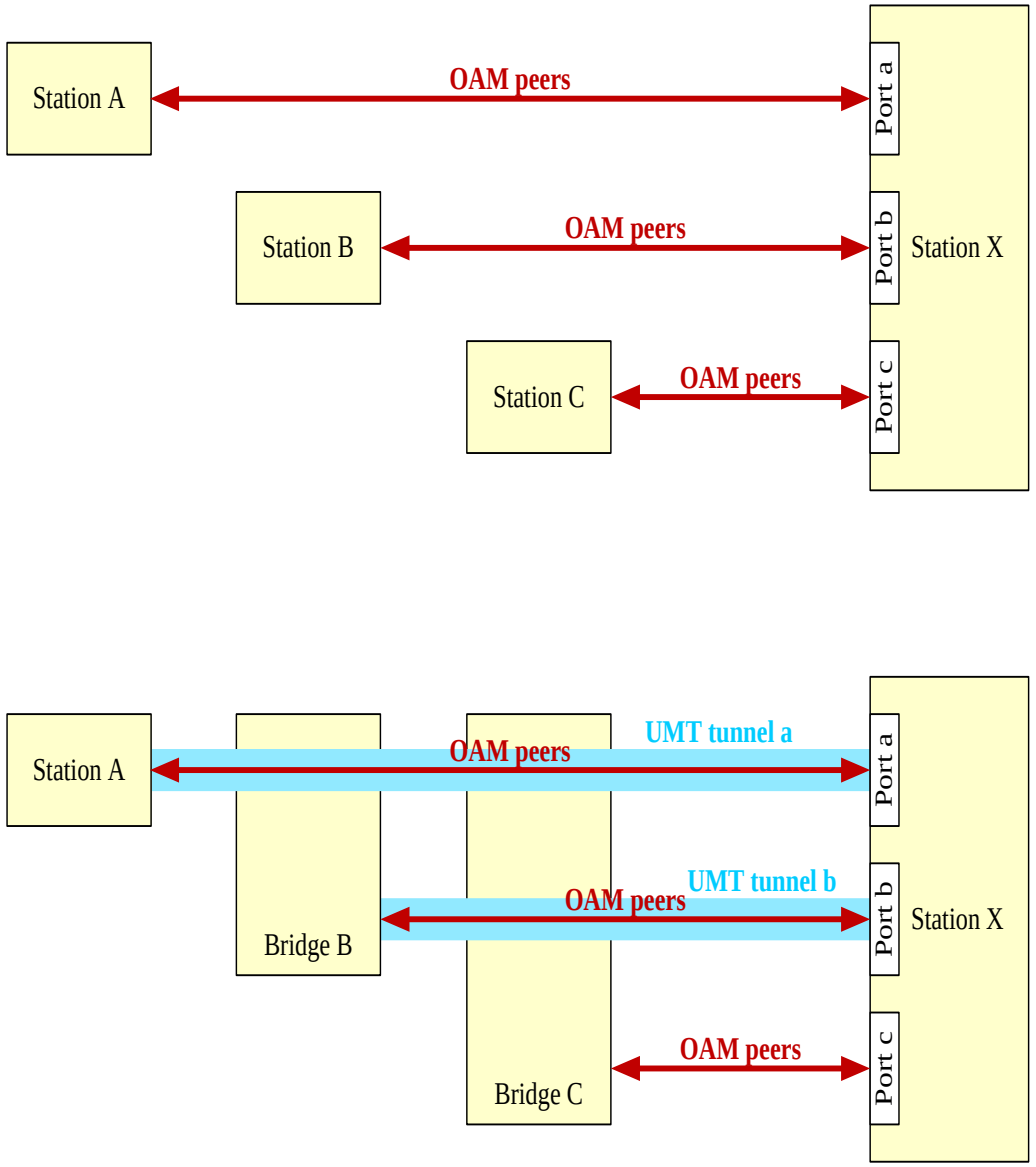
UMT Layering

Glen Kramer, Broadcom

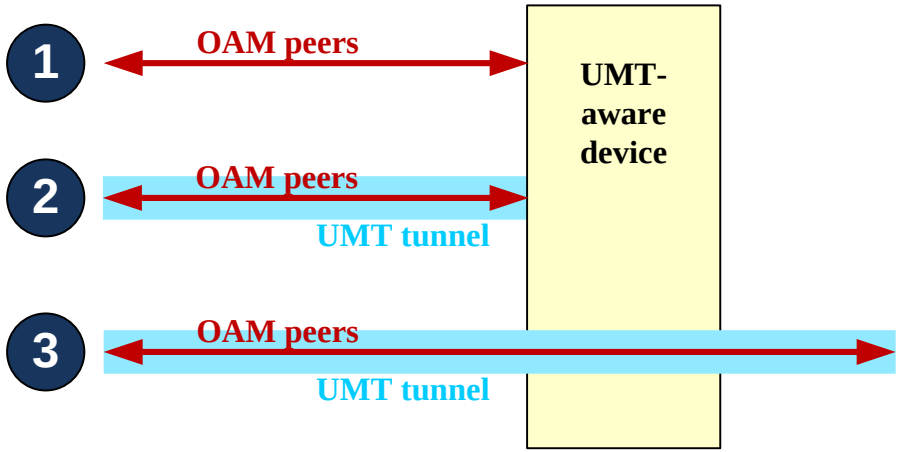
UMT emulates virtual links

- A device may support separate instances of a link layer protocol on separate ports.
  - Figure on the right uses OAM as an example
- UMT function emulates multiple virtual links that terminate at the same physical port.
  - Only P2P links or P2MP?
- A device can simultaneously terminate some UMTs and forward other UMTs
  - ex. Bridge C →



