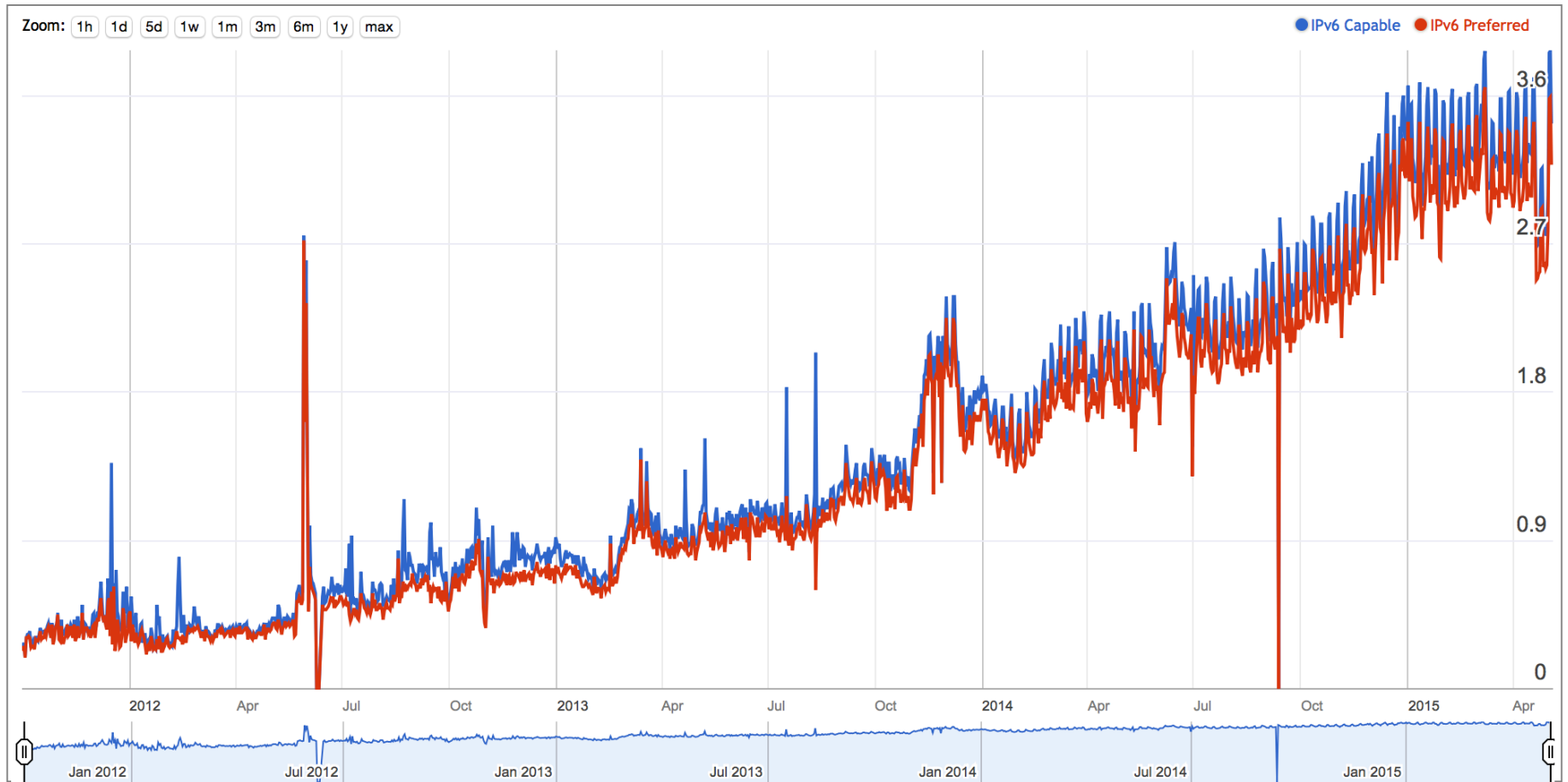


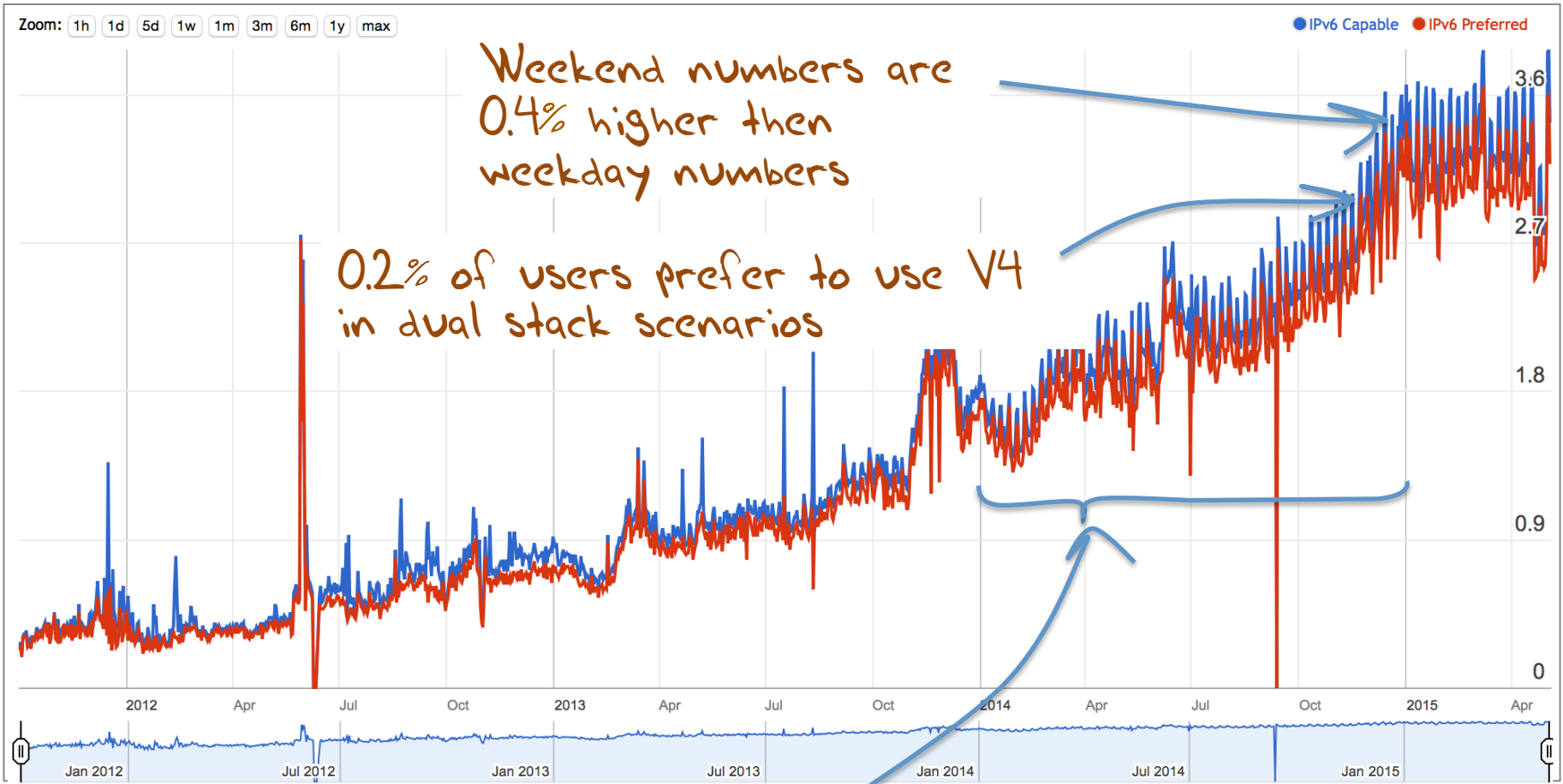
May 2015 Update on Measuring IPv6

Geoff Huston, George Michaelson
APNIC Labs
March 2015

IPv6: How Many Can?



IPv6: How Many Can?



IPv6 use has doubled across 2014

Forward Guesstimates

Best Case: IPv6 uptake doubles every year:

2019

(though it has to be observed that the first four months of 