

Addressing and Routing in 2014

Geoff Huston
APNIC

The Addressing View

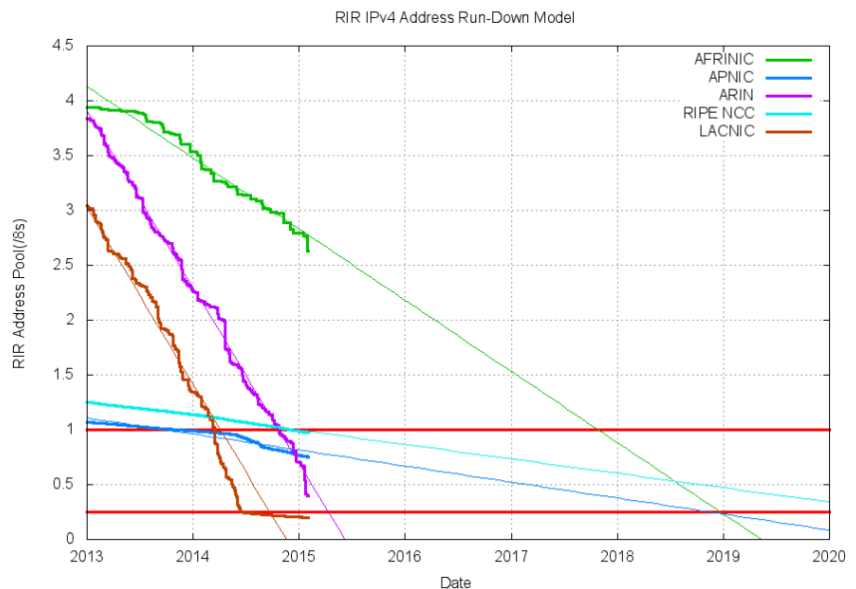


Addressing V4 Exhaustion

- We have been predicting that the exhaustion of the free pool of IPv4 addresses would eventually happen for the past 25 years
- And, we've now hit bottom!
 - APNIC, RIPE NCC and LACNIC are now empty of general use IPv4 addresses
 - We now have just ARIN and AFRINIC to go – ARIN is expected to run out in the coming weeks

Projected RIR Address Pool Exhaustion Dates:

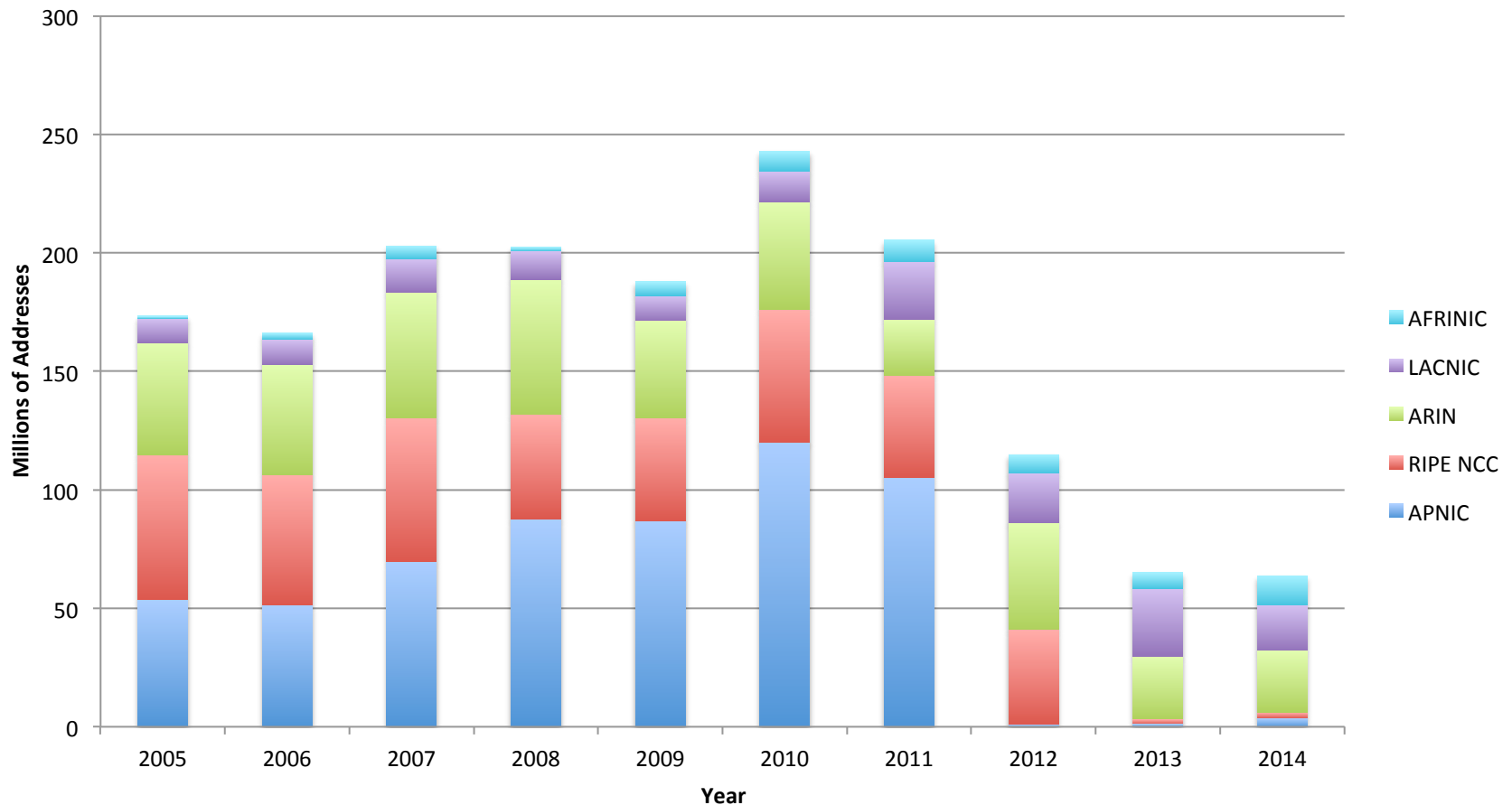
RIR	Projected Exhaustion Date	Remaining Addresses in RIR Pool (/8s)
APNIC:	19-Apr-2011 (actual)	0.7520
RIPE NCC:	14-Sep-2012 (actual)	0.9700
LACNIC:	10-Jun-2014 (actual)	0.1987
ARIN:	16-May-2015	0.3960
AFRINIC:	23-Jan-2019	2.6326



