

IPv4 / IPv6 Performance Measurement Panel

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The Environment

We use Google Ads to deliver test scripts to a very broad cross-section of Internet Users

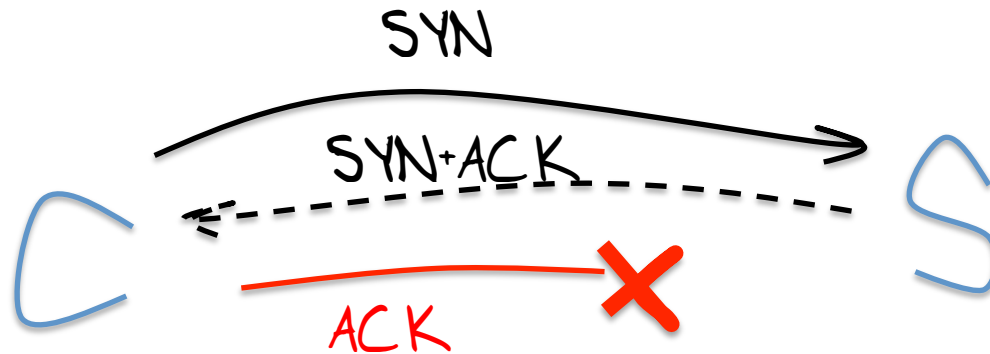
- We use a script that requests dual-stack end clients to fetch unique V6 and a V4 URLs from our servers

(servers located in the US, Germany and Australia)

- We have some 300,000 - 400,000 ads delivered per day
- We packet dump all activity on the server

