LLC Functionality

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Note: Personal views of contributor expressed herein.

Topic: Nendica Evolved Link Layer Architecture (ELLA) Study Item

See also:

- *Questions about the IEEE 802 Architecture* (2022-01-26)
- *VLAN-aware end stations in the IEEE 802 Architecture* (2022-02-24)

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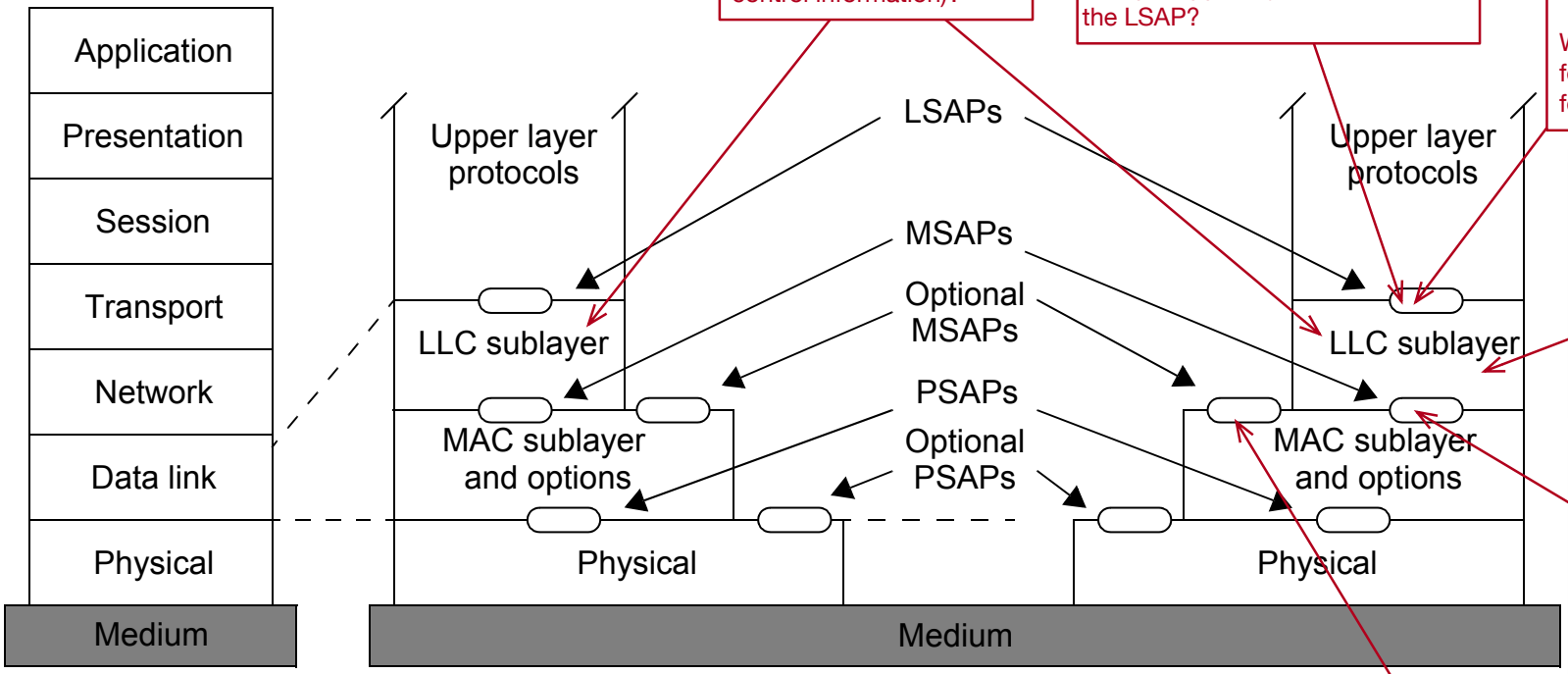
IEEE 802 Reference Model

source: *Questions about the IEEE 802 Architecture*

MSAP MAC service access point
LSAP link service access point



Can two LLC entities communicate (e.g. share control information)?

