

IPv4 Address Exhaustion: A Progress Report

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Chief Scientist

APNIC

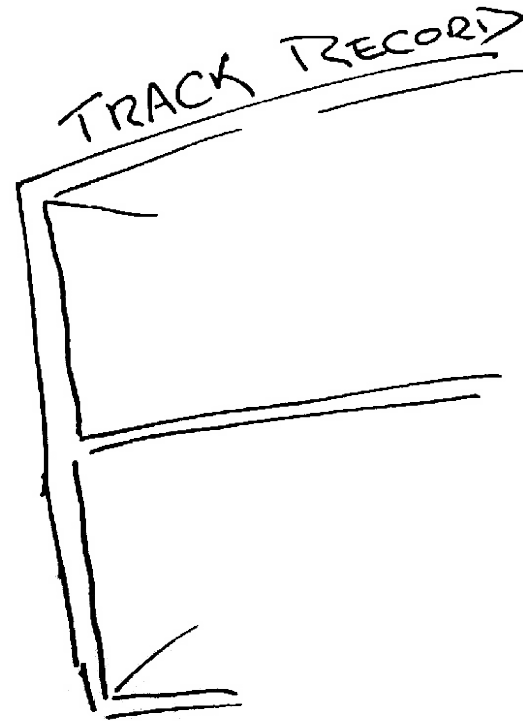
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28 August -
1 September 2011

Destination::IPv6



The mainstream
telecommunications
industry has a
rich history



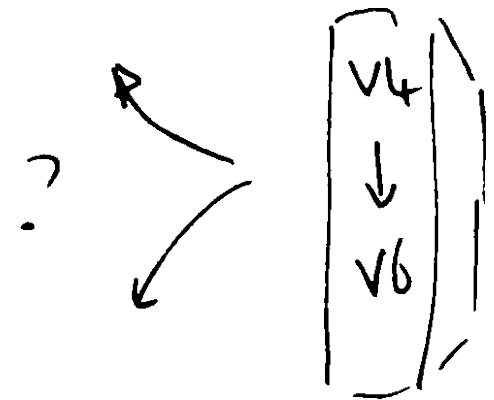
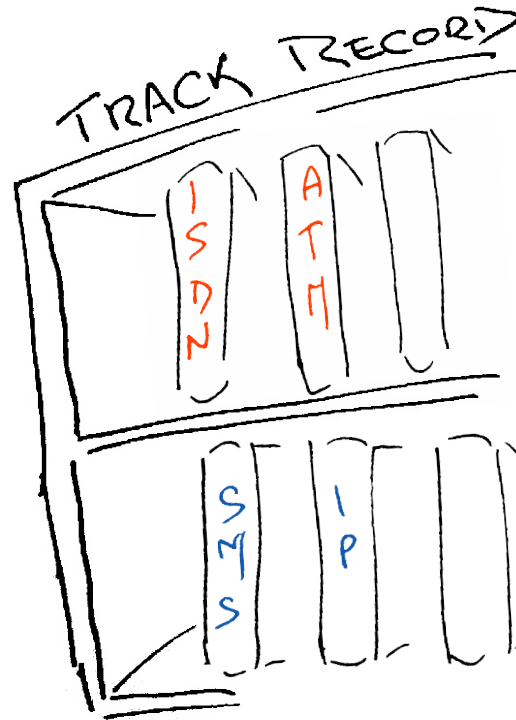
...of making very poor
technology choices



...of making very poor
technology guesses

A hand-drawn diagram titled "TRACK RECORD" in a large, curved, hand-drawn font at the top. Below the title, there are two rows of vertical rectangular slots, each containing text. The top row has three slots; the first two contain the letters "ISDN" and "ATM" written vertically in red ink. The bottom row has four slots; the first two contain the letters "SM" and "IP" written vertically in blue ink. The entire diagram is drawn with simple black outlines and colored text.

So, how are we going with the IPv4 to IPv6 transition?



Do we really need to worry about this?

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Surely IPv6 will just happen - its just a matter of waiting for the pressure of IPv4 address exhaustion to get to sufficient levels of intensity.

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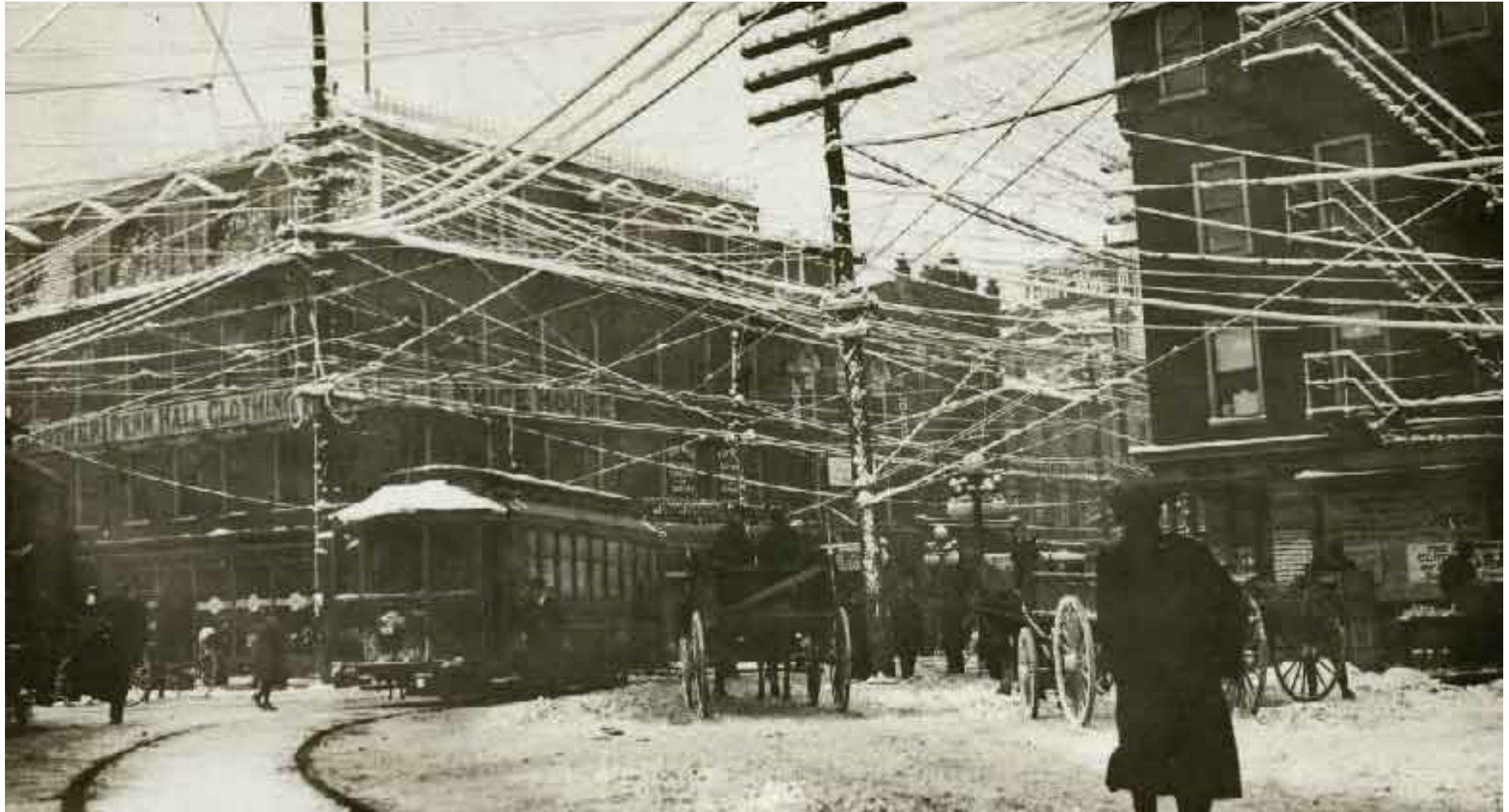
Surely IPv6 will just happen - its just a matter of waiting for the pressure of IPv4 address exhaustion to get to sufficient levels of intensity.

