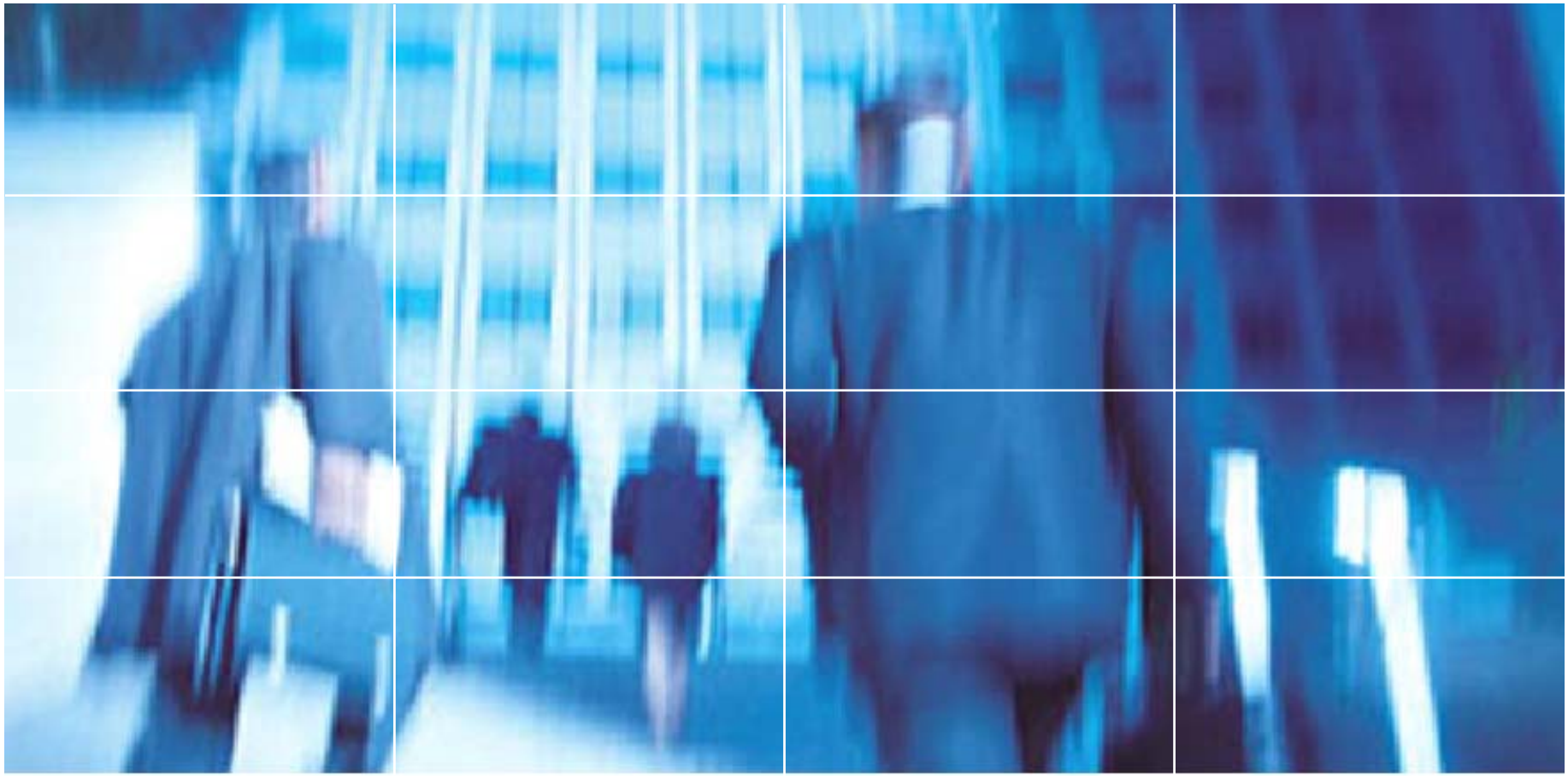


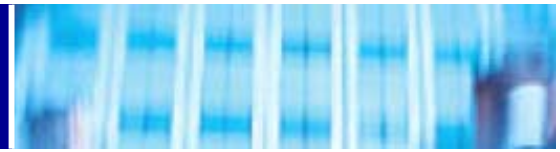
Extension of Multi-service Networks

Dave Siegel, VP Network Architecture & Long Range Planning

NANOG 32, Reston VA, October 17-19 2004

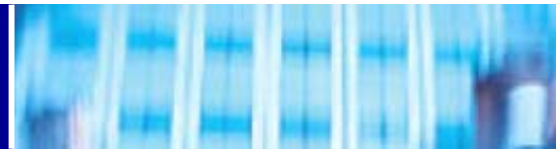
Global Crossing

Outline



- The services of a multi-service network
  - Service Modes
  - Applications
- The architecture of a multi-service network
  - Hardware
  - Features
- Extending the reach of a multi-service network
  - Peers
  - Partnerships
  - Next Generation Entrance Facilities

