

Internet Routing Table Analysis Update



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AfNOG 2011

Dar Es Salaam, Tanzania

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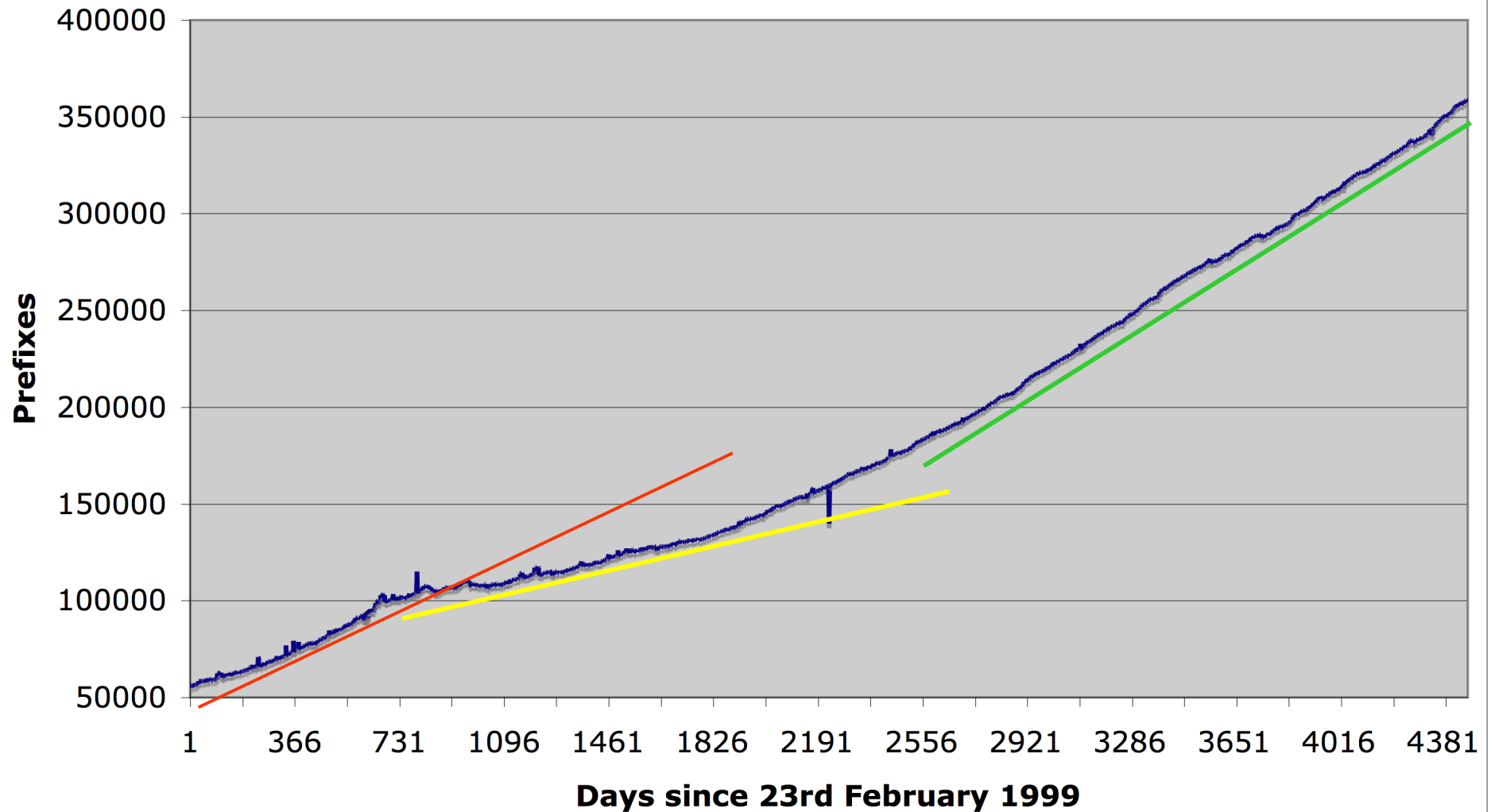
Motivation

- 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

Routing Report 4 June 2011

BGP routing table entries examined:	358561
Prefixes after maximum aggregation:	162439
Deaggregation factor:	2.21
Unique aggregates announced to Internet:	178183
Total ASes present in the Internet Routing Table:	37775
Prefixes per ASN:	9.49
Origin-only ASes present in the Internet Routing Table:	31544
Origin ASes announcing only one prefix:	15151
Transit ASes present in the Internet Routing Table:	5102
Transit-only ASes present in the Internet Routing Table:	134
Average AS path length visible in the Internet Routing Table:	4.3
Max AS path length visible:	36
Max AS path prepend of ASN (48687)	24
Prefixes from unregistered ASNs in the Routing Table:	747
Unregistered ASNs in the Routing Table:	395
Number of 32-bit ASNs allocated by the RIRs:	1425
Number of 32-bit ASNs visible in the Routing Table:	1129
Prefixes from 32-bit ASNs in the Routing Table:	2579
Special use prefixes present in the Routing Table:	0
Prefixes being announced from unallocated address space:	165
Number of addresses announced to Internet:	2450918336
Equivalent to 146 /8s, 22 /16s and 11 /24s	
Percentage of available address space announced:	66.1
Percentage of allocated address space announced:	66.1
Percentage of available address space allocated:	100.0
Percentage of address space in use by end-sites:	91.0
Total number of prefixes smaller than registry allocations:	149599

