What's going on with IPv6?

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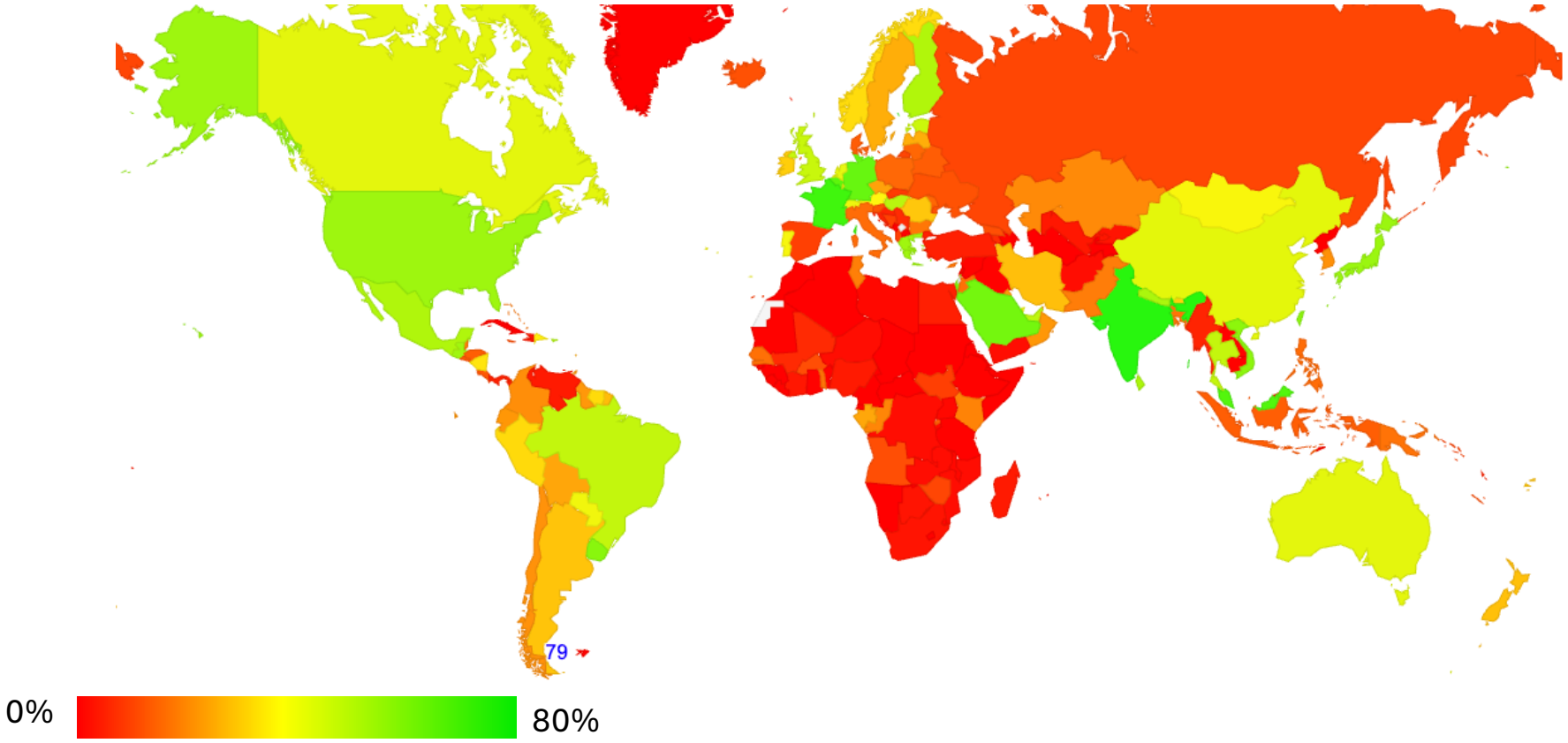
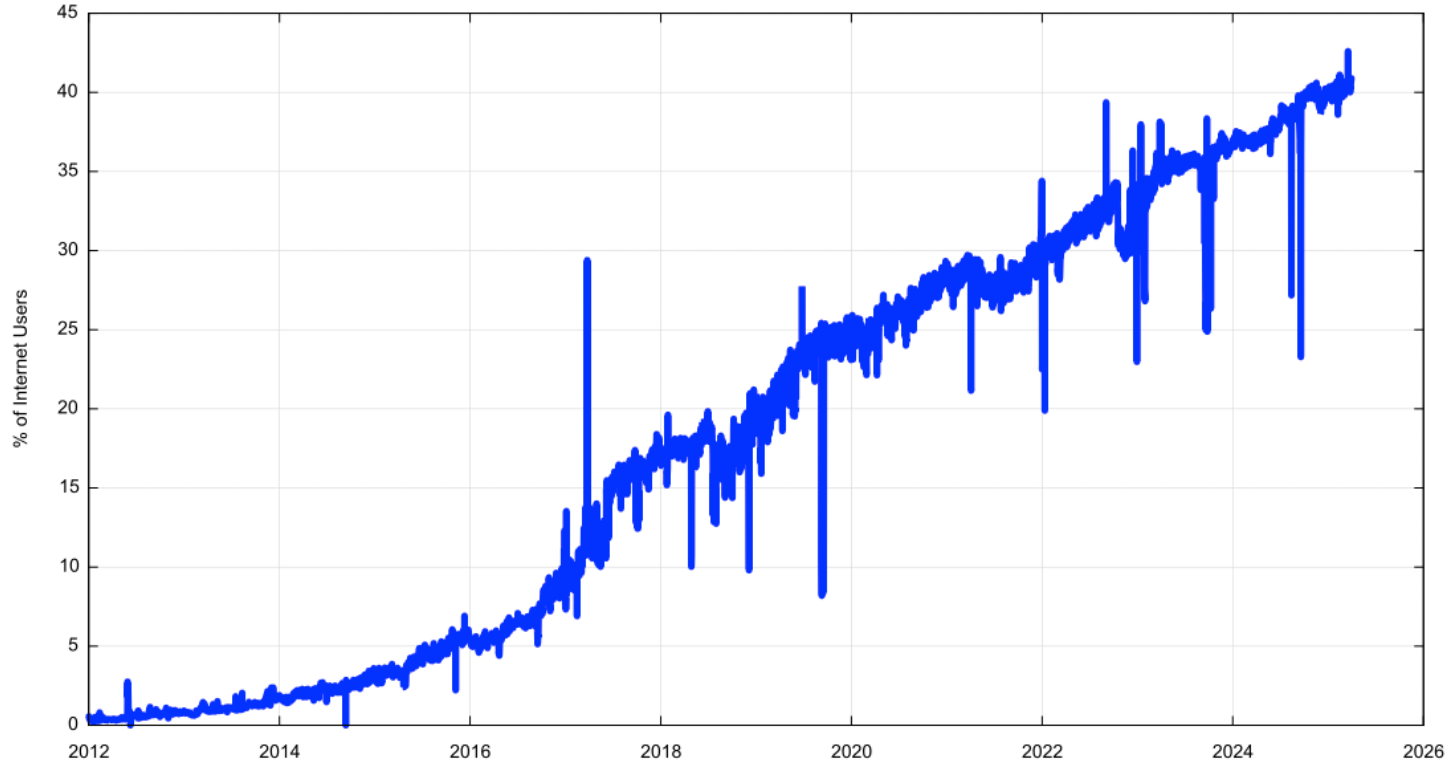
IPv6 Today

