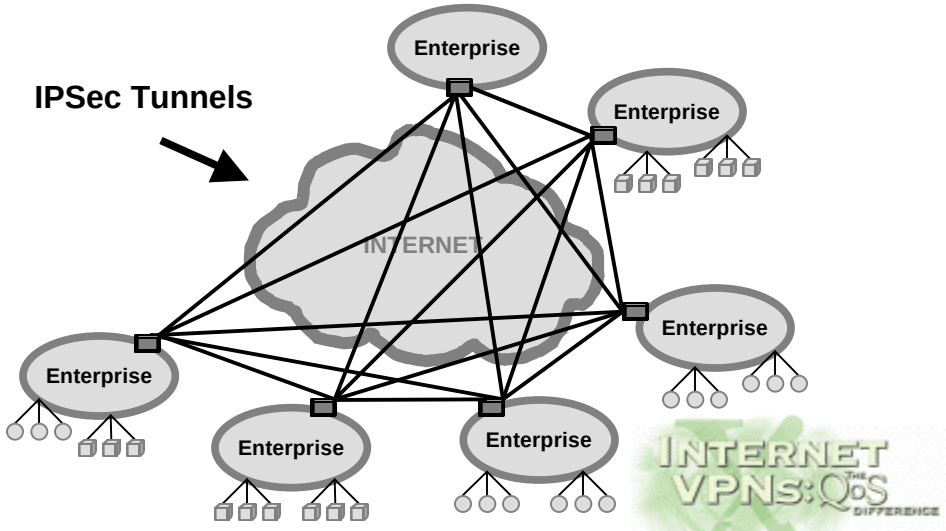
- Performance
  - QoS (bandwidth, latency, jitter, etc.)
  - Scalability (into multi-megabit services)
- Security
  - Tunneling/Encryption/Firewall
  - IPSec Encryption (DES, 3DES)
- Reliability
  - Dual Homing BGP4, Redundant Configurations
- Management
  - Customer/Provider Policy, SLA's, Billing, etc.

Internet VPNs - Applications

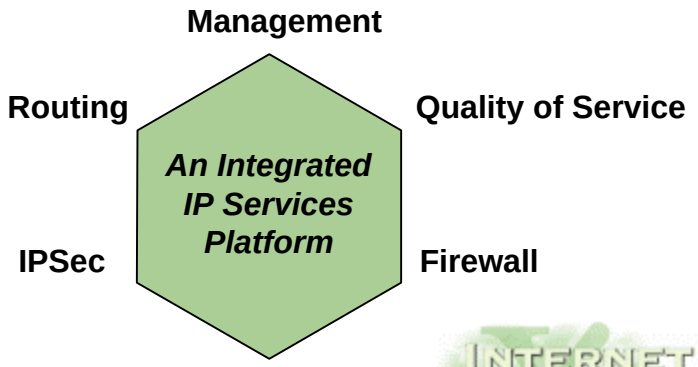
- Site to Site
  - replacement for private (leased) lines
  - alternative to Frame Relay / ATM
  - ***ideal for New/Incremental capacity***

- Dial-in / Remote User
  - replacement for private modem banks
  - ***secure extension of corporate LAN***
    - **mobile workers**
    - **day extenders**

