Internet Evolution and IPv6

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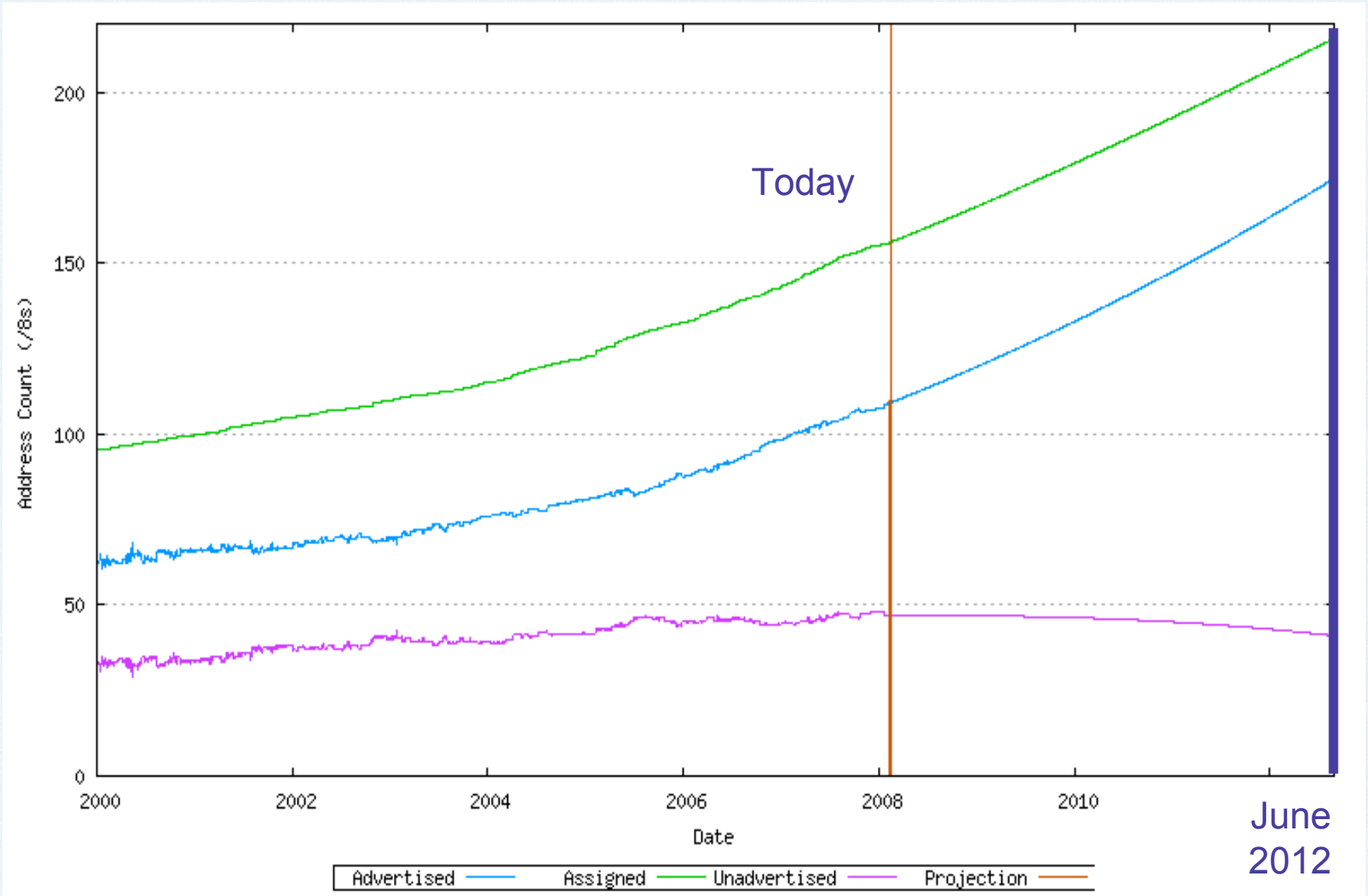
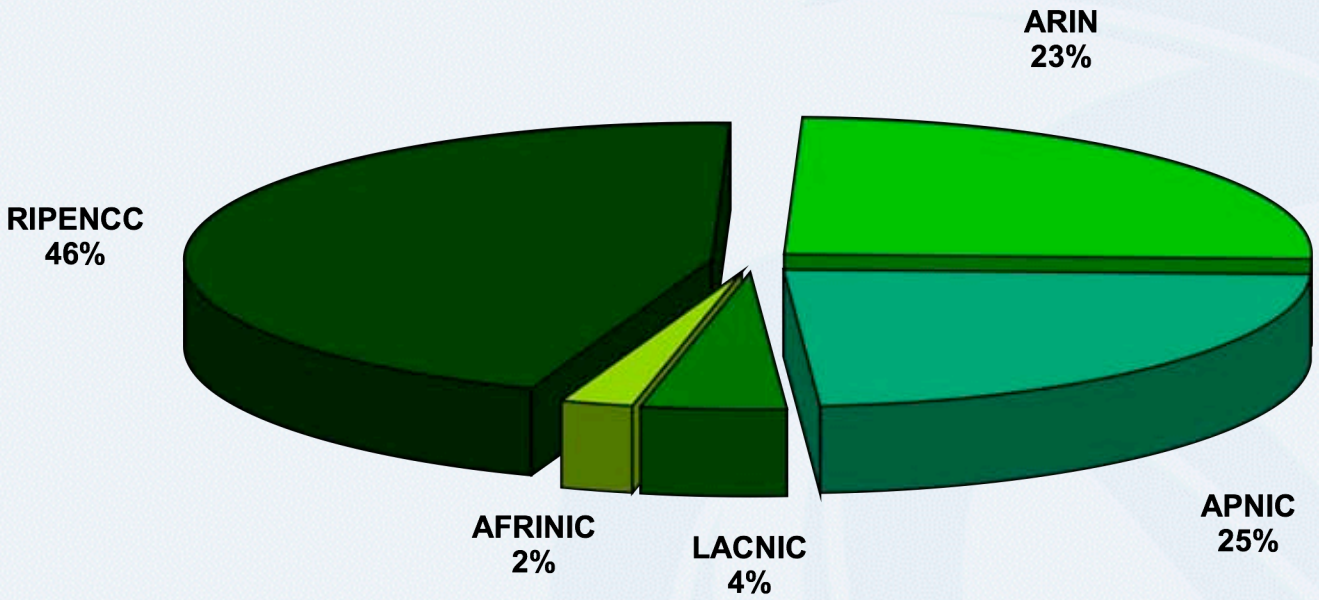
Projected lifetime of IPv4 addresses



