



HURRICANE ELECTRIC
INTERNET SERVICES

IPv6 in 2013

What a Long Strange Trip it's Been

SANOG21

Cox's Bazar, Bangladesh

28th January 2013

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Hurricane Electric

IPv6 in 2013 – Talk Outline

NATIVE IPv6
EVERYWHERE

- 30 years in the making
- IPv6 where we stand now (by the numbers)
- Why mobile & broadband are important to v6
- Where do we go next?



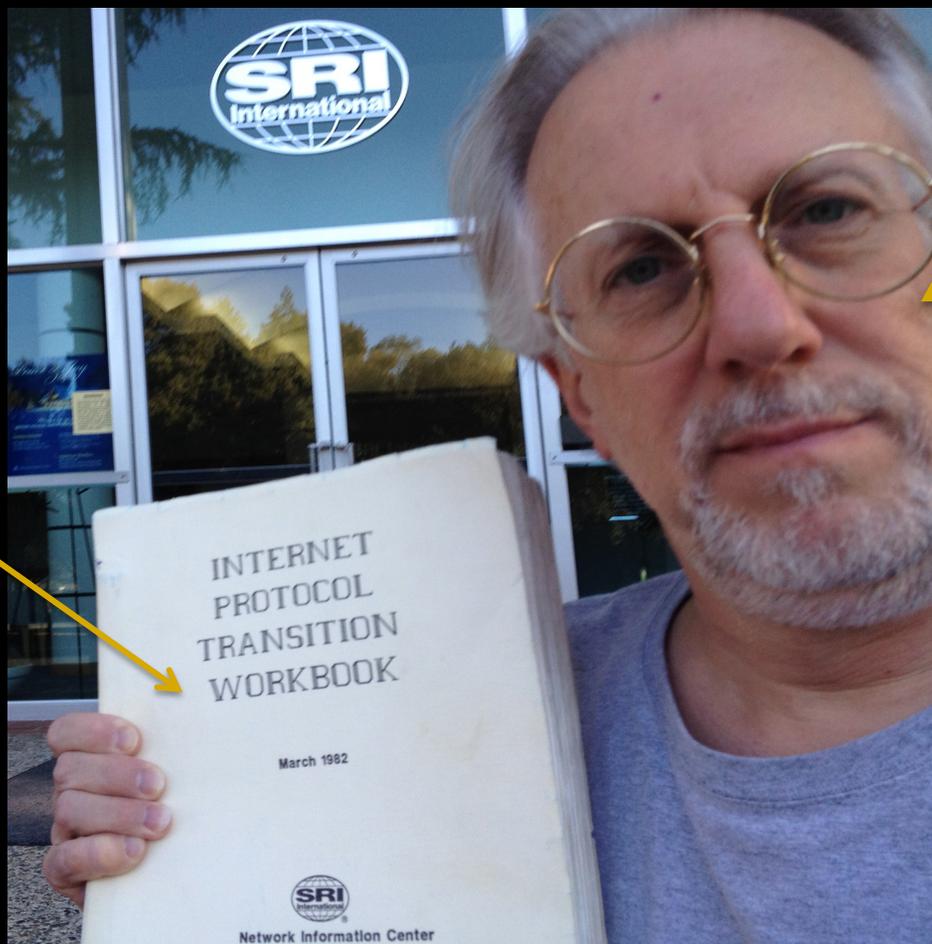
JANUARY 1983 ...

