Welcome to your IPv6 enabled transit network.

Whether you like it, or not.

- Rob Issac, 2 weeks ago

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 12 months

  - Enabled by default

- Automatically updates itself - IPv6 support widely deployed

- Does not do Teredo on Windows. Fine on Linux.

  - 6to4 etc. OK on both.

uTorrent

- IPv6 support - as of 2 weeks ago

  - 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

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 this 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

Making things up

- Most hosts I talk to can't do Azureus on Teredo, only 6to4 or native IPv6

- Teredo is for hosts behind v4 NAT, 6to4 doesn't work

- Lets say 5% of end user hosts are **not** behind v4 NAT

- That 5% is known: 11,899

- Therefore 100% is 237,980

- Compared to 26,722 IPv4 hosts
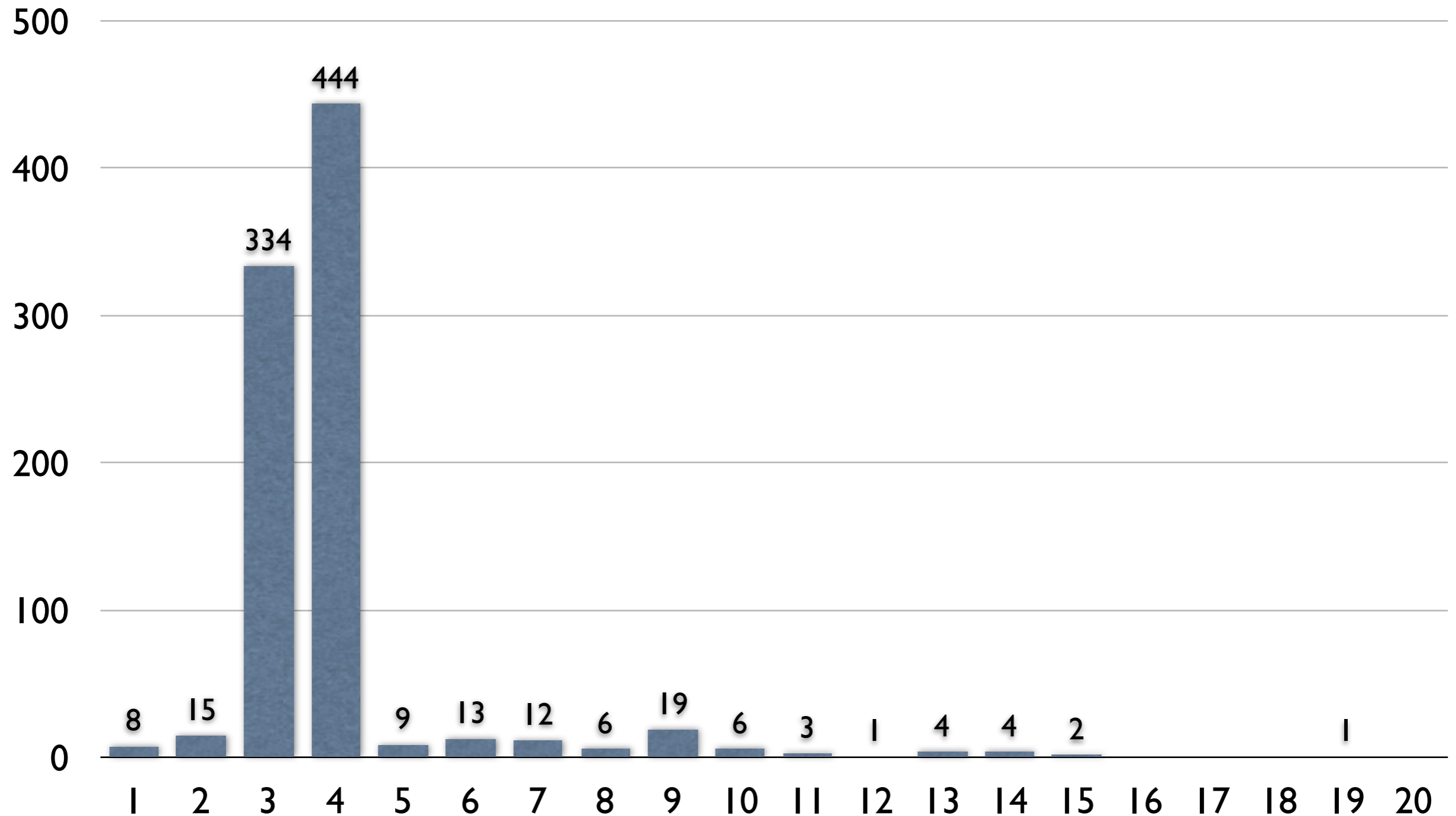
Teredo Health

