What is an Object Identifier (OID)?

An Object Identifier is a name used to identify an object. This object can be a country or an individual disk drive. The most common one, in the context of the IEEE-RAC, is the OUI (Organizationally Unique Identifier), and the organizationally derived, and assigned, assignments beyond the OUI. Most common subsequent identifiers include Ethernet address identifier, the Extended Unique Identifiers (EUI) or the World Wide Name (WWN) identifiers. Uniqueness, for conforming systems, is a prized property in both of these cases. Uniqueness is assumed by the building of a unique number starting with the OUI. This IEEE-RAC assigned OUI is an Object Identifier for the organization. This is a layer within a larger context of identifiers uniquely derived from the starting point of all OID's, the International Telecommunication Union Telecommunication Standardization Sector (ITU-T) and described in the ASN.1 standard. The path traceable to the ITU-T starting point is called the "arc" of the OID. This arc extends to the OUI and other RAC assigned designators and through the assignments made by the organization to the end point object identification.

Harald T. Alverson (Harald.T.Alvestrand@uninett.no) describes them on his Object Identifier page like this:

"What is an object identifier?
Object identifiers are, basically, strings of numbers. They are allocated in a hierarchical manner, so that, for instance, the authority for "1.2.3" is the only one that can say what "1.2.3.4" means.

They are used in a variety of protocols.

The formal definition of OIDs comes from ITU-T recommendation X.208 (ASN.1) [Ed. Note: ISO/IEC 8824:1994], which is available from the ITU (if you have your checkbook handy). The definition of OID is in chapter 28; the assignment of the "top of the tree" is given in appendixes B, C and D.

The encodings - how you can transfer an OID as bits on the wire - is defined in X.209 [Ed. Note: ISO/IEC 8825 -1, -2; ITU-T X.690, X.691 (1998 version should be used.)].

What object identifiers exist?
Millions and millions.... remember: once you have a valid OID that is yours to

handle, you will automatically have the right to assign any OID that starts off with the digits in your OID."

Allocation of Object Identifier Values in IEEE standards

From time to time, various IEEE activities, including standards development, have a requirement to allocate Object Identifier values. A common example of this requirement is for generating unique identifiers used in the definition of SNMP MIB modules, but other applications exist.

This tutorial defines a simple and consistent Object Identifier hierarchy, based on the use of the Object Identifier value that has been assigned by ISO to identify IEEE. This hierarchy can be used by current and future IEEE activities, with flexibility to meet the needs of standards defined by IEEE working groups. The intent is to establish a consistent practice within IEEE for the development and allocation of object identifiers. Consistency of Object Identifier allocation can facilitate implementation and operation of IEEE compliant equipment and systems.

Object Identifiers and ISO standards

As explained previously, an Object Identifier is an ASN.1 data type that is used as a means of defining unique identifiers for objects. Values of the Object Identifier data type can then be used to name the objects to which they relate.

The Object Identifier data type consists of a sequence of one or more non-negative integers, often referred to as arcs, that define a hierarchy, or tree, of object identifier values. The first arc in the sequence identifies the registration authority responsible for allocating the values of the second and subsequent arcs. For example:

iso(1)

indicates that an initial arc value of 1 identifies ISO as the registration authority. Subsequent arcs in the sequence are determined by ISO, or are allocated by registration authorities subordinate to ISO.

Under the iso arc, a second arc has been allocated to identify organizations recognized by ISO, such as IEEE; hence, the two-integer sequence

iso (1) iso-identified-organization (3)

Under the iso-identified-organization arc, a subsequent arc has been allocated to identify IEEE; hence, the three-integer sequence

iso (1) iso-identified-organization (3) ieee (111)

indicates that the fourth integer identifies a particular registry within IEEE, and that the allocation of the fourth and subsequent arcs is the responsibility of IEEE. The fourth level is reserved to define registries within IEEE. The following are the initial allocations:

registration-authority (1)
standards-association-numbered-series-standards (2)
standards-association-c-series-standards (3)
standards-press (4)
institute (5)
isto (6)

Other allocations will be made in the future as requirements arise. Administration and allocation of the fourth level is the responsibility of The Registration Authority of the IEEE Standards Association.

