ELLA: Proposed Aspects of IEEE Std 802 Revision

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+1 802 capable

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IEEE Std 802 - History

- IEEE Std 802-1990
- IEEE Std 802-2001
  - IEEE Std 802a-2003: Playpen EtherTypes
  - IEEE Std 802b-2004: OID hierarchy
- IEEE Std 802-2014
  - IEEE Std 802c-2017: Local MAC Address Usage
  - IEEE Std 802d-2017: URN allocation
  - P802f: YANG Data Model for EtherTypes
    - WG ballot opened, June 2021
- Procedurally, revision should follow before further amendments

IEEE Std 802 - Contents

1. Overview, Scope, Purpose
2. Normative references
3. Definitions
4. Family of IEEE 802 standards
5. Reference models (RMs)
6. General requirements for an IEEE 802 network
7. IEEE 802 network management
8. MAC addresses
9. Protocol identifiers
10. Allocation of OID values
11. Allocation of URN values

- Annex A (informative) Bibliography
- Annex B (informative) Reference models for IEEE 802 standards
- Annex C (informative) Examples of bit ordering for addresses
- Annex D (informative) List of IEEE 802 standards
- Annex E (informative) History
- [Annex F: (informative) YANG representation example (P802f)]

Proposal on how to revise

- 4. *Family of IEEE 802 standards* (pp 7-10)
  - ▫ 4.1 High-level view of IEEE 802 networks: revise; explain the commonality
  - ▫ 4.2 List of applications: delete
  - ▫ 4.3 Internationalization: minimize
  - ▫ 4.4 List of standards and projects: delete
- 5. *Reference models (RMs)* (pp 11-18): replace with LL Service & Architecture
  - ▫ 5.1 Describes Link Layer (LL) as one LLC over various MACs: replace
    - • Describes media-independent handover: delete
  - ▫ 5.2 Reference model for end stations (LLC/MAC/PHY): replace
  - ▫ 5.3 Interconnection: replace
    - • Barely mentions VLANs or priority; no reference to their role in architecture
- 6. *General requirements for an IEEE 802 network* (p 19)
  - ▫ Replace with (conformance-related?) description of LL service provided to client
- 7. *IEEE 802 network management* (pp 20-21): replace
- 8. *MAC Addresses* (pp 22-27, plus pp 12-19 of 802c)
  - ▫ Revise; merge with LL Service and Architecture
- 9. *Protocol identifiers* (pp 28-34)
  - ▫ Lists many 802.3 MAC frame formats, without assigning fields to layers
    - • Who's responsible for adding and stripping those fields?
  - ▫ Replace; merge with LL Service and Architecture

IEEE Std 802 – Proposed Revision

1. *Overview, Scope, Purpose*
2. *Normative references*
3. *Definitions*
4. *Family of IEEE 802 standards*
5. *Network and application scenarios served by IEEE 802*
6. *IEEE 802 Link Layer Service and Architecture*
7. *General requirements for an IEEE 802 network*
8. *IEEE 802 network management*
9. *Allocation of OID values*
10. *Allocation of URN values*

- *Annex A (informative) Bibliography*
- *Annex B (informative) Reference models for IEEE 802 standards*
- *Annex C (informative) Examples of bit ordering for addresses*
- *Annex D (informative) ~~List of IEEE 802 standards~~*
- *Annex E (informative) History*
- *Annex F: (informative) YANG representation example*

Link Layer Service and Architecture

- Layers, sublayers, and SAPs
  - LLC & LSAP
  - MAC & MSAP
  - PHY
  - VLAN-aware and priority-aware end station
- Link Layer (LL) service specification
  - LL Service User and LL Service Provider
  - LL modes
    - Service Characteristics
      - Transparency
      - Data loss, data insertion, data duplication, misordering, priority, QoS, time-sensitivity, flow control,...
  - LL Service primitives
  - LL Service parameters
  - LL Service sequences of actions and events
- MAC service specification
  - Refer to IEEE Std 802.1AC
- LSAP addresses and protocol discrimination
- MAC address
- Bridging and relay architecture

Service Characteristic statements

- 802.2:
  - *connectionless-mode service... may be useful when higher layers provide any essential recovery and sequencing services so that these do not need replicating in the data link layer.*

