

Internet Routing Table Analysis Update



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

Routing Report 12 February 2005

| | |
|---|------------|
| BGP routing table entries examined: | 155599 |
| Prefixes after maximum aggregation: | 90769 |
| Unique aggregates announced to Internet: | 74551 |
| Total ASes present in the Internet Routing Table: | 18969 |
| Origin-only ASes present in the Internet Routing Table: | 16484 |
| Origin ASes announcing only one prefix: | 7738 |
| Transit ASes present in the Internet Routing Table: | 2485 |
| Transit-only ASes present in the Internet Routing Table: | 80 |
| Average AS path length visible in the Internet Routing Table: | 4.5 |
| Max AS path length visible: | 22 |
| Prefixes from unregistered ASNs in the Routing Table: | 18 |
| Special use prefixes present in the Routing Table: | 0 |
| Prefixes being announced from unallocated address space: | 22 |
| Number of addresses announced to Internet: | 1374625740 |
| Equivalent to 81 /8s, 239 /16s and 31 /24s | |
| Percentage of available address space announced: | 37.1 |
| Percentage of allocated address space announced: | 58.6 |
| Percentage of available address space allocated: | 63.2 |
| Total number of prefixes smaller than registry allocations: | 72464 |

APNIC Region

| | |
|--|-----------|
| Prefixes being announced by APNIC Region ASes: | 30978 |
| Total APNIC prefixes after maximum aggregation: | 14936 |
| Prefixes being announced from the APNIC address blocks: | 29027 |
| Unique aggregates announced from the APNIC address blocks: | 14666 |
| APNIC Region origin ASes present in the Internet Routing Table: | 2204 |
| APNIC Region origin ASes announcing only one prefix: | 648 |
| APNIC Region transit ASes present in the Internet Routing Table: | 326 |
| Average APNIC Region AS path length visible: | 4.4 |
| Max APNIC Region AS path length visible: | 15 |
| Number of APNIC addresses announced to Internet: | 173936896 |
| Equivalent to 10 /8s, 94 /16s and 17 /24s | |
| Percentage of available APNIC address space announced: | 64.5 |

| | |
|----------------------|---|
| APNIC AS Blocks | 4608-4864, 7467-7722, 9216-10239, 17408-18431 23552-24575 |
| APNIC Address Blocks | 58/7, 60/7, 124/7, 126/8, 202/7, 210/7, 218/7, 220/7 and 222/8 |

ARIN Region

| | |
|---|-----------|
| Prefixes being announced by ARIN Region ASes: | 87104 |
| Total ARIN prefixes after maximum aggregation: | 52392 |
| Prefixes being announced from the ARIN address blocks: | 66324 |
| Unique aggregates announced from the ARIN address blocks: | 24080 |
| ARIN Region origin ASes present in the Internet Routing Table: | 9868 |
| ARIN Region origin ASes announcing only one prefix: | 3594 |
| ARIN Region transit ASes present in the Internet Routing Table: | 957 |
| Average ARIN Region AS path length visible: | 4.3 |
| Max ARIN Region AS path length visible: | 16 |
| Number of ARIN addresses announced to Internet: | 240880896 |
| Equivalent to 14 /8s, 91 /16s and 141 /24s | |
| Percentage of available ARIN address space announced: | 71.8 |

| | |
|---------------------|--|
| 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, 29696-30719, 31744-33791 |
| ARIN Address Blocks | 24/8, 63/8, 64/6, 68/7, 70/7, 72/8, 198/7, 204/6, 208/7 and 216/8 |

RIPE NCC Region

| | |
|---|-----------|
| Prefixes being announced by RIPE Region ASes: | 29389 |
| Total RIPE prefixes after maximum aggregation: | 20318 |
| Prefixes being announced from the RIPE address blocks: | 26341 |
| Unique aggregates announced from the RIPE address blocks: | 17498 |
| RIPE Region origin ASes present in the Internet Routing Table: | 6307 |
| RIPE Region origin ASes announcing only one prefix: | 3344 |
| RIPE Region transit ASes present in the Internet Routing Table: | 1074 |
| Average RIPE Region AS path length visible: | 5.1 |
| Max RIPE Region AS path length visible: | 22 |
| Number of RIPE addresses announced to Internet: | 187806784 |
| Equivalent to 11 /8s, 49 /16s and 180 /24s | |
| Percentage of available RIPE address space announced: | 65.8 |

| | |
|---------------------|--|
| 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, 33792-34815 |
| RIPE Address Blocks | 62/8, 80/5, 88/8, 188/8, 193/8, 194/7, 212/7 and 217/8 |

LACNIC Region

| | |
|---|----------|
| Prefixes being announced by LACNIC Region ASes: | 6790 |
| Total LACNIC prefixes after maximum aggregation: | 2418 |
| Prefixes being announced from the LACNIC address blocks: | 6684 |
| Unique aggregates announced from the LACNIC address blocks: | 3972 |
| LACNIC Region origin ASes present in the Internet Routing Table: | 420 |
| LACNIC Region origin ASes announcing only one prefix: | 128 |
| LACNIC Region transit ASes present in the Internet Routing Table: | 82 |
| Average LACNIC Region AS path length visible: | 5.0 |
| Max LACNIC Region AS path length visible: | 16 |
| Number of LACNIC addresses announced to Internet: | 17393664 |
| Equivalent to 1 /8s, 9 /16s and 104 /24s | |
| Percentage of available LACNIC address space announced: | 51.8 |