Services



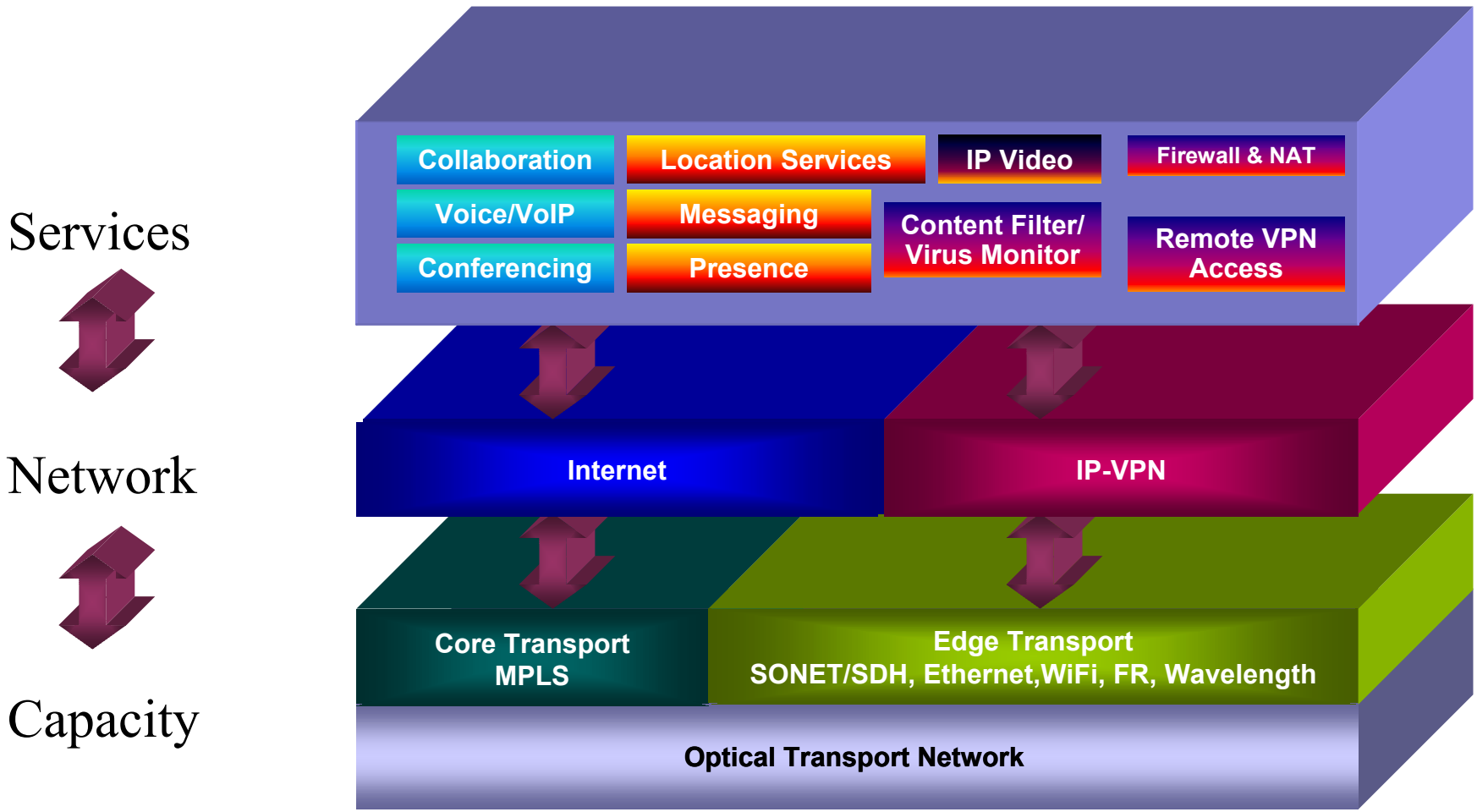
Service Modes

- Public Internet
  - Any connected port can reach any other connected port
- IP-VPN
  - Ports must be specifically configured to talk to other ports

