



Internet Routing Table Analysis Update

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SANOG 3

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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 reporting report started early 1999:
 - Routing table size
 - CIDR-Report style reporting on a per-RIR basis
 - ...and many other interesting features



Recent Changes

- Added LACNIC to report
 - Allocations from 200/7 address space
 - Allocations from AS blocks 26592 – 26623 and 27648 – 28671
- Added AfriNIC emerging RIR to report
 - Allocations from 196/8 address space



- | | |
|--|--|
|  APNIC |  ARIN |
|  RIPE NCC |  LACNIC |

Routing Report 20 January 2004

BGP routing table entries examined	131659
Prefixes after maximum aggregation	80992
Unique aggregates announced to Internet	63497
Total ASes present in the Internet Routing Table	16481
Origin-only ASes present in the Internet Routing Table	14310
Origin ASes announcing only one prefix	6590
Transit ASes present in the Internet Routing Table	2171
Transit-only ASes present in the Internet Routing Table	75
Average AS path length visible in the Internet Routing Table	4.8
Max AS path length visible	30
Illegal AS announcements present in the Routing Table	7
Non-routable prefixes present in the Routing Table	0
Prefixes being announced from unallocated address space	14
Number of addresses announced to Internet	1279777380
Equivalent to 76 /8s, 71 /16s and 218 /24s	
Percentage of available address space announced	34.5
Percentage of allocated address space announced	59.3
Percentage of available address space allocated	58.2
Total number of prefixes smaller than registry allocations	58068

APNIC Region

Prefixes being announced by APNIC Region ASes	24333
Total APNIC prefixes after maximum aggregation	13047
Prefixes being announced from the APNIC address blocks	22807
Unique aggregates announced from the APNIC address blocks	12904
APNIC Region origin ASes present in the Internet Routing Table	1972
APNIC Region origin ASes announcing only one prefix	587
APNIC Region transit ASes present in the Internet Routing Table	311
Average APNIC Region AS path length visible	4.9
Max APNIC Region AS path length visible	15
Number of APNIC addresses announced to Internet	134443904
Equivalent to 8 /8s, 3 /16s and 115 /24s	
Percentage of available APNIC address space announced	72.4

APNIC AS Blocks 4608 - 4864, 7467 - 7722, 9216 - 10239
 17408 - 18431, 23552 - 24575

APNIC Address Blocks 60/7, 202/7, 210/7, 218/7, 220/7 and 222/8

ARIN Region

Prefixes being announced by ARIN Region ASes	77182
Total ARIN prefixes after maximum aggregation	47899
Prefixes being announced from the ARIN address blocks	59744
Unique aggregates announced from the ARIN address blocks	20824
ARIN Region origin ASes present in the Internet Routing Table	8864
ARIN Region origin ASes announcing only one prefix	3120
ARIN Region transit ASes present in the Internet Routing Table	848
Average ARIN Region AS path length visible	4.6
Max ARIN Region AS path length visible	16
Number of ARIN addresses announced to Internet	214976672
Equivalent to 12 /8s, 208 /16s and 72 /24s	
Percentage of available ARIN address space announced	71.2

ARIN AS Blocks	1 - 1876, 1902 - 2042, 2044 - 2046, 2048 - 2106
	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, 29695 - 30719
	31744 - 32767
ARIN Address Blocks	24/8, 63/8, 64/6, 68/7, 70/8, 198/7, 204/6, 208/7
	and 216/8

RIPE NCC Region

Prefixes being announced by RIPE Region ASes	23560
Total RIPE prefixes after maximum aggregation	17160
Prefixes being announced from the RIPE address blocks	20405
Unique aggregates announced from the RIPE address blocks	13535
RIPE Region origin ASes present in the Internet Routing Table	5112
RIPE Region origin ASes announcing only one prefix	2750
RIPE Region transit ASes present in the Internet Routing Table	890
Average RIPE Region AS path length visible	5.5
Max RIPE Region AS path length visible	30
Number of RIPE addresses announced to Internet	149232000
Equivalent to 8 /8s, 229 /16s and 25 /24s	
Percentage of available RIPE address space announced	68.4

RIPE AS Blocks	1877 - 1901, 2043, 2047, 2107 - 2136, 2585 - 2614 2773 - 2822, 2830 - 2879, 3154 - 3353, 5377 - 5631 6656 - 6911, 8192 - 9215, 12288 - 13311, 15360 - 16383, 20480 - 21503, 24576 - 25599, 28672 - 29695, 30720 - 31743
RIPE Address Blocks	62/8, 80/6, 84/8, 188/8, 193/8, 194/7, 212/7 and 217/8