Generic UMT-aware device

- A generic UMT-aware device shall be able to support the following three modes of operation:
  1) Terminate native protocol X (e.g., OAM)
  2) Terminate protocol X carried in UMT
  3) Relay UMT traffic to other devices (bridging mode)



- From a protocol "x" point of view, there should be no difference whether the PDUs are carried as native xPDUs or as UMTPDUs
  - Full set of protocol "x" capabilities should be supported regardless of PDU encapsulation

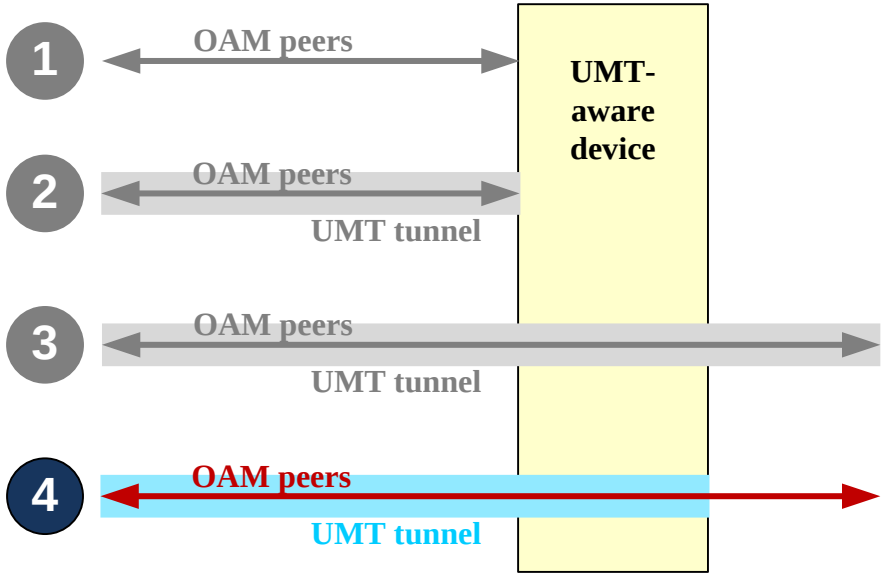
- We need to develop a layering model that supports all these modes. This is the main stumbling block right now.

Tunnelization & De-tunnelization

- There may be one more mode of operation

  4) Terminate a tunnel and forward native protocol xPDUs to other devices.

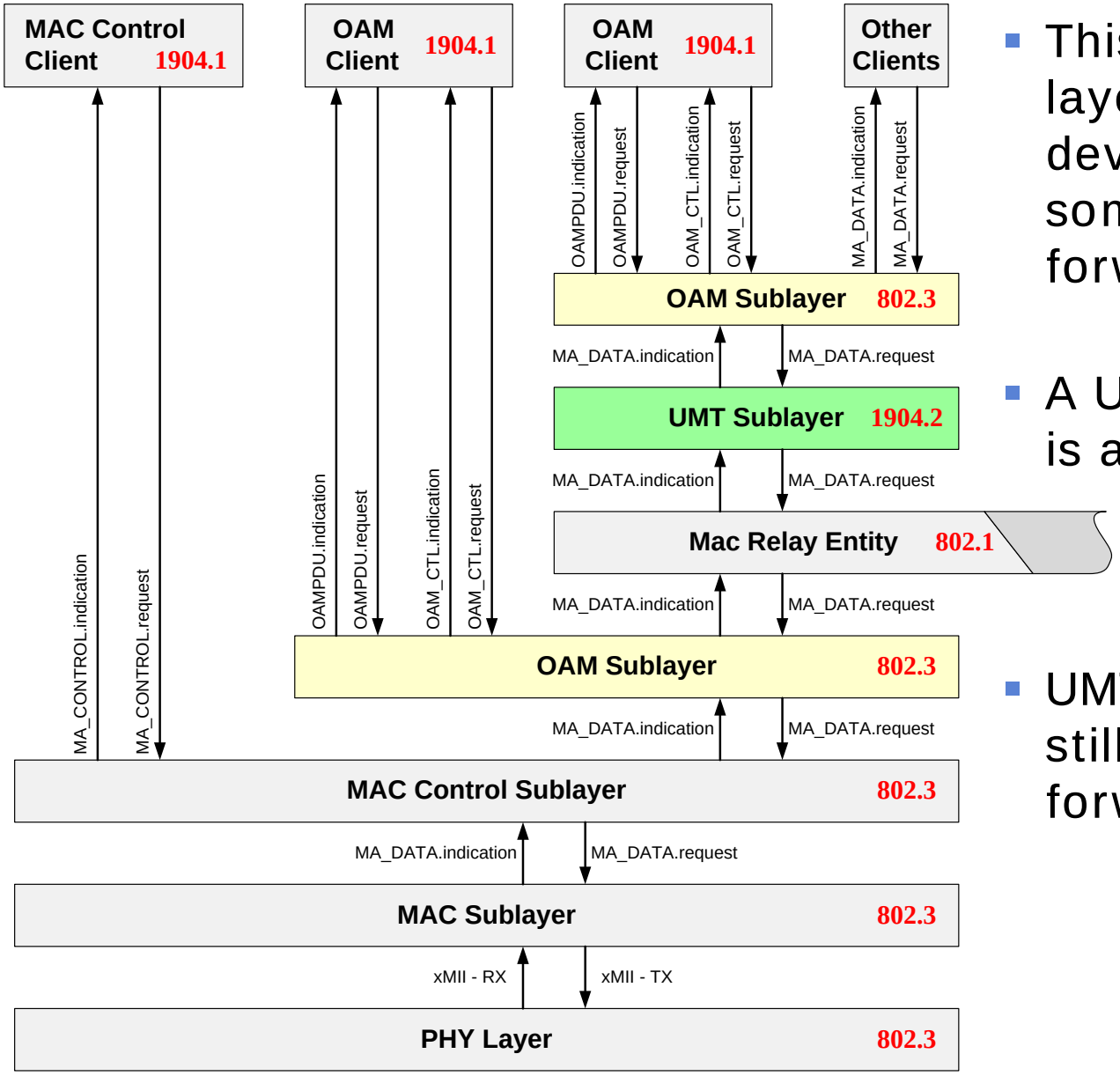
  In reverse direction, receive as native xPDU and forward as UMTPDU.