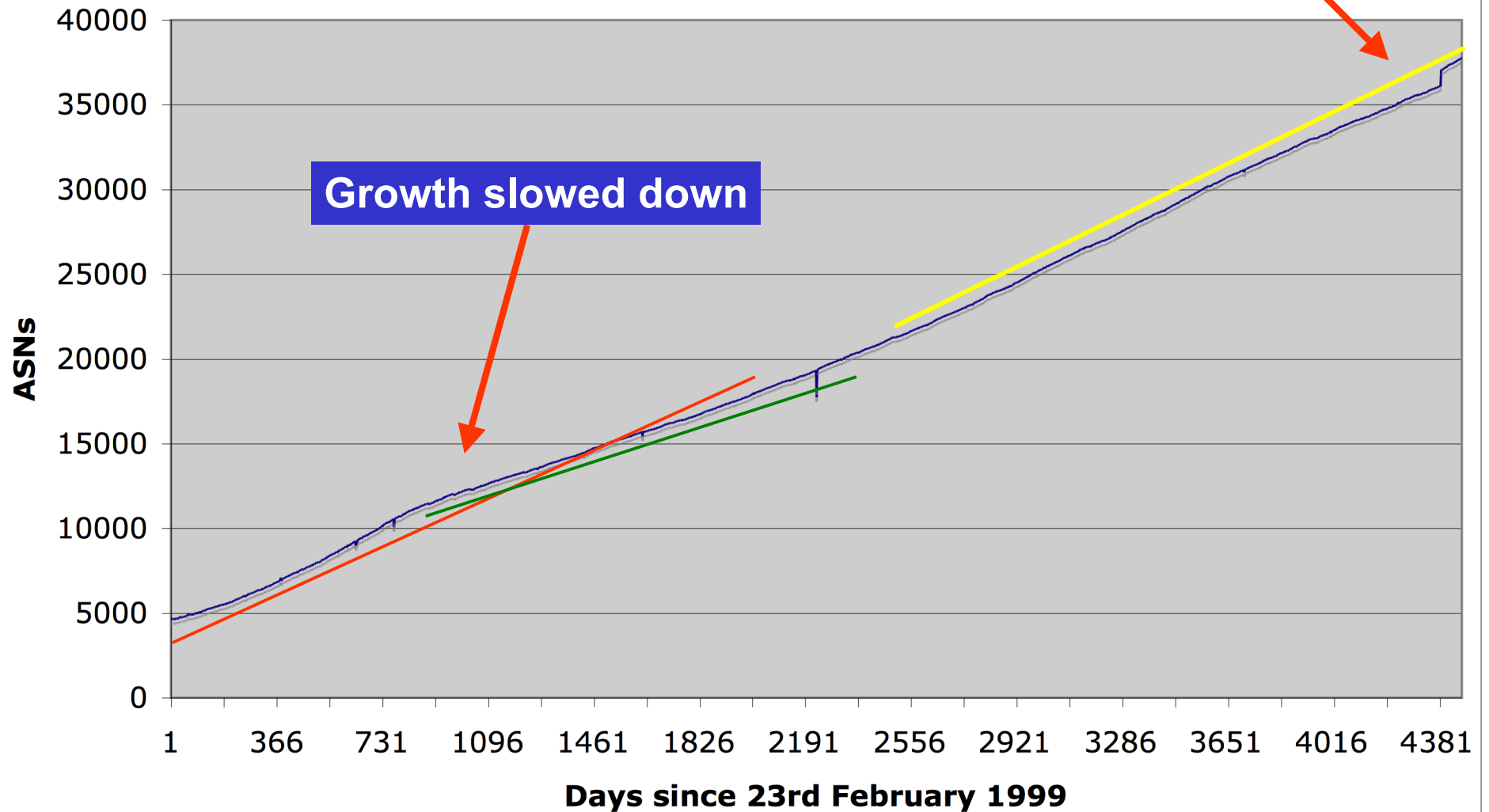
BGP Routing Table



AS Growth

4-byte ASNs appear

Growth slowed down



AfriNIC Region

Prefixes being announced by AfriNIC Region ASes:	7999
Total AfriNIC prefixes after maximum aggregation:	1909
AfriNIC Deaggregation factor:	4.19
Prefixes being announced from the AfriNIC address blocks:	6308
Unique aggregates announced from the AfriNIC address blocks:	1917
AfriNIC Region origin ASes present in the Internet Routing Table:	458
AfriNIC Prefixes per ASN:	13.77
AfriNIC Region origin ASes announcing only one prefix:	142
AfriNIC Region transit ASes present in the Internet Routing Table:	100
Average AfriNIC Region AS path length visible:	4.8
Max AfriNIC Region AS path length visible:	24
Number of AfriNIC region 32-bit ASNs visible in the Routing Table:	5
Number of AfriNIC addresses announced to Internet:	23586048
Equivalent to 1 /8s, 103 /16s and 229 /24s	
Percentage of available AfriNIC address space announced:	35.1

AfriNIC AS Blocks 36864-37887, 327680-328703 & ERX transfers

AfriNIC Address Blocks 41/8, 102/8, 105/8, 197/8

Global per AS prefix count summary

ASN	No of nets	/20 equiv	Max Agg	Description
6389	3641	3822	256	bellsouth.net, inc.
4766	2460	9500	922	Korea Telecom (KIX)
4323	1973	1081	400	Time Warner Telecom
18566	1875	355	269	Covad Communications
1785	1790	681	122	PaeTec Communications, Inc.
6478	1716	318	45	AT&T Worldnet Services
20115	1535	1540	633	Charter Communications
17974	1541	441	38	PT TELEKOMUNIKASI INDONESIA
7545	1537	301	86	TPG Internet Pty Ltd
10620	1512	278	157	TVCABLE BOGOTA
19262	1492	4936	307	Verizon Global Networks
4755	1470	634	166	TATA Communications formerly
7018	1367	7068	892	AT&T WorldNet Services
8151	1383	2724	364	UniNet S.A. de C.V.
22773	1337	2897	88	Cox Communications, Inc.
28573	1319	992	86	NET Servicos de Comunicacao S.A
2386	1268	536	911	AT&T Data Communications Serv
7011	1160	274	693	Citizens Utilities
11492	1153	235	87	Cable One
24560	1155	337	187	Bharti Airtel Ltd., Telemedia