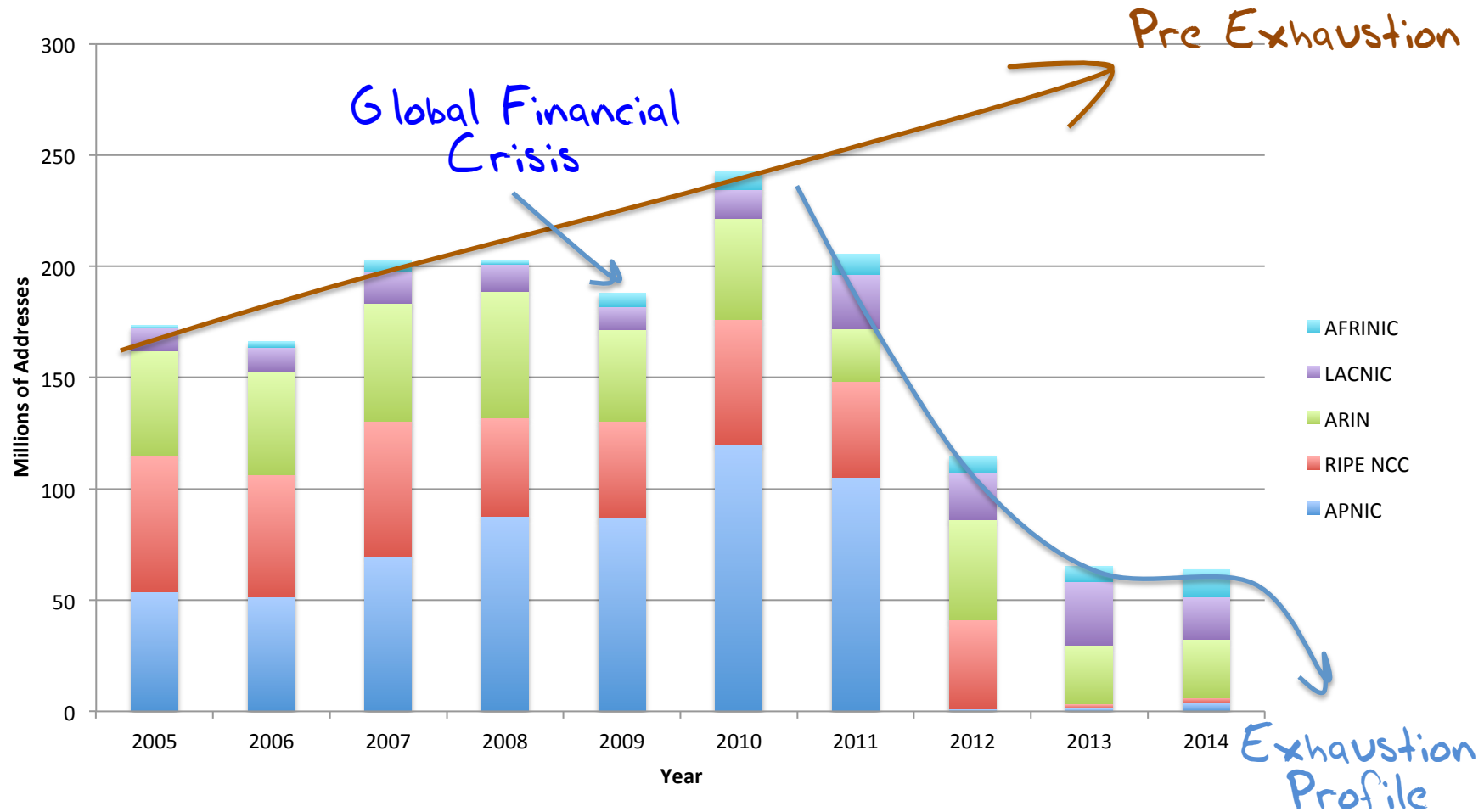
Projection of consumption of Remaining RIR Address Pools



Allocations in the Last Years of IPv4



Allocations in the Last Years of IPv4



Where did the Addresses Go?

Volume of Allocated IPv4 Addresses
(using units of millions of /32s)
per year

Rank	2010		2011		2012		2013		2014	
1	China	45.2	China	53.1	USA	28.2	USA	25.0	USA	24.5
2	USA	42.3	USA	21.2	Canada	16.7	Brazil	17.4	Brazil	10.9
3	Rep.Korea	25.7	Japan	16.9	Brazil	8.4	Colombia	3.8	Morocco	2.6
4	Japan	10.0	Rep.Korea	7.7	Russia	5.3	Argentina	1.6	Colombia	2.1
5	Australia	9.6	Indonesia	7.1	Iran	4.5	Egypt	1.6	South Africa	1.7
6	India	9.4	Brazil	6.3	Germany	3.4	Canada	1.4	Egypt	1.6
7	UK	8.1	India	6.0	South Africa	3.4	Nigeria	1.2	China	1.5
8	Germany	7.0	France	5.4	Italy	3.3	Chile	1.1	Canada	1.5
9	Russia	6.5	Russia	5.0	Colombia	2.6	Mexico	1.1	Kenya	1.4
10	Brazil	6.3	Germany	4.9	Romania	2.6	Seychelles	1.0	Mexico	1.1

APNIC runs out ↑

RIPE NCC runs out ↑

LACNIC runs out ↑

The IPv4 After-Market: Address Transfers

- There is a considerable residual demand for IPv4 addresses following exhaustion
 - IPv6 is not a direct substitute for the lack of IPv4
- Some of this demand is pushed into using middleware that imposes address sharing (Carrier Grade NATS, Virtual Hosting, etc)
- Where there is no substitute then we turn to the aftermarket
- Some address transfers are “sale” transactions, and they are entered into the address registries
- Some transfers take the form of “leases” where the lease holder’s details are not necessarily entered into the address registry



Address Transfers

Receiving RIR	2012	2013	2014
ARIN	28	19	42
APNIC	148	152	340
RIPE NCC	9	154	919
Total	185	325	1,301

Number of registered
Address transfers per year



Volume of addresses transferred
per year (millions of /32s p.a.)

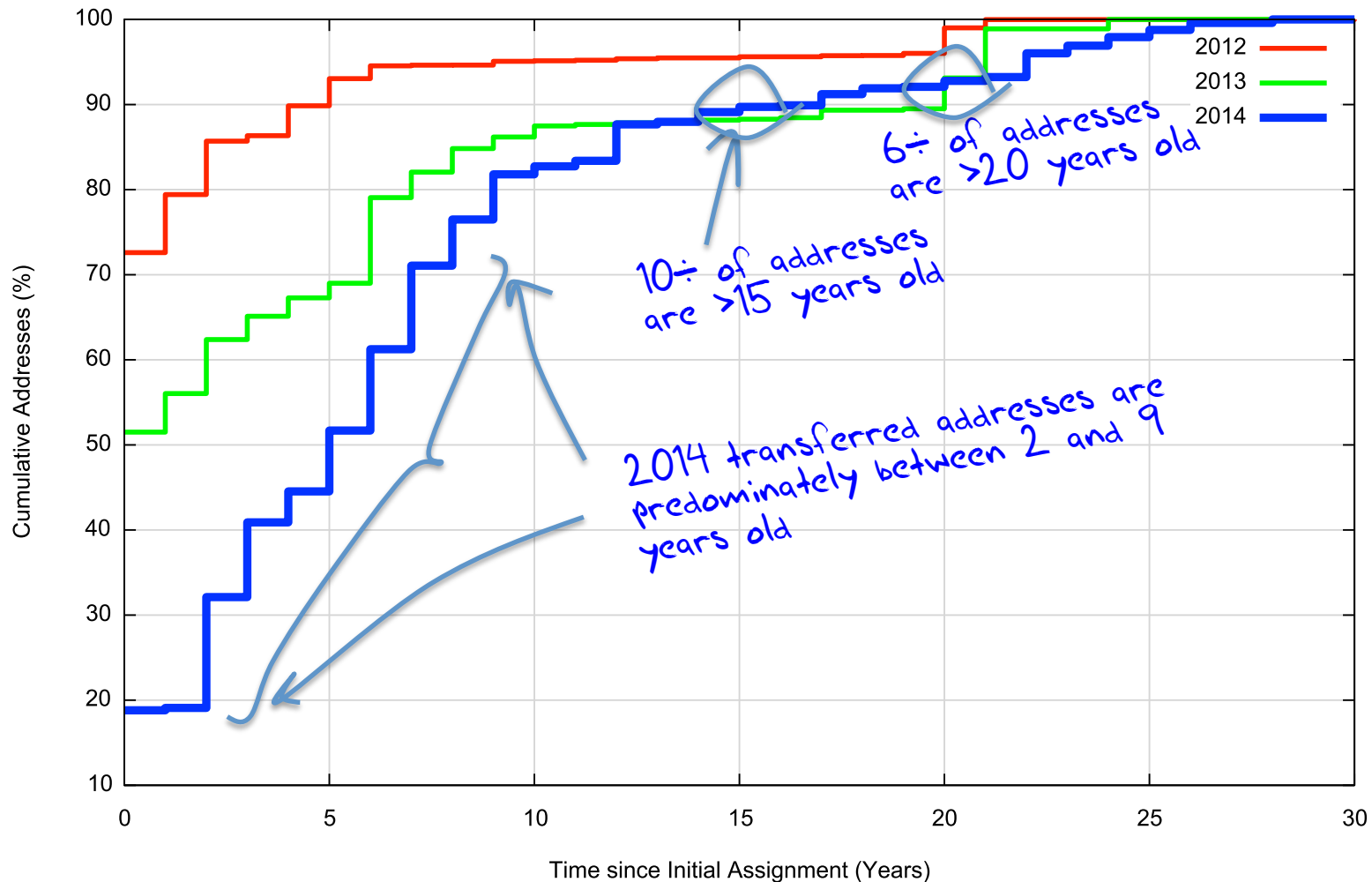


Receiving RIR	2012	2013	2014
ARIN	4.86	3.90	2.91
APNIC	1.78	1.74	3.71
RIPE NCC	0.06	1.81	9.35
Total	6.70	7.46	15.98

