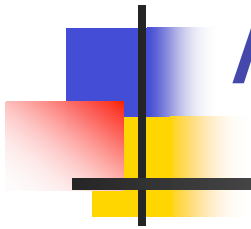
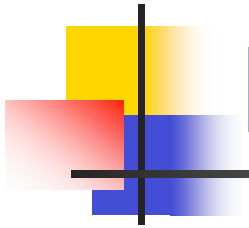


Internet Routing Table Analysis Update

Philip Smith
pfs@cisco.com
SANOG VII
Mumbai, January 2006



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 23 January 2006

BGP routing table entries examined:	179106
Prefixes after maximum aggregation:	100262
Unique aggregates announced to Internet:	87146
Total ASes present in the Internet Routing Table:	21329
Origin-only ASes present in the Internet Routing Table:	18551
Origin ASes announcing only one prefix:	8781
Transit ASes present in the Internet Routing Table:	2778
Transit-only ASes present in the Internet Routing Table:	72
Average AS path length visible in the Internet Routing Table:	4.5
Max AS path length visible:	25
Prefixes from unregistered ASNs in the Routing Table:	7
Special use prefixes present in the Routing Table:	0
Prefixes being announced from unallocated address space:	12
Number of addresses announced to Internet:	1481828384
Equivalent to 88 /8s, 82 /16s and 232 /24s	
Percentage of available address space announced:	40.0
Percentage of allocated address space announced:	59.0
Percentage of available address space allocated:	67.8
Total number of prefixes smaller than registry allocations:	86600

APNIC Region

Prefixes being announced by APNIC Region ASes:	37647
Total APNIC prefixes after maximum aggregation:	15883
Prefixes being announced from the APNIC address blocks:	35436
Unique aggregates announced from the APNIC address blocks:	17329
APNIC Region origin ASes present in the Internet Routing Table:	2463
APNIC Region origin ASes announcing only one prefix:	693
APNIC Region transit ASes present in the Internet Routing Table:	379
Average APNIC Region AS path length visible:	4.4
Max APNIC Region AS path length visible:	21
Number of APNIC addresses announced to Internet:	210802656
Equivalent to 12 /8s, 144 /16s and 151 /24s	
Percentage of available APNIC address space announced:	65.9

APNIC AS Blocks	4608-4864, 7467-7722, 9216-10239, 17408-18431
(pre-ERX allocations)	23552-24575, 37888-38911
APNIC Address Blocks	58/7, 60/7, 121/8, 122/7, 124/7, 126/8, 202/7
	210/7, 218/7, 220/7 and 222/8

ARIN Region

Prefixes being announced by ARIN Region ASes:	94169
Total ARIN prefixes after maximum aggregation:	56331
Prefixes being announced from the ARIN address blocks:	73466
Unique aggregates announced from the ARIN address blocks:	28116
ARIN Region origin ASes present in the Internet Routing Table:	10455
ARIN Region origin ASes announcing only one prefix:	3888
ARIN Region transit ASes present in the Internet Routing Table:	965
Average ARIN Region AS path length visible:	4.3
Max ARIN Region AS path length visible:	17
Number of ARIN addresses announced to Internet:	282810880
Equivalent to 16 /8s, 219 /16s and 90 /24s	
Percentage of available ARIN address space announced:	70.2

ARIN AS Blocks	1-1876, 1902-2042, 2044-2046, 2048-2106
(pre-ERX allocations)	2138-2584, 2615-2772, 2823-2829, 2880-3153
	3354-4607, 4865-5119, 5632-6655, 6912-7466
	7723-8191, 10240-12287, 13312-15359, 16384-17407
	18432-20479, 21504-23551, 25600-26591,
	26624-27647, 29696-30719, 31744-33791
	35840-36863
ARIN Address Blocks	24/8, 63/8, 64/6, 68/7, 70/6, 74/7, 76/8,
	198/7, 204/6, 208/7 and 216/8

RIPE NCC Region

Prefixes being announced by RIPE Region ASes:	35176
Total RIPE prefixes after maximum aggregation:	23723
Prefixes being announced from the RIPE address blocks:	32189
Unique aggregates announced from the RIPE address blocks:	21589
RIPE Region origin ASes present in the Internet Routing Table:	7533
RIPE Region origin ASes announcing only one prefix:	3942
RIPE Region transit ASes present in the Internet Routing Table:	1247
Average RIPE Region AS path length visible:	5.0
Max RIPE Region AS path length visible:	25
Number of RIPE addresses announced to Internet:	229857664
Equivalent to 13 /8s, 179 /16s and 89 /24s	
Percentage of available RIPE address space announced:	68.5

RIPE AS Blocks	1877-1901, 2043, 2047, 2107-2136, 2585-2614
(pre-ERX allocations)	2773-2822, 2830-2879, 3154-3353, 5377-5631
	6656-6911, 8192-9215, 12288-13311, 15360-16383
	20480-21503, 24576-25599, 28672-29695
	30720-31743, 33792-35839, 38912-39935
RIPE Address Blocks	62/8, 80/5, 88/6, 188/8, 193/8, 194/7, 212/7
	and 217/8

LACNIC Region

Prefixes being announced by LACNIC Region ASes:	10272
Total LACNIC prefixes after maximum aggregation:	3453
Prefixes being announced from the LACNIC address blocks:	8439
Unique aggregates announced from the LACNIC address blocks:	5043
LACNIC Region origin ASes present in the Internet Routing Table:	662
LACNIC Region origin ASes announcing only one prefix:	214
LACNIC Region transit ASes present in the Internet Routing Table:	123
Average LACNIC Region AS path length visible:	5.2
Max LACNIC Region AS path length visible:	22
Number of LACNIC addresses announced to Internet:	24757248
Equivalent to 1 /8s, 121 /16s and 196 /24s	
Percentage of available LACNIC address space announced:	36.9

