Technology Drivers

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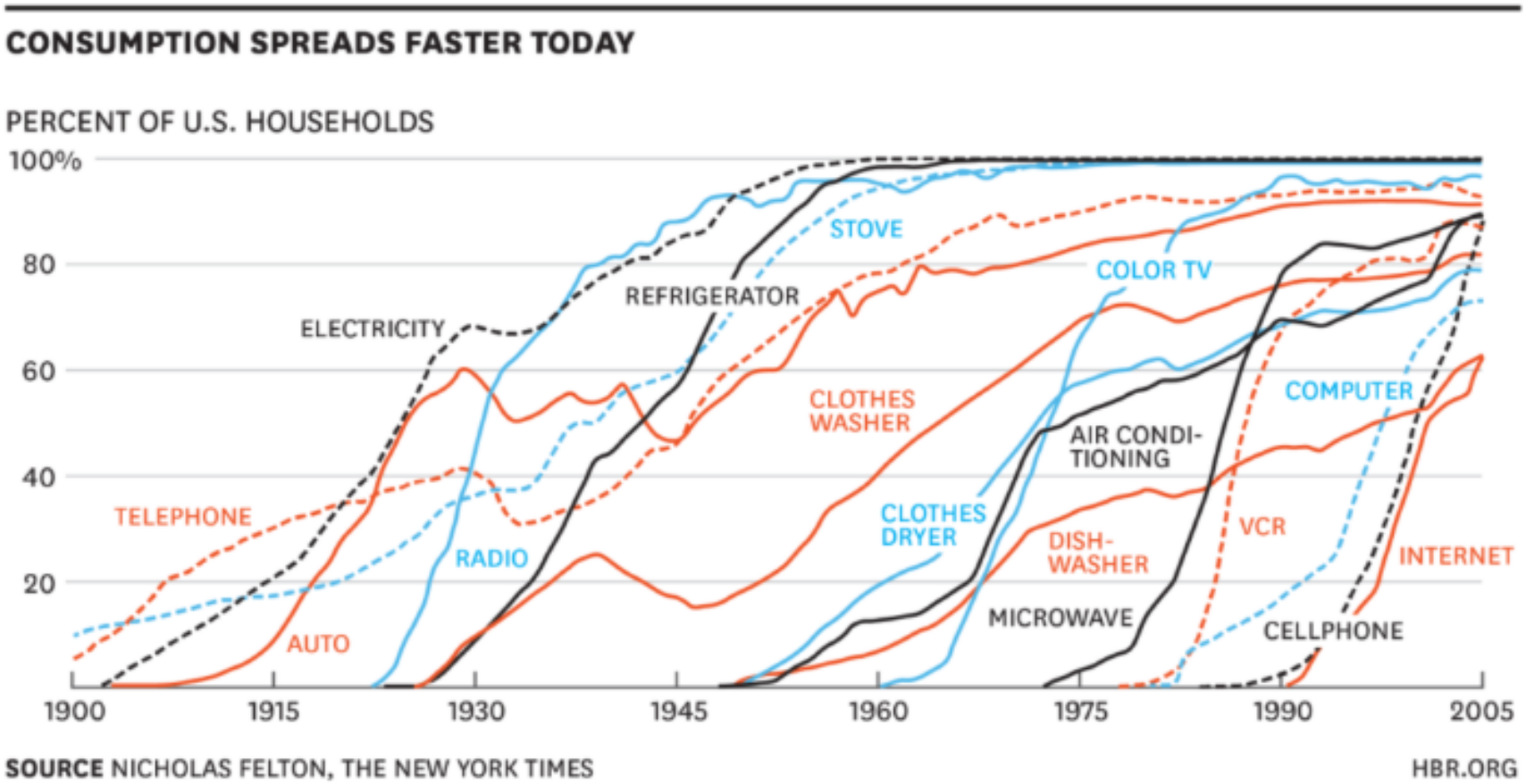
Some thoughts about internet technology and its evolution