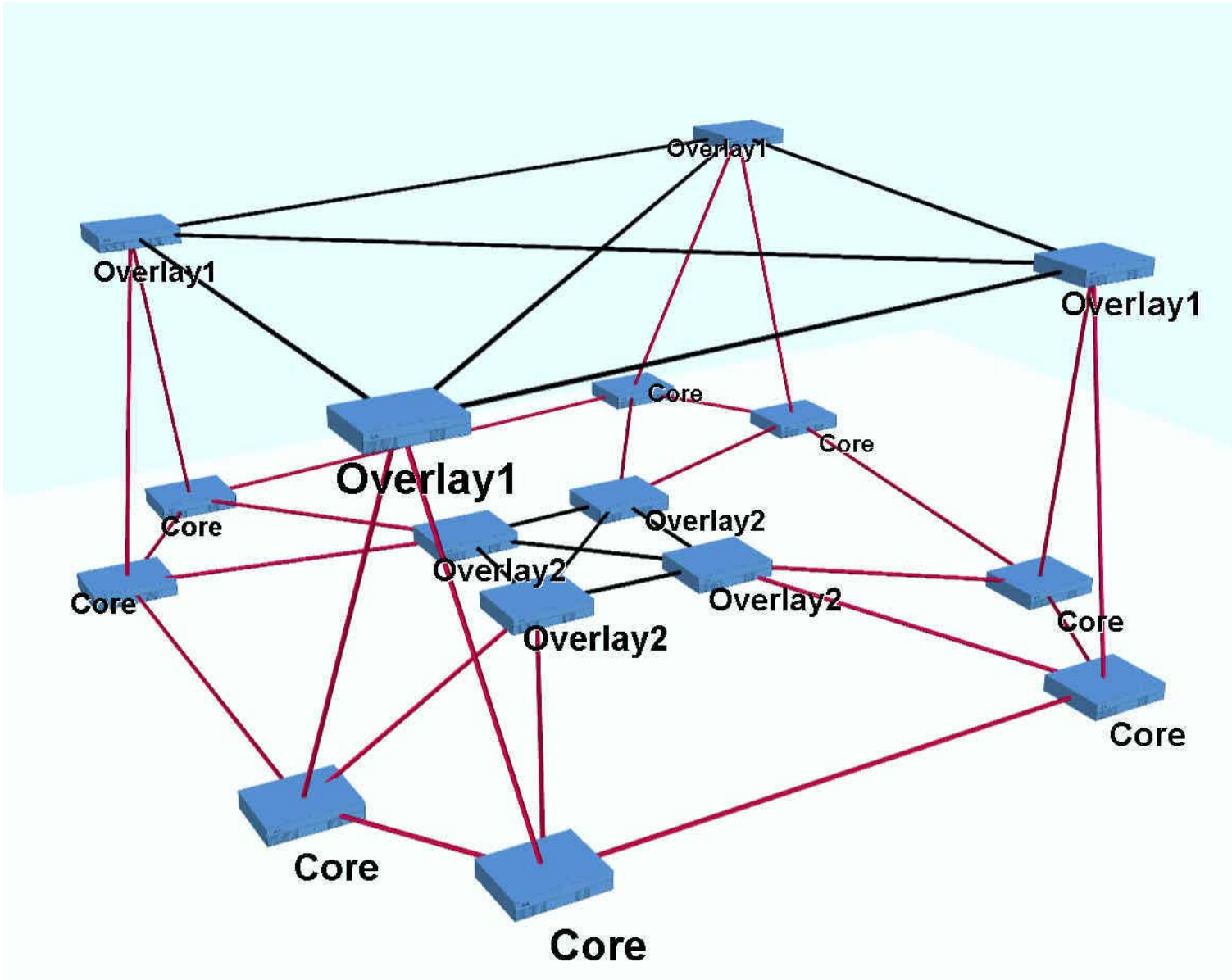
Applications

- Voice over IP
  - Toll By-pass
  - Long Distance
  - Local Service
- Video over IP
  - Point to point
  - Multi-point video conferences