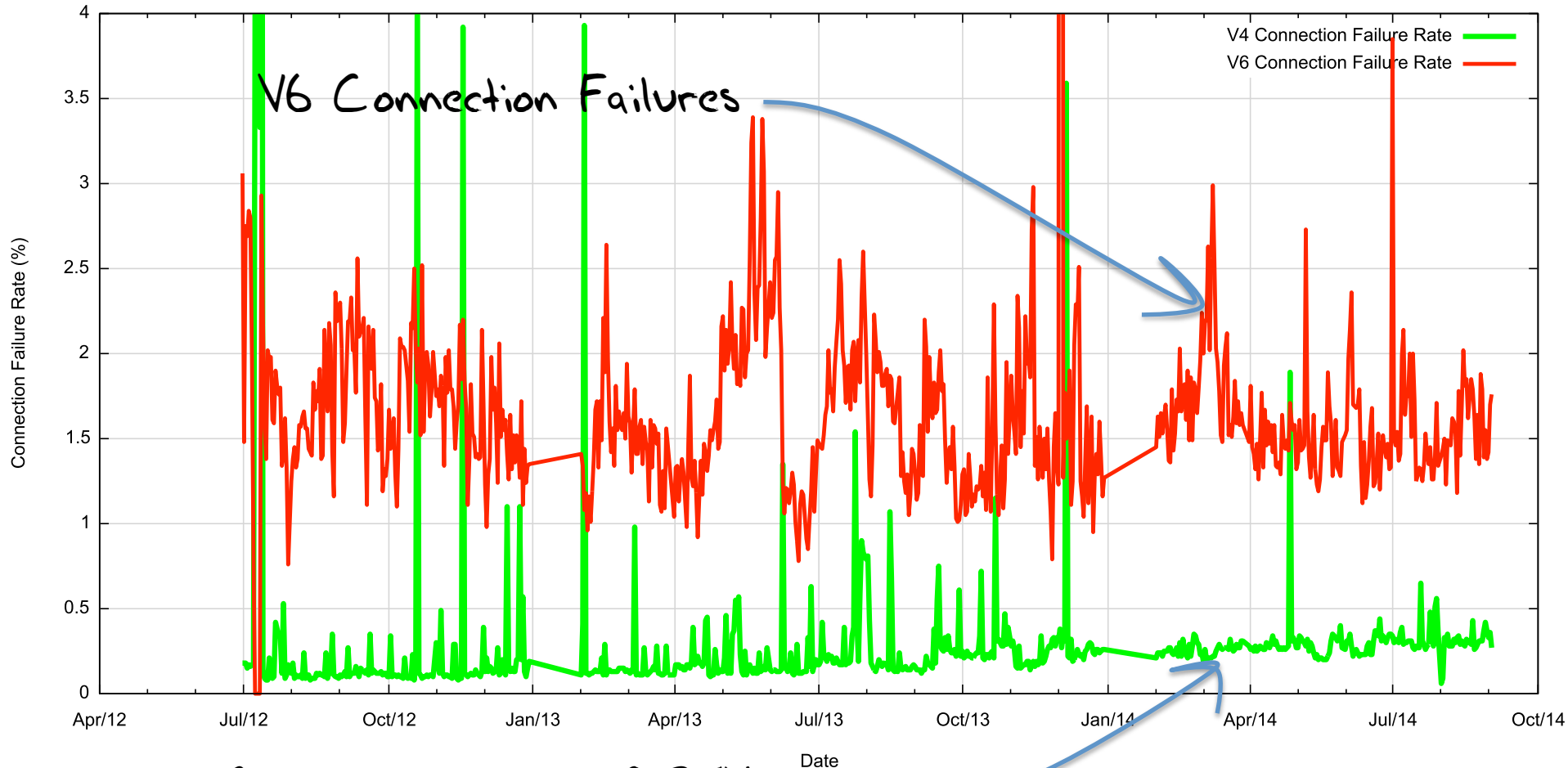
Connection Reliability

Looking at the TCP handshake, what proportion of IPv6 clients send us a SYN, but no following ACK?



Connection Reliability

Daily Connection Failure Rates



V6 Connection Failures

Background level of SYN probing

Connection Reliability

IPv4 failure rate: 0.2% - 0.3%

IPv6 failure rate: 1.4% – 1.8%

This appears to indicate that a visible proportion of IPv6-capable end user devices are located behind firewall/filter setups that permit outgoing IPv6 packets, but deny incoming IPv6 packets

IPv6 Connection Failure Rate by Origin AS

AS	Samples	Failure Rate (%)	AS Name	<i>This table looks at the origin AS's with more than 20 sample points – these are the origin AS's with the highest failure rates</i>
9794	39	94.87	DNET-ID-AP PT. Core Mediatech (D-NET),ID	
24183	22	77.27	DTS-ISP-CORE1-AP DTS LTD,NZ	
55680	129	74.42	KSI-UAJY-AS-ID Kantor Sistem Informasi Universitas Atma Jaya Yogyakarta,ID	
23678	815	70.06	MYKRIS-AS-MY MyKRIS Asia Sdn Bhd,MY	
28573	228	66.67	NET Servicios de Comunicacio S.A.,BR	
3549	632	65.51	LVLT-3549 - Level 3 Communications, Inc.,US	
27839	42	61.90	Comteco Ltda,BO	
23862	39	58.97	DILNET-AS-AP University of the Philippines Diliman,PH	
22773	80	57.50	ASN-CXA-ALL-CCI-22773-RDC - Cox Communications Inc.,US	
198864	1007	54.72	QMW-AC-UK Queen Mary and Westfield College, University of London,GB	
4755	419	52.74	TATACOMM-AS TATA Communications,IN	
49558	116	50.00	LIVECOMM-AS IT-Yaroslavl Ltd,RU	
14210	46	45.65	EDGECAST-DCA - EdgeCast Networks, Inc.,US	
17961	42	45.24	MITENE mitene internet co., ltd.,JP	
50498	43	44.19	LIPETSK-AS CJSC "ER-Telecom Holding",RU	
17660	507	44.18	DRUKNET-AS DrukNet ISP,BT	
25592	111	44.14	NETIS-AS NETIS TELECOM Inc. Yaroslavl region ISP provider Russia,RU	
132497	584	42.98	DNA-AS-AP SMARTLINK BROADBAND SERVICES PVT LTD,IN	
55947	189	41.80	BBNL-IN Bangalore Broadband Network Pvt Ltd,IN	
25593	36	41.67	LINKBYNET-AS Linkbynet S.A,FR	
45600	131	40.46	UPM-AS-AP University of the Philippines, Manila,PH	
5707	110	38.18	UTHSC-H - The University of Texas Health Science Center at Houston,US	
20306	21	38.10	ADELPHI - Adelphi University,US	
18106	183	37.70	VIEWQWEST-SG-AP Viewqwest Pte Ltd,SG	
33517	39	35.90	DYNDNS - Dynamic Network Services, Inc.,US	

