Network Working Group   R. Droms
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Expires: October 3, 2017   Cisco Systems
                                                               O. Troan
                                                    Cisco Systems, Inc.
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          DHCPv6 Relay Agent Assignment Notification (RAAN) Option
              draft-ietf-dhc-dhcpv6-agentopt-delegate-05.txt

Abstract

   The DHCP Relay Agent Assignment Notification (RAAN) option is sent
   from a DHCP server to a DHCP relay agent to inform the relay agent of
   IPv6 addresses that have been assigned or IPv6 prefixes that have
   been delegated to DHCP clients.

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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1. Introduction

   The DHCP Relay Agent Assignment Notification (RAAN) option
   encapsulates address and prefix options to indicate that an address
   or prefix has been assigned. The option may also carry other
   information required by the network element for configuration related
   to the assigned address or prefix.

   For example, a relay agent uses the RAAN option to learn when a
   prefix that has been delegated through DHCP prefix delegation (PD) to
   a DHCP client. The relay agent notifies the network element on which
   it is implemented of the delegation information so the network
   element can add routing information about the delegated prefix into
   the routing infrastructure.

   While the practice to date for DHCPv6 has been for the relay agents
   to "snoop" the client's message (encapsulated in the received Relay
   Message option, and which is forwarded to the client), this will no
   longer be possible when clients and servers use
   [I-D.ietf-dhc-sedhcpv6] to encrypt their communication.

   Use of the RAAN option has another benefit in that the Reply to a
   client's Release message, which does not have any useful information
   for the relay agent about the addresses or delegated prefixes the

client released, can now communicate this information in the RAAN
option to the relay agent.

2. Requirements Language and 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] when they
appear in ALL CAPS. When these words are not in ALL CAPS (such as
"should" or "Should"), they have their usual English meanings, and
are not to be interpreted as [RFC2119] key words.

The term "DHCP" in this document refers to DHCP for IPv6, as defined
in [RFC3315]. The terms "DHCP prefix delegation" and "DHCP PD" refer
DHCP for IPv6 prefix delegation, as defined in [RFC3633].

Additional terms used in the description of DHCP and DHCP prefix
delegation are defined in RFC 3315 and RFC 3633. In this document
"assigning" an IPv6 prefix is equivalent to "delegating" a prefix.

3. Option Semantics and Usage

The RAAN option carries information about assigned IPv6 addresses and
prefixes. It encapsulates IA Address options (RFC 3315) and/or IA
Prefix options (RFC 3633), and possibly other options that carry
other information related to the assigned IPv6 address or prefix.

The DHCP server is responsible for synchronizing any state created by
a node through the use of the RAAN option. For example, if a DHCP
server receives a Release message for a delegated prefix, it causes
the node to delete any state associated with that prefix by sending a
RAAN option containing an IA Prefix option with the released prefix
and a valid lifetime of zero.

When a DHCP server sends this option to a relay agent, it MUST
include all addresses and prefixes assigned to the client on the link
to which the option refers at the time the option is sent.

Examples of use:

o Populate an ACL with an assigned IPv6 address if the network
   security policy requires limiting IPv6 forwarding to devices that
   have obtained an address through DHCP.

o Inject routing information into a routing infrastructure about a
   delegated prefix on behalf of a requesting router.

4. Relay Agent Behavior

   A relay agent that wants information from the server in a RAAN option
   includes an ORO requesting the RAAN option in its Relay-Forw message.
   A relay agent may do this for any relayed message, regardless of the
   message type or the message contents.

   When a relay agent receives a Relay-Reply message containing a RAAN
   option, the relay agent may forward that option data to the node in
   which the relay agent is instantiated. If no RAAN option is included
   in the Relay-Reply, the relay agent MUST NOT assume anything with
   regard to RAAN data and MUST NOT forward any indication to the node
   in which the relay agent is instantiated.

   If a node creates state based on the information included in this
   option, it MUST remove that state when the lifetime as specified in
   the option expires.

   One concern with the RAAN option is that messages from the DHCP
   server may be received (or processed) out of order. But this concern
   is no different than that for the "snooping" which has been used by
   relay agents for many years (both in DHCPv4 and DHCPv6).
   Implementers should be aware of this and should consider making use
   of Leasequery ([RFC5007]) to resolve conflicts.