LACNIC Region

Prefixes being announced by LACNIC Region ASes	5429
Total LACNIC prefixes after maximum aggregation	2210
Prefixes being announced from the LACNIC address blocks	5005
Unique aggregates announced from the LACNIC address blocks	3137
LACNIC Region origin ASes present in the Internet Routing Table	367
LACNIC Region origin ASes announcing only one prefix	106
LACNIC Region transit ASes present in the Internet Routing Table	71
Average LACNIC Region AS path length visible	5.2
Max LACNIC Region AS path length visible	13
Number of LACNIC addresses announced to Internet	13962752
Equivalent to 0 /8s, 213 /16s and 14 /24s	
Percentage of available LACNIC address space announced	41.6

LACNIC AS Blocks 26592 - 26623, 27648 - 28671

LACNIC Address Blocks 200/7

"Emerging Afrinic" Region

Prefixes being announced by AfrinIC Region ASes	1150
Total AfrinIC prefixes after maximum aggregation	676
Prefixes being announced from the AfrinIC address blocks	736
Unique aggregates announced from the AfrinIC address blocks	568
AfrinIC Region origin ASes present in the Internet Routing Table	92
AfrinIC Region origin ASes announcing only one prefix	27
AfrinIC Region transit ASes present in the Internet Routing Table	12
Average AfrinIC Region AS path length visible	5.0
Max AfrinIC Region AS path length visible	16
Number of AfrinIC addresses announced to Internet	1758464
Equivalent to 0 /8s, 26 /16s and 213 /24s	
Percentage of available AfrinIC address space announced	10.5
AfrinIC AS Blocks	<none>
AfrinIC Address Blocks	196/8

Global per AS prefix count summary

ASN	No of nets	/20 equiv	Max Agg	Description
701	1398	8678	968	UUNET Technologies, Inc.
7018	1379	7028	959	AT&T
1239	945	3090	661	Sprint
1221	908	1101	649	Telstra Pty Ltd
6197	774	484	252	BellSouth Network Solutions,
3356	764	10925	609	Level 3 Communications, LLC
209	721	3530	505	Qwest
4134	705	2457	116	Data Communications Bureau
702	688	2074	571	UUNET - Commercial IP service
18566	681	176	8	Covad Communications
4323	675	591	203	Time Warner Communications, I
20115	600	330	336	Charter Communications
6198	546	346	197	BellSouth Network Solutions,
7843	510	551	122	Adelphia Corp.
852	505	1124	401	Telus Advanced Communications
7066	503	207	271	Virginia Polytechnic Institut
7132	454	7418	312	Southwestern Bell Internet Se
2386	422	544	223	AT&T Data Communications Serv
19029	402	171	258	New Edge Networks
690	398	58	268	Merit Network

Global Aggregation Savings Summary

ASN	No of Nets	Net Savings	Description
18566	681	673	Covad Communications
4134	705	589	Data Communications Bureau
6197	774	522	BellSouth Network Solutions,
4323	675	472	Time Warner Communications, I
7018	1379	420	AT&T
7843	510	388	Adelphia Corp.
27364	378	355	Armstrong Cable Services
6198	546	349	BellSouth Network Solutions,
22909	328	311	Comcast Cable Corporation
5668	321	305	Century Telephone
22773	331	301	Cox Communications, Inc. Atla
4355	391	290	EarthLink, Inc.
6140	353	287	ImpSat
1239	945	284	Sprint
9583	292	281	Satyam Infoway Ltd.,
376	383	269	Reseau Interordinateurs Scien
9443	344	265	Primus Telecommunications
20115	600	264	Charter Communications
1221	908	259	Telstra Pty Ltd
17676	295	257	XTAGE CORPORATION

List of Illegal AS's

Bad AS	Designation	Network	Transit AS	Description
64512	PRIVATE	131.95.1.240/28	16430	University of Southe
64198	RESERVED	192.107.195.0/24	22767	NASA Earth Science D
1877	UNALLOCATED	192.108.199.0/24	1876	Southern Methodist U
64198	RESERVED	198.10.49.0/24	22767	NASA Earth Science D
64512	PRIVATE	204.70.1.0/24	3561	Cable & Wireless USA

- Note NASA announcing reserved ASNs
- 1877 has come and gone from the Internet since this report started!

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:19	/9:4	/10:6	/11:15	/12:57
/13:105	/14:282	/15:497	/16:7548	/17:1852	/18:3440
/19:8904	/20:9346	/21:6699	/22:9422	/23:10992	/24:71724
/25:192	/26:298	/27:170	/28:28	/29:5	/30:43
/31:0	/32:11				

January 2004 ↑

February 2003 ↓

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:18	/9:3	/10:8	/11:12	/12:46
/13:92	/14:239	/15:446	/16:7344	/17:1594	/18:2893
/19:8154	/20:8067	/21:5785	/22:8758	/23:10493	/24:66729
/25:168	/26:174	/27:101	/28:97	/29:61	/30:161
/31:2	/32:97				