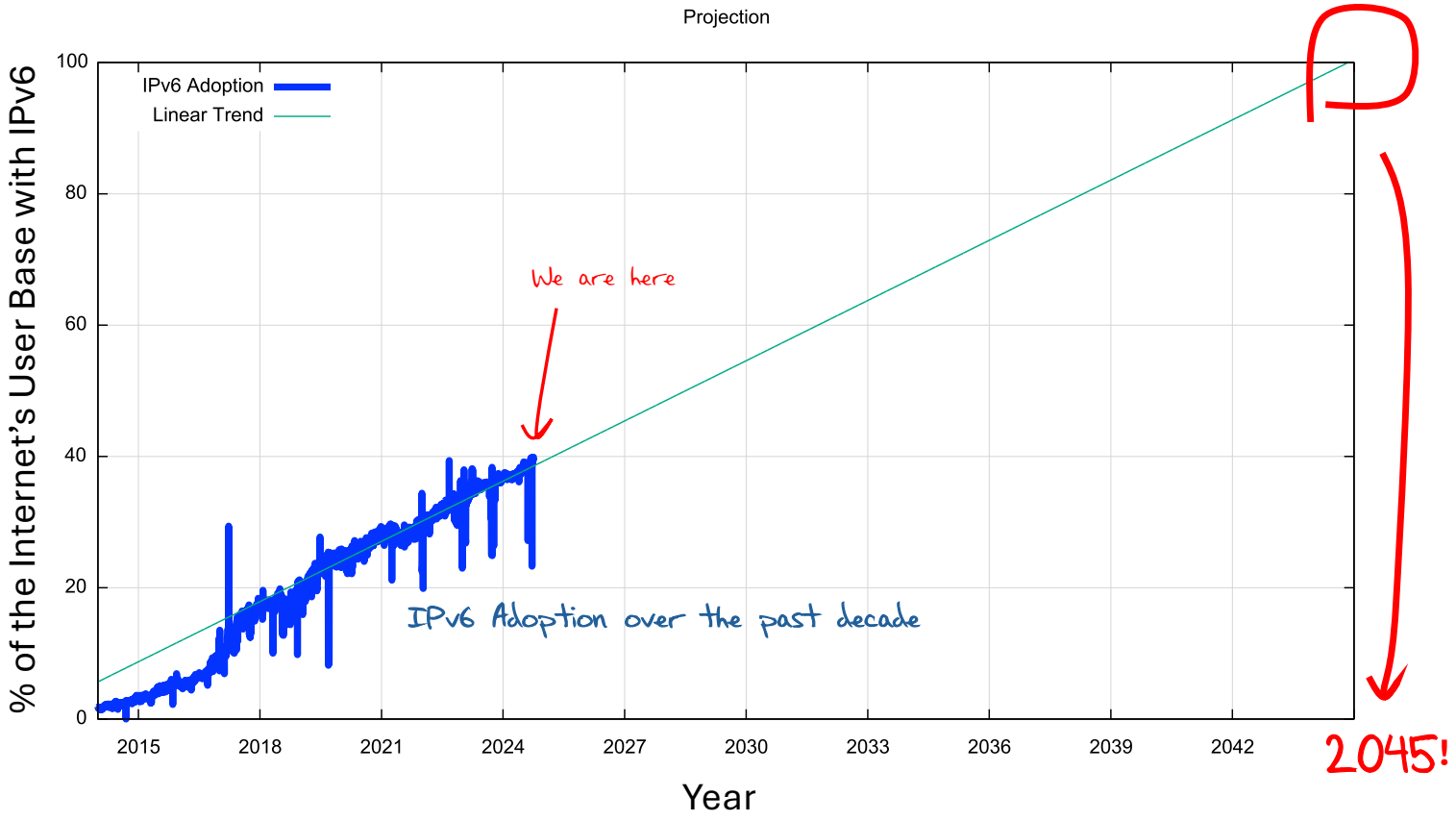


Per-Economy IPv6 Deployment Measurement - % of Users with IPv6

IPv6 Today


% of Internet Users
45
40
35
30
25
20
15
10
5
0
2012
2014
2016
2018
2020
2022
2024
2026