- In this mode, the device relays UMTPDU based on DA using regular bridging function, but at the egress port, converts it back into the native xPDU.

- Conversion from UMTPDU into xPDU involves the following:
  - Possible replacement of unicast DA with a well-known slow-protocol DA
  - Replacement of UMT EtherType with another EtherType
  - Possible replacement or removal of Opcode field.

Layering Diagram (ver. 1)



- This is a complete layering diagram for a device that terminates some UMTs and forwards other UMTs.
- A UMT-unaware device is a device that does not implement UMT sublayer.
- UMT-unaware device is still capable of forwarding UMT traffic.

OAM loopback

- OAM defines a optional loopback function (802.3, 57.2.11)
- When activated, this function causes all frames to be sent back (data and OAMPDUs).

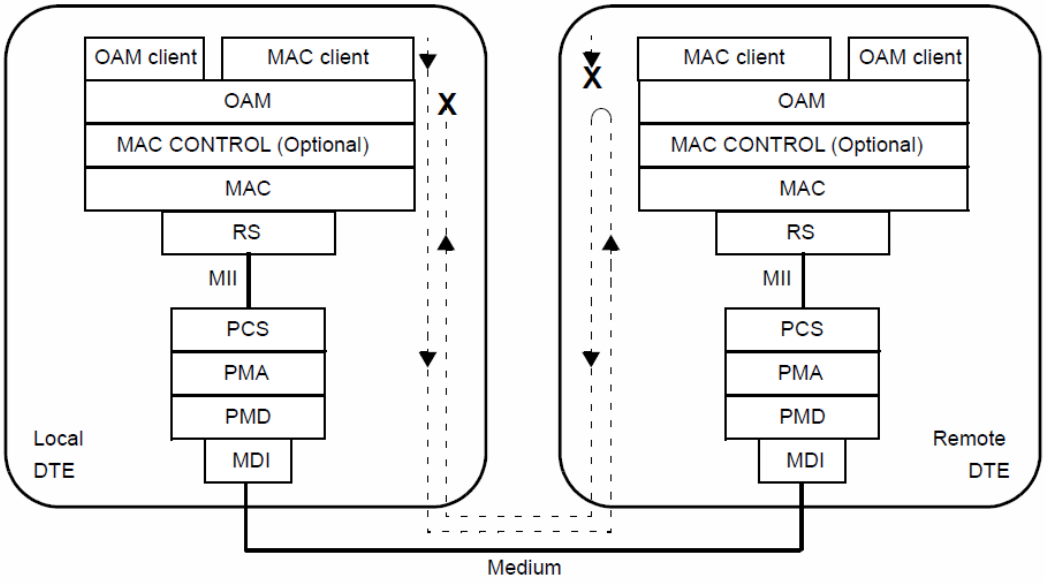
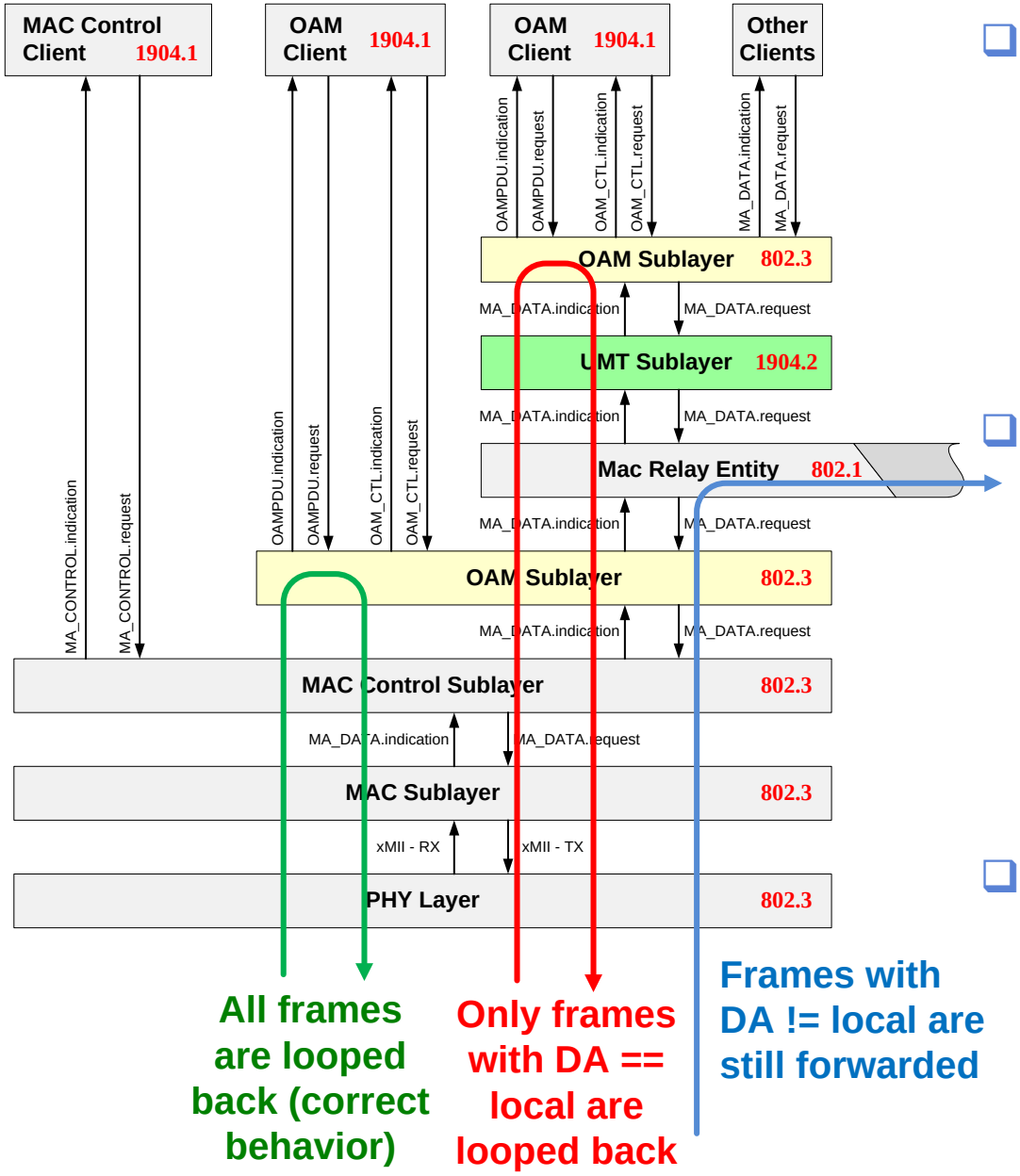