- 802.1Q:
  - *The MAC Service (IEEE Std 802.1AC) permits a negligible rate of reordering of frames with a given priority for a given combination of destination address, source address, and flow hash, if present, transmitted on a given VLAN.*
    - *Note: This is an inaccurate characterization of 802.1AC.*

- *IEEE Std 802.1AC*
  - *In general, the MAC Service provider can perform any or all of the following actions: Discard objects, Change the order of the objects*
  - *The MAC Service exhibits a negligible rate of the following: Object duplication, Reordering of objects for a given priority*
  - *Awareness of the characteristics of the MAC Service provided, e.g., the rate at which objects can be discarded, duplicated, or misordered, is part of the MAC Service user's a priori knowledge of the environment.*
  - *Although the MAC Service maintains the integrity of individual MSDUs, it does not necessarily deliver them to the receiving MAC Service user in the order in which they are presented by the transmitting MAC Service user, for example in cases where they have different priorities.*

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Why Specify the Link Layer?

▫ Many reasons

▫ One reason: so the upper layer knows how to use the 802 service

▫ Currently, this is complicated.

▫ See, for example, RFC8691 ("Basic Support for IPv6 Networks Operating Outside the Context of a Basic Service Set over IEEE Std 802.11")

▫ Note recent IETF/802 coordination discussions

- *https://mailarchive.ietf.org/arch/msg/ieee-ietf-coord/m2MYVLxygGsObD8PcdX6c6lEJLA/*

VLAN/priority-aware end station

- IEEE Std 802:
  - *IEEE Std 802.1Q specifies the method by which the MAC service is supported by virtual bridged LANs, the principles of operation of those networks, and the operation of VLAN-aware bridges,…*
  - Nothing about VLAN-aware end stations.

- 802.1Q (6.3 – Support of the MAC Service) :
  - *On the individual LANs of a Virtual Bridged Network, frames for different VLANs can be distinguished by the addition of a VLAN tag as the initial octets of a frame's MSDU.*
  - *A VLAN-aware end station can use the EISS Multiplex Entity (6.17) to provide multiple SAPs, one per VID of interest, to separate MAC Clients.*

EISS Multiplex Entity

Per 802.1Q:

On the individual LANs of a Virtual Bridged Network, frames for different VLANs can be distinguished by the addition of a VLAN tag as the initial octets of a frame's MSDU.

A VLAN-aware end station can use the EISS Multiplex Entity (6.17) to provide multiple SAPs, one per VID of interest, to separate MAC Clients.

single SAP

multiplexed SAPs

single SAP

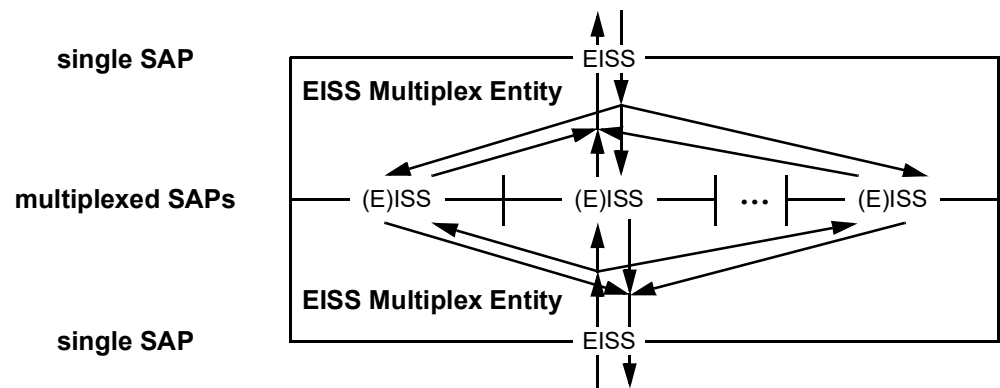**Figure 6-6—Two back-to-back EISS Multiplex Entities**

~~ISS~~ MS
(no VLAN)

~~ISS~~ MS
(VLAN 1)

