Measuring IPv6
RIPE 61 MAT WG

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What this is not

- We will note be measuring bit fields:
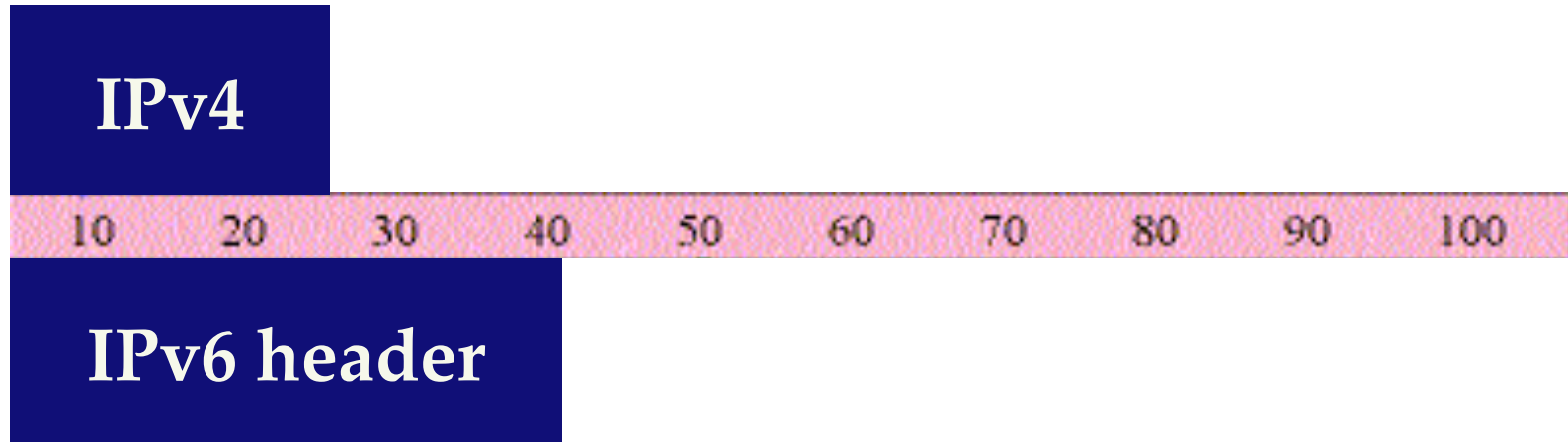
What this is not

- We will not be measuring headers:

IPv4

| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

IPv6 header

So what do we measure?

- Countries on IPv6? (123 countries)