How does the application express QoS requests?

How does LLC arbitrate when multiple upper layers have data for the LSAP?

What are the characteristics of the Link Layer service provided to the Link Layer client at the LSAP, analogous to the LLC specification in IEEE Std 802.2?

What parameters are passed?

What are the allowed frame formats? Which formats are forbidden or blocked?

What are the functions of the LLC?

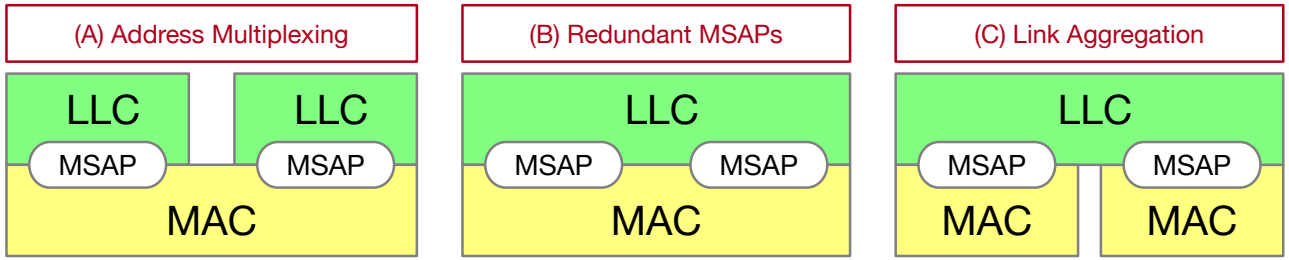
How are the parsing rules used to identify the service parameters (from LSAP and from MSAP)?

What are the allowed frame formats?

How is the MSAP characterized by MAC address; e.g., can an MSAP have multiple MAC addresses; e.g. multicast addresses).

Does the MAC handle this? Are there arbitration issues when both LLCs send data to the MAC?

Figure 3—IEEE 802 RM for end stations

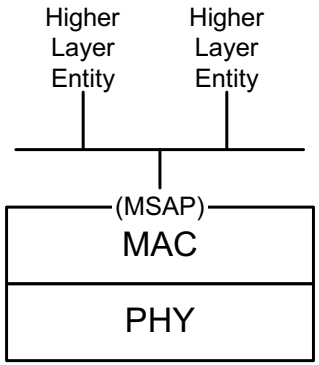


Do the MSAP and Optional MSAP allow configurations (A), (B), and (C)? The figure seems to suggest (A). IEEE 802 says “MAC sublayer provides one or more MAC service access points (MSAPs) as interfaces to the LLC sublayer in an end station”; this could be (A) or (B). Is (B) allowed? Do we need (B)? Is Link Aggregation (C) within the architecture?

LLC deletion has been proposed

- *Saying goodbye to LLC* (Mick Seaman, 2022-03-10)
- *Protocol identification in 802 LANs* (Mick Seaman, 2022-03-10)

