Measuring IPv6 Deployment

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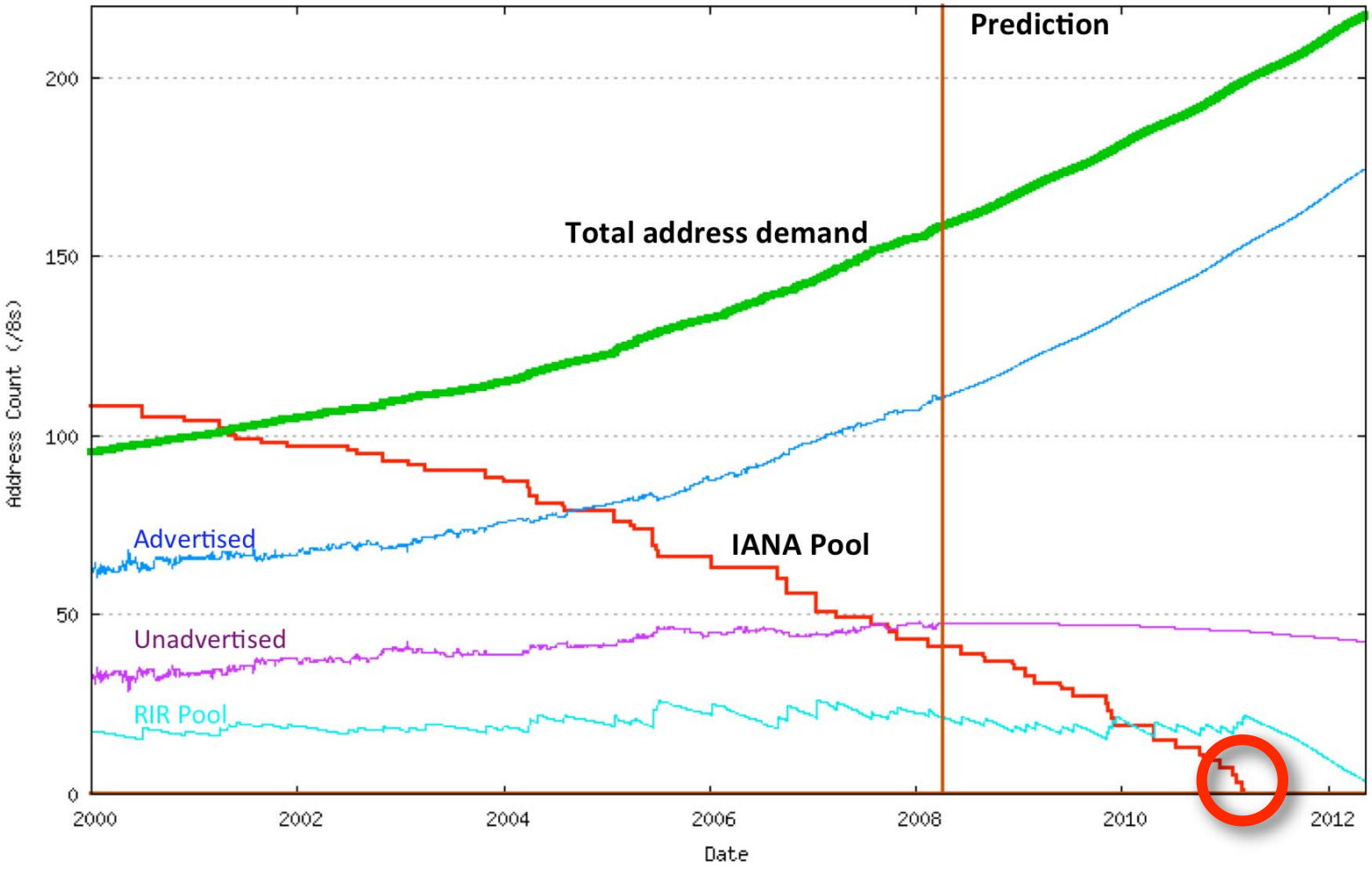
The story so far…

In case you hadn't heard by now, we appear to be running quite low on IPv4 addresses!

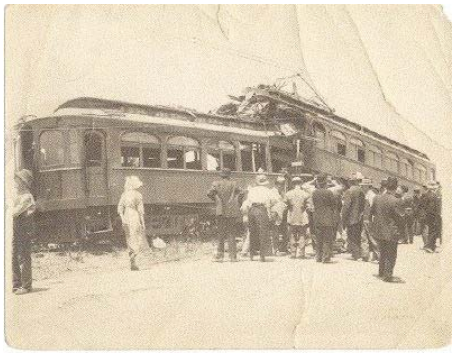
IANA Pool Exhaustion

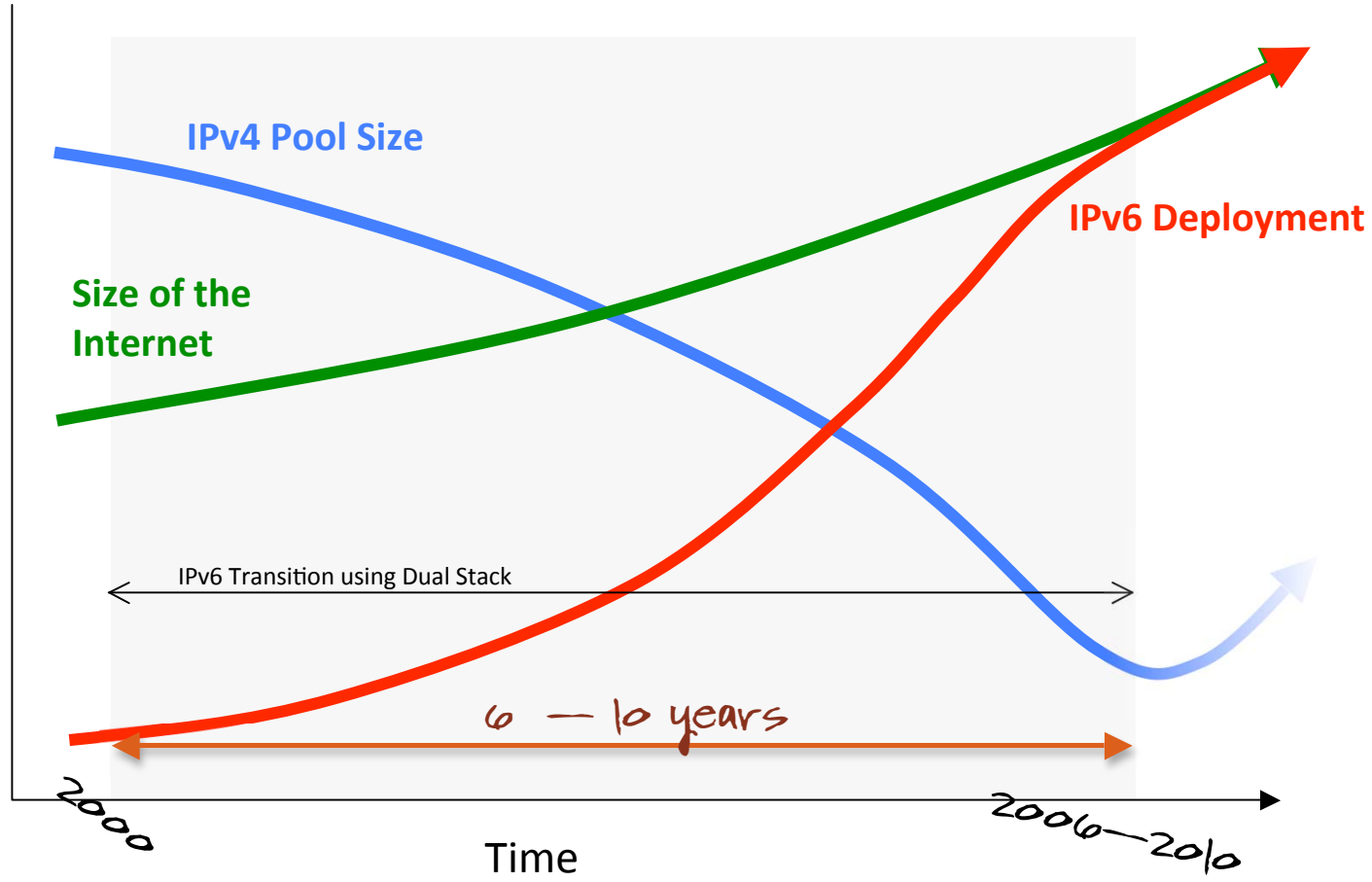


In this model, IANA allocates its last IPv4 /8 to an RIR on the 18th January 2011

This is the model's predicted exhaustion date as of the 26th April 2008. The predictive model is updated daily at:
http://ipv4.potaroo.net

