



Internet Routing Table Analysis Update

Philip Smith

SANOG 34

31st July 2019

Kolkata, India



Motivation

- 1998: No one was publishing any Internet routing table analysis
 - Only CIDR-Report reporting on top 20 contributors to routing table, and top 20 bad aggregators
- With support of APNIC, my weekly reporting report started 23rd February 1999:
 - Routing table size
 - CIDR-Report style reporting on a per-RIR basis
 - ...and many other interesting features
- Started recording global IPv6 table in September 2010

IPv4 Routing Report 29th July 2019

BGP routing table entries examined:	762552
Prefixes after maximum aggregation (per Origin AS):	294687
Deaggregation factor:	2.59
Unique aggregates announced (without unneeded subnets):	368695
Total ASes present in the Internet Routing Table:	65001
Prefixes per ASN:	11.73
Origin-only ASes present in the Internet Routing Table:	55884
Origin ASes announcing only one prefix:	23963
Transit ASes present in the Internet Routing Table:	9117
Transit-only ASes present in the Internet Routing Table:	287
Average AS path length visible in the Internet Routing Table:	4.4
Max AS path length visible:	42
Max AS path prepend of ASN (27978)	31
Prefixes from unregistered ASNs in the Routing Table:	25
Number of instances of unregistered ASNs:	25
Number of 32-bit ASNs allocated by the RIRs:	28042
Number of 32-bit ASNs visible in the Routing Table:	22886
Prefixes from 32-bit ASNs in the Routing Table:	103494
Number of bogon 32-bit ASNs visible in the Routing Table:	17
Special use prefixes present in the Routing Table:	0
Prefixes being announced from unallocated address space:	236
Number of addresses announced to Internet:	2839987200
Equivalent to 169 /8s, 70 /16s and 196 /24s	
Percentage of available address space announced:	76.7
Percentage of allocated address space announced:	76.7
Percentage of available address space allocated:	100.0
Percentage of address space in use by end-sites:	99.3
Total number of prefixes smaller than registry allocations:	253649

APNIC Region

Prefixed being announced by APNIC Region ASes:	206009
Total APNIC prefixes after maximum aggregation:	61604
APNIC Deaggregation factor:	3.34
Prefixed being announced from the APNIC address blocks:	201345
Unique aggregates announced from the APNIC address blocks:	84373
APNIC Region origin ASes present in the Internet Routing Table:	9934
APNIC Prefixes per ASN:	20.27
APNIC Region origin ASes announcing only one prefix:	2748
APNIC Region transit ASes present in the Internet Routing Table:	1489
Average APNIC Region AS path length visible:	4.5
Max APNIC Region AS path length visible:	27
Number of APNIC region 32-bit ASNs visible in the Routing Table:	4932
Number of APNIC addresses announced to Internet:	770894080
Equivalent to 45 /8s, 242 /16s and 233 /24s	

APNIC AS Blocks	4608-4864, 7467-7722, 9216-10239, 17408-18431
(pre-ERX allocations)	23552-24575, 37888-38911, 45056-46079, 55296-56319, 58368-59391, 63488-64098, 64297-64395, 131072-141625

APNIC Address Blocks	1/8, 14/8, 27/8, 36/8, 39/8, 42/8, 43/8, 49/8, 58/8 to 61/8, 101/8, 103/8, 106/8, 110/8 to 126/8, 133/8, 175/8, 180/8, 182/8, 183/8, 202/8, 203/8, 210/8, 211/8, 218/8 to 223/8
----------------------	--

Global per AS prefix count summary

ASN	No of nets /20	equiv	Max Agg	Description
8151	6266	3376	592	Uninet S.A. de C.V., MX
12479	5510	1629	141	UNI2-AS, ES
7545	4863	591	568	TPG-INTERNET-AP TPG Telecom Limited, AU
7155	4064	280	25	VIASAT-SP-BACKBONE - ViaSat, Inc., US
39891	3780	219	19	ALJAWWALSTC-AS, SA
11492	3684	240	615	CABLEONE - CABLE ONE, INC., US
6327	3564	1324	90	SHAW - Shaw Communications Inc., CA
22773	3444	2974	156	ASN-CXA-ALL-CCI-22773-RDC - Cox Communi
10620	3396	536	428	Telmex Colombia S.A., CO
8551	3326	379	46	BEZEQ-INTERNATIONAL-AS Bezeqint Interne
7552	3183	1459	31	VIETEL-AS-AP Viettel Group, VN
45899	3053	1764	110	VNPT-AS-VN VNPT Corp, VN
16509	3044	6390	1430	AMAZON-02 - Amazon.com, Inc., US
9808	2750	9043	63	CMNET-GD Guangdong Mobile Communication
20940	2701	506	1922	AKAMAI-ASN1, US
11830	2690	370	54	Instituto Costarricense de Electricidad
9829	2687	1488	559	BSNL-NIB National Internet Backbone, IN
16625	2635	1385	1912	AKAMAI-AS - Akamai Technologies, Inc.,
4766	2542	11119	761	KIXS-AS-KR Korea Telecom, KR
12389	2358	2230	661	ROSTELECOM-AS, RU

AfrINIC APNIC ARIN LACNIC RIPE NCC

List of Unregistered Origin ASNs (Global)

Bogon AS	Designation	Network	Transit AS	Description
230105	UNALLOCATED	38.110.79.0/24	23015	CMC180-TOR-AS - Cambridge Merc
260984	UNALLOCATED	45.175.186.0/23	16735	ALGAR TELECOM S/A, BR
266842	UNALLOCATED	45.238.156.0/22	265680	HNTELCO S.A, HN
64511	DOCUMENT	66.154.208.0/21	32522	MULTNOMAH-ESD - Multnomah Educ
64511	DOCUMENT	66.154.216.0/23	32522	MULTNOMAH-ESD - Multnomah Educ
64511	DOCUMENT	66.154.218.0/24	32522	MULTNOMAH-ESD - Multnomah Educ
65550	DOCUMENT	81.8.34.0/24	15924	BORUSANTELEKOM-AS, TR
65550	DOCUMENT	81.8.35.0/24	15924	BORUSANTELEKOM-AS, TR
65549	DOCUMENT	117.239.163.0/24	65544	UNKNOWN
64339	UNALLOCATED	143.0.108.0/22	18747	IFX18747 - IFX Corporation, US
64355	UNALLOCATED	156.40.196.0/24	30387	NIH-NET-NCCS - National Instit
64011	UNALLOCATED	166.133.128.0/18	20057	ATT-MOBILITY-LLC-AS20057 - AT&
64011	UNALLOCATED	166.133.192.0/18	20057	ATT-MOBILITY-LLC-AS20057 - AT&
64011	UNALLOCATED	166.184.9.0/24	20057	ATT-MOBILITY-LLC-AS20057 - AT&
64011	UNALLOCATED	166.220.64.0/19	20057	ATT-MOBILITY-LLC-AS20057 - AT&
64011	UNALLOCATED	166.220.96.0/19	20057	ATT-MOBILITY-LLC-AS20057 - AT&
65540	DOCUMENT	185.168.163.0/24	3257	GTT-BACKBONE GTT, DE
65537	DOCUMENT	189.206.63.0/24	11172	Alestra, S. de R.L. de C.V., M
65610	UNALLOCATED	192.96.139.0/24	11845	Vox-Telecom, ZA
64042	UNALLOCATED	192.104.151.0/24	7018	ATT-INTERNET4 - AT&T Services,
65550	DOCUMENT	196.219.246.0/24	8452	TE-AS TE-AS, EG
64506	DOCUMENT	198.55.226.0/23	14495	ASN-14495 - Nasdaq, Inc., US
64501	DOCUMENT	205.220.234.0/24	397005	CVSI-FIREFLY - Central Virgini
64510	DOCUMENT	216.52.28.0/24	12182	INTERNAP-2BLK - Internap Corpo
64510	DOCUMENT	216.52.29.0/24	12182	INTERNAP-2BLK - Internap Corpo

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0	/7:0	/8:14
/9:11	/10:36	/11:99	/12:290	/13:570	/14:1096	/15:1897	/16:13370
/17:7945	/18:13779	/19:25371	/20:39359	/21:45765	/22:87737	/23:71486	/24:396874
/25:803	/26:606	/27:626	/28:35	/29:20	/30:19	/31:4	/32:54

29th July 2018 ↑

29th July 2019 ↓

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0	/7:0	/8:10
/9:11	/10:38	/11:100	/12:291	/13:568	/14:1130	/15:1901	/16:13260
/17:8026	/18:13910	/19:25830	/20:40389	/21:47239	/22:95547	/23:77202	/24:436208
/25:892	/26:0	/27:0	/28:0	/29:0	/30:0	/31:0	/32:0



What about IPv6 ?