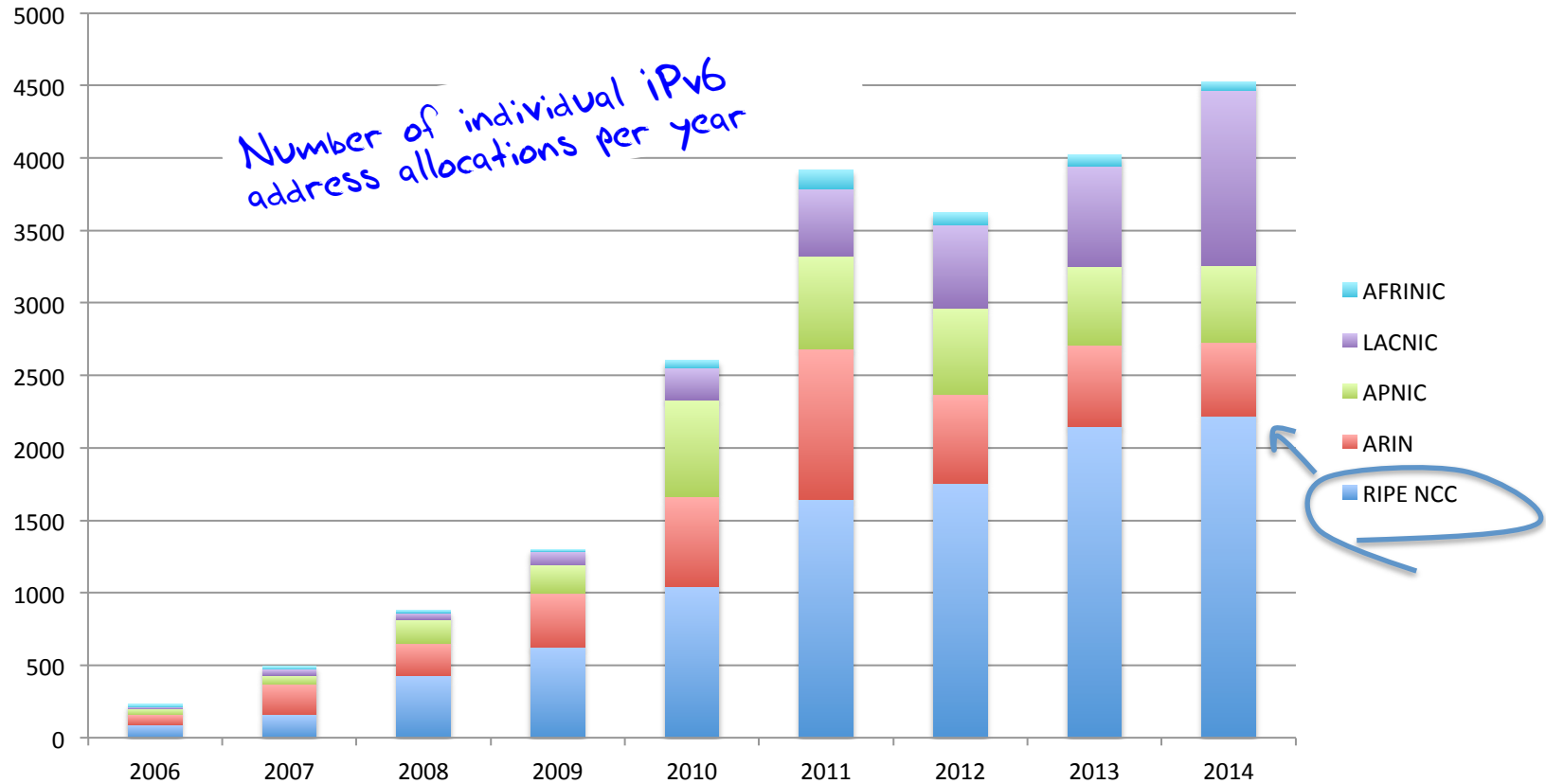


How old are transferred addresses?

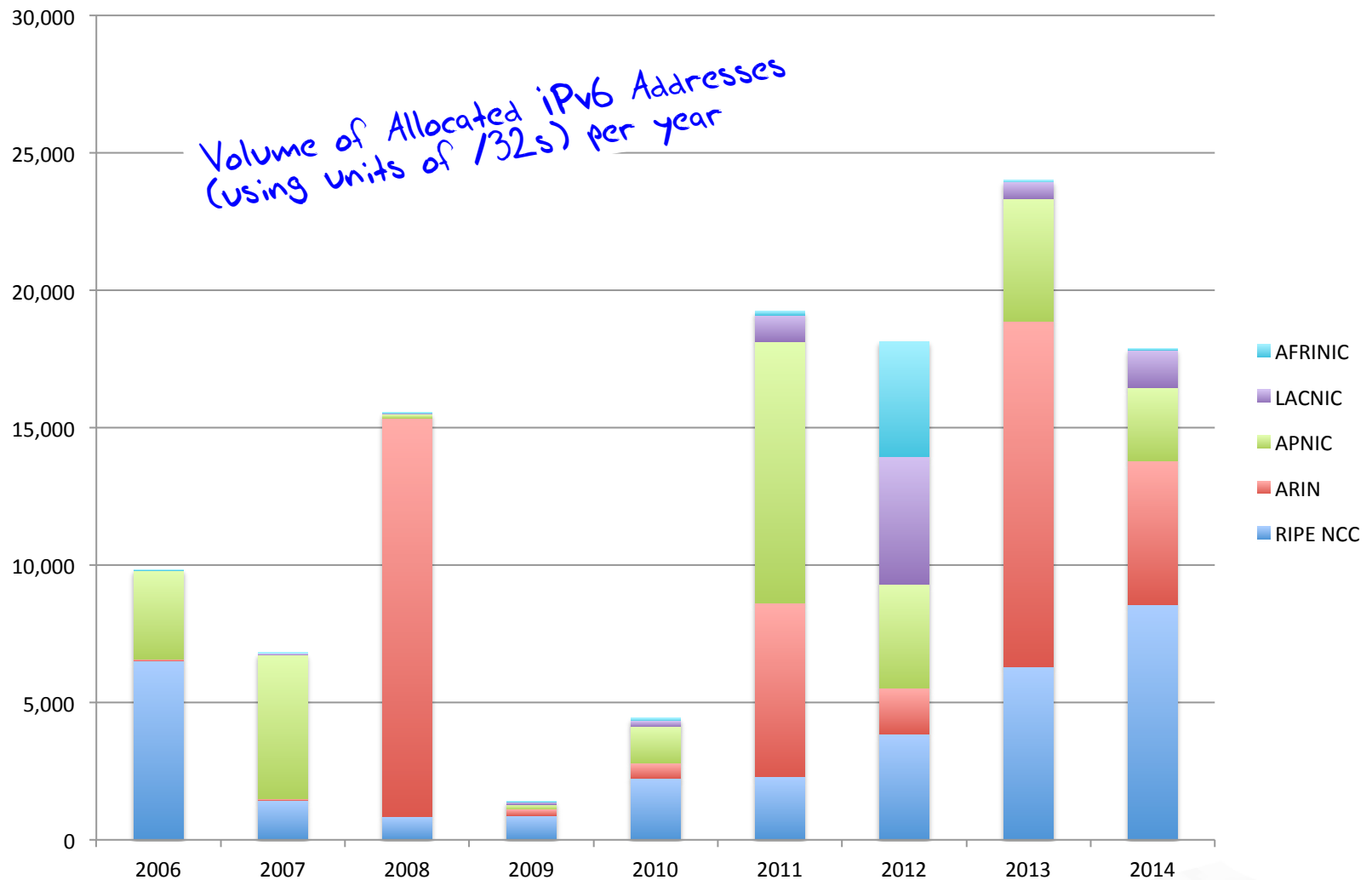
Cumulative Address Age Distribution for Transferred Addresses



IPv6 Allocations



IPv6 Allocated Addresses



Where did the IPv6 addresses go?