The Pace of Consumer Technology Adoption



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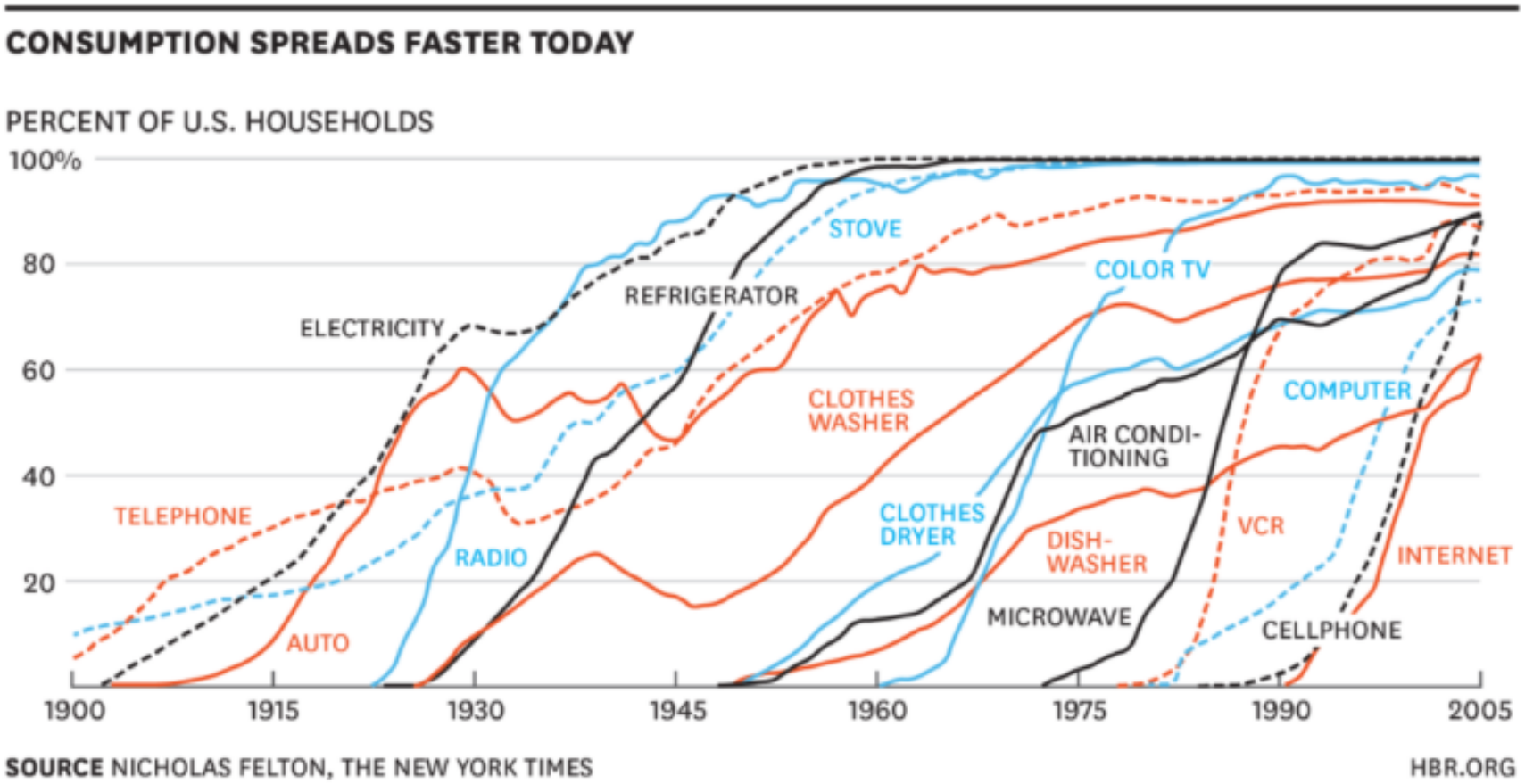


← Household Electricity → 50 years

← Telephone → 80 years

← Cellphones → 20 years

← Internet → 15 years

What Drives Technology Adoption?