B. Without LLC



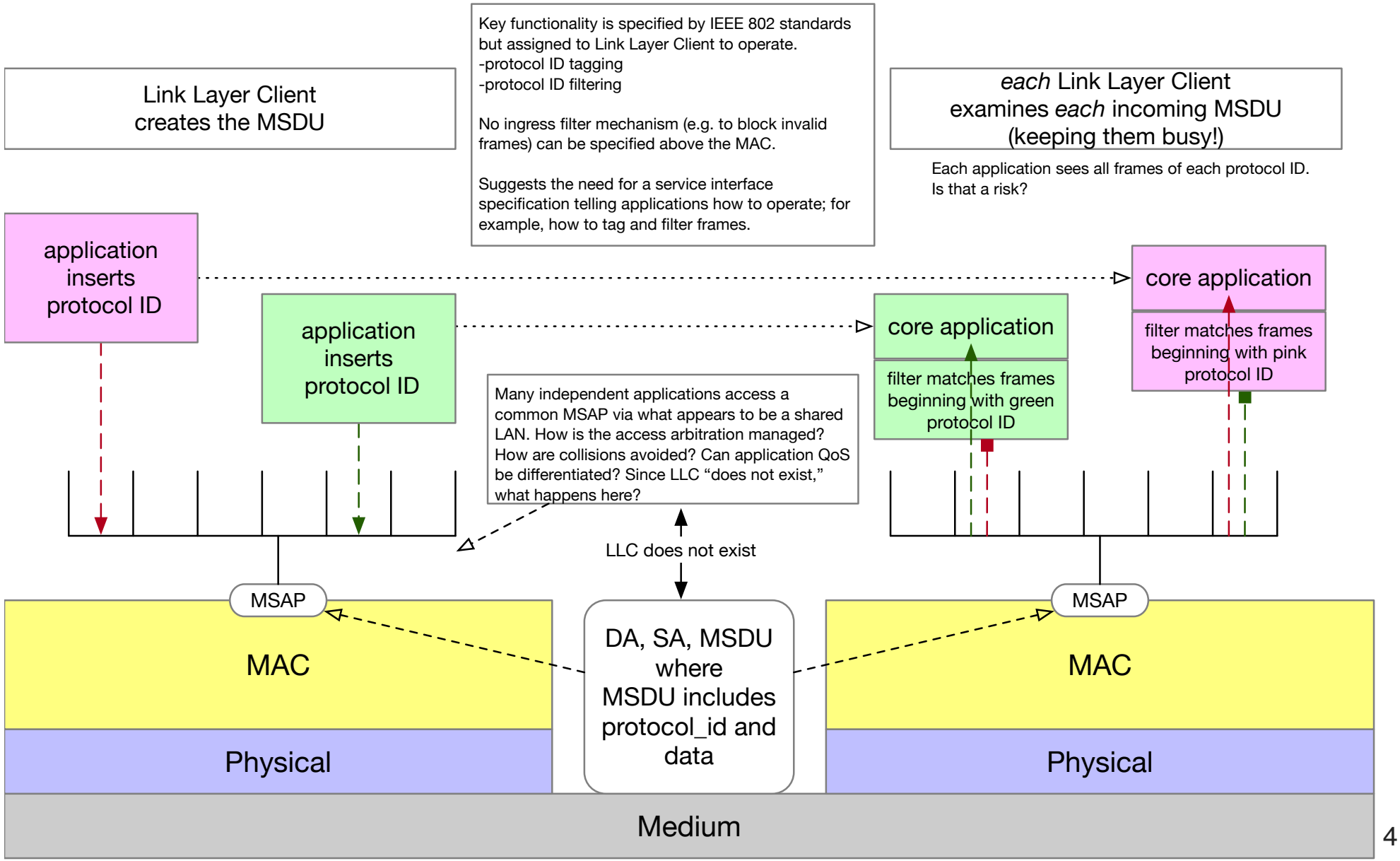
Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets.

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

source: *Saying goodbye to LLC*

Operation without LLC (without VLANs)

"Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets."
-1-22-0007-00-ICne ("Saying goodbye to LLC")



Operation without LLC (VLAN model 1)

"Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets."
-1-22-0007-00-ICne ("Saying goodbye to LLC")

VLAN-aware Link Layer Client creates the tagged MSDU

Key functionality is specified by IEEE 802 standards but assigned to Link Layer Client to operate.
-protocol ID and VLAN tagging
-protocol ID and VLAN filtering