LACNIC AS Blocks 26592-26623, 27648-28671

LACNIC Address Blocks 200/7

"Emerging Afrinic" Region

| | |
|--|---------|
| Prefixes being announced by AfrinIC Region ASes: | 1320 |
| Total AfrinIC prefixes after maximum aggregation: | 705 |
| Prefixes being announced from the AfrinIC address blocks: | 890 |
| Unique aggregates announced from the AfrinIC address blocks: | 714 |
| AfrinIC Region origin ASes present in the Internet Routing Table: | 95 |
| AfrinIC Region origin ASes announcing only one prefix: | 24 |
| AfrinIC Region transit ASes present in the Internet Routing Table: | 13 |
| Average AfrinIC Region AS path length visible: | 4.5 |
| Max AfrinIC Region AS path length visible: | 12 |
| Number of AfrinIC addresses announced to Internet: | 2171136 |
| Equivalent to 0 /8s, 33 /16s and 33 /24s | |
| Percentage of available AfrinIC address space announced: | 12.9 |

AfrinIC AS Blocks <none>

AfrinIC Address Blocks 196/8

Global per AS prefix count summary

| ASN | No of nets | /20 equiv | Max Agg | Description |
|-------|------------|-----------|---------|-------------------------------|
| 7018 | 1459 | 6602 | 974 | AT&T WorldNet Services |
| 721 | 1154 | 21851 | 317 | DLA Systems Automation Center |
| 701 | 1034 | 8309 | 881 | UUNET Technologies, Inc. |
| 4323 | 1032 | 672 | 221 | Time Warner Telecom |
| 1239 | 951 | 2880 | 627 | Sprint |
| 4134 | 883 | 4688 | 172 | Data Communications Bureau |
| 6197 | 860 | 378 | 402 | BellSouth Network Solutions, |
| 2386 | 827 | 511 | 608 | AT&T Data Communications Serv |
| 1221 | 786 | 1184 | 561 | Telstra Pty Ltd |
| 18566 | 770 | 208 | 6 | Covad Communications |
| 209 | 647 | 3467 | 498 | Qwest |
| 702 | 614 | 2020 | 506 | UUNET - Commercial IP service |
| 3356 | 596 | 10868 | 445 | Level 3 Communications, LLC |
| 4766 | 586 | 3414 | 281 | Korea Internet Exchange for " |
| 9583 | 586 | 48 | 11 | Satyam Infoway Ltd., |
| 3561 | 584 | 2370 | 416 | Cable & Wireless USA |
| 20115 | 578 | 481 | 304 | Charter Communications |
| 852 | 525 | 1126 | 399 | Telus Advanced Communications |
| 6478 | 496 | 822 | 97 | AT&T Worldnet Services |
| 3602 | 492 | 120 | 91 | Sprint Canada, Inc. |

Global Aggregation Savings Summary

| ASN | No of Nets | Net Savings | Description |
|-------|------------|-------------|-------------------------------|
| 721 | 1154 | 837 | DLA Systems Automation Center |
| 4323 | 1032 | 811 | Time Warner Telecom |
| 18566 | 770 | 764 | Covad Communications |
| 4134 | 883 | 711 | Data Communications Bureau |
| 9583 | 586 | 575 | Satyam Infoway Ltd., |
| 6197 | 860 | 458 | BellSouth Network Solutions, |
| 27364 | 468 | 450 | Armstrong Cable Services |
| 22773 | 469 | 445 | Cox Communications, Inc. Atla |
| 5668 | 441 | 424 | Century Telephone |
| 3602 | 492 | 401 | Sprint Canada, Inc. |
| 6478 | 496 | 399 | AT&T Worldnet Services |
| 7545 | 426 | 357 | TPG Internet Pty Ltd |
| 4755 | 456 | 355 | Videsh Sanchar Nigam Ltd. Aut |
| 22909 | 418 | 339 | Comcast Cable Corporation |
| 6467 | 365 | 334 | E.Spire Communications, Inc. |
| 17676 | 396 | 332 | XTAGE CORPORATION |
| 1239 | 951 | 324 | Sprint |
| 9929 | 350 | 315 | China Netcom Corp. |
| 4766 | 586 | 305 | Korea Internet Exchange for " |
| 9443 | 371 | 292 | Primus Telecommunications |