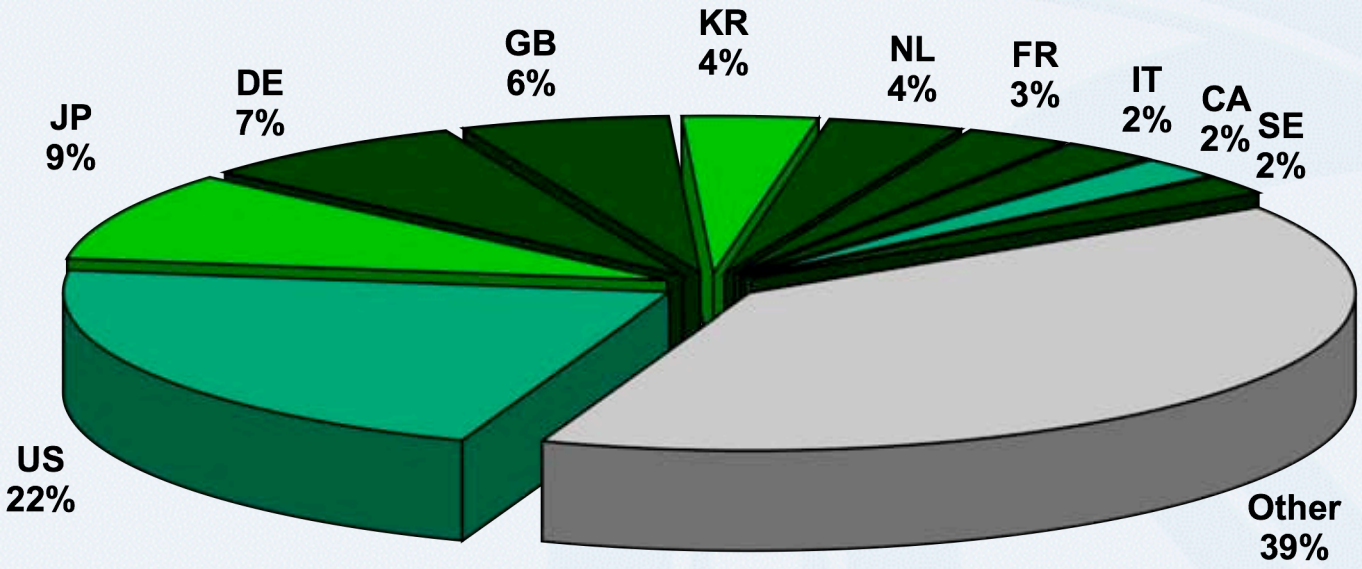
Where are IPv6 addresses today?

