A One Year Study of Internet IPv6 Traffic

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Haakon Ringberg (haakon@princeton.edu)
Craig Labovitz (labovit@arbor.net)
Danny McPherson (danny@arbor.net)
Scott Iekel-Johnson (scottij@arbor.net)

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Outline of Presentation

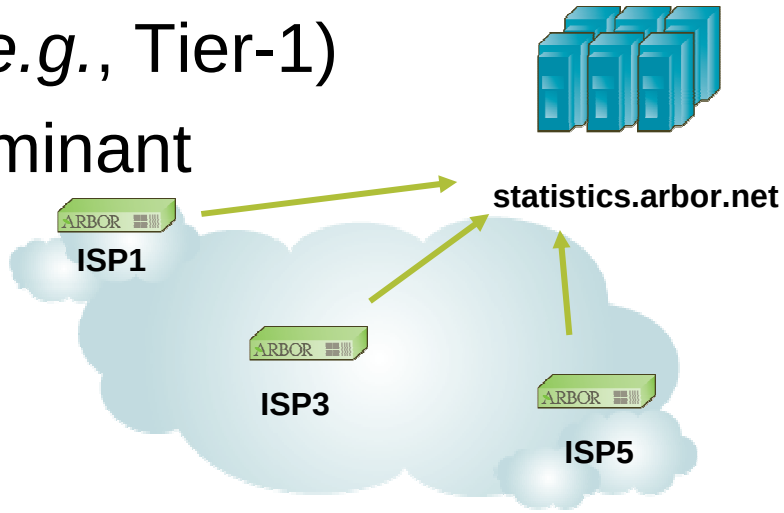
1. Goals and background
2. Methodology
3. Key results
4. Conclusion and discussion

Goal: Global and longitudinal perspective on Internet IPv6 traffic

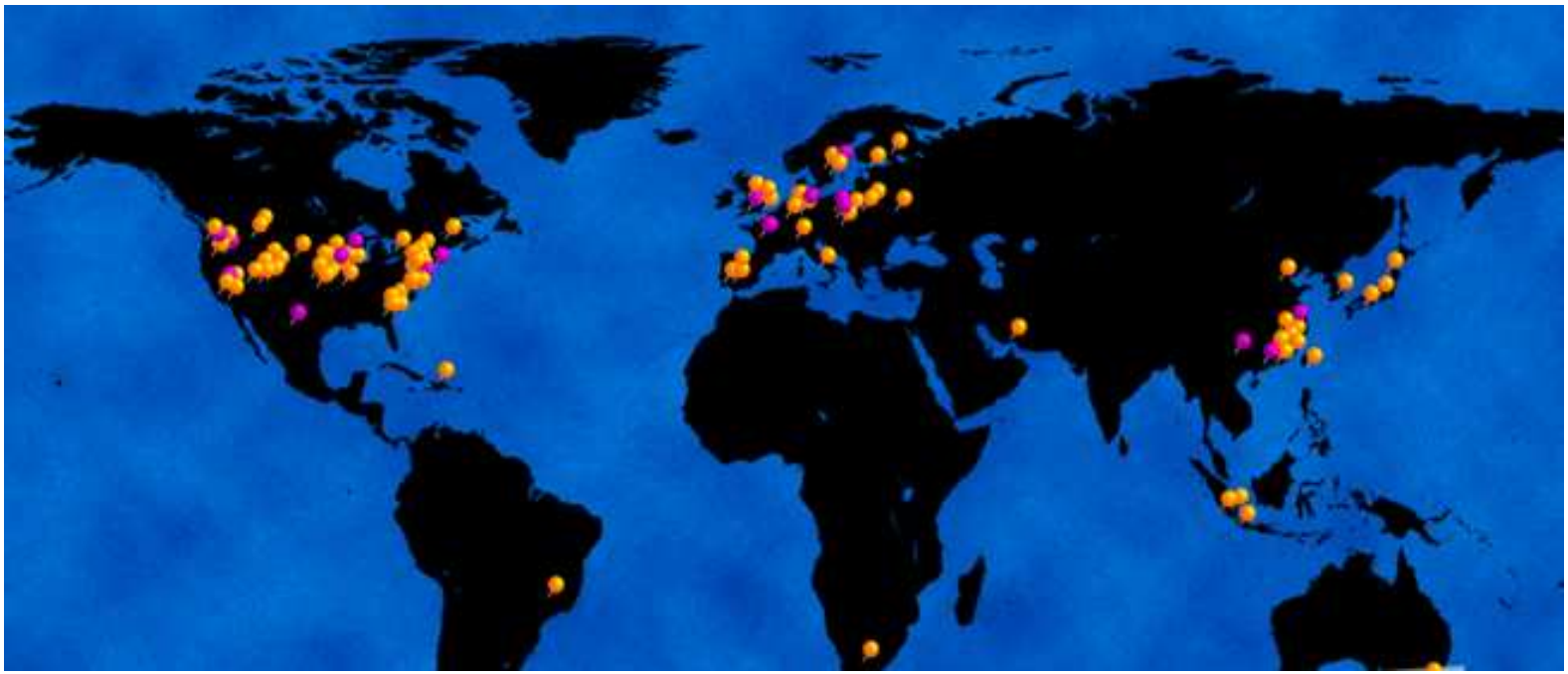
- Part of Arbor Networks project providing global perspective on *all* Internet traffic
  - Across geographic regions
  - And types of providers (content, higher ed)
  - Leveraging > 2k Arbor probe deployments
- Key insights
  - Growth in traffic for applications and services
  - Pervasiveness of unwanted traffic (*e.g.*, DDoS)