Or maybe not - let's look a bit closer at the situation

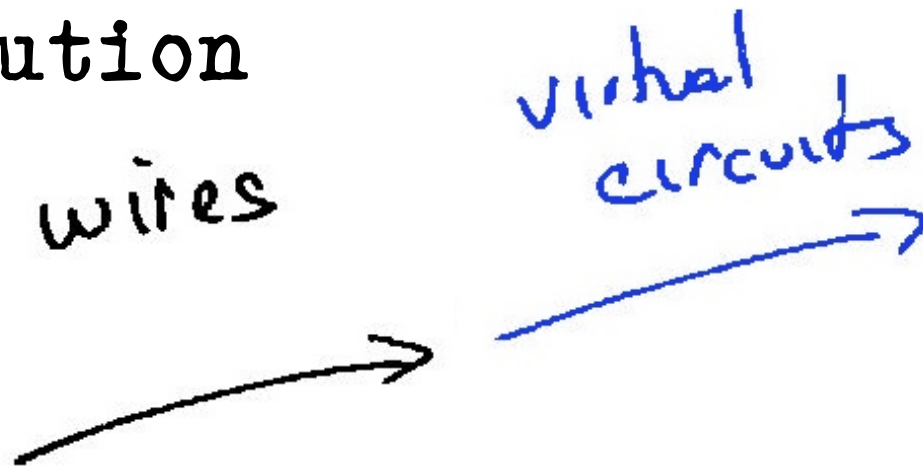
The
"inevitability"
of technological
evolution

wires

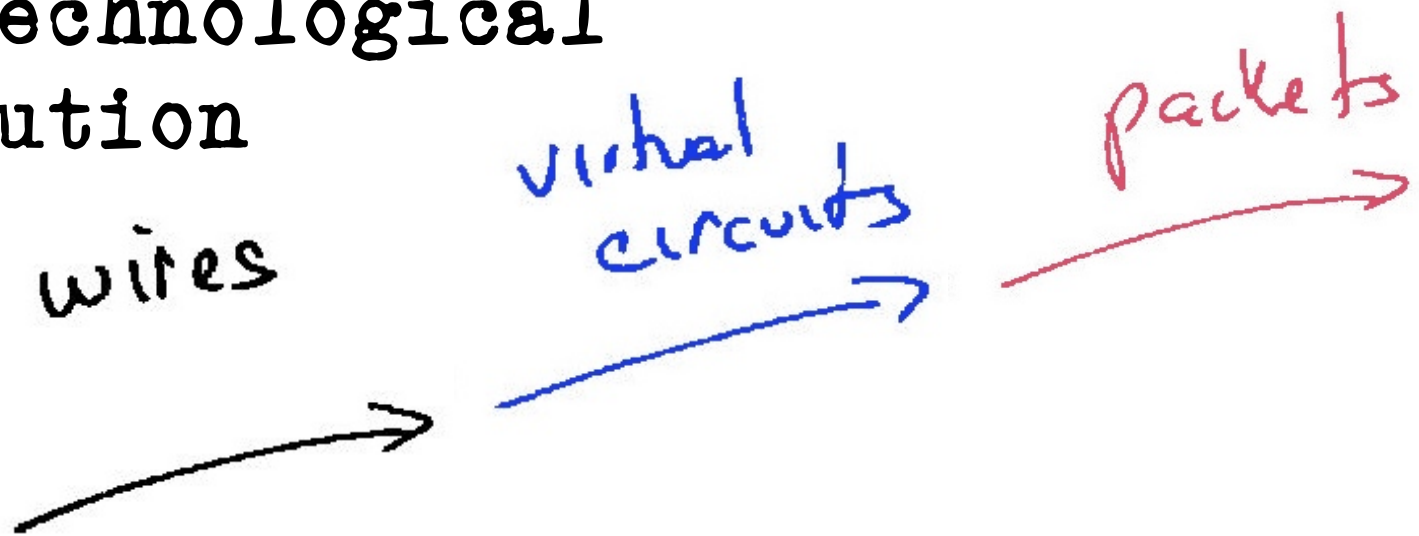




The
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The "inevitability" of technological evolution

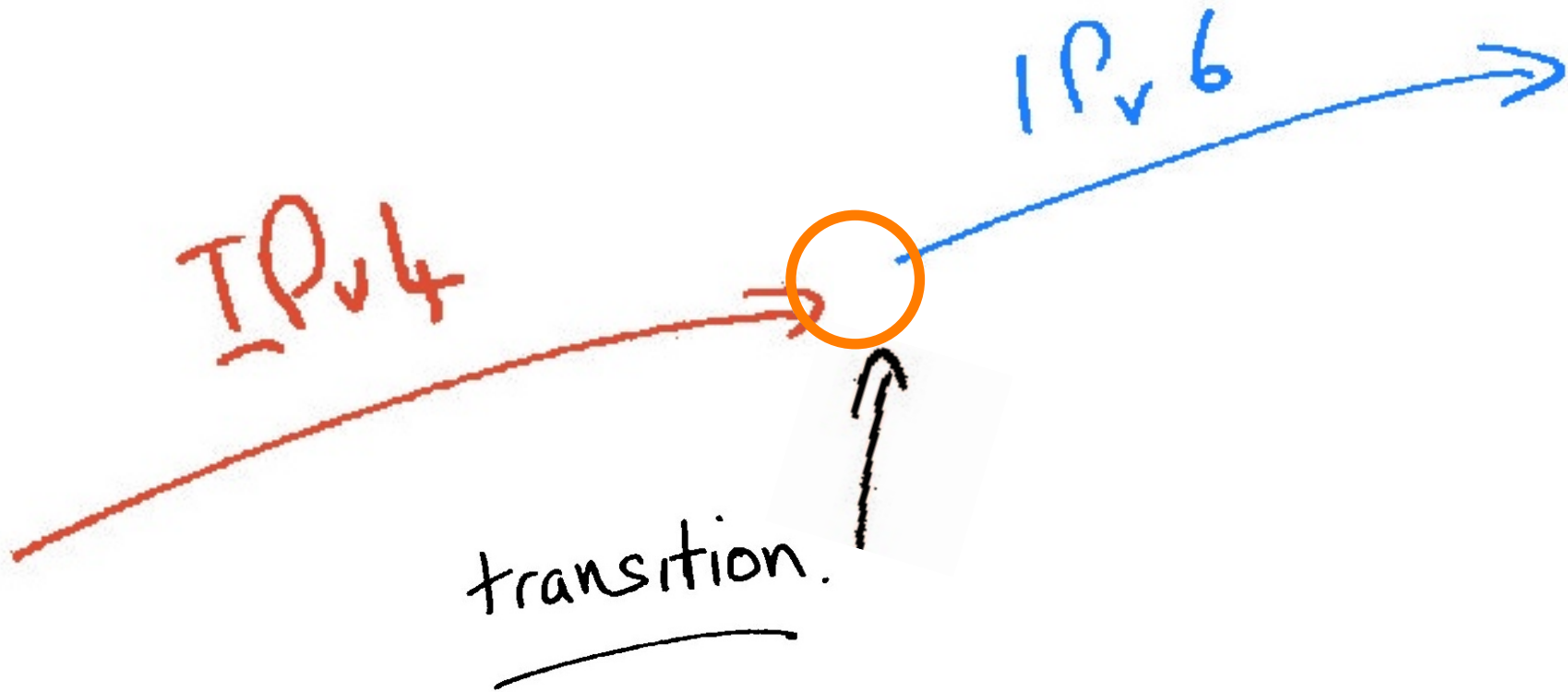


The
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evolution?

