Guidelines for 64-bit Global Identifier (EUI-64)
General

The IEEE-defined 64-bit Extended Unique Identifier (EUI-64) is an identifier whose limited uses include:

- A 64-bit identifier used to address hardware interfaces within existing IEEE 802 or IEEE 802-like networking applications.
- A 64-bit identifier of a specific hardware instance that is not necessarily a network address.
- A 64-bit identifier used to identify a design instance, as opposed to a hardware instance (eg. a model number).

The EUI-64 is formed as:

- A concatenation of a 24-bit Organizationally Unique Identifier (OUI) value assigned by the IEEE Registration Authority (IEEE RA) and a 40 bit extension identifier assigned by the organization with that OUI assignment. (This is an MA-L assignment.)
- A concatenation of a 28-bit value assigned by the IEEE RA and a 36-bit extension identifier assigned by the organization with that base assignment. (This is an MA-M assignment.)
- A concatenation of a 36-bit OUI-36 value assigned by the IEEE RA and a 28-bit extension identifier assigned by the organization with that OUI-36 assignment. (This is an MA-S assignment.)

The assigned EUI-64 identifier blocks are, by default, publically available. This permits users to identify the organization/company that was assigned an EUI-64. For those organizations/companies electing to use the private listing options, the assignee of an EUI-64 is not publicly available. The assignee of an EUI-64 block is responsible for administering the assigned EUI-64 identifiers. The IEEE RA does assign the base 24-bit, 28-bit or 36-bit number, but it has no control over the assignments of the individual EUI-64 and assumes no liability for assignments of duplicate EUI-64 identifiers by organizations/companies.

The term EUI-64 is trademarked by IEEE and should be so identified. Organizations are allowed limited use of this term for commercial purposes. Where such use is identification of features or capabilities specified within a standard or for claiming compliance to an IEEE standard this may be done without approval of IEEE, but other use of this term must be reviewed and approved by the IEEE RAC.

Mandatory IEEE RAC Coordination

When an EUI-64 is used within the context of an IEEE standard, the standard shall be reviewed by the IEEE RAC for correctness and clarity. When an EUI-

64 is referenced within non-IEEE standards, the standard developers should contact the RAC for review of proper usage.

EUI-64 Format

When an EUI-64 is provided by an authorized assignee of these values (i.e., by an assignee of an MA-L, MA-M or MA-S, the most- significant 24, 28 or 36 bits of EUI-64 are assigned to the organization/company by the IEEE RA. The least-significant bits are the extension identifier assigned by the organization/company.

An EUI-64 is a string of eight octets, labeled as *eui[0]* through *eui[7].* The format of the EUI-64 is illustrated below. The example assumes that an organization's/company's IEEE-assigned MA-L value is AC-DE-48$_{hex}$ and the organization/company-selected extension identifier for a given component is 23-45-67-AB-CD$_{hex}$. The EUI-64 value generated from these two numbers is AC-DE-48-23-45-67-AB-CD$_{hex}$.

An EUI-64 is properly displayed as shown with hyphens between numbers in canonical address representation (see the section "Non-canonical address representation" of the tutorial "Guidelines for Use Organizationally Unique Identifier (OUI) and Company ID (CID)") or as a hexidecimal number (ACDE48234567ABCD$_{16}$). As required, it may also be displayed as a binary number as illustrated below.

```
|         OUI(24)         |               extension identifier              | field
|         |         |     |         |         |         |         |         |
| eui[0]  | eui[1]  | eui[2] | eui[3] | eui[4]  | eui[5]  | eui[6]  | eui[7]  | order
|         |         |     |         |         |         |         |         |
|   AC    |   DE    |  48 |   23    |   45    |   67    |   AB    |   CD    | hex

10101100 11011110 01001000 00100011 01000101 01100111 10101011 11001101 binary
```

The following example assumes that an organization's/company's IEEE-assigned MA-S value is 00-1B-C5-05-3$_{hex}$ and the organization/company-selected extension identifier for a given component is 1-23-45-67$_{hex}$. The EUI-64 value generated from these two numbers is 00-1B-C5-05-31-23-45-67$_{hex}$.

```
|               OUI-36             |        extension identifier      | field
|         |         |        |     |         |         |         |     |
| eui[0]  | eui[1]  | eui[2] | eui[3] | eui[4] | eui[5]  | eui[6]  | eui[7] | order
|         |         |        |     |         |         |         |     |
|   00    |   1B    |   C5   |  05 |   31    |   23    |   45    |  67 | hex

00000000 00011011 10100101 00000101 00110001 00100011 10000101 01100111 binary
```

The encoding of data for transmission has many possibilities. Bit-serial encodings may differ on the ordering of bit transmissions within octets; and block codes (encoding multiple bits rather than single bits) normally transmit

octets in an ascending index-value order, though some block code encode multiple octets. The numeric value of an EUI does not change because of transmission order.

When transferred to other electronically-readable locations (e.g., within a disk file) the relative ordering of the octets may be changed, as specified within the applicable standard as long as the numeric value is retained.

Mapping an EUI-48 to an EUI-64

If you are generating an EUI-64 from an OUI-24, and are also using the OUI-24 to generate EUI-48s, see the description of creating a mapped EUI-64 in the EUI-48 tutorial.

Unassigned EUI-64 values

The all-zeros and all-ones EUI-64 values, 00-00-00-00-00-00-00-00$_{hex}$ and FF-FF-FF-FF-FF-FF-FF-FF$_{hex}$, are owned by the IEEE Registration Authority and will never be assigned, and are invalid for use as identifiers. These values are used to represent NULL or uninitialized EUI-64 values. As an example, these values may be fabricated into an integrated circuit to be initialized, by hardware or firmware.

Other worldwide identifiers based on EUI-64

Some formats of World Wide Names (WWN) are derived from an EUI-64. WWNs are used as disk and endpoint addresses in SCSI and associated protocols. Please refer to the Fibre Channel tutorial for more information. For more information please refer to EUI-64 to WWN Map (www.t10.org/ftp/t10/document.06/06-476r2.pdf) and latest INCITS SATA and SAS standards for additional WWN details.

IPv6 addressing derived from EUI-64 is defined in IETF RFC4291 Appendix A. Please see http://tools.ietf.org/html/rfc4291 and http://www.ietf.org/rfc/rfc2460.txt http://www.ietf.org/rfc/rfc5952.txt http://www.ietf.org/rfc/rfc6052.txt.

UUID addressing derived from EUI-64 address and OUIs are defined in http://www.ietf.org/rfc/rfc4122.txt and the international version in http://www.itu.int/ITU-T/studygroups/com17/oid/X.667-E.pdf.