Table Size	71862
Number of /32s	12775
Number of /48s	34203
Number of prefixes >/48	0 ← ISP is Filtering 😊
Number of prefixes >/32 and </48	20438
Number of prefixes >/16 and </32	3357

Number of IPv6 prefixes announced by prefix length

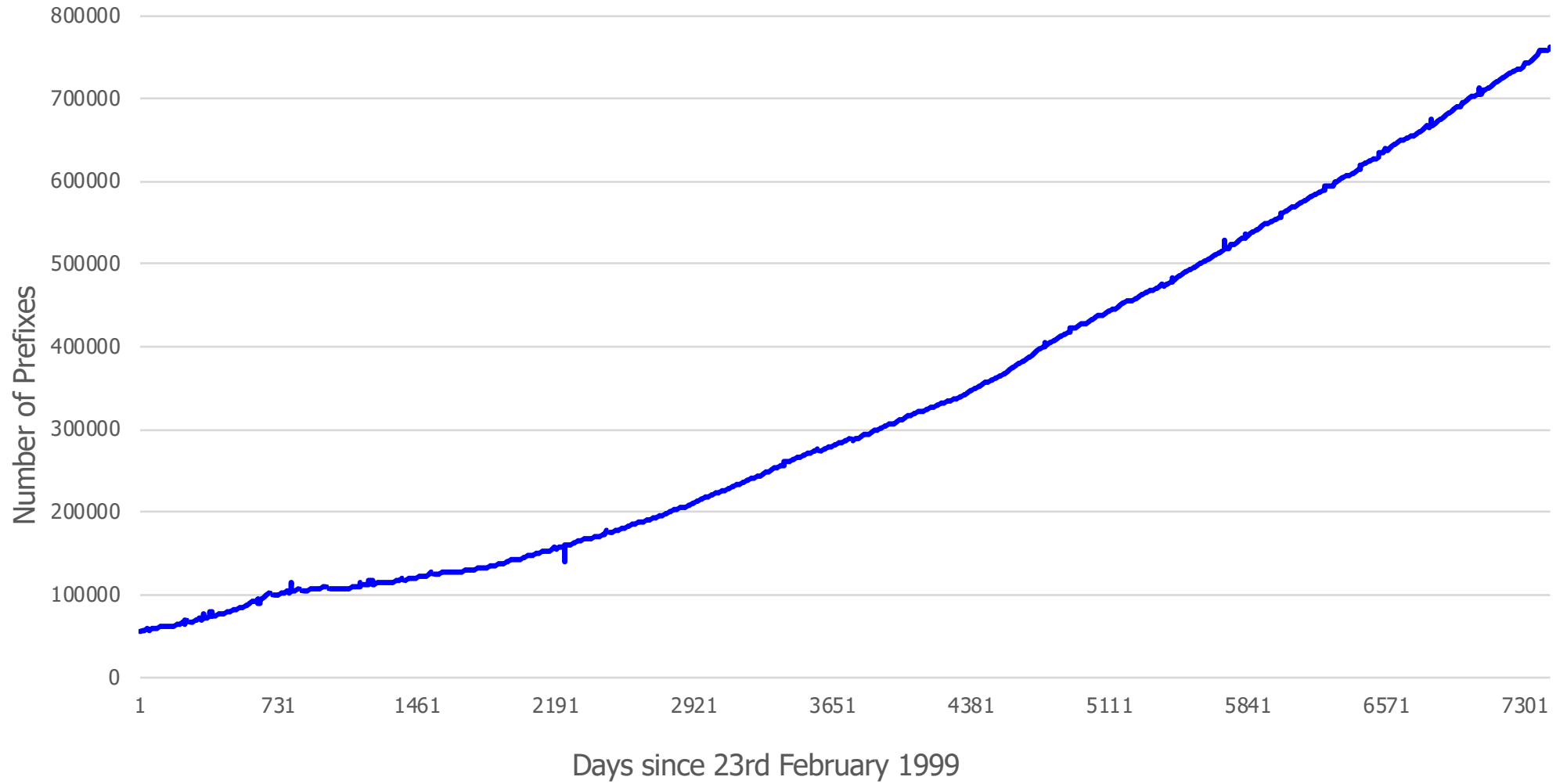
/16:0	/17:0	/18:0	/19:2	/20:13	/21:4	/22:6	/23:4
/24:2	/25:6	/26:13	/27:17	/28:87	/29:2424	/30:226	/31:124
/32:11272	/33:779	/34:630	/35:431	/36:2472	/37:445	/38:799	/39:267
/40:3299	/41:438	/42:692	/43:133	/44:4251	/45:377	/46:1595	/47:690
/48:27281	/49 → /128: FILTERED by ISP						

7th January 2019 ↑

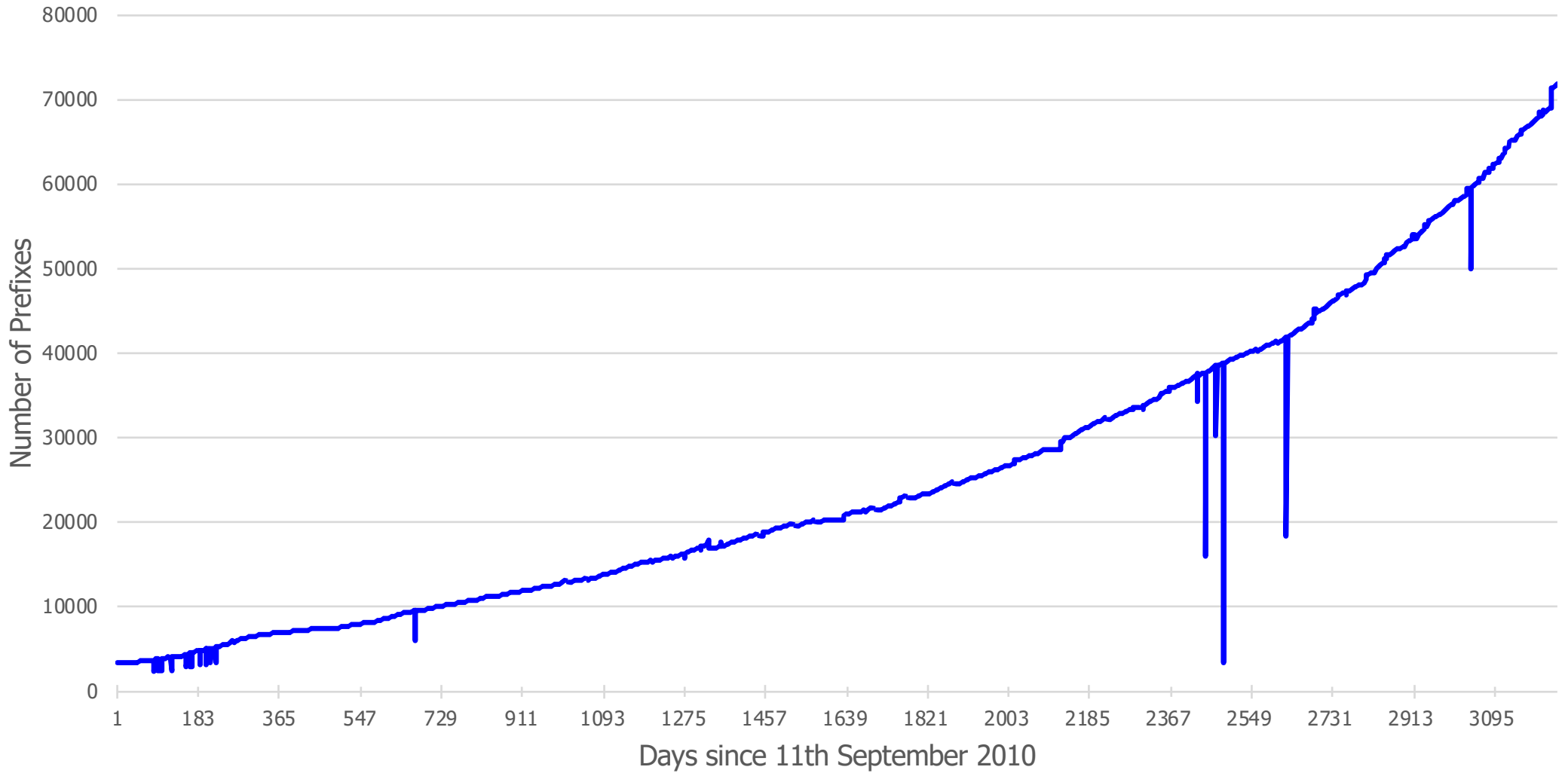
7th January 2011 ↓

/16:1	/17:0	/18:0	/19:2	/20:5	/21:4	/22:4	/23:1
/24:2	/25:1	/26:5	/27:5	/28:11	/29:4	/30:8	/31:5
/32:2409	/33:47	/34:27	/35:54	/36:94	/37:2	/38:8	/39:2
/40:108	/41:6	/42:27	/43:3	/44:29	/45:7	/46:13	/47:21
/48:1122	/49 → /128: FILTERED by ISP						

