Using DHCP-PD to Allocate /64 per Host

draft-collink-v6ops-ent64pd

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IPv6 Hosts Have Multiple Addresses

Just any “ordinary” host:

- A single-prefix network: link-local + stable + privacy + 464XLAT = 4
- Two-prefixes (multihoming or renumbering): 7

ChromeOS: the current requirement is 7-9 addresses per device

Future Use Cases: SIGCOMM CCR Paper (see PANRG talk)

RFC7934: “it is RECOMMENDED that IPv6 network deployments provide multiple IPv6 addresses from each prefix to general-purpose hosts. To support future use cases, it is NOT RECOMMENDED to impose a hard limit on the size of the address pool assigned to a host.”
Implications

● Scalability
  ○ ND and ND proxy caches on routers, switches and APs
  ○ EVPN Type 2 Routes

● Accountability
  ○ What device was using the given address?

● Unpredictable failure mode
  ○ When an address is blocked: how to know? What to do?
Proposed Solution

- Network provides DHCP-PD service
- The host requests a prefix (/64)
- The host uses delegated prefix to assign addresses to its interfaces and/or expand the network downstream
  - Just like in IPv4... but no need to use NAT!
Benefits: Scalability

**Before**

network has to scale to number of *addresses*

**After**

network has to scale to number of *endpoints*
Benefits: Security

Potential to Eliminate ND Cache Exhaustion Attack

**Before**

scanning connected /64 can exhaust ND cache

**After**

Directly connected /64 can be removed(*) from the interface

(*) when all hosts on the segment supports PD
Benefits: Accountability

DHCPv6-PD provides information of subnets used by hosts

• ... in the same way as DHCPv4
Benefits: Fate Sharing

Before
if number of IPv6 addresses/MAC is exceeded, some addresses lose connectivity

After
all host’s addresses share the same fate
Benefits: Network Extensibility

Before

Hosts can extend the network for IPv4 but not for IPv6

After

IPv6 network can be extended
Why /64?

All devices support SLAAC

SLAAC requires /64

Delegating /64 allows to extend the network
Applicability and Limitations

The solution provide benefits to large-scale networks, e.g.

- Large hotspots
- Enterprise networks
- Virtualization

Not so much for home networks

- If ISP provides a /60, that only supports 16 devices!
- But in home networks, SLAAC works fine
Coexistence with PIO and A-flag
Desired Behaviour

- Only use DHCP-PD in "large" networks
  - To prevent exhausting home network pools
- If both DHCP-PD and PIO with A=1 available:
  - Do not configure addresses from the PIO
Proposed solution

Add a new “P” flag in PIO

If P flag is set:

- Ignore A flag
- Start DHCPv6-PD, request a prefix, use it instead of PIO
Next Steps

Android implementation in progress

Adoption Call?