Network Working Group   D. Eastlake 3rd
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                 IANA Considerations and IETF Protocol Usage
                         for IEEE 802 Parameters

Status of This Memo

   This document specifies an Internet Best Current Practices for the
   Internet Community, and requests discussion and suggestions for
   improvements. Distribution of this memo is unlimited.

Abstract

   Some IETF protocols make use of Ethernet frame formats and IEEE 802
   parameters. This document discusses some use of such parameters in
   IETF protocols and specifies IANA considerations for allocation of
   code points under the IANA OUI (Organizationally Unique Identifier).

Table of Contents

1. Introduction

   Some IETF protocols use Ethernet or other [IEEE] 802 related
   communication frame formats and parameters [IEEE802]. These include
   MAC (Media Access Control) identifiers and protocol identifiers.

   This document specifies IANA considerations for the allocation of
   code points under the IANA OUI. It also discusses some other IETF
   use of IEEE 802 code points.

   [RFC5226] is incorporated herein except where there are contrary
   provisions in this document.

1.1. Notations Used in This Document

   This document uses hexadecimal notation. Each octet (that is, 8-bit
   byte) is represented by two hexadecimal digits giving the value of
   the octet as an unsigned integer. Successive octets are separated by
   a hyphen. This document consistently uses IETF bit ordering although
   the physical order of bit transmission within an octet on an IEEE
   [802.3] link is from the lowest order bit to the highest order bit
   (i.e., the reverse of the IETF's ordering).

   In this document:

   "IAB" stands for Individual Address Block, not for Internet
        Architecture Board;

   "MAC" stands for Media Access Control, not for Message Authentication
        Code; and

   "OUI" stands for Organizationally Unique Identifier.

   "**" indicates exponentiation. For example, 2**24 is two to the
        twenty-fourth power.

1.2. The IEEE Registration Authority

   Originally the responsibility of Xerox Corporation, the registration
   authority for Ethernet parameters is now the IEEE Registration
   Authority, available on the web at:

        http://standards.ieee.org/regauth/

   Anyone may apply to that Authority for parameters. They may impose
   fees or other requirements but commonly waive fees for applications
   from standards development organizations.

A list of some allocated OUIs and IABs and their holders is
downloadable from the IEEE Registration Authority site.

1.2.1. The IANA OUI

The OUI 00-00-5E has been allocated to IANA.

1.3. Acknowledgements

The contributions and support of the following people, listed in
alphabetic order, is gratefully acknowledged:

Bernard Aboba, Scott O. Bradner, Ian Calder, Michelle Cotton,
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Thompson.

2. Ethernet Identifier Parameters

Section 2.1 discusses EUI-48 (Extended Unique Identifier 48) MAC
identifiers, their relationship to OUIs and IABs, and allocations
under the IANA OUI. Section 2.2 extends this to EUI-64 identifiers.
Section 2.3 discusses other IETF MAC identifier use not under the
IANA OUI.

2.1. 48-Bit MAC Identifiers and OUIs

48-bit MAC "addresses" are the most commonly used Ethernet interface
identifiers. Those that are globally unique are also called EUI-48
identifiers. An EUI-48 is structured into an initial 3-octet OUI
(Organizationally Unique Identifier) and an additional 3 octets
assigned by the OUI holder. For organizations not requiring 3
octets' worth of identifiers, the IEEE allocates IABs (Individual
Address Blocks) instead, where the first 4 1/2 octets (36 bits) are
assigned, giving the holder of the IAB 1 1/2 octets (12 bits) they
can control.

The IEEE describes its assignment procedures and policies for IEEE
802 related identifiers in [802_O&A].

Two bits within the initial 3 octets of an EUI-48 have special
significance: the Group bit (01-00-00) and the Local bit (02-00-00).
OUIs and IABs are allocated with the Local bit zero and the Group bit
unspecified. Multicast identifiers may be constructed by turning on
the Group bit, and unicast identifiers constructed by leaving the
Group bit zero.

