                    IPv6 Customer Edge CE Routers LAN Prefix Delegation
                        draft-ietf-v6ops-cpe-lan-pd-06

Abstract

   This document defines requirements for IPv6 Customer Edge (CE)CE
Routers routers to support
   DHCPv6 Prefix Delegation for redistributing unused prefixes that were
   delegated to the a IPv6 CE Routerrouter.

  This document updates RFC 7084.

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Commenté [MB1]: Be consistent with RFC7084

1. Introduction

   This document defines requirements for DHCPv6 Prefix Delegation in
IPv6 Customer Edge (CE) Routersrouters
   ([RFC7084]) in order to properly utilize the IPv6 prefixes assigned
   by service providers. Many Service service Providers providers assign
prefixes larger
   then than /64 to the CE Routerrouters, as recommended in [RFC6177].
If an IPv6
   CE Router router does not support the Indentity Identity Association
for Prefix
   Delegation (IA_PD) Prefix Option (Section 21.21 of [RFC8415]) on the
LAN, it will not
   be able to assign any prefixes beyond its local interfaces, limiting
   the usefulness of assigning prefixes larger than /64 by the operator.

   Supporting IA_PD on the LAN interfaces of a CE router will allow those
unused
   prefixes to be distributed into a network. Note that efforts Work is
being done in the
    areas such as Stub Networking Auto Configuration (SNAC) working
Working groupGroup
   that depends on IPv6 prefixes being properly distributed in a LAN.

   Two models, hierarchical prefix and flat, have beenwere proposed in
the
   past for prefix sub-delegation beyond the an IPv6 CE Routerrouter.
   Hierarchical prefix delegation requires an IPv6 CE Router router to
sub
   delegate IPv6 prefixes based on set of rules. If more than one
   router uses hierarchical prefix delegation, a an IPv6 prefix tree is
   created. When no routing protocol is present enabled to discover the
network
   topology, it's it is possible to have unbalanced prefix delegation
tree
   which leads to running out of prefixes. For mMore information on
   heirachicalhierarchical prefix delegation is containedcan be found,
e.g., in Section 8.5 of
   CableLabs IPv6 eRouter Specifiction [eRouter]. A flat prefix
   delegation requires the router to be provisioned with the initial
   prefix and to assign /64 prefixes to all other prefix requests from
   routers downstreamin the LAN-facing interface. As the default
configuration is designed to be
   Tthe flat model is assumed to be used by the default to support zero
configuration networking.

The Home Networking ~~W~~working ~~group~~ Group ~~produced~~ specified solutions for prefix
delegation for home networks, including [RFC7695]. However, ~~The Home Networking~~these solutions haven't been deployed by ~~Service~~ service ~~Providers~~ providers or
IPv6 CE ~~Routers~~ routers since the publication, ~~partially~~ partially due to their complexity.

This document does not cover dealing with multi-provisioned networks with more than one service provider. Due to complexity of a solution that
would require routing, provisioning, and policy, this is out of scope of this document.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in
BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

3. Terminology

The document makes use of the terms defined in Section 4 of [RFC8415] and
Section 2 of [RFC7084].

The following terminology is defined for this document.

   * IPv6 CE ~~Router~~router: A router intended for home or small-office use
      that forwards packets not explicitly addressed to itself as
      defined in [RFC7084].

   * Service Provider: An entity that provides access to the Internet
      as defined in [RFC7084]

   * ULA: Unique Local Address as defined in [RFC4193].

   * GUA: Global Unique Addresses as defined in [RFC4291].

4. IPv6 End-User Network Architecture

The end-user network that has IPv6 ~~Customer Edge~~CE ~~Routers~~ routers with routers
and hosts downstream. Figure 1 illustrates the model topology.

```
                    +-----------+
                    |  Service  |
                    | Provider  |
                    |  Router   |
                    +-----+-----+
                          |
                          |
                          |  Customer
```

```
                    |  Internet Connection
                    |
              +-----v-----+
              |   IPv6    |
              |    CE     |
              |  Router   |
              +-----+-----+
                    |
              +-----+-+-------++------+-------+
              |       |              |
              |       |              |
          +---+----+  +-----+------+
          |  IPv6  |  |            |
          |  Host  |  |   Router   |
          |        |  |            |
          +--------+  +------------+
```
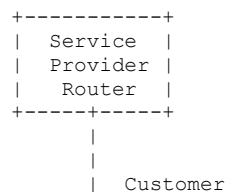
Figure 1: Example IPv6 End User Topology

5. Requirements

    ~~The~~ IPv6 CE ~~Router~~ routers distribute~~s~~ configuration information obtained
    during WAN interface provisioning to LAN-facing IPv6 hosts and routers.
    ~~Previously, a~~An [RFC7084~~]~~]-compliant CE ~~Router~~ router would only provide IPv6
    hosts with configuration information. This allows for addressing and
    routing of IPv6 prefixes to both hosts and routers. These
    requirements are in addition to the ones in Section 4.3 of [RFC7084].

5.1. LAN Prefix Delegation Requirements (~~LDP~~LPD)

    LPD-1: ~~The~~ IPv6 CE ~~Router~~ routers MUST support IPv6 prefix assignment
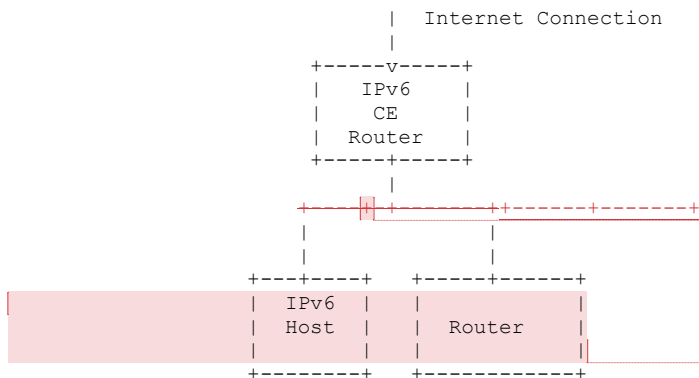   according to [RFC8415] (Identity Association for Prefix
            Delegation (IA_PD) option) on its ~~the~~ LAN interfaces.

