

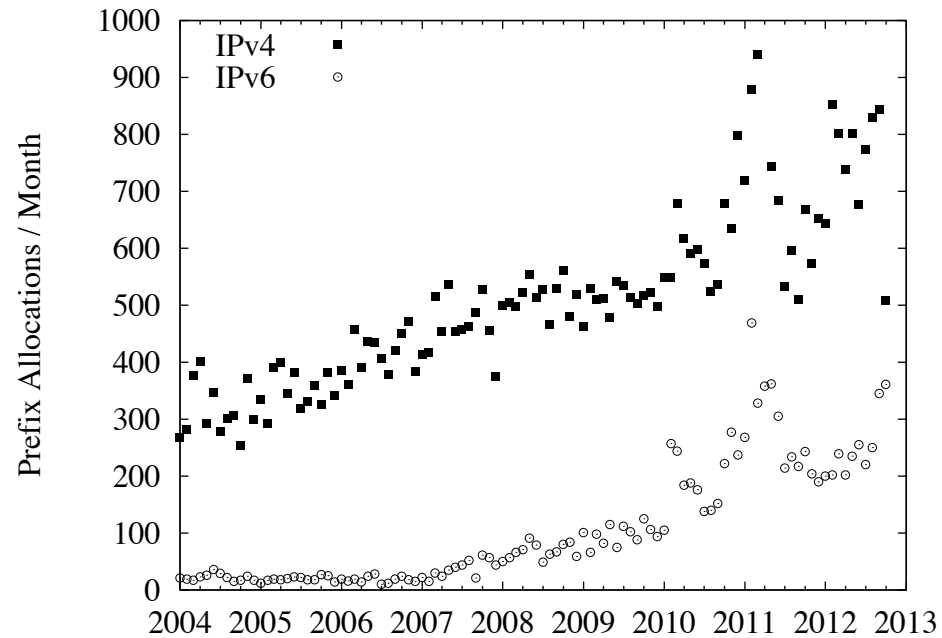
Assessing IPv6 Adoption

NANOG 57

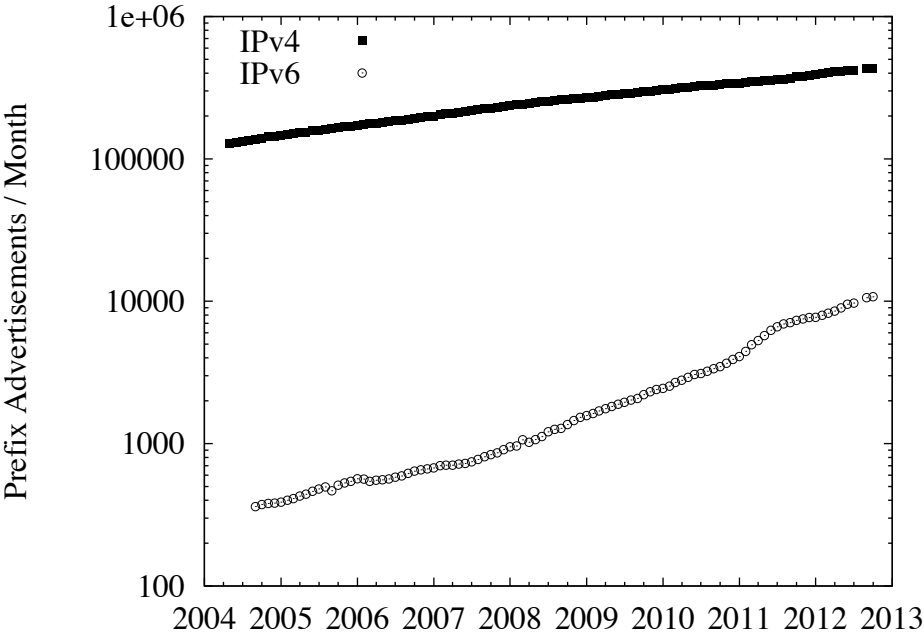
Datasets

Dataset	Time Period	Scale
RIR Address Allocations	Jan 2004 - Oct 2012	9,126 allocation snapshots (5 daily)
Route Views Routing Tables	Sep 2004 - Oct 2012	36,945 BGP table dumps (12 daily)
Google IPv6 Client Adoption	Sep 2008 - Oct 2012	millions of daily global samples
Arbor Netflow Traffic	Mar 2010 - Oct 2012	12 customers, 400 routers, daily avg.: 1.2 petabits/sec (peak)
Verisign TLD Zone Files	Apr 2007 - Oct 2012	24 daily snapshots of 2.5 million A+AAAA records (.com/.net)
