

Where are we with IPv6?

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APNIC

A “conventional” view of IPv6 transition:

“The minister for communications and information technology does not believe that regulatory intervention is appropriate. Adoption of IPv6 needs to be lead by the private sector. The private sector must recognise that adopting IPv6 is in their own best interests to protect their investment in online capabilities into the future. Issues of advantages and disadvantages, costs, risks, timing, methodology etc, have to be for each enterprise to assess for itself.”

Statement by the New Zealand Minister for Communications
24 August 2009

In other words:

Self interest on the part of consumers and producers will cause the market to sustain the transition to IPv6

This is not an instance of a “market failure”

There is no need for public sector intervention in the operation of the Internet, nor in this transition in particular

Lets explore these assertions with:

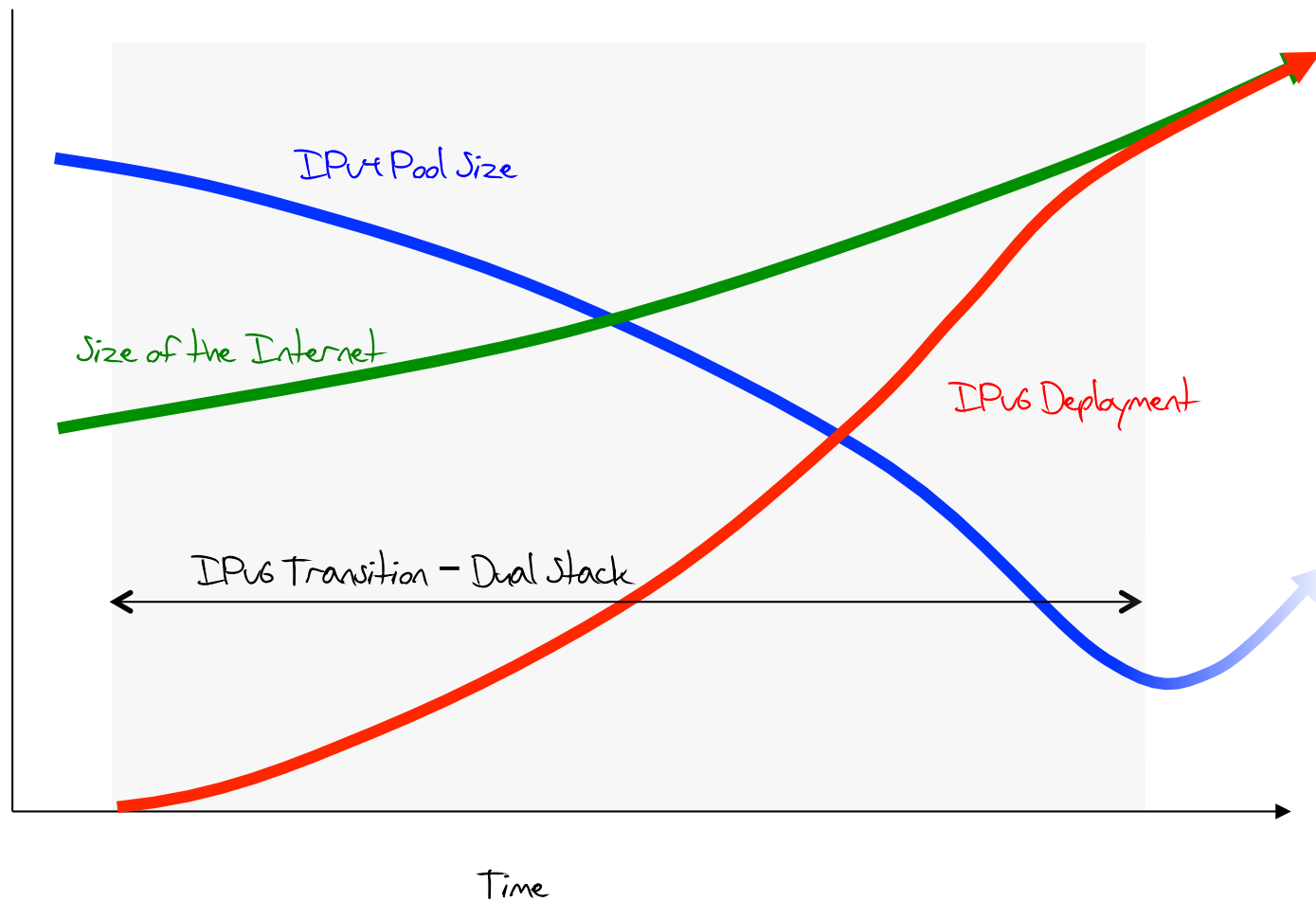
some data