5. Server Behavior

   When a server is responding to a request and the ORO contains an RAAN
   option, the server SHOULD include a RAAN option with all of the
   addresses and prefixes that have been (or are being assigned) to the
   client. If no addresses or prefixes are assigned, the server SHOULD
   send a RAAN option with no addresses or prefixes.

   If the DHCP server does include this option in a Relay-Reply message,
   it MUST include it in the option area of the Relay-Reply message sent
   to the relay agent intended as the recipient of the option.

   If the message received from the client contains no Client Identifier
   option or the server is otherwise unable to identify the client or
   the client's link (perhaps because of missing or invalid data in the
   request), the server MUST NOT include a RAAN option in the response.

6. Option Format

   The RAAN option has the following format:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           option-code          |             length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                               .
.                     encapsulated-options                      .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
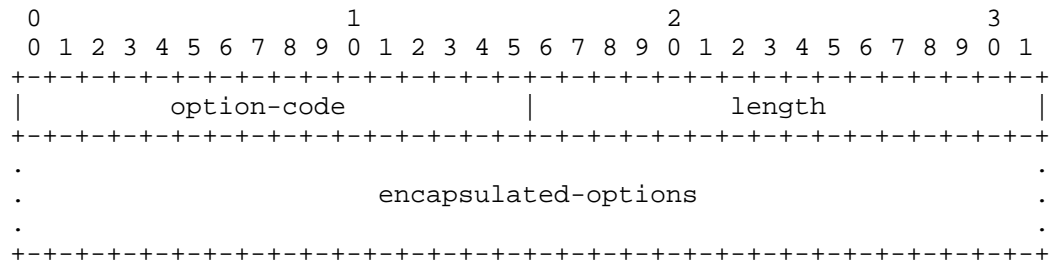
Figure 1: Relay Agent Assignment Notification Option Format

option-code   OPTION_AGENT_NOTIFY (TBD).

option-len   Length of encapsulated options, in octets.

encapsulated-options DHCP options to be delivered by the relay agent
                      Assignment Notification option.

7. Encapsulating DHCP Options in the RAAN Option

   The contents of options encapsulated in the RAAN option are
   interpreted according to the use of those options in the node on
   which the relay agent is implemented. For the purposes of address
   and prefix assignment, the uses of the DHCP IA Address and IA Prefix
   options are defined in this document.

   Note that the contents of these options are not necessarily the same
   as in the corresponding options sent to the DHCP client.

7.1. IA Address Option

   The fields in an IA Address option (OPTION_IAADDR, option code 5) are
   used as follows:

   IPv6 address   The IPv6 address assigned in this DHCP message

   preferred-lifetime   Not used by the relay agent; the server SHOULD
                         set this field to the preferred-lifetime of the
                         corresponding IA Address options in the message
                         to be forwarded to the client

   valid-lifetime   The lifetime of the information carried in this
                         IA Address option, expressed in units of
                         seconds; if the valid-lifetime is 0, the
                         information is no longer valid

   IAaddr-options   Not used by the relay agent; the server SHOULD
                          set this field to the IAaddr-options of the
                          corresponding IA Address option in the message
                          to be forwarded to the client

7.2. IA Prefix Option

   The fields in an IA Prefix option (OPTION_IAPREFIX, option code 28)
   are used as follows:

   preferred-lifetime   Not used by the relay agent; the server SHOULD
                          set this field to the preferred-lifetime of the
                          corresponding IA Prefix options in the message
                          to be forwarded to the client

   valid-lifetime   The lifetime of the information carried in this
                          IA Prefix option, expressed in units of seconds;
                          if the valid-lifetime is 0, the information is
                          no longer valid

   prefix-length   Length for this prefix in bits

   IPv6-prefix   The IPv6 prefix assigned in this DHCP message

   IAprefix-options   Not used by the relay agent; the server SHOULD
                          set this field to the IAprefix-options of the
                          corresponding IA Prefix option in the message to
                          be forwarded to the client

8. Requesting Assignment Information from the DHCP Server

   If a relay agent requires the DHCP server to provide information
   about assigned addresses and prefixes, it MUST include an Option
   Request option, requesting the Assignment Notification option, as
   described in section 22.7 of RFC 3315.