Ten years ago we had a plan …

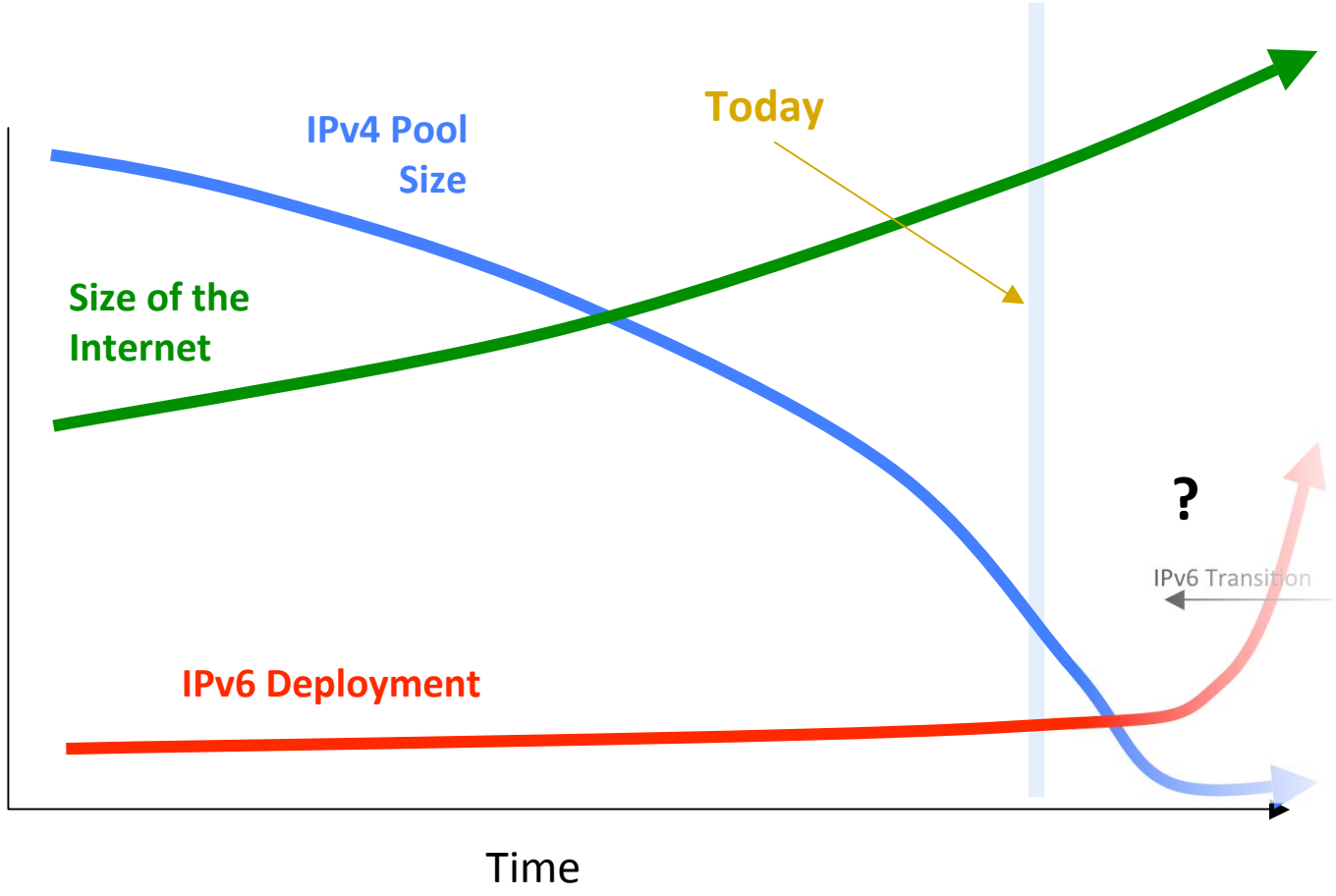




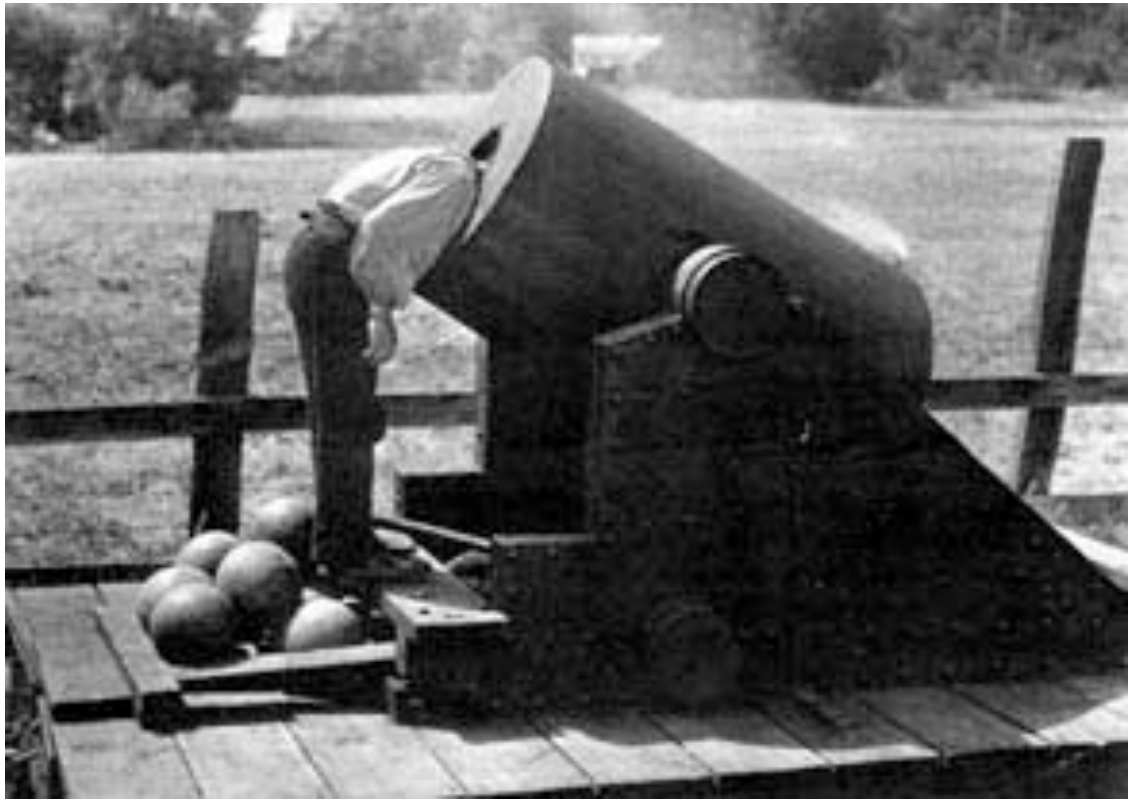
Oops!

We were meant to have completed the transition to IPv6 **BEFORE** we completely exhausted the supply channels of IPv4 addresses!

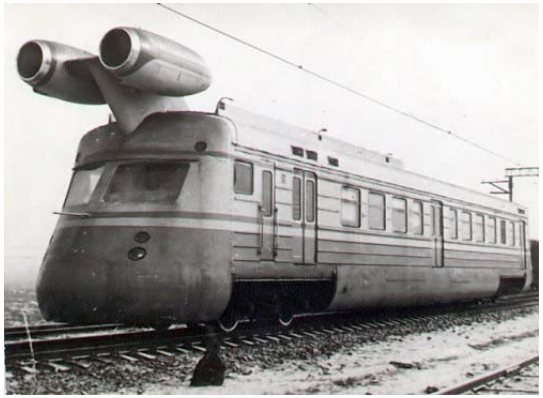
What's the revised plan?



Its just not looking good is it?



IPv6 Deployment



The new version of the plan is that we need to have much of the Internet also supporting IPv6 in the coming couple of years

How are we going today with this new plan?

OR: How much IPv6 is being used today?

If we had long term access to a production network…

- We could perform some form of packet header sampling
- Or with the right MIBS we could even do this packet and volume counting by protocol using SNMP

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If we had long term access to a production network…

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- Or with the right MIBS we could even do this packet and volume counting by protocol using SNMP

But:

- We don't have direct access to any such network
- And there does not appear to be any long term public sources of the relative use of IPv4 and IPv6 data in the public Internet that we can see

  Assuming that anyone is even collecting this data!

Are there other ways to answer this question?

Can the data we already collect be interpreted in such a way to provide some answers to this question?

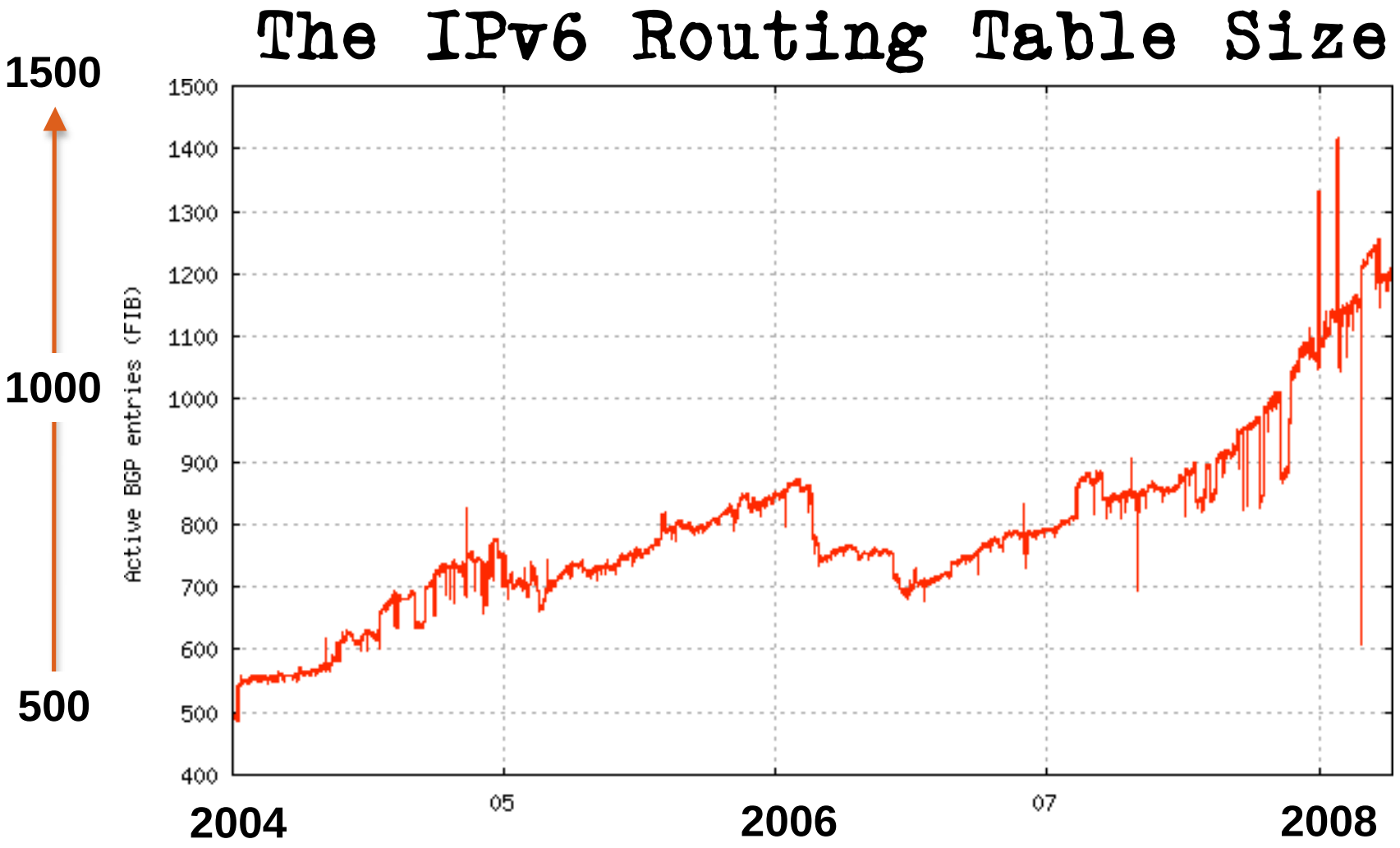
We have access to dual stack data for:

- BGP Route table
- DNS server traffic
- WEB Server access

and the data sets go back over the past 4 years

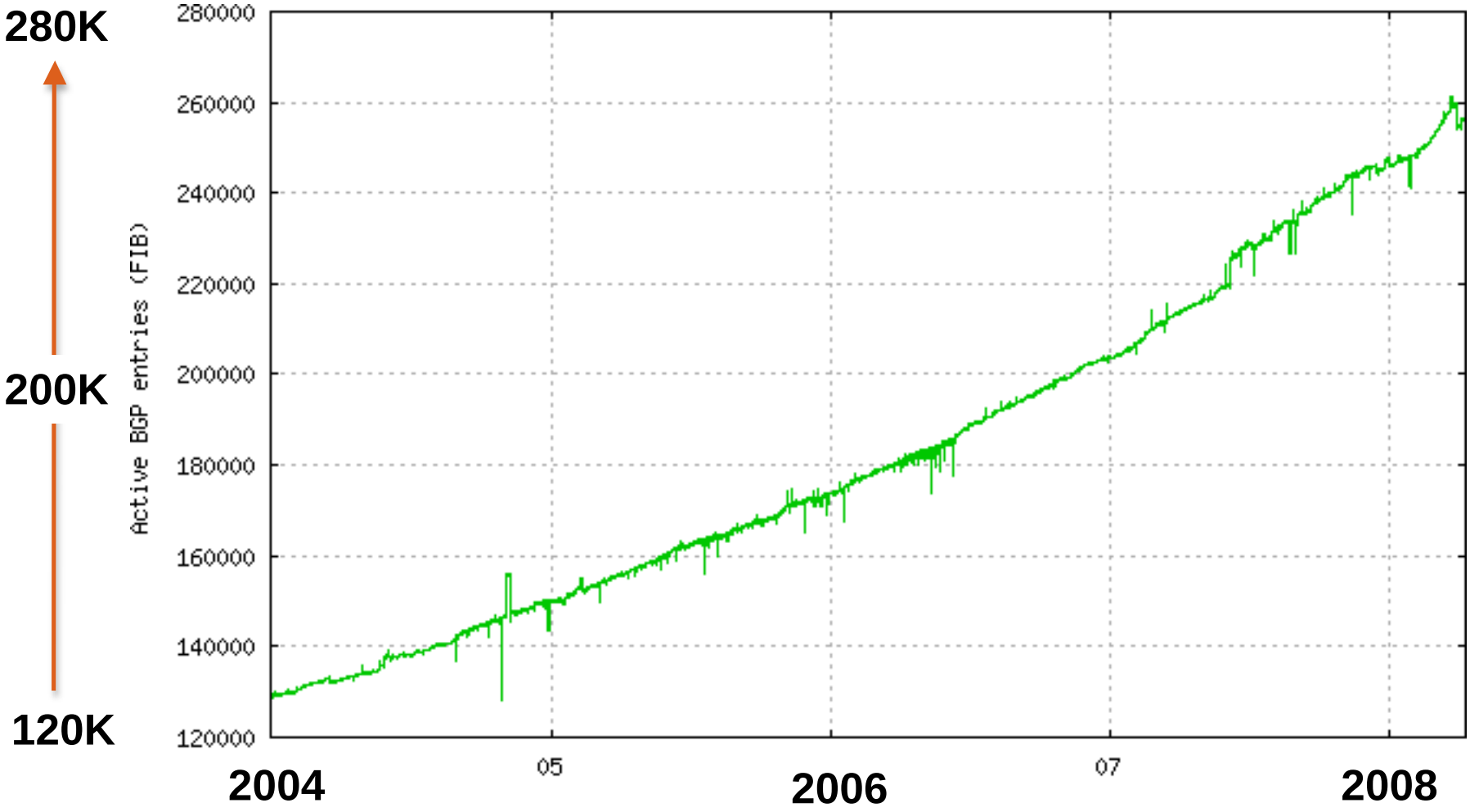
What can these data sets tell us in terms of IPv6 adoption today?

