



IPv6 and Internet2 Update

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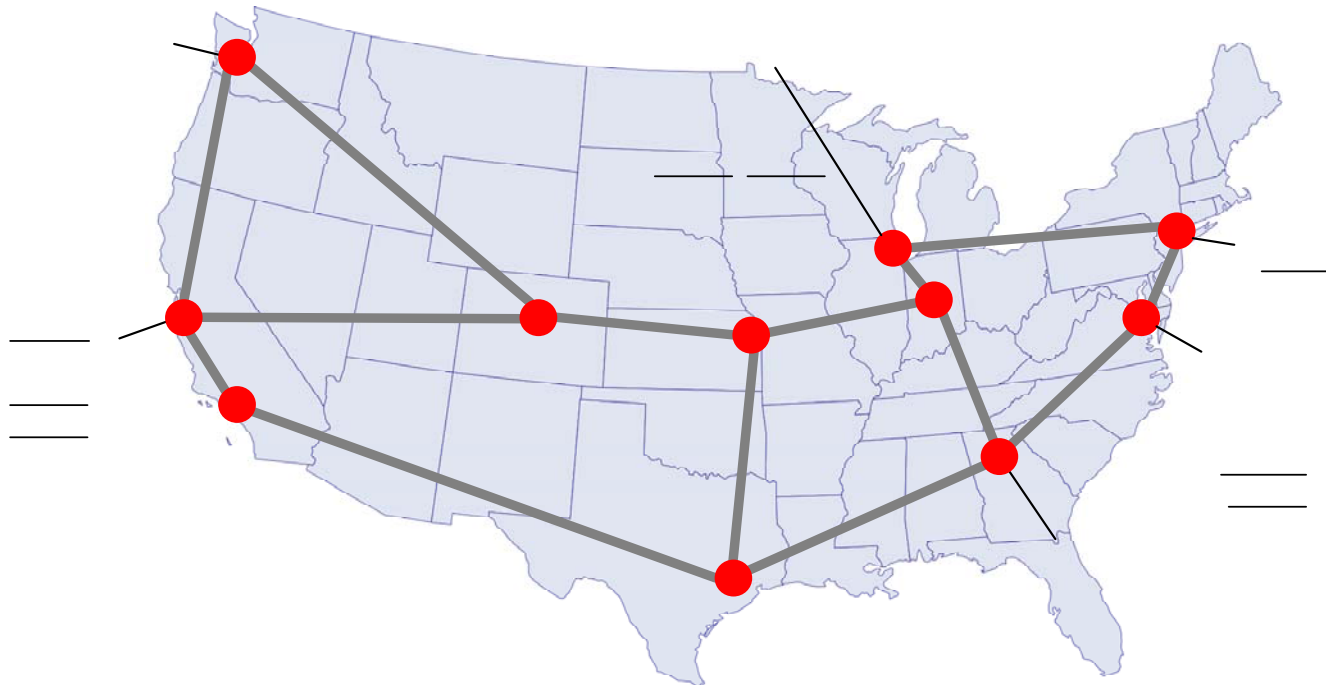
CCIRN Meeting
Poznan, Poland
5 June 2005

Abilene Peering

- Peering Methods
 - Exchange point
 - Direct peering to backbone router
 - Peering through GigaPoPs, through tunnels or BGP multihop
- Connectivity to Exchange Points
 - MANLAN (Internet2/NYSERnet partnership) – 10 GigE
 - PacWave-Seattle – 10 GigE
 - PacWave-LA – 10 GigE
 - Starlight – 2 x 10 GigE
 - NGIX East – 10 GigE
 - NGIX West – 1 GigE in very near future
 - Palo Alto PAIX – 333Mbps – **Live as of January 2005!**
- IPv6 and IP Multicast Peering Policy – open peering policy, with transit if desired – different from IPv4

