

Issues & Concerns with IPv6

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Concern

- IPv6 deployment not proceeding quickly enough
- When we look at IPv6 deployment today, and look at IPv4 address consumption projections:
 - We will not have a full-blown dual-stack IPv6 Internet by the time IPv4 address supply exhausts
 - This is not where we want to be...
 - Overall situation will continue to deteriorate until IPv6 becomes ubiquitous

The Need for IPv6

- The world needs IPv6; alternatives are bleak
 - Continued patching of IPv4 with NAT
 - Increased cost of developing software
 - Increased difficulty of deploying new applications
 - NAT workarounds complex, don't always work, constrain how services are deployed, etc.
 - Decreased robustness and reliability of Internet (at time when reliability requirement is *increasing*)
 - Decreased ability/freedom to run servers at home
 - Engineers understand the problem, public does not

Why Has IPv6 Not Been Deployed?

- Root cause: weakness of IPv6 Business Case
- Days of “altruistic” deployment long gone; need compelling business case to do anything
- IPv6 benefits mostly realized far in future (beyond typical business planning cycle)
- 3 options regarding IPv4 run out:
 - Continue with IPv4-only, use more NATs
 - Easiest, cheapest, path of least resistance, deploy IPv6 later, if it really becomes necessary
 - Clean-slate IPv6-only deployment
 - Dual-stack (both IPv4 and IPv6 simultaneously)

Clean-Slate IPv6-Only Deployment

- Get all of the benefits of IPv6
- None of the costs of supporting legacy IPv4
- (Possible) reduced total cost of ownership
- However, there is a catch: how to communicate with rest of Internet (1 billion+ users...)
- Protocol translation at a site's edge
 - Translation technologies work in some, but not all cases (thus risky)
 - 2nd class access to existing Internet generally viewed as poor (suicidal?) business strategy

Recommendation: Dual-Stack

- Fewest interoperability problems
- But, cost is higher (by definition) than either IPv4-only or IPv6-only
 - Gradually introduce IPv6, use it when you can
 - Phase out IPv4 over a decade or more
 - Interoperability better (and never worse) than IPv4-only
- Unfortunately, little benefit/ROI until later, when significant IPv6 deployment has taken place

Boiling Water Parable

- If you put a frog in boiling water, it will realize the danger and jump out immediately (yeah!)
- If you put frog in kettle of cool water and slowly bring to boil, frog won't recognize danger in time (oops!)
- Is IPv4 the kettle on the stove?
- See “creeping normalcy” or “boiling frog” in wikipedia

Where IPv6 Work is Taking Place

- IETF: many WGs continuing to refine technical standards
- RIRs: define policy for who gets IPv6 addresses
- NANOG/APRICOT/Operators: Folk discussing how to solve the deployment issues they encounter
- If you want to help, go to appropriate venue:
 - Much work already done
 - Many smart people already trying to fix problems
 - Do basic homework before jumping in

Summary

- IPv6 still is the best long-term option
- “Pain level” of IPv4 just isn't large enough (yet)
 - Inevitably, the pain level will increase
 - ISPs do see a future where they can no longer give each customer an IPv4 address.
- Key vendors/service providers continue to move towards IPv6 (albeit slowly)
- What to do: “buy IPv6” and/or push others on the importance of deploying it