The BGP view of IPv6

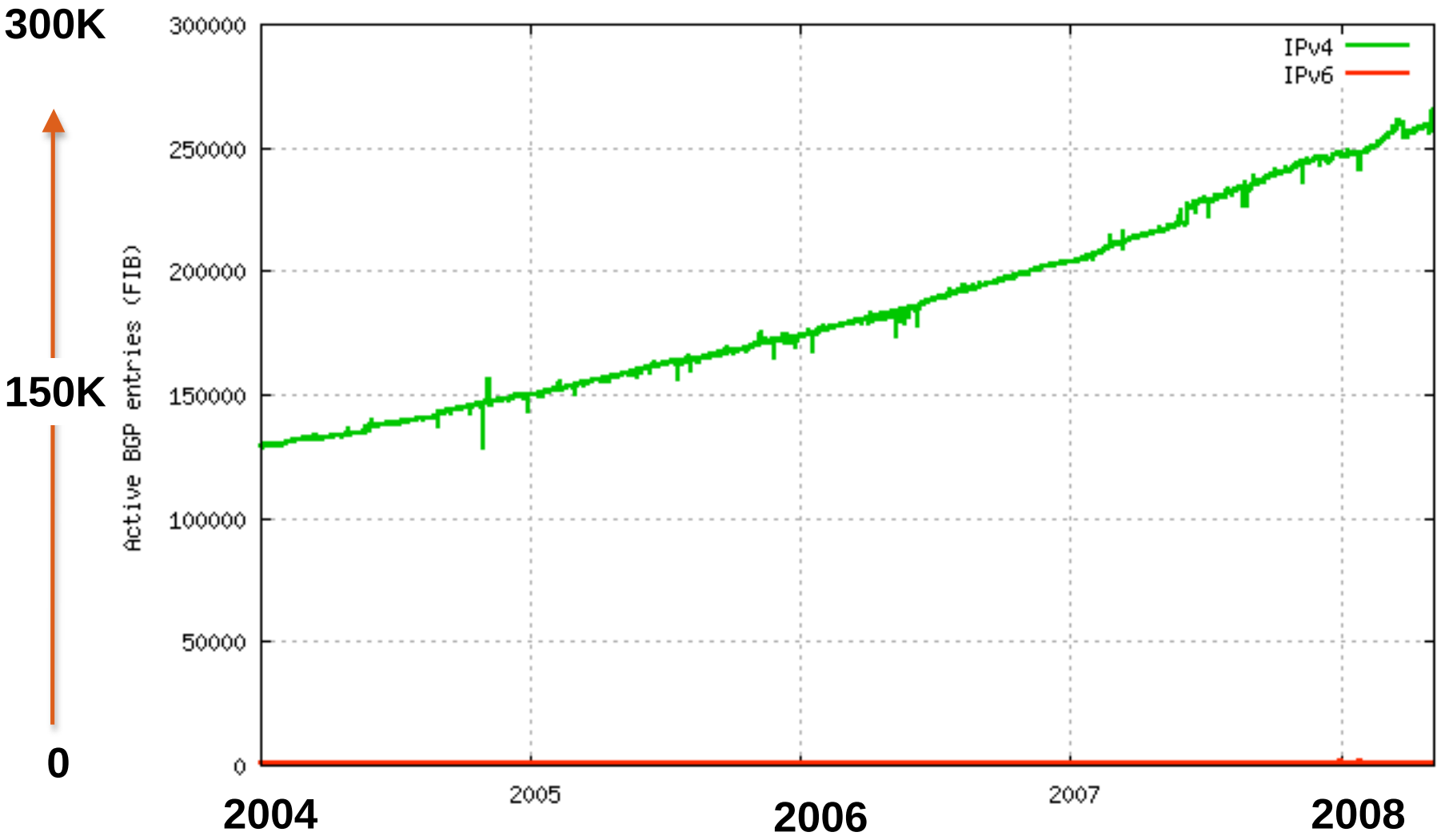


The BGP view of IPv4

The IPv4 Routing Table Size



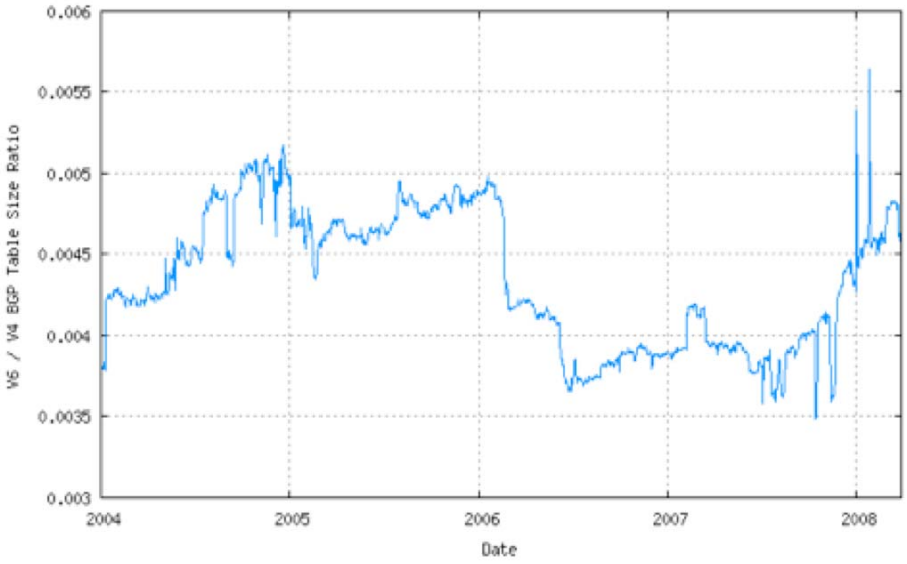
BGP: IPv6 and IPv4



BGP IPv6 : IPv4

What's this saying?

- V6 is 0.4% of IPv4 in terms of routing table entries
  - But the routing domain of IPv4 is heavily fragmented, while IPv6 is not



What's this saying?

- Since mid 2007 there appears to have been increased interest in experience with routing IPv6 over the public Internet

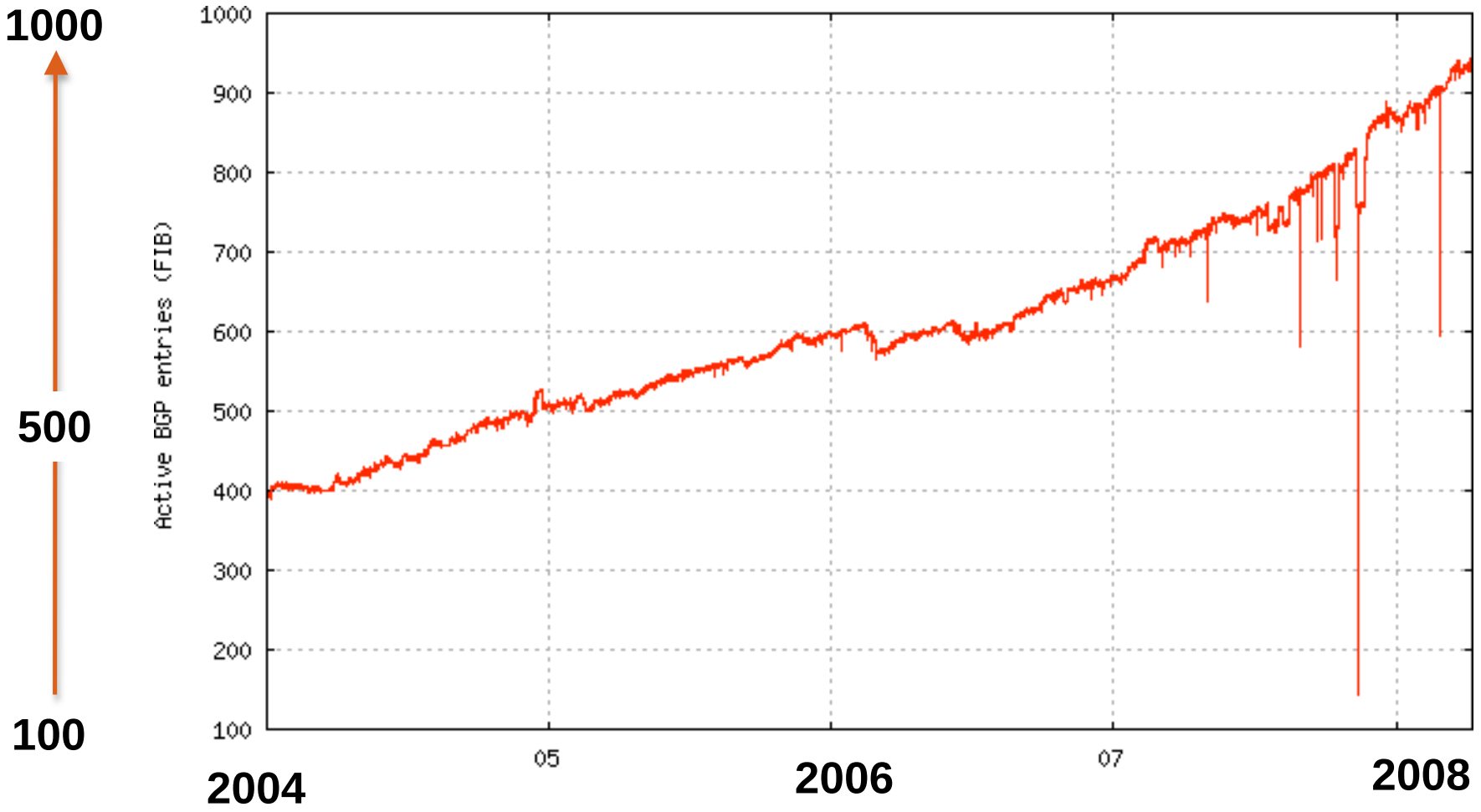
- But the relative level of IPv6 use cannot be readily determined from this data

