IPv6-Only:
An Unexpected Journey

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Problem: Running out of private IPv4 addresses

Not a solution: deploy IPv6

Solution: deploy IPv6-only

Proof of Concept: Guest Network

How:

- Disabled IPv4 on GoogleGuest and wired guest vlans
- Created GoogleGuest-IPv4 (+dedicated wired vlan) for fallback
- Enable NAT64 and Google public DNS64

Why:

- a lot of mobile devices which are IPv6-only ready

How Did It Go?

Went Well:

- 50k+ devices on IPv6-only
- Very few complains
- Bugs fixed
- A lot of IPv4 reclaimed

Didn't Went So Well:

- **Multiple SSIDs are confusing**
- **Accidental use of IPv4**
- **Issues are not reported**

The story was presented at IETF v6ops@ back in 2020 (slides)

What We Want for Global Rollout

IPv6-Only and IPv4-requiring devices coexist on the same network segment

IPv4 is provided as on-demand service

IPv6-Only devices work OK if/when move to IPv4-only network

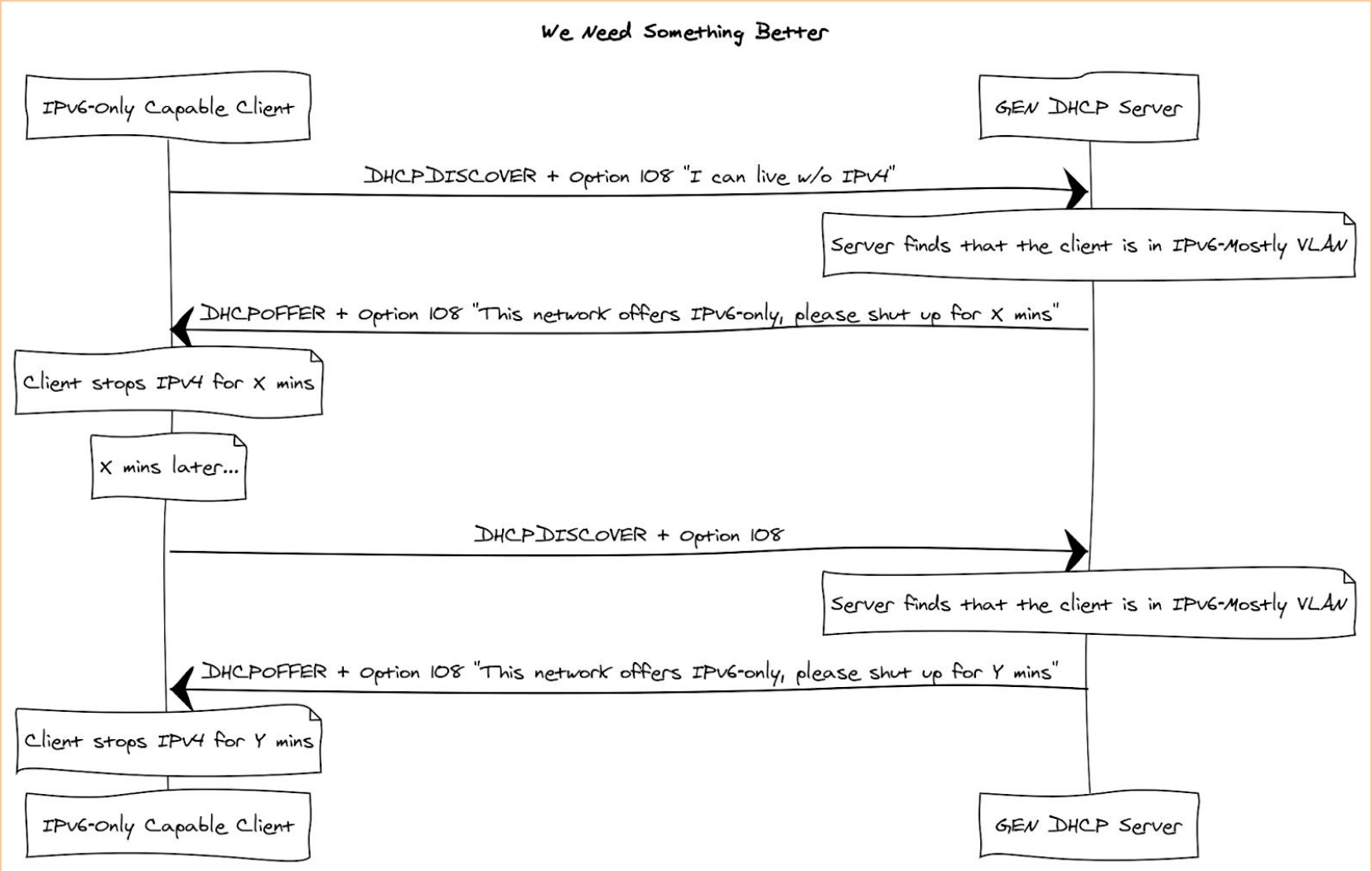
What If...