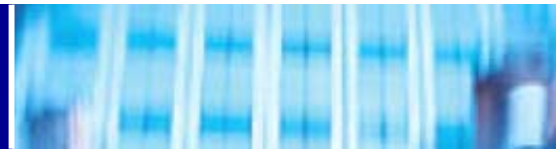
Multi-service network Framework



Multi-service architecture



Key Features



MPLS

- Enables logical separation of services on a common core

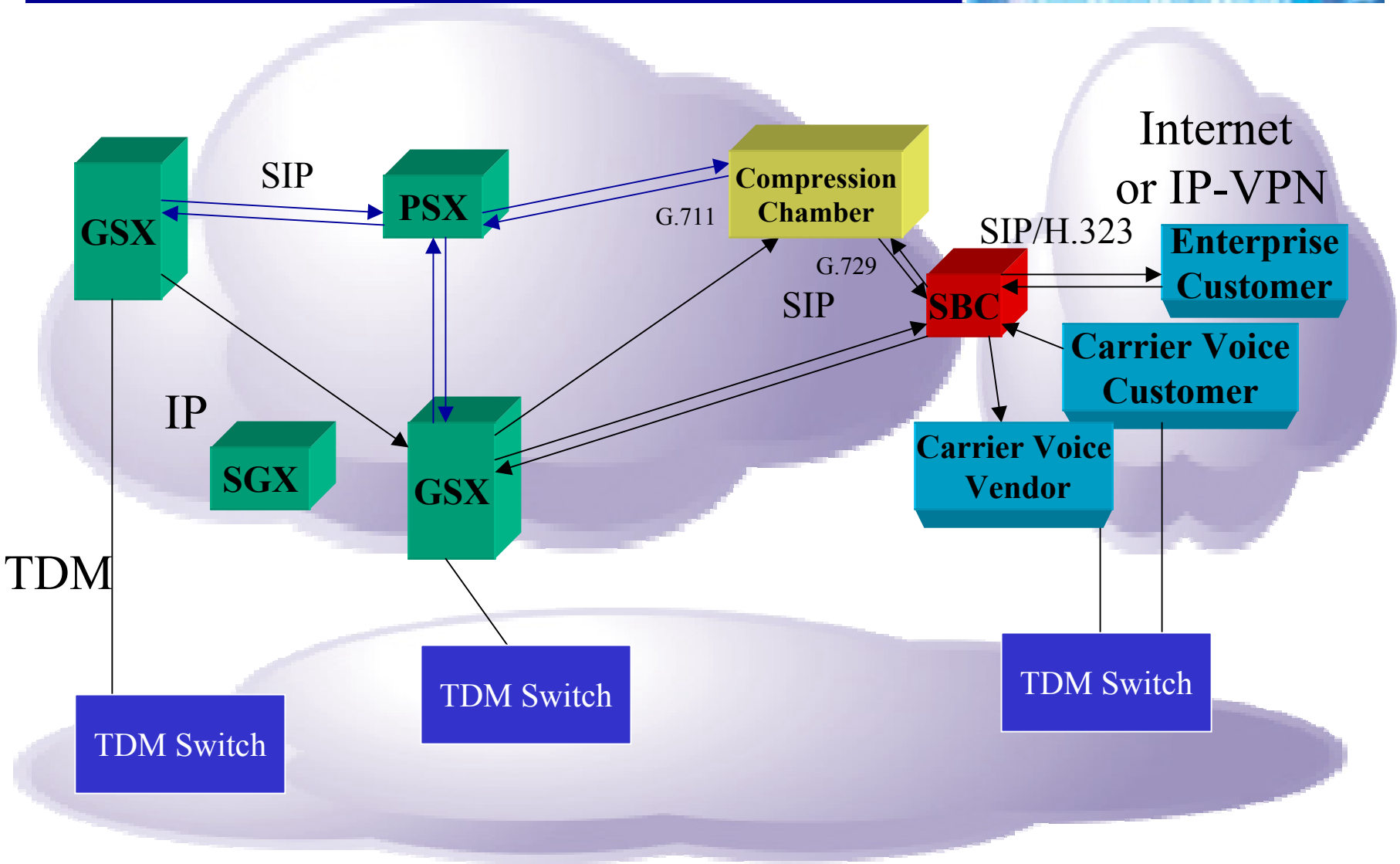
QoS

- Diffserv model - 3 CoS levels in Core
  - BE, or Best Effort
  - AF, or Assured Forwarding
  - EF, or Express Forwarding
- Internet is always mapped into BE
- VoIP always mapped into EF, and explicitly routed
- IP-VPN is fully Diffserv enabled, allowing customer to select any of the three classes for their packets.

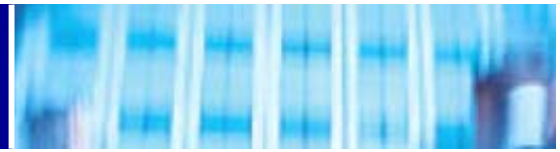
Fast IGP Convergence

- Re-routes should occur “reasonably” fast
  - 50ms != reasonable
  - 2 seconds or less is a common target for voice intra-continental

