



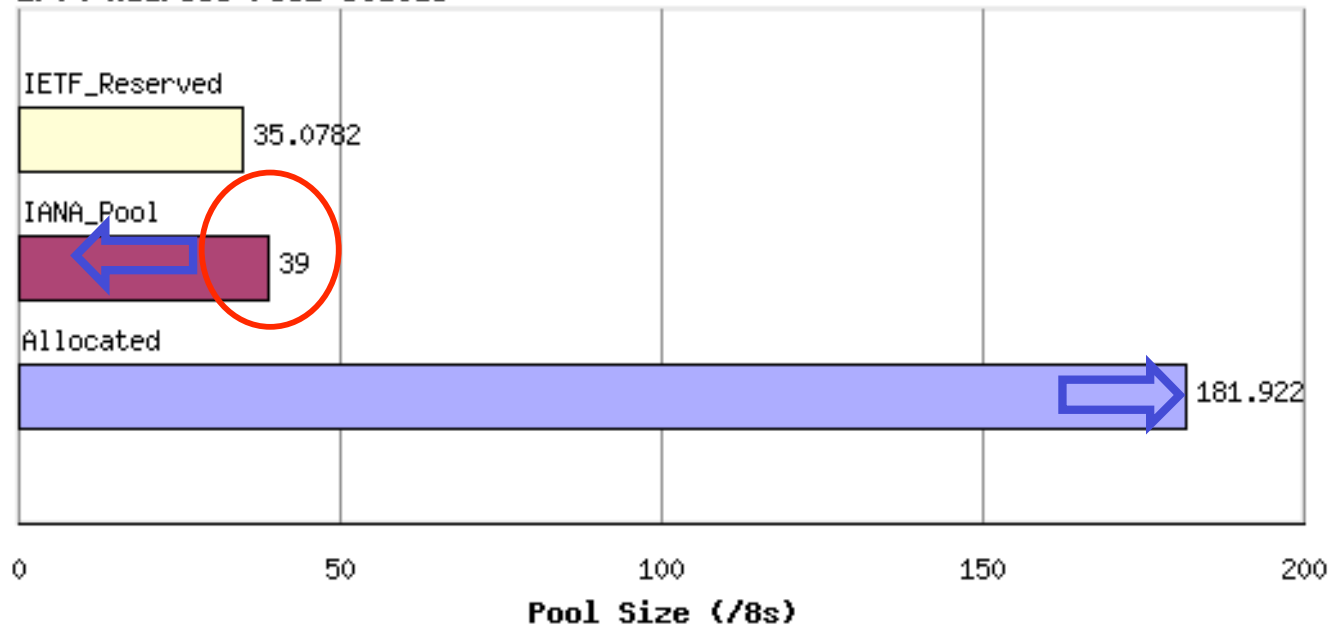
Beyond IPv4 ?