Internet based VPNs - IPSec



QoS and VPN capable CPE
for Carrier-Class VPN Services



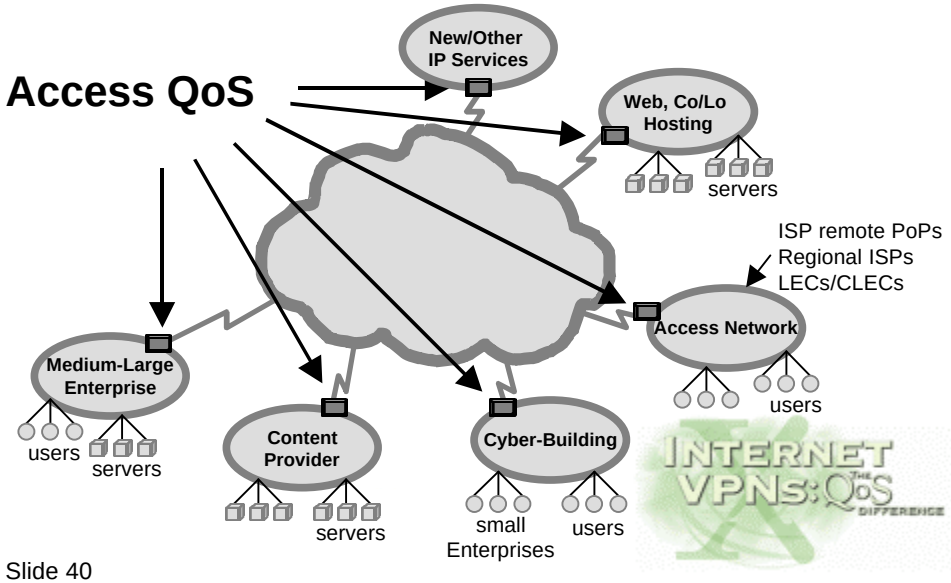
Internet VPNs and QoS

- If there is no differential treatment of traffic then the VPN is just “best-effort” on the Internet.
- If we handle VPN traffic differently then we can differentiate its QoS.
- IETF DiffServ and MPLS techniques can help us achieve this.

Internet VPNs and QoS

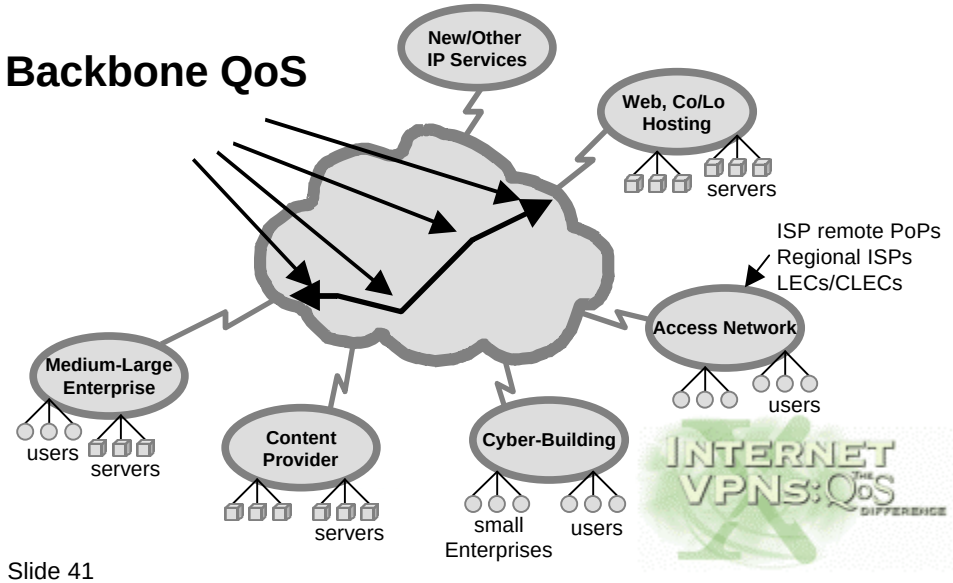
- Access QoS - e.g. Traffic Conditioning
  - Class-based Queuing (CBQ) e.g. Classification, shaping, policing, prioritization, allocation, provisioning, measurement, borrowing, policy management.
  - DiffServ marking
- Backbone QoS - e.g. Traffic Engineering
  - Bandwidth Provisioning and switching of aggregate flows
  - MPLS - Multiprotocol Label Switching