	2010		2011		2012		2013		2014	
1	Germany	654	China	8,997	Argentina	4,177	United States	12,537	United States	4,930
2	Japan	630	United States	6,253	Egypt	4,098	China	4,135	China	2,127
3	United States	504	Spain	667	China	3,136	UK	782	UK	1,090
4	China	339	UK	476	United States	1,337	Germany	651	Brazil	863
5	Belgium	270	Brazil	311	Italy	635	Russia	523	Germany	749
6	France	195	Germany	300	Russia	403	Netherlands	463	Netherlands	719
7	Brazil	160	Mexico	261	Germany	399	Brazil	450	Russia	716
8	UK	123	Venezuela	261	UK	356	France	435	France	436
9	Russia	117	Netherlands	241	Canada	323	Italy	339	Italy	410
10	Netherlands	103	Russia	160	Brazil	294	Switzerland	265	Switzerland	369

Volume of Allocated IPv6 Addresses
(using units of /32s) per country,
per year

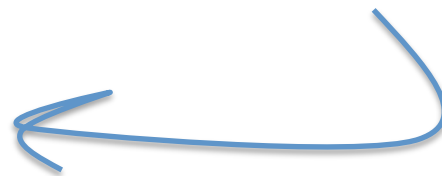


The Routing View



Routing Indicators for IPv4

Routing prefixes - growing by some 45,000 prefixes per year

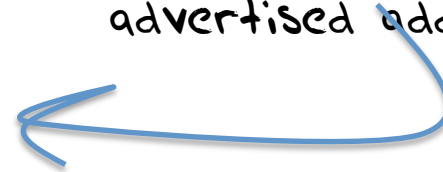


AS Numbers - growing by some 3,000 ASNs per year



Routing Indicators for IPv4

Address Exhaustion is now visible in the extent of advertised address space

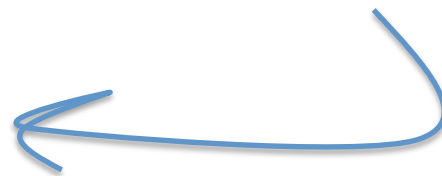


The average size of a routing advertisement is getting smaller



Routing Indicators for IPv4

More Specifics are still taking up
one half of the routing table



The “shape” of inter-AS
interconnection appears to be
steady, as the Average AS Path
length has been held steady
through the year



How can the IPv4 network continue to grow when we are running out of IPv4 addresses?

We are now recycling old addresses back into the routing system

IPv4 Address Reuse

The age distribution of new addresses announced into the routing system each year

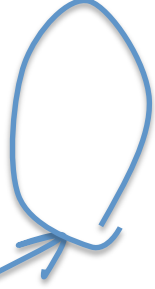
20% of new addresses in 2010 were more than 1 year old



50% of new addresses in 2014 were more than 1 year old



18% of new addresses in 2014 were more than 20 years old



it appears that this collection of "old" addresses includes space that has been leased rather than transferred i.e. the current address user is not listed in the address registry



IPv4 in 2014 - Growth is Slowing

- Overall IPv4 Internet growth in terms of BGP is at a rate of some **~9%-10% p.a.**
- Address span growing far more slowly than the table size
- The rate of growth of the IPv4 Internet is slowing down
 - Address shortages
 - Masking by NAT deployments and transfers
 - Saturation of critical market sectors
 - Transition uncertainty



The Route Views view of IPv6

World IPv6 Day

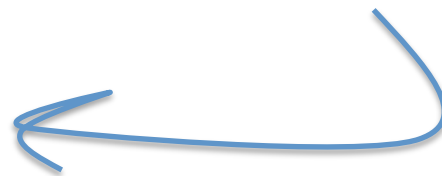


IANA IPv4 Exhaustion



Routing Indicators for IPv6

Routing prefixes - growing by some 6,000 prefixes per year



AS Numbers - growing by some 1,600 prefixes per year (which is half the V4 growth)



Routing Indicators for IPv6

Address consumption is happening at a constant rate, and not growing year by year

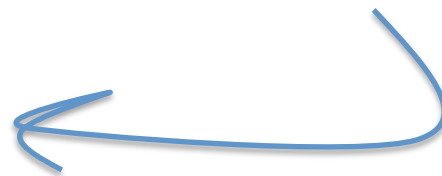


The average size of a routing advertisement is getting smaller



Routing Indicators for IPv6

More Specifics now take up one third of the routing table



The “shape” of inter-AS interconnection appears to be steady, as the Average AS Path length has been held steady through the year



IPv6 in 2013

- Overall IPv6 Internet growth in terms of BGP is **20% - 40 % p.a.**
 - 2012 growth rate was ~ 90%.

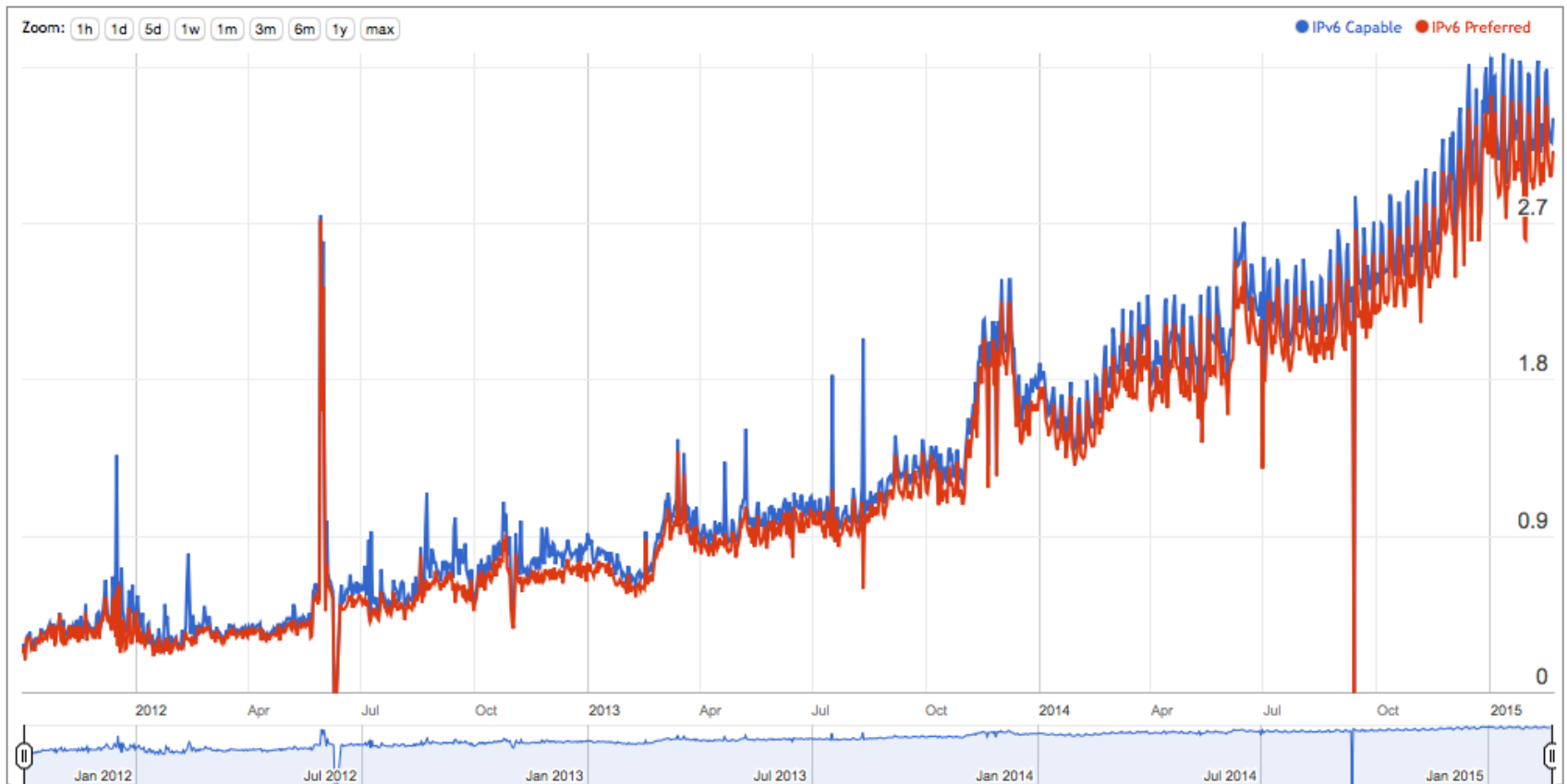
If these relative growth rates persist then the IPv6 network would span the same network domain as IPv4 in ~16 years time