VoIP Architecture



Voice peering



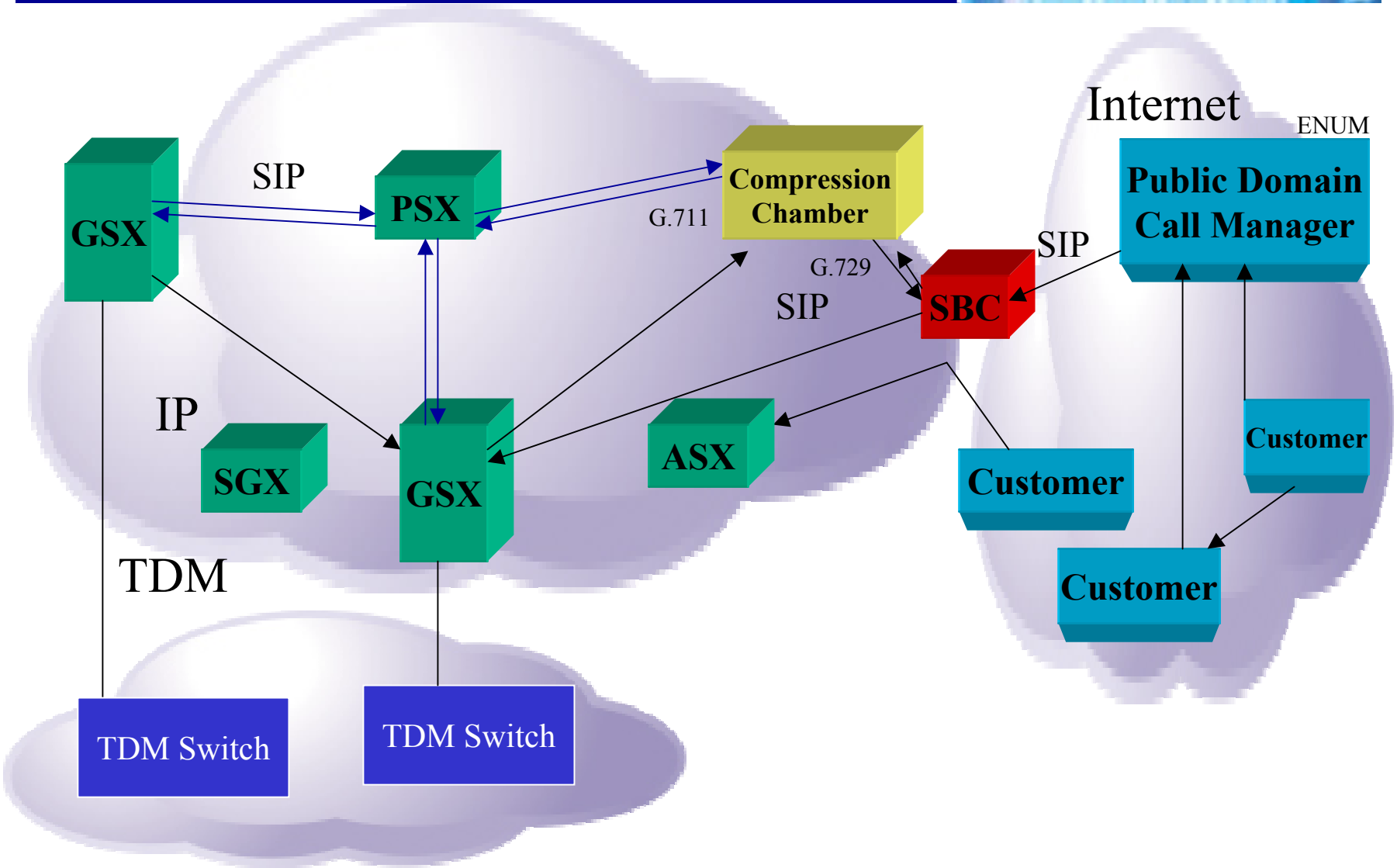
No such thing as a Voice peer

- Customers pay you by the minute to take calls initiated by them and deliver them to the destination
  - Could be a residential, retail, or another carrier (RBOC or IXC)
- You pay vendors to take your calls and deliver them to a destination
  - Usually an RBOC or another carrier

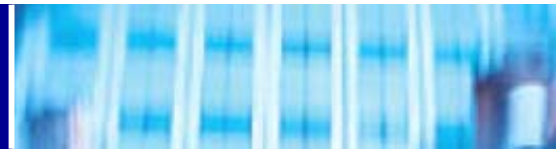
Moving to VoIP

- International carriers are the first to request your minutes as VoIP for much reduced rates
- Even RBOCs are interested in taking minutes from you with IP, but will do so only within the confines of existing tariffs
- Just because you want to give it to them with IP doesn't make it "enhanced"

The future of voice

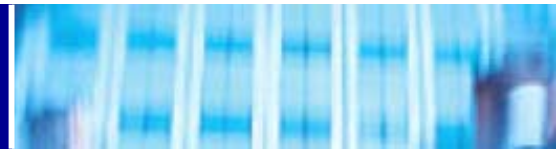


Overcoming internal challenges



- Technical
  - Demonstrate that QoS works
  - Demonstrate a reasonable implementation cost
- Operational
  - Prove that your IP network is as reliable as the voice network is by running it at or near 99.999% availability
  - Global Crossing Network Actuals, YTD:
    - IP-VPN 99.9991%
    - VoIP 99.9998%
    - Internet 99.9984%
  - Deploy IP Telephony internally as a cost savings measure
- Organizational
  - Bring your voice and data organizations closer together to strengthen the relationships between them
  - Position your voice engineers and operations personnel for career growth into the IP space

The peering coordinator



Imagine enabling these on a peer connection…

- Interprovider MPLS (for IP-VPN)
- Interprovider QoS
- Inter-AS MPLS with QoS

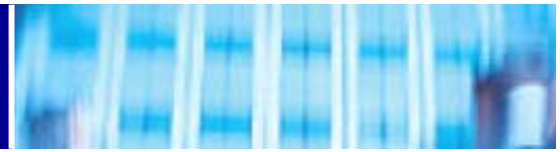
And the following occurs…

- You peer reserves all of the capacity on your networks best links
- Your peer resets latency and jitter tolerant packets into your EF class to insure that his customers get the best performance on your network

Which results in…

- A much more detailed peering agreement
  - Cost for reserving bandwidth
  - Parameters around CoS values, or perhaps a rate structure

Is your peer a partner?