- Utility?
- Consumer demand?
- Provider push?
- Marketing impetus?
- Cost?
- Revenue opportunities?
- FOMO? (fear of missing out)

Examples of Technology-Driven Transformations

Circuits to Packets

- 100x unit cost reduction in network service
- The change was large enough to destroy the existing telco market

Hardware to Cloudware

- 2x – 4x unit cost reduction
- Moderate pace of change that has allowed some incumbents to ride the change while others have had a harder time

Domain Name Certificates

- From luxury good to free commodity resulting in market destruction

Fixed to Mobile

- Higher value perception allowed a price premium for mobile services

Some providers see advantage in adoption

- Competitive positioning in a diverse market
- Early adoption of future mainstream technologies (first mover advantage)
- Perception of enhanced utility, security and safety in these more recent technologies

Sometimes it's not so obvious

- Why was IPv4 a runaway success while IPv6 has been a slow motion train wreck of prevarication and delay?
- Why is security in the Internet a market failure?
- Is Google now so entrenched that it is beyond all but the most disruptive of competitive technology pressures?

The saga of IPv6

IPv4 exhaustion was meant to propel IPv6 adoption

We were meant to have started and finished the transition before IPv4 ran out

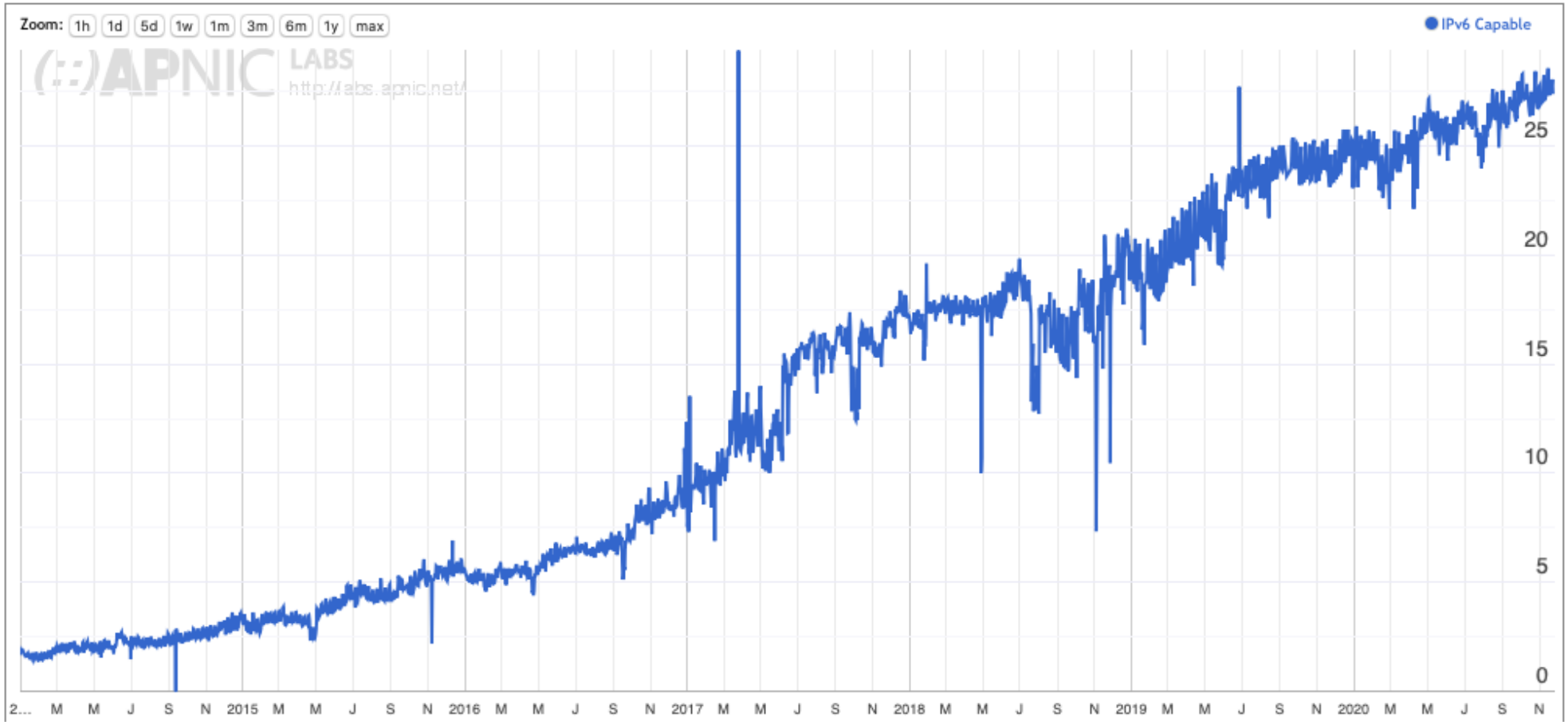
We have been playing on the precipice of IPV4 exhaustion for the past 10 years, yet no IPV4 exhaustion and no universal IPv6

25 year transition with no end in sight

Why?