Figure 57–4—OAM remote loopback

- Should this function be supported for OAMPDUs carried over UMT?
- Data frames are not carried under UMT. What frames should be looped-back?

Loop-back behavior



- One would expect identical OAM loop-back behaviors regardless of whether a device is managed using native OAM or OAM over UMT. But it is not the case.
- A loopback command received as native OAM (OAMPDU) will cause all frames to be looped back (OAMPDUs and data frames). This is the behavior defined in 802.3, C57.
- A loopback command received over UMT will loop back only locally-consumed frames (i.e., frames with DA == local MAC address)

802.1 MAC Bridge Architecture

- OAM was defined as a link-layer protocol
  - Behavior affects physical port and the associated link
  - DA is irrelevant (ignored)
- But UMT is a multi-hop protocol and the DA is important.
  - Only UMTPDUs with DA == local are processed.
  - All frames (including UMTPDUs) with DA != local are forwarded.

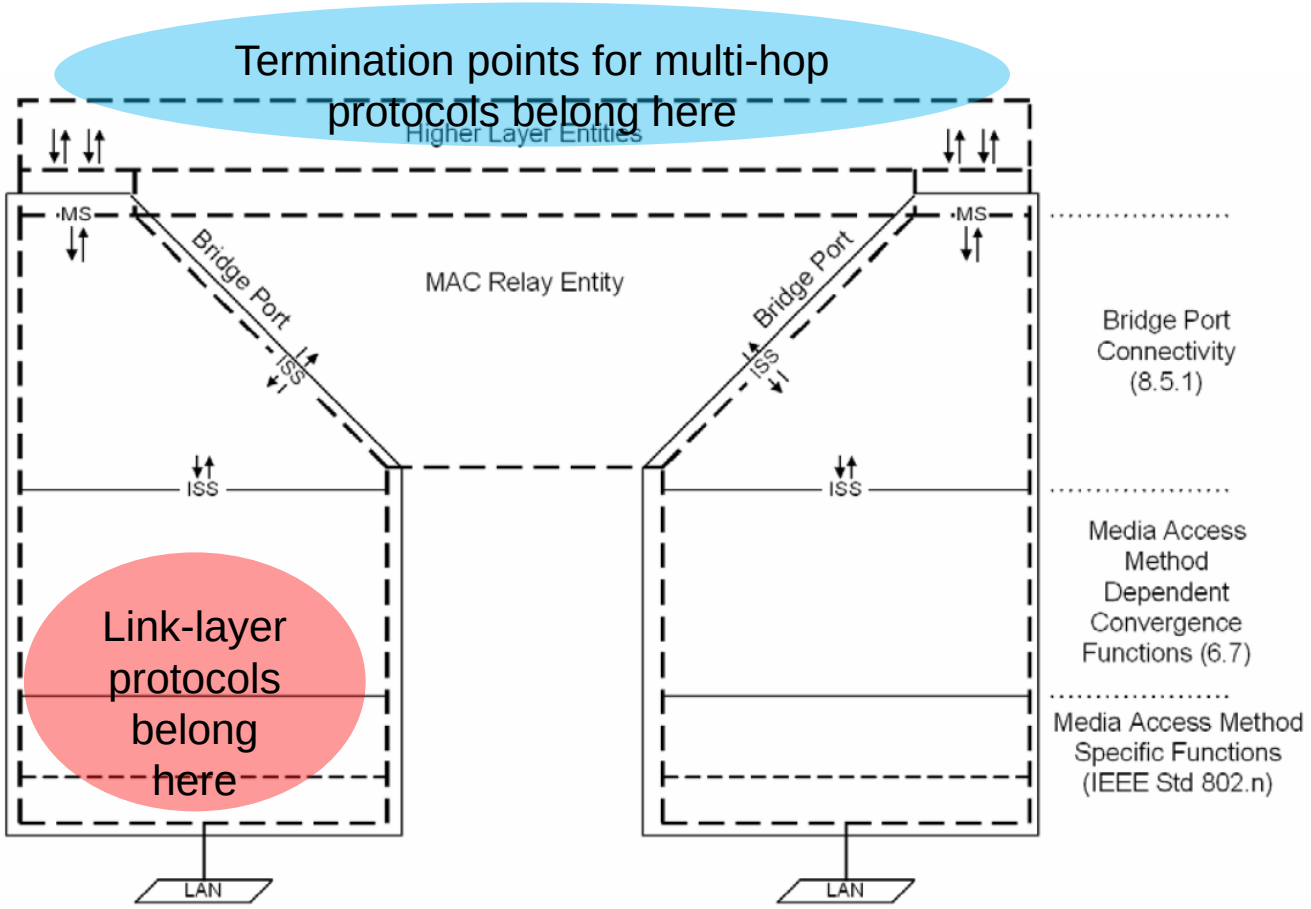
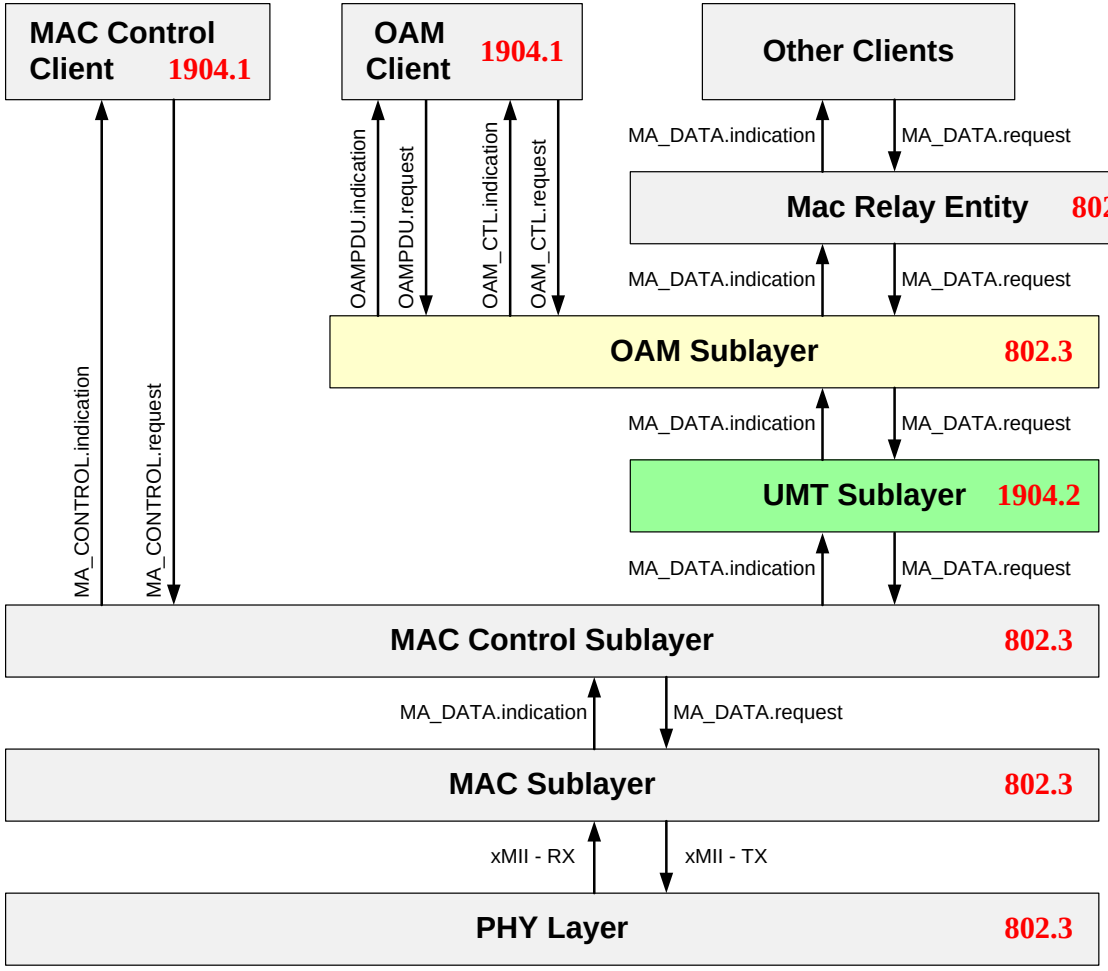