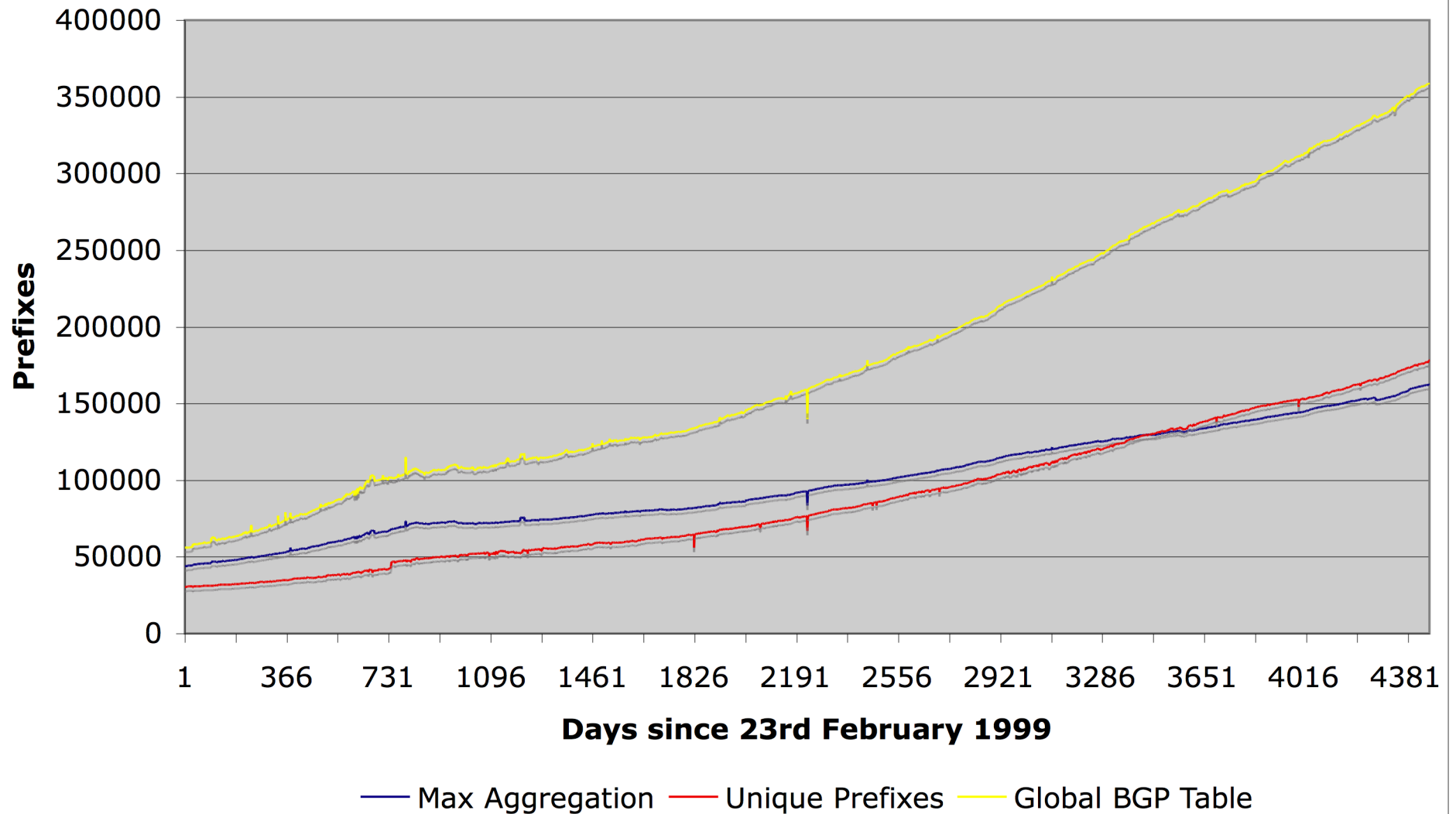
Global Aggregation Savings Summary

ASN	No of Nets	Net Savings	Description
6478	1716	1671	AT&T Worldnet Services
1785	1790	1668	PaeTec Communications, Inc.
18566	1875	1606	Covad Communications
4323	1973	1573	Time Warner Telecom
4766	2460	1538	Korea Telecom (KIX)
17974	1541	1503	PT TELEKOMUNIKASI INDONESIA
7545	1537	1451	TPG Internet Pty Ltd
10620	1512	1355	TVCABLE BOGOTA
4755	1470	1304	TATA Communications formerly
22773	1337	1249	Cox Communications, Inc.
28573	1319	1233	NET Servicos de Comunicacao S.A
19262	1492	1185	Verizon Global Networks
7552	1141	1134	Vietel Corporation
11492	1153	1066	Cable One
8151	1383	1019	UniNet S.A. de C.V.
24560	1155	968	Bharti Airtel Ltd., Telemedia
20115	1535	902	Charter Communications
9829	956	874	BSNL National Internet Backbo
17488	930	826	Hathway IP Over Cable Interne
8452	833	822	TEDATA

Global Per AS Maximum Aggregation % summary

ASN	No of nets	% Savings	Description
7552	1141	99	Vietel Corporation
8452	833	99	TEDATA
15475	544	99	Nile Online
3505	168	99	Vnet Internet Access, Inc.
26463	85	99	Macomb Intermediate School Di
3449	76	99	Universidad de Buenos Aires
55430	73	99	Starhub Internet Pte Ltd
23851	68	99	Chongqing Broadband Network C
17974	1541	98	PT TELEKOMUNIKASI INDONESIA
30693	506	98	Eonix Corporation
12479	432	98	Uni2 Autonomous System
35819	381	98	Bayanat Al-Oula Autonomous Sy
27747	260	98	Telecentro S.A.
5786	184	98	University of Puerto Rico
38264	143	98	Wateen National WiMAX/IMS
688	131	98	Department of Interior
26081	90	98	American Long Lines
45951	81	98	Augere Wireless Broadband Bangladesh
22845	80	98	Michigan Connect, LLC
24187	80	98	KIRZ AS ISP Bangkok Thailand

Max Aggregation vs Unique Prefixes



Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:20	/9:12	/10:28	/11:81	/12:228
/13:461	/14:798	/15:1395	/16:11917	/17:5834	/18:9733
/19:19342	/20:25663	/21:25940	/22:34114	/23:33063	/24:186681
/25:1084	/26:1275	/27:711	/28:165	/29:8	/30:2
/31:0	/32:6				

