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Mobility Header Home Agent Switch Message
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Abstract

   This document specifies a new Mobility Header message type that can
   be used between a home agent and mobile node to signal a mobile node
   that it should acquire a new home agent.

Conventions used in this document

   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 [1].

Table of Contents

1. **Introduction**

   RFC 3775 [2] contains no provision to allow a home agent to inform a
   mobile node that it needs to stop acting as the home agent for the
   mobile node. For example, a home agent may wish to handoff some of
   its mobile nodes to another home agent because it has become
   overloaded or it is going offline.

   This protocol describes a signaling message type that can be used to
   send a handoff notification between a home agent and mobile node.

2. **Scenarios**

   Here are some example scenarios where a home agent signaling message
   would be useful.

2.1 Overloaded

   There are a number of reasons a home agent might be considered
   overloaded. One might be that it is at, or near, its limit on the
   number of home bindings it is willing to accept. Another is that it
   has reached a pre-determined level of system resource usage - memory,
   cpu cycles, etc. In either case, it would be desirable for a home
   agent to reduce the number of home bindings before a failure occurs.

2.2 Load Balancing

   A home agent might know of other home agents that are not as heavily
   loaded as itself, learned through some other mechanism outside the
   scope of this document. An operator may wish to try and balance this
   load so a failure disrupts a smaller percentage of mobile nodes.

2.3 Maintenance

   Most operators do periodic maintenance in order to maintain
   reliability. If a home agent is being shutdown for maintenance, it
   would be desirable to inform mobile nodes so they do not lose
   mobility service.

2.4 Functional Load Balancing

   A Mobile IPv6 home agent provides mobile nodes with two basic
   services - a rendezvous server where correspondent nodes can find the
   current care-of address for the mobile node, and as an overlay router
   to tunnel traffic to/from the mobile node at its current care-of
   address.

   A mobility service provider could have two sets of home agents to
   handle the two functions. The rendezvous function could be handled
   by a machine specialized for high-speed transaction processing, while
   the overlay router function could be handled by a machine with high
   data throughput.

   A mobile node would start on the rendezvous server home agent and
   stay there if it does route optimization. However, if the original
   home agent detects that the mobile node is not doing route
   optimization, but instead reverse-tunneling traffic, it could
   redirect the mobile node to a home agent with better data throughput.

2.5 Home Agent Renumbering

   Periodically, a mobility service provider may want to shut-down home
   agent services at a set of IPv6 addresses and bring service back up
   at a new set of addresses. Note that this may not involve anything
   as complex as IPv6 network renumbering, it may just involve changing

the addresses of the home agents. With a signaling message, the
service provider could inform mobile nodes to look for a new home
agent.

3. **Home Agent Switch Message**

The Home Agent Switch message is used by the home agent to signal the
mobile node that it needs to stop acting as the home agent for the
mobile node, and that it should acquire a new home agent. Home Agent
Switch messages are sent as described in Section 4.