IPv6 – Global allocations by RIR



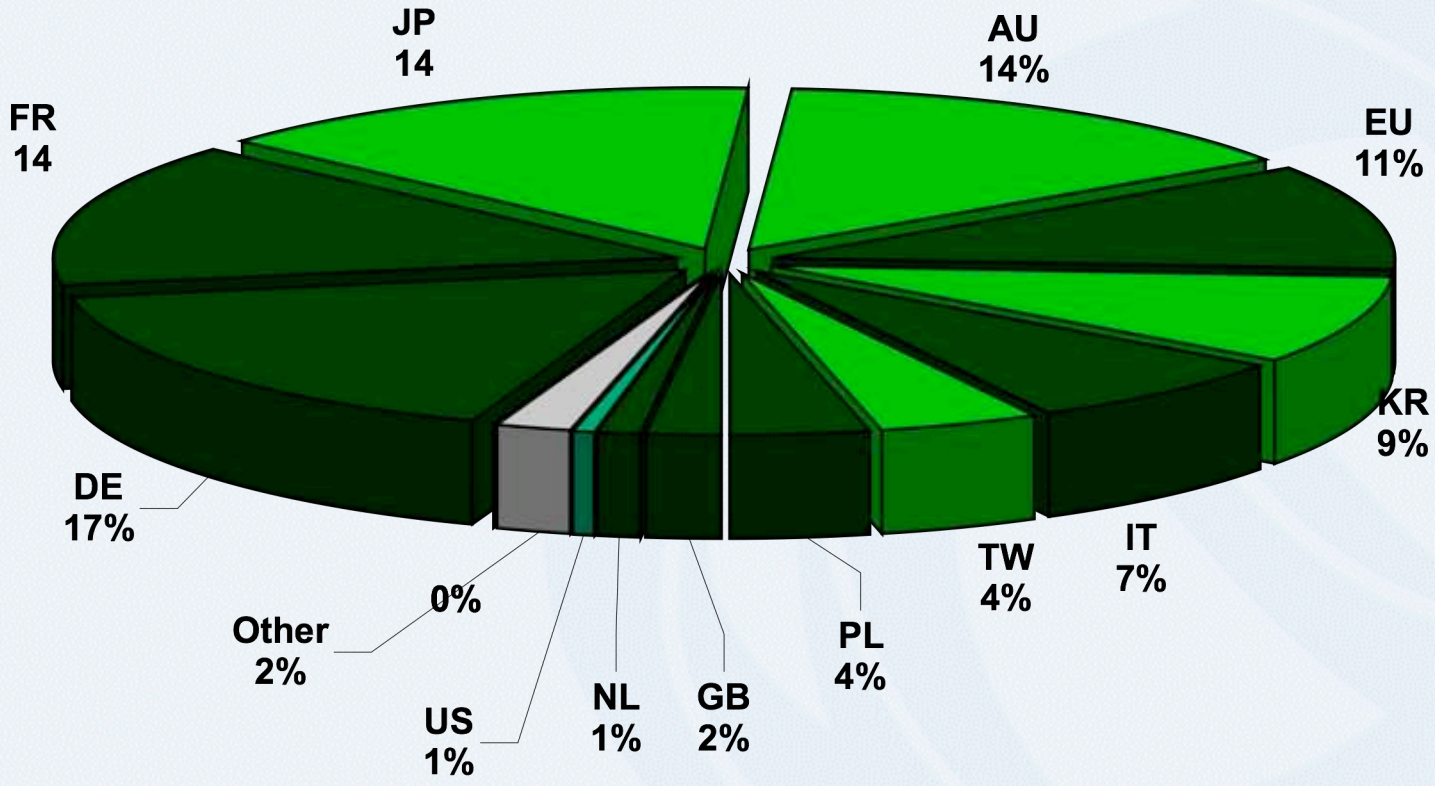
Unit: IPv6 prefix

IPv6 – Global allocations by CC



