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Experimental Message, Extension and Error Codes for Mobile IPv4  
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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 purpose, to evaluate enhancements to Mobile IPv4 messages before formal standards proposal.

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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 formal standards proposal.

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

Also, Mobile IP defines a general extension mechanism to allow

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

This document defines and reserves experimental numbers as per the recommendation of [BCP 82 \(section 2.2\)](#), [RFC 3692](#).

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## 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 in the range [0-255] to be assigned by IANA for experimental use.

**EXP-SKIP-EXT-TYPE:** A Mobile-IPv4 and ICMP router discovery (advertisement) extension number in the range [128-255] to be assigned by IANA for experimental use.

**EXP-NONSKIP-EXT-TYPE:** A Mobile-IPv4 and ICMP router discovery (advertisement) extension number in the range [0-127] to be assigned by IANA for experimental use.

**EXP-HA-ERROR-CODE:** A Mobile-IPv4 error code in the range [128-192] for use by HA in reply messages to indicate error condition.

**EXP-FA-ERROR-CODE:** A Mobile-IPv4 error code in the range [64-

127] for use by FA in reply messages to indicate error condition.

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

### 3. Experimental Message

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

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

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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:

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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|      Type      |                               Opaque. . .
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---

```

Type           EXP-MSG-TYPE (To be assigned by IANA)

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 assignment procedures.

A single experimental message type is recommended since this message can contain extensions based on which the message can be interpreted.

#### 4. Experimental Extensions

This document reserves Mobile IPv4 extensions in both the skippable and non-skippable range 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.

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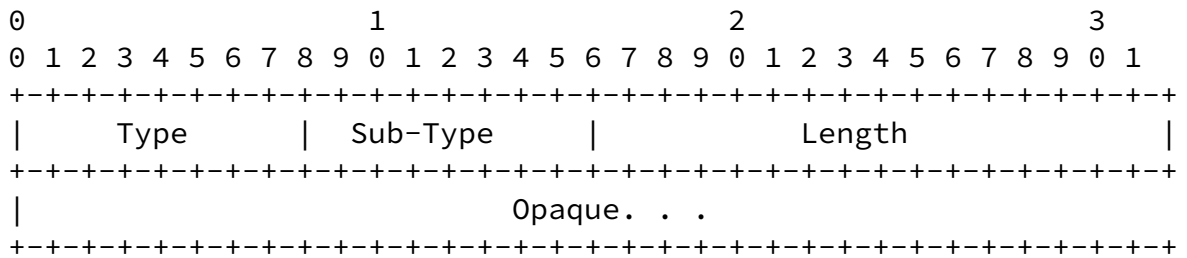
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Also, ICMP router discovery extension numbers in both the skippable and non-skippable range are reserved for experimental use.

##### 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      EXP-NONSKIP-EXT-TYPE (to be assigned by IANA) is the type, which describes an experimental extension.

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

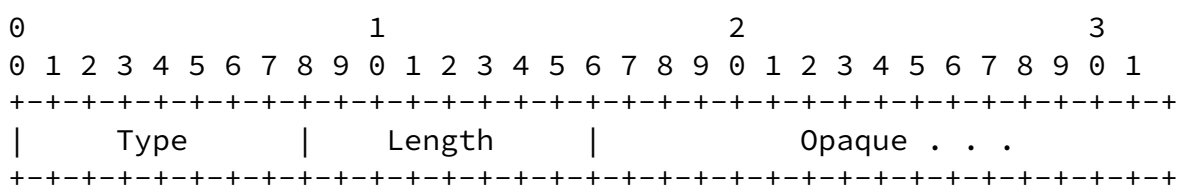
Length    Indicates the length (in bytes) of the data field within this extension. It does NOT include the Type, Sub-Type and Length bytes.

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

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

#### 4.2 Non-skippable Router Discovery Experimental Extension

This format is applicable for non-skippable extensions.



Type      EXP-NONSKIP-EXT-TYPE (to be assigned by IANA) 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, Sub-Type and Length bytes.

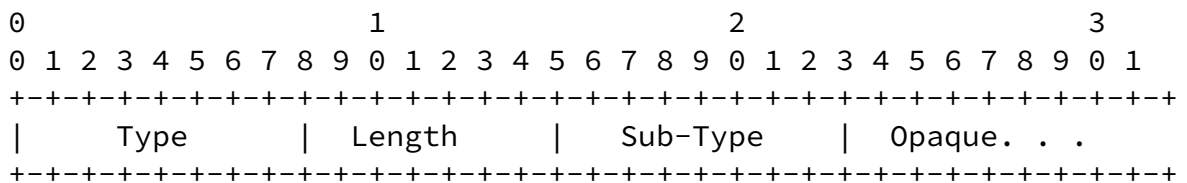
Opaque Zero or more octets of data, with structure defined only by the particular experiment it is used for.

