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IPv6 Traffic Levels on  
Hurricane Electric's backbone

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NANOG 45 – 27<sup>th</sup> January 2009  
*Santo Domingo, Dominican Republic*

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Hurricane Electric

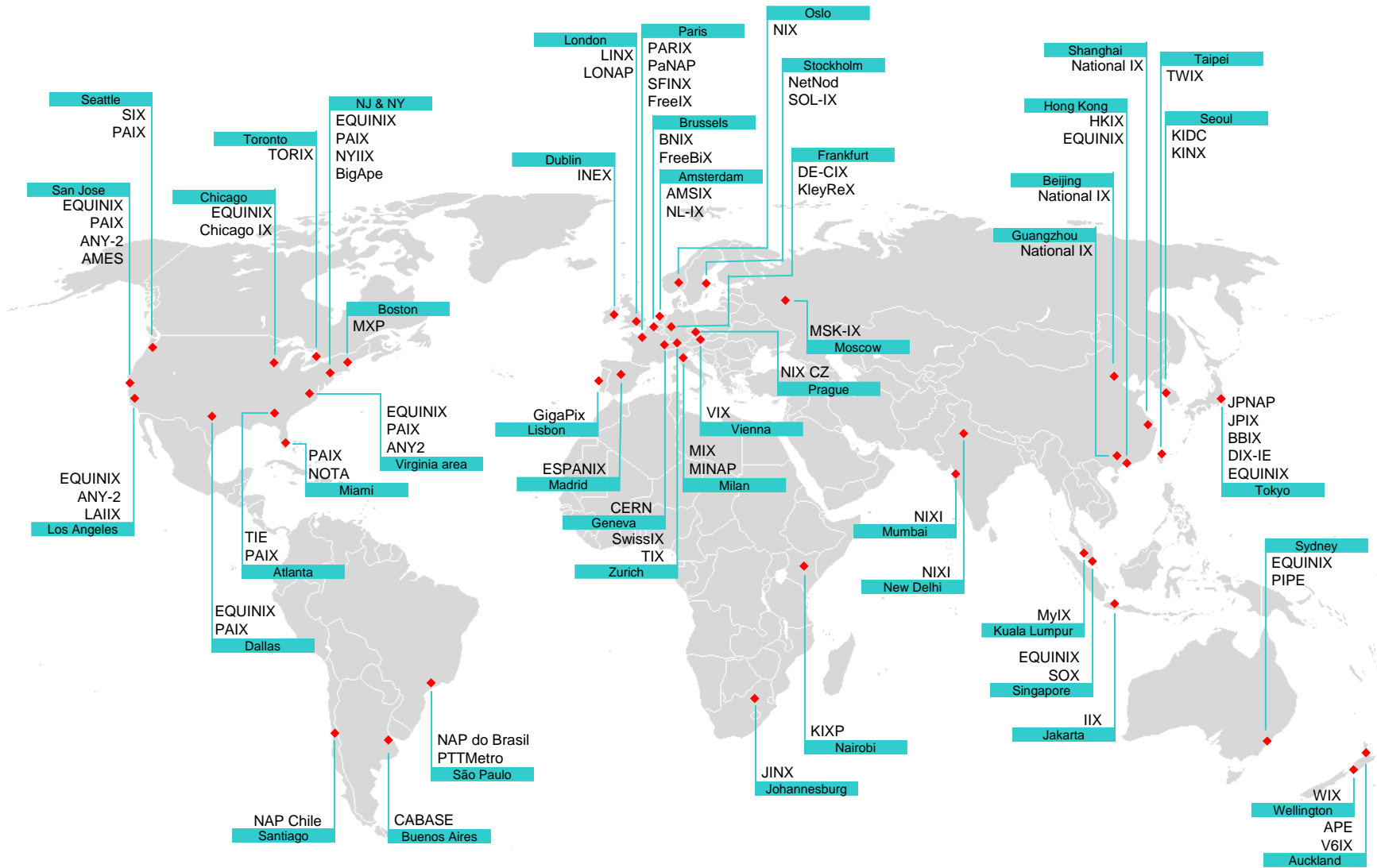
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# Hurricane Electric – Talk Outline

