

Network Working Group  
Request for Comments: 3115  
Obsoletes: 3025  
Category: Standards Track

G. Dommety  
K. Leung  
Cisco Systems  
April 2001

## Mobile IP Vendor/Organization-Specific Extensions

### Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

### Copyright Notice

Copyright (C) The Internet Society (2001). All Rights Reserved.

### RFC Editor Note:

This memo corrects discrepancies between the values assigned for CVSE-TYPE-NUMBER and NVSE-TYPE-NUMBER in RFC 3025 and in the Internet Assigned Numbers Authority's (IANA) repository. The difference in the assigned values are as follows:

CVSE-TYPE-NUMBER = 37 in RFC 3025  
CVSE-TYPE-NUMBER = 38 in IANA (Under Mobile IP numbers)

NVSE-TYPE-NUMBER = 133 in RFC 3025  
NVSE-TYPE-NUMBER = 134 in IANA (Under Mobile IP numbers)

This memo obsoletes RFC 3025, since the current implementations follow the IANA assignments.

### Abstract

This document defines two new extensions to Mobile IP. These extensions will facilitate equipment vendors and organizations to make specific use of these extensions as they see fit for research or deployment purposes.

## 1. Introduction

Current specification of Mobile IP [1] does not allow for organizations and vendors to include organization/vendor-specific information in the Mobile IP messages. With the imminent wide scale deployment of Mobile IP it is useful to have vendor or organization-Specific Extensions to support this capability. This document defines two extensions that can be used for making organization specific extensions by vendors/organizations for their own specific purposes.

### 1.1. Specification Language

The keywords "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 [3].

In addition, the following words are used to signify the requirements of the specification.

#### silently discard

The implementation discards the datagram without further processing, and without indicating an error to the sender. The implementation SHOULD provide the capability of logging the error, including the contents of the discarded datagram, and SHOULD record the event in a statistics counter.

## 2. Vendor/Organization Specific Extensions

Two Vendor/Organization Specific Extensions are described, Critical (CVSE) and Normal (NVSE) Vendor/Organization Specific Extensions. The basic differences between the Critical and Normal Extensions are that when the Critical extension is encountered but not recognized, the message containing the extension MUST be silently discarded, whereas when a Normal Vendor/Organization Specific Extension is encountered but not recognized, the extension SHOULD be ignored, but the rest of the Extensions and message data MUST still be processed. Another difference between the two is that Critical Vendor/Organization Extension has a length field of two octets and the NVSE has a length field of only one octet.

2.1. Critical Vendor/Organization Specific Extension (CVSE)

The format of this extension is as shown below.

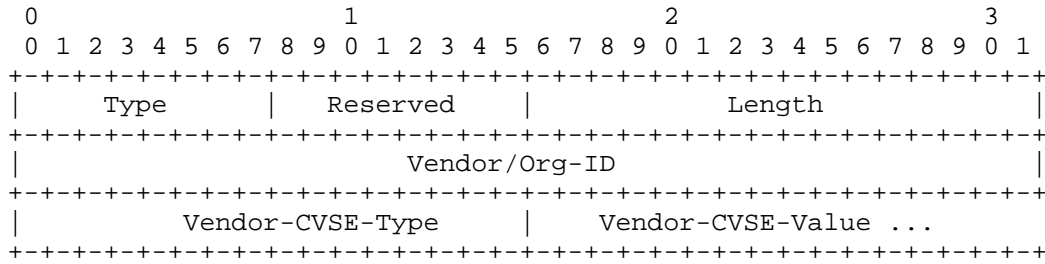


Figure 1: Critical Vendor/Organization Specific Extension

- Type            CVSE-TYPE-NUMBER 38
- Reserved       Reserved for future use. MUST be set to 0 on sending,  
MUST be ignored on reception.
- Length          Length in bytes of this extension, not including the Type  
and Length bytes.
- Vendor/Org-ID  
The high-order octet is 0 and the low-order 3 octets are  
the SMI Network Management Private Enterprise Code of the  
Vendor in network byte order, as defined in the Assigned  
Numbers RFC [2].
- Vendor-CVSE-Type  
Indicates the particular type of Vendor-CVSE-Extension.  
The administration of the Vendor-CVSE-Types is done by the  
Vendor.
- Vendor-CVSE-Value  
Vendor/organization specific data of this Vendor-CVSE-  
Extension. These data fields may be published in future  
RFCs. The Vendor-CVSE-Value is zero or more octets. The  
length of this field can be computed from the Length Field  
Value.