List of Unregistered AS's

| Bad AS | Designation | Network | Transit AS | Description |
|--------|-------------|-------------------|------------|----------------------|
| 64826 | PRIVATE | 64.200.250.0/23 | 7911 | Williams Communicati |
| 40439 | UNALLOCATED | 66.194.101.0/24 | 30439 | Memphis Daily News |
| 64513 | PRIVATE | 149.117.96.0/24 | 577 | Bell Advanced Commun |
| 64512 | PRIVATE | 199.213.17.0/25 | 15296 | Netera Alliance Inc. |
| 64512 | PRIVATE | 199.213.17.128/25 | 15296 | Netera Alliance Inc. |
| 64512 | PRIVATE | 199.216.97.0/28 | 15296 | Netera Alliance Inc. |
| 64512 | PRIVATE | 199.216.148.0/28 | 15296 | Netera Alliance Inc. |
| 65004 | PRIVATE | 200.0.113.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.0.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.1.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.2.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.3.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.4.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.5.0/24 | 28477 | Universidad Autonoma |
| 65004 | PRIVATE | 200.4.6.0/24 | 28477 | Universidad Autonoma |
| 65529 | PRIVATE | 216.21.199.0/24 | 14697 | VDot.Net |
| 65529 | PRIVATE | 216.152.237.0/24 | 14697 | VDot.Net |

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 | /11:14 | /12:62 |
| /13:146 | /14:311 | /15:566 | /16:8304 | /17:2405 | /18:4090 |
| /19:10079 | /20:10700 | /21:8446 | /22:11718 | /23:12917 | /24:84952 |
| /25:298 | /26:256 | /27:112 | /28:49 | /29:22 | /30:82 |
| /31:0 | /32:41 | | | | |

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Number of prefixes announced by prefix length

| | | | | | |
|----------|----------|----------|----------|-----------|-----------|
| /1:0 | /2:0 | /3:0 | /4:0 | /5:0 | /6:0 |
| /7:0 | /8:20 | /9:4 | /10:6 | /11:15 | /12:58 |
| /13:105 | /14:284 | /15:502 | /16:7564 | /17:1883 | /18:3482 |
| /19:8932 | /20:9271 | /21:6764 | /22:9559 | /23:11114 | /24:72635 |
| /25:175 | /26:266 | /27:150 | /28:27 | /29:5 | /30:15 |
| /31:0 | /32:10 | | | | |