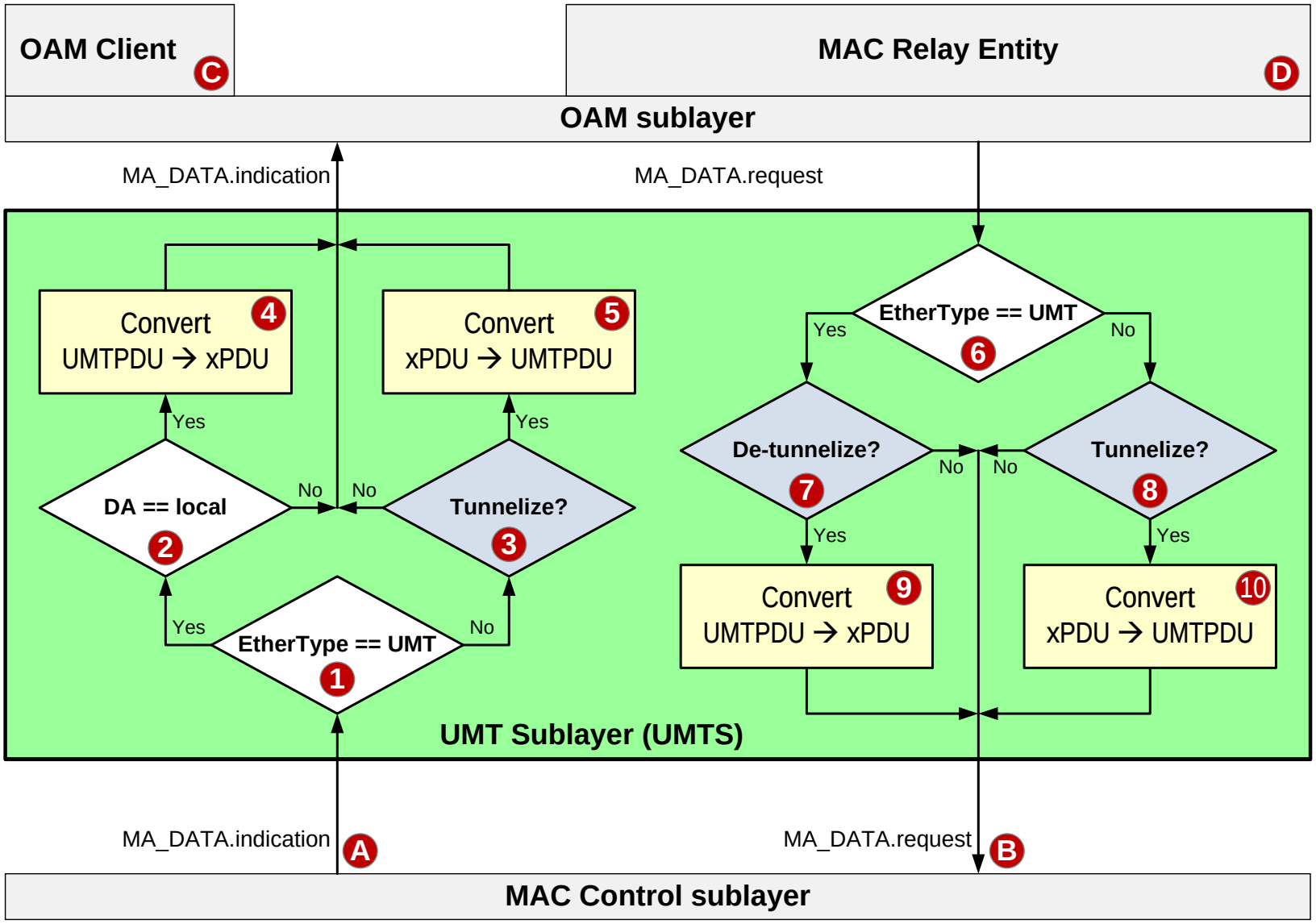
Figure 8-3—MAC Bridge architecture

Layering Diagram (ver. 2)

