

netext
Internet-Draft
Intended status: Standards Track
Expires: January 12, 2012

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July 11, 2011

Prefix Delegation for Proxy Mobile IPv6
draft-zhou-netext-pd-pmip-01.txt

Abstract

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

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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

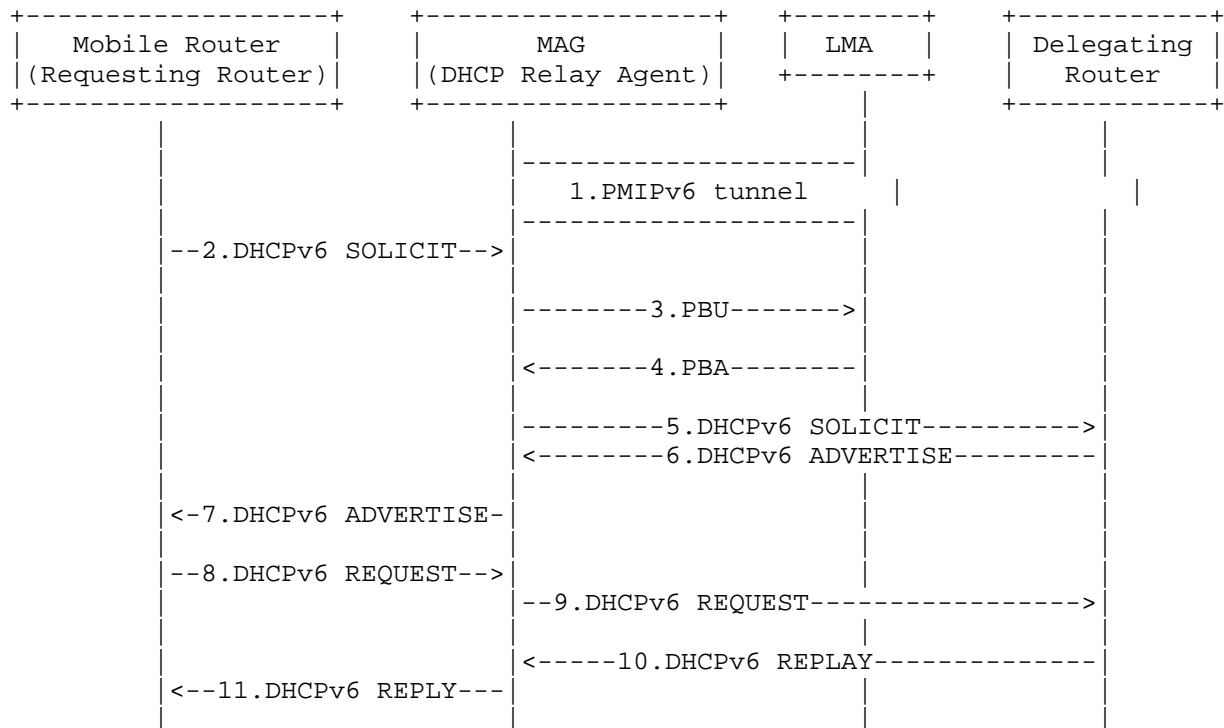


Figure 1: Prefix Delegation in PMIPv6

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 message 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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