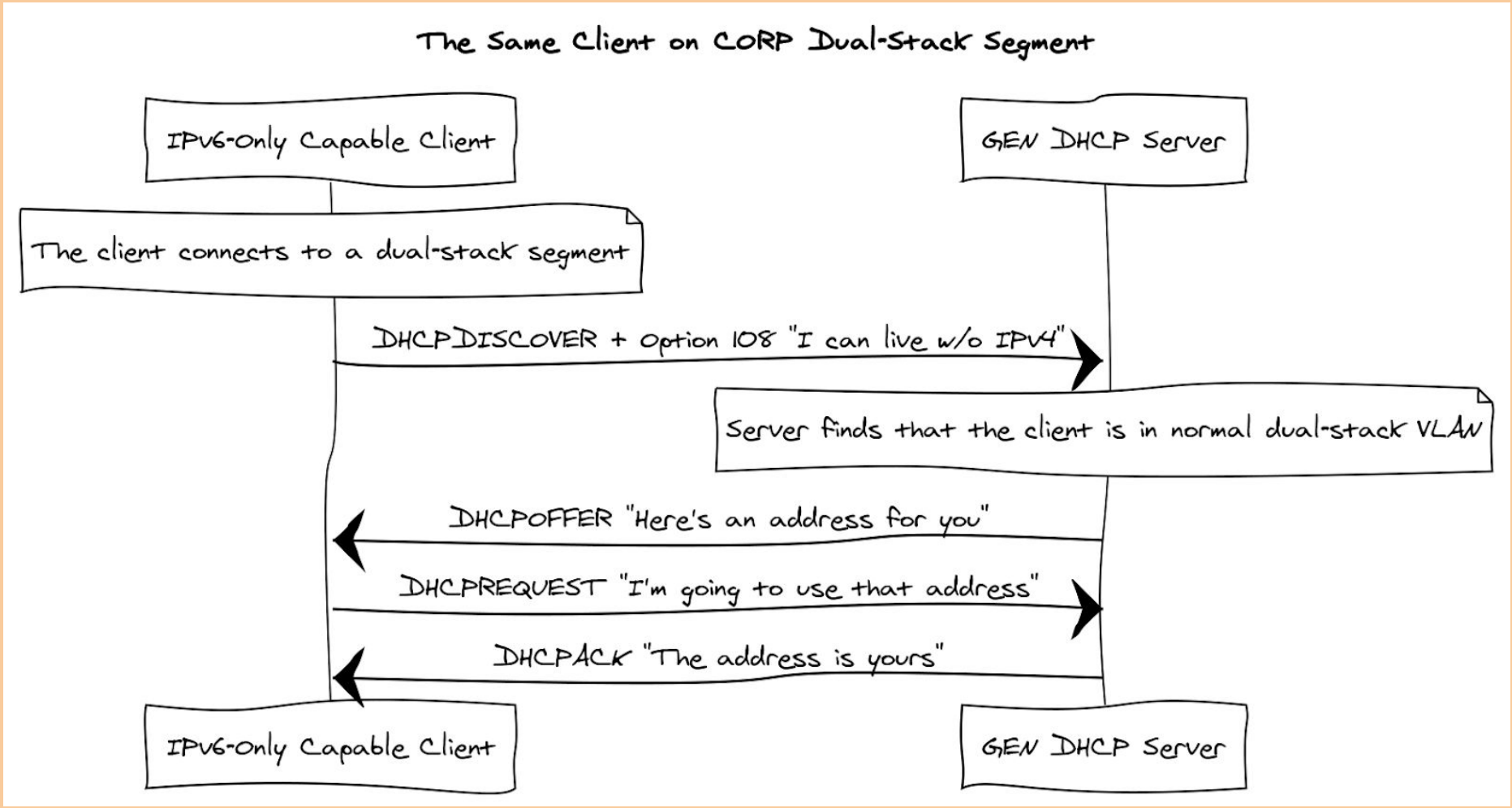
Client Indicates IPv6-only Capability

Server checks if the given network supports IPv6-Only