- No marginal unit cost improvement
- Incumbents feel no major pressure to adopt
- NATs vastly increase the address efficiency factor

The saga of IPv6



Drivers

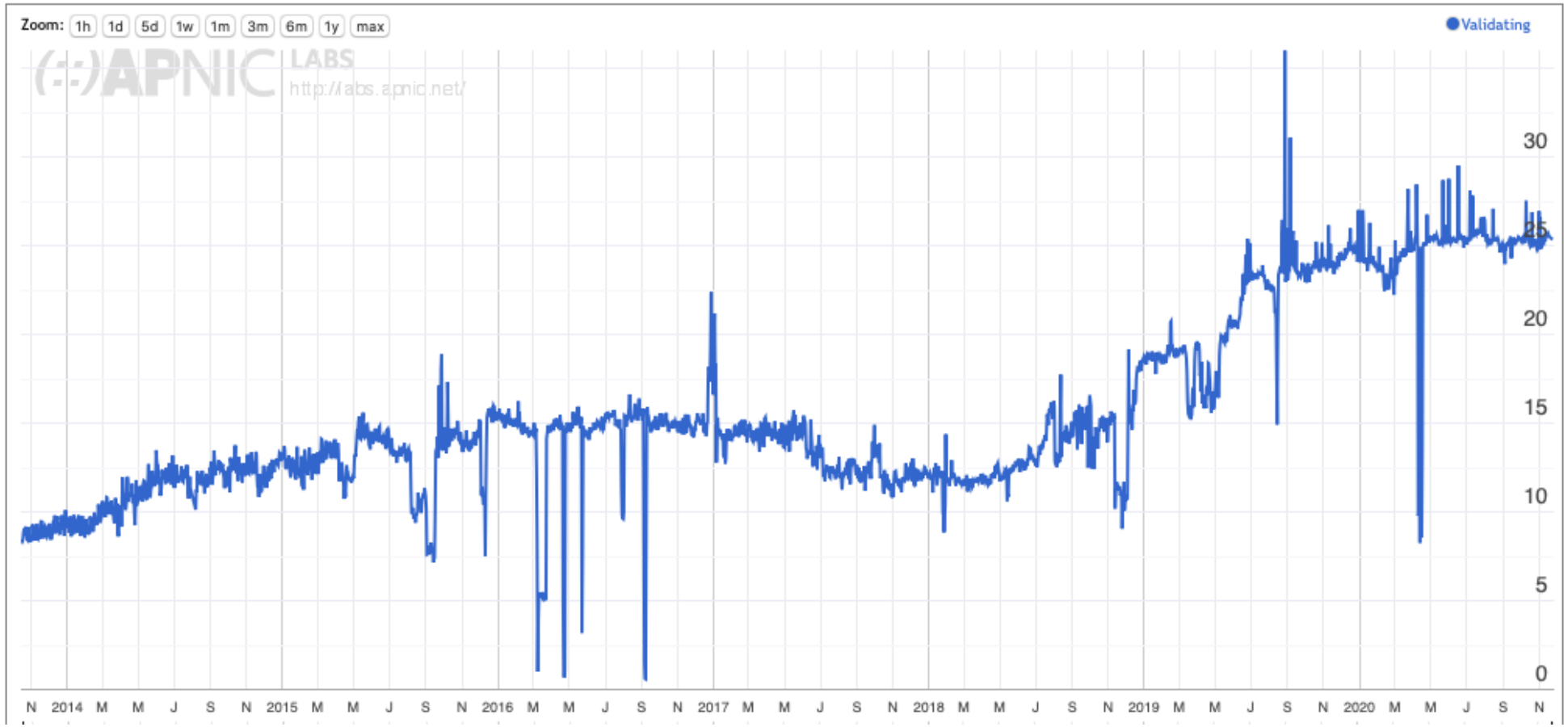
- No clear early adopter advantage
- No clear need
- Client/server architectures don’t require a universal address model
- NATs suppress demand through localisation and time multiplexing
- IPv6 is a 1990’s technology solution to a 1980’s networking architectural challenge – today’s CDN feeder networks do not need globally unique address plans across every device all of the time