Verisign TLD Packet Capture	28 Aug 2012	4 global sites, 8 gTLD NS letters (.com/.net), 4.1Bn queries
Alexa Top Host Probing	Apr 2011 - Oct 2012	10,000 servers probed daily

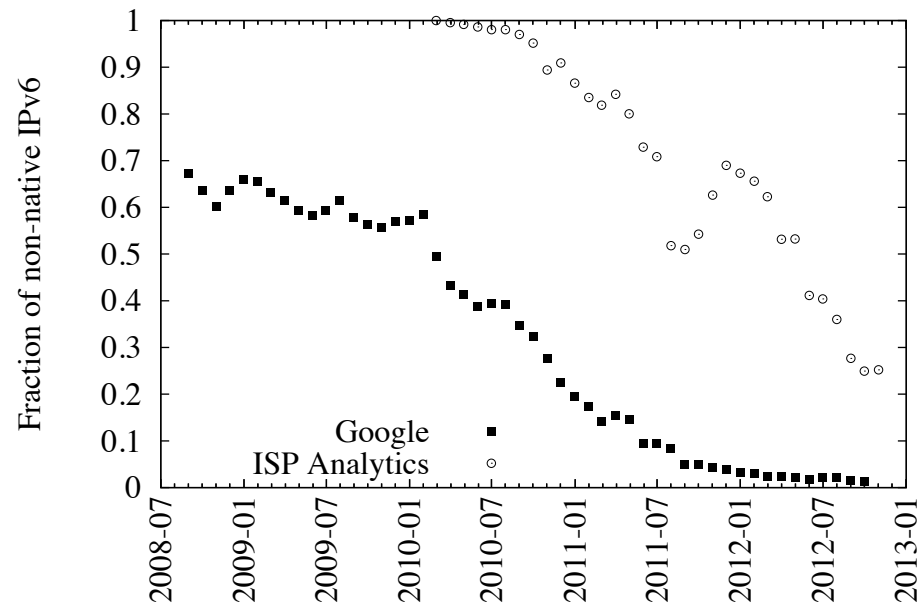
IPv4 and IPv6 Prefixes Allocated



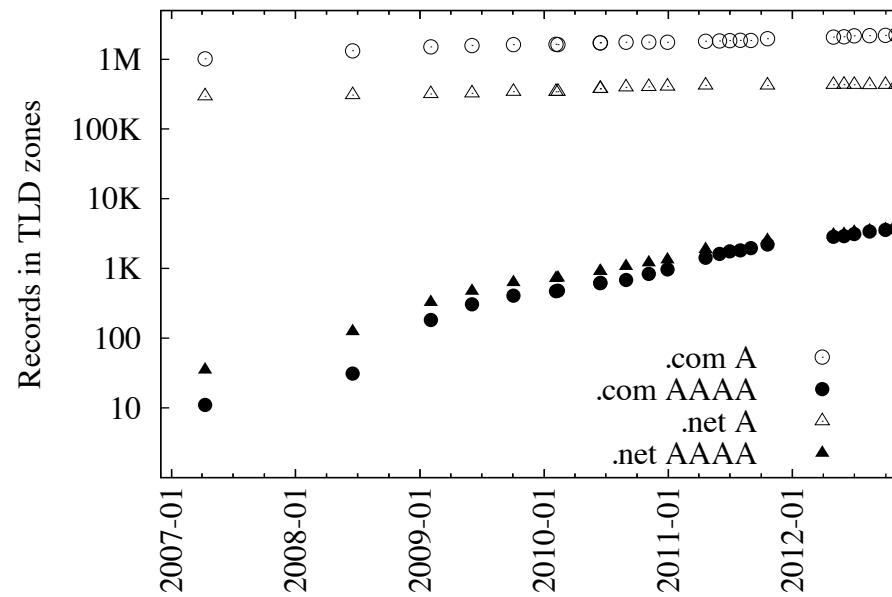
IPv4 and IPv6 Prefixes Advertised



Fraction of non-native IPv6 Traffic Seen by in Google.com and Arbor Samples



Number of A and AAAA Glue Records in the .com and .net zones



Resolver Population AAAA Demand

(Verisign .com/.net TLD Query Sample)

