

# Welcome to your IPv6 enabled transit network.

Whether you like it, or not.

- Rob Issac, August 2008

# IPv6's 'killer app'

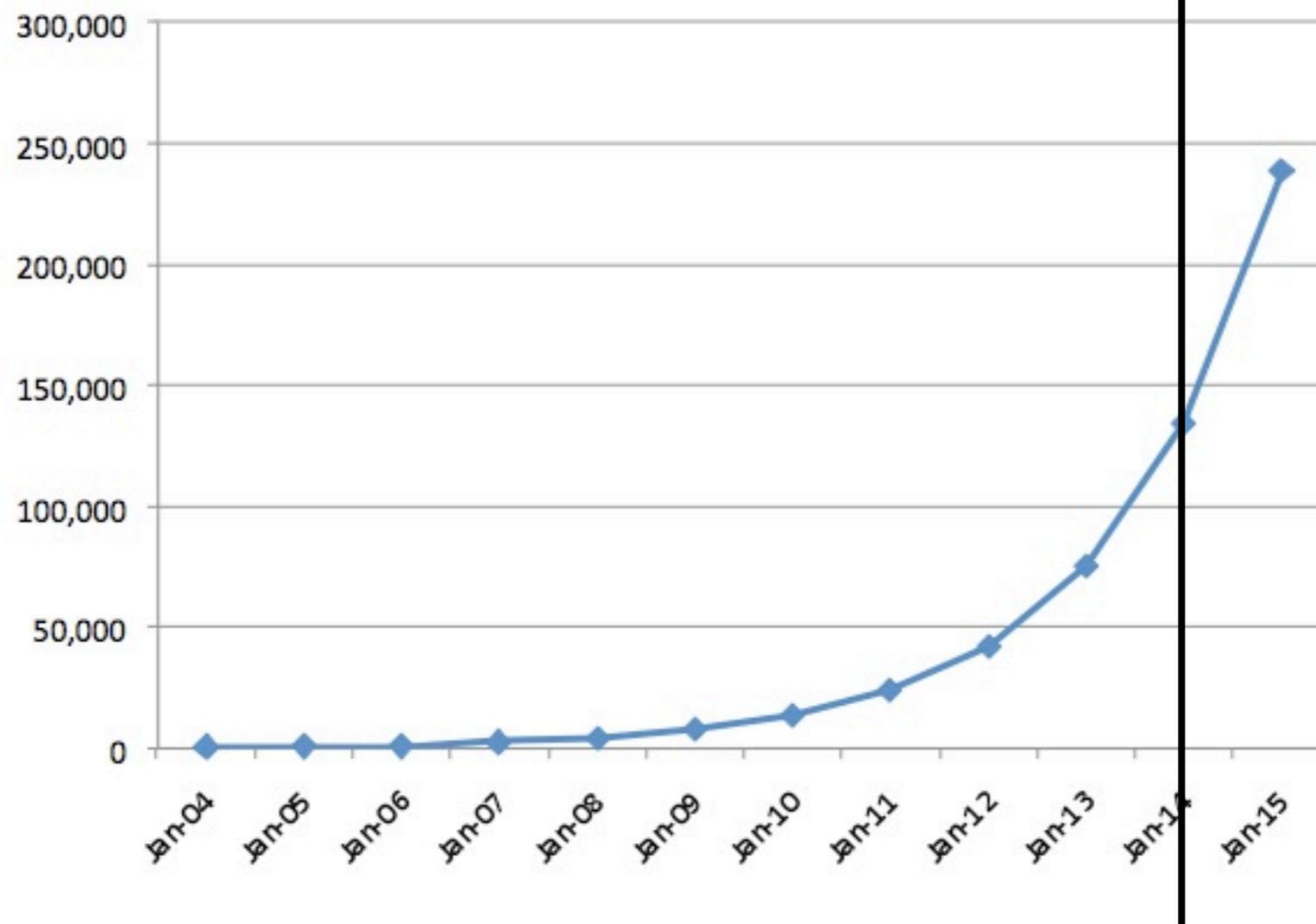
- We've long said that we haven't had one
- But we had one all along:
- End to end communication;
  - End to end .. Peer to peer
- Peer to peer is the killer app for IPv6

