MIP6 Working Group   H. Jang
Internet-Draft   A. Yegin
Intended status: Standards Track   Samsung
Expires: November 23, 2008   K. Chowdhury
                                                   Starent Networks
                                                           J. Choi
                                                           Samsung
                                                      May 22, 2008

DHCP Options for Home Information Discovery in MIPv6
draft-ietf-mip6-hiopt-17.txt

Status of this Memo

Abstract

   This draft defines a DHCP-based scheme to enable dynamic discovery of
   Mobile IPv6 home network information. New DHCP options are defined
   which allow a mobile node to request the home agent IP address, FQDN,
   or home network prefix and obtain it via the DHCP response.

Table of Contents

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
   pre-configuration, or dynamically discover it. The Mobile IPv6
   specification [RFC3775] describes how home agents can be dynamically
   discovered by mobile nodes that know the home network prefix. This
   scheme does not work when prefix information is not already available
   to the mobile node. One architecture to solve this problem is
   described in [I-D.ietf-mip6-bootstrapping-integrated-dhc]. This
   document specifies extensions to stateless DHCPv6 [RFC3736] [RFC3315]
   to deliver the home agent information to the mobile node in the form
   of the IP address of the home agent or the FQDN of the home agent.
   The information delivered to the mobile node may also include the
   home prefix for the mobile node. The solution involves defining a
   new DHCP option to carry home network prefix, home agent IP address
   and FQDN information. The mobile node MAY also use the home prefix
   to discover the list of home agents serving the home prefix using the
   Dynamic Home Agent Address Discovery mechanism specified in
   [RFC3775].

   As part of configuring the initial TCP/IP parameters, a mobile node
   can find itself a suitable home agent. Such a home agent might
   reside in the access network that the mobile node connects to, or in
   a home network that the mobile node is associated with. A mobile
   node can indicate its home network identity when roaming to a visited
   network in order to obtain the MIP6 bootstrap parameters from the
   home network. As an example, the visited network may determine the
   home network of the mobile node based on the realm portion of the NAI
   (Network Access Identifier) [RFC4282] used in access authentication.

   The mobile node may or may not be connected to the "home" network
   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 HMIPv6 [I-D.ietf-mipshop-4140bis] 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].

General mobility terminology can be found in [RFC3753]. The
following additional terms, as defined in [RFC4640], are used in this
document:

   o Access Service Provider (ASP): A network operator that
     provides direct IP packet forwarding to and from the
     mobile node.

   o Mobility Service Provider (MSP): A service provider
     that provides Mobile IPv6 service. In order to obtain
     such service, the mobile node must be authenticated and
     authorized to use the Mobile IPv6 service.

   o Mobility Service Authorizer (MSA): A service provider
     that authorizes Mobile IPv6 service.

3. DHCP options for HA Dynamic Discovery
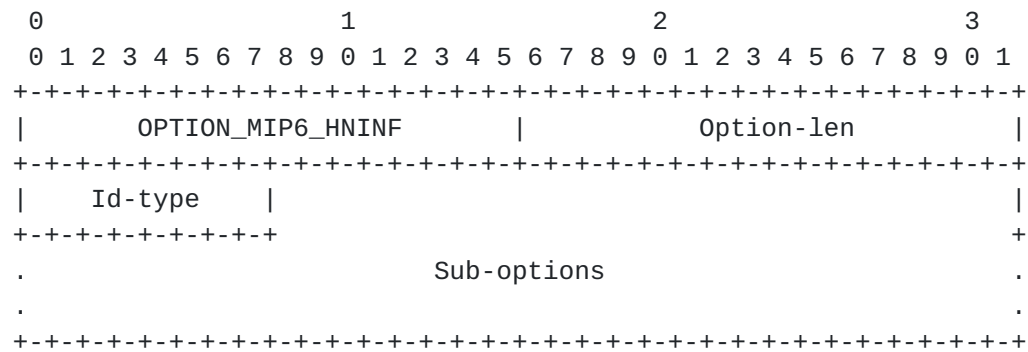
   This section introduces new DHCP options and their sub-options which
   are used for dynamic discovery of the home agent's IPv6 address, IPv6
   home network prefix, or FQDN information in Mobile IPv6. These
   options also carry an IPv4 address of the IPv6 home agent so that a
   mobile node can have access to Mobile IPv6 service over IPv4 as well.
   The detailed procedures are described in Section 2.3.2 of DSMIPv6
   (Mobile IPv6 support for dual stack Hosts and
   Routers)[I-D.ietf-mip6-nemo-v4traversal].