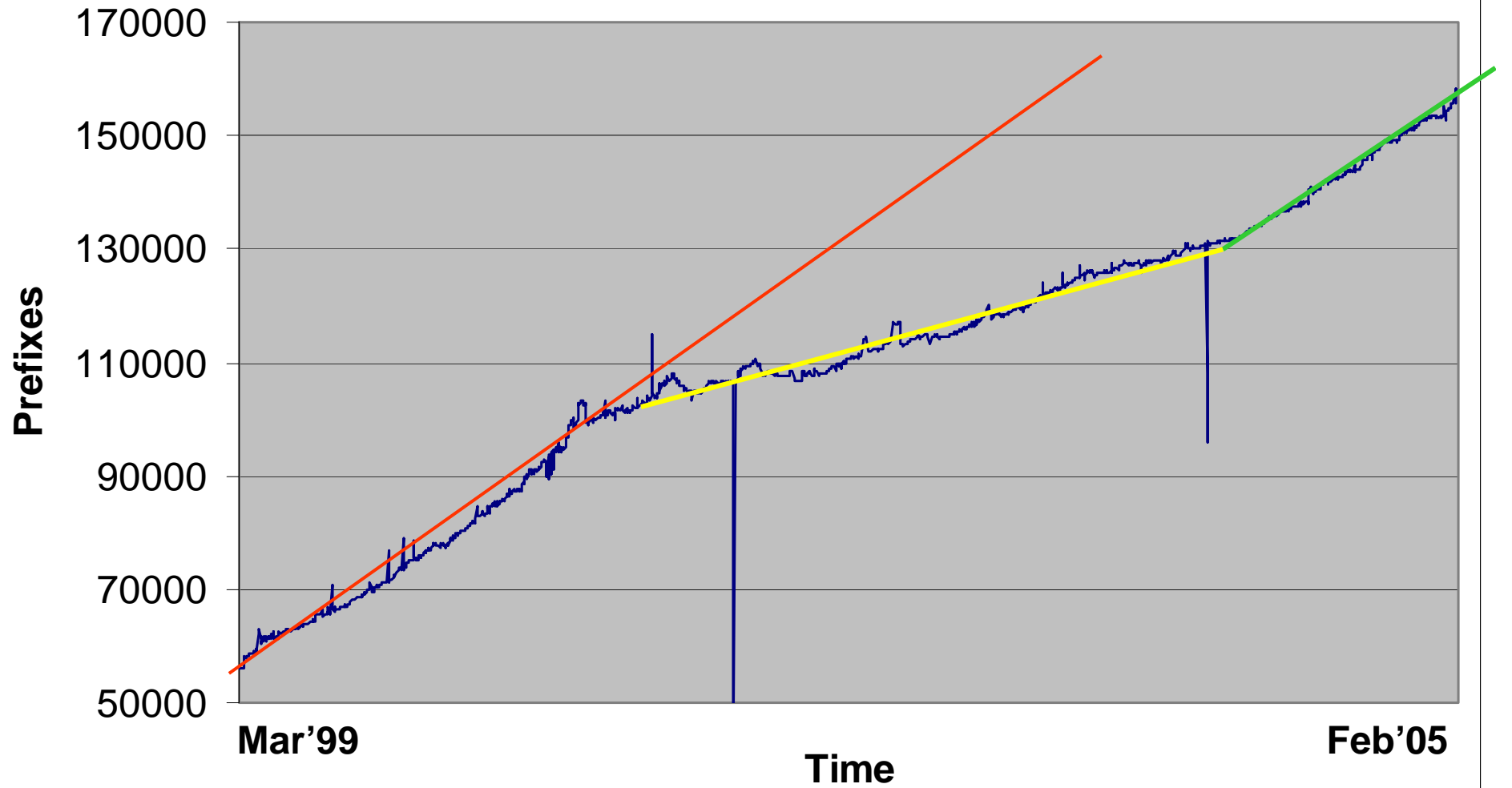
Advertised IANA Reserved Addresses

| 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 |
| 192.44.0.0/24 | 5501 | Fraunhofer Gesellschaft |
| 192.44.0.0/19 | 702 | UUNET - Commercial IP service |
| 192.70.164.0/24 | 25689 | National Research Council of |
| 192.84.205.0/24 | 719 | LANLINK autonomous system |
| 192.119.135.0/24 | 270 | NASA |
| 192.135.50.0/24 | 7018 | AT&T WorldNet Services |
| 192.172.0.0/19 | 721 | DLA Systems Automation Center |
| 192.200.100.0/24 | 7018 | AT&T WorldNet Services |

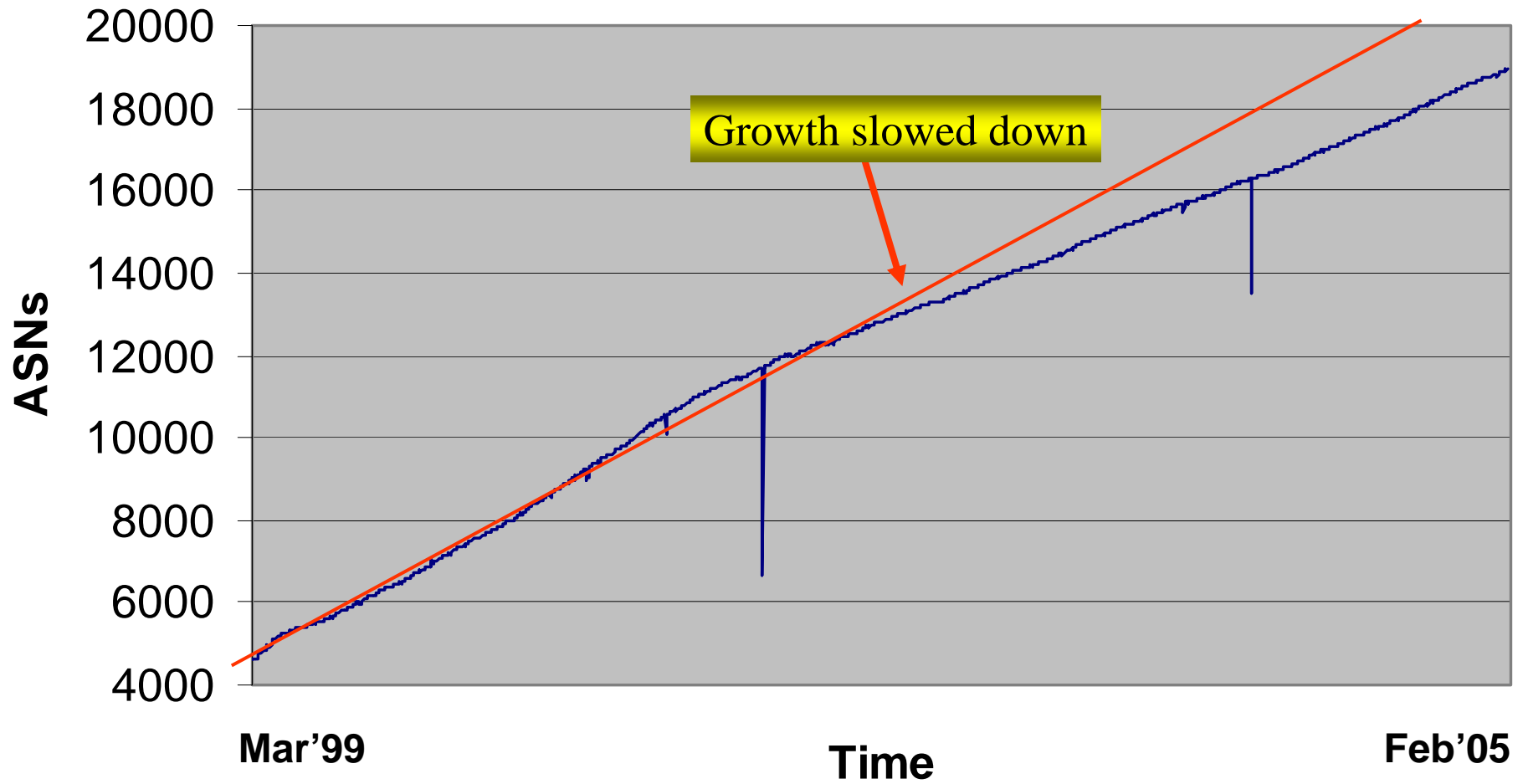
Prefixes Smaller than Registry Allocations