All	with any query	8,801,133 (100%)
	with A queries	8,603,372 (98%)
	with AAAA queries	2,967,950 (34%)
Active (>10k)	with any query	78,249 (0.9% of all)
	with A queries	77,983 (100%)
	with AAAA queries	69,729 (89%)

Top AAAA Lookups by Domain

(Verisign .com/.net TLD Query Sample)

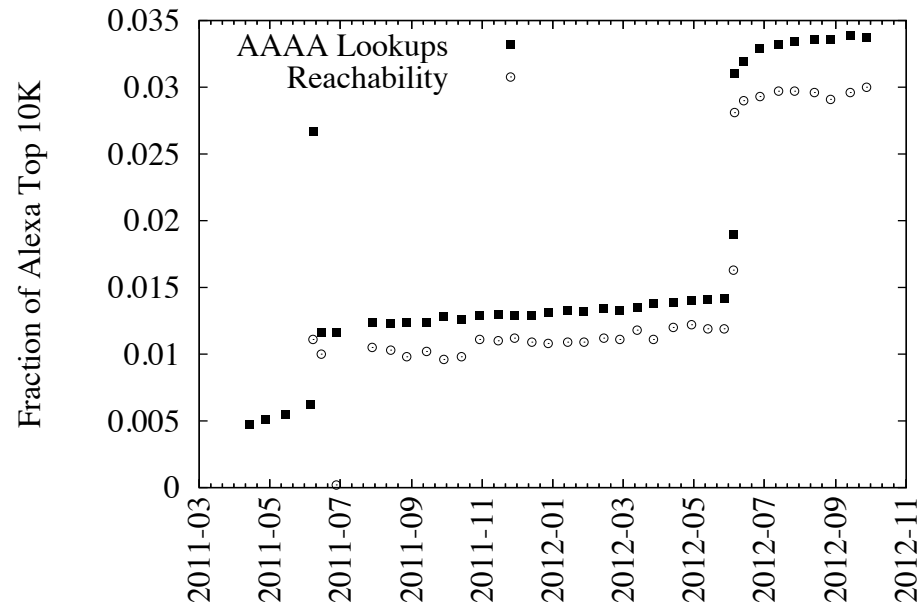
Domain by 2LD	AAAA K Queries	A Rank	A K Queries	Alexa Rank
gslb.com	3,421	6	5,776	
manitu.net	2,010	9	3,654	232K
msft.net	2,005	7	4,225	
gtld-servers.net	1,327	16	2,903	
register.com	1,291	17	2,879	4K
coremetrics.com	1,220	26	2,189	40K
facebook.com	1,158	22	2,558	1
savvis.net	1,144	12	3,507	211K
weather.com	1,013	25	2,200	132
cedexis-radar.net	1,013	193	584	
qq.com	901	109	860	9
iana-servers.net	891	36	1,775	
akam.net	875	31	2,011	998K
name-services.com	853	23	2,325	33K
wearehair.net	788	99	915	
ib-ibi.com	772	46	1,563	962K
apnic.net	765	54	1,456	48K
amazonaws.com	744	48	1,532	156
amazon.com	731	23	2,284	10
ultradns.net	696	35	1,792	326K
demonoid.com	686	90	966	53K
comcast.net	628	60	1,265	168
twtelecom.net	627	40	1,652	
shifen.com	623	103	889	
mediatemple.net	617	69	1,163	4K