Another example of a stalled transition

DNSSEC

- Adding digital signature into the DNS to allow end users to be able to rely on the correctness of data provided in a DNS response
- Increased unit cost without clear incremental benefits
- Another protracted transition with no end in sight

DNSSEC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Why?

- Increased operational cost without clear incremental benefits
- Not supported all the way to the edge of the network
- Structural lies in the DNS are now what we expect/depend upon
  - ”clean” DNS resolvers
  - DNS64
- No clear use case for a trusted DNS system
  - Too slow to replace the Web PKI
  - Does not get to the edge
  - Too many intermediaries

Why do transitions fail?

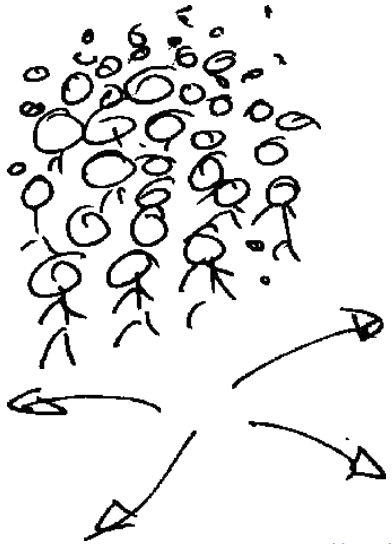
- No early adopter advantage
- Incumbent resistance
- Regulatory barriers
- No consumer interest
- No adoption momentum
- Alternate use models

Challenges for Adoption

1. This is a deregulated and highly competitive environment

There are many different players

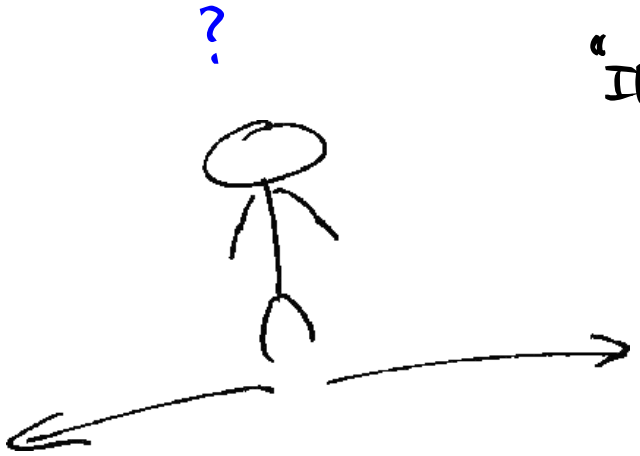
Each with their own perspective



And all potential approaches will be explored!

Challenges for Adoption

2. The myth of long-term planning



"IPv6 Transition will take many years...

5 years, maybe 10 years, maybe longer"