- 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
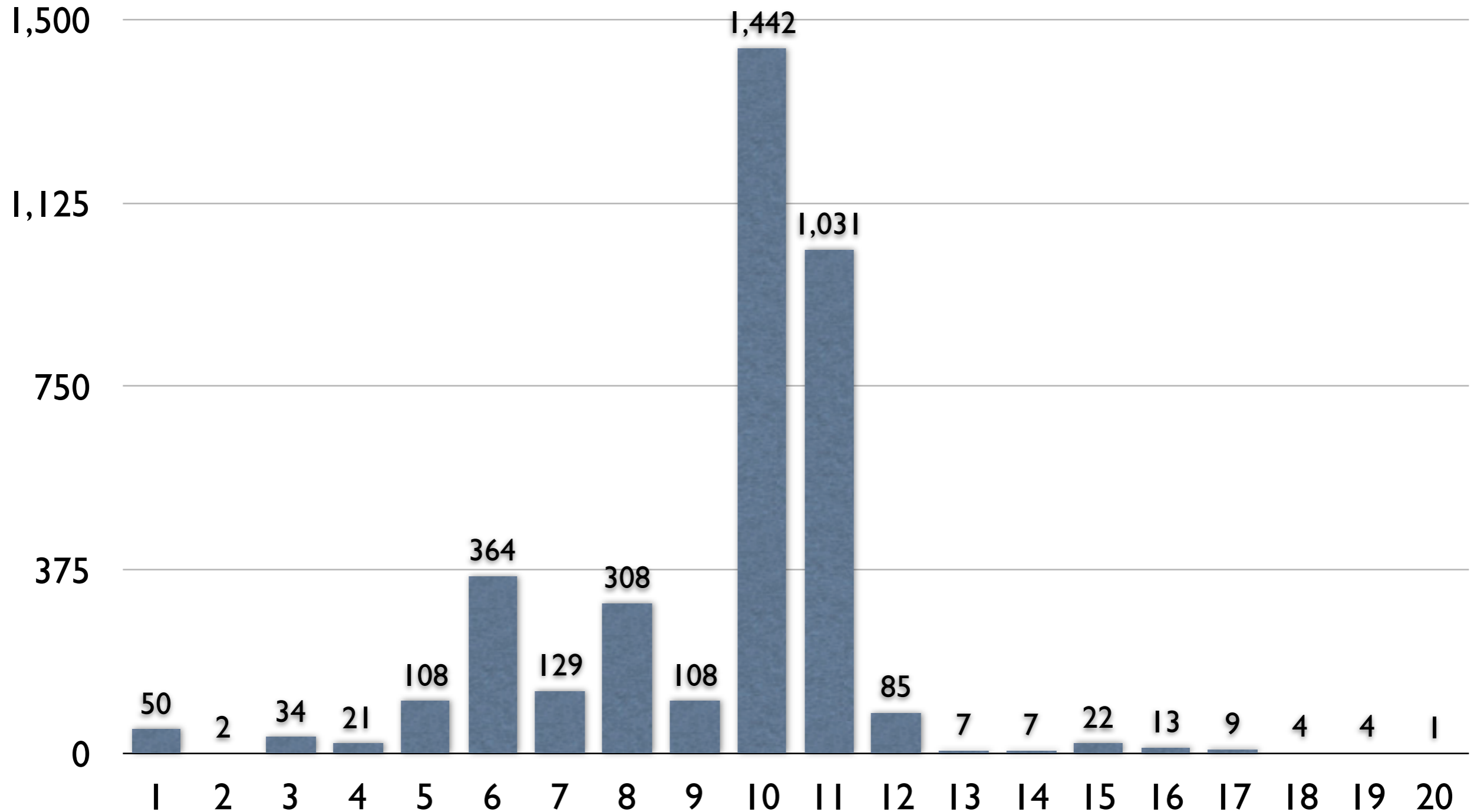
- Get your own Teredo relay

