



IPv6 Traffic Levels on Hurricane Electric's backbone

APRICOT 2009

February 23rd – Manila, Philippines

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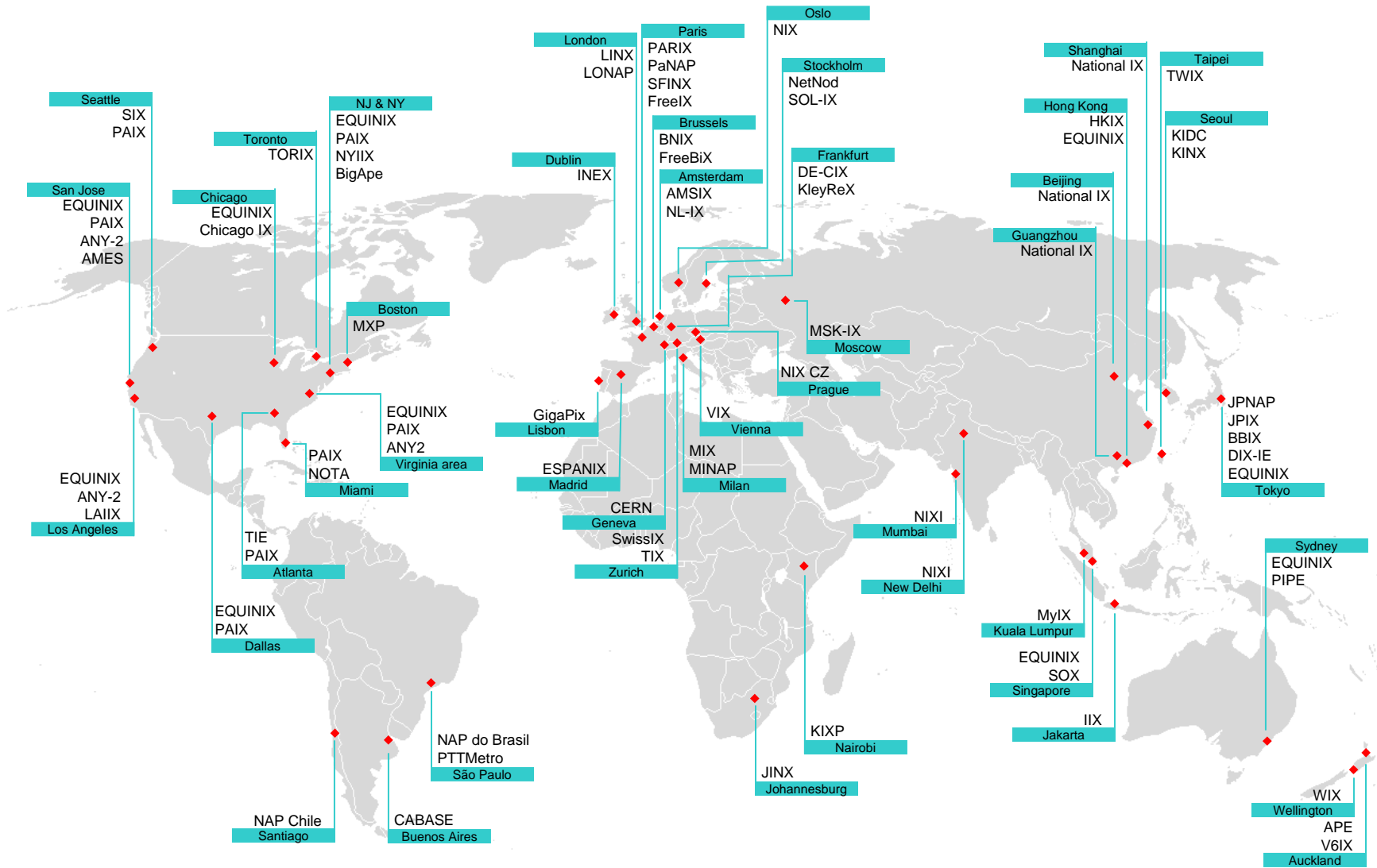
Hurricane Electric