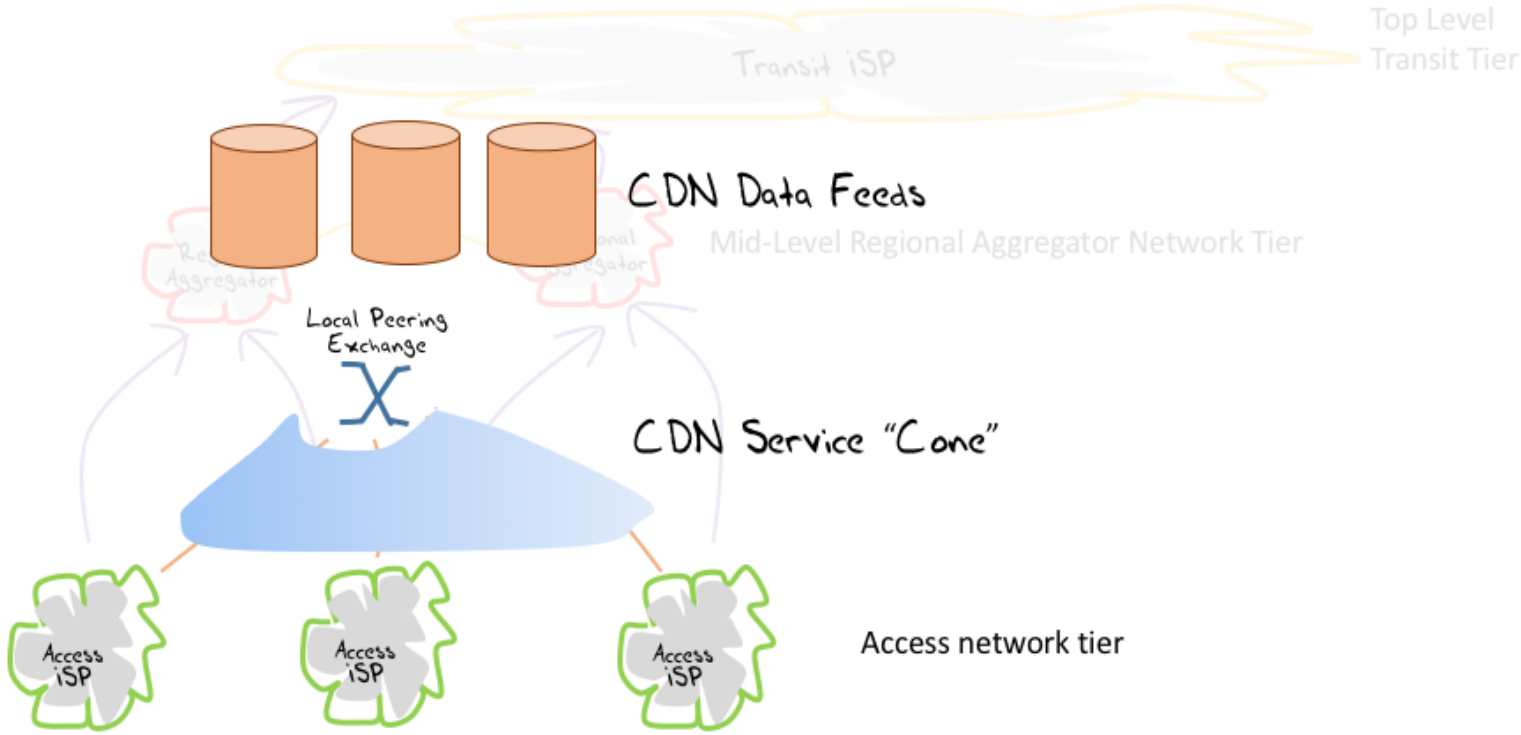
Are we still firmly committed to the plans we had 5 years ago? How about our 10-year-old plans?