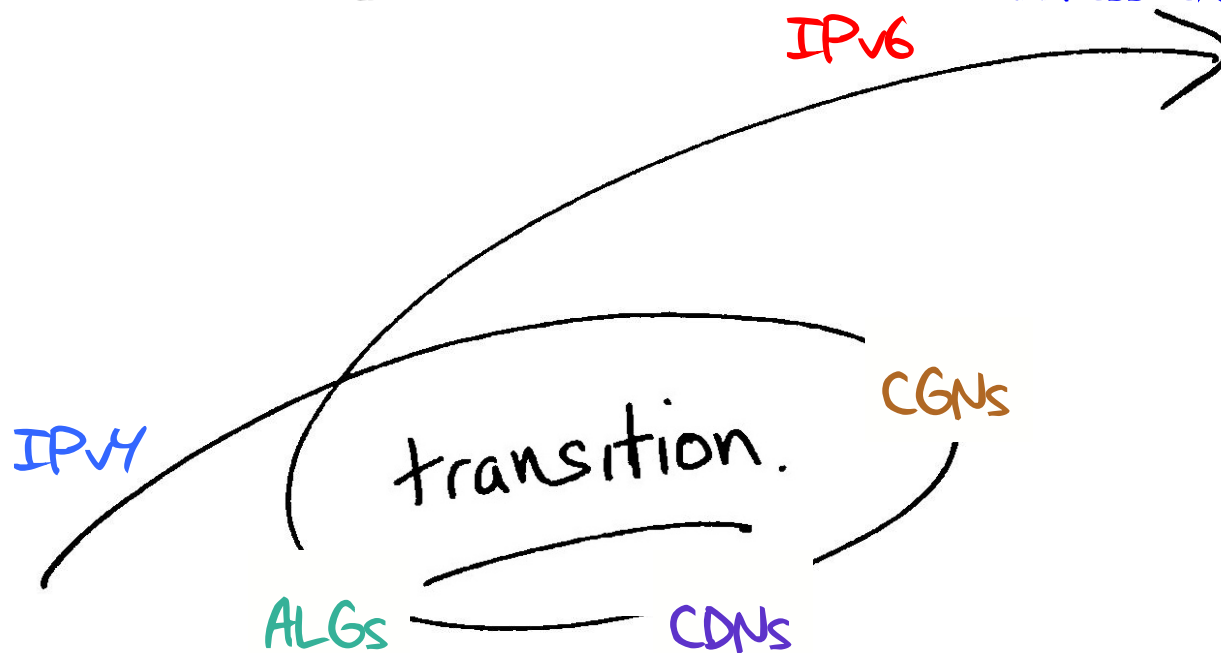
TPV4

196

The challenge often lies in managing the transition from one technology to another

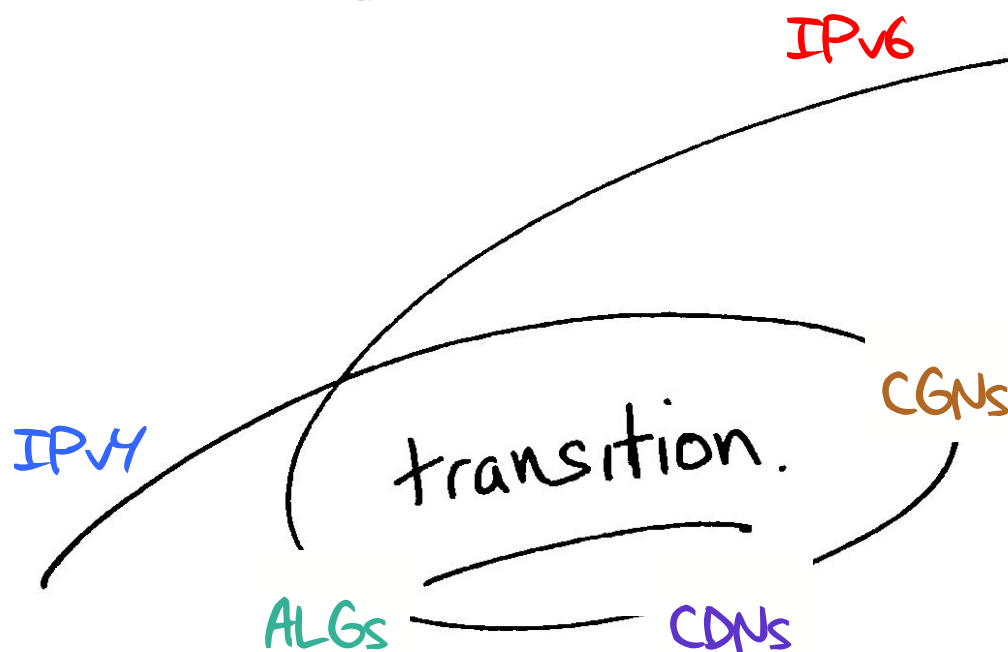


To get from "here" to "there" requires an excursion through an environment of CGNs, CDNs, ALGs and similar middleware 'solutions' to IPv4 address exhaustion



