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**DHCPv6 Prefix Delegation for NEMO**  
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Abstract

One aspect of network mobility support is the assignment of a prefix or prefixes to a Mobile Router (MR) for use on the links in the Mobile Network. DHCPv6 prefix delegation can be used for this configuration task.

## **1. Introduction**

One aspect of network mobility support is the assignment of a prefix or prefixes to a Mobile Router for use on the links in the Mobile Network. DHCPv6 prefix delegation [[RFC3633](#)] (DHCPv6PD) can be used for this configuration task.

## **2. 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 [RFC2119](#) [[RFC2119](#)].

The following terms used in this document are defined in the IPv6 Addressing Architecture document [[RFC4291](#)]:

- link-local unicast address
- link-local scope multicast address

The following terms used in this document are defined in the mobile IPv6 specification [[RFC3775](#)]:

- home agent (HA)
- home link

The following terms used in this document are defined in the Mobile Network terminology document [[RFC4886](#)]:

- Mobile Router (MR)
- Mobile Network
- mobile host (MH)

The following terms used in this document are defined in the DHCPv6 [[RFC3315](#)] and DHCPv6 prefix delegation [[RFC3633](#)] specifications:

- delegating router (DR)
- requesting router (RR)
- DHCPv6 relay agent

The following acronym is used in this document:

DHCPv6PD: DHCPv6 prefix delegation

## **3. Application of DHCPv6 prefix delegation to mobile networks for delegation of home prefixes**

The NEMO Basic protocol [[RFC3963](#)] extends the mobile IPv6 protocol [[RFC3775](#)] to enable network mobility. In this extension, a MR uses the mobile IPv6 protocol to establish and maintain a session with its HA, and uses bidirectional tunneling between the MR and HA to provide a path through which hosts attached to links in the Mobile Network



can maintain connectivity with nodes not in the Mobile Network.

The requirements for NEMO [[RFC4885](#)] include the ability of the MR to receive delegated prefixes that can then be assigned to links in the Mobile Network. DHCPv6PD can be used to meet this requirement for prefix delegation.

To use DHCPv6PD for Mobile Networks, the HA assumes the role of either the DR or a DHCPv6 relay agent and the MR assumes the role of the RR. Throughout the remainder of this document, the HA will be assumed to be acting as a DHCPv6PD DR or relay agent and the MR will be assumed to be acting as a RR.

If the HA is acts as relay agent, some other device acts as the DR. For example, the server providing DHCPv6 service in the home network might also provide NEMO DHCPv6PD service. Or, a home network with several HAs might configure one of those HAs as a DHCPv6PD server while the other HAs act as relay agents.

The HA and MR exchange DHCPv6PD protocol messages through the tunnel connecting them. The tunnel acts as the link labeled "DSL to subscriber premises" in figure 1 of the DHCPv6PD specification.

The DHCPv6PD server is provisioned with prefixes to be assigned using any of the prefix assignment mechanisms described in the DHCPv6PD specifications. Other updates to the HA data structures required as a side effect of prefix delegation are specified by the particular network mobility protocol. For example, in the case of Basic Network Mobility Support [[RFC3963](#)], the HA would add an entry in its binding cache registering the delegated prefix to the MR to which the prefix was delegated.

### **[3.1.](#) When the MR uses DHCPv6**

The MR initiates a DHCPv6 message exchange for prefix delegation whenever it establishes an MRHA tunnel to its HA. If the MR does not have any active delegated prefixes (with unexpired leases), the MR initiates a DHCPv6 message exchange with a DHCPv6 Solicit message as described in [section 17 of RFC 3315](#) and [section 12 of RFC 3633](#). If the MR has one or more active delegated prefixes, the MR initiates a DHCPv6 message exchange with a DHCPv6 Confirm message as described in [section 18.1.2 of RFC 3315](#) and [section 12 of RFC 3633](#).

