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                 Prefix Delegation for Proxy Mobile IPv6
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Abstract

   This document explains how network mobility and DHCPv6-based Prefix
   Delegation works with Proxy Mobile IPv6.

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   provisions of BCP 78 and BCP 79.

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[1](#). **Introduction**

   DHCPv6 prefix delegation [RFC 3633] (DHCPv6PD) can be used to assign
   mobile network prefix(es) to a Mobile Router as specified in DHCPv6
   Prefix Delegation for NEMO [draft-ietf-mext-nemo-pd-07]. However,
   there is a gap currently for this NEMO support in PMIPv6
   architecture. If a mobile router (MR) is provided Proxy Mobile IPv6
   Protocol as its mobility management when connecting the network and
   use DHCPv6PD to obtain prefix(es) for the nodes in the mobile network
   behind the MR, currently neither the Mobile Access Gateway (MAG) nor
   the Local Mobility Anchor (LMA) can be able to identify the packet
   including delegated prefix(es). When the MR (Requesting Router) uses
   DHCPv6 PD to obtain the delegated prefix(es), these prefix(es) SHOULD
   be associated with the PMIPv6 binding. Otherwise the packets
   addressed to the delegated prefix will be discarded by the MAG or the
   LMA. This document describes extension to PMIPv6 for supporting
   prefix delegation.

2. Convention & 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 [RFC 2119].

All the mobility related terms used in this document are to be interpreted as defined in Mobile IPv6 [RFC 3775], Network Mobility Basic Support protocol [RFC 3963], Proxy Mobile IPv6 specification [RFC 5213], DHCPv6 Prefix Delegation for NEMO [draft-ietf-mext-nemo-pd-07], DHCP Prefix Delegation [RFC3633] and Mobility Related Terminology [RFC 3753]. This document does not define any new terms.

3. **DHCPv6 Prefix Delegation for PMIPv6**

3.1. **Assumption**

   This specification extends PMIPv6 to assign not only the home network
   prefix but also the mobile network prefix for supporting network
   mobility. It assumes that a MR is a regular IPv6 router without
   extension for mobility managements. The MR sends the packets from
   its mobile network to the MAG and the MAG delivers the packets to the
   mobile network via the MR.

   In order to use DHCPv6PD as mobile network prefix assignment
   mechanism in mobile networks, this specification has following
   assumptions.

   o The Mobile Router MUST play the role of the Requesting Router.

   o The Delegating Router can be located either at LMA or some other
      device in the PMIPv6 domain.

   o The MAG MUST play the role of DHCPv6 Relay Agent to intercept the
      related DHCPv6 message from the Mobile Router.

   o The Mobile Router (Requesting Router) MUST obtain the home network
      prefix before initiating the DHCPv6 prefix delegation procedure.

   o All the mobile network prefixes managed in the Delegating Router
      MUST be reachable via local mobility anchor.

   o The Mobile Router (Requesting Router) SHOULD support Prefix
      Exclude Option for DHCPv6-based Prefix Delegation as described in
      [draft-ietf-dhc-pd-exclude].

3.2. **Network Mobility Service**

   The network mobility service of a mobile router is managed by the
   mobile node's policy profile defined in [RFC 5213]. During mobile
   router initial attachment procedure, the mobile access gateway MUST
   identify the mobile router and acquire the mobile router!_s policy
   profile to determine whether the network mobility service is offered
   to the mobile router. If the network mobility service needs to be
   offered to the mobile node, the mobile access gateway MUST set the
   Mobile Router Flag (R) when sending the Proxy Binding Update message
   to the local mobility anchor.