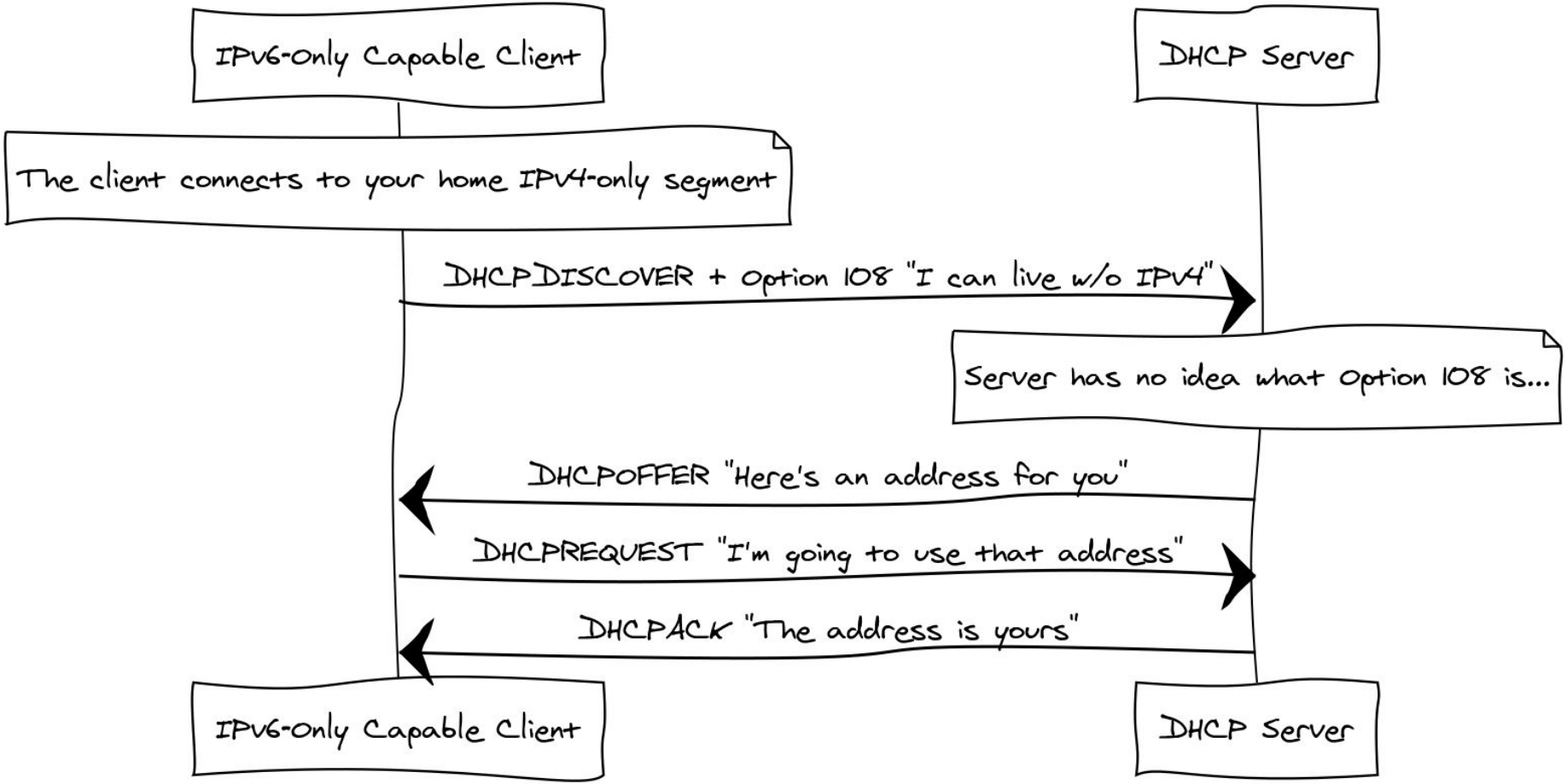
IPv6-Only Capable client on IPv6-Only capable network **No IPv4 allocated**