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

Challenges for Adoption

3. The Internet keeps changing

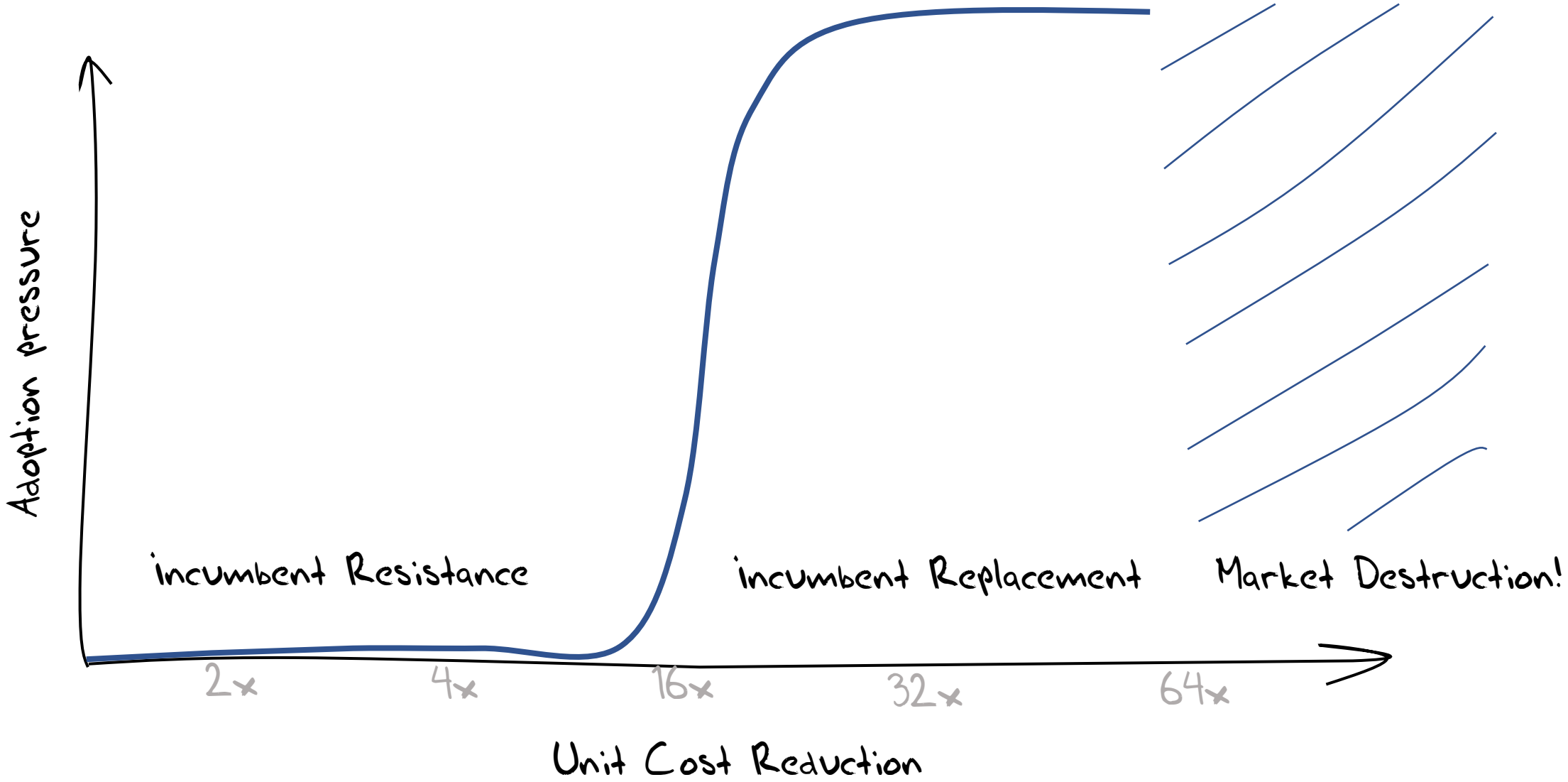
Today's Internet Architecture



What drives change?

- The Internet is a market, like any other
  - Consumers of Internet goods and services make purchasing choices
  - These consumer choices are what drives the market
- Consumers tend to show cost-based preferences
  - Innovation that reduces the cost base of services tend to gain market share
- The greater the cost shift the greater the impact of the innovation on the providers
  - There is often a “tipping point” of innovative change that makes it irresistible