IPv6 Connection Failure Rate by Origin AS

This table looks at the origin AS's where we have the highest number of samples

AS	Samples	Failure Rate (%)	AS Name
786	155,6773	0.97	JANET JISC Collections And Janet Limited,GB
15169	42,6530	0.06	GOOGLE - Google Inc.,US
8708	37,1377	3.48	RCS-RDS RCS & RDS SA,RO
7922	22,6027	1.93	COMCAST-7922 - Comcast Cable Communications, Inc.,US
6147	22,4882	1.37	Telefonica del Peru S.A.A.,PE
7018	17,2976	2.15	ATT-INTERNET4 - AT&T Services, Inc.,US
12322	17,0936	1.28	PROXAD Free SAS,FR
2516	11,4113	0.19	KDDI KDDI CORPORATION,JP
22394	10,7111	0.26	CELLCO - Cellco Partnership DBA Verizon Wireless,US
23910	10,0150	2.59	CNG I-CERNET2-AS-AP China Next Generation Internet CERNET2,CN
55430	7,3924	11.11	STARHUBINTERNET-AS-NGNBN Starhub Internet Pte Ltd,SG
4739	6,5637	0.67	INTERNODE-AS Internode Pty Ltd,AU
3303	6,2368	1.46	SWISSCOM Swisscom (Switzerland) Ltd,CH
10091	6,0175	3.29	SCV-AS-AP StarHub Cable Vision Ltd,SG
4773	4,3247	0.52	MOBILEONELTD-AS-AP MobileOne Ltd. Mobile/Internet Service Provider Singapore,SG
3320	42,006	1.04	DTAG Deutsche Telekom AG,DE
9506	24,627	0.30	MAGIX-SG-AP Magix Broadband Network,SG
31334	23,329	3.31	KABELDEUTSCHLAND-AS Kabel Deutschland Vertrieb und Service GmbH,DE
5610	22,883	0.94	T02-CZECH-REPUBLIC Telefonica Czech Republic, a.s.,CZ
6848	22,428	0.64	TELENET-AS Telenet N.V.,BE

IPv6 Connection Failure Rate for AsiaPac Nets

AS	Samples	Failure Rate (%)	AS Name
9794	31	93.55	DNET-ID-AP PT. Core Mediatech (D-NET),ID
45600	51	90.20	UPM-AS-AP University of the Philippines, Manila,PH
4755	181	81.77	TATACOMM-AS TATA Communications formerly VSNL is Leading ISP,IN
45637	40	72.50	UNIFONENETWORKS-AS-AP UniFone New Zealand Ltd,NZ
55680	65	72.31	KSI-UAJY-AS-ID Kantor Sistem Informasi Universitas Atma Jaya Yogyakarta,ID
17961	37	51.35	MITENE mitene internet co., ltd.,JP
17660	289	37.72	DRUKNET-AS DrukNet ISP,BT
45809	49	36.73	NZRS-AS-AP ASN for .nz registry content,NZ
17832	209	28.71	SIXNGIX-AS-KR Korea Internet Security Agency,KR
17996	43	27.91	UIINET-ID-AP PT Global Prima Utama,ID
10012	33	27.27	FUSION Fusion Communications Corp.,JP
23679	23	26.09	NUSANET-AS-ID Media Antar Nusa PT.,ID
9931	38	23.68	CAT-AP The Communication Authoity of Thailand, CAT,TH
4837	1,859	22.00	CHINA169-BACKBONE CNCGROUP China169 Backbone,CN
38794	58	20.69	BB-BROADBAND-TH-AS-AP BB-Broadband Co., Ltd. Transit AS,TH
3836	83	20.48	THAISARN-TH-AS-AP Thai Social/Scientific, Academic and Research Network,TH
56308	44	20.45	TELIN-NET-SG TELEKOMUNIKASI INDONESIA INTERNATIONAL, PTE.LTD,SG
18106	88	20.45	VIEWQWEST-SG-AP Viewqwest Pte Ltd,SG
7642	47	12.77	DHIRAAGU-MV-AP Dhiraagu Internet Services,MV
9431	75	12.00	AKUNI-NZ The University of Auckland,NZ
55947	44	11.36	BBNL-IN Bangalore Broadband Network Pvt Ltd,IN
7633	53	11.32	SOFTNET-AS-AP Software Technology Parks of India - Bangalore,IN
55430	71,832	11.07	STARHUBINTERNET-AS-NGNBN Starhub Internet Pte Ltd,SG
45506	128	10.16	AUSAID-AS-AP Australian Agency for International Development,AU
17451	257	9.73	BIZNET-AS-AP BIZNET NETWORKS,ID