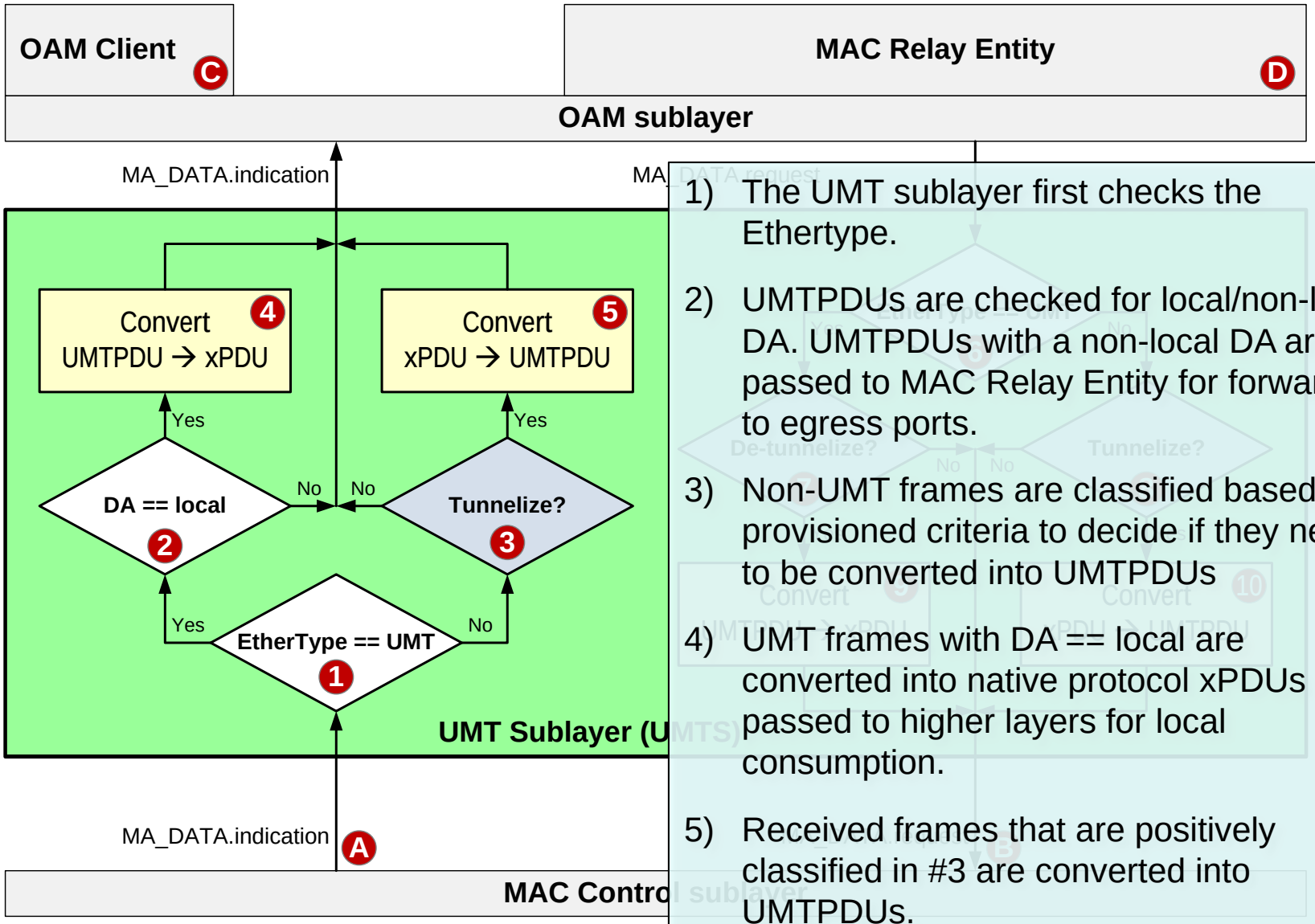


- This diagram is simpler.
- The loop-back behavior is correct for both OAMPDUs and UMTPDUs
- There is only one OAM sublayer. The OAM sublayer operates as defined in 802.3 and is not aware whether OAMPDUs are sent natively or as UMTPDUs.
- This layering model can support operation mode #4 shown on slide #3 (terminate a tunnel and forward native PDU to another device).