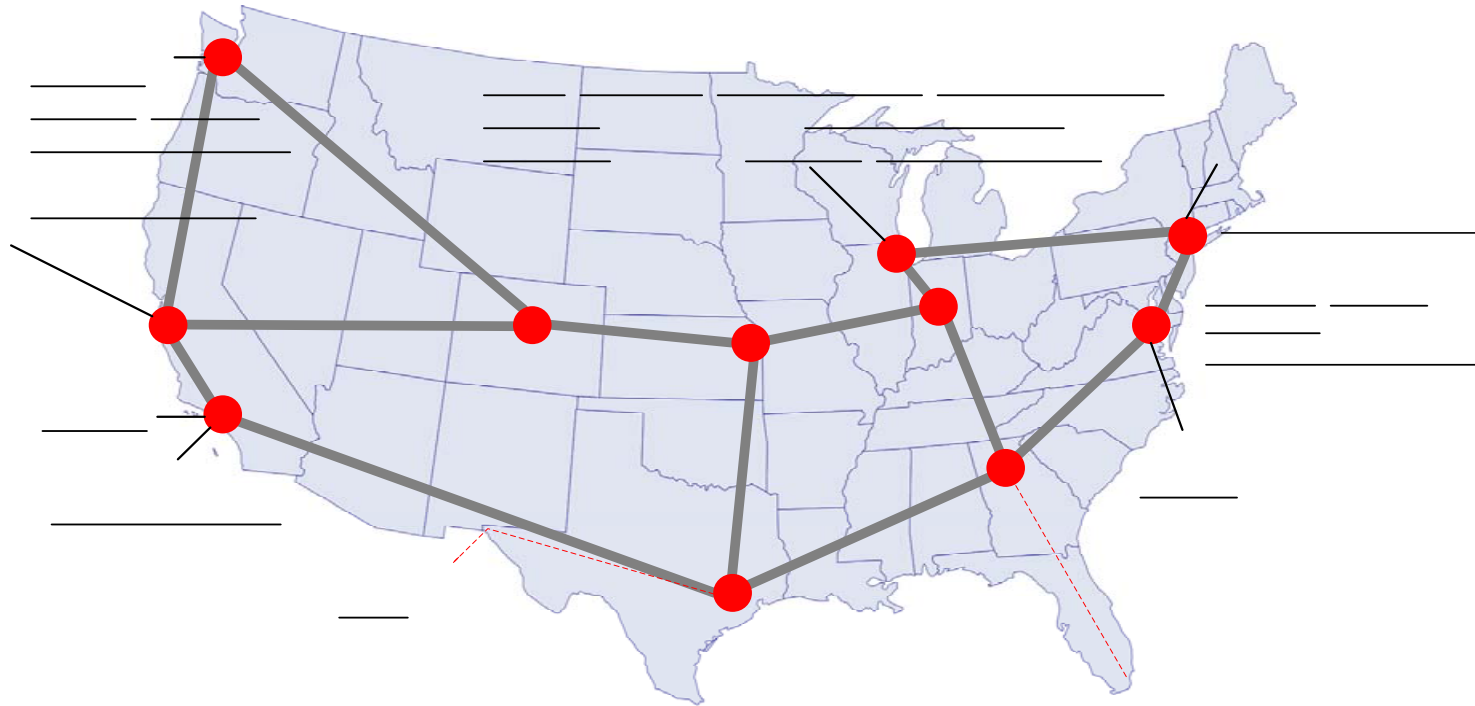


Abilene Federal/Research Peering





Abilene International Peering



Pacific Wave
AARNET.