some experience

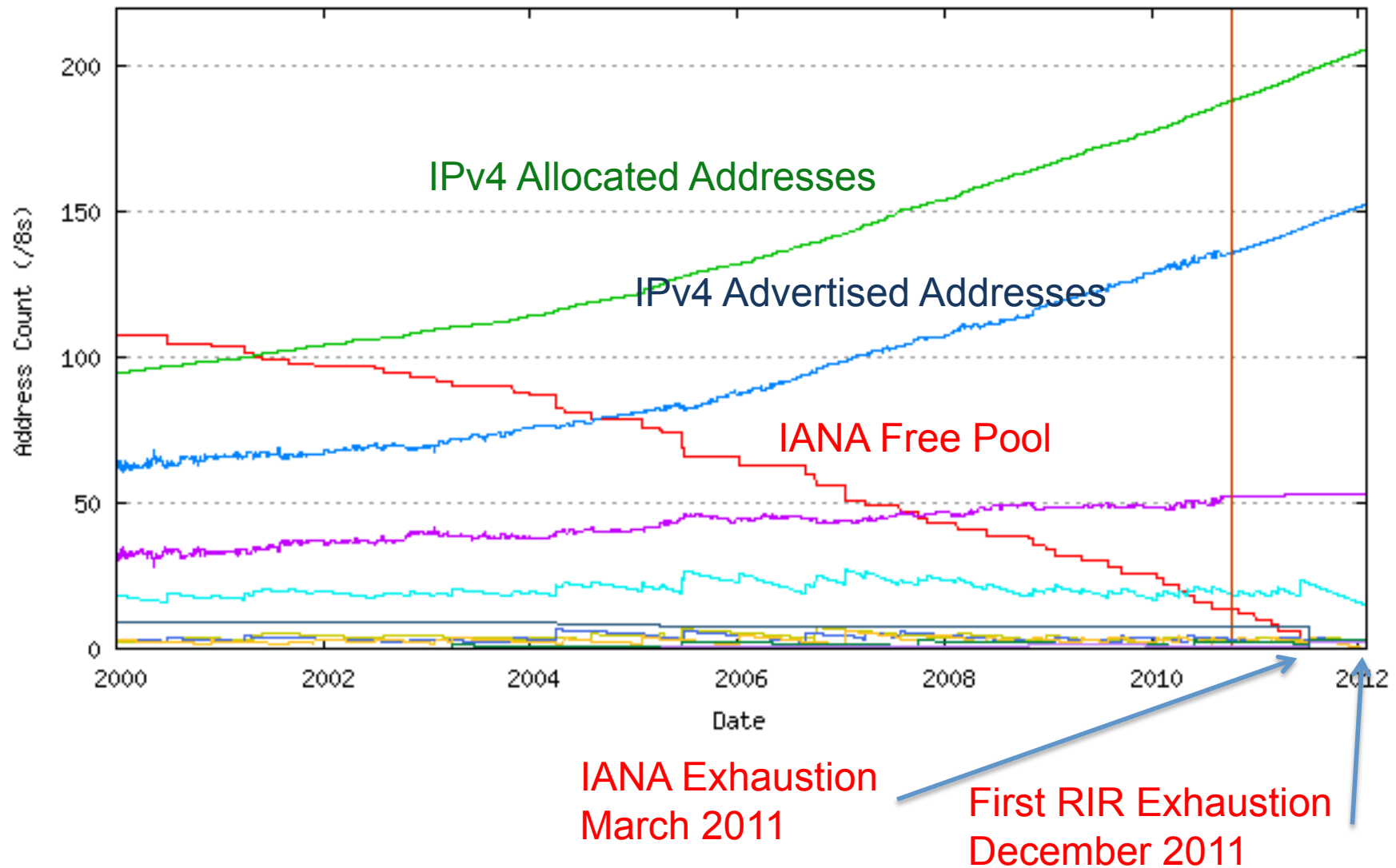
some perspectives

and a little economic theory

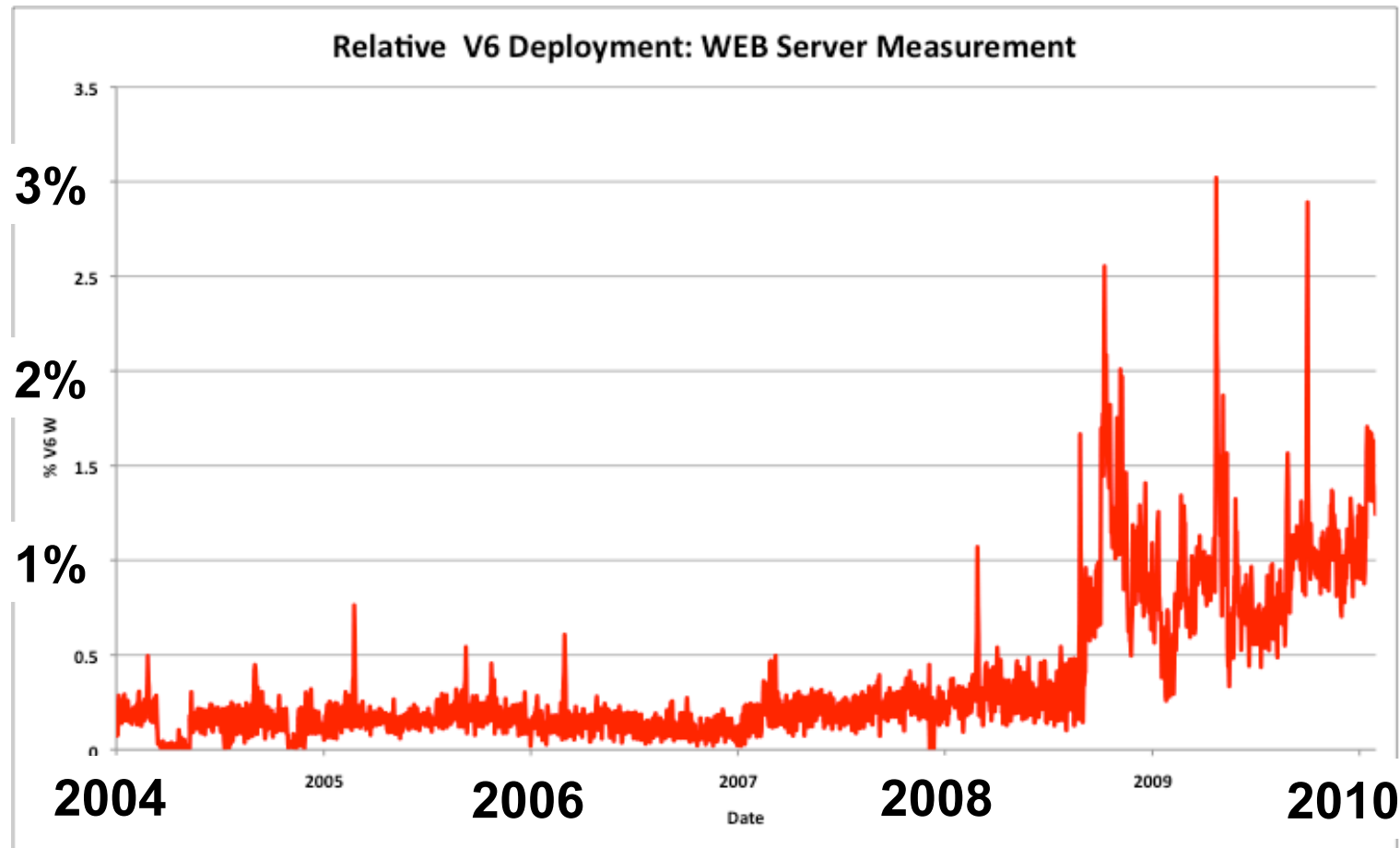
The IPv6 Transition Plan



Obligatory IPv4 Exhaustion Slide

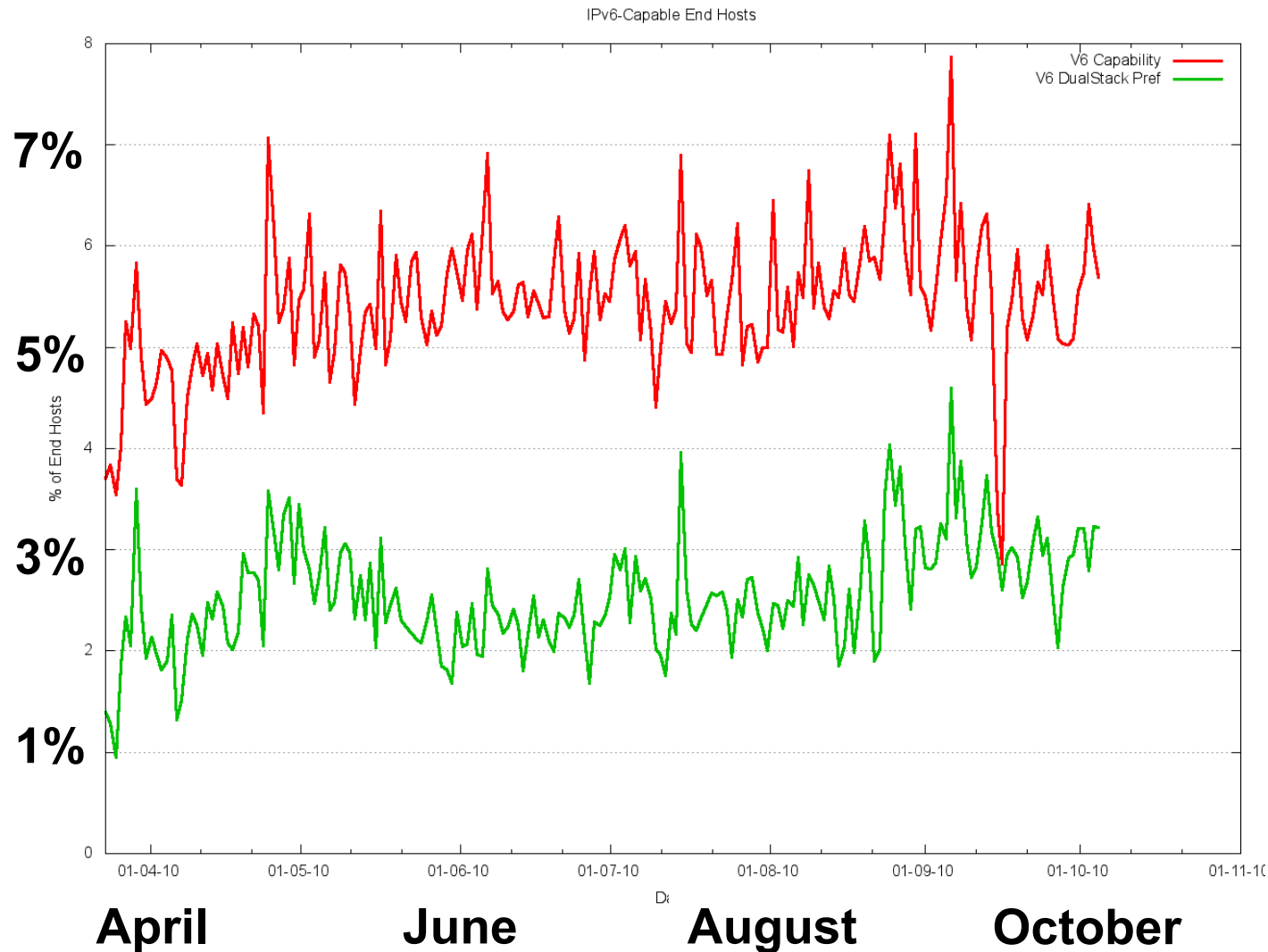


Measured IPv6 Deployment



Data from <http://www.apnic.net>

Measured IPv6 Deployment - 2010

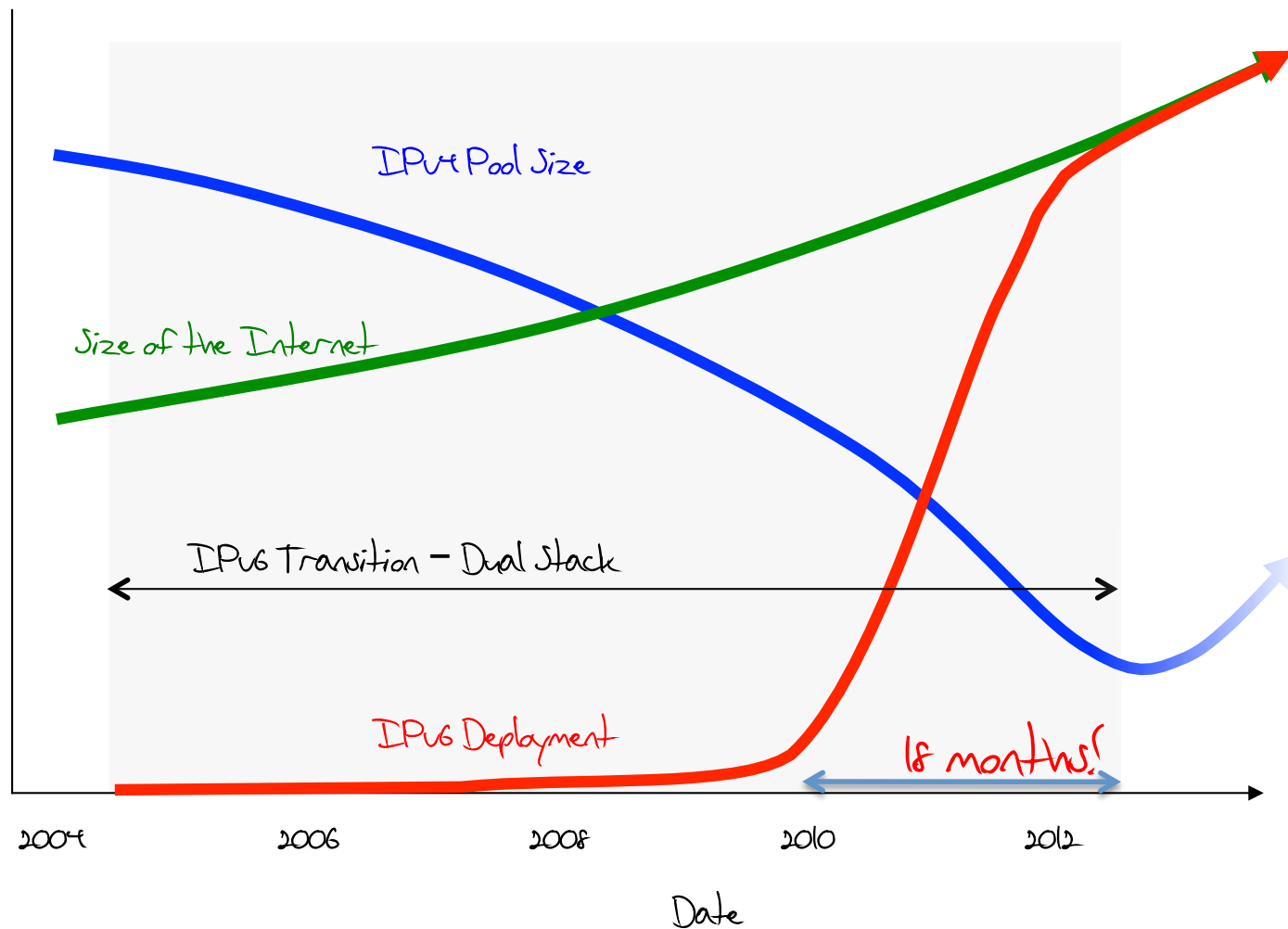


From <http://www.potaroo.net/stats/1x1>

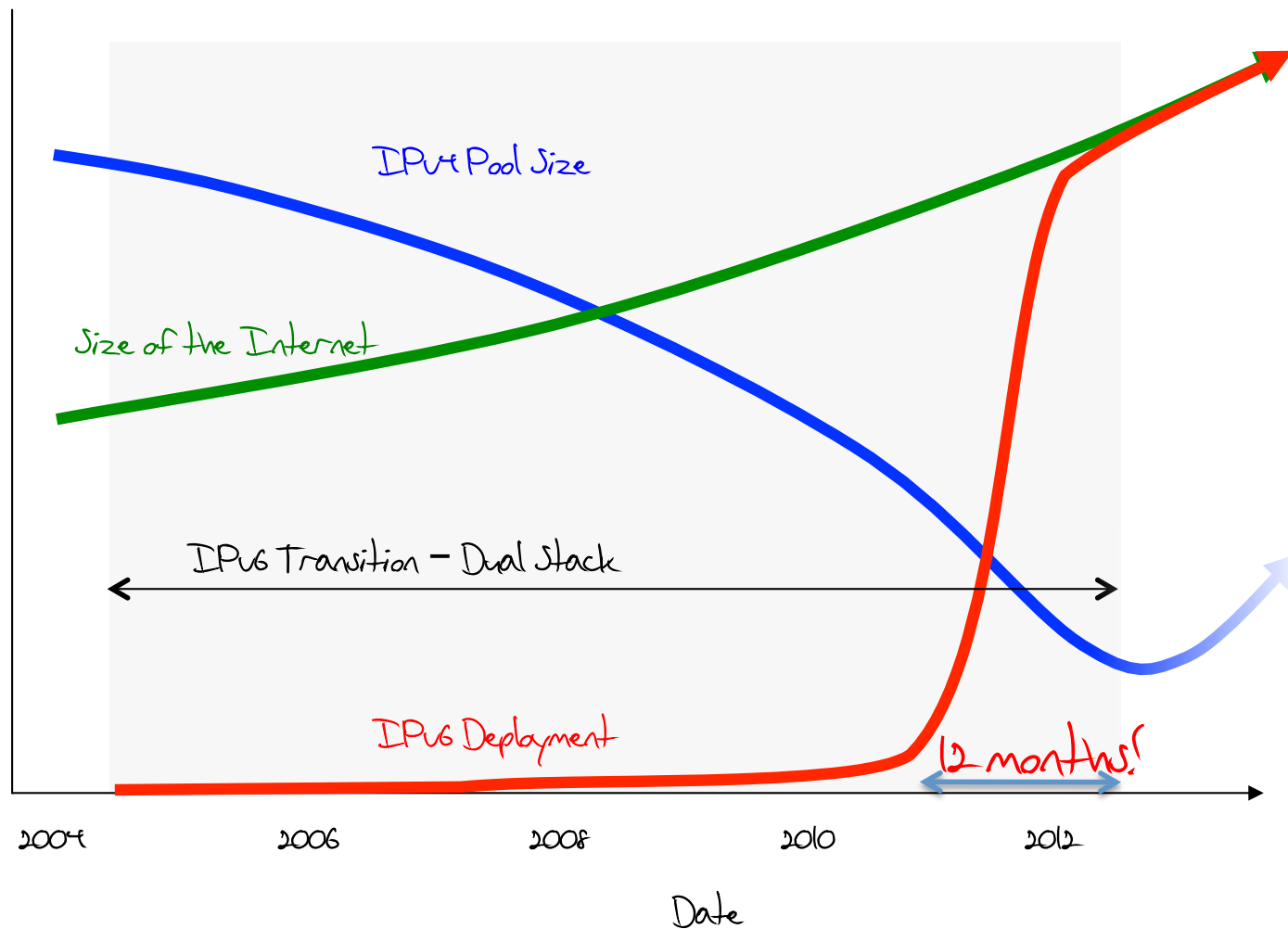
What is this telling us?

- If we want to avoid the “hard edge” of exhaustion of IPv4 addresses we need to complete the transition to IPv6 across most of the network before we run out of the unallocated pool
- We need to get end system and service IPv6 capability up from <5% of the network today to ~80 % by January 2012

The IPv6 Transition Plan - V2.0



The IPv6 Transition Plan - V2.1



Is this Plan Feasible?

Deploy IPv6 across some 1.7 billion users,
with more than a billion end hosts.

Is this Plan Feasible?