A look inside UMT sublayer

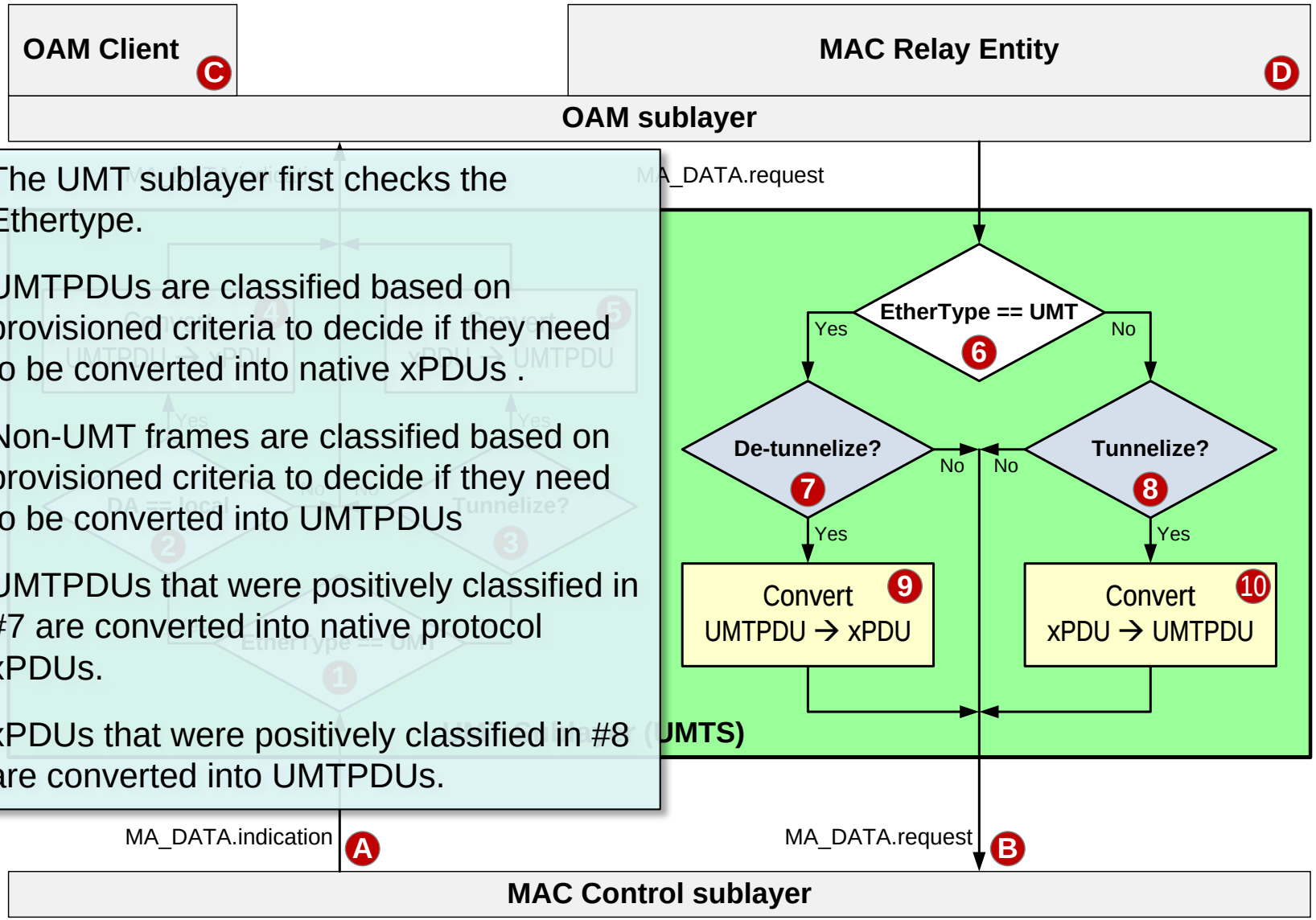


UMT sublayer – Rx direction



1) The UMT sublayer first checks the Ethertype.
2) UMTPDUs are checked for local/non-local DA. UMTPDUs with a non-local DA are passed to MAC Relay Entity for forwarding to egress ports.
3) Non-UMT frames are classified based on provisioned criteria to decide if they need to be converted into UMTPDUs
4) UMT frames with DA == local are converted into native protocol xPDUs and passed to higher layers for local consumption.
5) Received frames that are positively classified in #3 are converted into UMTPDUs.

UMT sublayer – Tx direction



6) The UMT sublayer first checks the Ethertype.