IPv4 GOES LIVE

January 1st 1983 ... IPv4 goes live

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The book is 30+
years old



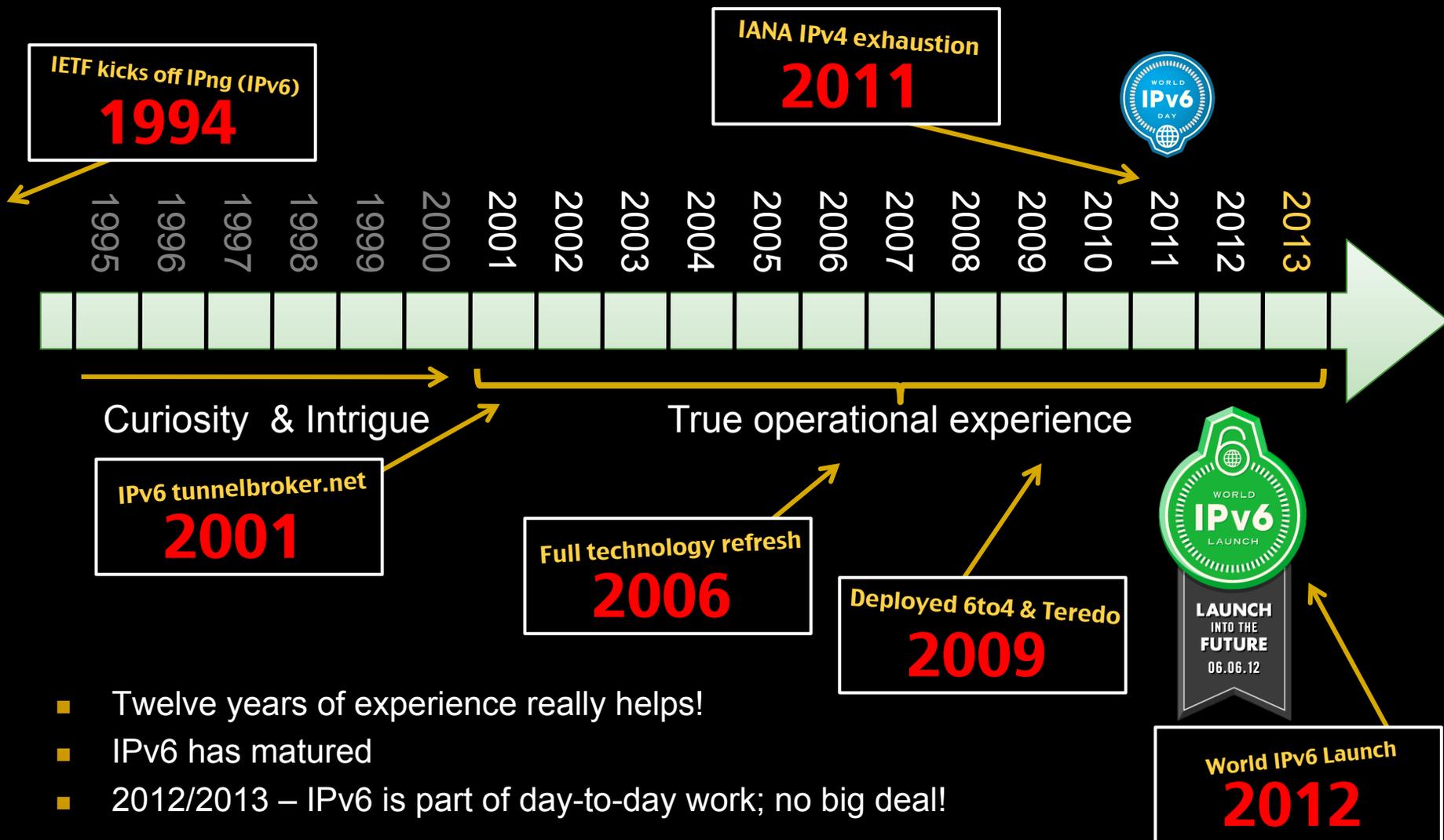
The owner is
definitely 30+
years older!

JANUARY 2013 ...

IPv6 GOING STRONG

Hurricane Electric's 12 year experience with IPv6

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- Twelve years of experience really helps!
- IPv6 has matured
- 2012/2013 – IPv6 is part of day-to-day work; no big deal!

JANUARY 2013 ...

