



# **Internet Routing Table Analysis Update**

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# Internet Routing Table Analysis

- **Thanks to APNIC for support**
- **Full view taken from NSPIXP2 in Japan**
- **Full BGP table**
  - no filters, no flap dampening**
- **Snapshot at 4am (+10GMT)**



# Internet Routing Table Analysis

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

`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**
- **AS space regionalised - historical allocations by InterNIC distributed between three regions**



# Internet Routing Table Analysis

- Results on APNIC web page

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

- Results to mailing lists

daily:

[bgp-stats@lists.apnic.net](mailto:bgp-stats@lists.apnic.net)

weekly:

[apops@lists.apnic.net](mailto:apops@lists.apnic.net)

[routing-wg@ripe.net](mailto:routing-wg@ripe.net)

[naipr@arin.net](mailto:naipr@arin.net)



# Some Definitions

- **“available” address space**  
everything except draft-manning-dsua-03.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 51% of address space (or 112  
/8s)

# 25th April summary

## Global summary

### Routing Report 25 April, 2000

BGP routing table entries examined	77238
Origin ASes present in the Internet Routing Table	7289
Origin ASes announcing only one prefix	2356
Transit ASes present in the Internet Routing Table	1034
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	3
Non-routable prefixes present in the Routing Table	0
Prefixes being announced from the IANA Reserved Address blocks	4
Number of addresses announced to Internet	1161880393
Equivalent to 69 /8s, 64 /16s and 227 /24s	
Percentage of available address space announced	31.3
Percentage of allocated address space announced	63.2
Percentage of available address space allocated	49.6

# 25th October summary

## Global summary

### Routing Report 25 October, 2000

BGP routing table entries examined	92781
Origin ASes present in the Internet Routing Table	8879
Origin ASes announcing only one prefix	3014
Transit ASes present in the Internet Routing Table	1223
Average AS path length visible in the Internet Routing Table	5.3
Max AS path length visible	14
Illegal AS announcements present in the Routing Table	2
Non-routable prefixes present in the Routing Table	0
Prefixes being announced from the IANA Reserved Address blocks	2
Number of addresses announced to Internet	1188157633
Equivalent to 70 /8s, 209 /16s and 216 /24s	
Percentage of available address space announced	32.1
Percentage of allocated address space announced	62.9
Percentage of available address space allocated	51.0

# 25th October summary

## APNIC region summary

### APNIC region Report 25 October, 2000

Prefixes being announced by APNIC Region ASes	14303
Prefixes being announced from the APNIC address blocks	12828
APNIC Region origin ASes present in the Internet Routing Table	1040
APNIC Region origin ASes announcing only one prefix	352
APNIC Region transit ASes present in the Internet Routing Table	171
Average APNIC Region AS path length visible	5.4
Max APNIC Region AS path length visible	13
Number of APNIC addresses announced to Internet	57196865
Equivalent to 3 /8s, 104 /16s and 193 /24s	
Percentage of available APNIC address space announced	67.3

APNIC AS Blocks 4608 - 4864, 7467 - 7722, 9216 - 10239,  
APNIC AS Blocks 17408 - 18431  
APNIC Address Blocks 61/8, 202/7 and 210/7



# APNIC Region routing table

## APNIC Region per AS prefix count summary

ASN	No of nets	/19 equiv	Description
1221	875	998	Telstra
9768	829	11	Korea Telecom
2764	458	129	connect.com.au pty ltd
4740	372	84	Ozemail
2907	359	875	SINET Japan
7657	344	16	The Internet Group Limited
4755	313	124	VSNL India
9269	215	24	Hong Kong CTI
4618	211	56	Internet Thailand
4763	199	44	Telstra New Zealand
7474	173	59	Optus Communications
7545	171	6	TPG Internet Pty Ltd
703	163	87	UUNET Technologies, Inc.
4433	158	125	Access One Pty Ltd
4786	139	7	NetConnect Communications Pty
4134	138	367	Data Communications Bureau
9304	136	16	Hutchcity
7496	135	8	Power Up
4766	123	431	KORnet Powered BY Korea Telec

