IEEE 802.1 Bridge Model

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Presentation supporting TD6/WP3

Figures based on L2CP layering - MEF42033 by Steve Haddock

802 Reference Model

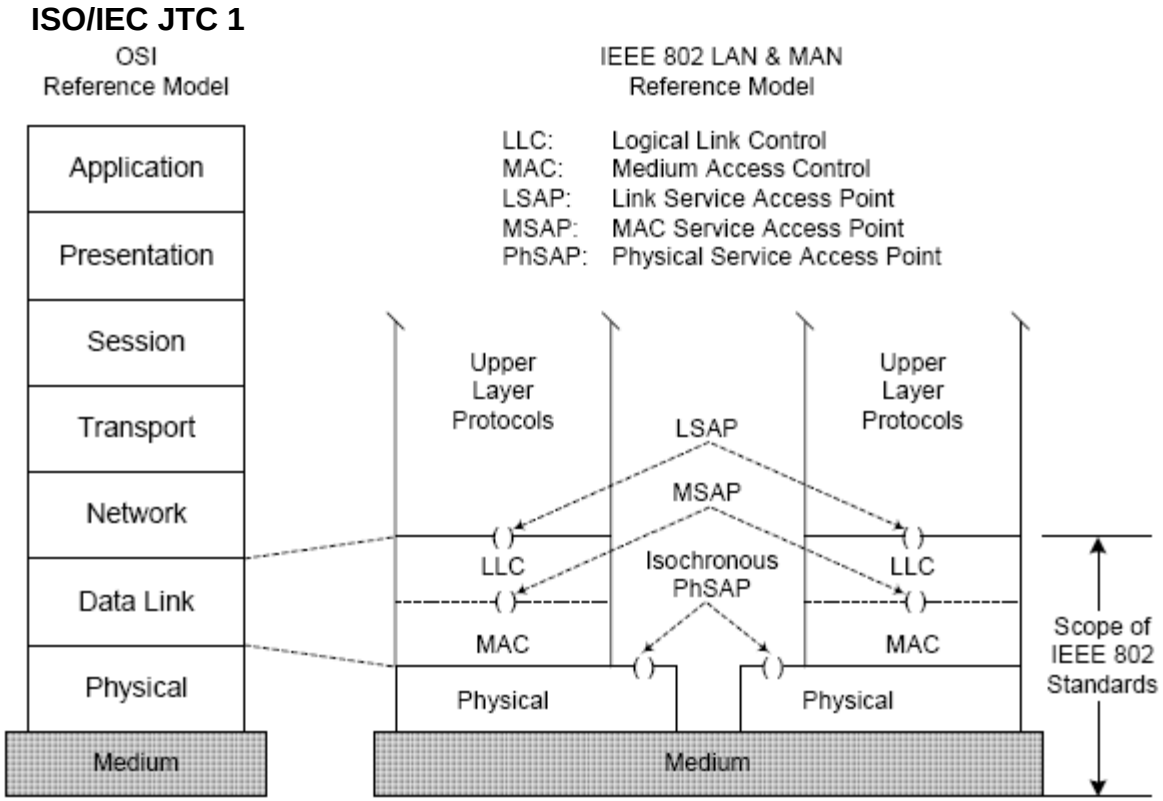


Figure 1—IEEE 802 RM for end stations (LAN&MAN/RM)

IEEE Std 802-2001 Overview and Architecture

802 MAC Sublayer with Bridging

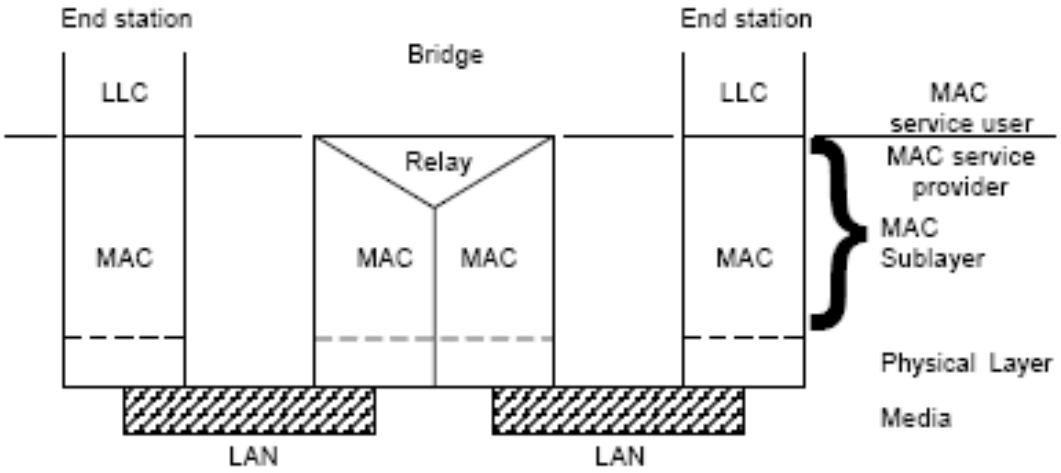
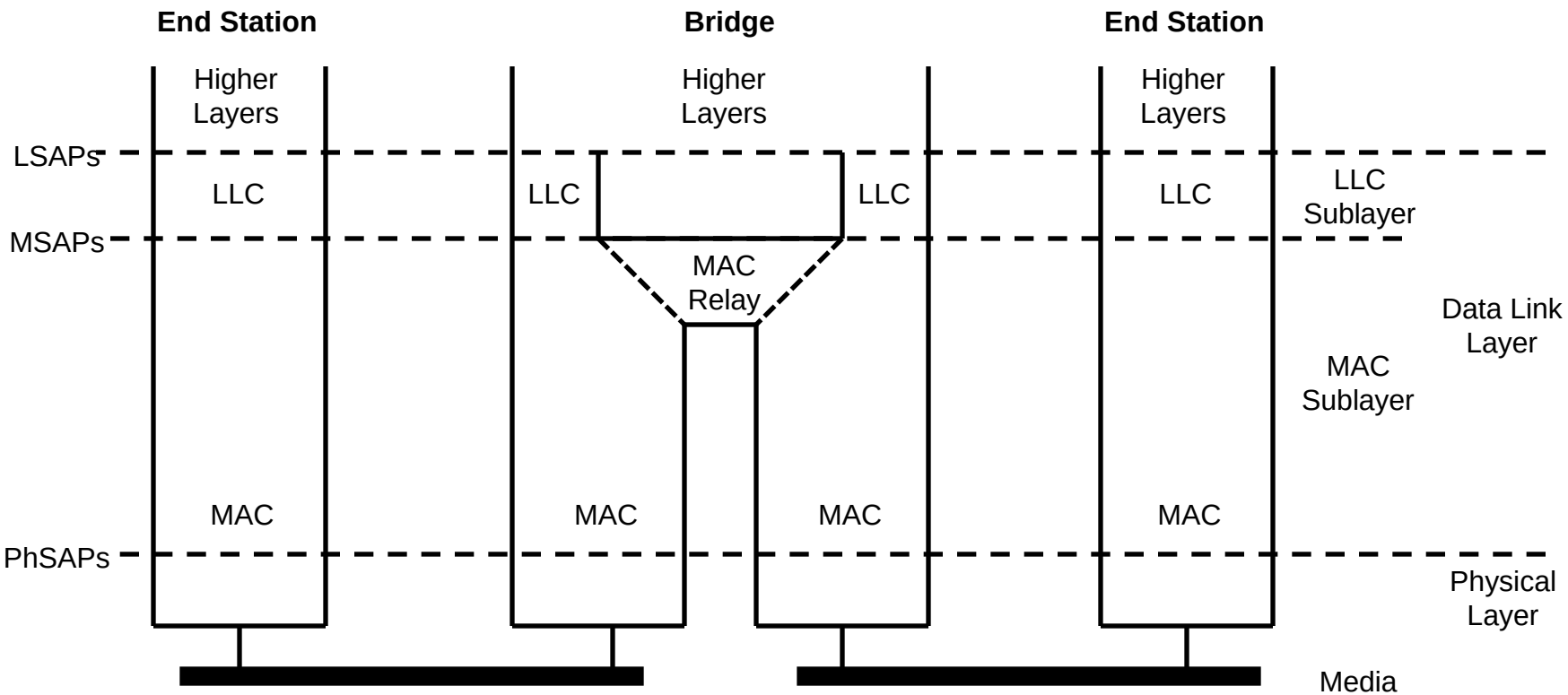