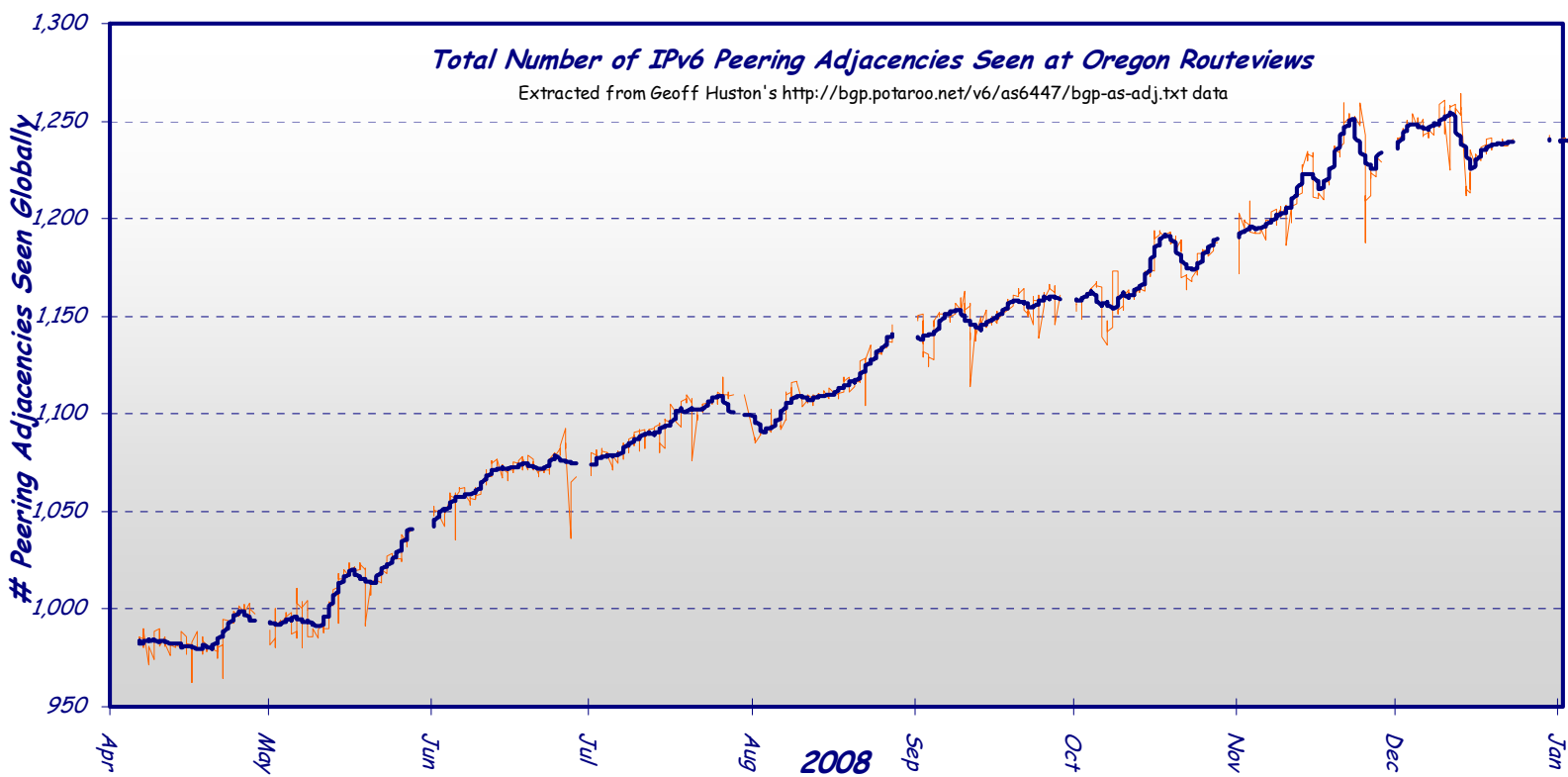
- IPv6 Peering
  - This is not news – there is lots of IPv6 peering
- Hurricane Electric traffic levels
  - Review of high-level view of IPv6 traffic
- Q: Does it matter what the traffic levels are?
  - Is there a better measure of IPv6's existence?



# 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

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# 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

## ■ IPv6 Peering mistakes

- ❑ Single port (dual stack) vs. dual ports
- ❑ IPv6 addressing patterns for backbones
  - See Roque Gagliano's IX best-practices document
- ❑ Charging for IPv6 address allocation (Huh?)