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Chief Scientist
APNIC

Religion, Technology, Engineering
and
The End of the world as we know it



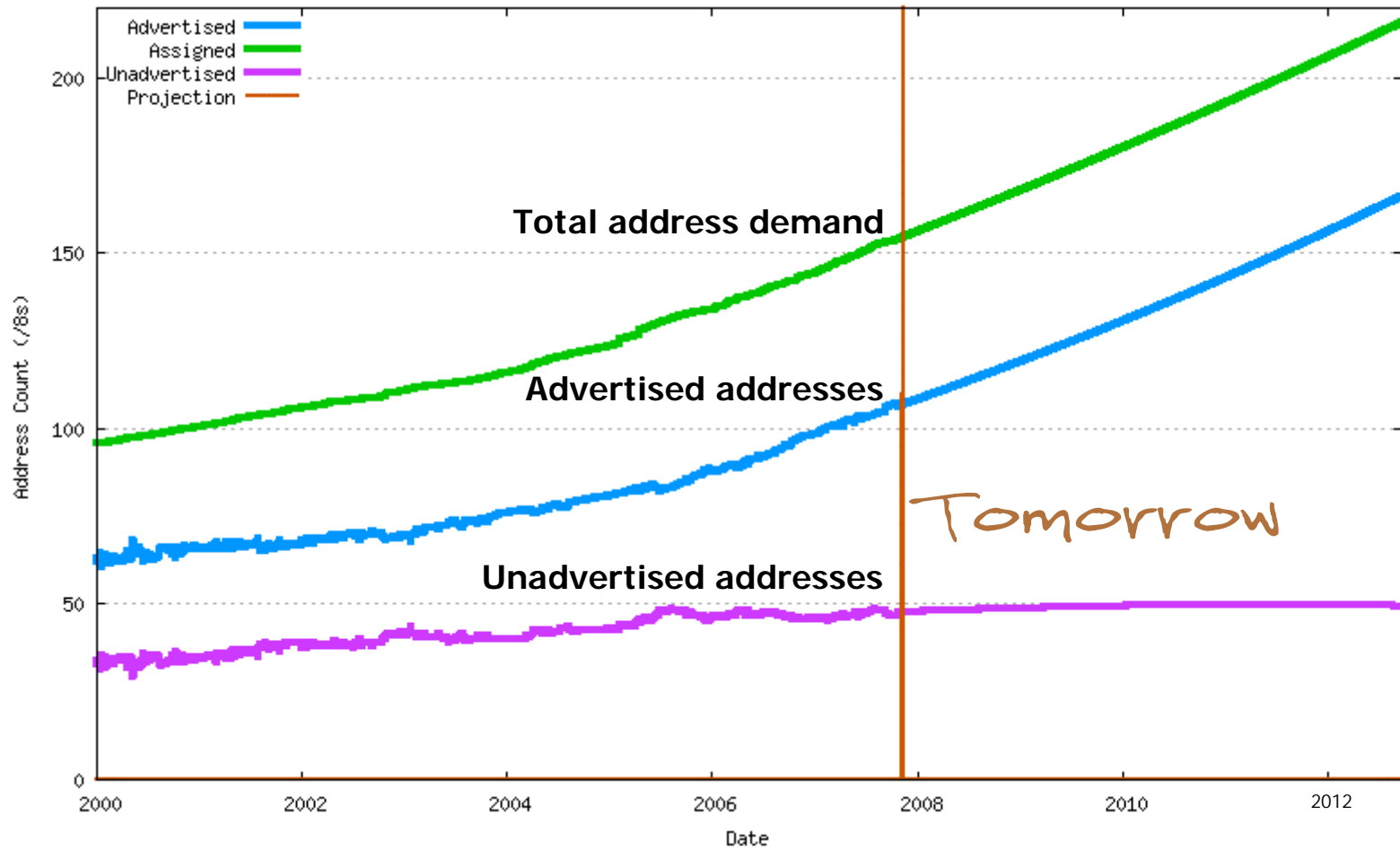
IPv4 Address Pool Status



Today

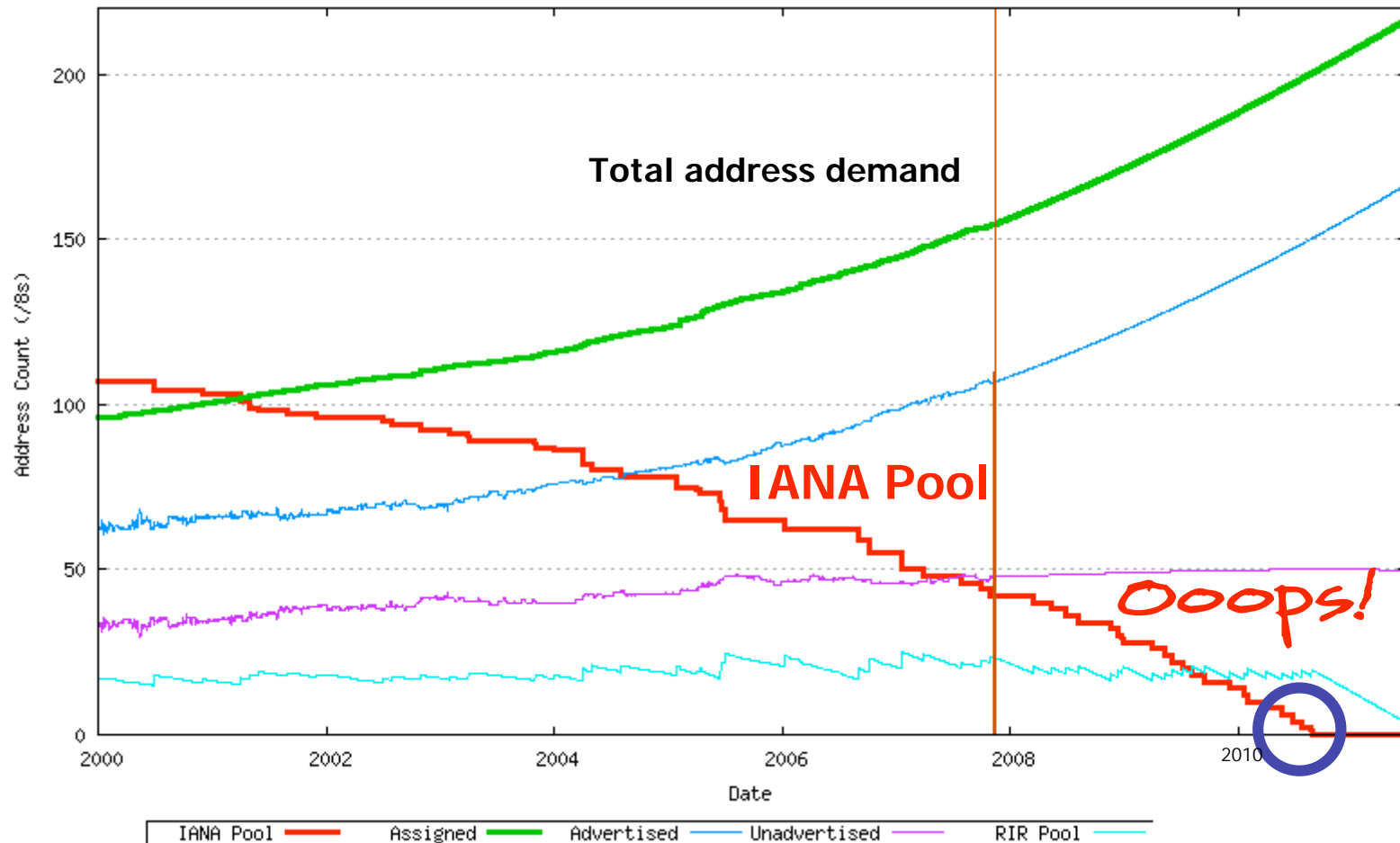


Data Prediction





Data Prediction

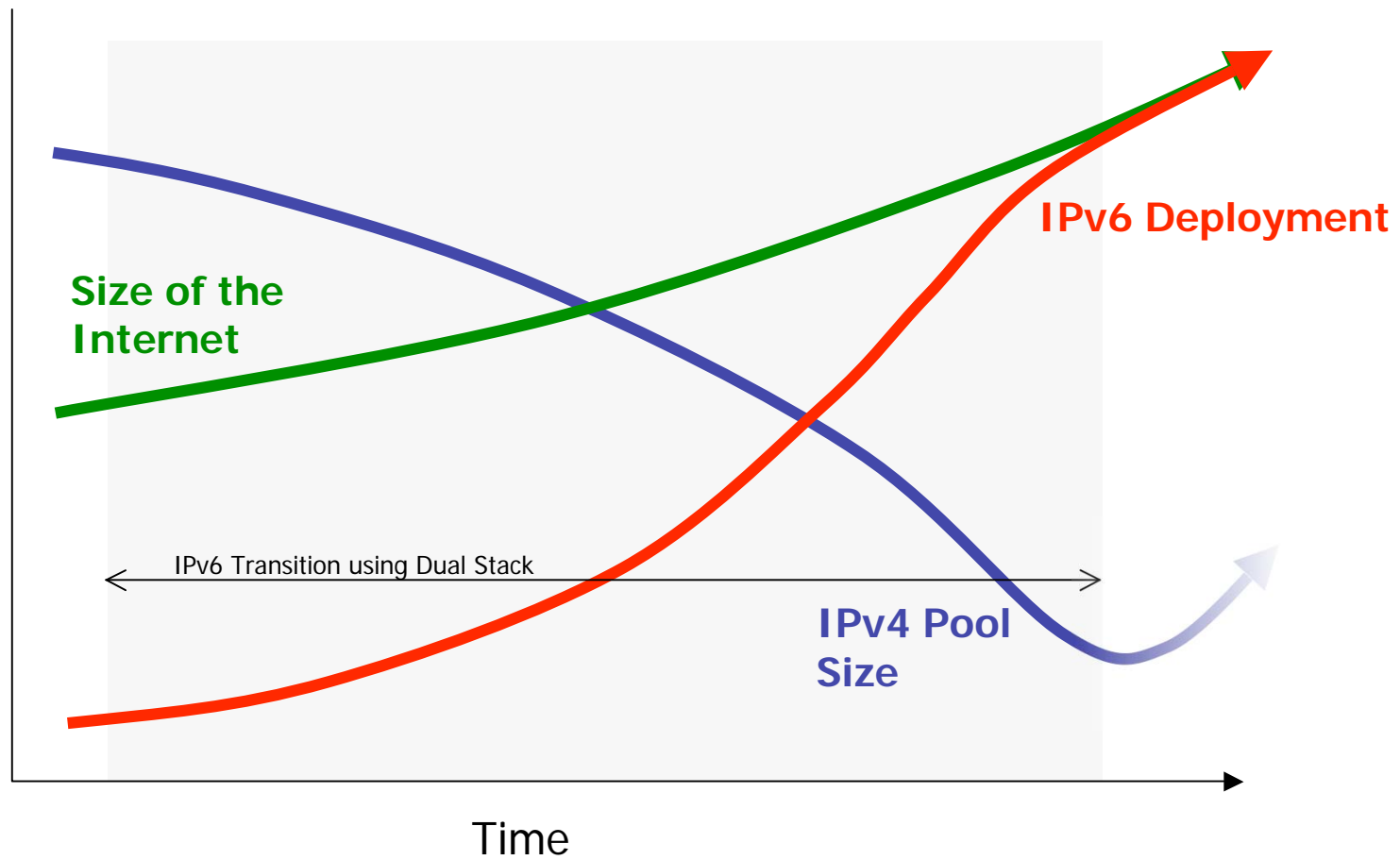




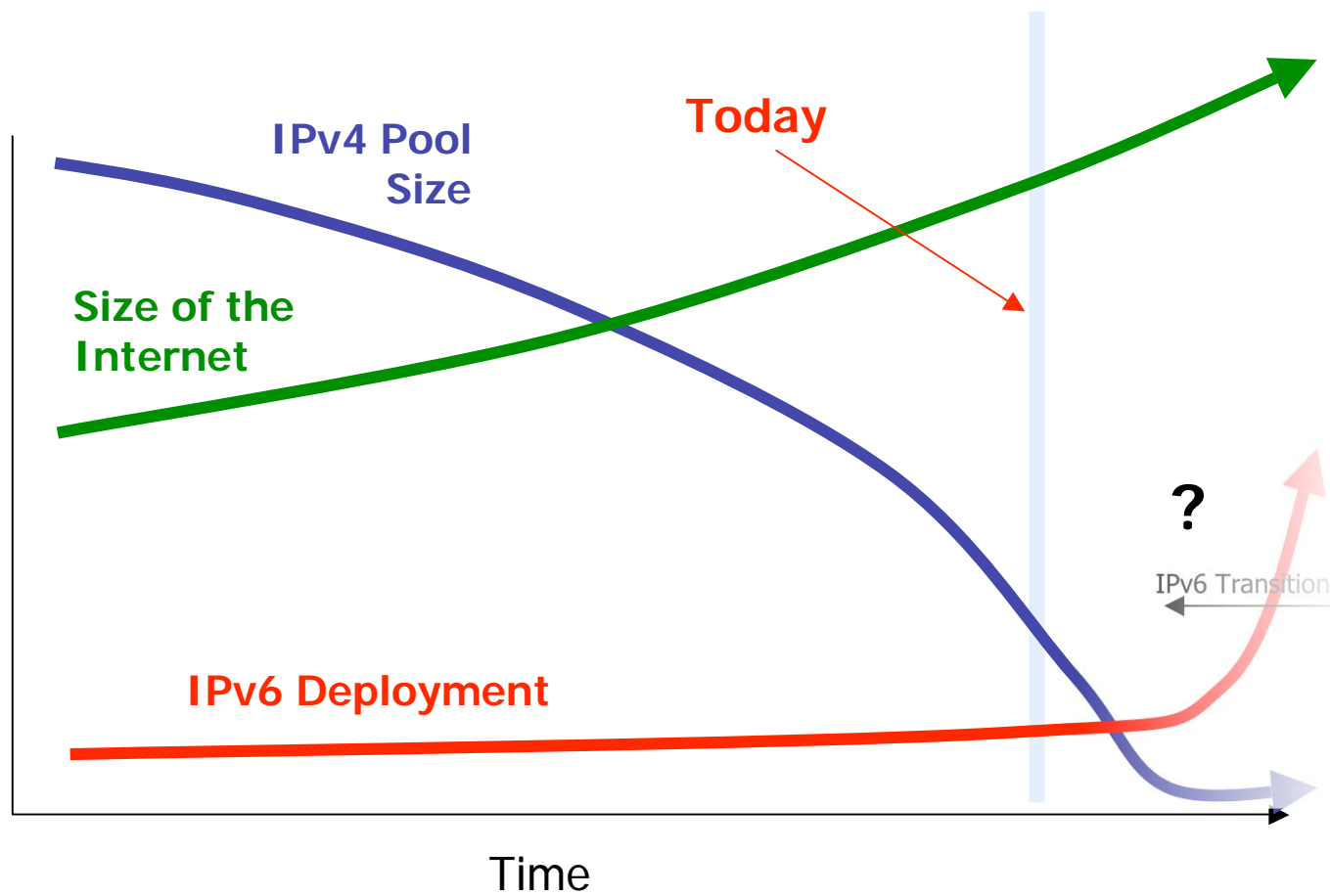
That's 24th January 2011

<http://ipv4.potaroo.net>

We had a plan ...



what's the revised plan?





Now what?

Some possible scenarios:

- Rapid IPv6 deployment
- Persist in IPv4 networks using more NATs
- Address markets emerging for IPv4
- Routing fragmentation
- IPv6 transition

Its Just Business:



- This entire network is customer funded
- And customers have absolutely no clue what this IPv6 stuff is about
- So they are not paying!

New Markets for IPv6?

The Universe of Tiny Things?



The world of billions of chattering devices unleashing new rivers of gold into the IP industry?

Or is this just the economy? There is no new money and these billions of chattering devices will generate much the same revenue as we have today

So we have to cram all these billions of new devices trillions of new packets into the same money that we have today.

technology leverage will make tomorrow's networks 1,000 times CHEAPER to deliver an IP packet than today's network?