# Global routing table

## Global per AS prefix count summary

ASN	No of nets	/19 equiv	Description
701	2072	3362	UUNET Technologies, Inc.
7018	1216	3040	AT&T
1	997	4550	BBN Planet
1221	875	998	Telstra
9768	829	11	Korea Telecom
7046	706	500	UUNET Technologies, Inc.
2914	700	1333	Verio, Inc.
1239	692	1635	Sprint ICM-Inria
816	667	144	UUNET Canada4
174	632	2990	PSINet Inc.
705	605	36	UUNET Technologies, Inc.
3561	576	1399	Cable & Wireless USA
6082	523	66	Management Analysis, Incorpor
209	501	553	Qwest
8013	494	63	PSINet Ltd. Canada
3549	482	419	Frontier GlobalCenter
271	470	380	BCnet Backbone
2764	458	129	connect.com.au pty ltd
3908	447	290	Supernet, Inc.

# E-mail output - miscellaneous

## List of Illegal AS's

Bad AS	Designation	Network	Transit AS	Description
64602	PRIVATE	63.236.57.0/24	209	Qwest
64605	PRIVATE	208.47.206.0/24	209	Qwest

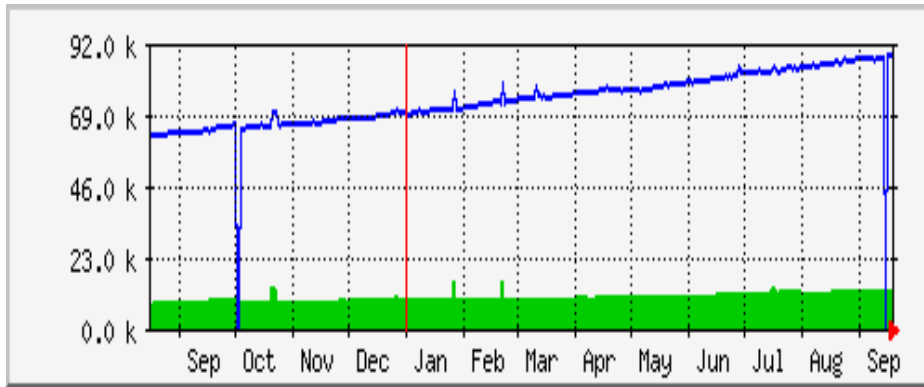
## Advertised IANA Reserved Addresses

Network	Origin AS	Description
27.0.0.0/16	1221	Telstra
110.0.253.88/30	9768	Korea Telecom

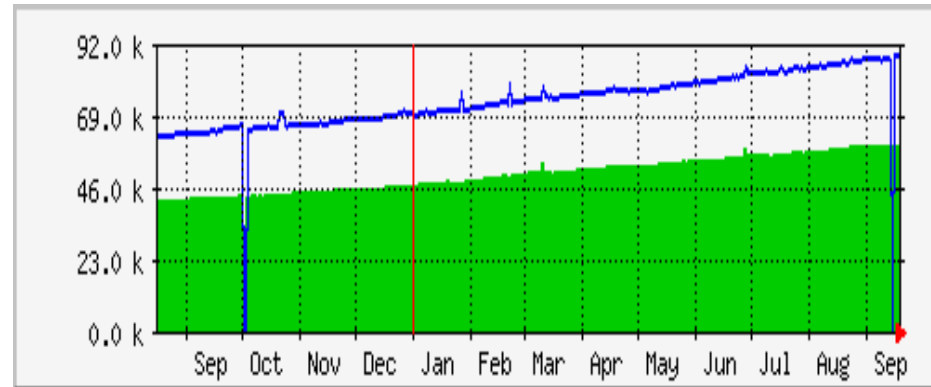
## Number of prefixes announced by prefix length

/1:0	/2:0	/3:0	/4:0	/5:0	/6:0
/7:0	/8:22	/9:4	/10:5	/11:9	/12:31
/13:58	/14:175	/15:289	/16:6708	/17:951	/18:1907
/19:6005	/20:3895	/21:3887	/22:5950	/23:7887	/24:53198
/25:438	/26:667	/27:239	/28:123	/29:103	/30:113
/31:0	/32:117				