# IPv4

- IPv4 is going to stick around for client/server
- We know how to NAT client/server
- As we NAT more customers, we free up addresses
  - Those addresses go on servers
  - We 'never' run out of IPv4 for servers

# The Bet

- I'll buy a round at AusNOG if, in 5 years, there are any 'wide area' client/server services that are IPv6 only

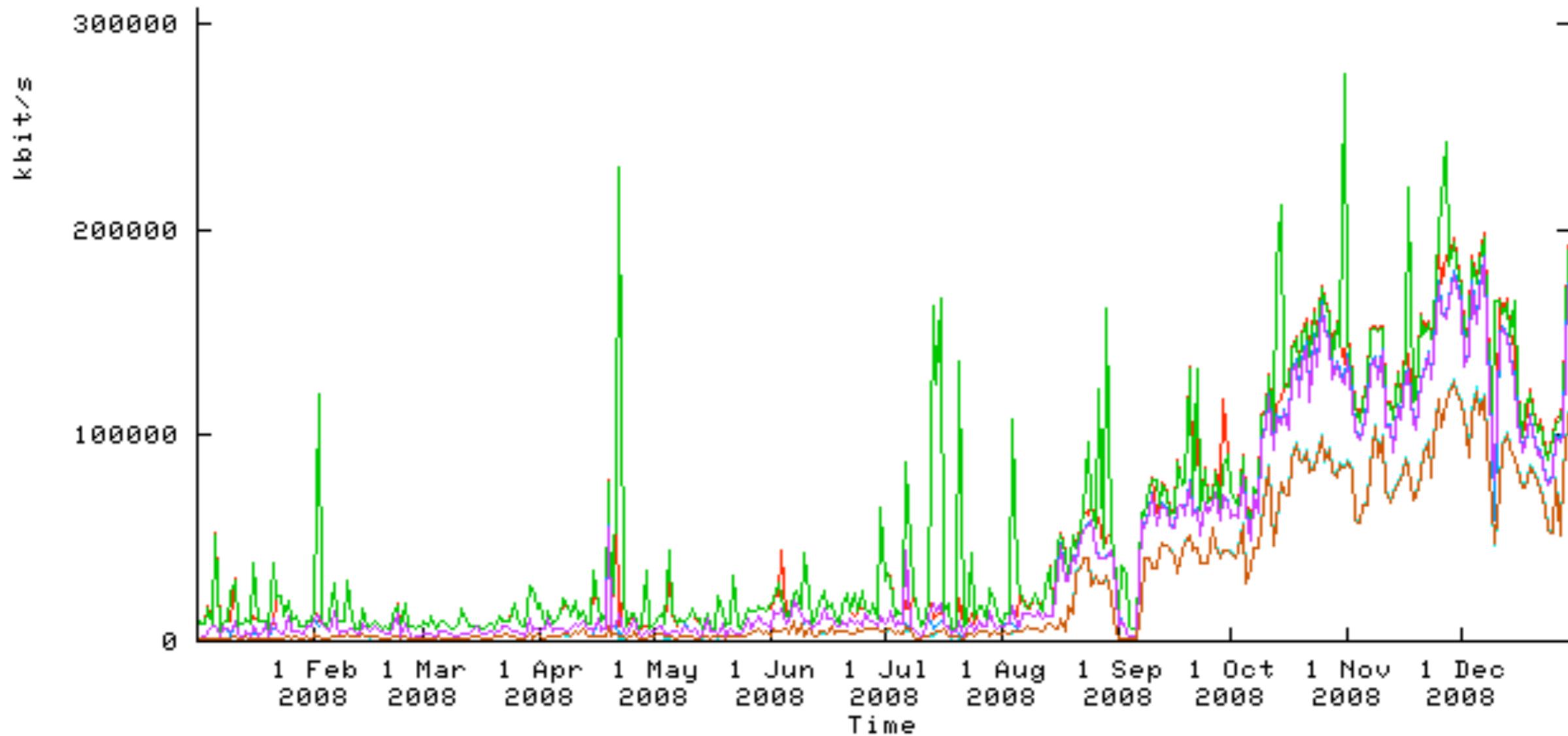


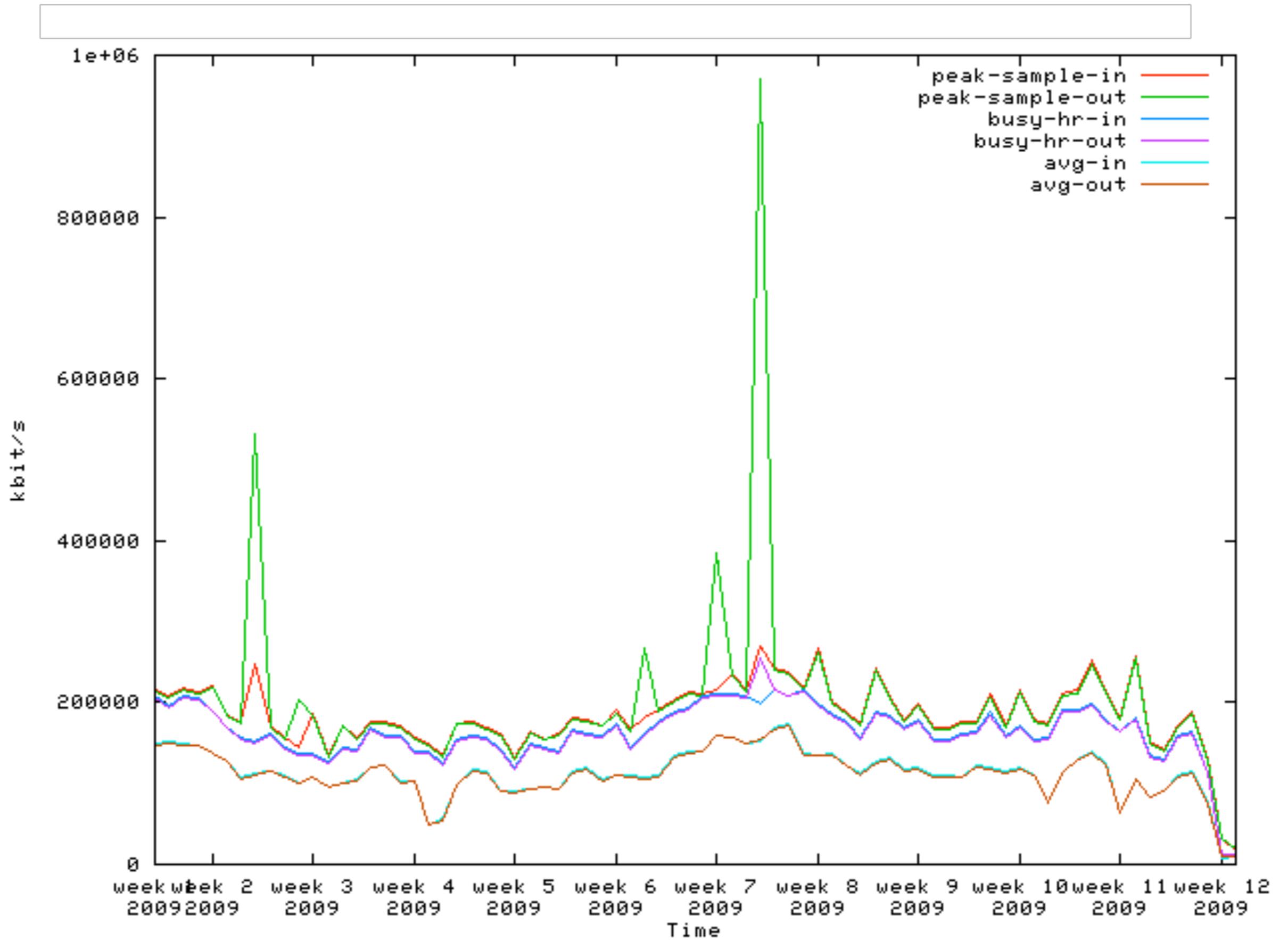
# Address+Port, DS Lite, etc.

