                Home Network Autoconfiguration via DHCPv6 Relay
                     draft-gmann-homenet-relay-autoconf-01

Abstract

   This document describes a method for efficiently delegating subnets
   of an IPv6 prefix among home routers while simultaneously creating
   functional routing tables in all home routers without the need for a
   routing protocol.

Requirements Language

   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 RFC 2119 [RFC2119].

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1. Introduction

   There are several mechanisms for distributing IPv6 address and
   routing information within a home network. However, many of these
   require complex new protocols, or hierarchical addressing topologies.
   A simpler and more efficient solution to home network
   autoconfiguration is to provide centralized prefix delegation
   control, utilize an existing protocol [RFC3315], and remove the need
   for a routing protocol. This simpler approach can be achieved by
   relaying all DHCPv6 IA_PD [RFC3633] requests and responses to and
   from the CPE Edge Router (CER) and snooping their contents along the
   way. This approach is analogous to how many Service Providers plan
   to distribute IPv6 prefixes to subscribers in the WAN.

2. Expected Home Network Topologies

   It is expected that home networks will be arbitrarily constructed by
   home users. Figure 1 illustrates an example multi-router home
   network topology.

   This document assumes that the vast majority of home networks will
   connect to a single ISP and will be generally constructed in a tree
   architecture. This document also assumes that IPv6 hosts are capable
   of dealing with multiple IPv6 addresses and have some manner of
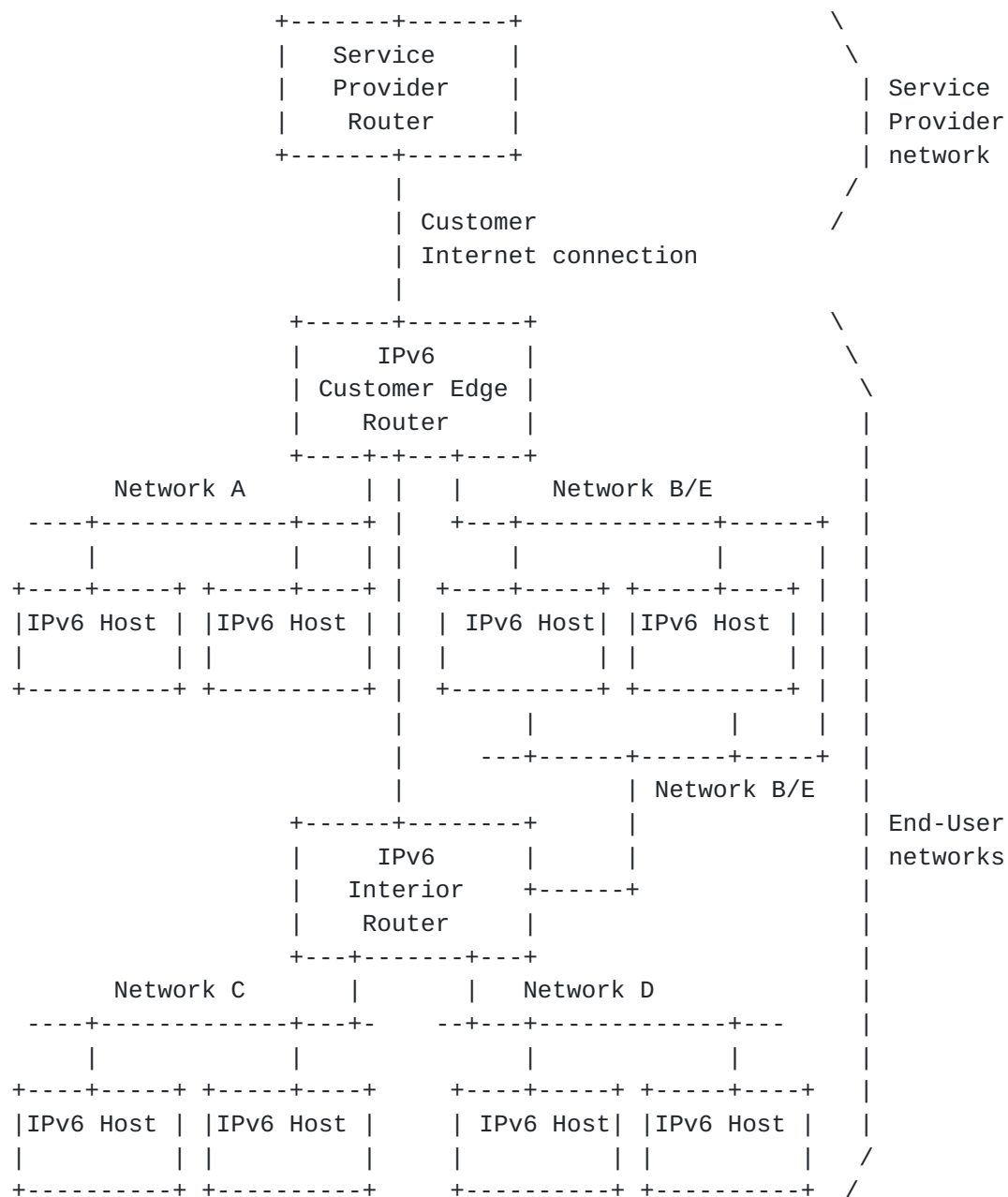   address selection functionality (internal multi-homing).

```
                  +-------+-------+                     \
                  |    Service    |                      \
                  |   Provider    |                      | Service
                  |    Router     |                      | Provider
                  +-------+-------+                      | network
                          |                             /
                          | Customer                   /
                          | Internet connection
                          |
                 +------+--------+                     \
                 |      IPv6     |                      \
                 | Customer Edge |                       \
                 |     Router    |                       |
                 +----+-+---+----+                       |
         Network A    | |   |       Network B/E          |
      ----+------------+----+ |   +---+------------+------+  |
          |           |    | | |       |            |    |  |
     +----+----+ +-----+----+ |   +----+-----+ +-----+----+ |  |
     |IPv6 Host | |IPv6 Host | |   | IPv6 Host| |IPv6 Host | |  |
     |         | |          | |   |         | |          | |  |
     +---------+ +---------+ |   +----------+ +----------+ |  |
                            |       |            |        |  |
                            |    ---+------+------+-----+  |
                            |       | Network B/E      |  |
                 +------+--------+   |                  | End-User
                 |      IPv6     |   |                  | networks
                 |    Interior   +------+               |
                 |     Router    |                      |
                 +---+-------+---+                       |
         Network C     |         |   Network D          |
      ----+------------+---+-   --+---+------------+---     |
          |           |         |            |          |
     +----+----+ +-----+----+   +----+-----+ +-----+----+   |
     |IPv6 Host | |IPv6 Host |   | IPv6 Host| |IPv6 Host |   |
     |         | |          |   |         | |          |  /
     +---------+ +----------+   +----------+ +----------+  /
```