2015 are tracking nowhere near a constant doubling rate, so this looks like a stretch objective!)

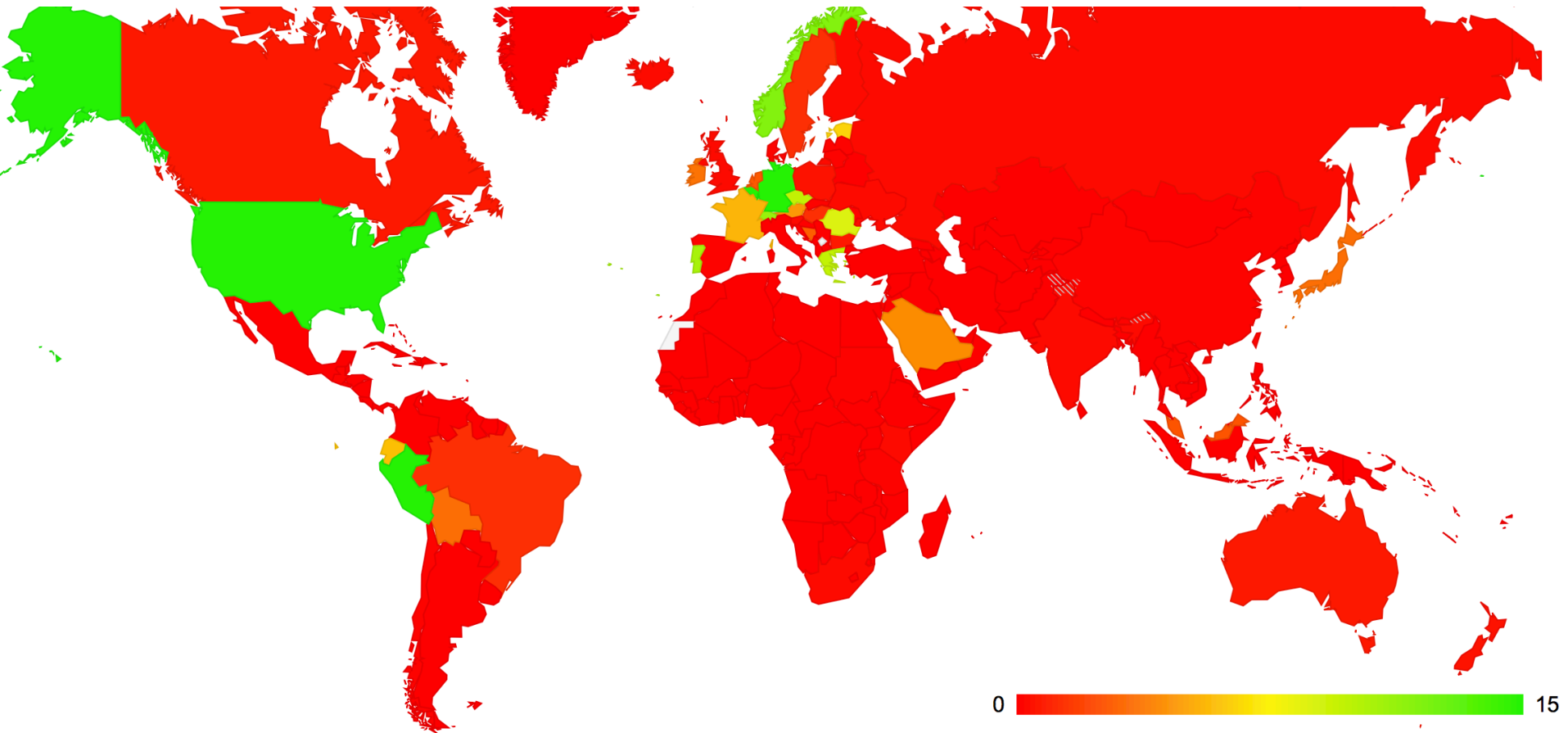
Worst Case: IPv6 additional uptake constant at a further 2% every year:

2067

(this is insane! If the transition takes longer than 10 more years from now then IPv6 is looking more and more like a discarded historical objective)

IPv6: Who Can?

