                    Vendor-Identifying Vendor Options for
           Dynamic Host Configuration Protocol version 4 (DHCPv4)

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

Abstract

   The Dynamic Host Configuration Protocol (DHCP) options for Vendor
   Class and Vendor-Specific Information can be limiting or ambiguous
   when a DHCP client represents multiple vendors. This document
   defines two new options, modeled on the IPv6 options for vendor class
   and vendor-specific information, that contain Enterprise Numbers to
   remove ambiguity.

Table of Contents

1. Introduction

   The DHCP protocol for IPv4, RFC 2131 [2], defines options that allow
   a client to indicate its vendor type (option 60), and the DHCP client
   and server to exchange vendor-specific information (option 43) [5].
   Although there is no prohibition against passing multiple copies of
   these options in a single packet, doing so would introduce ambiguity
   of interpretation, particularly if conveying vendor-specific
   information for multiple vendors. The vendor identified by option 60
   defines the interpretation of option 43, which itself carries no
   vendor identifier. Furthermore, the concatenation of multiple
   instances of the same option, required by RFC 2131 and specified by
   RFC 3396 [4], means that multiple copies of options 60 or 43 would
   not remain independent.

   In some circumstances, an implementation may need to support
   multiple, independently defined forms of vendor-specific information.
   For example, implementations that must conform to an industry-
   standard use of DHCPv4, to allow interoperability in a particular
   technology space, may be required to support the vendor-specific
   options of that industry group. But the same implementation may also
   require support for vendor-specific options defined by the
   manufacturer. In particular, this is an issue for vendors of devices
   supporting CableLabs [9] standards, such as DOCSIS, CableHome, and
   PacketCable, as those standards define an industry-specific use for
   options 60 and 43.

   This document defines two new options, modeled on the IPv6 options
   for vendor class and vendor-specific information defined in RFC 3315
   [6], that contain IANA-assigned Enterprise Numbers [3] to remove
   ambiguity about the interpretation of their contents. If desired,
   these new options can be used in addition to the current vendor class
   and vendor information options, whose definition is unaffected by
   this document.

1.1. 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 BCP 14, RFC 2119 [1].

2. Supporting Multiple Vendor Instances

   The options defined in this document may each contain data
   corresponding to more than one vendor. The data portion of each
   option defined here contains an enterprise number (assigned by IANA
   [3]), followed by an internal data length, followed by vendor-
   specific data. This sequence may be repeated multiple times within
   each option. Because the aggregate of the vendor-specific data for
   either option may exceed 255 octets, these options are hereby
   declared to be "concatenation-requiring", as defined by RFC 3396 [4].
   As such, for each of the two options defined here, the aggregate of
   all instances of vendor-specific data is to be considered one long
   option. These long options can be divided into smaller options for
   packet encoding in conformance with RFC 3396, on whatever octet
   boundaries are convenient to the implementation. Dividing on the
   boundaries between vendor instances is not required but may be
   convenient for encoding or packet tracing.

3. Vendor-Identifying Vendor Class Option

   A DHCP client may use this option to unambiguously identify the
   vendor that manufactured the hardware on which the client is running,
   the software in use, or an industry consortium to which the vendor
   belongs. The information contained in the per-vendor data area of
   this option is contained in one or more opaque fields that may
   identify details of the hardware configuration.

   This option may be used wherever Vendor Class Identifier (option 60)
   may be used, as described in RFC 2131 [2], except for DHCPNAK
   messages, where other options are not permitted. It is most
   meaningful in messages from DHCP client to DHCP server (DHCPDISCOVER,
   DHCPREQUEST, DHCPINFORM).

The format of the V-I Vendor Class option is as follows:

```
                      1 1 1 1 1 1
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |  option-code  |  option-len   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |      enterprise-number1        |
 |                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   data-len1   |               |
 +-+-+-+-+-+-+-+-+               |
 /       vendor-class-data1      /
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ----
 |      enterprise-number2        |   ^
 |                               |   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+   |
 |   data-len2   |               | optional
 +-+-+-+-+-+-+-+-+               |   |
 /       vendor-class-data2      /   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+   |
 ~              ...              ~   V
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ----
```
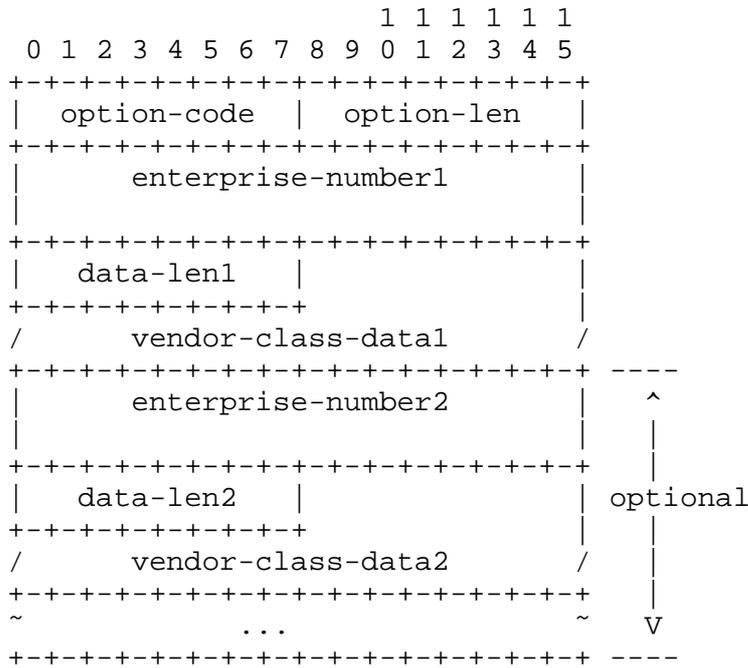
```
option-code            OPTION_V-I_VENDOR_CLASS (124)

option-len             total length of all following option data in
                       octets

enterprise-numberN     The vendor's 32-bit Enterprise Number as
                       registered with IANA [3]

data-lenN              Length of vendor-class-data field

vendor-class-dataN     Details of the hardware configuration of the
                       host on which the client is running, or of
                       industry consortium compliance
```