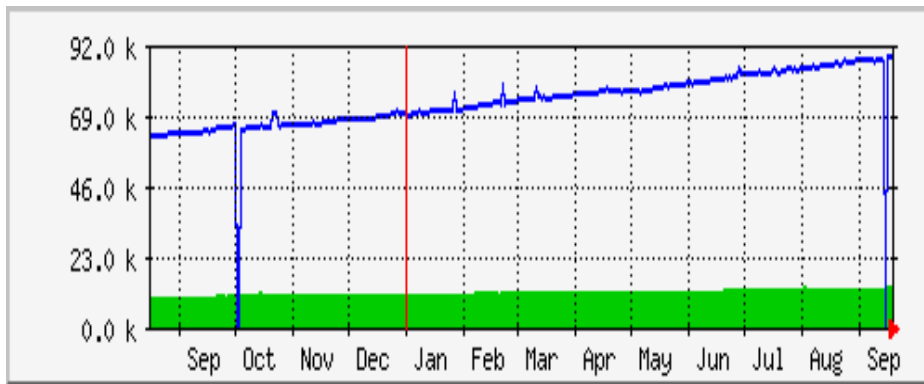
# Internet Routing Table size



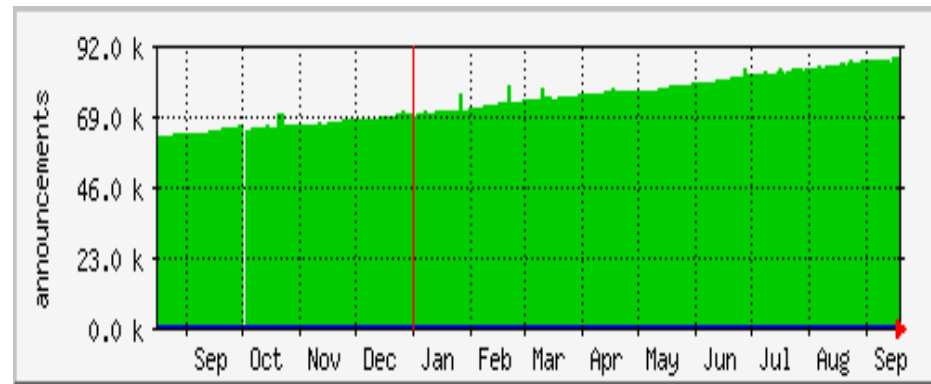
**APNIC**



**ARIN**

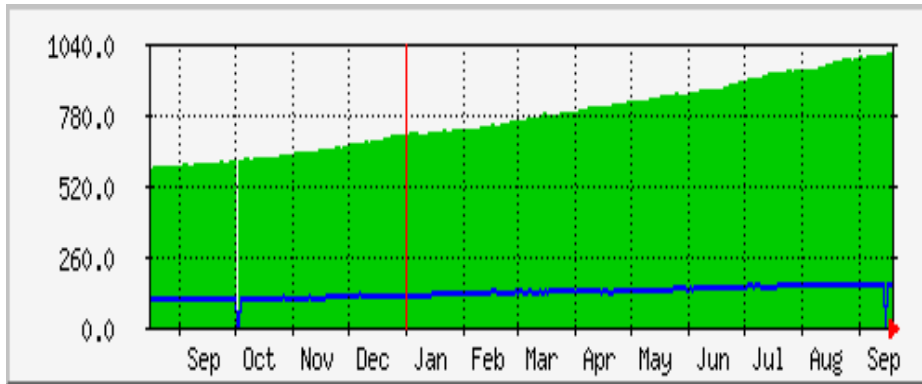


**RIPE NCC**

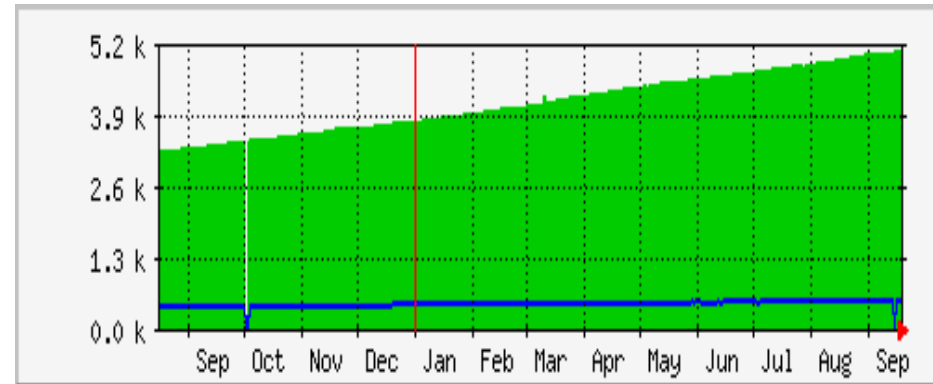


**Global**

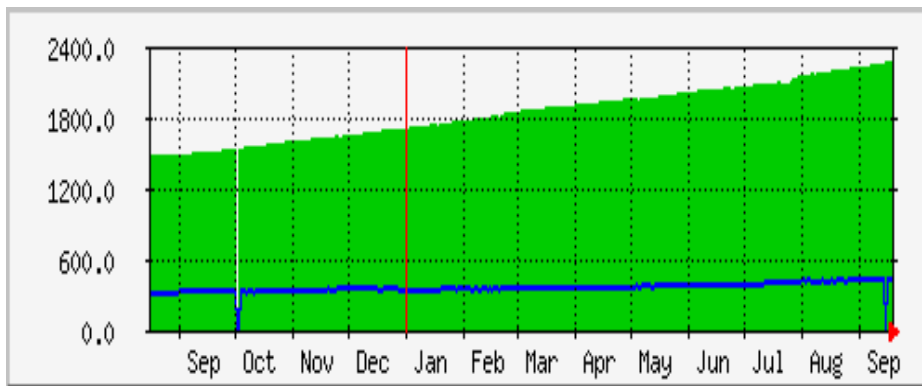
# origin versus transit ASes



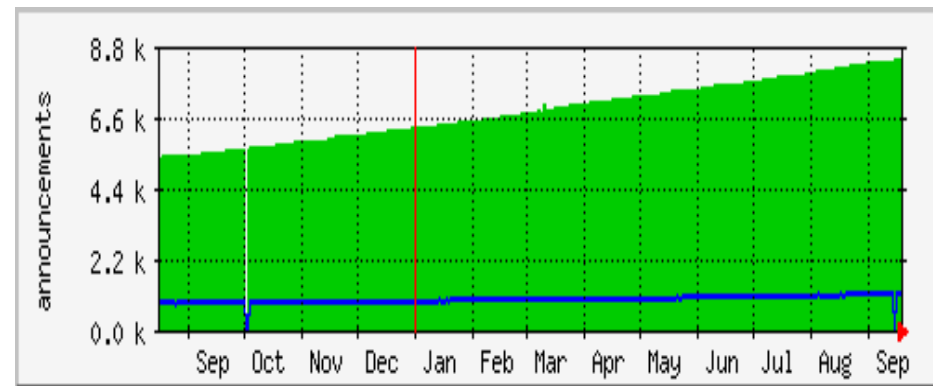