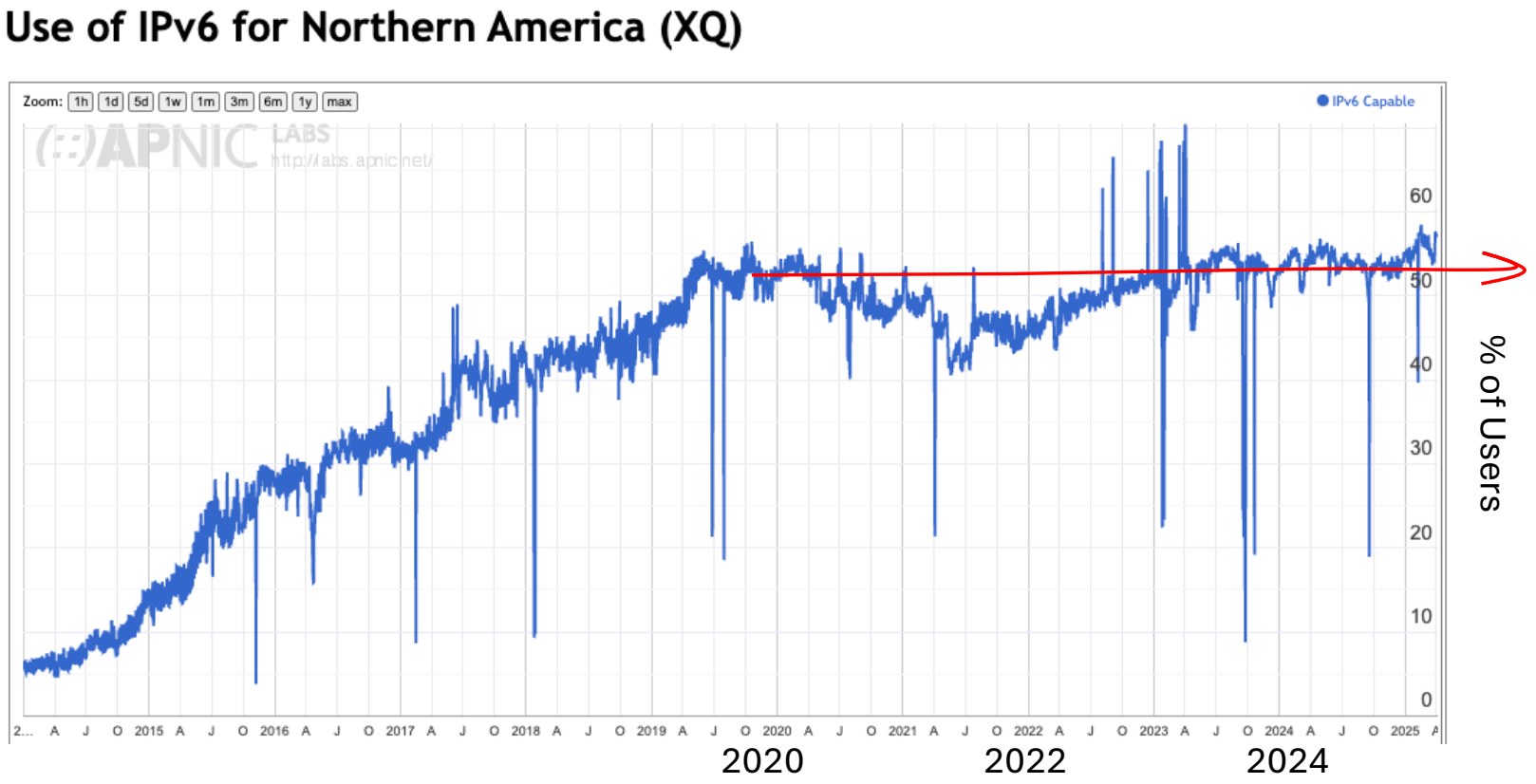
Projecting IPv6 Adoption



This is unexpected

- Back in the early nineties when the Internet was just picking up momentum NOBODY could conceive that a transition to IPv6 would take longer than five years - tops!
- A total timeframe to complete this transition from start to finish of fifty years was unthinkable!
- But that is where we are
- Why?