### **[3.2.](#) Use of MRHA tunnel for DHCPv6 messages**

The DHCPv6 specification requires the use of link-local unicast and link-local scope multicast addresses in DHCPv6 messages (except in certain cases as defined in [section 22.12](#) of the DHCPv6



specification). [Section 10.4.2](#) of the mobile IPv6 specification describes forwarding of intercepted packets, and the third paragraph of that section begins:

However, packets addressed to the mobile node's link-local address MUST NOT be tunneled to the mobile node.

The DHCPv6 messages exchanged between the HA and the MR originate only with the HA and the MR, and therefore are not "intercepted packets" and may be sent between the HA and the MR through the tunnel.

Even though the MRHA tunnel is a point to point connection, the MR SHOULD use multicast DHCPv6 messages as described in [RFC 3315](#) over that tunnel.

### **[3.3.](#) DHCPv6 Relay Agent for transmission of DHCPv6 messages**

A DHCPv6 relay agent function [[RFC3315](#)] can be used as an alternative to multicast DHCPv6 messages over the tunnel between the MR and the HA. In this configuration, the relay agent function is co-located in the MR with the DHCPv6 client function. Rather than using multicast to send DHCPv6 messages through the tunnel to the DHCPv6 server, the DHCPv6 client in the MR hands any outbound DHCPv6 messages to the co-located relay agent. Responses from the DHCPv6 server are delivered to the relay agent function in the MR, which extracts the encapsulated message and delivers it to the DHCPv6 client in the MR.

#### **[3.3.1.](#) Relay agent configuration**

The use of the relay agent function in the MR allows the MR to unicast DHCPv6 messages to the DHCPv6 server. The relay agent must be configured with the address of the DHCPv6 server or another DHCPv6 relay agent that will forward message on to a DHCPv6 server. For the purposes of NEMO, the relay agent assumes that the HA for the MR hosts the next hop in the path to the DHCPv6 server: either the DHCPv6 server or a relay agent that will forward message to the DHCPv6 server. Therefore, if the MR acts as a DHCPv6 relay agent, the MR MUST configure the DHCPv6 relay agent to forward DHCPv6 messages to the HA.

#### **[3.3.2.](#) Transmission of DHCPv6 messages**

In this configuration, when the DHCPv6 client in the MR sends a message, it hands the message to the DHCPv6 relay agent in the MR. The way in which this handoff takes place is beyond the scope of this document. The relay agent encapsulates the message from the client according to [RFC 3315](#) in a Relay-forward message and sends the



resulting DHCPv6 message to the HA. The relay agent sets the fields in the Relay-forward message as follows:

msg-type	RELAY-FORW
hop-count	1
link-address	A non-link-local address from the MR interface to the tunnel between the HA and MR
peer-address	A non-link-local address from the MR interface to the tunnel between the HA and MR
options	MUST include a "Relay Message option" [ <a href="#">RFC3315</a> ]; MAY include other options added by the relay agent.

### **[3.3.3.](#) Receipt of DHCPv6 messages**

In this configuration, messages from the DHCPv6 server will be returned to the DHCPv6 relay agent, with the message for the DHCPv6 client encapsulated in the Relay Message option [[RFC3315](#)] in a Relay-reply message. The relay agent function extracts the message for the client from the Relay Message option and hands the message to the DHCPv6 client in the MR. The way in which this handoff takes place is beyond the scope of this document.

### **[3.4.](#) Exchanging DHCPv6 messages when MR is at home**

When the MR is on its home link, the HA uses the home link to exchange DHCPv6PD messages with the MR. It is the responsibility of the implementation to determine when the MR is on its home link and to avoid use of any existing tunnel.

### **[3.5.](#) Minimizing DHCPv6PD messages**

DHCPv6PD in a Mobile Network can be combined with the Rapid Commit option [[RFC3315](#)] to provide DHCPv6 prefix delegation with a two message exchange between the mobile node and the DHCPv6 PD server.

### **[3.6.](#) DHCPv6PD and DHAAD**

The MR acting as RR needs a direct link to the DR (or relay) function. When the MR is away from Home, that link is the MRHA tunnel. If a MR needs to obtain a prefix by means of DHCPv6PD, it has to locate a HA that is capable of serving either as a DHCPv6PD relay agent or server. Since the use of DHCPv6PD is optional and comes as an addition to existing protocols [[RFC3775](#)] and [[RFC3963](#)], it can not be expected that all HAs are DHCPv6PD capable.

