Service Interfaces & Physical Instantiations

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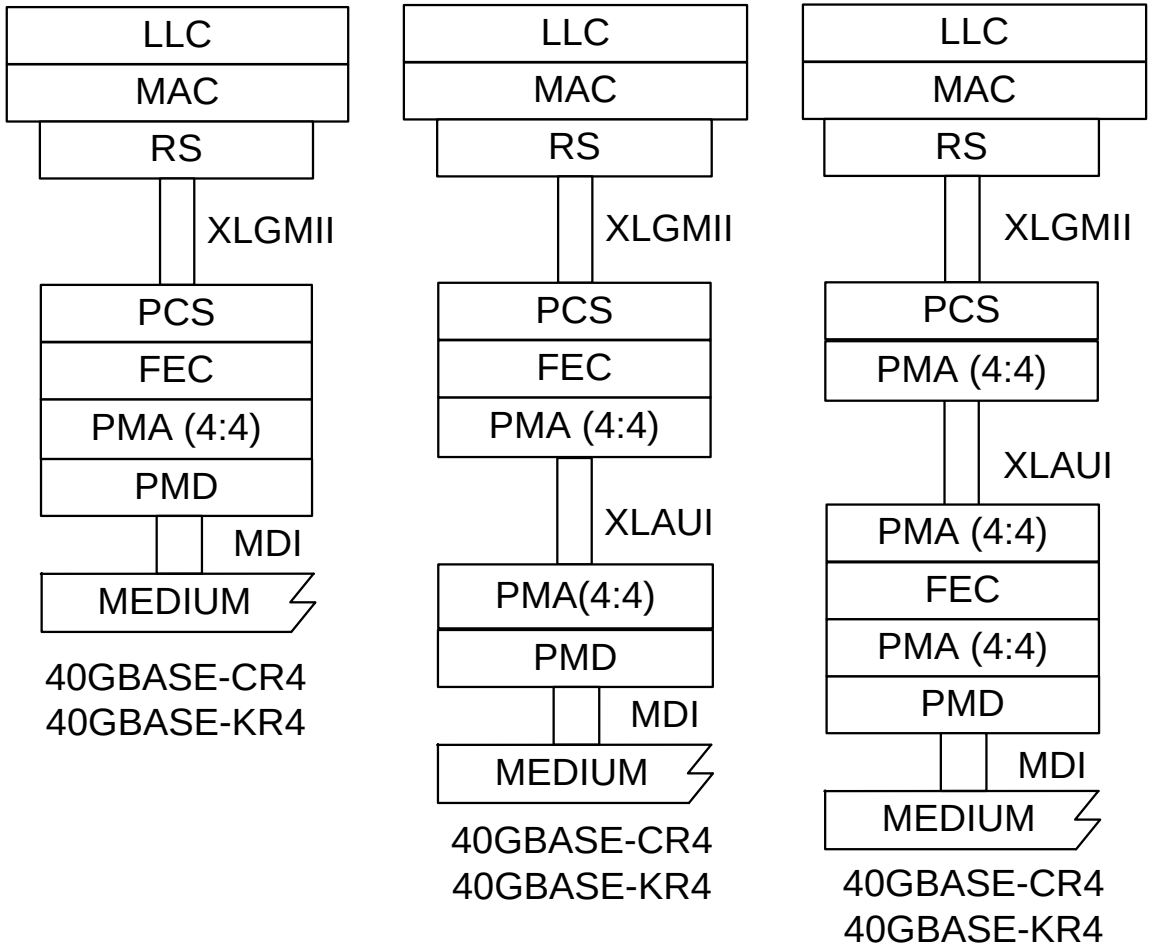
Introduction

- Addresses Comments #392, 395, and 411
  - 392: The FEC service interface section does not discuss that the implementation shown in Fig 83-2, where the XLAUI / CAUI is above the FEC sub-layer.
  - 395: It is unclear that for physical instantiations XLAUI / CAUI that retiming is required and no apparent PIC for it.
  - 411: Fig 80-2 and Fig 80-3 are very complex drawings as they try to capture the flexibility and multiple options inherent in the draft. Neither figure shows that XLAUI / CAUI is an optional physical instantiation. Also, FEC should be conditional based on PMD type. Given the various architectures it is also not obvious which SPx need to be measured.

