



Internet Routing Table Analysis Update

Philip Smith

SANOG 37

16th July 2021

Virtual Event



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 report started from 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 2nd July 2021

BGP routing table entries examined:	856076
Prefixes after maximum aggregation (per Origin AS):	323386
Deaggregation factor:	2.65
Unique aggregates announced (without unneeded subnets):	410995
Total ASes present in the Internet Routing Table:	71509
Prefixes per ASN:	11.97
Origin-only ASes present in the Internet Routing Table:	61507
Origin ASes announcing only one prefix:	25395
Transit ASes present in the Internet Routing Table:	10002
Transit-only ASes present in the Internet Routing Table:	318
Average AS path length visible in the Internet Routing Table:	4.3
Max AS path length visible:	54
Max AS path prepend of ASN (48366)	51
Prefixes from unregistered ASNs in the Routing Table:	1114
Number of instances of unregistered ASNs:	1120
Special use prefixes present in the Routing Table:	1
Prefixes being announced from unallocated address space:	530
Number of addresses announced to Internet:	3039906176
Equivalent to 181 /8s, 49 /16s and 73 /24s	
Total number of prefixes smaller than registry allocations:	284968

APNIC Region

Prefixes being announced by APNIC Region ASes:	230080
Total APNIC prefixes after maximum aggregation:	65763
APNIC Deaggregation factor:	3.50
Prefixes being announced from the APNIC address blocks:	225866
Unique aggregates announced from the APNIC address blocks:	90368
APNIC Region origin ASes present in the Internet Routing Table:	11695
APNIC Prefixes per ASN:	19.31
APNIC Region origin ASes announcing only one prefix:	3338
APNIC Region transit ASes present in the Internet Routing Table:	1663
Average APNIC Region AS path length visible:	4.5
Max APNIC Region AS path length visible:	32
Number of APNIC region 32-bit ASNs visible in the Routing Table:	6863
Number of APNIC addresses announced to Internet:	773709824
Equivalent to 46 /8s, 29 /16s and 224 /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, 131072-147769
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



What about IPv6 ?

Table Size	125034
Total number of ASNs	26437
Total number of Origin ASNs	26164
Number of /32s	20409
Number of /48s	57231
Number of prefixes >/48	0 ← ISP is Filtering 😊
Number of prefixes >/32 and </48	42776
Number of prefixes >/16 and </32	4610

Global per AS IPv4 prefix count summary

ASN	No of nets	/20 equiv	Max Agg	Description
8151	8535	3443	592	Uninet S.A. de C.V., MX
9808	7570	9000	58	CMNET-GD Guangdong Mobile Communication
12479	6723	1721	140	UNI2-AS, ES
7545	5788	783	678	TPG-INTERNET-AP TPG Telecom Limited, AU
16509	5205	9529	2322	AMAZON-02, US
11492	4791	316	669	CABLEONE, US
4538	4765	4192	74	ERX-CERNET-BKB China Education and Rese
7155	4027	264	32	VIASAT-SP-BACKBONE, US
22773	3961	3013	262	ASN-CXA-ALL-CCI-22773-RDC, US
20940	3662	3347	206	AKAMAI-ASN1, NL
7552	3545	1330	20	VIETEL-AS-AP Viettel Group, VN
7713	3528	1023	56	TELKOMNET-AS-AP PT Telekomunikasi Indon
16625	3505	1811	2442	AKAMAI-AS, US
10620	3406	525	650	Telmex Colombia S.A., CO
6327	3360	1317	69	SHAW, CA
39891	3267	187	22	ALJAWWALSTC-AS, SA
8551	2997	378	40	BEZEQ-INTERNATIONAL-AS Bezeqint Interne
12389	2907	2281	894	ROSTELECOM-AS, RU
45899	2800	1897	55	VNPT-AS-VN VNPT Corp, VN
30036	2579	372	134	MEDIACOM-ENTERPRISE-BUSINESS, US

AfriNIC APNIC ARIN LACNIC RIPE NCC

Global per AS IPv6 prefix count summary

ASN	No of Nets	Description
11172	3087	Alestra, S. de R.L. de C.V., MX
17622	2415	CNCGROUP-GZ China Unicom Guangzhou network, CN
45609	2140	BHARTI-MOBILITY-AS-AP Bharti Airtel Ltd. AS for GPRS Service
7552	2000	VIETEL-AS-AP Viettel Group, VN
12479	1567	UNI2-AS, ES
16509	1557	AMAZON-02, US
24547	1516	CMNET-V4HEBEI-AS-AP Hebei Mobile Communication Company Limit
17623	1499	CNCGROUP-SZ China Unicom Shenzen network, CN
45271	1402	ICLNET-AS-AP Idea Cellular Limited, IN
9808	1354	CMNET-GD Guangdong Mobile Communication Co.Ltd., CN
22773	1267	ASN-CXA-ALL-CCI-22773-RDC, US
28573	1210	CLARO S.A., BR
56046	1061	CMNET-JIANGSU-AP China Mobile communications corporation, CN
36183	962	AKAMAI-AS, US
18403	878	FPT-AS-AP The Corporation for Financing & Promoting Technolo
32098	873	TRANSTELCO-INC, US
38266	841	VODAFONE-IN Vodafone India Ltd., IN
4808	825	CHINA169-BJ China Unicom Beijing Province Network, CN
13335	819	CLOUDFLARENET, US
39891	796	ALJAWWALSTC-AS, SA

AfriNIC APNIC ARIN LACNIC RIPE NCC



Unassigned resources

- Use of unassigned address space is rampant
 - Currently 530 unassigned prefixes in IPv4 routing table
- Use of unassigned ASNs is also a big problem
 - Currently 418 unassigned ASNs in use
- Many are transited by well known / reputable operators
 - Why??

List of Unregistered Origin ASNs

The complete list in use:

940, 1013, 1631, 1636, 3577, 4879, 6292, 6485, 6505, 6565, 7837, 10425, 10926, 10931, 10981, 11011, 11044, 11207, 11223, 11247, 11316, 11490, 11610, 11636, 11825, 11842, 11945, 11969, 11974, 12071, 12077, 12176, 12232, 12240, 13224, 13317, 13339, 13492, 13583, 14076, 14350, 14428, 14439, 14461, 14552, 14594, 14651, 14880, 14889, 15037, 15115, 15132, 15181, 15182, 15200, 15220, 15329, 15804, 16615, 16636, 16666, 16769, 16804, 16808, 17811, 18493, 18548, 18604, 18691, 18781, 18796, 18805, 18821, 18976, 19081, 19140, 19142, 19176, 19330, 19359, 19521, 19533, 19658, 19700, 19708, 19926, 20089, 20118, 20190, 20200, 20421, 20438, 20443, 21584, 21665, 21666, 21695, 21714, 21861, 21986, 22063, 22160, 22271, 22272, 22484, 22538, 22539, 22649, 22694, 22733, 22736, 22743, 22774, 22830, 23061, 23194, 23448, 23474, 25568, 25600, 25800, 25831, 25879, 25890, 25978, 26015, 26016, 26018, 26051, 26140, 26195, 26286, 26295, 26520, 26643, 26663, 26682, 26757, 26768, 26799, 26861, 26922, 26986, 27174, 27289, 27335, 27384, 27386, 27426, 27470, 28141, 28348, 29763, 29769, 29829, 29855, 30004, 30006, 30037, 30104, 30155, 30265, 30307, 30550, 30631, 30654, 30656, 30699, 30982, 31781, 31813, 32021, 32121, 32151, 32187, 32202, 32203, 32282, 32346, 32358, 32497, 32581, 32591, 32596, 32669, 32679, 32772, 32842, 33020, 33023, 33042, 33051, 33158, 33232, 33245, 33299, 33394, 33417, 33448, 33484, 33617, 33625, 33628, 33679, 33732, 33780, 35846, 35948, 36002, 36051, 36215, 36357, 36461, 36465, 36843, 36886, 36893, 36900, 36928, 36957, 36979, 37034, 37155, 37161, 37320, 37382, 37434, 37442, 37466, 37475, 37476, 37505, 37512, 37544, 37547, 37591, 38055, 39991, 40186, 40255, 40279, 40399, 40544, 40600, 40745, 40751, 40779, 40909, 40920, 45247, 46080, 46086, 46123, 46161, 46228, 46233, 46318, 46414, 46423, 46453, 46472, 46501, 46614, 46645, 46673, 46766, 46783, 46815, 46876, 46916, 47044, 47069, 52597, 52661, 52697, 53298, 53328, 53358, 53419, 53552, 53614, 53627, 53651, 53657, 53715, 53751, 53771, 53929, 53947, 54041, 54076, 54148, 54193, 54209, 54231, 54262, 54278, 54309, 54338, 54517, 54590, 54726, 54730, 54752, 54753, 54776, 54787, 54829, 55827, 55873, 56096, 61837, 61913, 62828, 62865, 63248, 63305, 63387, 63477, 64011, 64042, 64140, 64339, 64500, 64506, 64638, 65022, 65540, 65544, 65549, 65550, 65552, 65595, 65724, 65725, 65999, 66011, 133178, 133425, 133457, 135074, 138432, 139191, 227171, 230105, 261050, 262331, 262488, 263091, 263100, 263107, 263463, 264085, 264480, 264493, 264575, 265039, 265048, 265089, 266209, 266372, 266842, 266988, 267131, 267193, 267874, 268270, 268338, 268652, 269156, 269854, 270386, 299616, 327074, 327734, 327745, 327869, 328007, 328115, 328118, 328139, 328226, 328276, 328330, 328369, 328402, 328439, 393266, 393314, 393320, 393377, 393385, 393446, 393491, 393583, 393588, 393612, 393866, 394011, 394039, 394156, 394376, 394402, 394467, 394519, 394550, 394721, 394879, 394936, 395350, 395438, 395596, 395822, 395898, 396330, 396448