| ASN | No of nets | Total ann. | Description |
|-------|------------|------------|-------------------------------|
| 18566 | 755 | 770 | Covad Communications |
| 6197 | 705 | 860 | BellSouth Network Solutions, |
| 7018 | 630 | 1459 | AT&T WorldNet Services |
| 2386 | 591 | 827 | AT&T Data Communications Serv |
| 4323 | 478 | 1032 | Time Warner Telecom |
| 27364 | 453 | 468 | Armstrong Cable Services |
| 9583 | 412 | 586 | Satyam Infoway Ltd., |
| 4766 | 399 | 586 | Korea Internet Exchange for " |
| 5668 | 376 | 441 | Century Telephone |
| 702 | 373 | 614 | UUNET - Commercial IP service |
| 1239 | 369 | 951 | Sprint |
| 6198 | 331 | 458 | BellSouth Network Solutions, |
| 10036 | 294 | 294 | C&M Communication Co. Ltd. |
| 6517 | 285 | 307 | Yipes Communications, Inc. |
| 6467 | 275 | 365 | E.Spire Communications, Inc. |
| 9929 | 275 | 350 | China Netcom Corp. |
| 11456 | 263 | 310 | Carolina Online, Inc. |
| 13609 | 256 | 305 | Choice One Communications Inc |
| 25844 | 245 | 245 | Skadden, Arps, Slate, Meagher |
| 701 | 244 | 1034 | UUNET Technologies, Inc. |