Data Set

- Source
  - ~100 voluntarily participating ISPs
  - Self-categorization of type (*e.g.*, Tier-1)
  - Self-categorization of predominant geographic region
- Description
  - One year period
  - Traffic in/out network into 5-min samples
  - Across top protocols, ports, ASNs, etc
  - Largely based on IP flow measurements



Global Footprint



- Global and longitudinal perspective
- 65 Americas, 27 EMEA, 6 AsiaPac
- Exceeding 5tbps of inter-domain traffic

IPv6 Context

- Imminent IANA IPv4 address exhaustion
  - Widely predicted to happen within next few years (*e.g.*, by CAIDA, Geoff Huston)
- IPv6 has many more available addresses
  - 28 orders of magnitude should be sufficient
- There have been some government pressure to make the transition
  - OMB mandate IPv6 to be available on routers
  - China's Next Generation Internet Initiative

IPv6 Transition

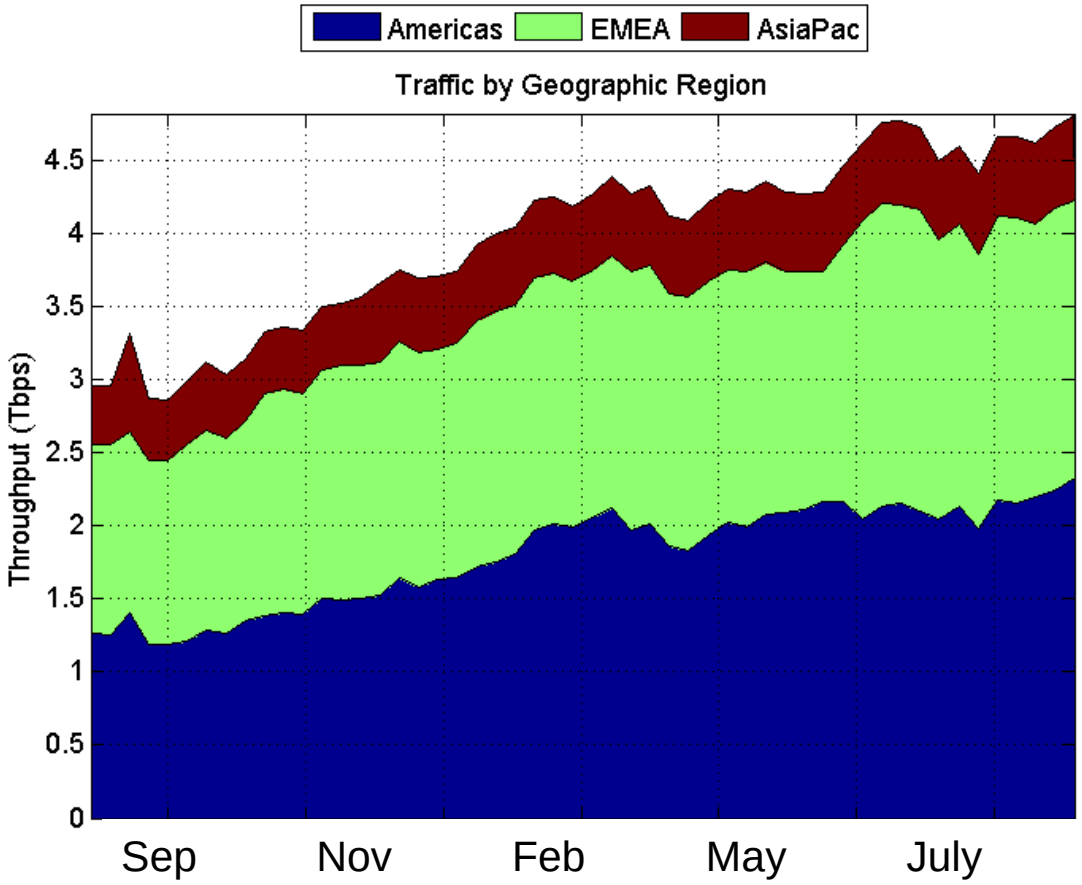
- How much IPv6 *traffic* is on the Internet?
- Various indirect estimates published
  - % ASNs with IPv6 BGP announcements 3%[1]
  - % Internet2 sites w/passing IPv6 grade 1%[2]
  - % Alexa Top 500 websites using IPv6 0.4%[1]
  - IPv6 DNS queries as % IPv4 DNS load 0.2%[3]
- IPv6 as % of all Internet traffic 0.002%

[1] http://bgp.he.net/ipv6-progress-report.cgi, [2] http://www.mrp.net/IPv6_Survey.html,
[3] http://www.potaroo.net/presentations/2008-06-18-ipv6-deployment.pdf