Lets refine the question

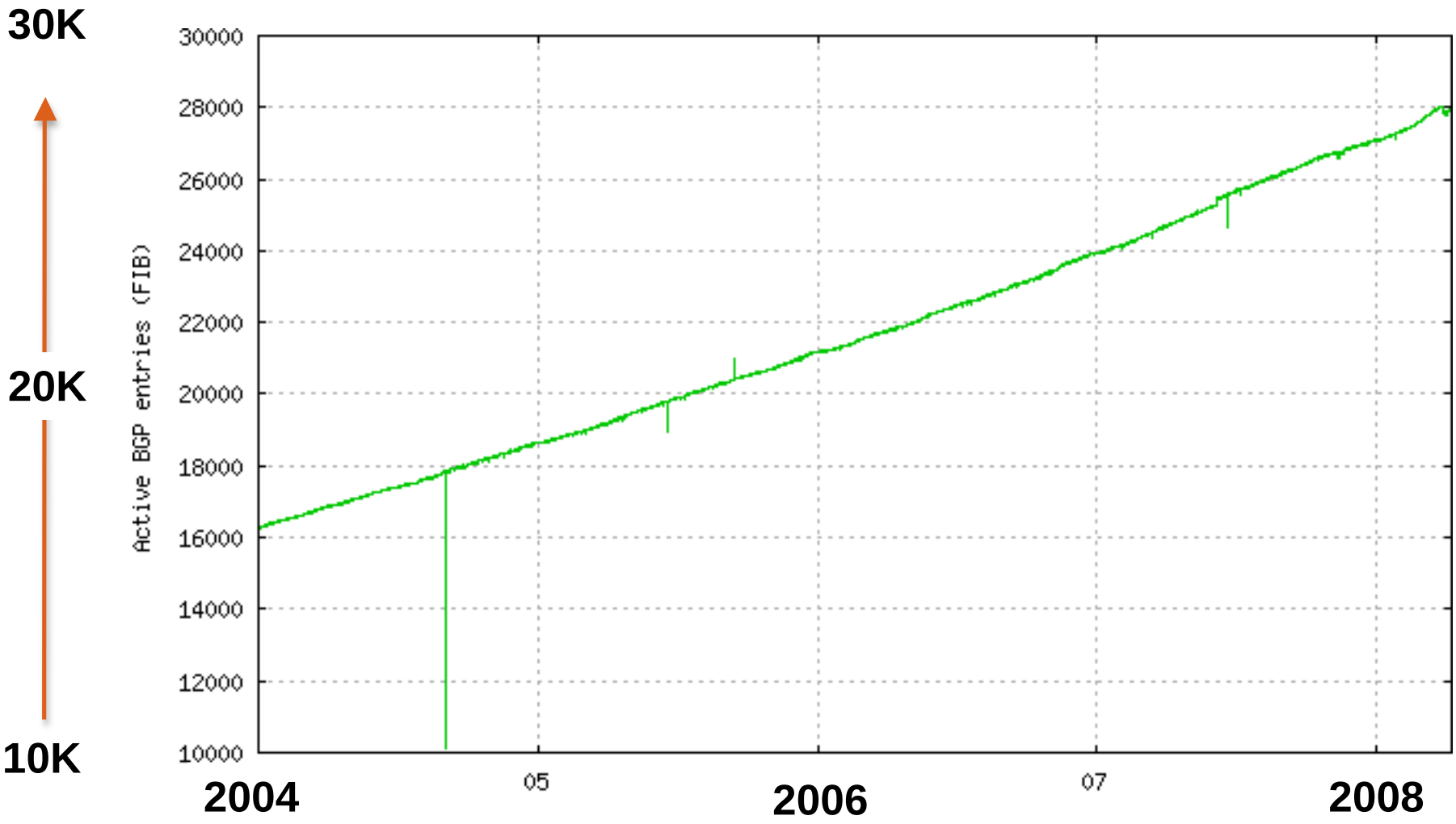
How much of the Internet today is **capable** of running IPv6?

One way to answer this is to look at IPv6 routing on a per-AS basis

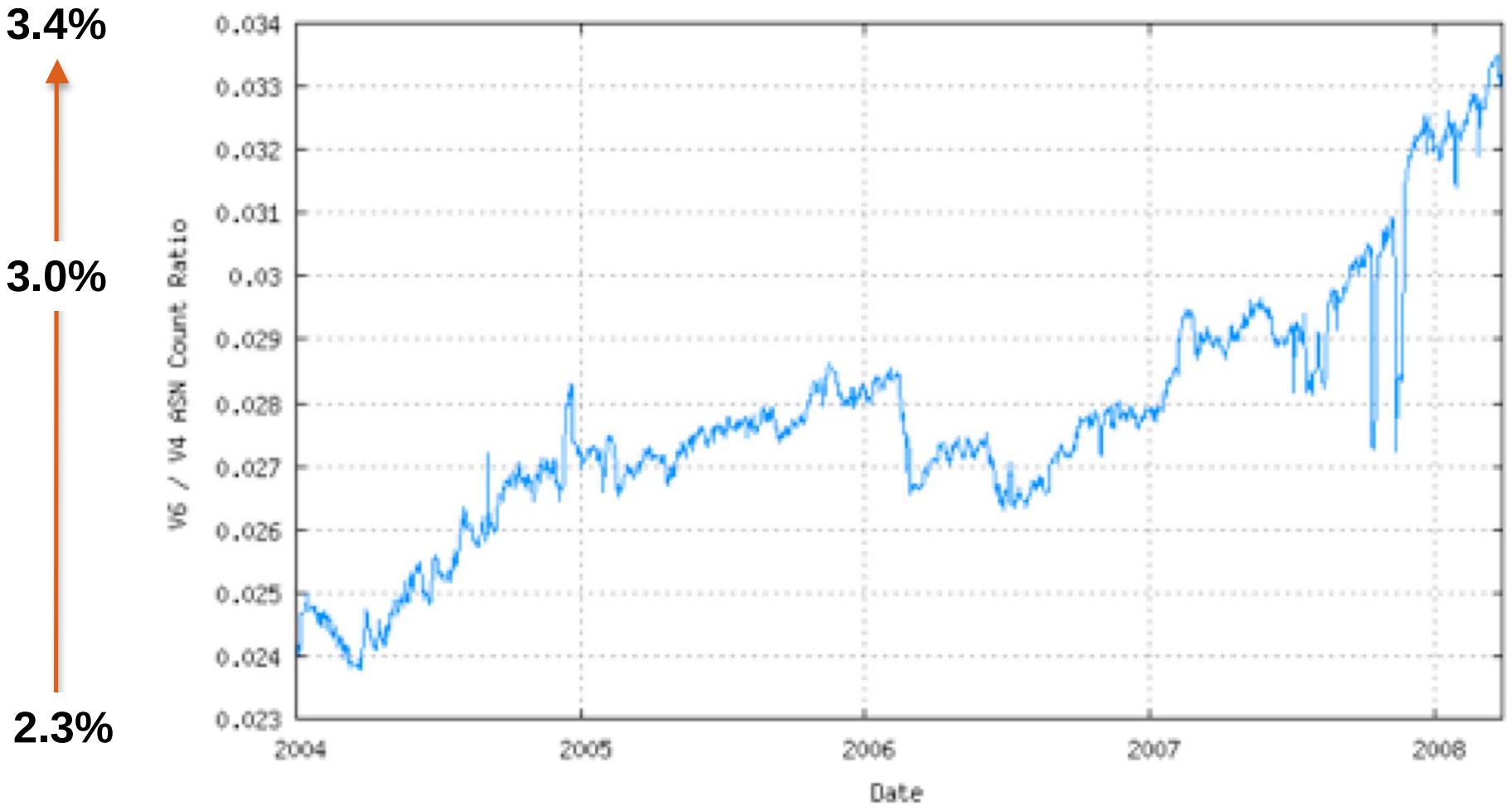
IPv6 AS Count



IPv4 AS Count



AS Count IPv6 : IPv4



What's this saying?

The number of AS's announcing IPv6 routes has risen from 2.5% to 3.3% from Jan 2004 to the present day

3.3% of the networks in the Internet are undertaking some form of IPv6 activity

That 3.3% is not uniform

In IPv4 3,802 AS's are transit networks and 24,138 are origin-only

Of the 3,802 IPv4 transit AS's 527 also have IPv6 routes

13.8% of V4 Transit AS's also route IPv6

Of the 24,138 V4 stub AS's 357 also route IPv6

1.5% of V4 Origin AS's also route IPv6

Capability vs Actual Use

As ~14% of the number of transit AS's are announcing IPv6 address prefixes, does this mean that 14% of the Internet's "core" is running IPv6 right now?

Probably not!

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Can we provide useful data about IPv6 use?

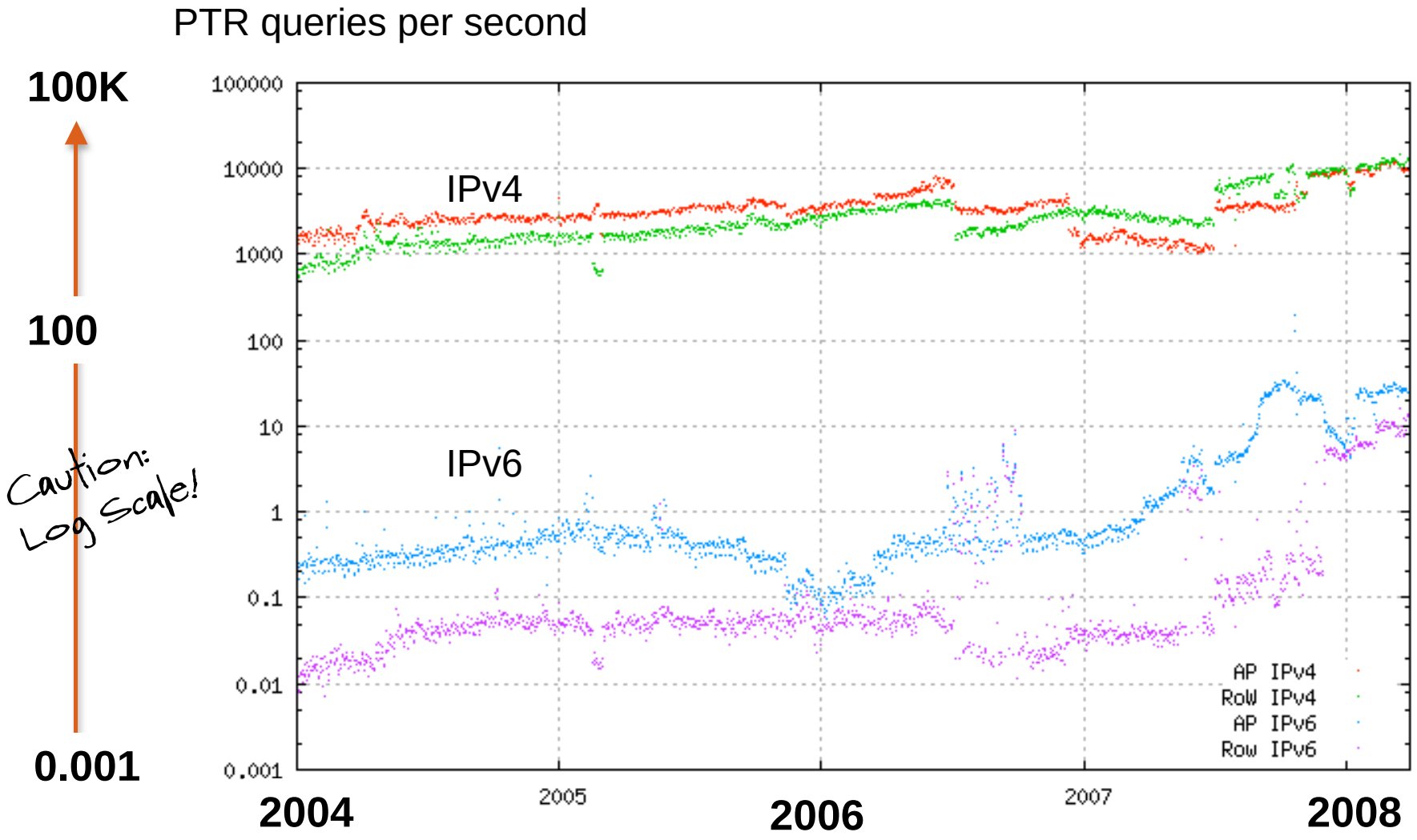
DNS Server Stats

- APNIC runs two sets of DNS servers for the reverse zones for IPv4 and IPv6
  - One set of servers are used to serve reverse zones for address ranges that are deployed in the Asia Pacific Area
  - The second set of servers are used as secondaries for zones served by RIPE NCC, LACNIC and AFRINIC

