The Day I Broke All the Treadmills

Jen Linkova
NANOG80, Oct 2020
This talk is about

IPv6-Only Enterprise Network

Image source: https://freesvg.org/magical-unicorn
Motivation

Running out of **private** IPv4 addresses

Dogfood and testing

Dual stack is hard

"Entities should not be multiplied without necessity."

**William of Ockham**
Project Scope

Guest Network

Guest WiFi
> 50% of all WiFi users

Wired Guest
Unauthorised devices
Design Elements

DNS64
- Google Public DNS64
- Provided via RDNSS

NAT64
- Same devices as NAT44
- Located at the site edge

SLAAC-Only Network
What % of users need IPv4?
Is a dedicated fallback network required?
How much IPv4 space can we save?

Pilot Goals

What would not work?
Any showstoppers?
Any impact on tech support?
High Demand for IPv6-Only networks

12 Pilot Sites Selection Criteria

- Wired Guest Host count
- NetOps team presence
- WiFi Guest Users Count
IPv6-Only Wired Guest Pilot

February - October 2019

Self-service portal to re-enable IPv4 on the port

Users are encouraged to report why they need IPv4
What I Broke Right Away
Most sites need <5 IPv4-enabled ports

A lot of IPv4 addresses saved

Wired Guest Pilot Results

Main IPv4 use case: Embedded systems/IoT
IPv6-Only Guest WiFi Pilot

Phase 1, Opt-In
June 2018 - March 2019
Dedicated SSID created
Call for volunteers issued

Phase 2, Opt-Out
April - October 2019
Guest WiFi is IPv6-only
Dedicated fallback SSID

Users are encouraged to report issues
Pilot Results
~10% of users moved to new SSID

Users incentives to report bugs

15 bugs reported

3 bugs fixed

Phase 1 Results
Phase 2 Results

- < 5% of users falled back to dual-stack SSID
- ~25K peak device count
- 12 bugs reported
- 4 applications fixed
What % of Users Need IPv4?

WiFi

< 5% fall back to the dual-stack SSID

~10% is using 2.4GHz SSID which is kept dual-stack

Wired

< 5 devices/site normally, ex. For Gym devices
IPv4 Address Space Utilization

WiFi

DHCPv4 pools utilization dropped by 5-8 times
Matches ~15% of users staying on dual-stack networks

Wired

almost all address space reclaimed
What Does Not Work? (*)

1. Gym Treadmills
2. Spotify application on laptops upvote, please!
3. 3rd-party VPN systems
4. StarCraft II
5. MacOS internet recovery image

(*) Top 5 by number of user complaints received
Is Dedicated Fallback Network Needed?

Short answer: yes

Wired Network:

Users **MUST** file an request to get IPv4

Exceptions are granted for 18 months

WiFi: dedicated SSID is NOT the best strategy

(see “Lessons Learned”)
Are There Any Showstoppers?

Short answer:

No, as long as a fallback mechanism exists.

Long answer:

It depends.

Mobile devices work in 99.9% of all cases

Laptops might be a different story.
What’s the Impact on Support Team?

Almost none.

Keys to success: **Plan Ahead!**

- Let users know about the change
- Provide users with fallback mechanisms
- Provide the support team with
  - Troubleshooting flowcharts
  - Known Issues page
Lessons Learned
“Just disable IPv6” is never a good workaround.

How would you re-enable IPv6 on all those devices?
The only way to get IPv6 operational experience is to turn off IPv4
What Do Happy Eyeballs Hide?

Network Issues
- Packetloss “by design”: draft-ietf-6man-grand
- Vendor Bugs/Broken IPv6

Process Issues
- IPv4-first Operations Mindset
- Designs with IPv4 dependencies
Early Adopters Are Crucial

- Willing to try IPv6-only
- Capable of reporting issues
- Maximum issues found
- Minimal user impact
IPv6(only) Support Requirement

IPv6/IPv6-only support requirements in RFPs must be:
- Explicit
- Specific

“IPv6 Support”

RDNSS Management over v6
Dedicated SSID/Network: Not Ideal

Dual-stack SSID naming is hard:

*Less “attractive” than IPv6-only one*

*Intuitive enough so users would use it*

- Guest-V4 ?
- Guest-IPv4 ?
- Guest-do-not-use-this-until-nothing-else-works?
Dedicated SSID/Network: Not Ideal

No control over SSID chosen by a device.

Devices switching between SSIDs.

Once SSID remembered - no way back.

Consider do not broadcast the fallback SSID
Dedicated SSID/Network: Not Ideal (III)

Even worse for wired LAN: twice more VLANs

Desirable:

IPv6-only and IPv4-enabled hosts coexistence

Hence, draft-ietf-dhc-v6only
Majority of offices have IPv6-only Guest network
Do you believe in IPv6-only enterprise networks?

I've deployed them!

Image source: https://freesvg.org/magical-unicorn