IPv6 use by Country – May 2015

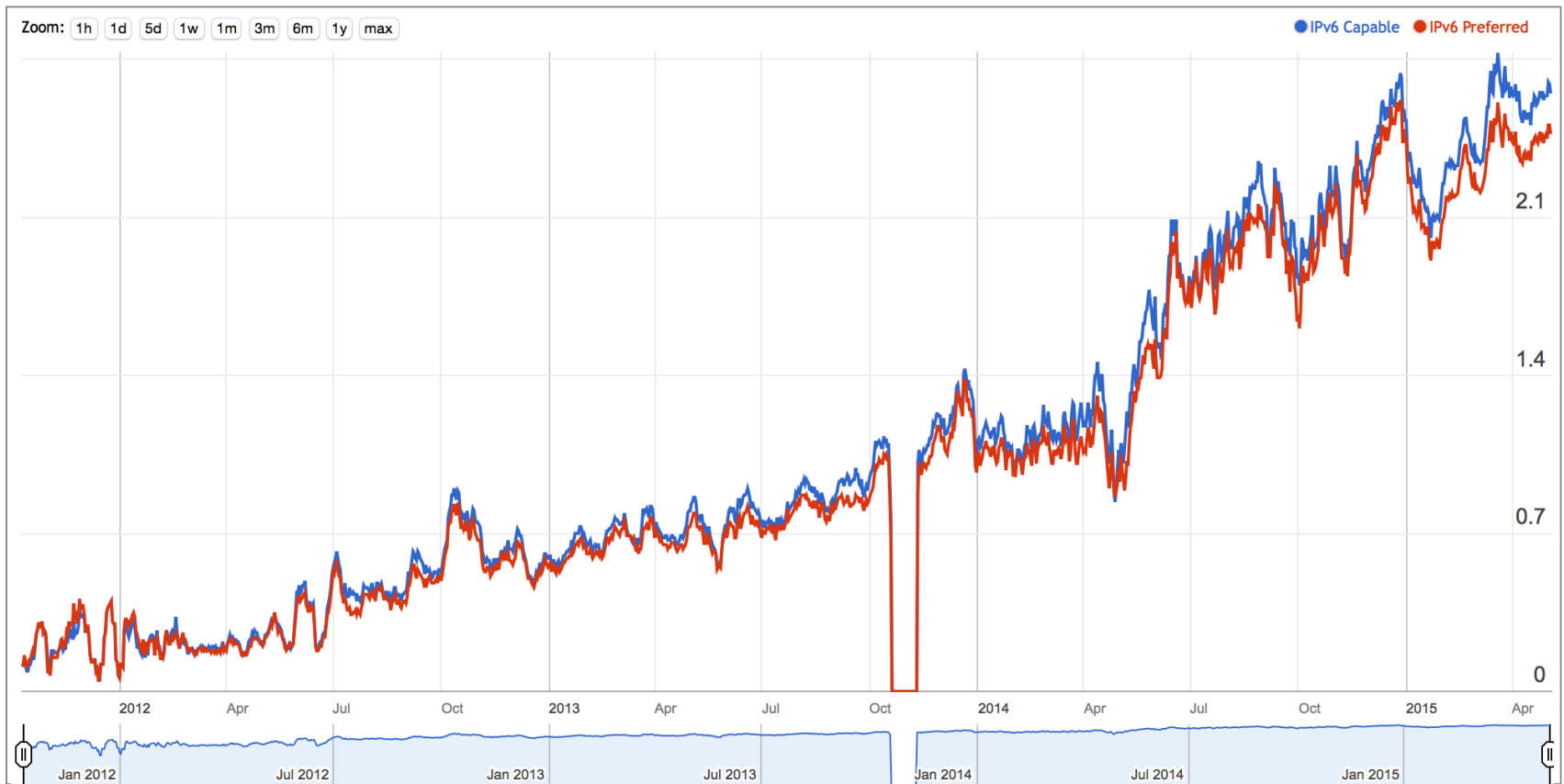


CC	Country	IPv6 Capable	IPv6 Preferred	Samples
BE	Belgium , Western Europe , Europe	38.32%	36.74%	164243
DE	Germany , Western Europe , Europe	19.24%	18.26%	406856
US	United States of America , Northern America , Americas	17.21%	15.89%	2451952
PE	Peru , South America , Americas	15.43%	14.81%	1579364
LU	Luxembourg , Western Europe , Europe	13.94%	12.91%	12930
NO	Norway , Northern Europe , Europe	11.47%	10.61%	61717
CH	Switzerland , Western Europe , Europe	10.02%	9.40%	82146
JP	Japan , Eastern Asia , Asia	9.36%	8.88%	504697
CZ	Czech Republic , Eastern Europe , Europe	9.06%	8.70%	369559
GR	Greece , Southern Europe , Europe	8.91%	8.53%	742366
PT	Portugal , Southern Europe , Europe	8.68%	8.40%	392306
RO	Romania , Eastern Europe , Europe	8.53%	8.42%	1383832
MY	Malaysia , South-Eastern Asia , Asia	7.01%	6.67%	667518
EE	Estonia , Northern Europe , Europe	6.46%	6.26%	62156
FR	France , Western Europe , Europe	5.66%	5.40%	1034355
EC	Ecuador , South America , Americas	4.38%	4.06%	546825
AT	Austria , Western Europe , Europe	3.86%	3.43%	71341
SG	Singapore , South-Eastern Asia , Asia	3.64%	2.98%	161112
BA	Bosnia and Herzegovina , Southern Europe , Europe	2.95%	2.86%	399160
BO	Bolivia , South America , Americas	2.94%	2.78%	106234
NL	Netherlands , Western Europe , Europe	2.57%	2.40%	265368
IE	Ireland , Northern Europe , Europe	2.56%	2.40%	104160
AU	Australia , Australia and New Zealand , Oceania	1.64%	1.58%	240253
SE	Sweden , Northern Europe , Europe	1.50%	1.11%	115038
HU	Hungary , Eastern Europe , Europe	1.34%	1.31%	685718
BT	Bhutan , Southern Asia , Asia	1.09%	1.03%	3301
BR	Brazil , South America , Americas	1.07%	1.03%	3494145
NZ	New Zealand , Australia and New Zealand , Oceania	1.05%	1.01%	73599
CA	Canada , Northern America , Americas	0.94%	0.77%	705304
SA	Saudi Arabia , Western Asia , Asia	0.79%	0.74%	447113
TW	Taiwan , Eastern Asia , Asia	0.64%	0.61%	1397015
SI	Slovenia , Southern Europe , Europe	0.61%	0.59%	138739
BG	Bulgaria , Eastern Europe , Europe	0.59%	0.57%	698535
PL	Poland , Eastern Europe , Europe	0.54%	0.53%	1012983