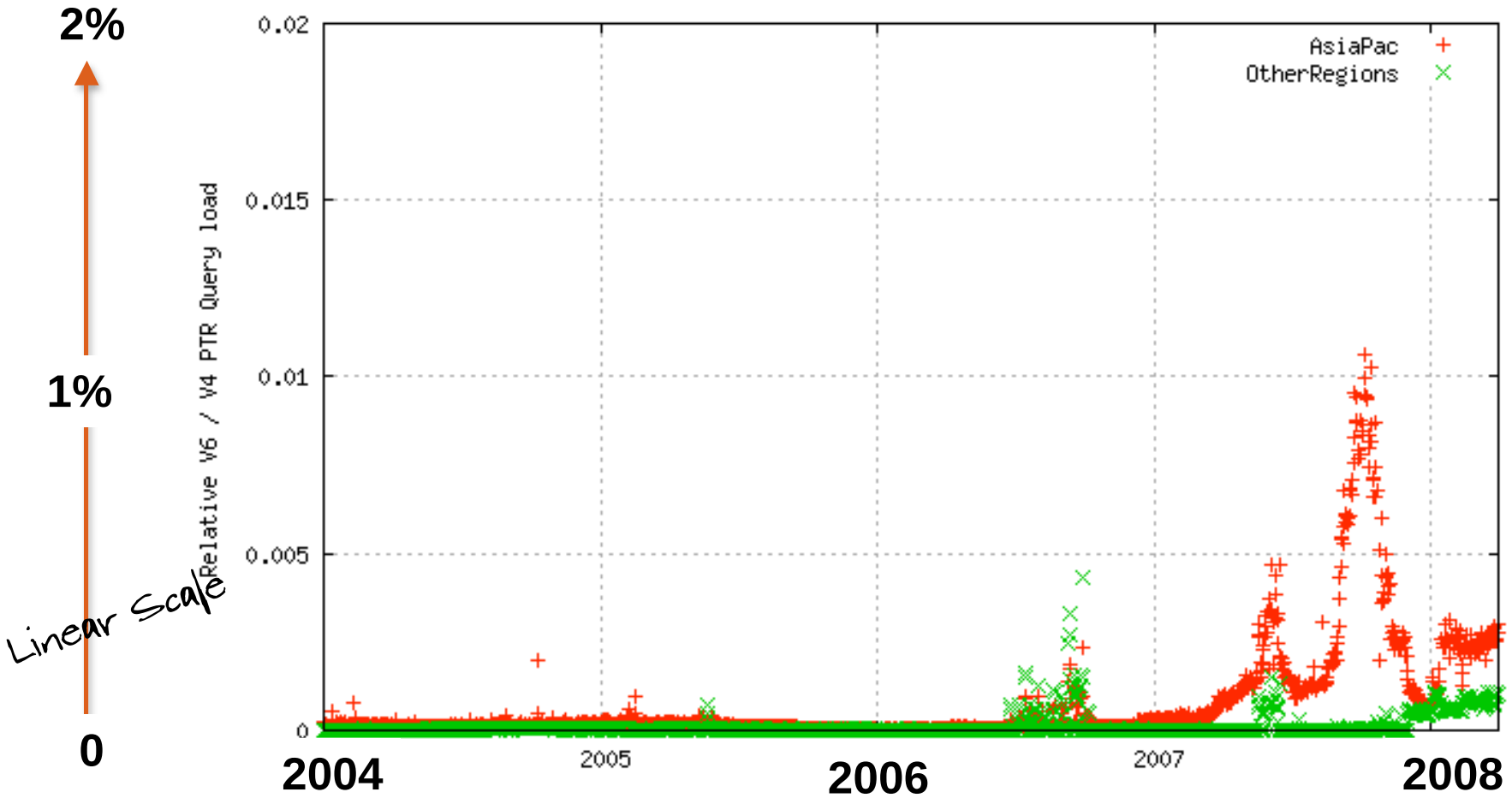
DNS Reverse Query Load

- Examine the average query load for reverse PTR queries for IPv6 and IPv4 zones for each of these server sets

DNS Reverse Query Load



Relative DNS Query Load



What's this saying?

- Reverse DNS queries for IPv6 addresses are around 0.2% of the IPv4 query load
- AsiaPac IPv6 query load is higher than for other regions
- Query load has increased since 2007
- The interactions of forwarders and caches with applications that perform reverse lookups imply a very indirect relationship between actual use of IPv6 and DNS reverse query data

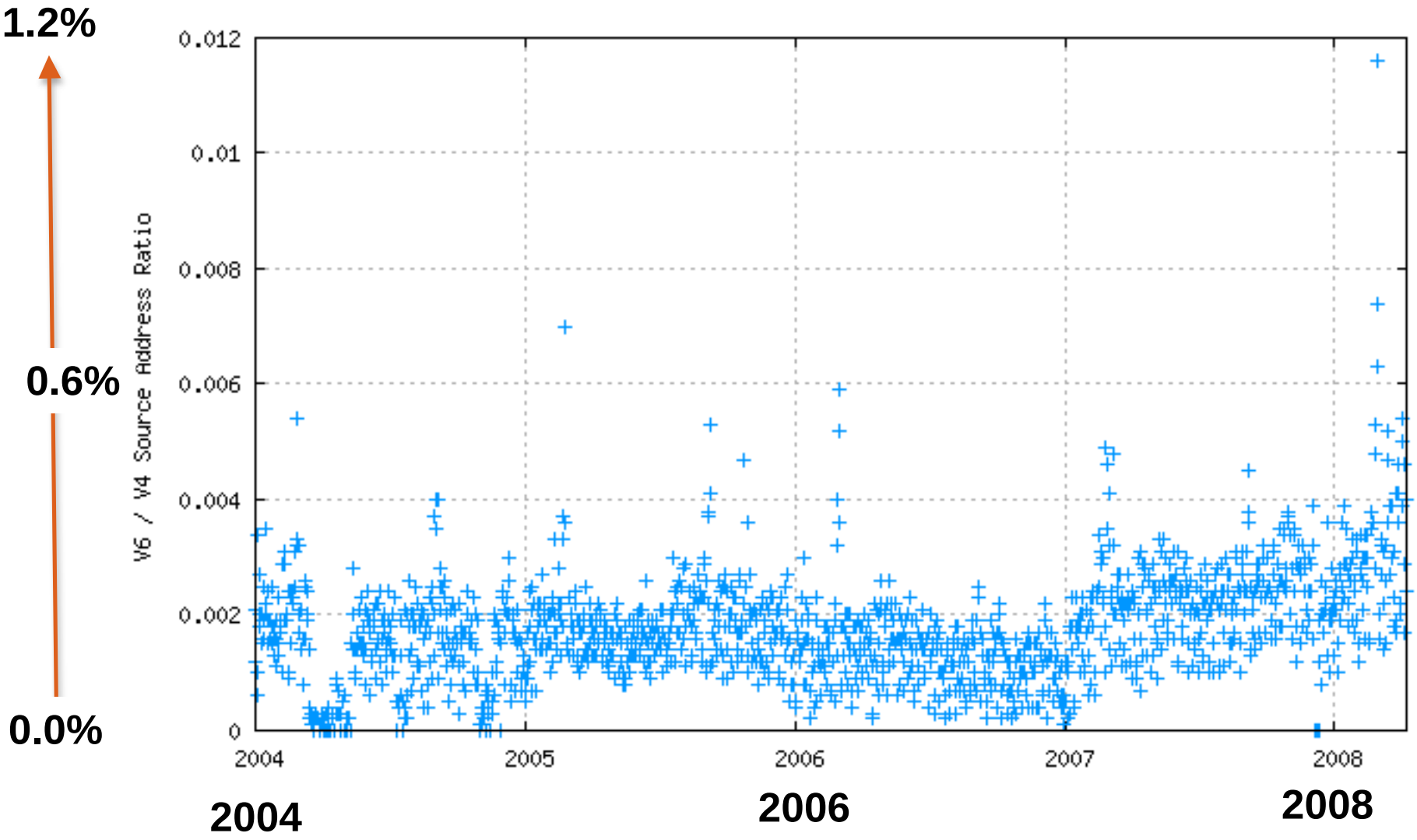
Web Server Stats

- Take a couple of dual-homed web servers:
  http://www.apnic.net
  http://www.ripe.net

