Time Stamping and the Baggy Pants model

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802.1 Audio Video Bridging Study Group

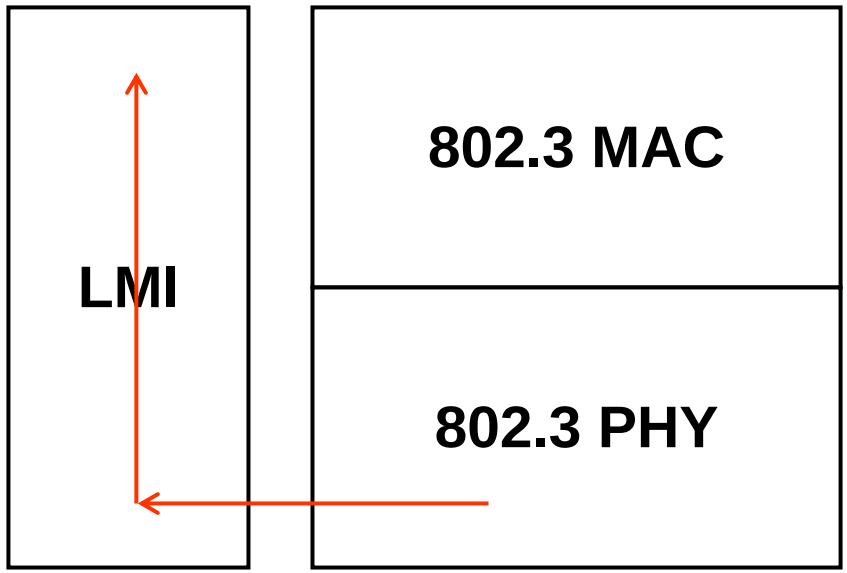
Rev. 1

Time stamping and the Baggy Pants model

- **How do AV Bridges correlate PHY sublayer timestamps with frames recognized and/or generated by PTP?**
- **We use “as-wireless-cavendish-TimeSync802_3_06_07_31.ppt” (modified) as a basis.**

  The modification is that we use *notifications* to report the arrival or transmission of a frame, rather than having the PTP Entity poll the management agent.

802.3 MAC and PHY

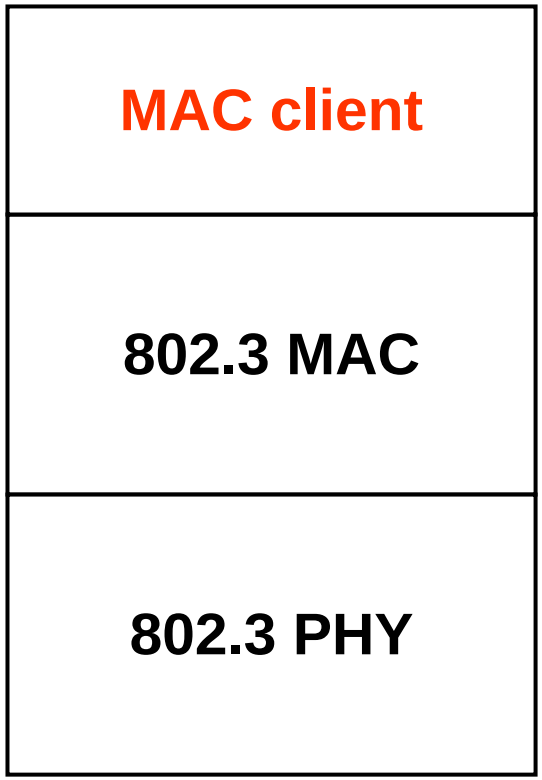


Notification (time hack) is generated by PHY layer when first bit goes in or out.

But, PHY doesn't know whether or not this frame should be timed, unless we change the MAC/PHY interface.