For globally unique EUI-48 identifiers allocated by an OUI or IAB
owner, the Local bit is zero. If the Local bit is a one, the
identifier is considered by IEEE 802 to be a local identifier under
the control of the local network administrator. If the Local bit is
on, the holder of an OUI (or IAB) has no special authority over
48-bit MAC identifiers whose first 3 (or 4 1/2) octets correspond to
their OUI (or IAB).

2.1.1. EUI-48 Allocations under the IANA OUI

   The OUI 00-00-5E has been assigned to IANA as stated in Section 1.2.1
   above. This includes 2**24 EUI-48 multicast identifiers from
   01-00-5E-00-00-00 to 01-00-5E-FF-FF-FF and 2**24 EUI-48 unicast
   identifiers from 00-00-5E-00-00-00 to 00-00-5E-FF-FF-FF.

   Of these EUI-48 identifiers, the following allocations have been made
   thus far:

      o The 2**23 multicast identifiers from 01-00-5E-00-00-00 through
         01-00-5E-7F-FF-FF have been allocated for IPv4 multicast
         [RFC1112].

      o The 2**20 multicast identifiers from 01-00-5E-80-00-00 through
         01-00-5E-8F-FF-FF have been allocated for MPLS multicast
         [RFC5332].

      o The 2**8 unicast identifiers from 00-00-5E-00-00-00 through
         00-00-5E-00-00-FF are reserved and require IESG Ratification
         for allocation (see Section 5.1).

      o The 2**8 unicast identifiers from 00-00-5E-00-01-00 through
         00-00-5E-00-01-FF have been allocated for the Virtual Router
         Redundancy Protocol (VRRP) [RFC3768].

2.1.2. EUI-48 IANA Allocation Considerations

   EUI-48 allocations under the current or a future IANA OUI (see
   Section 5.2) must meet the following requirements:

      o must be for standards purposes (either for an IETF Standard or
         other standard related to IETF work),

      o must be for a block of a power-of-two identifiers starting at a
         boundary that is an equal or greater power of two, including
         the allocation of one (2**0) identifier,

      o must not be used to evade the requirement for vendors to obtain
         their own block of identifiers from the IEEE, and

        o must be documented in an Internet-Draft or RFC.

    In addition, approval must be obtained as follows (see the procedure
    in Section 5.1):

        Small to medium allocations of a block of 1, 2, 4, ..., 32768,
            65536 (2**0, 2**1, 2**2, ..., 2**15, 2**16) EUI-48 identifiers
            require Expert Review.

        Large allocations of 131072 (2**17) or more EUI-48 identifiers
            require IESG Ratification (see Section 5.1).

    To simplify record keeping, all future allocations of 256 (2**8) or
    fewer identifiers shall have the Group bit unspecified, that is,
    shall be allocations of parallel equal-size blocks of multicast and
    unicast identifiers, even if one of these two types is not needed for
    the proposed use. The only exception is that requests for unicast-
    only identifier blocks of any size may be allocated out of the
    remaining identifiers in the large unicast range from
    00-00-5E-00-02-00 to 00-00-5E-8F-FF-FF.

2.2. 64-Bit MAC Identifiers

    IEEE also defines a system of 64-bit MAC identifiers including
    EUI-64s. Uptake of these "MAC-64" identifiers has been limited.
    They are currently used in constructing some IPv6 Interface
    Identifiers as described below and by the following IEEE standards:

    o IEEE 1394 (also known as FireWire and i.Link),

    o IEEE 802.15.4 (also known as ZigBee).

    Adding a 5-octet (40-bit) extension to a 3-octet (24-bit) OUI forms
    an EUI-64 identifier under that OUI. As with EUI-48 identifiers, the
    OUI has the same Group/unicast and Local/Global bits.

    The discussion below is almost entirely in terms of the "Modified"
    form of EUI-64 identifiers; however, anyone allocated such an
    identifier also has the unmodified form and may use it as a MAC
    identifier on any link that uses such 64-bit identifiers for
    interfaces.

2.2.1. IPv6 Use of Modified EUI-64 Identifiers

    MAC-64 identifiers are used to form the lower 64 bits of some IPv6
    addresses (Section 2.5.1 and Appendix A of [RFC4291] and Appendix A
    of [RFC5214]). When so used, the MAC-64 is modified by inverting the
    Local/Global bit to form an IETF "Modified EUI-64 identifier". Below

is an illustration of a Modified EUI-64 identifier under the IANA
OUI, where aa-bb-cc-dd-ee is the extension.