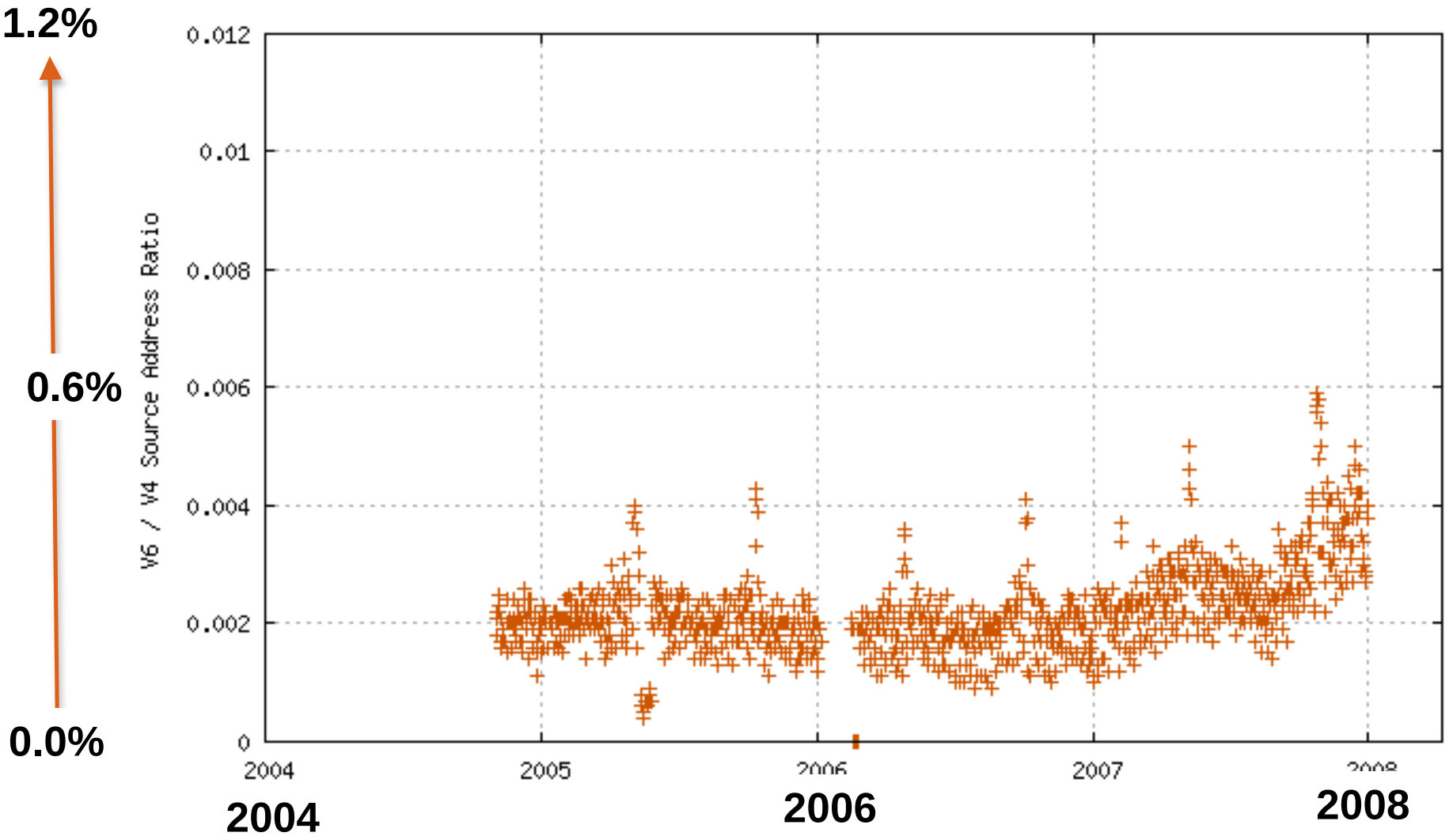
- Count the number of distinct IPv4 and IPv6 query addresses per day
  - Not the number of 'hits', just distinct source addresses that access these sites, to reduce the relative impact of robots and crawlers on the data and normalize the data against different profiles of use
- Look at the V6 / V4 access ratio

What proportion of end host systems will prefer end—to—end IPv6, when there is a choice?

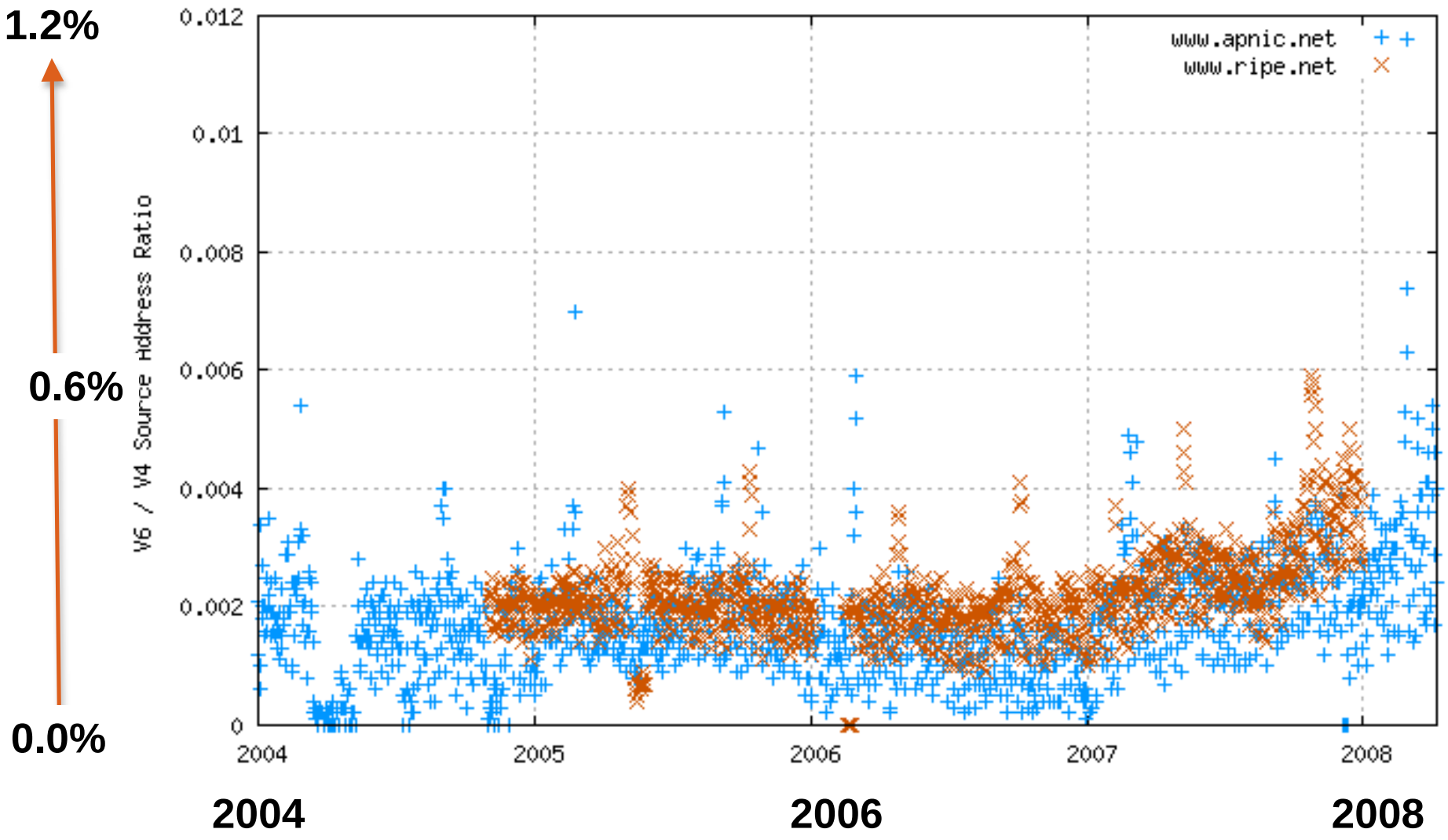
APNIC Web Server Stats



RIPE NCC Web Server Stats



Combined Stats



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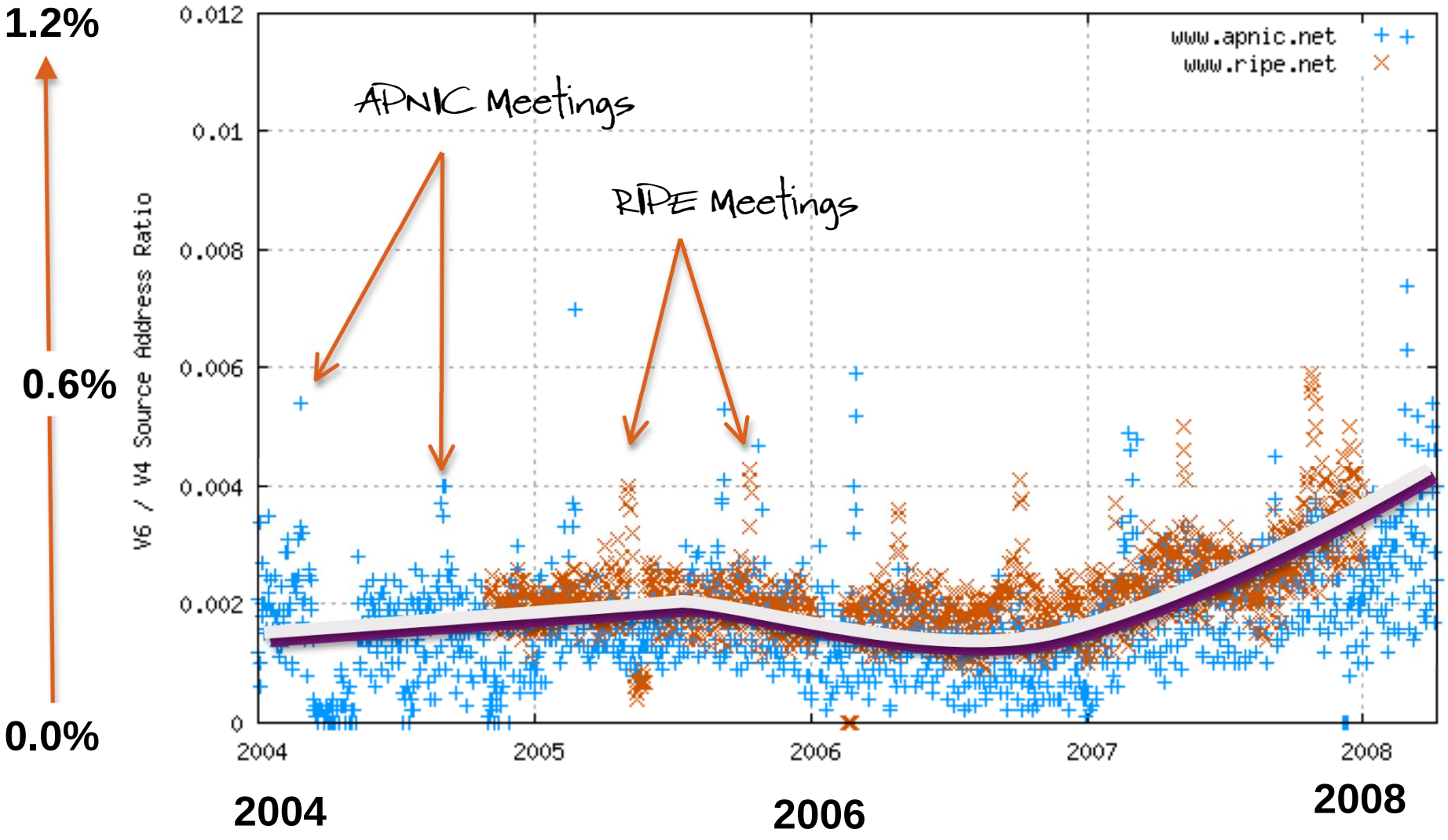
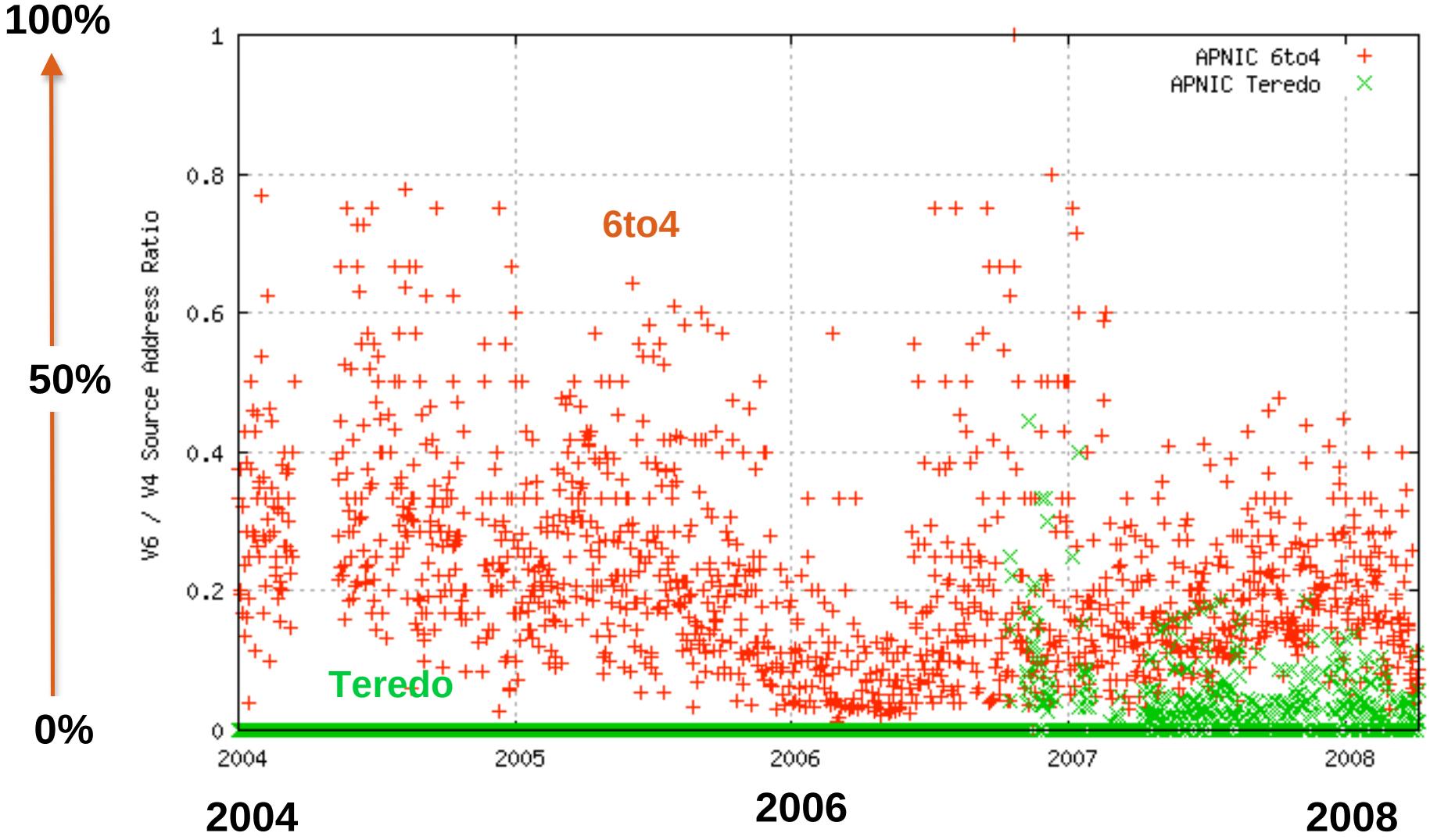