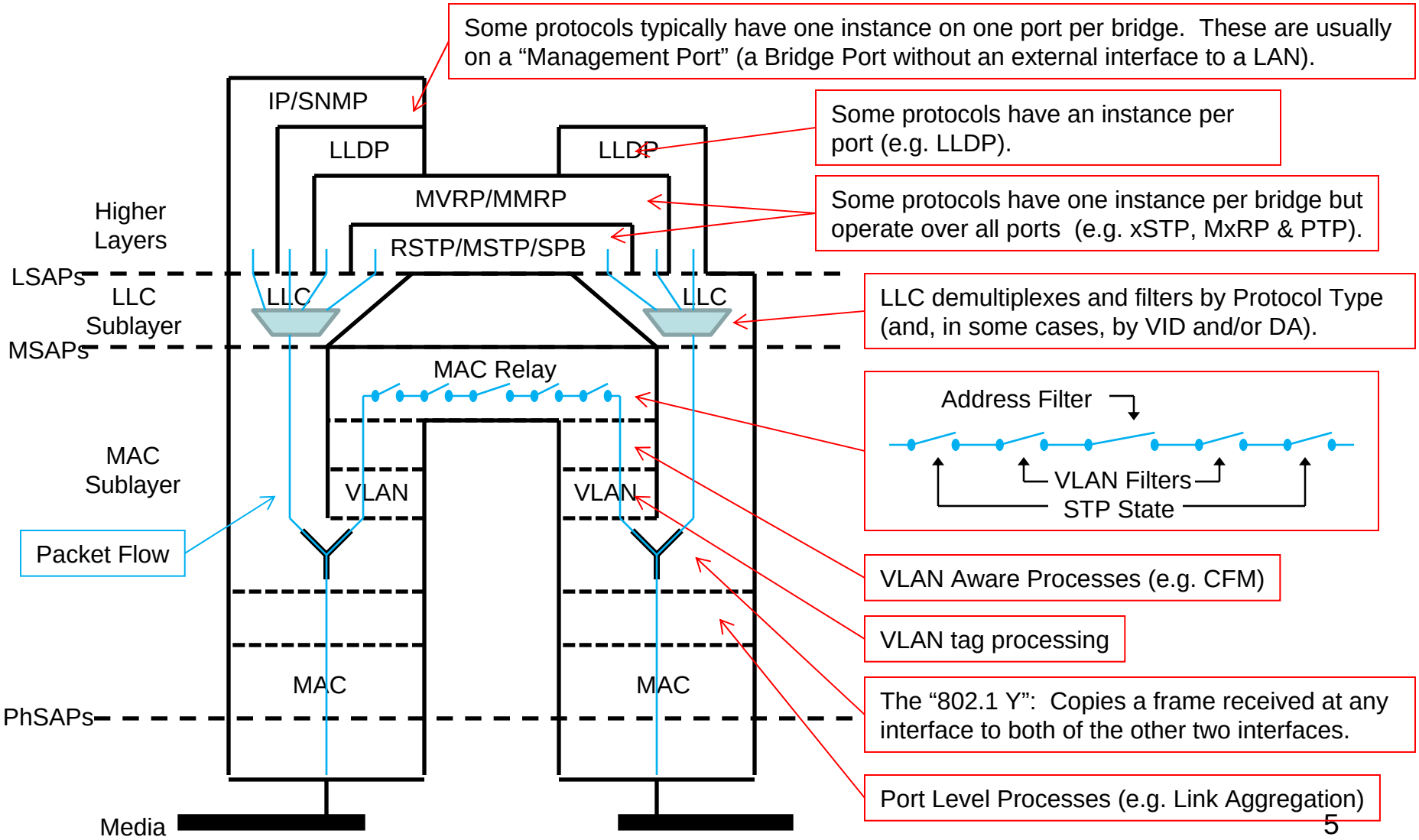
Figure 4—Internal organization of the MAC sublayer with bridging