Hurricane Electric – Talk Outline

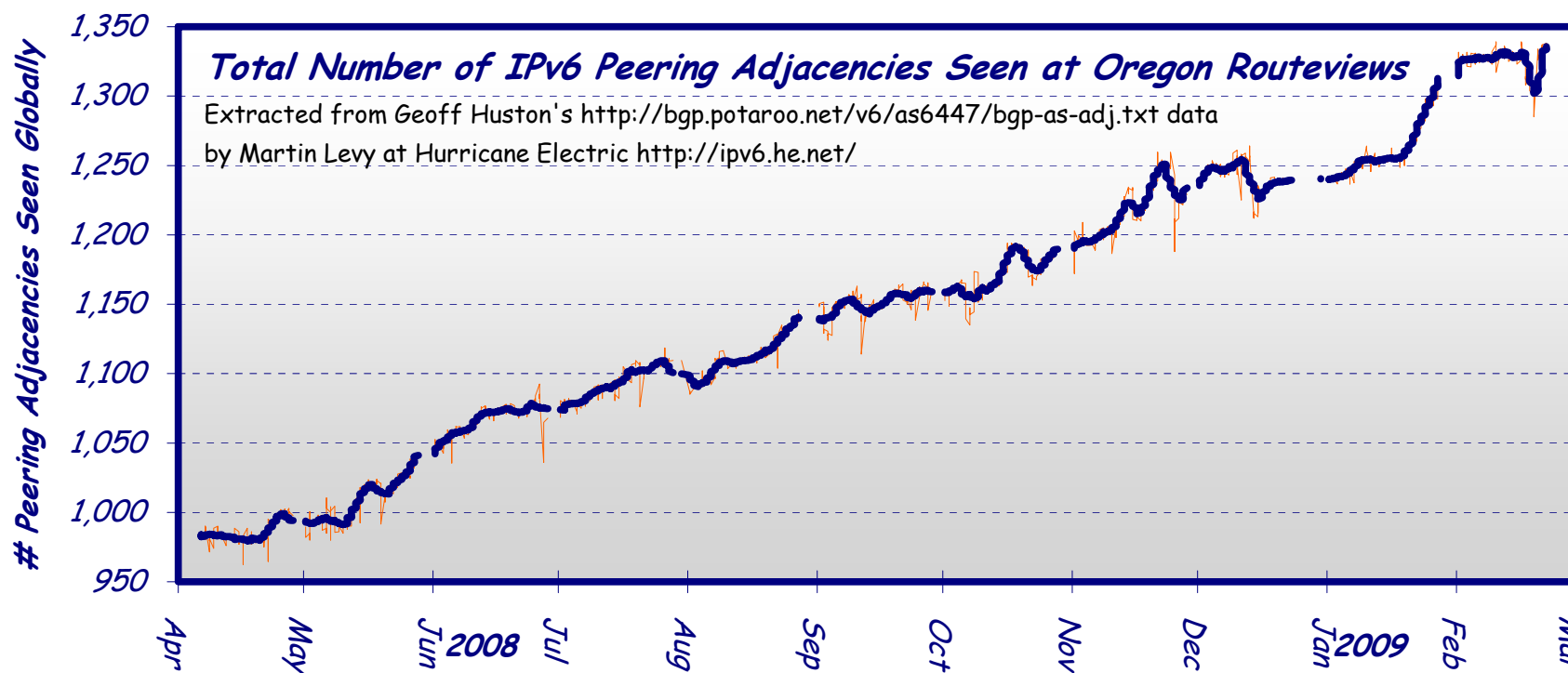
- IPv6 Peering
 - This is not news – there is lots of IPv6 peering
- Hurricane Electric traffic levels
 - Review of high-level view of IPv6 traffic
- Q: Does it matter what the traffic levels are?
 - Is there a better measure of IPv6's existence?



IPv6 at peering exchanges



IPv6 at peering exchanges



- IPv6 Peering
 - Is there any? (Hint: The answer is yes)
 - Hurricane Electric has 400+ IPv6 BGP neighbors



IPv6 at peering points

- IPv6 Peering successes
 - NAP's & IX's that promote IPv6 on home page
 - NAP's & IX's that realize they are just layer-2
 - NAP's & IX's that configure correctly reverse-DNS
 - PeeringDB shows IPv6 in use

- IPv6 Peering mistakes
 - Single port (dual stack) vs. dual ports
 - IPv6 addressing patterns for backbones
 - See Roque Gagliano's IX best-practices document
 - <http://tools.ietf.org/html/draft-rgaglian-v6ops-v6inixp-00>
 - Charging for IPv6 address allocation (Huh?)