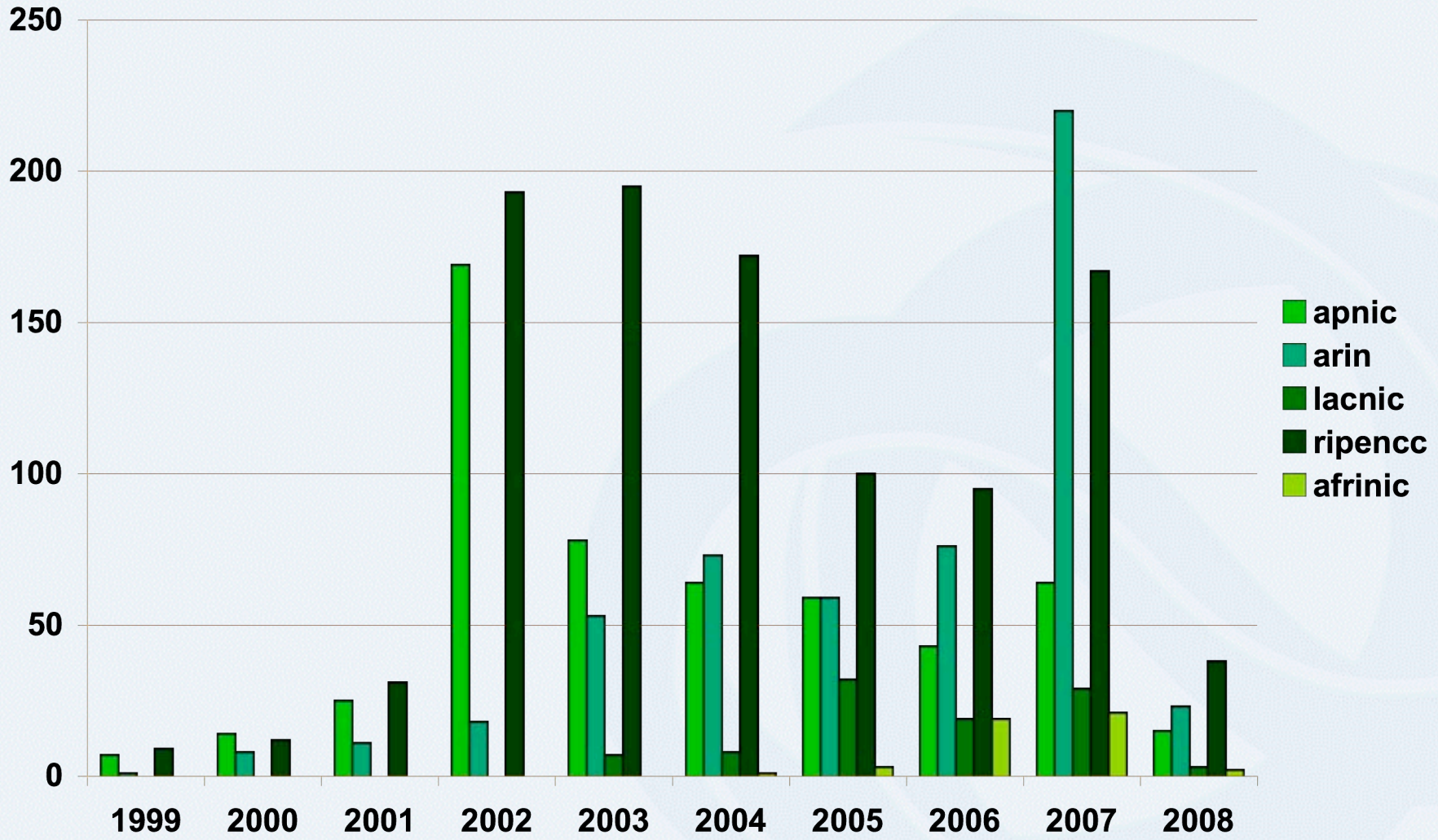
Unit: IPv6 prefix

IPv6 – Global allocations by CC



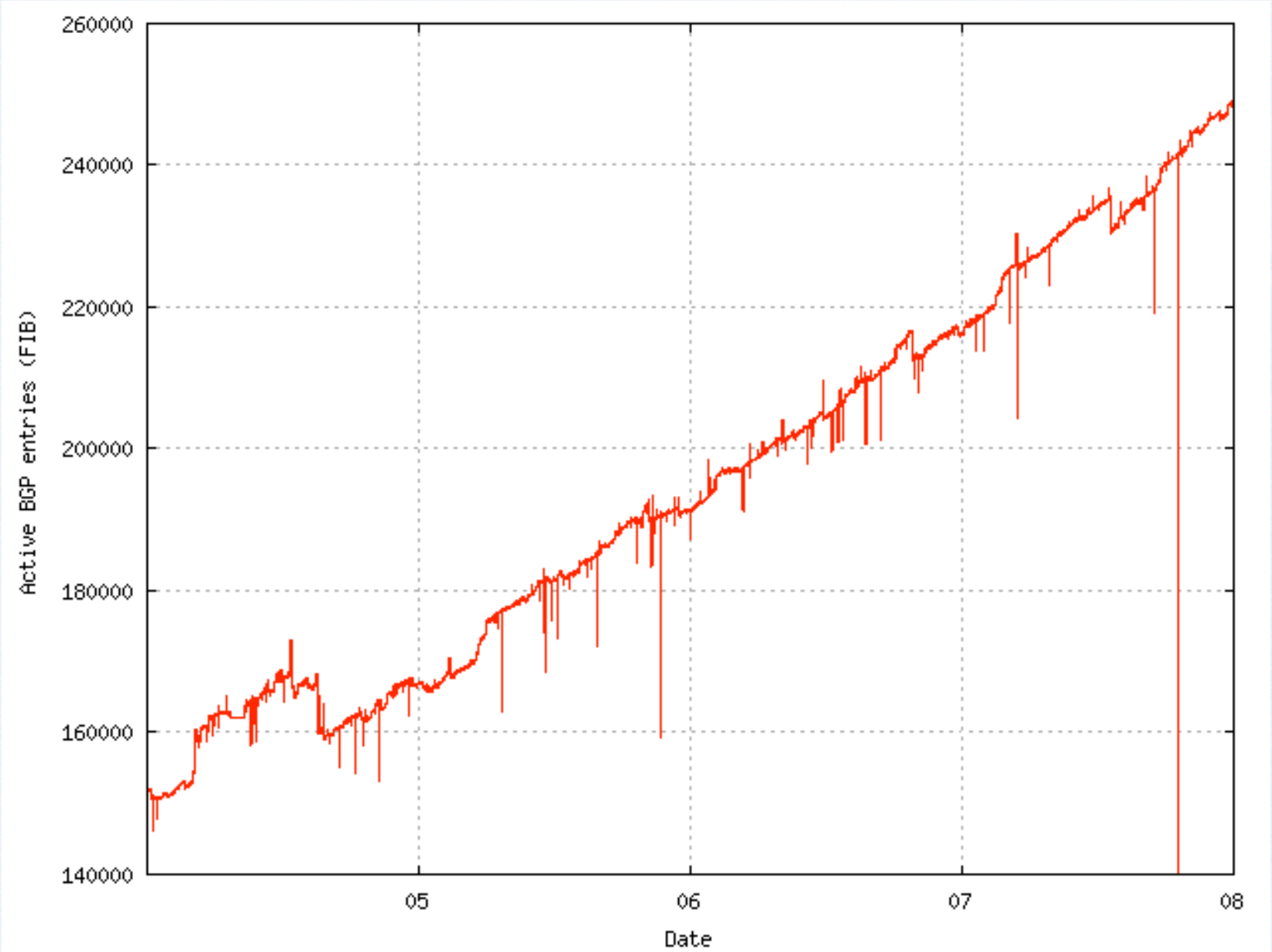