IPv6 BY THE NUMBERS

IPv6 measured via BGP ASNs with IPv6

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<http://bgp.he.net/ipv6-progress-report.cgi>

Networks Running IPv6

We can measure the percentage of networks running IPv6 by comparing the set of ASes in the IPv6 routing table to those in the combined set of IPv4 and IPv6.

IPv4 and IPv6 RIBs Last Parsed:
Sat Jan 26 01:02:18 PST 2013

IPv4 ASes: 43266

IPv6 ASes: 6686

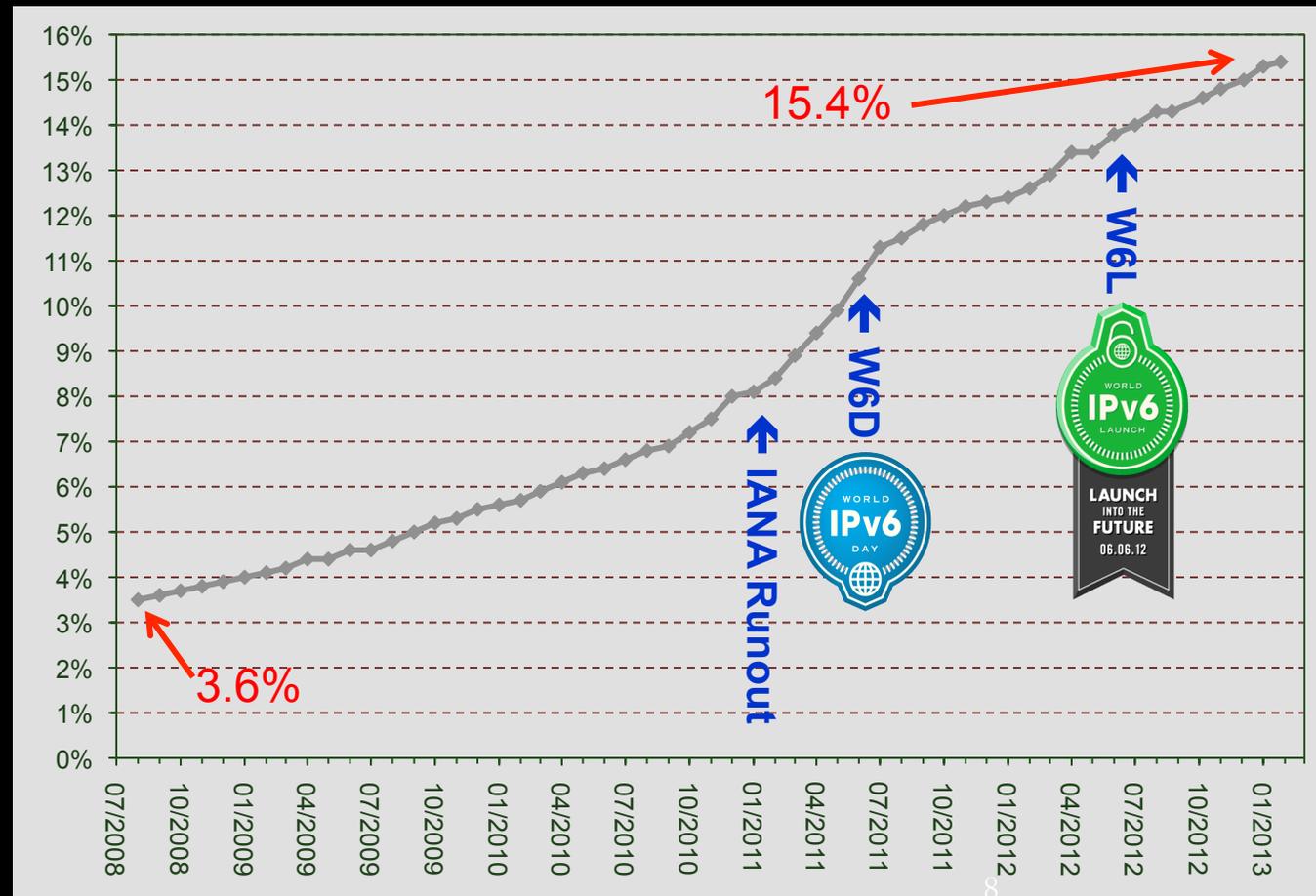
ASes using only IPv4: 36706