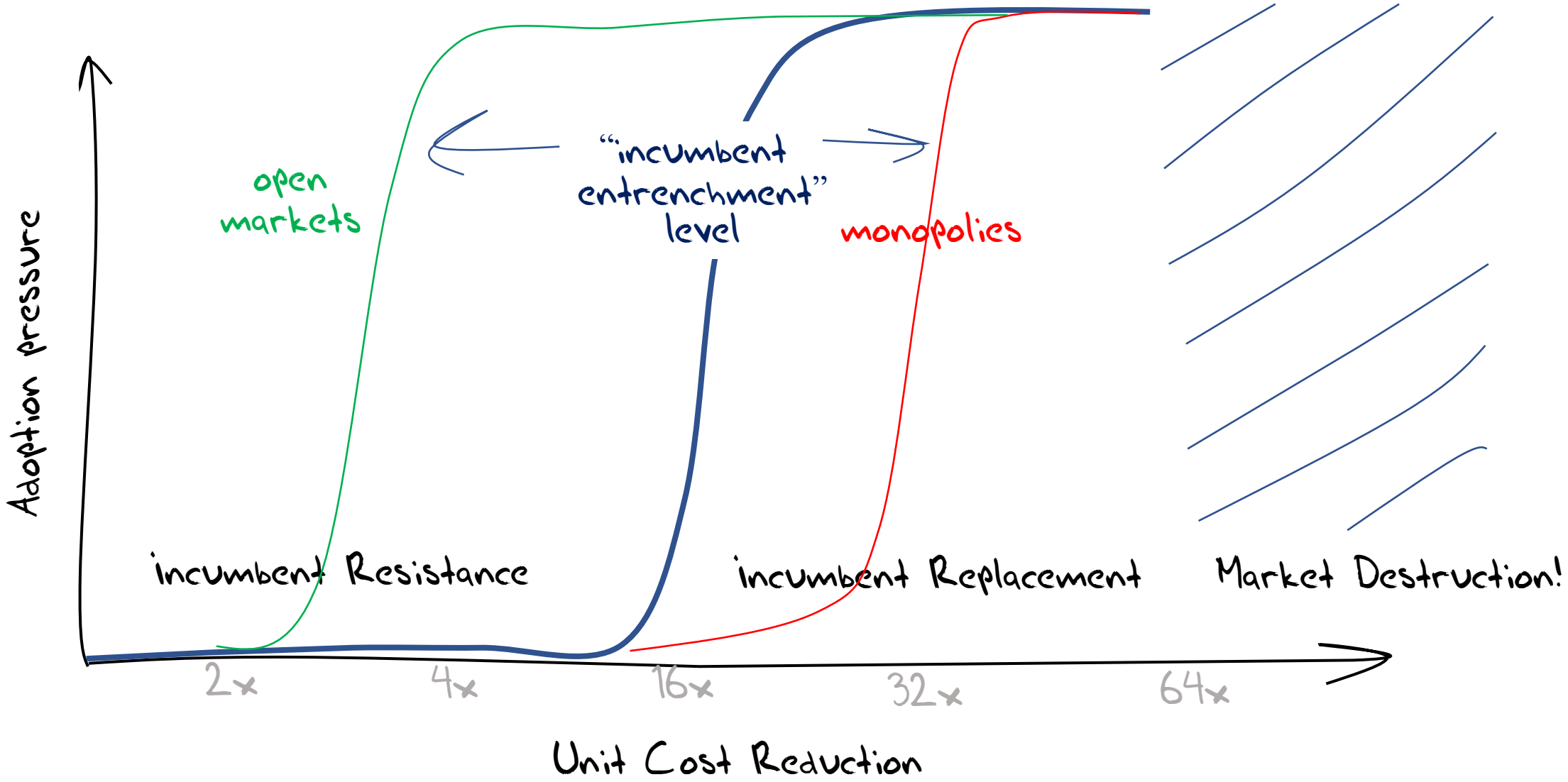
Economics of Innovation



What resists change?

- Volume tends to increase inertial resistance
  - And the digital world has massive volume
- Monopoly incumbency resists change
  - And the digital world is now dominated by a small set of incumbents
- Changes that do not impact the cost base of the service increases resistance
- The emergence of large scale digital incumbents creates its own challenges

Economics of Innovation



Telco lessons

- The entrenched incumbency of the telco regime created an "innovation debt"
  - Most of the ideas behind the internet were explored in the 1960's
  - But the integration of data services was resisted by the telcos as they suspected it would undermine the margins of the voice business
  - The longer this blockage remained the greater the pressure to break through
- The eventual breakthrough put the entirety of the telco revenues up for grab
  - And this is at the heart of the disruption in this sector

And today?

- We seem to be repeating this cycle
- The large scale incumbents are bedding down and stabilising their business model, and suppressing further unmanaged innovation pressures
- The longer this situation lasts the greater the level of disruption when it all falls apart!

Progress, far from consisting in change, depends on retentiveness. When change is absolute there remains no being to improve and no direction is set for possible improvement: and when experience is not retained, as among savages, infancy is perpetual. Those who cannot remember the past are condemned to repeat it.

George Satayana, The Life of Reason, 1905-1906

Thanks!