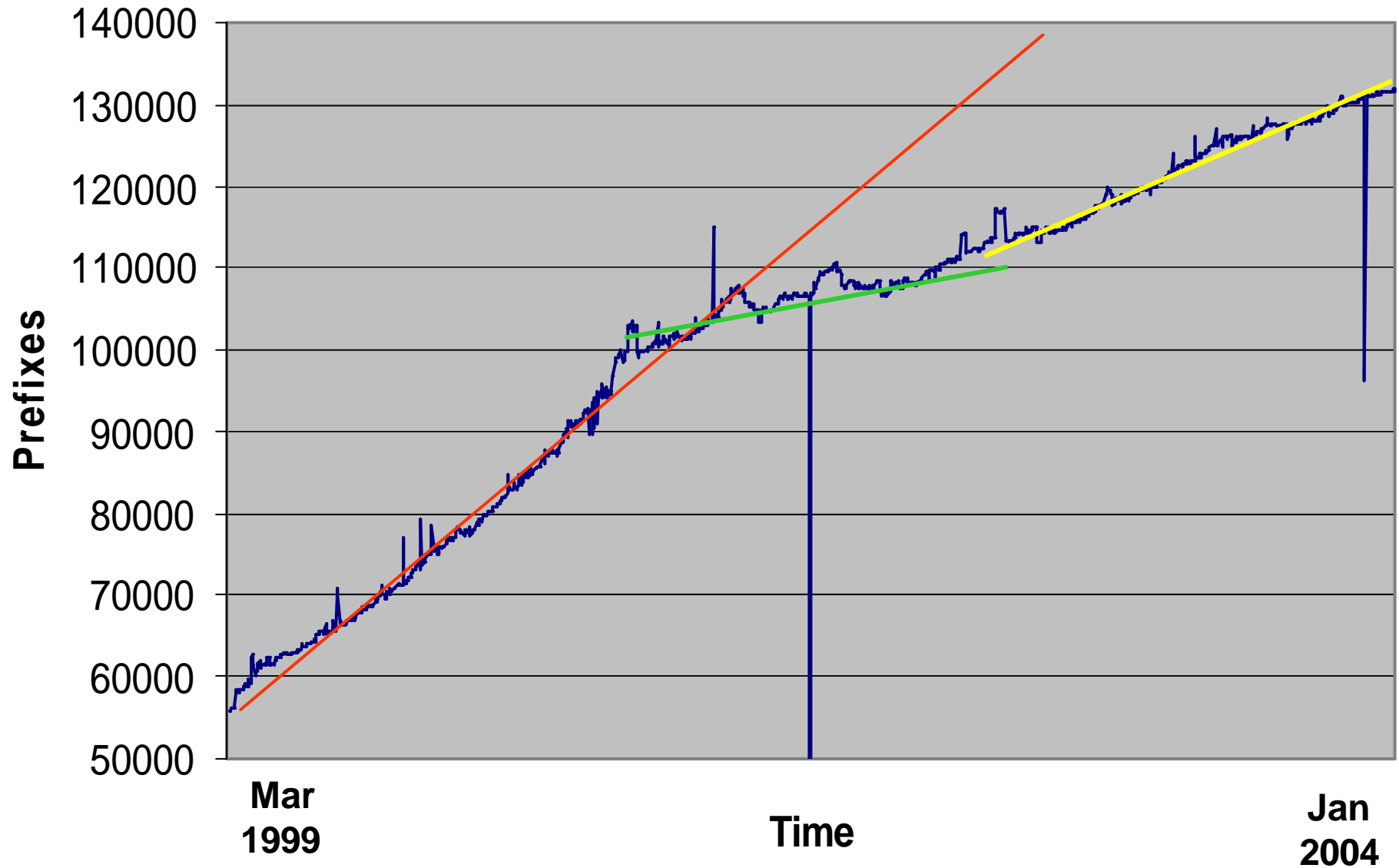
Advertised IANA Reserved Addresses

Network	Origin AS	Description
132.0.0.0/10	568	DISO-UNRRA
137.0.0.0/13	568	DISO-UNRRA
158.0.0.0/13	568	DISO-UNRRA
192.43.230.0/24	4738	South Australian Academic Res
192.44.0.0/19	702	UUNET - Commercial IP service
192.83.16.0/20	5515	Sonera Solution Autonomous Sy
192.83.32.0/19	5515	Sonera Solution Autonomous Sy
192.83.96.0/22	5515	Sonera Solution Autonomous Sy
192.83.100.0/24	5515	Sonera Solution Autonomous Sy
192.84.205.0/24	719	LANLINK autonomous system
192.119.135.0/24	270	NASA
192.135.50.0/24	7018	AT&T
192.136.79.0/24	719	LANLINK autonomous system
192.172.0.0/19	568	DISO-UNRRA