- I don't see these things getting traction
- This stuff is useful for apps requiring end-to-end
- Apps need to be modified for this to work
- Bittorrent and hopefully soon other apps already do IPv6
  - And Teredo lets that happen from behind IPv4 NAT
- It's easier to modify apps to do IPv6 than IPv4+hacks
- Worse than CGN

- The IPv6 roll out already happened
- Vista, Windows 7, etc.
- First big user:
  - Peer to peer

# Scary Graph





# Teredo and 6to4

- IPv6 Tunnelling mechanisms
- Widely supported - Windows, Linux, BSDs, OS X
- Enabled by default in Vista
  - Enable-able in XP(SP2+)
- Teredo for people behind IPv4 NAT
- 6to4 for people with no IPv4 NAT, or with ability to run 6to4 on NAT device

# Peer to Peer

- Bittorrent
  - Ignored and avoided by providers for a long time
  - DHT - tracker IPv6 support not required
  - Azureus and uTorrent DHT not compatible

# Azureus

- IPv6 support - for 2.5 years at least
- Enabled by default
- Can be disabled
- Automatically updates itself - IPv6 support widely deployed
- Does not do Teredo on Windows. Fine on Linux.
  - 6to4 etc. are OK on both.

# Azureus

- Peers exchanged with trackers
  - Few trackers support this - piratebay does though?
- Peers exchanged with DHT

# uTorrent

- IPv6 support - as of August 2008
- Enabled by default
- Automatic updates - IPv6 widely deployed
- DOES Teredo on Windows
  - Beta versions enabled Teredo on XP(SP2+) on install
  - Release, you have to push a button
  - Always does it on Vista, no way to disable

# uTorrent

- Peers exchanged with PEX
- Peers exchanged with trackers

# Counting packets

- 3 instances of Azureus on Linux hosts
  - IPv4
  - IPv6 6to4
  - IPv6 Teredo
- IPv4 addresses were used only for this experiment
  - Teredo and 6to4 addresses based off these IPv4 address

# DHT Numbers

per interface on my end

	Packets	Hosts	Bidir	Out Only	In Only
IPv4	121073	26722	18804	7894	24
6to4	75111	11139	6484	4647	8
Teredo	30514	3805	2006	809	990 (16)

Teredo was not able to ping 974 IPv6 hosts, so we could not send packets (!)

# DHT Numbers

per IP address on remote end

	Packets	Hosts	Bidir	Out Only	In Only
IPv4	121073	26722	18803	7894	24
6to4	93638	11899	6846	4539	513
Teredo	1498	288	146	141	0
Other v6	10489	1130	681	21	428