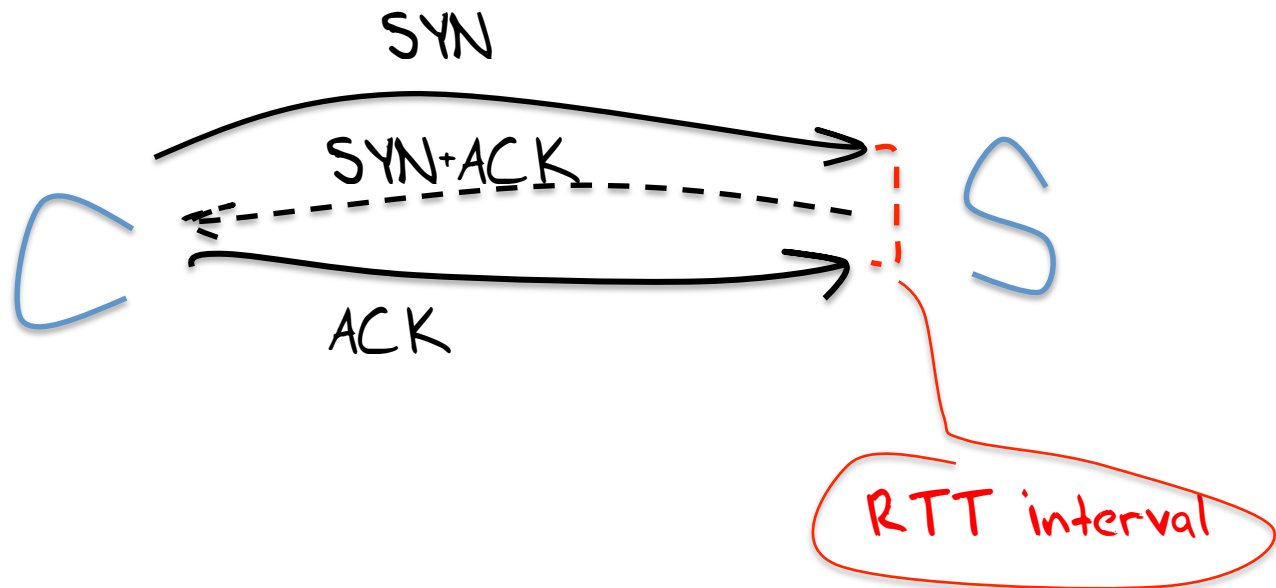
RTT Measurements

Data performance is highly dependent on the RTT across the data connection

Is IPv6 faster or slower than IPv4 in terms of an RTT comparison?