                            Figure 1

3. Home Router Behavior

   All routers within a home MUST be capable of determining whether or
   not they are the CER for their home. This document recommends use of
   the CER_ID [I-D.donley-dhc-cer-id-option] but other methods may also
   be used.

3.1. CER Behavior

Once a home router has determined that it is the CER, it is
responsible for requesting, receiving and sub-delegating a GUA prefix
from the ISP [RFC6204], [I-D.ietf-v6ops-6204bis].

Once the CER obtains a GUA prefix, it responds to all DHCPv6 requests
on its LAN interface. The CER MUST add a route to its routing table
mapping each delegated prefix to the DHCP client or DHCP relay to
which it was sent.

3.2. IR Behavior

Once a home router has determined that it is an Internal Router (IR)
(e.g. via receipt of the DHCP CER ID Option
[I-D.donley-dhc-cer-id-option] specifying a different router as CER)
and received an IA_PD, the IR MUST relay DHCPv6 IA_PD requests
[RFC3633] received on its LAN interface to the delegating router or
relay agent from which it received its IA_PD.

The IR MUST prefer its CER as its default router when directly
connected and MUST install an entry for IA_PD observed in DHCPv6
Relay message in its routing and forwarding tables. This behavior is
referred to as 'DHCP snooping'. When installing an entry in the
routing and forwarding tables for the observed IA_PD assignments, the
IR MUST map the IA_PD to the IR transmitting the request. The IR
MUST purge the IA_PD entry and the route to the prefix upon IA_PD
lease expiration.

4. Home Router Provisioning Example

1.   CER Receives a GUA and IA_PD from the ISP.

2.   CER configures a /64 on its LAN interface(s) and advertises
     itself as a default router candidate in its RA.

3.   Directly attached internal routers (Level 1 IRs) install a
     default router based on RAs received from the CER and initiate
     SLAAC when appropriate. When multiple default routers are
     advertised, L1 IRs will choose the default router that matches
     the received CER_ID whenever possible.

4.   Level 1 IRs initiate DHCPv6 with CER.

     A.   Requests include IA_PD and CER_ID options, and may include
          an IA_NA.

B.   The CER responds to the IR with an IA_PD (e.g. /64), a
     CER_ID that contains the CER's LAN IP, and IA_NA when
     applicable.

5.   The CER records to which IR each delegated prefix is distributed
     and construct its routing and forwarding tables accordingly
     [RFC3633].

6.   Level 1 IRs (L1IRs) advertise themselves as default router
     candidates via their RAs and indicate whether DHCPv6 information
     is available.

7.   Indirectly attached (e.g. Level 2) IRs install a default router
     based on RAs received from directly upstream IR(s) and initiate
     SLAAC when appropriate.

8.   Indirectly attached IRs initiate DHCPv6.

A.   Requests include IA_PD and CER_ID options, and may include
     an IA_NA.

B.   The directly upstream IR responds with: CER_ID that contains
     the CER's LAN IP, and IA_NA when applicable.

C.   The directly attached IR relays the IA_PD request to the
     delegating router or relay from which it obtained its IA_PD.

D.   The CER responds to the IA_PD request with an IR IPv6 Prefix
     (e.g. /64).

E.   This response is relayed back to the IR via one or more
     relays.

9.   The CER records the IR or DHCPv6 relay to which the delegated
     prefix is distributed and uses the mapping to build its routing
     and forwarding tables.

10. IRs inspect the contents of all relayed IA_PD response and
     record both the prefix contained and IR/downstream DHCPv6 relay
     the message is sent to. These prefix/address tuples are used to
     construct local routing and forwarding tables.

11. Indirectly attached IRs advertise themselves as default router
     candidates via their RAs and indicate whether DHCPv6 information
     is available.

12. Repeat steps 7 through 10 as needed.

5. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

6. Security Considerations

TBD

7. Acknowledgements

TBD

8. Normative References

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