

A man in a white shirt and red tie is standing on a green hill, holding a large red cable that arches over a yellow and blue landscape. The cable is thick and red, and the man is holding it with both hands, pulling it taut. The background is a textured, abstract landscape with yellow and blue areas.

Internet Routing Table Analysis

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Internet Routing Table Analysis

- **Aim**

Investigate regional trends in the routing table

Look specifically at Asia Pacific region

Internet Routing Table Analysis

- **Routing table taken from APNIC router view at NSPIXP2 in Japan**
- **Full BGP table**
 - “warts and all” - no filtering applied**
- **Daily snapshot taken at 4am AEST (+10 GMT)**

Internet Routing Table Analysis

- **All three Regional Internet Registry address and AS ranges included:**

<http://www.isi.edu/in-notes/iana/assignments/as-numbers>

<http://www.isi.edu/in-notes/iana/assignments/ipv4-address-space>

- **Exhaustive search of utilisation of former B space included**
- **Address/ASN assignments prior to APNIC existence not included**

Internet Routing Table Analysis

- **Results on APNIC web page**

<http://www.apnic.net/stats/bgp>

- **Results to mailing lists**

bgp-stats@lists.apnic.net (daily)

apops@lists.apnic.net (weekly)

Internet Routing Table Analysis

- **Output**

e-mail posts summary of processing

**data files record full routing table, and
breakdown**

**webpage summarises some “interesting
statistics”**

Some Definitions

- **Origin AS**

AS listed at end of the AS-PATH

- **Transit AS**

AS next to Origin AS in AS-PATH (excluding AS Path prepends)

- **“Illegal” AS**

> 64511 belong to private AS range

32768 to 64511 are reserved

16384 to 32767 are “held by IANA”

Some Definitions

- **“available” address space**

everything except draft-manning-dsua-01.txt which lists:

0/8, 10/8, 127/8, 169.254/16, 172.16/12, 192.0.2/24, 192.168/16 and 224/3

- **“allocated” address space**

everything from “available” which isn’t “IANA reserved”

currently this amounts to 49.6% of address space (or 110 /8s)

E-mail output example

Global summary

Asia Pacific Report 16 Feb, 2000

BGP routing table entries examined	73425
Origin ASes present in the Internet Routing Table	6683
Origin ASes announcing only one prefix	2112
Transit ASes present in the Internet Routing Table	989
Average AS path length visible in the Internet Routing Table	5.2
Max AS path length visible	13
Illegal AS announcements present in the Routing Table	4
Non-routable prefixes present in the Routing Table	0
Prefixes being announced from the IANA Reserved Address blocks	3
Number of addresses announced to Internet	1109177704
Equivalent to 66 /8s, 28 /16s and 181 /24s	
Percentage of available address space announced	29.9
Percentage of allocated address space announced	60.3
Percentage of available address space allocated	49.6

E-mail output example

Asia Pacific summary

Asia Pacific Report 16 Feb, 2000

Prefixes being announced by APNIC ASes	7311
Prefixes being announced from the APNIC address blocks	9297
APNIC origin ASes present in the Internet Routing Table	665
APNIC origin ASes announcing only one prefix	218
APNIC transit ASes present in the Internet Routing Table	101
Average APNIC AS path length visible	5.4
Max APNIC AS path length visible	11
Number of APNIC addresses announced to Internet	41517852
Equivalent to 2 /8s, 121 /16s and 131 /24s	
Percentage of available APNIC address space announced	48.9
APNIC ASes	4608 - 4864, 7467 - 7722, 9261 - 10239
APNIC Address Blocks	61/8, 202/7 and 210/7

AP routing table

APNIC per AS prefix count summary

ASN	No of nets	/19 equiv	Description
4740	392	82	Ozemail
7657	300	14	The Internet Group Limited
4755	183	68	Videsh Sanchar Nigam Ltd. Ind
9269	172	16	Hong Kong CTI
7545	168	6	TPG Internet Pty Ltd
4618	141	47	Internet Thailand
9706	141	4	Pusan Metropolitan City Offic
7496	127	5	Power Up
7714	116	57	NETLINK-NZ-AS-AP
4786	110	7	NetConnect Communications Pty
9304	104	19	Hutchcity
4766	103	208	KORnet Powered BY Korea Telec
7474	101	50	Optus Communication
7617	95	25	One.Net
4763	88	20	Telstra New Zealand
4713	86	306	NTT-OCNET
7586	82	7	Paradox Digital Pty
4739	75	35	Commerical Internet eXchange
4736	73	13	Magna Data