**APNIC**



**ARIN**

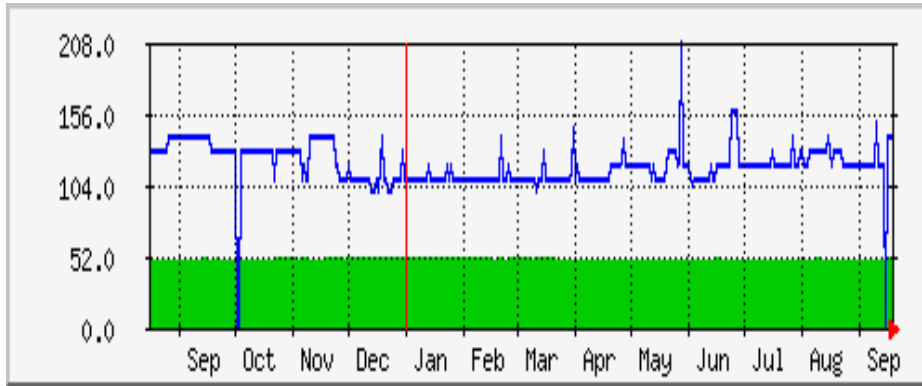


**RIPE NCC**

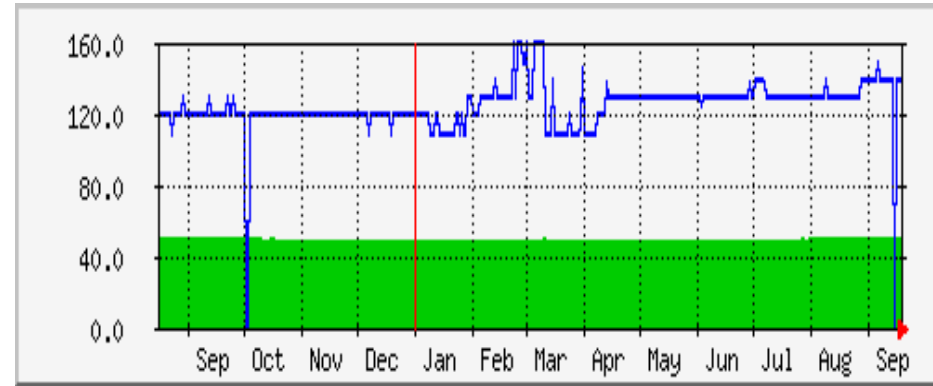


**Global**

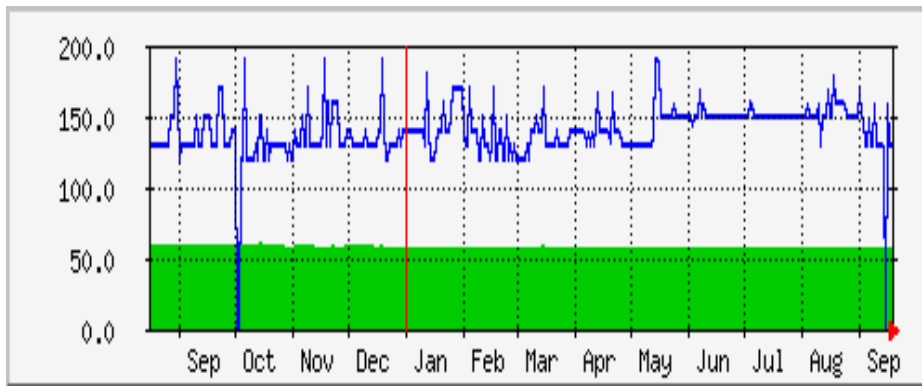
# average versus maximum AS path length



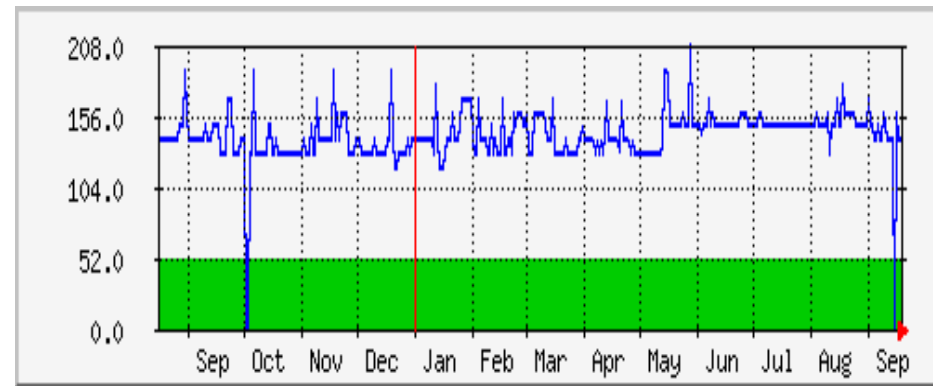
**APNIC**



**ARIN**

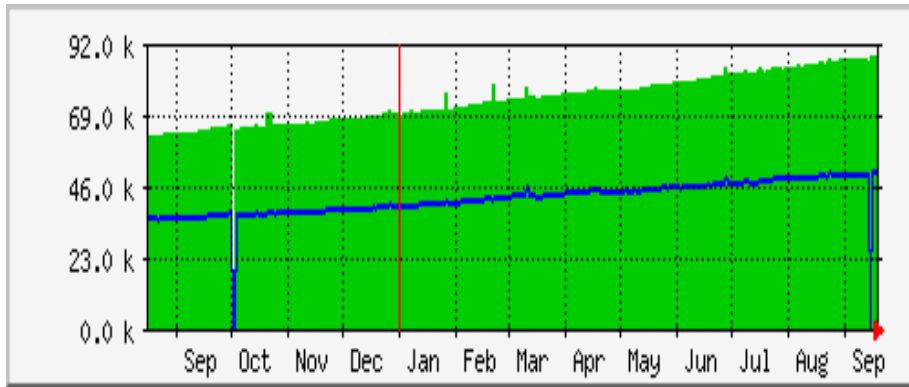


**RIPE NCC**

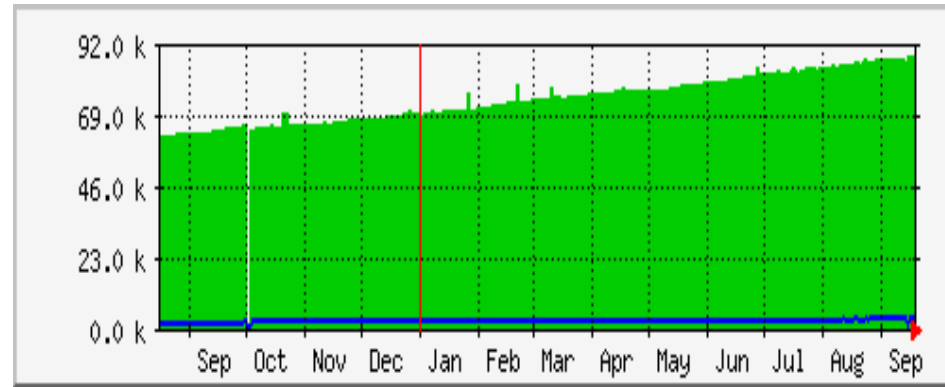


**Global**

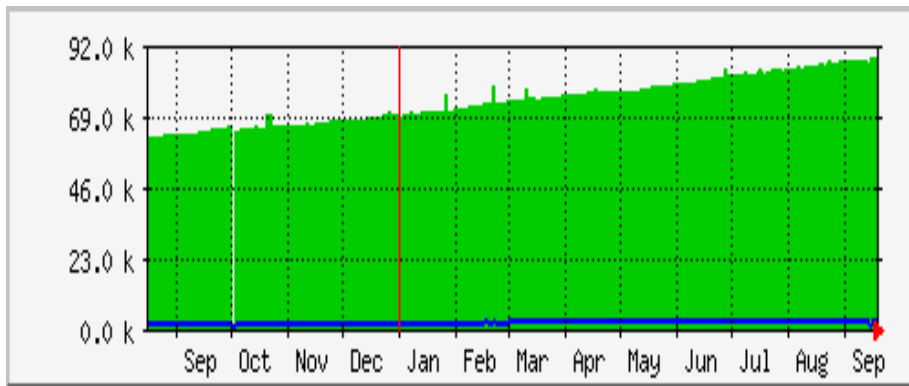