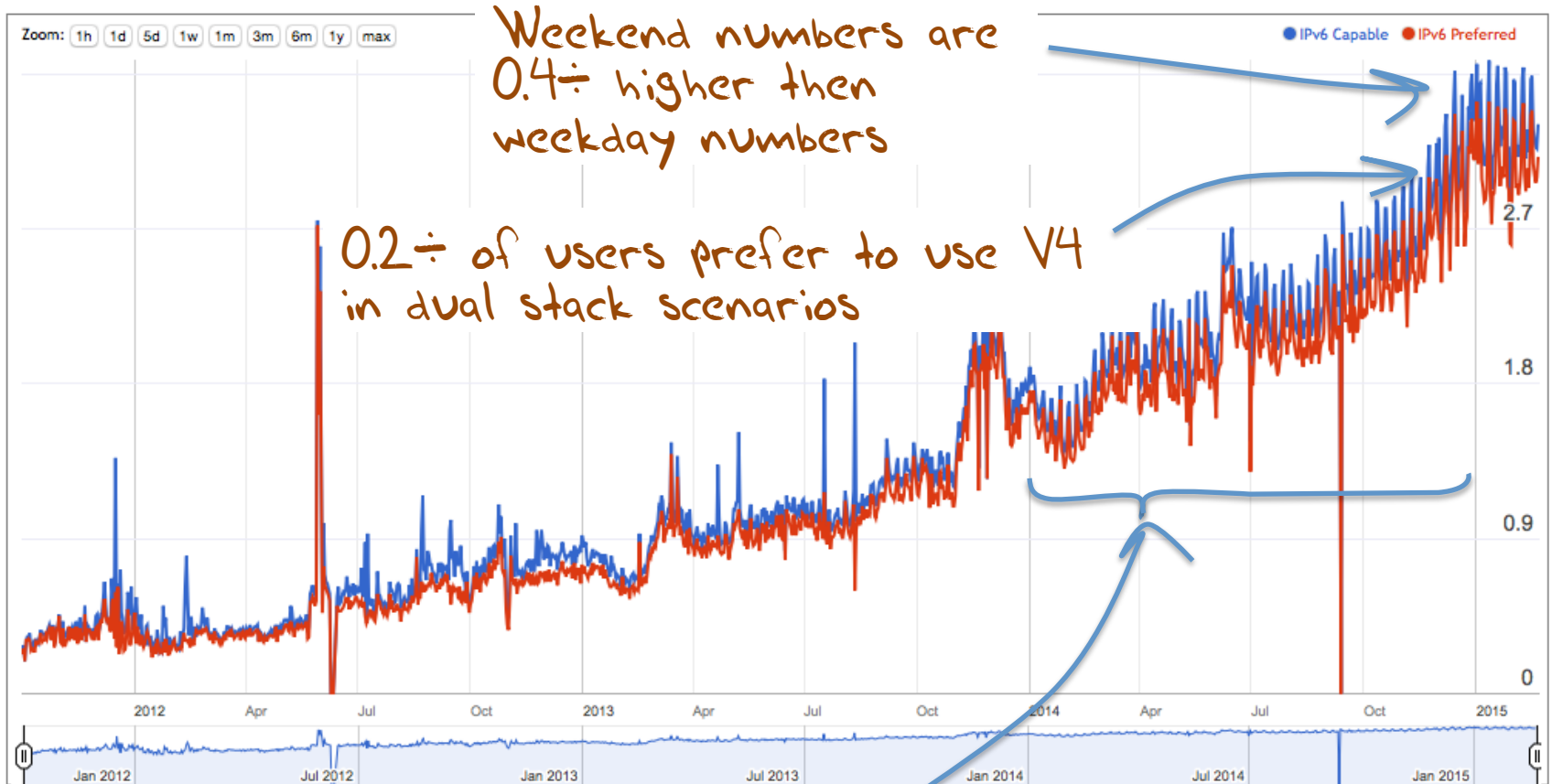
Are we all now using V6?



IPv6: How Many Can?



IPv6: How Many Can?



IPv6 use has doubled across 2014



Forward Guesstimates

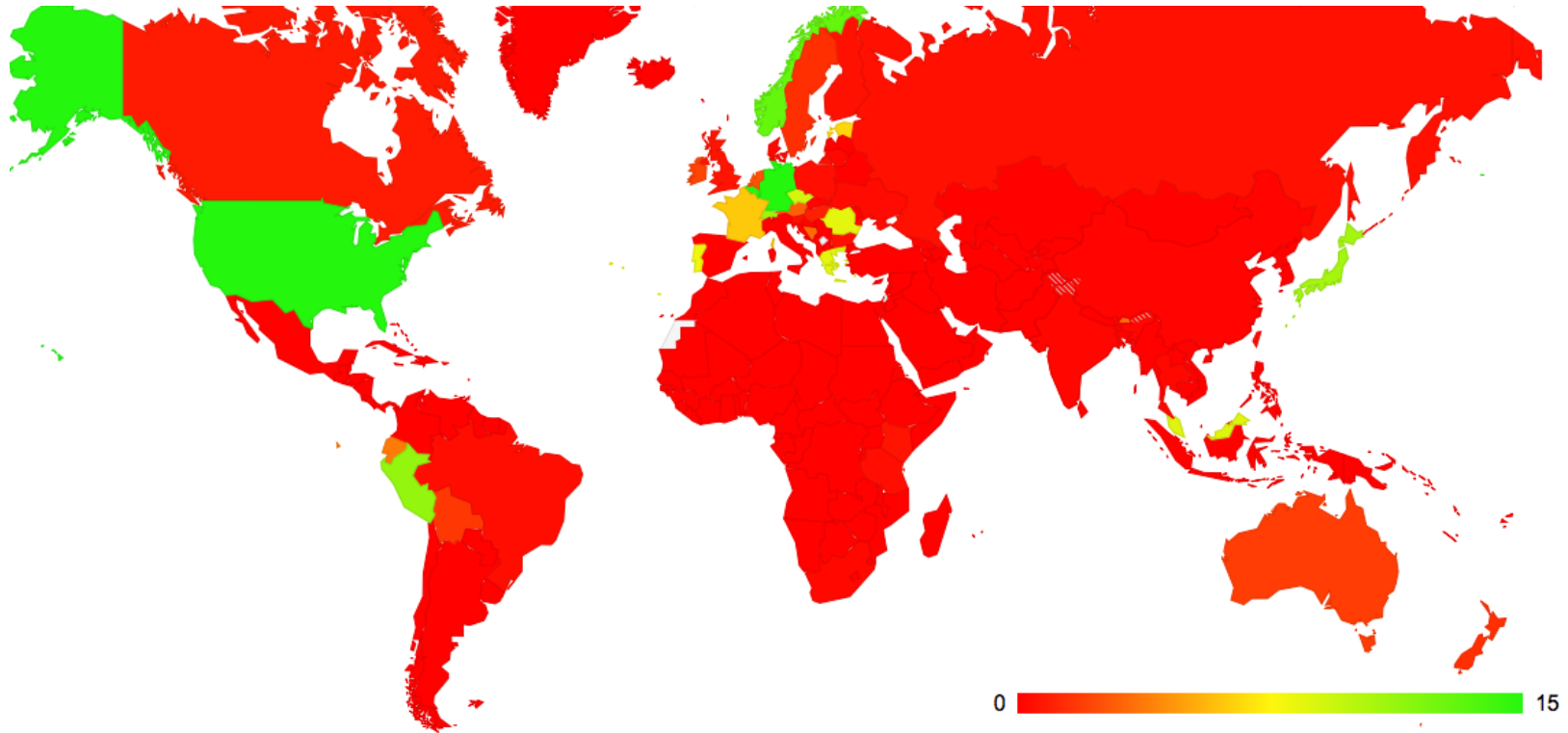
Best Case: IPv6 uptake doubles every year:
2019