What's this saying?

- Relative use of IPv6 when the choice is available is 0.2% in the period 2004 - 2006
- Relative use of IPv6 increased from 2007 to slightly over 0.4% today
  - Is interest in IPv6 slowing picking up again?
  - Increased use of auto-tunnelling of IPv6 on end host stacks?

Use of V6 Transition Tools

- APNIC Server Stats



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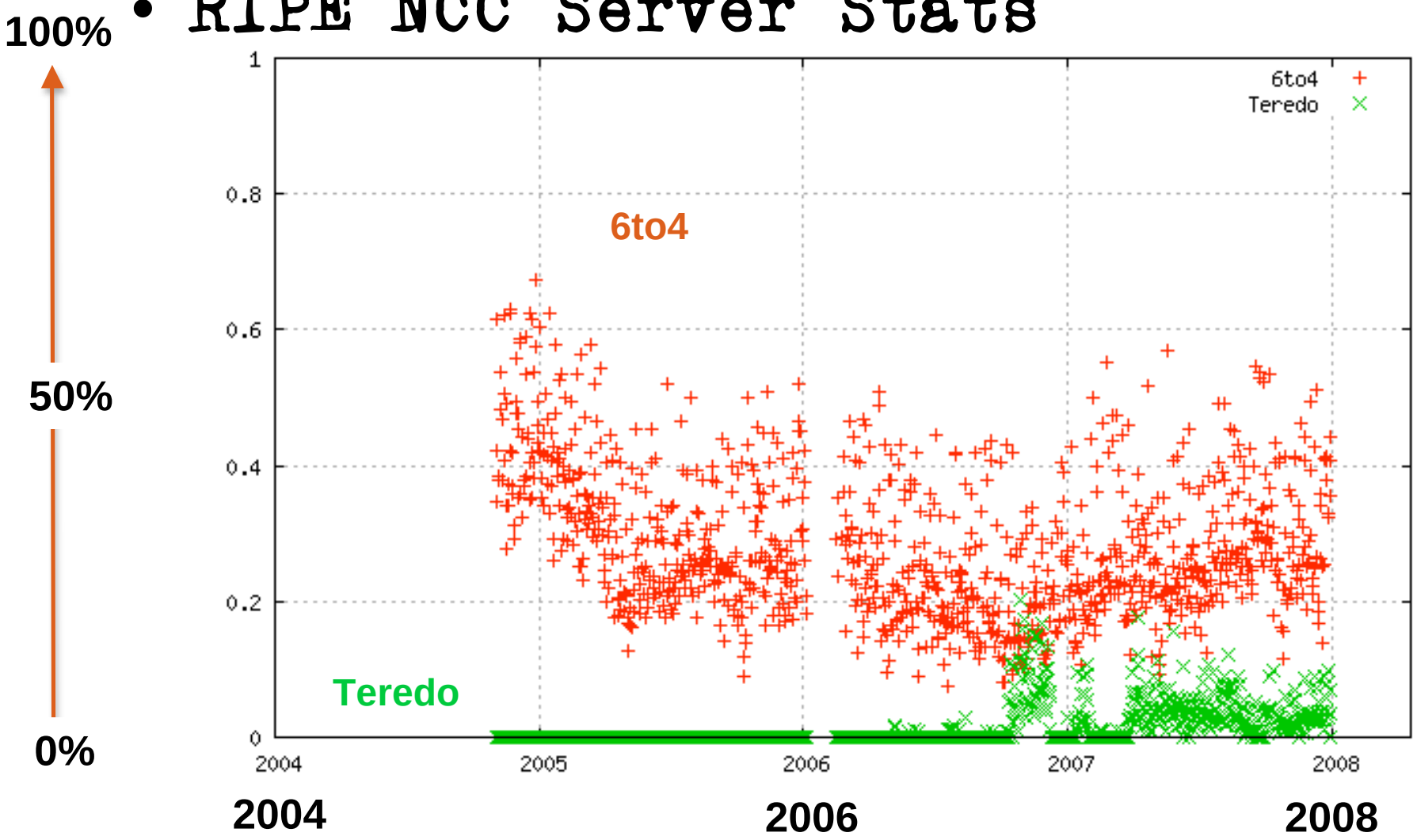

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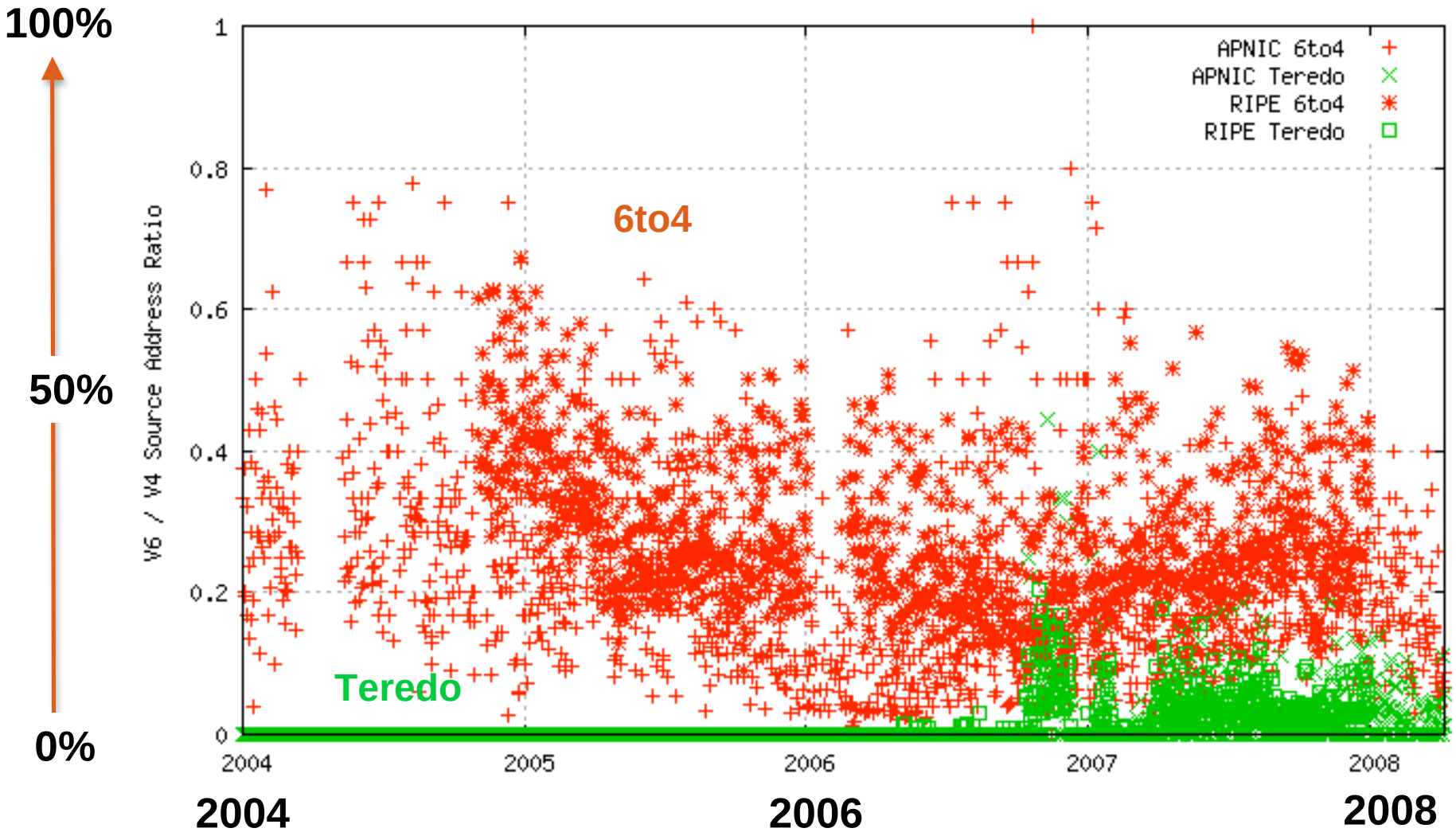

