DHCP Option for Home Information Discovery in MIPv6
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Abstract

This draft defines a DHCP-based scheme to enable dynamic discovery of Mobile IPv6 home agent address, home address, and home subnet. New DHCP options are defined to carry the information from a DHCP server to the DHCP client running on the mobile node.

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1. Introduction

Before a mobile node can engage in Mobile IPv6 signaling with a home agent, it should either know the IP address of the home agent via preconfiguration, or dynamically discover it. Mobile IPv6 specification \[2\] describes how home agents can be dynamically discovered by mobile nodes that know the home subnet prefix. This scheme does not work when prefix information is not already available to the mobile node. This problem can be solved by delivering one or more home subnet prefix information to the mobile node by means of DHCP. Subsequently, the mobile node can engage in dynamic home agent discovery using the prefix information. In addition to delivering the prefix information, DHCP can also be used to provide the IP addresses or FQDNs of the home agents that are available to the mobile node and the home address that the mobile node can use to register with the home agent.

The solution involves defining new DHCP options to carry home subnet prefix, home agent IP address, home agent’s FQDN information, and home address of the mobile node. A similar solution has already been defined for Mobile IPv4 home agents \[3\].

As part of configuring the initial TCP/IP parameters, a mobile node can obtain home network information for the subnet it is directly attached to, other subnets in the visited domain, or a subnet from its home domain. A mobile node can convey the target home subnet’s identity in order to receive corresponding information. For example the mobile node can provide realm portion of its user NAI (Network Access Identifier) and expect that a home network information from its home domain is returned. The availability of the requested information depends on the DHCP server having prior knowledge or dynamically discovering it. While the specific details are outside the scope of this document, use of static tables and AAA-assisted discovery are possible options \[8\].

The mobile node may or may not be connected to the "home" subnet when it attempts to learn Mobile IPv6 home network information. This allows operators to centrally deploy home agents while being able to bootstrap mobile nodes that are already roaming. This scenario also occurs when HMIP \[7\] is used, where the mobile node is required to discover the MAP (a special home agent) that is located multiple hops away from the mobile node’s attachment point.
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 [1].

Most of terms used in this draft are defined in Mobile IPv6 [2] and RFC3315 [4].
3.  DHCP options for HA Dynamic Discovery

This section introduces two DHCP options used for dynamic home agent discovery in Mobile IPv6.

3.1.  Home Network Identifier Option

This option is used to carry the identifier of the target home network. This identification allows mobile node to request information for a home subnet within the visited domain, or from a specific domain. It is assumed that the DHCP server has some mechanism to know or retrieve the requested Mobile IPv6 information such as [9]. The specifics of these mechanisms are outside the scope of this draft.

The mobile node MUST include this option along with its Option Request option in its request.

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|       OPTION_HNId             |           option-len          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     id-type   |A|   reserved  |                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                               +
|                                                               |
.                                                               .
.                                                               .
.                   Home Network Identifier                    .
.                                                               .
.                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

Home Network Identifier Option Format

option-code

OPTION_HNId (TBD)

option-len

Total length of the option

id-type

The type of Home Network Identifier:
0  Local (visited) domain

1  Network realm

A flag

A flag to specify whether the client requests a home address or not.

reserved

8-bit field reserved for future use. The value MUST be initialized to zero by the sender, and MUST be ignored by the receiver.

Id-type 0 indicates the mobile node is interested in learning the home network information that pertains to the immediately connected (visited) network. In that case, Home Network Identifier field is not used. This type can be used to discover local home agents in a visited network.

Id-type 1 indicates the format of Home Network Identifier field is a network realm as defined in [5]. In this case, the mobile node is interested in learning home network information that pertains to the given realm. This type can be used to discover home agents that are hosted by a user's home domain (as indicated by his/her NAI-based username -- user@HomeRealm).

If A flag is set in this option, the server should assign a home address to the client in the returned Home Network Information option. Otherwise, the server should not assign a home address option.

3.2. Home Network Information Option

This option is used to carry home network information to a mobile node in the form of one or more of home subnet prefix(es), home agent address(es), home agent FQDN(s), and mobile node's home address.

The server MUST provide all of the matching home subnet prefix(es), home agent address(es) or FQDN(s) in a Home Network Information option. If the server has no information to provide, it MUST set the option-len field to zero in this option. If the client set the A flag in Home Network Identifier option, it MUST provide an available home address to a client.
Home Network Information Option Format

option-code

OPTION_HNInf (TBD)

option-len

Total length of the option

hninfo-type

The type of following Home Network Information field. Possible values are:

0    Home subnet prefix
1    Complete IPv6 address of the home agent
2    FQDN of the home agent
3    IPv6 Home address

hninfo-len

8-bit unsigned integer. Total length of the following Home Network Information field.
Home Network Information

A home subnet prefix, home agent IP address, FQDN and home address to be assigned to a mobile node.