~~ISS~~ MS
(VLAN 2)

untagged or priority-tag

VLAN tag

VLAN tag

~~EISS~~ tag-aware MS
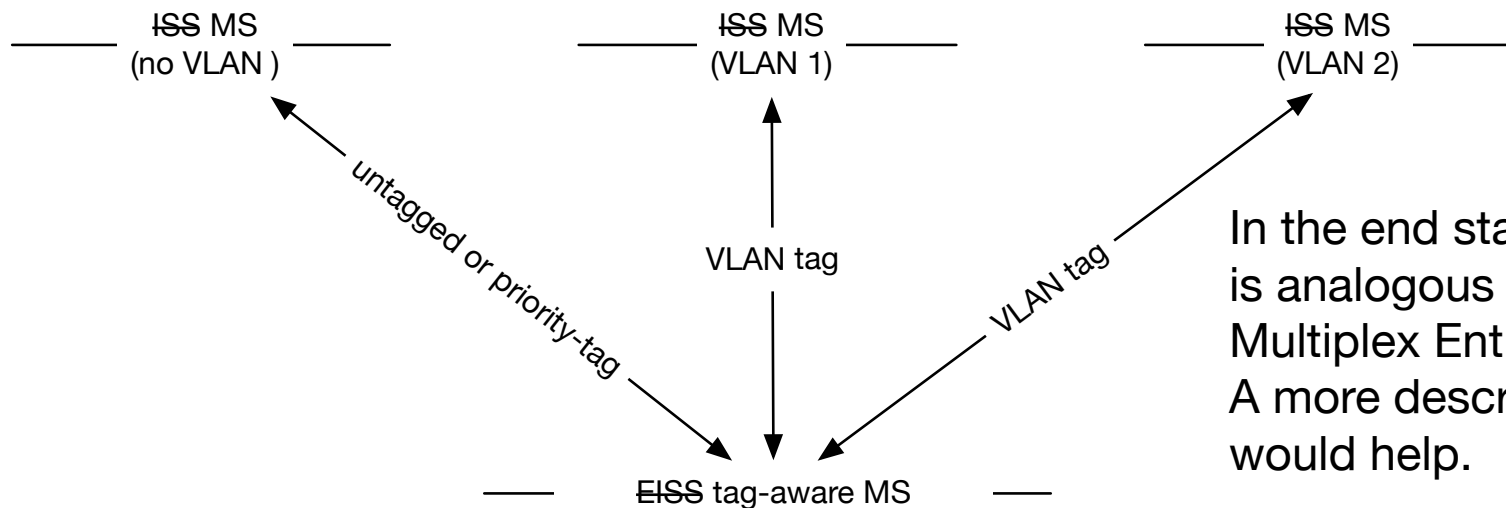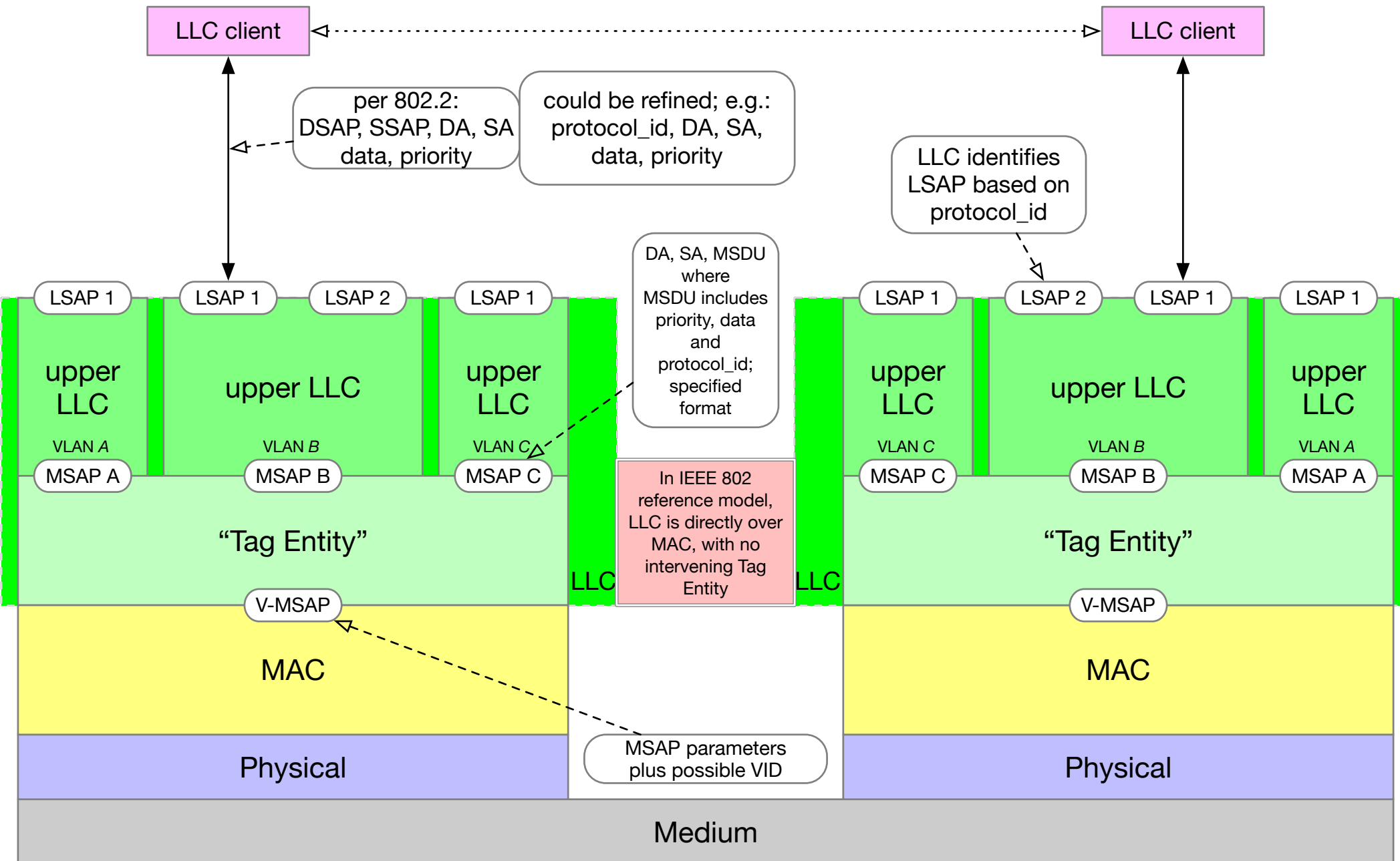
In the end station, this function is analogous to the "EISS Multiplex Entity" but different. A more descriptive name would help.