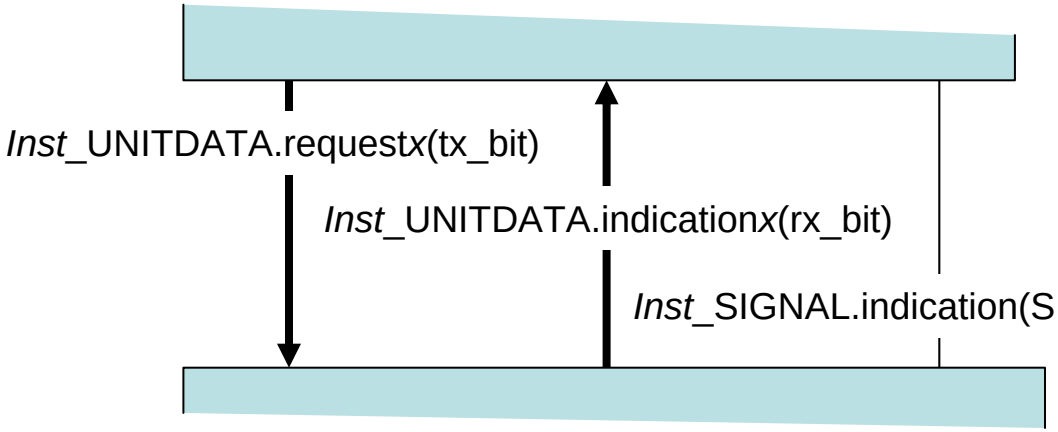
- These comments relate to
  - The flexibility of the IEEE P802.3ba architecture
  - Abstract Service Interfaces
  - Optional Physical instantiations of PMA service interface
    - XLAUI for 40 Gigabit Ethernet
    - CAUI for 100 Gigabit Ethernet

A Flexible Architecture
Example – 40GBASE-(C/K)R4

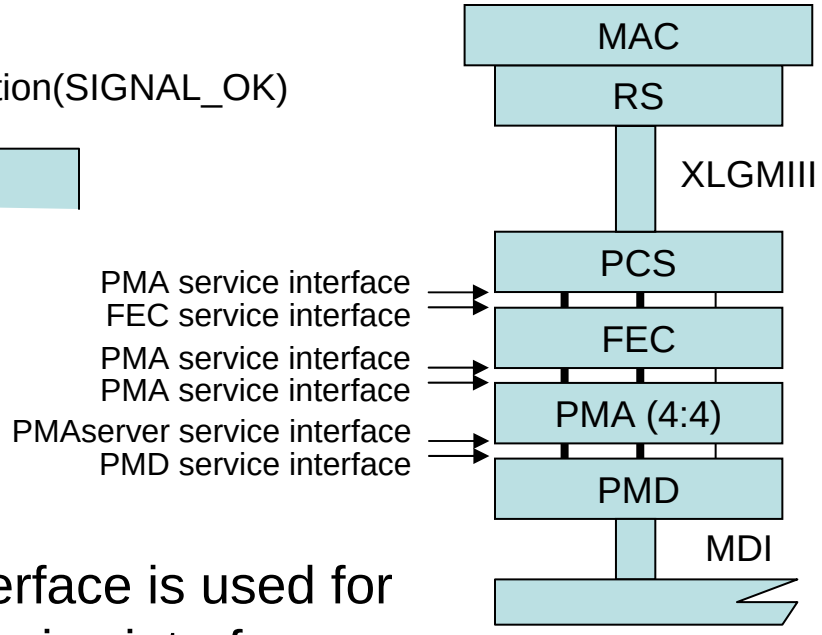


- Fixed locations:
  - PCS Sub-layer
  - PMD Sub-layer
- Flexible architecture to enable multiple implementations
  - Location of PMA Sub-layer(s)
  - Location of FEC Sub-layer
  - Optional Physical Instantiation(s)
  - Note – NO GUIDELINES PROVIDED
- Key Building Block – the same abstract service interface enables the use of the same optional physical instantiation