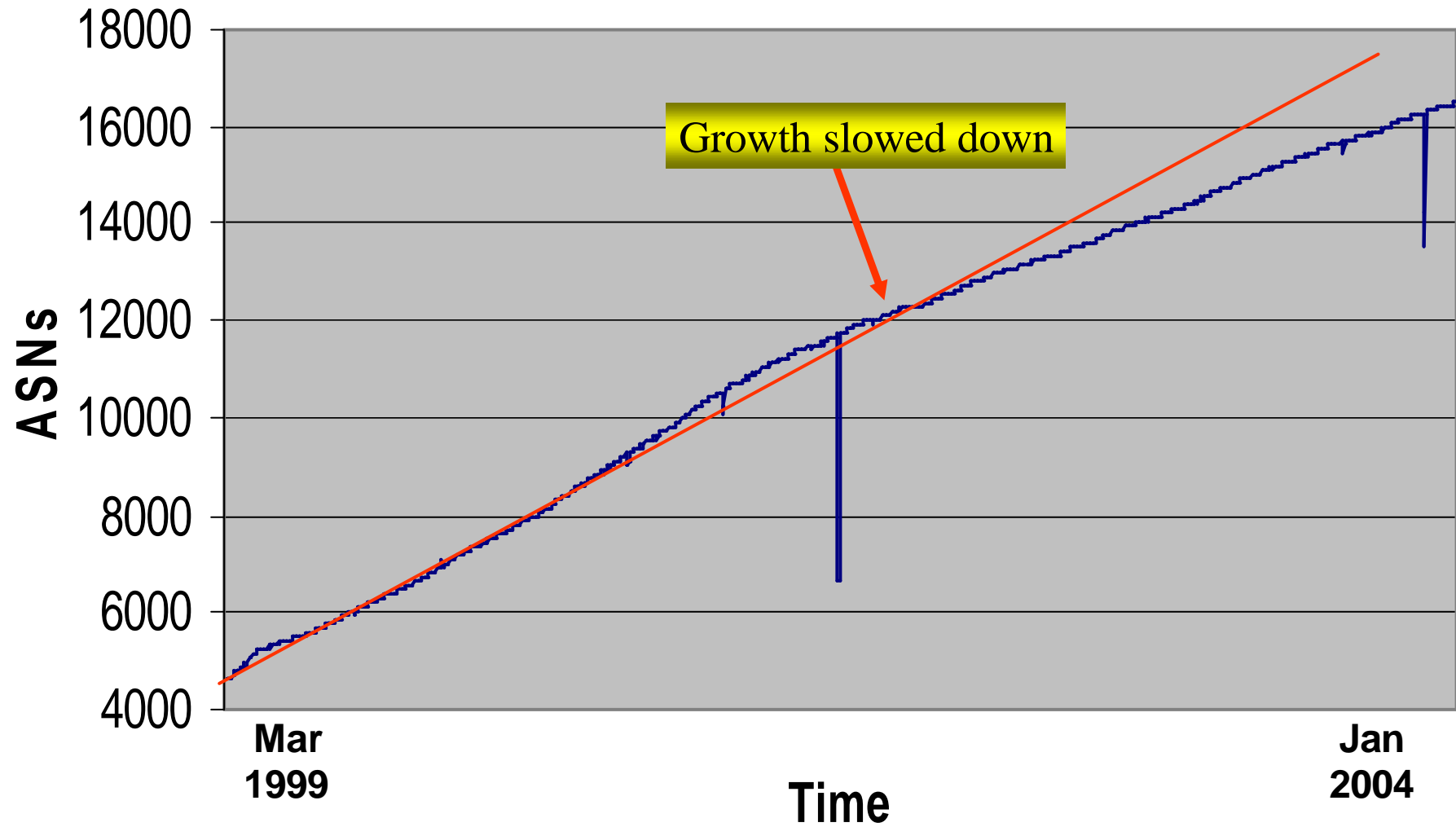
Prefixes Smaller than Registry Allocations

ASN	No of nets	Total ann.	Description
18566	665	681	Covad Communications
6197	619	774	BellSouth Network Solutions,
7018	505	1379	AT&T
701	420	1398	UUNET Technologies, Inc.
702	420	688	UUNET - Commercial IP service
6198	399	546	BellSouth Network Solutions,
7066	397	503	Virginia Polytechnic Institut
3356	396	764	Level 3 Communications, LLC
20115	380	600	Charter Communications
27364	372	378	Armstrong Cable Services
690	361	398	Merit Network
1239	331	945	Sprint
5668	284	321	Century Telephone
19029	262	402	New Edge Networks
25844	244	244	Skadden, Arps, Slate, Meagher
3320	228	281	Deutsche Telekom AG
4766	225	396	Korea Internet Exchange for "
6386	220	246	bellsouth.net, inc.
6517	216	240	Yipes Communications, Inc.
4355	215	391	EarthLink, Inc.