All other cases: **IPv4 Allocated**


We Need Something Better
IPv6-only Capable Client
GEN DHCP Server
DHCPDISCOVER + option 108 "I can live w/o IPV4"
Server finds that the client is in IPV6-Mostly VLAN
DHCPOFFER + option 108 "This network offers IPV6-only, please shut up for X mins"
Client stops IPV4 for X mins
X mins later...
DHCPDISCOVER + option 108
Server finds that the client is in IPV6-Mostly VLAN
DHCPOFFER + option 108 "This network offers IPV6-only, please shut up for Y mins"
Client stops IPV4 for Y mins
IPv6-only Capable Client
GEN DHCP Server


The Same Client on CORP Dual-Stack Segment
IPV6-Only Capable Client
GEN DHCP Server
The client connects to a dual-stack segment
DHCPDISCOVER + Option 108 "I can live w/o IPV4"
Server finds that the client is in normal dual-stack VLAN
DHCPOFFER "Here's an address for you"
DHCPREQUEST "I'm going to use that address"
DHCPACK "The address is yours"
IPV6-Only Capable Client
GEN DHCP Server

The Same Client on External IPV4-Only Segment



Solution Benefits

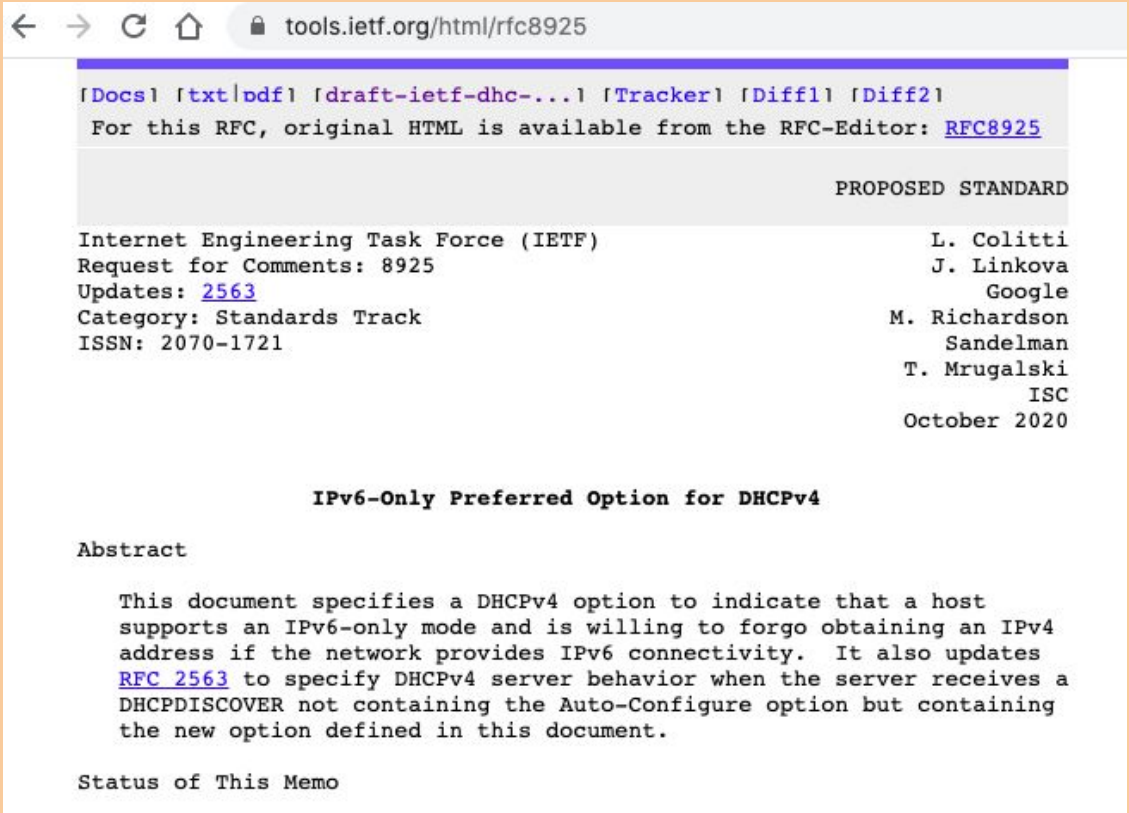
IPv6-Only and IPv4-requiring devices coexist on the same network segment

