Saying goodbye to LLC

(but not to LLC Addresses)

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Saying goodbye to LLC

- Current situation

- Architecture and management models

- Protocol discrimination in IEEE 802
  - EPD/LPD and all that

- Changing text in other 802 standards
  - Examples:
    - 802.1AX-2020
    - 802.1AE-2018
    - 802.1Q-2020

Current situation

- ISO/IEC 802-2:1989 has status 'stablized',
  IEEE 802.2-1998 is Inactive/Withdrawn

- Products no longer conform to 802.2-1989
  — Protocol discrimination by LLC Address is used
  — 'XID' and 'Test' functions not implemented

- IEEE Std 802-2014 LLC Address description incomplete
  — Historically focused on SNAP SAP and continued use of EtherTypes

- 802 and other important standards use LLC Addresses
  — IS-IS, RSTP, 802.11, …
  — No prospect of all these going away, 'fork-lift upgrade' impractical

- Many 802 standards refer to LLC as a distinct sublayer
  — Lip service a practical past expedient

- LLC sublayer does not & need not feature in management
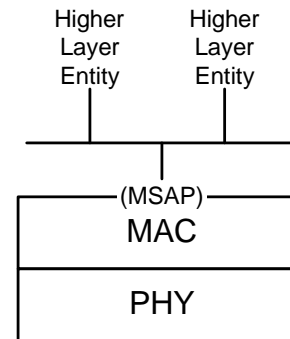
Architecture and management models

A. With LLC (presumed)

Higher Layer Entity | Higher Layer Entity

—(LSAP)—————(LSAP)—
LLC
—(MSAP)—
MAC

PHY
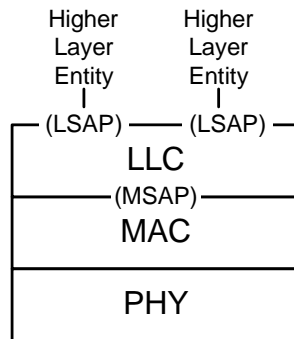
Each 'Higher Layer Entity' connects to an LSAP that adds/recognizes/removes its protocol id from the MSDU octets.

- SNAP SAP users fill in just part of the protocol identifier?

B. Without LLC

Higher Layer Entity | Higher Layer Entity

—(MSAP)—
MAC

PHY

Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets.

- Any length of protocol id supporting the required discrimination is OK.

- Opinions on mux/demux implementation may differ, but these models have **identical external behavior**.
- YANG for an IP interface augments the Ethernet (MAC) interface, not LLC
- MIB for a distinct LLC was SNA specific, expired at second IETF draft (1995)
- **No technical need** (except for any legacy LLC Type 2) **for LLC sublayer.**

Protocol discrimination in IEEE Std 802

IEEE Std 802-2014 Clause 9 Protocol Identifiers incomplete:

- No mention of LLC Addresses, except for SNAP SAP
    - Relied on IEEE Std 802.2 to complete the picture

- Relies on IEEE Std 802.3 for EPD
    - Dependency not completely clear

- Proposed resolution in

    http://www.ieee802.org/1/files/public/docs2020/maint-seaman-protocol-ids-in-std-802-0520-v01.pdf

    - Specifies media-dependent EPD and LPD encoding of protocol identifiers
    - Different 'types' reflect encoding and bridge re-encoding differences between media
    - Encoding specified in terms of what the MAC Service user encodes/decodes from initial octets of MSDU (no need for LLC Sublayer)

Changing text in existing standards

Many standards show or reference the 'LLC sublayer'

- But it is not difficult to move step by step towards the management/YANG model where the 'Higher Layer'/MAC Client uses the MAC Service directly
- Removes the vagueness associated with 'Higher Layer' in a world where MAC Clients occur even within media independent MAC functionality
- None of the steps is urgent, the historical ambiguity is not practically harmful, in effect we have lived with it for years

Changes in IEEE Std 802.1AX-2020

- Remove the sublayer "LLC (LOGICAL LINK CONTROL) OR OTHER AGGREGATOR CLIENT" and remove the following NOTE (which is not an accurate description of the interface stack for other reasons, and is historic)
- In the first paragraph of 9.6.1 replace "using the service provided by an LLC Entity that uses, in turn, a single instance of the MAC Service provided at" with "using a single instance of the MAC Service provided at"
- In 9.6.1 delete NOTE 1 (which explains that in this standard an "LLC Entity" handles EtherTypes"
- In B.2 g) replace "from the LLC sublayer or above" with "from the MAC Client".