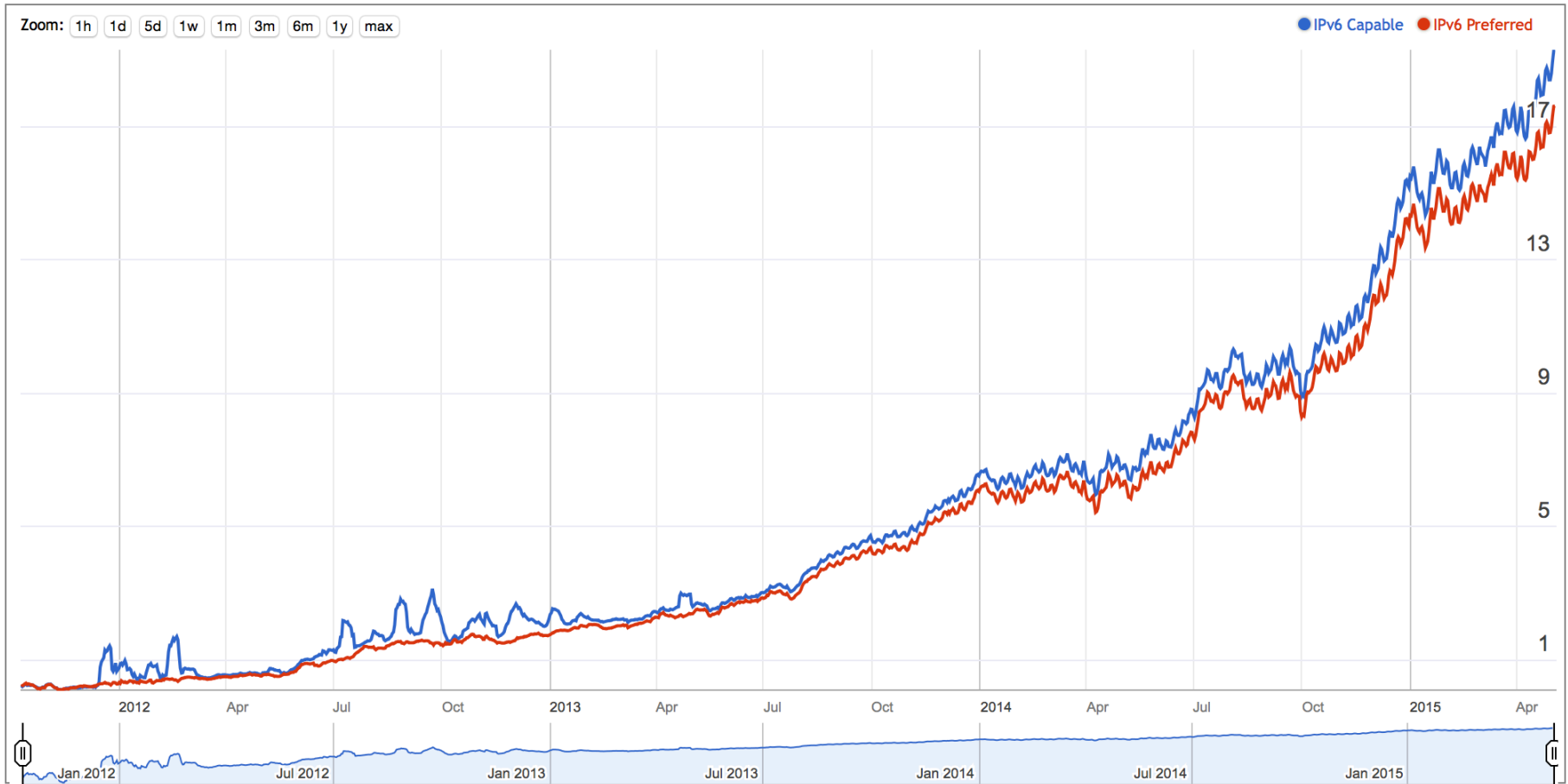


The Local View: NL

IPv6 Country Deployment for Netherlands (NL)



The Country View for the US



The Country View for the US

ASN	AS Name	IPv6 Capable	IPv6 Preferred	Samples
AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	36.49%	34.31%	489887
AS7018	ATT-INTERNET4 - ATT Services, Inc.	58.54%	55.35%	249834
AS701	UUNET - MCI Communications Services, Inc. dba Verizon Business	0.02%	0.01%	178177
AS22773	ASN-CXA-ALL-CCI-22773-RDC - Cox Communications Inc.	0.03%	0.06%	102499
AS20115	CHARTER-NET-HKY-NC - Charter Communications	0.03%	0.06%	88613
AS209	CENTURYLINK-US-LEGACY-QWEST - Qwest Communications Company, LLC	0.08%	0.07%	69337
AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	26.04%	24.07%	63573
AS10796	SCRR-10796 - Time Warner Cable Internet LLC	9.98%	9.57%	58504
AS6128	CABLE-NET-1 - Cablevision Systems Corp.	-	0.07%	55982
AS3549	LVLT-3549 - Level 3 Communications, Inc.		0.02%	48609
AS11427	SCRR-11427 - Time Warner Cable Internet LLC		14.35%	41208
AS11351	RR-NYSREGION-ASN-01 - Time Warner Cable Internet LLC		8.72%	35562
AS11426	SCRR-11426 - Time Warner Cable Internet LLC		15.93%	34694
AS12271	SCRR-12271 - Time Warner Cable Internet LLC		29.61%	31387
AS33363	BHN-TAMPA - BRIGHT HOUSE NETWORKS, LLC		0.03%	30555
AS5650	FRONTIER-FRTR - Frontier Communications of America, Inc.		0.04%	26834
AS7029	WINDSTREAM - Windstream Communications Inc		0.04%	24529
AS6939	HURRICANE - Hurricane Electric, Inc.		0.28%	22714
AS19108	SUDDENLINK-COMMUNICATIONS - Suddenlink Communications		0.03%	21029
AS15169	GOOGLE - Google Inc.		0.12%	19307
AS14618	AMAZON-AES - Amazon.com, Inc.		0.07%	19164
AS30036	MEDIACOM-ENTERPRISE-BUSINESS - Mediacom Communications Corp	0.52%	0.51%	18048
AS6389	BELLSOUTH-NET-BLK - BellSouth.net Inc.	39.62%	36.83%	15502
AS174	COGENT-174 - Cogent Communications	0.39%	0.28%	13952
AS12083	WOW-INTERNET - WideOpenWest Finance LLC	0.02%	0.03%	12988
AS22561	CENTURYLINK-LEGACY-LIGHTCORE - CenturyTel Internet Holdings, Inc.	0.08%	0.08%	12143
AS16586	CLEARWIRE - CLEAR WIRELESS LLC	0.07%	0.04%	10856
AS18747	IFX18747 - IFX Corporation	0.04%	0.04%	10738
AS4323	TWTC - tw telecom holdings, inc.	0.28%	0.13%	10321
AS11492	CABLEONE - CABLE ONE, INC.	0.01%	0.01%	9895
AS23520	COLUMBUS-NETWORKS - Columbus Networks USA, Inc.	2.36%	2.21%	9845
AS22394	CELLCO - Celco Partnership DBA Verizon Wireless	57.28%	52.97%	9316
AS5	SYMBOLICS - Symbolics, Inc.	0.00%	0.00%	8880
AS6079	RCN-AS - RCN	0.02%	0.02%	8787

7 providers in the US are supporting the majority of IPv6 use in the country.