IPv4 is provided as on-demand service

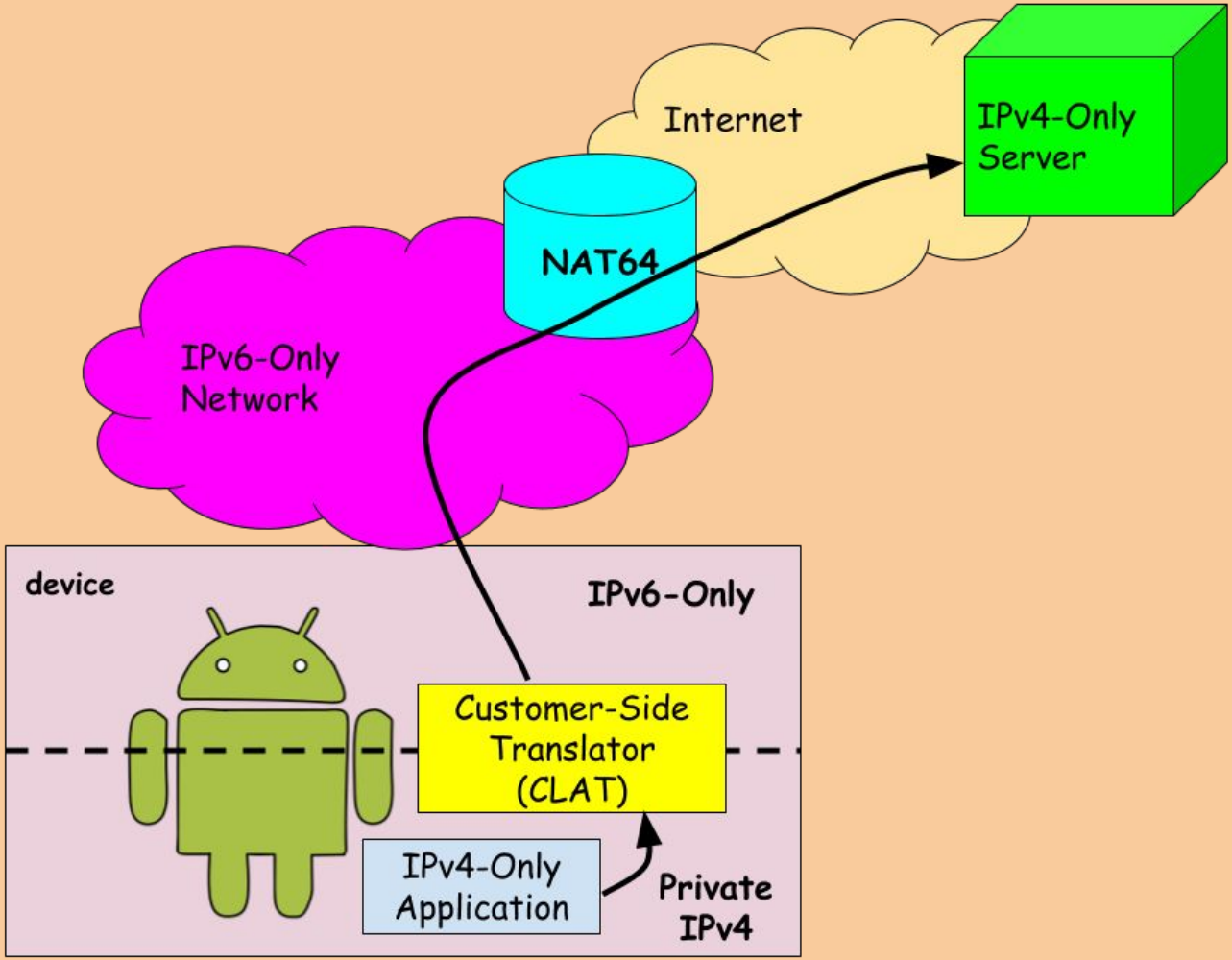
IPv6-Only devices work OK if/when move to IPv4-only network