Not everyone is feeling the pressure to adopt IPv6



https://stats.labs.apnic.net/ipv6/XQ

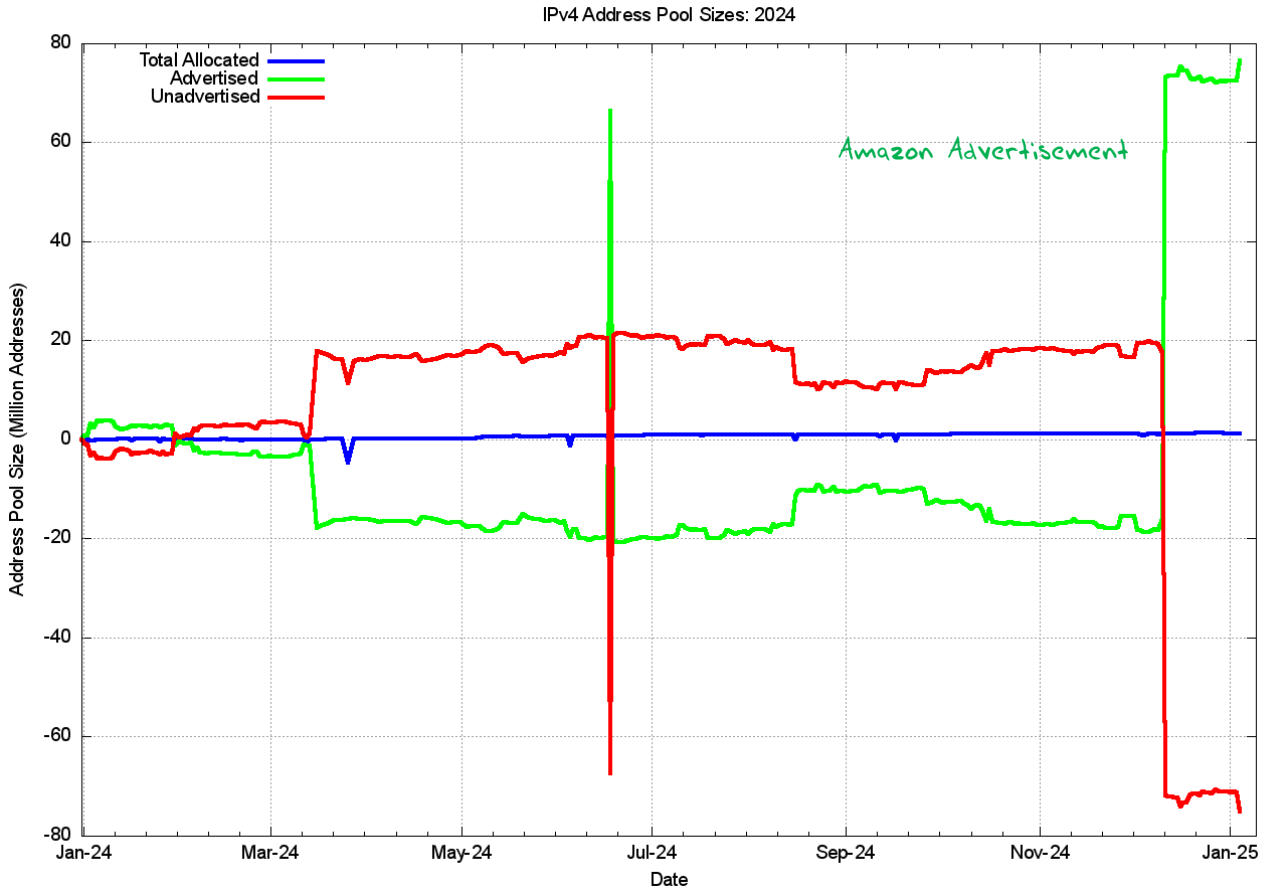
Networks are different from each other

- Small to medium scale networks with low growth probably feel little pressure to introduce IPv6 dual stack
  - Existing customer requirements are being met with IPv4
  - Low growth means little pressure to increase the address pools beyond current levels
  - Any expenditure to introduce dual stack becomes a cost without any increased revenue to offset this cost

Networks are different from each other

- Large scale networks with continued growth will see this differently
  - The way to alleviate the IPv4 scarcity pressure is to use Dual Stack and rely on end client preference to prefer to use IPv6 (Happy Eyeballs)
  - And place pressure on service provider platforms to adopt IPv6

IPv4 in the Cloud



Advertised Address Pool
+78M addresses

Allocated Address Pool
+1.2 M addresses

Unadvertised Address Pool
-78M addresses

What is this all about?

Is there enough residual growth in IPv4 to justify Amazon deploying a further 80M addresses?

What does "success" look like?

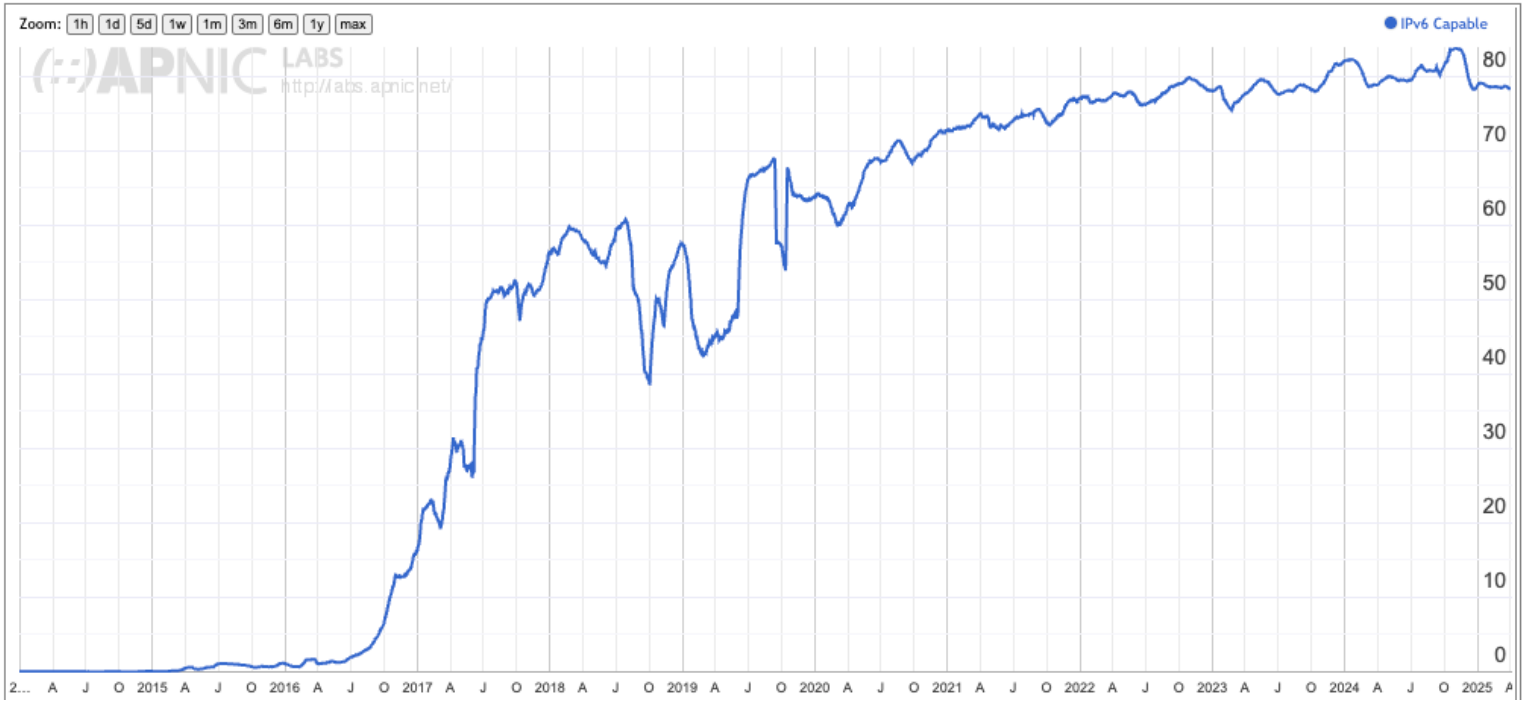
It’s likely that IPv4 will persist for many decades to come