This is not an unusual scenario

Concentration of IPv6

- Does this concentration of effort hold for the rest of the world?
- How many IPv6-enabled ISPs serve the majority of the world's IPv6 user population?

The Internet's IPv6 Top 30

Rank	AS	Name	CC	Est. V6 Users	%AS
1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	20,106,432.00	36
2	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US	16,243,047.00	58
3	AS3320	DTAG Deutsche Telekom AG	DE	6,579,879.00	26
4	AS2516	KDDI KDDI CORPORATION	JP	6,436,104.00	46
5	AS12322	PROXAD Free SAS	FR	2,673,831.00	21
6	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE	2,670,260.00	46
7	AS6147	Telefonica del Peru S.A.A.	PE	1,941,739.00	18
		TELENET-AS Telenet N.V.	BE	1,834,753.00	61
		Warner Cable Internet LLC	US	1,831,642.00	26
			MY	1,516,846.00	9
			DE	1,360,868.00	31
				5,100.00	31
				2,658.00	20
				6,381.00	9
				68,379.00	0
				51,104.00	23
				73,802.00	24
				18,097.00	32
				704,929.00	11
				699,632.00	15
				697,459.00	0
				651,163.00	17
				648,866.00	10
				589,750.00	2
				543,724.00	21
				515,337.00	24
				513,864.00	8
				505,898.00	18
				487,095.00	11
				438,321.00	37

Here we've combined estimates of the internet user population per country (ITU data) with estimates of market share of each provider (APNIC data) with the observations of the percent of users in each AS that appears to be IPv6 capable - this gives an estimate of the number of IPv6 users behind each provider

The Internet's IPv6 Top 30

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1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	20,106,432.00	36
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6	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE	2,670,260.00	46
7	AS6147	Telefonica del Peru S.A.A.	PE	1,941,739.00	18
8	AS6848	TELENET-AS Telenet N.V.	BE	1,834,753.00	61
9	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	1,831,642.00	26
10	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY	1,516,846.00	9
11	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE	1,360,868.00	31
12	AS12271	SCRR-12271 - Time Warner Cable Internet LLC	US	1,085,100.00	31
13	AS8708	RCS-RDS RCS RDS SA	RO	1,032,658.00	20
14	AS17676	GIGAINFRA Softbank BB Corp.	JP	976,381.00	9
15	AS4134	CHINANET-BACKBONE No.31,Jin-rong Street	CN	958,379.00	0
16	AS5432	BELGACOM-SKYNET-AS BELGACOM S.A.	BE	951,104.00	23
17	AS3303	SWISSCOM Swisscom (Switzerland) Ltd	CH	773,802.00	24
18	AS5610	O2-CZECH-REPUBLIC O2 Czech Republic, a.s.	CZ	718,097.00	32
19	AS131222	MTS-INDIA-IN 334,Udyog Vihar	IN	704,929.00	11
20	AS11427	SCRR-11427 - Time Warner Cable Internet LLC	US	699,632.00	15
21	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	697,459.00	0
22	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	US	651,163.00	17
23	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	US	648,866.00	10
24	AS28573	NET Servios de Comunicacao S.A.	BR	589,750.00	2
25	AS3243	MEO-RESIDENCIAL MEO - SERVICOS DE COMUNICACOES E MULTIMEDIA S.A.	PT	543,724.00	21
26	AS15169	GOOGLE - Google Inc.	US	515,337.00	24
27	AS14420	CORPORACION NACIONAL DE TELECOMUNICACIONES - CNT EP	EC	513,864.00	8
28	AS4538	ERX-CERNET-BKB China Education and Research Network Center	CN	505,898.00	18
29	AS2527	SO-NET So-net Entertainment Corporation	JP	487,095.00	11
30	AS12392	ASBRUTELE Brutele SC	BE	438,321.00	37

The Internet's IPv6 Top 30

Rank	AS	Name	CC	Est. V6 Users	Cumulative	
1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	20,106,432	20,106,432	25%
2	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US	16,243,047	36,349,479	45%
3	AS3320	DTAG Deutsche Telekom AG	DE	6,579,879	42,929,358	53%
4	AS2516	KDDI KDDI CORPORATION	JP	6,436,104	49,365,462	61%
5	AS12322	PROXAD Free SAS	FR	2,673,831	52,039,293	64%
6	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE	2,670,260	54,709,553	67%
7	AS6147	Telefonica del Peru S.A.A.	PE	1,941,739	56,651,292	69%
8	AS6848	TELENET-AS Telenet N.V.	BE	1,834,753	58,486,045	72%
9	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	1,831,642	60,317,687	74%
10	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY	1,516,846	61,834,533	76%
11	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE	1,360,868	63,195,401	77%
12	AS12271	SCRR-12271 - Time Warner Cable Internet LLC	US	1,085,100	64,280,501	79%
13	AS8708	RCS-RDS RCS RDS SA	RO	1,032,658	65,313,159	80%
14	AS17676	GIGAINFRA Softbank BB Corp.	JP	976,381	66,289,540	81%
15	AS4134	CHINANET-BACKBONE No.31,Jin-rong Street	CN	958,379	67,247,919	82%
16	AS5432	BELGACOM-SKYNET-AS BELGACOM S.A.	BE	951,104	68,199,023	84%
17	AS3303	SWISSCOM Swisscom (Switzerland) Ltd	CH	773,802	68,972,825	85%
18	AS5610	O2-CZECH-REPUBLIC O2 Czech Republic, a.s.	CZ	718,097	69,690,922	85%
19	AS131222	MTS-INDIA-IN 334,Udyog Vihar	IN	704,929	70,395,851	86%
20	AS11427	SCRR-11427 - Time Warner Cable Internet LLC	US	699,632	71,095,483	87%
21	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	697,459	71,792,942	88%
22	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	US	651,163	72,444,105	89%
23	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	US	648,866	73,092,971	90%
24	AS28573	NET Servios de Comunicacao S.A.	BR	589,750	73,682,721	90%
25	AS3243	MEO-RESIDENCIAL MEO - SERVICOS DE COMUNICACOES E MULTIMEDIA S.A.	PT	543,724	74,226,445	91%
26	AS15169	GOOGLE - Google Inc.	US	515,337	74,741,782	92%
27	AS14420	CORPORACION NACIONAL DE TELECOMUNICACIONES - CNT EP	EC	513,864	75,255,646	92%
28	AS4538	ERX-CERNET-BKB China Education and Research Network Center	CN	505,898	75,761,544	93%
29	AS2527	SO-NET So-net Entertainment Corporation	JP	487,095	76,248,639	93%
30	AS12392	ASBRUTELE Brutele SC	BE	438,321	76,686,960	94%

