

Guidelines for use of the 24-bit Organizationally Unique Identifiers (OUI):

Within 32-bit Context Dependent Identifier (CDI-32™), 40-bit Context Dependent Identifier (CDI-40™), 48-bit Extended Unique Identifier (EUI-48™), 60-bit Global Identifier (EUI-60™), and 64-bit Global Identifier (EUI-64™)

Within existing and new applications tutorial the 36-Bit Organizationally Unique Identifier can be applied to CDI-40 and all items farther down the list and an OUI based identifier

OUI Based Identifiers

The IEEE Registration Authority (IEEE-RA) administers the assignment of 24-bit identifiers, formally known as an "Organizationally Unique Identifier" (OUI).

CDI-32™ is a concatenation of a 24-bit OUI value assigned by the IEEE-RA and an 8-bit extension identifier assigned by the organization with that OUI assignment.

TCDI-40™ is a concatenation of a 24-bit OUI value assigned by the IEEE-RA and a 16-bit extension identifier assigned by the organization with that OUI assignment.

MAC-48 (obsolete label) is a concatenation of a 24-bit OUI assigned by the IEEE-RA and a 24-bit extension identifier assigned by the organization with that OUI assignment.

EUI-48™ is a concatenation of a 24-bit OUI value assigned by the IEEE-RA and a 24-bit extension identifier assigned by the organization with that OUI assignment.

EUI-60 (deprecated) is a concatenation of a 24-bit OUI assigned by the IEEE-RA and a 36-bit extension identifier assigned by the organization with that OUI assignment.

EUI-64™ is a concatenation of the 24-bit OUI value assigned by the IEEE-RA and a 40-bit extension identifier assigned by the organization with that OUI assignment.

EUI-48 and EUI-64 values are intended to be used within applications that require fixed size universal identifiers. Other applications may elect to use variable length identifiers (such as those defined in ASN.1, which support a more flexible and extensible hierarchy of organizational identifiers).

IAB Based Identifiers

The IEEE-RA administers the assignment of 36-bit Individual Address Block (IAB) identifiers. The IAB identifier is assigned by the IEEE-RA; it consists of a 24-bit OUI that has been assigned to the IEEE-RA for the purpose of creating IAB identifiers,

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concatenated with a 12 bit extension identifier assigned by the IEE-RA. IAB provides the assignee with a block of 4096 EUI-48 identifiers; these identifiers are created by the assignee by a further 12-bit extension identifier concatenated with the 36-bit IAB identifier.

IAB can only be used for the purpose of assigning EUI-48 identifiers; any other identifiers that might be created by the use of the 24-bit OUI value used to create the IAB remain the property of the IEEE-RA.

Deprecated and Obsolete Identifiers

A variety of alternative context-dependent identifiers, such as specialized [22-bit OUI-based identifiers](#), have been used in the past. Such uses are deprecated; the CDI-32 or CDI-40 should be used in future applications requiring the use of compact context-dependent identifiers.

The use of the MAC-48 identifier is obsolete; EUI-48 or EUI-64 should be used in current and future applications requiring the use of unique 48-bit identifiers.

The use of the EUI-60 identifier is deprecated. Since EUI-60 identifiers form a portion of World Wide Names (WWNs) value defined within multiple disk related standards, there is no plan to eliminate the use of these EUI-60 values within the foreseeable future. The term deprecated does not imply a demise of EUI-60 identifiers, but implies the EUI-64 (as opposed to EUI-60) identifiers should be used in future applications requiring the use of unique per-hardware instance identifiers.

IEEE Administered Identifiers

IEEE administers the assignment of 24-bit OUI values. The assignments of these values are public, so that a user of a MAC-48, EUI-48, or EUI-64 value can identify the organization that provided any value¹. The IEEE/RAC has no control over the assignments of the extension identifiers and assumes no liability for assignments of duplicate CDI-32, MAC-48, EUI-48, EUI-60, or EUI-64 identifiers assigned by manufacturers.

The 24-bit OUI value is intended to identify the organization that administers the remaining bits in CDI-32, CDI-40, EUI-48, EUI-60 and EUI-64 values. The OUI value should not be used (in isolation) to identify a vendor or the format of vendor-dependent information. When necessary to identify the vendor of a hardware device, the EUI-48 (or EUI-64) identifier should be used. This allows large organizations to assign distinct EUI-48 identifiers, so that each division can be identified as a distinct "vendor". Alternatively, groups within an SDO (standards development organization) can be identified by distinct EUI-48 (or EUI-64) identifiers administered by their sponsoring body.