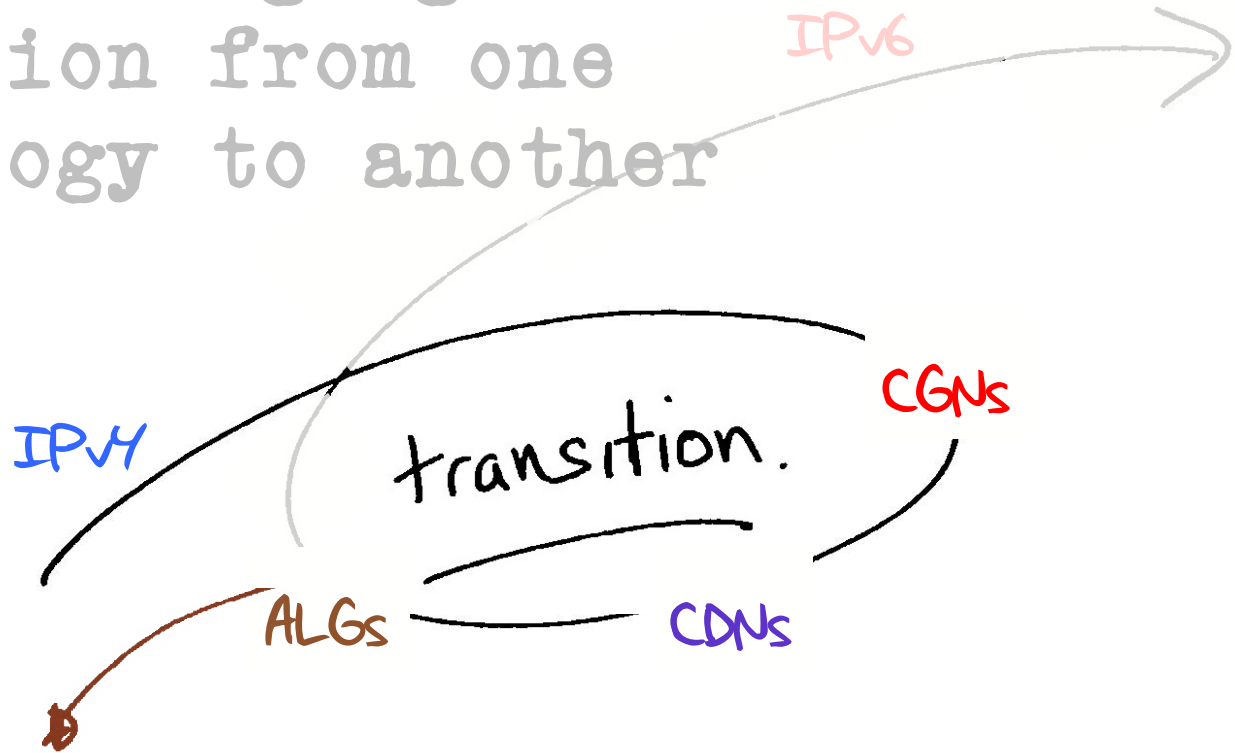
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To get from "here" to "there" requires an excursion through an environment of CGNs, CDNs, ALGs and similar middleware 'solutions' to IPv4 address exhaustion



Transition requires the network owner to undertake capital investment in network service infrastructure. What lengths will the network owner then go to to protect the value of this additional investment by locking itself into this "transitional" service model for an extended/indefinite period?

The challenge often lies in managing the transition from one technology to another



The risk in this transition phase is that the Internet heads off in a completely different direction!

How can we "manage" this transition?



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To ensure that the industry maintains collective focus on IPv6 as the objective of this exercise!



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To ensure that the industry maintains collective focus on IPv6 as the objective of this exercise!

And to ensure that we do not get distracted by attempting to optimize what were intended to be temporary measures

Challenges:

1. This is a deregulated and highly competitive environment



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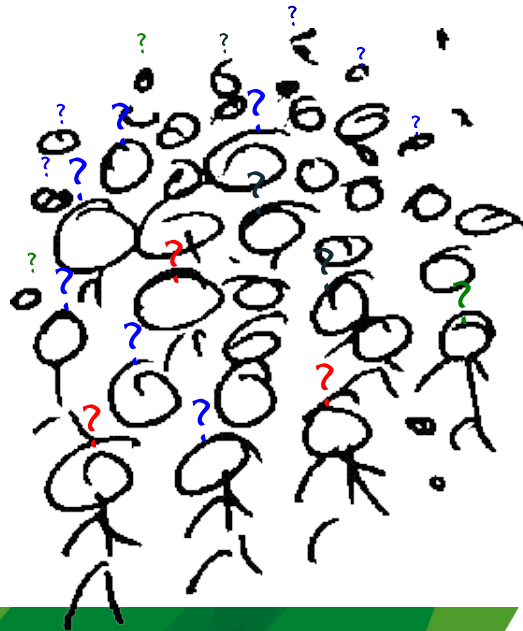
It is NOT a case of a single
"either/or" decision



Challenges:

1. This is a deregulated and highly competitive environment

There are many different players
Each with their own perspective



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And all potential approaches will be explored!

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There is no plan, just the interplay of various market pressures