List of Unregistered Origin ASNs

Far too many to list. See <http://thyme.apnic.net/current/data-badAS>:

Bad AS	Designation	Net Originated	Transit AS	Transit AS Name
62828	UNALLOCATED	8.21.130.0/24	3356	LEVEL3, US
393266	UNALLOCATED	8.23.52.0/24	46887	LIGHTOWER, US
18604	UNALLOCATED	8.25.204.0/24	3356	LEVEL3, US
394936	UNALLOCATED	8.33.224.0/24	174	COGENT-174, US
54338	UNALLOCATED	8.33.241.0/24	6461	ZAYO-6461, US
23061	UNALLOCATED	8.39.119.0/24	3356	LEVEL3, US
395438	UNALLOCATED	8.42.206.0/24	3356	LEVEL3, US
40544	UNALLOCATED	12.0.33.0/24	6461	ZAYO-6461, US
15132	UNALLOCATED	12.9.150.0/24	1239	SPRINTLINK, US
3577	UNALLOCATED	12.19.197.0/24	209	CENTURYLINK-US-LEGACY-QWEST,
21861	UNALLOCATED	12.37.59.0/24	7018	ATT-INTERNET4, US
13317	UNALLOCATED	12.44.10.0/24	7018	ATT-INTERNET4, US
63305	UNALLOCATED	12.49.58.0/24	7018	ATT-INTERNET4, US
31781	UNALLOCATED	12.71.107.0/24	7018	ATT-INTERNET4, US
21861	UNALLOCATED	12.106.212.0/24	7018	ATT-INTERNET4, US
26295	UNALLOCATED	12.110.210.0/23	7018	ATT-INTERNET4, US
21986	UNALLOCATED	12.110.215.0/24	7018	ATT-INTERNET4, US
54753	UNALLOCATED	12.111.79.0/24	209	CENTURYLINK-US-LEGACY-QWEST,
11969	UNALLOCATED	12.130.205.0/24	16966	SBCIDC-LSAN03, US
22538	UNALLOCATED	12.131.3.0/24	7018	ATT-INTERNET4, US
26295	UNALLOCATED	12.147.1.0/24	7018	ATT-INTERNET4, US
20118	UNALLOCATED	12.152.234.0/24	7018	ATT-INTERNET4, US
32282	UNALLOCATED	12.162.231.0/24	7018	ATT-INTERNET4, US
32282	UNALLOCATED	12.162.235.0/24	7018	ATT-INTERNET4, US
30656	UNALLOCATED	12.173.235.0/24	174	COGENT-174, US
33158	UNALLOCATED	12.183.21.0/24	7029	WINDSTREAM, US

List of Unregistered Origin ASNs

Far too many to list. See <http://thyme.apnic.net/current/data-badAS>:

Bad AS	Designation	Net Originated	Transit AS	Transit AS Name
36928	UNALLOCATED	41.205.240.0/24	327903	MICG, SL
36928	UNALLOCATED	41.205.241.0/24	327903	MICG, SL
36900	UNALLOCATED	41.220.48.0/20	29614	GHANATEL-AS, GH
36957	UNALLOCATED	41.223.130.0/24	16284	Inq-Digital-Nigeria-AS, NG
36957	UNALLOCATED	41.223.131.0/24	16284	Inq-Digital-Nigeria-AS, NG
36979	UNALLOCATED	41.223.146.0/24	37282	MAINONE, NG
65544	DOCUMENT	45.156.15.0/24	15924	BORUSANTELEKOM-AS, TR
268652	UNALLOCATED	45.165.20.0/22	264493	UNASSIGNED
267874	UNALLOCATED	45.175.152.0/22	52361	ARSAT - Empresa Argentina de
267874	UNALLOCATED	45.175.152.0/24	52361	ARSAT - Empresa Argentina de
267874	UNALLOCATED	45.175.153.0/24	28100	Cooperativa Villa del Rosari
267874	UNALLOCATED	45.175.154.0/24	52361	ARSAT - Empresa Argentina de
267874	UNALLOCATED	45.175.155.0/24	52361	ARSAT - Empresa Argentina de
269156	UNALLOCATED	45.180.252.0/22	263250	Barbosa & Costa Ltda, BR
269854	UNALLOCATED	45.189.76.0/22	265852	CARLOS PAZ TELEVISION SA, AR
269854	UNALLOCATED	45.189.77.0/24	265852	CARLOS PAZ TELEVISION SA, AR
269854	UNALLOCATED	45.189.78.0/24	265852	CARLOS PAZ TELEVISION SA, AR
269854	UNALLOCATED	45.189.79.0/24	265852	CARLOS PAZ TELEVISION SA, AR
299616	UNALLOCATED	45.190.4.0/23	269616	Malugainfor Comercio de Prod
299616	UNALLOCATED	45.190.4.0/24	269616	Malugainfor Comercio de Prod
299616	UNALLOCATED	45.190.5.0/24	269616	Malugainfor Comercio de Prod
328115	UNALLOCATED	45.220.50.0/23	36974	AFNET-AS, CI
328118	UNALLOCATED	45.221.8.0/22	20294	MTN-, UG
266988	UNALLOCATED	45.225.236.0/22	263569	DIRECT WIFI TELECOM LTDA. ME
266988	UNALLOCATED	45.225.239.0/24	263569	DIRECT WIFI TELECOM LTDA. ME
267131	UNALLOCATED	45.229.176.0/22	52630	MOTTANET TI - SERVICOS DE TE

List of Unassigned addresses

Far too many to list. See <http://thyme.apnic.net/current/data-add-IANA>:

Unassigned Network	ASN Information	AS Name
23.141.0.0/24	Origin: 395350	UNASSIGNED
	Transit: 11426	TWC-11426-CAROLINAS, US
23.142.80.0/24	Origin: 209319	IPV6ROUTING, US
	Transit: 46573	LAYER-HOST, US
23.162.32.0/24	Origin: 32444	SAFELINK-MV, US
	Transit: 6939	HURRICANE, US
27.100.7.0/24	Origin: 56096	UNASSIGNED
	Transit: 45455	TH-2S1N-AP Two S One N Co Ltd, Internet
27.126.156.0/22	Origin: 55827	UNASSIGNED
	Transit: 9930	TTNET-MY TIME dotCom Berhad No. 14, Jala
27.126.156.0/23	Origin: 55827	UNASSIGNED
	Transit: 9930	TTNET-MY TIME dotCom Berhad No. 14, Jala
41.57.124.0/24	Origin: 37442	UNASSIGNED
	Transit: 37204	TELONE, ZW
41.57.125.0/24	Origin: 37442	UNASSIGNED
	Transit: 37204	TELONE, ZW
<snip>		
41.77.208.0/22	Origin: 37475	UNASSIGNED
	Transit: 15964	CAMNET-AS, CM
41.77.240.0/21	Origin: 22769	DDOSING-BGP-NETWORK, US
	Transit: 3257	GTT-BACKBONE GTT, US
41.77.245.0/24	Origin: 22769	DDOSING-BGP-NETWORK, US
	Transit: 3257	GTT-BACKBONE GTT, US
41.78.40.0/22	Origin: 37161	UNASSIGNED
	Transit: 37350	IS-GHANA, GH
41.78.60.0/22	Origin: 6762	SEABONE-NET TELECOM ITALIA SPARKLE S.p.A
	Transit: 2516	KDDI KDDI CORPORATION, JP

List of Unassigned addresses

Far too many to list. See <http://thyme.apnic.net/current/data-add-IANA>:

Unassigned Network	ASN Information	AS Name
41.92.184.0/22	Origin: 36955	Matrix-ASN1, CM
	Transit: 15964	CAMNET-AS, CM
41.92.208.0/24	Origin: 36955	Matrix-ASN1, CM
	Transit: 15964	CAMNET-AS, CM
41.92.224.0/24	Origin: 15964	CAMNET-AS, CM
	Transit: 12956	TELEFONICA TELXIUS, ES
41.93.128.0/17	Origin: 22769	DDOSING-BGP-NETWORK, US
	Transit: 3257	GTT-BACKBONE GTT, US
<snip>		
196.55.33.0/24	Origin: 397336	VIRTUALSPROUT-01, US
	Transit: 3356	LEVEL3, US
196.55.36.0/23	Origin: 395046	SEXING-TECHNOLOGIES, US
	Transit: 19108	SUDDENLINK-COMMUNICATIONS, US
196.55.38.0/23	Origin: 395046	SEXING-TECHNOLOGIES, US
	Transit: 13876	FIBER-64, US
196.55.176.0/20	Origin: 7029	WINDSTREAM, US
	Transit: 3257	GTT-BACKBONE GTT, US
196.63.128.0/18	Origin: 139646	HKMTC-AS-AP HONG KONG Megalayer Technolo
	Transit: 3491	BTN-ASN, US
196.63.243.0/24	Origin: 54600	PEGTECHINC, US
	Transit: 174	COGENT-174, US
196.194.195.0/24	Origin: 136384	OPTIX-AS-AP Optix Pakistan Pvt. Limited,
	Transit: 9260	MULTINET-AS-AP Multinet Pakistan Pvt. Lt
196.194.196.0/24	Origin: 136384	OPTIX-AS-AP Optix Pakistan Pvt. Limited,
	Transit: 9260	MULTINET-AS-AP Multinet Pakistan Pvt. Lt
196.194.197.0/24	Origin: 136384	OPTIX-AS-AP Optix Pakistan Pvt. Limited,
	Transit: 9260	MULTINET-AS-AP Multinet Pakistan Pvt. Lt

