Tracking the Internet's BGP Table

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Telstra

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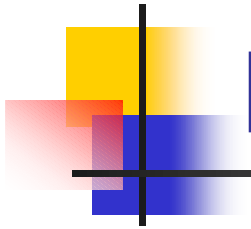
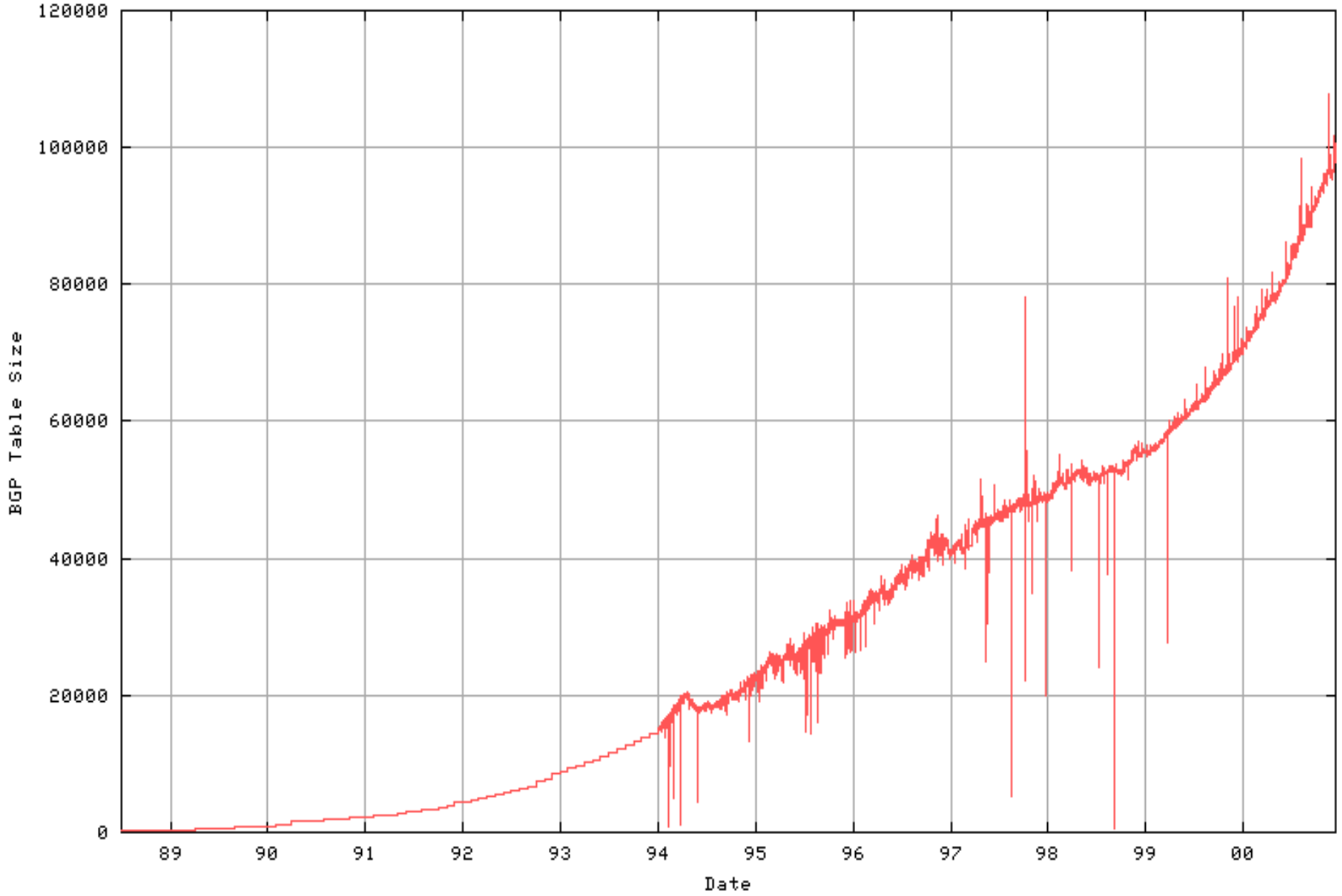
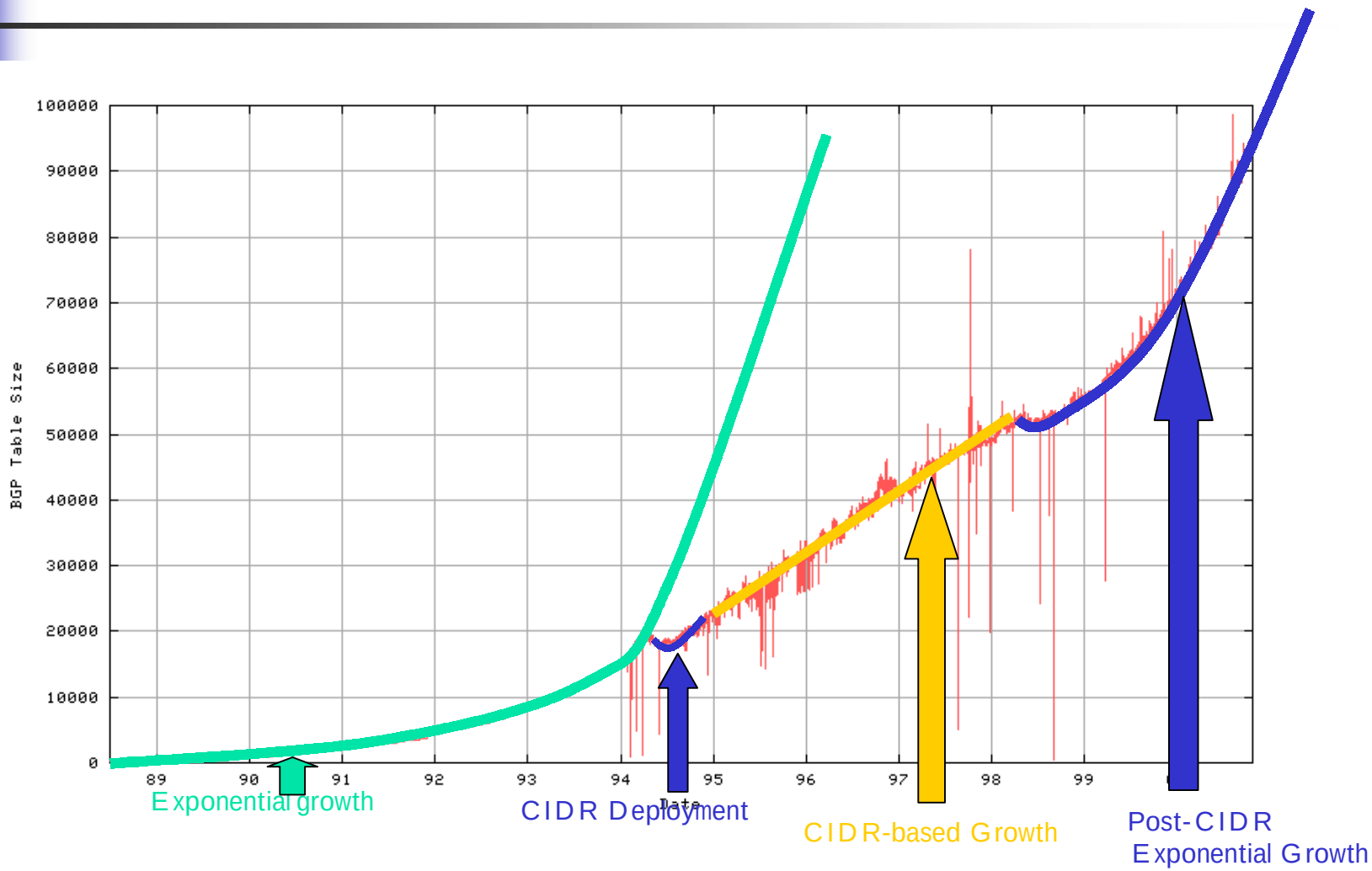


