Towards an IPv6-only network

Philip Smith

PacNOG 9

Suva, Fiji

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Why?

- IPv4 address space depletion
  - IANA pool is empty
  - APNIC now only delegating upto a maximum of one single /22 from remaining IPv4 pool to account holders
- How to continue growing the Internet?
  - IPv6 is the intended replacement for IPv4
  - "Virtually limitless" address space
  - Intentionally not compatible with IPv4
- IPv4 Internet will migrate to IPv6

Traditional migration

- Intended migration plan by IETF and IPv6 developers:
  - Deploy IPv6 across network, from customer to content to upstream
  - Run both IPv6 and IPv4 in parallel
    - Dual stack
  - Applications choose IPv6 before IPv4
  - IPv4 no longer used and we can turn it off

The reality…

- Many applications cannot support IPv6
- Many customer access technologies cannot be upgraded or are very expensive to upgrade
- IPv6 deployment is still not global
- IPv4 run-out means dual stack is no longer the complete answer
- ISPs still have to "tunnel" through providers not supporting IPv6
- Full migration to IPv6 will take longer than expected

What about IPv6 only?

- ❑ An IPv6 only network cannot directly talk to any IPv4 only networks
  - ▪ Protocol translation required
  - ▪ NAT-PT now historical and made obsolete
  - ▪ NAT64 replacement is still being developed
- ❑ Protocol Translation
  - ▪ NAT64 application/device requires knowledge of every application behaviour
    - ❑ Otherwise NAT64 device requires upgrade
    - ❑ (standard problem with NAT)

What works, what does not?

- NOG experiments in 2008 aimed to explore issues with trying to run an IPv6 only network
  - Separate IPv6-only wireless SSID
- IPv6 to IPv6 works perfectly well!
  - Not withstanding bugs and missing features in end-user devices, infrastructure, services,…
- But IPv6 to IPv4 is at mercy of the Protocol Translation middleware capability

IPv6 to IPv4 protocol translation

- Mapping of IPv6 to IPv4 addresses
  - 1 to 1?
    - How does this fit in an IPv4 /22?
  - 1 IPv4 to many IPv6?
    - How many users per IPv4 address?
    - 65000 ports possible, but these days a typical user needs around 1000 ports or more
  - Public IPv4 addresses required
    - Or private IPv4, but then private to public IPv4 NAT needed

Issues with Address/Protocol Translation

- Tracking users
  - Who used which address and when?
- Security
  - False sense of security!
- Lawful Intercept
  - Legal requirements, records keeping
- "Fate sharing"
  - One bad user affects everyone sharing the same public IPv4 address
- Etc etc

IPv6-only network Challenges

- Apart from accessing IPv4-only content...
- Routing protocols require "router-id"
  - "Router-id" 32-bit integer generated from IPv4 address on router
  - $\Rightarrow$ IPv6-only network requires manually created router-id
- WindowsXP only supports IPv4 resolver, even in IPv6-only environments
  - No support in older Windows → Windows 7 upgrade → hardware upgrade

IPv6-only network challenges

- Serverless autoconfiguration versus DHCPv6
  - Linux/FreeBSD, Windows, MacOS?

- Consumer aggregation/access
  - Do L2 devices support IPv6 protocol?
  - Could impact modems for Satellite, DSL, Cable, Wireless and WiMAX

- Virus/Worm scanners for email
  - Do they recognise embedded IPv6 addresses?

Moving forwards

- CERNET in China have been running IPv6-only network for a few years now
  - Using IVI as the "translation" or mapping system between IPv6 and IPv4

- Would running IPv6-only make sense for your organisation?

- Are there other issues not covered here?
  - Probably yes!