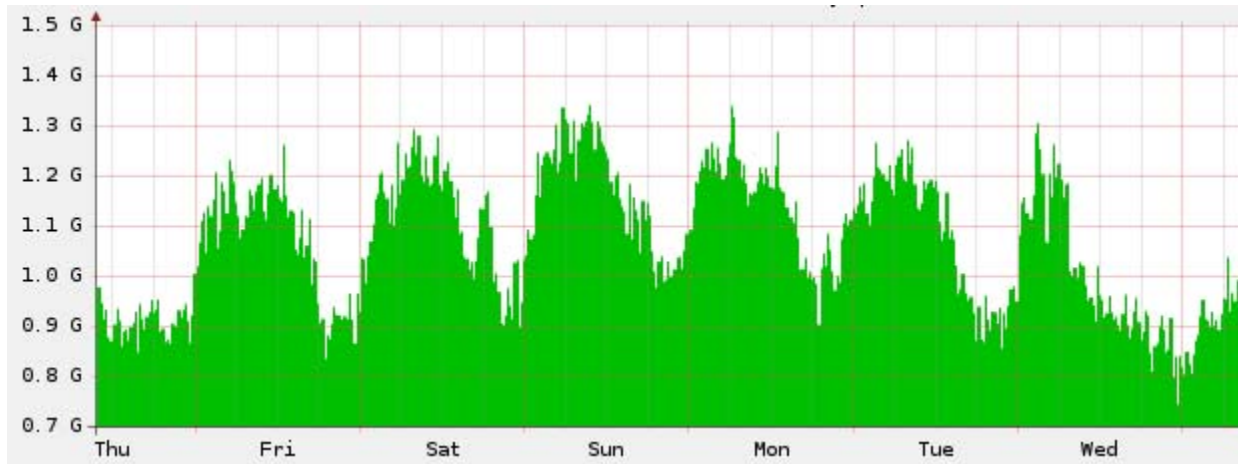


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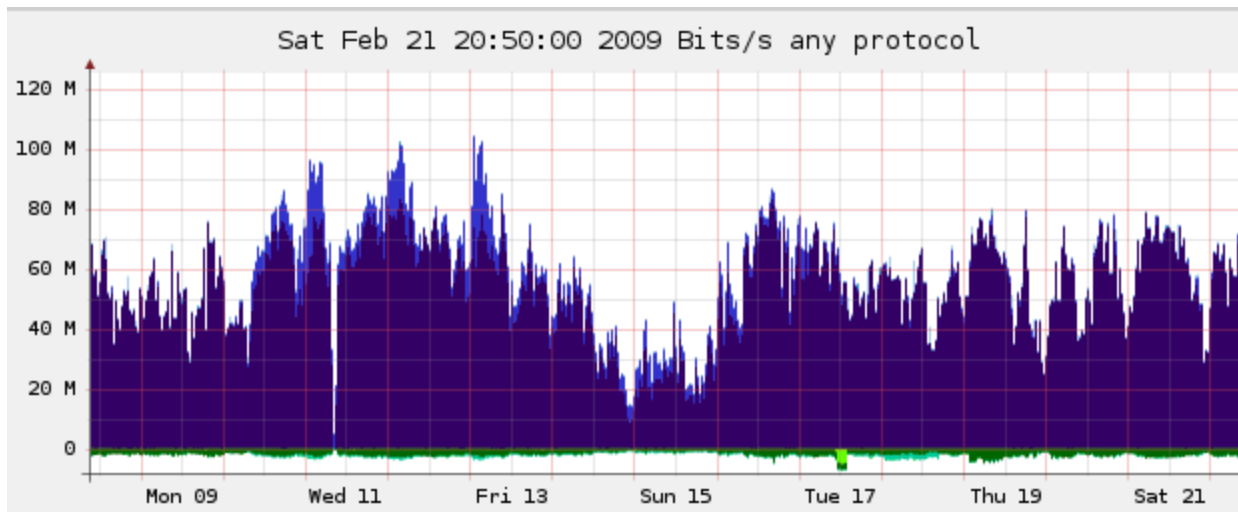
IPv6 Traffic



Hurricane Electric stats – overall IPv6 traffic



Overall IPv6 traffic



Sample IPv6 Peering Traffic
(summed globally)

