

Welcome to your IPv6 enabled transit network.

Whether you like it, or not.

- Rob Issac, August 2008

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

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 ..What's the difference?

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 18 months
- 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.

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

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 Data vs. Control

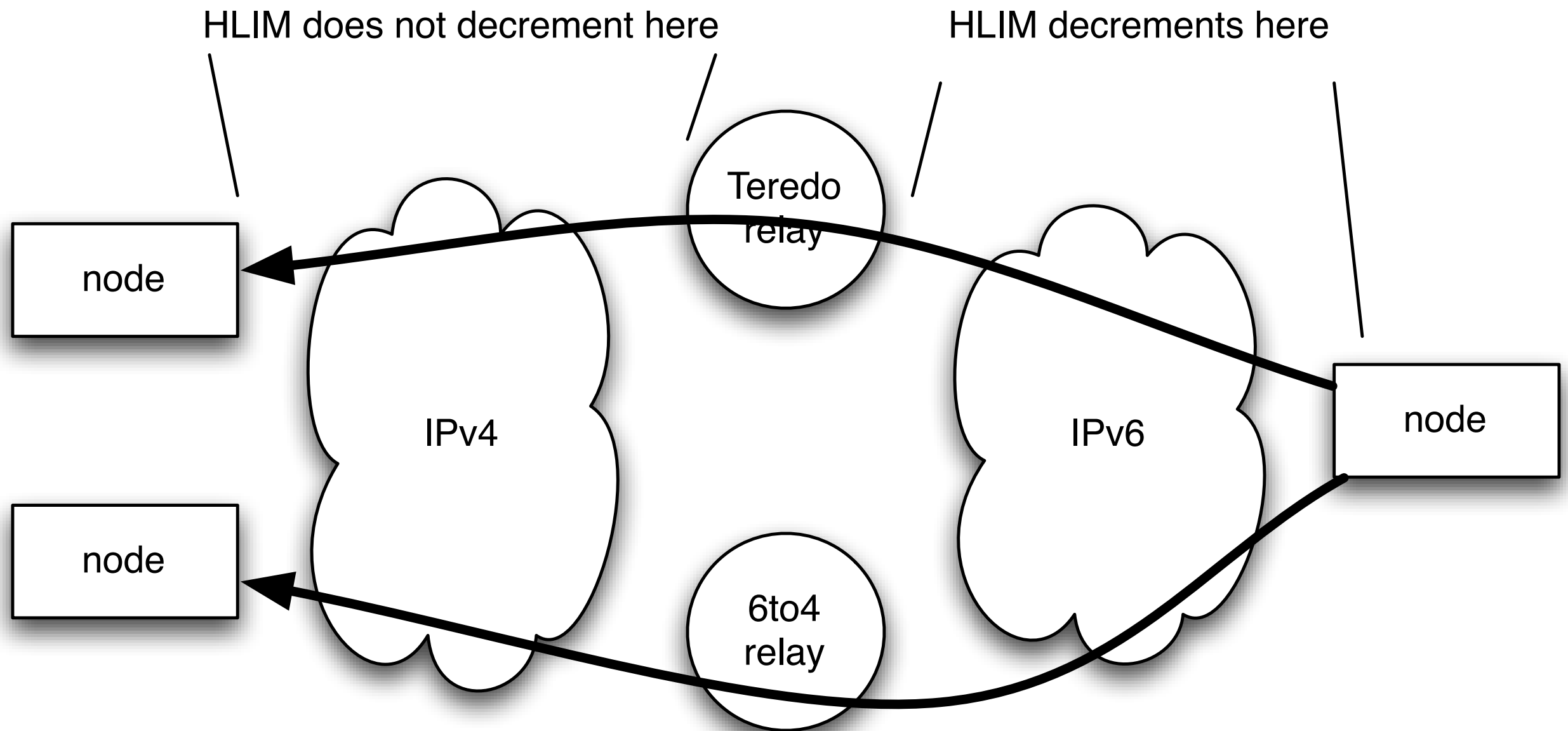
- Given n packets/bytes of Teredo payload, how much is data, how much is control?
- Easy to find out - count em
- This is not terribly useful as I am only doing DHT - no Bittorrent data
- results here plz