LACNIC AS Blocks	26592-26623, 27648-28671, plus ERX transfers
LACNIC Address Blocks	189/8, 190/8, 200/7

AfriNIC Region

Prefixes being announced by AfriNIC Region ASes:	1835
Total AfriNIC prefixes after maximum aggregation:	872
Prefixes being announced from the AfriNIC address blocks:	1217
Unique aggregates announced from the AfriNIC address blocks:	854
AfriNIC Region origin ASes present in the Internet Routing Table:	144
AfriNIC Region origin ASes announcing only one prefix:	44
AfriNIC Region transit ASes present in the Internet Routing Table:	24
Average AfriNIC Region AS path length visible:	4.6
Max AfriNIC Region AS path length visible:	12
Number of AfriNIC addresses announced to Internet:	3028736
Equivalent to 0 /8s, 46 /16s and 55 /24s	
Percentage of available AfriNIC address space announced:	9.0

AfriNIC AS Blocks 36864-37887 & ERX transfers
AfriNIC Address Blocks 41/8, 196/8

Global per AS prefix count summary

ASN	No of nets	/20 equiv	Max Agg	Description
7018	1468	6265	955	AT&T WorldNet Services
4323	1201	723	234	Time Warner Telecom
174	1037	5807	949	Cogent Communications
721	1029	21938	306	DLA Systems Automation Center
4134	978	6450	206	CHINANET-BACKBONE
6197	973	436	507	BellSouth Network Solutions,
701	966	8099	808	UUNET Technologies, Inc.
18566	892	272	8	Covad Communications
2386	879	501	687	AT&T Data Communications Serv
1239	850	2791	604	Sprint
9583	838	109	15	Sify Limited
4755	786	258	63	Videsh Sanchar Nigam Ltd. Aut
4766	719	3929	303	Korea Telecom (KIX)
1221	667	1364	474	Telstra Pty Ltd
209	659	3603	525	Qwest
20115	659	538	341	Charter Communications
11492	644	89	12	Cable One
22773	610	1478	33	Cox Communications, Inc.
19262	595	1705	140	Verizon Global Networks
702	587	1954	465	UUNET - Commercial IP service

Global Aggregation Savings Summary

ASN	No of Nets	Net Savings	Description
4323	1201	967	Time Warner Telecom
18566	892	884	Covad Communications
9583	838	823	Sify Limited
4134	978	772	CHINANET-BACKBONE
721	1029	723	DLA Systems Automation Center
4755	786	723	Videsh Sanchar Nigam Ltd. Aut
11492	644	632	Cable One
22773	610	577	Cox Communications, Inc.
19916	563	509	OLM LLC
855	558	499	Canadian Research Network
5668	518	494	CenturyTel Internet Holdings,
6197	973	466	BellSouth Network Solutions,
19262	595	455	Verizon Global Networks
7545	514	444	TPG Internet Pty Ltd
9498	508	439	BHARTI BT INTERNET LTD.
17488	436	427	Hathway IP Over Cable Interne
4766	719	416	Korea Telecom (KIX)
3602	521	415	Sprint Canada, Inc.
812	438	410	Rogers WAVE
17676	477	375	Softbank BB Corp.

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:18	/9:5	/10:8	/11:20	/12:87
/13:196	/14:349	/15:680	/16:8655	/17:2968	/18:4979
/19:11215	/20:12386	/21:10702	/22:13702	/23:14915	/24:97272
/25:310	/26:252	/27:202	/28:62	/29:26	/30:55
/31:3	/32:39				

January 2006 ↑

January 2005 ↓

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:19	/9:3	/10:7	/11:15	/12:60
/13:142	/14:313	/15:574	/16:8226	/17:2365	/18:4061
/19:9965	/20:10470	/21:8215	/22:11413	/23:12782	/24:83393
/25:249	/26:217	/27:90	/28:33	/29:9	/30:26
/31:0	/32:20				