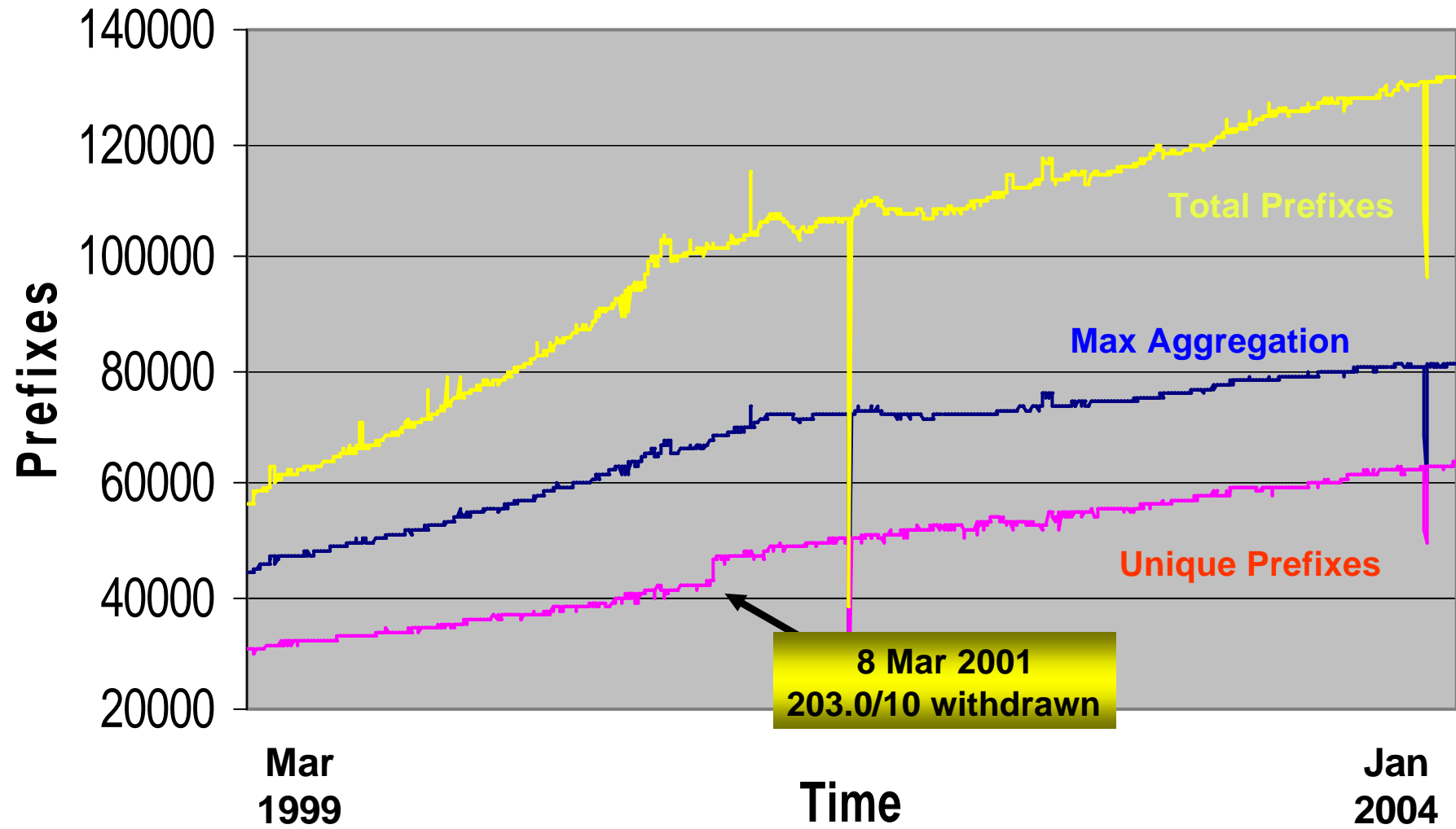
BGP Routing Table



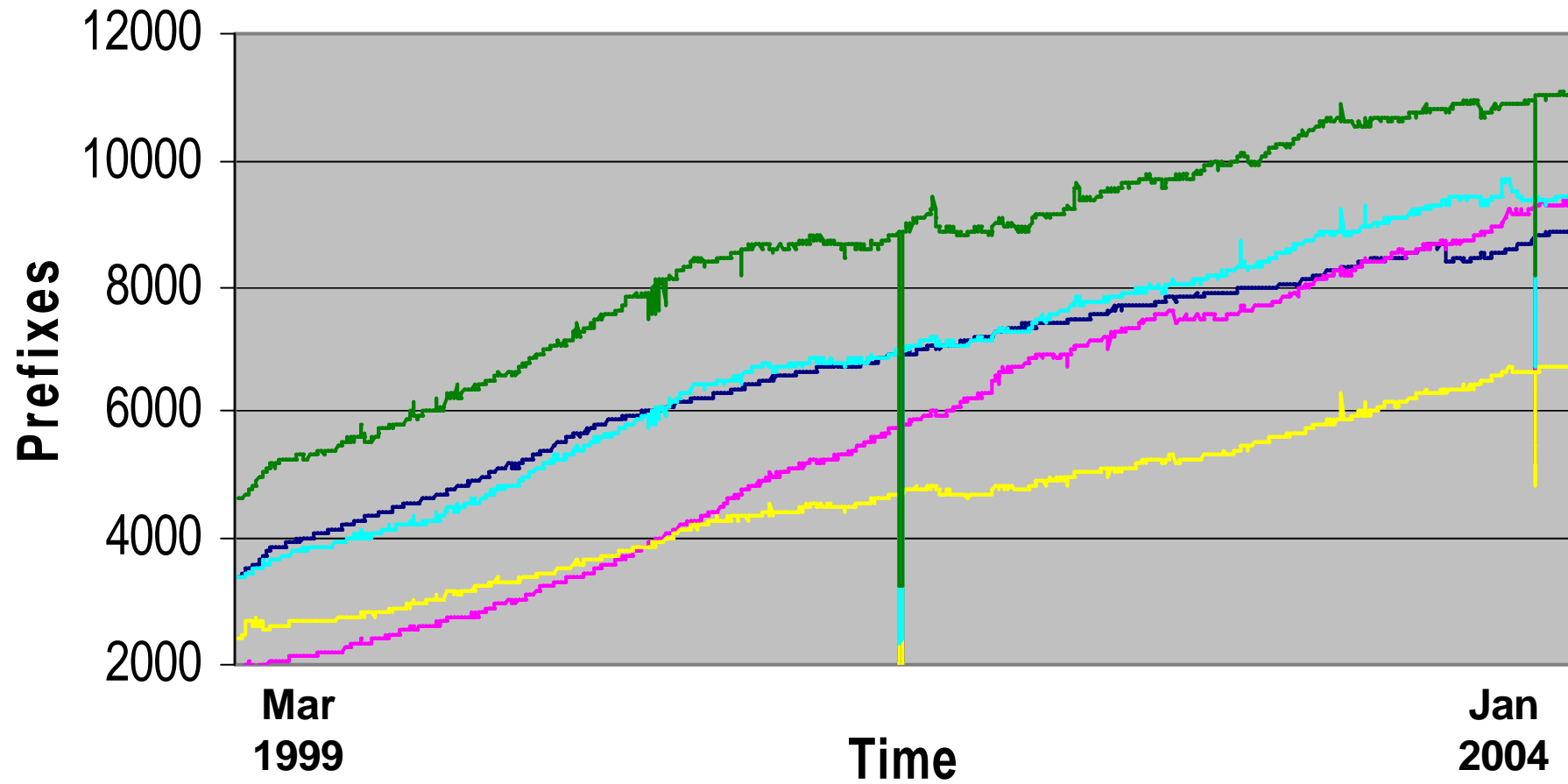
AS Growth