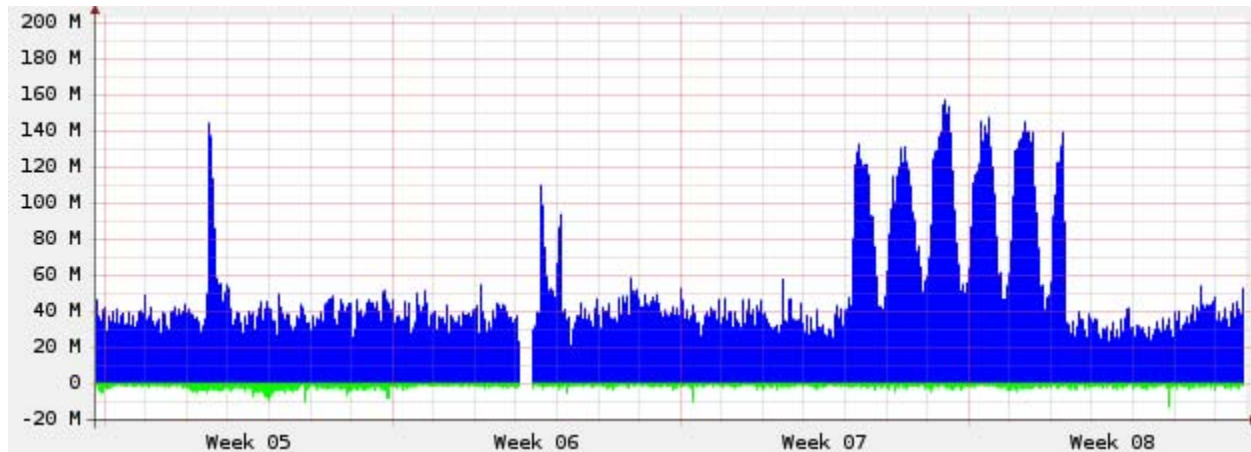


Hurricane Electric stats – IPv6 vs. IPv4 traffic

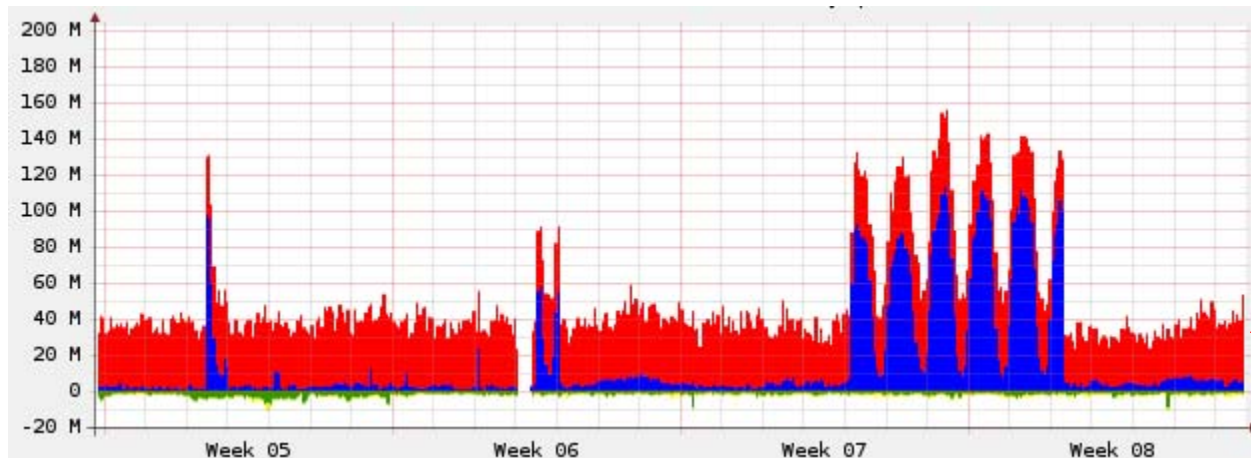


- IPv6 traffic levels don't relate to IPv4 traffic levels
 - Different customer base
 - Different traffic flows
- This will change – they will converge