for example: "Tag Entity"

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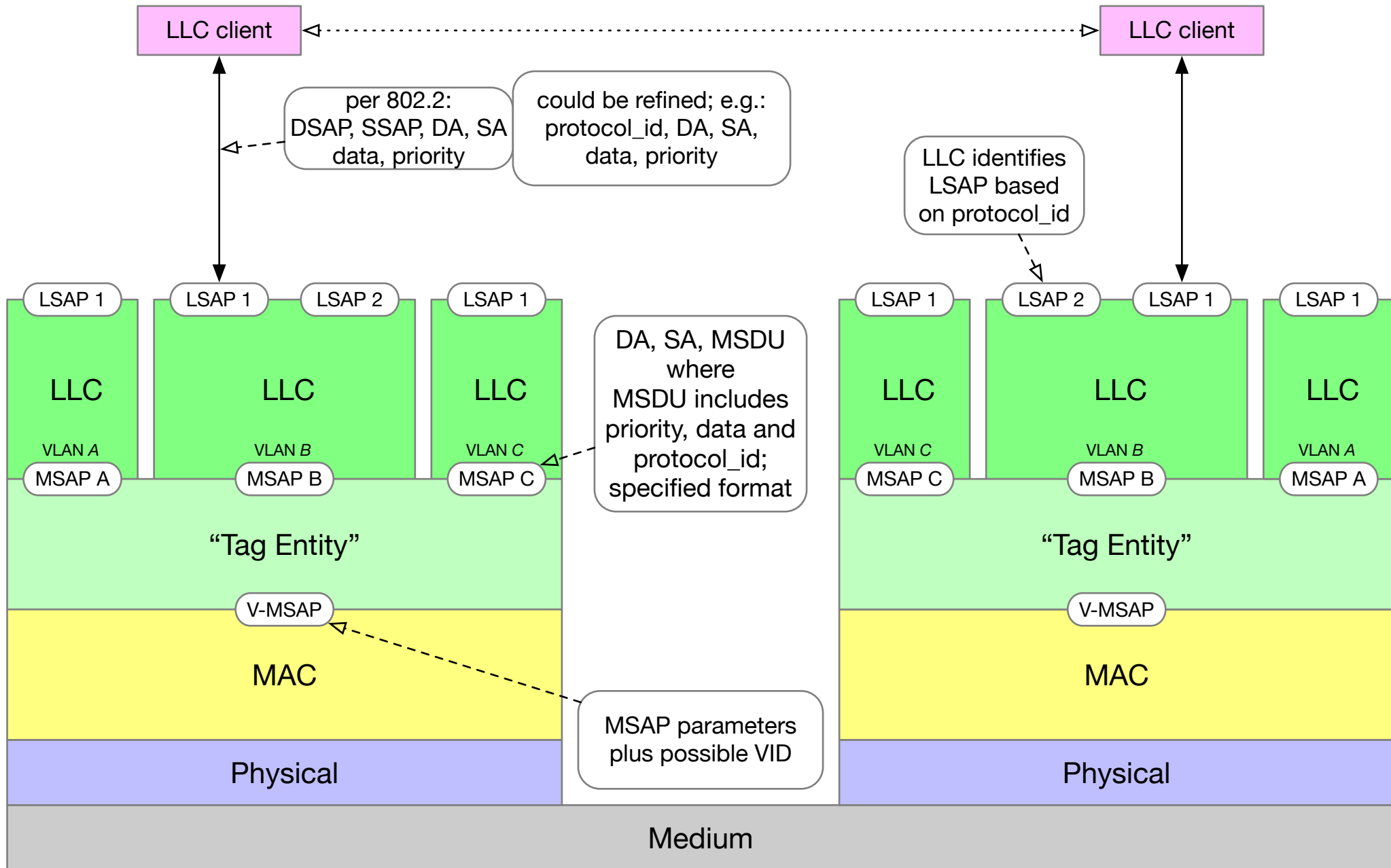
schematic End Station Architecture...