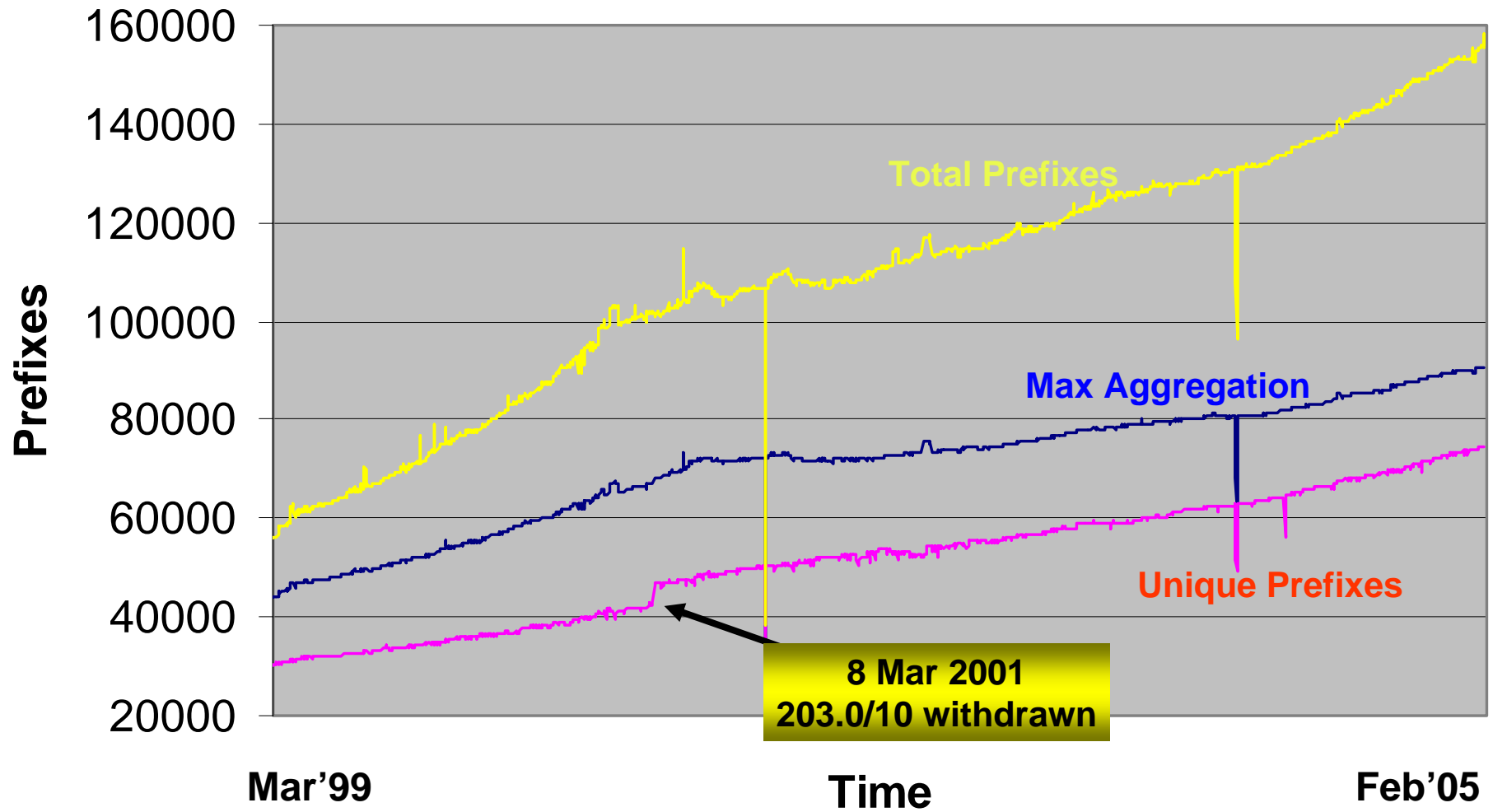
BGP Routing Table



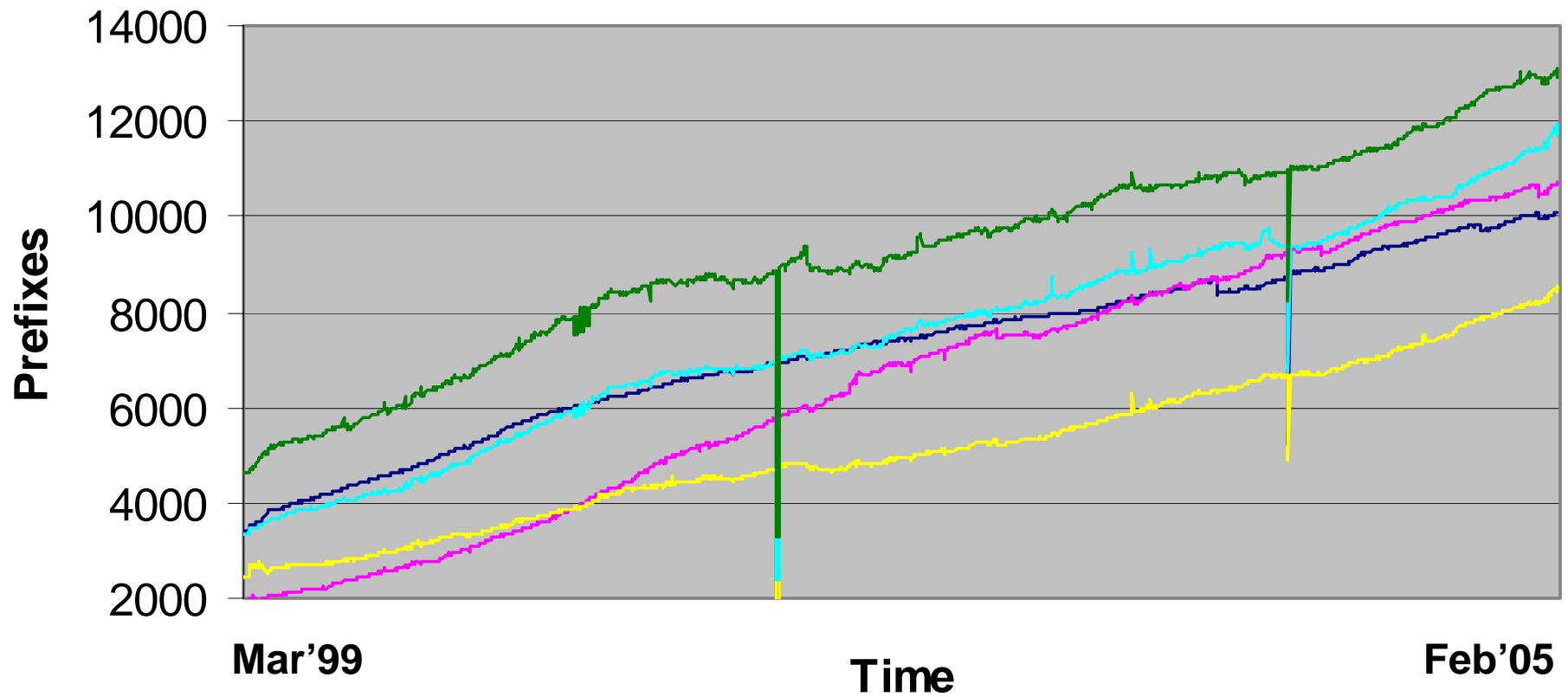
AS Growth



Max Aggregation vs Unique Prefixes