Internet Access QoS and VPNs



Backbone QoS and VPNs

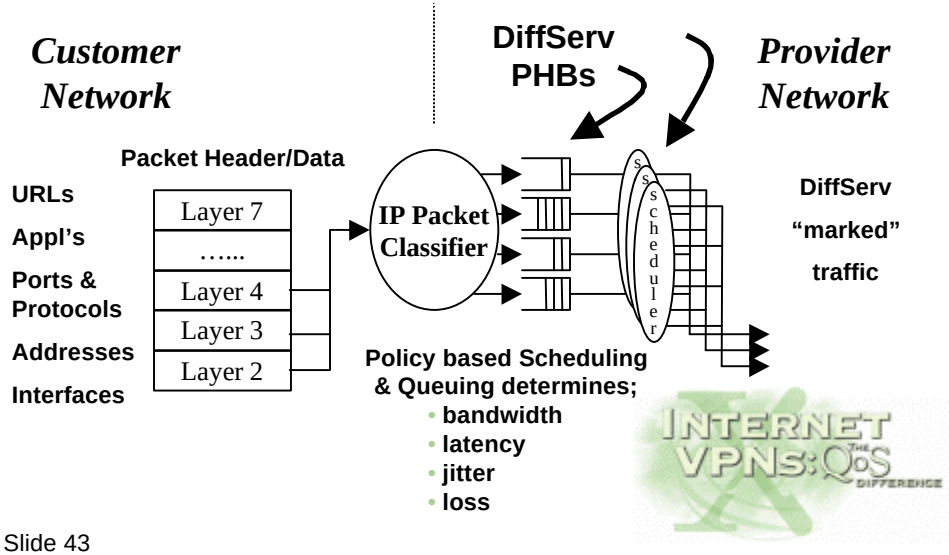
Backbone QoS



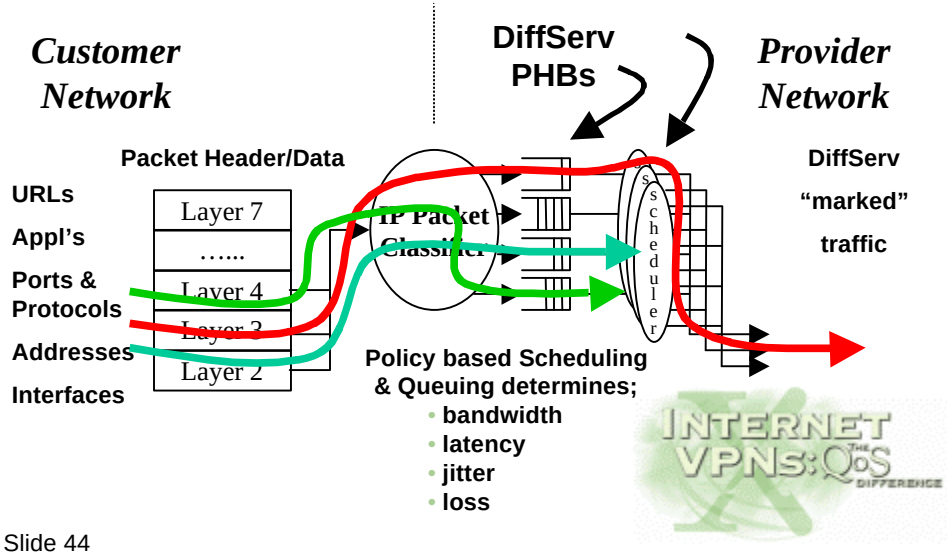
Internet QoS Concepts

- Condition Traffic and Mark at the access point
  - Classify, Shaping, Policing, Monitoring
- Provision bandwidth in the backbone for Contracted Aggregates
  - if you sell three 1 Mbit premium contracts then provision 3 Mbits premium capacity in total
- Forward traffic at each node according to Traffic Class membership (by marking)
  - **EF** (expedited)
  - **AF** (assured)
  - **DE** (default)

Class-Based Queuing (CBQ)