Hurricane Electric stats – IPv6 peering traffic



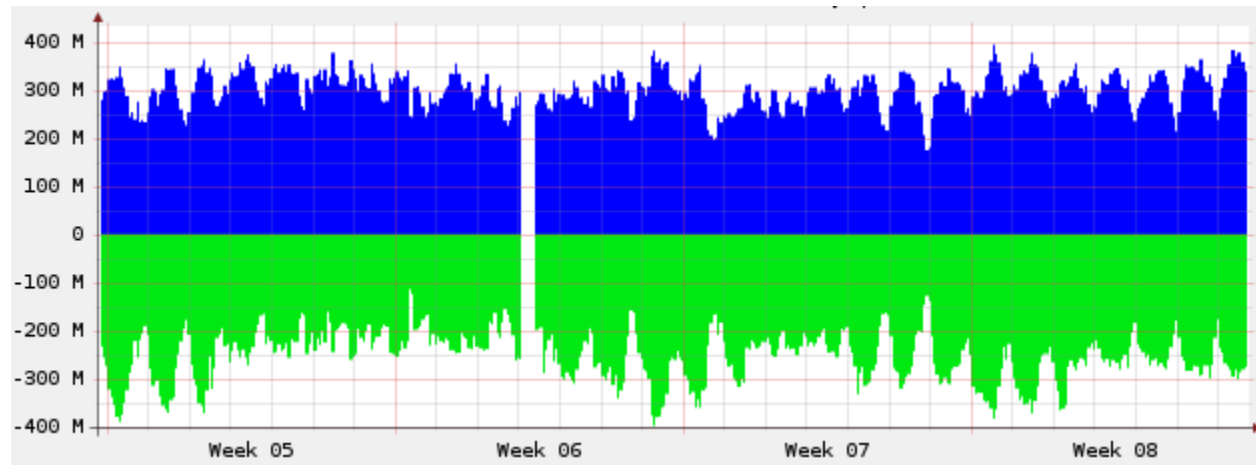
LINX IPv6 peering



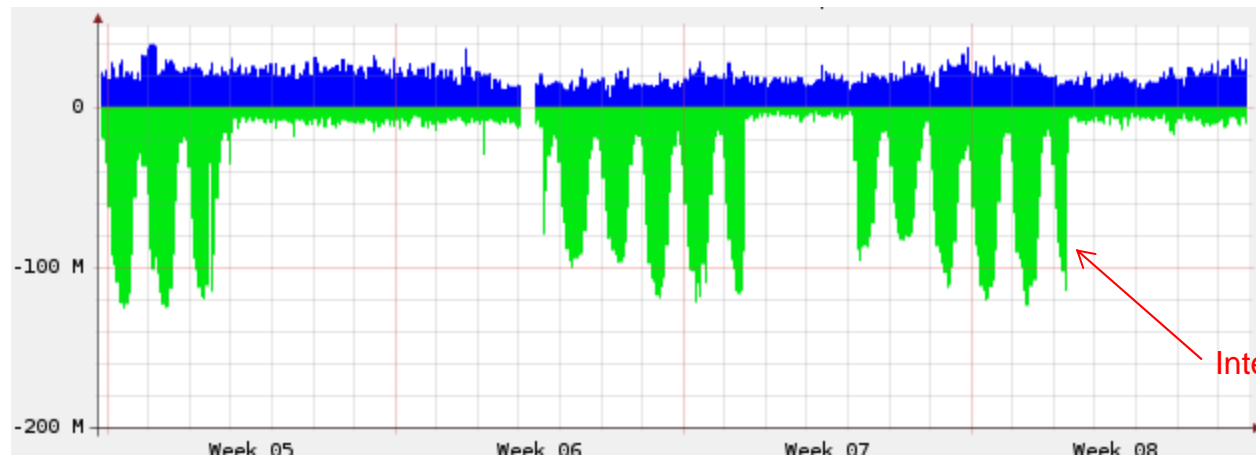
2002::/16



Hurricane Electric stats – IPv6 peering traffic



AMSIX IPv6 peering

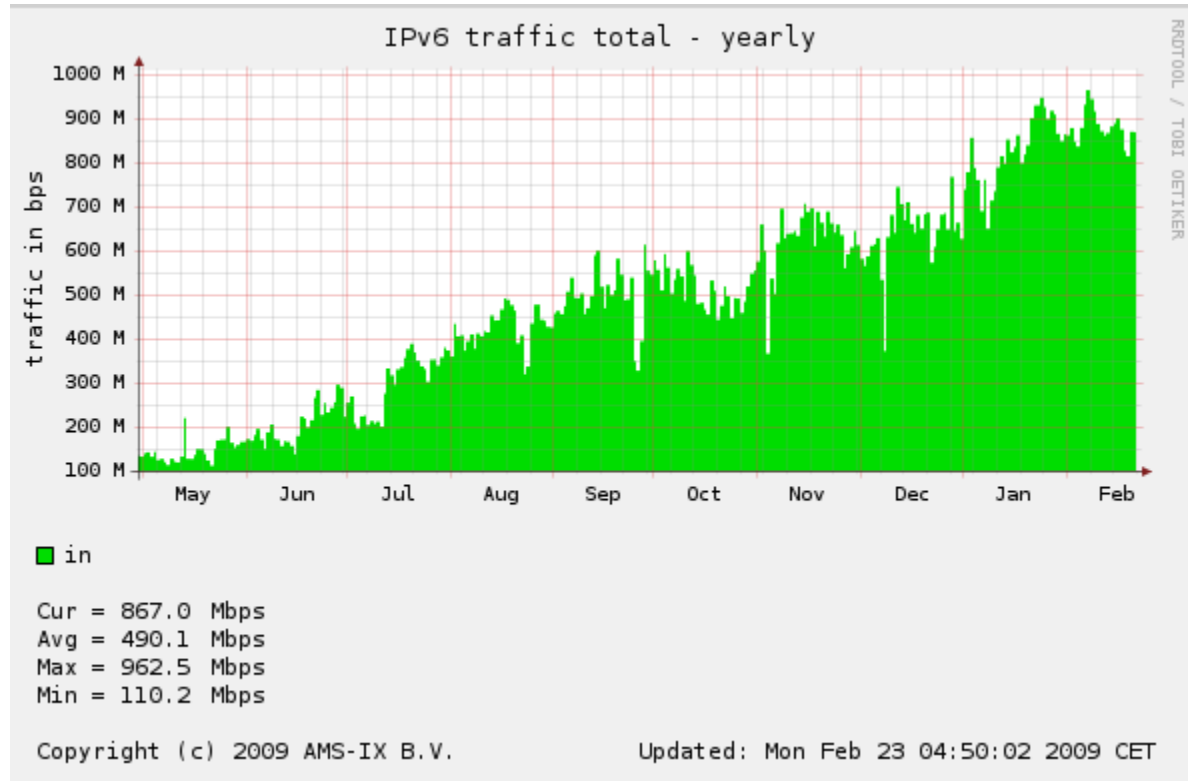


AMSIX IPv6 peering
(UDP traffic)