Methodology

- The BGP table monitor uses a router at the boundary of AS1221 which has a default-free eBGP routing table
  1. Capture the output from “show ip bgp” every hour
  2. Perform analysis of the data
     (and then discard the raw dump!)
  3. Update reports at www.telstra.net/ops/bgp

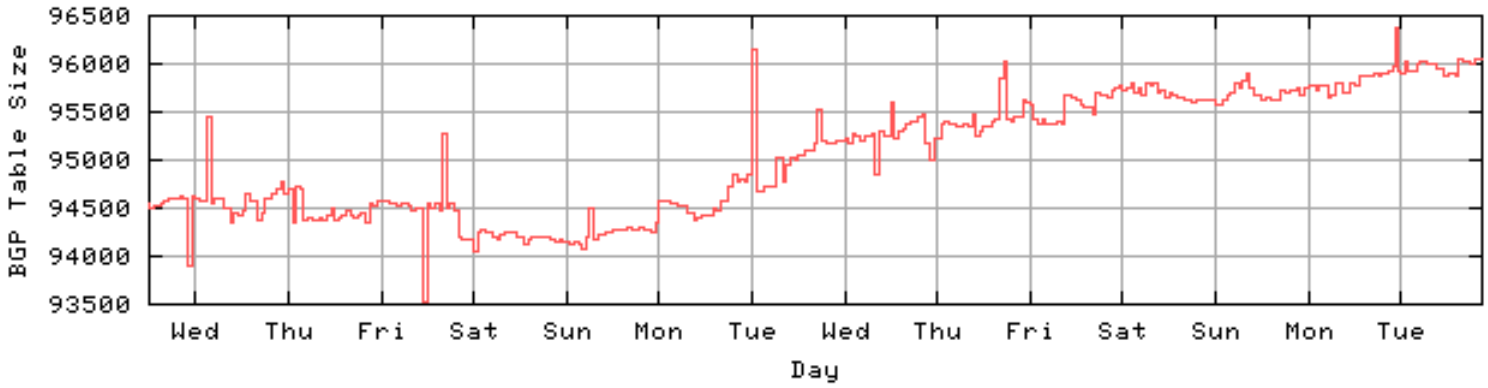

120000
100000
80000
60000
40000
20000
0
BGP Table Size
89
90
91
92
93
94
95
96
97
98
99
00
Date

Phases of Growth

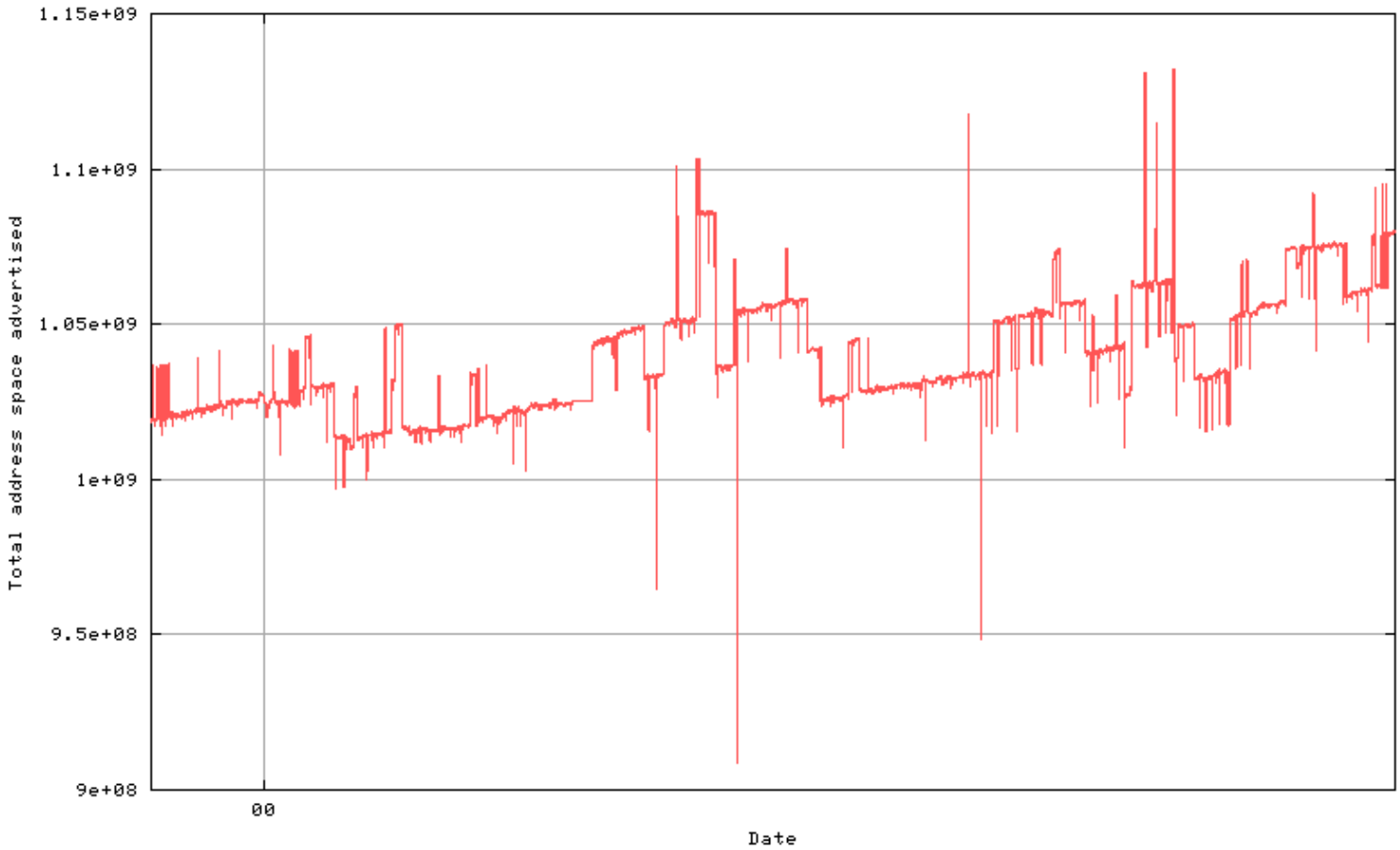


Growth Characteristics

- Short term route fluctuation is an absolute value (not a % of total routes) of 1,000 – 2,000 routes



