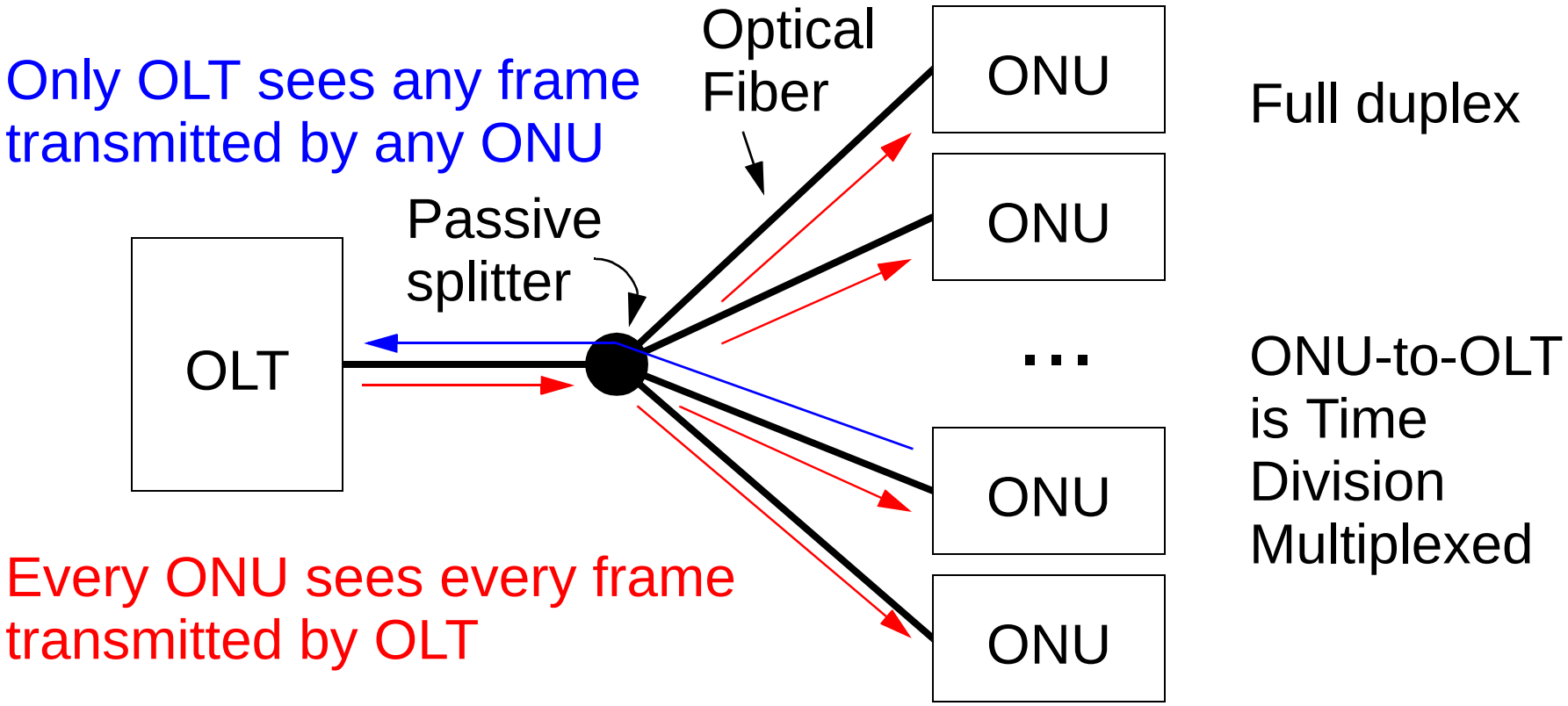
# 802.3ah Upper Layer Shared LAN Emulation

- **IEEE 802.3ah "Ethernet in the First Mile", Point-to-Multipoint Sub Task Force, is defining an Ethernet over Passive Optical Network (EPON) medium.**




(An ONU *may* consist of multiple Logical MACs -- TBD.)

# This is not an Ethernet

- **Point-to-point in “up” direction (ONU to OLT), broadcast in “down” direction (OLT to ONU).**
- **Imagine bridges attached to OLT and/or ONUs.**
  - **ONU bridges cannot see each others’ BPDUs or frames.**
  - **If OLT reflects ONU 1’s broadcast frame back down to reach ONU 2, ONU 1 does not know to ignore it.**
- **IEEE 802.3ah has considered these three solutions:**
  - **Leave it to upper layers to deal with this new medium.**
  - **Use “PON tags” below the MAC layer to emulate a bundle of point-to-point links.**
  - **Use PON tags and a trivial reflector function to emulate a shared medium, reflecting down all “upstream” traffic.**