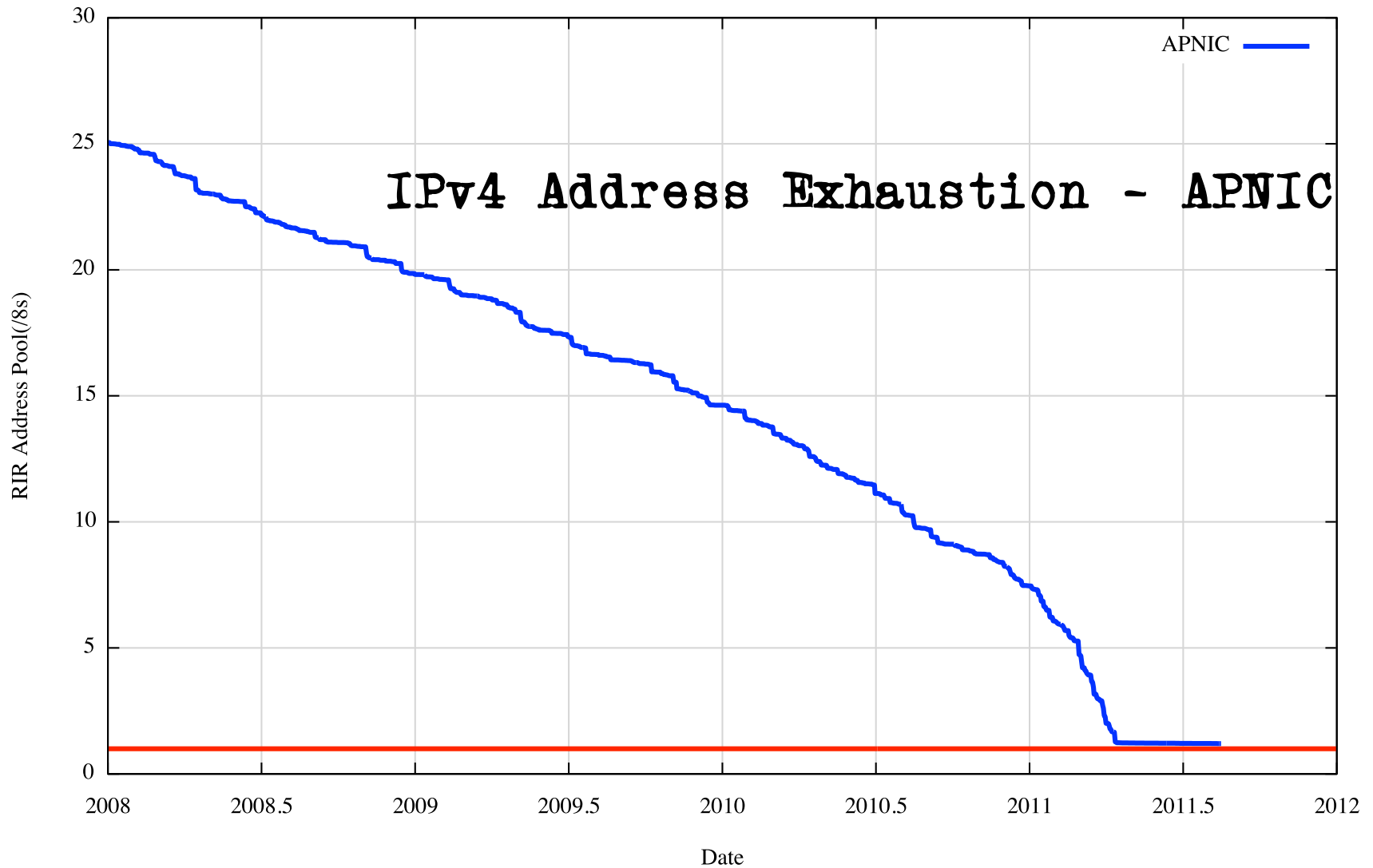
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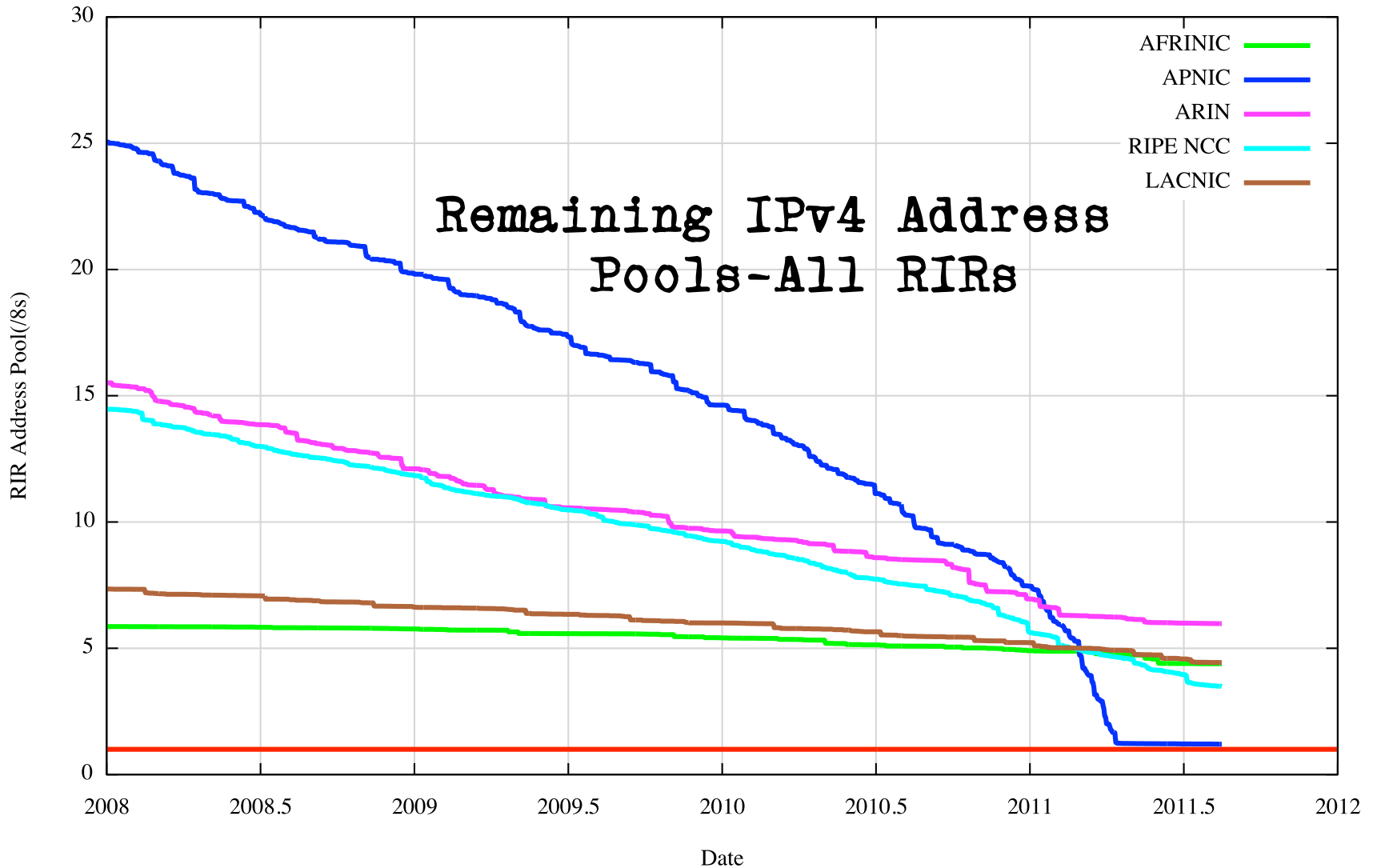
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2. Varying IPv4 Address Exhaustion Timelines