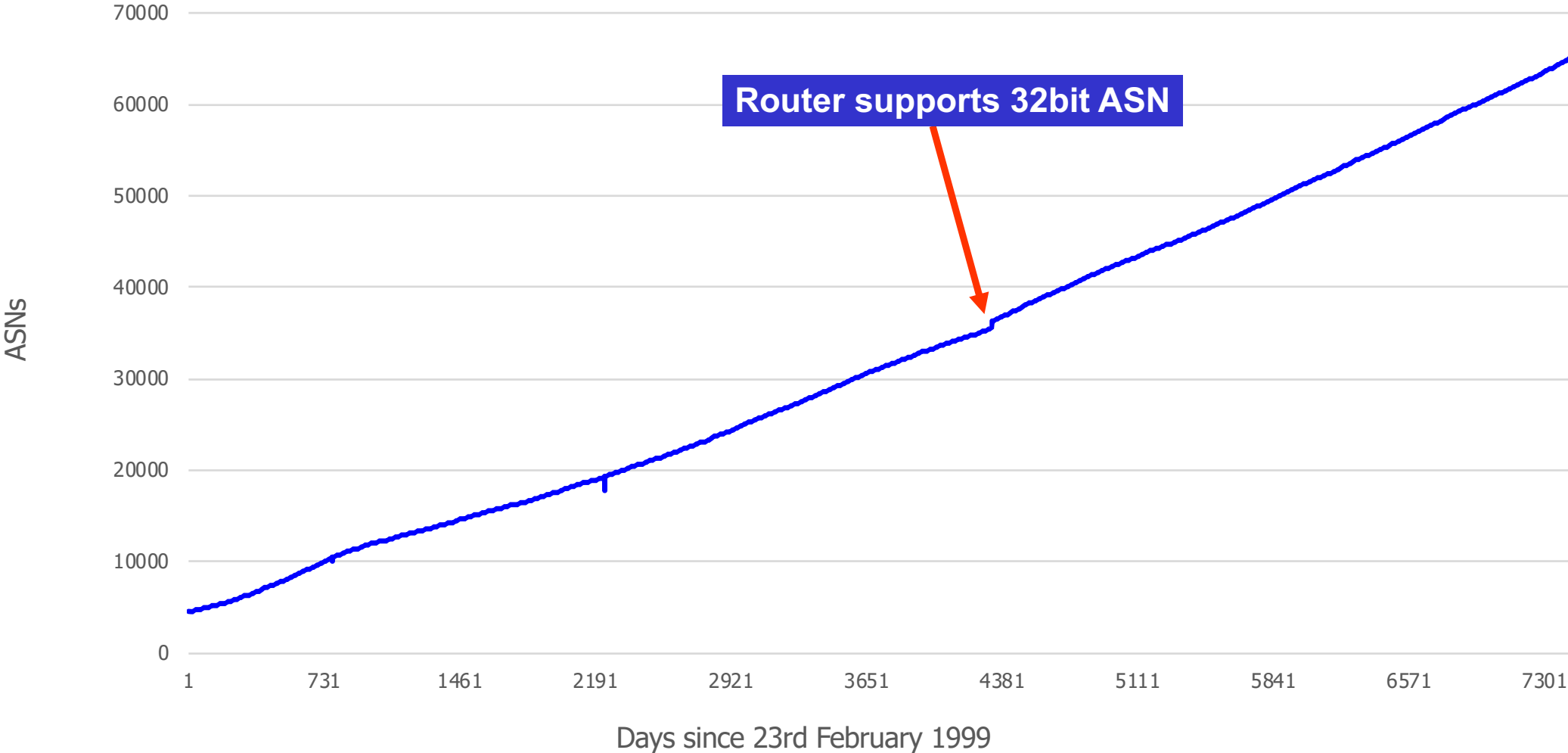
Global IPv4 Routing Table



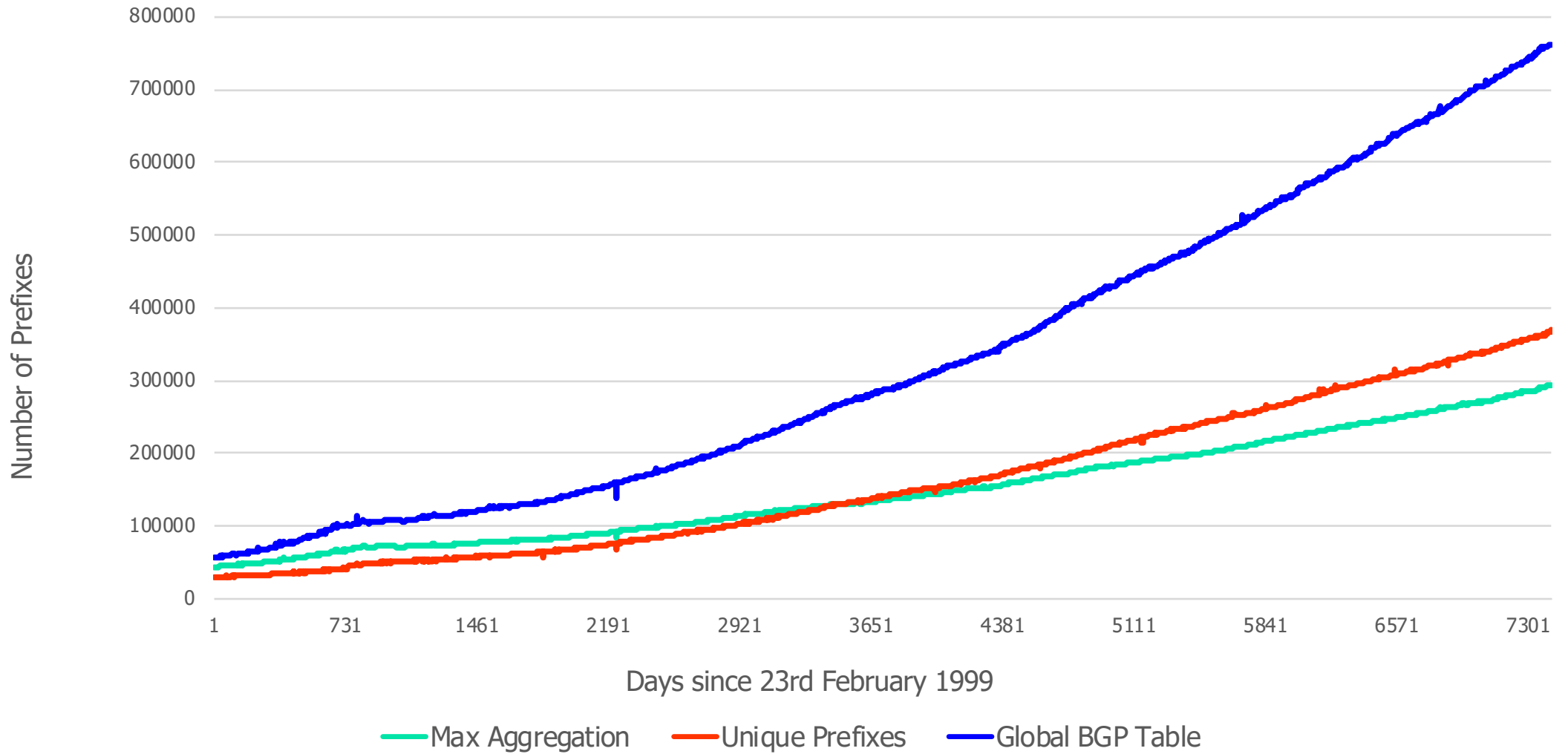
Global IPv6 Routing Table



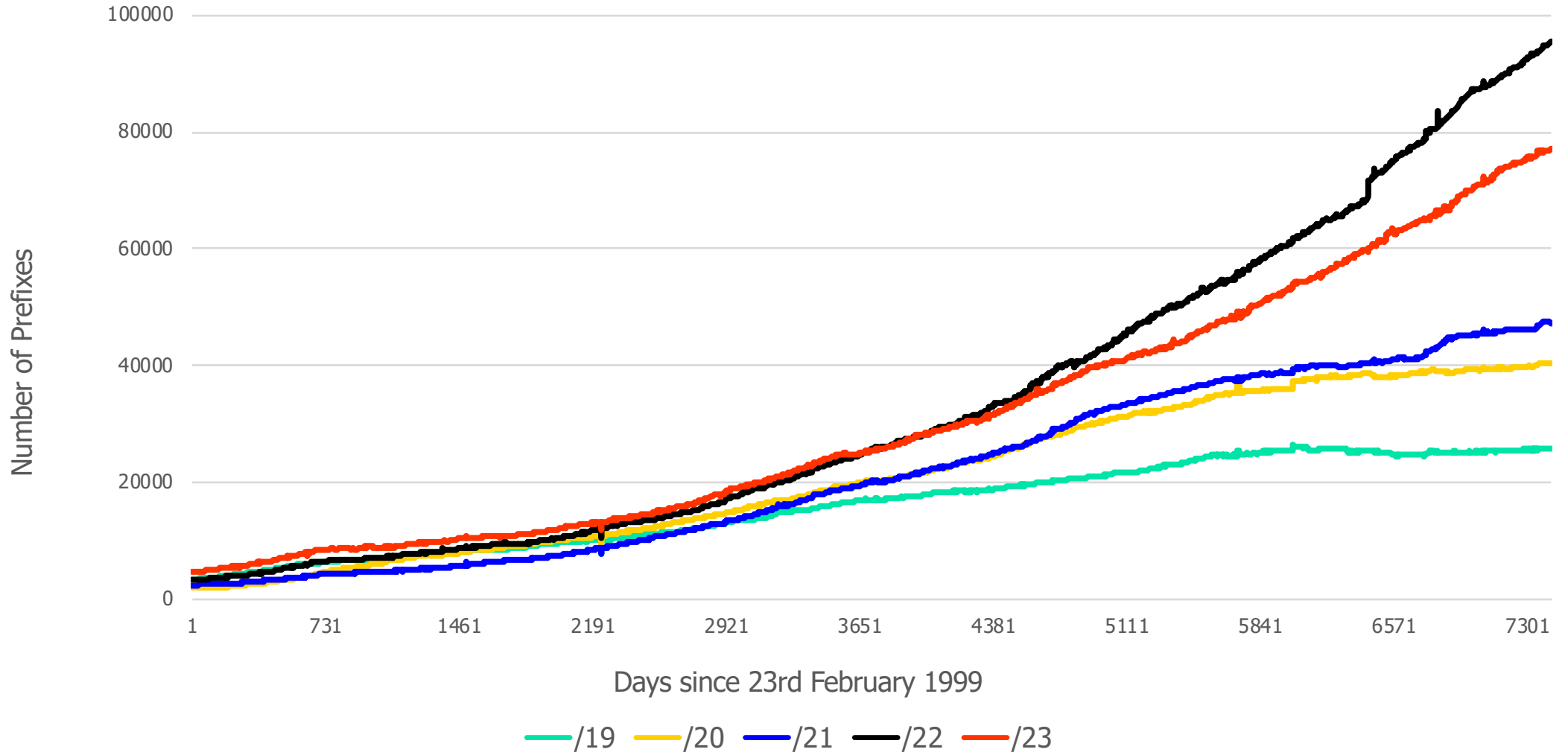
AS Growth



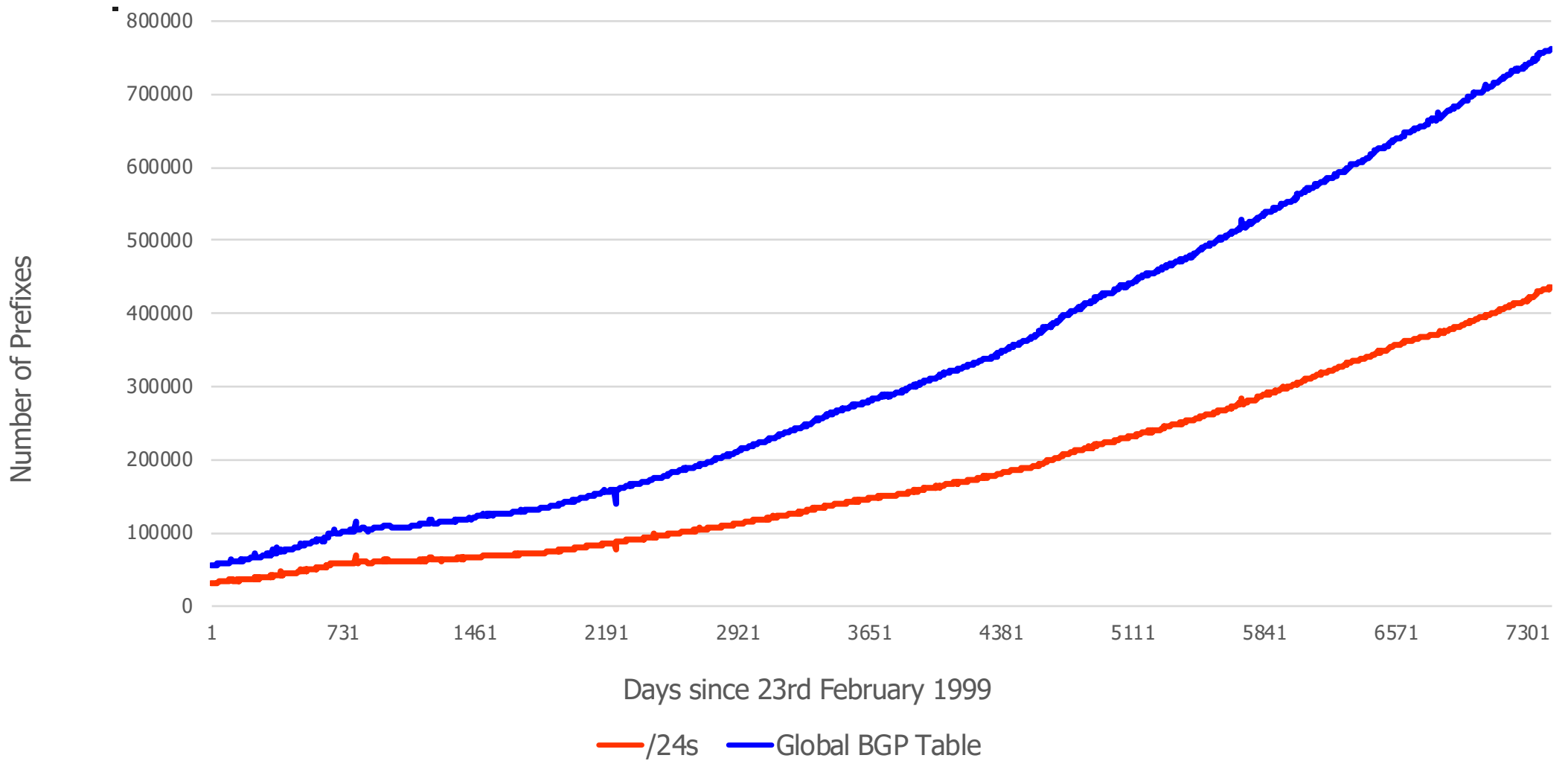
Max Aggregation vs Unique Prefixes



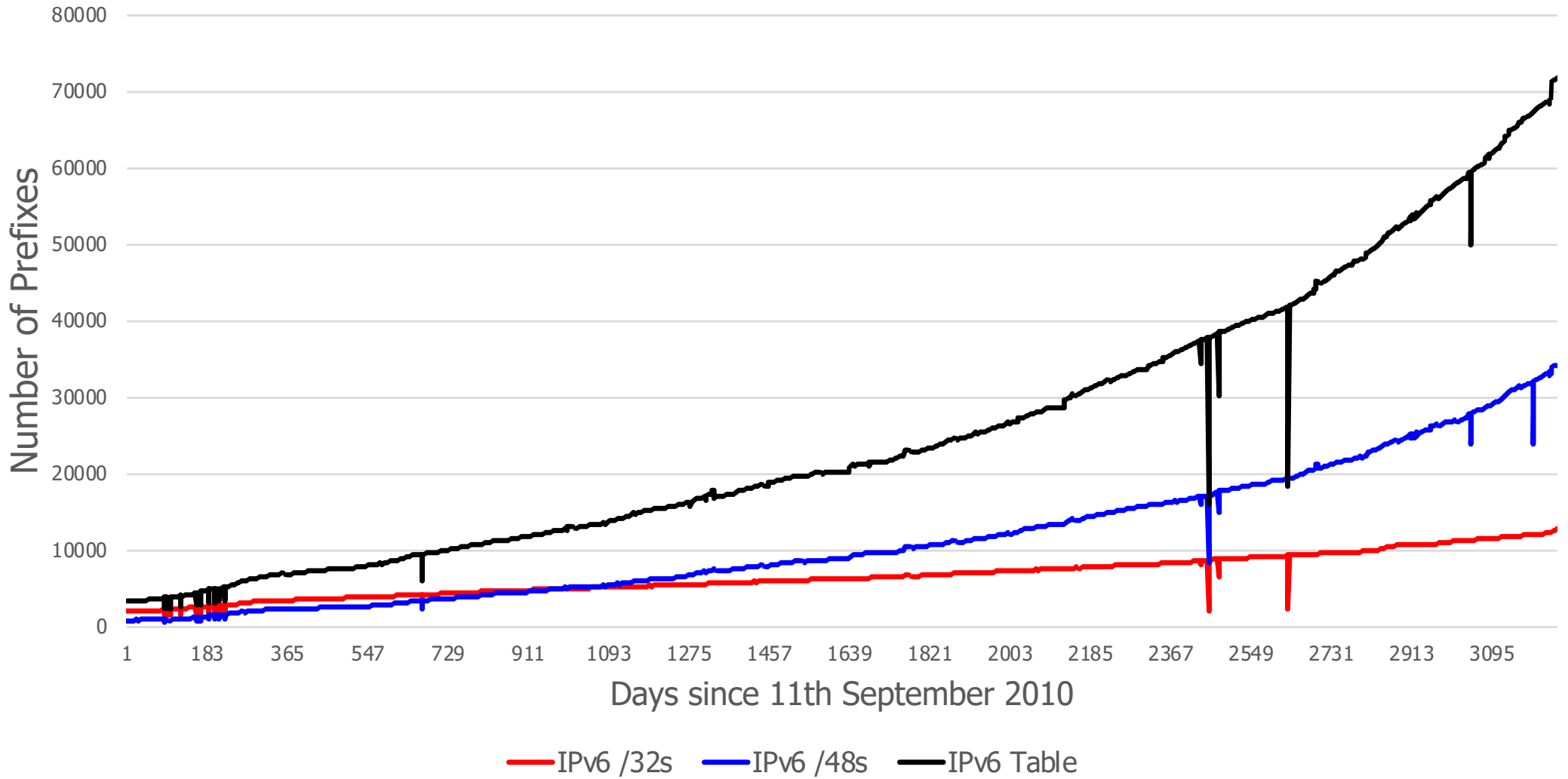
Prefix sizes announced



