              Support for Adjustable Maximum Router Lifetimes per Link

Abstract

   The IPv6 Neighbor Discovery protocol specifies the maximum time
   allowed between sending unsolicited multicast Router Advertisements
   (RAs) from a router interface as well as the maximum router lifetime.
   It also allows the limits to be overridden by documents that are
   specific to the link layer. This document allows for overriding
   these values on a per-link basis.

   This document specifies updates to the IPv6 Neighbor Discovery
   Protocol (RFC 4861) to increase the maximum time allowed between
   sending unsolicited multicast RAs from a router interface as well as
   to increase the maximum router lifetime.

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1. Introduction

   IPv6 Neighbor Discovery relies on IP multicast based on the
   expectation that multicast makes efficient use of available bandwidth
   and avoids generating interrupts in the network nodes. On some data
   link layers, multicast may not be natively supported. On such links,
   any possible reduction of multicast traffic will be highly
   beneficial. Unfortunately, due to the fixed protocol constants
   specified in [RFC4861], it is difficult to relax the multicast timers
   for Neighbor Discovery. There are already clarifications specific to
   the link technology about how to tune the Neighbor Discovery Protocol
   (NDP) constants for certain systems in order to reduce excess NDP
   traffic. For example, [RFC6459] and [RFC7066] contain such
   clarifications for 3GPP cellular links.

   This document specifies updates to the IPv6 Neighbor Discovery
   Protocol [RFC4861] to increase the maximum time allowed between
   sending unsolicited multicast RAs from a router interface as well as
   to increase the maximum router lifetime.

2. Requirements Language

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
   "OPTIONAL" in this document are to be interpreted as described in
   BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all
   capitals, as shown here.

3. Relationship between AdvDefaultLifetime and MaxRtrAdvInterval

   MaxRtrAdvInterval is an upper bound on the time between which two
   successive Router Advertisement messages are sent. Therefore, one
   might reason about the relationship between these two values in terms
   of a ratio K = AdvDefaultLifetime / MaxRtrAdvInterval, which
   expresses how many Router Advertisements are guaranteed to be sent
   before the router lifetime expires.

   Assuming unicast Solicited Router Advertisements or a perfectly
   stable network, on a theoretically perfect link with no losses, it
   would be sufficient to have K just above 1, so that the sent Router
   Advertisement refreshes the router entry just before it expires. On
   the real links that allow for some loss, one would need to use K > 2
   in order to minimize the chances of a single Router Advertisement
   loss causing a loss of the router entry.

   The exact calculation will depend on the packet loss probability. An
   example: if we take a ballpark value of 1% probability of a packet
   loss, then K = 2 will give 0.01% chance of an outage due to a packet
   loss, K = 3 will give 0.0001% chance of an outage, and so forth. To
   reverse the numbers, with these parameters, K ~= 1 gives 99%
   reliability, K ~= 2 gives 99.99% reliability, and K ~= 3 gives
   99.9999% reliability -- which should be good enough for a lot of
   scenarios.

   In a network with higher packet loss probabilities or if higher
   reliability is desired, the K might be chosen to be even higher. On
   the other hand, some of the data link layers provide reliable
   delivery at Layer 2, so there one might even consider using the
   "theoretical" value of K just above 1. Since the choice of these two
   parameters does not impact interoperability per se, this document
   does not impose any specific constraints on their values other than
   providing the guidelines in this section. Therefore, each individual
   link can optimize according to its use case.

   Also, AdvDefaultLifetime MUST be set to a value greater than or equal
   to the selected MaxRtrAdvInterval. Otherwise, a router lifetime is
   guaranteed to expire before the new Router Advertisement has a chance
   to be sent, thereby creating an outage.

4. Updates to RFC 4861

   This document updates Sections 4.2 and 6.2.1 of [RFC4861] to change
   the following router configuration variables.

   In Section 4.2, inside the paragraph that defines Router Lifetime,
   change 9000 to 65535 seconds.

   In Section 6.2.1, inside the paragraph that defines
   MaxRtrAdvInterval, change 1800 to 65535 seconds.

   In Section 6.2.1, inside the paragraph that defines
   AdvDefaultLifetime, change 9000 to 65535 seconds.

   As explained in Section 3, the probability of packet loss must be
   considered when choosing the relationship between MaxRtrAdvInterval
   and AdvDefaultLifetime.

5. Host Behavior

   Legacy hosts on a link with updated routers may have issues with a
   Router Lifetime of more than 9000 seconds. In the few
   implementations we have tested with general-purpose operating
   systems, there does not seem to be any issue with setting this field
   to more than 9000, but there might be implementations that
   incorrectly reject such RAs (since RFC 4861 requires receivers to
   handle any value).

6. Security Considerations

   On a link where Router Advertisements are few and far between, the
   detrimental effects of a rogue router that sends an unsolicited RA
   are greatly increased. These rogue RAs can be prevented by using
   approaches like RA-Guard [RFC6105] and SEcure Neighbor Discovery
   (SEND) [RFC3971].

7. IANA Considerations

   This document has no IANA actions.

8. References

8.1. Normative References

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