   The drafts [I-D.ietf-dime-mip6-integrated], [I-D.ietf-mip6-radius]
   and [I-D.ietf-mip6-bootstrapping-integrated-dhc] describe the
   complete procedure for home agent assignment among the mobile node,
   NAS (Network Access Server), DHCP and AAA entities for the
   bootstrapping procedure in the integrated scenario.

   A NAS is assumed to be co-located with a DHCP relay agent or a DHCP
   server in this solution. In a network where the NAS is not co-
   located with a DHCP relay nor a server, the server may not be
   provided with the home network information from the NAS, and thereby
   it may either fail to provide information, or provide home
   information which has been preconfigured by the administrator or
   which is acquired through a mechanism that is not described in this
   document.

3.1. Home Network Information Option

   This option is proposed to allow the exchange of home network
   information between the mobile node (DHCP client) and the DHCP
   server. It is used to indicate the target home network requested by
   the mobile node to the DHCP server in the Information-request
   message. In the Reply message, it conveys the home network
   information assigned by the DHCP server to the mobile node.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|       OPTION_MIP6_HNINF       |            Option-len         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Id-type     |                                               |
+-+-+-+-+-+-+-+-+                                               +
.                          Sub-options                          .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

    Option-code

        OPTION_MIP6_HNINF (TBD)

    Option-len

        1 + length of Sub-options in units of octets.

    Id-type

        The type of Home Network Information.

            0   Visited domain (local ASP)

            1   Target MSP

            2   No preference by the mobile node

    Sub-options

        A series of sub-options as specified in [Section 3.3](#).

The Id-type in the request specifies the location of the home network requested by the mobile node as below:
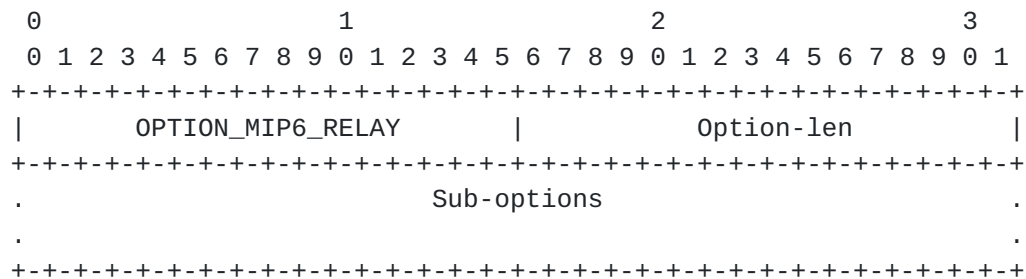
o The Id-type 0 indicates the mobile node is interested in
   learning the home network information that pertains to the
   currently visited network. This type can be used to
   discover local home agents in the local ASP. In this case,
   the Option-len is set to 1.

o The Id-type 1 indicates the mobile node is interested in
   learning the 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 or by any target
   domain. The option MUST carry a sub-option (defined in
   Section 3.3) whose Sub-opt-code is 1, which specifies the
   requested target MSP. The target MSP can be a mobile
   node's home MSP or any MSP which has a trusted roaming
   relationship with the mobile node's MSA.

o If the mobile node has no preference, the Id-type is set
   to 2 and the Option-len field is set to 1. In this case,
   the assignment of the home network information is within
   the server's own discretion. For a detailed description,
   refer to Section 4.

The Id-type in the reply indicates the location of the home network
information provided by the DHCP server which is carried in the
following sub-options.

Multiple sub-options may exist in a Home Network Information option
to carry more than one piece of home information.