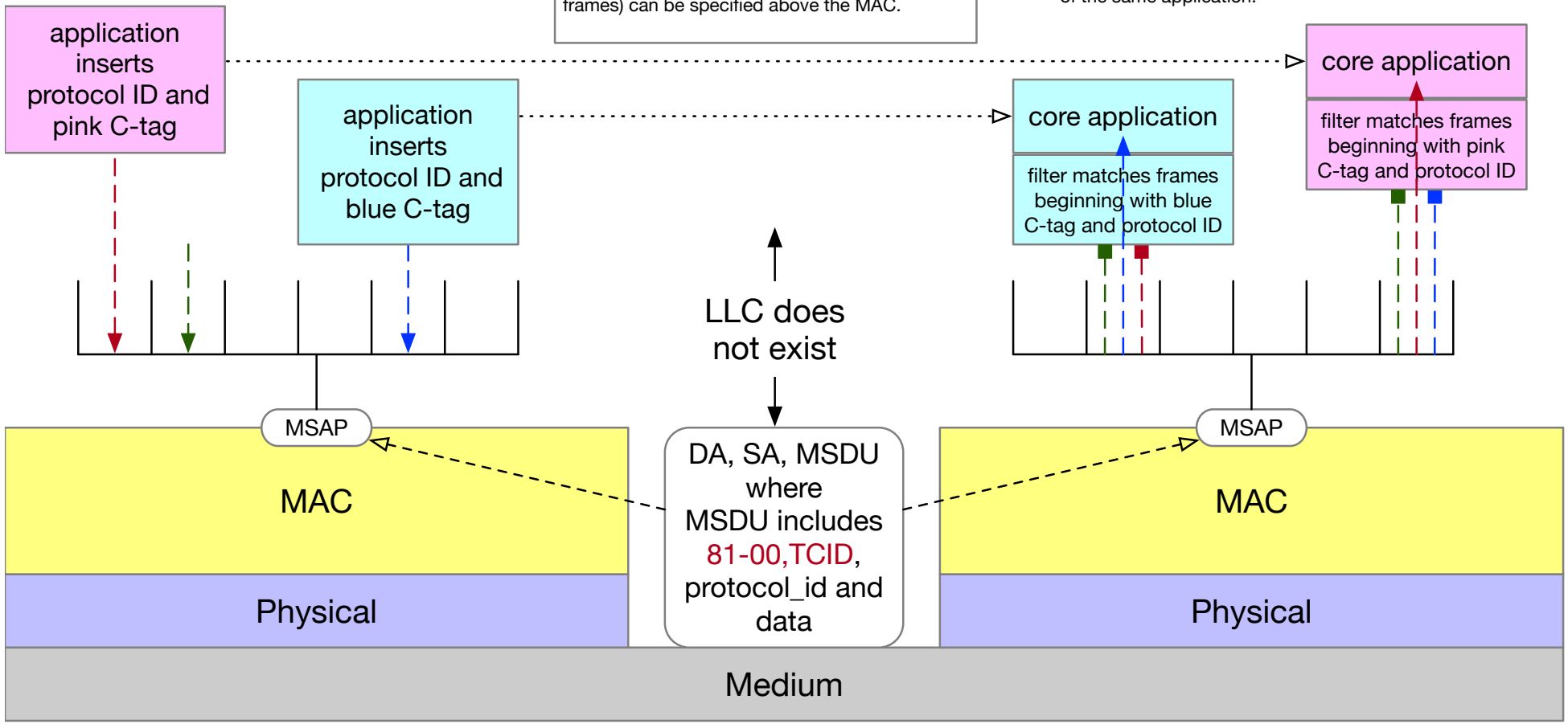
VLAN control is outsourced to applications. How are they assigned or controlled? What if VLANs are duplicated?