Global routing table

Global per AS prefix count summary

ASN	No of nets	/19 equiv	Description
701	1723	3131	ALTERNET (UUNET)
1221	964	1163	AARNET-AS (Telstra)
1	816	4584	BBN
3561	795	1972	CWUSA
2914	760	1216	VERIO
1239	719	1638	ICM-INRIA
3356	654	215	GLOBALNET
174	629	2851	PSINET
7046	611	385	UUNET-CUSTOMER
7018	587	2970	ATT-INTERNET4
209	552	643	QWEST
3602	480	72	INSINC
271	476	411	BCNET
2764	455	113	CONNECT-NET
816	451	179	UUNET
3301	447	284	TeliaNet Sweden
1785	434	865	ICM-1
4740	392	82	Ozemail
2907	383	932	SINET

E-mail output - miscellaneous

List of Illegal AS's

Bad AS	Designation	Network	Transit AS	Description
61100	RESERVED	200.27.198.0/24	6429	RDC-INTERNET
64333	RESERVED	209.4.83.0/24	10882	CLARITYCONNECT
64333	RESERVED	209.4.84.0/24	10882	CLARITYCONNECT
65523	PRIVATE	216.200.186.32/27	6461	ABOVENET

Advertised IANA Reserved Addresses

Network	Origin AS	Description
201.159.111.0/24	11733	TBI-LTD
219.91.160.0/22	7742	DOITNOWDOTCOM
219.91.164.0/23	7742	DOITNOWDOTCOM

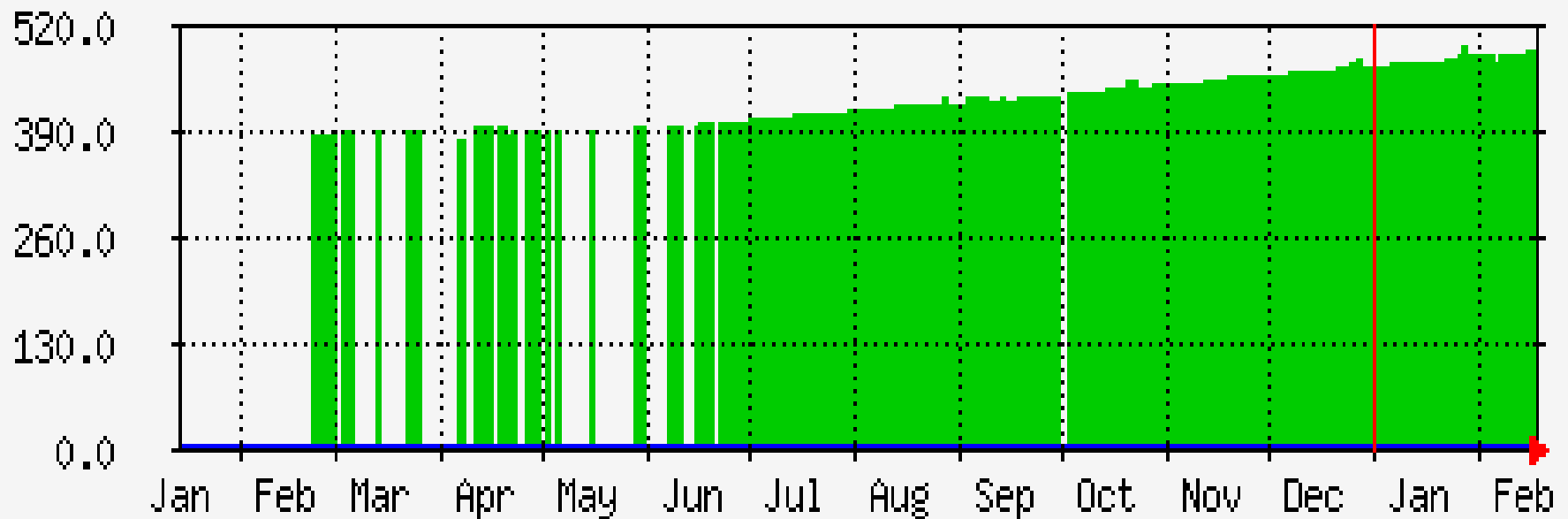
E-mail output - miscellaneous

Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:22	/9:4	/10:5	/11:9	/12:30
/13:42	/14:151	/15:265	/16:6337	/17:729	/18:1474
/19:4768	/20:2756	/21:3184	/22:4512	/23:6293	/24:42195
/25:131	/26:147	/27:85	/28:69	/29:49	/30:88
/31:0	/32:80				