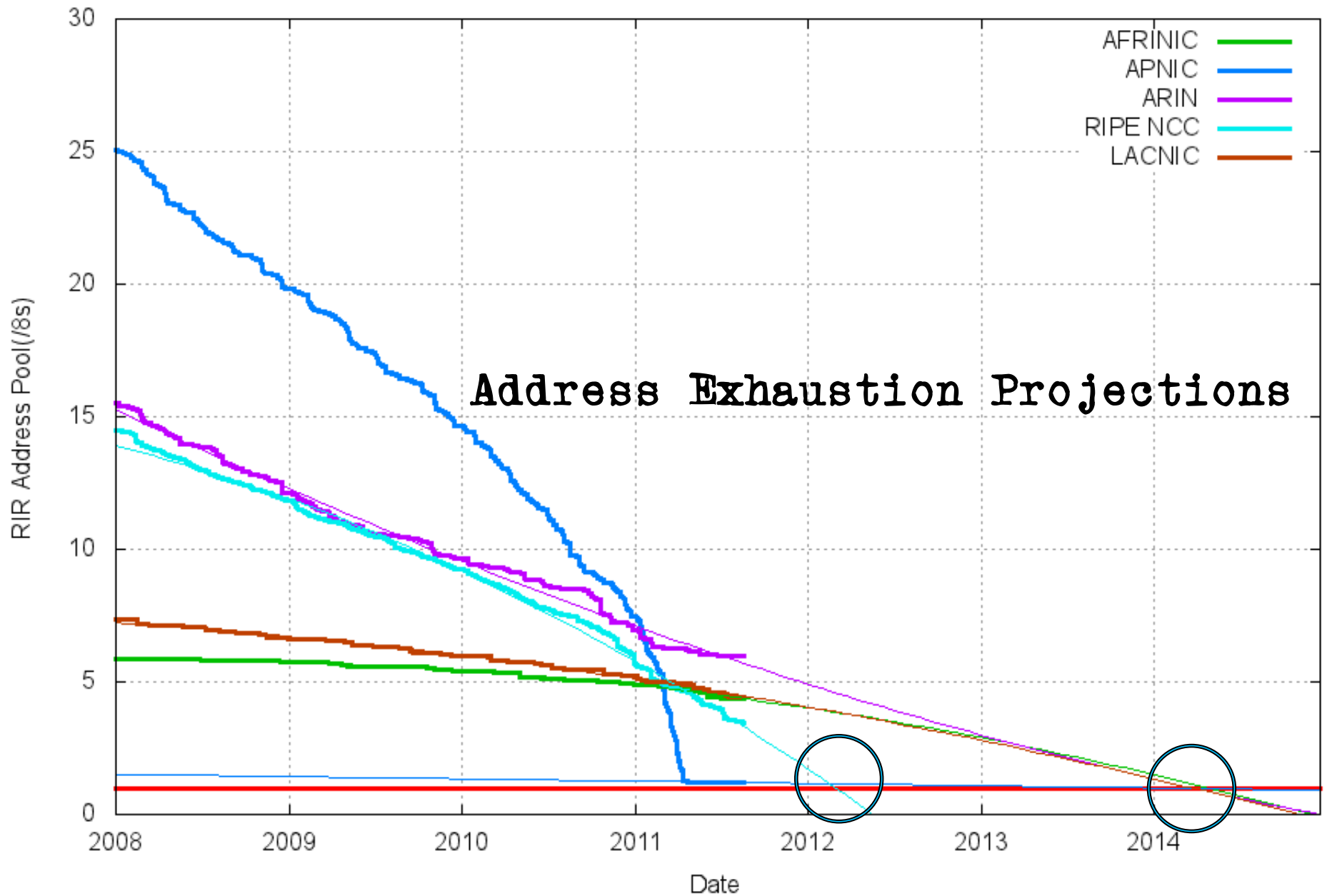
RIR IPv4 Address Run-Down Model



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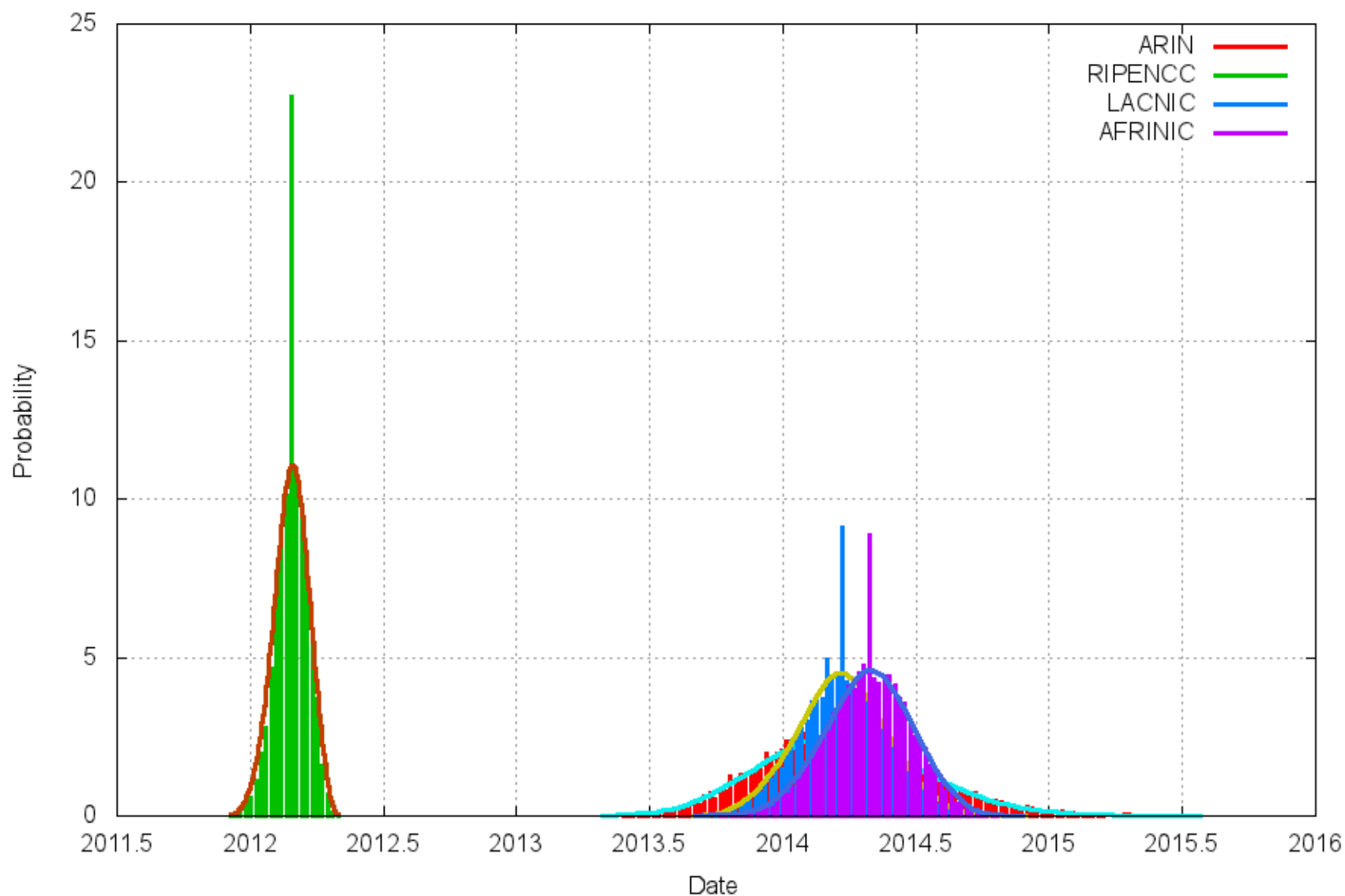


Exhaustion Predictions

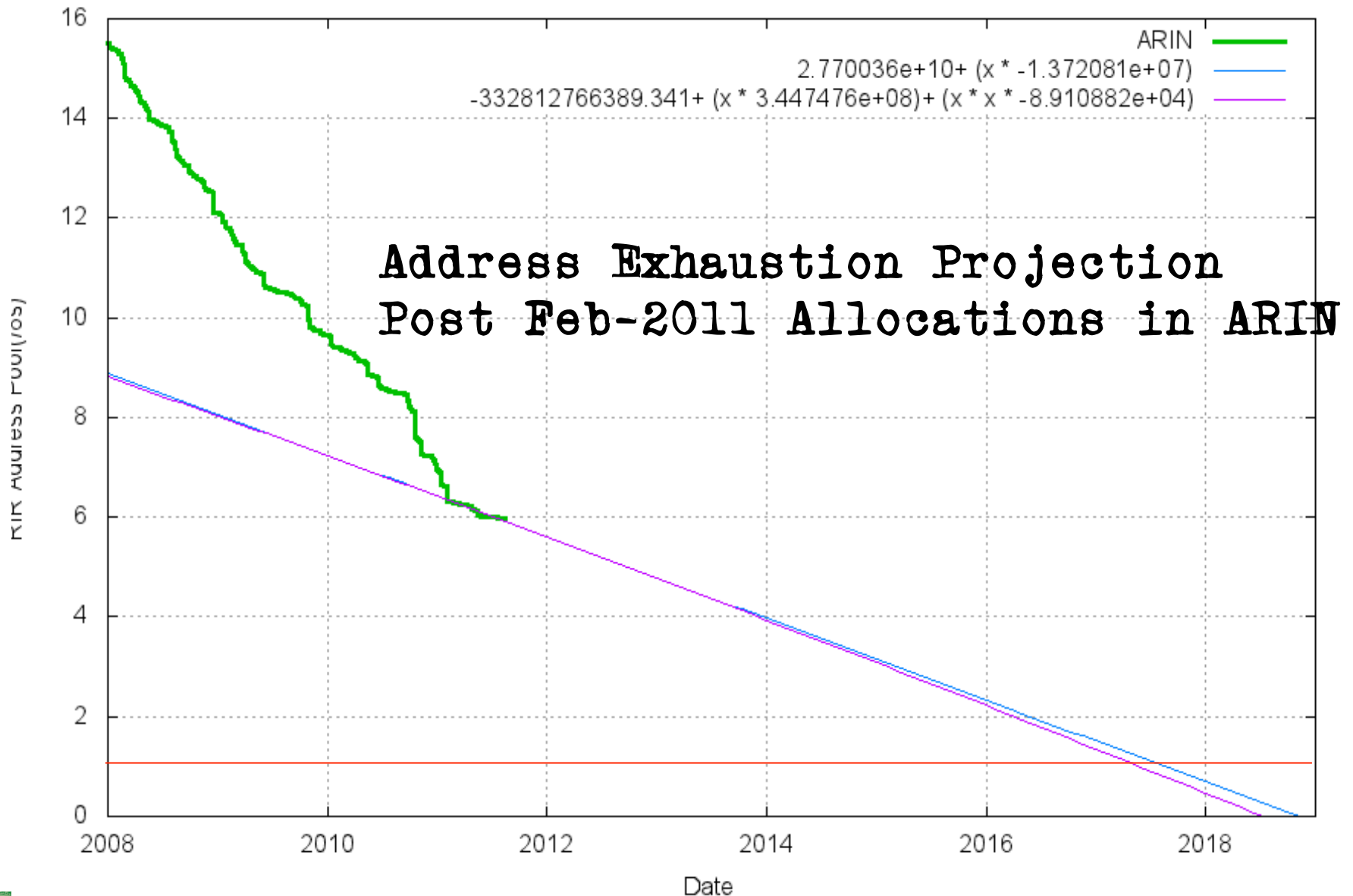
RIR	Predicted Exhaustion Date *	Remaining Address Pool (19 Aug 2011)
APNIC	19 April 2011 (actual)	1.20 /8s (0.3 /8s rsvd)
RIPE NCC	25 February 2012	3.47 /8s
LACNIC	22 March 2014	4.43 /8s
ARIN	23 March 2014	6.00 /8s
AFRINIC	28 April 2014	4.38 /8s