IEEE Std 802-2001 Overview and Architecture

Bridge Model with Higher Layers



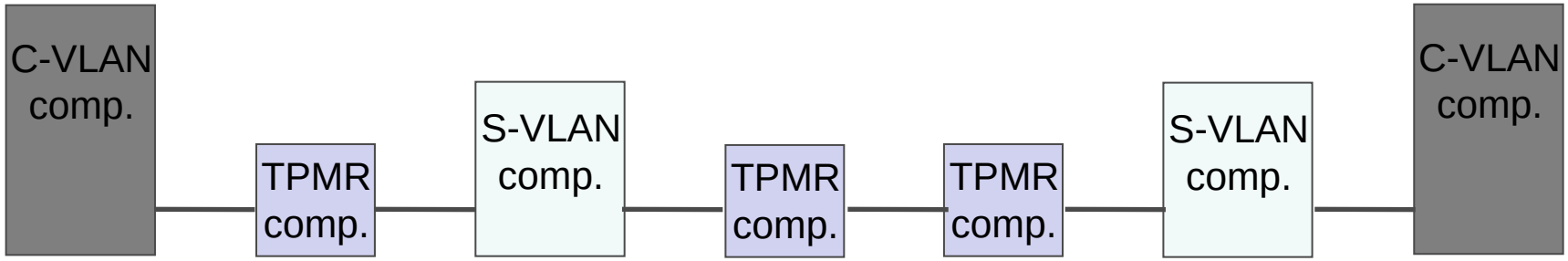
More Detailed Bridge Model



IEEE 802.1 Reserved

Address	Assignment	Filtered by:		
		C-VLAN Component	S-VLAN Component	TPMR Component
01-80-C2-00-00-00	Nearest Customer Bridge [a]	X		
01-80-C2-00-00-01	IEEE MAC Specific Control Protocols	X	X	X
01-80-C2-00-00-02	IEEE 802.3 Slow Protocols	X	X	X
01-80-C2-00-00-03	Nearest non-TPMR Bridge	X	X	
01-80-C2-00-00-04	IEEE MAC Specific Control Protocols	X	X	X
01-80-C2-00-00-05	Reserved for Future Standardization	X	X	
01-80-C2-00-00-06	Reserved for Future Standardization	X	X	
01-80-C2-00-00-07	Metro Ethernet Forum ELMI Protocol [b]	X	X	
01-80-C2-00-00-08	Provider Bridge Group Address	X	X	
01-80-C2-00-00-09	Reserved for Future Standardization	X	X	
01-80-C2-00-00-0A	Reserved for Future Standardization	X	X	
01-80-C2-00-00-0B	Reserved for Future Standardization	X		
01-80-C2-00-00-0C	Reserved for Future Standardization	X		
01-80-C2-00-00-0D	Provider Bridge MVRP Address	X		
01-80-C2-00-00-0E	Nearest Bridge, Individual LAN Scope [c]	X	X	X
01-80-C2-00-00-0F	Reserved for Future Standardization	X		

Scope of 802.1 Reserved Addresses



Nearest Bridge, Individual LAN Scope:

Nearest non-TPMR Bridge:

Nearest Customer Bridge:

A protocol uses any address appropriate to reach the device with which it wishes to peer. E.g. 802.1AB-2009 Link Layer Discovery Protocol (LLDP) and 802.1X-2010 Port-based Network Access Control specify the use of any of the above addresses to allow a Customer Bridge to discover

- if it is attached to a TPMR, or
- if it is connected to a Provider Bridge (possibly through a TPMR), or
- its peer Customer Bridge (possibly through a Provider Network and several TPMRs).

PTP/Ethernet examples

802.1 Handling of 1588 frames

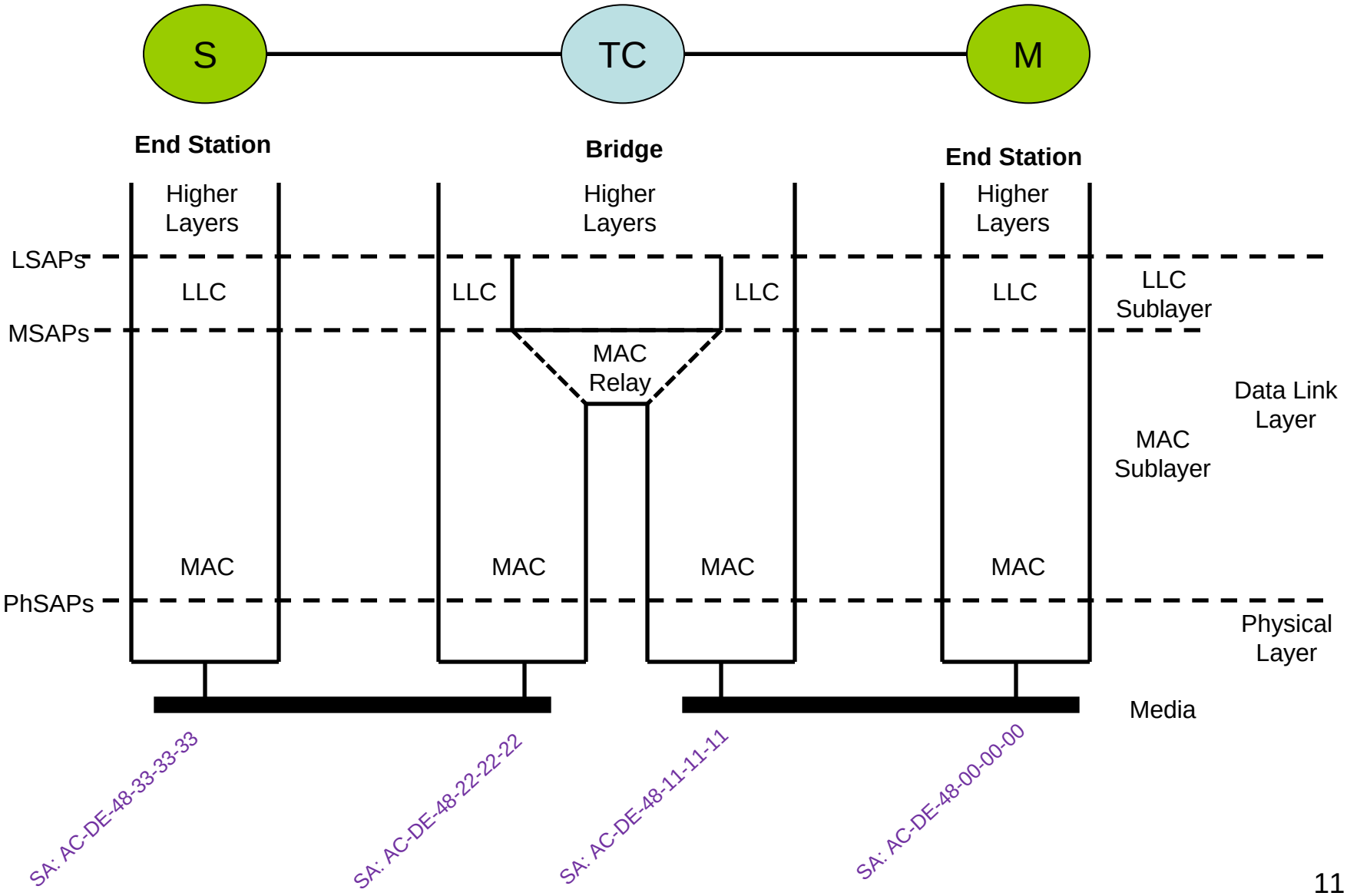
- 802.1 Bridges
  - Decide whether to filter or forward an 1588 frame based on the Destination Address and VID.
  - Decide whether to peer an 1588 frame based on the protocol identifier (and, in some cases, the DA and/or VID).
  - These are orthogonal decision points.
- Two-port bridge as the model
  - Simplified model for the normal multiport bridge case
  - Note: an actual 2-port bridge does not have learning

- PTP messages
  - Maintaining the original SA (to identify the clock) is only for optional features (e.g., acceptable master table)
  - ClockID (within the PTP message) should be used instead