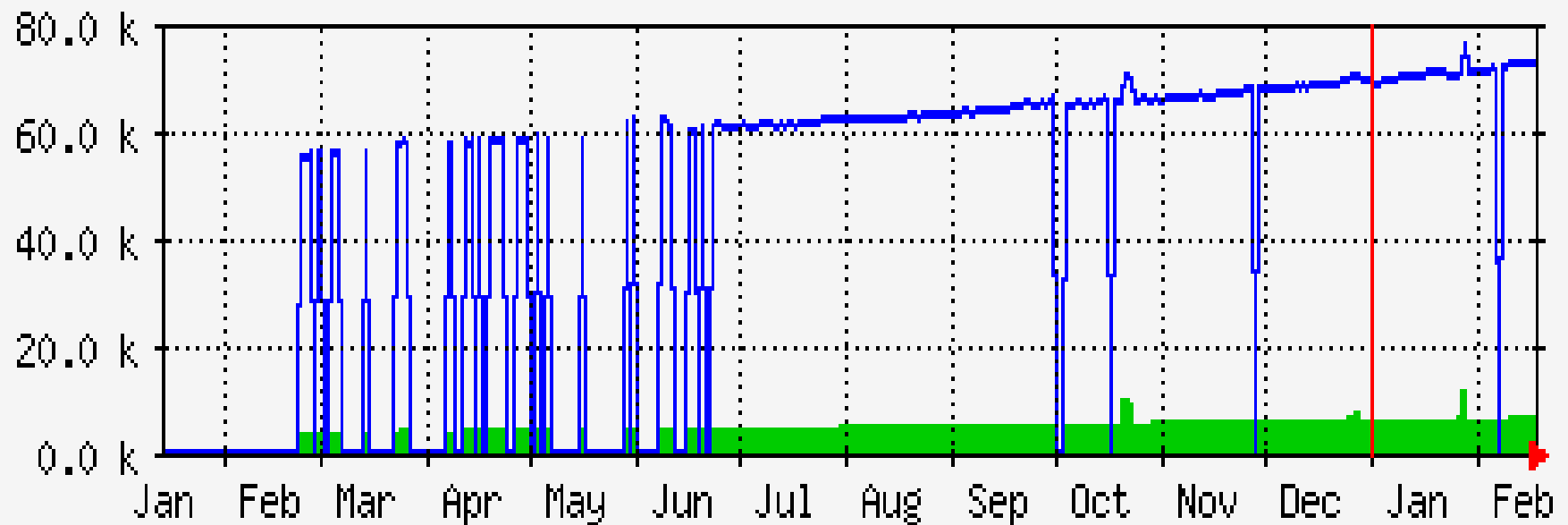
Trend graphs

Percentage/10 of APNIC allocated address space being announced



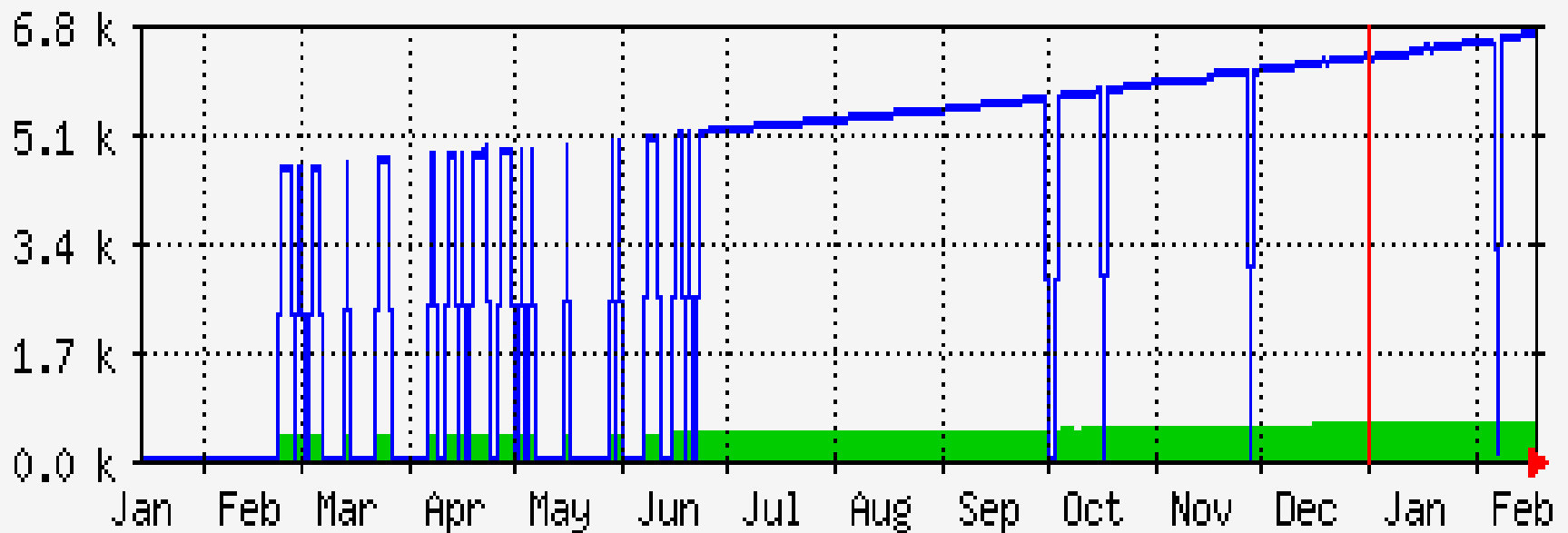
Trend graphs