RTT Estimate

Measuring the time interval for the completion of the TCP handshake



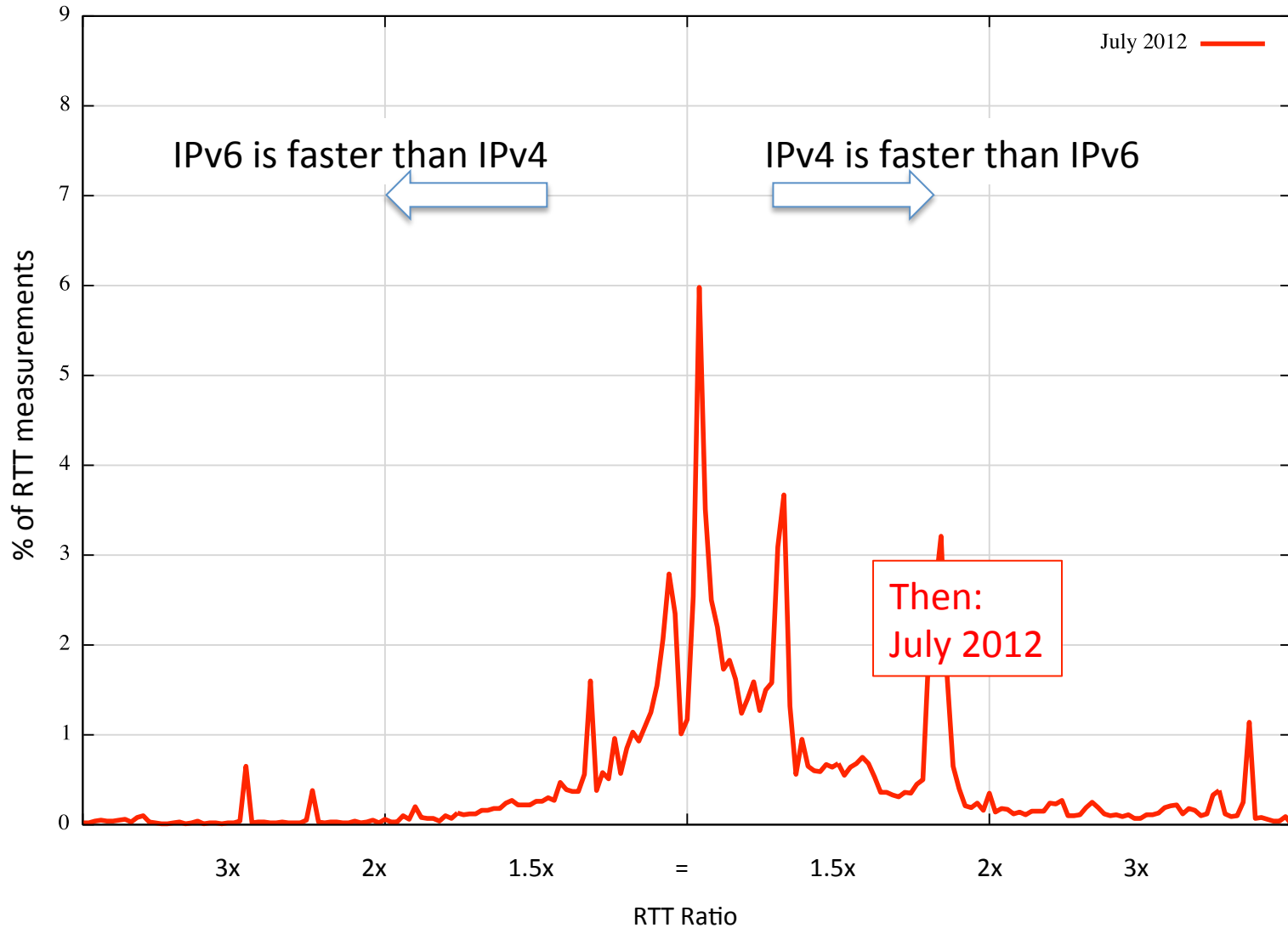
Paired RTT Distribution

Take the TCP handshake and measure the elapsed time at the server between the initial SYN and the following ACK packet

