           Mobile IP Vendor/Organization-Specific Extensions

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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.

```
    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      |   Reserved    |              Length           |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        Vendor/Org-ID                          |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |        Vendor-CVSE-Type       |    Vendor-CVSE-Value ...
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
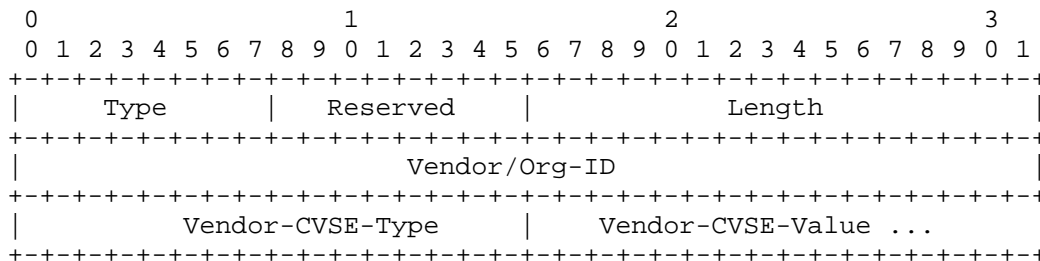
         Figure 1: Critical Vendor/Organization Specific Extension

   Type   CVSE-TYPE-NUMBER 37

   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)
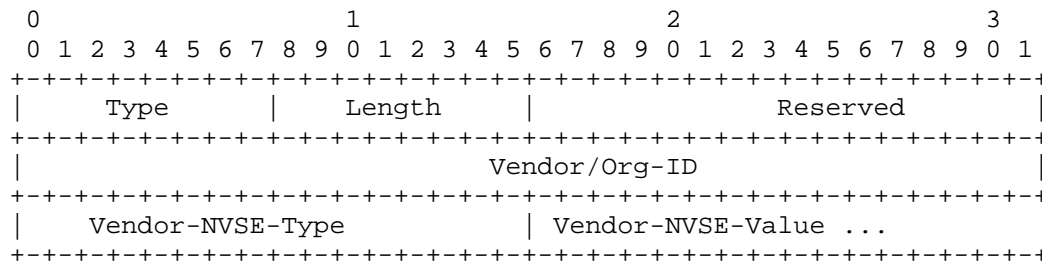
The format of this extension is as shown below.

```
 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     |     Length    |             Reserved          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Vendor/Org-ID                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Vendor-NVSE-Type           | Vendor-NVSE-Value ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

            Figure 2: Normal Vendor/Organization Specific Extension

Type   NVSE-TYPE-NUMBER 133

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 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.

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7. References

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Acknowledgement