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1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	20,106,432	20,106,432	25%
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9	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	1,000,000	60,317,687	74%
10	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	JP	1,000,000	61,834,533	76%
11	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE	1,360,868	63,195,401	77%
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14	AS17676	GIGAINFRA Softbank	JP	976,381	66,289,540	81%
15	AS4134	CHINA169-INDIA-334, Udyog Vihar	CN	958,379	67,247,919	82%
16	AS5427	SCRR-11427 - Time Warner Cable Internet LLC	BE	951,104	68,199,023	84%
17	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CH	773,802	68,972,825	85%
18	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	CZ	718,097	69,690,922	85%
19	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	IN	704,929	70,395,851	86%
20	AS28573	NET Servios de Comunicacao S.A.	US	699,632	71,095,483	87%
21	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	697,459	71,792,942	88%
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26	AS15169	GOOGLE - Google Inc.	US	515,337	74,741,782	92%
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28	AS4538	ERX-CERNET-BKB China Education and Research Network Center	CN	505,898	75,761,544	93%
29	AS2527	SO-NET So-net Entertainment Corporation	JP	487,095	76,248,639	93%
30	AS12392	ASBRUTELE Brutele SC	BE	438,321	76,686,960	94%

It's a very uneven takeup of IPv6 - 94% 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

Rank	ASN	AS Name	CC	Users (est.)	Cum %	V6 Users (es	Cum %
1	AS4134	CHINANET-BACKBONE No.31,Jin-rong Street	CN	331,375,813	11%	958,379	1%
2	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	207,538,281	18%	697,459	2%
3	AS9829	BSNL-NIB National Internet Backbone	IN	64,921,528	20%	12,032	2%
4	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	55,163,733	22%	20,106,432	27%
5	AS17974	TELKOMNET-AS2-AP PT Telekomunikasi Indonesia	ID	45,790,585	24%	1,395	27%
6	AS8151	Uninet S.A. de C.V.	MX	38,873,450	25%	1,321	27%
7	AS24560	AIRTELBROADBAND-AS-AP Bharti Airtel Ltd., Telemedia Services	IN	33,059,829	26%	283	27%
8	AS8452	TE-AS TE-AS	EG	31,736,339	27%	438	27%
9	AS4713	OCN NTT Communications Corporation	JP	29,337,551	28%	274,089	27%
10	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US	28,132,561	29%	16,243,047	47%
11	AS9121	TTNET Turk Telekomunikasyon Anonim Sirketi	TR	26,493,481	30%	293	47%
12	AS3320	DTAG Deutsche Telekom AG	DE	25,064,879	31%	6,579,879	55%
13	AS28573	NET Servios de Comunicacao S.A.	BR	24,313,582	32%	589,750	56%
14	AS45595	PKTELECOM-AS-PK Pakistan Telecom Company Limited	PK	22,505,324	32%	28	56%
15	AS9299	IPG-AS-AP Philippine Long Distance Telephone Company	PH	22,256,692	33%	216	56%
16	AS9808	CMNET-GD Guangdong Mobile Communication Co.Ltd.	CN	20,305,792	34%	103,127	56%
17	AS701	UUNET - MCI Communications Services, Inc. dba Verizon Business	US	20,063,623	35%	3,423	56%
18	AS45899	VNPT-AS-VN VNPT Corp	VN	19,043,787	35%	28	56%
19	AS18881	Global Village Telecom	BR	18,898,151	36%	200,712	56%
20	AS3215	AS3215 Orange S.A.	FR	18,421,196	36%	1,757	56%
21	AS4766	KIXS-AS-KR Korea Telecom	KR	18,057,570	37%	522	56%
22	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY	16,331,969	38%	1,516,846	58%
23	AS4812	CHINANET-SH-AP China Telecom (Group)	CN	16,183,891	38%	30,434	58%
24	AS36903	MT-MPLS	MA	16,064,418	39%	293	58%
25	AS55577	BEAMTELE-AS-AP Beam Telecom Pvt Ltd	IN	16,041,448	39%	0	58%
26	AS37054	TGN	MG	14,884,522	40%	0	58%
27	AS3269	ASN-IBSNAZ Telecom Italia S.p.a.	IT	14,058,629	40%	785	58%
28	AS2516	KDDI KDDI CORPORATION	JP	13,994,404	41%	6,436,104	66%
29	AS4808	CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network	CN	13,637,626	41%	171,171	66%
30	AS7738	Telemar Norte Leste S.A.	BR	13,455,246	42%	1,781	66%

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 5 of the top 30 largest ISPs have any significant IPv6 deployments

The Internet is heavily skewed

The 30 largest ISPs service 42% 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 across the entire Internet would be 20% today, rather than 3.6%

Maybe there is more to it...

- A number of these largest ISPs operate in the developing world
 - With a tendency to be late adopters so as to reduce capital risk for their enterprise
- So can we look at the “value” of an ISP’s customers?
 - One possible approach is to multiply the estimated user population by the per capita GDP in that country
 - Perhaps this ranking exposes those ISPs who can afford to deploy V6, but so far have not moved