3.2. MIP6 Relay Agent Option

This option carries the home network information for the mobile node
(the NAS may know this, for instance, through AAA by using
[I-D.ietf-mip6-radius] or [I-D.ietf-dime-mip6-integrated]) from the
DHCP relay agent to the DHCP server. The DHCP relay agent sends this
option to the DHCP server in the Relay-forward message.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         OPTION_MIP6_RELAY         |          Option-len         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                         Sub-options                           .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

     Option-code

         OPTION_MIP6_RELAY (TBD)

     Option-len

         The length of Sub-options in units of octets.
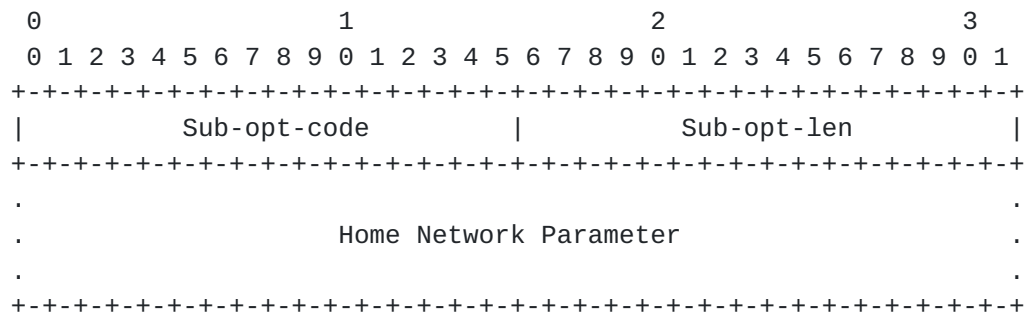
     Sub-options

         A series of sub-options as specified in [Section 3.3](#).

   Multiple sub-options may exist in a MIP6 Relay Agent option to carry
   more than one piece of home information.

3.3. Common Sub-options

   This sub-option is a container for a home network parameter in the
   Home Network Information option or in the MIP6 Relay Agent option.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Sub-opt-code       |            Sub-opt-len        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                               .
.                    Home Network Parameter                    .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

     Sub-opt-code

          A 16-bit unsigned integer for the type of the following
          Home Network Parameter field. Possible values are:

             0   Reserved

             1   Home network identifier

             2   IPv6 home network prefix

             3   IPv6 home agent address

             4   IPv4 address of the IPv6 home agent

             5   Home agent FQDN

             6 .. (2^16-1) Reserved

     Sub-opt-len

          The length of the Home Network Parameter field in units
          of octets.

     Home Network Parameter

          The provided home network information according to the
          Sub-opt-code. This is encoded as specified below.

   While the Sub-opt-codes 1, 2, 3, 4, and 5 are available in the MIP6
   Relay Agent option and the Home Network Information option returned
   by the DHCP server, a value of 1 is the only Sub-opt-code available
   in the requesting Home Network Information option by the mobile node.

   When the Sub-opt-code is set to 1 in the request, the Home Network
   Parameter field MUST contain an identifier to specify the home
   network requested by the mobile node. This field MUST be set in the
   form of a FQDN [RFC1035], encoded as specified in Section 8 of

[RFC3315]. This sub-option in the request SHOULD be copied into the Home Network Information option returned in the reply.

When the Sub-opt-code is set to 2, the Home Network Parameter field MUST include the 8-bit Prefix-Len followed by the 128-bit IPv6 Home Network Prefix. The Prefix-Len information indicates the number of leading bits in the IPv6 Home Network Prefix that are valid. The prefix information is provided so that the mobile node can perform dynamic home agent discovery as defined in [RFC3775]. The information may also be used to allow the mobile node to determine whether the home agent information received via DHCPv6 corresponds to a home agent on-link or not.

When the Sub-opt-code is set to 3, the Home Network Parameter field MUST contain the 128-bit IPv6 address of the home agent.

When the Sub-opt-code is set to 4, the Home Network Parameter field MUST contain the 32-bit IPv4 address of the IPv6 home agent.

When the Sub-opt-code is set to 5, it MUST contain the FQDN of the home agent as described in Section 8 of [RFC3315].

4. Option Usage

   The requesting and sending of the proposed DHCP options follow the
   rules for DHCPv6 options in [RFC3315].