If an implementation does not recognize the CVSE, according to RFC 2002 [1], the entire packet is to be silently dropped.

2.2. Normal Vendor/Organization Specific Extension (NVSE)

The format of this extension is as shown below.

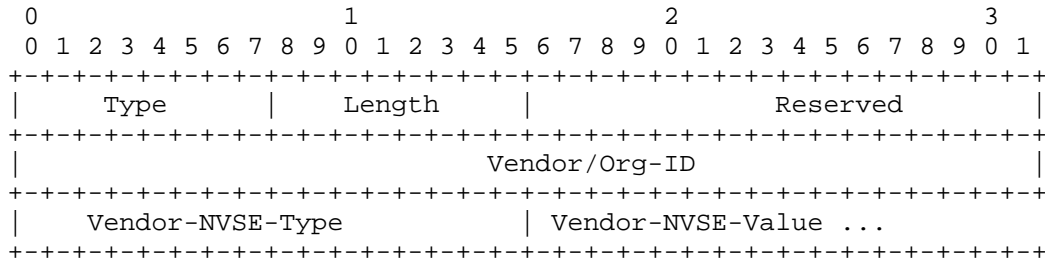


Figure 2: Normal Vendor/Organization Specific Extension

- Type            NVSE-TYPE-NUMBER 134
- Length         Length in bytes of this extension, not including the Type and Length bytes.
- Reserved       Reserved for future use. To be set to 0.
- Vendor/Org-ID  
                 The high-order octet is 0 and the low-order 3 octets are the SMI Network Management Private Enterprise Code of the Vendor in network byte order, as defined in the Assigned Numbers RFC [2].
- Vendor-NVSE-Type Indicates the particular type of Vendor-NVSE-Extension. The administration of the Vendor-NVSE-Types is done by the Vendor.
- Vendor-NVSE-Value  
                 Vendor/organization specific data of this Vendor-NVSE-Extension. These data fields may be published in future RFCs. The Vendor-NVSE-Value is zero or more octets. The length of this field can be computed from the Length Field Value.

### 2.3 Vendor/Organization Specific Extensions Processing Considerations

When a Mobile IP entity receives a registration request message (or any other request/update message) with an extension of type CVSE-TYPE-NUMBER and recognizes it, but the extension contains an unknown/unsupported vendor ID or Vendor-CVSE-Type, a registration reject (or the appropriate deny message) MUST be sent with the error code to indicate that the registration was rejected due to the presence of an unknown CVSE.

When a Mobile IP entity receives a registration reply (or any other mobile IP reply/acknowledgement message) with an extension of type CVSE-TYPE-NUMBER and recognizes it, but the extensions contains an unknown/unsupported vendor ID or Vendor-CVSE-Type, the processing is performed as described below.

1. If the Mobile IP entity is a transit node for the reply (i.e., this entity processes and sends the registration reply to another entity) a registration reject (or the appropriate deny message) MUST be sent with the error code to indicate that the registration was rejected due to the presence of an unknown CVSE. For example, FA when it receives an unknown CVSE in a registration reply from the HA, should send a registration reject to the MN.
2. If the Mobile IP entity is not a transit node for the reply, the reply is treated as a reject (or the appropriate deny message) due to the presence of an unknown CVSE.

While designing enhancements wherein a CVSE is included in a reply message, it should be noted that the reply message could be discarded by the mobile IP entity processing this message. Enhancements that include a CVSE should take this into consideration during design.

When a Mobile IP entity receives a mobile IP related message (registration request/reply, advertisement/solicitation, etc.) with an extension of type NVSE-TYPE-NUMBER and recognizes it, but the extension contains an unknown/unsupported vendor ID or Vendor-NVSE-Type, the entire extension is skipped.

