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Experimental Message, Extensions, and Error Codes for Mobile IPv4

Status of This Memo

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Abstract

Mobile IPv4 message types range from 0 to 255. This document reserves a message type for use by an individual, company, or organization for experimental purposes, to evaluate enhancements to Mobile IPv4 messages before a formal standards proposal is issued.

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1. Introduction

Mobile IPv4 message types range from 0 to 255. This document reserves a message type for experimental purposes, to evaluate enhancements to Mobile IPv4 messages before a formal standards proposal is issued.

Without experimental message capability, one would have to select a type value from the range defined for IANA assignment, which may result in collisions.

Within a message, Mobile IP defines a general extension mechanism allowing optional information to be carried by Mobile IP control messages. Extensions are not skippable if defined in the range [0-127] and are skippable if defined in the range [128-255]. This document reserves extension types in both the skippable and non-skippable ranges for experimental use.

Mobile IPv4 defines error codes for use by the FA [64-127] and HA [128-192]. This document reserves an error code in both of these ranges for experimental use.

The definition of experimental numbers in this document is made according to the recommendation of Section 2.2 of BCP 82, RFC 3692.

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 [1].

In addition, this document frequently uses the following terms:

EXP-MSG-TYPE: A Mobile-IPv4 message number assigned for experimental use. IANA has assigned message number 255 for this.

EXP-SKIP-EXT-TYPE: A Mobile-IPv4 and ICMP router discovery Agent Advertisement extension number assigned for experimental use. IANA has assigned extension number 255 for this.

EXP-NONSKIP-EXT-TYPE: A Mobile-IPv4 and ICMP router discovery Agent Advertisement extension number for experimental use. IANA has assigned extension number 127 for this.

EXP-HA-ERROR-CODE: A Mobile-IPv4 error code for use by the HA in MIPv4 reply messages to indicate an error condition. IANA has assigned error code 192 for this.

EXP-FA-ERROR-CODE: A Mobile-IPv4 error code for use by FA in reply messages to indicate an error condition. IANA has assigned error code 127 for this.

Mobility Entity: Entities as defined in [2] (home agent, foreign agent, and mobile node).

3. Experimental Message

As the nature and purpose of an experimental message cannot be known in advance, the structure is defined as having an opaque payload. Entities implementing the message can interpret the message according to their implementation. Interpreting based on extensions present in the message is one suggestion.

These messages may be used between the mobility entities (Home Agent, Foreign Agent, and Mobile Node). Experimental messages MUST be authenticated using any of the authentication mechanisms defined for Mobile IP ([2], [5]).

This message MAY contain extensions defined in Mobile IP, including vendor-specific extensions [4].

IP fields:

Source Address: Typically the interface address from which the message is sent.

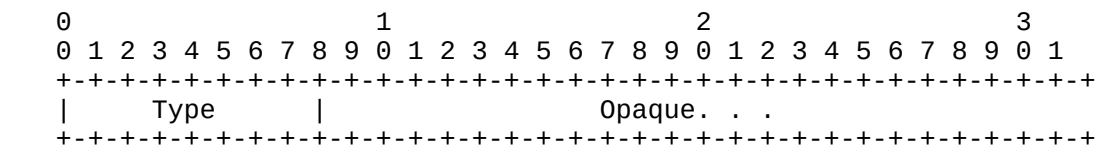
Destination Address: The address of the agent or the Mobile Node.

UDP fields:

Source Port Set according to RFC 768 (variable)

Destination Port Set to the value 434

Mobile IP fields shown below follow the UDP header.



Type 255 (EXP-MSG-TYPE)

Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

Once an experimental message has been tested and shown to be useful, a permanent number should be obtained through the normal IANA numbers assignment procedures.

A single experimental message type is defined. This message can contain extensions based on which the message can be interpreted.

Up-to-date values for the message types for Mobile IP control messages are specified in the most recent "Assigned Numbers" [3].