        02-00-5E-aa-bb-cc-dd-ee

The first octet is shown as 02 rather than 00 because, in Modified
EUI-64 identifiers, the sense of the Local/Global bit is inverted
compared with EUI-48 identifiers. It is the globally unique values
(universal scope) that have the 02 bit on in the first octet, while
those with this bit off are locally assigned and out of scope for
global allocation.

The Local/Global bit was inverted to make it easier for network
operators to type in local-scope identifiers. Thus, such Modified
EUI-64 identifiers as 1, 2, etc. (ignoring leading zeros), are
local. Without the modification, they would have to be
02-00-00-00-00-00-00-01, 02-00-00-00-00-00-00-02, etc., to be local.

As with MAC-48 identifiers, the 01 bit on in the first octet
indicates a group identifier.

When the first two octets of the extension of a Modified EUI-64
identifier are FF-FE, the remainder of the extension is a 24-bit
value as assigned by the OUI owner for an EUI-48. For example:

        02-00-5E-FF-FE-yy-yy-yy
or
        03-00-5E-FF-FE-yy-yy-yy

where yy-yy-yy is the portion (of an EUI-48 global unicast or
multicast identifier) that is assigned by the OUI owner (IANA in this
case). Thus, any holder of one or more EUI-48 identifiers under the
IANA OUI also has an equal number of Modified EUI-64 identifiers that
can be formed by inserting FF-FE in the middle of their EUI-48
identifiers and inverting the Local/Global bit.

   (Note: [EUI-64] defines FF-FF as the bits to be inserted to create
   an IEEE EUI-64 identifier from a MAC-48 identifier. That document
   says the FF-FE value is used when starting with an EUI-48
   identifier. The IETF uses only FF-FE to create Modified EUI-64
   identifiers from 48-bit Ethernet station identifiers regardless of
   whether they are EUI-48 or MAC-48 local identifiers. EUI-48 and
   local MAC-48 identifiers are syntactically equivalent, and this
   doesn't cause any problems in practice.)

   In addition, certain Modified EUI-64 identifiers under the IANA OUI
   are reserved for holders of IPv4 addresses as follows:

          02-00-5E-FE-xx-xx-xx-xx

   where xx-xx-xx-xx is a 32-bit IPv4 address. For Modified EUI-64
   identifiers based on an IPv4 address, the Local/Global bit should be
   set to correspond to whether the IPv4 address is local or global.
   (Keep in mind that the sense of the Modified EUI-64 identifier
   Local/Global bit is reversed from that in (unmodified) MAC-64
   identifiers.)

2.2.2. EUI-64 IANA Allocation Considerations

   The following table shows which Modified EUI-64 identifiers under the
   IANA OUI are reserved, used, or available as indicated.

      02-00-5E-00-00-00-00-00 to 02-00-5E-0F-FF-FF-FF-FF reserved

      02-00-5E-10-00-00-00-00 to 02-00-5E-EF-FF-FF-FF-FF available for
         allocation

      02-00-5E-F0-00-00-00-00 to 02-00-5E-FD-FF-FF-FF-FF reserved

      02-00-5E-FE-00-00-00-00 to 02-00-5E-FE-FF-FF-FF-FF used by IPv4
         address holders as described above

      02-00-5E-FF-00-00-00-00 to 02-00-5E-FF-FD-FF-FF-FF reserved

      02-00-5E-FF-FE-00-00-00 to 02-00-5E-FF-FE-FF-FF-FF used by holders
         of EUI-48 identifiers under the IANA OUI as described above

      02-00-5E-FF-FF-00-00-00 to 02-00-5E-FF-FF-FF-FF-FF reserved

   The reserved identifiers above require IESG Ratification (see Section
   5.1) for allocation. IANA EUI-64 identifier allocations under the
   IANA OUI must meet the following requirements:

      o must be for standards purposes (either for an IETF Standard or
         other standard related to IETF work),

      o must be for a block of a power-of-two identifiers starting at a
         boundary which is an equal or greater power of two, including
         the allocation of one (2**0) identifier,

      o must not be used to evade the requirement for vendors to obtain
         their own block of identifiers from the IEEE, and

     o must be documented in an Internet Draft or RFC.