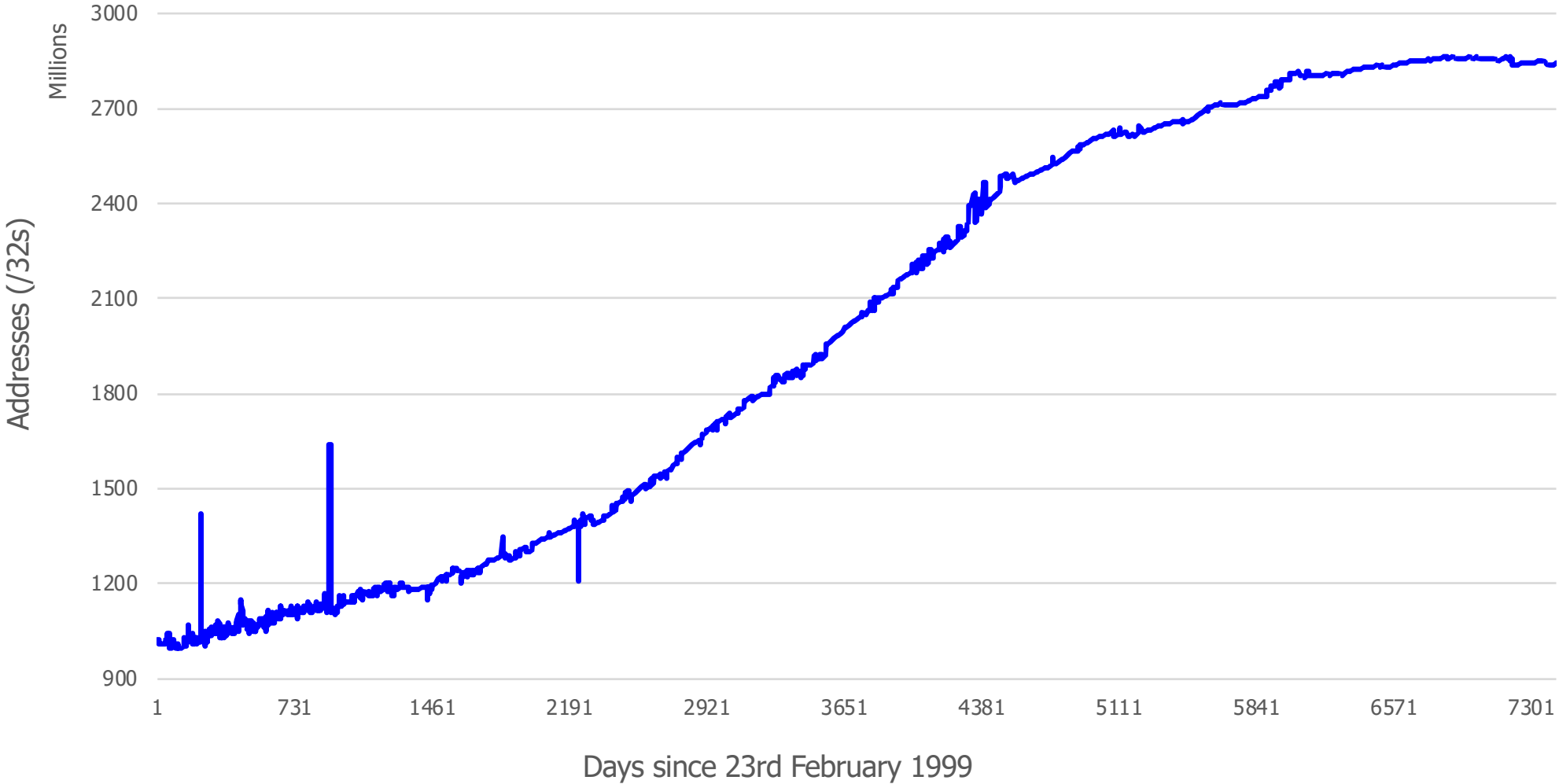
/24s announced



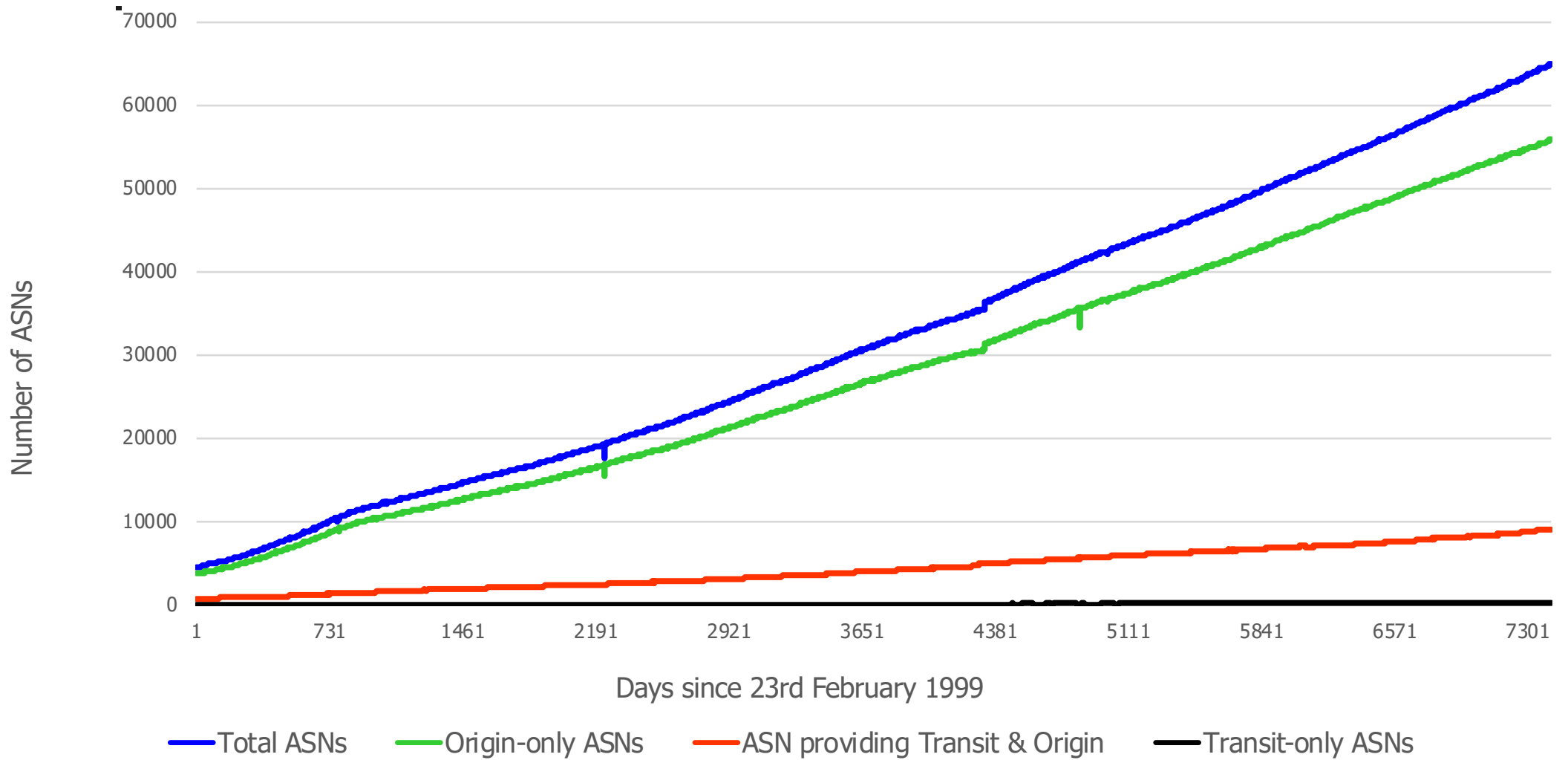
IPv6 /32s vs /48s



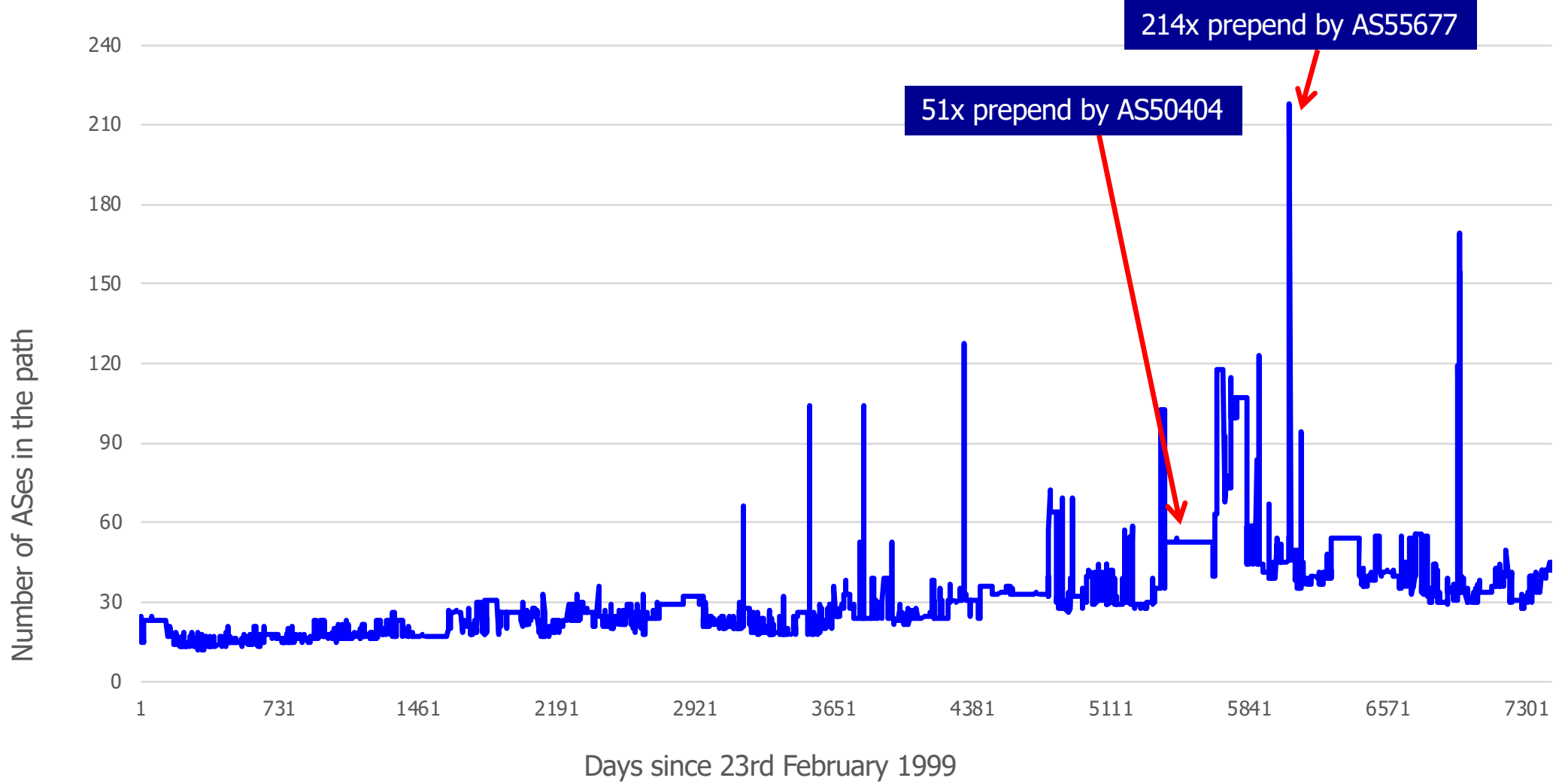
IPv4 Address Space announced



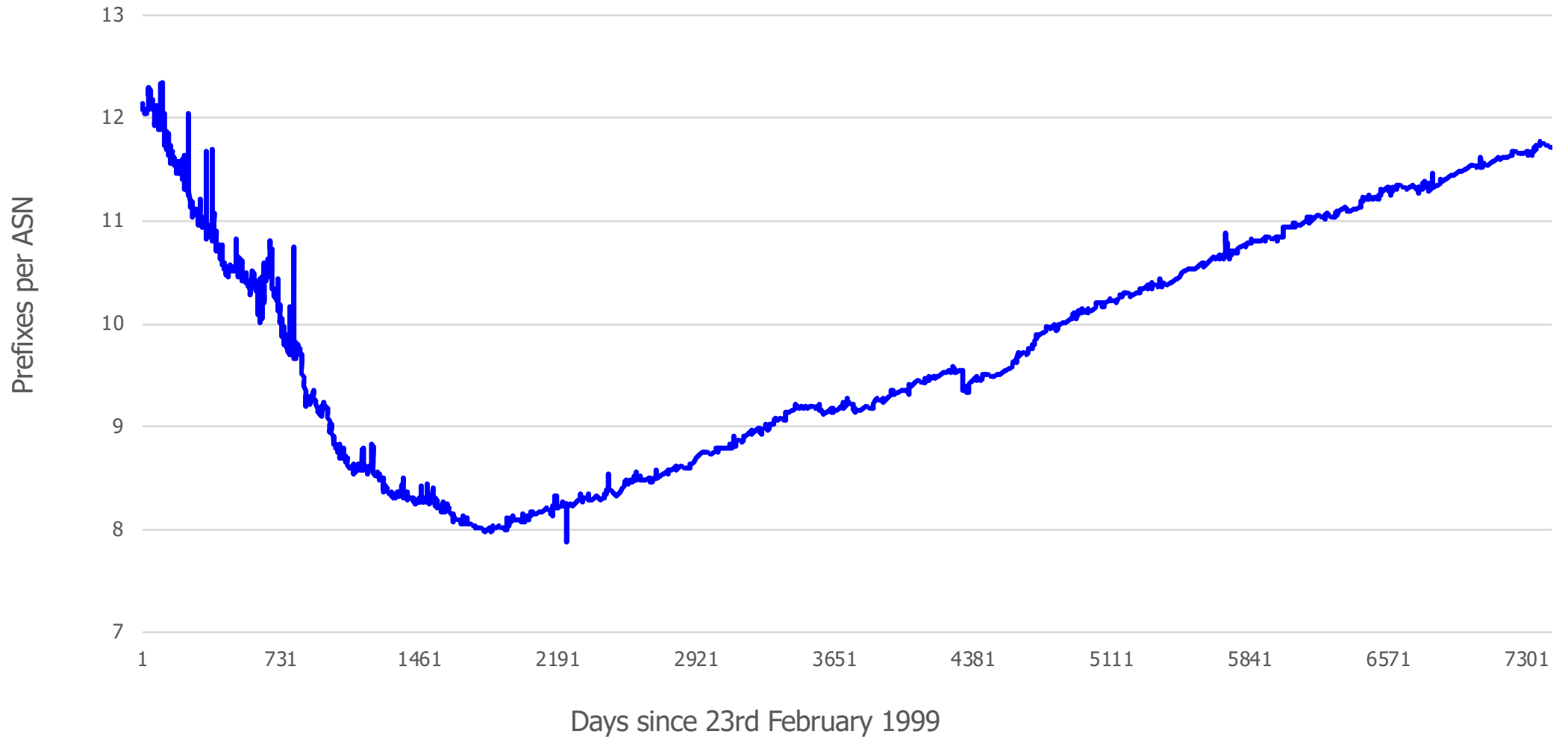
AS Announcements



Maximum AS Path Length



Prefixes per ASN





Looking at Deaggregation

- CIDR Report