The message described below follows the Mobility Header format
specified in Section 6.1 of [2]:

```
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 | Payload Proto |  Header Len   |   MH Type    |    Reserved   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |           Checksum            |                              |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                              |
 |                                                              |
 .                                                              .
 .                        Message Data                          .
 .                                                              .
 |                                                              |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The Home Agent Switch Message uses the MH Type value (TBD). When
this value is indicated in the MH Type field, the format of the
Message Data field in the Mobility Header 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
                                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                                |# of Addresses |   Reserved    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+                                                               +
.                                                               .
.                     Home Agent Addresses                      .
.                                                               .
+                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+                                                               +
.                                                               .
.                      Mobility options                         .
.                                                               .
+                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

# of Addresses

  A 16-bit unsigned integer indicating the number of IPv6 home agent
  addresses in the message. If set to zero, the mobile node MUST
  perform home agent discovery.

Reserved

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

Home Agent Addresses

  A list of alternate home agent addresses for the mobile node. The
  number of addresses present in the list is indicated by the "# of
  Addresses" field in the Home Agent Switch message.

Mobility options

   Variable-length field of such length that the complete Mobility
   Header is an integer multiple of 8 octets long. This field
   contains zero of more TLV-encoded mobility options. The encoding
   and format of defined options MUST follow the format specified in
   Section 6.2 of [2]. The receiver MUST ignore and skip any options
   with it does not understand.

   This specification does not define any options valid for the Home
   Agent Switch message.

If no home agent addresses and no options are present in this
message, no padding is necessary and the Header Len field in the
Mobility Header will be set to 0.

4. **Home Agent Operation**

4.1 **Sending Home Agent Switch Messages**

When sending a Home Agent Switch message, the sending node constructs
the packet as it would any other Mobility Header, except:

  o The MH Type field MUST be set to (TBD).

  o If alternative home agent addresses are known, the sending home
     agent SHOULD include them in the list of suggested alternate
     home agents. The home agent addresses field should be
     constructed as described in Section 10.5.1 of [2], which will
     randomize addresses of the same preference in the list.

  o The "# of addresses" field MUST be filled-in corresponding to
     the number of home agent addresses included in the message. If
     no addresses are present, the field MUST be set to zero, forcing
     the mobile node to perform home agent discovery by some other
     means.

The Home Agent Switch message MUST use the home agent to mobile node
IPsec ESP authentication SA for integrity protection.

A home agent SHOULD send a Home Agent Switch message when a known
period of unavailability is pending so the mobile node has sufficient
time to find another suitable home agent.

The sending node does not need to be the current home agent for the
mobile node, for example as described in [3], but it MUST have a
security association with the mobile node so the message is not
rejected. In this case, the Home Agent Switch message SHOULD only
contain the address of the home agent sending the message in the Home

   Agent Addresses field, which implies the mobile node should switch to
   using the sender as its new home agent.

4.2 Retransmissions

   If the home agent does not receive a response from the mobile node -
   either a Binding Update message to delete its home binding if it is
   the current home agent, or a Binding Update message to create a home
   binding if it is not the current home agent, then it SHOULD
   retransmit the message, until a response is received. The initial
   value for the retransmission timer is INITIAL-HA-SWITCH-TIMEOUT.

   The retransmissions by the home agent MUST use an exponential back-
   off mechanism, in which the timeout period is doubled upon each
   retransmission, until either the home agent gets a response from the
   mobile node to delete its binding, or the timeout period reaches the
   value MAX-HA-SWITCH-TIMEOUT.

4.3 Mobile Node Errors

   If a mobile node does not understand how to process a Home Agent
   Switch Message, it will send a Binding Error message as described in
   Section 5.1.

   If a mobile node is unreachable, in other words, it still has a home
   binding with the home agent after reaching the timeout period of MAX-
   HA-SWITCH-TIMEOUT, the home agent SHOULD NOT make any conclusions
   about its status.

   In either case, the home agent SHOULD attempt to continue providing
   services until the lifetime of the binding expires.

   Attempts by the mobile node to extend the binding lifetime with a
   Binding Update message SHOULD be rejected, and a Binding
   Acknowledgement SHOULD be returned with status value 129
   (Administratively prohibited) as specified in Section 6.1.8 of [2].

5. Mobile Node Operation

5.1 Receiving Home Agent Switch Messages

   Upon receiving a Home Agent Switch message, the Mobility Header MUST
   be verified as specified in [2], specifically:

      o The Checksum, MH type, Payload Proto and Header Len fields
        MUST meet the requirements of Section 9.2 of [2].

      o The packet MUST be covered by the home agent to mobile node
        IPsec ESP authentication SA for integrity protection.

   If the packet is dropped due to the above tests, the receiving node
   MUST follow the processing rules as Section 9.2 of [2] defines. For
   example, it MUST send a Binding Error message with the Status field
   set to 2 (unrecognized MH Type value) if it does not support the
   message type.

   Upon receipt of a Home Agent Switch message, the mobile node MUST
   stop using its current home agent for services and MUST delete its
   home binding by sending a Binding Update message as described in [2].
   This acts as an acknowledgement of the Home Agent Switch message.
   Alternately, if the sender of the message is not the current home
   agent, sending a Binding Update message to create a home binding will
   act as an acknowledgement of the Home Agent Switch message.

   If the Home Agent Switch message contains a list of alternate home
   agent addresses, the mobile node SHOULD select a new home agent as
   described in Section 5.2, and establish the necessary IPsec security
   associations with the new home agent by whatever means required as
   part of the mobile node/home agent bootstrapping protocol for the
   home agent's mobility service provider. If no alternate home agent
   addresses are included in the list, the mobile node MUST first
   perform home agent discovery.

5.2 Selecting a Home Agent

   In most cases, the home agent addresses in the Home Agent Switch
   message will be of other home agents on the home link of the mobile
   node. In this case, the mobile node SHOULD select a new home agent
   from the addresses as they are ordered in the list. If the first
   address in the list is unable to provide service, then the subsequent
   addresses in the list should be tried in-order.

   In the case that the home agent addresses in the Home Agent Switch
   message are not all home agents on the home link of the mobile node
   (the computed prefix is different), the mobile node SHOULD select one
   on the home link first, if available, followed by home agents not on
   the home link. Choosing a home agent not on the home link might
   require a change of the home address for the mobile node, which could
   cause a loss of connectivity for any connections using the current
   home address.

6. Operational Considerations

   This document does not specify how an operator might use the Home
   Agent Switch message in its network. However, it might be the case
   that a home agent provides service for many thousands of mobile

nodes. Care should be taken to reduce the signaling overhead
required for handing off many mobile nodes to an alternate home
agent.

7. Procotol Constants

```
INITIAL-HA-SWITCH-TIMEOUT             5 seconds
MAX-HA-SWITCH-TIMEOUT                 20 seconds
```


8. IANA Considerations

A new Mobility Header type is required for the following new message
described in Section 3:

   (TBD) Home Agent Switch message

9. Security Considerations

As with other messages in [2], the Home Agent Switch message MUST use
the home agent to mobile node IPsec ESP authentication SA for
integrity protection.

The Home Agent Switch message MAY use the IPsec ESP SA in place for
Binding Updates and Acknowledgements as specified in Section 5.1 of
[2], in order to reduce the number of configured security
associations. This also gives the message authenticity protection.

Some operators may not want to reveal the list of home agents to on-
path listeners. In such a case, the Home Agent Switch message should
use the home agent to mobile node IPsec ESP encryption SA for
confidentiality protection.

10. References

10.1 Normative References

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

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

[10.2](#) Informative references

   [3] Wakikawa, R. (Editor), "Home Agent Reliability Protocol", [draft-ietf-mip6-hareliability-01.txt](#), October, 2006.

Acknowledgments

   We would like to thank the authors of a number of previous drafts
   that contributed content to this document:

        o [draft-wakikawa-mip6-nemo-haha-spec-00.txt](#)
        o [draft-deng-mip6-ha-loadbalance-02.txt](#)
        o [draft-kempf-mip6-ha-alert-00.txt](#)
        o [draft-haley-mip6-mh-signaling-00.txt](#)

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