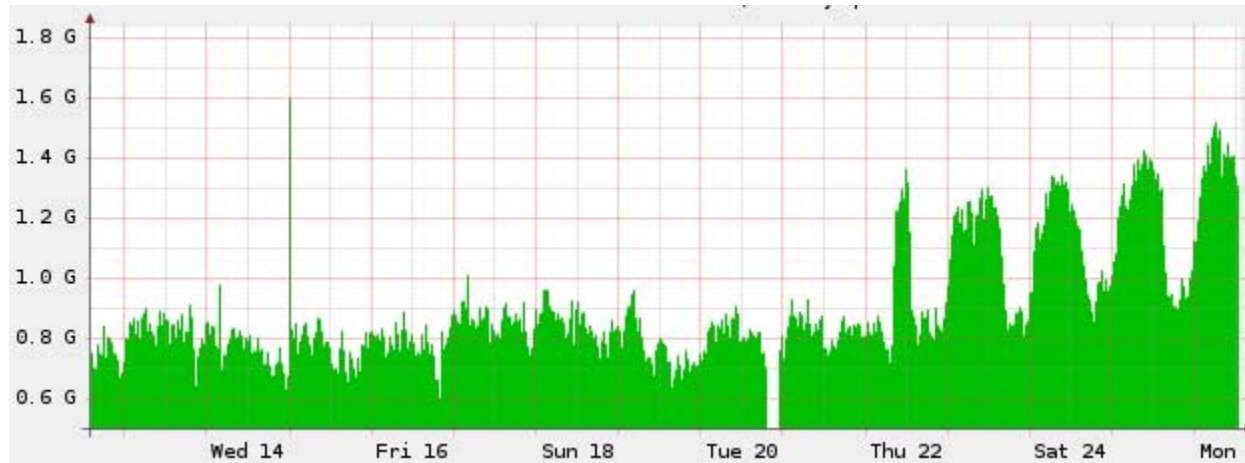
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# Hurricane Electric