 - www.cidr-report.org
 - Encourages aggregation following CIDRisation of Internet
 - Today: extensive suite of reports and tools covering state of BGP table
- Routing Report
 - BGP table status on per RIR basis
 - Original CIDR Report and a whole lot more



Deaggregation Factor

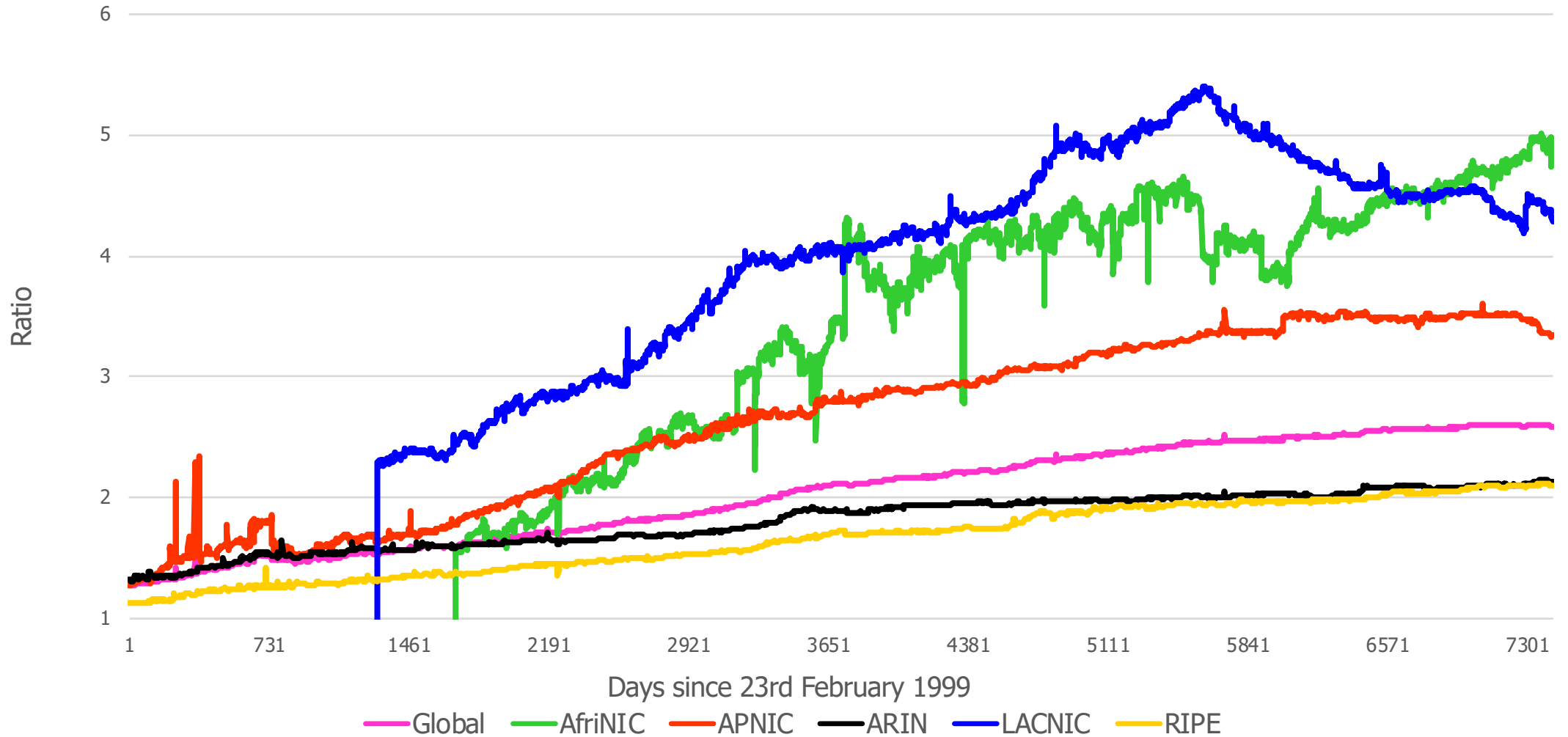
- Routing Report
 - One summary takes BGP table and aggregates prefixes by origin AS
 - Called “Max Aggregation” in report
 - Global and per RIR basis
 - <http://thyme.apnic.net/current/>
- Calculates **Deaggregation** Factor:
 - Measure of Routing Table size/Aggregated Size
 - Global value has been increasing slowly and steadily since “records began”