** Here “exhaustion” is defined as the point when the RIR’s remaining pool falls to 1 /8*

RIR IPv4 Address Run-Down Model - Variance Analysis



ARIN - Address Pool Consumption Model



Reality Acceptance

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Or not

Is IPv4 address exhaustion a "here and now" problem or a "imminent future" problem?

Reality Acceptance

Or not

Is IPv4 address exhaustion a "here and now" problem or a "imminent future" problem?

"It's not happening until it's happening to me!"

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Exhaustion is occurring variously over a period of many years

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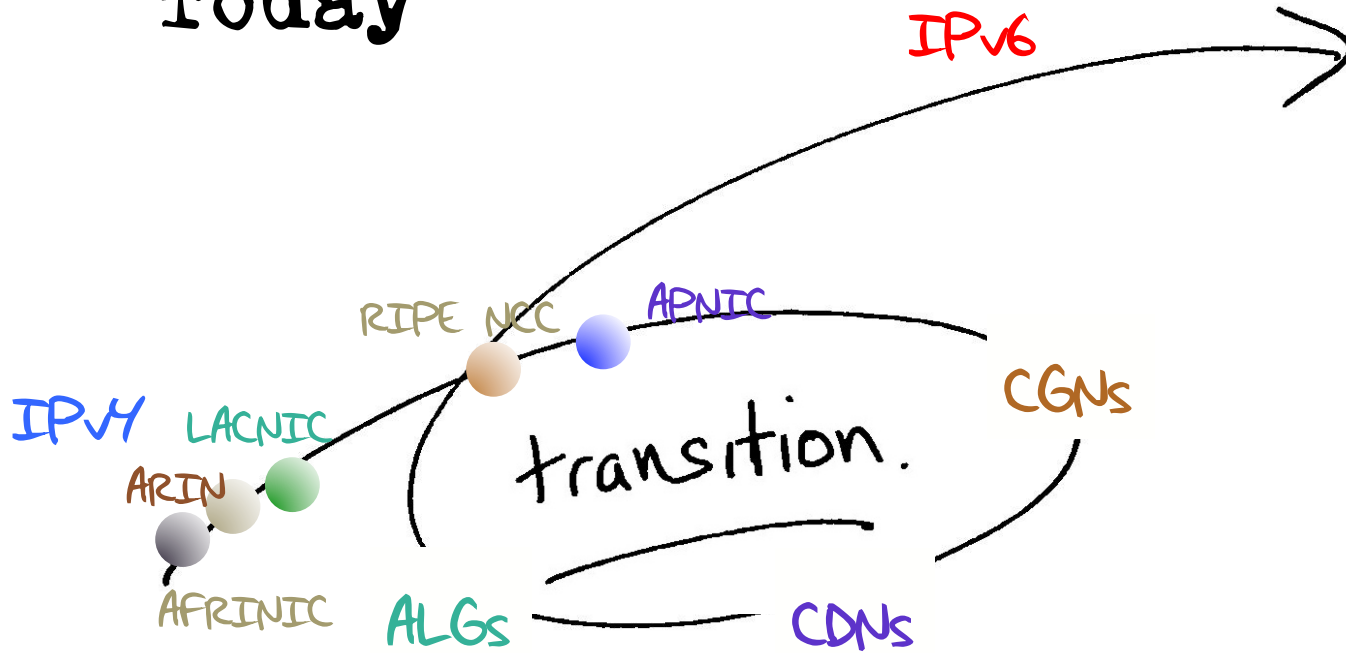
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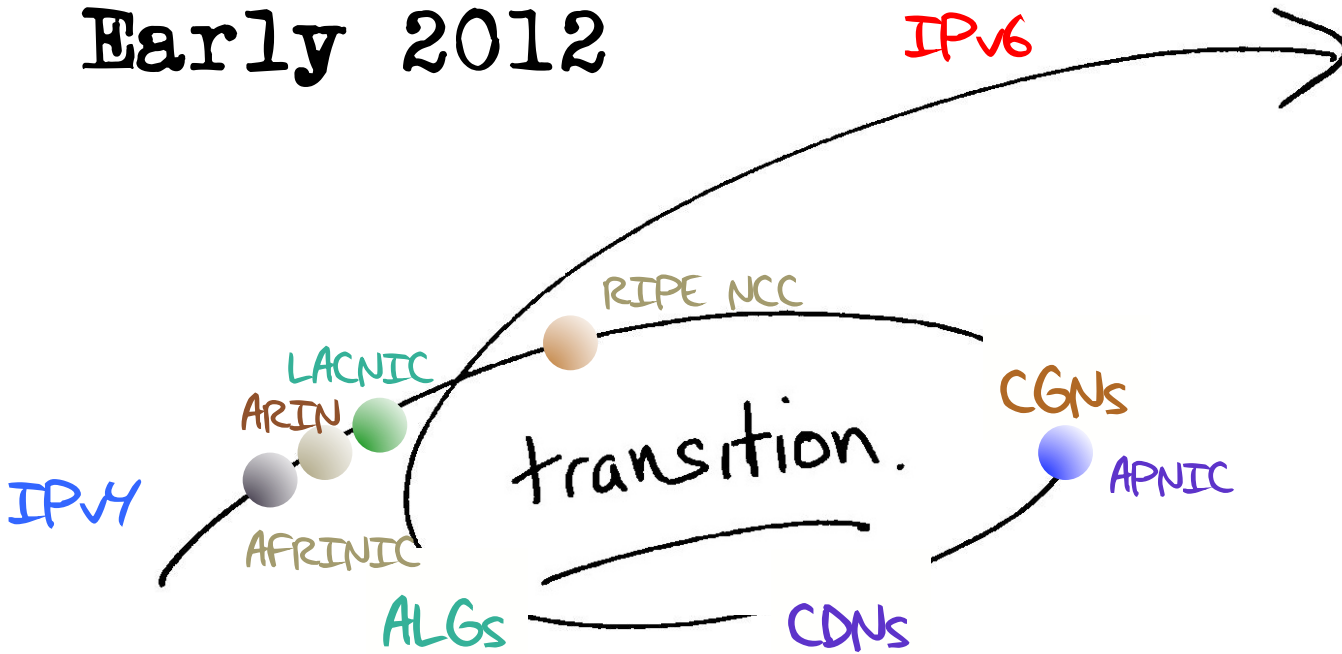
3. Regional Diversity