ASes using only IPv6: 126

ASes using IPv4 and IPv6: 6560

ASes using IPv4 or IPv6: 43392

Percentage of ASes (IPv4 or IPv6)
running IPv6: 15.4%



IPv6 routing and it's steady march upwards

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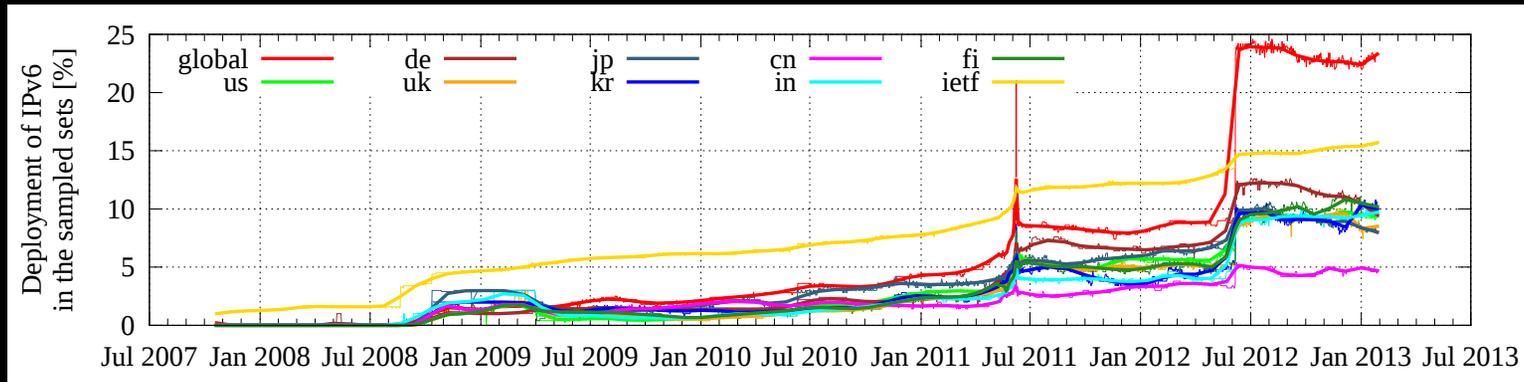
http://bgp.he.net/report/prefixes#_prefixes



http://bgp.he.net/report/prefixes#_networks

IPv6 within hosting and it's steady march upwards

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<http://www.eggert.org/meter/ipv6>