4.1. Mobile Node Behavior

   A mobile node does not need to perform the home information discovery
   procedure after every change in attachment. It may try to perform
   the home network information discovery when it lacks home network
   information for MIPv6 or needs to change the home agent for some
   reasons, for example, to recover from the single point of failure of
   the existing home agent or to use the local home agent located in the
   network where the mobile node is currently attached. Note that
   despite the home information discovery procedure the mobile node may
   decide to keep the old home agent still in use afterwards, in order
   to avoid losing the current sessions.

   For acquiring the home network information, a mobile node MUST send
   an Information-request message including the Home Network Information
   option according to the stateless DHCPv6 procedures
   [RFC3736][RFC3315]. The mobile node MUST also include the Option
   code for the Home Network Information option in the Option Request
   option in the request.

   During the process of requesting the bootstrapping information, the
   mobile node MUST clarify its preference about the requested home
   network with the Id-type in the Home Network Information option. If
   it does not care about the location of the home network where the
   home agent is to be assigned, it MUST clarify that fact by setting
   the Id-type to 2. Id-type 2 means that the mobile node has no
   preferred home network and is willing to use any information provided
   by the DHCP server. Once it decides where the home agent is to be
   assigned, the specific information to be assigned depends mainly on
   the server's policy or the server's knowledge.

   When the mobile node sets the Id-type to 1 in the request, it MUST
   include a sub-option with Sub-opt-code 1 which carries the FQDN of
   the target network such as "example.com". Note that a single Home
   Network Information option can carry at most one sub-option with Sub-
   opt-code 1.

   The mobile node MUST NOT include a Home Network Information option
   whose Id-type is other than 0, 1, and 2 as defined as Section 3.1.

   A value of 1 is the only Sub-opt-code available in the request.

   The mobile node can request more than one instance of home

information by using multiple Home Network Information options in the
request. For instance, if the mobile node wants to retrieve home
network information from both the visited network (ASP) and the
target MSP with a single transaction, it can request the information
by using two Home Network Information options with Id-type 0 and Id-
type 1. It can also request the home information for more than one
target MSPs at the same time by including multiple Home Network
Information options with Id-type 1. However, there MUST NOT be more
than one Home Network Information option with Id-type 0 nor more than
one Home Network Information option with Id-type 2 in the request.

On receiving the Reply message including a Home Network Information
option, the mobile node SHOULD check whether the option is valid. It
MUST ignore any option whose Id-type is other than 0, 1, and 2. It
MUST also ignore any sub-option in the reply whose Sub-opt-code is
other than 1, 2, 3, 4, and 5 as described in Section 3.3.

When the mobile node obtains a Home Network Information option with
Id-type 1, it SHOULD check whether the returned option includes the
home network identifier in its sub-options. If it is not provided in
the sub-options, the Home Network Information option MUST be ignored
and skipped. The home network identifiers provide a way to match the
Home Network Information options in the request and the reply when
the mobile node has sent the request with multiple Home Network
Information options with the same Id-type 1 but with different home
network identifiers.

As described later in Section 4.3, servers attempt to place multiple
options and in the order of preference. When provided with multiple
Home Network Information options having different id-types or with
multiple sub-options for the same id-type, the mobile node SHOULD
choose the first one that it can employ.

If the mobile node attempts to retrieve information in its current
network but fails, it SHOULD employ previously retrieved information.
If no information has been retrieved previously and there is no
configuration that enables the mobile node to find and use a home
agent, the mobile node SHOULD log an error and, depending on
configured policy, revert to network access without a mobility
protocol.

4.2. NAS/DHCP Relay Agent Behavior

As described in Section 3, a NAS is assumed to be co-located with a
DHCP relay or a DHCP server. The NAS communicates with the mobile
node during the network access authentication and typically also
interacts with backend AAA systems. It is expected that the NAS is
or becomes aware of the mobility related information for the mobile

node at this time using mechanisms such as Diameter attributes
[I-D.ietf-dime-mip6-integrated] or RADIUS attributes
[I-D.ietf-mip6-radius]. The NAS passes the information to the co-
located DHCP relay agent or the server. The following describes the
behavior of the DHCP relay agent when the NAS functions as a DHCP
relay.