APNIC routes announced (7311)
versus
Global routes announced (73425)



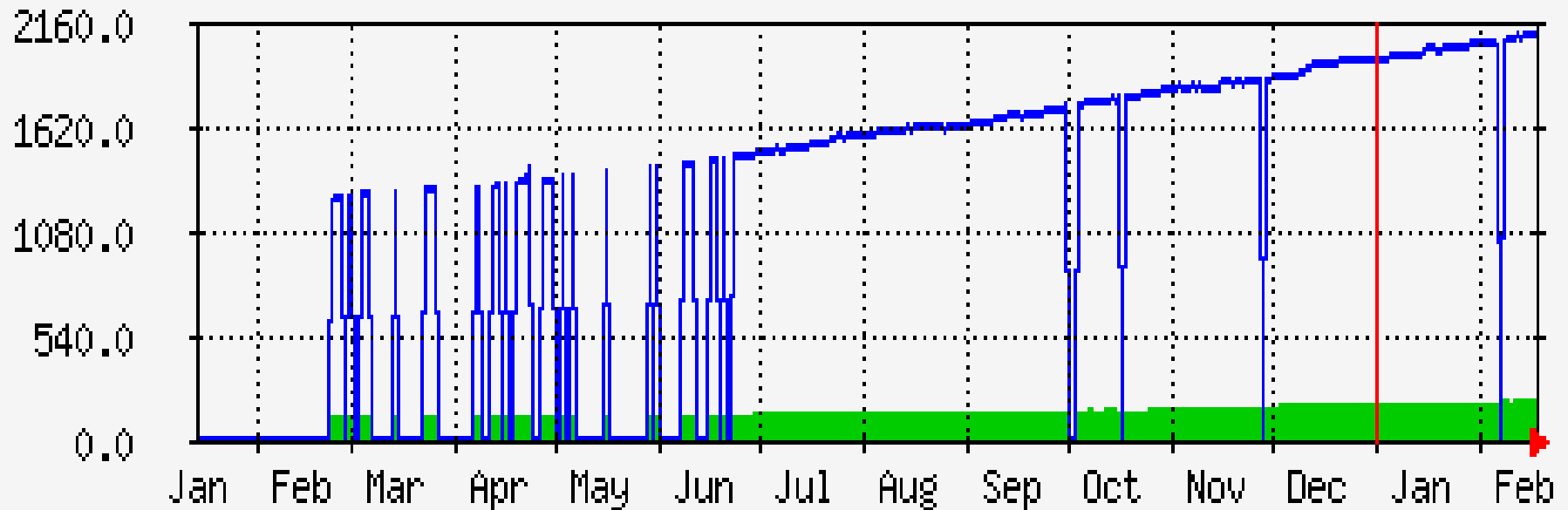
Trend graphs

APNIC origin ASes (665)
versus
Global origin ASes (6683)