List of Unassigned addresses

Far too many to list. See <http://thyme.apnic.net/current/data-add-IANA>:

Unassigned Network	ASN Information	AS Name
199.248.239.0/24	Origin: 6565	UNASSIGNED
	Transit: 6939	HURRICANE, US
199.250.61.0/24	Origin: 32421	BLCC, US
	Transit: 3356	LEVEL3, US
202.45.148.0/24	Origin: 45247	NOBEL-HK-AS-AP Nobel Ltd., HK
	Transit: 3549	LVLT-3549, US
202.74.47.0/24	Origin: 55873	UNASSIGNED
	Transit: 131996	NGNSB-AS-AP NEVIGATE GLOBAL NETWORK SDN.
202.94.1.0/24	Origin: 4808	CHINA169-BJ China Unicom Beijing Provinc
	Transit: 4837	CHINA169-BACKBONE CHINA UNICOM China169
203.160.138.0/24	Origin: 4755	TATACOMM-AS TATA Communications formerly
	Transit: 6453	AS6453, US
203.160.139.0/24	Origin: 4755	TATACOMM-AS TATA Communications formerly
	Transit: 6453	AS6453, US
<snip>		
206.251.62.0/24	Origin: 32021	UNASSIGNED
	Transit: 328303	INETCOM-AS, GH
206.251.63.0/24	Origin: 328303	INETCOM-AS, GH
	Transit: 3491	BTN-ASN, US
207.2.120.0/21	Origin: 18885	M2NGAGE2, US
	Transit: 6939	HURRICANE, US
207.167.64.0/18	Origin: 7837	UNASSIGNED
	Transit: 22489	ZCOLO-SAN01, US
207.254.136.0/21	Origin: 30689	FLOW-NET, JM
	Transit: 23520	COLUMBUS-NETWORKS, US
208.69.72.0/24	Origin: 209	CENTURYLINK-US-LEGACY-QWEST, US
	Transit: 3356	LEVEL3, US

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0	/7:0	/8:9
/9:11	/10:38	/11:100	/12:287	/13:578	/14:1168	/15:1913	/16:13366
/17:8217	/18:13958	/19:25874	/20:40790	/21:48516	/22:101207	/23:83731	/24:473610
/25:1272	/26:0	/27:0	/28:0	/29:0	/30:0	/31:0	/32:0

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/1:0	/2:0	/3:0	/4:0	/5:0	/6:0	/7:0	/8:17
/9:14	/10:41	/11:102	/12:305	/13:589	/14:1193	/15:1994	/16:13473
/17:8333	/18:13972	/19:25443	/20:42348	/21:50325	/22:106876	/23:91525	/24:498123
/25:1403	/26:0	/27:0	/28:0	/29:0	/30:0	/31:0	/32:0



More /8s ?

- 2nd July 2020

4.0.0.0/8	3356
12.0.0.0/8	7018
17.0.0.0/8	714
32.0.0.0/8	2686
38.0.0.0/8	174
53.0.0.0/8	31399
55.0.0.0/8	721
73.0.0.0/8	7922
214.0.0.0/8	721

32/8 withdrawn by AT&T

AS8003 (Global Resource Systems *aka* US DoD) added 9 /8s

- 2nd July 2021:

4.0.0.0/8	3356
7.0.0.0/8	8003
11.0.0.0/8	8003
12.0.0.0/8	7018
17.0.0.0/8	714
21.0.0.0/8	8003
22.0.0.0/8	8003
26.0.0.0/8	8003
28.0.0.0/8	8003
29.0.0.0/8	8003
30.0.0.0/8	8003
33.0.0.0/8	8003
38.0.0.0/8	174
53.0.0.0/8	31399
55.0.0.0/8	721
73.0.0.0/8	7922
214.0.0.0/8	721

Number of IPv6 prefixes announced by prefix length

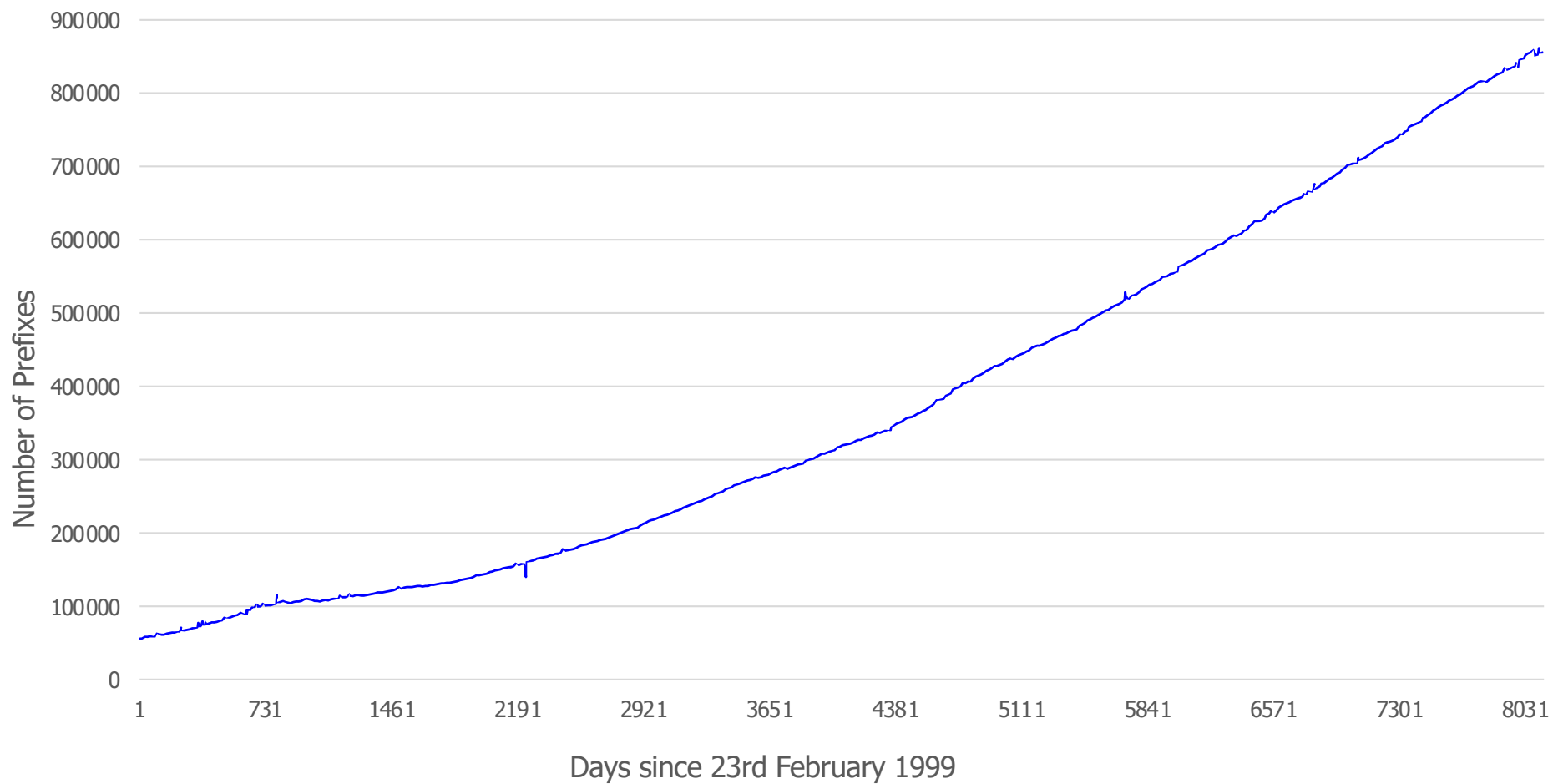
/16:1	/17:0	/18:0	/19:2	/20:5	/21:3	/22:5	/23:4
/24:6	/25:3	/26:8	/27:7	/28:18	/29:11	/30:11	/31:7
/32:3310	/33:64	/34:39	/35:88	/36:137	/37:6	/38:28	/39:5
/40:204	/41:9	/42:29	/43:12	/44:70	/45:9	/46:47	/47:33
/48:2164	/49 → /128: FILTERED by ISP						