No ingress filter mechanism (e.g. to block invalid frames) can be specified above the MAC.

each VLAN-aware Link Layer Client examines *each* incoming tagged MSDU

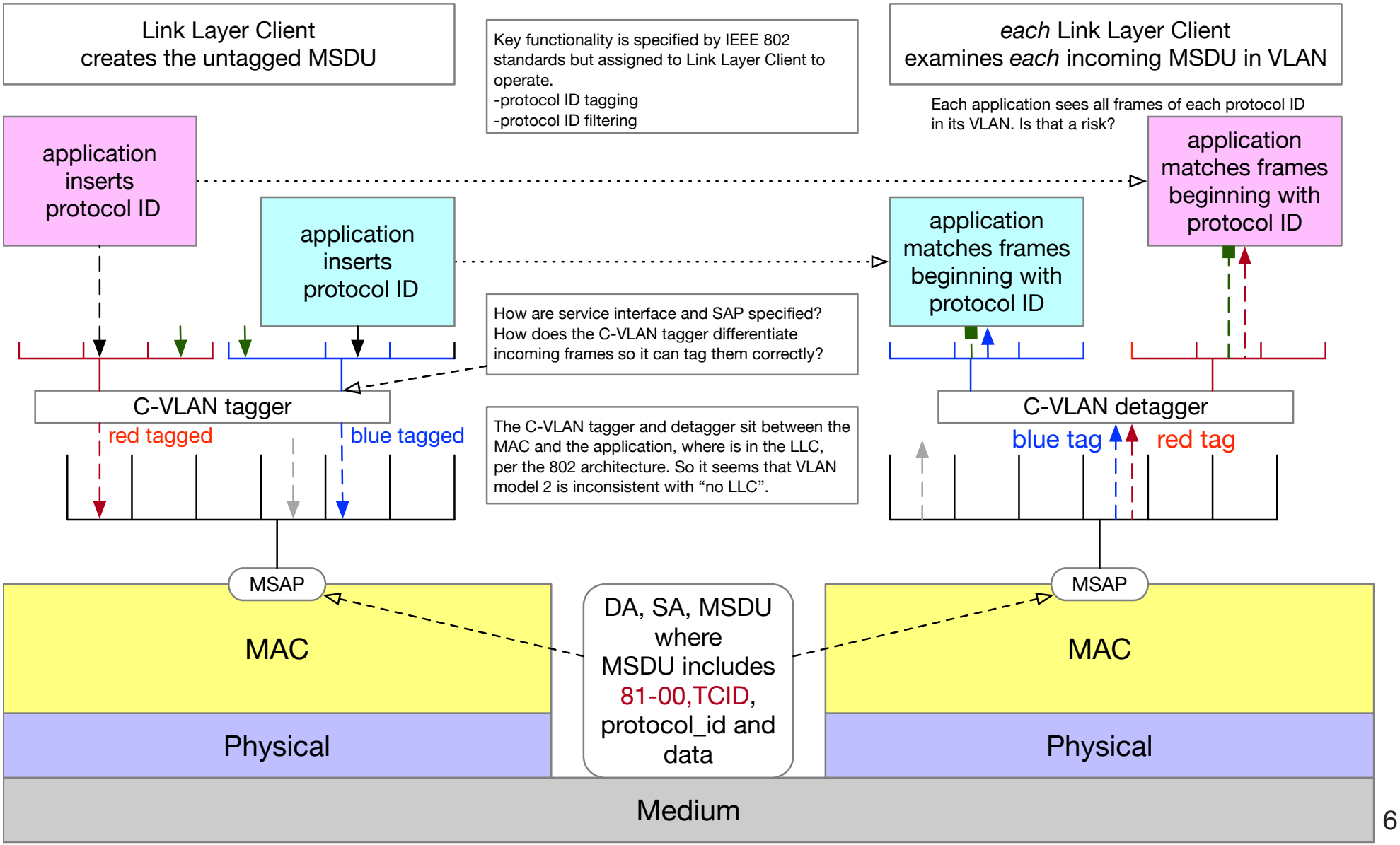
Each application sees all frames of each protocol ID *and each VLAN*. Is that a risk?

VLAN tags are isolating: they lead to separate instances of the same application.