The Internet's 30 Most Valuable ISPs

Rank	ASN AS Name	CC	Value (MU\$)	Cum %	Users (est.)	Cum %	V6 Users (est.)	Cum %
1	AS7922 COMCAST-7922 - Comcast Cable Communications, Inc.	US	2,848,104	6%	55,163,733	2%	20,106,432	25%
2	AS4134 CHINANET-BACKBONE No.31,Jin-rong Street	CN	2,185,755	10%	331,375,813	13%	958,379	26%
3	AS7018 ATT-INTERNET4 - ATT Services, Inc.	US	1,452,484	13%	28,132,561	14%	16,243,047	46%
4	AS4837 CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	1,368,923	16%	207,538,281	21%	697,459	47%
5	AS4713 OCN NTT Communications Corporation	JP	1,137,241	18%	29,337,551	22%	274,089	47%
6	AS3320 DTAG Deutsche Telekom AG	DE	1,132,256	20%	25,064,879	23%	6,579,879	55%
7	AS701 UUNET - MCI Communications Services, Inc. dba Verizon Business	US	1,035,885	22%	20,063,623	23%	3,423	55%
8	AS3215 AS3215 Orange S.A.	FR	796,109	24%	18,421,196	24%	1,757	55%
9	AS22773 ASN-CXA-ALL-CCI-22773-RDC - Cox Communications Inc.	US	595,908	25%	11,541,901	24%	3,180	55%
10	AS5089 NTL Virgin Media Limited	GB	544,229	26%	12,961,537	25%	2,778	55%
11	AS2516 KDDI KDDI CORPORATION	JP	542,479	27%	13,994,404	25%	6,436,104	63%
12	AS12322 PROXAD Free SAS	FR	539,616	28%	12,486,186	26%	2,673,831	66%
13	AS20115 CHARTER-NET-HKY-NC - Charter Communications	US	515,178	29%	9,978,268	26%	3,263	66%
14	AS3269 ASN-IBSNAZ Telecom Italia S.p.a.	IT	493,950	30%	14,058,629	27%	785	66%
15	AS2856 BT-UK-AS BT Public Internet Service	GB	474,856	31%	11,309,315	27%	3,002	66%
16	AS4766 KIXS-AS-KR Korea Telecom	KR	469,063	32%	18,057,570	28%	522	66%
17	AS1221 ASN-TELSTRA Telstra Pty Ltd	AU	460,430	33%	7,049,485	28%	219,155	66%
18	AS17676 GIGAINFRA Softbank BB Corp.	JP	441,091	34%	11,378,880	28%	976,381	68%
19	AS209 CENTURYLINK-US-LEGACY-QWEST - Qwest Communications Company, LLC	US	403,111	35%	7,807,693	28%	5,850	68%
20	AS5607 BSKYB-BROADBAND-AS British Sky Broadcasting Limited	GB	400,829	35%	9,546,276	29%	3,923	68%
21	AS3462 HINET Data Communication Business Group	TW	399,494	36%	12,523,329	29%	40,978	68%
22	AS3352 TELEFONICADESPANIA TELEFONICA DE ESPANA	ES	396,531	37%	13,446,739	30%	227	68%
23	AS8151 Uninet S.A. de C.V.	MX	391,922	38%	38,873,450	31%	1,321	68%
24	AS3209 VODANET Vodafone GmbH	DE	380,927	39%	8,432,616	31%	4,734	68%
25	AS20001 ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	369,600	39%	7,158,638	32%	1,831,642	70%
26	AS15557 LDCOMNET Societe Francaise du Radiotelephone S.A	FR	342,455	40%	7,924,070	32%	165,896	70%
27	AS10796 SCRR-10796 - Time Warner Cable Internet LLC	US	340,130	41%	6,587,843	32%	648,866	71%
28	AS6128 CABLE-NET-1 - Cablevision Systems Corp.	US	325,468	41%	6,303,854	32%	1,154	71%
29	AS6830 LGI-UPC Liberty Global Operations B.V.	AT	317,689	42%	6,343,628	32%	144,636	71%
30	AS5384 EMIRATES-INTERNET Emirates Telecommunications Corporation	AE	315,704	43%	7,568,663	33%	99	71%

"Net User Value"

- Lets multiply the estimated user population by the GDP per capita
- 30 providers (by AS) account for 43% of the estimated "value" base of the Internet Just 6 of these providers have significant IPv6 deployment programs
- One view is that if/when all of these 30 ISPs complete a large scale IPv6 deployment, then they would exert a very strong "pull through" effect on the entire Internet because these most valuable ISPs tend to have the greatest "influencer" ability on the ISP space

Another View of IPv6

Rank	ASN	AS Name	CC	Value (MU\$)	Cum %	Users (est.)	Cum %	V6 Users (est.)	Cum %
1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	2,848,104	6%	55,163,733	2%	20,106,432	25%
2	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US	1,452,484	9%	28,132,561	3%	16,243,047	45%
3	AS3320	DTAG Deutsche Telekom AG	DE	1,132,256	11%	25,064,879	4%	6,579,879	53%
4	AS2516	KDDI KDDI CORPORATION	JP	542,479	12%	13,994,404	4%	6,436,104	60%
5	AS12322	PROXAD Free SAS	FR	539,616	13%	12,486,186	5%	2,673,831	64%
6	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE	263,614	13%	5,835,645	5%	2,670,260	67%
7	AS6147	Telefonica del Peru S.A.A.	PE	70,879	14%	10,892,788	5%	1,941,739	69%
8	AS6848	TELENET-AS Telenet N.V.	BE	141,852	14%	3,023,348	5%	1,834,753	72%
9	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	369,600	15%	7,158,638	5%	1,831,642	74%
10	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY	167,158	15%	16,331,969	6%	1,516,846	76%
11	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE	195,457	15%	4,326,848	6%	1,360,868	77%
12	AS12271	SCRR-12271 - Time Warner Cable Internet LLC	US	182,478	16%	3,534,333	6%	1,085,100	79%
13	AS8708	RCS-RDS RCS RDS SA	RO	45,931	16%	5,230,112	6%	1,032,658	80%
14	AS17676	GIGAINFRA Softbank BB Corp.	JP	441,091	17%	11,378,880	7%	976,381	81%
15	AS4134	CHINANET-BACKBONE No.31,Jin-rong Street	CN	2,185,755	21%	331,375,813	18%	958,379	82%
16	AS5432	BELGACOM-SKYNET-AS BELGACOM S.A.	BE	198,191	21%	4,224,110	18%	951,104	84%
17	AS3303	SWISSCOM Swisscom (Switzerland) Ltd	CH	265,289	22%	3,184,324	18%	773,802	85%
18	AS5610	O2-CZECH-REPUBLIC O2 Czech Republic, a.s.	CZ	42,858	22%	2,212,366	18%	718,097	85%
19	AS131222	MTS-INDIA-IN 334,Udyog Vihar	IN	9,723	22%	6,641,466	19%	704,929	86%
20	AS11427	SCRR-11427 - Time Warner Cable Internet LLC	US	239,575	23%	4,640,227	19%	699,632	87%
21	AS4837	CHINA169-BACKBONE CNCGROUP China169 Backbone	CN	1,368,923	25%	207,538,281	26%	697,459	88%
22	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	US	201,704	26%	3,906,718	26%	651,163	89%
23	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	US	340,130	26%	6,587,843	26%	648,866	90%
24	AS28573	NET Servios de Comunicacao S.A.	BR	268,325	27%	24,313,582	27%	589,750	90%
25	AS3243	MEO-RESIDENCIAL MEO - SERVICOS DE COMUNICACOES E MULTIMEDIA S.A.	PT	56,487	27%	2,637,365	27%	543,724	91%
26	AS15169	GOOGLE - Google Inc.	US	112,247	27%	2,174,065	27%	515,337	92%
27	AS14420	CORPORACION NACIONAL DE TELECOMUNICACIONES - CNT EP	EC	38,731	27%	6,638,852	27%	513,864	92%
28	AS4538	ERX-CERNET-BKB China Education and Research Network Center	CN	18,975	27%	2,876,718	27%	505,898	93%
29	AS2527	SO-NET So-net Entertainment Corporation	JP	178,362	28%	4,601,235	27%	487,095	93%
30	AS12392	ASBRUTELE Brutele SC	BE	55,350	28%	1,179,701	28%	438,321	94%