Interesting customer traffic



Hurricane Electric stats – IPv6 @ AMS-IX



Total AMSIX IPv6 traffic

<http://www.ams-ix.net/technical/stats/sflow/?type=ipv6>



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IPv6 6to4 *

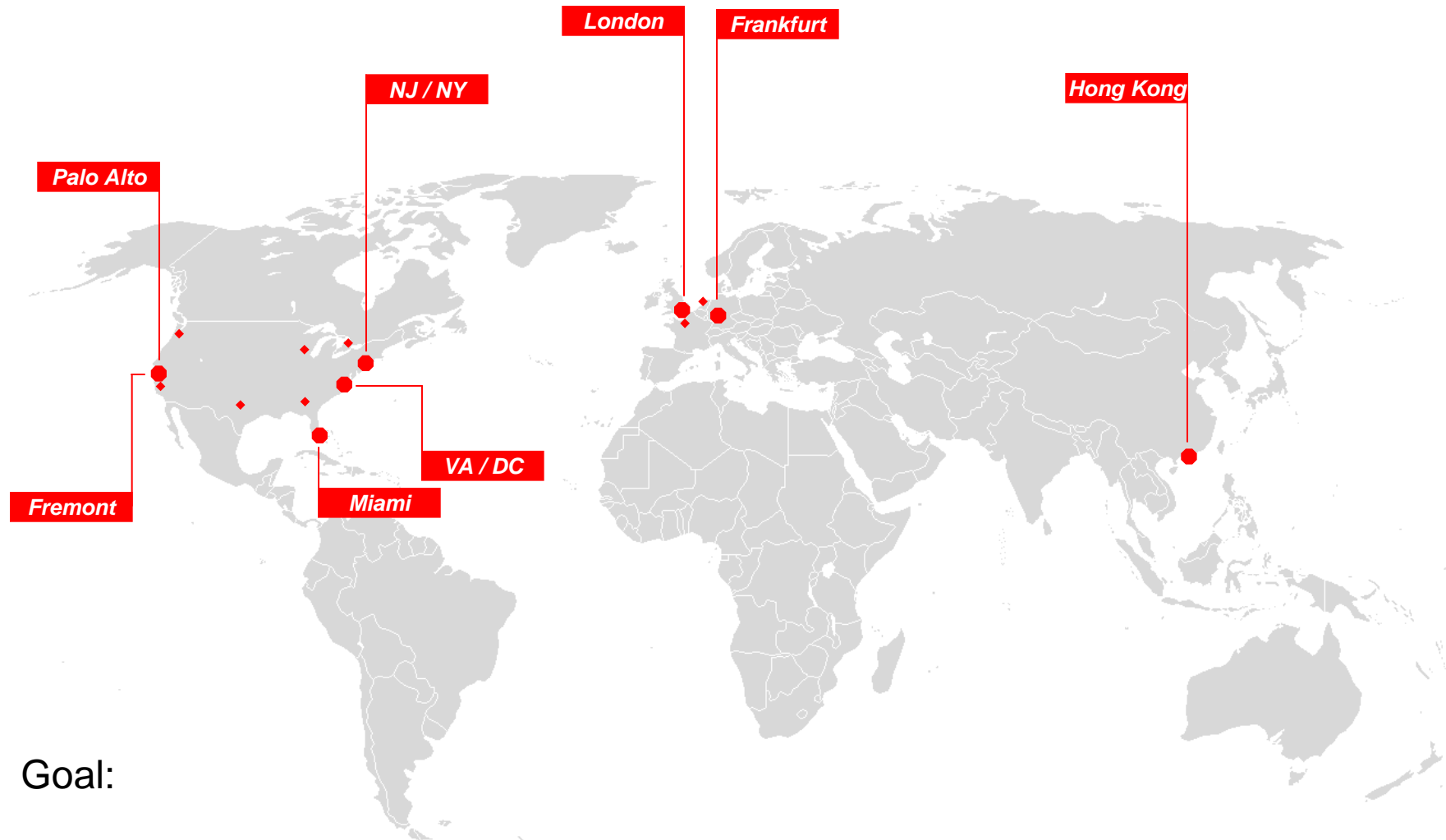
** 6to4 (sometimes written 6 to 4) is a system that allows IPv6 packets to be transmitted over an IPv4 network (generally the IPv4 internet) without the need to configure explicit tunnels. Routing conventions are also in place that allow 6to4 hosts to communicate with hosts on the IPv6 internet. It is typically used when an end-site or end-user wants to connect to the IPv6 Internet using their existing IPv4 connection.*