802.3 MAC and PHY

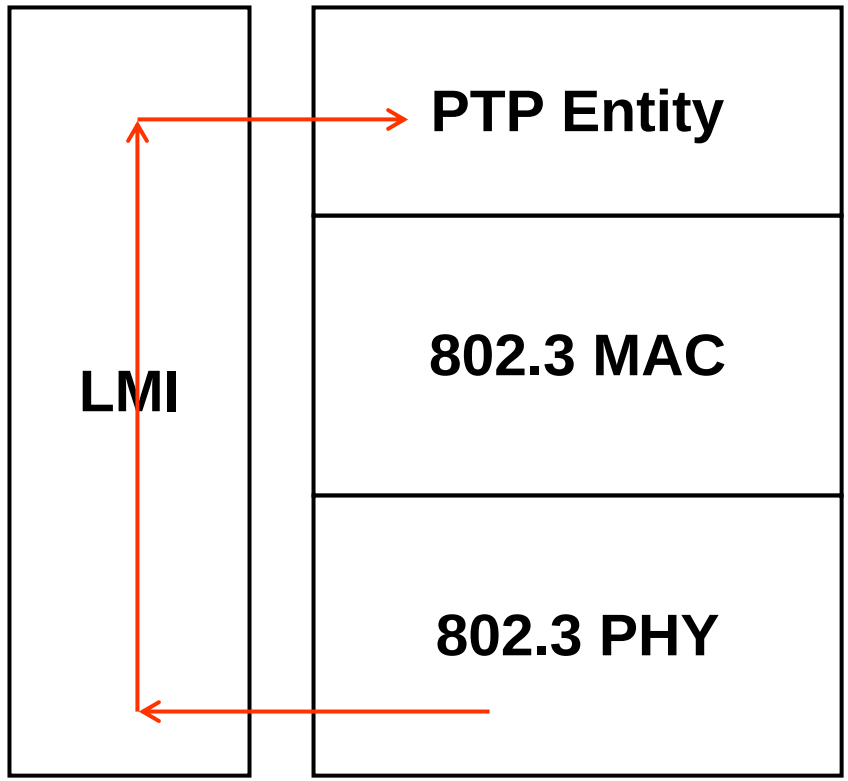
MAC client can tell which frames need to be timed, but is too far from the PHY layer to accurately time the frame.



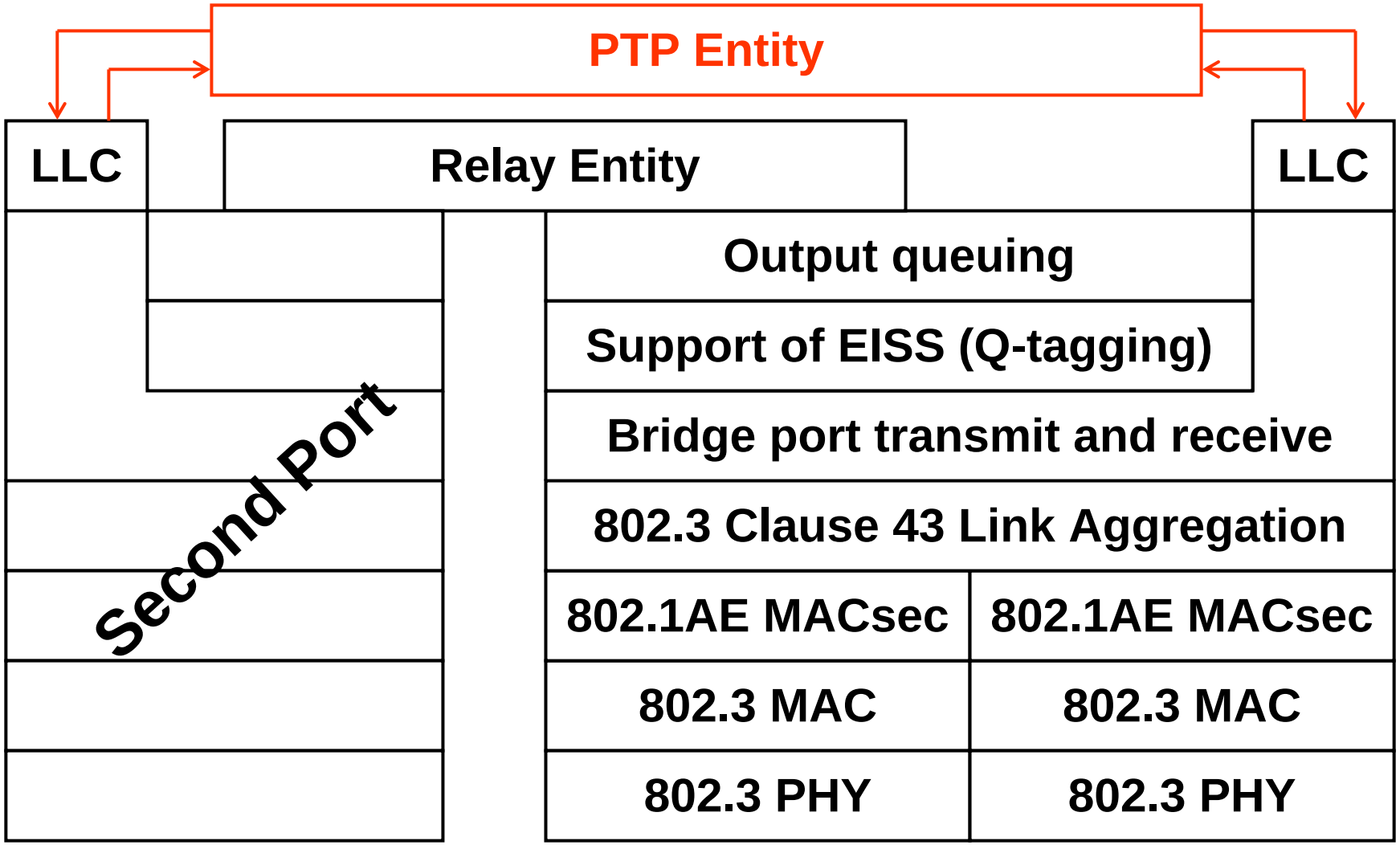
Notification (time hack) is generated by PHY layer when first bit goes in or out.