United States	1,012	675		1	Asia Pacific	14	8		1	Cyprus	2	2		1
Germany	364	243		1	Romania	13	11		1	Jordan	2	2		1
China	236	45		5	Slovakia	13	13		1	Liechtenstein	2	2		1
Netherlands	189	140		1	Luxembourg	13	12		1	Isle of Man	2	2		1
Australia	173	85		2	Philippines	13	11		1	Senegal	1	1		1
United Kingdom	156	136		1	Argentina	12	12		1	Mali	1	1		1
Japan	149	120		1	Bulgaria	12	10		1	Sudan	1	1		1
Canada	140	70		2	Uruguay	10	8		1	Tunisia	1	1		1
France	119	90		1	Mexico	10	9		1	Ghana	1	1		1
Russian Federation	117	95		1	Estonia	9	9		1	Nauru	1	1		1
Indonesia	115	41		2	Lithuania	9	5		1	Panama	1	1		1
Brazil	88	67		1	Mauritius	9	5		1	Lebanon	1	1		1
Sweden	85	73		1	Saudi Arabia	8	7		1	Grenada	1	1		1
Switzerland	85	69		1	Pakistan	8	6		1	Lao People's Democratic Republic	1	1		1
Czech Republic	84	71		1	Latvia	7	7		1	Bangladesh	1	1		1
Austria	74	56		1	Greece	7	6		1	Belarus	1	1		1
Poland	72	70		1	Colombia	6	6		1	Greenland	1	1		1
European Union	70	32		2	Iceland	6	6		1	Guam	1	1		1
Hong Kong	69	32		2	Turkey	6	6		1	American Samoa	1	1		1
Korea, Republic of	68	16		4	Macao	5	2		2	Guadeloupe	1	1		1
Italy	57	51		1	Iran, Islamic Republic of	5	5		1	Zambia	1	1		1
New Zealand	46	36		1	Bosnia and Herzegovina	5	5		1	Haiti	1	1		1
Norway	40	32		1	Sri Lanka	5	4		1	Belize	1	1		1
Malaysia	36	22		1	Serbia	5	5		1	Bhutan	1	1		1
Thailand	35	17		2	Qatar	4	1		4	Puerto Rico	1	1		1
Finland	33	30		1	United Arab Emirates	4	4		1	El Salvador	1	1		1
India	29	18		1	Israel	4	4		1	Maldives	1	1		1
Singapore	29	18		1	Moldova, Republic of	4	4		1	Cote d'Ivoire	1	1		1
Denmark	28	22		1	Nepal	3	2		1	Monaco	1	1		1
Ukraine	26	22		1	Costa Rica	3	3		1	Holy See (Vatican City State)	1	1		1
Ireland	26	22		1	Venezuela, Bolivarian Republic of	3	3		1	Samoa	1	1		1
Taiwan	25	17		1	Fiji	3	3		1	Macedonia, The Former Yugoslav Republic of	1	1		1
Slovenia	25	24		1	Tanzania, United Republic of	3	3		1	Oman	1	1		1
Egypt	24	4		6	Netherlands Antilles	3	3		1	Saint Kitts and Nevis	1	1		1
Spain	20	19		1	Cuba	3	3		1	Virgin Islands, U.S.	1	1		1
Hungary	19	15		1	Croatia	3	3		1	Uzbekistan	1	1		1
Belgium	18	18		1	Kenya	3	3		1	Jersey	1	1		1
South Africa	17	14		1	Malta	2	2		1	Rwanda	1	1		1
Viet Nam	17	7		2	Peru	2	2		1	Honduras	1	1		1
Chile	16	8		2	Trinidad and Tobago	2	2		1					
Ecuador	16	5		3	Armenia	2	2		1					
Portugal	14	13		1	Dominican Republic	2	2		1					

Network growth on IPv6?

IPv6 Prefixes Originated (240 Days)

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

ASN's with IPv6 Announcements (240 Days)
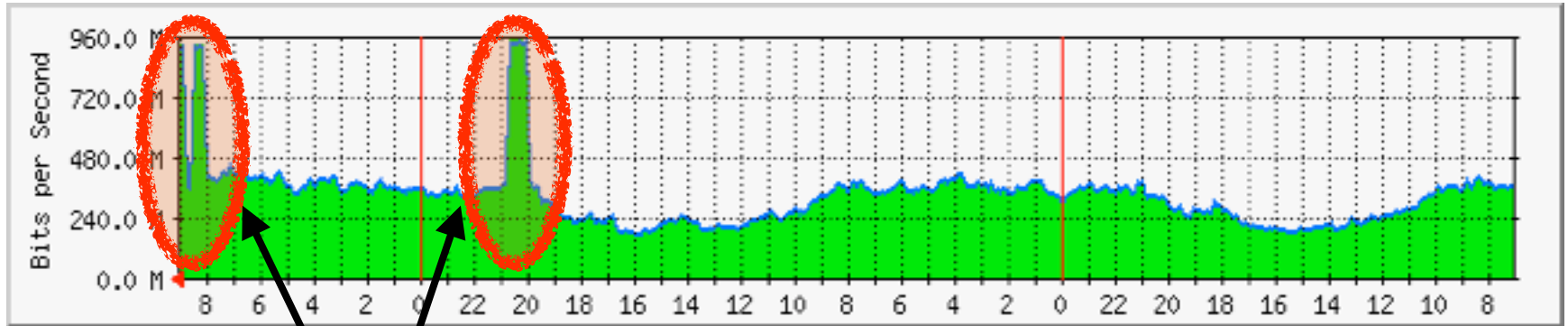
http://bgp.he.net/report/prefixes#_networks

