

# Update on IEEE 802.1

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# Before We Start – Disclaimer

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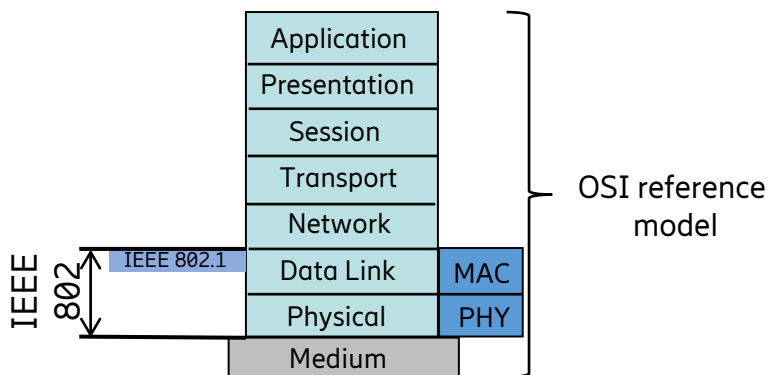
## Per IEEE SA Standards Board Bylaws

“At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.”



# Working Group

- Architecture and Bridging
  - Traditionally, the Higher Layer Interface
- Part of the LAN / MAN Standards Committee
  - Along with 802.3, 802.11, 802.15, ...
  - Wired and wireless standards for data link and physical layers
  - In operation since March 1980



## IEEE 802.1 Working Group

*Chair: Glenn Parsons*  
*Vice-chair: Jessy Rouyer*

**TSN Task Group**  
*Chair: János Farkas*

**Security Task Group**  
*Chair: Mick Seaman*

**Maintenance Task Group**  
*Chair: Paul Congdon*

**YANGsters**  
*Chair: Scott Mansfield*

**Nendiica**  
*Chair: Roger Marks*

# 802 reference model

MSAP    MAC service access point  
LSAP    link service access point

PSAP    PHY service access point

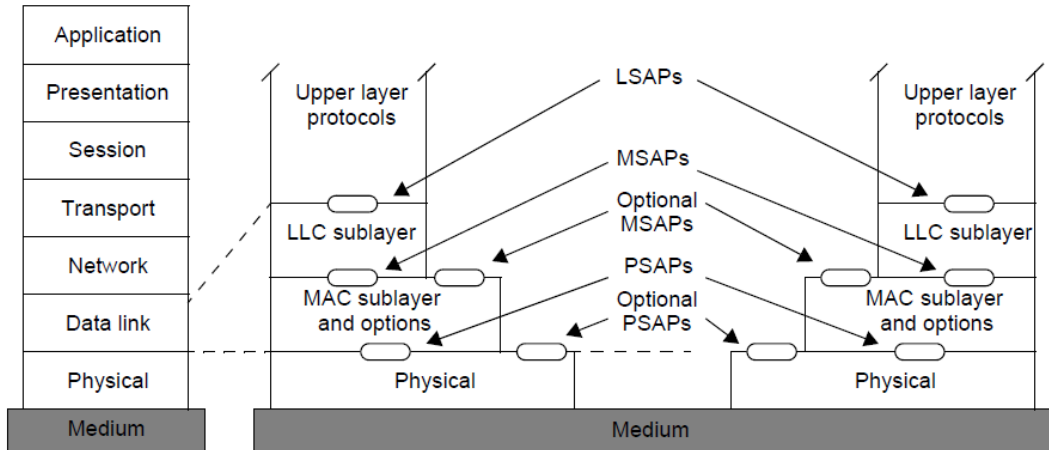


Figure 3 - IEEE Std 802

- Current IEEE 802 family of working groups
- 802.1 Bridging and Architecture
- 802.3 Ethernet
- 802.11 Wireless LAN (WLAN)
- 802.15 Wireless Personal Area Network (WPAN)
- 802.16 Broadband Wireless Access (BWA)
- 802.21 Media Independent Handover
- 802.22 Wireless Regional Area Networks (WRAN)

# MAC address

- 48-bit or 64-bit number used to identify the source and destination MAC entities
- May also be used to identify a MAC SAP
- If the Individual/Group (I/G) bit is set to 1, the address is a group MAC address
- If the Universal/Local (U/L) bit is set to 1, the address is locally administered