Worst Case: IPv6 uptake constant 2% every year:
2067



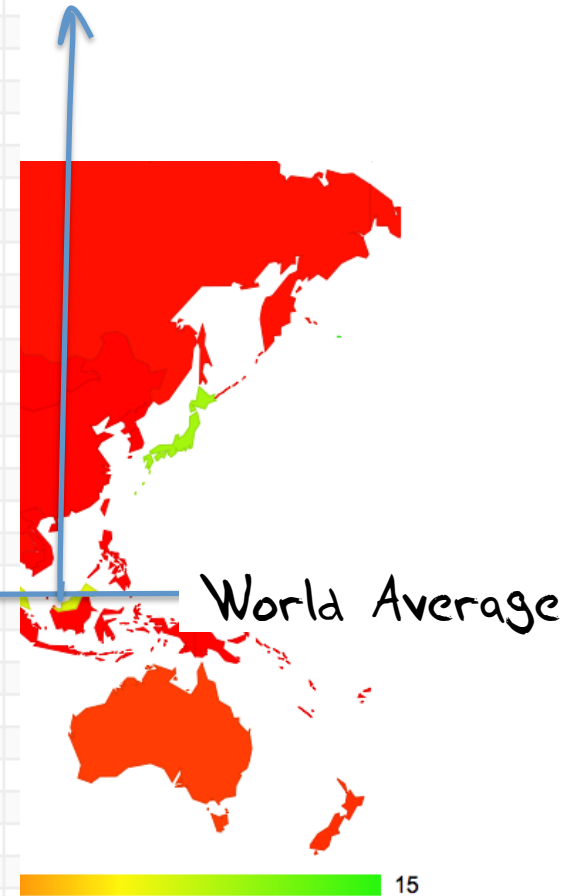
IPv6: Who Can?

IPv6 use by Country – February 2015



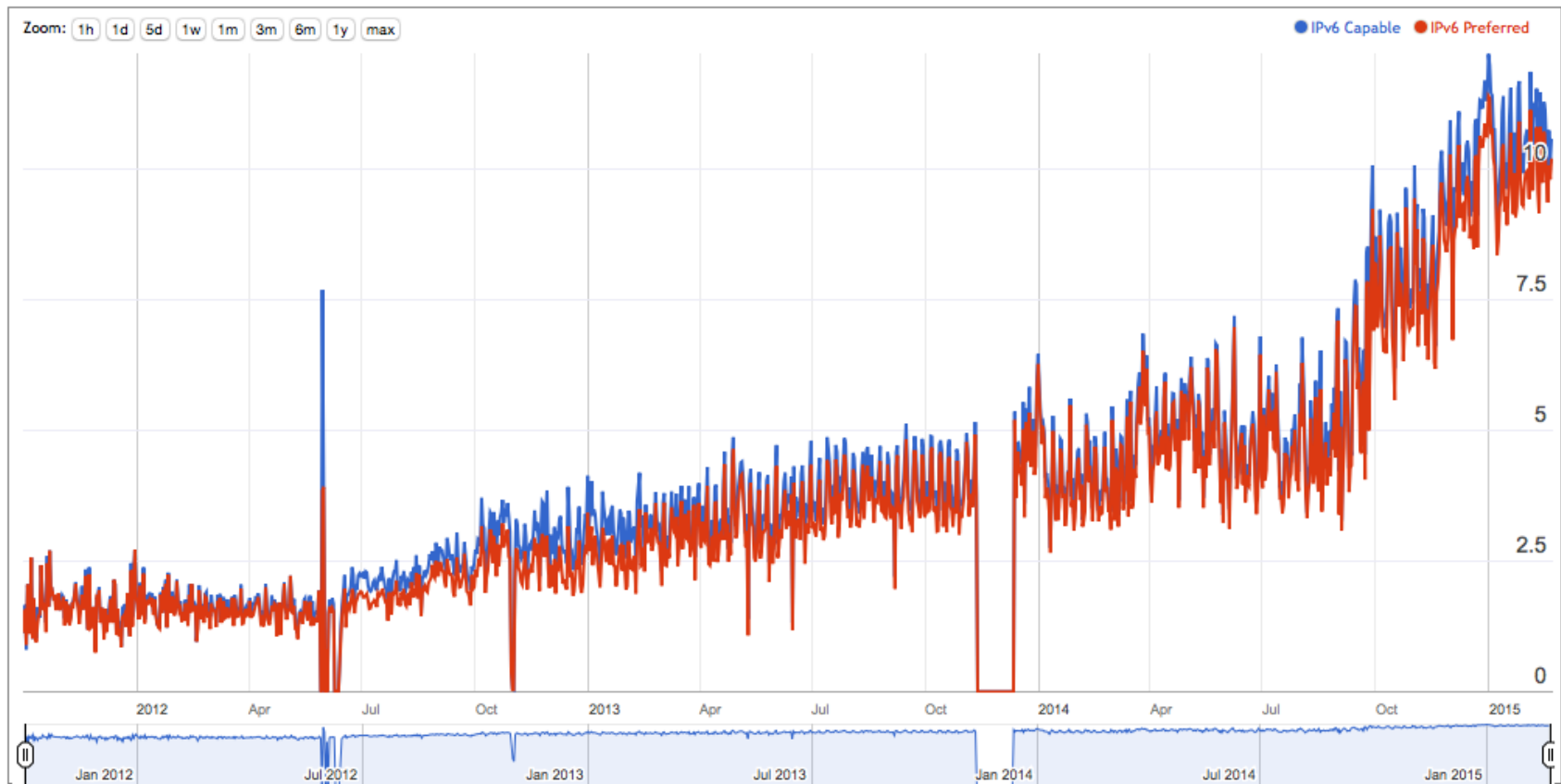
IPv6: Who Can?

CC	Country	IPv6 Capable
BE	Belgium, Western Europe, Europe	37.04%
DE	Germany, Western Europe, Europe	17.32%
LU	Luxembourg, Western Europe, Europe	15.04%
US	United States of America, Northern America, Americas	14.96%
NO	Norway, Northern Europe, Europe	13.84%
CH	Switzerland, Western Europe, Europe	11.10%
EU	European Union, Western Europe, Europe	11.07%
JP	Japan, Eastern Asia, Asia	10.49%
PE	Peru, South America, Americas	10.14%
CZ	Czech Republic, Eastern Europe, Europe	9.14%
RO	Romania, Eastern Europe, Europe	8.43%
MY	Malaysia, South-Eastern Asia, Asia	7.93%
GR	Greece, Southern Europe, Europe	7.77%
PT	Portugal, Southern Europe, Europe	6.38%
FR	France, Western Europe, Europe	5.91%
EE	Estonia, Northern Europe, Europe	5.75%
SG	Singapore, South-Eastern Asia, Asia	4.71%
BA	Bosnia and Herzegovina, Southern Europe, Europe	3.37%
EC	Ecuador, South America, Americas	3.31%
AT	Austria, Western Europe, Europe	2.73%
NL	Netherlands, Western Europe, Europe	2.37%
BT	Bhutan, Southern Asia, Asia	2.14%
AU	Australia, Australia and New Zealand, Oceania	1.58%
IE	Ireland, Northern Europe, Europe	1.43%
SE	Sweden, Northern Europe, Europe	1.36%
NZ	New Zealand, Australia and New Zealand, Oceania	0.95%
BO	Bolivia, South America, Americas	0.92%
CA	Canada, Northern America, Americas	0.86%
TW	Taiwan, Eastern Asia, Asia	0.71%
GB	United Kingdom of Great Britain and Northern Ireland, Northern Europe, Europe	0.69%
CN	China, Eastern Asia, Asia	0.59%
SI	Slovenia, Southern Europe, Europe	0.55%
FI	Finland, Northern Europe, Europe	0.52%
RU	Russian Federation, Eastern Europe, Europe	0.50%