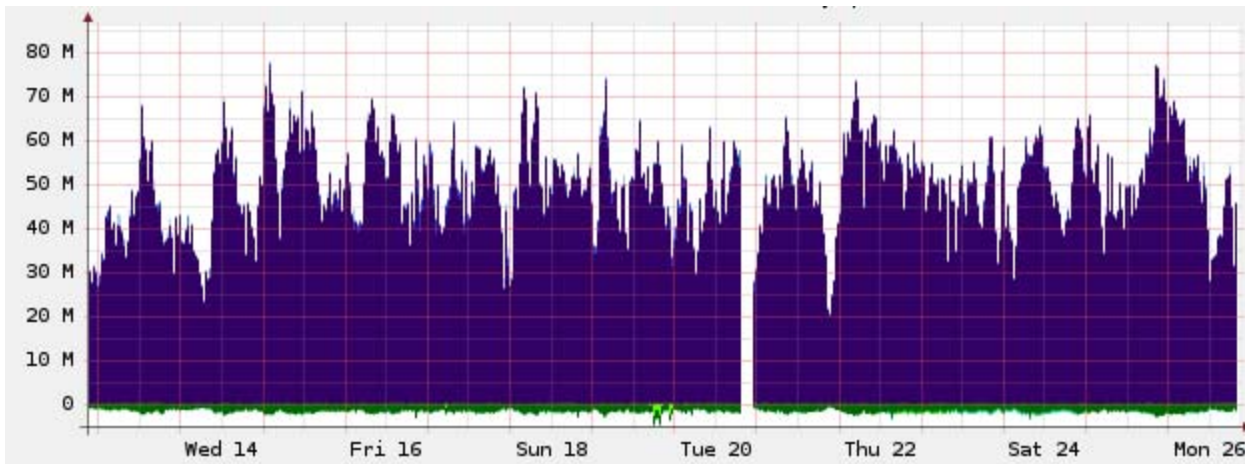
## IPv6 Traffic



# Hurricane Electric stats – overall IPv6 traffic



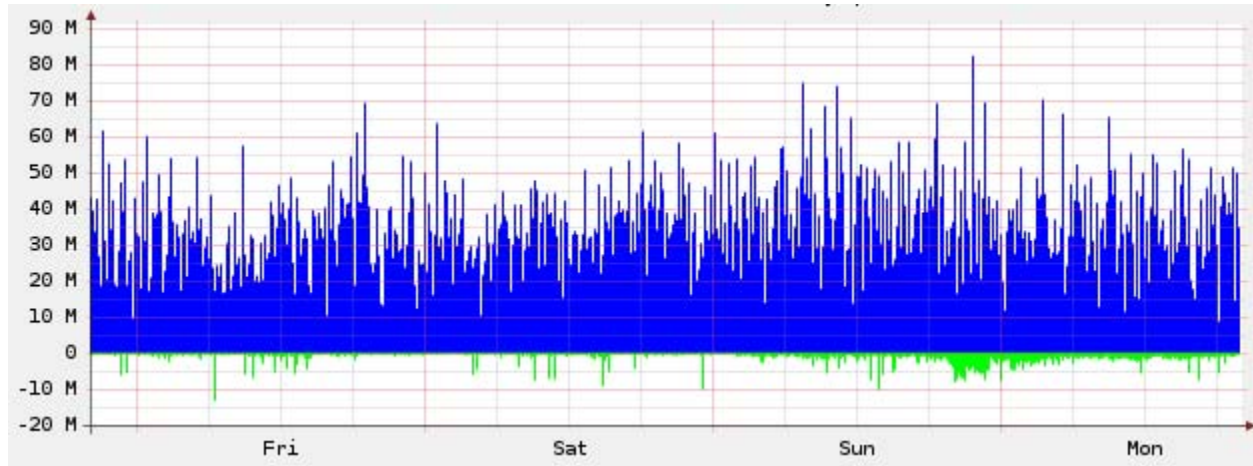
Overall IPv6 traffic



Sample IPv6 Peering Traffic (summed globally)



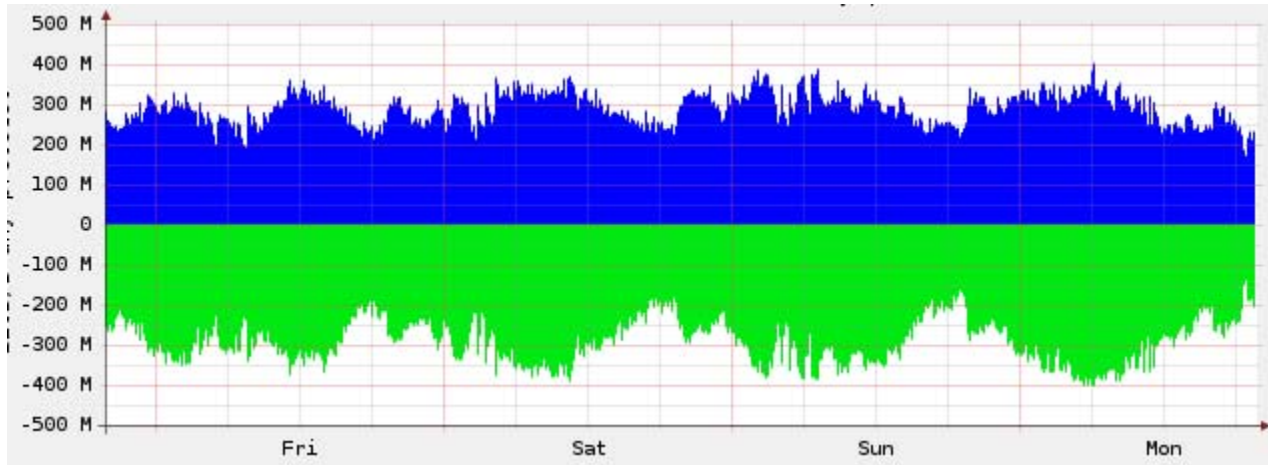
# Hurricane Electric stats – IPv6 peering traffic