This option contains information corresponding to one or more
Enterprise Numbers. Multiple instances of this option may be present
and MUST be concatenated in accordance with RFC 3396 [4]. An
Enterprise Number SHOULD only occur once among all instances of this
option. Behavior is undefined if an Enterprise Number occurs
multiple times. The information for each Enterprise Number is
treated independently, regardless or whether it occurs in an option
with other Enterprise Numbers or in a separate option.

The vendor-class-data comprises a series of separate items, each of
which describes some characteristic of the client's hardware
configuration or capabilities. Examples of vendor-class-data
instances might include the version of the operating system the
client is running or the amount of memory installed on the client.

Each instance of the vendor-class-data is formatted as follows:

```
                      1 1 1 1 1 1
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   data-len     |               |
 +-+-+-+-+-+-+-+-+  opaque-data   |
 /                                /
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The data-len is one octet long and specifies the length of the opaque
vendor class data in network byte order.

4. Vendor-Identifying Vendor-Specific Information Option

DHCP clients and servers may use this option to exchange vendor-
specific information. Either party may send this option, as needed.
Although a typical case might be for a client to send the Vendor-
Identifying Vendor Class option, to elicit a useful Vendor-
Identifying Vendor-Specific Information Option, there is no
requirement for such a flow.

This option may be used in any packets where "other" options are
allowed by RFC 2131 [2], specifically DHCPDISCOVER, DHCPOFFER,
DHCPREQUEST, DHCPACK, and DHCPINFORM.

The format of the V-I Vendor-specific Information option is as
follows:

```
                      1 1 1 1 1 1
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |  option-code  |  option-len   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |      enterprise-number1        |
 |                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   data-len1   |               |
 +-+-+-+-+-+-+-+ option-data1    |
 /                               /
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ----
 |      enterprise-number2        |   ^
 |                               |   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+   |
 |   data-len2   |               | optional
 +-+-+-+-+-+-+-+ option-data2    |   |
 /                               /   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+   |
 ~              ...              ~   V
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ----
```
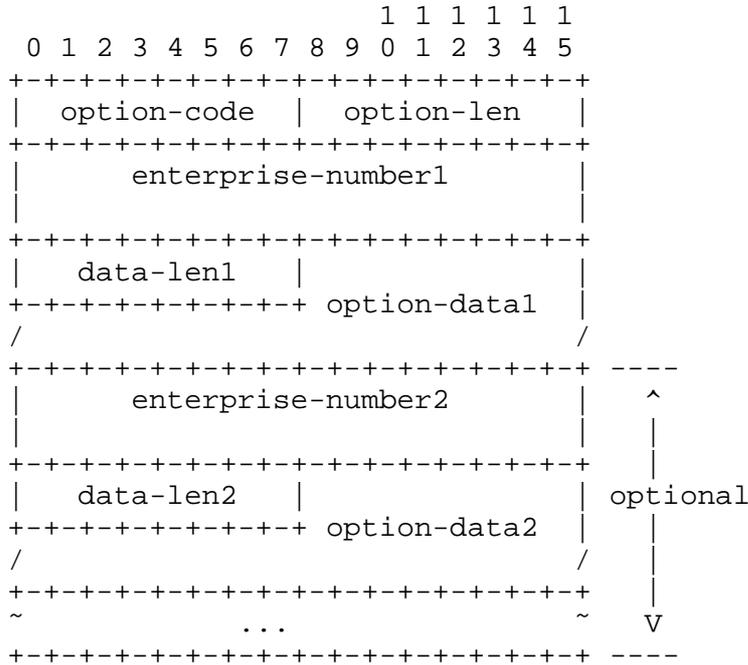
        option-code   OPTION_V-I_VENDOR_OPTS (125)

        option-len   total length of all following option data in
                             octets

        enterprise-numberN   The vendor's registered 32-bit Enterprise Number
                             as registered with IANA [3]

        data-lenN   Length of option-data field

        option-dataN   Vendor-specific options, described below

   The definition of the information carried in this option is vendor
   specific. The vendor is indicated in the enterprise-number field.
   This option contains information corresponding to one or more
   Enterprise Numbers. Multiple instances of this option may be present
   and MUST be concatenated in accordance with RFC 3396 [4].

   An Enterprise Number SHOULD only occur once among all instances of
   this option. Behavior is undefined if an Enterprise Number occurs
   multiple times. The information for each Enterprise Number is
   treated independently, regardless or whether it occurs in an option
   with other Enterprise Numbers, or in a separate option.

Use of vendor-specific information allows enhanced operation,
utilizing additional features in a vendor's DHCP implementation.
Servers not equipped to interpret the vendor-specific information
sent by a client MUST ignore it. Clients that do not receive desired
vendor-specific information SHOULD make an attempt to operate without
it.

The encapsulated vendor-specific option-data field MUST be encoded as
a sequence of code/length/value fields of identical format to the
DHCP options field. The option codes are defined by the vendor
identified in the enterprise-number field and are not managed by
IANA. Option codes 0 and 255 have no pre-defined interpretation or
format. Each of the encapsulated options is formatted as follows:

```
                        1 1 1 1 1 1
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |  subopt-code  |  subopt-len   |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   /        sub-option-data        /
   /                               /
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
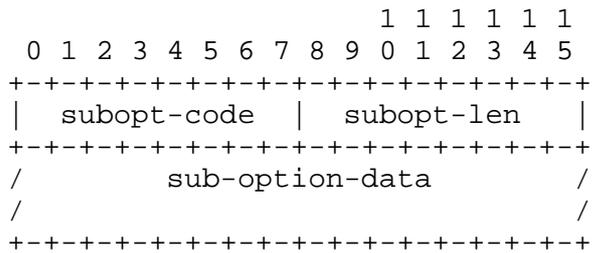
   subopt-code   The code for the encapsulated option

   subopt-len   An unsigned integer giving the length of the
                       option-data field in this encapsulated option in
                       octets

   sub-option-data   Data area for the encapsulated option

5. IANA Considerations

   The values for the OPTION_V-I_VENDOR_CLASS and OPTION_V-I_VENDOR_OPTS
   option codes have been assigned from the numbering space defined for
   public DHCP Options in RFC 2939 [7].

6. Security Considerations

   This document in and by itself provides no security, nor does it
   impact existing security. DHCP provides an authentication and
   message integrity mechanism, as described in RFC 3118 [8], which may
   be used if authenticity is required for data carried by the options
   defined in this document.

7. References

7.1. Normative References

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

   [2] Droms, R., "Dynamic Host Configuration Protocol", RFC 2131,
        March 1997.

   [3] IANA, "Private Enterprise Numbers",
        <http://www.iana.org/assignments/enterprise-numbers>.

   [4] Lemon, T. and S. Cheshire, "Encoding Long Options in the Dynamic
        Host Configuration Protocol (DHCPv4)", RFC 3396, November 2002.

7.2. Informative References

   [5] Alexander, S. and R. Droms, "DHCP Options and BOOTP Vendor
        Extensions", RFC 2132, March 1997.

   [6] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C., and M.
        Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)",
        RFC 3315, July 2003.

   [7] Droms, R., "Procedures and IANA Guidelines for Definition of New
        DHCP Options and Message Types", BCP 43, RFC 2939, September
        2000.

   [8] Droms, R. and W. Arbaugh, "Authentication for DHCP Messages",
        RFC 3118, June 2001.

URIs

   [9] <http://www.cablelabs.com/>

8. Author's Address

   Josh Littlefield
   Cisco Systems, Inc.
   1414 Massachusetts Avenue
   Boxborough, MA 01719
   USA

   Phone: +1 978-936-1379
   EMail: joshl@cisco.com

9. Full Copyright Statement

   Copyright (C) The Internet Society (2004).

   This document is subject to the rights, licenses and restrictions
   contained in BCP 78, and except as set forth therein, the authors
   retain all their rights.

   This document and the information contained herein are provided on an
   "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS
   OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET
   ENGINEERING TASK FORCE DISCLAIM 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.

Intellectual Property

   The IETF takes no position regarding the validity or scope of any
   Intellectual Property Rights or other rights that might be claimed to
   pertain to the implementation or use of the technology described in
   this document or the extent to which any license under such rights
   might or might not be available; nor does it represent that it has
   made any independent effort to identify any such rights. Information
   on the IETF's procedures with respect to rights in IETF Documents can
   be found in BCP 78 and BCP 79.

   Copies of IPR disclosures made to the IETF Secretariat and any
   assurances of licenses to be made available, or the result of an
   attempt made to obtain a general license or permission for the use of
   such proprietary rights by implementers or users of this
   specification can be obtained from the IETF on-line IPR repository at
   http://www.ietf.org/ipr.

   The IETF invites any interested party to bring to its attention any
   copyrights, patents or patent applications, or other proprietary
   rights that may cover technology that may be required to implement
   this standard. Please address the information to the IETF at ietf-
   ipr@ietf.org.

Acknowledgement

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