Reaction of Stateless Address Autoconfiguration (SLAAC) to Flash-Renumbering Events

draft-ietf-v6ops-slaac-renum

Flash Renumbering

Que?

What is Flash Renumbering?

Both DHCPv6 leases and Router Advertisements used by SLAAC, contain preferred and valid lifetime values. These lifetimes tell clients how long they **should** use an address for, and **can** use an address for, respectively.

Flash renumbering is considered to be when the advertised prefix/address becomes invalid before the expiration of the Valid Lifetime. This may happen for several reasons, some intentional some unintentional, but it does happen.

When this happens, clients may be temporarily left with broken IPv6 connectivity that often gets masked by Happy Eyeballs.

Flash Renumbering

What may cause Flash Renumbering?

DHCPv6 is widely used for configuring broadband CPE routers. These CPE routers may crash, be manually rebooted, or the WAN-link may be unstable, all of which may trigger a renumbering event, invalidating addresses configured by SLAAC.

ISP networks often have maintenance which may require prematurely invalidating DHCPv6 leases prior to their configured lease times.

LAN-side network topology changes that do not trigger “link-down” events on end-hosts.

Flash Renumbering

SLAAC's Current Reaction

None, by default. It's up to the end-hosts to decrement and expire the timers naturally, before choosing a new address.

RFC4861 specifies the following default values for use in RAs and subsequently by SLAAC:

- Valid Lifetime: 2592000 seconds (30 days)
- Preferred Lifetime: 604800 seconds (7 days)

If an alternative prefix is advertised, end-hosts will bind an address from that prefix, but you're then at the mercy of longest-match for source address selection until the Preferred Lifetime expires (the old address becomes "deprecated").

- 7 days is an excessively long time to be left with a stale address and broken connectivity
- Between 7 and 30 days, end-hosts will not be able to communicate with the new owner of the old prefix
- RFC4862 does not currently allow a Valid Lifetime lower than 2 hours.

Flash Renumbering

Proposed Operational Mitigations

- Use fixed/static prefix assignments where possible.
- Recommend using alternative lifetime values based on the Router Lifetime (AdvDefaultLifetime) value:
  - AdvValidLifetime: 48 * AdvDefaultLifetime (using current default value: 86400 seconds)
  - AdvPreferredLifetime: AdvDefaultLifetime (using current default value: 1800 seconds)
  - These default values can be tweaked by the operator
- Additional mitigations in the context of a CPE router, proposed in: **`draft-ietf-v6ops-cpe-slaac-renum`**

Improving the Reaction of Customer Edge Routers to Renumbering Events

draft-ietf-v6ops-cpe-slaac-renum

CPE Renumbering Events

Flash Renumbering By ISP

The problems previously described can perhaps most frequently be witnessed on a network connected to a residential broadband service that uses dynamic prefix delegation.

ISPs have regular operational requirements that may trigger flash renumbering. i.e.,

- Physically or logically re-parenting exchanges
- Reloading BNGs, DHCPv6 relays or servers

CPE Renumbering Events

Proposed Operational Mitigations

This document currently highlights 3 things a CPE router can implement to minimize the likelihood of a flash renumbering event, and the impact one has on the end user.

- Send an RA containing the old prefix PIO, with Preferred Lifetime values of 0
  - Proactively telling end-hosts to deprecate the stale prefix
  - Implicitly requiring CPE to store lease state in persistent storage
- RA PIOs should not use Preferred and Valid Lifetime values greater than those received in the DHCPv6 lease from which the prefix was obtained
- Do not send DHCPv6 RELEASE messages upon reboot events

CPE Renumbering Events

What Else Can We Do?

- Further expand on the relationship between DHCPv6 and RA lifetimes, recommending that RA PIO lifetimes to be calculated as a fraction of the DHCPv6 lease lifetime
  - Quicker reaction if the DHCPv6 lease fails to renew

- Reiterate RFC7084's W-5 and RFC8415's comments about stable DUID usage:

"... the DUID used by a client or server SHOULD NOT change over time if at all possible; for example, a device's DUID should not change as a result of a change in the device's network hardware or changes to virtual interfaces (e.g. logical PPP (over Ethernet) interfaces that may come and go in Customer Premises Equipment routers)."

- Recommend DHCPv6 Reconfigure for planned events
  - Not widely supported
  - Requires authenticated DHCPv6
- Update SLAAC itself within the 6man working group: **`draft-gont-6man-slaac-renum`**