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Home Network Autoconfiguration via DHCPv6 Relay
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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].

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 September 13, 2012.

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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).

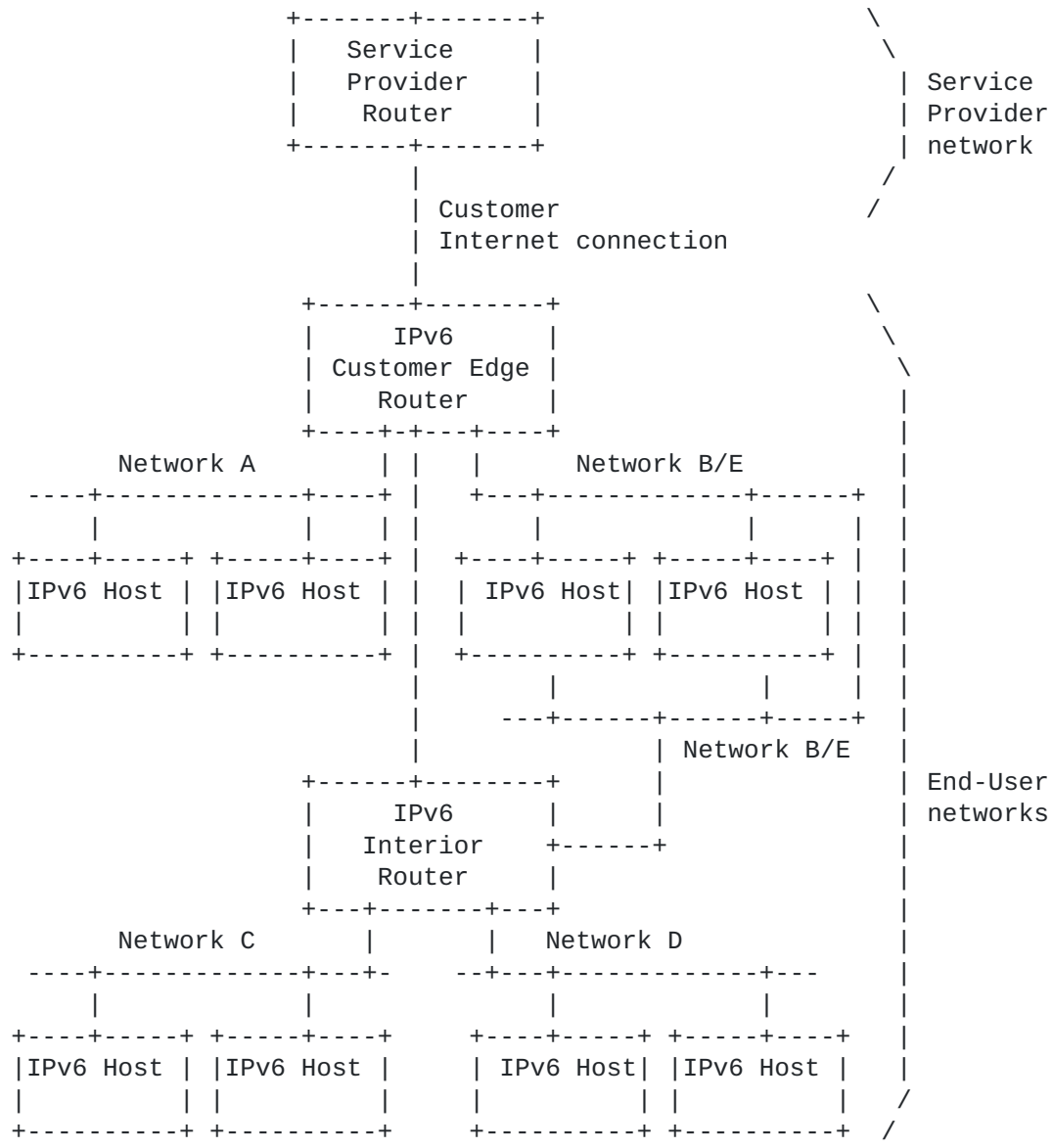

Figure 1

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

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