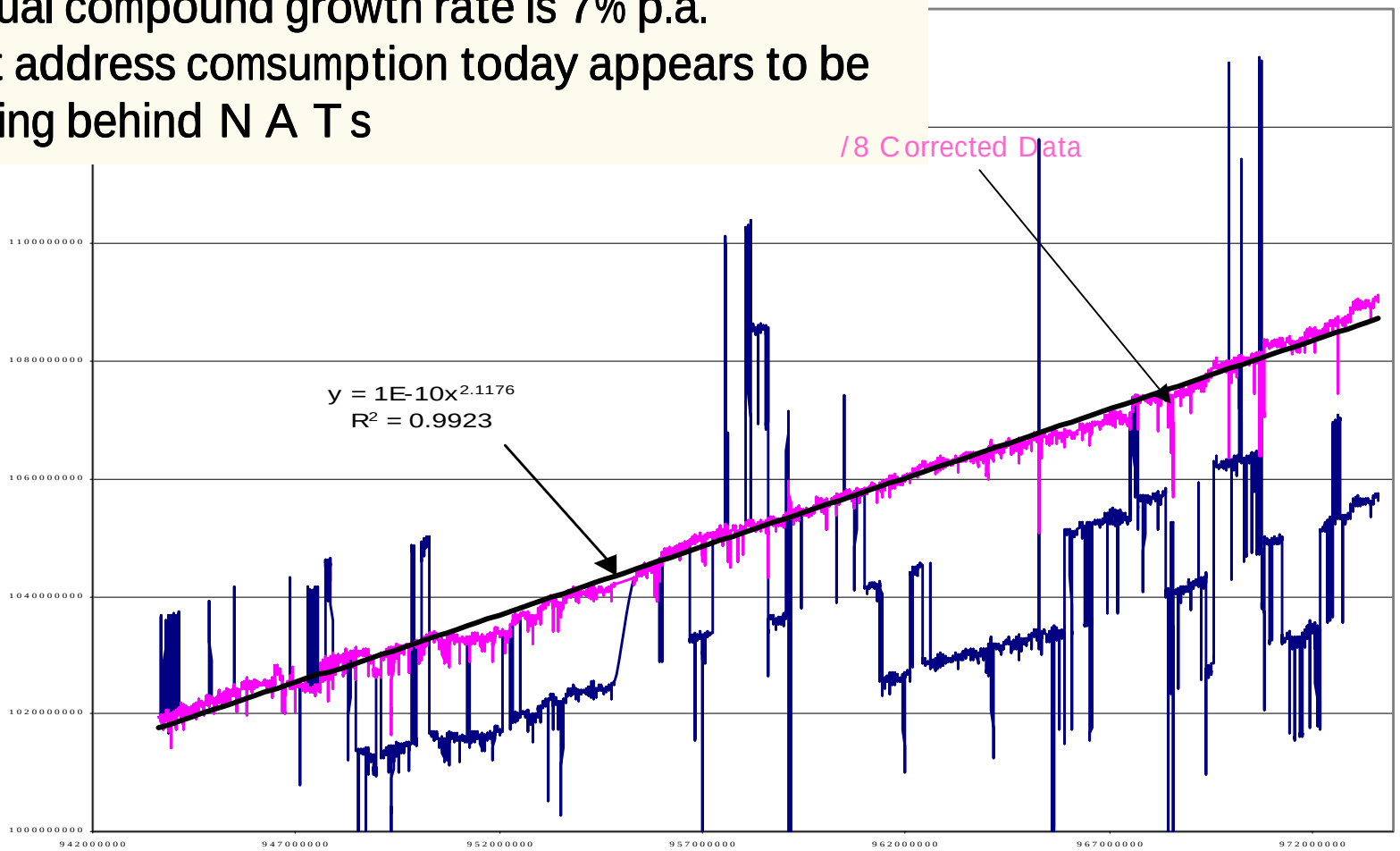
Routed Address Space



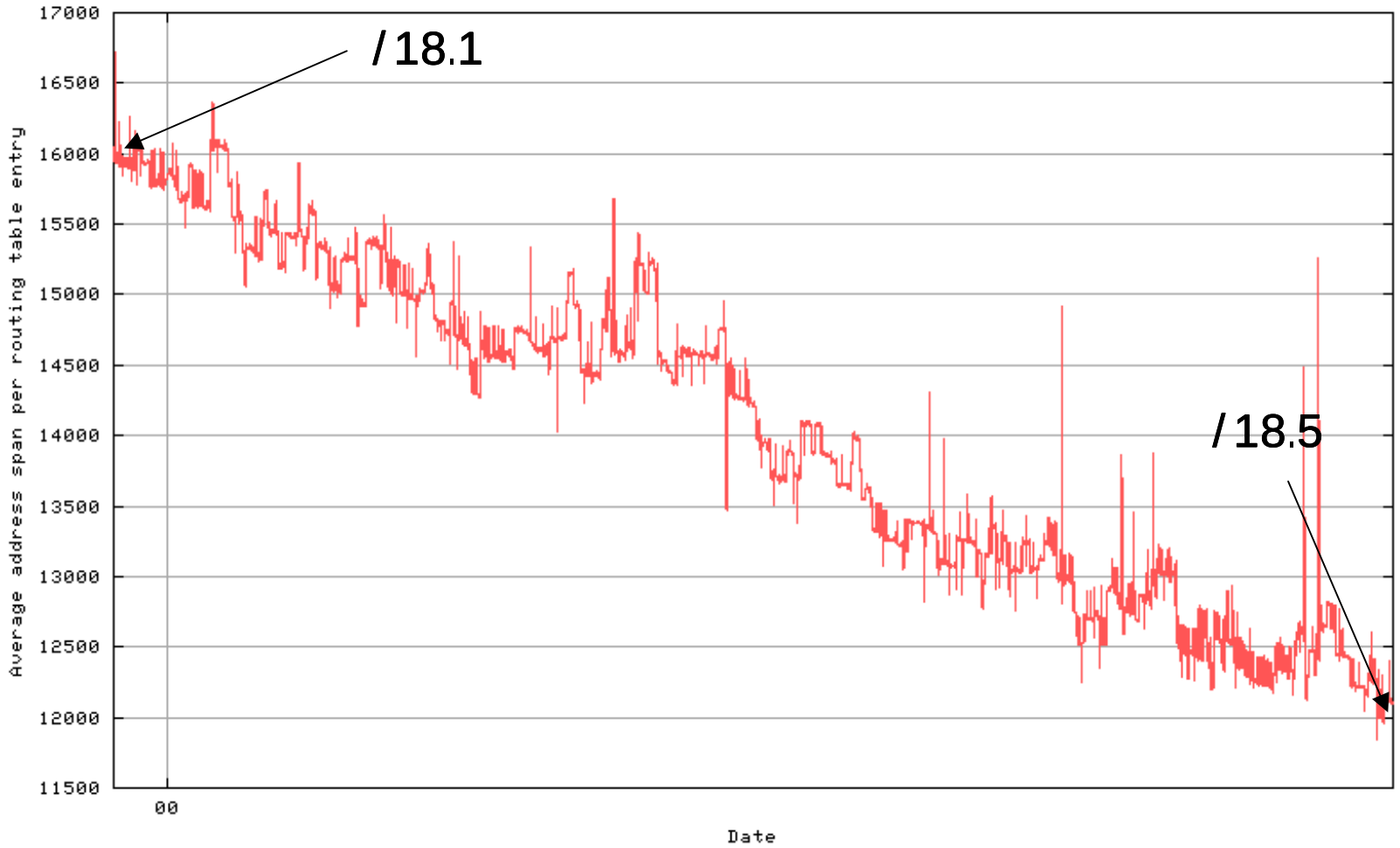
Fluctuation is due to announcement / withdrawals of /8 prefixes
11 months of data does not provide clear longer growth characteristic

Routed Address Space (/8 Corrected)

Annual compound growth rate is 7% p.a.
Most address comsumption today appears to be ocurring behind NATs