9. IANA Considerations

   IANA is requested to assign an option code from the "DHCPv6 and
   DHCPv6 options" registry http://www.iana.org/assignments/
   dhcpv6-parameters to OPTION_AGENT_NOTIFY.

10. Security Considerations

   Security issues related to DHCP are described in RFC 3315 and RFC
   3633.

The RAAN option may be used to mount a denial of service attack by
causing a node to incorrectly populate an ACL or incorrectly
configure routing information for a delegated prefix. This option
may also be used to insert invalid prefixes into the routing
infrastructure or add invalid IP addresses to ACLs in nodes.
Communication between a server and a relay agent, and communication
between relay agents, can be secured through the use of IPSec, as
described in [I-D.ietf-dhc-relay-server-security].

11. Changes Log

   If this section is included in the document when it is submitted for
   publication, the RFC Editor is requested to remove it.

   Changes in rev -01:

      o Added section describing use of "Server Reply Sequence Number"
         option to allow resequencing of out-of-order messages.

   Changes in rev -02:

      o Made editorial change in section 1: s/the appropriate routing
         protocols/the routing infrastructure/

      o Updated first paragraph in Section 3 to allow multiple IA
         Address options and/or IA Prefix options

      o Renamed section 3 to "Options Semantics and Usage"

      o Added paragraph to section "Option Semantics and Usage"
         requiring that the DHCP server must include all addresses/
         prefixes for the client (on that link) in the RAAN option

      o Added list of use cases to section "Option Semantics and Usage"

      o Added section "Relay Agent Behavior"

      o Added section "Server Behavior"; moved second paragraph of
         section "Option Semantics and Usage" to "Server Behavior"

      o Updated reference to draft-ietf-dhc-dhcpv6-srsn-option-00

      o Clarified descriptions of various option fields in section
         "Encapsulating DHCP options in the RAAN Option"

   Changes in rev -03: refreshed after expiration.

Changes in rev -04: all references to the "Server Reply Sequence Number" option were removed from the draft.

Changes in rev -05:

   o Converted the -04 text version to xml.

   o Updated introduction to add motivation for option because of [I-D.ietf-dhc-sedhcpv6], and also Reply to Release "snooping" issues.

   o Updated security considerations to reference IPsec document ([I-D.ietf-dhc-relay-server-security]).

12. References

12.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
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   [RFC3315] Droms, R., Ed., Bound, J., Volz, B., Lemon, T., Perkins,
              C., and M. Carney, "Dynamic Host Configuration Protocol
              for IPv6 (DHCPv6)", RFC 3315, DOI 10.17487/RFC3315, July
              2003, <http://www.rfc-editor.org/info/rfc3315>.

   [RFC3633] Troan, O. and R. Droms, "IPv6 Prefix Options for Dynamic
              Host Configuration Protocol (DHCP) version 6", RFC 3633,
              DOI 10.17487/RFC3633, December 2003,
              <http://www.rfc-editor.org/info/rfc3633>.

12.2. Informative References

   [I-D.ietf-dhc-relay-server-security]
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              Between Servers and Relay Agents", draft-ietf-dhc-relay-
              server-security-04 (work in progress), March 2017.

   [I-D.ietf-dhc-sedhcpv6]
              Li, L., Jiang, S., Cui, Y., Jinmei, T., Lemon, T., and D.
              Zhang, "Secure DHCPv6", draft-ietf-dhc-sedhcpv6-21 (work
              in progress), February 2017.

   [RFC5007] Brzozowski, J., Kinnear, K., Volz, B., and S. Zeng,
              "DHCPv6 Leasequery", RFC 5007, DOI 10.17487/RFC5007,
              September 2007, <http://www.rfc-editor.org/info/rfc5007>.

Authors' Addresses

    Ralph Droms

    Email: rdroms.ietf@gmail.com

    Bernie Volz
    Cisco Systems, Inc.
    1414 Massachusetts Ave
    Boxborough, MA   01719
    USA

    Email: volz@cisco.com

    Ole Troan
    Cisco Systems, Inc.
    Oslo
    Norway

    Email: otroan@cisco.com