- There is no significant functional difference in the two protocols
- Established IPv4 networks do not feel under any pressure to change to Dual Stack if their newtwork is providing an acceptable level of service

- And that means that a target of 100% is not likely in every economy
  - There will be variance here as to what ”success” means

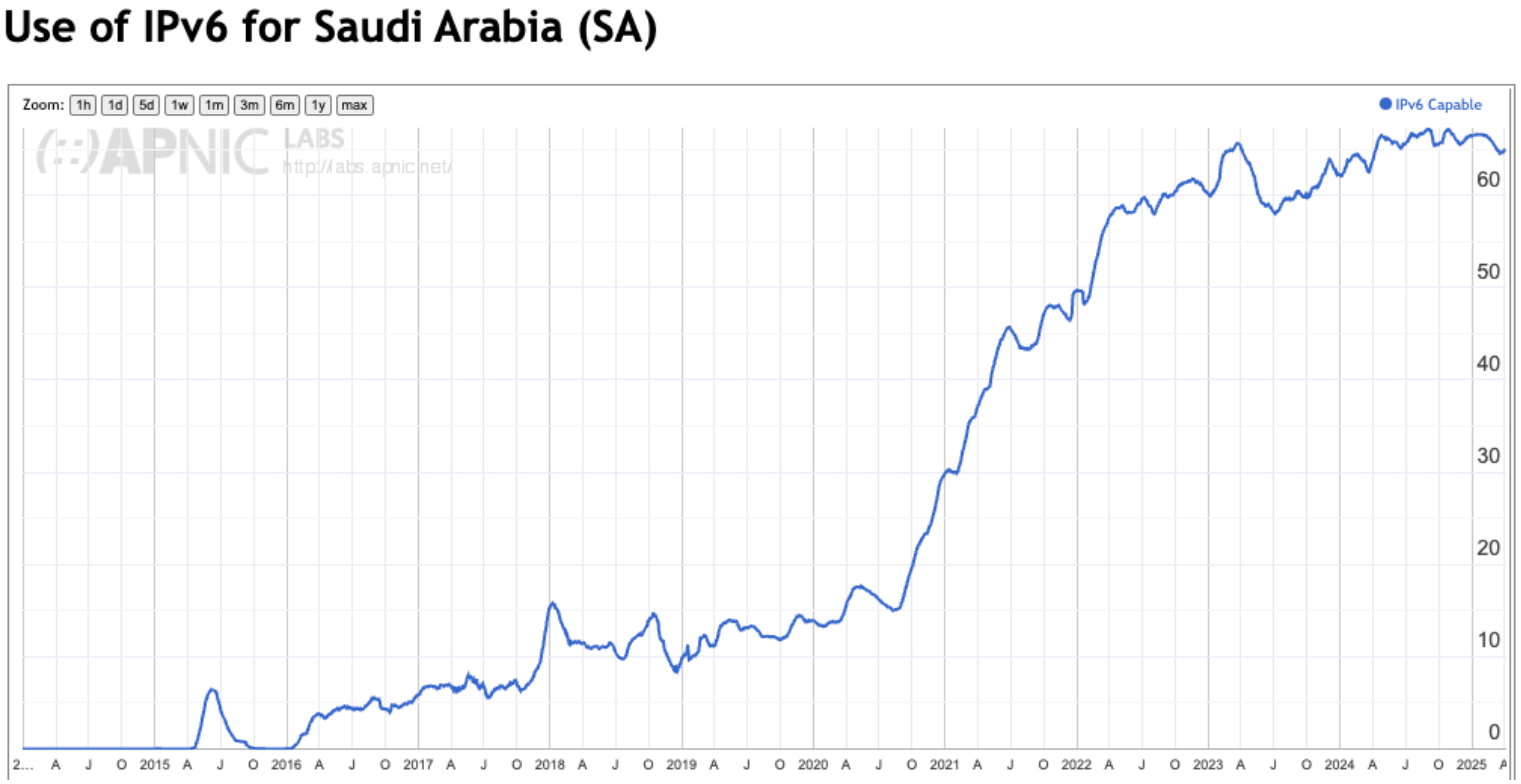
India - Success?