Or have we reached some limit to the economic viability of communications that imply that ever smaller valued transactions can't be sustained over ever larger networks?

Do RFID and Bluetooth provide a different model of communication that is viable in the universe of things, where the identity is global but the communication is strictly limited in scope and

And if you ever are curious enough to enlarge this slide to see if there is text all the way down the page you will have got yourself to this point, where it becomes obvious that I've got nothing more to say and I want to fill up the bottom of the slide with tiny text.

Business Realism



So far IPv6 is a dismal business failure on the supply side

IPv6 adoption represents the marginal benefit of a pretty minor technology change with all the costs of a major forklift upgrade



Its just not looking very good is it?

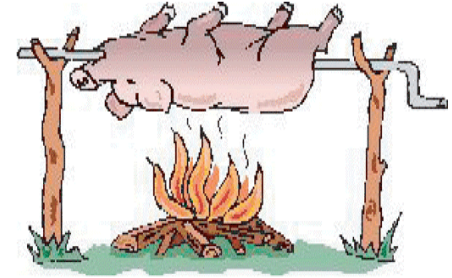
Scenario A:
It's simply a Matter of Faith



The "lets deploy IPv6 now!" option:

The global internet adopts IPv6 universally before January 2011 and completely quits all use of IPv4 before well before address pool exhaustion

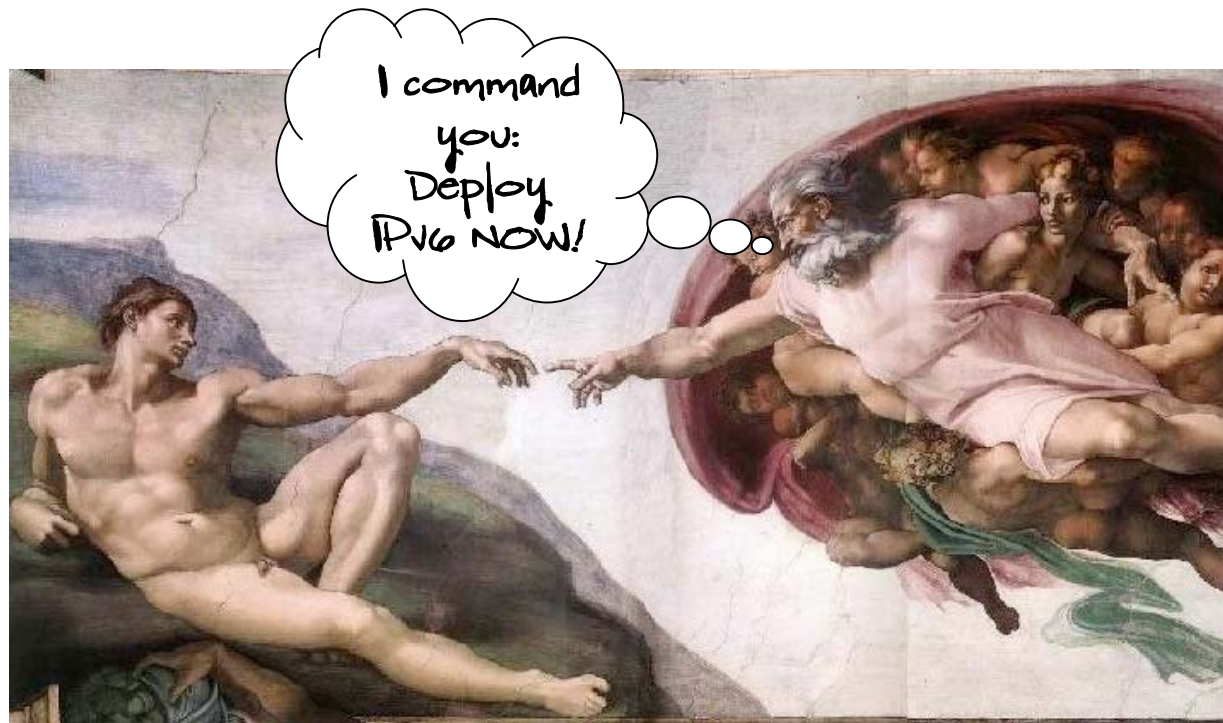
Faith and Reality



BIG and FAST don't go together!

Faith and Religion

divine intervention required?



Scenario B:
IPv4 and NATs



The "lets just use more NATs"
option

can we continue to deploy more NATs
to keep the Internet on IPv4
indefinitely?

NATs on steroids



- Incremental piecemeal deployment is just too seductive to ignore!

Shift ISP infrastructure to private address realms

Multi-level NAT deployments both at the customer edge and within the ISP network

Fun new products to play with: carrier scale NATs?

New forms of product differentiation to replace the QoS debacle: premium higher margin products without NAT?

