



# Microsoft Corporate Network: Journey to IPv6

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# Enterprise Network Overview



- ▶ Four regions with smaller campuses and tail sites
  - ▶ Puget Sound (Redmond, WA) – the main campus (> 100 buildings)
  - ▶ North America, Europe/Middle East/Africa, and Asia Pacific
  - ▶ 790+ locations in total
- ▶ Combination of on-premise DCs and services in Azure
- ▶ ~230K end users
- ▶ ~ 1400 LOB applications managed by Microsoft IT
- ▶ ~ 1.2M devices hitting the network

# History of Dual Stack

**2001**

Microsoft Research investigating and deploying IPv6  
ISATAP – first on Windows servers, then on a HW platform

**First IPv6 Addressing Architecture**

**2006**

IPv6 more broadly deployed using mixture of ISATAP and native (India, China, Redmond/WA)

**Still many IPv4-only networks...**

**2016**

IPv6 pushed to wireless & wired Corpnet  
Including on-prem datacenter networks

**World IPv6 Day**

**2011 – IPv6 became strategic**

Public space moved to Azure  
Backbone network – Dual Stack rolled out  
Managed labs dual stacked  
Though **no end user network** segments enabled with IPv6

# Resulting IPv6 vs IPv4 Traffic

- ▶ 34% of Corpnet traffic is IPv6
  - ▶ 66% on IPv4-Only
  - ▶ Based on Windows 10 Telemetry

GOAL: IPv6 enabled everywhere,  
IPv6-Only everywhere we can



# Microsoft Drivers for IPv6-Only

- ▶ Industry pressure = Microsoft Product Group requirements
  - ▶ [June 2015 Apple WWDC](#) announced IPv6-Only
  - ▶ >87 apps in Apple App Store
- ▶ Exhaustion of IPv4 space (RFC1918)
  - ▶ Current estimation suggests **in 2 – 3 years**
- ▶ Overlapping RFC1918 space
  - ▶ Azure; Acquisitions (Nokia, LinkedIn, GitHub etc.)
  - ▶ Outsourcing partners also use the same 10./8 space – issues for VPN
- ▶ Operational complexity of dual stack
  - ▶ Sizing of IPv4 subnets constantly questioned? IPv6 gets “forgotten” in deployments?



# Attempt at IPv6-only Wireless Guest Network

- ▶ PoC did not catch a major issue with VPN
  - ▶ IPv6-only leverages NAT64&DNS64 to access IPv4-only resources
  - ▶ Majority of VPN clients don't work through NAT64
    - ▶ RFC 7269 notes IPsec issues – a VPN needs NAT Traversal support in IKE and must use IPsec ESP over UDP
- When the VPN concentrator is dual-stacked, IPv6 gets you out
  - ▶ Roll out of dual-stack in our wireless guest globally
  - ▶ We know that our Guest portal today does not support RADIUS authentication over IPv6
    - ▶ Scream test of ipv6 only in the next 12 months when vendors deliver IPv6-only
  - ▶ WLAN Infrastructure management over IPv6
    - ▶ One of our wireless vendors doesn't support AP dynamically discovering WCL over IPv6 in the current code.



# Remote Access VPN



- ▶ NG-VPN dual stacked on the inside
  - ▶ Rollout during 2017/2018
  - ▶ Currently ~200K users
- ▶ VPN is a big consumer of IPv4 address Space
- ▶ NG-VPN concentrators IPv4-only on the outside
  - ▶ Need to be dual stacked
  - ▶ Dependency on our load balancing solution (work in progress)
  - ▶ Our security vendor didn't support IPv6-Only client profile
  - ▶ Beta code testing started in Oct, 2018. Main release in Jan, 2019
- ▶ IPv6-Only (on the inside) Proof of Concept
  - ▶ NAT64/DNS64 for IPv4-only corporate resources
  - ▶ We perform split-tunneling
  - ▶ Need to be dual stacked

# IPv6-only SSID for Product Groups

- ▶ Production IPv6-Only network for Product Groups
- ▶ Helps to meet the industry and regulatory requirements for Microsoft products
  - ▶ Apple AppStore, Google play, US Fed Gov't
- ▶ Pure Internet connectivity with NAT64/DNS64
  - ▶ Test cases focused on consumers, services living on the internet and in the Cloud
- ▶ Challenge with Android platform
  - ▶ Doesn't support DHCPv6
  - ▶ RDNSS needed on our building routers (upgrades in progress)
- ▶ Deployed in 15 locations globally



# IPv6-only on SSID CORPNET

- ▶ Started pilot of IPv6-only wireless Corpnet
  - ▶ -Opt-in parallel SSID in 9 sites in USA and EMEA
  - ▶ Better control over what connects to our wireless network than on wired
  - ▶ Impact building router (EOL program), building router code (RDNSS)
- ▶ Dependency on NAT64/DNS64 availability
  - ▶ We don't have it deployed everywhere (only in the US today)
- IPv6 issues with both wireless vendors
  - ▶ IPv6 no internet connectivity – RAs being dropped by Aruba controllers
  - ▶ Cisco WLCs randomly de-authenticating IPv6 clients
  - ▶ Lesson learned: Proactive IPv6 bug scrubs

# Summary: Status of IPv6/IPv6-only

- VPN does not work through NAT64 (re [RFC 7269](#))
- In dual stack, IPv4 can hide IPv6 bugs
- Android requires RDNSS (!)
- IPv6 claims on paper  $\neq$  IPv6 reality ☹️
- Engage with vendors
- Applications are the big unknown

IPv6 gets all the blame 😊



# Resources



- ▶ APNIC Blog Microsoft IT IPv6 posts
  - ▶ [January 2017](#)
  - ▶ [September 2018](#)
- ▶ PacketPushers.net [IPv6 Buzz Podcast](#) (008) – August 30, 2018





**Thank you!**