When receiving a DHCP message from the mobile node, the DHCP relay
agent forwards the message to the All_DHCP_Servers multicast address,
or other addresses configured by the network administrator as per
[RFC3315]. If the relay determines that the NAS has passed home
network information for this mobile node and has available home
information for it, it SHOULD include the home network information in
a MIP6 Relay Agent option, and attach this option in the Relay-
forward message. When providing the home network information, the
relay MUST include a sub-option whose Sub-opt-code is 1, and set the
Home Network Parameter field to the FQDN of the network where the
home information is assigned. That FQDN information will be compared
with the target MSP requested by the mobile node when a DHCP server
searches for the matching information.

The relay SHOULD include each home network parameter in a sub-option,
and include all sub-options in a single MIP6 Relay Agent option. It
MUST NOT include any sub-option whose Sub-opt-code is other than 1,
2, 3, 4, and 5 as described in Section 3.3.

In case the DHCP relay does not maintain any home network information
for the requesting mobile node, it simply forwards the received
message to the DHCP server according to the [RFC3315].

Upon receiving a Relay-reply message from the DHCPv6 server, the
relay SHALL follow the guidelines defined in [RFC3315]. It extracts
a Reply message from the Relay Message option in the Relay-reply
message and relays it to the mobile node.

4.3. DHCP Server Behavior

When the server receives a Relay-forward message, it may include the
MIP6 Relay Agent option in case there was home information available
for the mobile node at the relay. The MIP6 Relay Agent option which
does not include a sub-option with Sub-opt-code 1 MUST be ignored.
Otherwise, the home network information received from the relay
SHOULD be kept in the server so that the server can provide the
information when it is requested by the mobile node. The server may
carry this in the reply when the mobile node requested the home
network information with an Id-type of 1.

The server MUST ignore any sub-option in a MIP6 Relay Agent option

whose Sub-opt-code is other than 1, 2, 3, 4, and 5, as described in
Section 3.3.

When a DHCP server receives an Information-request message either
directly or encapsulated in a Relay-forward message, it SHOULD check
whether the Information-request includes the Home Network Information
option. If the mobile node included a Home Network Information
option and a Home Network Information option is requested by the
Option Request option in the Information-request, the server MUST
include a Home Network Information option in the Reply message.

The server MUST ignore any Home Network Information option in the
request whose Id-type is other than 0, 1, and 2 as described in
Section 3.1. It MUST also ignore any sub-option in the request whose
Sub-opt-code is not 1.

It MUST construct the Home Network Information option(s) according to
the following logic, and include it or them in the Reply. In case
the Information-request message includes:

   o A. Home Network Information option with Id-type 0

     The DHCP server MUST include each configured local home
     network parameter in a sub-option, and include all
     sub-options in a single Home Network Information option.
     It MUST set the Id-type to 0 in the Home Network Information
     option to be returned.

   o B. Home Network Information option with Id-type 1

     Any Home Network Information option which carries more than
     one target MSP or which does not carry any target MSP MUST be
     ignored. Otherwise, the DHCP server searches its database
     by using the received target MSP as a key. If the DHCP server
     has home network information for the target MSP, it MUST include
     each home network parameter in a sub-option, and include all
     these sub-options in a single Home Network Information option.
     It MUST set the Id-type to 1 in the Home Network Information
     option to be returned, and copy the sub-option of the request
     which includes the target MSP into the Home Network Information
     option to be returned.

o C. Home Network Information option with Id-type 2

In this case, the assignment of home information relies
on the server's local policy, and the DHCP server is required
to have its own policy so that it can reply with the proper
information in the Home Network Information option. The policy
can be determined based on several factors such as home agent
availability and the authorization information of the mobile
node. However, the specific policy setting is not in the scope
of this document. For each instance of home network information
selected, the DHCP server MUST include each home network
parameter in a sub-option, and include all these sub-options
in a Home Network Information option with Id-type 0 or 1 in
the reply.

The server MUST NOT include a Home Network Information option in the
reply whose Id-type is other than 0, 1, and 2. It also MUST NOT
include a sub-option in the reply whose Sub-opt-code is other than 1,
2, 3, 4, and 5 as described in Section 3.3.

The Reply message can carry multiple Home Network Information
options. The provided multiple options SHOULD be listed in order of
preference. Multiple sub-options also SHOULD be listed in order of
preference within a single Home Network Information option.