Generic multi-lane abstract service interface



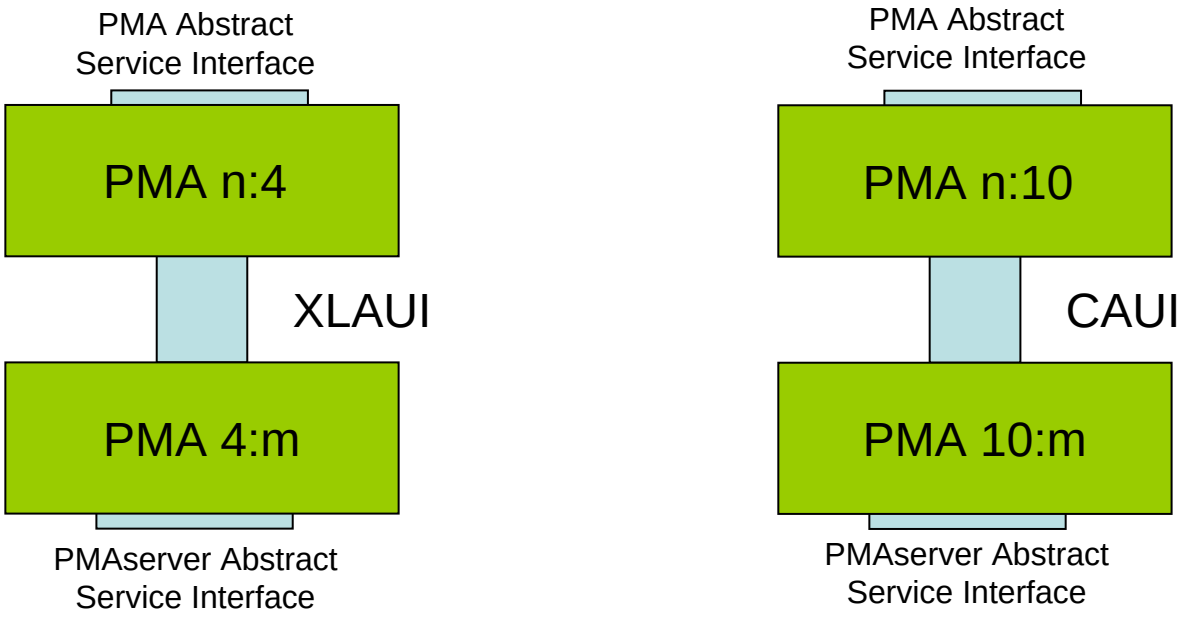
x = 0 through *p*-1
Inst = PMA for PMA service interface
PMAserver for PMA service interface
FEC for FEC interface
PMD for PMD interface