Problems with using non-local SA and higher layer entities

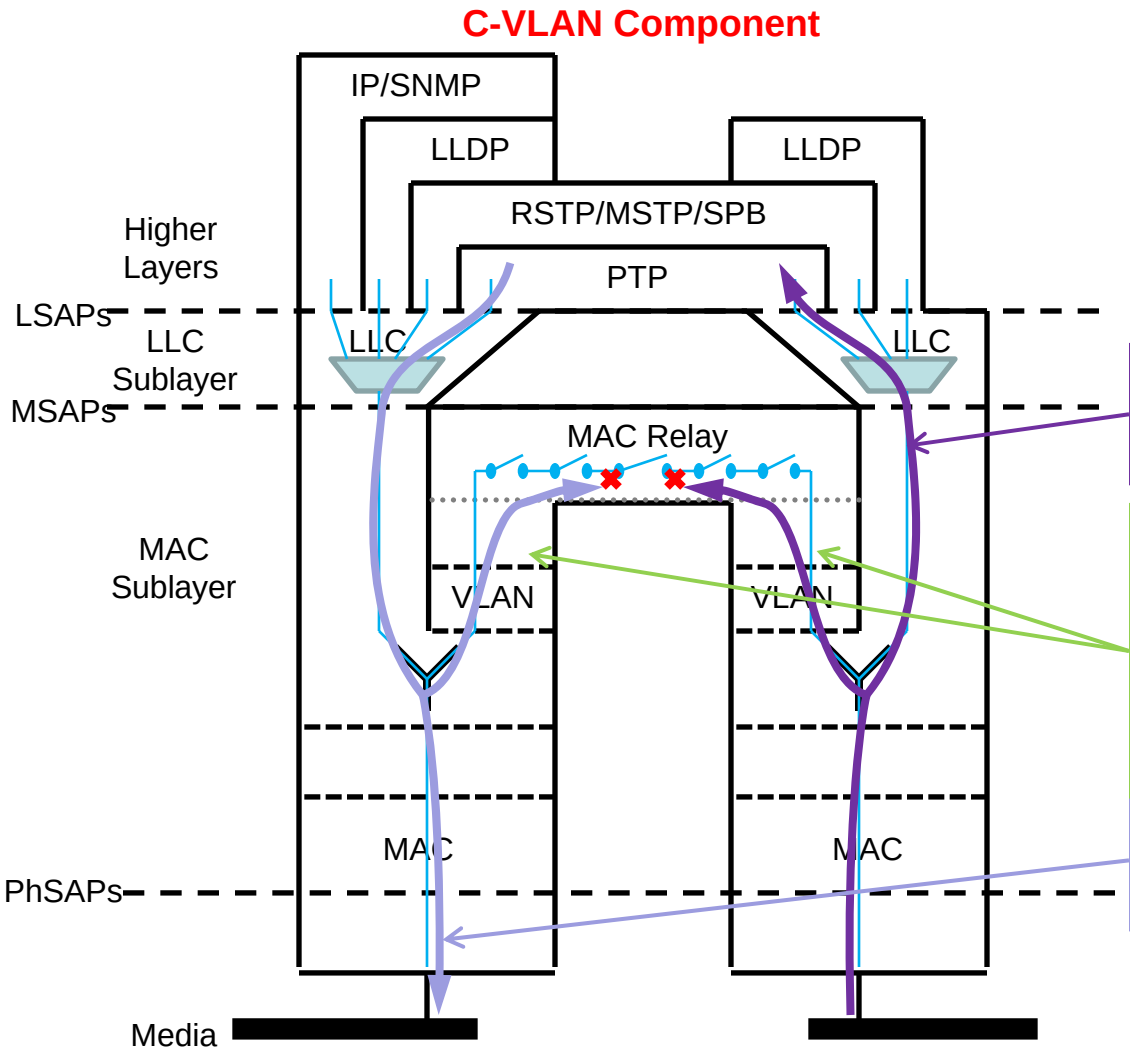
- Local learning
  - The transmitted frame's SA is learnt on the outgoing port.
  - A subsequent frame received on this port with that DA will be dropped, resulting in connectivity loss.
- Network learning
  - The higher-layer entities aren't directly aware of the port states of the bridge, and might therefore transmit the modified frame on a port blocked by RSTP.
  - This could cause other bridges to learn the SA of the re-transmitted frame on inappropriate ports.
  - It could also cause multiple, possibly differently modified copies of the frame being received at the destination
- Breaking VLAN boundaries
  - Higher layer entities must not transmit information received on one VLAN onto another VLAN

Bridge Model with PTP



Customer Bridge – PTP example A

PTP aware bridge – nearest bridge multicast



Normal behaviour of nearest bridge Multicast DA

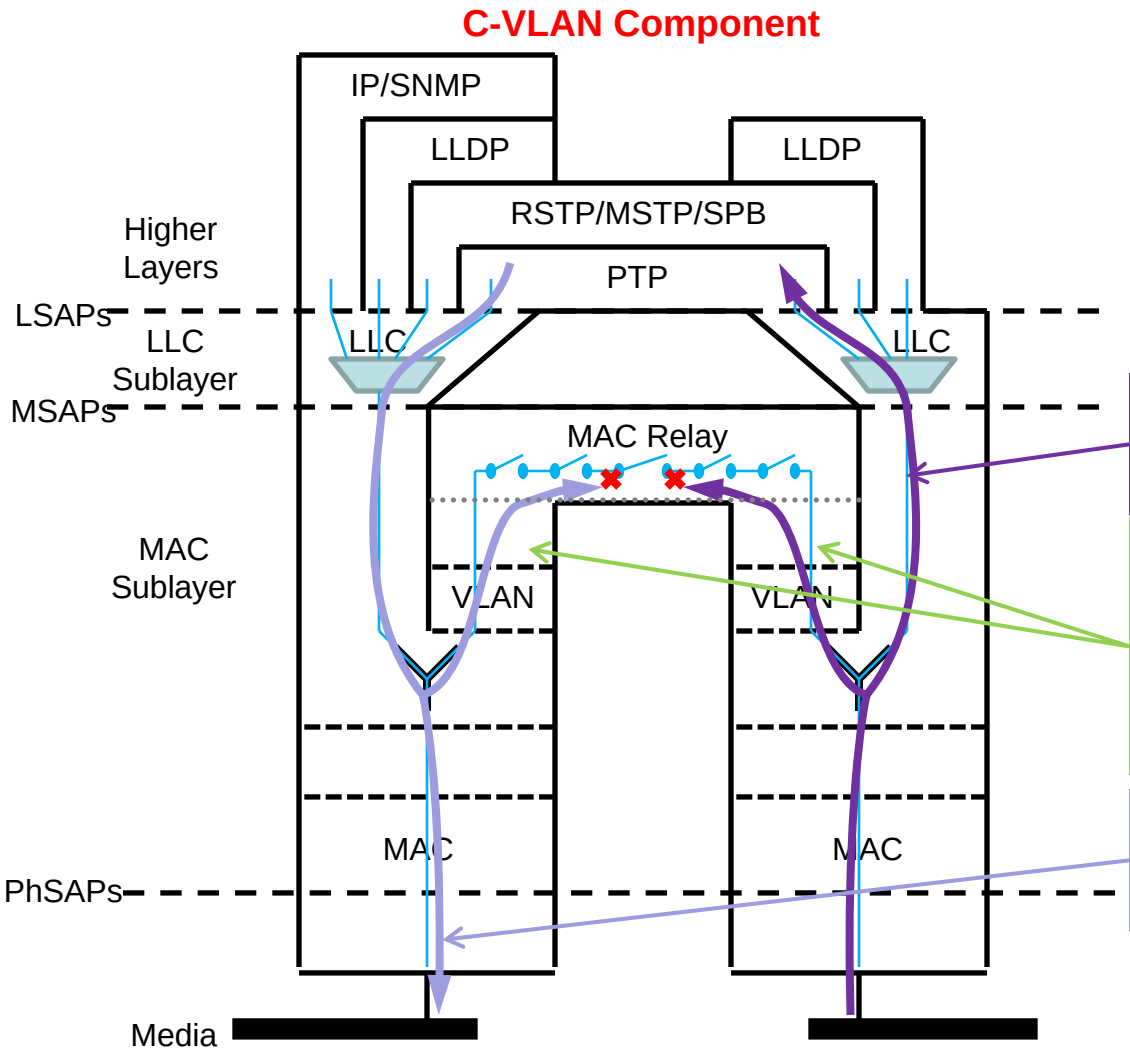
Ingress PTP Message -- Peer
SA: AC-DE-48-00-00-00
DA: 01-80-C2-00-00-0E