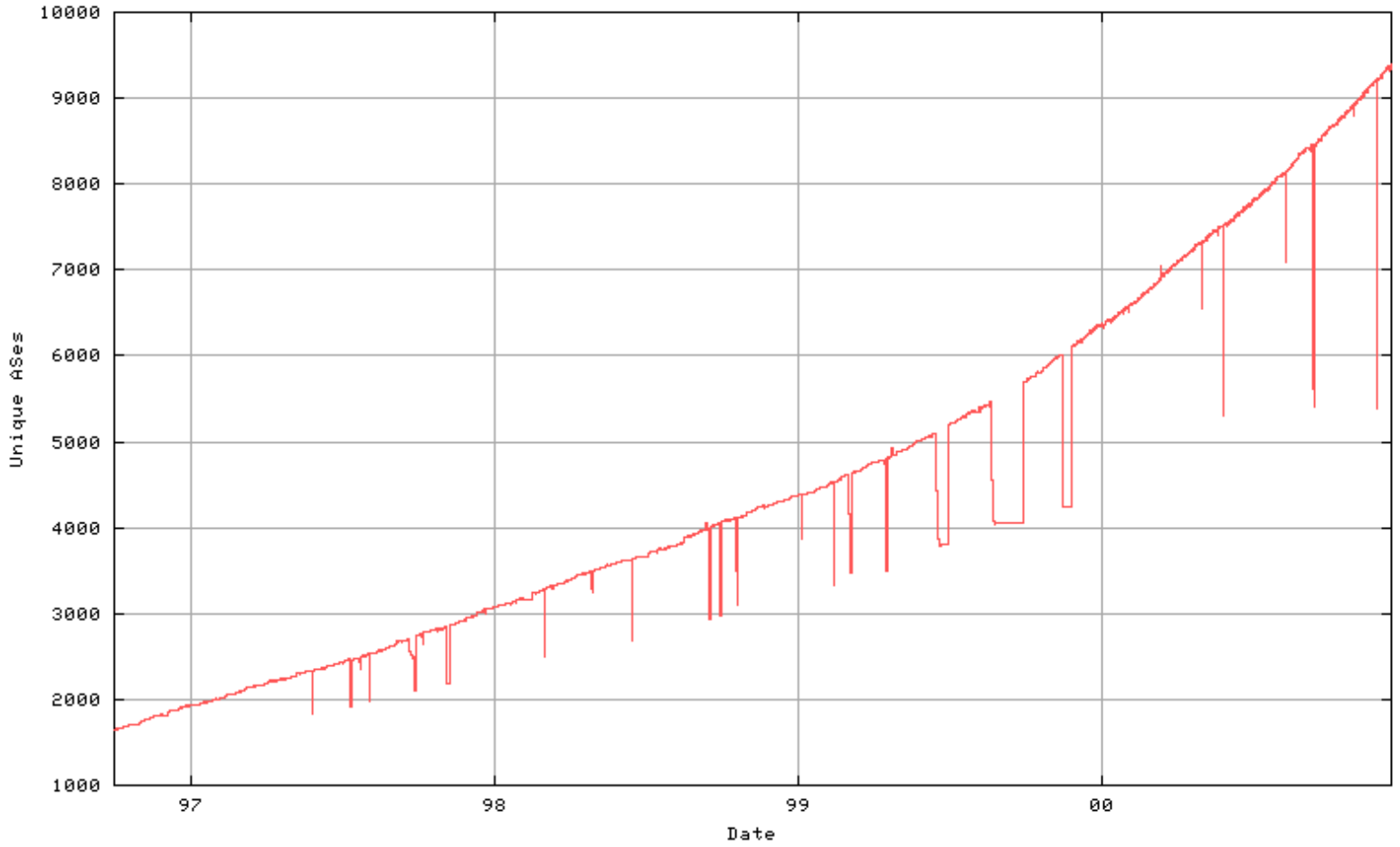


Average size of a routing table entry



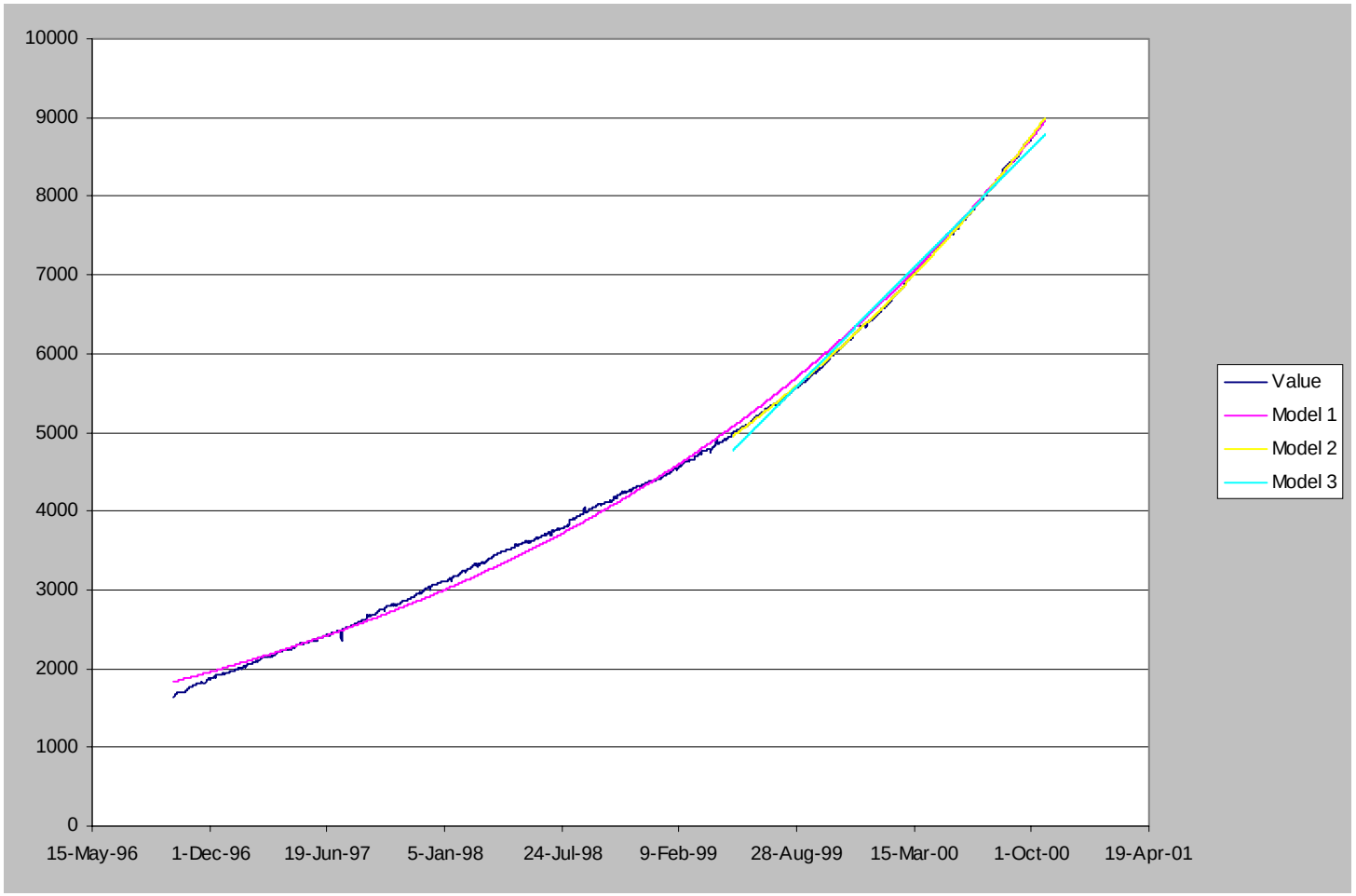
The BGP routing tale is growing at a faster rate than the rate