40GBASE-KR

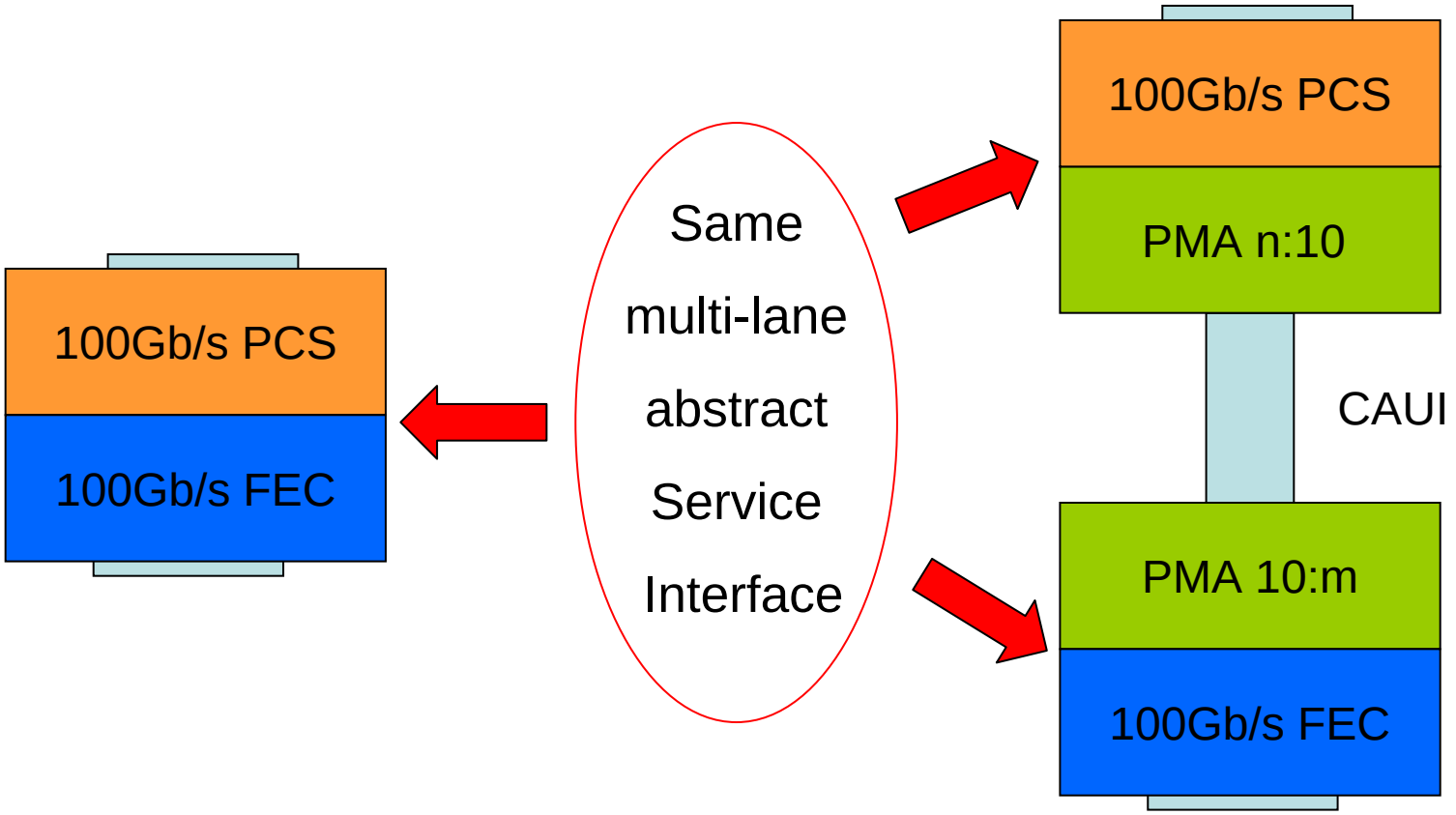
The same muti-lane abstract service interface is used for the PMA, PMAserver, FEC and PMD service interfaces supporting a flexible architecture with optional FEC and multiple PMA sublayers