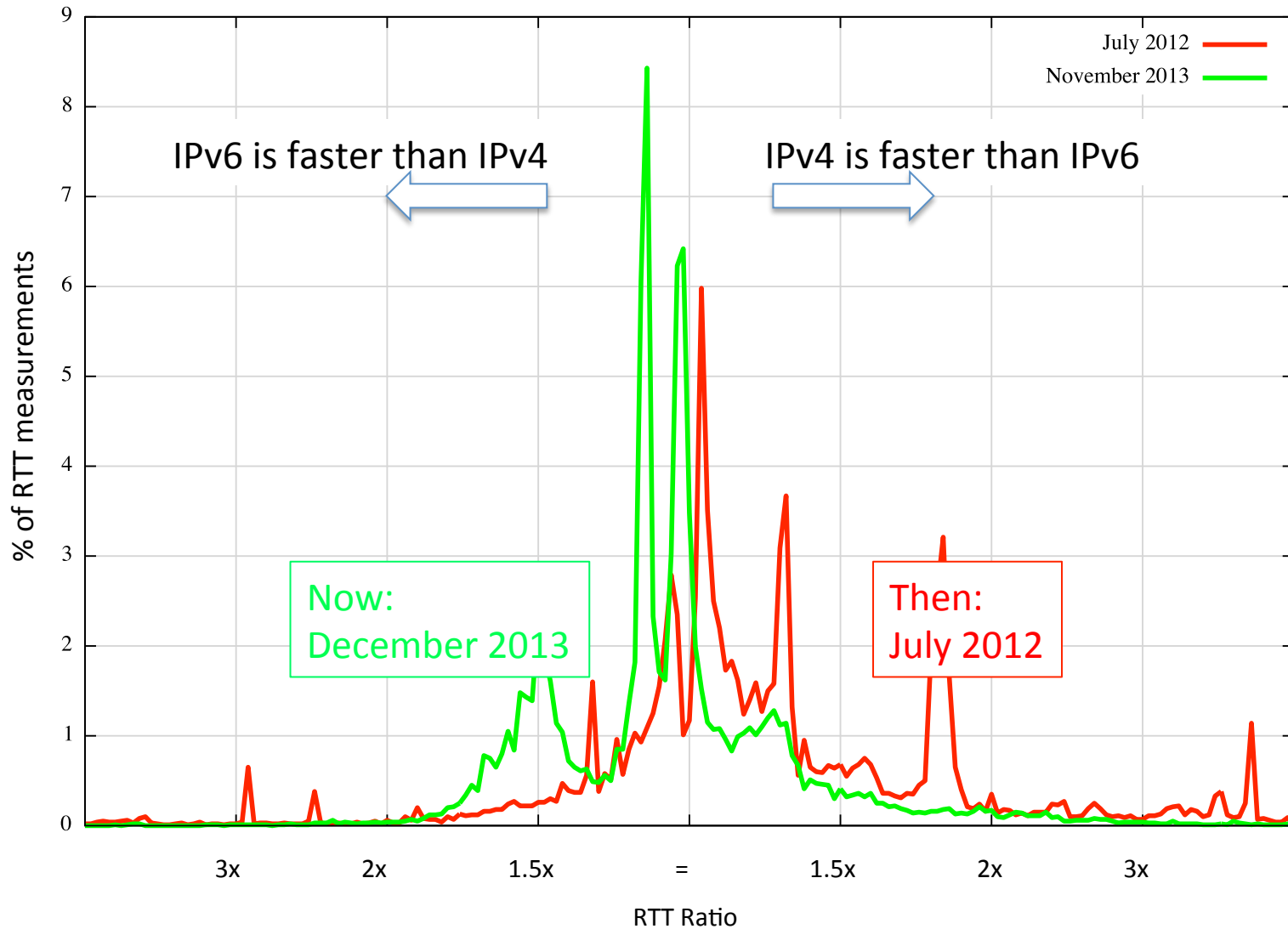
- this time value is an indicator of the RTT

Take the measurements where we have web log evidence that the IPv4 and IPv6 addresses correspond to a single experiment, and generate a ratio of the two RTT values