<http://www.google.com/ipv6/statistics.html>



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IPV6 TRAFFIC BY THE NUMBERS

2011 WORLD IPV6 DAY &



2012 WORLD IPV6 LAUNCH



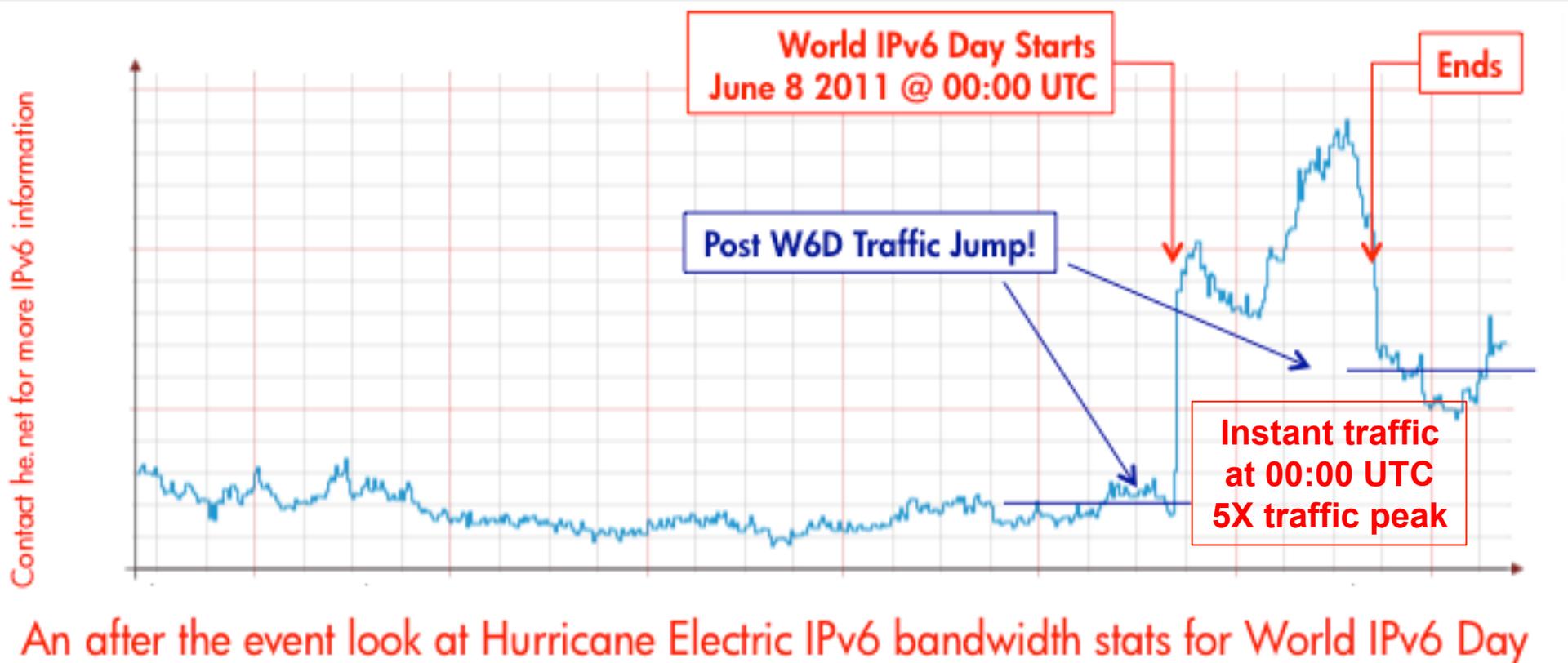
<http://www.worldipv6launch.org/>

Driving Global IPv6 Traffic!

But first ... a review of 2011 World IPv6 Day

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- World IPv6 Day was about enabling web-based traffic for IPv6
 - Focus on content providers
 - Web (port 80 & 443 TCP traffic) plotted below