   In addition, approval must be obtained as follows (see the procedure
   in Section 5.1):

      Small to medium allocations of a block of 1, 2, 4, ..., 134217728,
         268435456 (2**0, 2**1, 2**2, ..., 2**27, 2**28) EUI-64
         identifiers require Expert Review.

      Allocations of any size, including 536870912 (2**29) or more
         EUI-64 identifiers, may be made with IESG Ratification (see
         Section 5.1).

   To simplify record keeping, all allocations of 65536 (2**16) or less
   EUI-64 identifiers shall have the Group bit unspecified, that is,
   shall be allocations of parallel equal size blocks of multicast and
   unicast identifiers, even if one of these two types is not needed for
   the proposed use.

2.3. Other MAC-48 Identifiers Used by IETF

   There are two other blocks of MAC-48 identifiers that are used by the
   IETF as described below.

2.3.1. Identifiers Prefixed 33-33

   All MAC-48 multicast identifiers prefixed "33-33" (that is, the 2**32
   multicast MAC identifiers in the range from 33-33-00-00-00-00 to
   33-33-FF-FF-FF-FF) are used by the IETF for global IPv6 multicast
   [RFC2464]. In all these identifiers, the Group bit (the bottom bit
   of the first octet) is on, as is required to work properly with
   existing hardware as a multicast identifier. They also have the
   Local bit on and are used for this purpose in IPv6 networks.

      (Historical note: It was the custom during IPv6 design to use "3"
      for unknown or example values, and 3333 Coyote Hill Road, Palo
      Alto, California, is the address of PARC (Palo Alto Research
      Center, formerly "Xerox PARC"). Ethernet was originally specified
      by Digital Equipment Corporation, Intel Corporation, and Xerox
      Corporation. The pre IEEE [802.3] Ethernet protocol has sometimes
      been known as "DIX" Ethernet from the first letters of the names
      of these companies.)

2.3.2. The 'CF Series'

   The Informational [RFC2153] declared the 3-octet values from CF-00-00
   through CF-FF-FF to be OUIs available for allocation by IANA to
   software vendors for use in PPP [RFC1661] or for other uses where
   vendors do not otherwise need an IEEE-assigned OUI. It should be
   noted that, when used as MAC-48 prefixes, these values have the Local
   and Group bits on, while all IEEE-allocated OUIs have those bits off.
   The Group bit is meaningless in PPP. To quote [RFC2153]: "The
   'CF0000' series was arbitrarily chosen to match the PPP NLPID 'CF',
   as a matter of mnemonic convenience."

   CF-00-00 is reserved, and IANA lists multicast identifier
   CF-00-00-00-00-00 as used for Ethernet loopback tests.

   In over a decade of availability, only a handful of values in the 'CF
   Series' have been allocated. (See http://www.iana.org under both
   Ethernet Parameters and PPP Parameters.)

2.3.2.1. Changes to RFC 2153

   The IANA Considerations in [RFC2153] are updated as follows (no
   technical changes are made): Use of these identifiers based on IANA
   allocation is deprecated. IANA is directed not to allocate any
   further values in the 'CF Series'.

3. Ethernet Protocol Parameters

   Ethernet protocol parameters provide a means of indicating the
   contents of a frame -- for example, that its contents are IPv4 or
   IPv6.

   The concept has been extended to labeling by "tags". A tag in this
   sense is a prefix whose type is identified by an Ethertype that is
   then followed by either another tag, an Ethertype, or an LSAP
   protocol indicator for the "main" body of the frame, as described
   below. Traditionally in the [802_O&A] world, tags are fixed length
   and do not include any encoding of their own length. Thus, anything
   that is processing a frame cannot, in general, safely process
   anything in the frame past an Ethertype it does not understand. An
   example is the C-tag (formerly the Q-tag) [802.1Q]. It provides
   customer VLAN and priority information for a frame.