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

A mobility entity, which 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 EXP-SKIP-EXT-TYPE (to be assigned by IANA) 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 bytes.

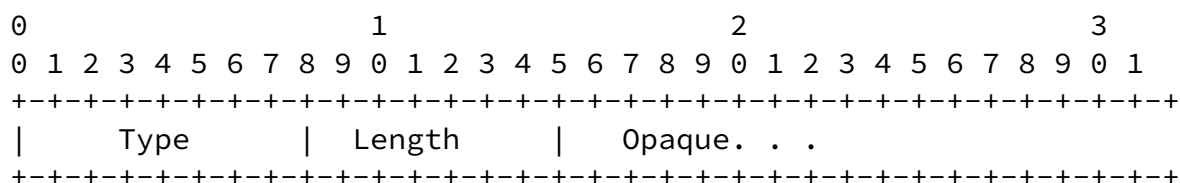
Sub-Type is a unique number given to each member in the aggregated type.

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

Since 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        EXP-SKIP-EXT-TYPE (to be assigned by IANA) 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 bytes.

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

A node, which receives a router advertisement with this extension should ignore the extension.

#### 5. Experimental Error Codes

This document reserves reply error code EXP-FA-ERROR-CODE, in the range [64-127], for use by the FA. This document also reserves reply error code EXP-HA-ERROR-CODE, in the range [128-192], for use by the HA.

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

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



## 6. Mobility Entity Considerations

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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 later case, it is suggested that experimental extensions MUST not be used in deployed products and usage be restricted to experimentations only.

## 7. IANA Considerations

IANA services are required for this draft. Since a new message type is needed to be reserved as experimental, a value must be assigned for EXP-MSG-TYPE from the Mobile IP control message space.

Also, values for EXP-NONSKIP-EXT-TYPE and EXP-SKIP-EXT-TYPE must be assigned for experimental extensions.

The value for EXP-NONSKIP-EXT-TYPE should be assigned from the numbering space for non-skippable extensions which may appear in control messages, and also (with the same number) from the numbering space for non-skippable extensions which may appear in ICMP router discovery messages. The value 127 is suggested in both cases.

The value for EXP-SKIP-EXT-TYPE should be assigned from the numbering space for skippable extensions which may appear in control messages, and also (with the same number) from the numbering space for skippable extensions which may appear in ICMP router discovery messages. The value 255 is suggested in both cases.

Also, values for EXP-HA-ERROR-CODE and EXP-FA-ERROR-CODE must be assigned for experimental error code. The suggested values are 192 for the EXP-HA-ERROR-CODE and 127 for the EXP-FA-ERROR-CODE.

## 8. Security Considerations

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

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## 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.

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

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## 11. Acknowledgements

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The authors would also like to acknowledge Thomas Narten for his initial review of the draft and reference to [\[6\]](#) for general guidelines.

## 12. References

### 12.1 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", [RFC 3344](#), August 2002.

- [3] Reynolds, J. and J. Postel, "Assigned Numbers", STD 2, [RFC 1700](#), October 1994.

## 12.2 Informative References

- [4] G. Dommety, K. Leung, "Mobile IP Vendor/Organization-Specific Extensions" [RFC 3115](#), April 2001
- [5] C. Perkins, P. Calhoun, "Mobile IPv4 Challenge/Response Extensions", [RFC 3012](#), November 2000
- [6] T. Narten, "Assigning Experimental and Testing Numbers Considered Useful", [BCP 82](#), [RFC 3692](#), January, 2004

## 13. Authors' Addresses

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