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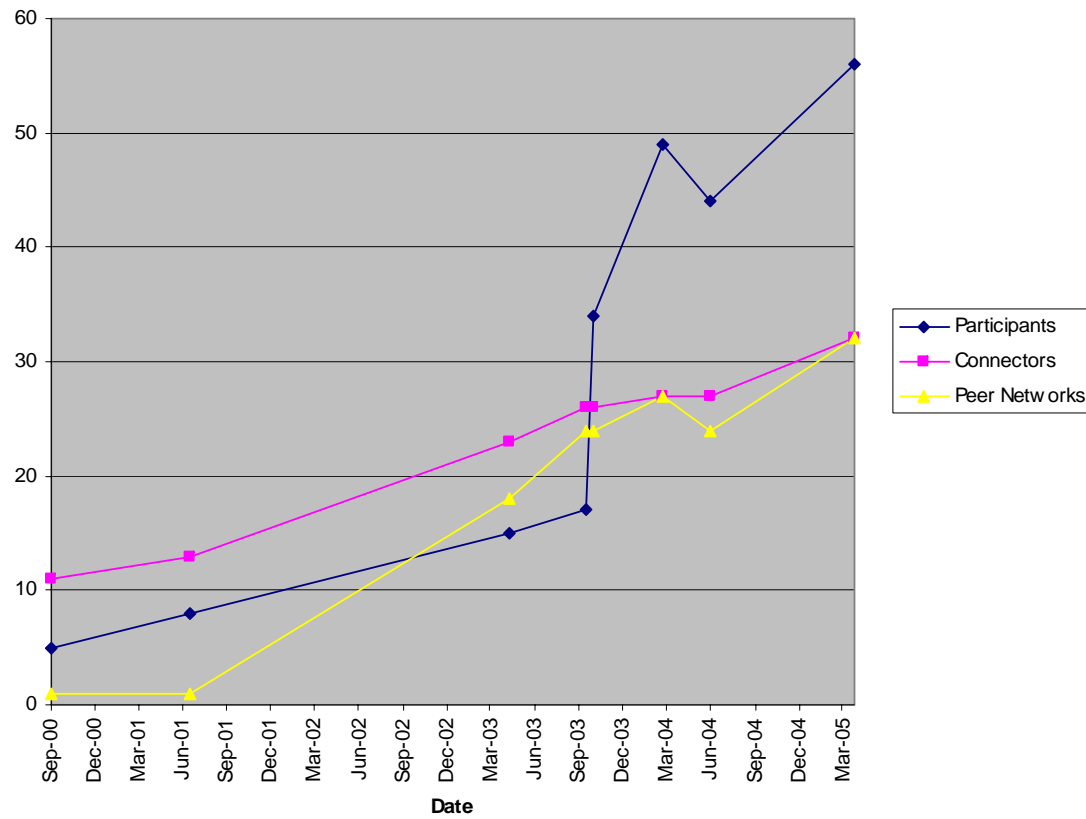
IPv6 Participants and Connectors

- Participants: 56
- Connectors: 26
- Peers: 34
 - 1 Corporate
 - 3 Federal
 - 26 International



Abilene IPv6 Growth

IPv6 Participant/Connector/Peer Growth





Additional IPv6 Deployment

- Backbone unicast enabled
 - Routing – BGP and IS-IS
- 6 to 4 tunnel relays:
 - Indiana University
 - Pittsburgh Supercomputer Center

While Abilene and Gigapops are IPv6-enabled, a “last mile” problem persists as it relates to IPv6. Theories:

- Hardware doesn't support IPv6
- Application server time-outs
- Difficulty convincing administrators of value
- Ensuring security isn't being compromised
- Application protocols don't support IPv6

- Abilene NOC activities:
 - Limiting the v6 prefixes connectors send us as we do for IPv4
 - Limited filtering for peer networks
- New v6-security e-mail list

Deployment Issues

- [This is an old slide, but unfortunately, its still true]
- Many monitoring tools are missing, impacting security
 - Schools are reluctant to deploy fully because of potential for attacks
 - For example, difficulty in supporting access lists that monitor address/port number – extended header implementation problem

- Abilene is IPv6 Multicast enabled, but is not currently part of the global m6bone infrastructure
- NYSERnet, New York's research and education network, is configuring IPv6 Multicast across their backbone