Teredo Health

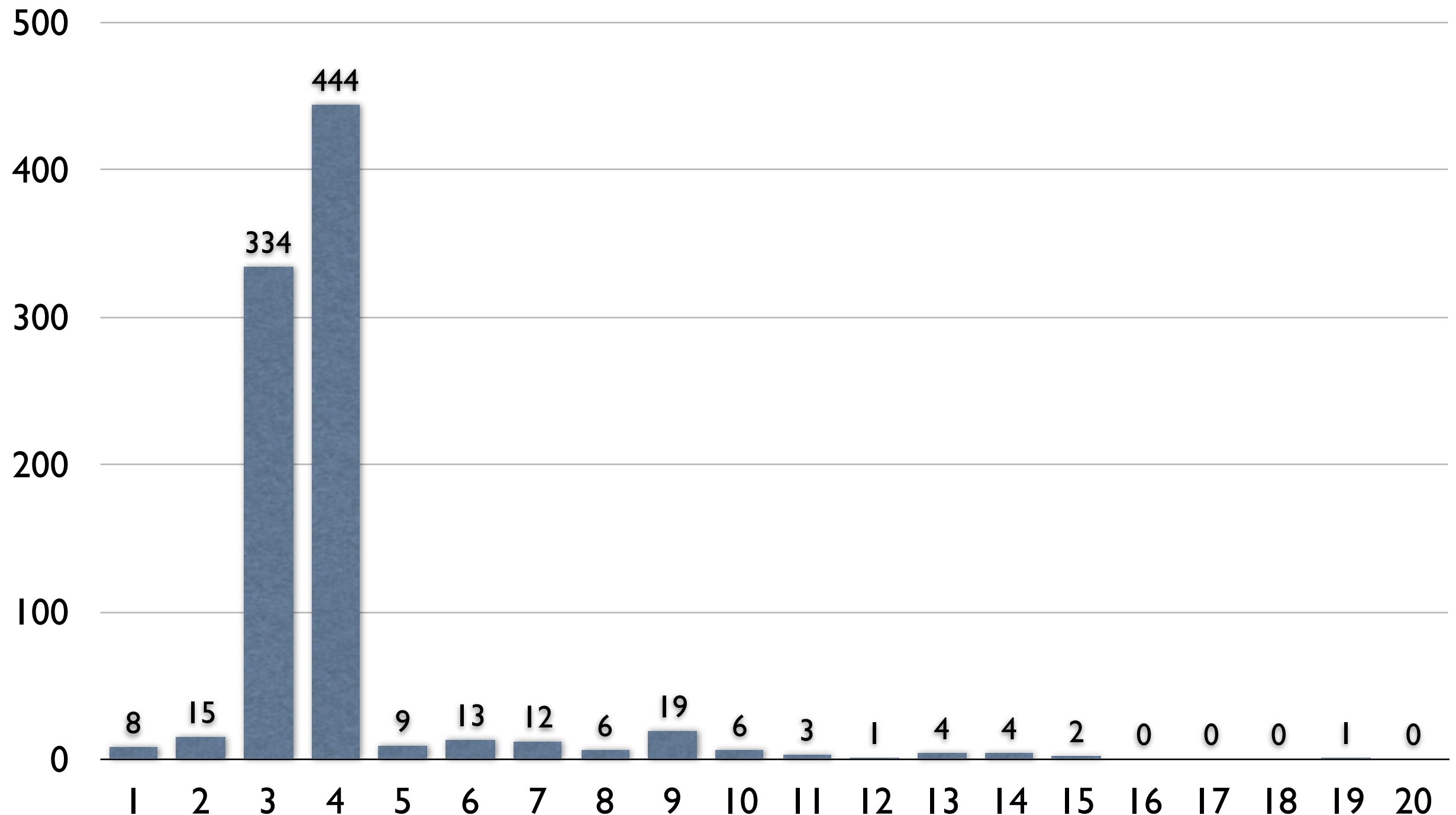
- Teredo requires ICMPv6 Echo request (ping), or it won't work
- Failure looks like a time out
 - End users call it 'slow'
- Get routes for 2001::/32
- Get your own Teredo relay