June 2011 ↑

June 2009 ↓

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:19	/9:10	/10:22	/11:58	/12:167
/13:347	/14:602	/15:1153	/16:10475	/17:4717	/18:8078
/19:16918	/20:20092	/21:19903	/22:25822	/23:25632	/24:151077
/25:842	/26:1001	/27:545	/28:142	/29:8	/30:5
/31:0	/32:8				

Prefixes Smaller than Registry Allocations

ASN	No of nets	Total ann.	Description
6389	2243	3641	bellsouth.net, inc.
18566	1838	1875	Covad Communications
6478	1670	1716	AT&T Worldnet Services
10620	1402	1512	TVCABLE BOGOTA
11492	1107	1153	Cable One
7011	1061	1160	Citizens Utilities
1785	1050	1790	PaeTec Communications, Inc.
4323	886	1973	Time Warner Telecom
22773	852	1337	Cox Communications, Inc.
28573	815	1319	NET Servicos de Comunicacao S.A
7018	765	1367	AT&T WorldNet Services
22561	755	928	Digital Teleport, Inc
7029	747	990	Alltel Information Services,
13407	724	771	Computer Telephone Corp
3356	706	1106	Level 3 Communications, LLC
7303	690	960	Telecom Argentina Stet-France
8452	632	833	TEDATA
4766	627	2460	Korea Telecom (KIX)
14420	617	675	CORPORACION NACIONAL DE TELEC
19262	606	1492	Verizon Global Networks



June 2011

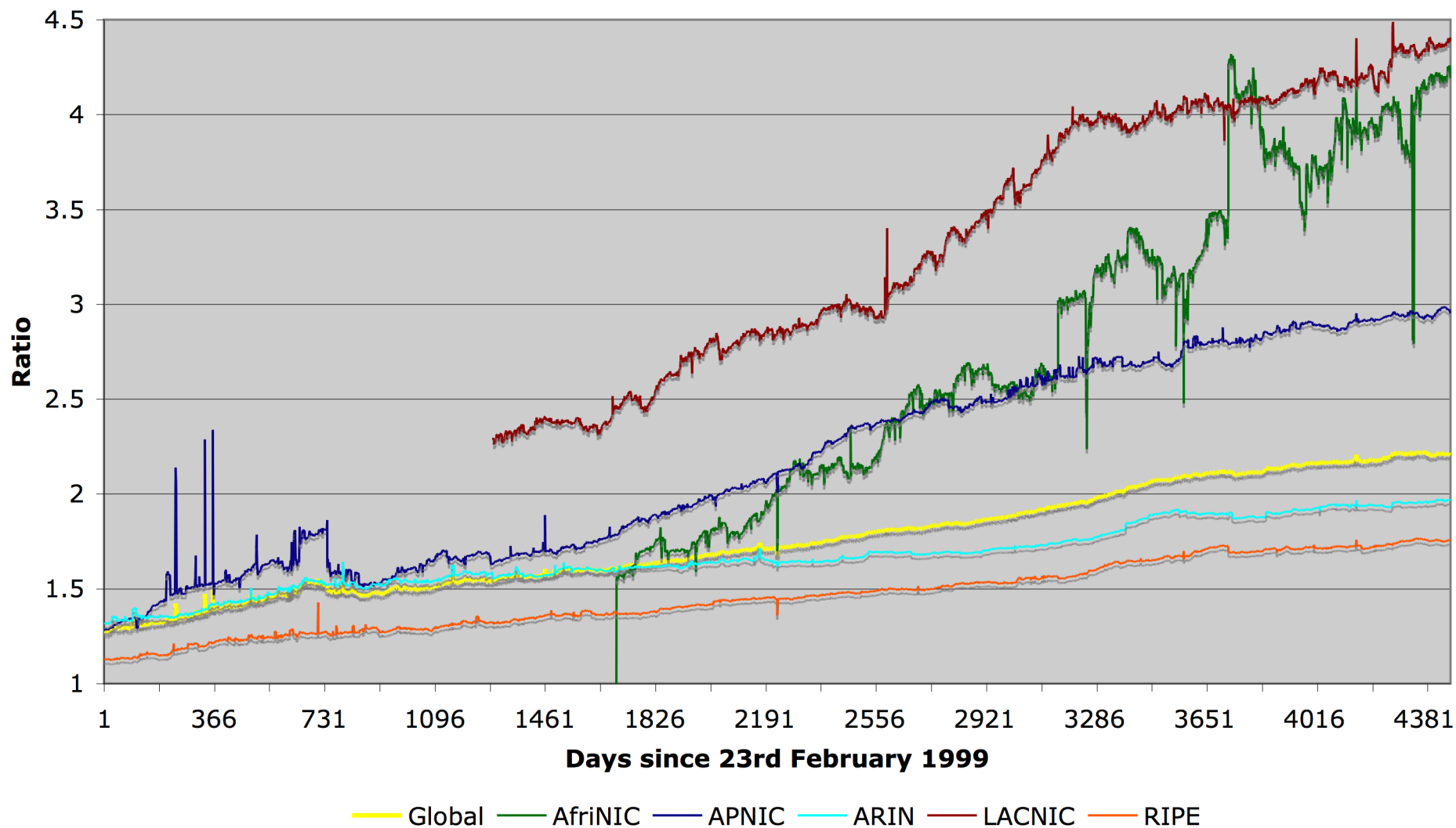
Total Prefixes

- Global BGP Table
 - 359k prefixes
- Europe & Middle East
 - 85k prefixes
- North America
 - 141k prefixes
- Asia & Pacific
 - 89k prefixes
- Africa
 - 8k prefixes
- Latin America & Caribbean
 - 44k prefixes

Deaggregation Factor

- Global Average
 - 2.21
- Europe & Middle East
 - 1.76
- North America
 - 1.97
- Asia & Pacific
 - 2.95
- Africa
 - 4.19
- Latin America & Caribbean
 - 4.40