2nd July 2011 ↑

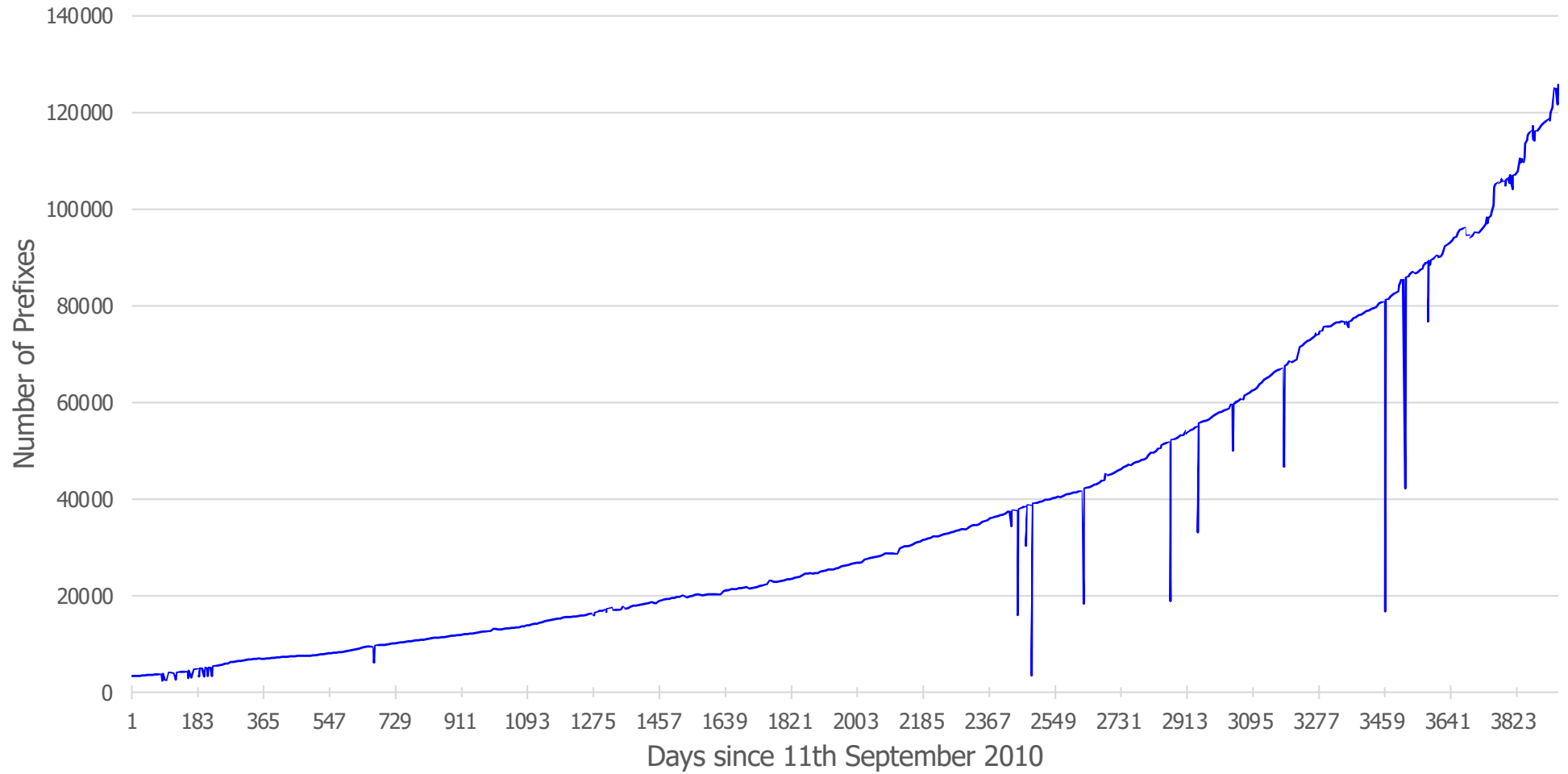
2nd July 2021 ↓

/16:0	/17:0	/18:0	/19:1	/20:14	/21:3	/22:7	/23:7
/24:28	/25:8	/26:15	/27:20	/28:117	/29:3671	/30:521	/31:198
/32:20409	/33:2146	/34:1858	/35:781	/36:4488	/37:815	/38:1417	/39:816
/40:9141	/41:689	/42:2722	/43:617	/44:11460	/45:1039	/46:2514	/47:2273
/48:57231	/49 → /128: FILTERED by ISP						