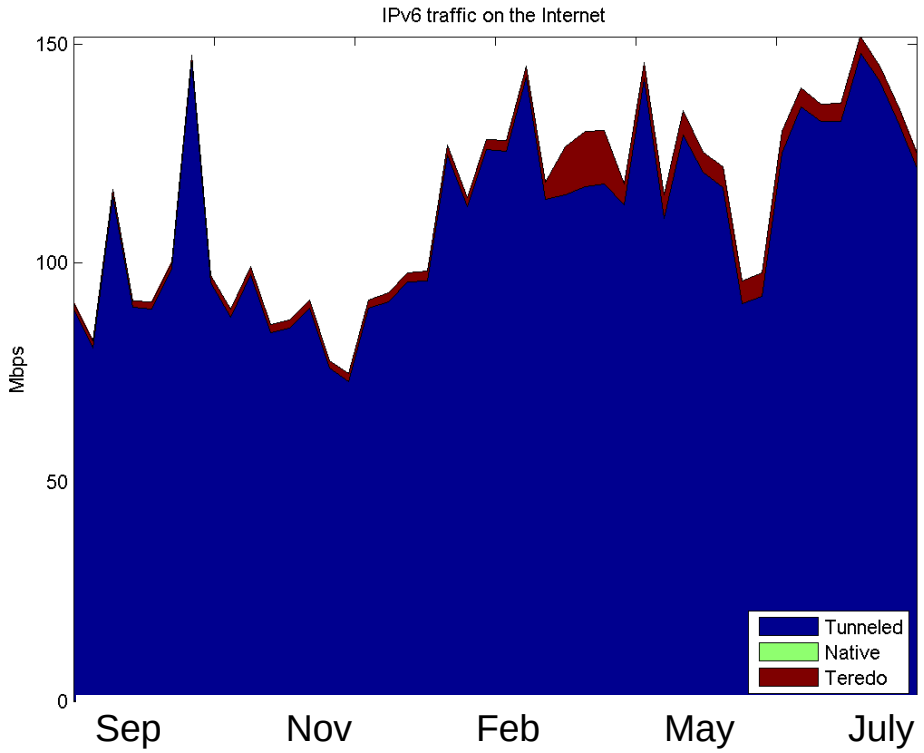
IPv6 Measurement Methodology

- Inter-domain IPv6 traffic
- Native IPv6 traffic
  - Requires that routers support NetFlow v9
- Multiple forms of IPv6-over-IPv4 tunneled
  - Tunneled over IPv4 protocol 41
  - Teredo traffic, tunneled over UDP port 3544