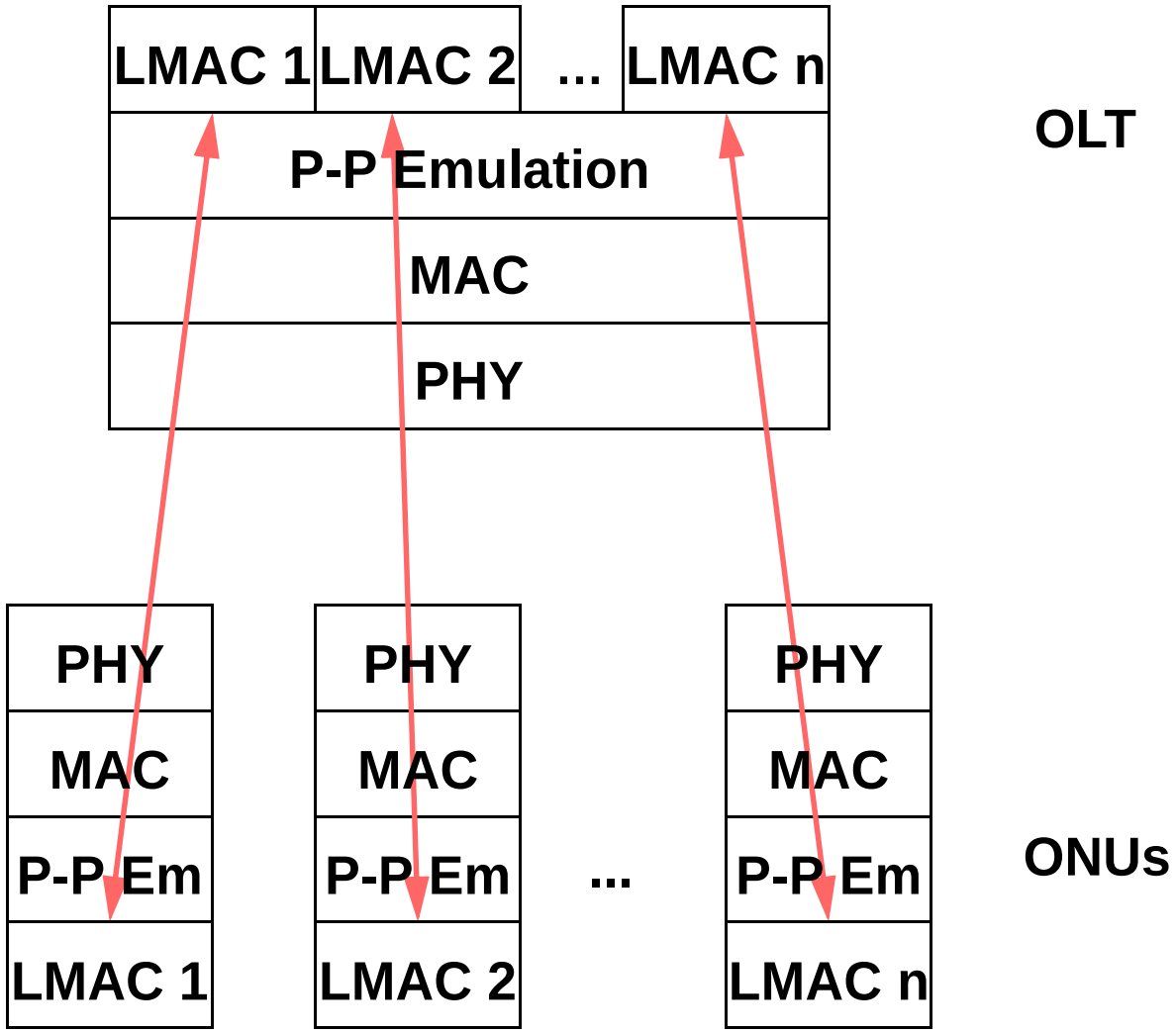
# Deal with it! Leave it to Upper Layers.

- **Long term, it is perfectly possible that IETF (or other organizations) will modify and/or develop protocols that will work over an EPON.**
- **Short term, this might be acceptable for IEEE 802.26, but *not* for IEEE 802.3.**

# Point-to-Point Emulation

- **Each OLT-to-ONU frame contains a Logical Link ID (LLID) identifying which ONU Logical MAC should receive it.**
- **At OLT, there is one Logical MAC (with standard 802.3 MAC interface) for each ONU Logical MAC.**
- **This emulates a bundle of point-to-point links.**
- **This is perfectly compatible with higher layer functions which know how to connect to 802.3 media.**
- ***BUT*: Any frame, for example a multicast, that is to be transmitted to multiple ONU Logical MACs must be transmitted multiple times, which wastes bandwidth.**