   There are two types of protocol identifier parameters that can occur
   in Ethernet frames after the initial MAC-48 destination and source
   identifiers:

      Ethertypes: These are 16-bit identifiers appearing as the initial
         two octets after the MAC destination and source (or after a
         tag) which, when considered as an unsigned integer, are equal
         to or larger than 0x0600.

      LSAPs: These are 8-bit protocol identifiers that occur in pairs
         immediately after an initial 16-bit (two octet) remaining frame
         length, which is in turn after the MAC destination and source
         (or after a tag). Such a length must, when considered as an
         unsigned integer, be less than 0x5DC or it could be mistaken as
         an Ethertype. LSAPs (Link-Layer Subnet Access Points) occur in
         pairs where one is intended to indicate the source protocol
         handler and one the destination protocol handler; however, use
         cases where the two are different have been relatively rare.

Neither Ethertypes nor LSAPs are allocated by IANA; instead, they are
allocated by the IEEE Registration Authority (see Section 1.2 above
and the Ethertype Annex below). However, both LSAPs and Ethertypes
have extension mechanisms so that they can be used with five-octet
Ethernet protocol identifiers under an OUI, including those allocated
by IANA under the IANA OUI.

When using the IEEE 802 LLC format (SNAP) [802_O&A] for a frame, an
OUI-based protocol identifier can be expressed as follows:

    xx-xx-AA-AA-03-yy-yy-yy-zz-zz

where xx-xx is the frame length and, as above, must be small enough
not to be confused with an Ethertype; "AA" is the LSAP that indicates
this use and is sometimes referred to as the SNAP SAP; "03" is the
LLC control octet indicating datagram service; yy-yy-yy is an OUI;
and zz-zz is a protocol number, under that OUI, allocated by the OUI
owner. The odd five-octet length for such OUI-based protocol
identifiers was chosen so that, with the LLC control octet ("03"),
the result is 16-bit aligned.

When using an Ethertype to indicate the main type for a frame body,
the special "OUI Extended Ethertype" 88-B7 is available. Using this
Ethertype, a frame body can begin with

    88-B7-yy-yy-yy-zz-zz

where yy-yy-yy and zz-zz have the same meaning as in the SNAP format
described above.

It is also possible, within the SNAP format, to use an arbitrary
Ethertype. Putting the Ethertype as the zz-zz field after an all
zeros OUI (00-00-00) does this. It looks like

          xx-xx-AA-AA-03-00-00-00-zz-zz

   where zz-zz is the Ethertype.

      (Note that, at this point, the 802 protocol syntax facilities are
      sufficiently powerful that they could be chained indefinitely.
      Whether support for such chaining is generally required is not
      clear, but [802_O&A] requires support for

         xx-xx-AA-AA-03-00-00-00-88-B7-yy-yy-yy-zz-zz

      even though this could be more efficiently expressed by simply
      pinching out the "00-00-00-88-B7" in the middle.)

   As well as labeling frame contents, 802 Protocol types appear within
   NBMA (Non-Broadcast Multi-Access) Next Hop Resolution Protocol
   [RFC2332] messages. Such messages have provisions for both two octet
   Ethertypes and OUI based protocol types.

3.1. Ethernet Protocol Allocation under the IANA OUI

   Two-octet protocol numbers under the IANA OUI are available, as in

         xx-xx-AA-AA-03-00-00-5E-zz-zz.

   A number of such allocations have been made out of the 2**16 protocol
   numbers available from 00-00-5E-00-00 to 00-00-5E-FF-FF (see [IANA]).
   The extreme values of this range, 00-00-5E-00-00 and 00-00-5E-FF-FF,
   are reserved and require IESG Ratification for allocation (see
   Section 5.1). New allocations of SNAP SAP protocol (zz-zz) numbers
   under the IANA OUI must meet the following requirements:

      o the allocation must be for standards use (either for an IETF
         Standard or other standard related to IETF work),

      o it must be documented in an Internet-Draft or RFC, and

      o such protocol numbers are not to be allocated for any protocol
         that has an Ethertype (because that can be expressed by putting
         an all zeros "OUI" before the Ethertype as described above).

   In addition, the Expert Review (or IESG Ratification for the two
   reserved values) must be obtained using the procedure specified in
   Section 5.1.