Top 10 Resource Records Queried For

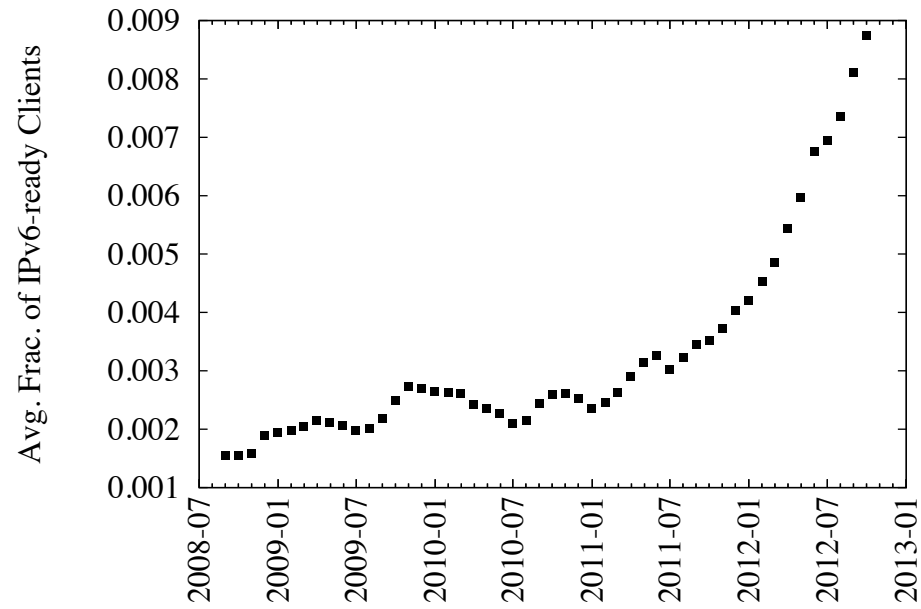
(Verisign .com/.net TLD Query Sample)

Record Type	Million Queries	Percentage
A	2,741	66.60%
MX	551	13.40%
AAAA	430	10.50%
DS	171	4.20%
NS	64	1.60%
TXT	61	1.50%
ANY	43	1.00%
SPF	12	0.30%
SRV	12	0.30%
A6	8	0.20%
Other	20	0.50%
Total	4,116	

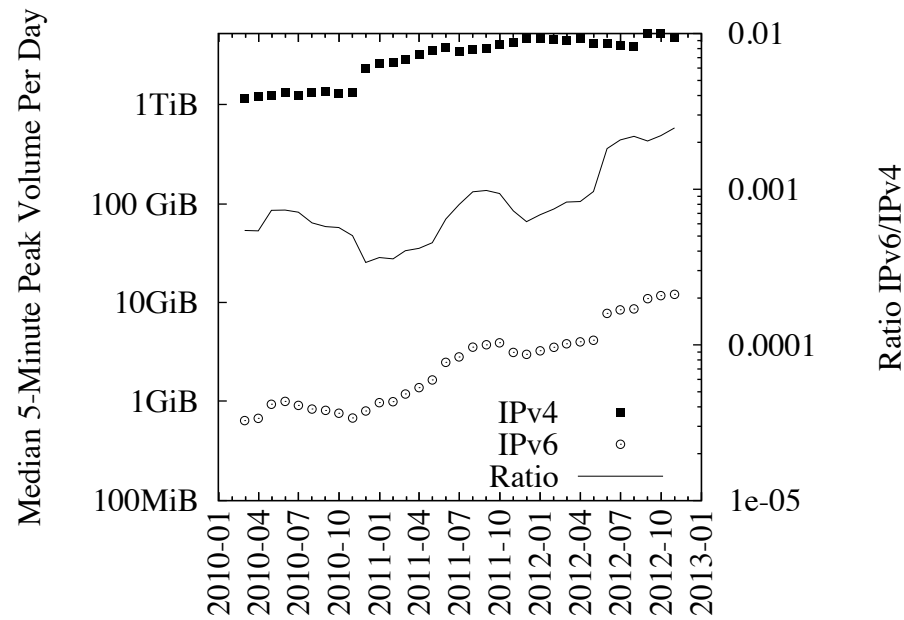
AAAA Lookups and IPv6 Pings for Alexa top 10K domains