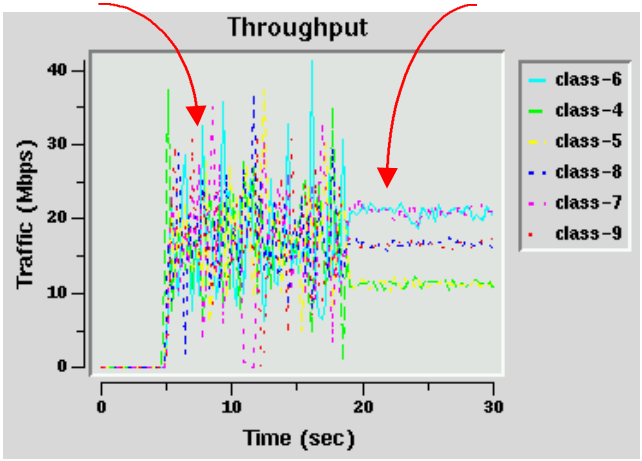


Class-Based Queuing (CBQ)

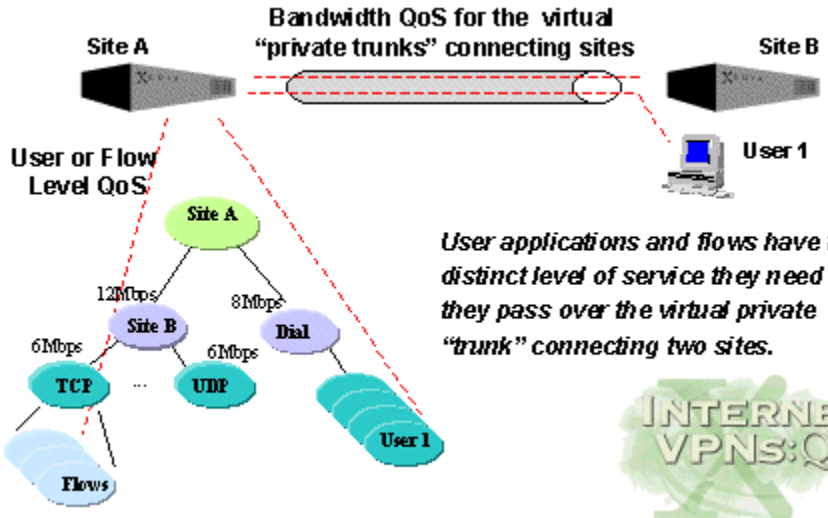


Impact of CBQ (DiffServ)