Deaggregation: RIR Regions vs Global

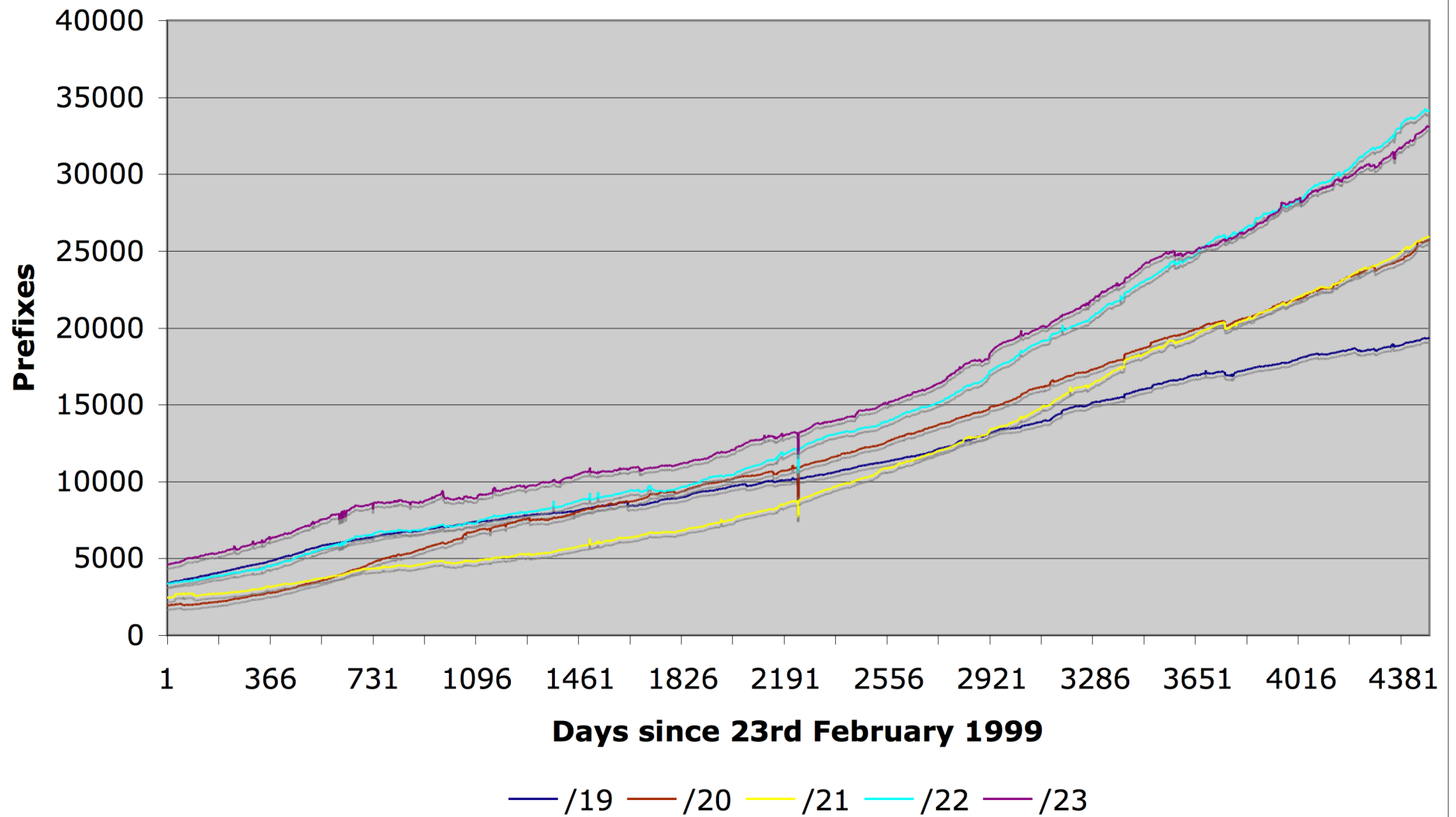


Africa Aggregation Savings Summary

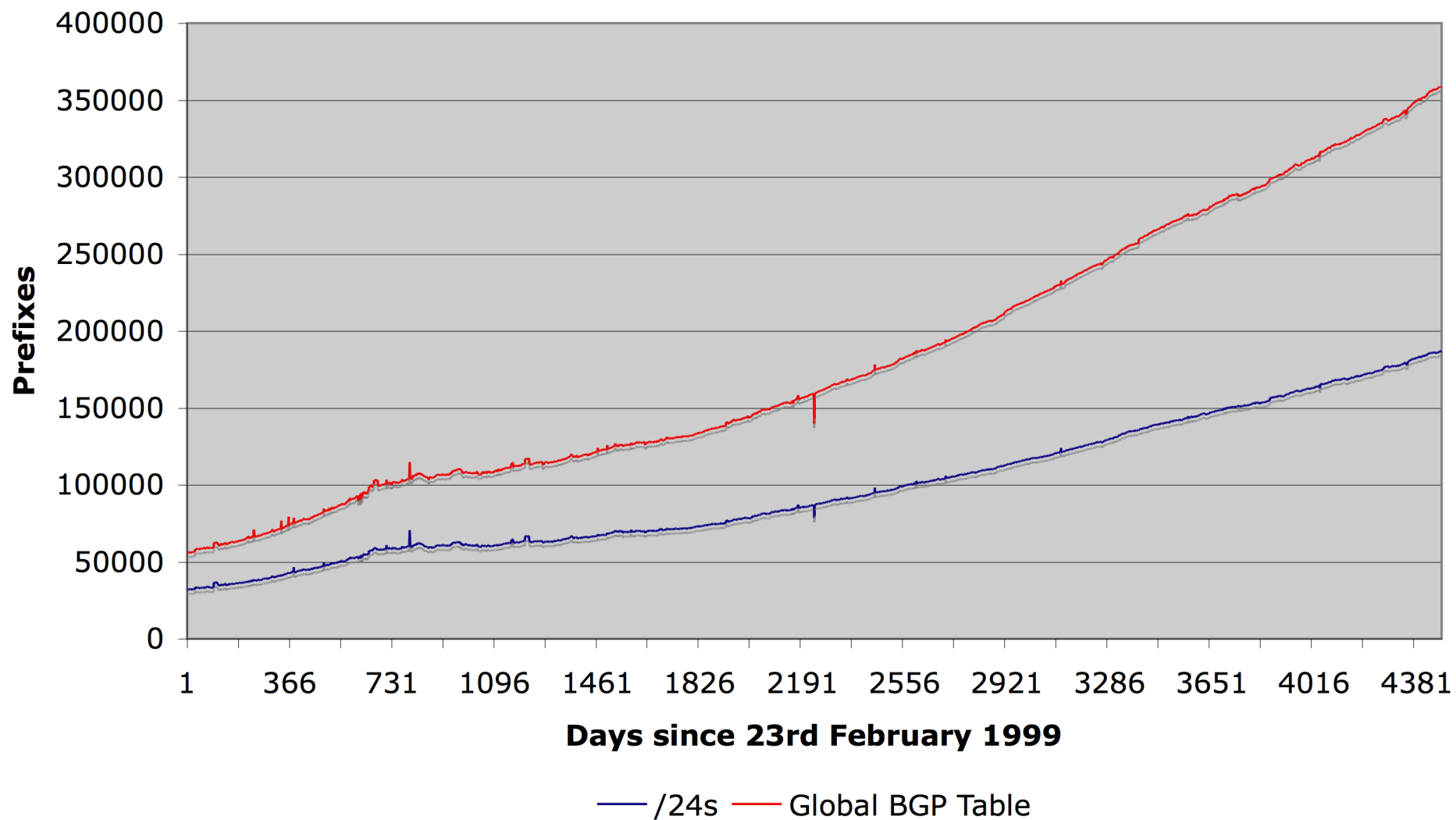
ASN	No of Nets	Savings	Description
8452	833	822	TEDATA
24863	721	684	LINKdotNET AS number
15475	544	536	Nile Online
36992	294	280	Etisalat MISR
6713	241	228	Itissalat Al-MAGHRIB
33776	218	207	Starcomms Nigeria Limited
24835	208	198	RAYA Telecom - Egypt
29571	193	181	Ci Telecom Autonomous system
15706	130	125	Sudatel Internet Exchange Aut
29975	133	116	Vodacom
36874	123	116	Cybersmart
37061	102	99	One Communications Ltd
15399	78	74	Wananchi Online Limited
37054	89	72	Data Telecom Service
20928	71	69	Noor Advanced Technologies AS
16637	150	64	MTN Network Solutions
23889	76	51	MAURITIUS TELECOM
37134	52	51	Mobitel Nigeria Limited
36923	53	49	Swift Networks Limited
8094	50	47	PUKNET