Unit: 32 prefix

IPv6 – Global allocation trend

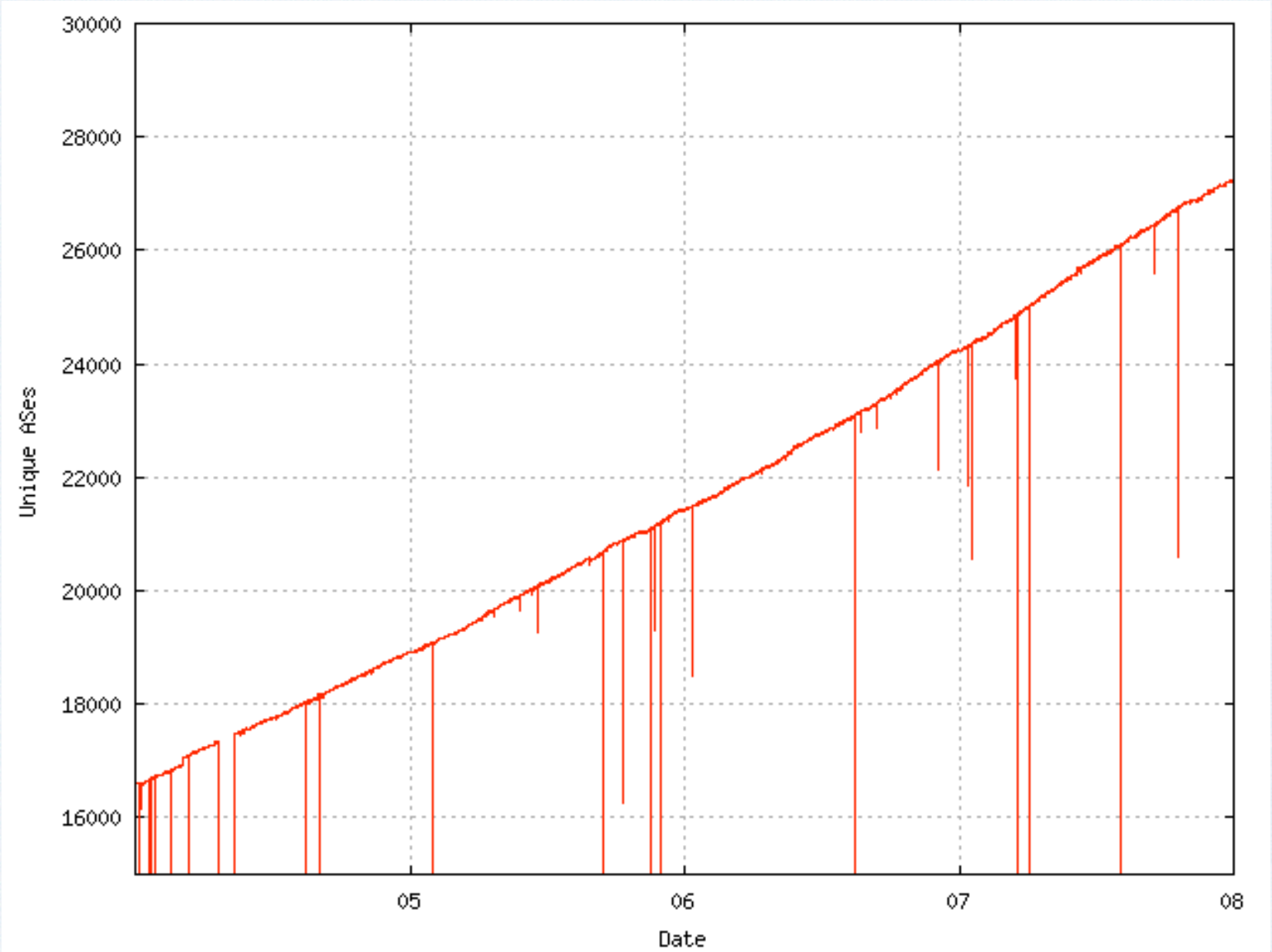


How much IPv6 is actually in use?