Deploy IPv6 across some 1.7 billion users, with more than a billion end hosts, and upgrade hundreds of millions of routers, firewalls and middleware units.

Is this Plan Feasible?

Deploy IPv6 across some 1.7 billion users, with more than a billion end hosts, hundreds of millions of routers, firewalls and middleware units, and audit billions of lines of configuration codes and filters.

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Is this Plan Feasible?

Deploy IPv6 across some 1.7 billion users, with more than a billion end hosts, hundreds of millions of routers, firewalls and middleware units, audit billions of lines of configuration codes and filters, and audit hundreds of millions of ancillary support systems - ***all within the next 360 days.***



Lessons from the Past

If this transition to IPv6 is proving challenging, then how did we ever get the IPv4 Internet up and running in the first place?

IPv4 Deployment Lessons

Technology: packet switching vs circuit switching

- lower network costs though pushing of functionality and cost to end systems exposed a new demand schedule for communications services

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i.e. packet switching was far cheaper than circuit switching. This drop in cost exposed new market opportunities for emergent ISPs

IPv4 Deployment

Business: exposed new market opportunity in a market that was actively shedding many regulatory constraints

- exposed new market opportunities via arbitrage of circuits
- presence of agile high-risk entrepreneur capital willing to exploit short term market opportunities exposed through this form of arbitrage
- volume-based suppliers initially unable to redeploy capital and process to meet new demand
 - unable to cannibalize existing markets
 - unwilling to make high risk investments

The Internet has often been portrayed as the “poster child” for deregulation in the telecommunications sector in the 1990’s.

The rapid proliferation of new services, the creation of new markets, and the intense level of competition in every aspect of the Internet is seen as a successful outcome of this policy of deliberate disengagement by the regulator.