3.3. Binding association with the delegated prefix

3.3.1. Mobile Router initiated prefix delegation in PMIPv6

```
+------------------+     +-----------------+    +--------+    +-----------+
|  Mobile Router   |     |      MAG        |    |  LMA   |    | Delegating|
|(Requesting Router)|    |(DHCP Relay Agent)|   +--------+    |  Router   |
+------------------+     +-----------------+         |        +-----------+
        |                        |                   |               |
        |                        |-------------------|               |
        |                        |  1.PMIPv6 tunnel  |               |
        |                        |-------------------|               |
        |--2.DHCPv6 SOLICIT-->|                      |               |
        |                        |                   |               |
        |                        |--------3.PBU------>|               |
        |                        |                   |               |
        |                        |<-------4.PBA-------|               |
        |                        |                   |               |
        |                        |---------5.DHCPv6 SOLICIT---------->|
        |                        |<--------6.DHCPv6 ADVERTISE---------|
        |                        |                   |               |
        |<-7.DHCPv6 ADVERTISE-|                      |               |
        |                        |                   |               |
        |--8.DHCPv6 REQUEST-->|                      |               |
        |                        |--9.DHCPv6 REQUEST----------------->|
        |                        |                   |               |
        |                        |<-----10.DHCPv6 REPLAY-------------|
        |<--11.DHCPv6 REPLY---|                      |               |
        |                        |                   |               |
```
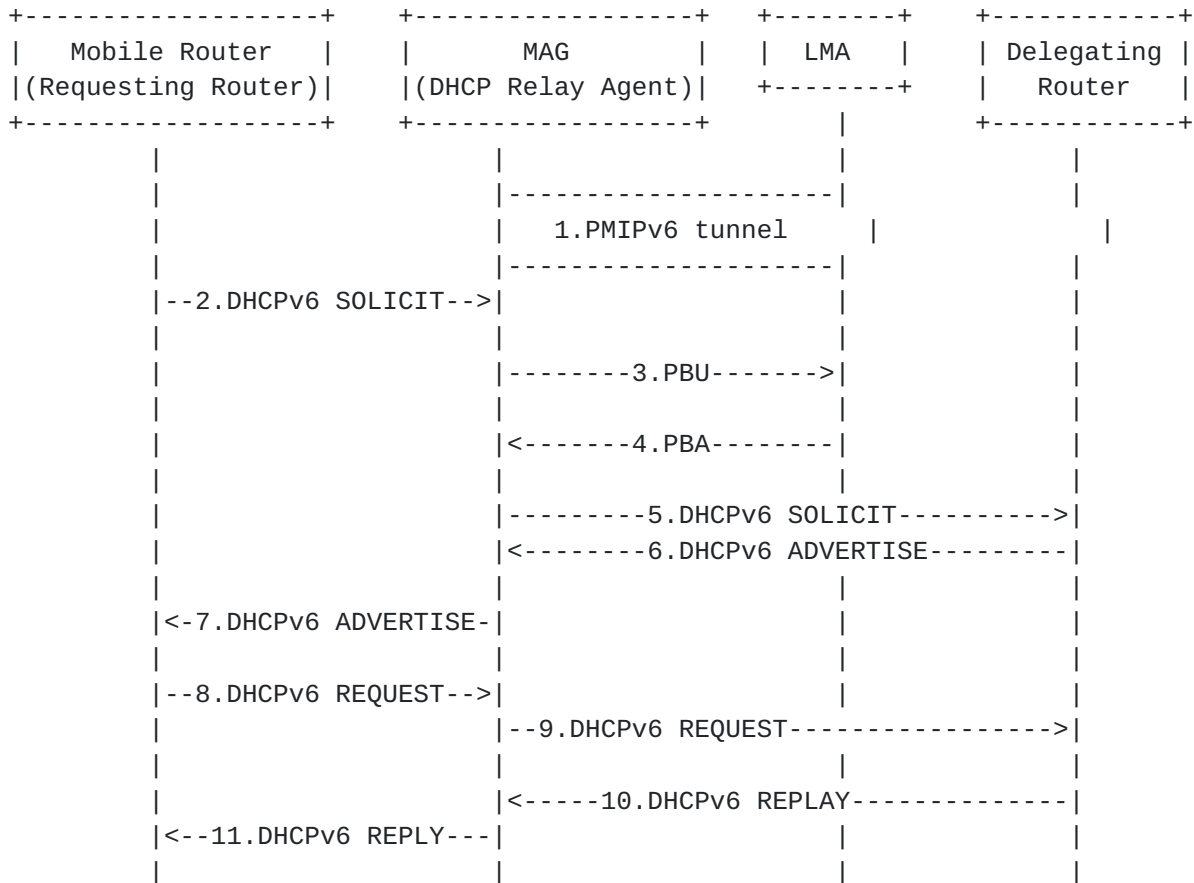
                    Figure 1: Prefix Delegation in PMIPv6

   The steps of the procedure in Figure 1 are as following.

   1. The PMIPv6 tunnel is set up between the MAG and LMA. The MAG
   plays function of DHCPv6 relay agent between the MN and the DHCPv6
   server and intercept all the DHCP related messages.

   2. The mobile router which acts as a "Requesting Router" as
   described in [RFC 3633] sends DHCPv6 SOLICIT massage including one or
   more IA_PD option(s) to the MAG to acquire the delegated prefix(es).

   3. Upon receiving DHCPv6 SOLICIT the MAG sends a Proxy Binding
   Update message including a Mobile Network Prefix mobility option as
   defined in Section 4.3 of [RFC 3963] to the LMA. All the
   considerations from Section 5.3.1 of [RFC 5213] MUST be applied on
   the encapsulated Proxy Binding Update message.

4. On reception of the Proxy Binding Update the LMA returns the
assigned prefix in the Mobile Network Prefix option carried by a
Proxy Binding Acknowledgment to the MAG. The assigned prefix is the
same one which will be assigned via DHCPv6PD in step 6 which MUST be
added the delegated prefix(es) in its binding cache which is extended
as in Section 3.5.1.

5. The DHCPv6 relay agent on the MAG as described in [RFC 3315]
relays the DHCPv6 SOLICIT message to the delegation router. NOTE:
Step 3 and Step 5 are processed in parallel.