6to4 and Teredo Perf

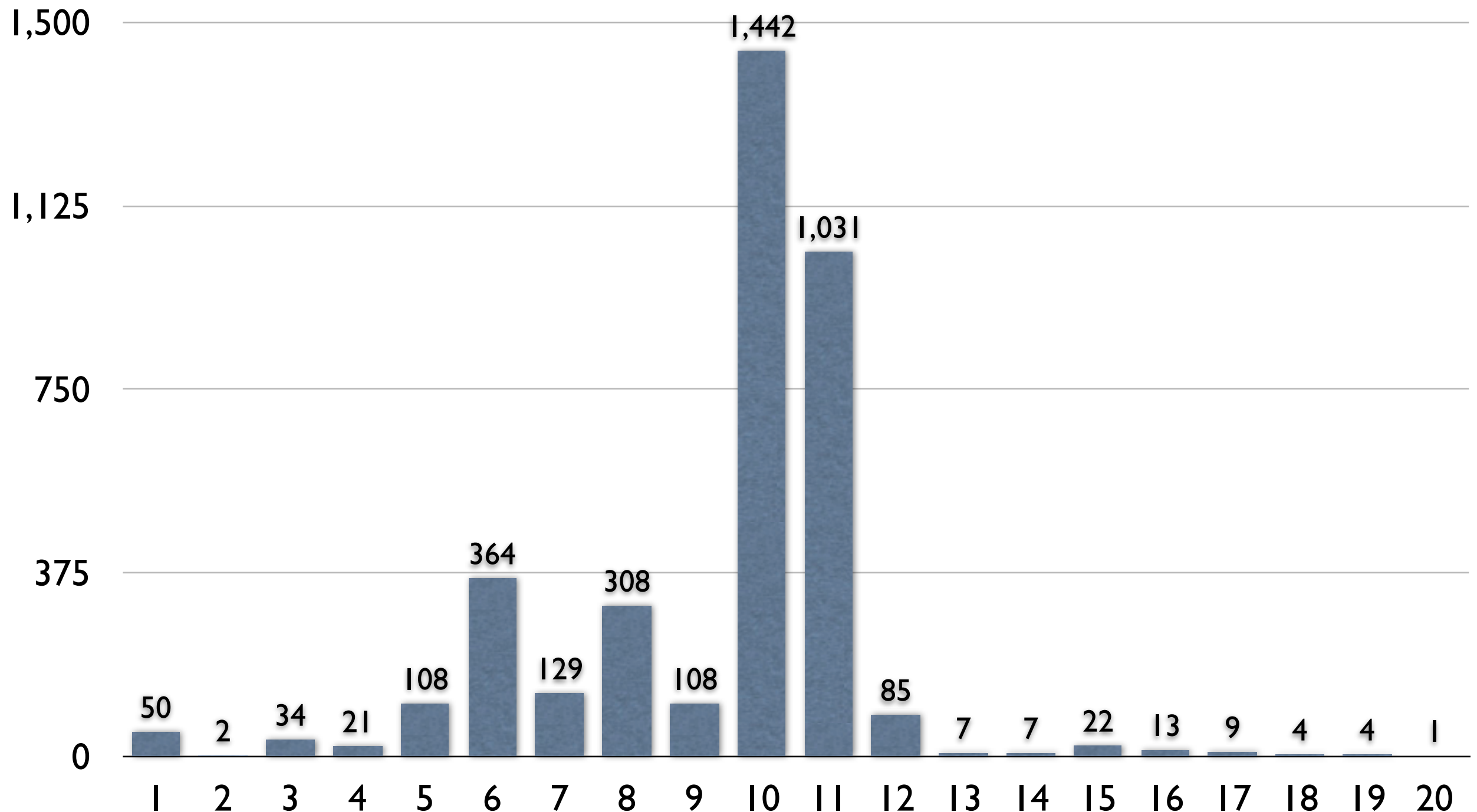
- Thousands of packets coming to me through Teredo and 6to4 relays
- Look at HLIM (TTL)
- Assume start HLIM is 128 if $HLIM > 64$
- Assume start HLIM is 64 if $HLIM < 64$
- Infer IPv6 hop distance to Teredo and 6to4 relays
- Lower distance is better
 - Teredo and 6to4 work best with short IPv6 path