Use of IPv6 for India (IN)



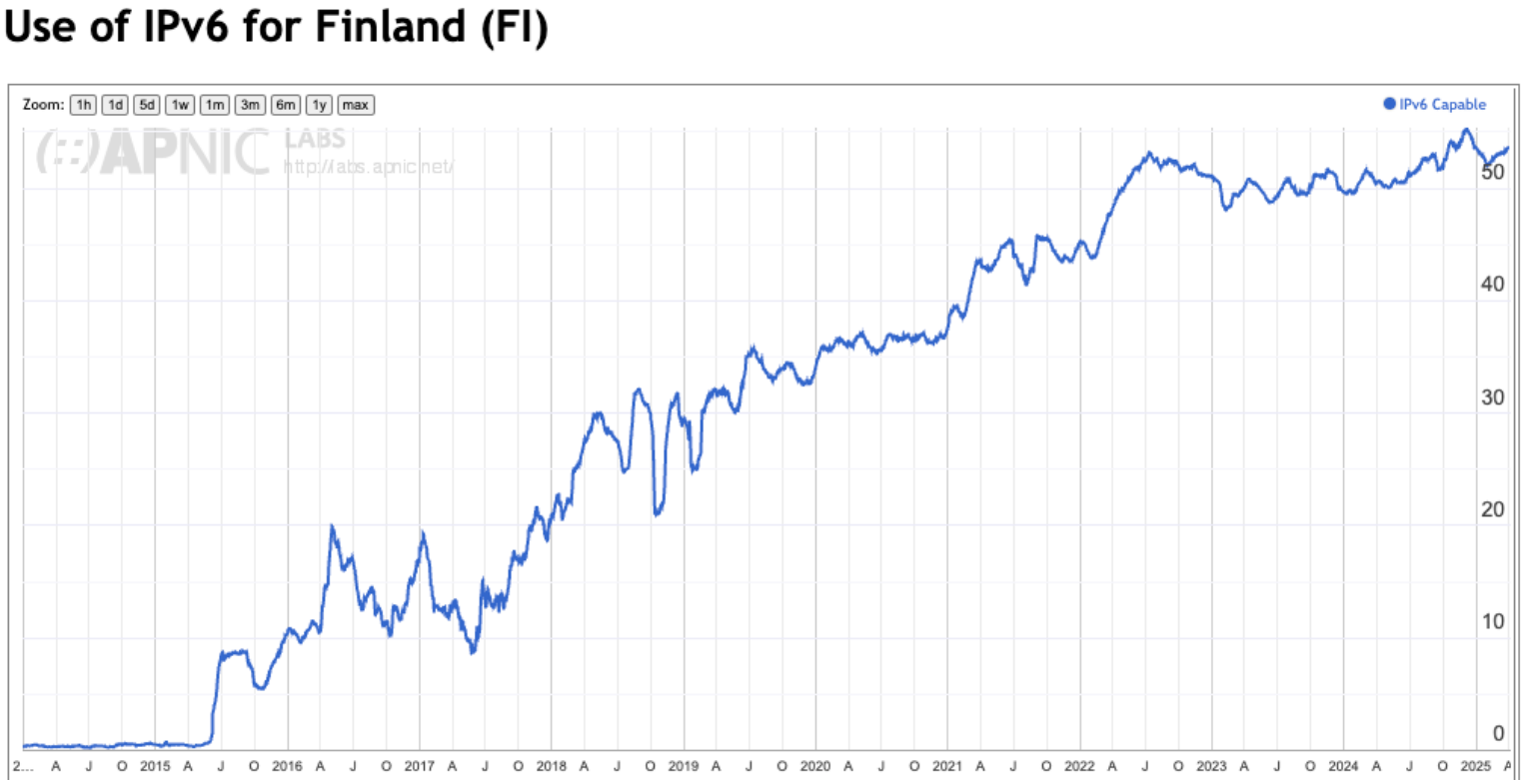
77%

Saudi Arabia - Success?



