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Reducing energy consumption of Router Advertisements
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Abstract

Frequent Router Advertisement messages can severely impact host power consumption. This document recommends operational practices to avoid such impact.

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1. Introduction

Routing information is communicated to IPv6 hosts by Router Advertisement messages. If these messages are too frequent, they can severely impact power consumption on battery-powered hosts.

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].

2. Problem scenarios

2.1. Solicited multicast RAs on large networks

On links with a large number of battery-powered devices, sending solicited Router Advertisements multicast can severely impact host power consumption. This is because every time a device joins the network, all devices on the network receive a multicast Router Advertisement. In the worst case, if devices are continually joining and leaving the network, and the network is large enough, then all devices on the network will receive solicited Router Advertisements at the maximum rate specified by section 6.2.6 of [RFC4861], which is one every 3 seconds.

2.2. Frequent periodic Router Advertisements

Some networks send periodic multicast Router Advertisements (e.g., once every few seconds). This may be due to a desire to ensure that hosts always have access to up-to-date router information.

3. Consequences

Observed reactions to frequent Router Advertisement messages by battery-powered devices include:

- Some hosts simply experience bad battery life on these networks and otherwise operate normally. This is frustrating for users of these networks.

- Some hosts react by dropping all Router Advertisement messages when in power saving mode on any network, e.g., [1]. This causes devices to lose connectivity when in power-saving mode, potentially disrupting background network communications, because the device is no longer able to send packets or acknowledge received traffic.

- Some hosts react by dropping *all* IPv6 packets when in power saving mode, [2]. This disrupts network communications.

Compounding the problem, when dealing with devices that drop Router Advertisements when in power saving mode, some network administrators work around the problem by sending RAs even more frequently. This causes devices to engage in even more aggressive filtering.

4. Recommendations

1. Router manufacturers SHOULD allow network administrators to configure the routers to respond to with unicast Router Advertisements to Router Solicitations if:

   * The Router Solicitation's source address is not the unspecified address, and:

   * The solicitation contains a valid Source Link-Layer Address option.

2. Networks that serve large numbers (tens or hundreds) of battery-powered devices SHOULD enable this behaviour.

3. Networks that serve battery-powered devices SHOULD NOT send multicast RAs too frequently (e.g., more than one every 5-10 minutes for current battery-powered devices) unless the information in the RA packet has substantially changed. If there is a desire to ensure that hosts pick up configuration changes quickly, those networks MAY send frequent Router Advertisements for a limited period of time (e.g., not more than one minute) immediately after a configuration change.

No protocol changes are required. Responding to Router Solicitations with unicast Router Advertisements is already allowed by section 6.2.6 of [RFC4861], and Router Advertisement intervals are already configurable by the administrator to a wide range of values.

5. Acknowledgements

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6. IANA Considerations

None.

7. Security Considerations

None.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC4861] Narten, T., Nordmark, E., Simpson, W., and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)", RFC 4861, September 2007.

8.2. URIs

[1] https://code.google.com/p/android/issues/detail?id=32662

[2] http://www.gossamer-threads.com/lists/nsp/ipv6/54641

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