# Relative prefix sizes



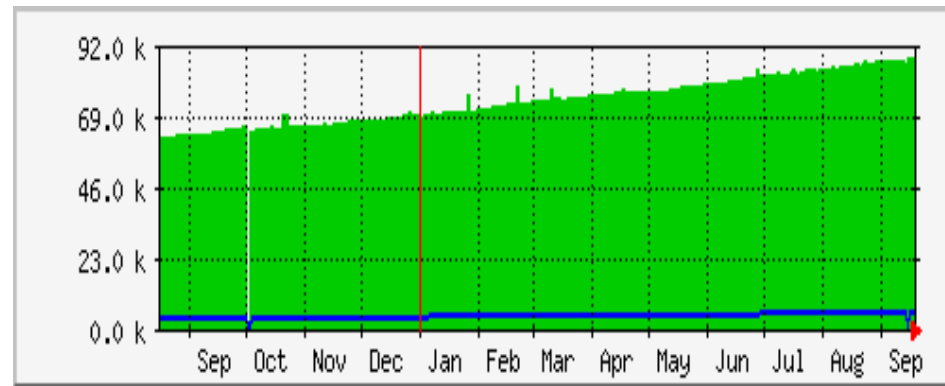
**/24s**



**/21s**



**/20s**



**/19s**



# Observations

- **Current routing table growth rate**

**66200 prefixes on 25-10-1999**

**77200 prefixes on 25-04-2000**

**92800 prefixes on 25-10-2000**

**routing table will reach 100k prefixes by end  
December 2000**

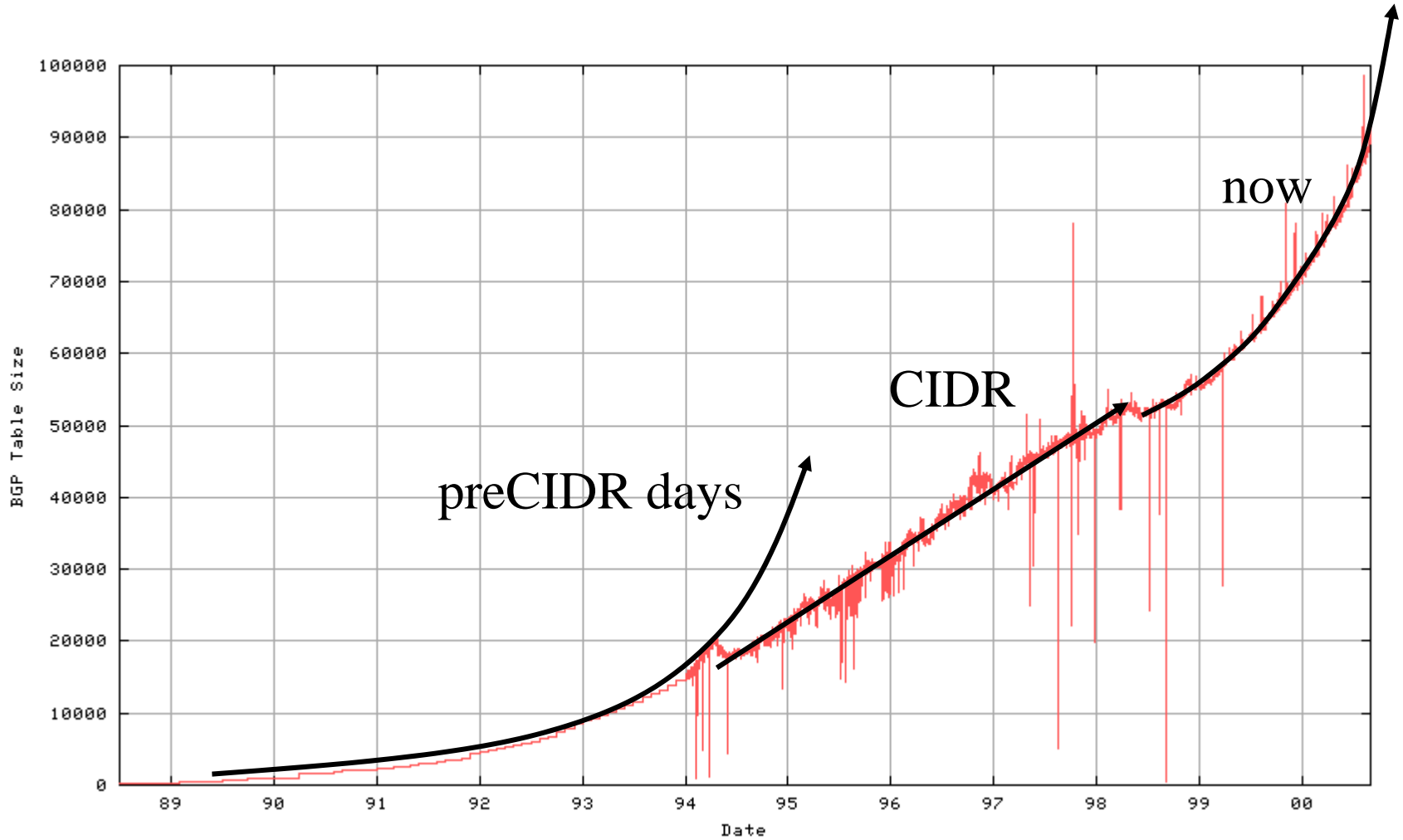
**6 months ago, my prediction was September  
2001**

**exponential growth has returned**

- **Is this a problem?**



# [www.telstra.net/ops/bgptable.html](http://www.telstra.net/ops/bgptable.html)





# Observations

- **51% of total useable IPv4 address space is allocated**  
equivalent to ~112 /8s
- **Only 62.9% of allocated IPv4 space is announced to the Internet (~68 /8s)**  
**where is the rest???**



# Observations

- **Current AS growth rate**
  - 5870 ASNs on 25-10-1999**
  - 7290 ASNs on 25-04-2000**
  - 8880 ASNs on 25-10-2000**
  - will reach 10K ASNs by December 2000**
  - previous prediction July 2001**
- **Around 17000 ASNs have been assigned as of 30-08-2000**
  - 8880 are in use on the Internet**
  - where are the rest???**