Identifier Applications

In new applications, the OUI values are expected to generate extended unique identifiers of the following forms:

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- [CDI-32](#): A 32-bit identifier used to identify a very small number of design instances.
- [CDI-40](#): A 40-bit identifier used to identify a small number of design instances.
- MAC-48: An obsolete label; A term previously used to distinguish between types of EUI-48.
- [EUI-48](#): Limited uses include:
 - A 48-bit identifier used to address hardware interfaces within existing 802 based networking applications.
 - A 48-bit identifier used to identify a design instance, as opposed to a hardware instance. Examples include software interface standards (such as VGA), the model number for a product, or the form/function of vendor-specific content.
- [EUI-60](#): Deprecated; A 60-bit identifier used to identify each hardware instance of a product, such as a disk drive.
- [EUI-64](#): A 64-bit identifier used to identify each hardware instance of a product, regardless of application, such as wireless devices and computerized toasters, as well as EUI-48 identifier applications.

NOTE: When used to identify a hardware instance in new applications, the IEEE/RAC intends to migrate from EUI-48 to EUI-64 identifiers. However, for backward compatibility, this transition may be difficult for some 802-related applications. Therefore, policies for allowing selective use of 48-bit identifiers within 802-related systems are being developed (see the following subclause for further details).

EUI-64 value was originally conceived as a mechanism to avoid excess consumption of OUI values within high-volume non-networking applications. Given the minimal probability of consuming all EUI-64 identifiers, the IEEE/RAC places minimal restrictions on their use within standards. Unless mandated by backwards-compatibility constraints, the use of EUI-64 is preferred to the use of EUI-48.

The terms EUI-48 and EUI-64 are trademarked by IEEE. Companies are allowed to use this term for commercial purposes, but only if their use of this term has been reviewed by the IEEE/RAC and the proposed products using the EUI-48 or EUI-64 conform to these restrictions.

CDI-32 and CDI-40 Identifier Restrictions

In some applications, for example, in data communications protocols that are sensitive to payload or throughput constraints, context-dependent identifiers, based on the concatenation of a 24-bit OUI value with a 1-byte or 2-byte extension identifier administered by the organization to which the OUI is assigned, have been used. Such identifiers have typically been used in order to allow for vendor-defined extensions to a base standard.

There are potential problems with the use of such identifiers that make it preferable to use EUI-48 or EUI-64 wherever possible:

- If the context within which the assignment of extension identifiers is required to be unique is not accurately defined, then there is the danger of

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inadvertent re-use of an existing identifier assignment for a different purpose, leading to ambiguity in the use of the assigned values;

- If the chosen size of the extension identifier is small relative to the actual number of identifier values that will need to be assigned under a single OUI, then the result could be an unacceptable rate of consumption of OUI values, and potential difficulty in the owner of an OUI meeting the Registration Authority's requirement that 95% of the block assignment represented by their existing OUI be consumed before making use of a further assignment.

Consequently, the use of context-dependent identifiers is acceptable, subject to the use meeting all of the following requirements:

- The context within which the context-dependent identifier is used, and within which its identifier values are required to be unique is clearly defined in the relevant standard.
- The size of the chosen extension identifier is large enough to accommodate all conceivable requirements for the allocation of distinct values under a single OUI within the defined context.
- The IEEE/RAC has approved the identifier and the definition of the context within which it will be used.
- Tutorial material that describes the context-dependent identifier and its application, suitable for inclusion in this website, is submitted to the IEEE/RAC.

Further details are defined in [Guidelines for use of a Context Dependent Identifier \(CDI-32 or CDI-40\)](#).

EUI-48 Identifier Restrictions

48-bit EUI-48 identifiers were originally created to serve as network or media access control (MAC) addresses for local area networks (LANs) by IEEE Project 802. Within this environment, EUI-48 identifiers are intended to identify items of real physical equipment, parts of such equipment, or functions that apply to many instances of physical equipment.

The use of 48-bit identifiers has been extended to serve as protocol identifiers to identify protocol designs and design revisions of protocols operating between instances of physical equipment, where there are expected to be far fewer such protocols identified than there are items of addressable physical equipment.

The total number of EUI-48 identifiers available, while large, is NOT inexhaustible. The IEEE/RAC has the duty to promote the continued availability of the EUI-48 capability in conjunction with IEEE standards and non-IEEE standards, for the benefit of the world-wide community using those standards.