Global and longitudinal traffic dataset

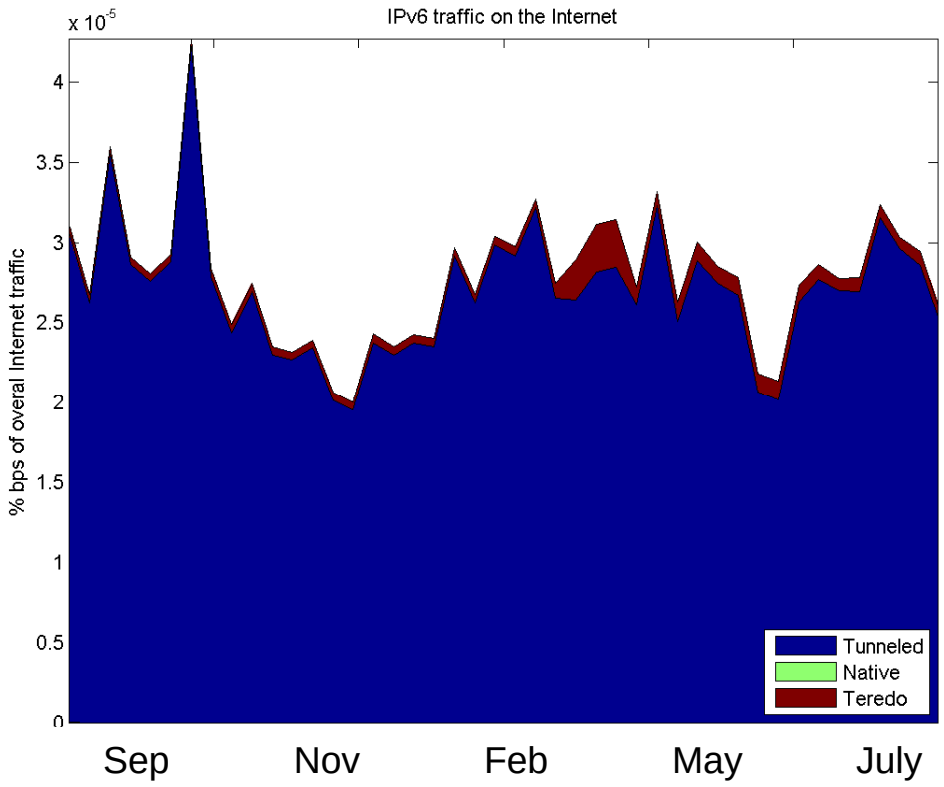


IPv6 traffic is growing…



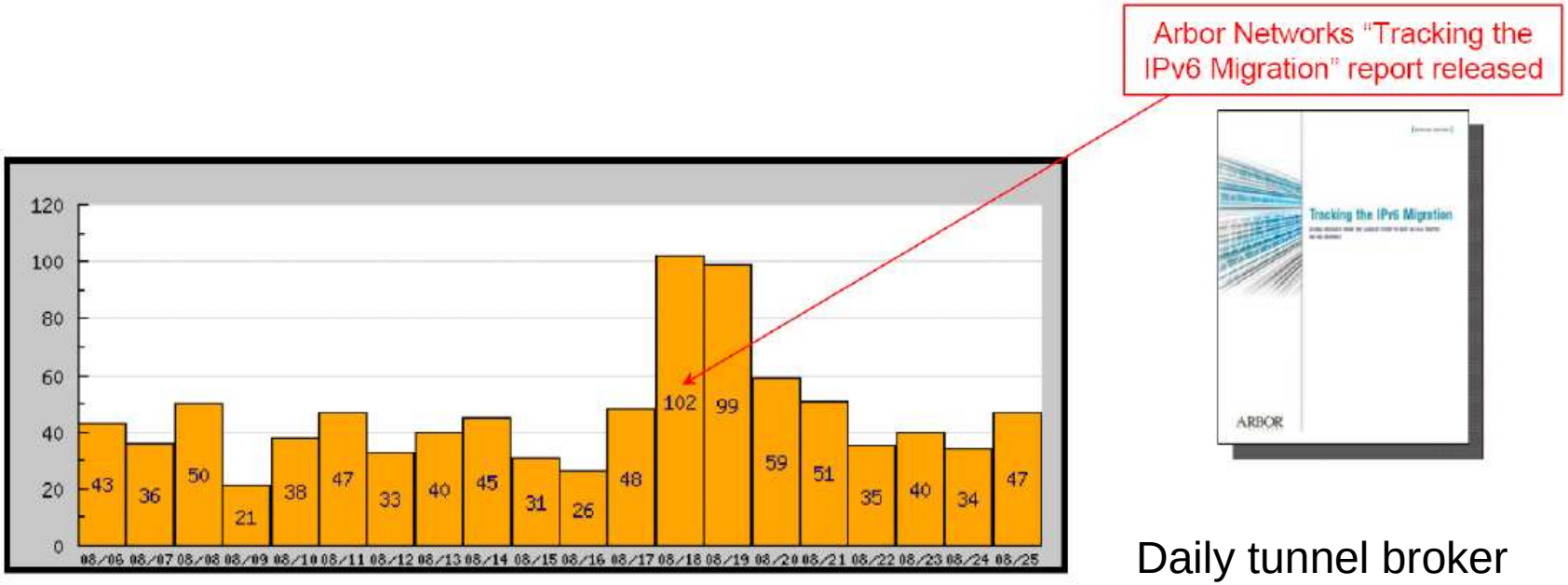
- > 30% increase between first and last quarter
- Approaching 150 Mbps of inter-domain IPv6

IPv6 as fraction of Internet traffic



- < 3 *thousandths* of 1 *percent* average
- Growing more slowly than IPv4 inter-domain

Immediate IPv6 Report Impact!



Daily tunnel broker account signups for HE

Hurricane Electric TunnelBroker – http://tunnelbroker.net/

IPv6 Methodology Objections, I

- Not monitoring *your* network
  a) Please sign up today!
  b) 5tbps of inter-domain traffic is representative
- North American / European bias to networks participating in study
- Focused on inter-domain traffic
  - Intra-domain not studied
- Data set primarily flow based
  - More DPI measurements needed for future work

IPv6 Methodology Objections, II

- Undercounting native IPv6 traffic
  - Monitoring requires NetFlow v9
  - Networks themselves have decided not to perform this upgrade
- Undercounting Teredo traffic
  - Data traffic need not traverse UDP 3544
  - Teredo relays and servers listen on 3544
  - Only 2 deployments saw more than an occasional few kbps of UDP 3544 traffic

Why So Little IPv6 traffic?

- Findings
  - There is growth in IPv6 traffic
  - But stagnant compared to overall Internet traffic
  - And very little percentagewise
- Why?
  1. Money: high costs, no added revenue
  2. Chicken/egg problem: no users, no content
  3. IPv4 is working well, why mess with it?

Thanks! Questions?

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