Normal traffic on wire **Traffic on wire with CBQ applied**

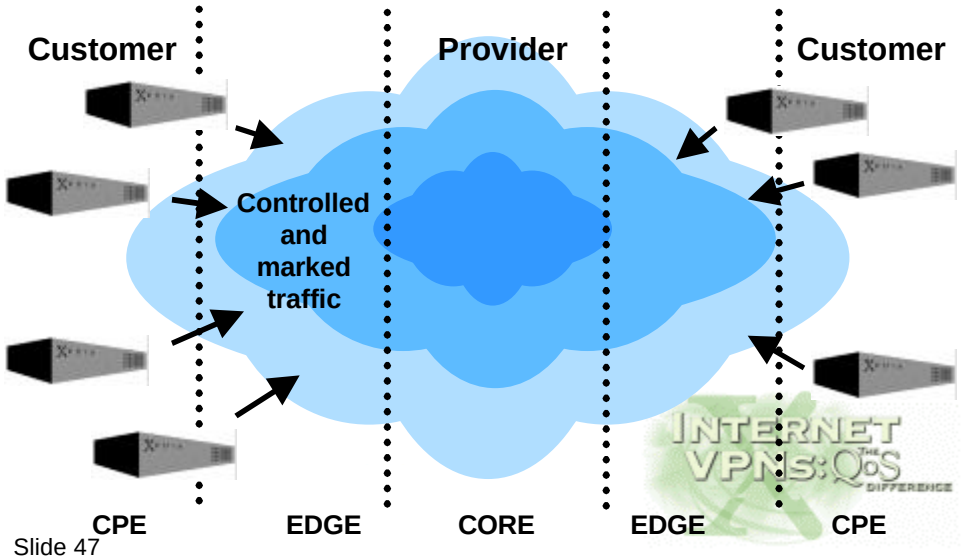


CBQ hierarchy for QoS Policy

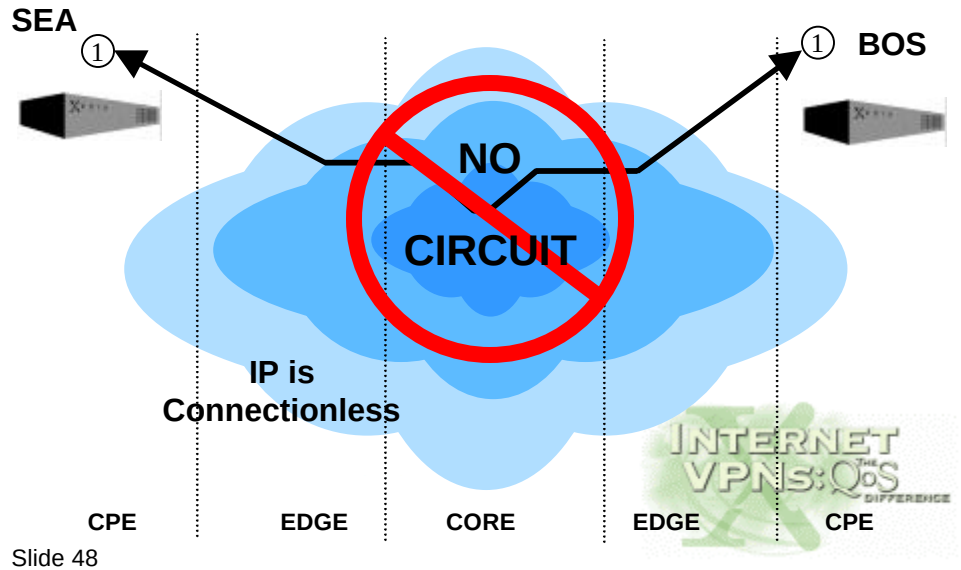


User applications and flows have the distinct level of service they need as they pass over the virtual private "trunk" connecting two sites.