Operation without LLC (VLAN model 2)

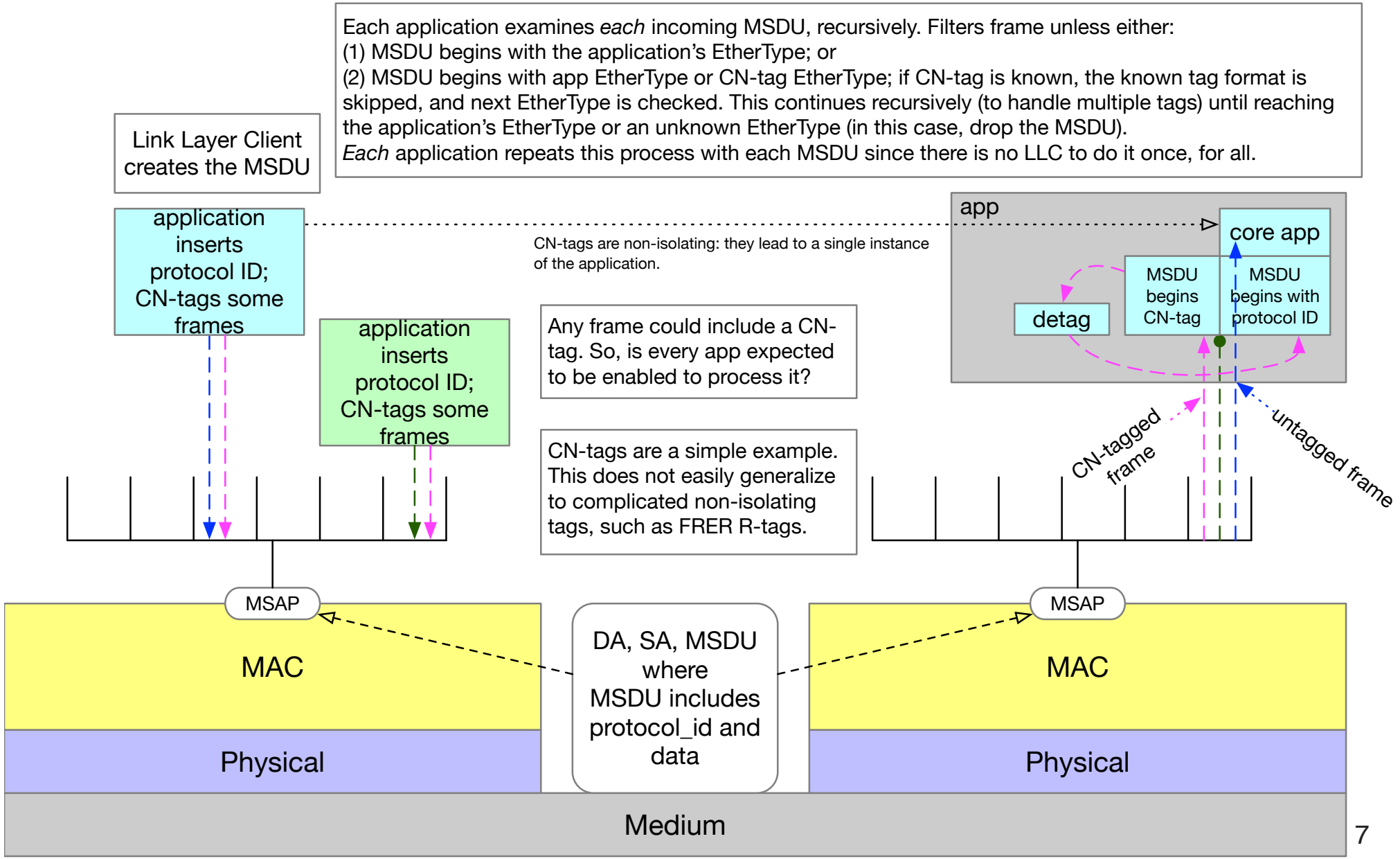
"Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets."
-1-22-0007-00-ICne ("Saying goodbye to LLC")



Operation without LLC (CN-tag, model 1)

"Each 'Higher Layer Entity' at the same MSAP fills in/recognizes its protocol identifier in initial MSDU octets."
-1-22-0007-00-ICne ("Saying goodbye to LLC")

Each application examines *each* incoming MSDU, recursively. Filters frame unless either:
(1) MSDU begins with the application's EtherType; or
(2) MSDU begins with app EtherType or CN-tag EtherType; if CN-tag is known, the known tag format is skipped, and next EtherType is checked. This continues recursively (to handle multiple tags) until reaching the application's EtherType or an unknown EtherType (in this case, drop the MSDU).
Each application repeats this process with each MSDU since there is no LLC to do it once, for all.