schematic End Station Architecture...

LLC client .... LLC client

per 802.2: DSAP, SSAP, DA, SA, data, priority

could be refined; e.g.: protocol_id, DA, SA, data, priority

LLC identifies LSAP based on protocol_id

DA, SA, MSDU where MSDU includes priority, data and protocol_id; specified format

In IEEE 802 reference model, LLC is directly over MAC, with no intervening Tag Entity

MSAP parameters plus possible VID

| LSAP 1 | LSAP 1 | LSAP 2 | LSAP 1 | | LSAP 1 | LSAP 2 | LSAP 1 | LSAP 1 |

upper LLC — VLAN A — MSAP A
upper LLC — VLAN B — MSAP B
upper LLC — VLAN C — MSAP C

LLC

"Tag Entity"

V-MSAP

MAC

Physical

upper LLC — VLAN C — MSAP C
upper LLC — VLAN B — MSAP B
upper LLC — VLAN A — MSAP A

LLC

"Tag Entity"

V-MSAP

MAC

Physical

Medium

schematic End Station Architecture

LLC client

LLC client

per 802.2:
DSAP, SSAP, DA, SA
data, priority

could be refined; e.g.:
protocol_id, DA, SA,
data, priority

VLAN A
VLAN A
LSAP 1

VLAN B
VLAN B
LSAP 1

VLAN B
LSAP 2

VLAN C
VLAN C
LSAP 1

VLAN A
VLAN C
LSAP 1

VLAN B
VLAN B
LSAP 2

VLAN B
LSAP 1

VLAN C
VLAN A
LSAP 1

LLC identifies LSAP
based on
(1) VID
(2) protocol_ID

SAP between LLC and
Tag Entity disappears;
this provides more
freedom.

LLC
(VLAN-aware)

LLC
(VLAN-aware)

V-MSAP

V-MSAP

MAC

MAC

MSAP parameters
plus possible
exposed VID

Physical

Physical

Medium

Next topic: MSAP Multiplicity

Per IEEE Std 802-2014:

The MAC sublayer provides one or more MAC service access points (MSAPs) as interfaces to the LLC sublayer in an end station.

What is this MSAP multiplicity per end station? [Note: No indication that this is VLAN multiplexing.]

How is the MSAP characterized? Is an MSAP identified by one and only one MAC address?

- MAC Client can send frames from multiple SAs; the SA of each frame is a MAC service parameter.
- MAC Client can receive frames to multiple DAs.
    - the DA and SA are exposed to the MAC Client, so it can discriminate based on them

    -LSAP *"source_address"* and *"destination_address"* parameters provide … logical concatenation of the MAC address field (SA and/or DA) and… (SSAP/DSAP)

- So: the MSAP is characterized by the list of all MAC addresses that it is configured to receive.
    - this is not a multiplicity of MSAPs
- We do not need multiple MSAPs per end station.
- A hardware device could have multiple "end stations," each with an MSAP.