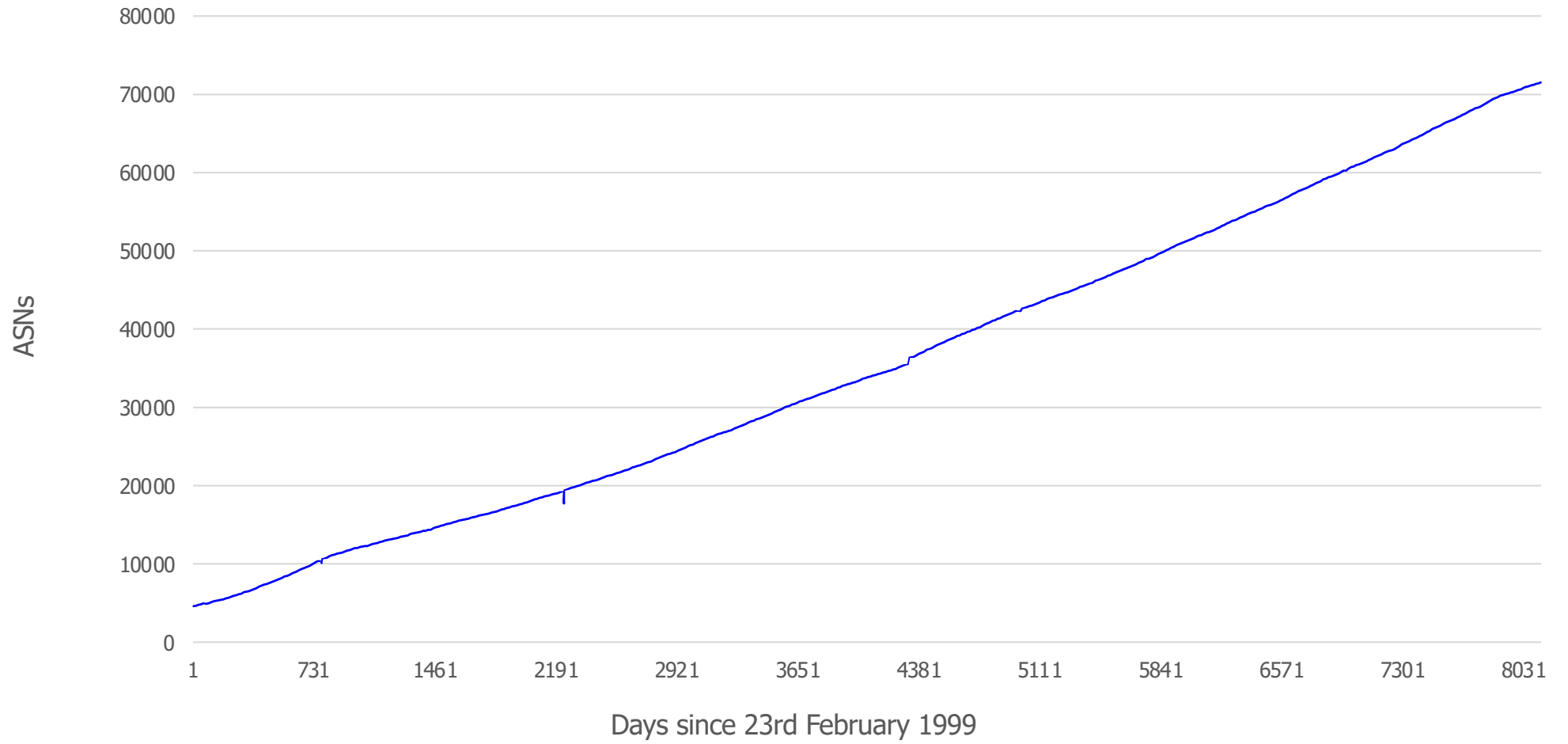
Global IPv4 Routing Table



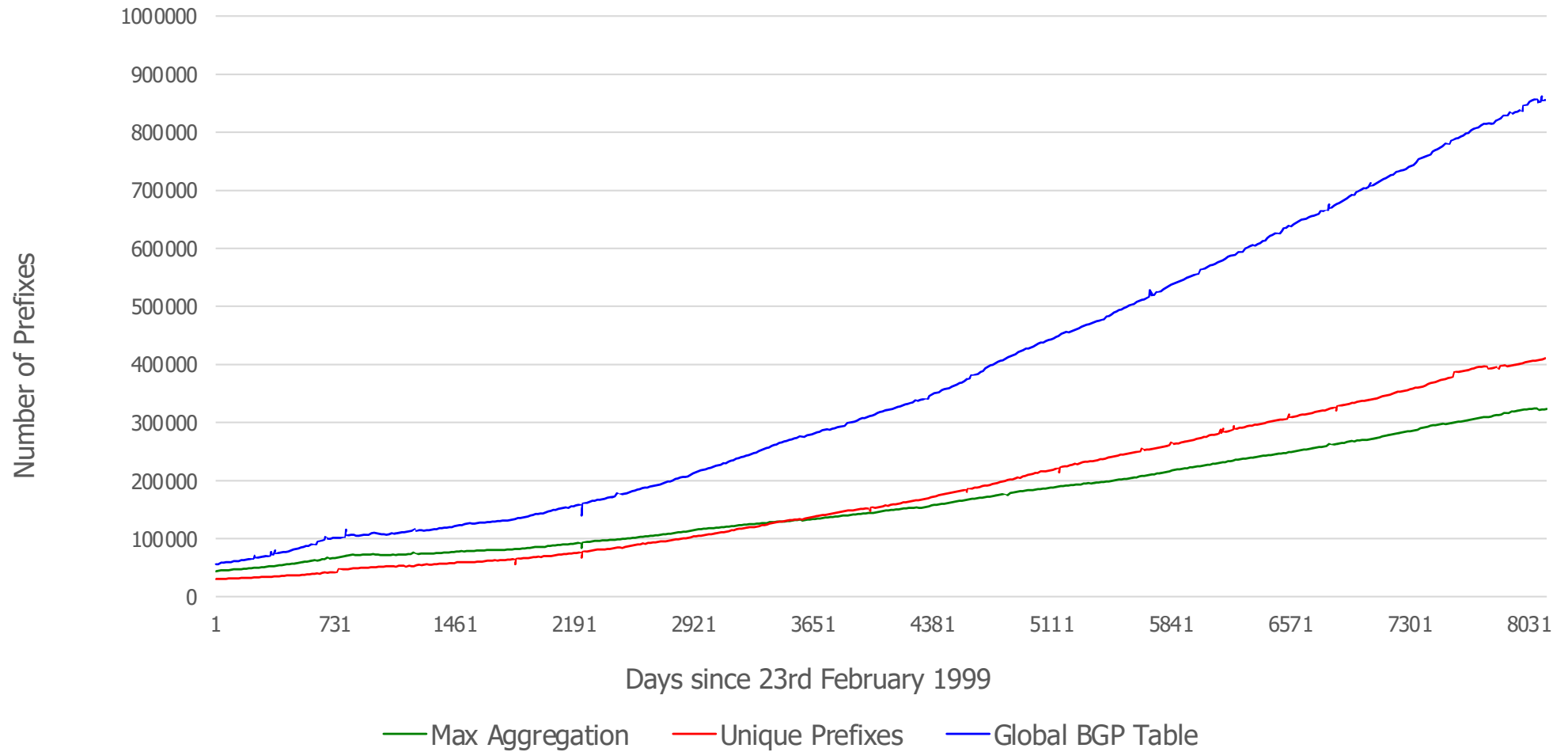
Global IPv6 Routing Table



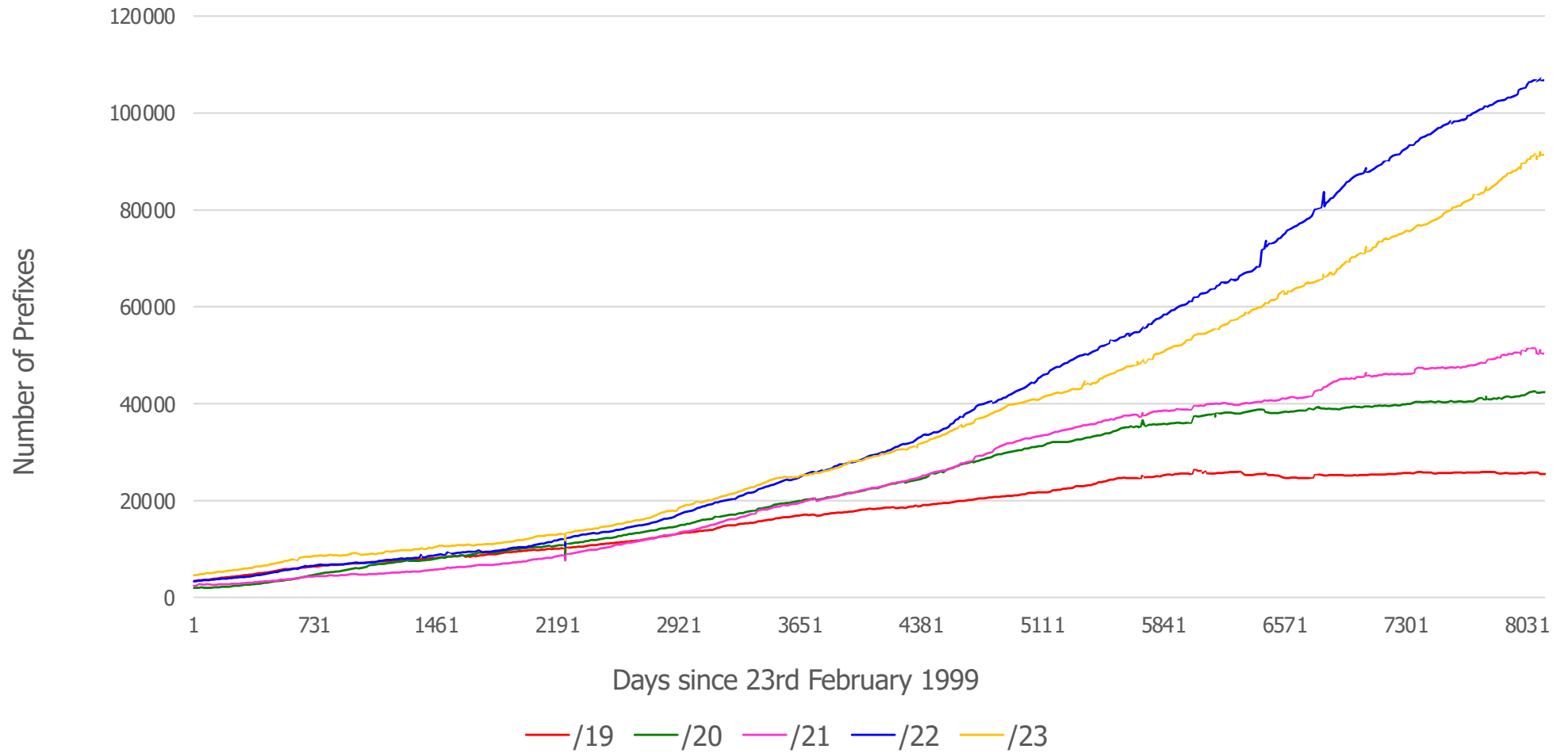
AS Growth



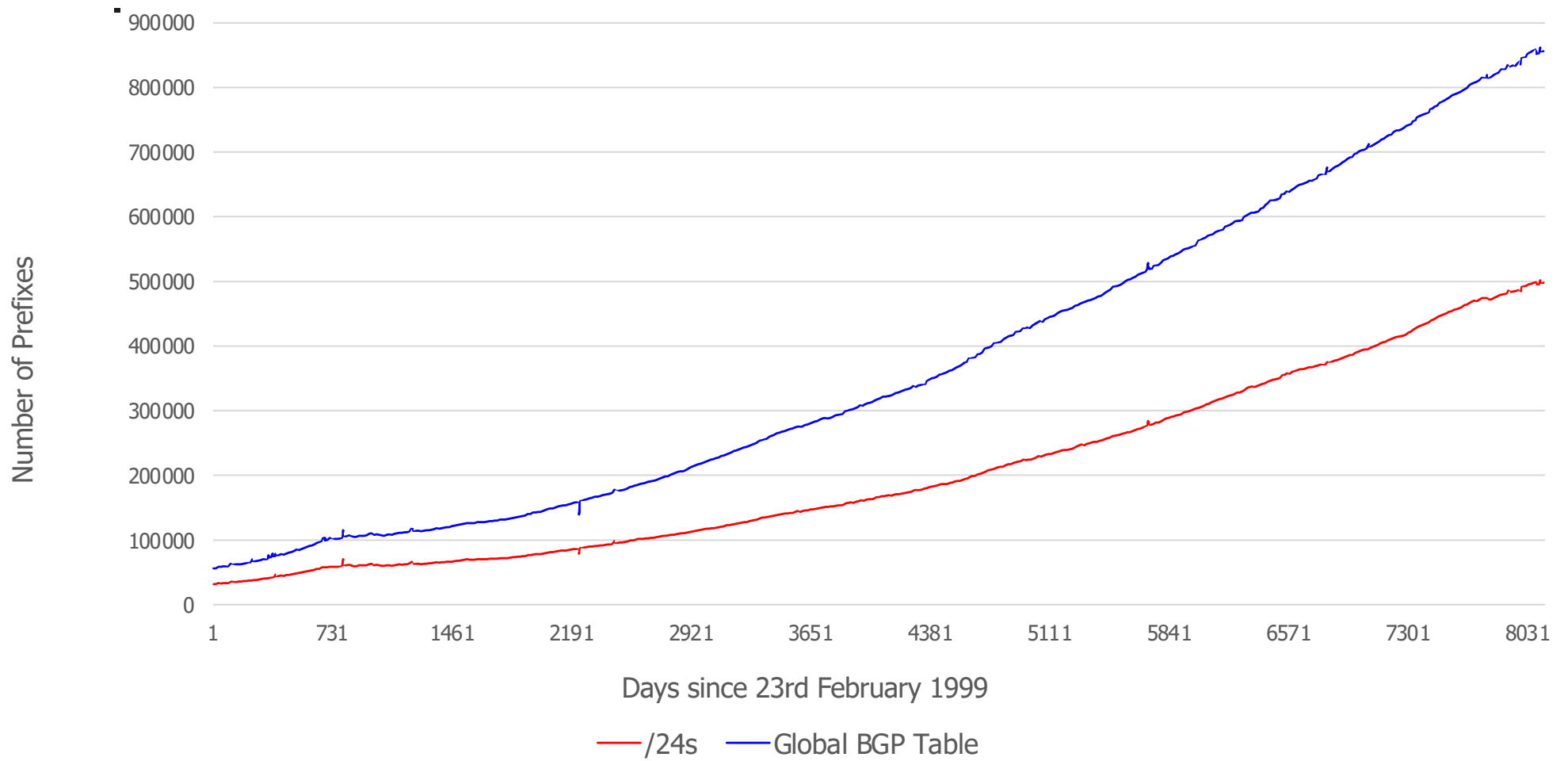
Max Aggregation vs Unique Prefixes



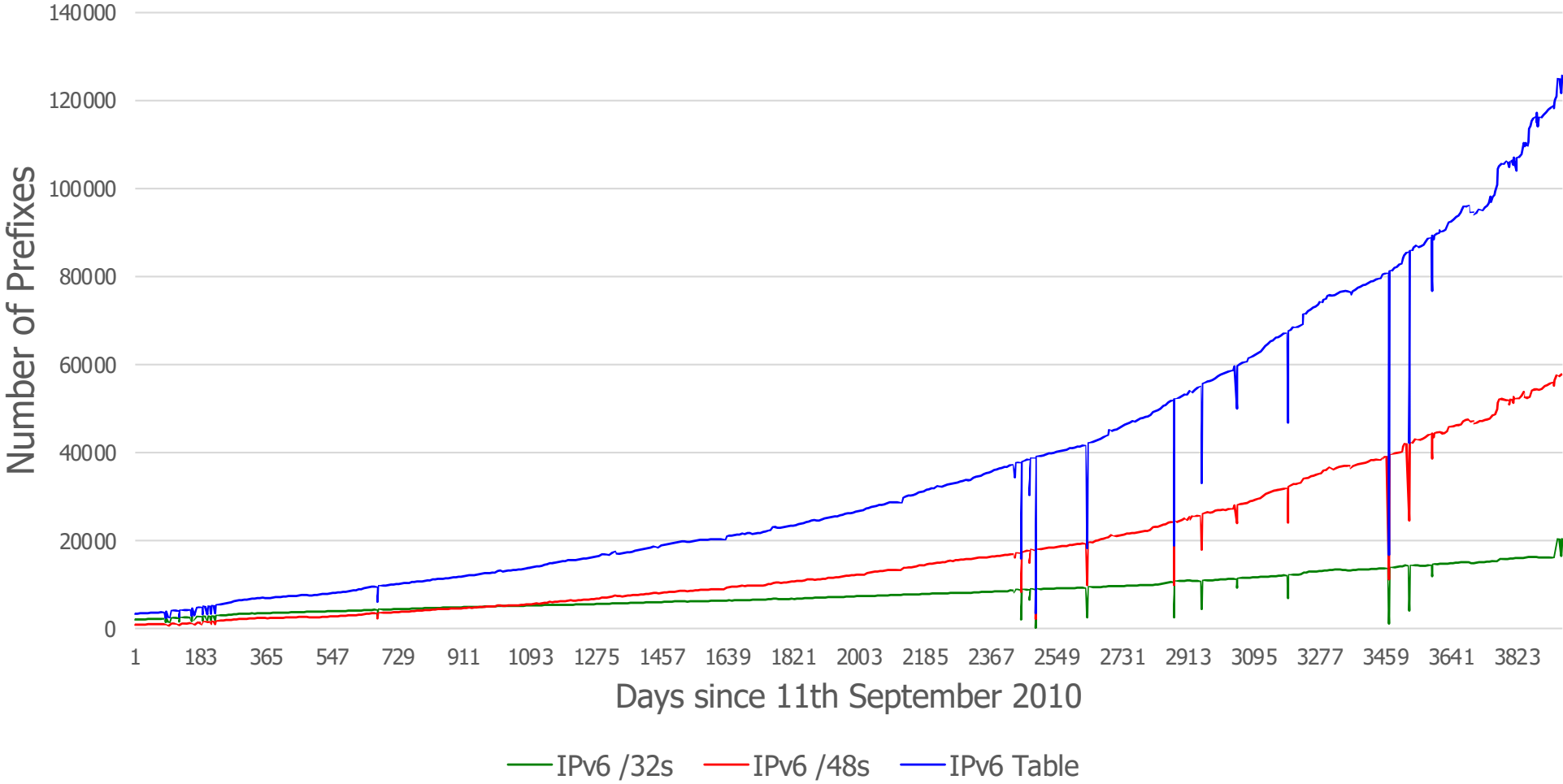
Prefix sizes announced



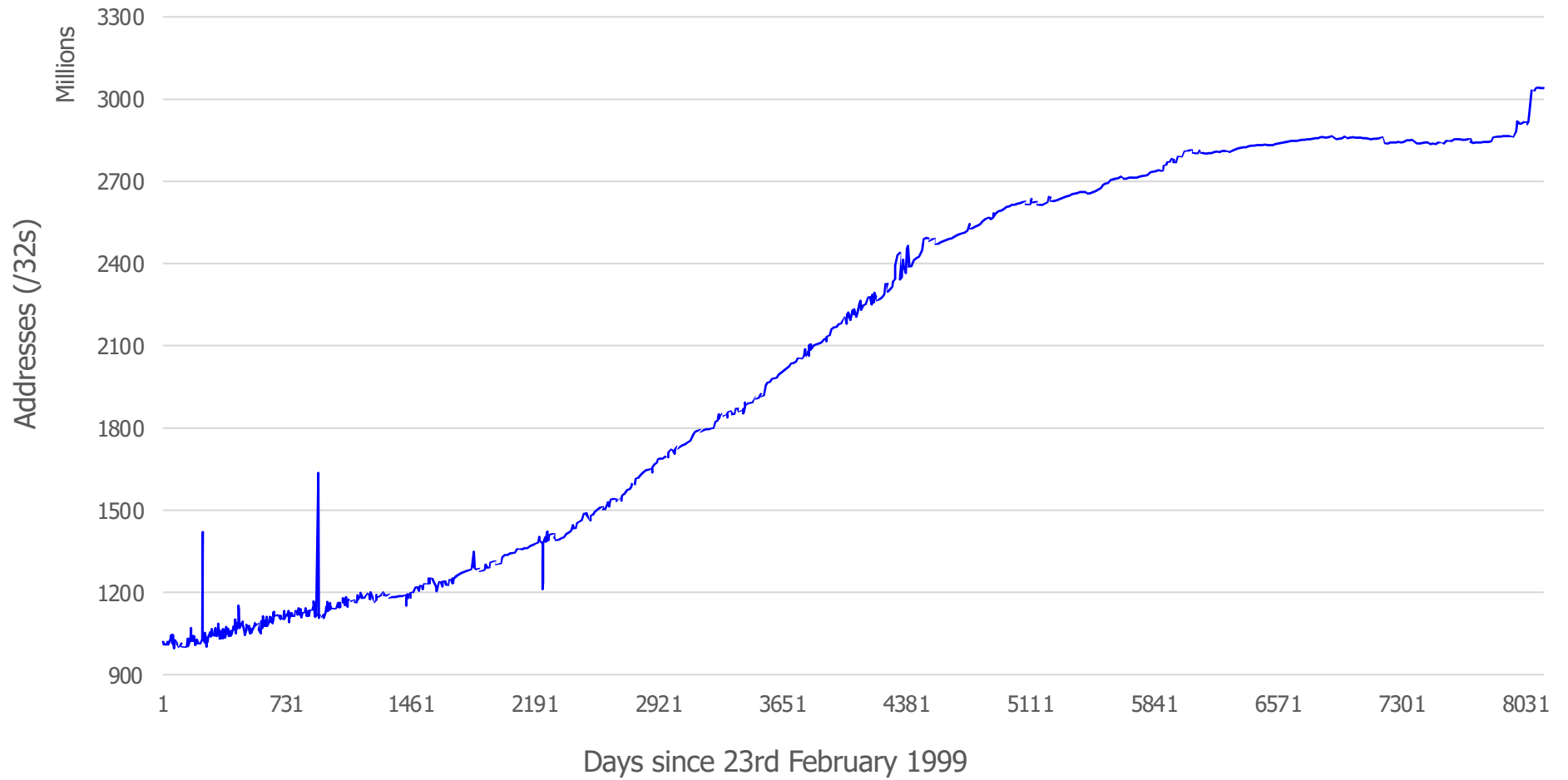
/24s announced



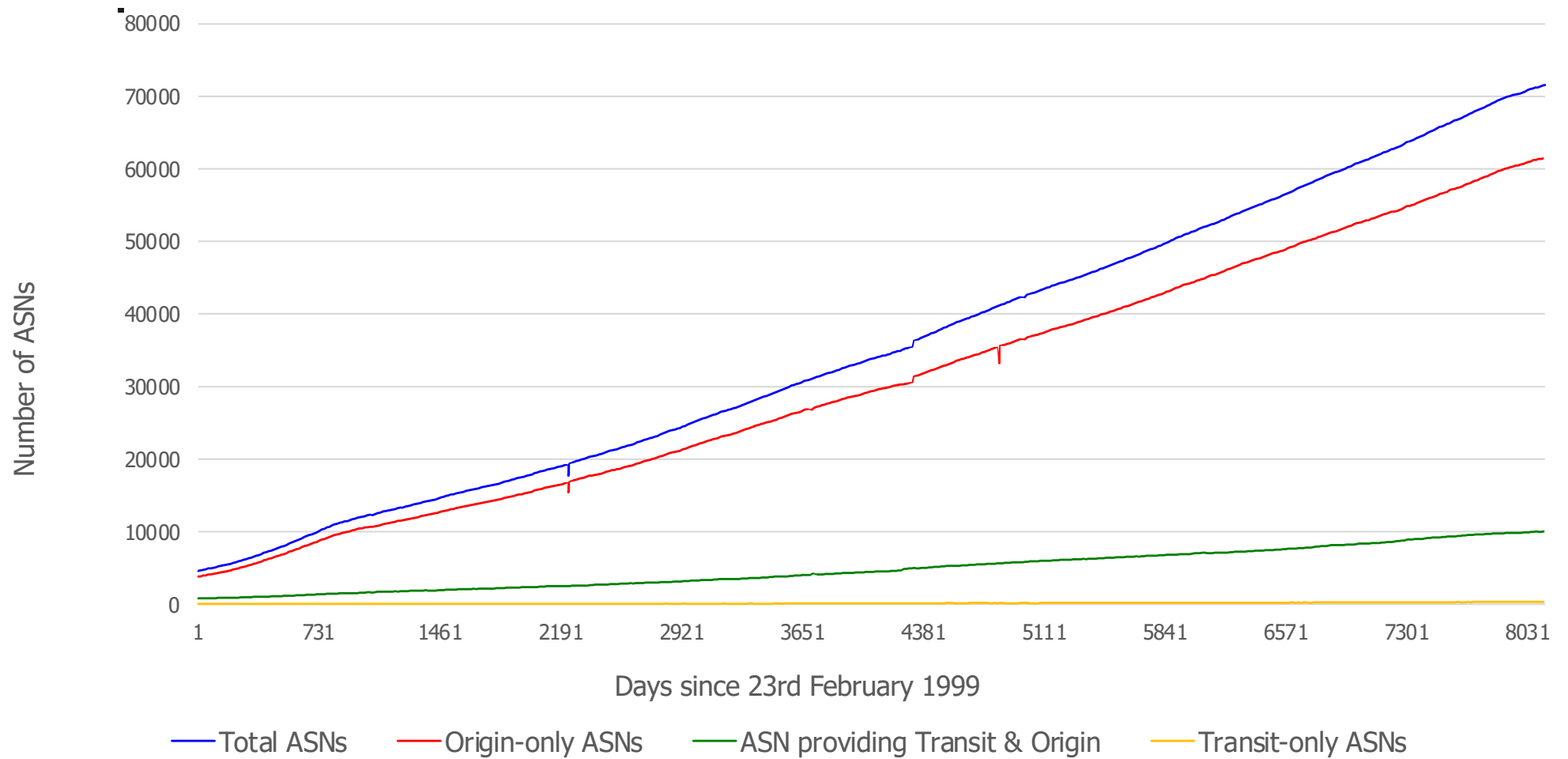
IPv6 /32s vs /48s



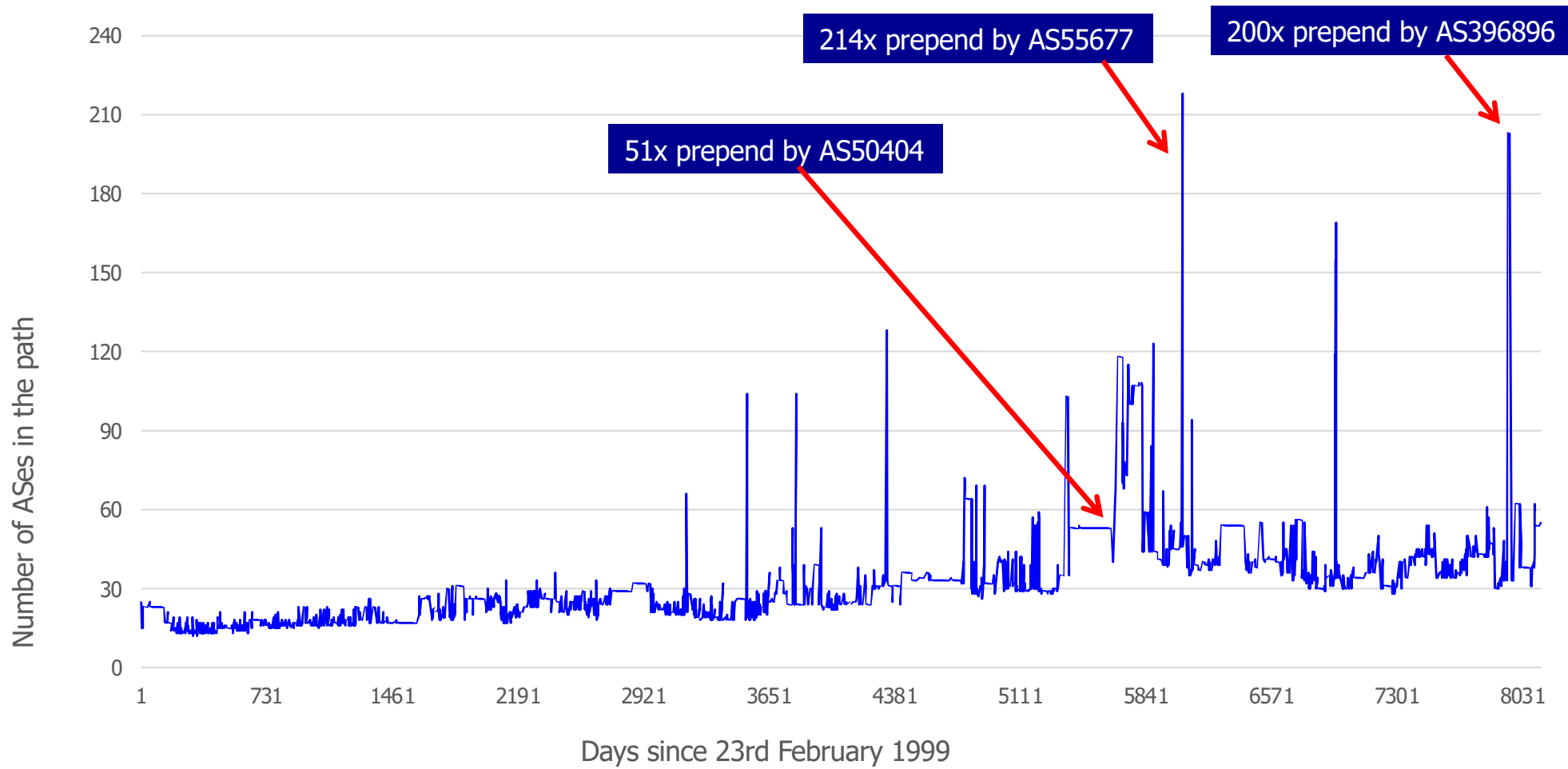
IPv4 Address Space announced



AS Announcements



Maximum AS Path Length





Looking at Deaggregation

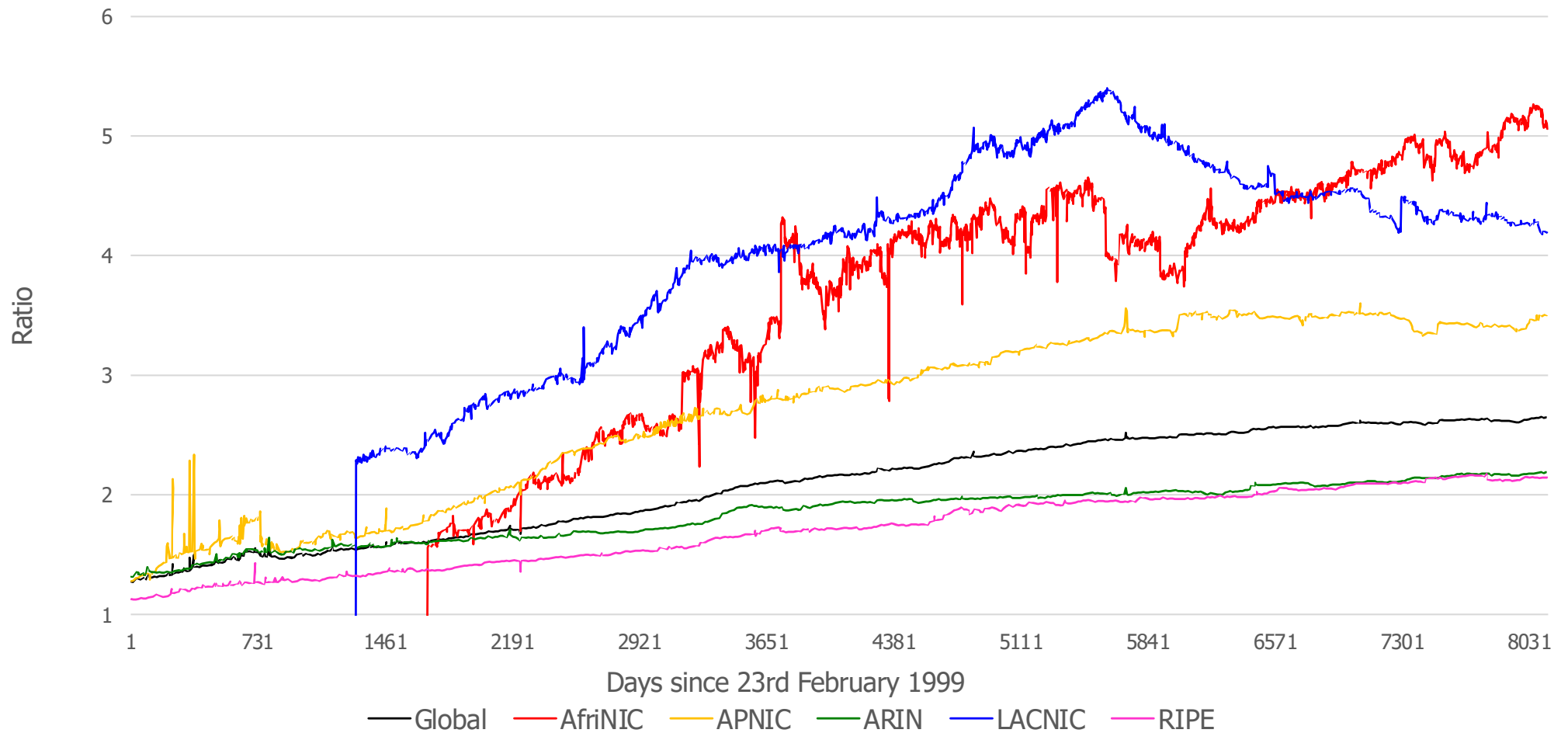
- Routing Report
 - One summary takes BGP table and aggregates prefixes by origin AS
 - Called “Max Aggregation” in report
 - Global and per RIR basis
 - <http://thyme.apnic.net/current/>
- Calculates **Deaggregation** Factor:
 - Measure of Routing Table size/Aggregated Size
 - Global value has been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



July 2021

- **Total Prefixes**
- Global BGP Table
 - 856k prefixes
- North America
 - 250k prefixes
- Europe & Middle East
 - 238k prefixes
- Asia & Pacific
 - 230k prefixes
- Latin America & Caribbean
 - 111k prefixes
- Africa
 - 26k prefixes
- **Deaggregation Factor**
- Global Average
 - 2.65
- North America
 - 2.19
- Europe & Middle East
 - 2.14
- Asia & Pacific
 - 3.49
- Latin America & Caribbean
 - 4.18
- Africa
 - 5.07

Deaggregation: RIR Regions vs Global



Asia Pacific Aggregation Savings Summary