IEEE-RA Registry Requirements

The IEEE Registration Authority (IEEE-RA) shall allocate an arc within its domain to uniquely identify each registry for which the IEEE-RA is the registration authority, to wit:

registration-authority (1)
oui (a) = OUI-24 (value in decimal)
iab (b) = OUI-36 (value in decimal)
ether-type (c)
dot3-mfgr-id (d)
{other registries go here....}

Note: The values (a), (b),…etc. will be allocated actual numeric values, and this note removed, once the RAC have agreement on what goes under the registration-authority arc and each individual registry arc..

Hence, the OUI registry would appear under the arc:

iso (1) iso-identified-organization (3) ieee (111) registration-authority (1) oui (a)

The arcs following each of these registry arcs will likely be allocated in order to allow the contents of each registry to be represented[1].

[1] For example, the OUI registry will likely contain the OUI value in the next arc, followed by arcs for the name, address, etc. of the assignee, plus any other relevant attributes such as whether the entry is publicly available.

There are fundamentally two requirements that need to be met here:

1. To provide a structure that allows the current registered details (for example, the assignee for a given OUI, etc., essentially all of the information captured on the application form, plus any other information that the RA holds relative to an assignment) associated with each number assignment can be identified; and
2. To provide a structure within which a given assignee can allocate the user-assignable portion of the various identifier spaces that are available to an owner of an assigned number, such as EUI-48, EUI-64…etc., and further record any details associated with those number assignments (type of equipment the number was assigned to,…etc).

Using the same "root" assignment for both purposes is desirable, as the result is a unified naming structure that all users can understand, while still allowing for "customization" at the leaves of the naming tree to provide for diverging needs and uses.

To make this possible, the first arc in each registry contains an arc for each possible number that can be assigned by the RA within that registry, and the next arc below each assigned number determines whether the subsequent arcs are allocated for RA use or for assignee use, as follows:

> <register-name>-xxx (xxx) ra-registration-data (1) <register-name>-assignee-values (2)

Given that the registration details recorded by the RA, and the range of uses to which each assigned value can be put, differs by registry, the arcs below this point are specific to each registry, although where a common structure exists, this is reflected in the arc structure chosen.

Developing the detailed structure of the OID tree for the IEEE-RA registries is likely to take some time; as this does not affect other users of IEEE object identifiers, this document will be updated once that work has completed.

Object Identifiers within IEEE standards

To identify objects within IEEE Standards, each standard is allocated an arc under either the standards- association-numbered-series-standards (2) arc or the standards-association-c-series-standards (3) arc. The former is used for standards, such as IEEE Std 1394 or IEEE Std 802, that have a standard identifier that starts with a numeral; the latter is used for standards, such as IEEE Std C37 or IEEE Std C57, where the standard identifier starts with the letter "C". The arc allocated to each standard is numbered according to the numeric part of the standard identifier. That is, IEEE Std 1394 would be identified by:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-numbered-series-standards (2) std-1394 (1394)

and IEEE Std C37 would be identified by:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-c-series-standards (3) std- c37 (37)

Where standards that have multiple parts or sub-standards, such as the 802 series and the C37 series, each part or sub-standard would be allocated an arc of the form:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-numbered-series-standards (2) lan-man-stds (802) part3-csma-cd (3)

and:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-c-series-standards (3) std- c37 (37) part91 (91)

The responsibility for allocating any subsequent arcs under the individual standard lies with the standard identified by the sequence of arcs. The responsibility of the RA to assign numbers ceases at the point that the standard's arc has been defined, and the organization responsible for that standard takes responsibility for allocating numbers for any subsequent arcs beyond that level, and therefore no further administrative effort is needed before that standard can allocate OID values under its point in the tree. However, there are some common practices that should be considered for allocations below the standard number/part number.