    LPD-2: ~~The~~ IPv6 CE ~~Router~~ routers MUST assign a prefix from the delegated
            prefix as specified by L-2 in Section 4.3 of [RFC7084]. If
            not insufficient
            are available the IPv6 CE ~~Router~~ router SHOULD log a system
            management error.

    LPD-3: The prefix assigned to a link MUST NOT change in the absence
            of topology or configuration changes.

    LPD-4: After LAN link prefix assignments, the IPv6 CE ~~Router~~ router MUST
            make the remaining IPv6 prefixes available to other routers
            via Prefix Delegation.

    LPD-5: ~~The~~ IPv6 CE ~~Router~~ routers MUST install a route to the assigned
            IA_PD with a next-hop of the IPv6 node that was assigned the
            prefix. The IPv6 CE ~~Router~~ router MUST remove the route when
            IA_PD
```

Commenté [MB10]: fix

Commenté [MB11]: The following definitions are worth to remind (grabbed from RFC8504):

==
IPv6 node - a device that implements IPv6.
IPv6 router - a node that forwards IPv6 packets not explicitly addressed to itself. IPv6 host - any IPv6 node that is not a router.
==

Commenté [MB12]: The preamble of that section also reminds that «It also supports connectivity of these devices in the absence of any working WAN interface. », should that be repeated here for clarity?

Commenté [MB13]: As there might be many

Commenté [MB14]: I don't parse this.

Commenté [MB15]: I'm afraid this does not cover the case of a policy where for example a user instruct that a node is not always being assigned to same prefix (avoid internal tracking or whatsoever). There is no configuration change in such case but the prefix must change.

I suggest:

s/topology or configuration changes/a local policy or a topology change.

Commenté [MB16]: As there may be more than one.

lease expires.

    LPD-6:    By default, the IPv6 CE ~~Router~~ router ~~firewall~~ filtering
rules MUST allow
                    forwarding of packets with an outer IPv6 header containing a
                    source address belonging to Delegated Prefixes, along with
                    reciprocal packets from the same flow, following the
                    recommendations of [RFC6092].  This updates WPD-5 of
                    Section 4.2 of [RFC7084] to not drop packets from prefixes
that have been
                    delegated.

    LPD-7:    ~~The~~ IPv6 CE ~~Router~~ routers MUST provision IA_PD prefixes with
a
                    prefix-length of 64 unless configured to use a different
prefix~~-~~
                    length by ~~the~~ a user.  The prefix length of 64 is used as
that
                    is the current prefix length supported by SLAAC (see
[RFC7421]).

    LPD-8:    ~~If the~~ IPv6 CE ~~Router~~ routers ~~is~~ are configured to generate
an ULA prefix as
                    defined in ULA-1 of Section 4.3 of [RFC7084]. after LAN link
prefix
                    assignment of the ULA prefixes the IPv6 CE ~~Router~~ router MUST
make
                    the remaining IPv6 prefixes available to other routers via
                    Prefix Delegation.

    LPD-9:    If ~~the~~ an IPv6 CE ~~r~~Router is provisioning both ULA and GUA
via prefix
                    delegation, the GUA SHOULD appear first in the packet.

    LPD-10:   IPv6 CE Routers MUST NOT delegate prefixes via DHCPv6 on the
                    LAN using lifetimes that exceed the remaining lifetimes of
                    the corresponding prefixes learned on the WAN ~~via DHCPv6-PD~~.

6.  Security Considerations

    This document does not add any new security considerations beyond
    those mentioned in Section 4 of [RFC8213] and Section 22 of
    [RFC8415].

7.  IANA Considerations

    This document makes no request of IANA.

8.  Acknowledgements

    Thanks to the following people for their guidance and feedback:
    Marion Dillon, Erik Auerswald, Esko Dijk, Tim Carlin, Richard
    Patterson, Ted Lemon, Michael Richardson, Martin Huneki, Gabor
    Lencse, Ole Troan, Brian Carpenter, David Farmer, Tim Chown, Ron
    Bonica, and Erica Johnson.

9.  References

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**Commenté [MB17]:** I wonder whether you checked the list at https://www.rfc-editor.org/rfc/rfc8987.html#section-4.2 and see if there items that can be reused here. I'm not asking for any specific change.

**Commenté [MB18]:** Should we check if this sourced from the node to which the prefix was delegated?

**Commenté [BMI19]:** May be refer to S-1 of 7084, instead?

**Commenté [MB20]:** Not sure which part is updated there, especially that WPD is for the WAN side not LAN.

**Commenté [MB21]:** Or «the CE router administrator»

**Commenté [MB22]:** Maybe move this to be out the reco but as a note

**Commenté [MB23]:** Please check as the full sentence is difficult to parse as it is currently.

**Commenté [MB24]:** How is this different from LPD-4?

**Commenté [MB25]:** May also point to RFC6092 as this is cited in the main body.

## 9.1. Normative References

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           Richardson, M., Jiang, S., Lemon, T., and T. Winters,
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## 9.2. Informative References

[RFC7695]  Pfister, P., Paterson, B., and J. Arkko, "Distributed
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Author's Address

[Commenté [BMI26]: Should be moved to be listed as info]

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