Again, the Teredo ping problem impacts the in-only number

# Teredo Relay Software

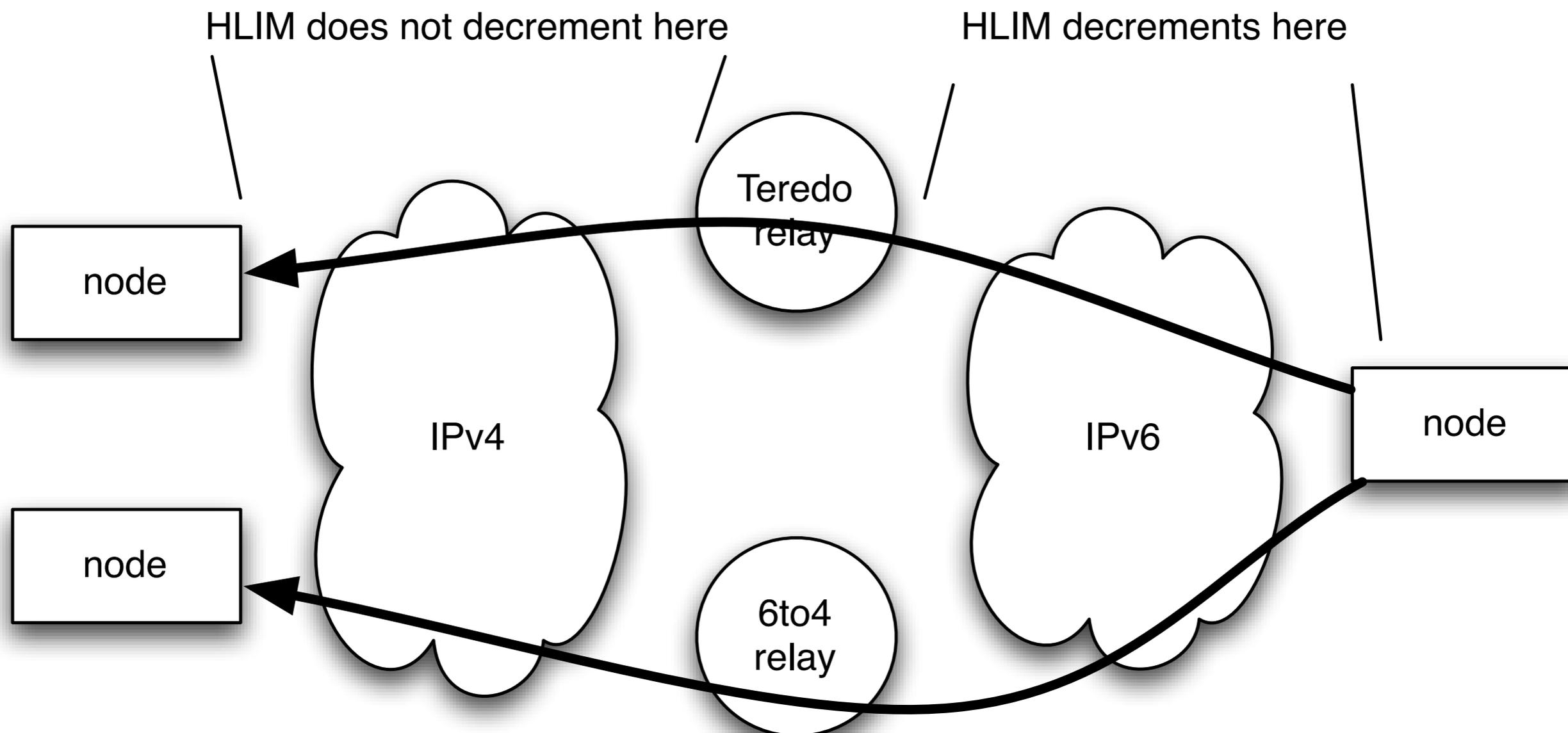
- One can detect the relay software fairly easily
- Look at UDP/IPv4 encapsulation source port
- Miredo uses port 3545 by default for all packets to/from a Teredo relay
- Window uses other ports