Max Aggregation vs Unique Prefixes

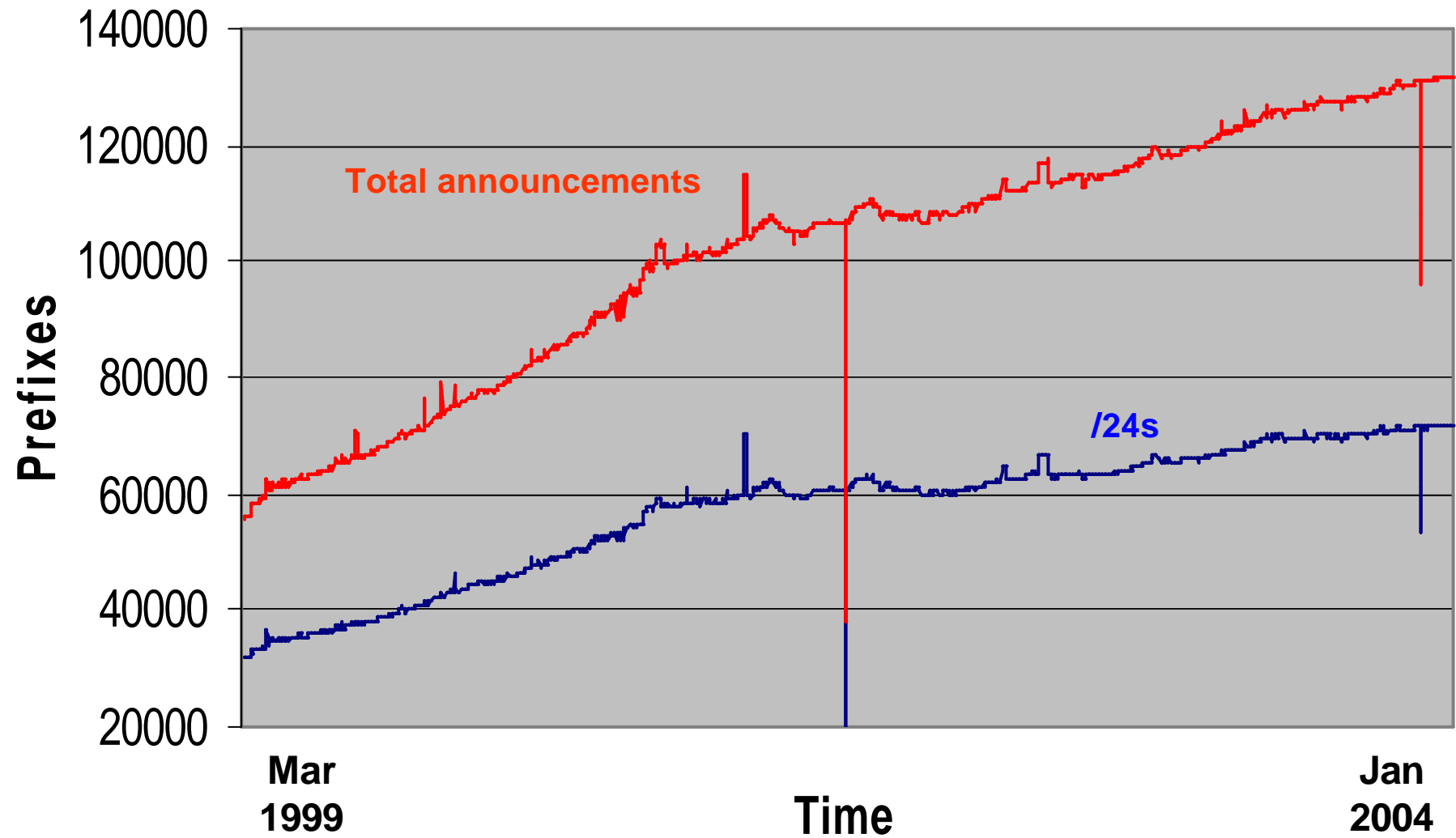


Prefixes sizes announced

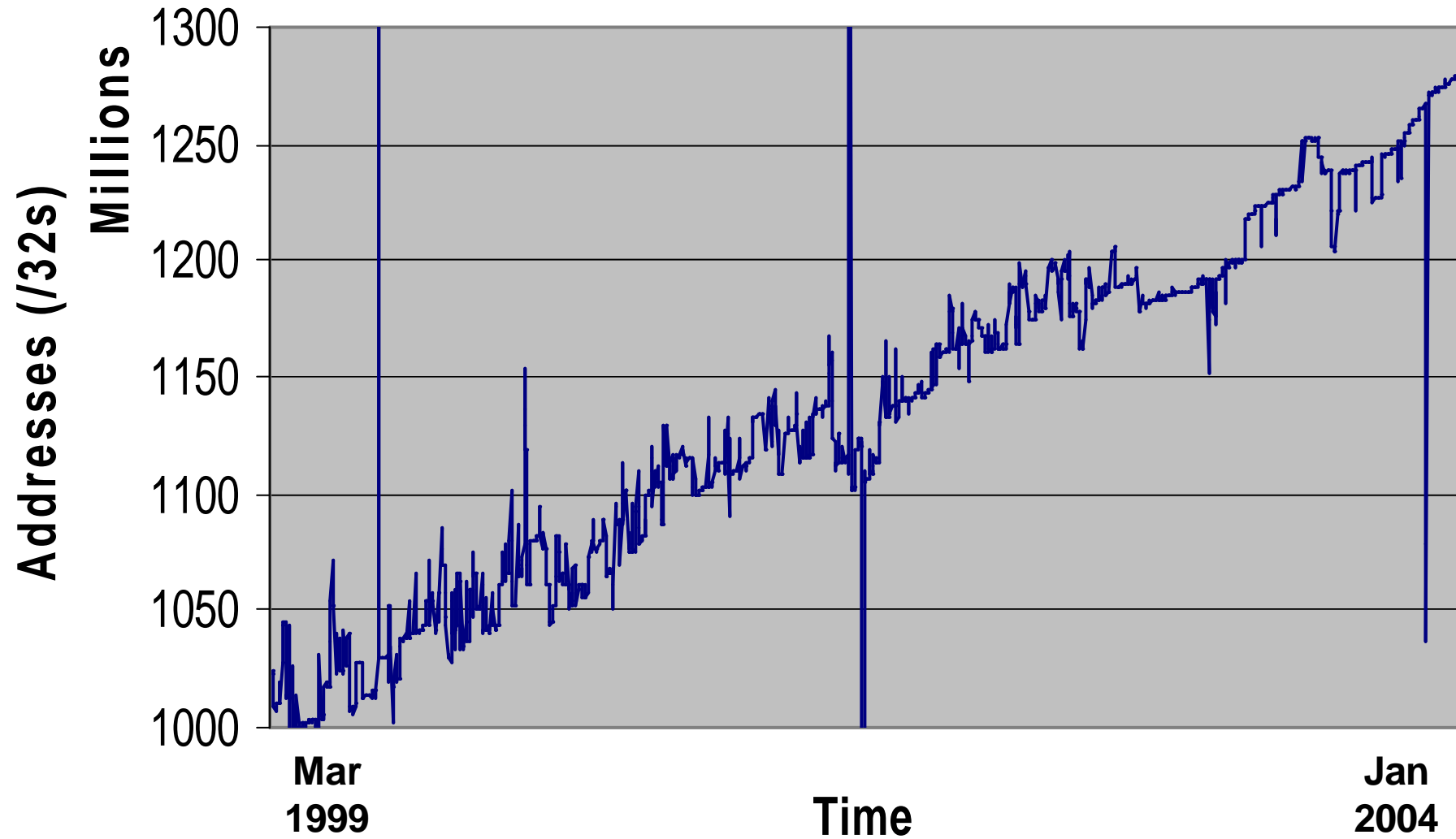