# Point-to-Point Emulation



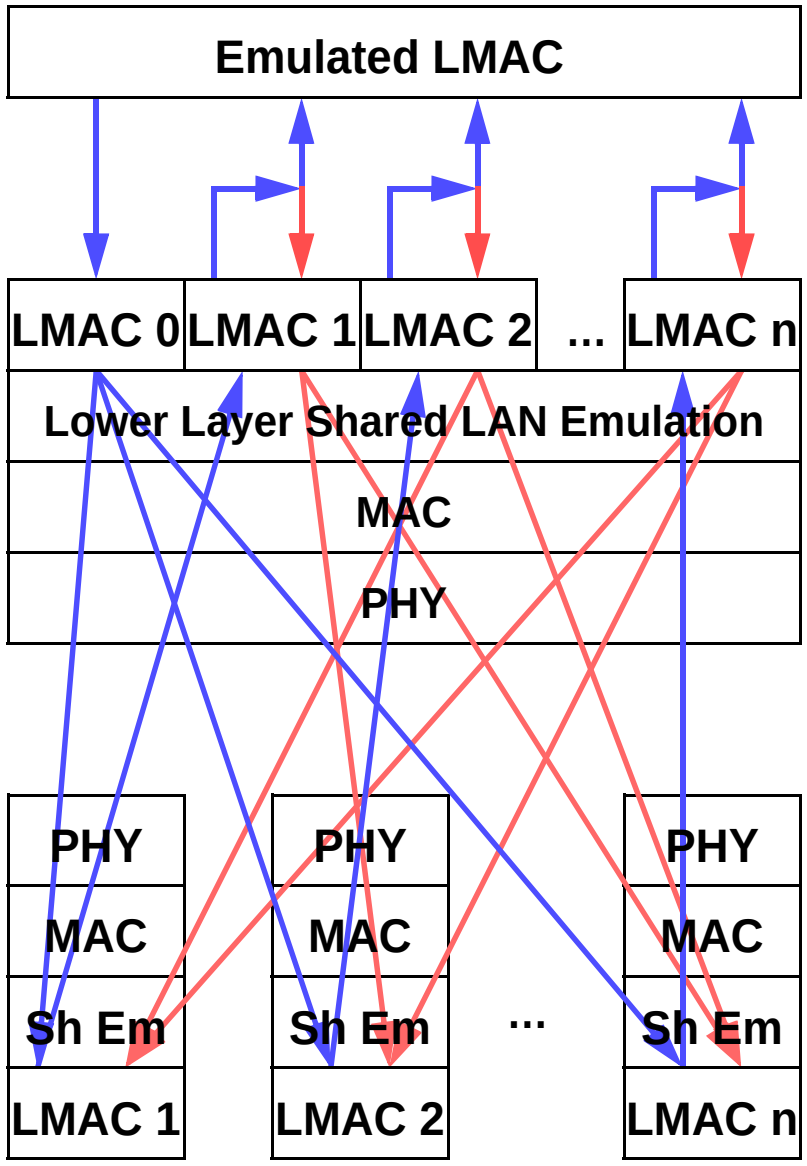
# Trivial Shared LAN Emulation

- **Every downstream (OLT-to-ONU) frame is received by every ONU.**
- **Every upstream (ONU-to-OLT) frame is reflected by the OLT, tagged with the originating ONU's ID. It is received by every ONU *except* the original transmitter.**
- **This emulates a single shared medium.**
- **This is perfectly compatible with higher layer functions which know how to connect to 802.3 media.**
- ***BUT*: Any frame, for example a unicast frame, that is to be transmitted only to the OLT, must be reflected back to the ONUs, which wastes bandwidth.**