802.3 MAC and PHY (802.1 / 802.3 model)

Fortunately, since there are no queues, and since all sublayers take 0 time to perform their functions, the PTP Entity can correlate the raw time hack notifications from the PHY layer with frames passing to or from the MAC, and determine the send/receive times.

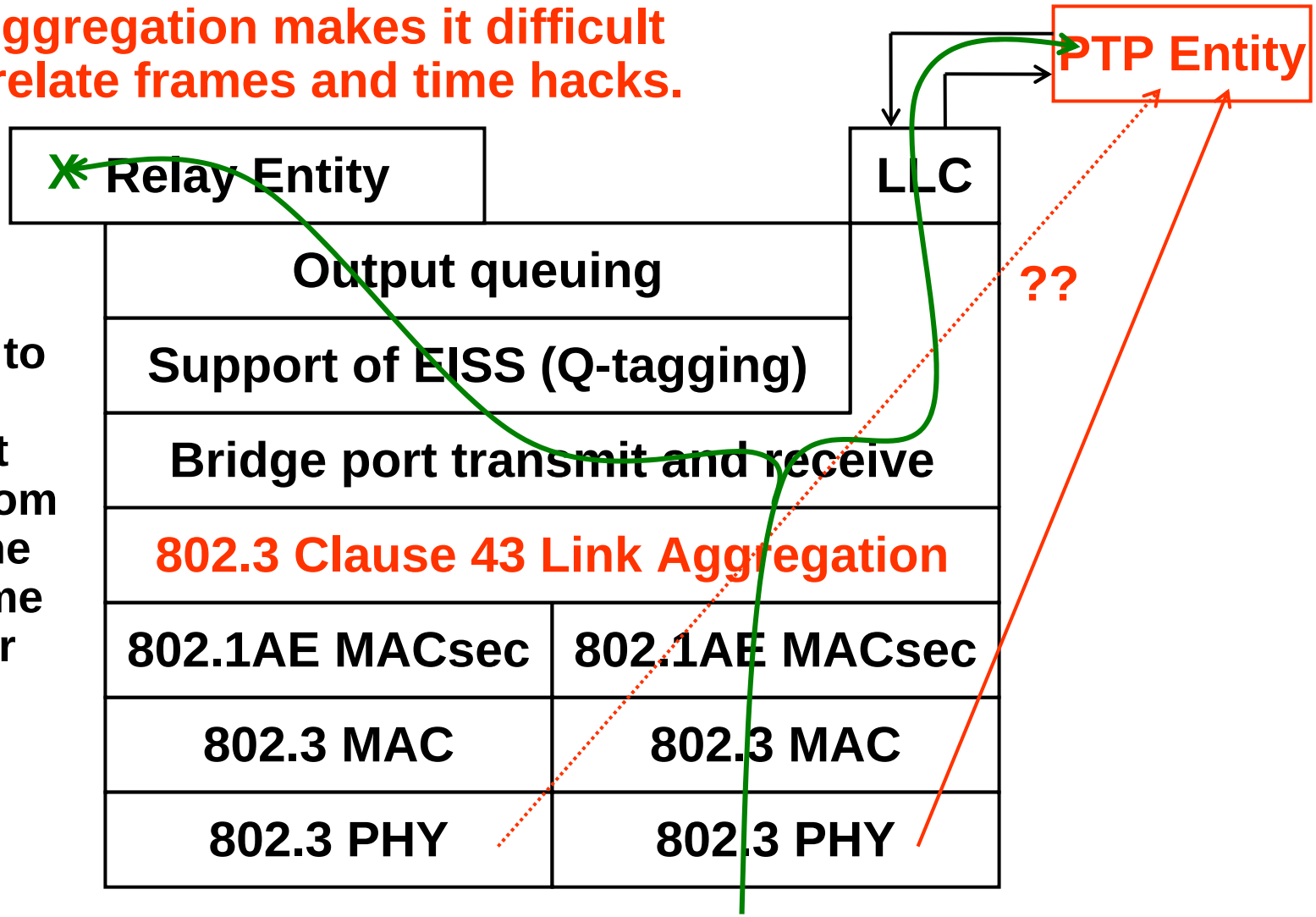


Baggy Pants diagram (2 ports) of a Bridge



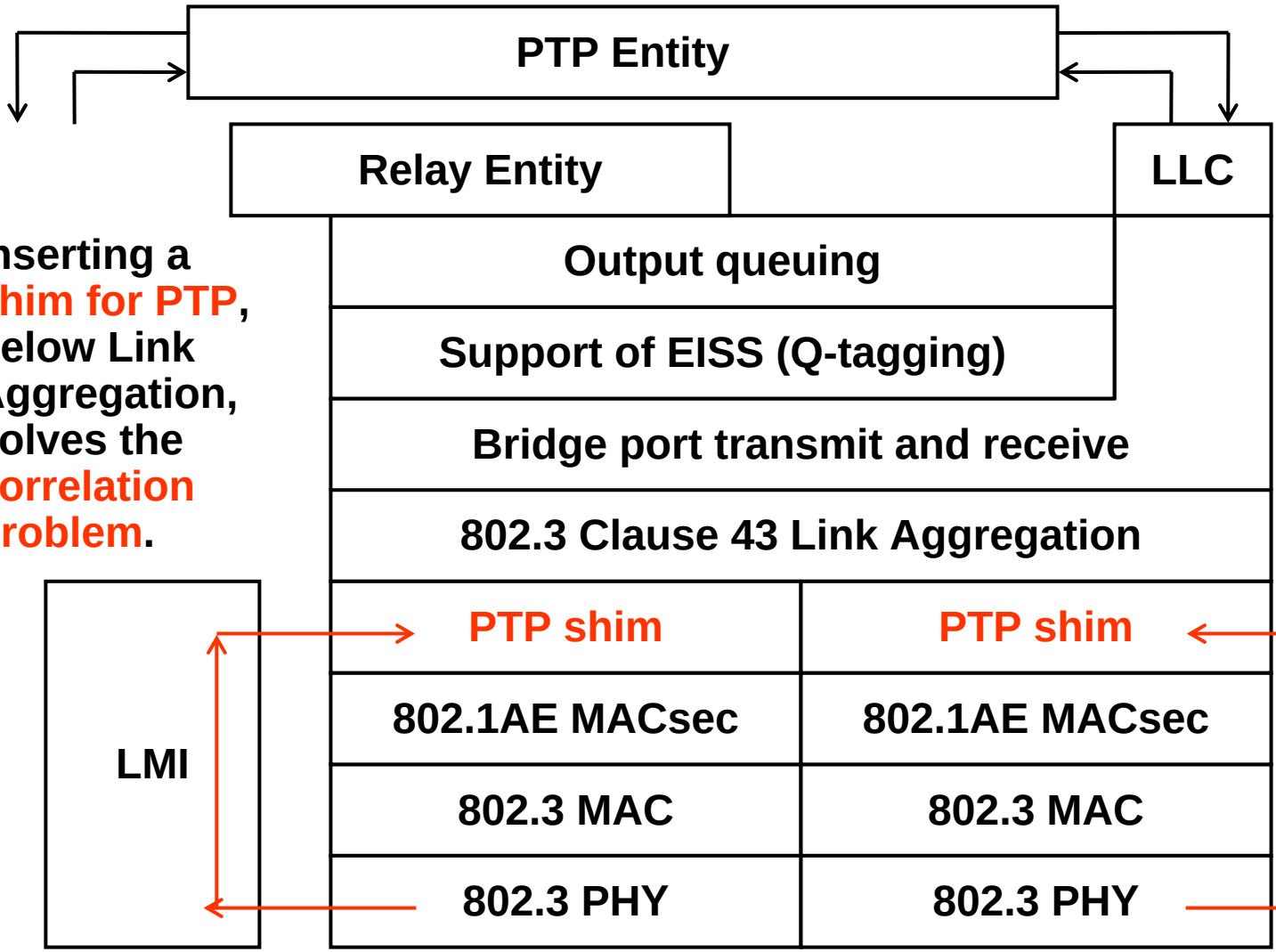
Baggy Pants diagram (2 ports) of a Bridge

