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Support for adjustable maximum router lifetimes per-link
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Abstract

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

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 April 20, 2016.

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1. Introduction

IPv6 Neighbor Discovery relies on IP multicast with the expectation to be efficient with respect to available bandwidth and to avoid generating interrupts in the network nodes. On some datalink-layer network, for example IEEE 802.11 WiFi, this is not the case because of limitations in the services offered by the datalink-layer network [draft-vyncke-6man-mcast-not-efficient-01]. 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 link technology specific clarifications how to tune protocol constants for certain system with the expectation to reduce excess Neighbor Discovery Protocol (NDP) traffic. 3GPP cellular links are one existing example [RFC6459][RFC7066].

This document specifies updates to the IPv6 Neighbor Discovery Protocol [RFC4861] for relaxing the the maximum time allowed between sending unsolicited multicast Router Advertisements (RA) from a router interface as well as for the maximum router lifetime.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

3. Relationship between AdvDefaultLifetime and MaxRtrAdvInterval

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

Assuming unicast Solicited Router Advertisements or a perfectly stable network, on a theoretically perfect link with no losses, it would have been 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 which 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% percent 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 - the latter should be good enough for a lot of scenarios.

In a network with higher packet loss or if the 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 the 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 accordingly 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 RFC4861

This document updates Section 6.2.1. of [RFC4861] to update the following router configuration variables. MaxRtrAdvInterval MUST be no greater than 65535. AdvDefaultLifetime MUST be between MaxRtrAdvInterval and 65535.

This document also updates Sections 6.2.1., 6.2.2., 6.2.4. and 6.2.5. of [RFC4861] so that AdvSendAdvertisements can be set "FALSE" but the router would still continue be a router and respond with RAs to solicited RSes .

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 issues with setting this field to more than 9000, but there might be implementations that incorrectly (since RFC4861 requires receivers to handle any value) reject such RAs.

6. Security Considerations

On a link where router advertisements are few and far between, the attack window for a rogue router to send an unsolicited RA is greatly increased. These attacks can easily be prevented by using SeND [RFC3971]

7. IANA Considerations

This document does not require any IANA action.

8. Acknowledgements

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9. References

9.1. Normative References

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9.2. Informative References

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