of growth of announced address space

Number of AS's in the table



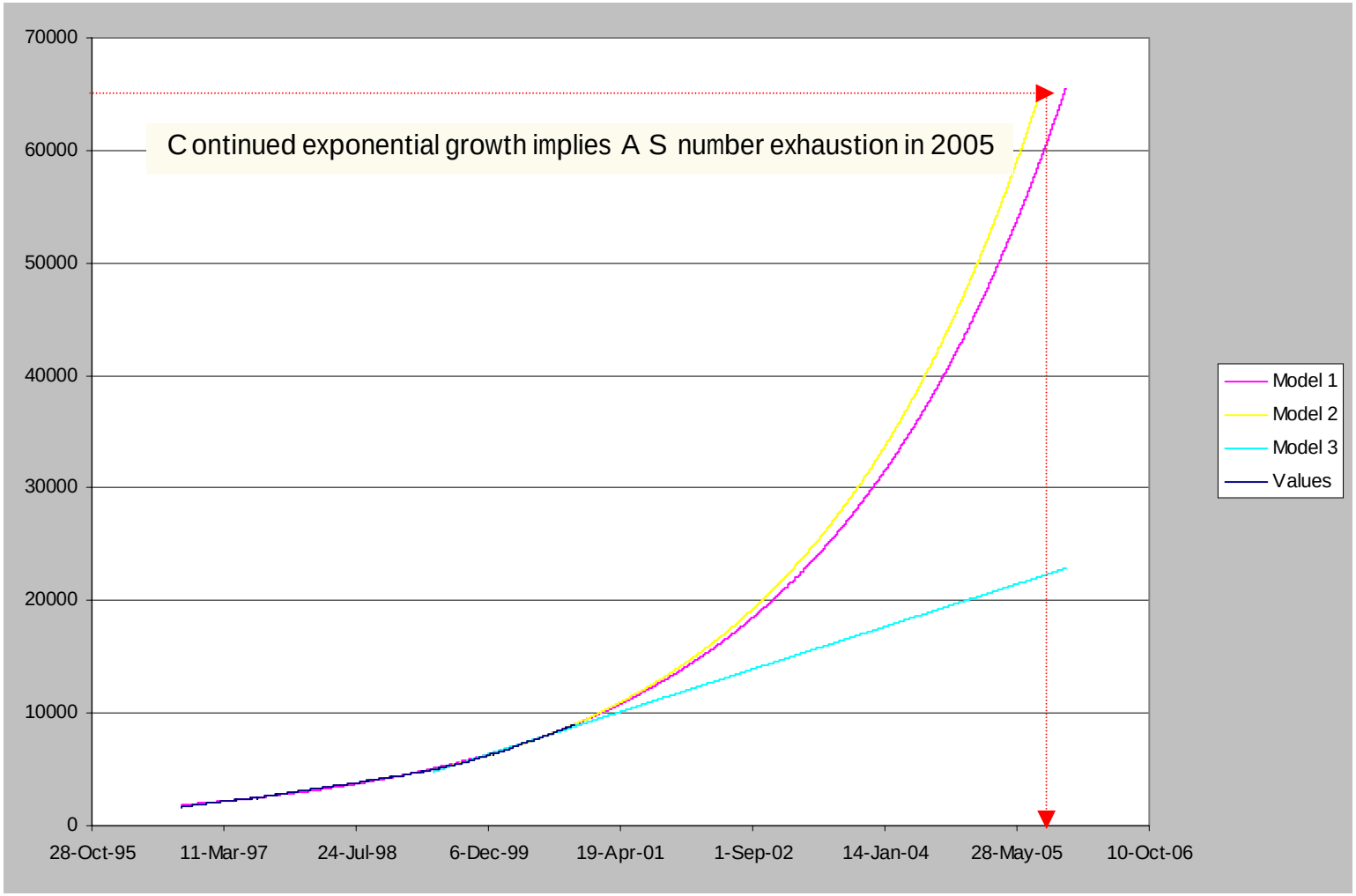
Exponential growth is evident in a longer term view of the AS deployment rate