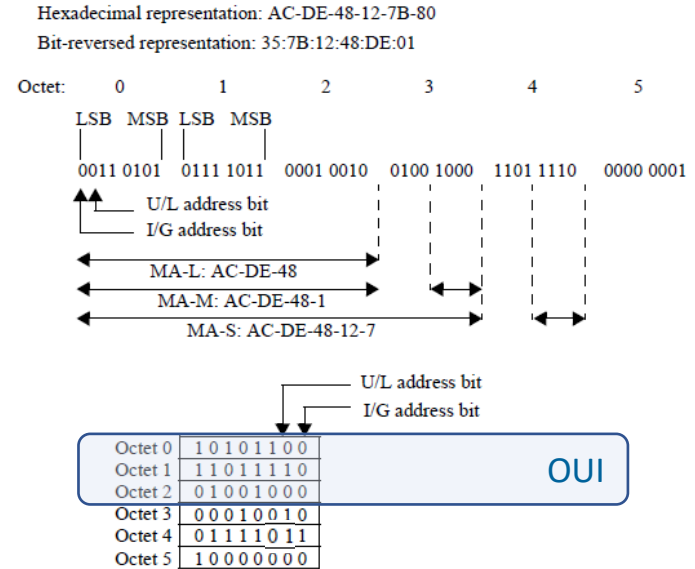


Figure 10 – IEEE Std 802

# Local space organization

- In order to avoid exhaustion, methods were put in place to encourage more use of local MAC addresses
- The optional Structured Local Address Plan (SLAP) specifies different assignment approaches in four specified regions of the local space
  - Extended Local
  - Standard Assigned
  - Administratively Assigned
  - Reserved

Hexadecimal representation: AA-DE-48-12-7B-80

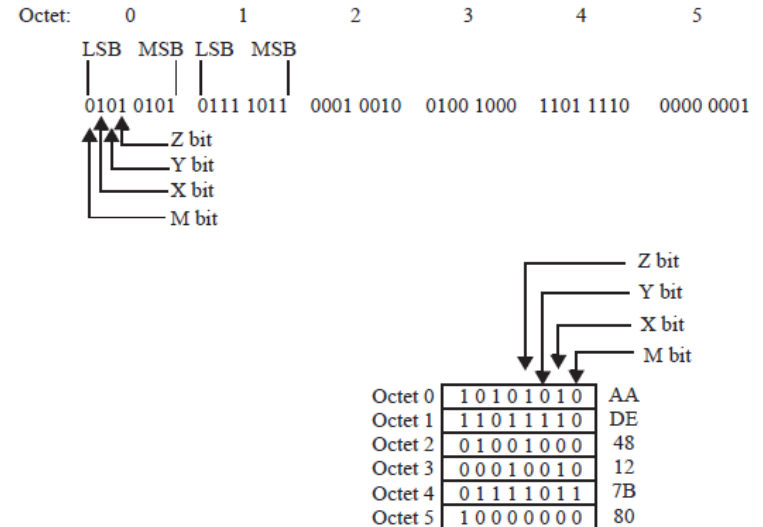


Figure 11a – IEEE Std 802c

# IEEE Std 802 and the RAC

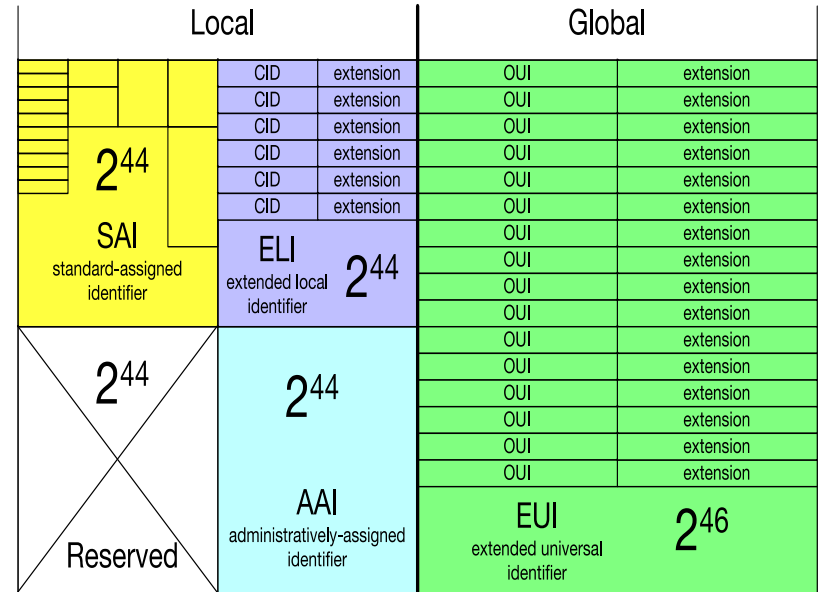
- IEEE Std 802 is the primary standard for multiple IEEE Registration Authority administered registries
  - IEEE RA administered universally unique MAC address registries (MA-L, MA-M and MA-S)
  - Specifications for use of Organizationally Unique Identifier (OUI) contained in MA-L, and Company ID (CID)
    - Including specifications for use of the CID in local MAC address space
  - Hierarchical registries (e.g., oid and urn)

octet identifier	MSB								LSB			
	0	1	2	3	4	5						
MA-L	24-bit OUI				24-bit extension							
MA-M	28-bit MA-M base					20-bit extension						
MA-S	36-bit OUI-36							12-bit extension				
example value (hex)	AC		DE		48		23		45		67	
example value (binary)	1010	1100	1101	1110	0100	1000	0010	0011	0100	0101	0110	0111