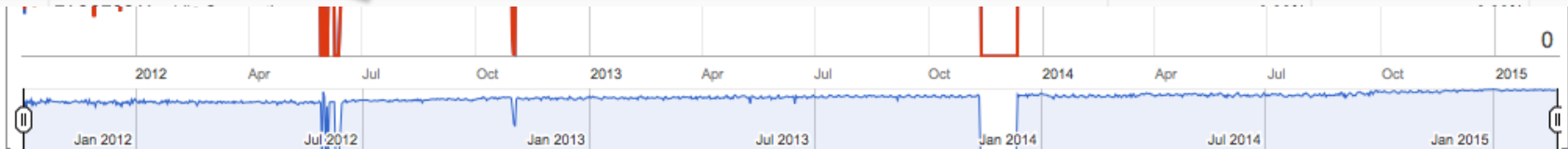
The Local View: Japan

IPv6 Country Deployment for Japan (JP)



The Local View: Japan

ASN	AS Name	IPv6 Capable	IPv6 Preferred	Samples
AS4713	OCN NTT Communications Corporation	0.63%	0.54%	195716
AS2516	KDDI KDDI CORPORATION	56.53%	53.60%	92293
AS17676	GIGAINFRA Softbank BB Corp.	8.92%	8.43%	76877
AS2518	BIGLOBE BIGLOBE Inc.	0.53%	0.50%	35332
AS2527	SO-NET So-net Entertainment Corporation	21.17%	19.33%	30164
AS9824	JTCL-JP-AS Jupiter Telecommunication Co. Ltd	0.01%	0.01%	27779
AS17511	K-OPTICOM K-Opticom Corporation	0.21%	0.18%	25273
AS10013	FBDC FreeBit Co.,Ltd.	0.76%	0.74%	21830
AS2510	INFOWEB FUJITSU LIMITED	0.54%	0.48%	19657
AS17506	UCOM UCOM Corp.	0.66%	0.63%	15194
AS10010	TOKAI TOKAI Communications Corporation	21.63%	19.85%	15018
AS2497	IIJ Internet Initiative Japan Inc.	0.31%	0.28%	14519
AS2519	VECTANT VECTANT Ltd.	0.32%	0.30%	11864
AS9617	ZAQ KANSAI MULTIMEDIA SERVICE COMPANY	0.00%	0.01%	11507
AS2514	INFOSPHERE NTT PC Communications, Inc.	0.13%	0.10%	11122
AS18126	CTCX Chubu Telecommunications Company, Inc.	48.48%	40.19%	8816
AS4685	ASAHI-NET Asahi Net	0.07%	0.07%	8056
AS7679	QTNET Kyushu Telecommunication Network Co.,Inc.	0.00%	0.00%	6488
AS4725	ODN SOFTBANK TELECOM Corp.	0.45%	0.00%	6379
AS37903	EMOBILE Ymobile Corporation	0.00%	0.00%	6326
AS4721	JCN Jupiter Telecommunications Co., Ltd.	0.02%	0.00%	6218
AS2907	SINET-AS Research Organization of Information and Systems, National Institute of Informatics	2.72%	2.59%	5222
AS9354	TDNC Community Network Center Inc.	5.28%	4.94%	4714
AS9365	ITSCOM its communications Inc.	8.65%	8.54%	4450
AS7522	STCN STNet, Incorporated	29.42%	24.94%	4034



The Internet's IPv6 Top 30

			Est. V6 Users	V6 Takeup
1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US 17,355,202	37.9%
2	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US 9,723,491	44.3%
3	AS2516	KDDI KDDI CORPORATION	JP 7,202,025	57.0%
4	AS3320	DTAG Deutsche Telekom AG	DE 5,522,595	23.6%
5	AS12322	PROXAD Free SAS	FR 2,669,010	22.6%
6	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE 2,206,030	42.5%
7	AS6848	TELENET-AS Telenet N.V.	BE 1,883,091	60.4%
8	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY 1,496,962	10.0%
9	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE 1,433,337	34.3%
10	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US 1,277,087	24.2%
11	AS6147	Telefonica del Peru S.A.A.	PE 1,166,632	12.5%
12	AS29562	KABELBW-ASN Kabel BW GmbH	DE 970,595	36.6%
13	AS17676	GIGAINFRA Softbank BB Corp.	JP 952,051	9.1%
14	AS2527	SO-NET So-net Entertainment Corporation	JP 870,065	21.1%
15	AS5432	BELGACOM-SKYNET-AS BELGACOM S.A.	BE 828,286	19.9%
16	AS12271	SCRR-12271 - Time Warner Cable Internet LLC	US 825,253	28.2%
17	AS8708	RCS-RDS RCS RDS SA	RO 823,591	19.5%
18	AS3303	SWISSCOM Swisscom (Switzerland) Ltd	CH 801,227	25.2%
19	AS12392	ASBRUTELE Brutele SC	BE 762,615	66.2%
20	AS5610	O2-CZECH-REPUBLIC Telefonica Czech Republic, a.s.	CZ 724,773	33.2%
21	AS4134	CHINANET-BACKBONE No.31,Jin-rong Street	CN 698,620	0.3%
22	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	US 695,620	12.1%
23	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	US 580,599	16.8%
24	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN 570,117	0.3%
25	AS6389	BELLSOUTH-NET-BLK - BellSouth.net Inc.	US 569,459	34.6%
26	AS18126	CTCX Chubu Telecommunications Company, Inc.	JP 566,614	48.4%
27	AS11427	SCRR-11427 - Time Warner Cable Internet LLC	US 550,651	15.5%
28	AS4538	ERX-CERNET-BKB China Education and Research Network Center	CN 539,349	27.1%
29	AS39832	NO-OPERA Opera Software ASA	NO 533,040	99.8%
30	AS22394	CELLCO - Cellco Partnership DBA Verizon Wireless	US 476,140	53.6%



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1	AS7922 COMCAST-7922 - Comcast Cable Communications, Inc.	US 17,355,202	37.9%	17,355,202	23.0%
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3	AS2516 KDDI KDDI CORPORATION	JP 7,202,025	57.0%	34,280,719	45.5%
4	AS3320 DTAG Deutsche Telekom AG	DE 5,522,595	23.6%	39,803,315	52.8%
5	AS12322 PROXAD Free SAS	FR 2,669,010	22.6%	42,472,326	56.3%
6	AS31334 KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE 2,206,030	42.5%	44,678,356	59.2%
7	AS6848 TELENET-AS Telenet N.V.	BE 1,883,091	60.4%	46,561,448	61.7%
8	AS4788 TMNET-AS-AP TM Net, Internet Service Provider	MY 1,496,962	10.0%	48,058,410	63.7%
9	AS20825 UNITYMEDIA Unitymedia NRW GmbH	DE 1,433,337	34.3%	49,491,748	65.6%
10	AS20001 ROADRUNNER-WEST - Time Warner Cable Internet LLC	US 1,277,087	24.2%	50,768,836	67.3%
11	AS6147 Telefonica del Peru S.A.A.	PE 1,166,632	12.5%	51,935,469	68.9%
12	AS29562 KABELBW-ASN Kabel BW GmbH	DE 970,595	36.6%	52,906,064	70.2%
13	AS17676 GIGAINFRA Softbank BB Corp.	JP 952,051	9.1%	53,858,115	71.4%
14	AS2527 SO-NET So-net Entertainment Corporation	JP 870,065	21.1%	54,728,180	72.6%
15	AS5432 BELGACOM-SKYNET-AS BELGACOM S.A.	BE 828,286	19.9%	55,556,467	73.7%
16	AS12271 SCRR-12271 - Time Warner Cable Internet LLC	US 825,253	28.2%	56,381,720	74.8%
17	AS8708 RCS-RDS RCS RDS SA	RO 823,591	19.5%	57,205,311	75.9%
18	AS3303 SWISSCOM Swisscom (Switzerland) Ltd	CH 801,227	25.2%	58,006,539	76.9%
19	AS12392 ASBRUTELE Brutele SC	BE 762,615	66.2%	58,769,155	77.9%
20	AS5610 O2-CZECH-REPUBLIC Telefonica Czech Republic, a.s.	CZ 724,773	33.2%	59,493,928	78.9%
21	AS4134 CHINANET-BACKBONE No.31,Jin-rong Street	CN 698,620	0.3%	60,192,548	79.8%
22	AS10796 SCRR-10796 - Time Warner Cable Internet LLC	US 695,620	12.1%	60,888,169	80.7%
23	AS11426 SCRR-11426 - Time Warner Cable Internet LLC	US 580,599	16.8%	61,468,768	81.5%
24	AS4837 CHINA169-BACKBONE CNCGROUP China169 Backbone	CN 570,117	0.3%	62,038,886	82.3%
25	AS6389 BELL SOUTH-NET-BLK - BellSouth.net Inc.	US 569,459	34.6%	62,608,345	83.0%
26	AS18126 CTCX Chubu Telecommunications Company, Inc.	JP 566,614	48.4%	63,174,960	83.8%
27	AS11427 SCRR-11427 - Time Warner Cable Internet LLC	US 550,651	15.5%	63,725,611	84.5%
28	AS4538 ERX-CERNET-BKB China Education and Research Network Center	CN 539,349	27.1%	64,264,960	85.2%
29	AS39832 NO-OPERA Opera Software ASA	NO 533,040	99.8%	64,798,001	85.9%
30	AS22394 CELLCO - Cellco Partnership DBA Verizon Wireless	US 476,140	53.6%	65,274,142	86.6%