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”

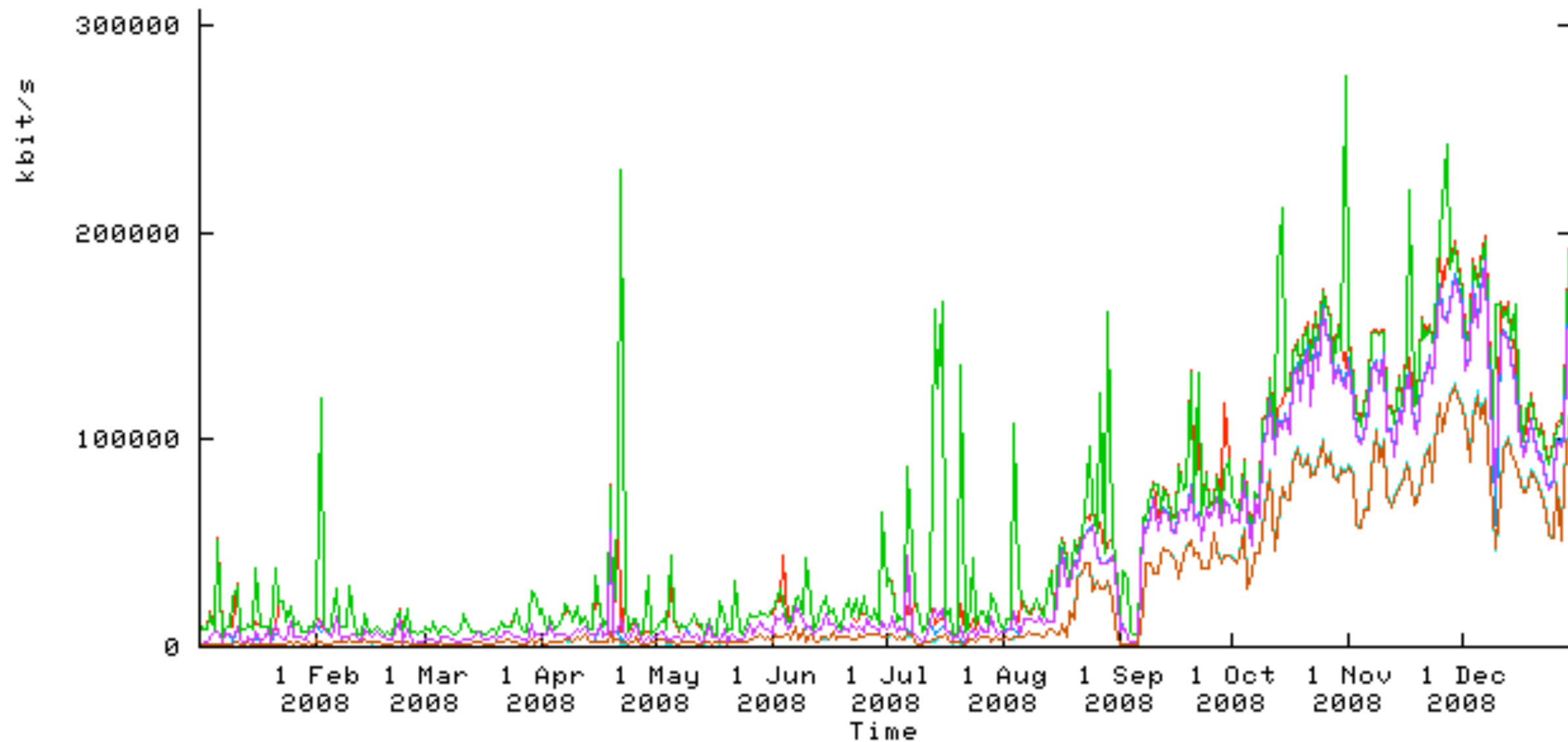
Detecting Teredo

- 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

Scary Graph



Future work

- I need to do this experiment with uTorrent
 - Some problems there, I'd need free bandwidth, and immunity from copyright prosecution..
- I need to do this experiment periodically - this is the second run
- Open to more suggestions for evaluating 'quality', with a view toward a periodic evaluation