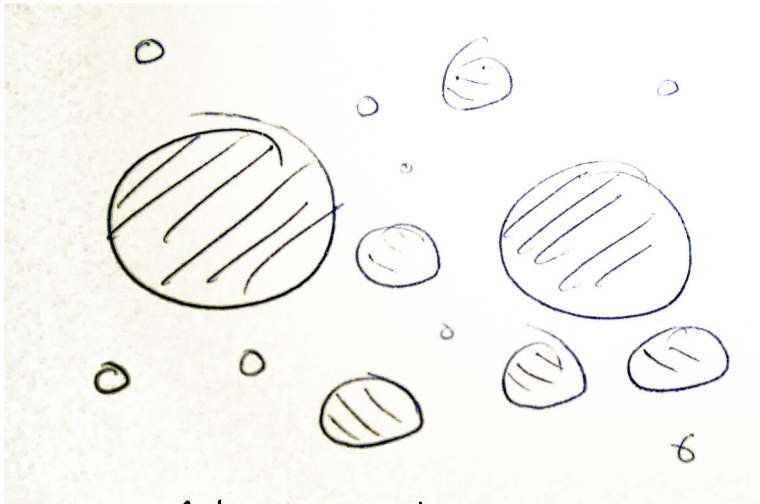
But is this still true today?

Do we still see intense competition in this industry? Is there still strong impetus for innovation and entrepreneurial enterprise? Will this propel the transition to IPv6?

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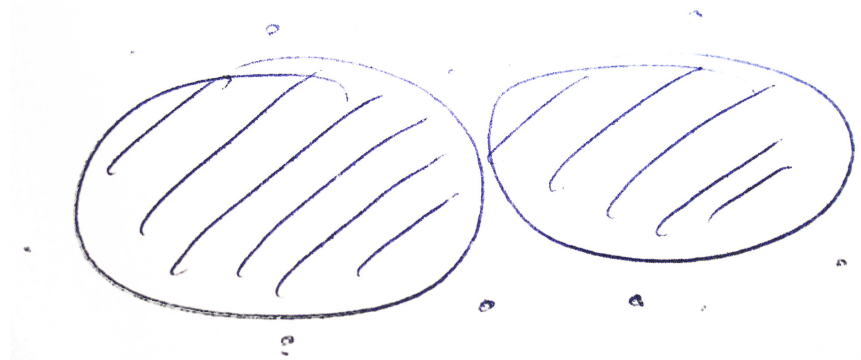
Or is this industry lapsing back into a mode of local monopolies, vertical bundling and strong resistance to further change and innovation?

How “Balanced” is this industry?



A diverse connection
of large and small
ISP enterprises

OR

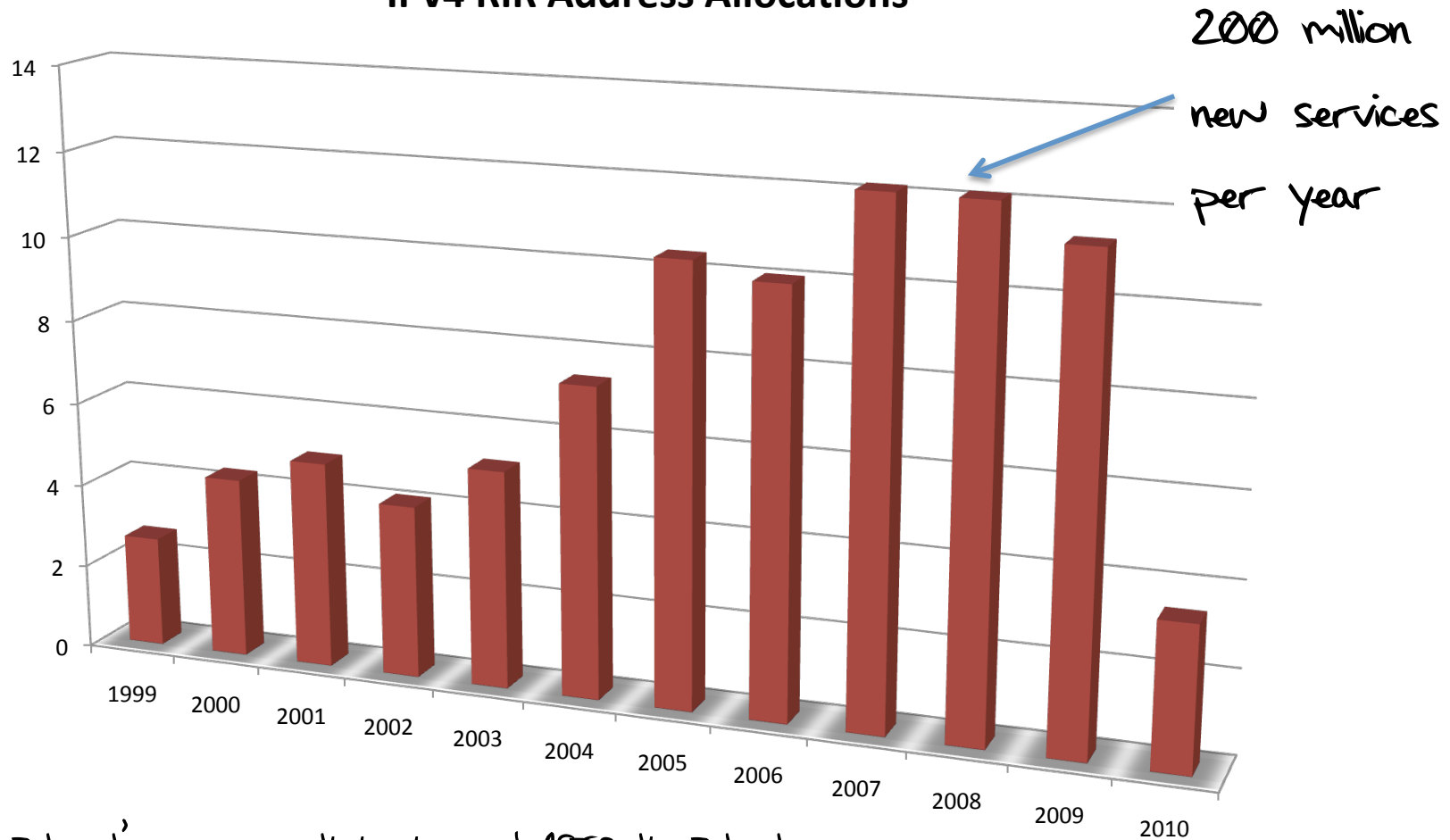


A small number of very
large enterprises and
some very small
independent players left
hanging on for the ride

What can IPv4 address allocation data tell us about this industry?

How “Big” is this Industry?

IPv4 RIR Address Allocations



The Internet's major growth has happened AFTER the Internet "boom" of 1999 to 2001

Who got all those addresses in 2009?