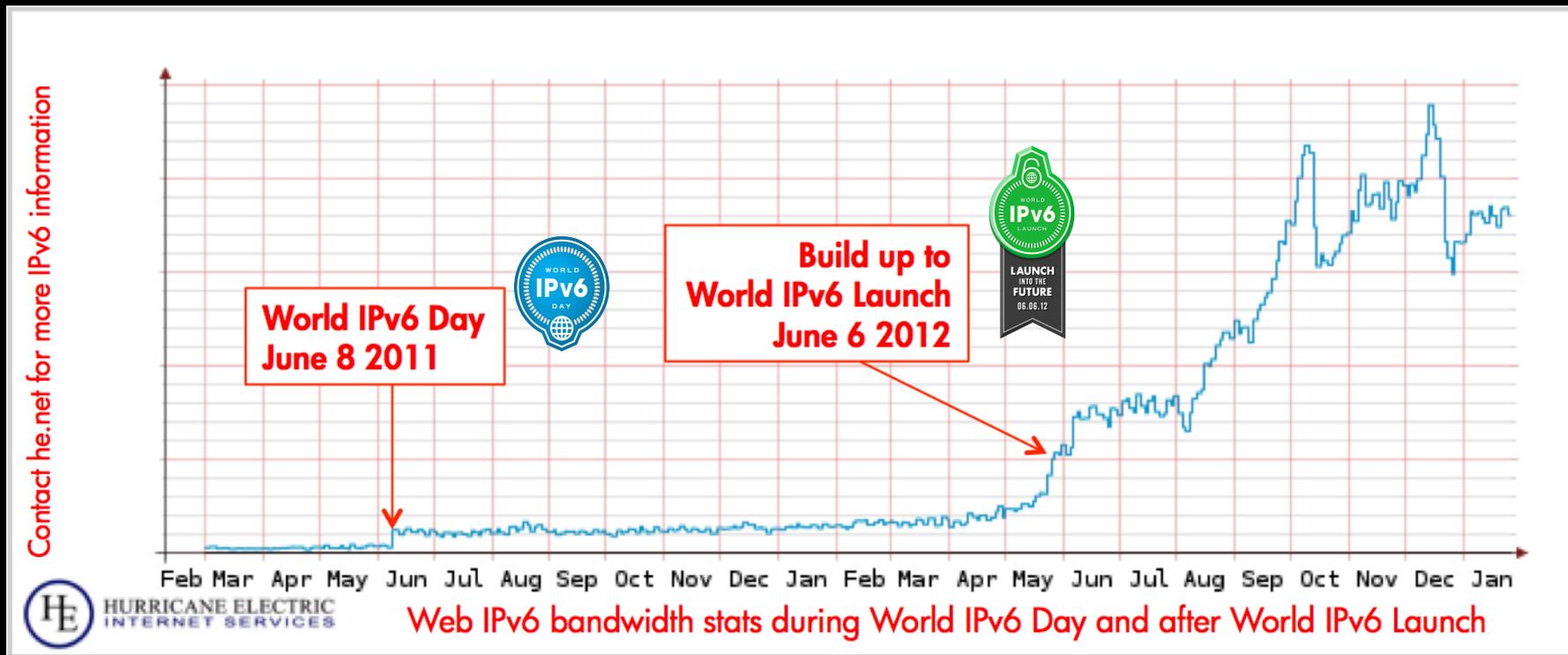


Already presented at SANOG 18 Pokhara Nepal

2012 World IPv6 Launch - real IPv6 traffic

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- Continued long-term win since W6D in IPv6 traffic levels
 - That means there are both content and eyeballs are in play
- Routing improvements since June/2012
 - Additional peering implemented (ie: IPv6 following IPv4)



Can we say IPv6 is on-par with IPv4?

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■ YES

- We can provide IPv6 alongside IPv4 to broadband or mobile users without disruption

■ NO

- We still think that IPv6 is hard – it's not!

An example from AT&T's IPv6 deployment

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- The current web IPv6 traffic on our backbone is 650 times more than last year at this time.
- AT&T started activating residential gateways in 4Q'11 and is continuing to ramp up quickly, and could reach up to 5 million homes by the end of 2012.
- For our IPv6 enabled customers, we're seeing more than 20 percent of traffic transition to IPv6, which also speaks to the increasing number of IPv6-enabled content providers.
- We have dual-stack enabled our enterprise, consumer and corporate websites and portals to support both IPv4 and IPv6.

<http://www.attinnovationspace.com/innovation/story/a7782696>

The screenshot shows the AT&T website's support page for IPv6. The page has a navigation bar with 'Shop', 'myAT&T', and 'Support' tabs, and a search bar. Below the navigation bar are links for 'Wireless', 'Digital TV', 'Internet', 'Home Phone', 'Billing & Account', 'Orders & Repairs', 'Communities', and 'Contact Us'. The main content area features the heading 'IPv6 - The Internet is Getting Bigger... and AT&T is Ready'. Below the heading is a paragraph: 'AT&T is prepared for IPv6 across our products, services, and network infrastructure for all of our customers. Most customers will not need to take any action for IPv6 - AT&T has you covered.' This is followed by a sub-heading: 'To learn more about IPv6, select from the 5 topics below.' Below this text is a photograph of a family (a boy, a girl, and a man) sitting on a couch and using various devices (tablet, laptop, smartphone). At the bottom of the page is a navigation bar with five icons: a globe for 'AT&T and IPv6', an information icon for 'IPv6 Basics', a magnifying glass over a laptop for 'IPv6 Compatibility', a shopping cart for 'Equipment Shop', and a video camera for 'Video'. There are also two call-to-action buttons: 'Small business customers, learn more about IPv6' and 'Enterprise customers, learn more about IPv6'.