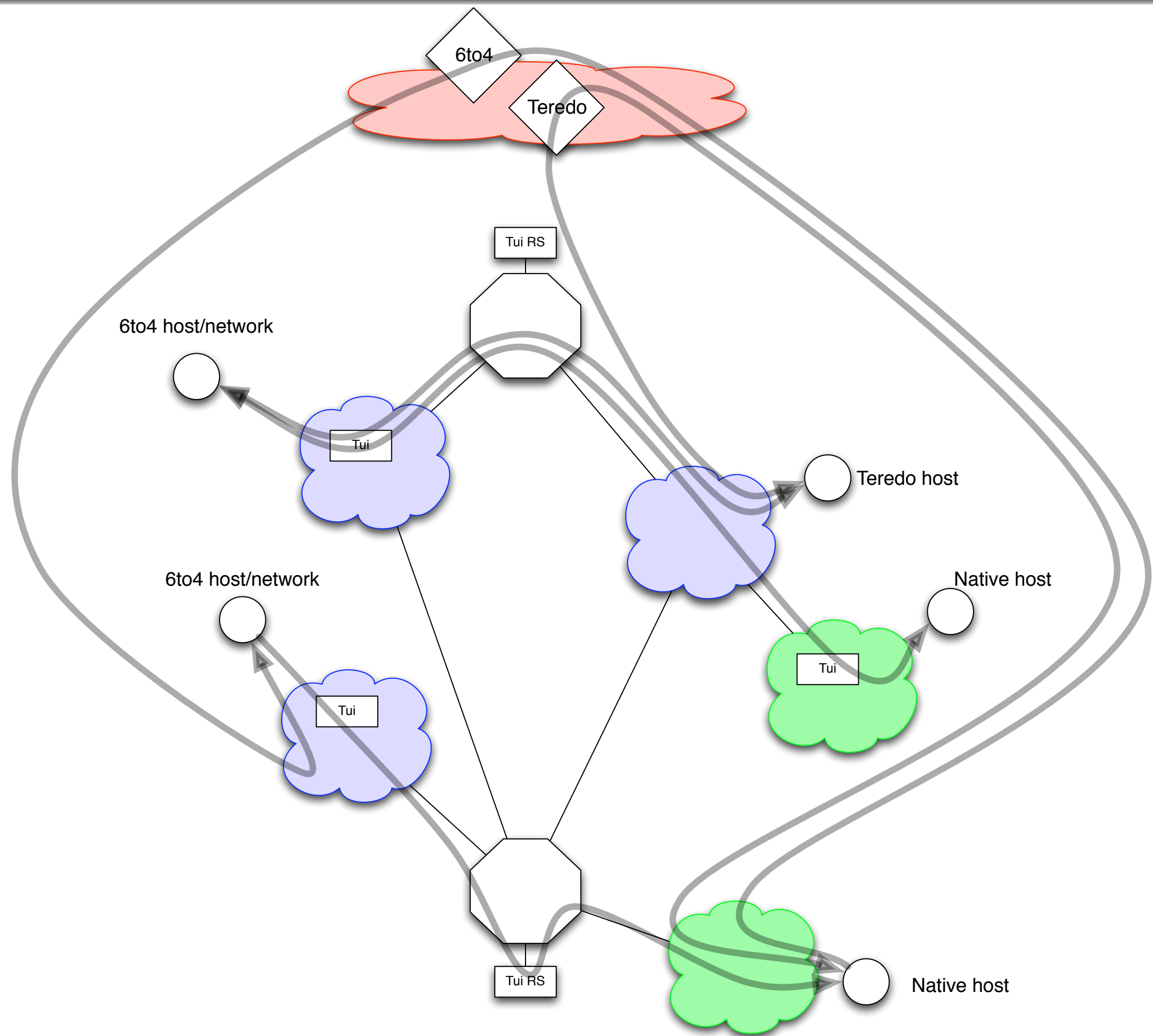
Tui

Teredo and 6to4 relay
IPv6 peering mesh



Overview

- FreeBSD based + other bits
- Runs on x86
- Supplied as free hardware - Soekris
- Teredo relay
- 6to4 relay
- IPv6 peering cloud over IPv4
- BGP with Quagga - part of your ASN