Note that there MUST NOT be more than one Home Network Information
option with Id-type 0 nor more than one Home Network Information
option with Id-type 2 in the reply. The value of Id-type 2 is valid
in the reply only when the server received the option with Id-type 2
but has no data to be returned to the mobile node.

In case the server cannot find any home information, it must proceed
as follows:

o For Id-type 0 or 2, it MUST return a Home Network
Information option with the Id-type set to the requested
Id-type and the Option-len set to 1.

o In case of Id-type 1 in the request, it MUST return a Home
Network Information option by setting the Id-type to 1,
include the Home Network Information sub-option with the
target MSP, and set the Option-len to 1 + the length of
this sub-option.

There is no requirement that the server return this option and its
data in a Relay message as another Relay Agent option
[RFC4580][RFC4649].

The DHCP server should provide all of the matching home information
in Home Network Information option(s) based on its policy. While
searching for the home network information by using the target MSP as
a key, it may return the results when the key is partially matched.
For example, on receipt of a Home Network Information option which
specifies "xxx.example.com" as the target network, it may return the
home network information assigned for "example.com" to the mobile
node. Note that the detailed rule for returning partially matched
instances of home network information follows the server's own policy
and is outside the scope of this document.

There can be several ways that the DHCP server knows the requested
home network information. For instance, as described in
[I-D.ietf-mip6-radius] and [I-D.ietf-dime-mip6-integrated], a NAS can
learn the information via RADIUS or Diameter, respectively, during
network access authentication, and the DHCP relay co-located with the
NAS can transfer it to the DHCP server by using the DHCP option
specified in Section 3.2 and Section 3.3. Or the home information
may have been configured statically in the DHCP server by the
administrator. However, the mechanism by which the DHCP server is
provisioned with the home network information or obtains it
dynamically is outside the scope of this document.

5. Security Considerations

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

   The mechanisms in this specification could be used by attackers to
   learn the addresses of home agents in the home network, or to feed
   incorrect information to mobile nodes.

   The ability to learn addresses of nodes may be useful to attackers
   because brute-force scanning of the address space is not practical
   with IPv6. Thus, they could benefit from any means which make
   mapping the networks easier. For example, if a security threat
   targeted at routers or even home agents is discovered, having a
   simple mechanism to easily find out possible targets may prove to be
   an additional security risk.

   Apart from discovering the address(es) of home agents, attackers will
   not be able to learn much from this information, and mobile nodes
   cannot be tricked into using wrong home agents, as the actual
   communication with the home agents employs mutual authentication.

   The mechanisms from this specification may also leak interesting
   information about network topology and prefixes to attackers, and
   where there is no security to protect DHCP, even modify this
   information. Again, the mobile nodes and home agents employ end-to-
   end security when they communicate with each other. The authentic
   source of all information is that communication, not the information
   from DHCP.

   However, attacks against the information carried in DHCP may lead to
   denial-of-service if mobile nodes are unable to connect to any home
   agent, or choose a home agent that is not the most preferred one.

6. **IANA Consideration**

   IANA is requested to assign the following new DHCPv6 Option Codes,
   DHCPv6 Sub-option Codes, and Id-type Codes in the registry maintained
   in http://www.iana.org/assignments/dhcpv6-parameters:

   IANA is requested to assign the following new DHCPv6 Option Codes:

      o OPTION_MIP6_HNINF for the Home Network Information option
      o OPTION_MIP6_RELAY for the MIP6 Relay Agent option

   The Sub-option Codes for the Home Network Information option and the
   MIP6 Relay Agent option share a common namespace, and should be
   placed under the same registry. These Sub-option Codes should be
   placed in a new name space "DHCPv6 Mobile IPv6 Sub-option Codes".

      o Reserved   0
      o Home network identifier   1
      o IPv6 Home network prefix   2
      o IPv6 Home agent address   3
      o IPv4 address of the IPv6 home agent   4
      o Home agent FQDN   5
      o Reserved   6 .. (2^16-1)

   IANA is requested to create a new registry for the Home Network
   Information Option Id-type Codes.

      o Visited domain (local ASP)   0
      o Target MSP   1
      o No preference by the mobile node 2

   New Codes for these name spaces can be allocated using Standards
   Action or IESG approval according to [RFC2434].