7) UMTPDUs are classified based on provisioned criteria to decide if they need to be converted into native xPDUs .

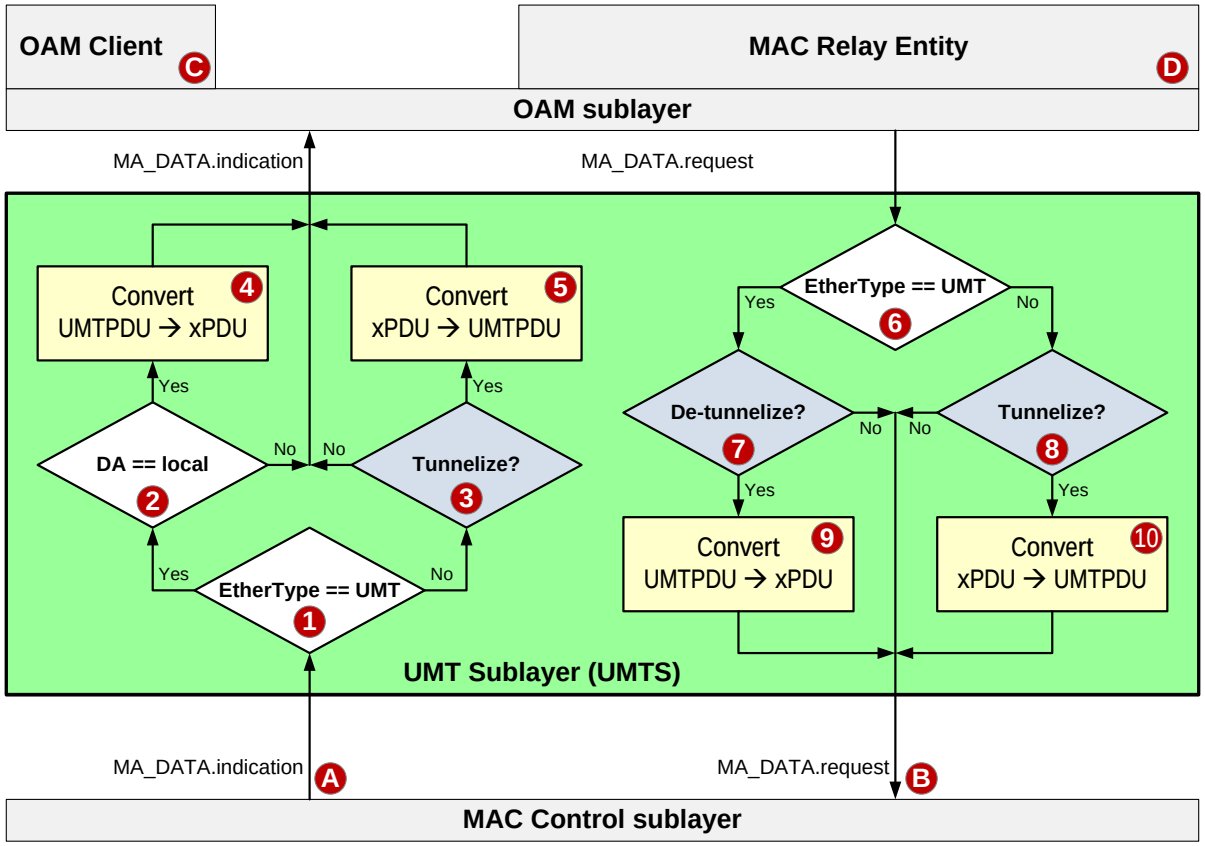
8) Non-UMT frames are classified based on provisioned criteria to decide if they need to be converted into UMTPDUs

9) UMTPDUs that were positively classified in #7 are converted into native protocol xPDUs.

10) xPDUs that were positively classified in #8 are converted into UMTPDUs.

Four modes of operation

#	Mode of operation	Rx direction	Tx direction
1	Process native protocol (OAM)	A→1→3→C	C→6→B
2	Process OAM carried over UMT	A→1→2→4→C	C→6→8→10→B
3	Relay UMT traffic to other devices	A→1→2→D	D→6→7→B
4	De-tunnelize and forward as xPDU Tunnelize and forward as UMTPDU	A→1→2→D A→1→3→5→D	D→6→7→9→B D→6→7→B



Thank You