NAT Futures

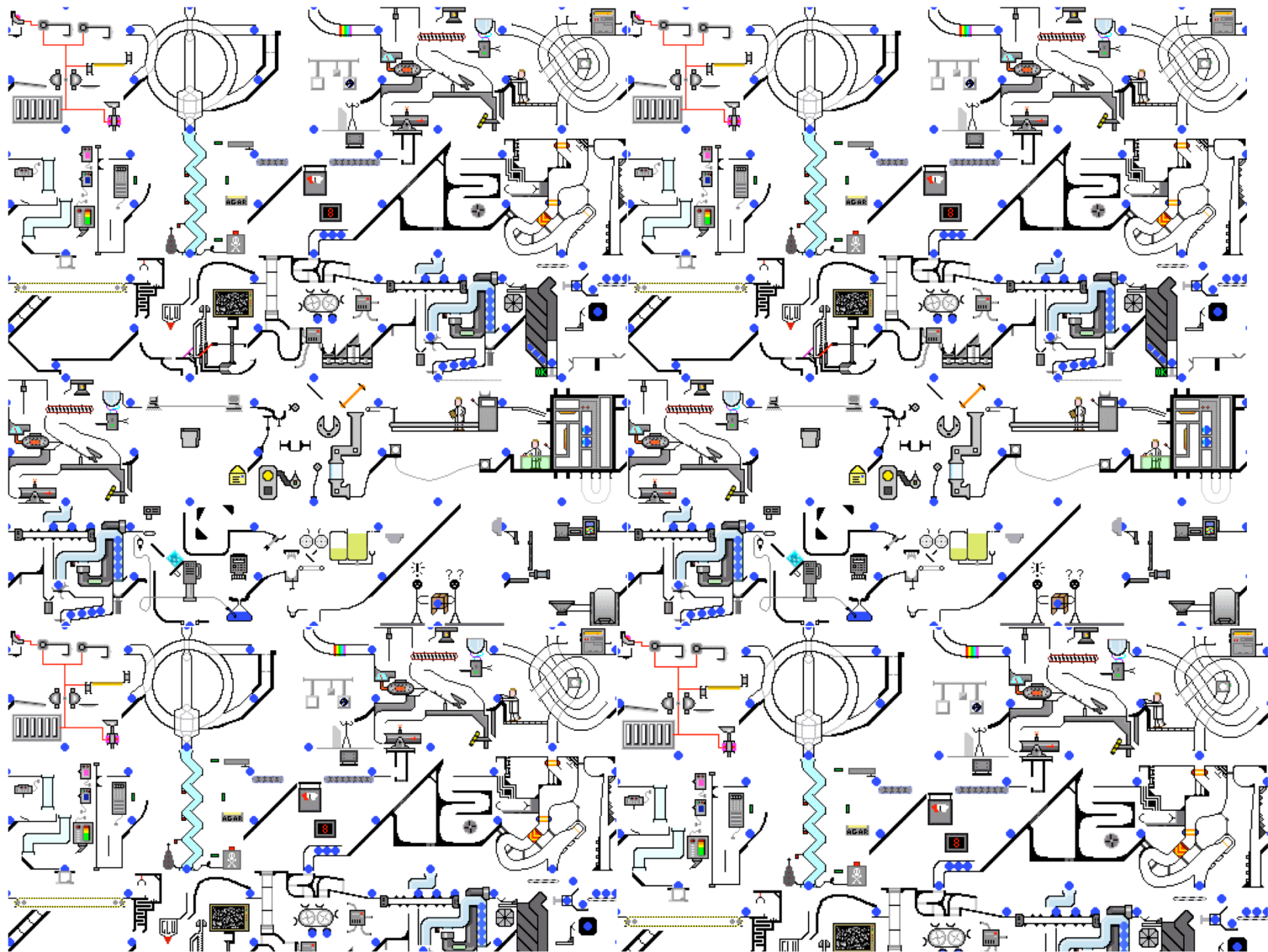


Are NATs just more of the same? Is this the "safe" option?

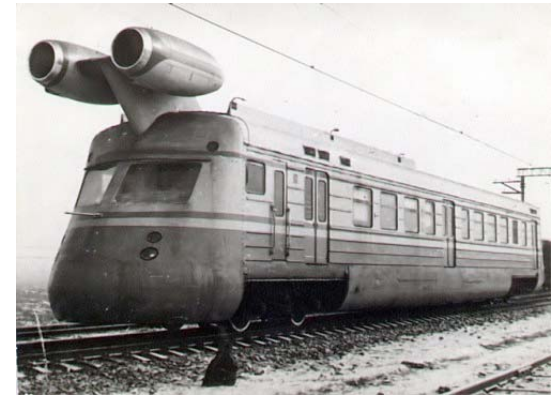
How far can NATs scale?

How complex can we get with this network?

Are we willing to find out?



Scenario C: Transition to IPv6



- IPv6 is not backward compatible with IPv4 on the wire
- So its "dual stack" or nothing

Either dual stack in the host, or dual stack via protocol translating proxies

Double or Quits?



- Dual Stack transition is an "and" proposition

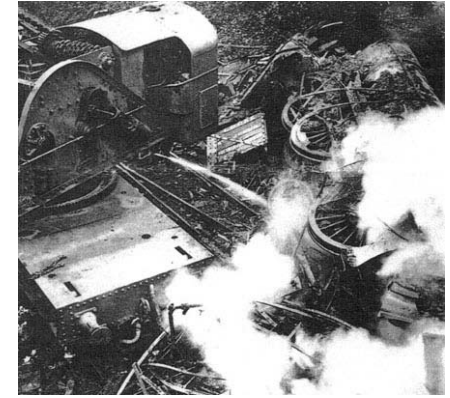
*It's a case of IPv4 and IPv6
Double the fun and double the cost?*

- But for how long?

*So we need to stretch IPv4 out to encompass tomorrow's
Internet, and the day after, and ...*

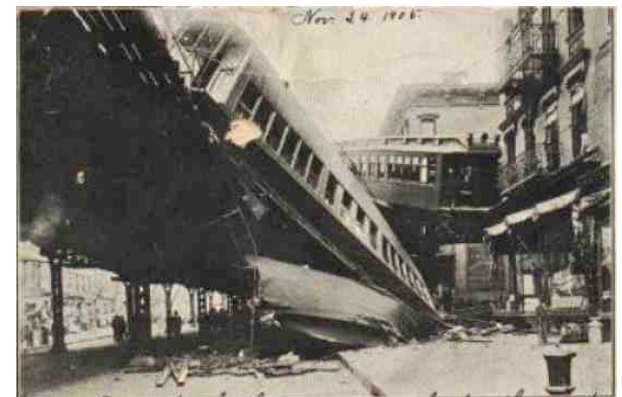
Using ... NATS?

Making IPv4 Last Longer



- Not every address is "in use"
End host utilization levels of addresses are estimated to be around 5% — 20% of the address pool
- So could we flush more addresses back into circulation?
Yes, but you really won't like it!

So what can we do?



What could be useful
right now is ...



- Clear and coherent information
- Appreciation of the broader context
- Some pragmatic workable approaches

And an admission that failure is an option: some transitions are not 'natural' for a deregulated industry.

What should we preserve?



The Internet:

- Functionality of applications
- Viability of routing
- Capability to sustain continued growth
- Integrity of the network infrastructure

If we can!

