A little IPv6 History

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History of IPv6

• 1990: IETF realized that IPv4 address space would run out
  • Took steps to alleviate that

• 1993, IETF requested proposals for “next generation” protocol
  • IPv6 proposed in 1994 (among other proposals)
  • Translation proposed in 1998; extended life of IPv4 Internet by ~15 years
  • IPv6 standardized in 1998
  • Research trial deployments…
  • Supporting work in DHCP, DNS, routing protocols, etc.
  • Implementation in various operating systems; Linux and MacOS early, Windows late

• Uptake of prefixes started 2007
  • ICANN policy for prefix allocation 2006
  • IP Journal discussion: Fred Baker, John Klensin, Geoff Huston, and Tony Hain commented on IPv6 deployment
  • Tokyo University report on reality of IPv4 exhaustion predictions

• IANA allocation of last IPv4 /8 prefixes in 2011

https://www.oecd.org/sti/ieconomy/44961688.pdf
Exhaustion timeframes

• All RIRs have now entered their respective end phases
  • Lots of IPv6 prefixes to allocate
  • IPv4 only for new entrants, and then in small quantities

https://ipv4.potaroo.net/plotend.png
Why not make a market in IPv4 addresses?

- People have.
- 90% of sales are to CDNs and large social media sites.
- The largest blocks have already been sold; increasingly, the blocks that remain are small ones, which can be difficult to manage.

https://www.ripe.net/manage-ips-and-asns/ipv4/ipv4-pool
Sure, but it’s time to sell, not to buy

- And then there’s the price…
  - ISC recently sold a /15 at $14/address.
    - $14*2^{15} = $458,752
  - AWS recently purchased half of MIT’s address space at (reportedly) $20/address
    - $20*2^{24}/2 = $16.8M
    - MIT using it to fund IPv6 deployment
    - Amazon using it to hold ground while deploying IPv6
  - Now apparently about $20-25/address depending on purchase prefix size

http://ipv4marketgroup.com/ipv4-pricing/

Use in IETF Internet Drafts (June 5 2020)

• I think it is fair to say that of 1728 current internet drafts,
  • 704 mention IPv6 and
  • 493 mention IPv4.
  • Many Internet Drafts are at layers other than the IP layer and don’t mention either by name
• Getting graphics and examples in IPv6 remains a challenge. We're getting there, though, and IPv6 remains a central theme.
• The big deployment challenge is enterprise networks…
Usage statistics

• There are a number of statistical sources, but the most common ones are probably Google, Akamai, and APNIC

• Differences:
  • Google reports http/s requests to it using IPv4 and IPv6
    • Google is often a CDN and tells us about the last mile network
  • Akamai reports file downloads using IPv4/IPv6
    • Akamai is often a CDN and tells us about the last mile network
  • APNIC uses a google advertisement with three links:
    • One only uses IPv4 (tells that the site is supported end to end at all)
    • One only uses IPv6 (tells that the site is IPv6 Capable and is supported end to end using IPv6)
    • One has both address formats; the one the user chooses is interpreted to be the one s/he prefers and is supported end to end using IPv6

• APNIC has no CDN; these requests tell about end-to-end connectivity across the backbone
69 countries show 5% or more IPv6 traffic (Google)
12 countries show 40% or more IPv6 traffic (Google)
10 countries in Latin America above 5% of traffic (Google)