Advertised IANA Reserved Addresses

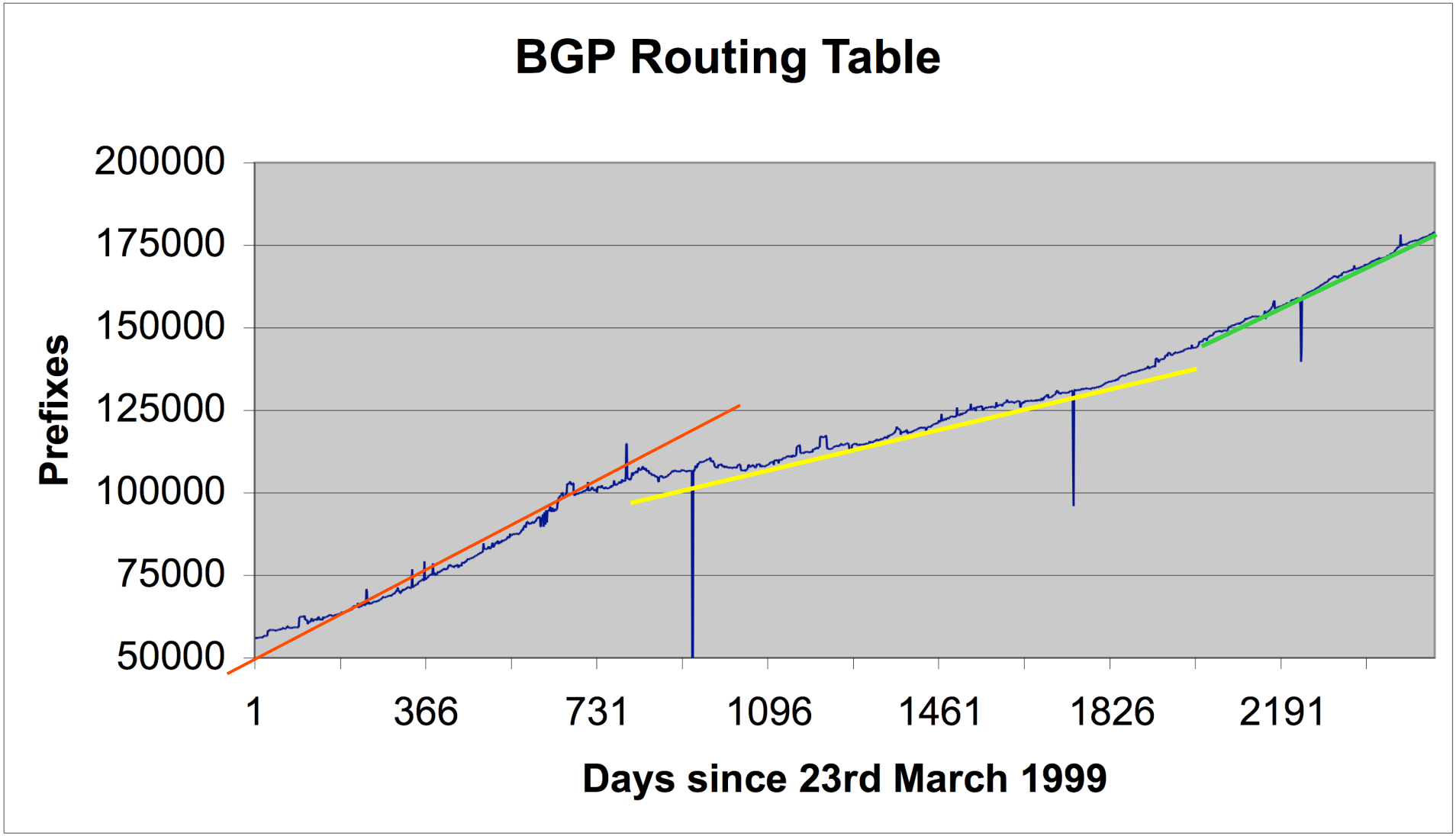
Network	Origin AS	Description
132.0.0.0/10	721	DLA Systems Automation Center
137.0.0.0/13	721	DLA Systems Automation Center
158.0.0.0/13	721	DLA Systems Automation Center
192.43.230.0/24	7575	Australian Academic and Rease
192.44.0.0/24	5501	Fraunhofer Gesellschaft
192.44.0.0/19	702	UUNET - Commercial IP service
192.70.164.0/24	25689	National Research Council of
192.72.0.0/18	4780	Digital United Inc.
192.72.0.0/16	4780	Digital United Inc.
192.84.205.0/24	719	LANLINK autonomous system
192.119.135.0/24	270	NASA
192.172.0.0/19	721	DLA Systems Automation Center