Learning
AC-DE-48-00-00-00 is on right port
AC-DE-48-11-11-11 is right port
AC-DE-48-22-22-22 is left port
Any frames received to AC-DE-48-00-00-00 on the left port will be relayed to the right port

Egress PTP Message
SA: AC-DE-48-22-22-22
DA: 01-80-C2-00-00-0E

Customer Bridge – PTP example B

PTP aware bridge – nearest bridge multicast



Special behaviour of nearest bridge Multicast DA

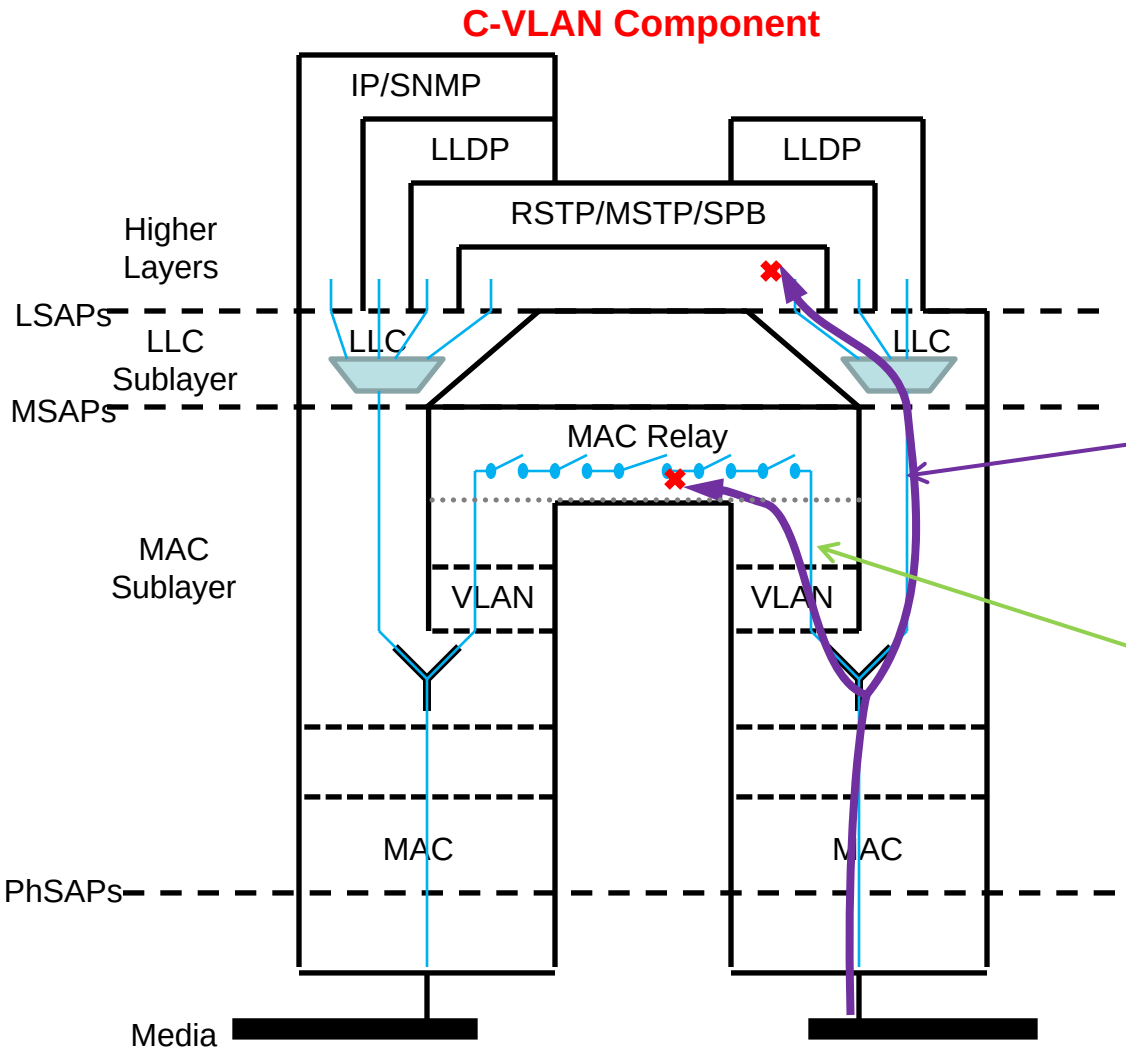
Ingress PTP Message -- Peer
SA: AC-DE-48-00-00-00
DA: 01-80-C2-00-00-0E

Learning
AC-DE-48-00-00-00 is on right port
…replaced by:
AC-DE-48-00-00-00 is on left port
Any frames received to this address on the left port will be discarded