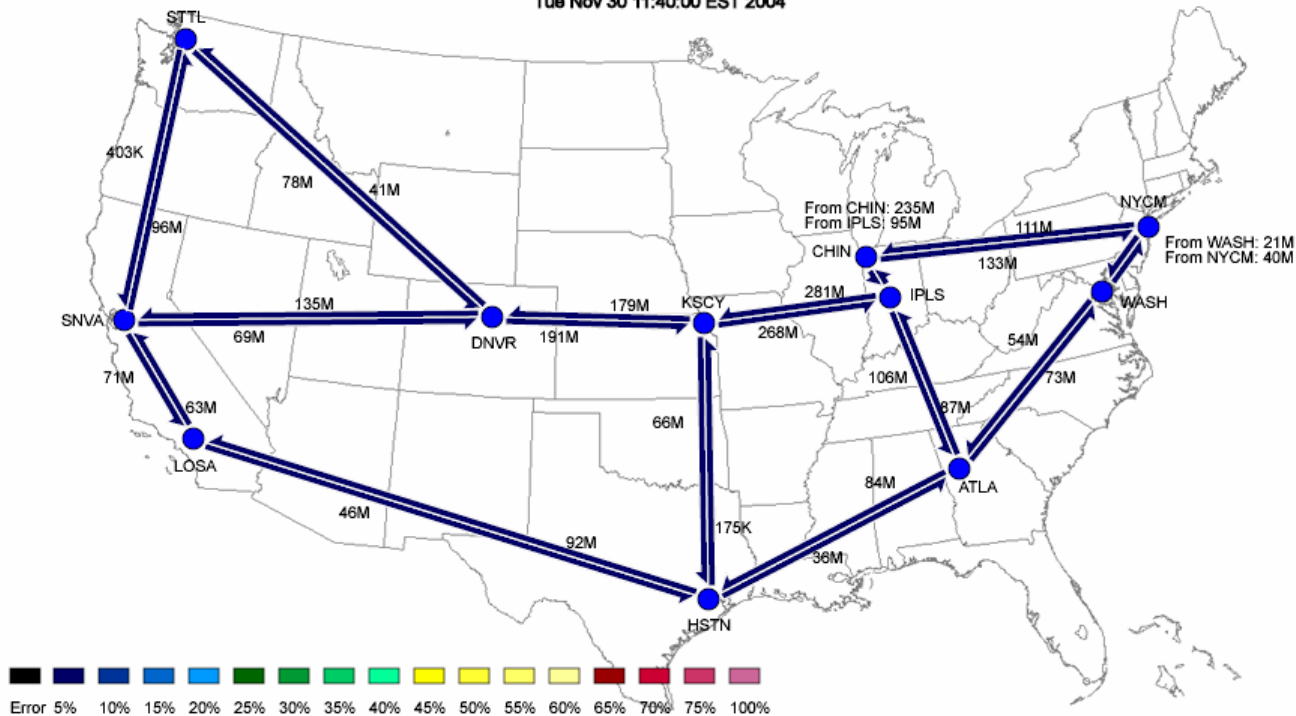
IPv6 Traffic Map

Abilene IPv6 Backbone Traffic Map

[IPv6-Aggregate](#) [IPv6-TCP](#) [IPv6-UDP](#) [IPv6-Multicast](#) [IPv6-Other](#)

Abilene IPv6 Aggregate Backbone Traffic

Tue Nov 30 11:40:00 EST 2004





Abilene IPv4/IPv6 Measurement

- Backbone measurements via IPv4 and IPv6:
 - BWCTL – Bandwidth Control
 - OWAMP – One Way Active Measurement Protocol
- Measurements to and from Abilene backbone
 - <http://e2epi.internet2.edu/pipes/ami/pmp-info.html>
- Difference between IPv6 and IPv4 performance on Abilene is indistinguishable