— /19s — /20s — /21s — /22s — /23s

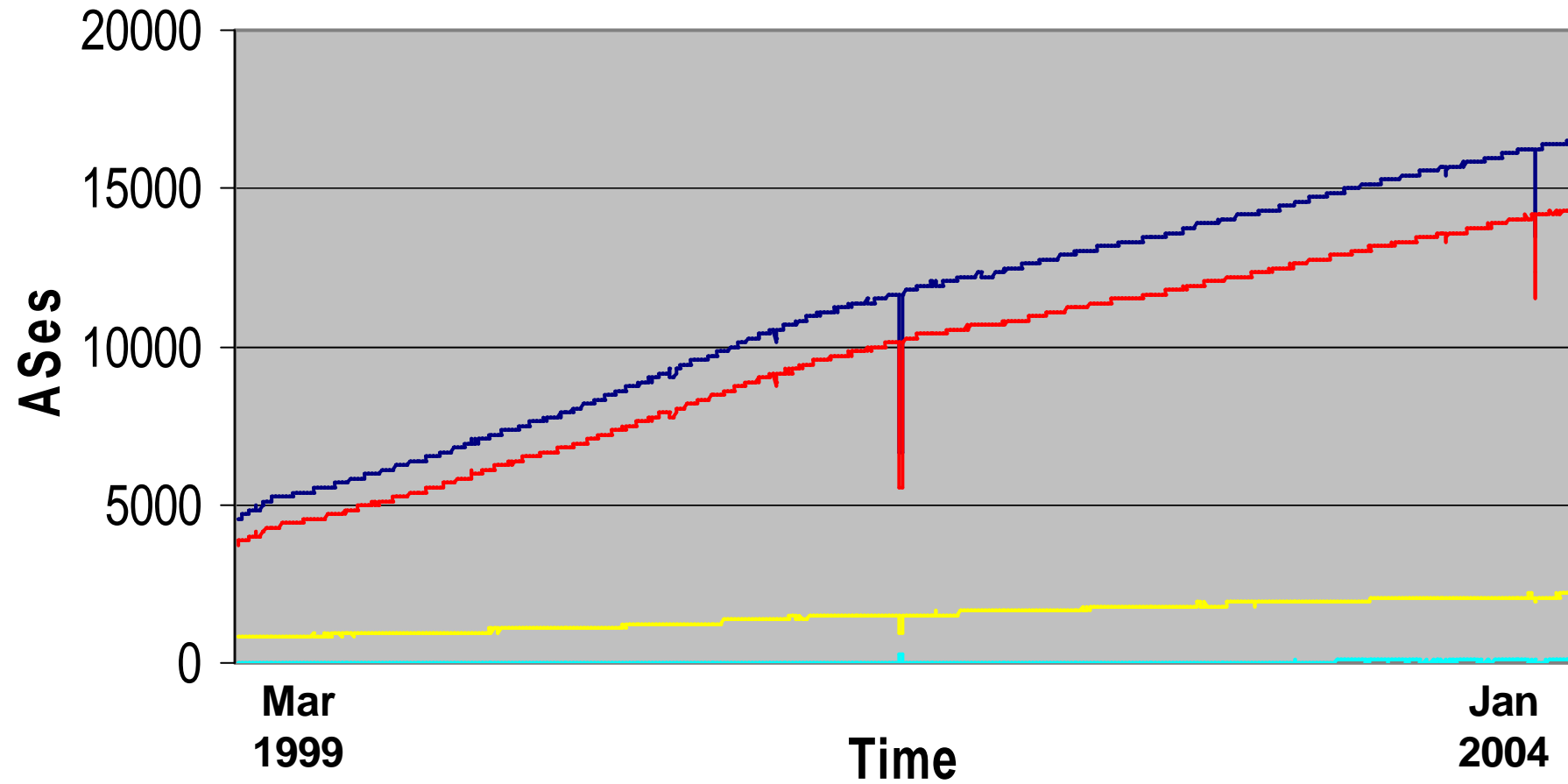
/24s announced



Address Space announced



AS Announcements



— Total — Origin Only — Transit — Transit Only

Internet Routing Table Analysis Update



Questions?