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

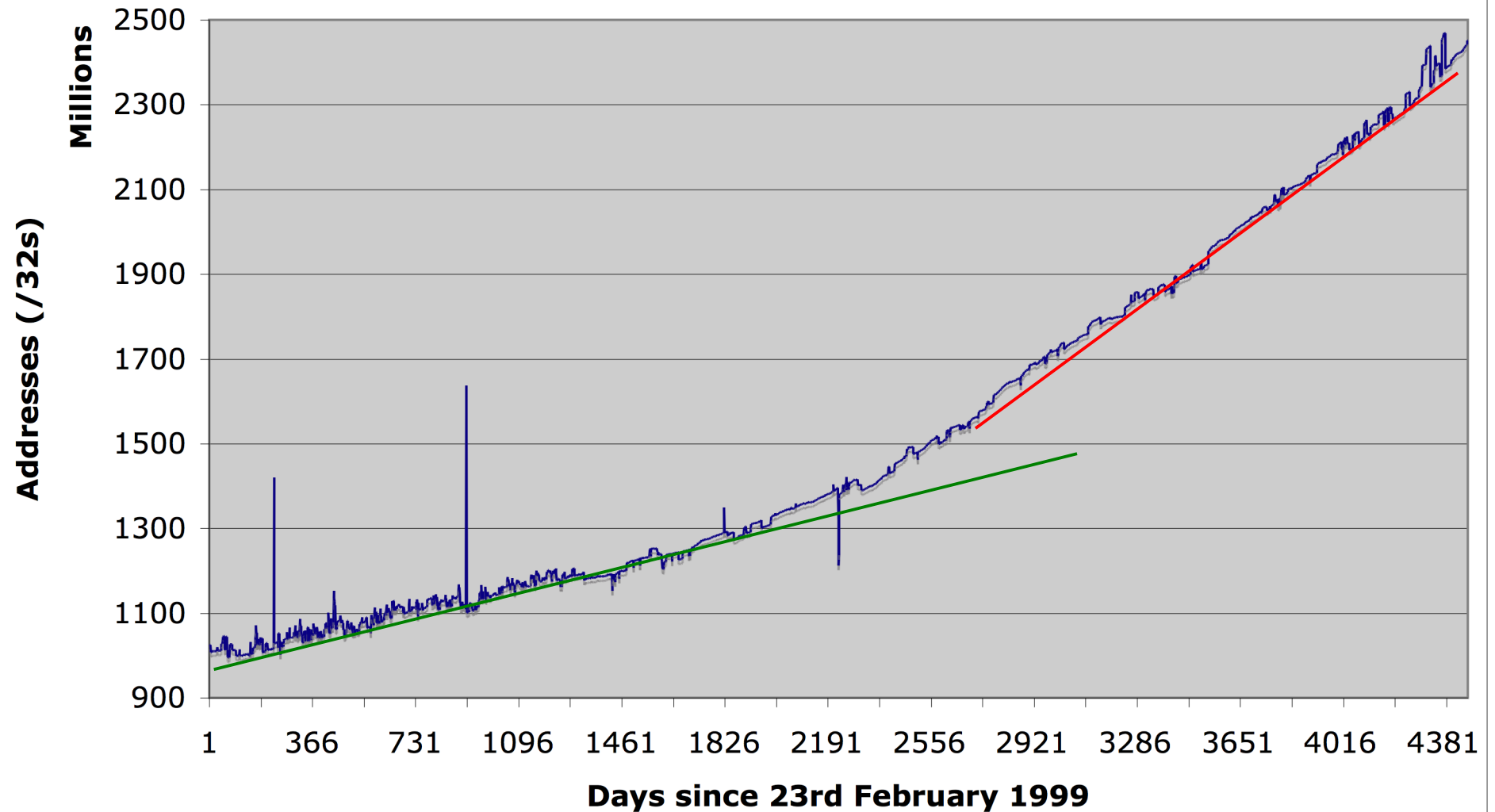
Prefix sizes announced



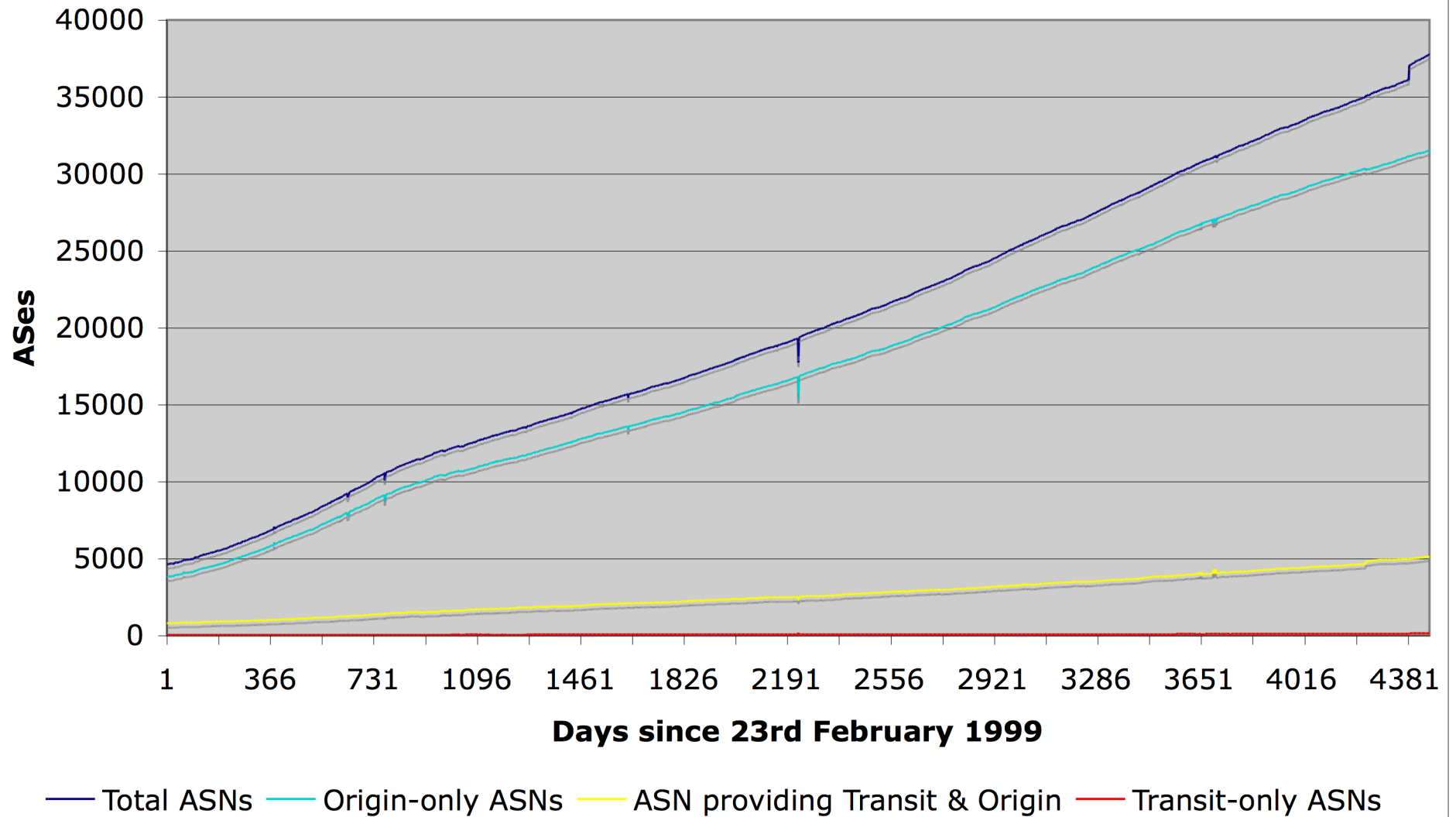