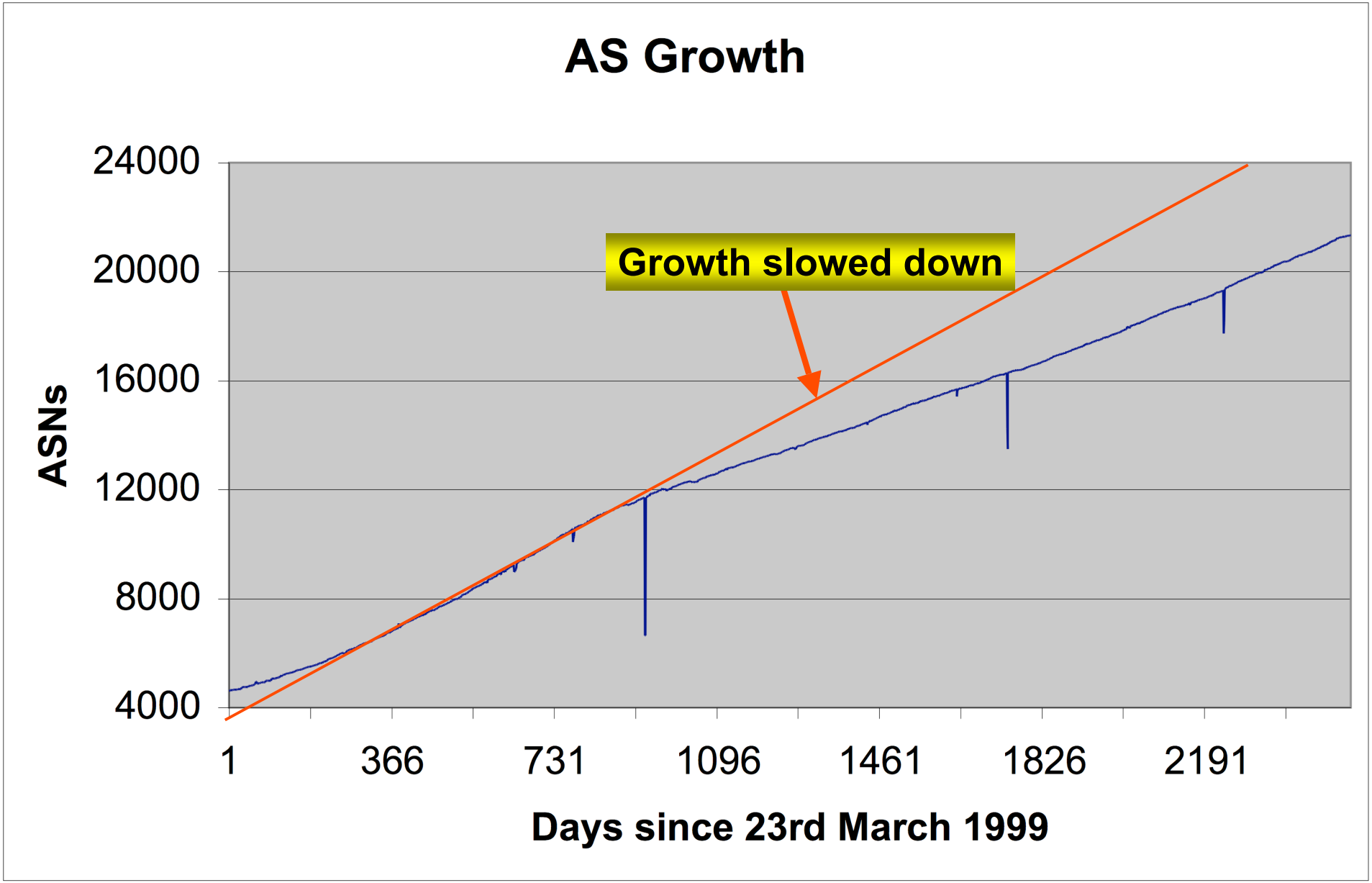
List of Unregistered AS's

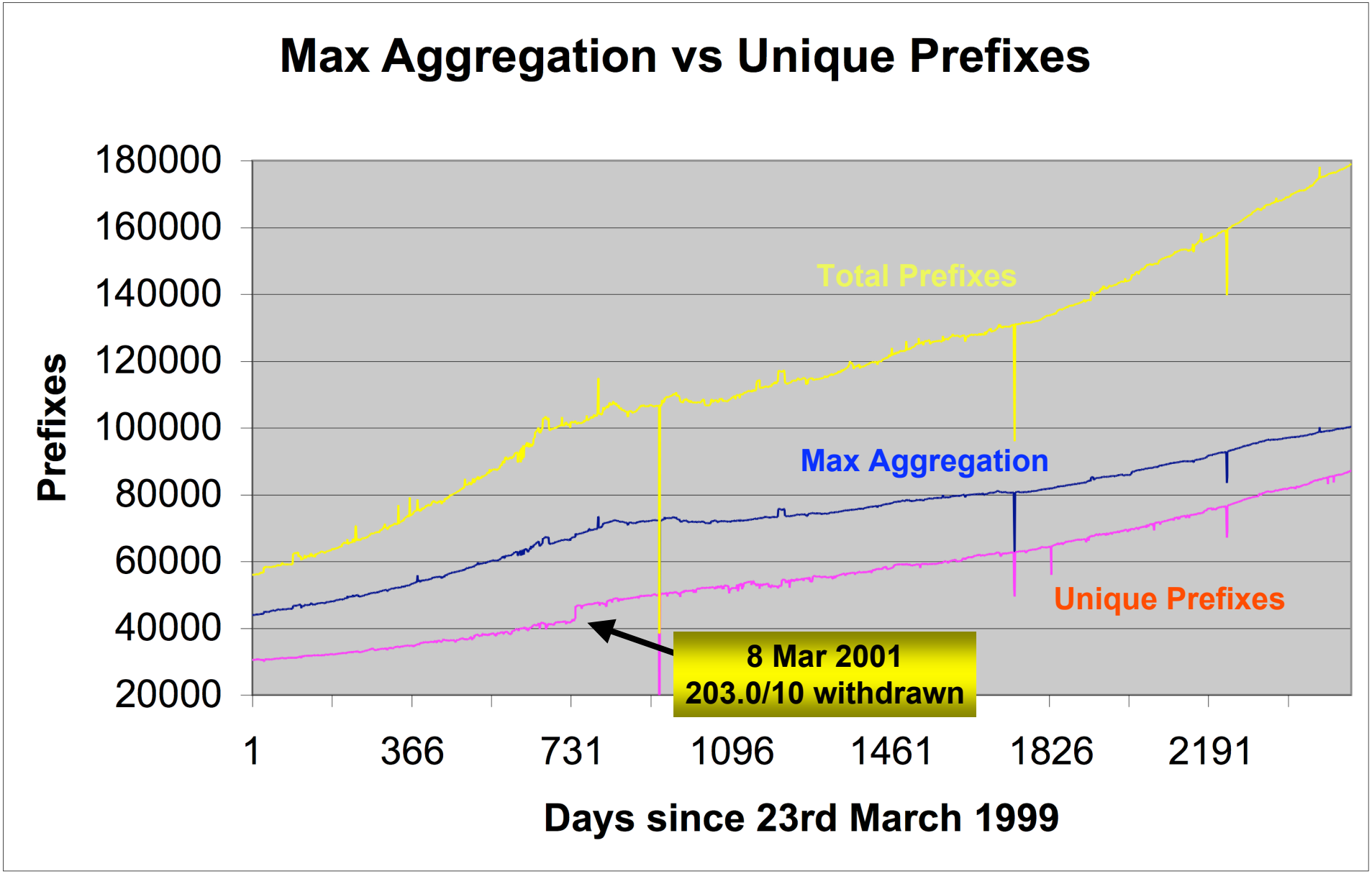
Bad AS	Designation	Network	Transit AS	Description
65005	PRIVATE	159.153.148.0/22	24989	IX Europe Frankfurt