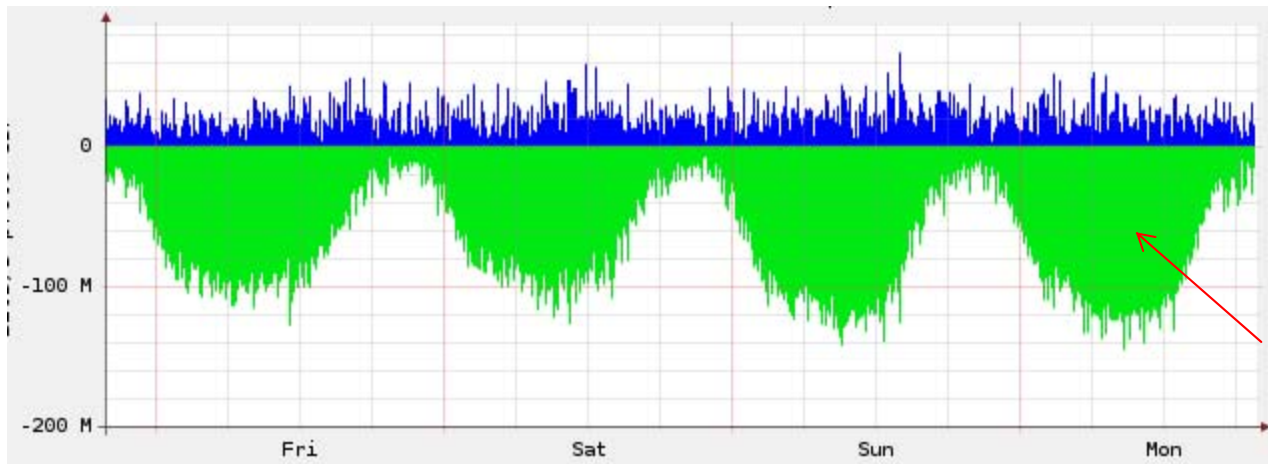
LINX IPv6 peering



# Hurricane Electric stats – IPv6 peering traffic



AMSIX IPv6 peering



AMSIX IPv6 peering  
(UDP traffic)

Interesting customer traffic



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# Hurricane Electric

## IPv6 6to4 \*

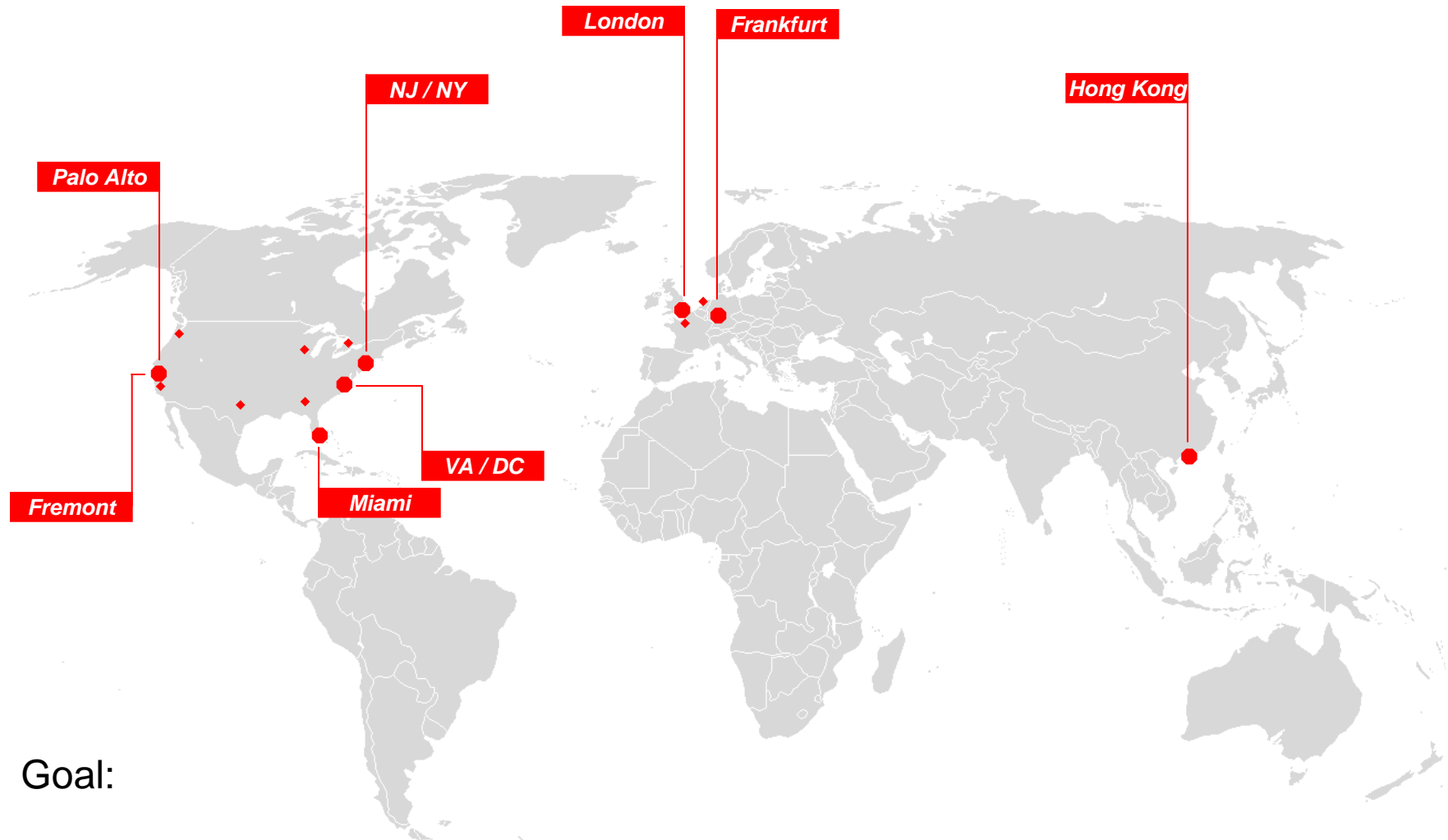
*\* 6to4 (sometimes written 6 to 4) is a system that allows IPv6 packets to be transmitted over an IPv4 network (generally the IPv4 internet) without the need to configure explicit tunnels. Routing conventions are also in place that allow 6to4 hosts to communicate with hosts on the IPv6 internet. It 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>