ASN	No of Nets	Savings	Description
9808	7571	7513	CMNET-GD Guangdong Mobile Communication Co.Ltd.
7545	5730	5051	TPG-INTERNET-AP TPG Telecom Limited, AU
4538	4766	4692	ERX-CERNET-BKB China Education and Research Net
7552	3560	3540	VIETEL-AS-AP Viettel Group, VN
7713	3529	3473	TELKOMNET-AS-AP PT Telekomunikasi Indonesia, ID
45899	2800	2745	VNPT-AS-VN VNPT Corp, VN
9498	2356	2111	BBIL-AP BHARTI Airtel Ltd., IN
45090	2114	2043	CNNIC-TENCENT-NET-AP Shenzhen Tencent Computer
4755	2113	1923	TATACOMM-AS TATA Communications formerly VSNL i
23969	1932	1916	TOT-NET TOT Public Company Limited, TH
4766	2429	1862	KIXS-AS-KR Korea Telecom, KR
9829	1878	1835	BSNL-NIB National Internet Backbone, IN
18403	1815	1773	FPT-AS-AP The Corporation for Financing & Promo
9394	1792	1771	CTTNET China TieTong Telecommunications Corpora
24560	1953	1614	AIRTELBROADBAND-AS-AP Bharti Airtel Ltd., Telem
56041	1486	1401	CMNET-ZHEJIANG-AP China Mobile communications c
56047	1364	1334	CMNET-HUNAN-AP China Mobile communications corp
45609	1644	1316	BHARTI-MOBILITY-AS-AP Bharti Airtel Ltd. AS for
56046	1295	1208	CMNET-JIANGSU-AP China Mobile communications co
9583	1738	1204	SIFY-AS-IN Sify Limited, IN

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

India Aggregation Savings Summary

ASN	No of Nets	Savings	Description
9498	2356	2111	BBIL-AP BHARTI Airtel Ltd., IN
4755	2113	1923	TATACOMM-AS TATA Communications formerly VSNL i
9829	1878	1835	BSNL-NIB National Internet Backbone, IN