Link Aggregation makes it difficult to correlate frames and time hacks.



According to the model, you cannot tell to or from which of the links a frame was sent or received.

Baggy Pants diagram (2 ports) of a Bridge



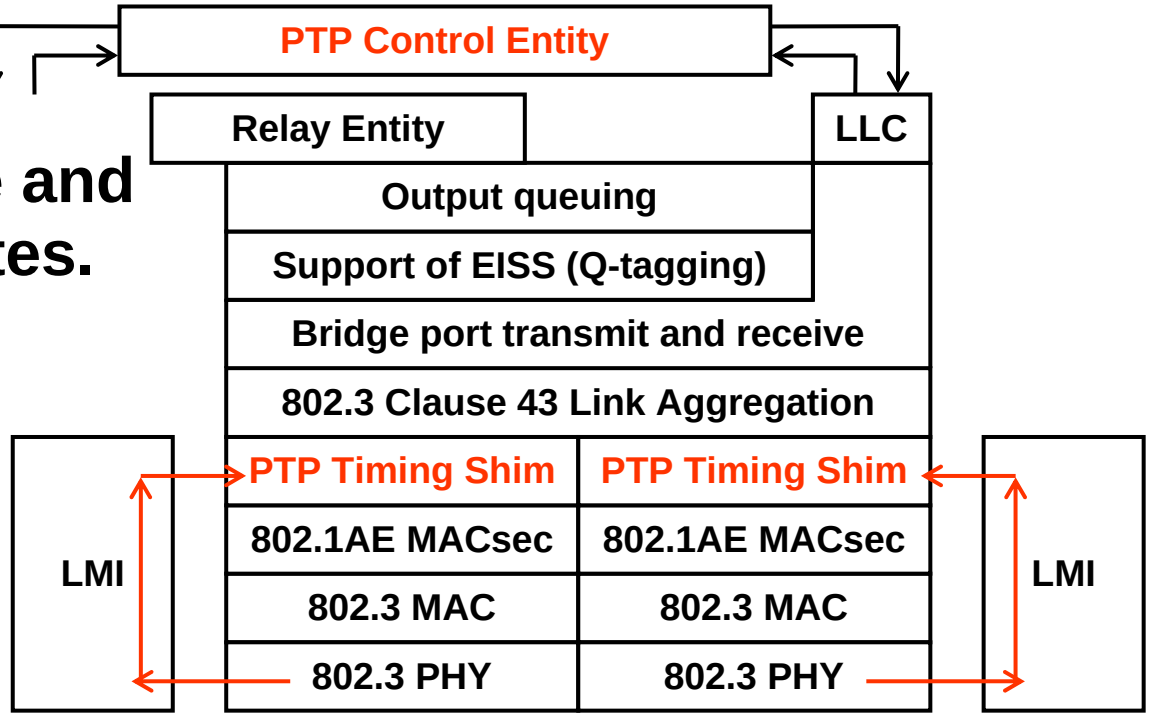
Inserting a **shim for PTP**, below Link Aggregation, solves the **correlation problem**.