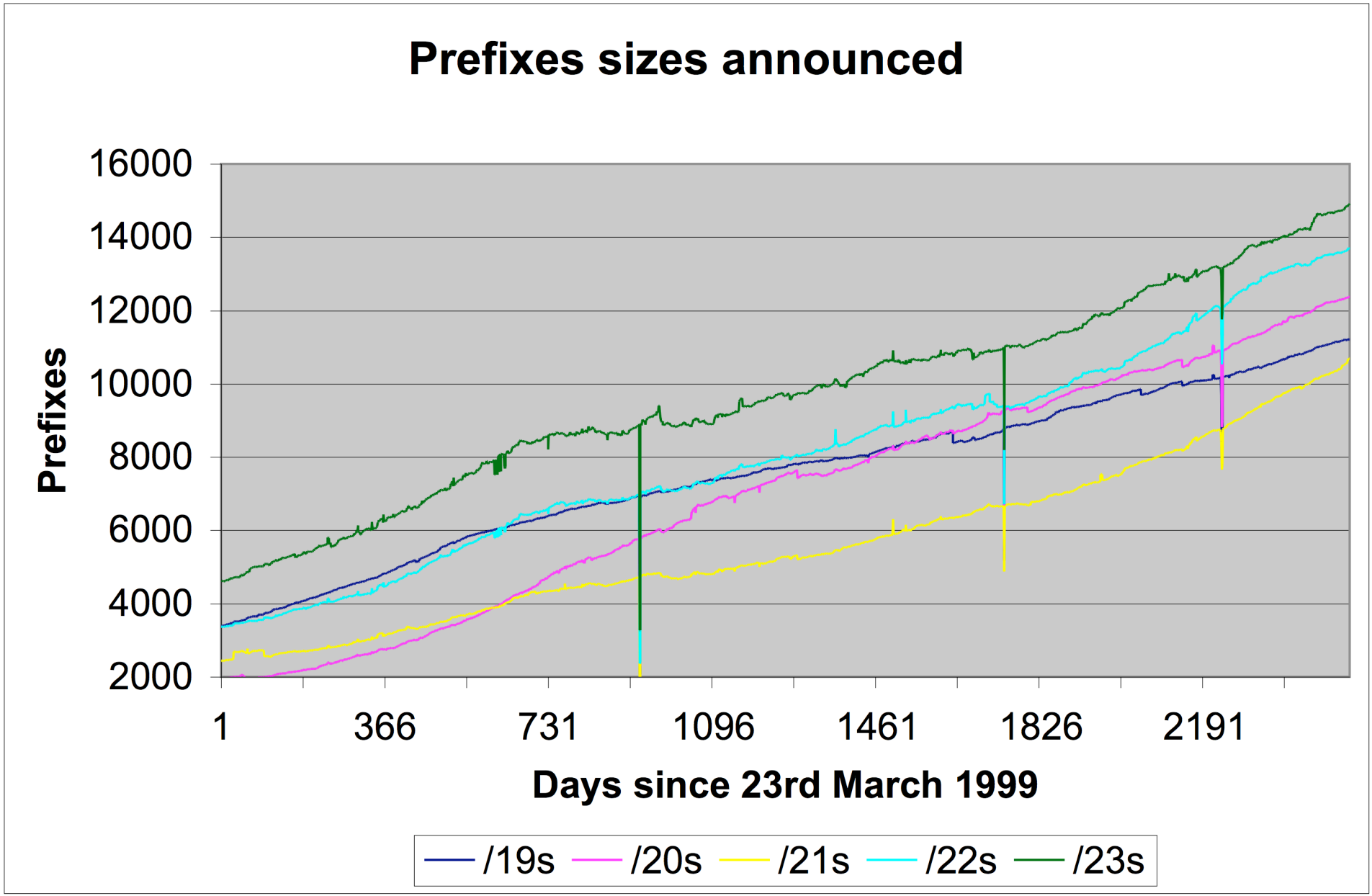
Prefixes Smaller than Registry Allocations