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

HLIM does not decrement here

HLIM decrements here

node

Teredo relay

IPv4

IPv6

node

node
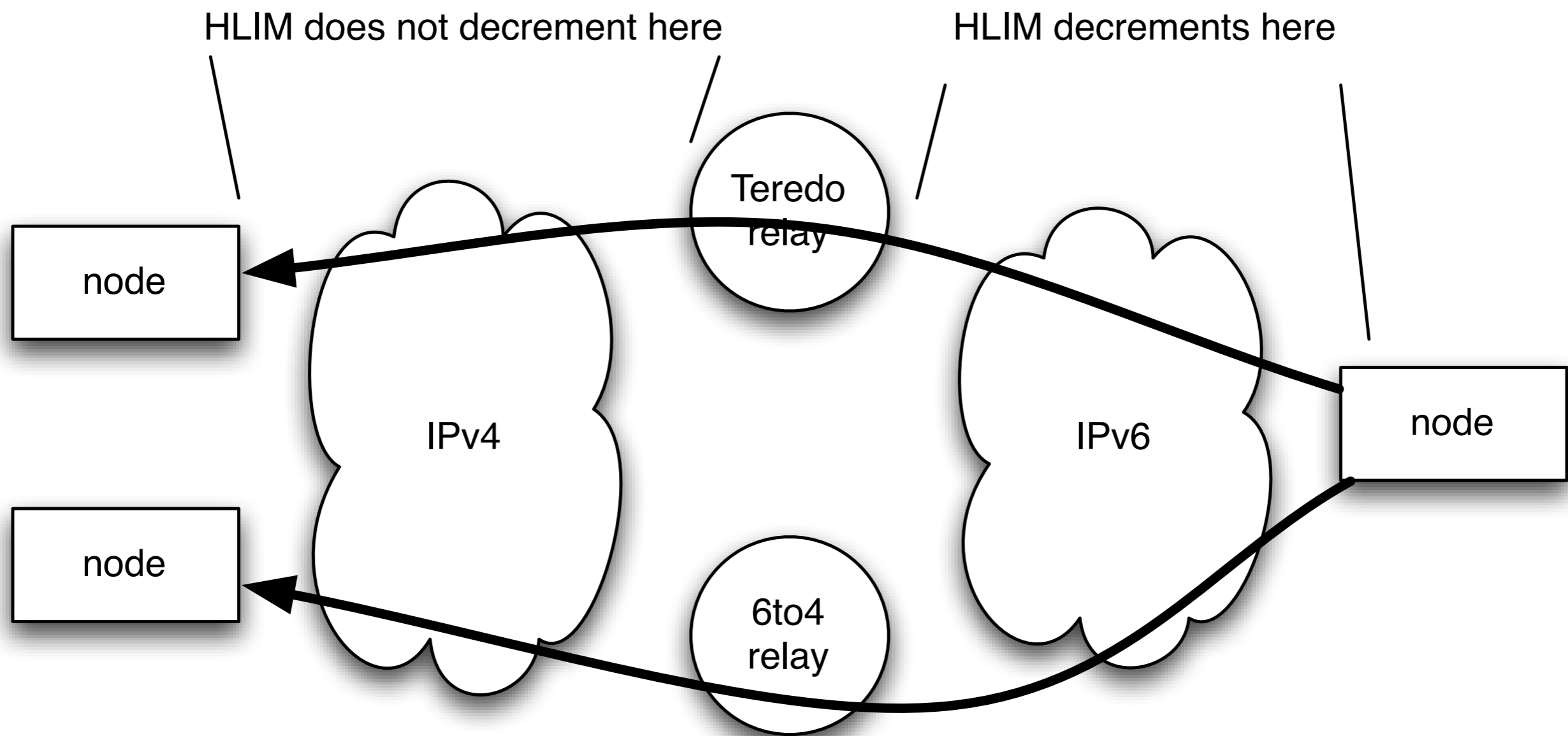
6to4 relay

Native to 6to4 relay dist

Native to Teredo relay dist

P2P Community

- Very little discussion about uTorrent 1.8 and IPv6

- Users saying things like:

  - "IPv6 isn't deployed, no one uses it"

  - "You need IPv6 enabled firewalls for this to work"

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

- Teredo relays are terrible

Future work

- I need to do this experiment with uTorrent

- I need to do this experiment periodically

- Open to more suggestions for evaluating 'quality', with a view toward a periodic evaluation