24560	1945	1606	AIRTELBROADBAND-AS-AP Bharti Airtel Ltd., Telem
45609	1640	1312	BHARTI-MOBILITY-AS-AP Bharti Airtel Ltd. AS for
9583	1738	1204	SIFY-AS-IN Sify Limited, IN
17488	1221	1075	HATHWAY-NET-AP Hathway IP Over Cable Internet,
55410	847	815	VIL-AS-AP Vodafone Idea Ltd, IN
45820	878	788	TTSL-MEISISIP Tata Teleservices ISP AS, IN
18101	861	776	RELIANCE-COMMUNICATIONS-IN Reliance Communicati

Pakistan Aggregation Savings Summary

ASN	No of Nets	Savings	Description
17557	717	690	PKTELECOM-AS-PK Pakistan Telecommunication Comp
132165	599	550	CONNECT-AS-AP Connect Communications, PK
9541	568	458	CYBERNET-AP Cyber Internet Services Pvt Ltd., P
38264	316	312	WATEEN-IMS-PK-AS-AP National WiMAXIMS environme
23674	321	298	NAYATEL-PK Nayatel Pvt Ltd, PK
58895	241	183	EBONE1-PK Ebone Network PVT. Limited, PK
55714	250	173	APNIC-FIBERLINK-PK Fiberlink Pvt.Ltd, PK
23966	164	151	LDN-AS-PK LINKdotNET Telecom Limited, PK
38710	189	144	WORLDCALL-AS-LHR Worldcall Broadband Limited, P
139879	144	137	GALAXY-AS-AP Galaxy Broadband, PK

Bangladesh Aggregation Savings Summary

ASN	No of Nets	Savings	Description
23956	173	168	AMBERIT-BD-AS AmberIT Limited, BD
24342	126	121	BRAC-BDMAIL-AS-BD BRACNet Limited, BD
23688	96	90	LINK3-TECH-AS-BD-AP Link3 Technologies Ltd., BD
23923	94	88	AGNI-AS Agni Systems Limited, BD
7565	86	84	BDCOM-BD Rang Nilu Square, 5th Floor, House 75
17469	89	81	ACCESSTEL-AS-AP Access Telecom BD Ltd., BD
24323	87	72	AAMRA-NETWORKS-AS-AP aamra networks limited, BD
38031	69	64	OPTIMAX-BD-AS-AP OptiMax Communication Ltd., BD