Operation without LLC (CN-tag, model 2)

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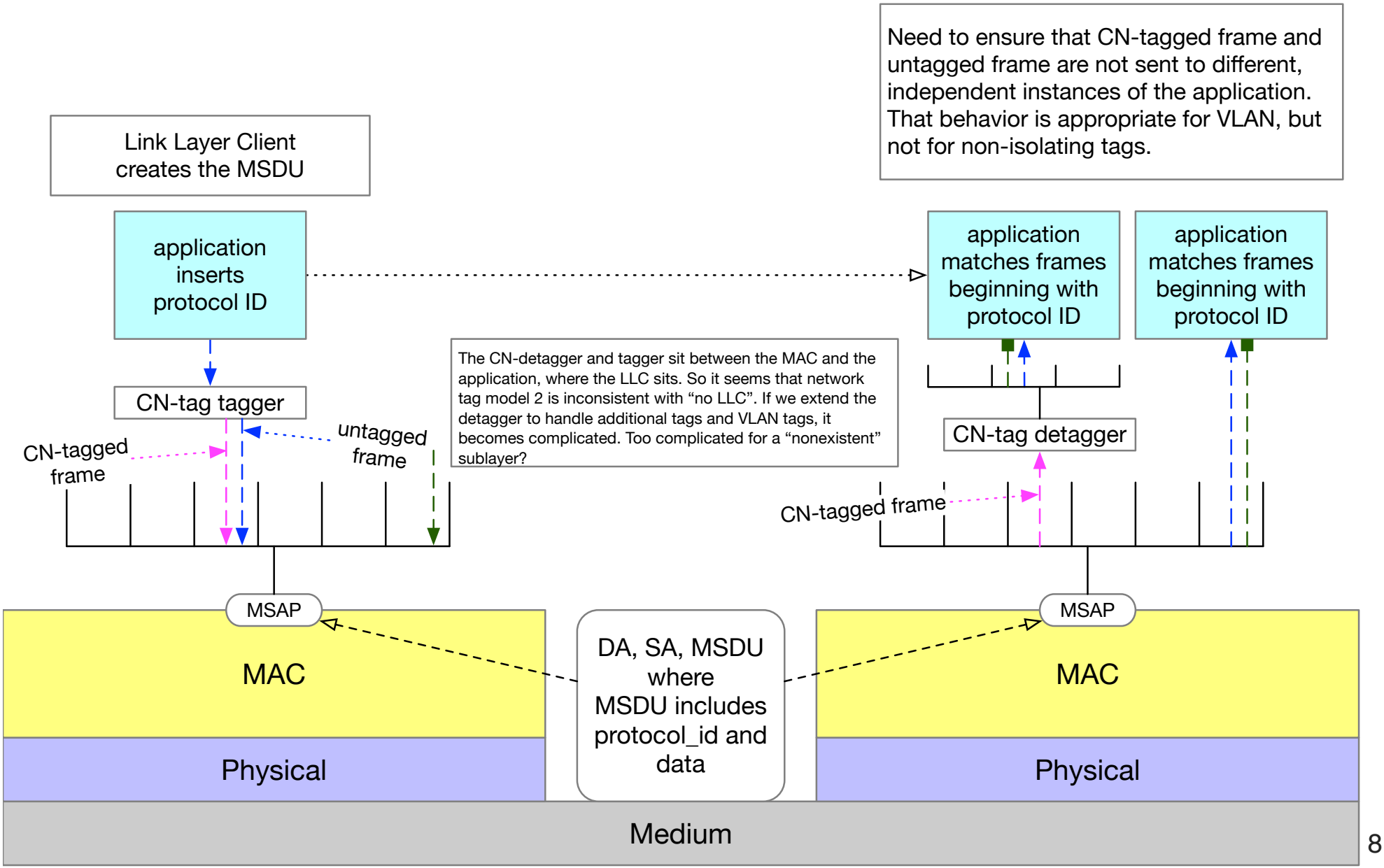