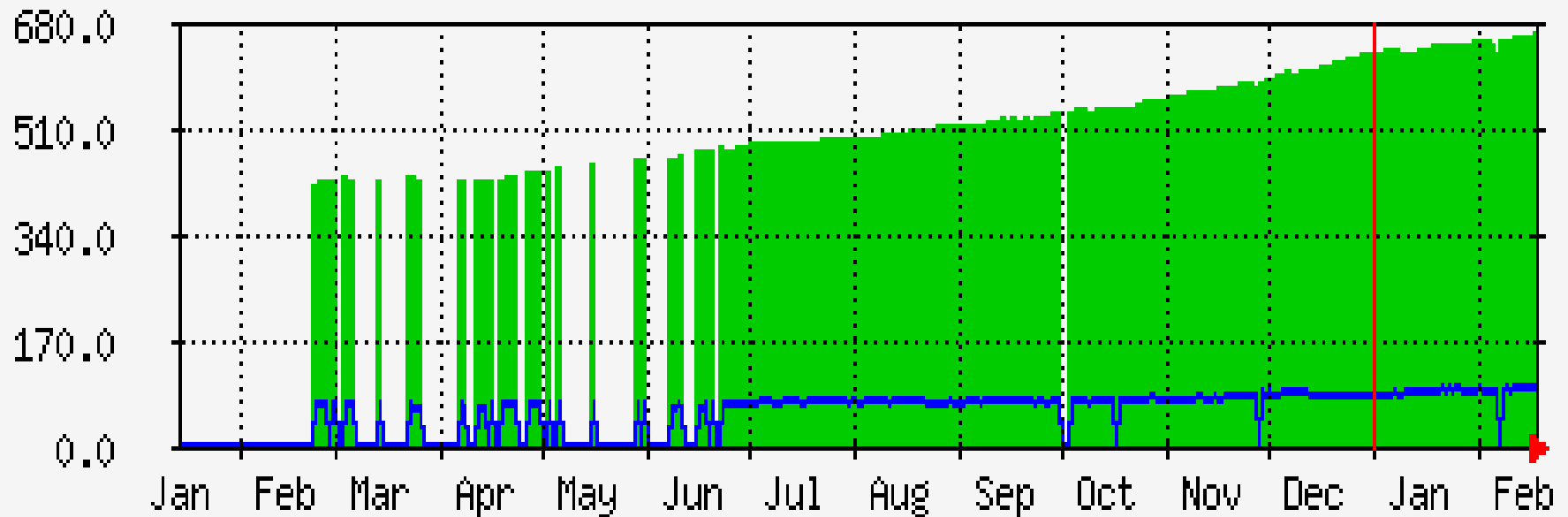
Trend graphs

APNIC ASes (218) announcing one prefix
versus
Global ASes (2112) announcing one prefix



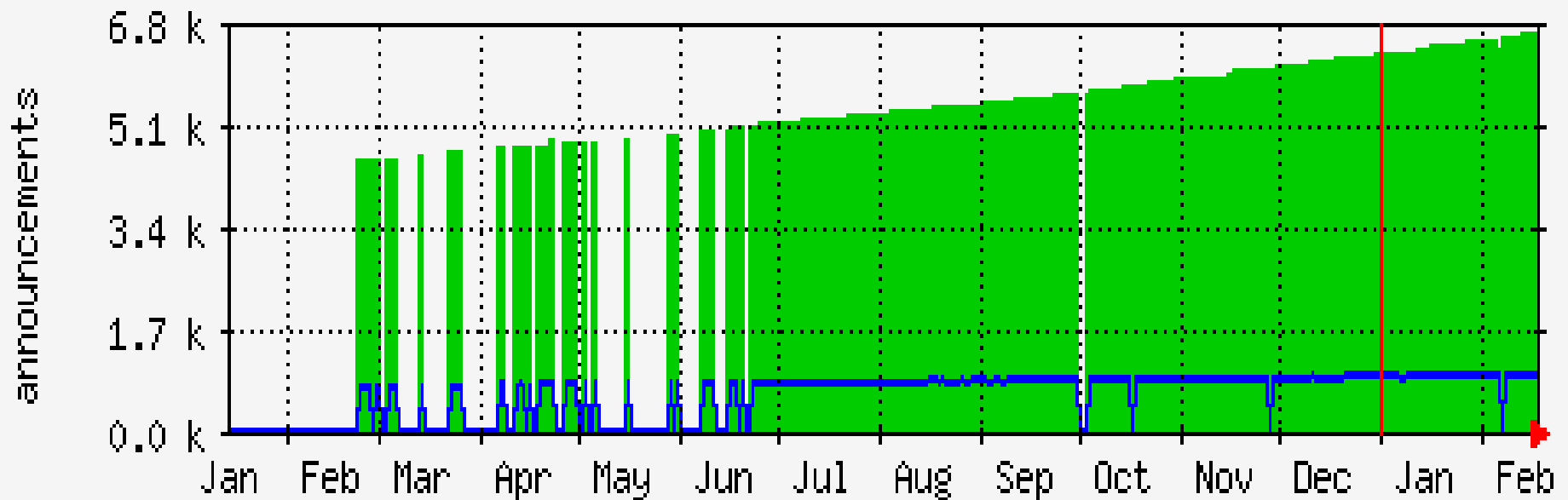
Trend graphs

APNIC origin ASes (665)
versus
APNIC transit ASes (101)