Measuring IPv6 Traffic
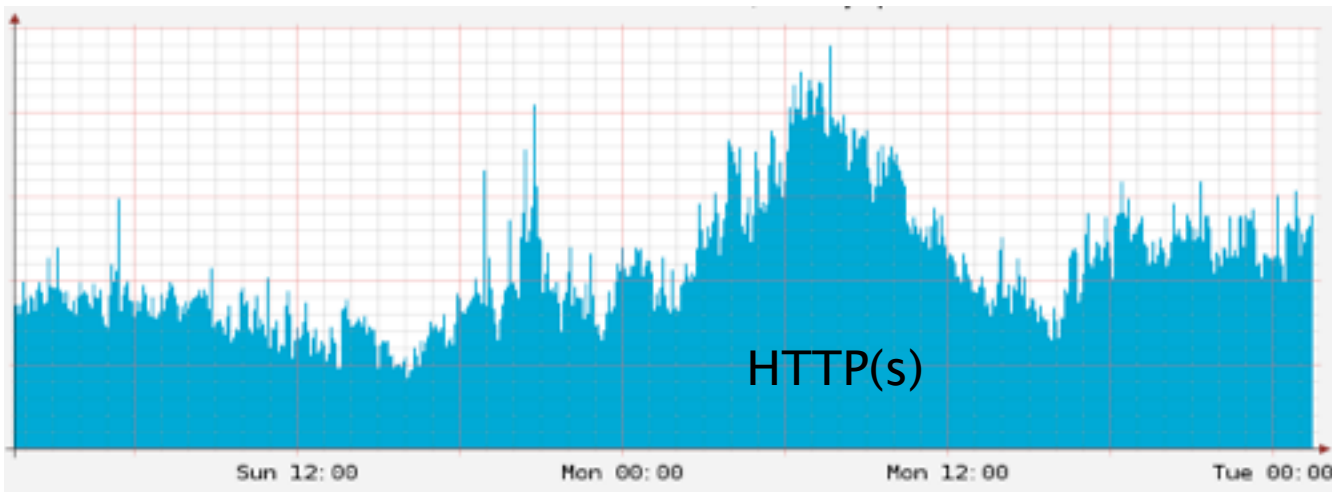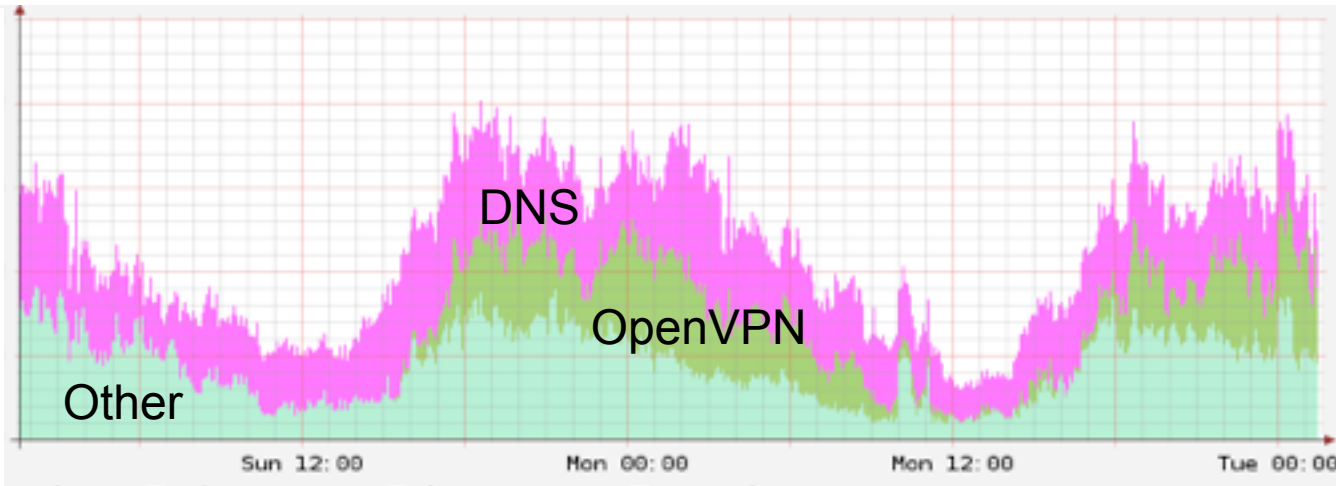
Measuring IPv6 Attacks