Maybe IPv6 is further ahead than we thought...

The 30 largest IPv6 providers account for 94% of the total IPv6 user population

These same 30 providers also encompass 28% of the total “user value” of the Internet

The "Net User Value" view of the IPv6 Internet

Rank	ASN	AS Name	CC	V6 Value	Cum %	Value (MU\$)	Cum %	Users (est.)	Cum %	V6 Users (est.)	Cum %
1	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	US	1,038,095	2%	2,848,104	6%	55,163,733	2%	20,106,432	25%
2	AS7018	ATT-INTERNET4 - ATT Services, Inc.	US	838,629	4%	1,452,484	9%	28,132,561	3%	16,243,047	45%
3	AS3320	DTAG Deutsche Telekom AG	DE	297,233	4%	1,132,256	11%	25,064,879	4%	6,579,879	53%
4	AS2516	KDDI KDDI CORPORATION	JP	249,489	5%	542,479	12%	13,994,404	4%	6,436,104	60%
5	AS31334	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH	DE	120,624	5%	263,614	12%	5,835,645	4%	2,670,260	64%
6	AS12322	PROXAD Free SAS	FR	115,555	5%	539,616	13%	12,486,186	5%	2,673,831	67%
7	AS20001	ROADRUNNER-WEST - Time Warner Cable Internet LLC	US	94,568	5%	369,600	14%	7,158,638	5%	1,831,642	69%
8	AS6848	TELENET-AS Telenet N.V.	BE	86,085	6%	141,852	15%	3,023,348	5%	1,834,753	72%
9	AS3303	SWISSCOM Swisscom (Switzerland) Ltd	CH	64,466	6%	265,289	15%	3,184,324	5%	773,802	72%
10	AS20825	UNITYMEDIA Unitymedia NRW GmbH	DE	61,474	6%	195,457	15%	4,326,848	5%	1,360,868	74%
11	AS12271	SCRR-12271 - Time Warner Cable Internet LLC	US	56,024	6%	182,478	16%	3,534,333	5%	1,085,100	75%
12	AS5432	BELGACOM-SKYNET-AS BELGACOM S.A.	BE	44,625	6%	198,191	16%	4,224,110	6%	951,104	77%
13	AS17676	GIGAINFRA Softbank BB Corp.	JP	37,848	6%	441,091	17%	11,378,880	6%	976,381	78%
14	AS11427	SCRR-11427 - Time Warner Cable Internet LLC	US	36,122	6%	239,575	18%	4,640,227	6%	699,632	79%
15	AS11426	SCRR-11426 - Time Warner Cable Internet LLC	US	33,620	6%	201,704	18%	3,906,718	6%	651,163	80%
16	AS10796	SCRR-10796 - Time Warner Cable Internet LLC	US	33,501	6%	340,130	19%	6,587,843	6%	648,866	80%
17	AS15169	GOOGLE - Google Inc.	US	26,607	6%	112,247	19%	2,174,065	7%	515,337	81%
18	AS2119	TELENOR-NEXTEL Telenor Norge AS	NO	20,932	6%	216,971	19%	2,173,514	7%	209,683	81%
19	AS12392	ASBRUTELE Brutele SC	BE	20,566	7%	55,350	19%	1,179,701	7%	438,321	82%
20	AS2527	SO-NET So-net Entertainment Corporation	JP	18,882	7%	178,362	20%	4,601,235	7%	487,095	82%
21	AS11351	RR-NYSREGION-ASN-01 - Time Warner Cable Internet LLC	US	18,325	7%	206,750	20%	4,004,459	7%	354,923	83%
22	AS29562	KABELBW-ASN Kabel BW GmbH	DE	16,238	7%	122,917	20%	2,721,038	7%	359,461	83%
23	AS4788	TMNET-AS-AP TM Net, Internet Service Provider	MY	15,525	7%	167,158	21%	16,331,969	8%	1,516,846	85%
24	AS1221	ASN-TELSTRA Telstra Pty Ltd	AU	14,314	7%	460,430	22%	7,049,485	8%	219,155	85%
25	AS5610	O2-CZECH-REPUBLIC O2 Czech Republic, a.s.	CZ	13,911	7%	42,858	22%	2,212,366	8%	718,097	86%
26	AS6147	Telefonica del Peru S.A.A.	PE	12,635	7%	70,879	22%	10,892,788	8%	1,941,739	89%
27	AS3243	MEO-RESIDENCIAL MEO - SERVICOS DE COMUNICACOES E MULTIMEDIA S.A.	PT	11,645	7%	56,487	22%	2,637,365	8%	543,724	89%
28	AS6389	BELLSOUTH-NET-BLK - BellSouth.net Inc.	US	11,135	7%	90,125	22%	1,745,602	8%	215,665	90%
29	AS4713	OCN NTT Communications Corporation	JP	10,625	7%	1,137,241	24%	29,337,551	9%	274,089	90%
30	AS8708	RCS-RDS RCS RDS SA	RO	9,069	7%	45,931	25%	5,230,112	10%	1,032,658	91%

IPv6 Today...

- Is being used by some 4% of the world's users
- Is being actively deployed in significant volumes in 20 countries
- 30 ISPs serve the bulk of the V6 user population
- These providers represent 28% of the “net user value” of the Internet
- Their IPv6 users represent 7% of the total “net user value” of the Internet

Thanks!