From Wikipedia, the free encyclopedia <http://en.wikipedia.org/wiki/6to4>

Or read RFC3056 at <http://tools.ietf.org/html/rfc3056>



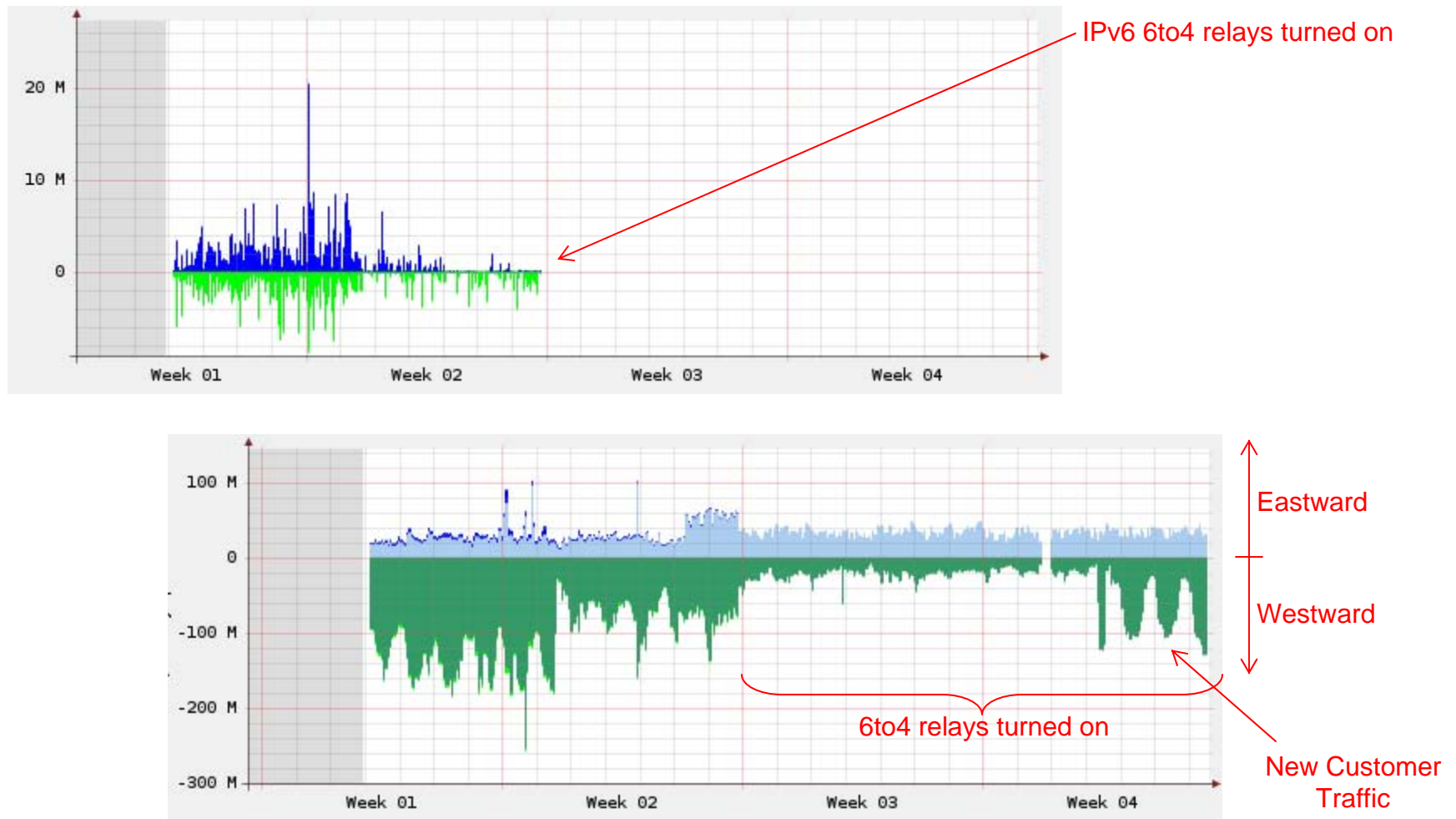
Hurricane Electric 6to4 Relay Deployment



Goal:

Localize 6to4 traffic (2002::/16 & 192.88.99.1/32 via anycast routing)