Egress PTP Message
SA: AC-DE-48-00-00-00
DA: 01-80-C2-00-00-0E

Customer Bridge – PTP example C

non-PTP aware bridge – nearest bridge multicast



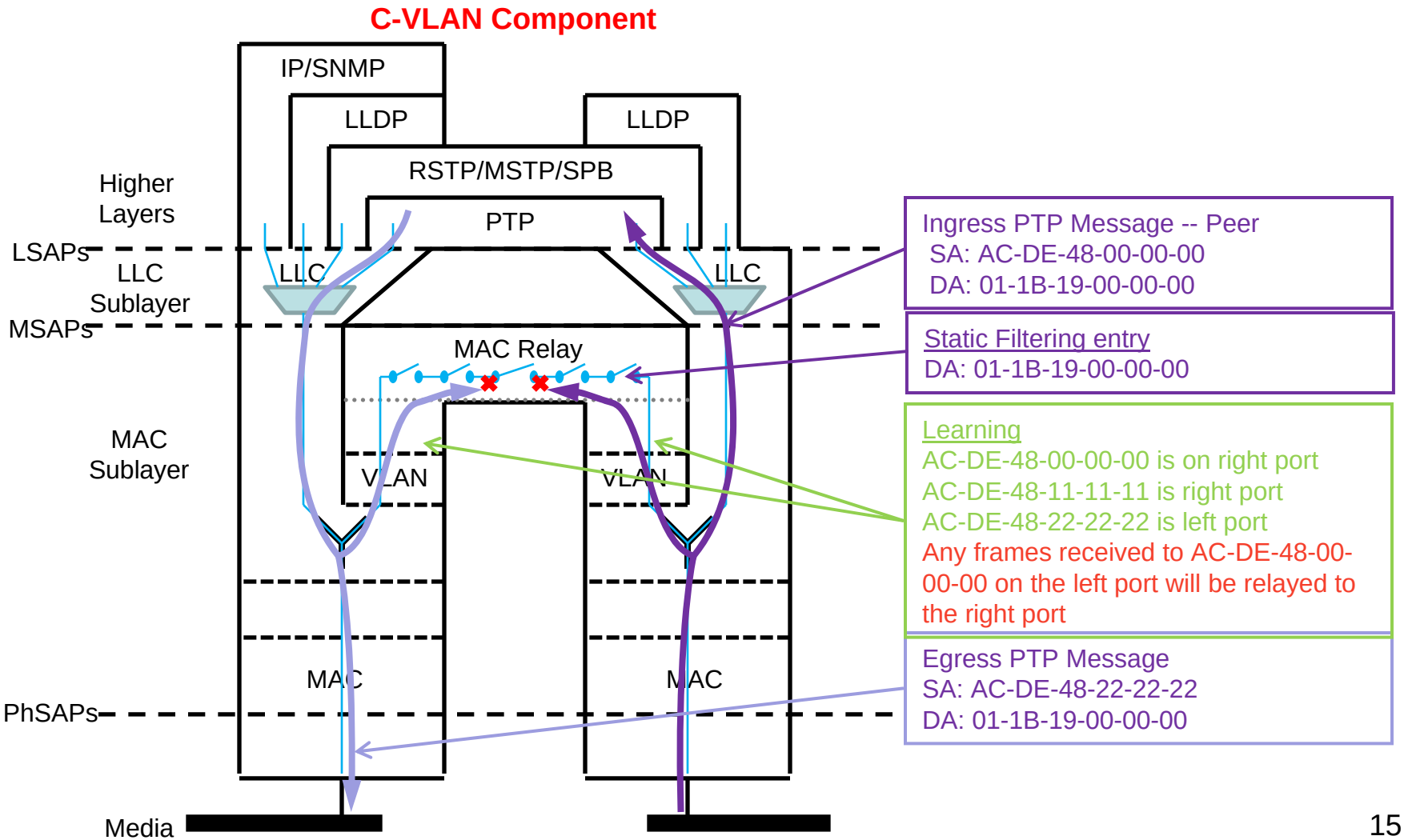
Normal behaviour of nearest bridge Multicast DA

Ingress PTP Message -- Discard
SA: AC-DE-48-00-00-00
DA: 01-80-C2-00-00-0E

Learning
AC-DE-48-00-00-00 is on right port
Any frames received to AC-DE-48-00-00-00 on the left port will be relayed to the right port