That's all.

Changes in IEEE Std 802.1AE-2018

- Remove Bibliographic reference to ISO/IEC/IEEE 8802.2 and references to it elsewhere in the standard
- In the initial text of clause 6, delete NOTE 4.
- In 6.1 delete "provided to an LLC Client", "to an LLC Client", "used by an LLC client".
- In 6.2 delete "to an LLC Entity".
- In 11.1 delete "to LLC and", and simply remove LLC boxes and LSAP from Figure 11-1 through to Figure 11-13, changing "(MS)" to "(MSAP)".

That's all.

Changes in IEEE Std 802.1Q-2018

- In 5.13 remove bullet c), the requirement to implement a conformant LLC class, doubtful whether anyone does anymore. Adjust PICS to match.
- Remove LLC (boxes) and replace MS (if present) with MSAP in Figure 6-1, 8-4, 8-5, 8-6, 8-7, 8-8, 8-9, 8-19, 10-4, 10-6, 11-1, 15-1, 15-2, 15-4, 22-1, 22-4, 22-7, 22-8, 22-9, 22-13, 23-3, 25-1, 25-6, 25-13, 26-8, 26-10, 27-5, 35-1, 39-1, 39-2, 39-3, 40-2, 40-3, 40-5, 40-6, 44-2,
- In 6.3 NOTE 2, replace "The LLC entity in a" with "A", and replace "discard the frame and not deliver it to any LLC User." with "discard the frame."
- In 6.12 a) rewrite to refer to an updated IEEE Std 802, or to be standa-alone and not require 8802-2 to be consulted for the protocol identifier format.
- 6.22 (which specifies LPD and EPD) requires careful consideration, but is not affected by the architecural change which is the subject of this presentation.
- In 8.2 delete "to an LLC Entity that operates LLC Type 1 procedures", and delete the sentences beginning "Other types of LLC procedures .." and "Each instance of the MAC Service is provided to a distinct LLC Entity .." and the following NOTE which extends an LLC Entity to cover EtherTypes.
- In 8.3 b) replace "The LLC Entity or Entities that support Higher Layer Entities" with "The MSAPs that support MAC Clients".
- In 8.3 delete "an LLC Entity that uses".

Changes in IEEE Std 802.1Q-2018 (cont.)

- In 8.3.12 replace "an LLC Entity" with "MAC Clients" and "the LLC Entity" with "the MAC Clients".
- In 8.13.3 replace the refernces to DL_ parameters by the equivalent refernces to use of LLC Addresses as a protocol identifier. Add a historic note. Update the IS-IS, allowing the use of the LLC Encapsulation EtherType.
- In 8.13.7 replace "a single LLC Entity attached to" with "a single MSAP supported by a Bridge Port".
- In 10.5 c) replace "using" with "uses" and delete ", shall use LLC procedures" and delete the following NOTE 2 (which explains we really mean using EtherTypes and not LLC").
- Update the NOTE to Figure 14-1.
- Replace "If the LLC entity of a Bridge Port ...transmit ... particular Bridge Port" with "If a particular Bridge Port is used to transmit".
- In 22.1.7 delete "LLC".
- In 23.13 delete "by an LLC entity that uses, in turn", and delete the following NOTE 1.
- In the NOTE in 36.1.1 replace "The LLC-SAP of a" with "A".
- In the NOTE in 36.1.3.1 replace "the LLC" with "MAC Clients supported by a Bridge Port".

Changes in IEEE Std 802.1Q-2018 (cont.)

That's all, apart form a half-dozen cross references from the PICS.