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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].

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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 on the link 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

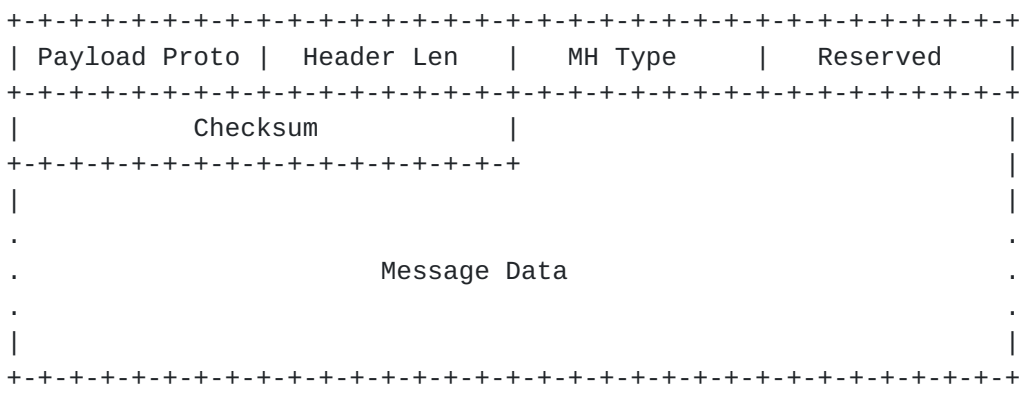
Periodically, a mobility service provider may want to shut-down home agent services at a set of IPv6 addresses and bring service back up at a new set of addresses. Note that this may not involve anything

as complex as IPv6 network renumbering, it may just involve changing the addresses of the home agents. There are various reasons why a mobility service provider might want to do this; an example is if the service provider revokes the account of a user it has reason to believe might use the old home agent address to disrupt service for other users. With a signaling message, the service provider could inform mobile nodes to look for a new home agent.

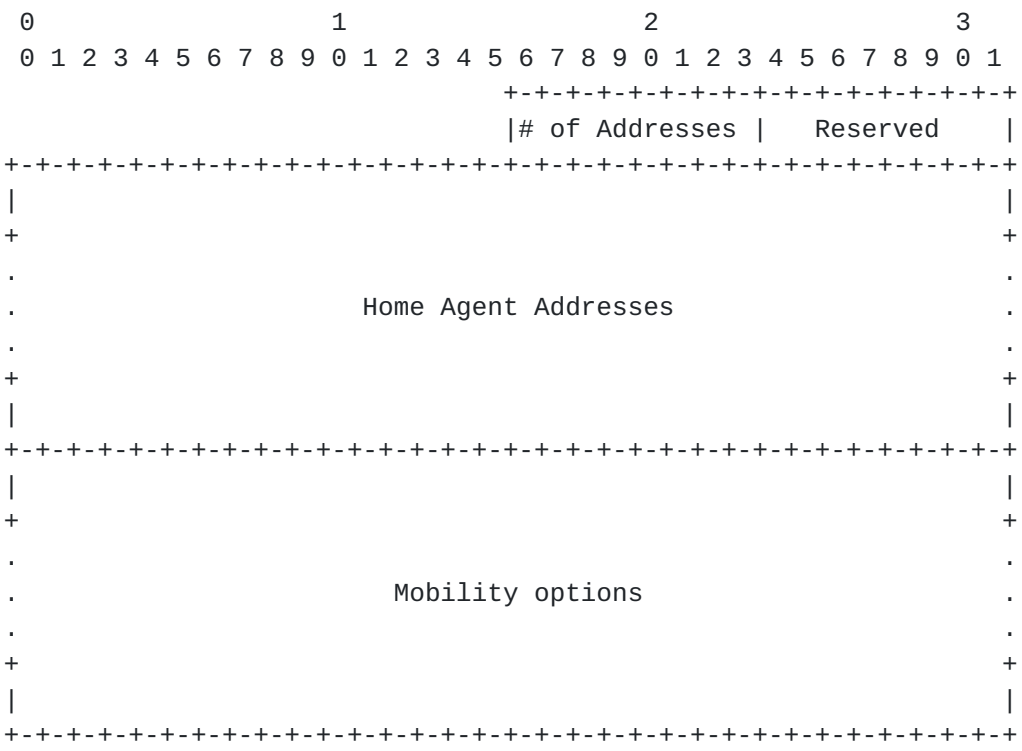
3. Home Agent Switch Message

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]:



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:



# 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 on the home link 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:

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

4.2 Retransmissions

If the home agent does not receive a response from the mobile node (a Binding Update message to delete its home binding), 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:

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

- 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.

If the Home Agent Switch message contains a list of alternate home agent addresses, the mobile node SHOULD select a home agent at random 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.

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 on the home link 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

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- draft-wakikawa-mip6-nemo-haha-spec-00.txt
- draft-deng-mip6-ha-loadbalance-02.txt
- draft-kempf-mip6-ha-alert-00.txt
- draft-haley-mip6-mh-signaling-00.txt

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