<https://www.att.com/ipv6>



WHY DO IPV6 TALKS KEEP MENTIONING CGNs?

My one-and-only slide on CGNs

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- CGNs are a fact-of-life (I hate saying that)
 - IPv4 addressing is exhausted
 - Customer growth is increasing
- TWC did a clever study on the subject
 - “TCO of CGN” Lee Howard, Time Warner Cable
- CGNs for IPv4 & native IPv6
 - Both done together
 - Never ignore IPv6

Conclusions

1. CGN costs \$2 million over five years for every 10,000 users it's used for, or \$40 per user per year.
2.

```
graph LR; A["$0 - $40  
Buy  
Addresses"] --> B["$40 - $71  
Deploy  
CGN"]; B --> C["$70 +  
CGN + Sell  
IPv4"]
```
3.

Price before scarcity	Basic Internet (CGN)	Advanced Internet (status quo)
\$33/month	\$37.83/month	\$40.88/month
\$400/year	\$454/year	Up to \$495/year
4. The rational network will have 100% IPv6 by end of 2014.

<http://www.nanog.org/meetings/nanog56/abstracts.php?pt=MjAyNSZuYW5vZzU2&nm=nanog56>



MOBILE AND IPV6

Mobile and IPv6

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- 3GPP & Release 8, 9 & 10
 - Dual Stack agreed upon
 - Dual Stack PDP contexts
 - DHCPv6
- More importantly ... deployment is happening



Mobile and IPv6

NATIVE IPv6
EVERYWHERE

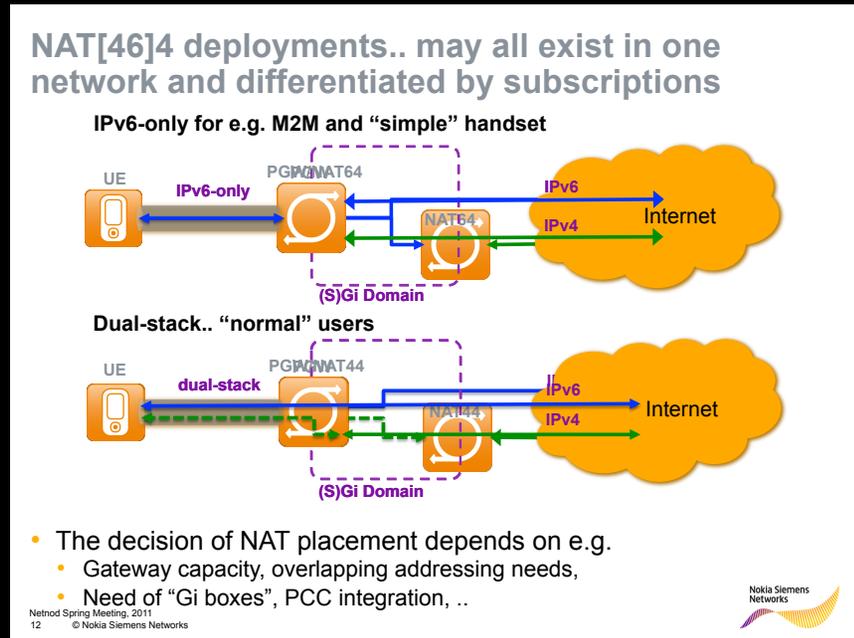
- Works in both theory & practice
 - NAT64/DNS64
 - One PDP context
 - Battery life?