The Fine Print



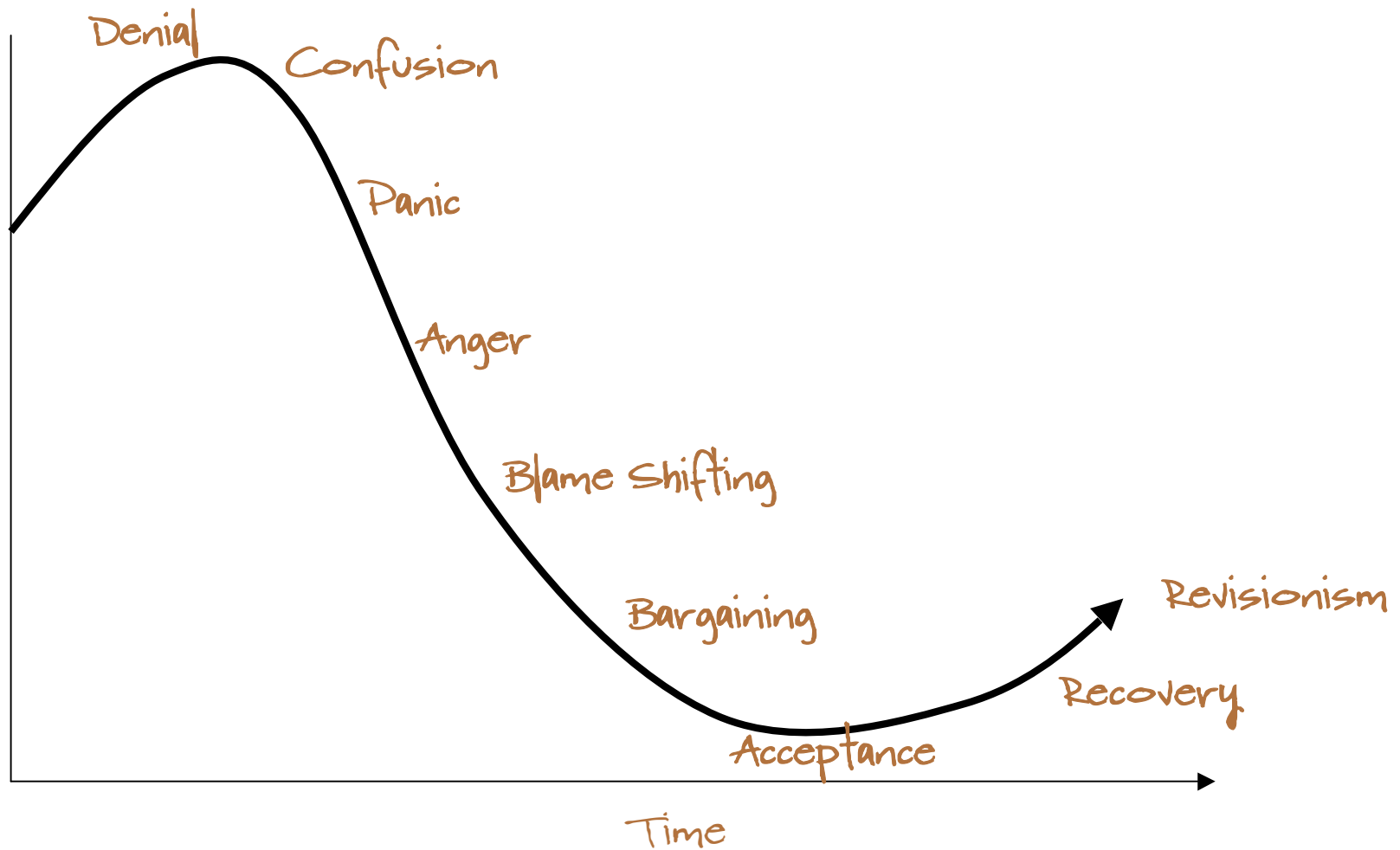
It is likely that there will be some disruptive aspects of this situation that will impact the entire industry

the original transition plan is a business failure
resolution of this failure is now going to be tough

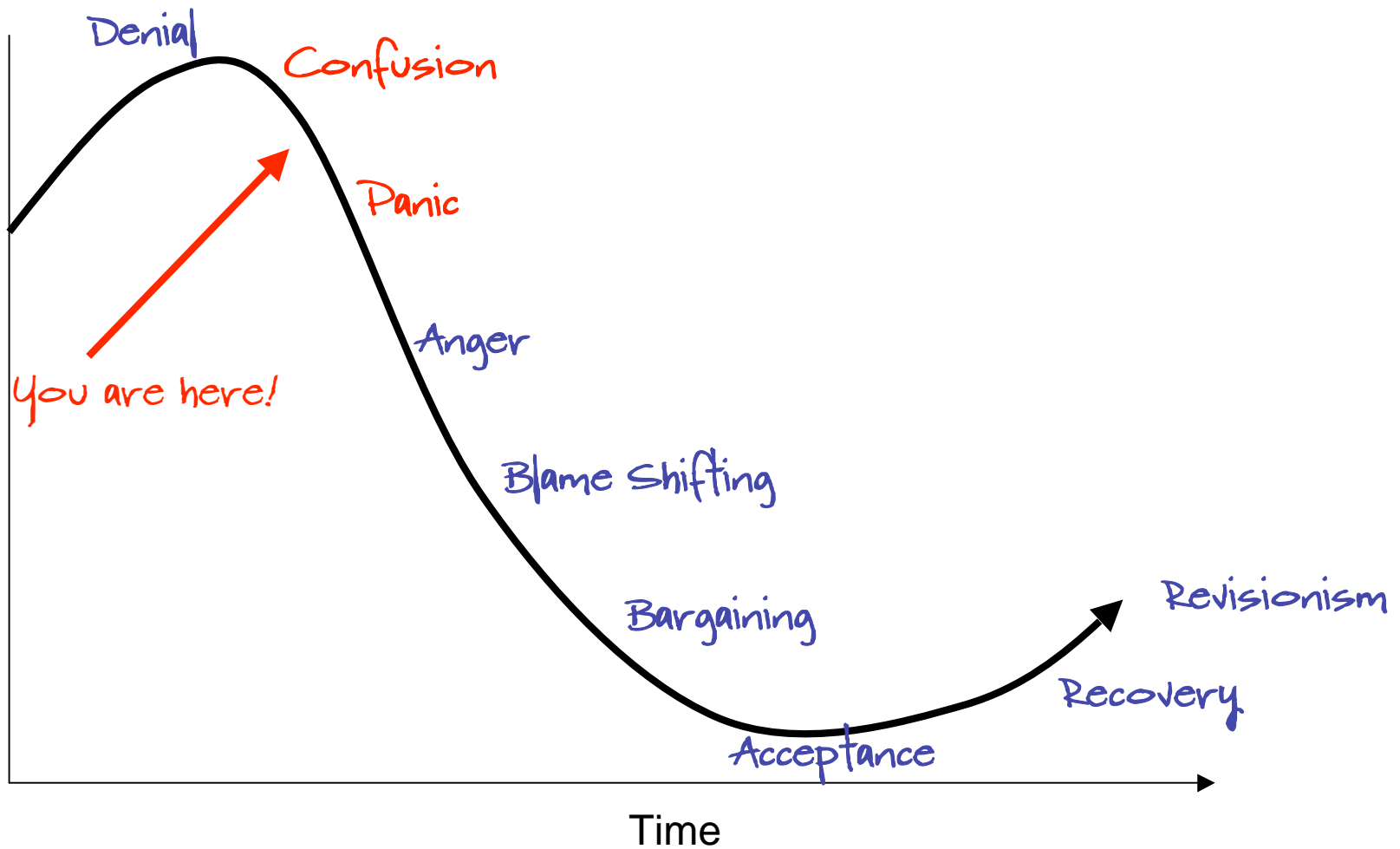
This will probably not be seamless nor costless