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22	AS10796 SCRR-10796 - Time Warner Cable Internet LLC	US 695,620	12.1%	60,888,169	80.7%
23	AS11426 SCRR-11426 - Time Warner Cable Internet LLC	US 580,599	16.8%	61,468,768	81.5%
24	AS4837 CHINA169-BACKBONE CNCGROUP China169 Backbone	CN 570,117	0.3%	62,038,886	82.3%
25	AS6389 BELL SOUTH-NET-BLK - BellSouth.net Inc.	US 569,459	34.6%	62,608,345	83.0%
26	AS18126 CTCX Chubu Telecommunications Company, Inc.	JP 566,614	48.4%	63,174,960	83.8%
27	AS11427 SCRR-11427 - Time Warner Cable Internet LLC	US 550,651	15.5%	63,725,611	84.5%
28	AS4538 ERX-CERNET-BKB China Education and Research Network Center	CN 539,349	27.1%	64,264,960	85.2%
29	AS39832 NO-OPERA Opera Software ASA	NO 533,040	99.8%	64,798,001	85.9%
30	AS22394 CELLCO - Cellco Partnership DBA Verizon Wireless	US 476,140	53.6%	65,274,142	86.6%

It's a very uneven takeup of IPv6 - 86% of the world's IPv6 users sit behind just 30 ISPs



Some Observations

- If you allow the customer to own and maintain their own CPE then the CPE upgrade path is a critical issue – old CPE drags the IPv6 numbers down
- Mobile providers should see higher penetration numbers ... but legacy handsets seem to pull the numbers down
- There are some high penetration numbers on “greenfield” deployments, but its rare to see:

49,AS16591,"GOOGLE-FIBER - Google Fiber Inc.",US,155096,87.3%



The Internet's 30 Largest ISPs

AS		V6 Users	Cum V6 Users	Cum Users	% User:
1	AS4134 CHINANET-BACKBONE No.31,Jin-rong Street	CN 686,462 0.3%	686,462 0.9%	262,501,487	11.4%
2	AS4837 CHINA169-BACKBONE CNCGROUP China169 Backbone	CN 569,568 0.3%	1,256,030 1.7%	436,619,656	18.9%
3	AS7922 COMCAST-7922 - Comcast Cable Communications, Inc.	US 17,369,224 37.9%	18,625,254 24.7%	482,497,561	20.9%
4	AS9829 BSNL-NIB National Internet Backbone	IN 3,536 0.0%	18,628,791 24.7%	515,899,466	22.4%
5	AS8151 Uninet S.A. de C.V.	MX 1,035 0.0%	18,629,827 24.7%	545,386,899	23.7%
6	AS4713 OCN NTT Communications Corporation	JP 201,493 0.8%	18,831,320 24.9%	571,905,467	24.8%
7	AS9121 TTNET Turk Telekomunikasyon Anonim Sirketi	TR 46 0.0%	18,831,367 24.9%	596,613,101	25.9%
8	AS3320 DTAG Deutsche Telekom AG	DE 5,530,042 23.6%	24,361,409 32.3%	620,021,944	26.9%
9	AS8452 TE-AS TE-AS	EG 0 0.0%	24,361,409 32.3%	642,839,031	27.9%
10	AS7018 ATT-INTERNET4 - ATT Services, Inc.	US 9,771,116 44.5%	34,132,526 45.2%	664,814,121	28.8%
11	AS28573 NET Servios de Comunicacao S.A.	BR 130,867 0.6%	34,263,393 45.4%	685,230,533	29.7%
12	AS4766 KIXS-AS-KR Korea Telecom	KR 497 0.0%	34,263,891 45.4%	703,127,048	30.5%
13	AS24560 AIRTEL BROADBAND-AS-AP Bharti Airtel Ltd., Telemedia Services	IN 101 0.0%	34,263,992 45.4%	720,384,304	31.2%
14	AS701 UUNET - MCI Communications Services, Inc. dba Verizon Business	US 2,141 0.0%	34,266,133 45.4%	737,608,471	32.0%
15	AS3215 AS3215 Orange S.A.	FR 1,006 0.0%	34,267,140 45.4%	754,795,978	32.7%
16	AS17974 TELKOMNET-AS2-AP PT Telekomunikasi Indonesia	ID 209 0.0%	34,267,350 45.4%	771,821,727	33.5%
17	AS9299 IPG-AS-AP Philippine Long Distance Telephone Company	PH 0 0.0%	34,267,350 45.4%	787,775,284	34.2%
18	AS18881 Global Village Telecom	BR 30,008 0.2%	34,297,358 45.4%	803,599,971	34.9%
19	AS4788 TMNET-AS-AP TM Net, Internet Service Provider	MY 1,498,704 10.0%	35,796,063 47.4%	818,520,387	35.5%
20	AS9808 CMNET-GD Guangdong Mobile Communication Co.Ltd.	CN 76,096 0.5%	35,872,159 47.5%	833,204,643	36.1%
21	AS45595 PKTELECOM-AS-PK Pakistan Telecom Company Limited	PK 29 0.0%	35,872,189 47.5%	846,837,815	36.7%
22	AS45899 VNPT-AS-VN VNPT Corp	VN 25 0.0%	35,872,214 47.5%	860,371,065	37.3%
23	AS3269 ASN-IBSNAZ Telecom Italia S.p.a.	IT 328 0.0%	35,872,543 47.5%	873,716,520	37.9%
24	AS4812 CHINANET-SH-AP China Telecom (Group)	CN 21,640 0.2%	35,894,183 47.6%	886,844,441	38.5%
25	AS2516 KDDI KDDI CORPORATION	JP 7,208,287 57.0%	43,102,471 57.1%	899,497,448	39.0%
26	AS5089 NTL Virgin Media Limited	GB 1,443 0.0%	43,103,915 57.1%	911,955,842	39.6%
27	AS3352 TELEFONICA DE ESPANA TELEFONICA DE ESPANA	ES 51 0.0%	43,103,966 57.1%	924,334,784	40.1%
28	AS36903 MT-MPLS	MA 35 0.0%	43,104,001 57.1%	936,174,875	40.6%
29	AS12322 PROXAD Free SAS	FR 2,665,721 22.5%	45,769,722 60.6%	948,014,521	41.1%
30	AS7738 Telemar Norte Leste S.A.	BR 975 0.0%	45,770,697 60.6%	959,551,901	41.6%



Some Further Observations

IPv6 support is still very patchy:

While most of the V6 activity in terms of user counts is confined to 30 ISPs, just 6 of the top 30 largest ISPs have any significant IPv6 deployments

The Internet is heavily skewed

The 30 largest ISPs service 40% of the entire Internet user population

If these 30 providers were to achieve an average 50% IPv6 uptake in their customer base, then the total IPv6 capability level would be 20% rather than 3.6%



Thank You