24389	76	62	GRAMEENPHONE-AS-AP GrameenPhone Ltd., BD
17471	64	59	CYBERNET-BD-AS Grameen Cybernet Ltd. Bangladesh

Sri Lanka Aggregation Savings Summary

ASN	No of Nets	Savings	Description
9329	122	107	SLTINT-AS-AP Sri Lanka Telecom Internet, LK
5087	82	77	LANKA-COM Lanka Communication Services, LK
45224	60	57	BELLNET-AS-AP Lanka Bell Limited, LK
18001	68	55	DIALOG-AS Dialog Axiata PLC., LK
132045	52	47	AIRTEL-AS-ISP Bharti Airtel Lanka Pvt. Limited,

Nepal Aggregation Savings Summary

ASN	No of Nets	Savings	Description
23752	99	89	NPTELECOM-NP-AS Nepal Telecommunications Corpor
17501	89	79	WLINK-NEPAL-AS-AP WorldLink Communications Pvt
4007	84	72	SUBISU-CABLENET-AS-AP Subisu Cablenet Pvt Ltd,
4613	70	67	MOS-NP Mercantile Office Systems, NP
38565	54	50	NCELL-AS-NP Ncell Pvt. Ltd., NP
24550	55	47	WEBSURFERNP-AS-NP Websurfer Nepal Internet Serv

Maldives Aggregation Savings Summary

ASN	No of Nets	Savings	Description
7642	113	101	DHIRAAGU-MV-AP DHIVEHI RAAJJEYGE GULHUN PLC, MV
55944	45	41	OOREDOO-MV Ooredoo Maldives Plc, MV

Afghanistan Aggregation Savings Summary

ASN	No of Nets	Savings	Description
131284	54	42	ETISALATAFG-AS-AP Etisalat Afghan, AF

Bhutan Aggregation Savings Summary

ASN	No of Nets	Savings	Description
No operator announcing more than 40 prefixes			



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 growth has speeded 2021
 - How to interpret this?
- /48 announcements continue to grow rapidly
 - 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?