And will probably involve various forms of regulatory intervention, no matter what direction we might take from here

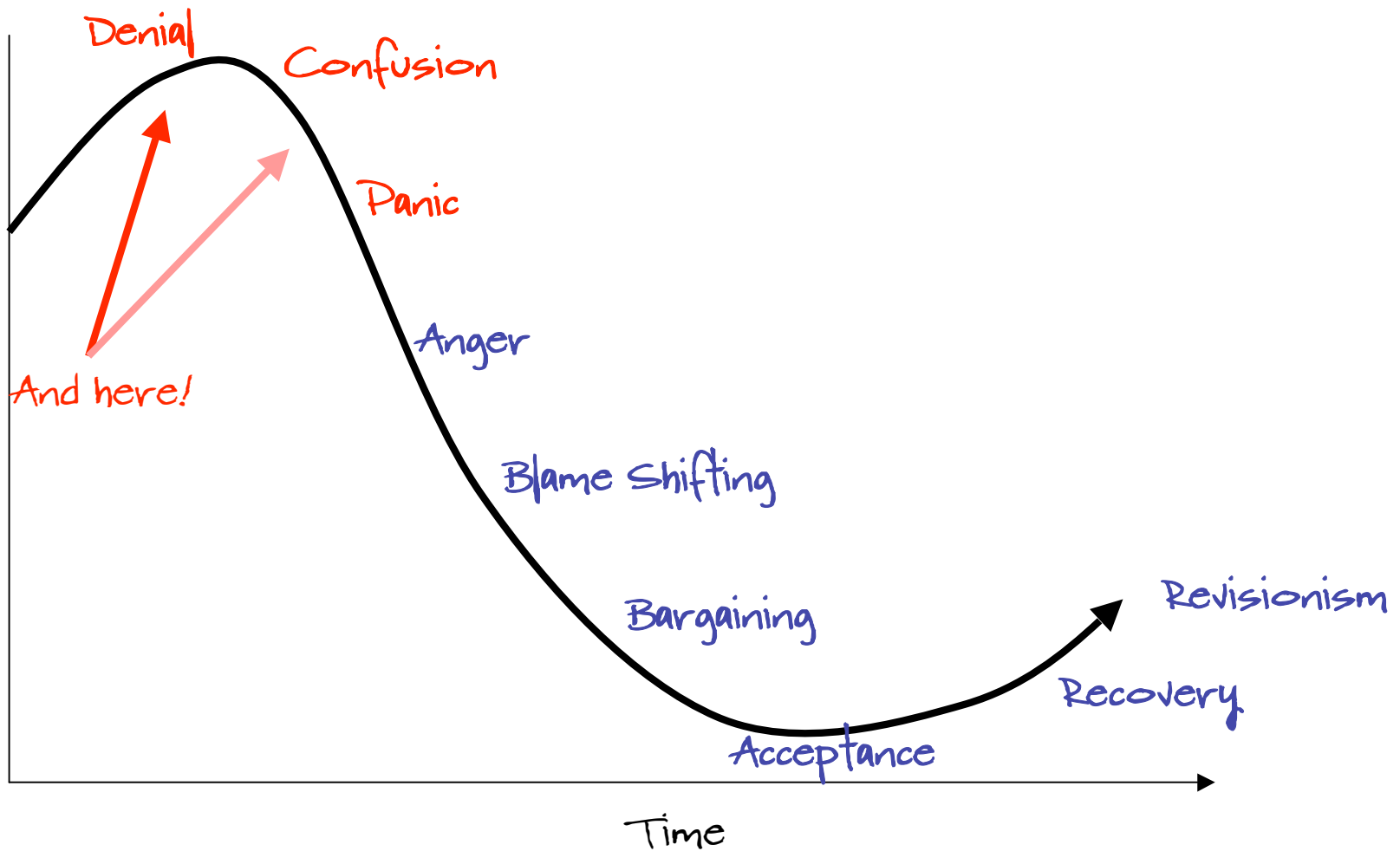
Coping with Crises