No noise traffic, so scalability issues

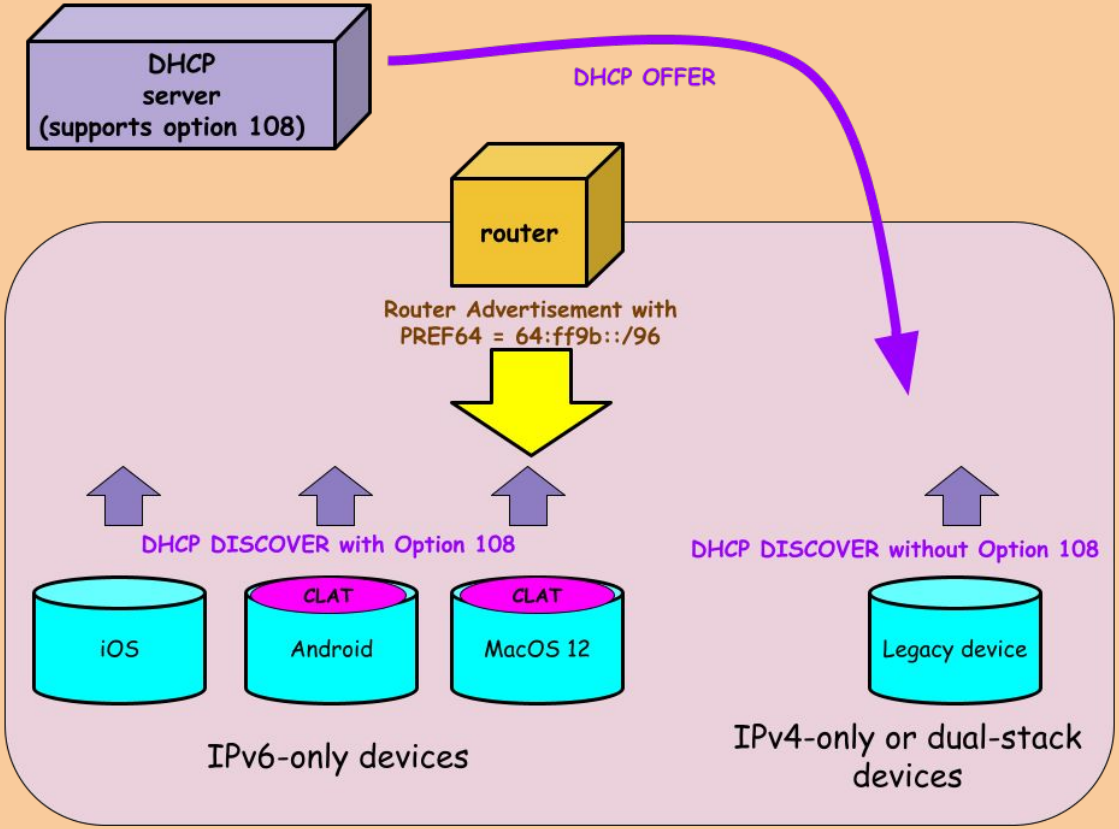
https://tools.ietf.org/html/rfc8925




IPv4-ONLY APPLICATIONS
WHAT YEAR IS IT
quickmeme.com


Internet
IPv4-Only
Server
NAT64
IPv6-Only
Network
device
IPv6-Only
Customer-Side
Translator
(CLAT)
IPv4-Only
Application
Private
IPv4

PREF64 (RFC8781) + DHCPv6 Option 108 (RFC8925)



Also deployed at RIPE85 Network: (see presentation)


THE OWLS ARE NOT
WHAT THEY SEEM.

Lessons Learned

Expectation: 10+ years of IPv6 operational experience

Reality: dual-stack operational experience

Expectation: IPv6 works.

Reality: yeah…most of the time…