IPv4 – routed prefixes

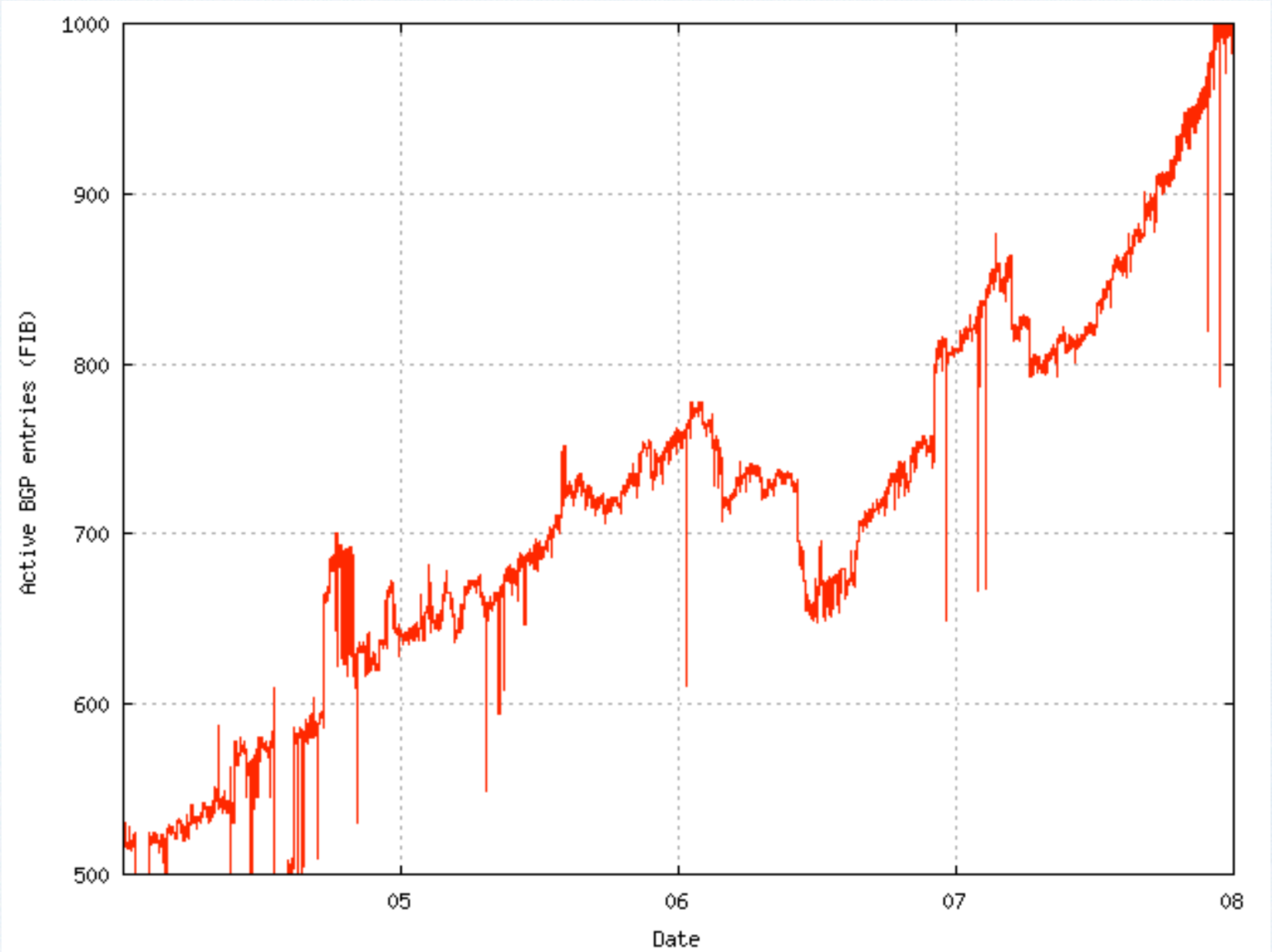


IPv4 – routed ASNs

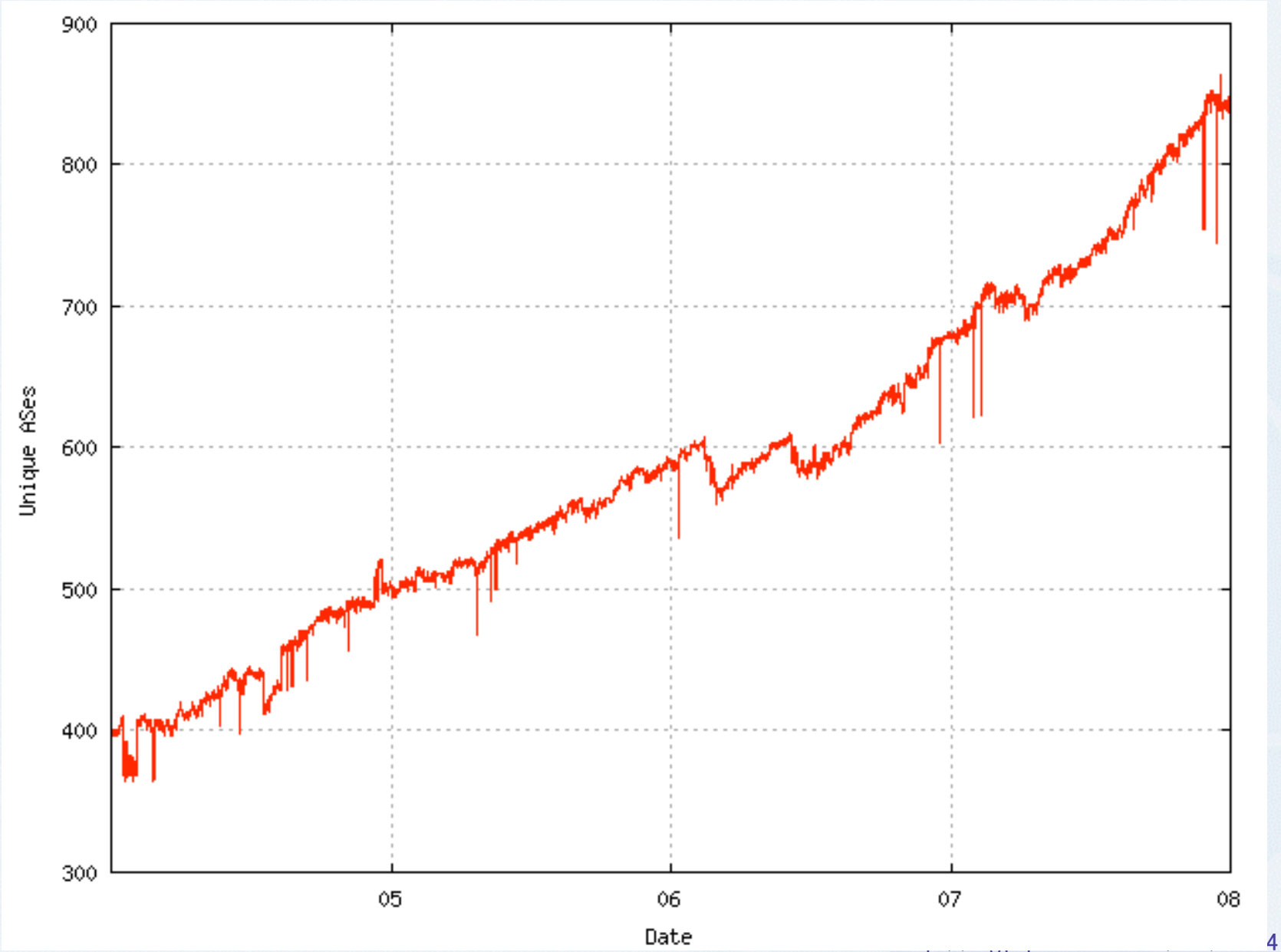


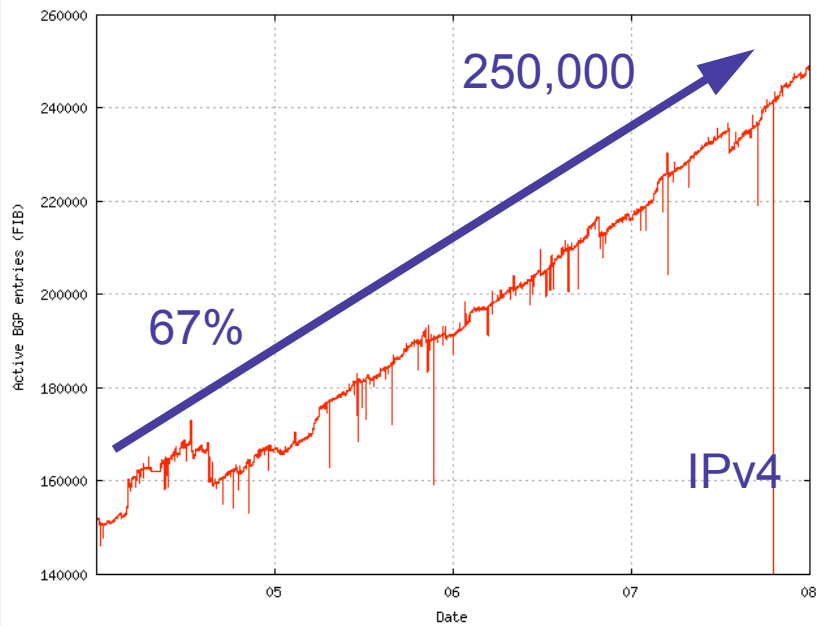
html

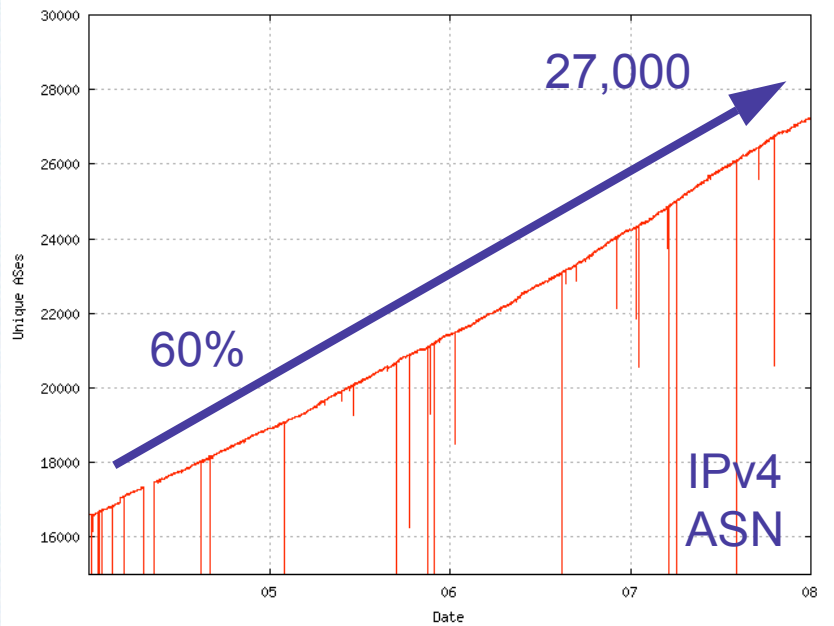
IPv6 – routed prefixes



IPv6 – routed ASNs




250,000
67%
IPv4