A **PTP shim** also makes the "0-time" **correlation more plausible**.

Shim is **above MACsec** because time is important.

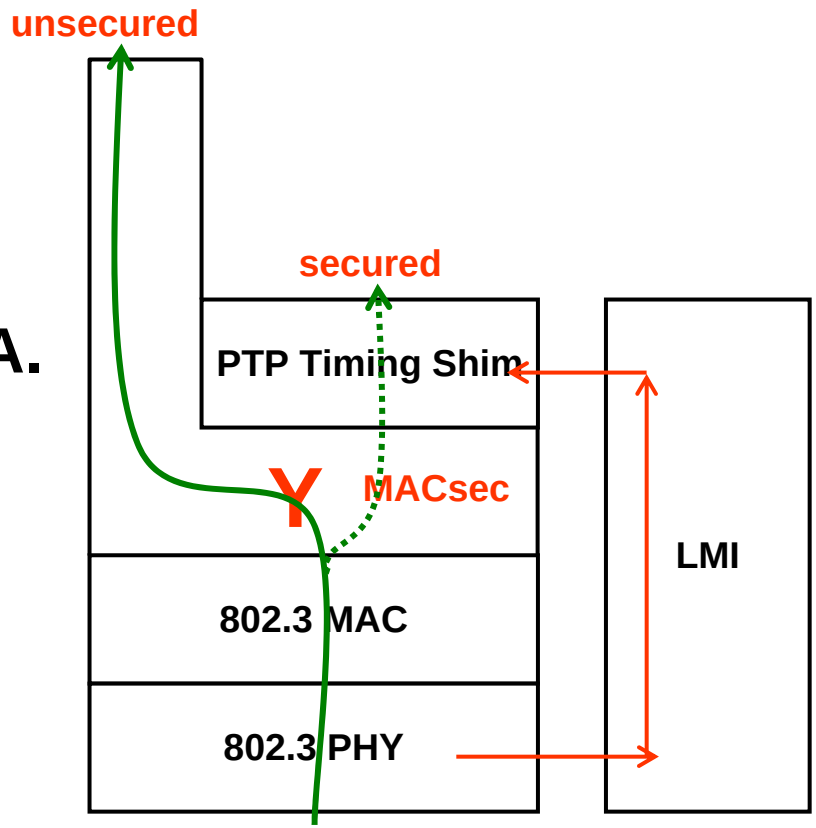
Model for collecting timing information

- **PTP Control Entity drives the protocol.**
- **PTP Timing Shim collects timing information.**
- **They communicate out-of-band.**
- **PTP Timing Shims recognize timed frames by EtherType and the following two bytes.**



Model for collecting timing information

- **802.1AE MACsec confuses things somewhat, because it has an unsecured port inserting outgoing and extracting incoming frames.**
- **This does not necessarily invalidate the model; it simply means that a time hack notification might not be accompanied by a M_UNITDATA. Indication.**



Reality (sigh!)

- **The real question is, how complex must the hardware be?**
- **Typically, the PTP Control Entity is in software, and the PTP Timing Shim is in hardware.**
- **Either:**
  1. **We design the protocol so that it is highly unlikely that two timed frames (in the same direction) could occur so closely together that the software would not have time to fetch the timing information; or**
  2. **We indicate that the timing information must be somehow correlated with the frame, perhaps by including the timing information with the frame, perhaps by a timing indication FIFO that can never get out of synch with the frames' data.**

Reality (sigh!)

- **We can probably design the protocol to avoid the "time needed to fetch the timer" problem.**

  Doing so will encourage early implementation, so let's try.

  We may or may not be able to do this for all features.

- **But, given that:**

  We expect other timing protocols to use this same model; and

  It will complicate the protocol and/or reduce its capabilities to enforce gaps for time stamp fetching;

- **We should warn the implementer that some kind of FIFO or queuing mechanism will be needed, at least in the long term.**