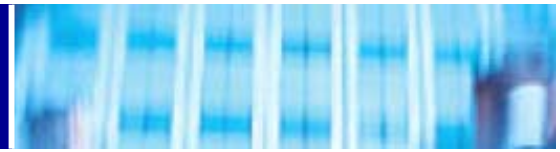


NNI's are not peering connections

- NNI's extend the reach of your network
- NNI's are clearly identified in your provisioning systems
- NNI's are established following the creation of a partnership negotiated between the companies marketing organizations
- The commercial agreement replaces the peering agreement

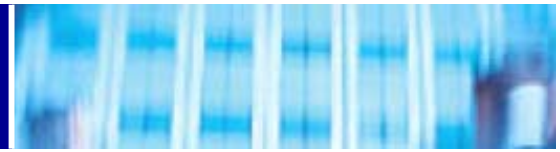
- Peers that are in direct competition with each other have no interest in aligning features and capabilities
- Peers may not even desire to enhance performance of applications across their network boundaries lest you decide to purchase value add services from a competitor

The commercial agreement



- Branding: What name are the services sold under on the partner's network
- Who provides the front line support to the end user
- What services can be sold
- What service features are supported
- What is the cost structure
- Who does the customer receive the bill from
- What operations structure is required (NOC to NOC)
- What OSS information needs to be exchanged
- Is the arrangement bi-lateral
- What is the architecture

Extending IP-VPNs



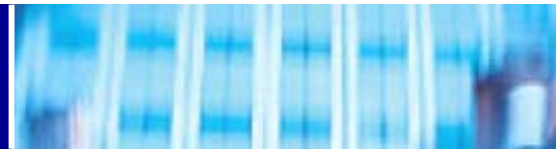
Good

- Build an Interprovider MPLS type A connection to a partner with a frame relay or ATM interface
- Does the job, but…
  - Inserts a layer 3 hop in the customer VPN
  - Provisioning is manual
  - Redundancy must be designed and configured on a per-VPN instance
  - No Visibility

Better

- Set up Interprovider MPLS type C with a partner
  - No layer 3 hops. Seamless interconnect
  - Provisioning can be somewhat automated
  - Redundancy is enabled across all VPNs with redundant partner connections
- OSS
  - Exchange of network alarms between event management systems
  - Exchange of relevant network statistics for billing and/or portal
- Product features and capabilities must be aligned

Interprovider QoS

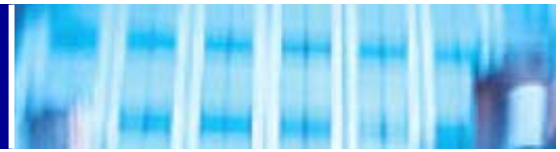


Technical and Product issues

- Enabling QoS on a local link to another provider and setting up re-classification mappings is trivial
- Differing treatment and application of QoS parameters can create issues in maintaining end-to-end consistency of product features
  - One provider supports maintaining transparency of original IP precedence and the partner re-writes IP precedence (i.e. transparency cannot be supported end-to-end)
  - One provider uses 3 Classes of Service while another uses 8. While translation tables can be built, global product consistency cannot be maintained

Being partners means more than Interprovider MPLS, Interprovider QoS, Interprovider OSS, and Interprovider NOC communications, you must align yourselves on product features and capabilities as well

NG Entrance facilities



Local Exchange Carriers implementing MPLS

Backbones implementing MPLS

If most new services are either Internet or closed IP Networks, let's

- Build MPLS NNI's to our local exchange carriers
- Use it for
  - IP-VPNs
  - Internet Access pipes
  - L2vpn's (I.e. Ethernet)
  - VoIP

Thank You

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