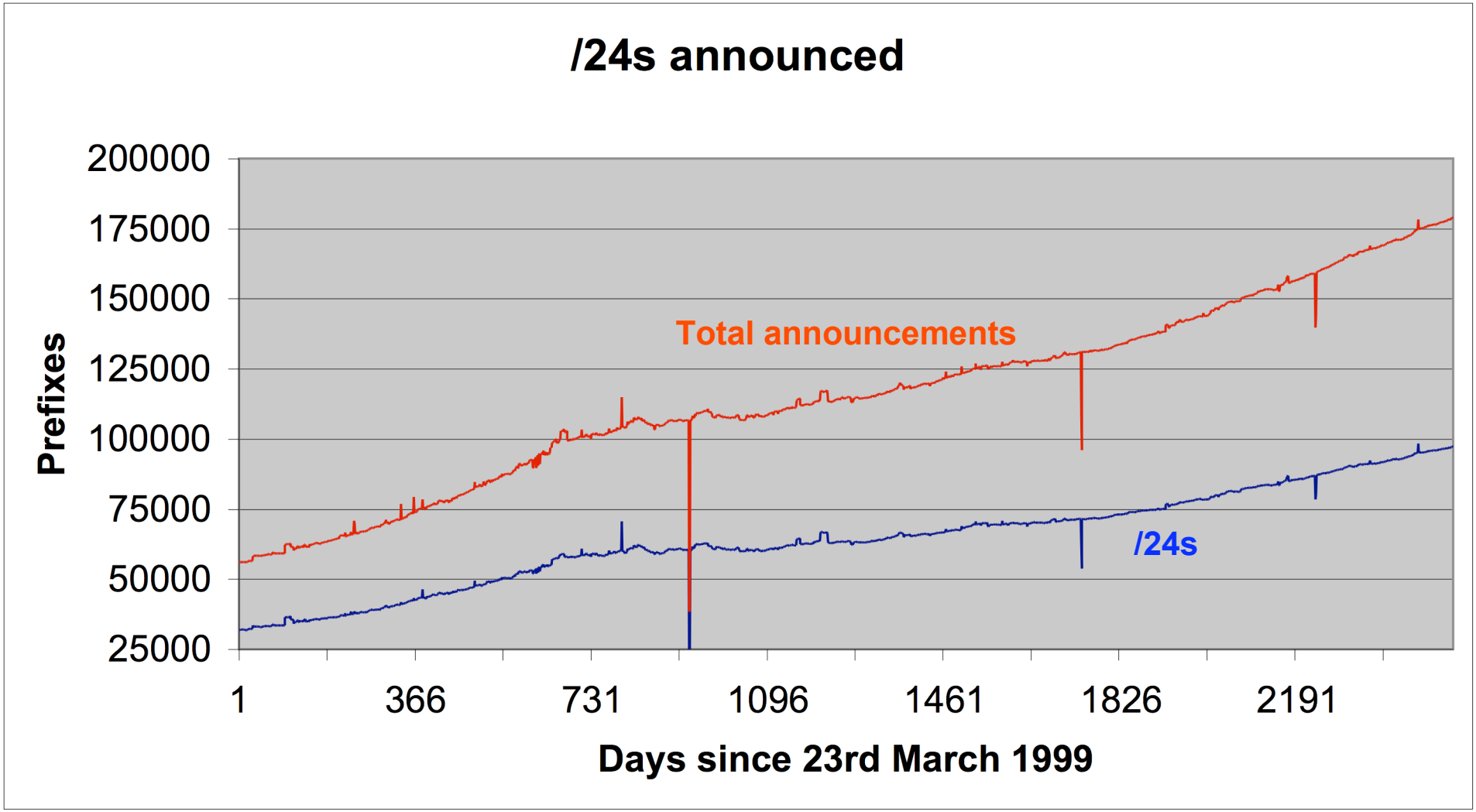
ASN	No of nets	Total ann.	Description
18566	875	892	Covad Communications
6197	785	973	BellSouth Network Solutions,
7018	748	1468	AT&T WorldNet Services
9583	660	838	Sify Limited
11492	635	644	Cable One
2386	613	879	AT&T Data Communications Serv
4323	576	1201	Time Warner Telecom
19916	557	563	OLM LLC
4766	519	719	Korea Telecom (KIX)
855	444	558	Canadian Research Network
5668	407	518	CenturyTel Internet Holdings,
7011	402	468	Citizens Utilities
702	372	587	UUNET - Commercial IP service
1239	366	850	Sprint
6198	357	500	BellSouth Network Solutions,
6517	342	370	Yipes Communications, Inc.
15270	334	361	PaeTec.net -a division of Pae
812	317	438	Rogers WAVE
22773	315	610	Cox Communications, Inc.
13609	290	332	Choice One Communications Inc