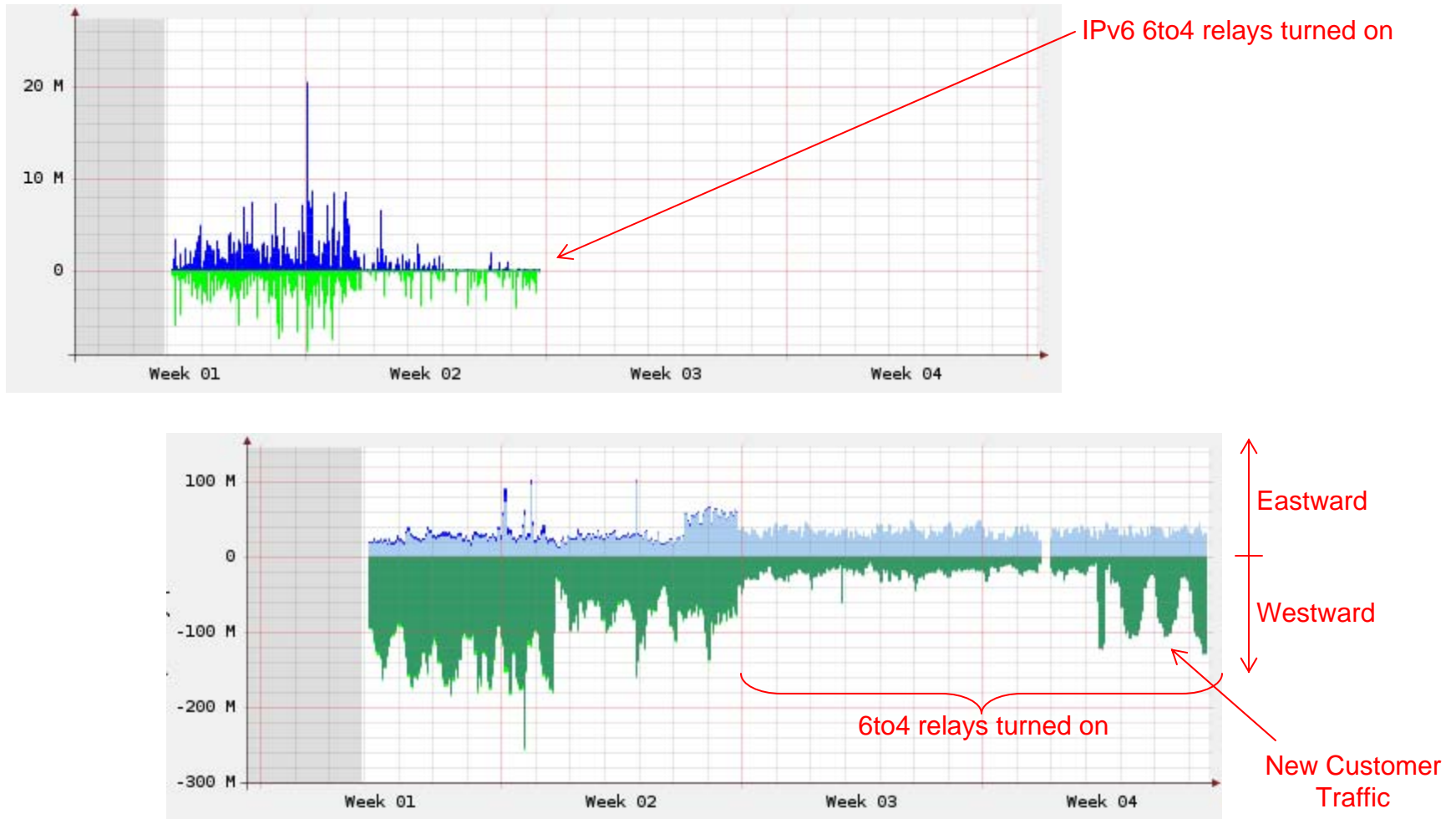
# Hurricane Electric 6to4 Relay Deployment