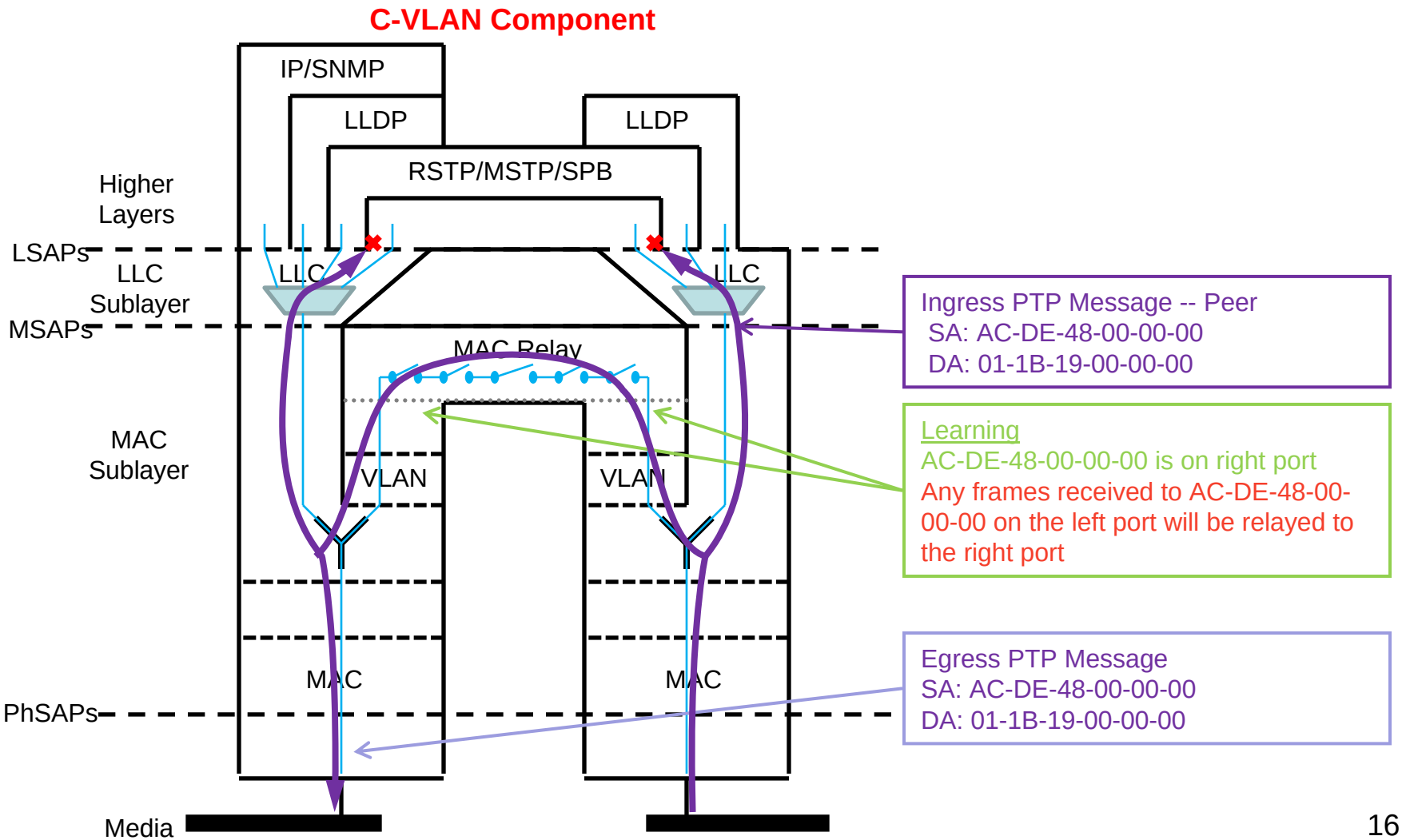
Customer Bridge – PTP example D

PTP aware bridge – PTP multicast



Customer Bridge – PTP example E

non-PTP aware Bridge – PTP multicast

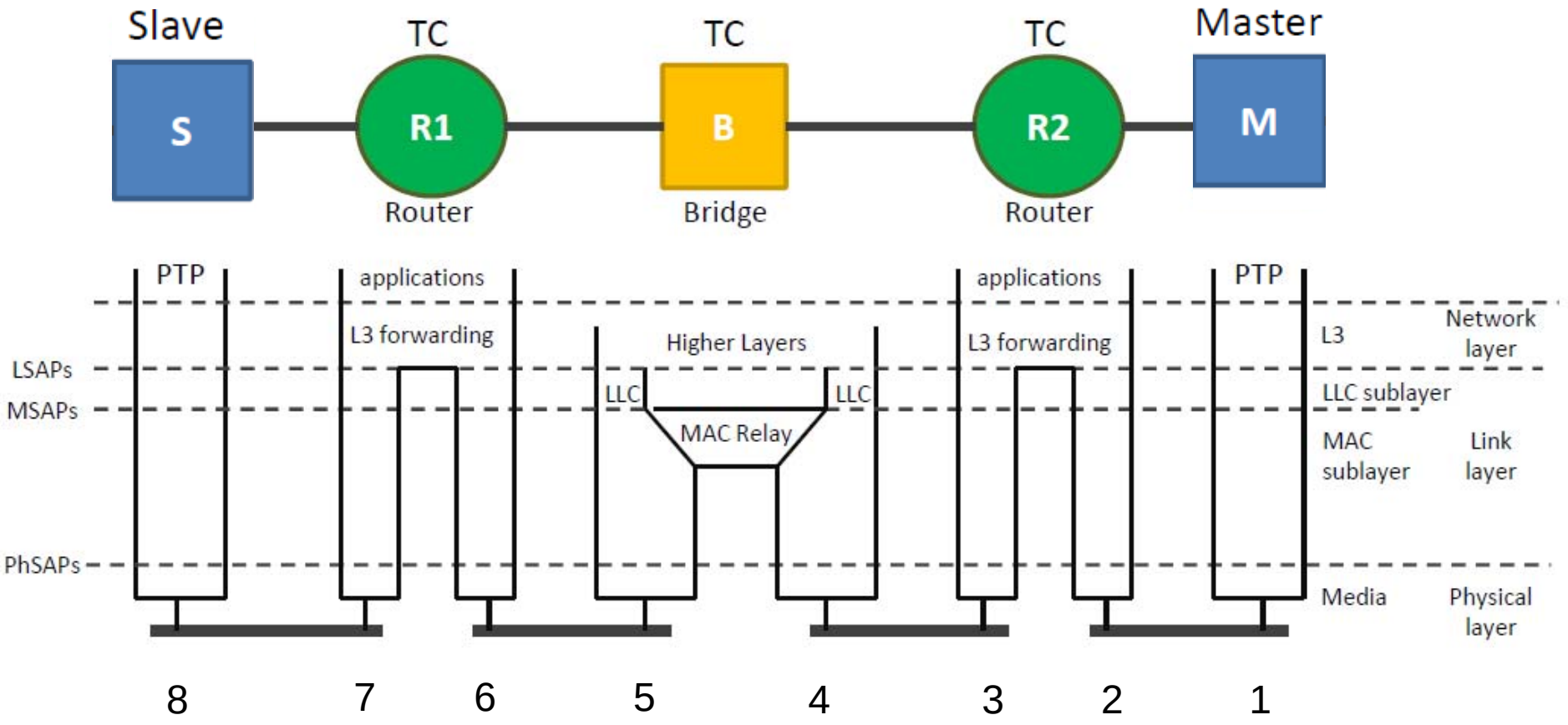


Addressing for PTP/Ethernet

- Full on path support (M-TC-S)
  - Nearest bridge multicast MAC DA
    - Example A
- Partial on path support (M-TC-X-S)
  - PTP/Ethernet multicast MAC DA
    - Example D, E