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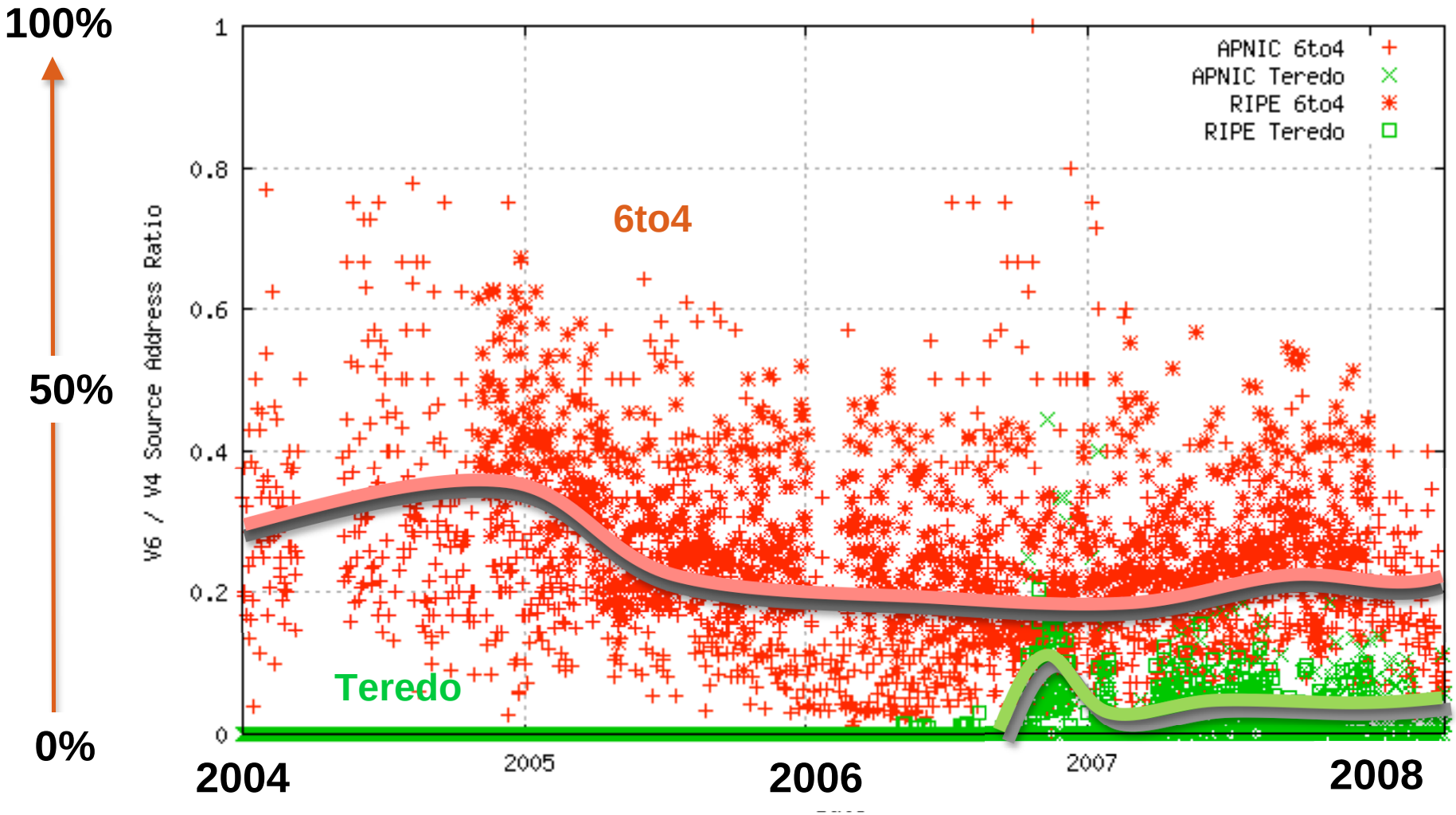

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- Around 25% of IPv6 clients appear to use tunneling techniques to reach IPv6 servers

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Where are we with IPv6?

- Over a tenth of the transit ISPs of the IPv4 Internet are active in IPv6 deployment in some fashion

This is not the same as saying that the core of the Internet is already dual stack

But it is saying that service providers appear to be on some kind of deployment path of IPv6

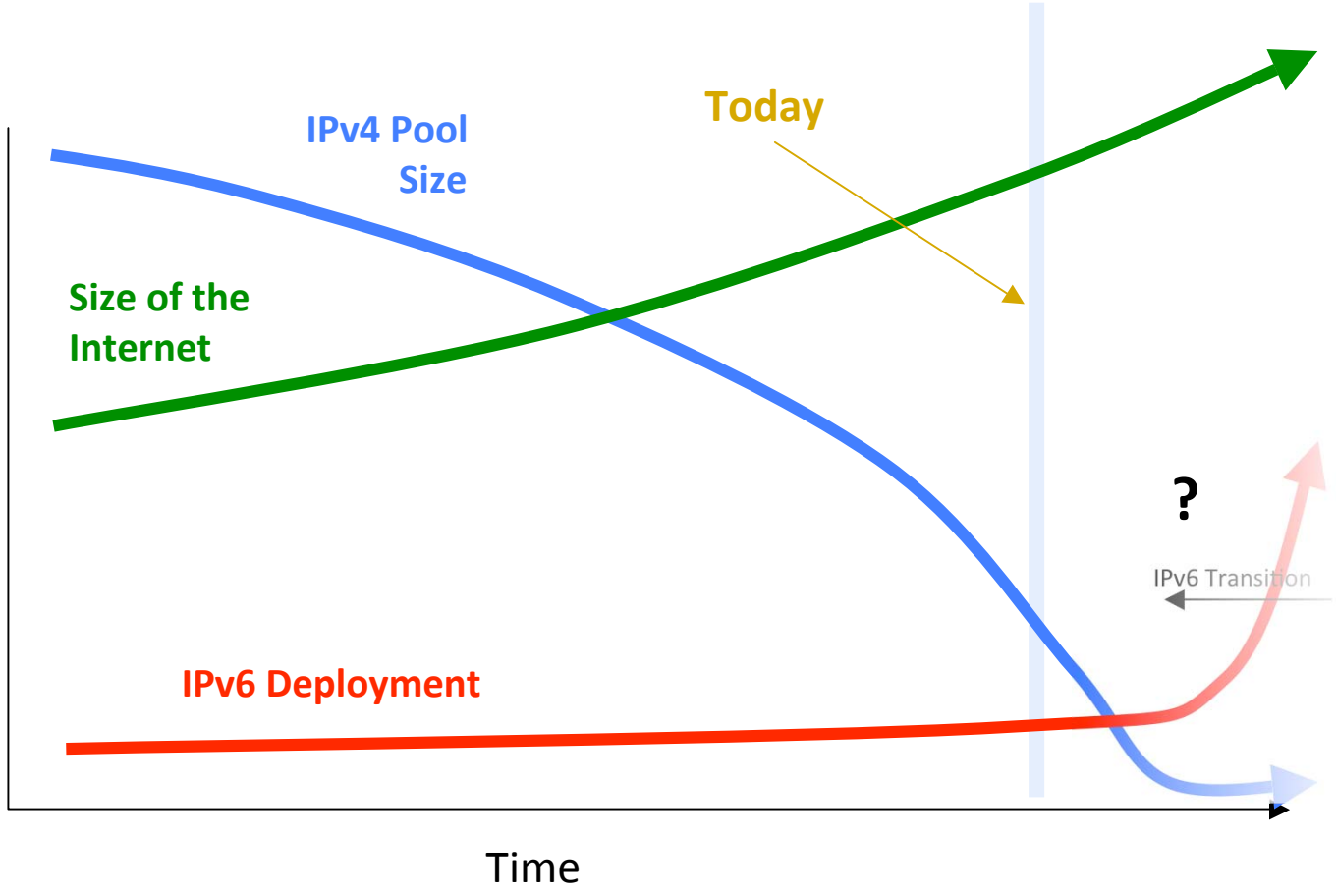
Where are we with IPv6?

- The "size" of the IPv6 deployment in terms of end host IPv6 capability is around 2 to 3 per thousand Internet end hosts at present

  At most!

  This observed ratio may be higher than actual levels of IPv6 capability due to:
  - Widespread NAT use in IPv4 undercounts IPv4 host counts
  - These web sites are tech weenie web sites. More general sites may have less IPv6 clients

What's the revised plan?



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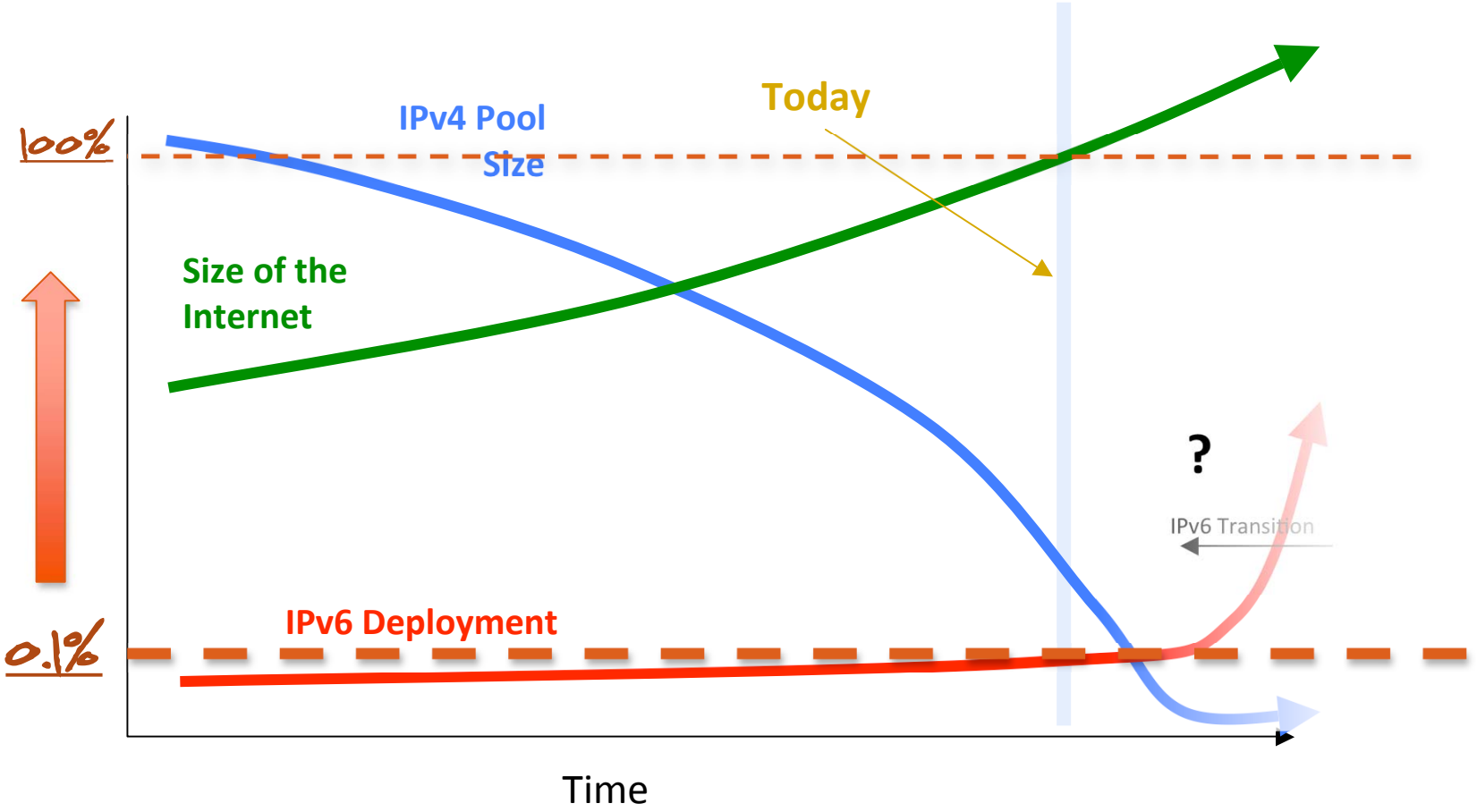

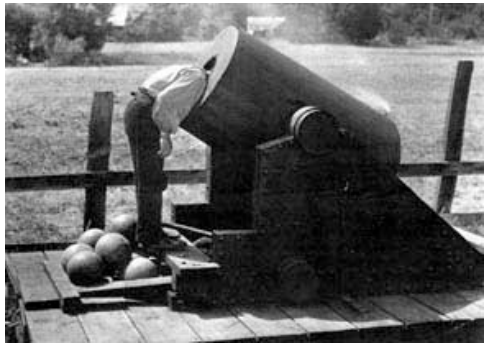

Thank You!

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