Goal:

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

# Hurricane Electric 6to4 traffic



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# Hurricane Electric

## IPv6 Teredo \*

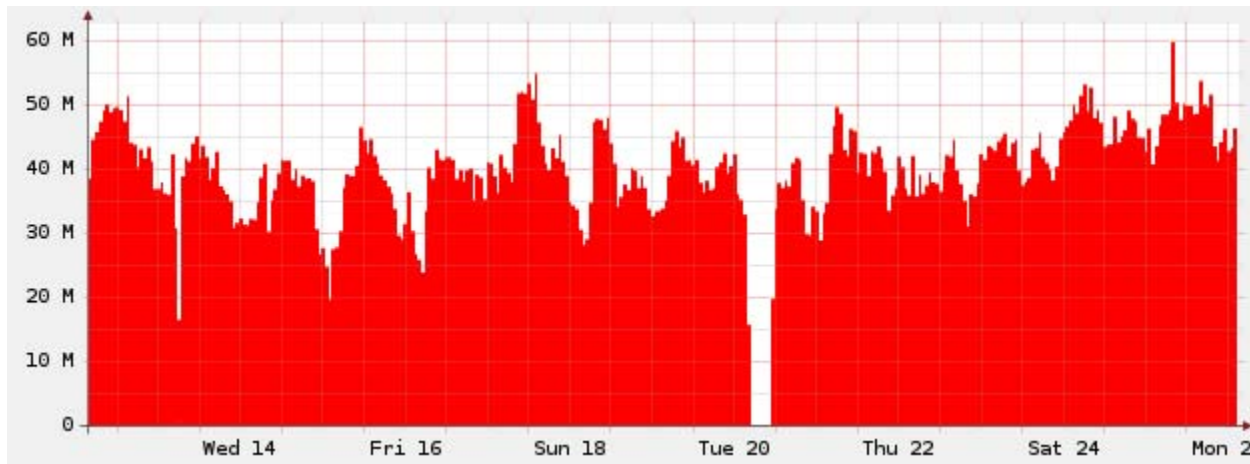
*\* Teredo is a tunneling protocol designed to grant IPv6 connectivity to nodes that are located behind IPv6-unaware NAT devices. It defines a way of encapsulating IPv6 packets within IPv4 UDP datagrams that can be routed through NAT devices and on the IPv4 internet.*

From Wikipedia, the free encyclopedia [http://en.wikipedia.org/wiki/Teredo\\_tunneling](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 via AMS-IX
  - 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?

	<b>Address</b>	<b>Notes</b>	<b>Count</b>
Count of IPv6 addresses within .COM domain (Queries on 78,630,991 domains to find AAAA records)  Measured on Jan 18, 2009	::ffff:0:0/96	v4-mapped	95,292
	2000::/3	unicast	42,759
	::	unspecified	16,177
	::/96	v4-compatible	884
	2002::/16	6to4	562
	:::1	localhost	447
	invalid	invalid	105
	3ffe::/16	6bone	93
	fe80::/10	link-local	35
	fec0::/10	site-local	1
	2001::/32	teredo	2
	fc00::/7	ULA	1



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## 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?
  - IPv6 with an AAAA or IPv4 with a A record
  - If both ends are IPv4 & IPv6 enabled



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# Q&A



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