IPv6 can boost mobile performance, battery life, proponents say

A panel of experts at CES laid out some consumer benefits of the next Internet Protocol

By [Stephen Lawson](#), IDG News Service | [Internet](#) 2 [Like](#) 65 [+1](#) 26

January 11, 2013, 2:53 AM — IPv6, the next version of the Internet Protocol, could make life easier and battery life longer for electronics-addicted consumers.



www.netnod.se/files/download/163

<http://www.itworld.com/internet/335395/ipv6-can-boost-mobile-performance-battery-life-proponents-say>



MOTIVATING PEOPLE

TO USE IPv6

IPv6 Tunnels and IPv6 Certification

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Hurricane Electric's IPv6 Tunnel Broker

<http://tunnelbroker.net/>

(IPv6 Tunnels Exist! – sometimes it's the only way)

Hurricane Electric's IPv6 Certification Program

<http://ipv6.he.net/certification/>

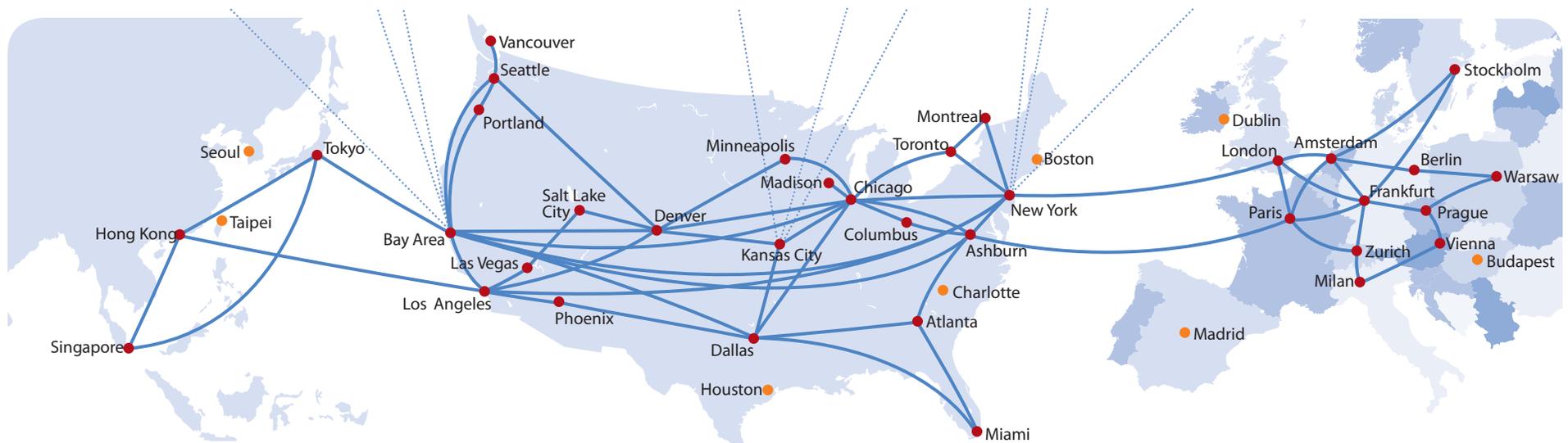
(It's a free test – but we have a prize at the end)

A QUICK UPDATE ABOUT HURRICANE ELECTRIC'S NETWORK

Hurricane Electric – IPv6 Global Network

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All Hurricane Electric POPs are full IPv6 Native routing and peering



Map outdated!

IPv6 peering at all major peering points in US, Europe & Asia. Private and public peering capacity at 10Gbps and above.



SUMMARY

Summary

NATIVE IPv6
EVERYWHERE

- Every portion of the story now available
 - DNS, Content & Hosting
 - Backbone & Interconnects
 - Broadband & Mobile
 - Laptops, Tablets, Smartphones & more
- Legacy network elements will always be the concern
- CGNs (for continued IPv4 operation)
 - Must be done in conjunction with IPv6 implementation
 - Should never be used as an excuse to ignore IPv6





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