NOTE that according to RFC 2002 [1], when an extension numbered within the range 0 through 127 is encountered in a registration message but not recognized, the message containing that extension MUST be silently discarded. This document is compliant with the above specification and specifies the action if the extension of type CVSE-TYPE-NUMBER is encountered and recognized, but does not support the vendor ID or the vendor type extension within.

## 2.4 Error Codes

The following error codes are defined.

Registration denied by the Foreign agent:

ERROR-FA-1 100: Unsupported Vendor-ID or unable to interpret Vendor-CVSE-Type in the CVSE sent by the Mobile Node to the Foreign Agent.

ERROR-FA-2 101: Unsupported Vendor-ID or unable to interpret Vendor-CVSE-Type in the CVSE sent by the Home Agent to the Foreign Agent.

Registration denied by the Home agent:

ERROR-HA-1 140: Unsupported Vendor-ID or unable to interpret Vendor-CVSE-Type in the CVSE sent by the Mobile Node to the Home Agent.

ERROR-HA-2 141: Unsupported Vendor-ID or unable to interpret Vendor-CVSE-Type in the CVSE sent by the Foreign Agent to the Home Agent.

## 3. Restrictions

Multiple TLV's with the types CVSE-TYPE-NUMBER and NVSE-TYPE-NUMBER can be included in a message. TLVs with types CVSE-TYPE-NUMBER and NVSE-TYPE-NUMBER can be placed anywhere after the fixed portion of the Mobile IP message. These TLVs are expected to be protected by the corresponding authenticator as necessary. Ordering of these TLV's should not be modified by intermediate nodes.

## 4. IANA Considerations

The Critical Vendor/Organization Specific Extension (CVSE) as defined in Section 2.1 and Normal Vendor/Organization Specific Extension (NVSE) as defined in section 2.2 are proposed new extensions to the Mobile IP protocol, defined in RFC 2002 [1] and extended in RFC 2356 [5].

IANA has assigned a Type value of CVSE-TYPE-NUMBER for the Critical Vendor/Organization Specific Extension (CVSE), and a Type value of NVSE-TYPE-NUMBER for the Normal Vendor/Organization Specific Extension (NVSE). The numbers CVSE-TYPE-NUMBER and NVSE-TYPE-NUMBER for the CVSE and the NVSE are taken from the numbering space defined for Mobile IP registration extensions [1].

IANA has assigned new Foreign Agent Error Codes, ERROR-FA-1 and ERROR-FA-2 taken from the numbering space defined for Mobile IP Foreign Agent error codes [1]. IANA has also assigned new Home Agent Error Codes, ERROR-HA-1 and ERROR-HA-2 taken from the numbering space defined for Mobile IP Home Agent error codes [1].

## 5. Security Considerations

This document assumes that the Mobile IP messages are authenticated using a method defined by the Mobile IP protocol. This document does not impose any additional requirements on Mobile IP messages from a security point of view. So this is not expected to be a security issue.

## 6. Acknowledgments

The authors would like to thank TR45.4 WG, TR45.6 WG, Basavaraj Patil, Phil Roberts, Jouni Malinen, and Patrice Calhoun for their useful discussions.

## 7. References

- [1] Perkins, C., "IP Mobility Support", RFC 2002, October 1996.
- [2] Reynolds, J. and J. Postel, "Assigned Numbers", STD 2, RFC 1700, October 1994.
- [3] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [4] Montenegro, G., "Reverse Tunneling for Mobile IP", RFC 2344, May 1998.
- [5] Montenegro, G. and V. Gupta, "Sun's SKIP Firewall Traversal for Mobile IP", RFC 2356, June 1998.

## 8. Authors' Addresses

Gopal Dommety  
Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134

E-Mail: [gdommety@cisco.com](mailto:gdommety@cisco.com)

Kent Leung  
Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134

E-Mail: [kleung@cisco.com](mailto:kleung@cisco.com)



## 9. Full Copyright Statement

Copyright (C) The Internet Society (2001). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