4. Other OUI-Based Parameters

   Some IEEE 802 and other protocols provide for parameters based on an
   OUI beyond those discussed above. Such parameters most commonly
   consist of an OUI plus one octet of additional value. They are
   usually called "vendor specific" parameters, although "organization
   specific" might be more accurate. They would look like

        yy-yy-yy-zz

   where yy-yy-yy is the OUI and zz is the additional specifier. An
   example is the Cipher Suite Selector in IEEE 802.11 ([802.11], page
   125).

   Values may be allocated under the IANA OUI for such other OUI-based
   parameter usage by Expert Review except that, for each use, the
   additional specifier values consisting of all zero bits and all one
   bits (0x00 and 0xFF for a one-octet specifier) are reserved and
   require IESG Ratification (see Section 5.1) for allocation. The
   allocations must be for standards use (either for an IETF Standard or
   other standard related to IETF work) and be documented in an
   Internet-Draft or RFC. The first time a value is allocated for a
   particular parameter of this type, an IANA registry will be created
   to contain that allocation and any subsequent allocations of values
   for that parameter under the IANA OUI. The Expert will specify the
   name of the registry.

   (If a different policy from that above is required for such a
   parameter, a BCP or Standards Track RFC must be adopted updating this
   BCP and specifying the new policy and parameter.)

5. IANA Considerations

   The entirety of this document concerns IANA Considerations for the
   allocation of Ethernet parameters in connection with the IANA OUI and
   related matters.

   Specifically:

      Section 1.2.1 provides information on the IANA-assigned OUI.

      Section 2.1.1 lists current EUI-48 assignments under this OUI.

      Section 2.1.2 specifies IANA considerations for EUI-48
      assignments.

      Section 2.2.2 specifies IANA considerations for EUI-64
      assignments.

Section 3.1 provides a pointer to current protocol identifier
assignments under the IANA OUI, and specifies IANA considerations
for protocol identifier assignments.

Section 4 briefly provides IANA considerations relating to OUI-
based miscellaneous allocations.

5.1. Expert Review and IESG Ratification

This section specifies the procedure for Expert Review and IESG
Ratification of MAC, protocol, and other IANA OUI-based identifiers.
The Expert(s) referred to in this document shall consist of one or
more persons appointed by and serving at the pleasure of the IESG.
The procedure described for Expert Review allocations in this
document is fully consistent with the IANA Expert Review policy
described in Section 4.1 of [RFC5226].

While finite, the universe of code points from which Expert judged
allocations will be made is felt to be large enough that the
requirements given in this document and the Experts' good judgment
are sufficient guidance. The idea is for the Expert to provide a
light sanity check for small allocations of EUI identifiers with
increased scrutiny by the Expert for medium-sized allocations of EUI
identifiers, and allocations of protocol identifiers and other IANA
OUI based parameters. However, it can make sense to allocate very
large portions of the MAC identifier code point space. (Note that
existing allocations include one for 1/2 of the entire multicast code
point space and one for 1/16 of the multicast code point space.) In
those cases, and in cases of the allocation of "reserved" values,
IESG Ratification of an Expert Review approval recommendation is
required as described below. The procedure is as follows:

    The applicant always completes the appropriate Template from the
       Template Annex below and sends it to IANA <iana@iana.org>.

    IANA always sends the Template to an appointed Expert. If the
       Expert recuses themselves or is non-responsive, IANA may choose
       an alternative appointed Expert or, if none are available, will
       contact the IESG.

    If the allocation is based on Expert Review:

       If IANA receives a disapproval from an Expert selected to
          review an application Template, the application will be
          denied.
       If IANA receives approval and code points are available, IANA
          will make the requested allocation.

   If the allocation is based on IESG Ratification, the procedure
   starts with the first two steps above for Expert Review. If
   the Expert disapproves the application, they simply inform
   IANA; however, if the Expert believes the application should be
   approved, or is uncertain and believes that the circumstances
   warrant the attention of the IESG, the Expert will inform IANA
   about their advice and IANA will forward the application,
   together with the reasons for approval or uncertainty, to the
   IESG. The IESG must decide whether the allocation will be
   granted. This can be accomplished by a management item in an
   IESG telechat as done for other types of requests. If the IESG
   decides not to ratify a favorable opinion by the Expert or
   decides against an application where the Expert is uncertain,
   the application is denied, otherwise it is granted. The IESG
   will communicate its decision to the Expert and to IANA.