Active BGP entries (FIB)
Date
260000
240000
220000
200000
180000
160000
140000
05
06
07
08


27,000
60%
IPv4
ASN
Unique ASes
Date
30000
28000
26000
24000
22000
20000
18000
16000
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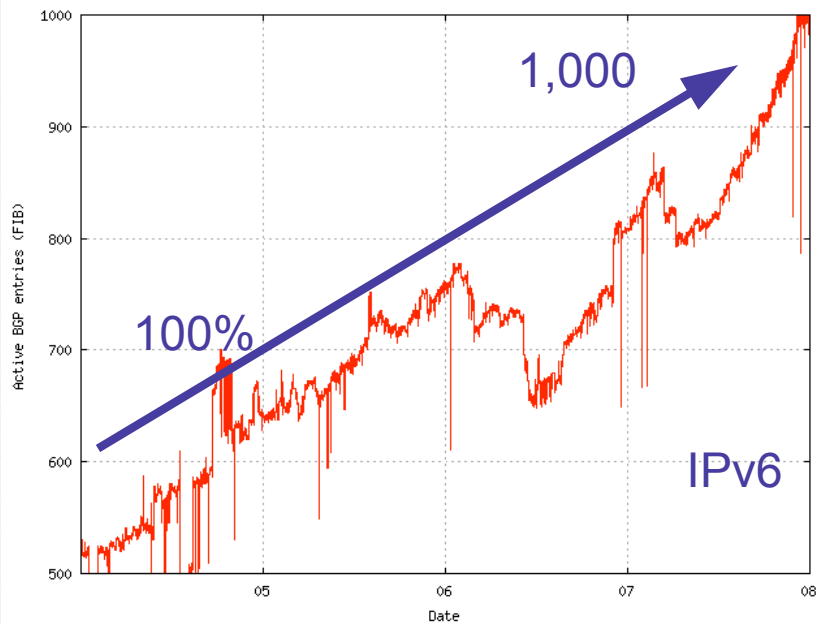
07
08