Attack traffic via 6to4 … limited by Gig–E port on each 6to4 relay box

(redacted source address -> 192.88.99.1 (6to4 anycast) -> v6 address of IRC server in US)

This attack is useless (A Gig is nothing these days).

T–Shirts as THE IPv6 Business Case?

T–Shirts as THE IPv6 Business Case?

Hurricane Electric sends email
saying "free IPv6 t-shirt"
for sage-level users

Certification Tests Taken Last 20 Days

From: <ipv6@he.net>
Date: Thu, May 27, 2010 at 11:32 PM
Subject: Hurricane Electric IPv6 Update
…
* Attention Sages!

Hurricane Electric would like to send you an "IPv6" T-shirt!

Please log into http://ipv6.he.net/certification/, and verify your address information which will only be used for shipping out this T-shirt.

After making certain it is correct (remember to click "Update Info" if you made changes, before validating), you will see T-shirt size selections for S/M/L/XL/XXL, and a button that will submit your preferred shirt size and log that you have validated your address.

This is optional, and will only be sent to validated addresses.

We'll be adding on some points to your score for Sages that want to get a T-shirt!

We are looking to get the t-shirts out around the end of June. We need make sure to get enough of each size before sending them out to all of you. …
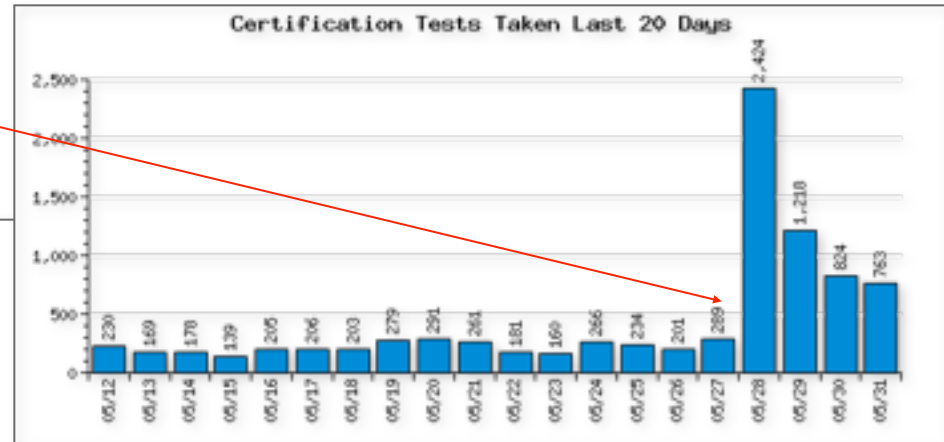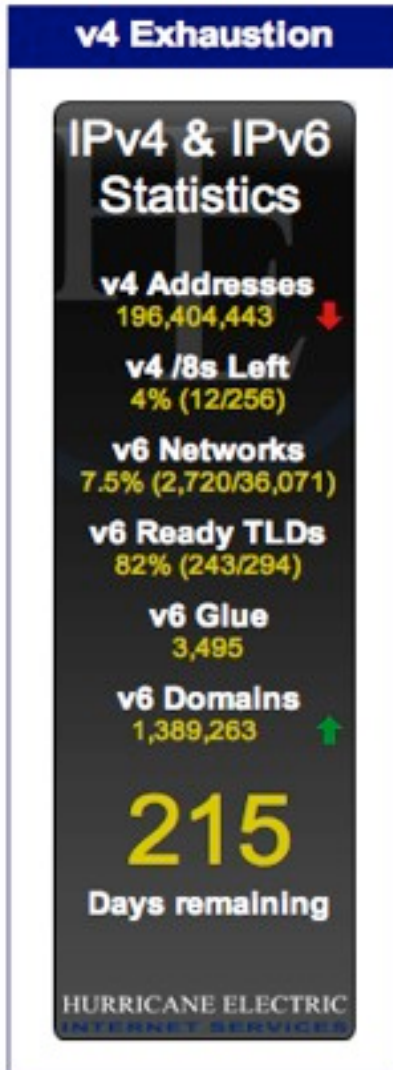
T-Shirts -- Not just a US Fad!