The developing group for each standard decides how further arcs will be allocated within their standards, in a manner that meets their particular needs. For example, in the IEEE 802.1 Working Group, the seventh arc will be used to define the type of allocations that are being made. The only type defined so far is for MIBs, but others can be added in the future:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-numbered-series-standards (2) lan-man-stds (802) ieee802dot1 (1) ieee802dot1mibs (1)

Below this arc, each individual IEEE 802.1 MIB module can get its own identifier. The set of MIB modules that are defined within IEEE Std 802.1Q are already assigned arcs at this level; further arcs will be assigned as new 802.1 standards require them.[2] For the 802.1Q Textual Convention MIB the arc would be:

> iso (1) iso-identified-organization (3) ieee (111) standards-association-numbered-series-standards (2) lan-man-stds (802) ieee802dot1 (1) ieee802dot1mibs (1) ieee8021TcMib(1)

[2] The MIB modules for IEEE Std 802.1X , IEEE Std 802.1AB, and IEEE Std 802.1AE were assigned under a previous scheme; given the SNMP rule of not assigning two OID arcs to the same MIB module, these will only be included under the scheme described here if future revisions of those standards involve revised or extended MIB definitions.

It is the responsibility of each standards developing group to ensure that subsequent arc values are documented, so that the same OID value is never assigned to two different objects. In the IEEE 802.1 Working Group, this has involved placing tables of OID allocations in an annex within the standard concerned; in the IEEE 802.3 Working Group, a master spreadsheet of allocated OID values is maintained by the Chair and posted on their website. For future allocations, a master spreadsheet, held in a place that is broadly visible yet has a single point of control, is appropriate.

Before fixing the subsequent numbers in the sequence, please consider how the identifier will be used. A standards body could decide that, as well as allocating multiple sets of OID values for use within standards, there are other uses that make sense within their organization; for example, to identify working papers, participants in the process, procedural documents, etc.. Thus, an additional number in the sequence may be useful to distinguish between objects within a standard and objects that are allocated identifiers for other purposes.

The allocation scheme should construct subsequent arcs in a manner that leaves appropriate “escapes” for unforeseen uses. The simple expedient of allocating a “type of allocation” value as the eighth arc (as in the IEEE 802.1 Working Group usage described above) is sufficient to ensure that such an escape is always available.

Migration From Previous Object Identifier Allocations

The Object Identifier hierarchy described in this tutorial need not affect existing IEEE standards that have already solved this problem by using a specific allocation obtained elsewhere (for example, from ANSI). The primary aims of documenting this procedure are:

a) To ensure that Object Identifiers can be allocated under

iso (1) iso-identified-organization (3) ieee (111) standards-association (1)

in a manner that ensures that they are unique, and

b) To avoid the need for any further administrative overhead on the part of the IEEE-RA or IEEE standards committees (such as having to submit and process applications for the use of Object Identifier arcs) for any future uses of Object Identifiers in IEEE standards.

For those working groups that have already made use of other allocation schemes (IEEE 802.3 and IEEE 802.1 are both examples), it may be considered appropriate to migrate existing allocations to the hierarchy defined in this clause. In considering this, the following should be borne in mind:

c) While it might be perceived as “tidy” to have all IEEE Object Identifiers allocated under a single arc of the Object Identifier tree, this is not a requirement, as long as any given Object Identifier identifies a single object.

d) If migration is desired, there is no requirement to remove the old Object Identifier values[3]. Indeed, this is not permitted for objects defined in SNMP MIB modules, nor is it permitted to associate such objects with more than one Object Identifier value. Instead, new definitions are required to be created and registered under the desired Object Identifier tree[4].

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[3] There is no general requirement that an object should only have a single identifier; if it has more than one, then it can be "reached" by following more than one branch of the naming tree, just as a map can provide more than one path to a destination.

[4] This appears to contradict the earlier statement and footnote that indicate that it doesn't matter if multiple object identifiers point at the same object; however, this is a specific requirement imposed on SNMP MIB objects by the relevant IETF standards, and not a general rule.