1,000
100%
IPv6
Active BGP entries (FIB)
Date
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700
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500
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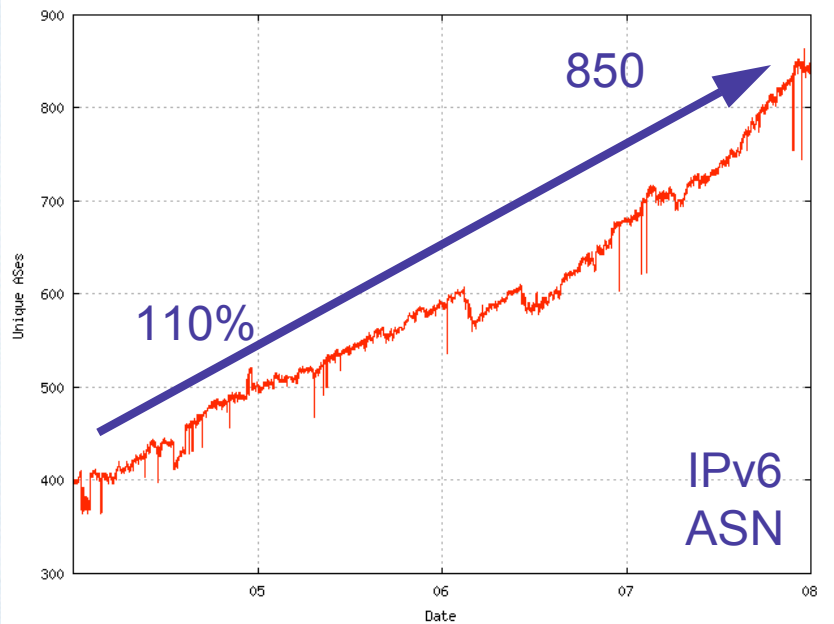
850
110%
IPv6
ASN
Unique ASes
Date
900
800
700
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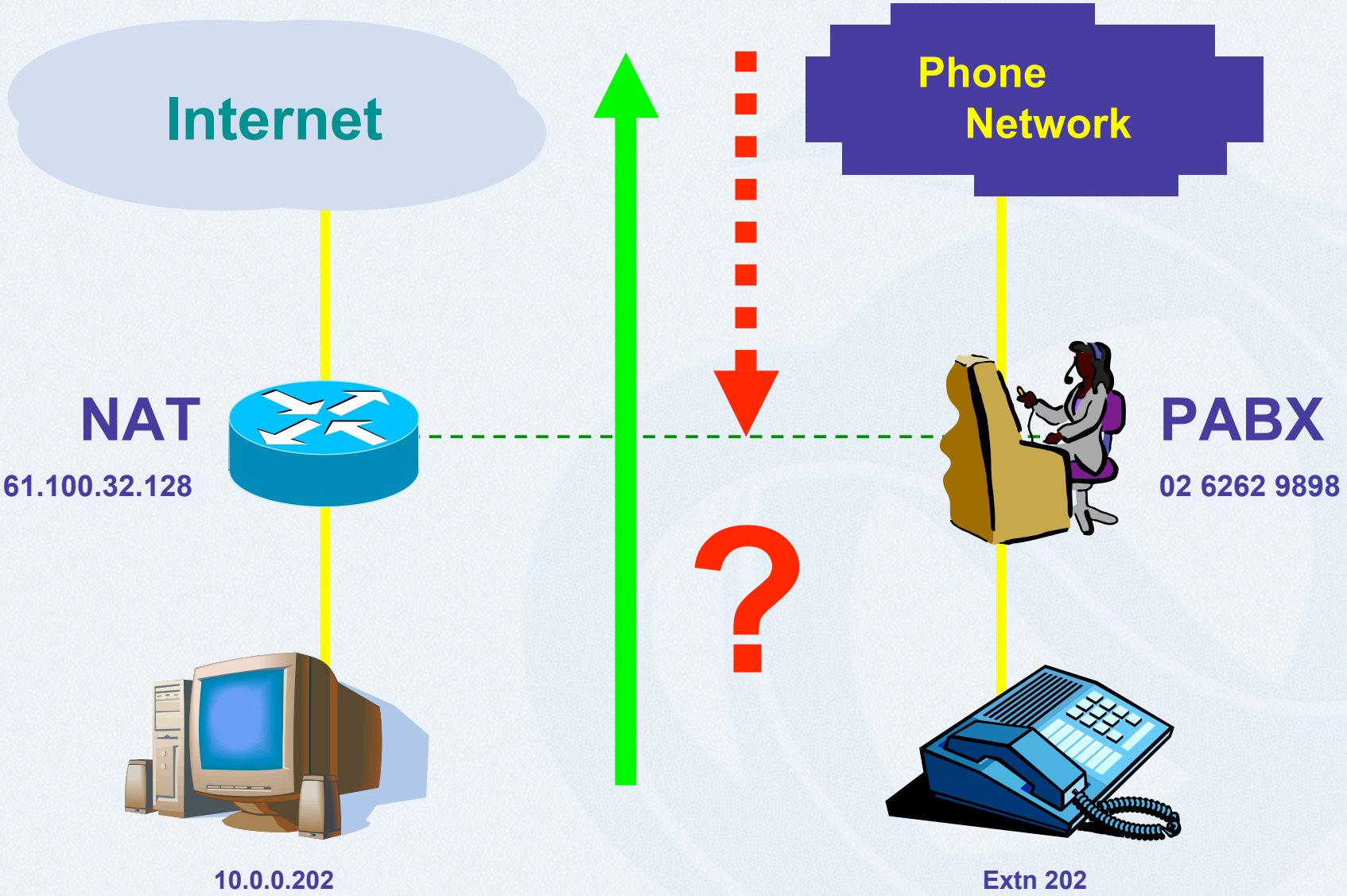
07
08

The InterNAT today

The NAT problem



The InterNAT Today

- Everything now engineered for NAT
  - Client-initiated transactions
  - Application-layer identities
  - Server agents for multi-party rendezvous
  - It seems to work.
- Who bears the cost?
  - End users buy the NATs
  - Applications developers do the hard work
  - ISP costs are externalised
  - But, it does cost a lot.

Where is the ISP Industry?

- Telco consolidation…
  - Intense competition in the ISP industry has finished
  - The focus has shifted away from the ISP and away carriage services and towards to content services
- Commoditization…
  - Mass market access deployment has marginal rates of return on capital
  - ISP products remain undifferentiated – triple play, NGN and IMS based products have so far failed to achieve visible takeup
- Stasis…
  - Low margins and poor capital return have created a sluggish industry that is unresponsive to change
  - Resistive to efforts to evolve the IP level service model

The problem with IPv6?

- Technical
  - IPv6 is stable and well tested
  - But transition issues are still being resolved
- Business
  - NAT has worked too well
  - Existing industry based on externalizing the costs for address scarcity, and insecurity
  - Lack of investor interest in more infrastructure investment: Short term vs long term
  - IPv6 promotion - too much too early?
    - IPv6 is “tired” not “wired”

The result…

- Short term business pressures result in deferral of IPv6 investments
- Insufficient linkage between the added cost and complexity of NAT-based applications and the costs of deploying IPv6
- An evolutionary adoption proves difficult in today's environment
  - …or in the foreseeable future?

How can it happen?

The IPv4 revolution

- The 1990's – a new world of…
  - Cheaper switching technologies
  - Cheaper bandwidth
  - Lower operational costs
  - The PC revolution, funded by users
- The Internet boom
  - The dumb (and cheap) network
  - Technical and business innovation at the ends
  - Many rewards for new services and innovation

An IPv6 revolution…

- The 2000's – a new world of…
  - Commodity Internet provision, lean and mean
  - Massive reduction in cost of consumer electronics
  - A network-ready society
- The IPv6 boom?
  - "Internet for Everything"
  - Serving the communications requirements of a device-dense world
  - Device population some 2–3 orders of magnitude larger than today's Internet
  - Service costs must be cheaper by 2-3 orders of magnitude – per packet

IPv6 – From PC to iPOD to iPOT

- A world of billions of chattering devices

- Or even trillions…

In conclusion…

The IPv6 Challenge

- Still too few compelling benefits to drive new investments in existing services
- But the silicon industry has made the shift from value to volume years ago
- The Internet industry might follow this lead
  - From value to volume in IP(v6) packets
  - Reducing packet transmission costs by orders of magnitude
  - To an IPv6 Internet embracing a world of trillions of devices
  - To a true utility model of service provision

Thank you

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