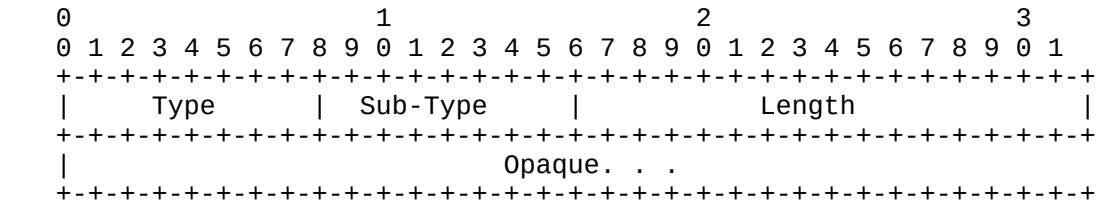
4. Experimental Extensions

This document reserves Mobile IPv4 extensions in both the skippable and non-skippable ranges for experimental purposes. The long extension format (for non-skippable extensions) and short extension format (for skippable extensions), as defined by [2], are used for Mobile IPv4 experimental extensions.

Also, ICMP router discovery extension numbers in both the skippable and non-skippable ranges are reserved for experimental use.

4.1. Non-skippable Mobile IPv4 Experimental Extension

This format is applicable for non-skippable extensions and may carry information more than 256 bytes.



Type 127 (EXP-NONSKIP-EXT-TYPE) is the type, which describes an experimental extension.

Sub-Type A unique number given to each member in the aggregated type.

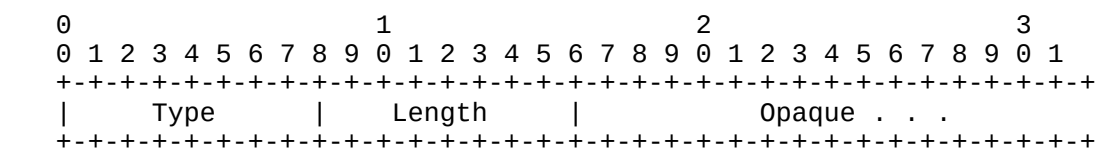
Length Indicates the length (in bytes) of the data field within this extension. It does NOT include the Type, Sub-Type, and Length fields.

Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

As the length field is 16 bits wide, the extension data can exceed 256 bytes in length.

4.2. Non-skippable ICMP Router Discovery Exp. Extension

This format is applicable for non-skippable extensions.



Type 127 (EXP-NONSKIP-EXT-TYPE) is the type, which describes an ICMP router discovery experimental extension.

Length Indicates the length (in bytes) of the data field within this extension. It does NOT include the Type and Length fields.

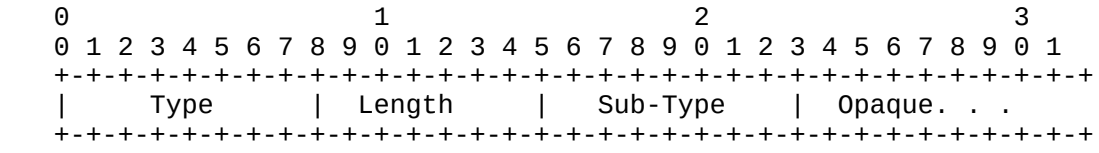
Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

A node that receives a router advertisement with this extension should ignore the extension if it does not recognize it.

A mobility entity that understands this extension but does not recognize it should drop (ignore) the router advertisement.

4.3. Skippable Mobile IPv4 Experimental Extension

This format is applicable for skippable extensions, which carry information less than 256 bytes.



Type 255 (EXP-SKIP-EXT-TYPE) is the type, which describes an experimental extension.

Length Indicates the length (in bytes) of the data field within this extension. It does NOT include the Type and Length fields.

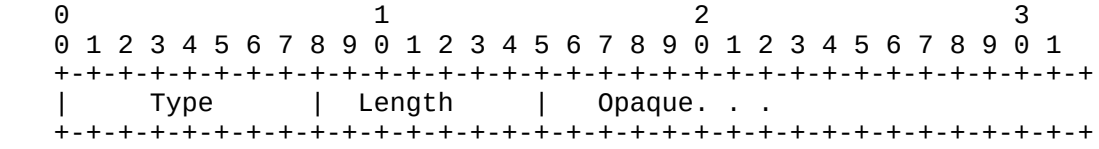
Sub-Type A unique number given to each member in the aggregated type.

Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

As the length field is 8 bits wide, the extension data cannot exceed 256 bytes in length.

4.4. Skippable ICMP Router Discovery Experimental Extension

This format is applicable for skippable ICMP router discovery extensions. This extension should be ignored if an implementation does not understand it.