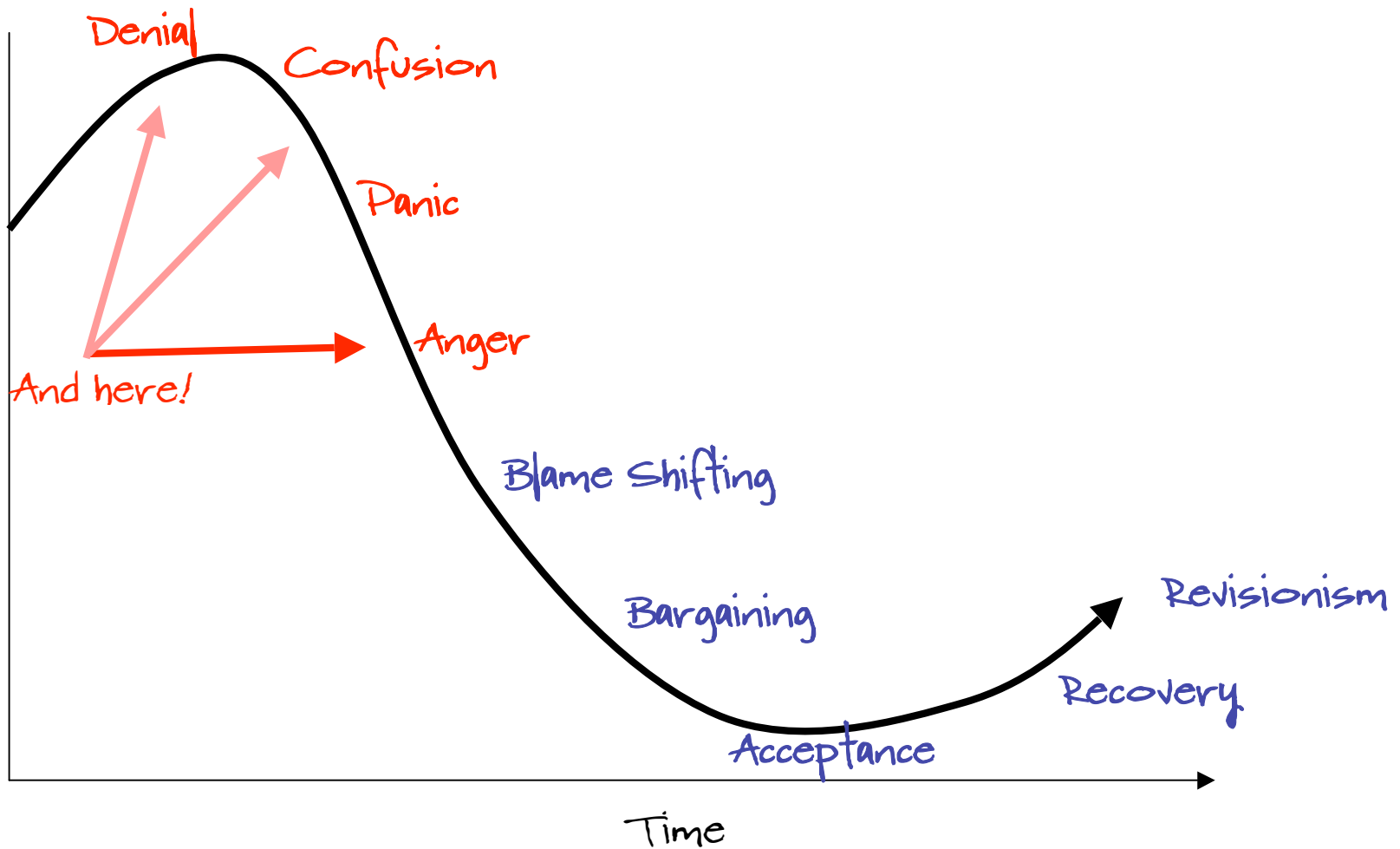
Coping with Crises



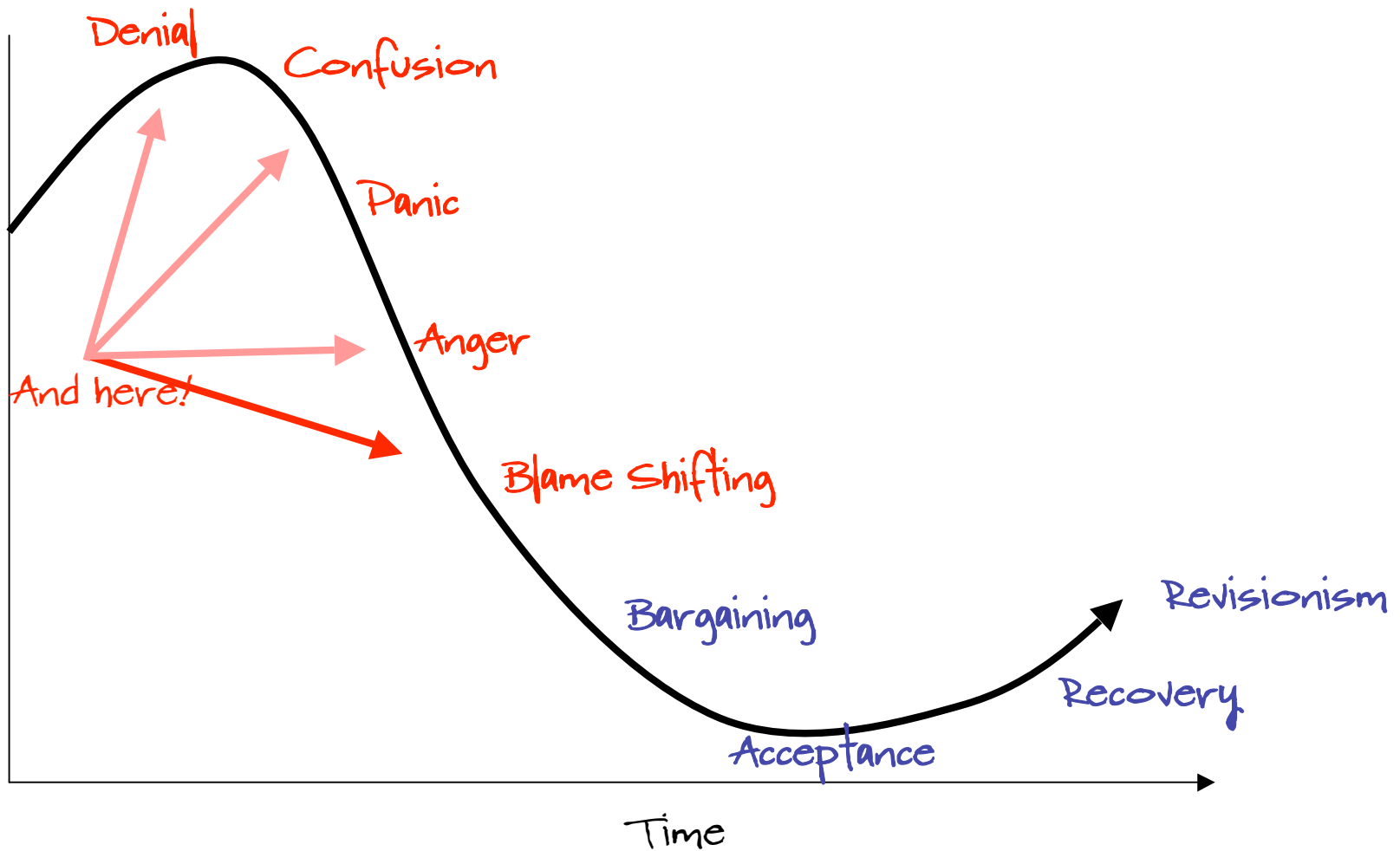
Coping with Crises



Coping with Crises



Coping with Crises



Thank You