With the exception of such protocol identifiers, EUI-48 identifiers are intended to identify items of real physical equipment or parts of such equipment such as separable subsystems or individually addressable ports. The expected use should not exceed one EUI-48 identifier per hardware subsystem or at most a very low

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number of EUI-48 identifier per physical instances of such equipment (e.g. groups of ports as in IEEE Std 802.3ad, for link aggregation). Allocation of a single EUI-48 bit identifier to identify or permit addressing of a fixed and permanent function associated with a real item of physical equipment occurs for the lifetime of that equipment or an indefinite period of use.

In particular any application that called for subdivision of the available number space, for block allocation to physical equipment without an identifiable physical instance per EUI-48 identifier, or for encoding functional capabilities within significant bits or bit patterns of the identifier, has the potential to rapidly exhaust the address space. To reduce the prospect of exhaustion, new applications and proposed extensions to current applications with significant volume expectations are STRONGLY encouraged to make use of EUI-64, rather than EUI-48, to identify hardware instances.

New applications that require address format matching to the existing base of EUI-48 equipment will be reviewed by the IEEE/RAC and such exceptions will only be approved on a case-by-case basis. Given the widespread use of hardware identifiers, particularly within consumer based IP applications, the number of exceptions (which use EUI-48 vs EUI-64 identifiers to identify hardware instances) is expected to be small. Non-standard uses of EUI-48 are not supported.

The IEEE/RAC solicits any information about threats to the viability of the unique EUI-48/EUI-48/EUI-64 address space, whether an IEEE proposed standard or another standard or specification. Further, in carrying out this duty to preserve the longevity of these identifier capabilities, the RAC will act, via liaison or direct coordination, to prevent potentially abusive uses for the consumption of the OUI.

The IEEE/RAC regards the consistent enforcement of these restrictions as a fundamental and realistic basis for ensuring longevity of the EUI-48 identifier capability, with a target lifetime of 100 years for existing applications using EUI-48 identifiers.

Further details are defined in [Guidelines for use of a 48-bit Extended Unique Identifier \(EUI-48\)](#).

Non-Overlapping Assignments

The organization that purchases an OUI is encouraged to assign only one form of EUI-48 identifier, regardless of application. The intent of this restriction is to reduce possible errors introduced by the complexities of managing multiple context-dependent address spaces within each organization.

Thus, EUI-48 values that specify I/O driver software interfaces, language codes, and hardware model numbers never overlap. Similarly, EUI-64 values that specify I/O driver software interfaces, language codes, hardware model numbers, and hardware instances never overlap. This no-overlap strategy is expected to reduce

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unintentional duplication of EUI values, by elimination of subjective application-class judgments, although a few more EUI values may be consumed.

Null Values

Many applications have found it useful to define a [distinct null identifier](#), most often indicating the absence of a valid EUI-48 or EUI-64 value. The recommended null values are FF-FF-FF-FF-FF-FF and FF-FF-FF-FF-FF-FF-FF-FF, for EUI-48 and EUI-64 values, respectively. Values based on a zero-valued OUI, such as 00-00-00-00-00-00 and 00-00-00-00-00-00-00-00, must not be used, since the OUI value of 00-00-00 has been assigned and could therefore be used for other purposes.

Documentation of Use

Given the possible confusions of bit ordering and byte positioning, applications must clearly specify a mapping of the OUI value (expressed as hexadecimal digits) to the applicable register or byte-string sequence, in an unambiguous manner. To ensure clarity, each mapping should be self contained. If deemed necessary to cross-reference other documents within a series, the specific document and page number shall be cross-referenced, so that unfamiliar readers can easily find the source.

To avoid changes in existing standards, the working group has the option of providing tutorials, to be posted on the IEEE/RAC web site.

If a standard, or its cross-referenced portions of other standards, does not conform to these documentation policies, the IEEE/RAC can recommend the standard not be approved.

Identifier Consumption

The OUI assignment allows the assignee to generate approximately 1 trillion (10^{12}) unique EUI-64 values, by varying the last 40 bits. Similarly, the assignee can generate approximately 69 billion (10^9) unique EUI-60 values, by varying the last 36 bits. Alternatively, the assignee can generate approximately 16 million (10^6) unique EUI-48 values, by varying the last 24 bits. IEEE intends not to assign another value to a manufacturer until the manufacturer has consumed, in product, the preponderance (more than 90%) of the block of potential EUI-48, EUI-60, or EUI-64 values. It is incumbent upon the manufacturer to ensure that large portions of the unique word block are not left unused in manufacturing.

¹Except for private OUI values, where the owner of the OUI value is confidential. These remain private.