Table 6 – RAC Guide to EUI, OUI and CID

# Unicast MAC Address Space

- “Any failure of such uniqueness invalidates the fundamental premises of IEEE 802 network operation and may lead to disruption. Therefore, administrators should ensure that the probability of local MAC address non-uniqueness is acceptably small.” (IEEE Std 802c-2017, §8.4.1)
- “Administrators who wish to assign local MAC addresses in an arbitrary fashion (for example, randomly) and yet maintain compatibility with other assignment protocols operating under the SLAP on the same LAN may assign a local MAC address as AAI.” (IEEE Std 802c-2017, §8.4.4.3)





# IEEE Std 802 revision

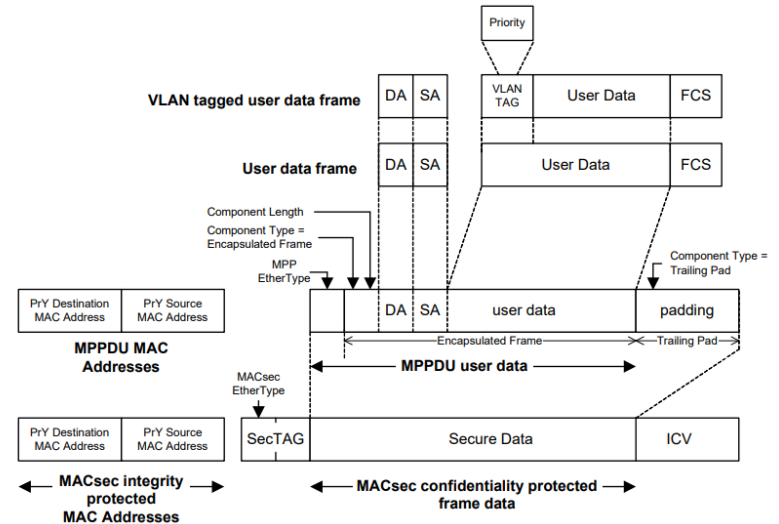
- IEEE standards must be revised at least every 10 years to remain active
  - Revision of IEEE Std 802 will likely start in 2022 and finish before EoY 2024
- Study of architecture issues currently underway
  - [Evolved Link Layer Architecture \(ELLA\)](#)
  - Includes mapping of MAC address(es) to MSAP(s)

# MAC Security and Privacy

- MAC Security (MACsec) [802.1AE]
  - MACsec secures a link or a VLAN with encryption
  - MACsec counters 802.1X man-in-the-middle attacks
- Privacy Considerations [802E]
  - Specifies a privacy threat model for IEEE 802 technologies
  - Provides recommendations on how to protect against privacy threats
  - Promotes a consistent approach to threat mitigation by IEEE 802 protocol developers
- MAC Privacy Protection [P802.1AEdk]
  - Specifies privacy enhancements that reduces the ability of external observers to correlate user data frames, their sizes, transmission timing and transmission frequency with users' identities and activities.
  - The encapsulation format allows one or more user data frames and padding to be carried within the confidentiality protected data of a consolidating frame, hiding the users' MAC addresses and original frame sizes.

# P802.1AEdk - MAC Privacy protection

- It specifies an encapsulation format that allows one or more user data frames and padding octets to be carried within the confidentiality protected data of consolidating frames, hiding the users MAC addresses and original frame sizes. The transmitter can balance the privacy improvement against the loss of efficiency and delay by controlling the sizes of consolidating frames and when they are transmitted.
- Even when data confidentiality protection is provided, unauthorized observers can correlate MAC addresses, frame sizes, and frame transmission timing with user identities, the applications being used, and with the content or purpose of LAN communications.
  - Proprietary solutions to enhance privacy, guarding against such network traffic analysis have been developed.
  - Vendors and users have expressed a desire for a standard interoperable solution for use in conjunction with IEEE Std 802.1AE MAC Security.



From the [Project authorization Request \(PAR\)](#)

Draft Figure 17-2 (from a [contribution](#))

# Additional information

- IEEE 802.1 Working Group website - <http://ieee802.org/1>
  - Nendica - <https://1.ieee802.org/802-nendica/>
  - Security TG - <http://ieee802.org/1/security>
- IEEE 802.1 standards (Freely available through [IEEE GET on Xplore](#))
  - [IEEE Std 802-2014](#)
  - [IEEE Std 802c-2017](#)
  - [IEEE 802E-2020](#)
- IEEE 802.1 WG technical tutorials
  - IEEE 802.1 TSN Webinar Series: <https://engagestandards.ieee.org/TSN-Webinar-Series.html>
  - TSN: <http://www.ieee802.org/1/files/public/docs2018/tsn-farkas-intro-0318-v01.pdf>
  - IEEE Std 802c – Local MAC Addresses: <https://mentor.ieee.org/802-ec/dcn/17/ec-17-0174.pdf>
  - IEEE 802.1Q (from IETF 86): <https://www.ietf.org/proceedings/86/slides/slides-86-edu-ieee802-2.pdf>
- IEEE Registration Authority
  - Guide to EUI, OUI and CID: <https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/tutorials/eui.pdf>