# Trivial Shared LAN Emulation

**Trivial Upper-Layer Shared LAN Emula-tion**

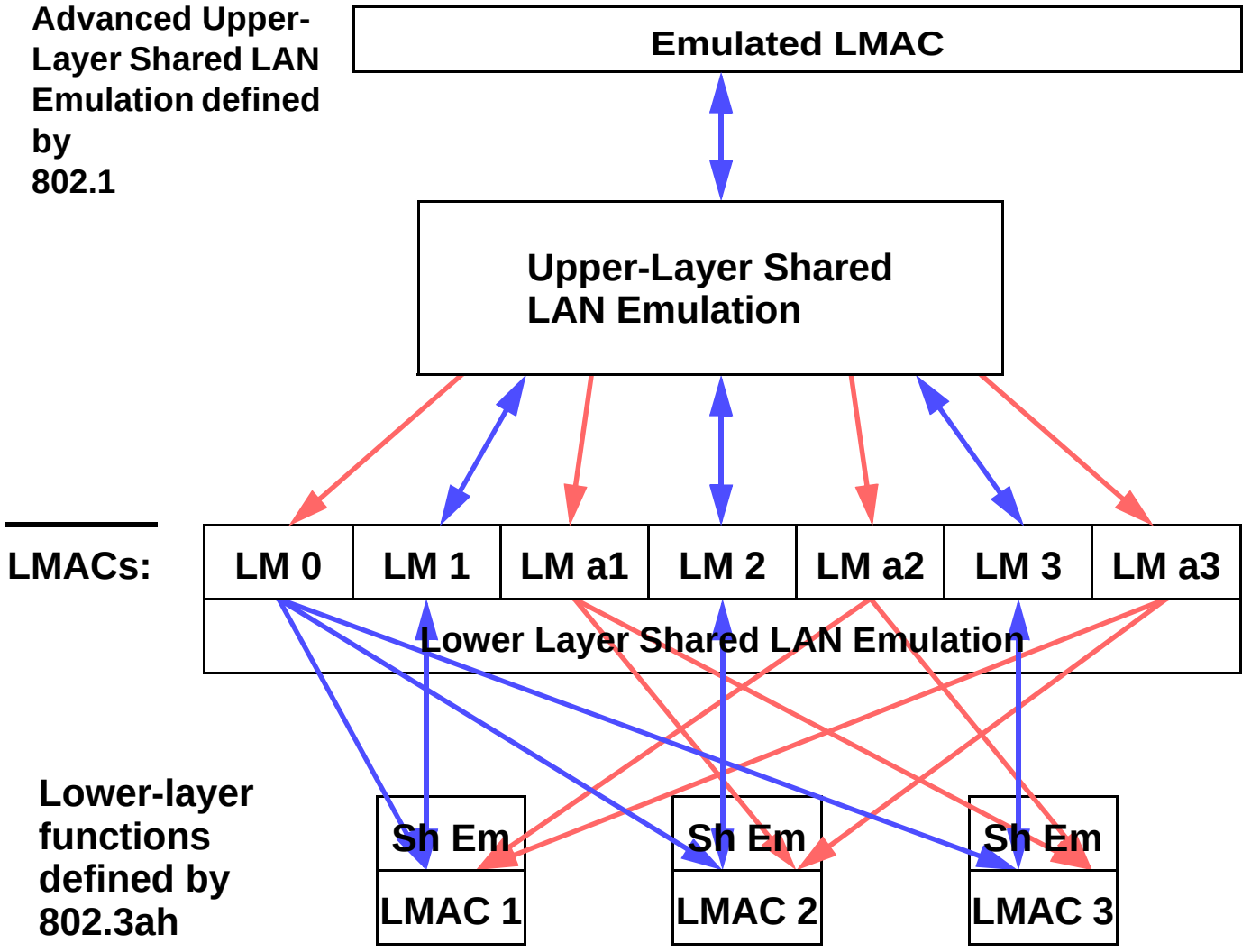
**Lower-layer functions defined by 802.3ah**



# Advanced Upper-Layer Shared LAN Emulation

- **For each ONU Logical MAC, define two OLT Logical MACs (with standard 802.3 MAC interface):**
  - **A point-to-point OLT Logical MAC (LM *n*) which reaches *only* ONU Logical MAC *n*.**
  - **A point-to-multipoint OLT Logical Anti-MAC (LM a*n*) which reaches all ONU Logical MACs *except n*.**
- **Define one OLT Logical MAC which reaches every ONU Logical MAC (LM 0).**
- **Define a bridge-like function which uses LM 0 and the LM's and LM a's to echo ONU-to-OLT frames only when necessary.**

# Advanced Upper-Layer Shared LAN Emulation



# Advanced Upper-Layer Shared LAN Emulation

- **Not exactly a bridge — notice the one-way MACs!**
- **No spanning tree BPDUs are generated.**
- **Extra information must pass across the Emulated LMAC, if a bridge lives above the Emulated LMAC.**
  - **— Configuration (e.g. {VLAN, FID} assignments).**
  - **— Dynamic parameters (e.g. timeout parameters).**
  - **— Spanning tree port state changes (e.g. Listening->Learning).**
- **The Shared LAN Emulation must know about spanning tree topology changes.**
  - **— Perhaps it recognizes the BPDUs it conveys.**

# pon-model-4.pdf is not the last word!

- **Separate “Up Function” and “Down Function” must be combined into a single function.**
- **{VLAN, FID} configuration is not mentioned.**
- **There may be a better way to model the special interactions between a bridge and a Shared LAN Emulation.**
- **There *must* be others!**

# Issues which are Relevant, but Not Now

- **IEEE 802.3ah may provide a mechanism to partition an EPON into multiple independent shared media in order to support multiple service providers.**
  - **This would be handled as multiple independent instances of the Shared LAN Emulation function.**
- **IEEE 802.3ah may require a link layer encryption mechanism tied to IEEE 802.1X, much (or exactly) like 802.11.**

# The Three Questions:

- **Will this work?**
- **Is this a good way to divide the job of ensuring 802.3 compatibility between P802.3ah and 802.1?**
- **Is IEEE 802.1 willing to take on this task?**