Paired RTT Distribution

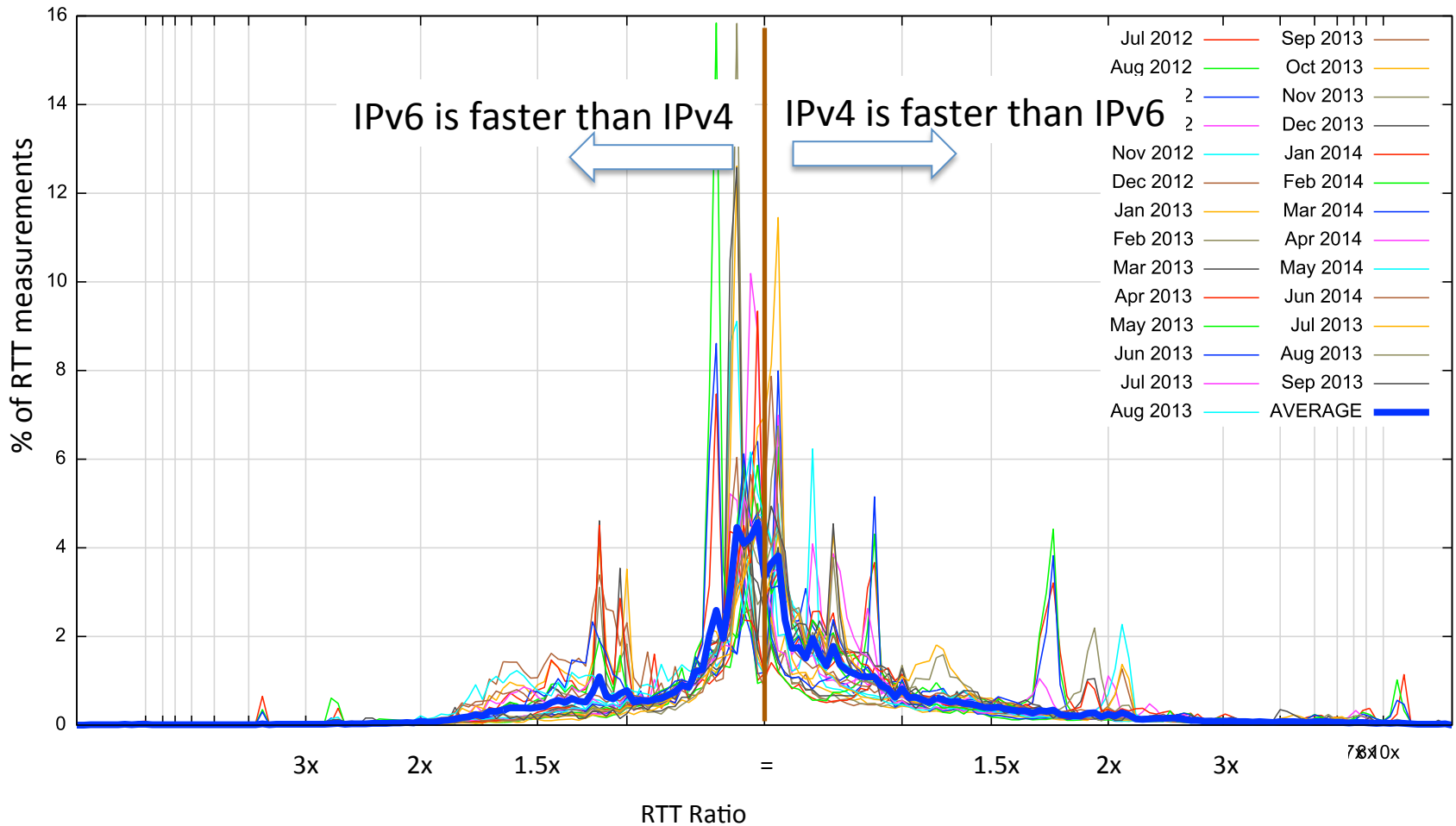


Paired RTT Distribution



Paired RTT Distribution

Comparison of Measured RTTs



RTT Distribution

- There is a slight change in the RTT distributions over the past 12 months favoring IPv6 being slightly faster than IPv4
 - This could be due to different network paths between IPv4 and IPv6
 - Or less deployment of port 80 trapping middleware in IPv6 as compared to IPv4