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Improving the Reaction of Customer Edge Routers to Renumbering Events
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Abstract

In scenarios where network configuration information related to IPv6 prefixes becomes invalid without any explicit signaling of that condition (such as when a CPE crashes and reboots without knowledge of the previously-employed prefixes), hosts on the local network will continue using stale prefixes for an unacceptably long period of time, thus resulting in connectivity problems. This document specifies improvements to Customer Edge Routers that help mitigate the aforementioned problem for typical residential and small office scenarios.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on May 4, 2020.

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1. Introduction

In scenarios where network configuration information related to IPv6 prefixes becomes invalid without any explicit signaling of that condition, nodes on the local network will continue using stale prefixes for an unacceptably long period of time, thus resulting in connectivity problems. This problem is documented in detail in [I-D.gont-v6ops-slaac-renum].

This document specifies improvements to Customer Edge Routers that help mitigate the aforementioned problem for residential or small office scenarios.

2. Improved CPE behavior

This section specifies and clarifies requirements for CPE routers (particularly when they advertise with SLAAC [RFC4862] prefixes learned via DHCPv6-PD [RFC8415]) that can help mitigate the problem discussed in Section 1. This would obviously make robustness dependent on the CPE (on which the user or ISP may have no control), as opposed to the host itself.

The updated behaviour is as follows:

- CPE routers MUST signal stale configuration information as specified in Section 2.2

- CPE routers MUST implement the DHCPv6-PD/SLAAC interface specified in Section 2.1.

- CPE routers SHOULD NOT automatically send DHCPv6-PD RELEASE messages upon reboot events.

2.1. Interaction Between DHCPv6-PD and SLAAC

The "Preferred Lifetime" and "Valid Lifetime" of PIOs [RFC4861] corresponding to prefixes learned via DHCPv6-PD MUST NOT span past the lease time of the DHCPv6-PD prefixes. This means that the advertised "Preferred Lifetime" and "Valid Lifetime" MUST be dynamically adjusted such that the advertised lifetimes never span past the lease time of the prefixes delegated via DHCPv6-PD.

This is in line with these existing requirements from other specifications, which we reference here for clarity:

- [RFC8415] specifies, in Section 6.3, that "if the delegated prefix or a prefix derived from it is advertised for stateless address autoconfiguration [RFC4862], the advertised preferred and valid lifetimes MUST NOT exceed the corresponding remaining lifetimes of the delegated prefix."

RATIONALE:

  * The lifetime values employed for the "Preferred Lifetime" (AdvPreferredLifetime) and "Valid Lifetime" (AdvValidLifetime) should never be larger than the remaining lease time for the corresponding prefix (as learned via DHCPv6-PD).

  * The lifetime values advertised for prefixes corresponding to a prefix leased via DHCPv6-PD should be dynamically updated (rather than static values), since otherwise the advertised lifetimes would eventually span past the DHCPv6-PD lease time.

2.2. Signaling Stale Configuration Information

In order to phase-out stale configuration information:

- A CPE router sending RAs that advertise dynamically-learned prefixes (e.g. via DHCPv6-PD) on an interface MUST record, on stable storage, the list of prefixes being advertised on each network segment.

- Upon changes to the advertised prefixes, and after bootstrapping, the CPE router advertising prefix information via SLAAC should proceed as follows:

* Any prefixes that were previously advertised via SLAAC, but that are not currently intended for address configuration, MUST be advertised with a PIO option with the "A" bit set to 1 and the "Valid Lifetime" and a "Preferred Lifetime" set to 0.

* Any prefixes that were previously advertised via SLAAC as "on-link", but that are not currently not considered "on-link", MUST be advertised with a PIO option with the "L" bit set to 1 and the "Valid Lifetime" and a "Preferred Lifetime" set to 0.

* If both of the previous conditions are met (a prefix was previously advertised with both the "A" and "L" bits set, but is currently *not* intended for address configuration and is *not* considered on-link), the prefix MUST be advertised with a PIO option with both the "A" and "L" bits set to 1 and the "Valid Lifetime" and a "Preferred Lifetime" set to 0. That is. the advertisements of the previous two steps can be coalesced into a single one with both the "A" and "L" bits set.

* The aforementioned advertisement SHOULD be performed for at least the "Valid Lifetime" previously employed for such prefix.

The aforementioned improved behaviour assumes compliance with the following existing requirements from other specifications, which we reference here for clarity:

o [RFC7084] specifies (requirement LE-13, in Section 4.3) that when the delegated prefix changes (i.e., the current prefix is replaced with a new prefix without any overlapping time period), "the IPv6 CE router MUST immediately advertise the old prefix with a Preferred Lifetime of zero and a Valid Lifetime of either a) zero or b) the lower of the current Valid Lifetime and two hours (which must be decremented in real time) in a Router Advertisement message as described in Section 5.5.3, (e) of [RFC4862]"

3. IANA Considerations

This document has no actions for IANA.

4. Security Considerations

This document discusses a problem that may arise in scenarios where dynamic IPv6 prefixes are employed, and proposes improvements to Customer Edge Routers [RFC7084] to mitigate the problem for residential or small office scenarios. It does not introduce new security issues.

5. Acknowledgments

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6. References

6.1. Normative References

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[RFC4862] Thomson, S., Narten, T., and T. Jinmei, "IPv6 Stateless Address Autoconfiguration", RFC 4862, DOI 10.17487/RFC4862, September 2007, <https://www.rfc-editor.org/info/rfc4862>.

[RFC8415] Mrugalski, T., Siodelski, M., Volz, B., Yourtchenko, A., Richardson, M., Jiang, S., Lemon, T., and T. Winters, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", RFC 8415, DOI 10.17487/RFC8415, November 2018, <https://www.rfc-editor.org/info/rfc8415>.

6.2. Informative References

[I-D.gont-6man-slaac-renum] Gont, F. and J. Zorz, "Reaction of Stateless Address Autoconfiguration (SLAAC) to Renumbering Events", draft-gont-6man-slaac-renum-01 (work in progress), February 2019.

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[RFC7084] Singh, H., Beebee, W., Donley, C., and B. Stark, "Basic Requirements for IPv6 Customer Edge Routers", RFC 7084, DOI 10.17487/RFC7084, November 2013, <https://www.rfc-editor.org/info/rfc7084>.

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