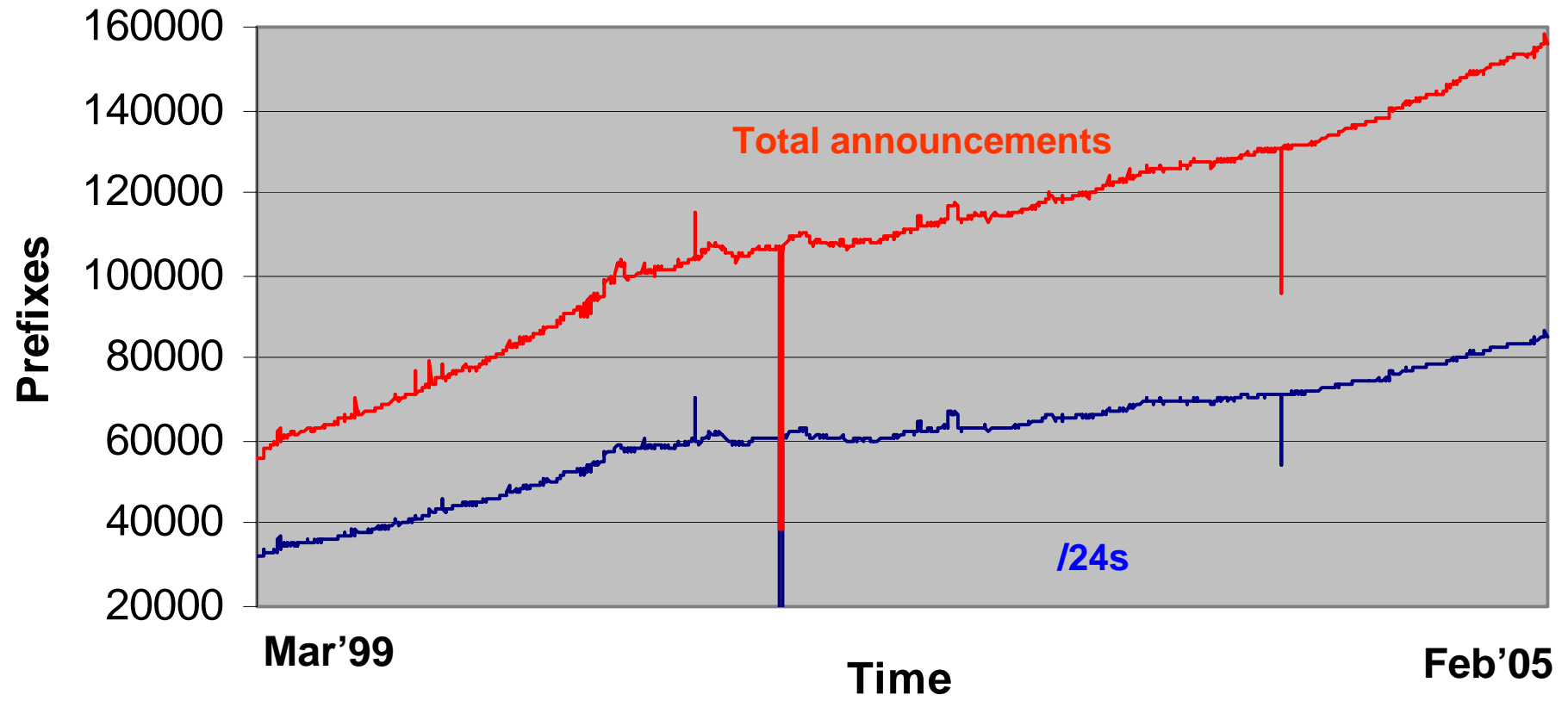


Prefixes sizes announced

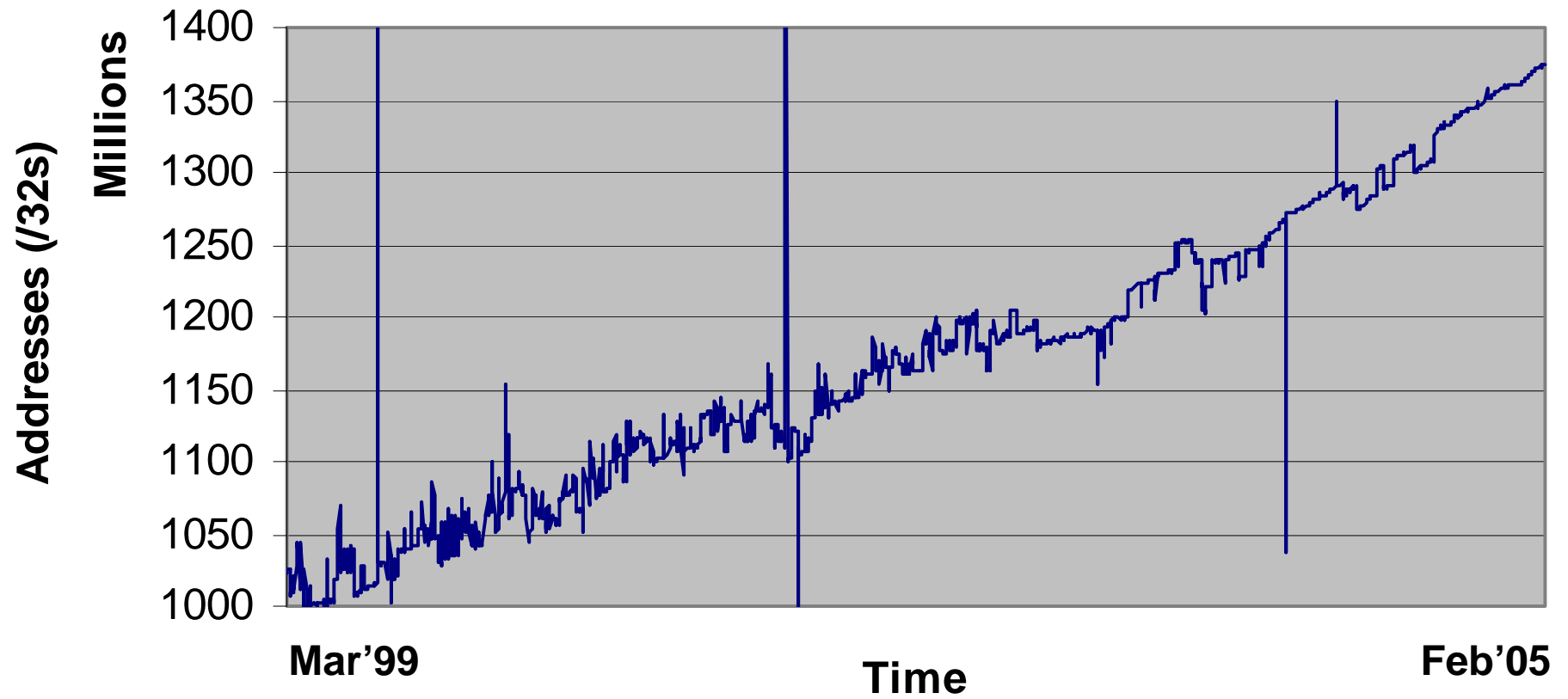


— /19s — /20s — /21s — /22s — /23s

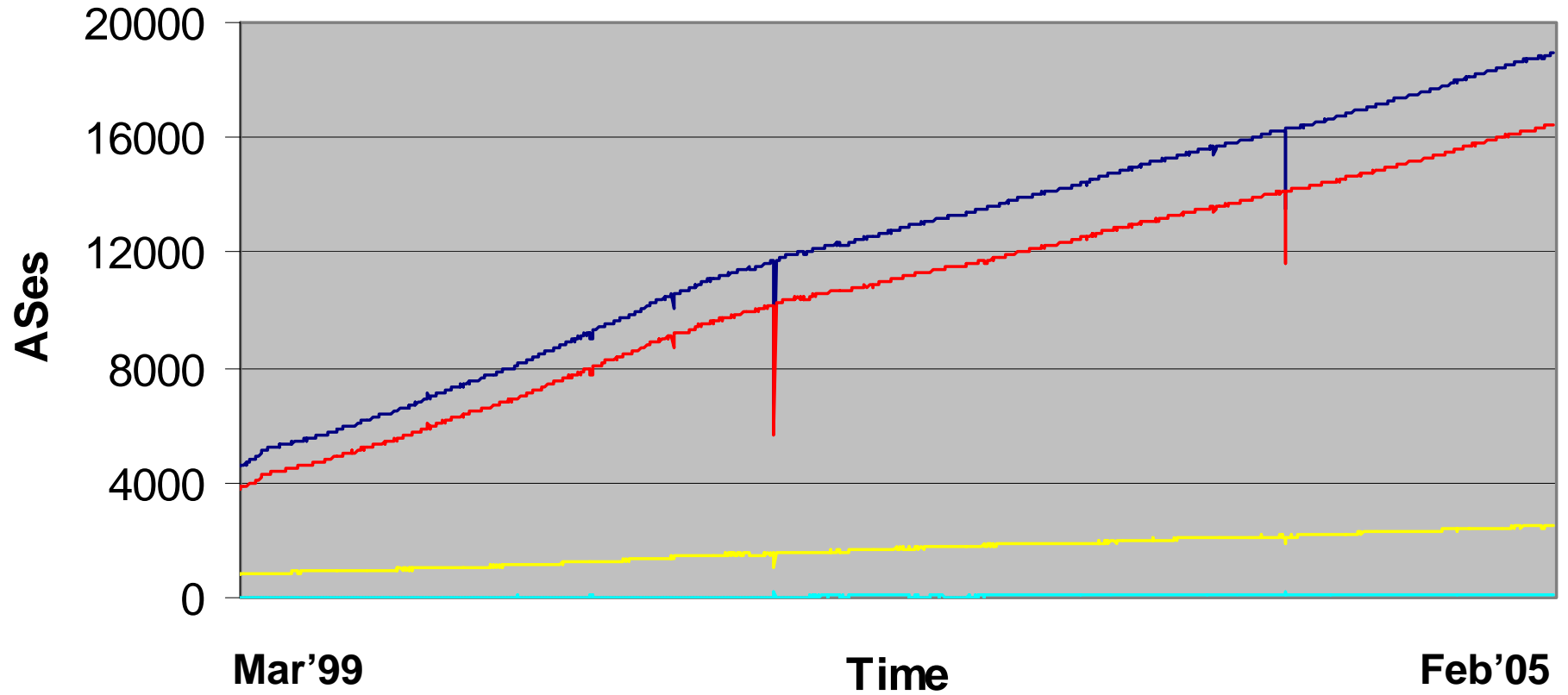
/24s announced



Address Space announced



AS Announcements



— Total — Origin Only — Transit — Transit Only

Internet Routing Table Analysis Update



Questions?