

# Will the Internet be reliably bad enough to preserve PPVPNs?

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## Agenda

- disclaimer
- MPLS - what was it for?
- MPLS - what is it used for?
- PPVPN - what are they?
- PPVPN - why?
- Internet - what is it?
- Internet - how is it?
- do it yourself
- so what does that mean?

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## Disclaimer

- downside:
  - I do not work for a MPLS vendor  
(hardware, software or services)
  - I have spotty knowledge of ISP internals
- upside
  - been following Internet operations since '80s
  - been following MPLS since before it was MPLS
  - was IETF Area Director of MPLS for a while
  - know more than a bit about QoS

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## MPLS - what was it for?

- TAG Switching tried to be an ATM displacer  
provide configurable circuits in a packet network
- IETF MPLS WG justification:

*“This base technology (label swapping) is expected to improve the price/performance of network layer routing, improve the scalability of the network layer, and provide greater flexibility in the delivery of (new) routing services (by allowing new routing services to be added without a change to the forwarding paradigm). ...*

*MPLS makes use of a routing approach whereby the normal mode of operation is that L3 routing (e.g., existing IP routing protocols and/or new IP routing protocols) is used by all nodes to determine the routed path.”*

draft-ietf-mpls-framework-00.txt - 5/12/1997

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## MPLS - what was it for?, contd.

- traffic engineering came later
- VPNs came later
- controllable QoS came later

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## MPLS - what was it for?, contd.

- then ASICs became **the** answer  
less need to *“improve the price/performance of network layer routing”*
- but network capacity became a problem  
major congestion points in ISP backbones  
even before the theoretical doubling every 3 months  
ya know, with explicit routes MPLS can help  
can route traffic in ways that L3 routing would not  
can take into account source address

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## MPLS - what was it for?, contd.

- traffic engineering
  - send traffic along paths that have capacity or low latency, or reliability ...
  - set up LSPs with RSVP or CRLDP
- fast reroute
  - set up alternate paths to be invoked on failure
  - do not wait for L3 routing when a link goes down

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## MPLS - what was it for?, contd.

- then came WDM, DWDM & the fiber glut
  - at least in some places - like much of the US
- Odlyzko and others said ‘throwing bandwidth is cheaper’
- Yakov & BGP/MPLS VPNs (2/1998)
  - “2547” VPNs
  - create separate worlds
  - as secure as frame relay/ATM
- diffserv & MPLS (1999)
  - add controllable QoS

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## MPLS - what is it used for?

- little MPLS TE in US
  - enough cheap capacity
    - can avoid operations load & cost
  - not same story in some other places
    - capacity not available or not cheap
  - enterprise nets & tail circuits a different story
    - MPLS TE may not help here
- fast reroute
- PPVPN
- multi-provider MPLS still an issue

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## PPVPN - what are they?

- provider provisioned virtual private networks
  - pay provider to get private (network) world

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## PPVPN - why?

- logical isolation of address space
- logical isolation of routing domain
- logical isolation of traffic (could also encrypt)
- moral equivalent of frame relay or ATM VPN
- something to buy rather than build
- outsource management of WAN services
- someone to point at

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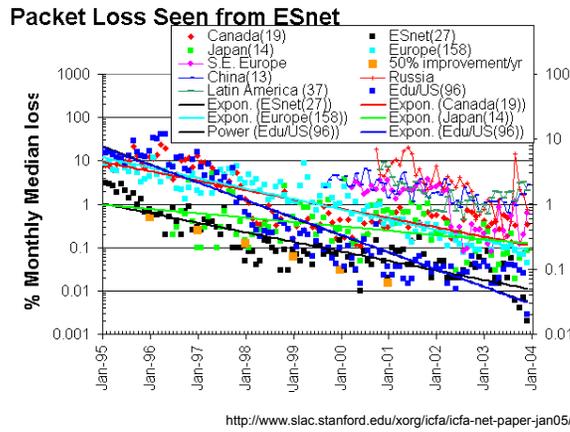
## Internet - what is it?

- IP as a Common Bearer Service
- over existing networks
  - original “Fundamental Goal” of IP protocols
- many types of networks
- local management
- thousands of ISPs
- network does not determine applications can be run

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# Internet - how is it?

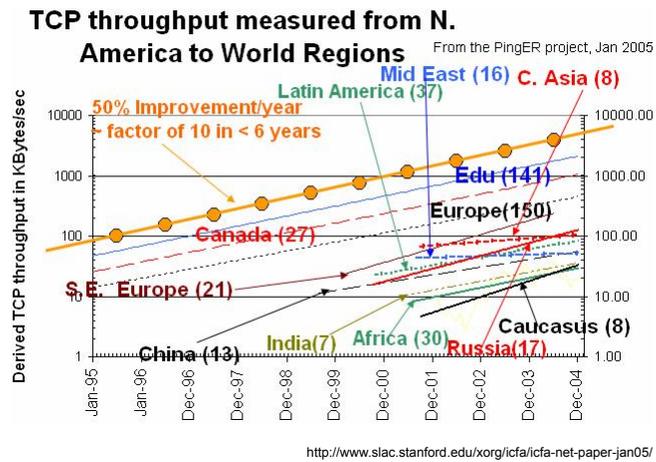
- getting better - packet loss



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# Internet - how is it?, contd.

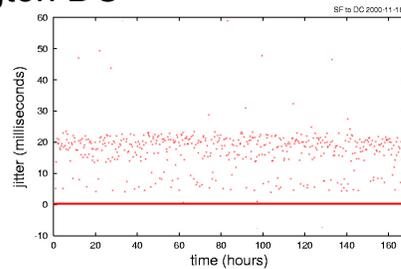
- getting better - goodput



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## Internet - how is it?, contd.

- quite good - jitter
- Steve Casner et al, NANOG presentation  
<http://www.nanog.org/mtg-0105/casner.html>
- experiment on active ISP backbone  
San Francisco to Washington DC  
POP to POP  
1Mbps average data rate  
15 5 to 7 day trials  
results:  
99.99% availability  
jitter < 1ms for 99.99% of packets sent



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## Internet - how is it?, contd.

- caveats
  - good Internet is not universal
  - multiple 300 second outages in Casner's testing
    - slow convergence after link failures
    - can be mitigated using MPLS fast reroute
  - no one to point at if multi-ISP
  - no guarantees just expectations
  - ISP business model may cause more problems in the future

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## Do it yourself

- customer can use their own equipment to provide equivalent of PPVPN
  - using site to site tunnels over commodity Internet service
  - can encrypt (better security model anyway)
- can be full mesh or any other network architecture
  - tunnels are just router-to-router “wires”
- can even run pseudo-wires over I2tpv3
  - carry TDM, frame relay etc

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## So what does that mean?

- why would an enterprise not to it themselves?
  - quality is fine (almost all of the time)
    - without any ISP-managed QoS/TE
    - no extra fee for add-on service or for QoS
    - works across ISPs
    - keeps ISP out of security umbrella
- but
  - full-mesh can get hard if many sites
  - have to have staff to manage
  - only yourself to blame if something goes wrong

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So --

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enough to preserve PPVPNs?