/24s announced



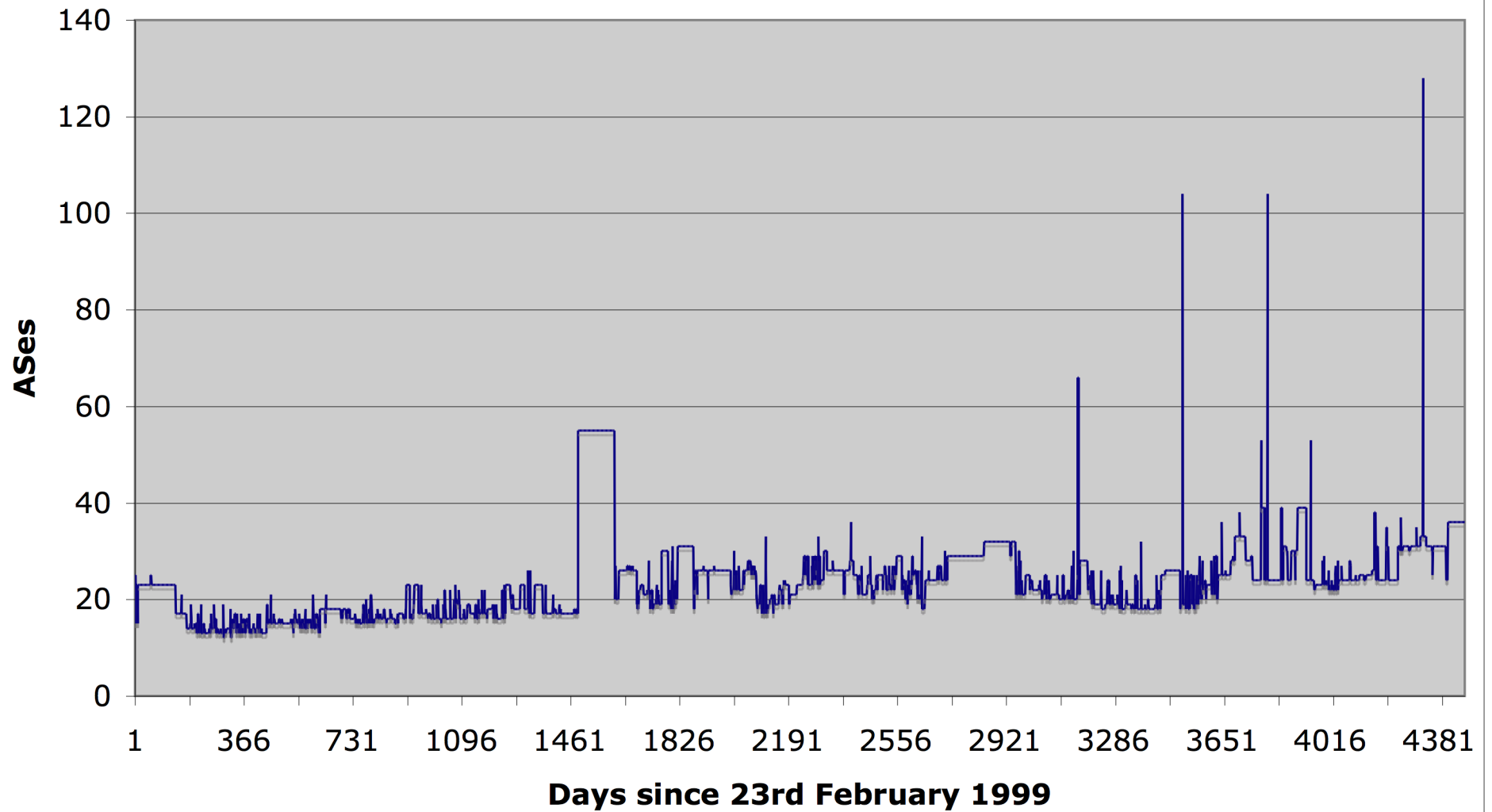
Address Space announced



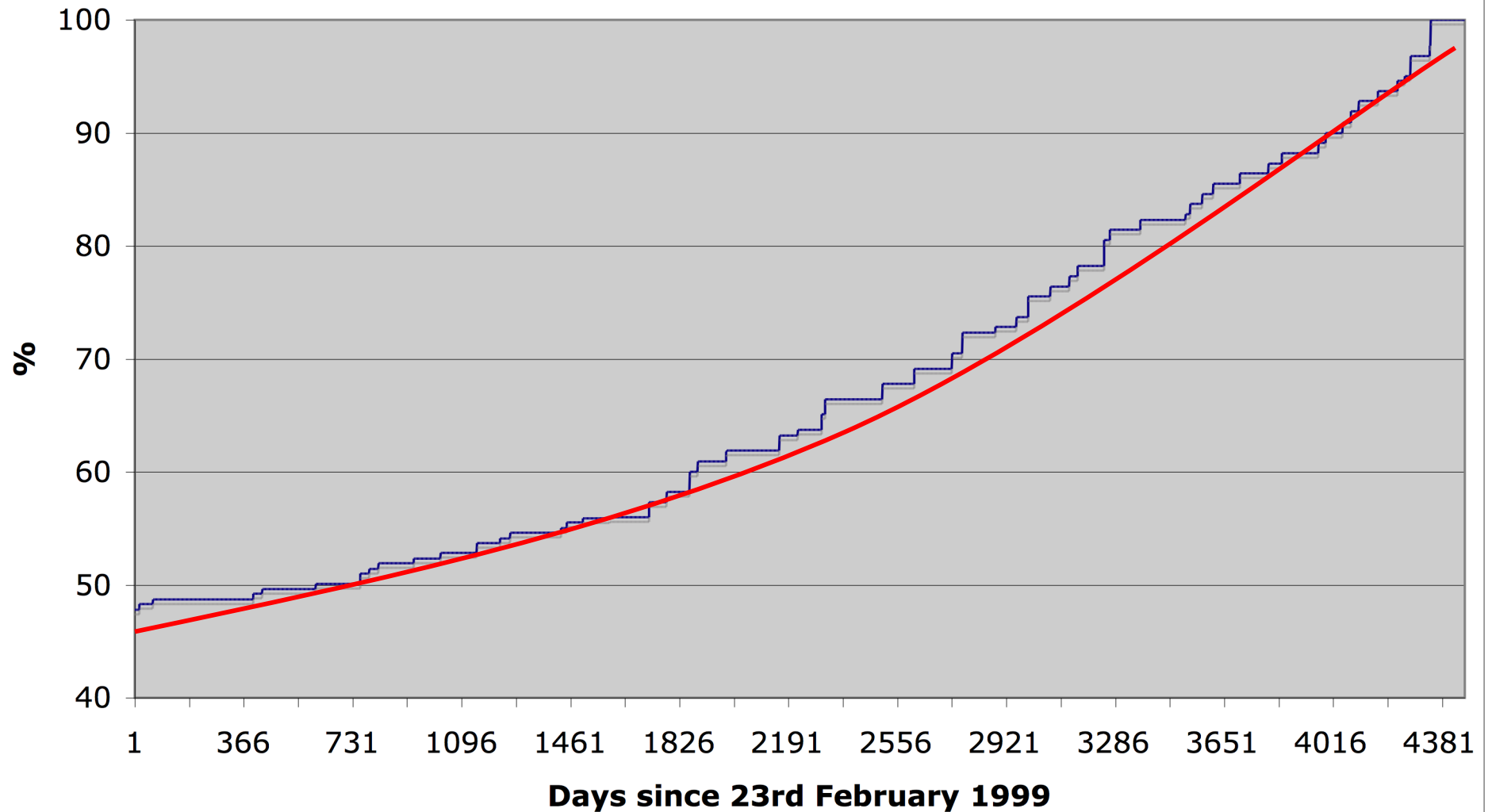
AS Announcements



Maximum AS Path Length



Growth in IPv4 Address Space Allocations



Internet Routing Table Analysis Update



Questions?