6. The delegating router inserts one or more IA_PD option(s)
including the delegated prefix(es) and send it to the MAG (DHCPv6
relay agent) via the DHCPv6 ADVERTISE message.

7. The MAG relays the DHCPv6 ADVERTISE message to the MN.

8. The MN sends DHCPv6 REQUEST message with the IA_PD option(s)
received from previous message to the MAG (DHCPv6 relay agent).

9. The MAG relays the DHCPv6 REQUEST message to the delegating
router.

10. The delegating router responses the REQUEST to the MAG via
DHCPv6 REPLY message.

11. The MN receives one or more IA_PD prefix(es) in the DHCPv6 REPLY
message from the MAG.

3.3.2. Mobile Router refresh prefix delegation in PMIPv6

When the mobile router sends DHCPv6 Renew messages to extend the
lifetime of the delegated prefix, the messages are also intercepted
by the MAG and relayed to the delegating router. If the MAG finds
that the lifetime of the delegated prefix which is stored in the
IA_PD Prefix Option carried by the DHCPv6 reply message set to zero,
the MAG SHOULD triggers a Proxy Binding Update to remove the binding
for that mobile network prefix.

3.4. Mobile Access Gateway Operation

3.4.1. Extension to Binding Update List Entry Data Structure

In order to support this specification, the conceptual Binding Cache
entry data structure needs to be extended with a new prefix
information field as [RFC 3963] does. This prefix information field
is used to store the mobile network prefix information which is
assigned to the mobile router in the Proxy Binding Acknowledgement

during the procedure of Binding association with the delegated prefix
in [section 3.2](#).

3.4.2. Forwarding

Forwarding packets sent to the mobile router!_s mobile network prefix

o On receiving a packet from the bi-directional tunnel established
   with the mobile router!_s local mobility anchor, the mobile access
   gateway MUST use the destination address of the inner packet to
   forward it on the interface where the destination mobile network
   prefix is hosted.

Forwarding packets sent by the mobile router

o On receiving a packet from a mobile router connected to its access
   link, the mobile access gateway MUST ensure that there is an
   established binding for that mobile router with its local mobility
   anchor before tunneling the packet to the mobile router!_s local
   mobility anchor.

All other considerations from 6.10.5 MUST be applied here also.

3.4.3. Handover

When the mobile router moves from the previously attached mobile
access gateway to the newly attached mobile access gateway, the newly
attached mobile access gateway MAY know the mobile network prefix
which is assigned during the previous attachment from some network
element, e.g. from the previous mobile access gateway. It is out of
scope of this specification that how the newly attached mobile access
gateway obtains the previously assigned mobile network prefix. After
handover to the new mobile access gateway, a Proxy Binding Update
message including the assigned mobile network prefix (if available)
MUST be sent from the new mobile access gateway to the local mobility
anchor. The local mobility anchor MUST check the mobile network
prefix in the Proxy Binding Update message and return the same
assigned mobile network prefix in the Proxy Binding Acknowledgement
message. If the previously assigned mobile network prefix is not
available in the new mobile access gateway, the new mobile access
gateway MUST contain the mobile network prefix set with 0 in the
Proxy Binding Update message. In this case, the local mobility
anchor MUST return the same previously assigned mobile network prefix
in Proxy Binding Acknowledgement.

3.5. **Local Mobility Anchor Operation**

3.5.1. **Extension to Binding Cache Entry Data Structure**

   In order to support this specification, the conceptual Binding Cache
   entry data structure needs to be extended with a new prefix
   information field as [RFC 3963] does. This prefix information field
   is used to store the mobile network prefix information which is
   assigned to the mobile router in the Proxy Binding Acknowledgement
   during the procedure of Binding association with the delegated prefix
   in section 3.2.

3.5.2. **Forwarding**

   Intercepting packets sent to the mobile router!_s mobile network
   prefix

   o When the local mobility anchor is serving to the mobile router, it
      MUST be able to receive packets those are sent to the mobile
      router!_s mobile network. In order to receive those packets, the
      mobile access gateway MUST advertise a connected route into the
      Routing Infrastructure for the mobile router!_s mobile network
      prefix(es).

   Forwarding packets to the mobile router

   o On receiving a packet from a correspondent node with the
      destination address matching the mobile router!_s mobile network
      prefix(es) the local mobility anchor MUST forward the packet
      through the bi-directional tunnel set up for that mobile router.

   All other considerations from 5.6.2 MUST be applied here also.

4. Security Considerations

All security considerations from the base Proxy Mobile IPv6 [RFC 5213], DHCPv6 Prefix Delegation specification [RFC 3633] apply when using the extensions defined in this document.

5. IANA Considerations

   This document reuses the mobile network prefix option defined in [RFC
   3963] in Proxy Mobile IPv6 to assign the mobile network prefix via
   DHCPv6 for prefix delegation. It does not introduce any additional
   IANA considerations.

6. **Normative References**

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               Thubert, "Network Mobility (NEMO) Basic Support Protocol",
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