This specification extends Dynamic Home Agent Address Discovery and the Home Agent Information Option in order to enable the detection by a MR of all HAs that are DHCPv6PD capable. A new 'D' bit is introduced to let Home Agents advertise that they are willing to









there is no need in an implementation to support the case where some HAs would support Mobile Routers while others would be participating to DHCPv6 Prefix Delegation but none could do both.

If none of the Home Agents support DHCPv6PD, the Home Agent MAY reply with a list of Home Agents that only support NEMO basic Mobile Routers or Mobile IPv6 Mobile Nodes. In this case, the DHCPv6PD Support Flag MUST be set to 0.

The modified message format is as follows.

```

      0               1               2               3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|      Type      |      Code      |      Checksum      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|      Identifier      |R|D|      Reserved      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|
+
+
|
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

#### DHCPv6PD Support Flag (D)

A one-bit flag that when set indicates that the Home Agents listed in this message participate to DHCPv6 Prefix Delegation.

For a description of the other fields in the message, see [[RFC3775](#)] and [[RFC 3963](#)].

#### **3.6.3. Modified Home Agent Information Option**

A new flag (D) (Support for DHCPv6PD) is introduced in the Home Agent Information Option defined in [[RFC3775](#)] and [[RFC 3963](#)].

If a Home Agent participates to DHCPv6PD, it SHOULD set the flag. If the HA sets the 'D' flag, then it MUST also set the 'R' flag, Indicating that it supports Mobile Routers, as defined in [[RFC 3963](#)].



In implicit mode, the HA must save the delegated prefix with the binding cache entry of the Mobile Router. When the BCE is cleared, the HA loses the information about the delegated prefix. Because the MR will use DHCPv6 when it reestablishes its tunnel to the HA (see [Section 3.1](#)), the HA will be able to add the delegated prefix back to



the BCE.

At the time this draft was written, one way in which a DR can explicitly notify a relay agent about delegated prefixes, is to use the "DHCP Relay Agent Assignment Notification Option" [[I-D.ietf-dhc-dhcpv6-agentopt-delegate](#)].

Another alternative, if the RR is part of the same administrative domain as the home network to which it is attached through the HA, and the RR can be trusted, the RR can use a routing protocol like OSPF to advertise any delegated prefixes.

NEMO explicit mode is recommended to take advantage of the function already defined for NEMO.

### **3.8. Other DHCPv6 functions**

The DHCPv6 messages exchanged between the MR and the HA may also be used for other DHCPv6 functions in addition to DHCPv6PD. For example, the HA may assign global addresses to the MR and may pass other configuration information such as a list of available DNS recursive resolvers to the MR using the same DHCPv6 messages as used for DHCPv6PD.

The HA may act as a DHCPv6 relay agent for MHs while it acts as a DR for MRs.

## **4. Changes in this draft**

This document is based on [draft-ietf-nemo-dhcpv6-pd-03](#) and includes the use of the DHCPv6 relay agent in the MR, as described in [Section 3.3](#), from [draft-dupont-mext-dhcrelay-00](#).

## **5. Security Considerations**

This document describes the use of DHCPv6 for prefix delegation in Mobile Networks. It does not introduce any additional security considerations beyond those described in the "Security Considerations" section of the DHCPv6 base specification [[RFC3315](#)] and the "Security Considerations" of the DHCPv6 Prefix Delegation specification [[RFC3633](#)].

Following the DHCPv6 Prefix Delegation specification, HAs and MRs SHOULD use DHCPv6 authentication as described in section "Authentication of DHCP messages" of the DHCPv6 specification [[RFC3315](#)], to guard against attacks mounted through prefix





delegation.

## 6. IANA Considerations

This document describes the use of DHCPv6 for prefix delegation in Mobile Networks. It does not introduce any additional IANA considerations.

## 7. Normative References

- [RFC3633] Troan, O. and R. Droms, "IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6", [RFC 3633](#), December 2003.
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