Today

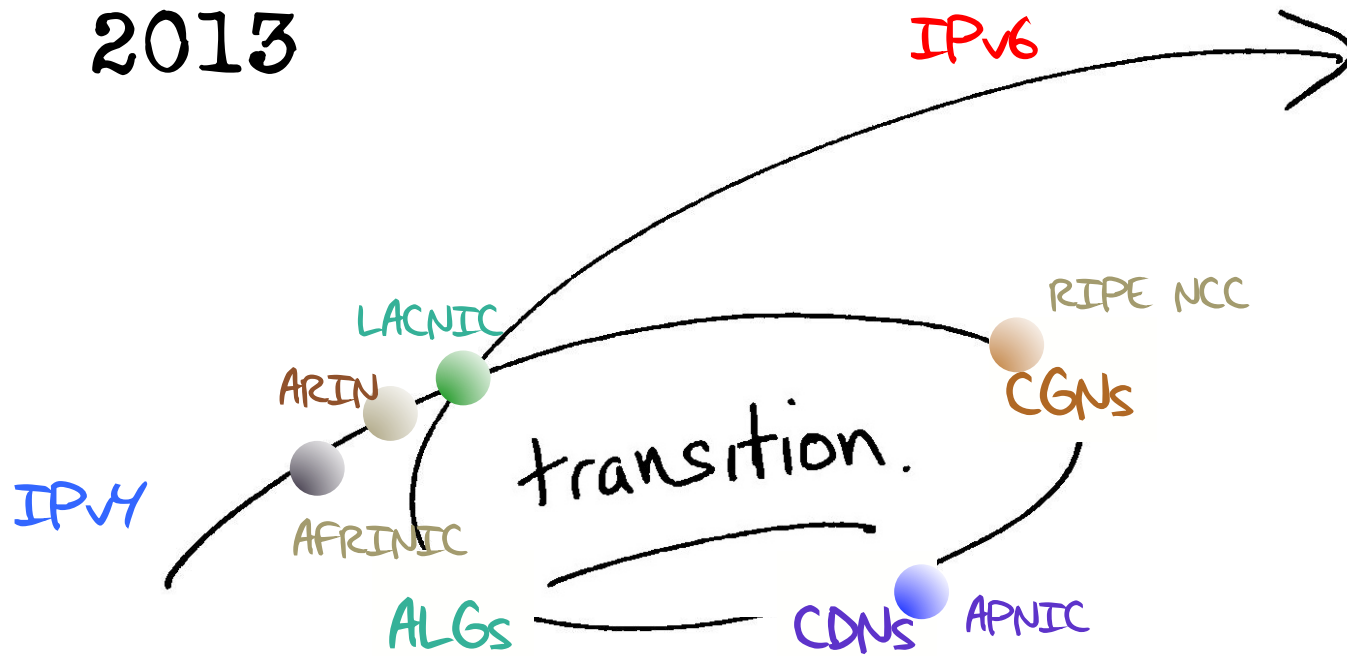


Early 2012

IPv6



2013



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By 2013 it is possible that different regions will be experiencing very different market pressures for the provision of Internet services, due to differing transitional pressures from IPv4 exhaustion



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What's the level of risk that the differing environments of transition lead to significantly different outcomes in each region?

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Will we continue to maintain coherency of a single Internet through this transition?

What's the level of risk that the differing environments of transition lead to significantly different outcomes in each region?

The Myth of the Long Term Plan

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"Transition will take many years..."

5 years, maybe 10 years, maybe longer⁾⁾

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Are we still firmly committed to the plans we had 5 years ago?

How about our 10 year old plans?

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“Transition will take many years...

5 years, maybe 10 years, maybe longer”

Are we still committed to the plans we had 5 years ago? How about our 10 year old plans?

The longer the period of transition, the higher the risk of losing the plot and heading into other directions

201x?

IPv6

IPv4

ARIN

~~LACNIC~~

AFRINIC

CGNs

RIPE NCC

transition.

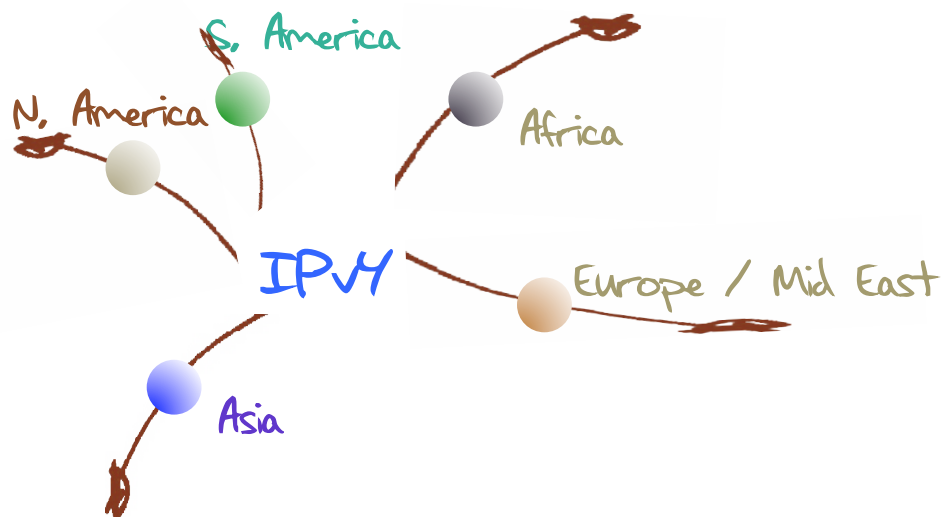
ALGs

CDNs

APNIC

IPv6

20xx?



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3. Regional Diversity

Market pressures during an extended transition may push the Internet along different paths in each region

Can we help the Internet
through this transition?



Can we help the Internet through this transition?

Or at least, how can we avoid making it any
worse?

Three thoughts...



Three thoughts...

If we want one working Internet at the end of all this, then keep an eye on the larger picture

think about what is our common interest here

and try to find ways for local interests to converge with common interests

Three thoughts...

Addresses should be used in working networks, not hoarded

scarcity creates pain and uncertainty

extended scarcity prolongs the pain and increases the unpredictability of the entire transition process

Three thoughts...

A rapid transition represents the best chance of achieving an IPv6 network as an outcome

The more time we spend investing time, money and effort in deploying IPv4 address extension mechanisms, the higher the risk that we will lose track of the temporary nature of transition

If we are truly committed to achieving a single and coherent IPv6 Internet then perhaps it's necessary to compress the timelines for transition, not extend them!

Thank You!