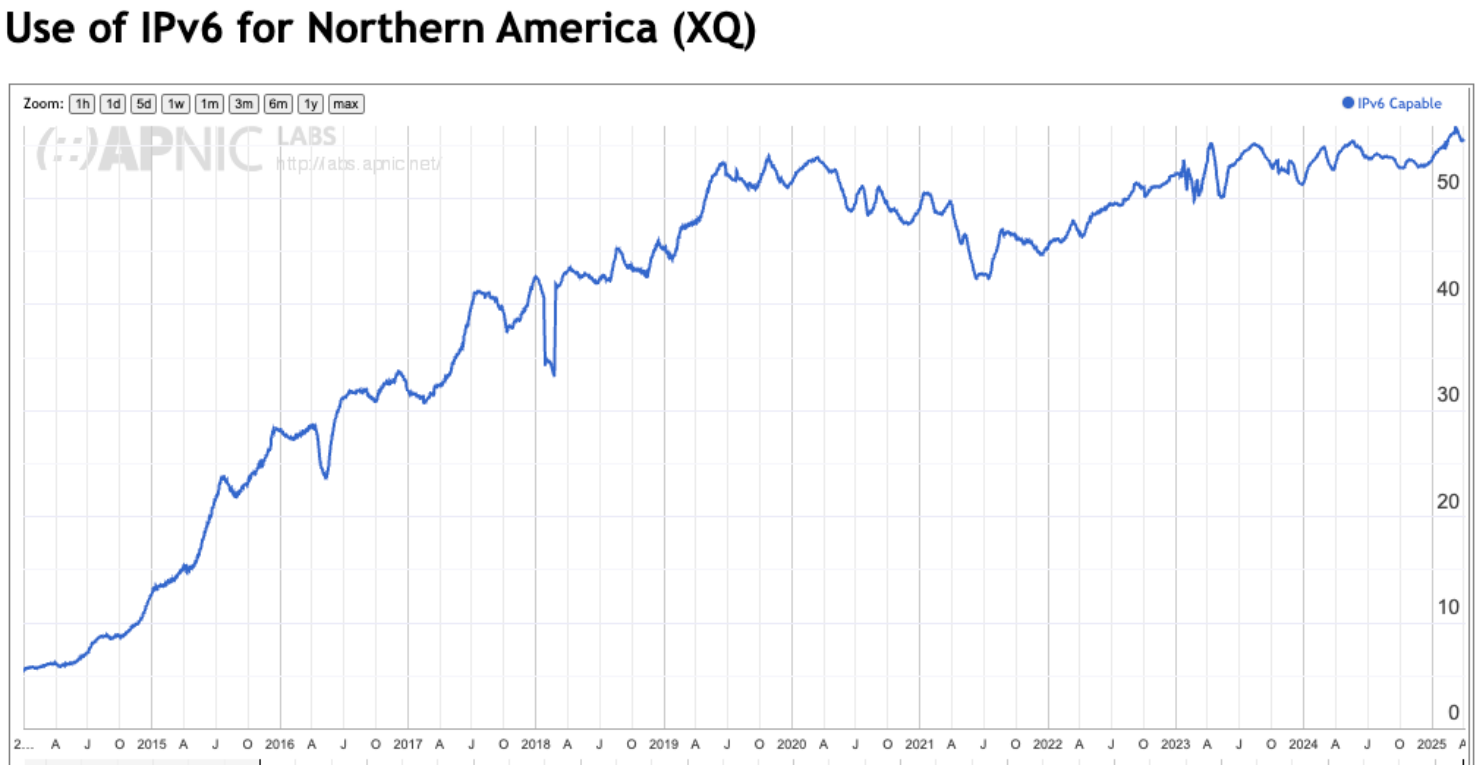
65%

Finland - Success?



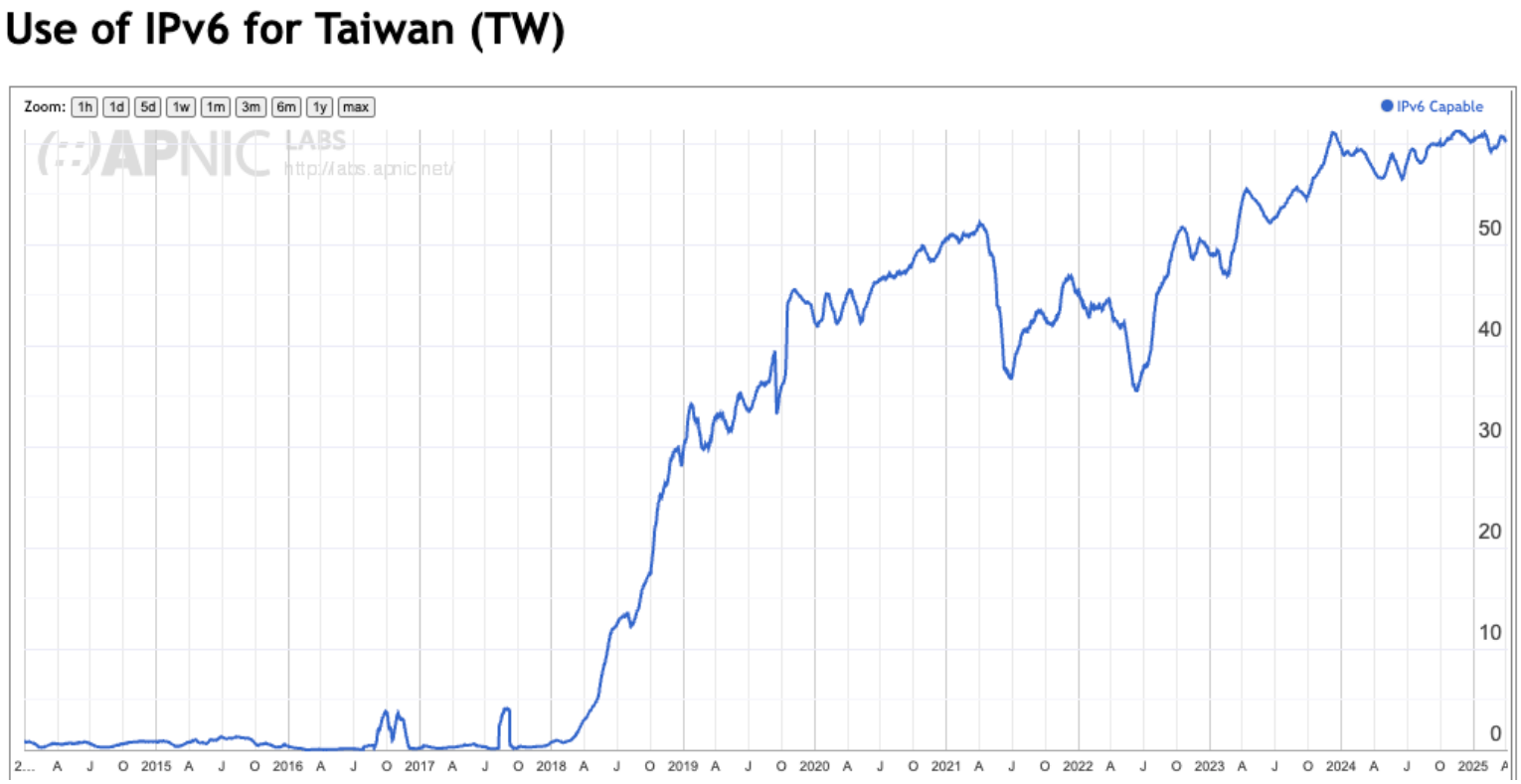
55%

North America - Success?