Type 255 (EXP-SKIP-EXT-TYPE) is the type, which describes an experimental extension.

Length Indicates the length (in bytes) of the data field within this extension. It does NOT include the Type and Length fields.

Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

5. Experimental Error Codes

This document reserves the reply error code EXP-FA-ERROR-CODE for use by the FA. This document also reserves the reply error code EXP-HA-ERROR-CODE for use by the HA.

These experimental error codes may be used in registration reply messages.

It is recommended that experimental error codes be used with experimental messages and extensions whenever none of the standardized error codes are applicable.

6. Mobility Entity Considerations

Mobility entities can send and receive experimental messages. Implementations that don’t understand the message type SHOULD silently discard the message.

Experimental extensions can be carried in experimental messages and standards-defined messages. In the latter case, it is suggested that experimental extensions MUST NOT be used in deployed products and that usage be restricted to experiments only.

7. IANA Considerations

This document defines a control message to be used between mobility entities, two new extension formats, and two new error codes. To ensure correct interoperation based on this specification, IANA has reserved values in the Mobile IPv4 number space, as defined in [2], for one new message type, two new extensions, and two error codes.

7.1. New Message Type

A new Mobile IPv4 control message using UDP port 434, type 255 (EXP-MSG-TYPE), has been defined by IANA. This value has been taken from the same number space as Mobile IP Registration Request (Type = 1) and Mobile IP Registration Reply (Type = 3).

7.2. New Extension Values

The following extension types are introduced by this specification:

Experimental non-skippable extension: The value 127 (EXP-NONSKIP-EXT-TYPE) has been assigned from the numbering space for non-skippable extensions, which may appear in Mobile IPv4 control messages.

Also, the same number, 127 (EXP-NONSKIP-EXT-TYPE), has been assigned from the numbering space for non-skippable extensions, which may appear in ICMP router discovery messages.

Experimental skippable extension: The value 255 (EXP-SKIP-EXT-TYPE) has been assigned from the numbering space for skippable extensions, which may appear in Mobile IPv4 control messages.

Also, the same number, 255 (EXP-SKIP-EXT-TYPE), has been assigned from the numbering space for skippable extensions, which may appear in ICMP router discovery messages.

7.3. New Error Codes

The value 192 (EXP-HA-ERROR-CODE) has been defined by IANA to be used as a code field in messages generated by HA.

Also, the value 127 (EXP-FA-ERROR-CODE) has been defined by IANA to be used as the code field in messages generated by the FA.

8. Security Considerations

Like all Mobile IP control messages, the experimental messages MUST be authenticated per the requirements specified in [2] or [5]. Experimental messages without a valid authenticator SHOULD be discarded.

9. Backward Compatibility Considerations

Mobility entities that don't understand the experimental message MUST silently discard it.

Mobility entities that don't understand the experimental skippable extensions MUST ignore them. Mobility entities that don't understand the non-skippable experimental extensions MUST silently discard the message containing them. This behavior is consistent with section 1.8 of [2].

Foreign Agents and Home Agents SHOULD include an experimental error code in a reply message only if they have a general indication that the receiving entity would be able to parse it. This is indicated if the request message was of type EXP-MSG-TYPE or contained at least one experimental extension.

10. Acknowledgements

The authors would like to acknowledge Henrik Levkowetz for his detailed review of the document and suggestion to incorporate experimental extensions in this draft.

The authors would also like to acknowledge Thomas Narten for his initial review of the document and reference to [6] for general guidelines.

11. References

11.1. Normative References

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

[2] Perkins, C., "IP Mobility Support for IPv4", RFC 3344, August 2002.

[3] Reynolds, J., "Assigned Numbers: RFC 1700 is Replaced by an On-line Database", RFC 3232, January 2002.

11.2. Informative References

[4] Dommety, G. and K. Leung, "Mobile IP Vendor/Organization-Specific Extensions", RFC 3115, April 2001.

[5] Perkins, C. and P. Calhoun, "Mobile IPv4 Challenge/Response Extensions", RFC 3012, November 2000.

[6] Narten, T., "Assigning Experimental and Testing Numbers
     Considered Useful", BCP 82, RFC 3692, January 2004.

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