Relays

- Miredo for Teredo
- FreeBSD stf for 6to4

Peering Mesh

- Uses BGP over 6to4
- 2 central route servers ATM - one BGP session to each
- Route Servers do not alter next-hop
- 6to4 is not just for traffic to/from 2002::/16
- Actually a LISP-ALT implementation, unintentionally

6to4 Review

Ethernet II, Src: 3com_61:7b:2c (00:10:5a:61:7b:2c), Dst: Axxceler_0b:02:22 (00:c0:69:0b:02:22)
Internet Protocol, Src: 202.74.202.114 (202.74.202.114), Dst: 203.147.108.1 (203.147.108.1)

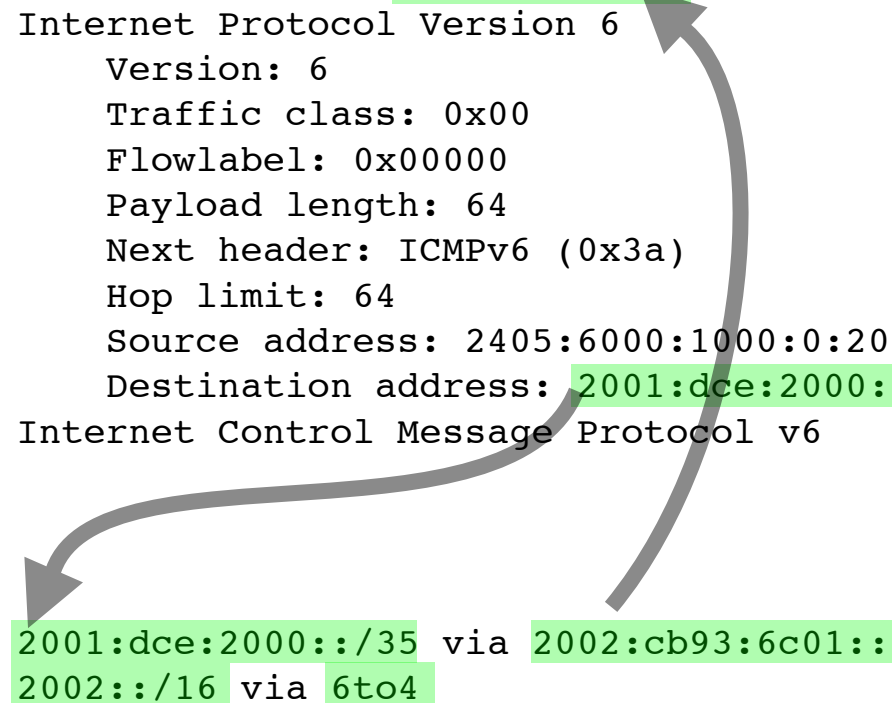
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
Total Length: 124
Identification: 0x0000 (0)
Flags: 0x04 (Don't Fragment)
Fragment offset: 0
Time to live: 64
Protocol: IPv6 (0x29)
Header checksum: 0x8242 [correct]
Source: 202.74.202.114 (202.74.202.114)
Destination: 203.147.108.1 (203.147.108.1)

Internet Protocol Version 6

Version: 6
Traffic class: 0x00
Flowlabel: 0x00000
Payload length: 64
Next header: ICMPv6 (0x3a)
Hop limit: 64
Source address: 2405:6000:1000:0:204:76ff:fef8:4338 (2405:6000:1000:0:204:76ff:fef8:4338)
Destination address: 2001:dce:2000:2::130 (2001:dce:2000:2::130)

Internet Control Message Protocol v6

2001:dce:2000::/35 via 2002:cb93:6c01::
2002::/16 via 6to4



Progress

- About 8 nodes in NZ right now
- Some on soekris hardware, some on 'normal' hardware or VMWare
- 2 x route servers in NZ - at two biggest peering exchanges
- Two Cisco peers on the mesh - works fine