Google.com IPv6-Ready Clients



IPv4 and IPv6 Traffic Volume from Arbor's 12-provider Sample



Application Mix

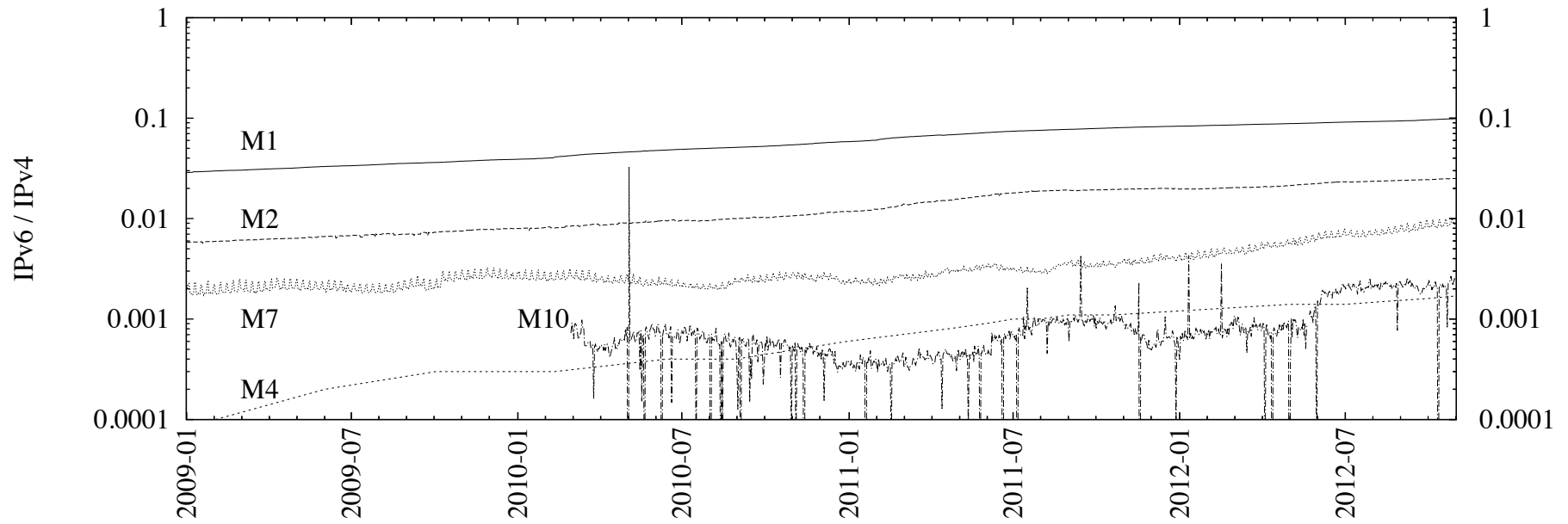
(one day Arbor snapshot)

App.	IPv6 (%)	IPv4 (%)
http	63.04	62.4
dns	4.09	0.14
ssh	2.65	0.11
rsync	2.65	n/a
nntp	1.03	0.13
https	0.39	3.91
flash	0.11	2.39
other TCP	18.72	3.2
other UDP	1.73	11.9
other	4.94	14.1

IPv6 Adoption Current State

Name	Current Status
Address allocation	200+ IPv6 prefixes allocated per month (over 20% of total new allocations)
Address advertisement	10500+ IPv6 prefixes advertised per month (2% of total)
Transition Technologies	Native IPv6 makes up about 75% of traffic
DNS Nameservers	0.16% of .com and 0.84% of .net servers with A also have AAAA
DNS Resolvers	34% of all and 89% of active resolvers query for AAAA records
DNS Queries	AAAA records are the 3rd most popular RR query type and AAAA lookups tend towards under-the-hood services rather than content
Server readiness	3% of the Alexa top 10K web sites are reachable via IPv6
Client readiness	0.8% of clients could access Google via IPv6
Traffic Volume	Peak IPv6 traffic is 0.2% of observed peak IPv4 ISP traffic volume
Application Mix	Aside from HTTP, IPv6 is used for a different set of applications than IPv4

Longitudinal Measures



Trends and Projections