55%

Taiwan - Success?



60%

China - more to come?

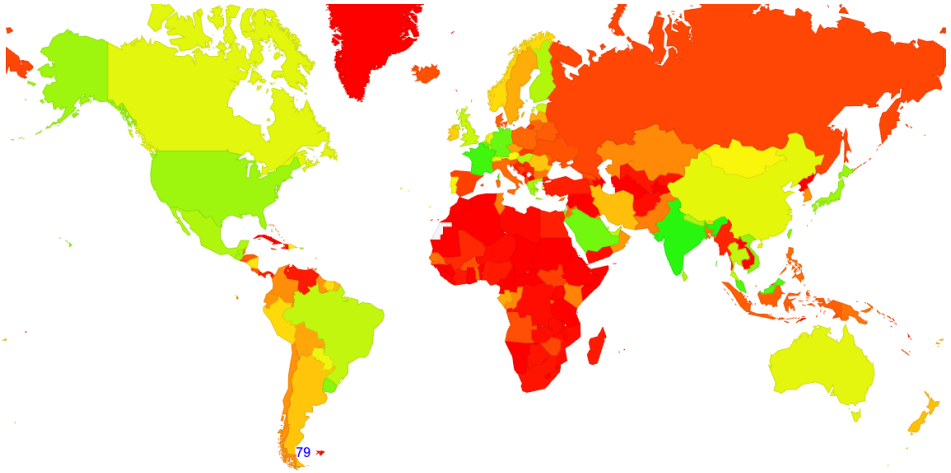
Use of IPv6 for China (CN)

45%

When do we declare "success"?

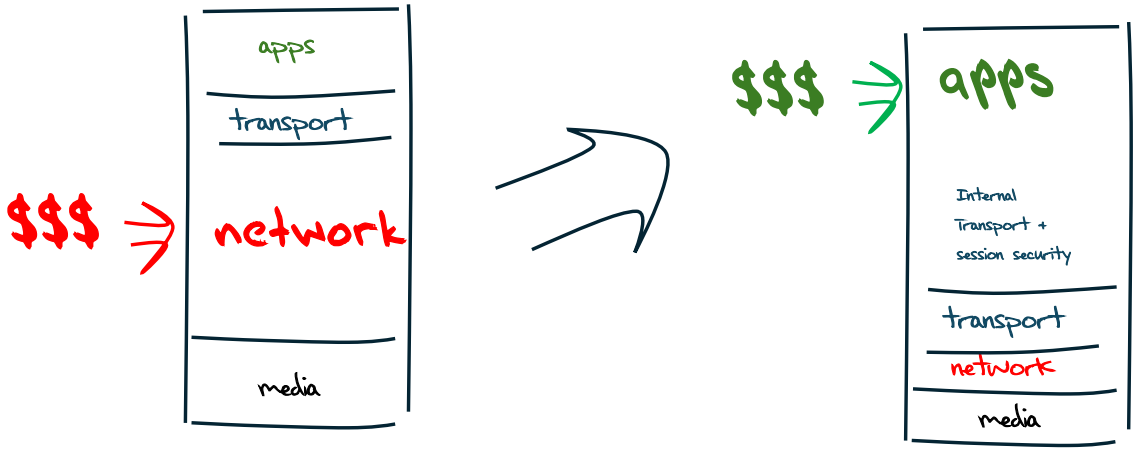
Clearly, across all of Africa, much of the Middle East, Western Asia and Southern Europe, the Internet infrastructure in incapable of sustaining further growth without some effort to support integration of dual stack platforms.

But in many other economies it may be that we have already achieved “success” in this effort, and there is little to be gained by pushing the IPv56 message in these markets.



And networks are changing

- Money has moved up the protocol stack



So, who pays for the IPv6 transition?

- Networks need to make the investment to switch to a dual stack mode that includes IPv6
- But neither the user base nor the content world really care
  - And they are certainly not going to pay a premium to the network operator for IPv6
- And in the application service world, IP addresses are **not** the critical resource any more
- We've changed the "currency" of networks!

What does this mean?

- We no longer operate within a strict address-based network architecture
  - Clients no longer use a permanent unique public IP address to communicate with servers
  - Servers no longer use a permanent unique public IP address to communicate with clients
- Address scarcity takes on a different dimension when you don't need public addresses to uniquely number every host and service

A Network of Names

- Today's public Internet is largely a service delivery network using CDNs to push content and service as close to the user as possible
- The multiplexing of multiple services onto underlying service platforms is an application-level function tied largely to TLS and service selection using SNI
- The DNS is now used to perform "closest match" service platform selection, supplanting the role of routing
  - Most large CDNs run a BGP routing table with an average AS Path Length that is intended to converge to 1!

A new Internet Architecture

- We've moved from end-to-end peer networks to client/server asymmetric networks
- We've replaced single platform servers-plus-network to replicated servers-minus-network with CDNs
- Clients aren't identified with a unique public IP address – clients are inside NATs are uniquely identified only in a local context
- Individual services aren't identified with a unique public IP address – services are identified in the DNS

A new Internet Architecture

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We've moved from address-based networks to name-based services

What am I saying?

- The slow uptake of IPv6 is not because this industry is chronically stupid or short sighted
- There is something else going on here…

- In our efforts to deliver bigger, faster, cheaper services we've moved our attention away from the IP level of the protocol stack and today the concentrated effort lies in services and applications
- I suspect we have now done enough with IPv6 that is now has adequate momentum to continue deployment in future years - slowly!

Thank You!