Hurricane Electric 6to4 traffic



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IPv6 Teredo *

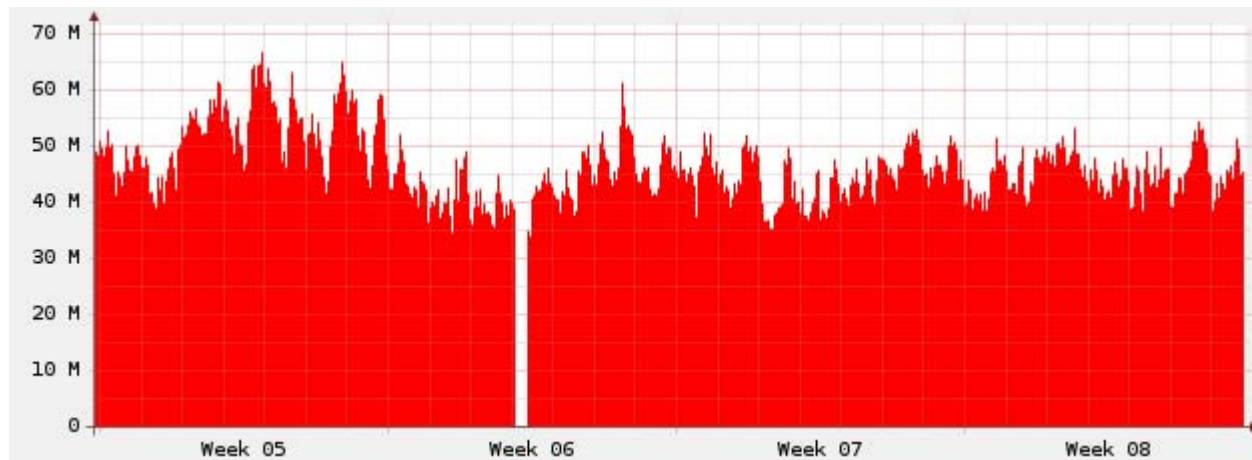
** Teredo is a tunneling protocol designed to grant IPv6 connectivity to nodes that are located behind IPv6-unaware NAT devices. It defines a way of encapsulating IPv6 packets within IPv4 UDP datagrams that can be routed through NAT devices and on the IPv4 internet.*

From Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Teredo_tunneling

Or read RFC4380 at <http://tools.ietf.org/html/rfc4380>



Hurricane Electric – Teredo traffic



- Traffic is all eastward across the Atlantic
 - Flows towards teredo.bit.nl AS12859 over AMS-IX
 - See <http://teredo.bit.nl/> for graphs (270+ Mbps processed)
 - 2001::/32 announce by other networks including:
 - AS12637 (Seeweb), AS1257 (Tele2), etc.

IPv6 Qualitative Viewpoint



IPv6 – less quantitative and more qualitative

■ IPv6 readiness on a backbone

- Does a backbone have IPv6 enabled?
- Are domains served by IPv6 DNS servers
- Do the basic services operate on v4 & v6?

RFC5156 says:

2.2. IPv4-Mapped Addresses

::FFFF:0:0/96 are the IPv4-mapped addresses [RFC4291]. Addresses within this block should not appear on the public Internet.

2.3. IPv4-Compatible Addresses

::<ipv4-address>/96 are the IPv4-compatible addresses [RFC4291]. These addresses are deprecated and should not appear on the public Internet.

Count of IPv6 addresses within .COM domain (Queries on 78,630,991 Domains to find AAAA records)

Measured on Jan 18, 2009

Address	Notes	18/01/09	23/01/09	13/02/09
::ffff:0:0/96	v4-mapped	95,292	96,801	107,729
2000::/3	unicast	42,759	43,448	46,233
::	unspecified	16,177	16,266	17,038
::/96	v4-compatible	884	895	912
2002::/16	6to4	562	569	641
::1	localhost	447	455	614
invalid	invalid	105	102	111
3ffe::/16	6bone	93	98	101
fe80::/10	link-local	35	36	40
fec0::/10	site-local	1	1	1
2001::/32	teredo	2	1	
fc00::/7	ULA	1	1	1
Total IPv6		156,358	158,673	173,421
Total usable IPv6		43,323	44,018	46,874



IPv6 – less quantitative and more qualitative

- IPv6 readiness when there's lots of traffic
 - Is preferring IPv6 over IPv4 the right thing?
 - Usenet traffic via IPv6 is 1:1 replacement for IPv4

- So, does it really matter which protocol used?
 - Cooperative applications with IPv6 enabled can still use IPv4 (even if both ends are IPv4 & IPv6 enabled)

- IPv6 traffic levels increasing
 - Increase in backbone peering & interconnection more important



Q&A



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