July 2019

- **Total Prefixes**
- Global BGP Table
 - 763k prefixes
- North America
 - 227k prefixes
- Europe & Middle East
 - 221k prefixes
- Asia & Pacific
 - 206k prefixes
- Latin America & Caribbean
 - 98k prefixes
- Africa
 - 21k prefixes
- **Deaggregation Factor**
- Global Average
 - 2.59
- North America
 - 2.14
- Europe & Middle East
 - 2.11
- Asia & Pacific
 - 3.34
- Latin America & Caribbean
 - 4.33
- Africa
 - 4.75

Deaggregation: RIR Regions vs Global



Asia Pacific Aggregation Savings Summary

ASN	No of Nets	Savings	Description
7545	4863	4295	TPG-INTERNET-AP TPG Telecom Limited, AU
7552	3183	3152	VIETEL-AS-AP Viettel Group, VN
45899	3053	2943	VNPT-AS-VN VNPT Corp, VN
9808	2750	2687	CMNET-GD Guangdong Mobile Communication Co.Ltd.
9829	2687	2128	BSNL-NIB National Internet Backbone, IN
9394	2072	2048	CTTNET China TieTong Telecommunications Corpora
4755	2158	1968	TATACOMM-AS TATA Communications formerly VSNL i
9498	2130	1930	BBIL-AP BHARTI Airtel Ltd., IN
4766	2542	1781	KIXS-AS-KR Korea Telecom, KR
23969	1791	1775	TOT-NET TOT Public Company Limited, TH
45090	1734	1687	CNNIC-TENCENT-NET-AP Shenzhen Tencent Computer
7713	2225	1629	TELKOMNET-AS-AP PT Telekomunikasi Indonesia, ID
134705	1707	1584	ITACE-AS-AP Itace International Limited, HK
18403	1562	1526	FPT-AS-AP The Corporation for Financing & Promo
56041	1217	1167	CMNET-ZHEJIANG-AP China Mobile communications c
17974	1144	1113	TELKOMNET-AS2-AP PT Telekomunikasi Indonesia, I
9583	1674	1111	SIFY-AS-IN Sify Limited, IN
4808	1502	1099	CHINA169-BJ China Unicom Beijing Province Netwo
24560	1288	979	AIRTELBROADBAND-AS-AP Bharti Airtel Ltd., Telem
45609	1251	874	BHARTI-MOBILITY-AS-AP Bharti Airtel Ltd. AS for

<http://thyme.apnic.net/current/data-CIDRnet-APNIC>

South Asia Aggregation Savings Summary

ASN	No of Nets	Savings	Description
9829	2687	2128	BSNL-NIB National Internet Backbone, IN
4755	2158	1968	TATACOMM-AS TATA Communications formerly VSNL i
9498	2130	1930	BBIL-AP BHARTI Airtel Ltd., IN
9583	1674	1111	SIFY-AS-IN Sify Limited, IN
24560	1288	979	AIRTELBROADBAND-AS-AP Bharti Airtel Ltd., Telem
45609	1251	874	BHARTI-MOBILITY-AS-AP Bharti Airtel Ltd. AS for
132165	907	845	CONNECT-AS-AP Connect Communications, PK
17488	1026	824	HATHWAY-NET-AP Hathway IP Over Cable Internet,
18101	960	820	RELIANCE-COMMUNICATIONS-IN Reliance Communicati
45528	949	749	TIKONAIN-AS Tikona Infinet Ltd., IN
45271	829	730	ICLNET-AS-AP Idea Cellular Limited, IN
45820	675	579	TTSL-MEISISIP Tata Teleservices ISP AS, IN
17439	624	544	NETMAGIC-AP Netmagic Datacenter Mumbai, IN
55410	456	426	VIL-AS-AP Vodafone Idea Ltd, IN
9541	485	394	CYBERNET-AP Cyber Internet Services (Pvt) Ltd.,
45595	393	381	PKTELECOM-AS-PK Pakistan Telecom Company Limite
17762	404	373	HTIL-TTML-IN-AP Tata Teleservices Maharashtra L
38264	352	345	WATEEN-IMS-PK-AS-AP National WiMAX/IMS environm
10029	359	341	SHYAMSPECTRA-AS SHYAM SPECTRA PVT LTD, IN
38266	390	337	VODAFONE-IN Vodafone India Ltd., IN



Importance of Aggregation

- Size of routing table
 - Router memory no longer seems to be a problem
 - Routers routinely carry over 1 million prefixes
- Convergence of the Routing System
 - Is this something we need to worry about?
 - Bigger table takes longer for CPU to process
 - BGP updates take longer to deal with
 - BGP Instability Report tracks routing system update activity
 - <http://bgpupdates.potaroo.net/instability/bgpupd.html>

The BGP Instability Report

The BGP Instability Report is updated daily. This report was generated on 29 July 2019 06:44 (UTC+1000)

50 Most active ASes for the past 14 days

RANK	ASN	UPDs	%	Prefixes	UPDs/Prefix	AS NAME
1	6762	355299	5.38%	363	978.79	SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
2	9829	293312	4.44%	2697	108.75	BSNL-NIB National Internet Backbone, IN
3	13904	93253	1.41%	168	555.08	COSLINK - Cherryland Services Inc, US
4	27738	86788	1.31%	847	102.47	Ecuadortelecom S.A., EC
5	5972	76057	1.15%	1845	41.22	DNIC-ASBLK-05800-06055 - DoD Network Information Center, US
6	47331	72811	1.10%	5663	12.86	TTNET, TR
7	262691	69753	1.06%	136	512.89	CONECTA LTDA., BR
8	2561	69058	1.05%	77	896.86	EUN, EG
9	16509	60610	0.92%	3087	19.63	AMAZON-02 - Amazon.com, Inc., US
10	8151	58509	0.89%	6366	9.19	Uninet S.A. de C.V., MX
11	7939	48591	0.74%	19	2557.42	UNIVCENTFLA - University of Central Florida, US
12	39028	46773	0.71%	27	1732.33	ULSK-AS, RU
13	36903	43331	0.66%	843	51.40	MT-MPLS, MA
14	20852	41202	0.62%	137	300.74	ATLANT-TELECOM-AS AtlantTelecom Autonomus System, BY
15	531	36220	0.55%	126	287.46	DNIC-AS-00531 - Headquarters, USAISC, US
16	46562	33629	0.51%	351	95.81	TOTAL-SERVER-SOLUTIONS - Total Server Solutions L.L.C., US
17	7579	33624	0.51%	108	311.33	INTERNEX-AS-AP InterNex Australia Pty Ltd, AU
18	11492	32828	0.50%	3694	8.89	CABLEONE - CABLE ONE, INC., US
19	138659	30949	0.47%	5	6189.80	CYBERLINK-AS-AP Cyberlink Online, BD
20	10620	30809	0.47%	3420	9.01	Telmex Colombia S.A., CO
21	35487	29933	0.45%	36	831.47	MISAKA, EU
22	15135	28577	0.43%	28	1020.61	DYN-HC - Oracle Corporation, US
23	5800	28329	0.43%	96	295.09	DNIC-ASBLK-05800-06055 - DoD Network Information Center, US
24	58224	26896	0.41%	819	32.84	TCI, IR
25	50710	25790	0.39%	519	49.69	EARTHLINK-AS, IQ
26	21859	24654	0.37%	428	57.60	ZNET - Zenlayer Inc, US
27	3832	22667	0.34%	20	1133.35	CINE-NET - Cinenet Communications, US
28	19058	21300	0.32%	37	575.68	IRTC-NET - Illinois Rural Telecommunication Co., US

