OAM for laned systems

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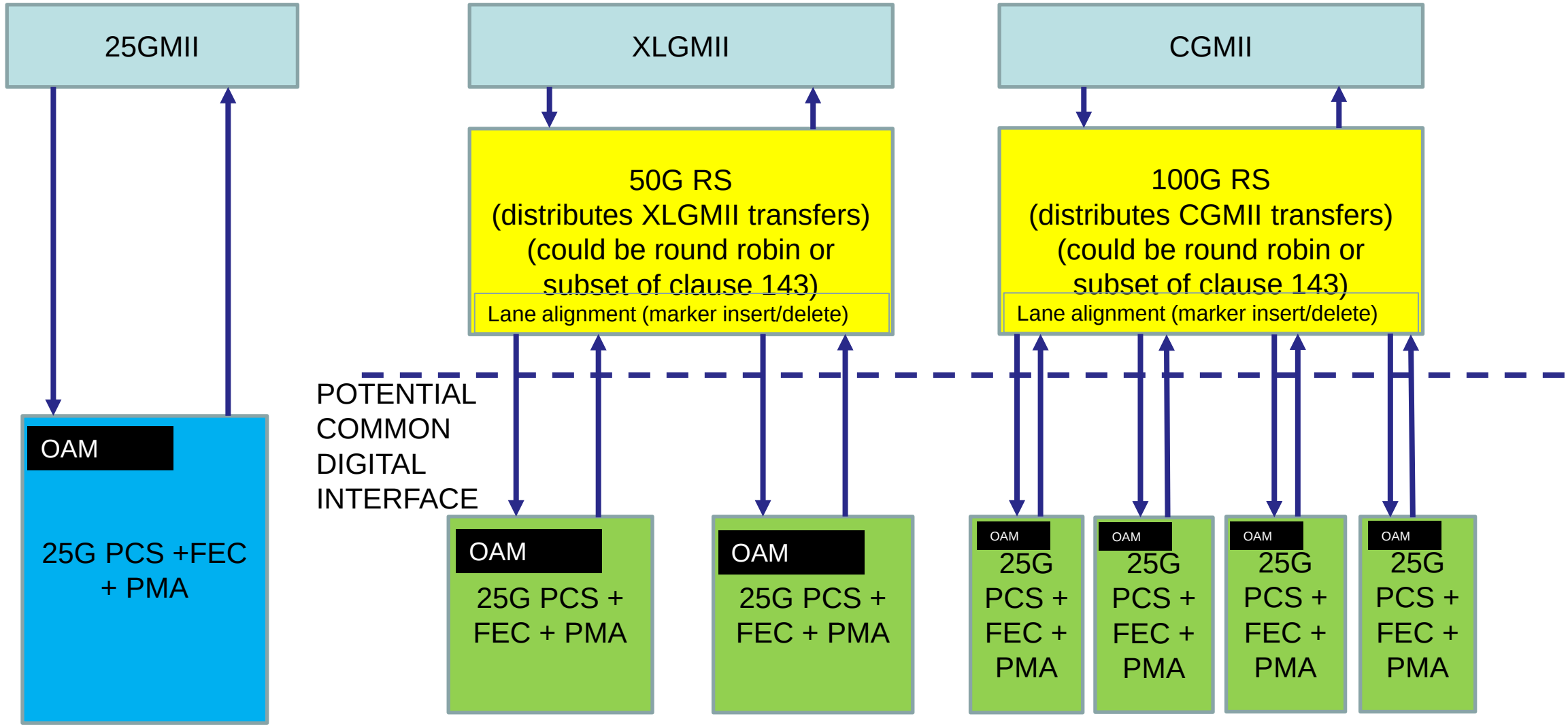
Laning as a full PHY stack

- Several choices at first, one at last:
  - ~~– Lane PMA only as a unit? (combine at FEC) (like Cl 55)~~
    - ~~• Similar to BASE-T model, although FEC isn't separate sublayer~~
  - ~~– Lane PMA & FEC as a unit? (combine at PCS) (like Cl 91 & 94)~~
    - ~~• Allows integration and repetition of a PMA/FEC with independent BER~~
  - – Lane PMA/FEC/PCS as a unit? (combine at RS) (Cl 143)
    - Allows independent PHY units to be bonded
    - PCS & FEC can still be internally laned if needed, independent of PMA

Lane PMA + FEC + PCS



OAM per Lane or OAM per Link?

- OAM per Lane:
  - Add 3 duplicate register spaces for OAM
  - Leave it to the user (out of scope/management entity) to consider them as a whole
- OAM per Link (a link is 1,2, or 4 lanes):
  - Reduce information at the source to one parameter per link
  - Use the one register space
- Additional issues:
  - Do we want to report alignment / pair swap information?
  - Reconciliation Sublayers are layered above MDIO functionality, reporting would need to be in an AUI or PCS sublayer above the individual lanes

Basic OAM parameters (802.3bp/ch)

- Basic parameters for control of the OAM link
  - Toggle bit, message valid, message #, etc.
- Message number: gives meaning to what follows
- SNR indicator
  - Specifies control of the entire link (all lanes)
  - Includes two link-level requirements
    - Indication that link will drop and relink in 2 ms to 4 ms
    - Request for link partner to exit LPI and send idles
- Suggests this is best consolidated for all lanes

Message parameters

- Content is outside 802.3 scope
  - Whether all 4 lanes carry the same data or not IS in scope
- Annex 149B.2 describes content that would be uniform for all lanes on the link
  - MAC messages – must be at link level
  - Power supply health likely common
  - Internal temperature might vary
- Annex 149B.2 also includes content that is lane-specific
  - Some could be consolidated, reporting worst lane
  - Lane-specific information could be vendor-specific or added in fields as needed, but would still be one message per link

Lane Specific Information

- REC as defined would be per-lane
  - Usage may be per-link (to diagnose a faulty link)
  - Do we need per-lane?
    - Helps diagnose cable/connector faults, but may not be required
- Polarity is really only useful per-lane, but indication of any polarity swap might be enough
- Do we need pair-swap information?
  - 4-pair BASE-T reports swaps and auto-corrects

Complications

- Consolidation across lanes in the transmitted OAM information necessitates inter-lane communication at the PCS
- Some individual lane information controls link-level events
  - PHY Health/SNR indicator
    - PHY link is failing and will drop link and relink within 2 ms to 4 ms after the end of the current OAM frame
    - LPI refresh is insufficient to maintain PHY SNR. Request link partner to exit LPI and send idles (used only when EEE is enabled)
  - These also necessitate inter-lane communication
- These can be figured out later if OAM is transmitted per-lane

Recommendations

- We can do everything we need to do at the receiver after aggregating separate OAMs from each lane.
  - Consider defining 802.3ch-level OAM, with multiple registers (one set per lane)
  - Table what to do with aggregate controls for now.
- Need to consider whether we need to identify pair swaps, but can wait on that
- We don’t have to solve this now.

THANK YOU!