7. Acknowledgments

The authors would like to thank Kilian Weniger, Domagoj Premec,
Basavaraj Patil, Vijay Devarapalli, Gerardo Giaretta, Bernie Volz,
David W. Hankins, Behcet Sarikaya, Vidya Narayanan, Francis Dupont,
Sam Weiler, Jari Arkko, Alfred Hoenes, Suresh Krishnan, and Miguel A.
Diaz for their valuable feedback.

8. References

8.1. Normative References

   [I-D.ietf-mip6-bootstrapping-integrated-dhc]
              Chowdhury, K. and A. Yegin, "MIP6-bootstrapping for the
              Integrated Scenario",
              draft-ietf-mip6-bootstrapping-integrated-dhc-06 (work in
              progress), April 2008.

   [I-D.ietf-mip6-nemo-v4traversal]
              Soliman, H., "Mobile IPv6 support for dual stack Hosts and
              Routers (DSMIPv6)", draft-ietf-mip6-nemo-v4traversal-06
              (work in progress), November 2007.

   [RFC1035] Mockapetris, P., "Domain names - implementation and
              specification", STD 13, RFC 1035, November 1987.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC2434] Narten, T. and H. Alvestrand, "Guidelines for Writing an
              IANA Considerations Section in RFCs", BCP 26, RFC 2434,
              October 1998.

   [RFC3315] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C.,
              and M. Carney, "Dynamic Host Configuration Protocol for
              IPv6 (DHCPv6)", RFC 3315, July 2003.

   [RFC3736] Droms, R., "Stateless Dynamic Host Configuration Protocol
              (DHCP) Service for IPv6", RFC 3736, April 2004.

   [RFC3775] Johnson, D., Perkins, C., and J. Arkko, "Mobility Support
              in IPv6", RFC 3775, June 2004.

   [RFC4282] Aboba, B., Beadles, M., Arkko, J., and P. Eronen, "The
              Network Access Identifier", RFC 4282, December 2005.

   [RFC4580] Volz, B., "Dynamic Host Configuration Protocol for IPv6
              (DHCPv6) Relay Agent Subscriber-ID Option", RFC 4580,
              June 2006.

   [RFC4649] Volz, B., "Dynamic Host Configuration Protocol for IPv6
              (DHCPv6) Relay Agent Remote-ID Option", RFC 4649,
              August 2006.

8.2. Informative References

   [I-D.ietf-dime-mip6-integrated]
              Korhonen, J., Bournelle, J., Tschofenig, H., Perkins, C.,
              and K. Chowdhury, "Diameter Mobile IPv6: Support for
              Network Access Server to Diameter Server Interaction",
              draft-ietf-dime-mip6-integrated-08 (work in progress),
              February 2008.

   [I-D.ietf-mip6-radius]
              Chowdhury, K., "RADIUS Mobile IPv6 Support",
              draft-ietf-mip6-radius-04 (work in progress),
              February 2008.

   [I-D.ietf-mipshop-4140bis]
              Castelluccia, C., "Hierarchical Mobile IPv6 Mobility
              Management (HMIPv6)", draft-ietf-mipshop-4140bis-02 (work
              in progress), April 2008.

   [RFC3753] Manner, J. and M. Kojo, "Mobility Related Terminology",
              RFC 3753, June 2004.

   [RFC4640] Patel, A. and G. Giaretta, "Problem Statement for
              bootstrapping Mobile IPv6 (MIPv6)", RFC 4640,
              September 2006.

Authors' Addresses

    Heejin Jang
    Samsung Advanced Institute of Technology
    P.O. Box 111
    Suwon 440-600
    Korea

    Email: heejin.jang@samsung.com

    Alper E. Yegin
    Samsung Electronics
    Istanbul
    Turkey

    Email: a.yegin@partner.samsung.com

    Kuntal Chowdhury
    Starent Networks
    30 International Place
    Tewksbury, MA 01876
    US

    Email: kchowdhury@starentnetworks.com

    JinHyeock Choi
    Samsung Advanced Institute of Technology
    P.O. Box 111
    Suwon 440-600
    Korea

    Email: jinchoe@samsung.com