5.2. Informational IANA Web Page Material

   IANA also maintains an informational listing on its web site
   concerning Ethertypes, OUIs, and multicast addresses allocated under
   OUIs other than the IANA OUI. IANA shall update that list when
   changes are provided by the Expert.

5.3. OUI Exhaustion

   When the available space for either multicast or unicast EUI-48
   identifiers under OUI 00-00-5E have been 90% or more exhausted, IANA
   should request an additional OUI from the IEEE Registration Authority
   (see Section 1.2) for further IANA allocation use.

6. Security Considerations

   This document is concerned with allocation of parameters under the
   IANA OUI and closely related matters. It is not directly concerned
   with security.

7. Normative References

   [802_O&A] "IEEE Standard for Local and Metropolitan Area Networks:
             Overview and Architecture", IEEE 802-2001, 8 March 2002.

             "IEEE Standard for Local and Metropolitan Area Networks:
             Overview and Architecture / Amendment 1: Ethertypes for
             Prototype and Vendor-Specific Protocol Development", IEEE
             802a-2003, 18 September 2003.

8. Informative References

[802.1Q] "IEEE Standard for Local and metropolitan area networks /
          Virtual Bridged Local Area Networks", IEEE 802.1Q-2005, 19
          May 2006.

[802.3]   "IEEE Standard for Information technology /
          Telecommunications and information exchange between systems
          / Local and metropolitan area networks / Specific
          requirements / Part 3: Carrier sense multiple access with
          collision detection (CSMA/CD) access method and physical
          layer specifications", IEEE 802.3-2005, 9 December 2005.

[802.11] "IEEE Standard for Information technology /
          Telecommunications and information exchange between systems
          / Local and metropolitan area networks / Specific
          requirements / Part 11: Wireless LAN Medium Access Control
          (MAC) and Physical Layer (PHY) Specifications", IEEE
          802.11-2007, 11 June 2007.

[EUI-64] IEEE, "Guidelines for 64-bit Global Identifier (EUI-64)
          Registration Authority", <http://standards.ieee.org/
          regauth/oui/tutorials/EUI64.html>, March 1997.

[IANA]   Internet Assigned Numbers Authority, Ethernet Types,
          <http://www.iana.org>.

[IEEE]   Institute of Electrical and Electronics Engineers,
          <http://www.ieee.org>.

[IEEE802] IEEE 802 LAN/MAN (Local Area Network / Metropolitan Area
          Network) Standards Committee, <http://www.ieee802.org>.

[RFC1112] Deering, S., "Host Extensions for IP Multicasting", STD 5,
          RFC 1112, Stanford University, August 1989.

[RFC1661] Simpson, W., "The Point-to-Point Protocol (PPP)", STD 51,
          RFC 1661, July 1994.

[RFC2153] Simpson, W., "PPP Vendor Extensions", RFC 2153, May 1997.

[RFC2332] Luciani, J., Katz, D., Piscitello, D., Cole, B., and N.
          Doraswamy, "NBMA Next Hop Resolution Protocol (NHRP)", RFC
          2332, April 1998.

[RFC2464] Crawford, M., "Transmission of IPv6 Packets over Ethernet
          Networks", RFC 2464, December 1998.

   [RFC3768] Hinden, R., "Virtual Router Redundancy Protocol (VRRP)",
              RFC 3768, April 2004.

   [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing
              Architecture", RFC 4291, February 2006.

   [RFC5214] Templin, F., Gleeson, T., and D. Thaler, "Intra-Site
              Automatic Tunnel Addressing Protocol (ISATAP)", RFC 5214,
              March 2008.

   [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an
              IANA Considerations Section in RFCs", BCP 26, RFC 5226, May
              2008.

   [RFC5332] Eckert, T., Rosen, E., Ed., Aggarwal, R., and Y. Rekhter,
              "MPLS Multicast Encapsulations", RFC 5332, August 2008.