Rank		Company	IPv4 addresses (M)
1	CN	China Mobile Communications Corporation	8.39
2	US	AT&T Internet Services	6.82
3	CN	China TieTong Telecommunications Corporation	4.19
4	CN	Chinanet Guandong Province Network	4.19
5	KR	Korea Telecom	4.19
6	CN	North Star Information Hi.tech Ltd. Co.	4.19
7	JP	NTT Communications Corporation	4.19
8	US	Verizon Internet Services Inc.	3.78
9	US	Sprint Wireless	3.54
10	CN	China Unicom Shandong Province Network	2.10
11	CN	Chinanet Jiangsu Province Network	2.10
12	CN	Chinanet Zhejiang Province Network	2.10
13	FR	LDCOM Networks (France)	2.10
14	IT	Telecom Italia	2.10
15	US	Comcast	1.90

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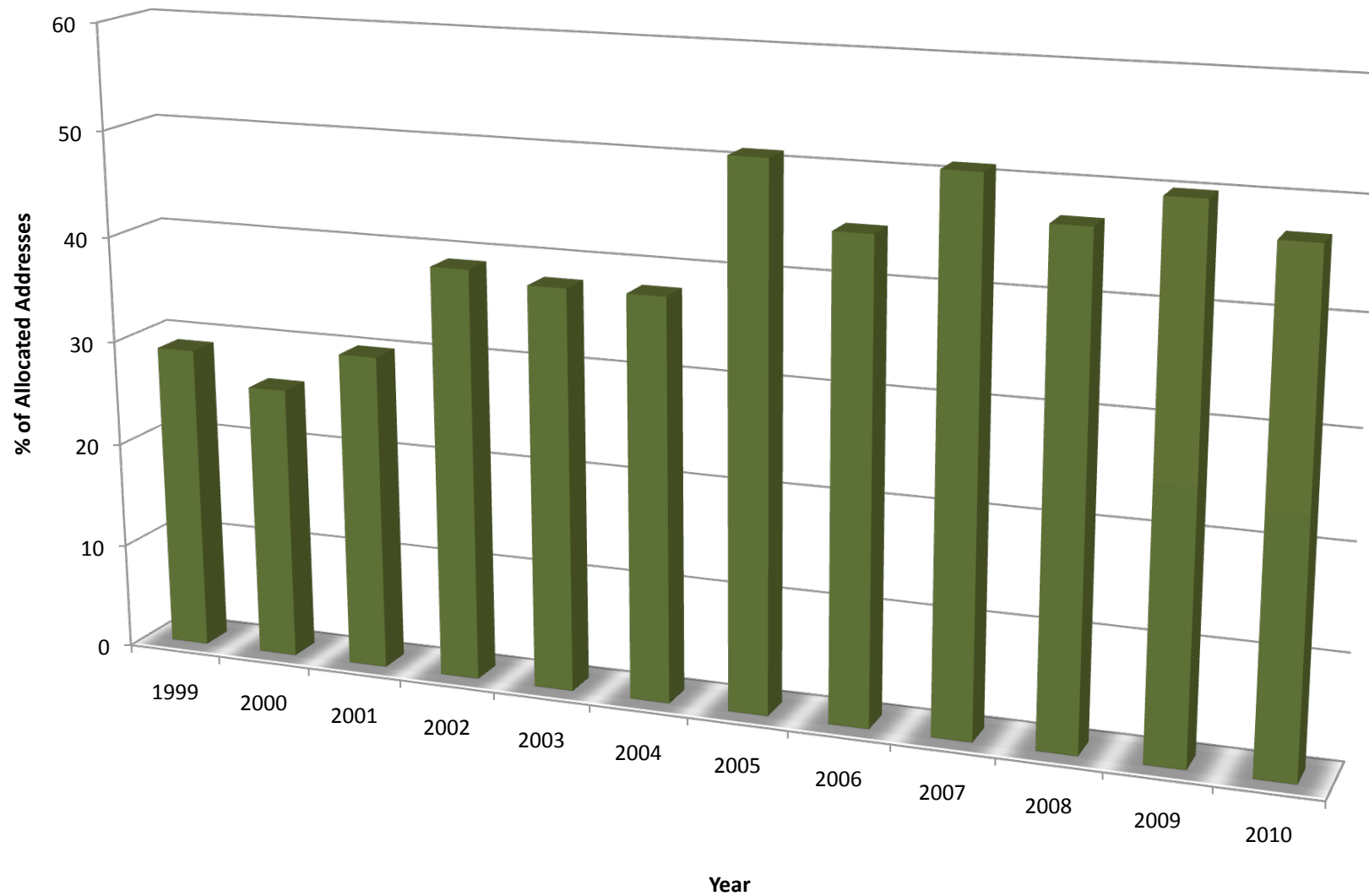
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25% of all the IPv4 addresses allocated in 2009
went to just 15 ISP enterprises