AS Number Trend Models

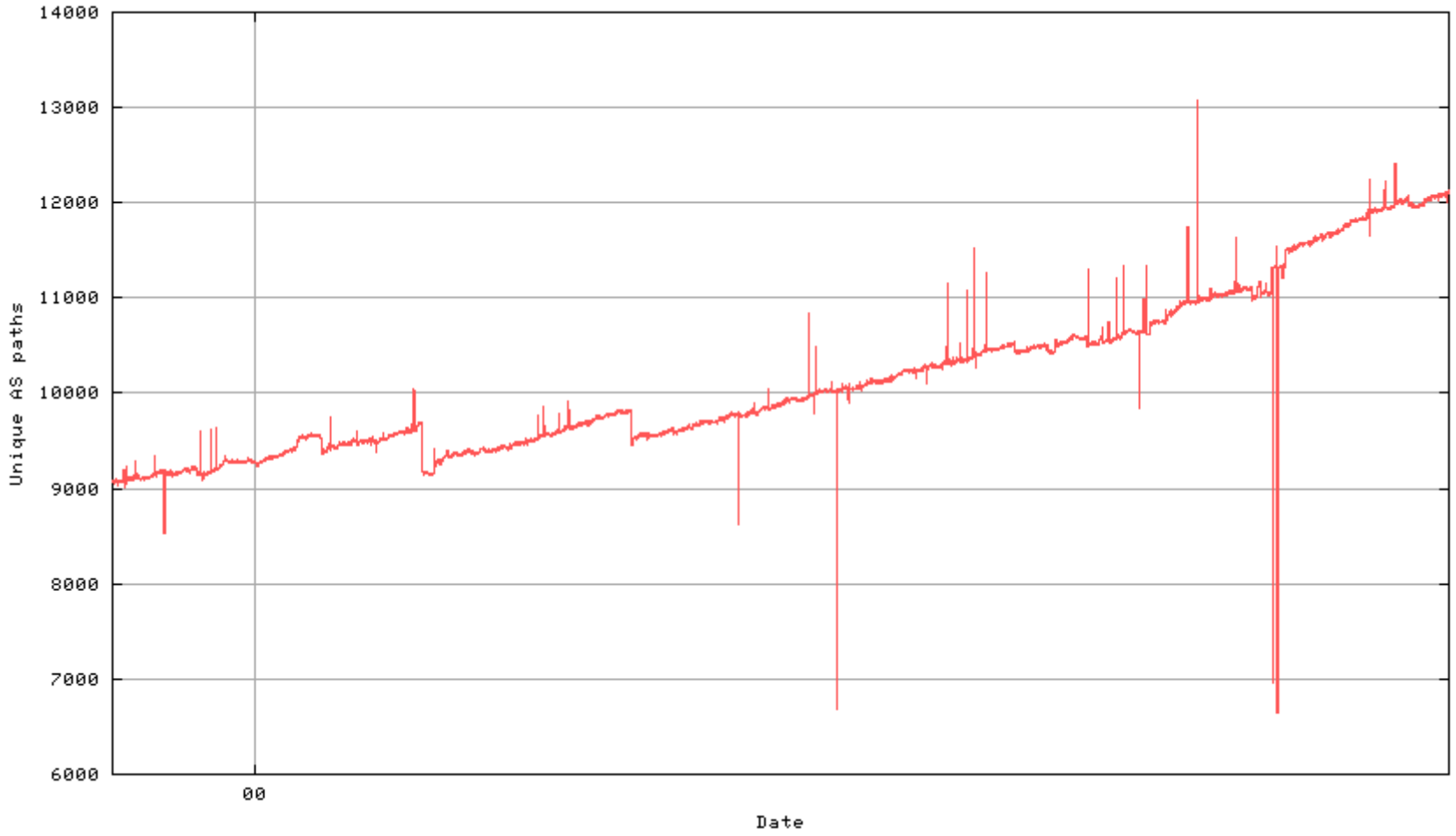


Best fit model is an exponential model using 12 months of data

AS Number Use - Extrapolation



Number of distinct AS Paths



Observations for 99/00

- Low growth in the number of routed addresses

  0.6% growth / month (7% / year)

- High growth in number of route advertisements

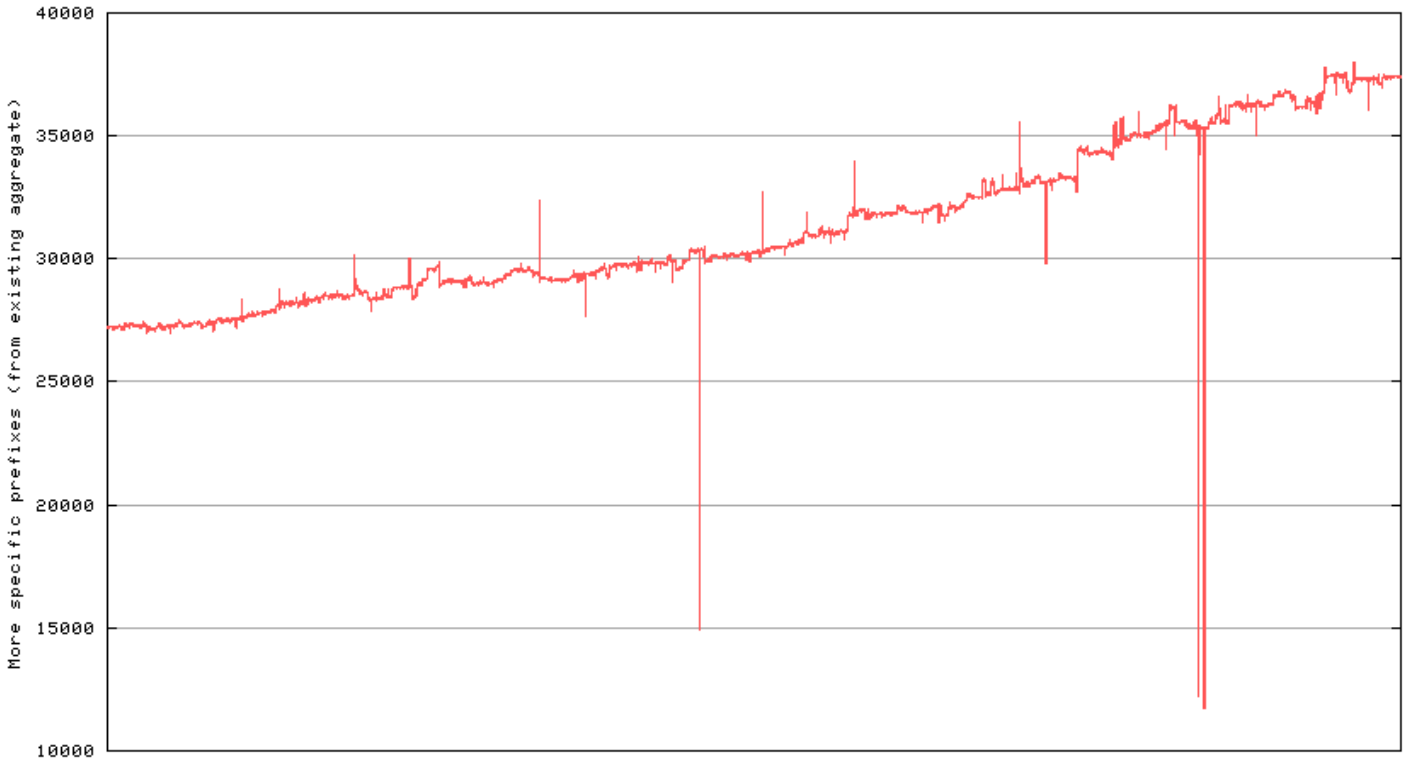
  3% growth / month (42% / year)