Appendix A. Templates

   This annex provides the specific templates for IANA allocations of
   parameters. Explanatory words in parenthesis in the templates below
   may be deleted in a completed template as submitted to IANA.

A.1. EUI-48/EUI-64 Identifier or Identifier Block Template

      Applicant Name:

      Applicant Email:

      Applicant Telephone: (starting with country code)

      Use Name: (brief name of Parameter use such as "Foo Protocol")

      Document: (ID or RFC specifying use to which the identifier or
      block of identifiers will be put.)

      Specify whether this is an application for EUI-48 or EUI-64
      identifiers:

      Size of Block requested: (must be a power-of-two-sized block, can
      be a block of size one (2**0))

      Specify multicast, unicast, or both:

A.2. 5-Octet Ethernet Protocol Identifier Template

      Applicant Name:

      Applicant Email:

      Applicant Telephone: (starting with country code)

      Use Name: (brief name of use of code point such as "Foo Protocol")

      Document: (ID or RFC specifying use to which the protocol
      identifier will be put.)

A.3.   Other IANA OUI-Based Parameter Template

       Applicant Name:

       Applicant Email:

       Applicant Telephone: (starting with country code)

       Protocol where the OUI Based Parameter for which a value is being
       requested appears: (such as: Cipher Suite selection in IEEE
       802.11)

       Use Name: (brief name of use of code point to be allocated, such
       as "Foo Cipher Suite")

       Document: (ID or RFC specifying use to which the other IANA OUI
       based parameter value will be put.)

Appendix B.   Ethertypes

   This annex lists some Ethertypes specified for IETF Protocols or by
   IEEE 802 as known at the time of publication. A more up-to-date list
   may be available on the IANA web site, currently at [IANA]. The IEEE
   Registration Authority page of Ethertypes,
   http://standards.ieee.org/regauth/ethertype/eth.txt, may also be
   useful. See Section 3 above.

B.1.   Some Ethertypes Specified by the IETF

       0x0800   Internet Protocol Version 4 (IPv4)
       0x0806   Address Resolution Protocol (ARP)
       0x0808   Frame Relay ARP
       0x880B   Point-to-Point Tunneling Protocol (PPTP)
       0x880C   General Switch Management Protocol (GSMP)
       0x8035   Reverse Address Resolution Protocol (RARP)
       0x86DD   Internet Protocol Version 6 (IPv6)
       0x8847   MPLS
       0x8848   MPLS with upstream-assigned label
       0x8861   Multicast Channel Allocation Protocol (MCAP)
       0x8863   PPP over Ethernet (PPPoE) Discovery Stage
       0x8864   PPP over Ethernet (PPPoE) Session Stage

B.2. Some IEEE 802 Ethertypes

        0x8100 IEEE Std 802.1Q - Customer VLAN Tag Type (C-Tag, formerly
                                    called the Q-Tag)
        0x8808 IEEE Std 802.3   - Ethernet Passive Optical Network (EPON)
        0x888E IEEE Std 802.1X - Port-based network access control
        0x88A8 IEEE Std 802.1Q - Service VLAN tag identifier (S-Tag)
        0x88B5 IEEE Std 802   - Local Experimental Ethertype
        0x88B6 IEEE Std 802   - Local Experimental Ethertype
        0x88B7 IEEE Std 802   - OUI Extended Ethertype
        0x88C7 IEEE Std 802.11i - Pre-Authentication
        0x88CC IEEE Std 802.1AB - Link Layer Discovery Protocol (LLDP)
        0x88E5 IEEE Std 802.1AE - Media Access Control Security
        0x88F5 IEEE Std 802.1ak - Multiple VLAN Registration Protocol
                                    (MVRP)
        0x88F6 IEEE Std 802.1Q - Multiple Multicast Registration
                                    Protocol (MMRP)
        0x890D IEEE 802.11r   - Fast Roaming Remote Request

Author's Address

   Donald E. Eastlake 3rd
   155 Beaver Street
   Milford, MA 01757 USA

   Phone: +1-508-634-2066
   EMail: d3e3e3@gmail.com