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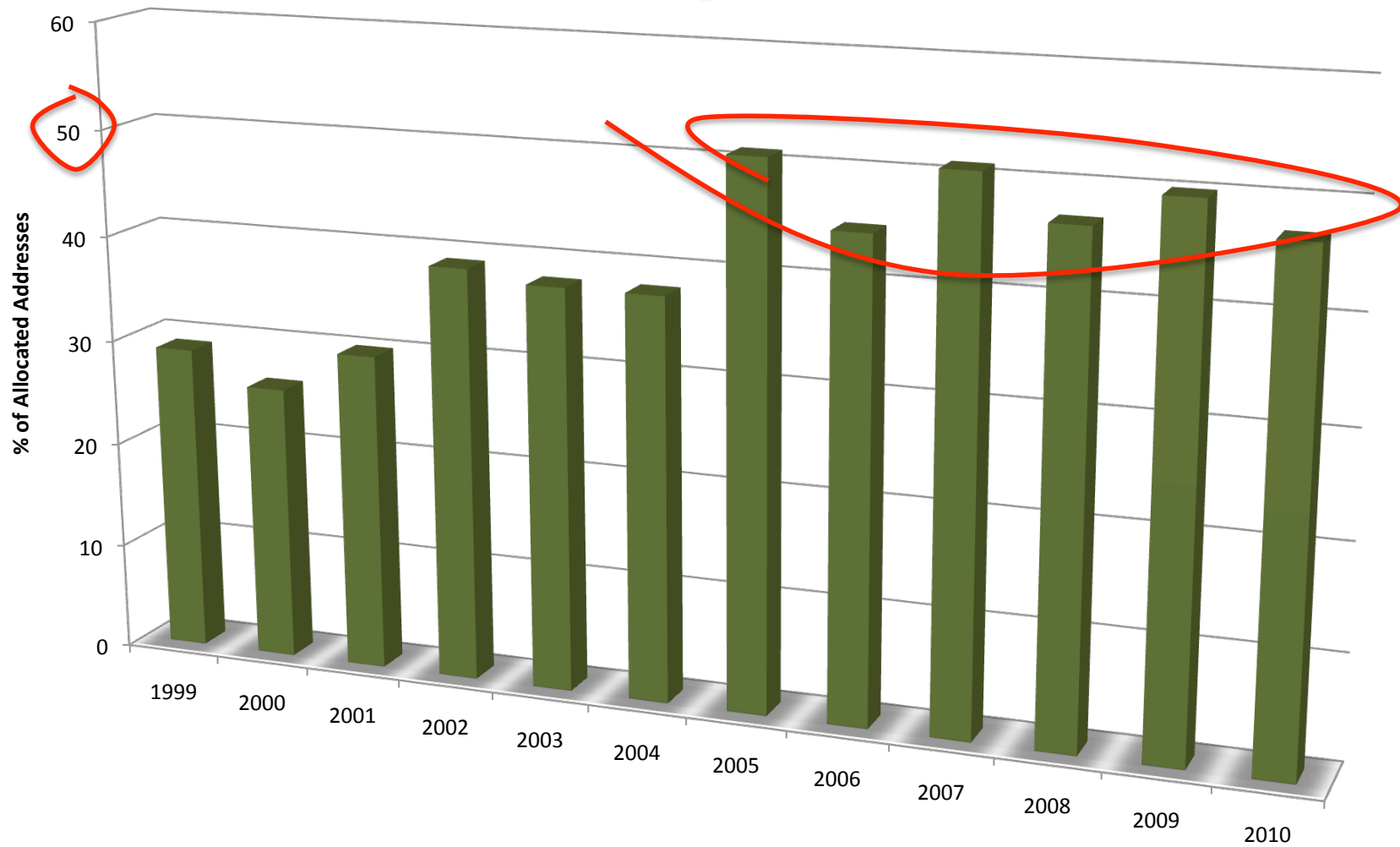
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Largest 1% of ISPs



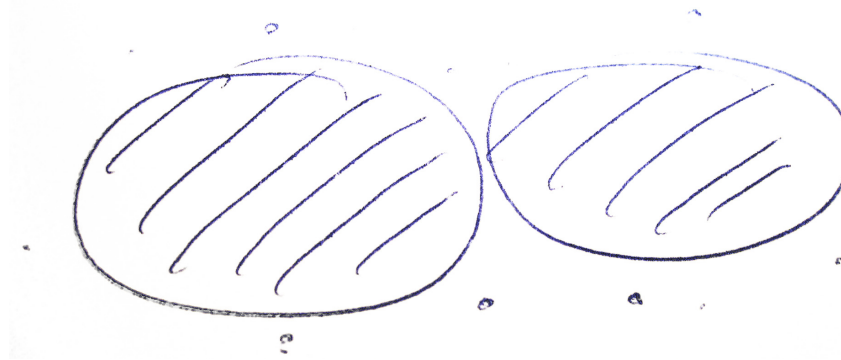
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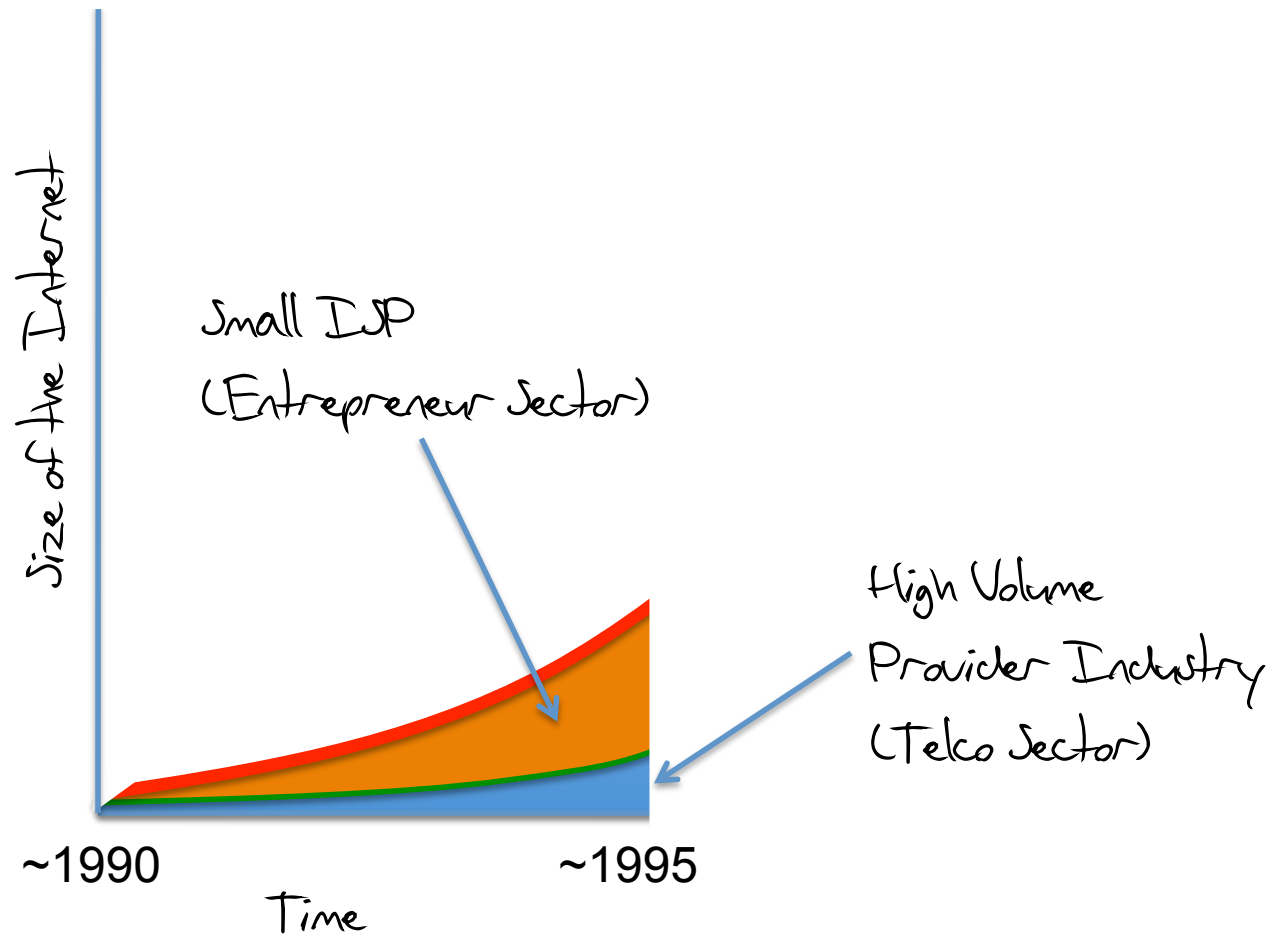
Massive consolidation in this industry appears to have been in place since 2005