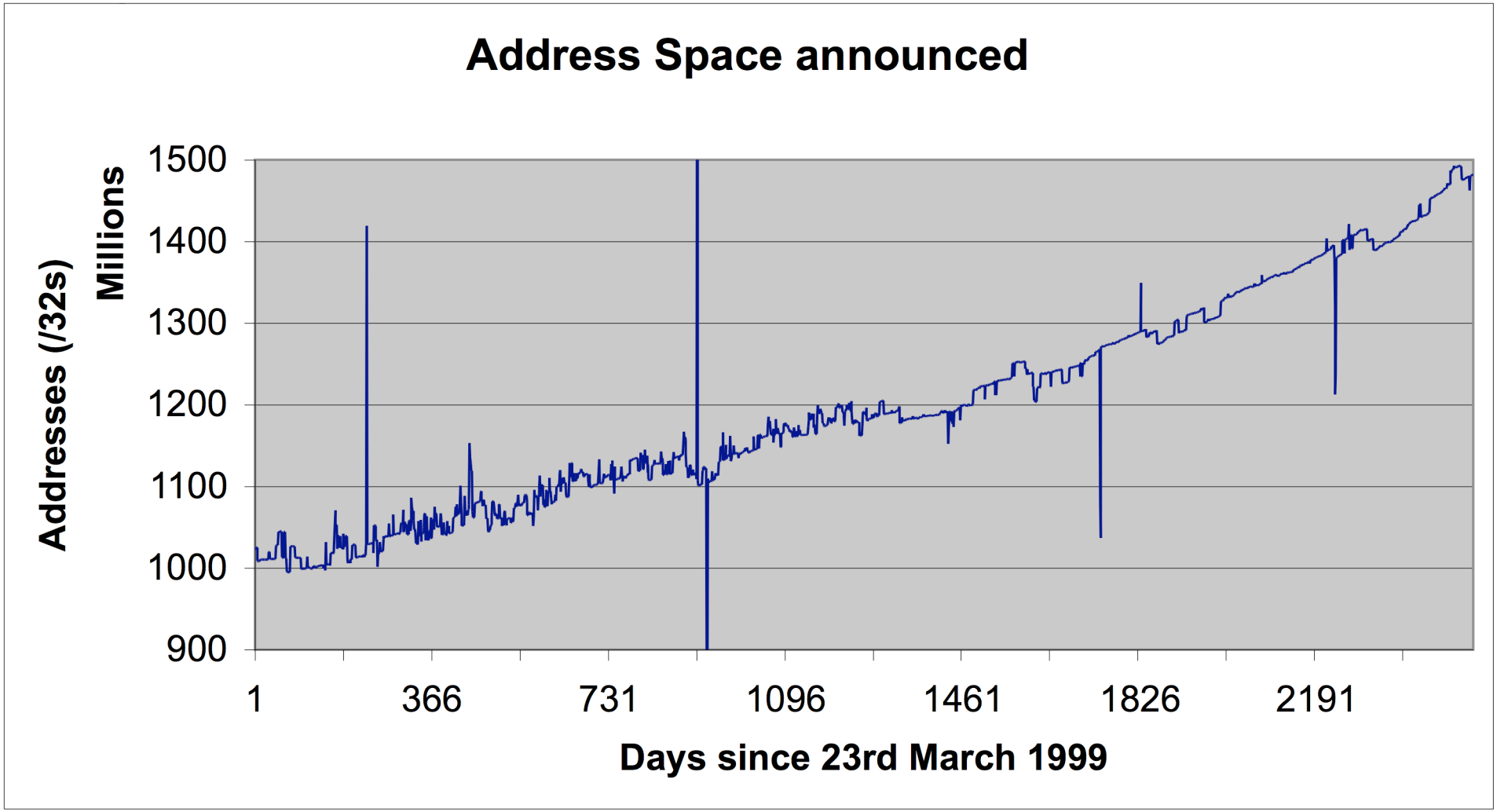

BGP Routing Table
Prefixes
200000
175000
150000
125000
100000
75000
50000
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999

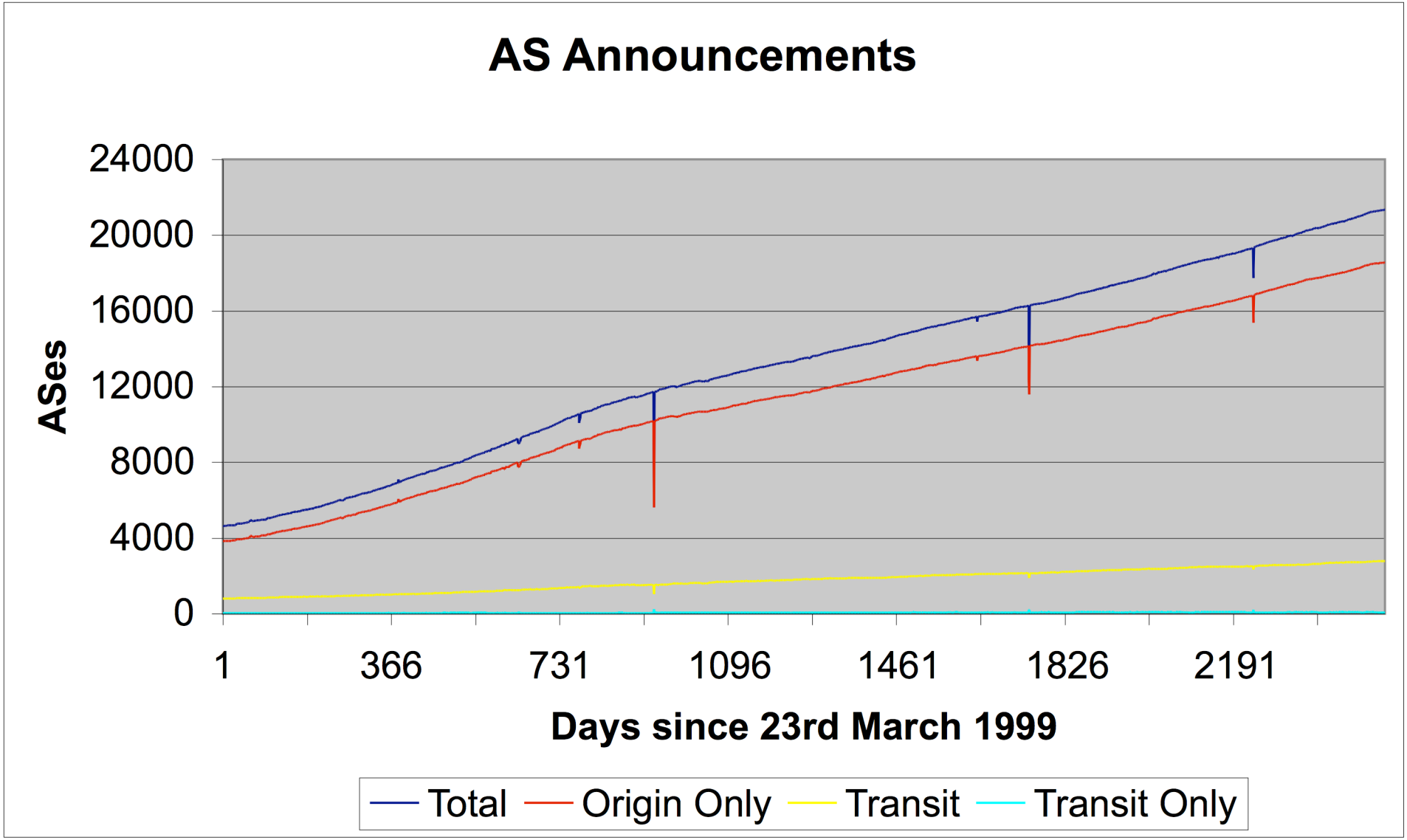

AS Growth
24000
20000
16000
12000
8000
4000
ASNs
Growth slowed down
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999