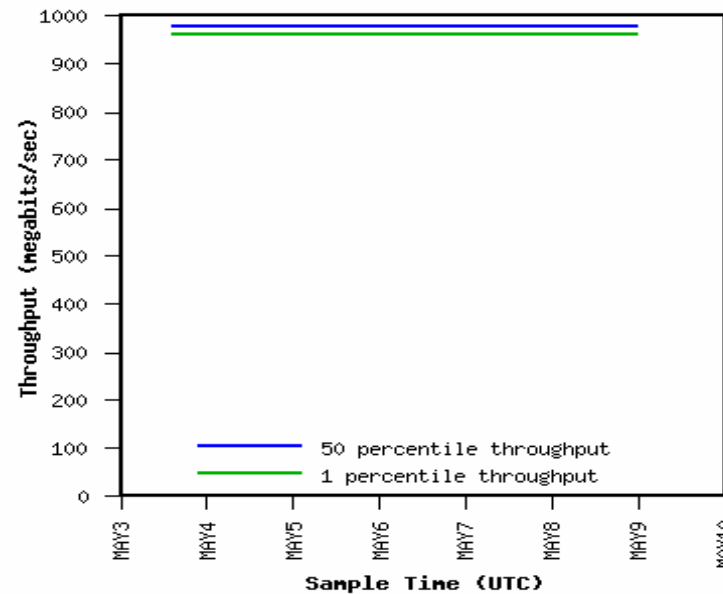
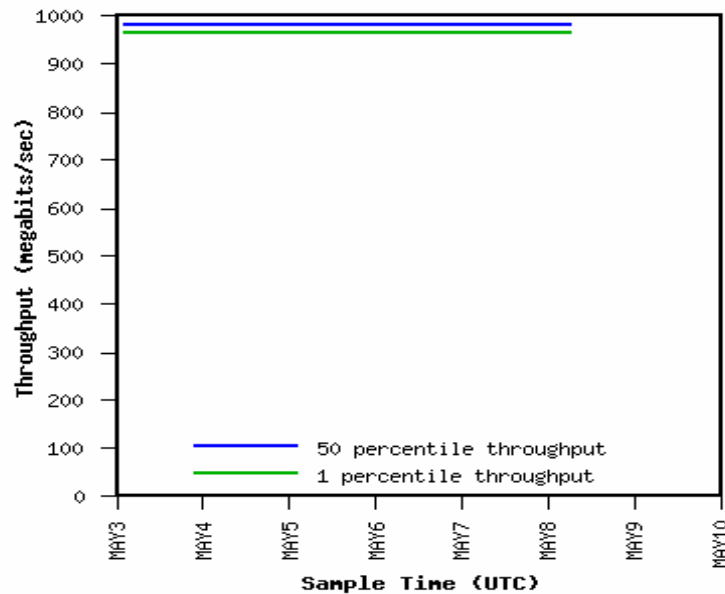


IPv4/IPv6 Comparative Performance Graphics

Tue May 3 16:25:40 UTC 2005 --- Tue May 10 16:25:40 UTC 2005

Select Timeframe

- [BWCTL TCP Status](#) [BWCTL TCP Status Map](#) [BWCTL Worst TCP Ten](#)
- [BWCTL UDP Status](#) [BWCTL UDP Status Map](#) [BWCTL Worst UDP Ten](#)
- [OWAMP Status](#) [OWAMP Status Map](#) [OWAMP Worst Ten](#)





IPv4/IPv6 Comparative Performance

- Reviewed Abilene backbone 180 TCP throughput (iperf) measurements for a specific period – May 12 around 13:00 UTC.
- Measurement systems have 1GigE interfaces
- Measurements averaged 980Mbps with IPv4 tests and 977Mbps with IPv6 tests
- IPv6 lags IPv4 TCP throughput by about .1 - .3 percent for most measurements across same links.
- Other than saying that IPv6 performance differences are insignificant, do these measurements say anything else?



Measuring percentage of IPv4 traffic vs IPv6

- Reasonable question
- Challenges
 - What links to measure
 - Presenting meaningful data
 - What time periods
 - Going back in time



Internet2 IPv6 member activities

- North Carolina State University and Centaur Labs -- IPv6 streaming audio feeds from radio stations WCPE and WZYC
- IPv6 H.323 at Georgia Tech
- NYSERnet experimenting with IPv6 Multicast via the international M6bone effort
- Abilene IPv6-enabled hosts
 - <http://ipv6.internet2.edu/ipv6hosts.shtml>

- Currently monitoring applications like
 - VRVS (CaIREN)– IPv6 support in development
 - Internet2 detective – detecting IPv6
 - DVTS (Wide)
- Very preliminary interest in finding synergies with amateur radio community and IPv6



Support for IPv6

- **Tutorials**

- Two day workshops, hands-on experience
- Descriptions and planning guides
 - <http://ipv6.internet2.edu/workshops/index.shtml>
 - <http://ipv6.internet2.edu/workshops/setup/>
- Alternate discussion/lecture with hands-on lab exercises
- Slides are available
 - <http://ipv6.internet2.edu/presentations/>



Internet2 Commitment

- Internet2 is committed to deploying an IPv6 native dual stack network for the research community.
- Internet2 is committed to encouraging connectors, peers, and members to fully deploy IPv6 on their networks.
- Internet2 will monitor IPv6 penetration in the future to provide guidance to the community.
 - Network penetration.
 - Availability of software and tools
 - Security Issues



For Further Information ...

- References

- <http://www.internet2.edu>
- <http://abilene.internet2.edu>
- <http://www.abilene.iu.edu>
- <http://ipv6.internet2.edu>

- Questions?

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