PTP/IP examples

Bridge & Router model

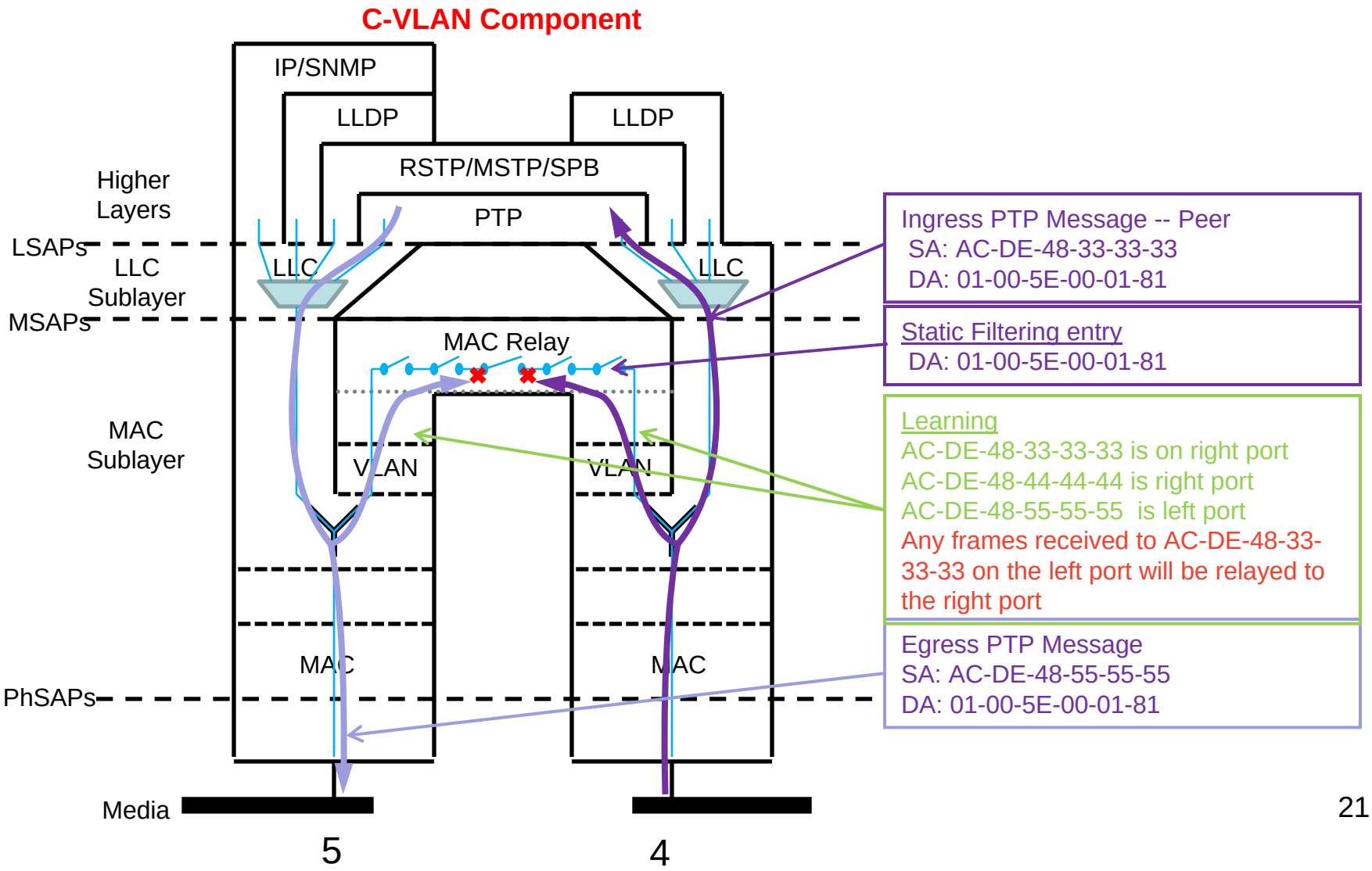


Problem with addressing

- Unicast IPv4
  - ARP determines the MAC unicast DA
  - MAC unicast DA is sent through relay – static filtering is not appropriate as it would block other traffic
  - MAC unicast DA is difficult to predict and manage in the filtering database
- Multicast IPv4
  - Maps to IPv4 MAC multicast DA
    - 224.0.1.129 -> 01-00-5E-00-01-81
  - Can be blocked at the relay with a static filtering entry

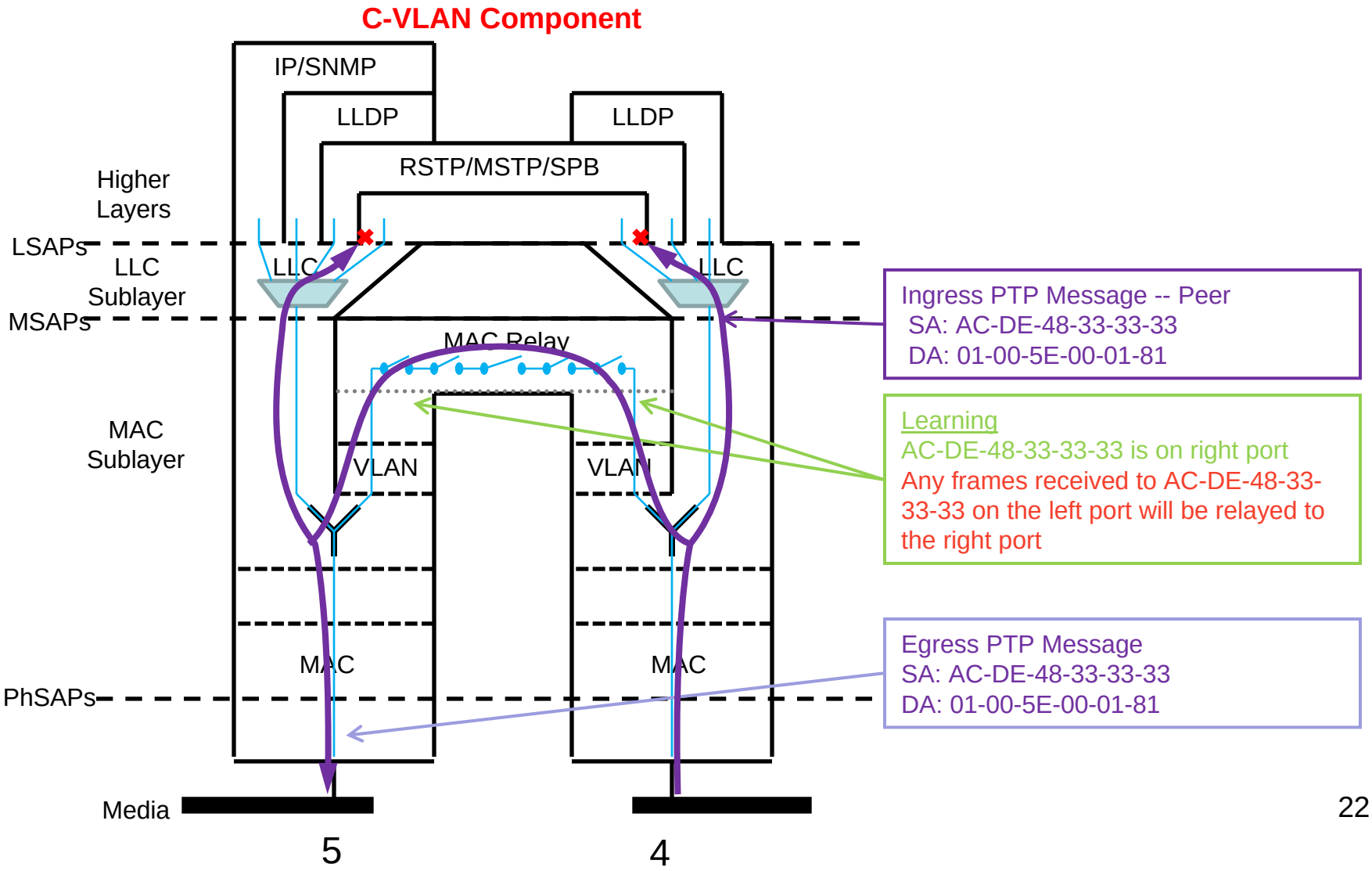
Customer Bridge – PTP example F

PTP aware bridge – PTP/IP multicast



Customer Bridge – PTP example G

non-PTP aware Bridge – PTP/IP multicast



Addressing for PTP/IP

- Potential solution requires PTP-aware router to **NOT** use ARP (or neighbor discovery) to determine MAC DA for unicast PTP/IP frames

- Full on path support (M-TC-S)
  - Nearest bridge multicast MAC DA
    - Example A
- Partial on path support (M-TC-X-S)
  - PTP/IP multicast MAC DA
    - Example F, G