50 Most active Prefixes for the past 14 days

RANK	PREFIX	UPDs	%	Origin AS -- AS NAME
1	201.183.255.0/24	51272	0.74%	27738 -- Ecuadortelecom S.A., EC
2	132.170.30.0/23	48591	0.70%	7939 -- UNIVCENTFLA - University of Central Florida, US
3	172.83.45.0/24	29768	0.43%	46562 -- TOTAL-SERVER-SOLUTIONS - Total Server Solutions L.L.C., US
4	216.238.254.0/23	29038	0.42%	13904 -- COSLINK - Cherryland Services Inc, US
5	23.35.212.0/22	27855	0.40%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
6	23.50.160.0/20	27407	0.39%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
7	23.50.184.0/22	25845	0.37%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
8	64.68.236.0/22	25763	0.37%	13904 -- COSLINK - Cherryland Services Inc, US
9	23.50.176.0/20	25749	0.37%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
10	23.50.188.0/22	25536	0.37%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
11	2.16.70.0/23	25183	0.36%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
12	92.123.208.0/22	24972	0.36%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
13	88.221.100.0/22	24954	0.36%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
14	92.122.68.0/22	24944	0.36%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
15	95.101.156.0/22	24821	0.36%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
16	88.221.28.0/22	24733	0.35%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
17	2.19.16.0/20	24555	0.35%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
18	2.16.146.0/23	24498	0.35%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
19	2.20.4.0/22	24221	0.35%	6762 -- SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT
20	193.118.40.0/24	22313	0.32%	21859 -- ZNET - Zenlayer Inc, US
21	162.212.150.0/23	17980	0.26%	30321 -- BURNINGMAN - Burning Man, US
22	177.136.12.0/24	16310	0.23%	52871 -- TASCOM TELECOMUNICAÇÕES LTDA, BR
23	68.69.37.0/24	15469	0.22%	14858 -- HISNET - Hanson Information Systems, Inc. / Family Net, US 19058 -- IRTC-NET - Illinois Rural Telecommunication Co., US
24	109.195.207.0/24	15166	0.22%	39028 -- ULSK-AS, RU
25	209.177.171.0/24	14339	0.21%	18465 -- WORKDAY-01 - Workday, Inc., US
26	68.69.45.0/24	14132	0.20%	14858 -- HISNET - Hanson Information Systems, Inc. / Family Net, US 19058 -- IRTC-NET - Illinois Rural Telecommunication Co., US
27	162.88.46.0/24	14055	0.20%	15135 -- DYN-HC - Oracle Corporation, US
28	204.208.170.0/24	14025	0.20%	5972 -- DNIC-ASBLK-05800-06055 - DoD Network Information Center, US
29	68.70.218.0/24	13193	0.19%	13904 -- COSLINK - Cherryland Services Inc, US
30	68.70.217.0/24	13190	0.19%	13904 -- COSLINK - Cherryland Services Inc, US
31	82.196.154.0/24	12424	0.18%	29651 -- CTCS, RU
32	159.138.67.0/24	11832	0.17%	136907 -- HWCLOUDS-AS-AP HUAWEI CLOUDS, HK

The BGP IPv6 Instability Report

This report is updated daily. The current report was generated on 29 July 2019 01:22 (UTC+1000)

50 Most active ASes for the past 14 days

RANK	ASN	UPDs	%	Prefixes	UPDs/Prefix	AS NAME
1	23650	328690	16.51%	76	4324.87	CHINANET-JS-AS-AP AS Number for CHINANET jiangsu province backbone, CN
2	6718	135267	6.79%	8	16908.38	NAV NAV Communications, RO
3	26615	122768	6.17%	107	1147.36	Tim Celular S.A., BR
4	9829	89551	4.50%	453	197.68	BSNL-NIB National Internet Backbone, IN
5	38457	89496	4.50%	5	17899.20	HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
6	28573	83535	4.20%	1123	74.39	CLARO S.A., BR
7	28176	81751	4.11%	12	6812.58	Quick Soft tecnologia da Informacao Ltda, BR
8	38082	59790	3.00%	9	6643.33	IIT-TIG-AS-AP True International Gateway Co., Ltd., TH
9	30036	58836	2.96%	927	63.47	MEDIACOM-ENTERPRISE-BUSINESS - Mediacom Communications Corp, US
10	50937	45342	2.28%	2	22671.00	PAGINIEUROPENE-AS, RO
11	5588	33135	1.66%	20	1656.75	GTSCE GTS Central Europe / Antel Germany, CZ
12	203271	28032	1.41%	1	28032.00	BNTPRO, TR
13	12222	27426	1.38%	258	106.30	AKAMAI - Akamai Technologies, Inc., US
14	8376	25785	1.30%	1330	19.39	, JO
15	53692	23054	1.16%	3	7684.67	ISN-4 - Interop Show Network, US
16	32629	20033	1.01%	2	10016.50	CITY-OF-CHARLOTTE-ASN - City of Charlotte, US
17	49762	19577	0.98%	1	19577.00	SMN-AS, FI
18	33047	18887	0.95%	23	821.17	INSTART - Instart Logic, Inc, US
19	56485	18811	0.94%	3	6270.33	THEHOST-AS, UA
20	30361	18242	0.92%	2	9121.00	SWIFTWILL2 - Swiftwill, Inc., US
21	12654	17891	0.90%	37	483.54	RIPE-NCC-RIS-AS Reseaux IP Europeens Network Coordination Centre (RIPE NCC), NL
22	3573	14723	0.74%	143	102.96	ACCENTURE - Accenture LLP, US
23	263885	12959	0.65%	9	1439.89	Central NET, BR
24	9890	12865	0.65%	1	12865.00	ATOSINFOTECH-SG-AP ATOS Information Technology (Singapore) Pte Ltd, SG
25	36351	12684	0.64%	111	114.27	SOFTLAYER - SoftLayer Technologies Inc., US
26	2571	11254	0.57%	7	1607.71	DHLNET - DHL Information Services (Europe) s.r.o, CZ
27	16331	11095	0.56%	1	11095.00	TELE-ENTRE-FI-AS, FI
28	53184	8162	0.41%	19	429.58	INB Telecom EIRELI - ME, BR
29	22394	8086	0.41%	680	11.89	CELLCO - Cellco Partnership DBA Verizon Wireless, US

50 Most active Prefixes for the past 14 days

RANK	PREFIX	UPDs	%	Origin AS -- AS NAME
1	2a06:9087:ffff::/48	28032	1.30%	203271 -- BNTPRO, TR
2	2620:144:a00::/40	23054	1.07%	53692 -- ISN-4 - Interop Show Network, US
3	2a0a:8880::/48	22671	1.05%	50937 -- PAGINIEUROPENE-AS, RO
4	2a0a:8880:1::/48	22671	1.05%	50937 -- PAGINIEUROPENE-AS, RO
5	2a05:1c01::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
6	2a00:ece0::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
7	2a05:1c02::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
8	2a05:1c03::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
9	2a05:1c04::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
10	2a05:1c00::/32	22528	1.04%	6718 -- NAV NAV Communications, RO
12	2620:0:2f0::/48	20025	0.93%	32629 -- CITY-OF-CHARLOTTE-ASN - City of Charlotte, US
15	2001:67c:245c::/48	19577	0.91%	49762 -- SMN-AS, FI
16	2a03:8160:14::/48	18837	0.87%	33047 -- INSTART - Instart Logic, Inc, US
17	2401:4800:2::/48	18639	0.86%	38457 -- HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
18	2401:4800::/48	18624	0.86%	38457 -- HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
19	2401:4800:feed::/48	18597	0.86%	38457 -- HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
20	2a01:9dc0::/32	18241	0.85%	30361 -- SWIFTWILL2 - Swiftwill, Inc., US
21	2401:4800:3021::/48	16821	0.78%	38457 -- HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
22	2401:4800:2011::/48	16815	0.78%	38457 -- HNS-AS-AP Honesty Net Solution (I) Pvt Ltd, IN
23	2804:214:85cb::/48	14333	0.66%	26615 -- Tim Celular S.A., BR
24	2804:214:85ca::/48	14333	0.66%	26615 -- Tim Celular S.A., BR
25	2804:214:85c9::/48	14331	0.66%	26615 -- Tim Celular S.A., BR
26	2804:214:85cc::/48	14330	0.66%	26615 -- Tim Celular S.A., BR
27	2804:214:85c8::/48	14330	0.66%	26615 -- Tim Celular S.A., BR
28	2804:214:85cd::/48	14315	0.66%	26615 -- Tim Celular S.A., BR
29	2804:214:85cf::/48	14312	0.66%	26615 -- Tim Celular S.A., BR
30	2804:214:85ce::/48	14308	0.66%	26615 -- Tim Celular S.A., BR
31	2a00:ad87:4600::/48	12865	0.60%	9890 -- ATOSINFOTECH-SG-AP ATOS Information Technology (Singapore) Pte Ltd, SG
32	2804:14c:8586::/48	12619	0.59%	28573 -- CLARO S.A., BR
33	2604:2e89:8014::/48	11954	0.55%	30036 -- MEDIACOM-ENTERPRISE-BUSINESS - Mediacom Communications Corp, US
34	2804:14c:8584::/48	11767	0.55%	28573 -- CLARO S.A., BR
35	2804:14c:85a4::/48	11738	0.54%	28573 -- CLARO S.A., BR
36	2804:14c:8585::/48	11129	0.52%	28573 -- CLARO S.A., BR



IPv4 Observations

- Routing table continues to grow
 - Linear growth for last 8 years
 - Even though total address space announced has levelled off over the last 3 years
- /24 announcements continue to grow
 - Clearly many operators are deaggregating down to the smallest prefix size considered routable
 - Do operators still filter prefix sizes smaller than /24?
 - (A few /25s through /32s are visible)
- Overall global deaggregation ratio growth has slowed
 - Significant improvements in Latin America



IPv6 Observations

- Routing table growing more quickly in 2019
 - More deployment, or more deaggregation?
- /48 announcements continue to grow
 - Operators seem to believe that IPv6 /48 needs to be treated like IPv4 /24 ☹️
- Noticeable increases:
 - According to RIR allocation boundaries
 - Along nibble boundaries



Internet Routing Table Analysis Update

Questions?