- High growth in number of AS's

  3.5% growth / month (51% / year)

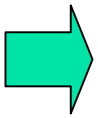
Multi-homing on the rise?

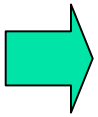
- Track rate of CIDR “holes” – currently 40% of all route advertisements are routing ‘holes”



T his graph tracks the number of address prefix advertisements which are part of an advertised larger address prefix

Prefix Growth – Aug 00 to Oct 00

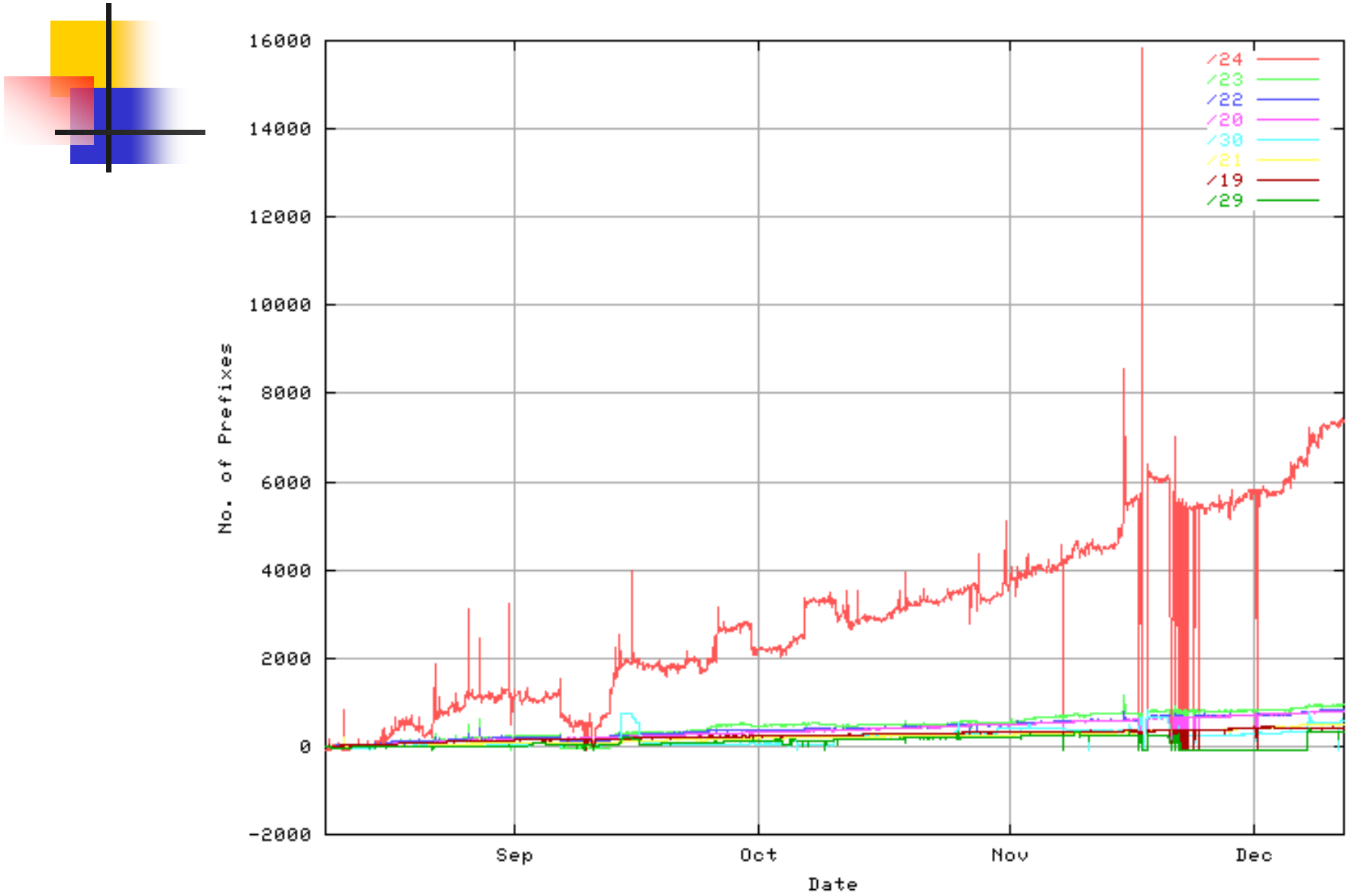


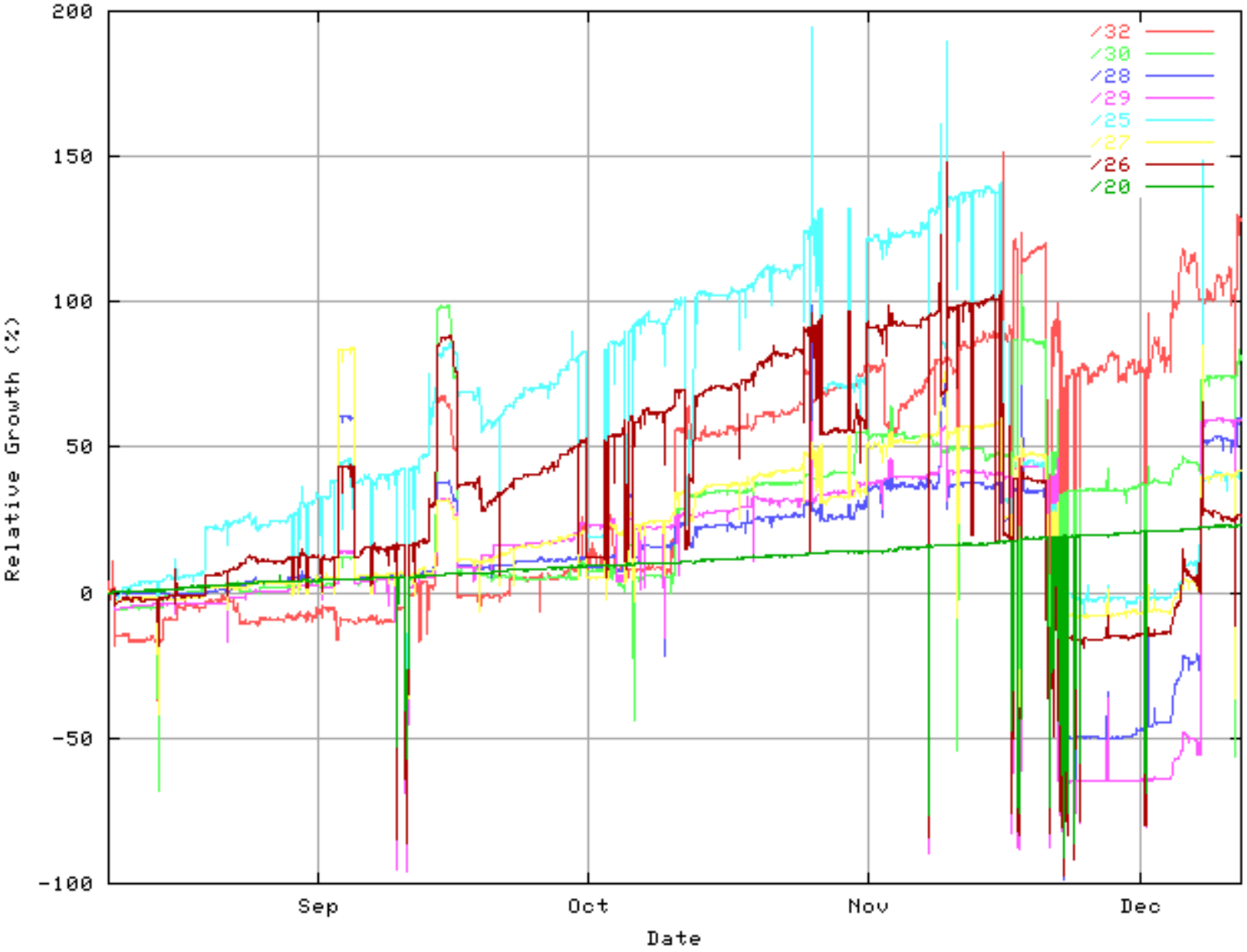


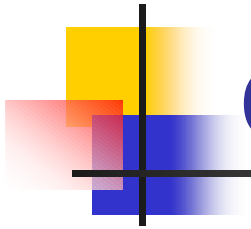
```
/16   6553 ->   6670   absolute growth =  117, relative =   1.79%
/17    889 ->    936   absolute growth =   47, relative =   5.29%
/18   1763 ->   1884   absolute growth =  121, relative =   6.86%
/19   5704 ->   5984   absolute growth =  280, relative =   4.91%
/20   3423 ->   3854   absolute growth =  431, relative =  12.59%
/21   3621 ->   3856   absolute growth =  235, relative =   6.49%
/22   5415 ->   5870   absolute growth =  455, relative =   8.40%
/23   7298 ->   7788   absolute growth =  490, relative =   6.71%
/24  49169 ->  52449   absolute growth = 3280, relative =   6.67%
/25    208 ->    436   absolute growth =  228, relative = 109.62%
/26    334 ->    606   absolute growth =  272, relative =  81.44%
/27    469 ->    667   absolute growth =  198, relative =  42.22%
/28    357 ->    452   absolute growth =   95, relative =  26.61%
/29    579 ->    764   absolute growth =  185, relative =  31.95%
/30    746 ->   1026   absolute growth =  280, relative =  37.53%
```

T he largest significant relative growth in recent times is /20, tracking the allocation policy change in the RIRs

While the absolute number is low, the largest relative growth is in /25 prefixes, and /25 to /30 represent the greatest area of prefix growth in relative terms


16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
No. of Prefixes
Sep
Oct
Nov
Dec