Conclusions

- application protocol identification is a core function of the LLC
- application protocol identification relies on protocol identifiers
- tagged frames can end up in the end station, where the LLC sits
- end-station VLAN tags are isolating
  - both the VID and the protocol ID are required to distinguish applications
- other tags are non-isolating
- tagging and application protocol identification both rely on the same set of protocol identifiers in the same MSDU location
  - though tags do not identify higher-layer applications that use the IEEE 802 service
- protocol identification encoding entangles application protocol identification and tags
- application protocol identification requires an LLC functionality
- tag processing requires an LLC functionality that recognizes tags and their formats
- application protocol identification and tag processing require a *common* LLC functionality
- removing LLC pushes LLC tasks onto the apps and into functions that sits where the LLC sits even if they are not called “LLC”
- pushing LLC functions into apps requires each app to repeat tasks on each frame
- other LLC functionality can be important:
  - arbitrating among multiple application transmission requests
  - filtering invalid frames
  - providing a single, simple interface specification for apps
    - including hiding the “MSDU format” (i.e. EPD/LPD) from the application
  - providing a single interface to multiple LANs, considering QoS requirements
  - others TBD
- an LLC is indispensable

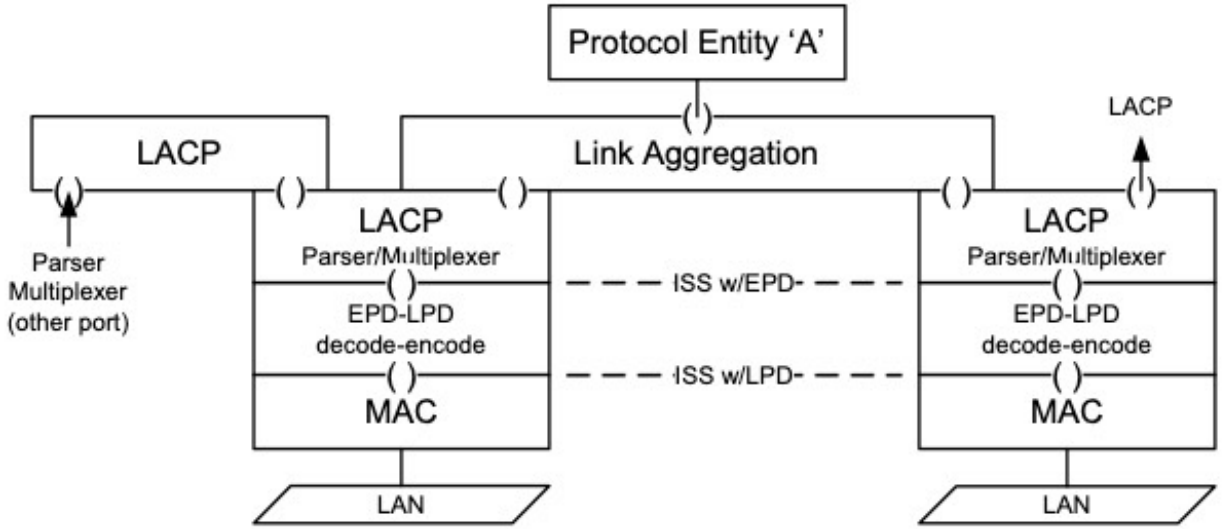

Figure 1-14—Using Link Aggregation LACP over LPD media

source: Protocol identification in 802 LANs