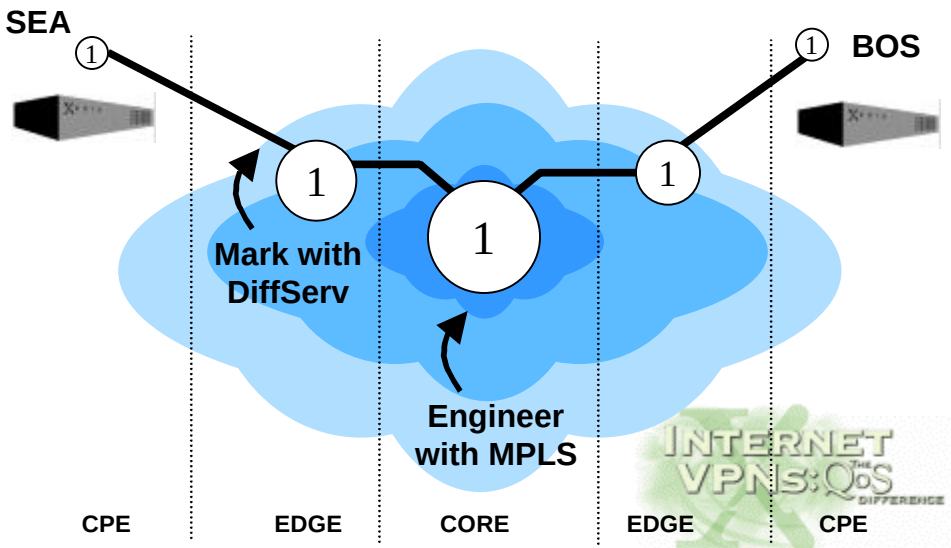
Access QoS for the VPN



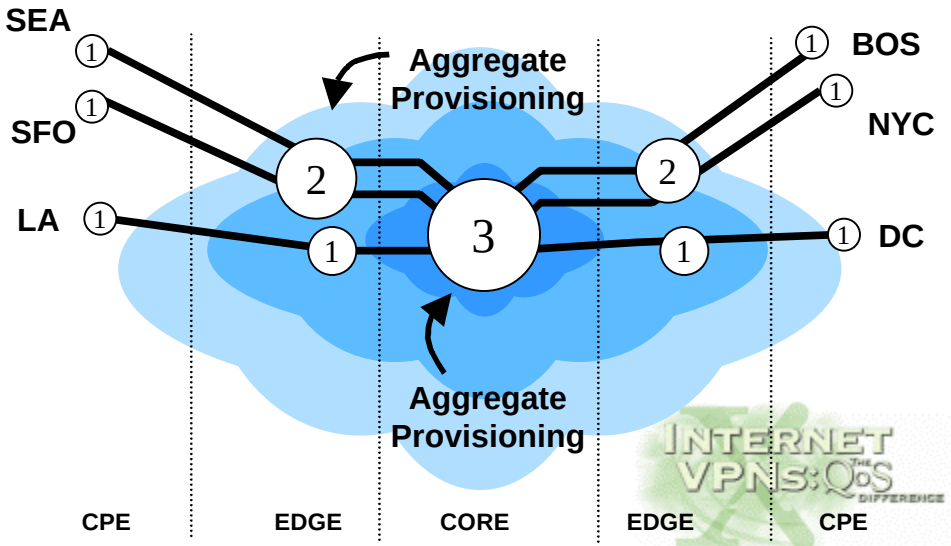
Backbone QoS for the VPN



End-to-End QoS Provisioning



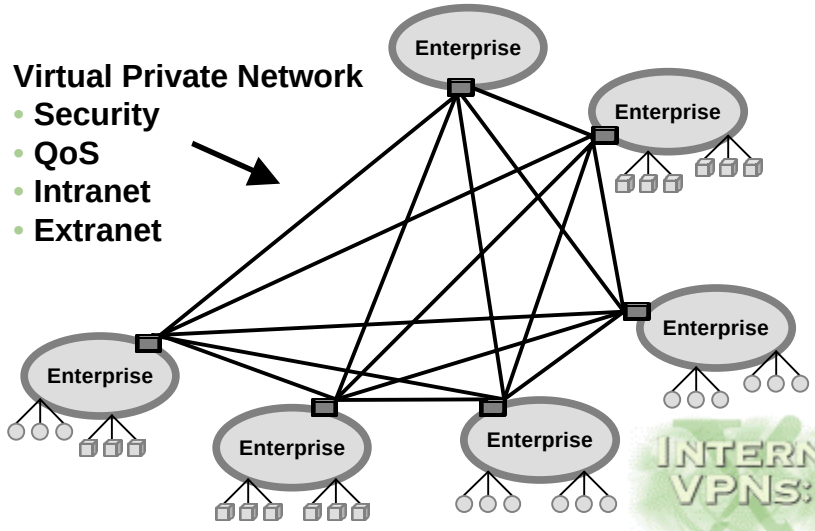
Backbone QoS for the VPN



Internet VPN with QoS

Virtual Private Network

- **Security**
- **QoS**
- **Intranet**
- **Extranet**



Summary

- Internet VPNs require QoS, therefore VPN traffic must be treated differentially on the Internet.
- The technologies and products for delivering Internet QoS are becoming available now.
- Internet VPN services will deliver premium service level commitments.

Roundtable Discussion

- Your roundtable moderator
- Senior Market Analyst in TeleChoice's Market Research Group
- Primary work in network and systems planning, product and business unit strategies, and architecture for wide-area and local networks.
- Consults and speaks internationally with a wide range of clients


Eric Zines

TeleChoice

INTERNET VPNS: THE QoS DIFFERENCE

Roundtable Discussion

- Ashley Stephenson - Chairman, Xedia.
- Responsible for Xedia's strategic direction, vision and engineering activities.
- Author and frequent industry speaker on QoS, VPNs, and the future of the Internet.