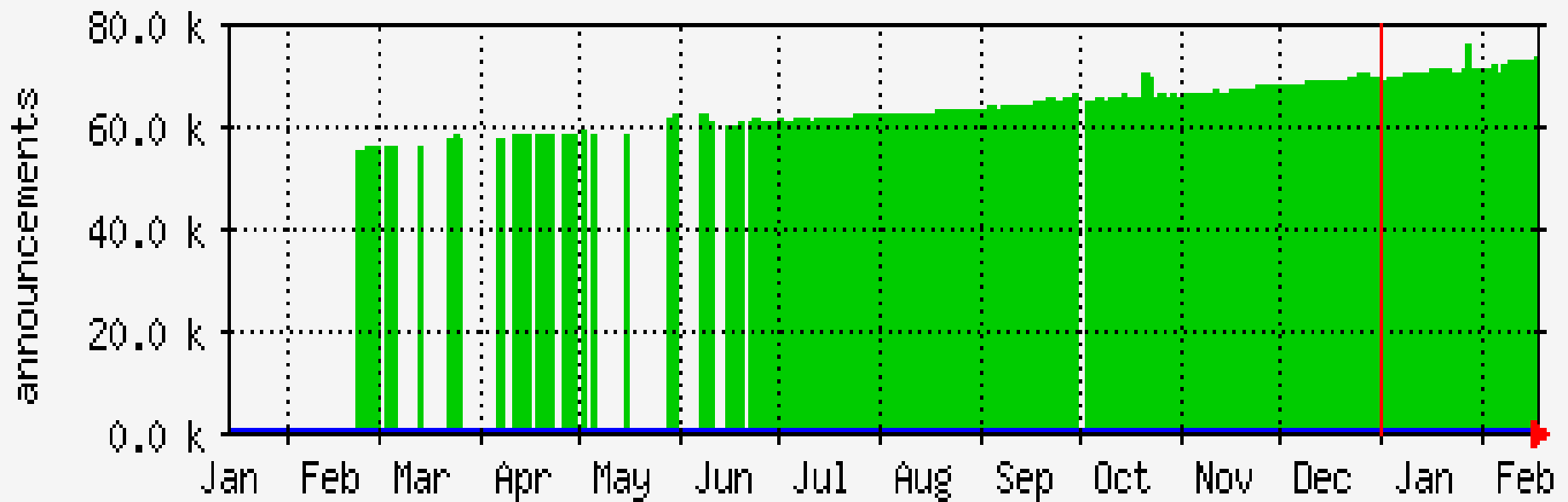
Trend graphs

Internet **origin** ASes (6683)
versus
Internet **transit** ASes (989)



Trend graphs

Internet Routing Table Growth



Observations

- **Current routing table growth rate**
61500 prefixes on 01-07-1999
70300 prefixes on 01-01-2000
at this rate, routing table will reach 100k
prefixes by September 2001

Observations

- **49.6% of total useable IPv4 address space is allocated**
equivalent to ~110 /8s
of this, only 61.4% is announced to the Internet (~68 /8s)
where is the rest?

Observations

- **Current AS growth rate**
5200 ASNs on 01-07-1999
6320 ASNs on 01-01-2000
will reach 10K ASNs by July 2001
- **Over 14000 ASNs have been assigned**
6300 are in use on the Internet
where are the rest?

Observations

- **/24s announced to Internet**

35008 on 01-07-1999

39710 on 01-01-2000

**4700 new /24s compared with 8800 new
prefix announcements in last 6 months**

Why? Multihoming? Laziness?

Observations

- **/21s, /22s and /23s announced**
11480 on 01-07-1999
13070 on 01-01-2000
1590 new /21s, /22s and /23s in last 6 months

Observations

- **Internet AS Path Length in last 6 months**

average is constant at 5.3 ASNs

maximum length fluctuated from 12 to 25 ASNs!

Comments

- **How much of this really matters?**
- **What is interesting?**
- **What about Internet “stability”**
 - BGP convergence rates?**
 - route flap dampening?**
- **Is 100K prefixes a problem?**