- Certifications by Region

Sage Certs	Region	Countries
778	Europe	33
684	European Comm.	22
650	North America	7
596	US	1
67	Asia	4
85	Asia	20
27	South America	8
6	Africa	3

- http://tunnelbroker.net/usage/sages_by_country_and_state.php

Accelerating towards the wall?

v4 Exhaustion

IPv4 & IPv6 Statistics

v4 Addresses
196,404,443 ↓

v4 /8s Left
4% (12/256)

v6 Networks
7.5% (2,720/36,071)

v6 Ready TLDs
82% (243/294)

v6 Glue
3,495

v6 Domains
1,389,263 ↑

215

Days remaining

HURRICANE ELECTRIC
INTERNET SERVICES
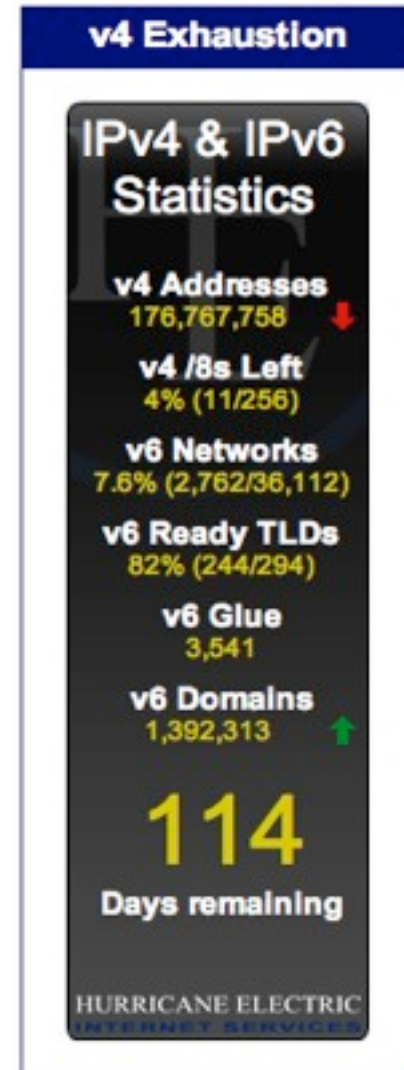
In 6.5 days, we got 101 days closer to IPv4 exhaustion.

We also added an IPv6 TLD, 46 domains added IPv6 glue and more than 3,000 domains added IPv6.

v4 Exhaustion

IPv4 & IPv6 Statistics

v4 Addresses
176,767,758 ↓

v4 /8s Left
4% (11/256)

v6 Networks
7.6% (2,762/36,112)

v6 Ready TLDs
82% (244/294)

v6 Glue
3,541

v6 Domains
1,392,313 ↑

114

Days remaining

HURRICANE ELECTRIC
INTERNET SERVICES

Q&A

?

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