# Teredo Health

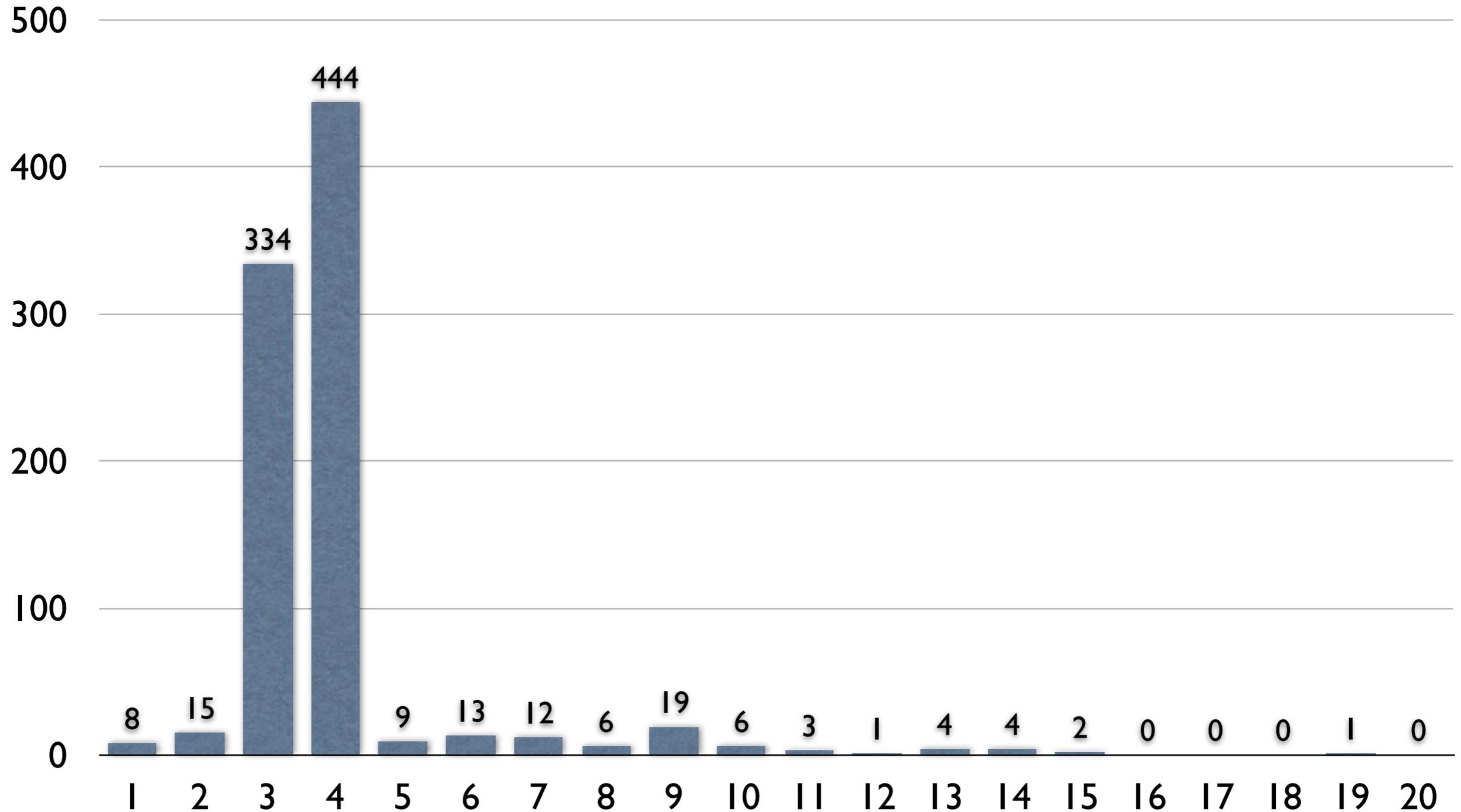
- Teredo requires ICMPv6 Echo request (ping), or it won't work
- Failure looks like a time out
  - End users call it 'slow'
- Get routes for 2001::/32
- Get your own Teredo relay