When hninfo-type is set to 0, the data field MUST contain 8-bit prefix length information followed by a 128-bit IPv6 address beginning with the available network prefix.

When hninfo-type is set to 1, the data field MUST contain a 128-bit IPv6 address of the home agent.

When hninfo-type is set to 2, the data field MUST contain a FQDN as described in RFC1035 [6].

When hninfo-type is set to 3, the data field MUST contain the 8-bit reserved field, 8-bit prefix length field of the following home address, 32-bit lifetime of the following home address and the 128-bit home address to be assigned to a client. The lifetime is expressed in units of seconds.

The home address, or hninfo-type = 3, should be included if and only if the client sets A flag in Home Network Identifier option. Setting the lifetime to 0xffffffff ("infinity") means a permanent assignment of an address to the client. The lifetime of the assigned home address should not be longer than the lifetime of its prefix since the home address cannot survive the prefix lifetime.

If id-type is 0 in Home Network Identifier option, the server should reply with the available home agent(es) or home address information in the visited network. Otherwise, it should return that information in the specified home network in Home Network Identifier field in the request option.

Single option can carry multiple information preceded by hninfo-type and hninfo-len fields. The length fields help identify the information boundaries.
4. Option Usage

The requesting and sending of this option follows the rules for DHCP options in [4].

4.1. DHCP Server - Home Agent Relation

The DHCP server does not have to be co-located with a home agent, or even be on the home subnet of the mobile node. Its location with respect to home network does not matter as long as it possesses the requested information.

4.2. Mobile Node Considerations

When a Mobile IPv6 mobile node finds itself with neither a home subnet prefix/home address nor a home agent address, it may request the needed information with Option Request option. For instance, a mobile node connecting to a network for the first time may acquire a DHCP address and solicit for home network information at the same time.

A mobile node MUST identify the desired information with Home Network Identifier option. For example, a DHCP server may have information about home agents from several domains (and subnets). It relies on the mobile node to select the domain for determining which ones it should provide in response to the client’s request.

When the mobile node gets more than one home agent address, it MUST have a selection mechanism to determine which one to use for establishing a Mobile IPv6 session. In case it retrieves only home subnet prefix(es), it needs to perform dynamic home agent discovery to learn the IP addresses of the home agents. Similarly, if FQDN of a home agent is retrieved, the mobile node can use DNS to resolve it to IPv6 address(es) of the home agents. If the mobile node receives both IPv6 address(es) and FQDN(s) of the home agents, it SHALL use the IPv6 information of the home agents. When the mobile node requests and receives the home address information from the DHCP server, it SHALL use it to perform Mobile IPv6 home registration. For detailed mobile node behavior, refer to section 3.6 of [9].

When an MN sends a Binding Update message to home agent by using HoA which is assigned in Home Network Information option, the requested lifetime in Binding Update message MUST not be shorter than the lifetime of the HoA. Since the HoA lifetime is not greater than its prefix lifetime, it is guaranteed that binding cache entry’s lifetime is not greater than the home prefix lifetime. Note that, according to 10.3.1 of MIPv6, the lifetime for the binding cache entry MUST NOT be greater than the remaining valid lifetime for the subnet prefix of
HoA specified with the Binding Update.

4.3. DHCP Server Considerations

It is assumed that the DHCP server has access to home network information for its clients for this option to be useful. The DHCP server can rely on pre-configuration, or some dynamic discovery mechanisms for obtaining this information. In case it does not have any information, or it cannot locate matching information based on Home Network Identifier, it returns a Home Network Information option with 0-length data. The DHCP server can either return the IPv6 address(es) of home agent or the FQDN(s) of home agents. It is not required for the DHCP server to return both.

When a DHCP server assigns a HoA to an MN, it should guarantee that the lifetime of assigned HoA MUST NOT be greater than that of the subnet prefix in the MN’s HoA. The lifetimes of HoAs for assignments are can be negotiated when the home prefix is delivered from the home agent, or configured by DHCP administrator’s policy. The details are outside the scope of this document.
5. Security Considerations

Secure delivery of home agent, home address, and home link information from a DHCP server to the mobile node (DHCP client) relies on the overall DHCP security. The particular option defined in this draft does not have additional impact on the DHCP security.

Aside from the DHCP client to server interaction, an operator must also ensure secure delivery of mobile IP information to the DHCP server. This is outside the scope of DHCP and the newly defined option.
6. IANA Consideration

This document introduces two new DHCPv6 options, Home Agent Request option and Home Agent Reply option. The type numbers for new DHCP options are currently TBD. An appropriate request will be made to IANA if this Internet draft gets accepted as an RFC.
7. Normative References


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