# Observations

- **/24s announced to Internet**

**37700 on 25-10-1999**

**44441 on 25-04-2000**

**53198 on 25-10-2000**

**8757 new /24s compared with total of 15543  
new prefix announcements in last 6 months**

**Why? Multihoming? Laziness?**



# Observations

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

**average is constant at 5.3 ASNs**

**maximum length fluctuated from 11 to 25 ASNs!**



# What about...?

- **African Regional Registry**
- **Latin American and Caribbean Regional Registry**
- **Same statistics produced for those two future registry regions**
  - work out location of ASes and calculate accordingly**

# 30th August summary

## African summary

### Routing Report 30 August, 2000

```
Prefixes being announced by AFRINIC Region ASes:                671
Prefixes being announced from the AFRINIC address blocks:         0
AFRINIC Region origin ASes present in the Internet Routing Table: 45
AFRINIC Region origin ASes announcing only one prefix:           15
AFRINIC Region transit ASes present in the Internet Routing Table: 5
Average AFRINIC Region AS path length visible:                   4.9
  Max AFRINIC Region AS path length visible:                       7
Number of AFRINIC addresses announced to Internet:                 0
  Equivalent to 0 /8s, 0 /16s and 0 /24s
  Percentage of available AFRINIC address space announced:        0.0

AFRINIC AS Blocks          none as yet
AFRINIC Address Blocks     none as yet
```

# 30th August summary

## Central+Southern American summary

### Routing Report 30 August, 2000

Prefixes being announced by LACNIC Region ASes:	3952
Prefixes being announced from the LACNIC address blocks:	0
LACNIC Region origin ASes present in the Internet Routing Table:	321
LACNIC Region origin ASes announcing only one prefix:	114
LACNIC Region transit ASes present in the Internet Routing Table:	52
Average LACNIC Region AS path length visible:	5.7
Max LACNIC Region AS path length visible:	10
Number of LACNIC addresses announced to Internet:	0
Equivalent to 0 /8s, 0 /16s and 0 /24s	
Percentage of available LACNIC address space announced:	0.0

LACNIC AS Blocks           none as yet

LACNIC Address Blocks    none as yet



# African routing table

## African per AS prefix count summary

ASN	No of nets	/19 equiv	Description
3741	270	353	The Internet Solution ZA
2018	84	100	Foundation for Research Devel
2905	71	128	The Internetworking Company o
5713	43	93	Telkom SA Ltd
6083	18	17	Olivetti Africa
6127	15	13	Information and Decision Supp
7390	15	2	National Lan Suppliers
8452	14	0	GEGA NET Autonomous System
6089	13	3	Intertech Systems
6713	13	7	Itissalat Al-MAGHRIB
6180	11	0	Network Information Services
8524	11	1	AUCEGYPT Autonomous System
10798	11	0	Standard Bank of South Africa
11569	11	10	satellite data networks
11845	8	1	Data Pro Business Online
5710	6	12	Global internet Access CC
8346	6	2	SONATEL-AS Autonomo
13519	5	0	MEDIAPOST CC
5536	4	1	Internet Egypt Network

# Southern American routing table

## Central+South American per AS prefix count summary

ASN	No of nets	/19 equiv	Description
8151	331	188	UniNet S.A. de C.V.
6429	210	54	RdC Internet
10834	131	25	ADVANCE TELECOMUNICACIONES S.
6503	128	85	AVANTEL, S.A.
4926	94	11	Telintar S.A.
1916	78	273	Fundacao de Amparo a Pesquisa
2277	78	10	ECUANET - CORPORACION ECUATOR
7418	77	39	Provedora de Servicios de Co
6471	75	44	ENTEL CHILE S.A.
6140	70	14	IMPSAT ARGENTINA, S.A.
1840	61	10	Universidad de las Americas
7993	59	4	Global One Chile
13999	58	2	Mega Cable S.A. de C.V.
7984	57	11	Global One Colombia
4270	54	15	Red de Interconexion Universi
5704	53	3	Caribbean Internet Service, C
3632	49	21	CONACYT Consejo Nacional de C
11992	49	2	Integrated Systems
11415	47	6	IMPSAT Comunicacoes Ltda



# Final Slide...

- **Routing table growing exponentially (again)**
  - should we care, or worry?
  - those /24s - arrgh!
- **AS assignment accelerating**
  - more multihoming?
- **What other stats would be interesting?**
- **Any comments?**