# 6to4 and Teredo Perf

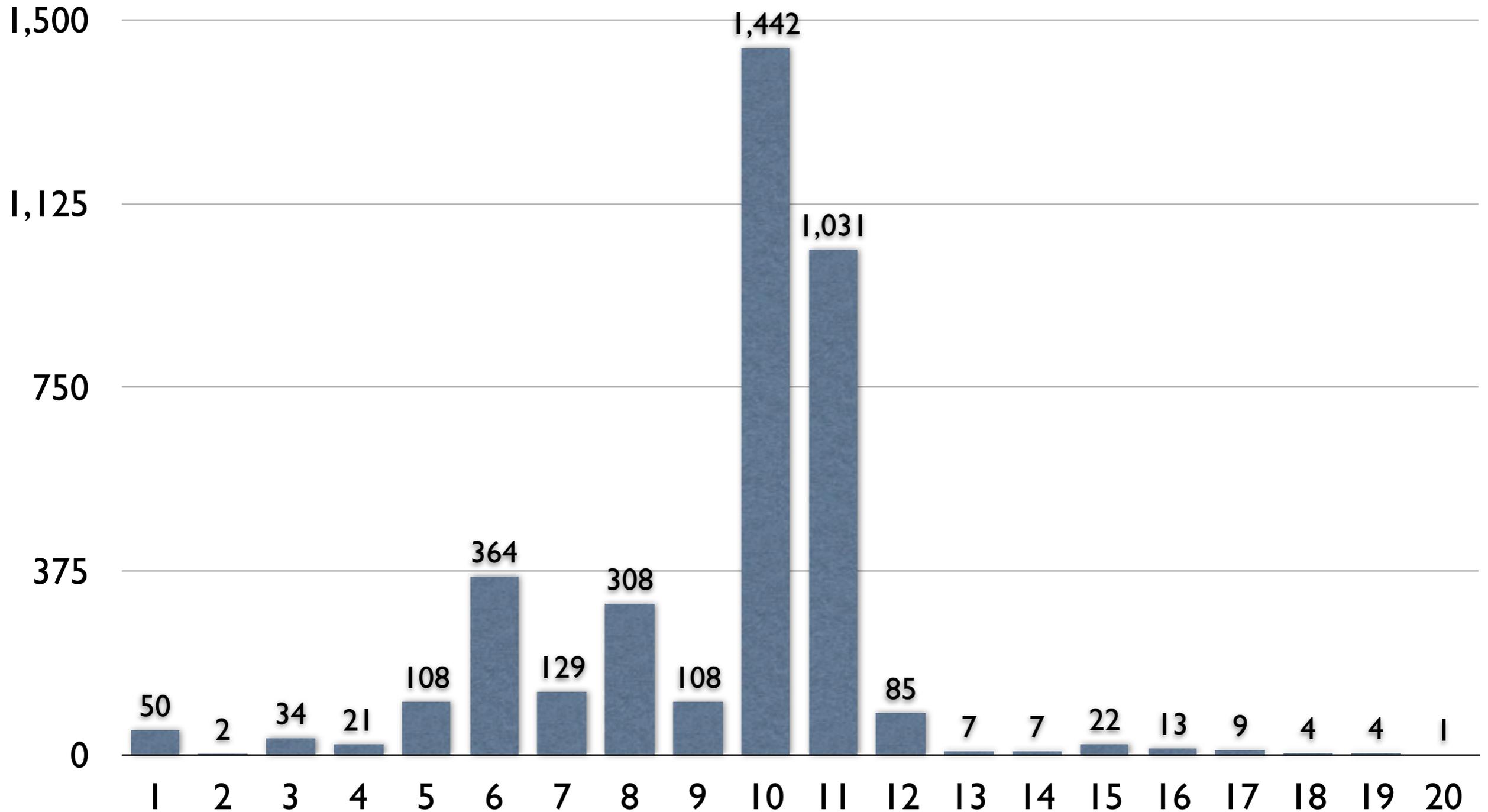
- Thousands of packets coming to me through Teredo and 6to4 relays
- Look at HLIM (TTL)
- Assume start HLIM is 128 if  $HLIM > 64$
- Assume start HLIM is 64 if  $HLIM < 64$
- Infer IPv6 hop distance to Teredo and 6to4 relays
- Lower distance is better
  - Teredo and 6to4 work best with short IPv6 path



# Native to 6to4 relay hops



# Native to Teredo relay hops



# P2P Community

- Very little discussion about uTorrent 1.8 and IPv6
- Some of the only discussion involves people in this room
- Users saying things like:
  - “IPv6 isn’t deployed, no one uses it”
  - “You need IPv6 enabled firewalls for this to work”

# Detecting Teredo

- Get some IPv4 flow capture
- Look for packets to 3544/UDP (Teredo control)
- Grab the source address and port
- Packets to/from that source address and port are Teredo

# Conclusions

- IPv6 is very real, today.
- Most IPv6 users don't even realise that it's going on.
  - ... and they're probably "power users"
- 6to4 relays are pretty good, in the IPv6 -> IPv4 direction
  - I cannot draw conclusions on the IPv4 -> IPv6 direction
- Teredo relays are terrible

# Tui

- A project that does lots of stuff
- Pre-packaged Teredo/6to4 relay software
- Free
- <http://www.braintrust.co.nz/>

# Recent Work

- In the past 10 days, I've done this with uTorrent
- uTorrent only exchanges IPv6 peer information with PEX and trackers
  - No DHT
- I had to run an actual torrent
  - Top TPB torrent's nfo file
- Still churning the data

# Future work

- I need to do this experiment periodically
- Open to more suggestions for evaluating 'quality', with a view toward a periodic evaluation

# ipv6wwtest

- Gives you data you can use when deciding to turn on AAAA on your website
- Javascript, 4/5 transparent |x|px display:none; GIFs.
- <http://www.braintrust.co.nz/ipv6wwtest/>
- Give me your data, please

- Wikipedia ran this on 1 in every 100 pages
  - Did you notice?
  - Also with PMTUD problem detection
- A few percent of people had problems
- Results differ for different sites, times of day, etc.
- Google use this trick as well, on [www.google.com](http://www.google.com), and got slightly different results

# Q&A