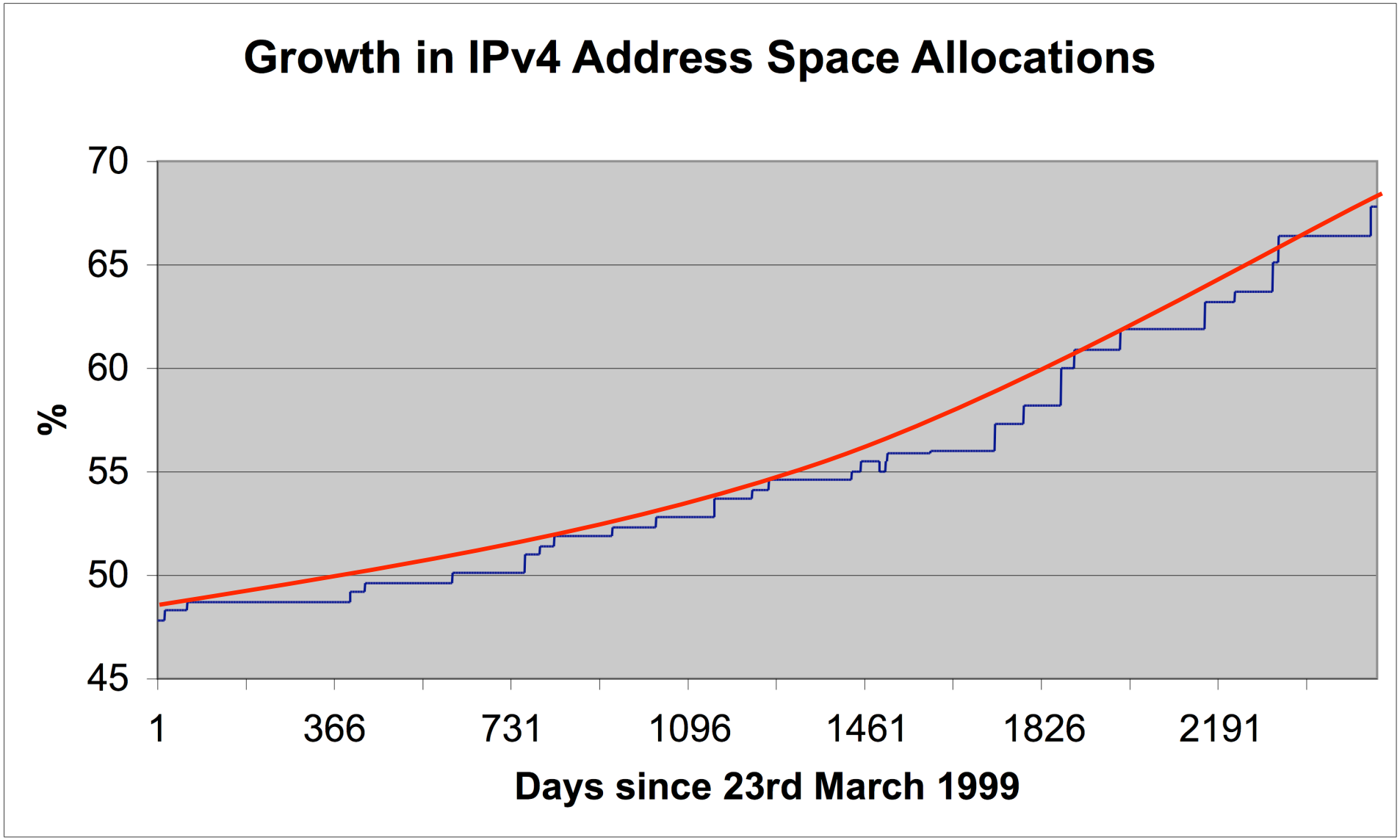

Max Aggregation vs Unique Prefixes
Prefixes
180000
160000
140000
120000
100000
80000
60000
40000
20000
Total Prefixes
Max Aggregation
Unique Prefixes
8 Mar 2001
203.0/10 withdrawn
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999

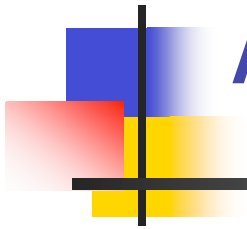

Prefixes sizes announced
Prefixes
16000
14000
12000
10000
8000
6000
4000
2000
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999
/19s
/20s
/21s
/22s
/23s


/24s announced
Prefixes
200000
175000
150000
125000
100000
75000
50000
25000
Total announcements
/24s
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999


Address Space announced
Addresses (/32s)
Millions
1500
1400
1300
1200
1100
1000
900
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999


AS Announcements
ASes
24000
20000
16000
12000
8000
4000
0
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999
Total
Origin Only
Transit
Transit Only


Growth in IPv4 Address Space Allocations
70
65
60
55
50
45
%
1
366
731
1096
1461
1826
2191
Days since 23rd March 1999



Internet Routing Table Analysis Update

Questions?