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IPv4 Deployment Then

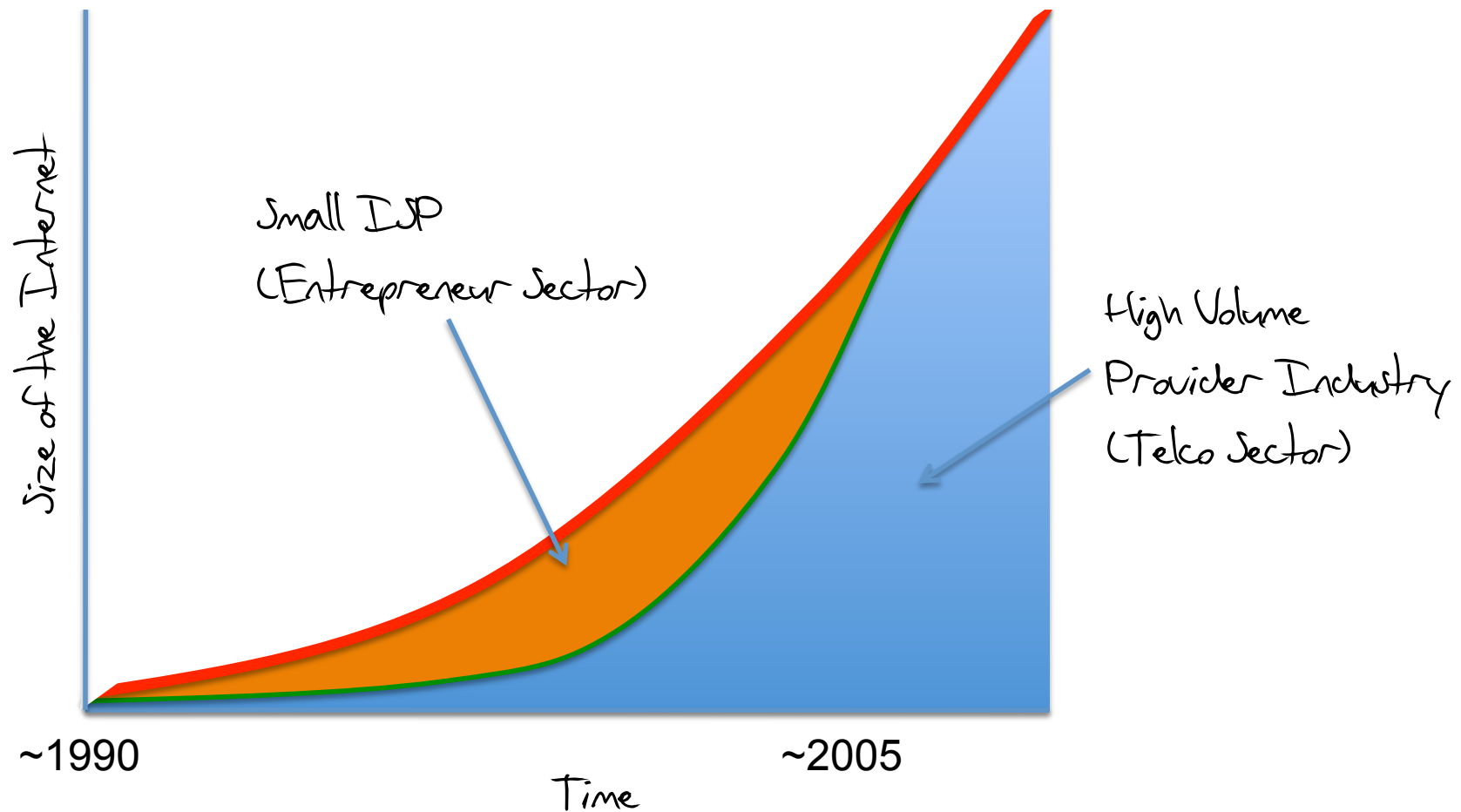


IPv4 Deployment

Business:

the maturing Internet market represented an opportunity for large scale investment that could operate on even lower cost bases through economies of scale

IPv4 Deployment Now



Back to IPv6 Transition...

What about IPv6 Transition?

Will the same technology, cost and regulatory factors that drove the deployment of the IPv4 Internet also drive this industry through the transition from IPv4 to IPv6?

IPv6 vs IPv4

Are there *competitive differentiators*?

X $\text{cost}_4 = \text{cost}_6$

X $\text{functionality}_4 = \text{functionality}_6$

no inherent consumer-visible difference

no visible consumer demand

no visible competitive differentiators other than *future risk*

Market Failure!

Wikinomics:

“In economics, a market failure exists when the production or use of goods and services by the market is not efficient. That is, there exists another outcome where market participants' overall gains from the new outcome outweigh their losses (even if some participants lose under the new arrangement). Market failures can be viewed as scenarios where individuals' pursuit of pure self-interest leads to results that are not efficient – that can be improved upon from the societal point-of-view. The first known use of the term by economists was in 1958, but the concept has been traced back to the Victorian philosopher Henry Sidgwick.”

http://en.wikipedia.org/wiki/Market_failure

IPv6 Transition as a Public Good?

Is the transition to IPv6 is *non-excludable* and *non-rivalrous*?

In which case this transition issue parallels that of a *public good*

With an implication that conventional market dynamics in a deregulated environment will not lead to this transition being undertaken

And a corollary that if this transition is considered to be necessary or essential then some form of *public good solution* needs to be considered

What is Happening Here?

Given that Dual Stack requires IPv4, and IPv4 is the critically scarce good here, are we wedging ourselves into inaction?

- Is Ipv6 inevitable? Are there alternate directions for this industry that represent lower risk and/or increased opportunities for the larger class of actors?
- What environmental factors will determine the common direction of providers and consumers?

What's the problem?

Competition, diversity and innovation require that potential newcomers have access to the entire consumer market on fair terms

If all the IPv4 addresses are locked in the hands of incumbents, then this industry runs the risk of deflecting all potential newcomers, and lapsing into local monopolies with a stagnant technology base

What's at stake?

If we want an Internet that continues to thrive on innovation and creativity

If we want an Internet that is propelled by the critical edge of competition at every level

If we want a future for the Internet

Then we need to get this IPv6 transition
underway across the entire industry...

now!

Thank You