Date
/24
/23
/22
/20
/30
/21
/19
/29

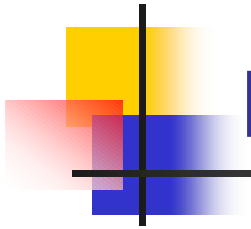

200
150
100
50
0
-50
-100
Relative Growth (%)
Sep
Oct
Nov
Dec
Date
/32
/30
/28
/29
/25
/27
/26
/20



Conjectures....

BGP table size will continue to rise exponentially

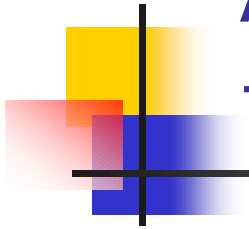
- Multi-homing at the edge of the Internet is on the increase
- The interconnectivity mesh is getting denser
  - The number of AS paths is increasing faster than the number of AS's
  - Average AS path length remains constant
- AS number deployment growth will exhaust 64K AS number space in August 2005 if current growth trends continue



More conjecturing....

- Inter-AS Traffic Engineering is being undertaken through routing discrete prefixes along different paths -- globally (the routing mallet!)
- RIR allocation policy (/19, /20) is driving one area of per-prefix length growth in the aggregated prefix area of the table
- BUT - NAT is a **very** common deployment tool
- NAT, multihoming and TE is driving even larger growth in the /24 prefix area

And while we are having such a good time conjecturing...



- Over 12 months average prefix length in the table has shifted from /18.1 to /18.5
- More noise (/25 and greater) in the table, but the absolute level of noise is low (so far)
- Most routing table flux is in the /24 to /32 prefix space – as this space gets relatively larger so will total routing table flux levels
  - “Flux” here is used to describe the cumulative result of the withdrawals and announcements

This is fun – lets have even more conjectures...

- CIDR worked effectively for four years, but its effective leverage has now **finished**
- Provider-based service aggregation hierarchies as a model of Internet deployment structure is more theoretic than real these days

  i.e. provider based route aggregation is leaking like a sieve!

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