nAUI - Architectural Perspective

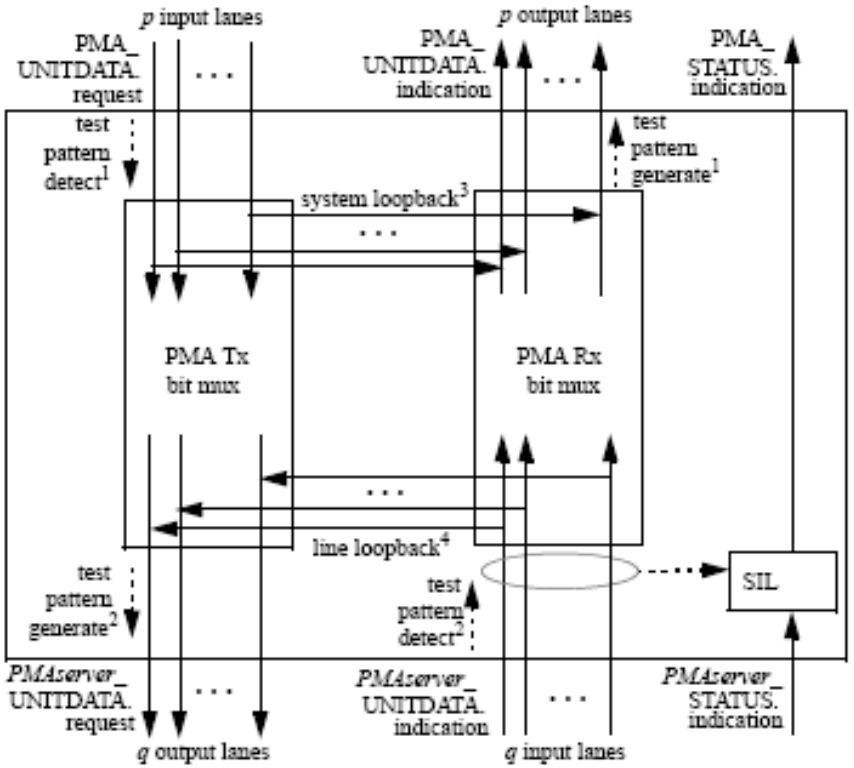


- nAUI is a physical instantiation of the connection between two adjacent PMA sublayers
  - XLAUI is a 10 Gb/s by 4 lane physical instantiation of the respective 40 Gb/s connection
  - CAUI is a 10 Gb/s by 10 lane physical instantiation of the respective 100 Gb/s connection
- Number of lanes above/below matched by adjusting the ‘n’ and ‘m’ values.
  - For connecting to PCS and FEC sub-layers : 4 lanes at 40Gb/s and 20 lanes at 100Gb/s
  - For PMA and PMD sub-layers: implementation dependent
- Optional testability for the nAUI via the inclusion of PMA sub-layers
- Retiming in the Rx path via the inclusion of the PMA sub-layer

Example - Implementing a CAUI



PMA Functionality



PMAserver PMD, PMA, or FEC, depending on which layer is below this PMA
SIL Signal Indication Logic

[1] If physically instantiated interface (XLAUI/CAUI) immediately above this PMA
[2] If physically instantiated interface (XLAUI/CAUI or PMD service interface) immediately below this PMA, or if this is the closest PMA to the PMD
[3] If this is the closest PMA to the PCS
[4] If this is the closest PMA to the PMD

Figure 83–5—PMA Functional Block Diagram

Per Draft 1.1

- Tx / Rx Path
- Bit Muxing
- Adjustment of interface width (primarily today for 100GbE)
  - PCSL to Physical (PCS / PMA: 20 to 10)
  - Physical to PCSL (PMA/FEC: 10 to 20)
  - Physical to Physical (PMA/PMA, PMA/PMD 10 to 4)
- Link status
- Optional Test Pattern Generation (note 1)
- Optional Test Pattern Detection (note 2)
- Optional System Loopback (note 3)
- Optional Line Loopback (note 4)

Clock and Data Recovery

Per Draft 1.1

83.5.1 Per input-lane clock and data recovery

If the interface between the PMA client and the PMA is physically instantiated (XLAUI/CAUI), the PMA provides per lane clock and data recovery (CDR) at the PMA service interface as specified in Annex 83A. If the interface between the PMA server and the PMA is physically instantiated (XLAUI/CAUI or the PMD service interface for 40GBASE-SR4 or 100GBASE-SR10), the PMA provides per lane CDR at the PMA server service interface as specified in Annex 83A or 86.6.1 as appropriate.

Suggested Re-wording

If the interface between the PMA client and the PMA is physically instantiated (XLAUI/CAUI), the PMA shall provide per lane clock and data recovery (CDR) at the PMA service interface as specified in Annex 83A. If the interface between the PMA server and the PMA is physically instantiated (XLAUI/CAUI or the PMD service interface for 40GBASE-SR4 or 100GBASE-SR10), the PMA shall provide per lane CDR at the PMA server service interface as specified in Annex 83A or 86.6.1 as appropriate.

Guidelines

1. A single scalable generic multi-lane abstract service interface is used for the PMA, PMAserver, FEC and PMD service interfaces supporting a flexible architecture with optional FEC and multiple PMA sublayers (include figures from page 4)
    1. An instance of this interface can only connect service interfaces with the same number of lanes. A PMA is required to convert between lane widths.

2. nAUI is a physical instantiation of the connection between two adjacent PMA sublayers (include figures from Page 5)
    a. As a physical instantiation it defines electrical and timing specification as well as a requiring a receive re-timing function.
    b. XLAUI is a 10 Gb/s by 4 lane physical instantiation of the respective 40 Gb/s connection
    c. CAUI is a 10 Gb/s by 10 lane physical instantiation of the respective 100 Gb/s connection
    d. Number of lanes above/below PMA sublayer matched by adjusting the ‘n’ and ‘m’ values.

3. The physical instantiation nAUI, and associated PMAs, can replace any instance of the generic multi-lane abstract service interface

4. Opportunities for optional test pattern generation, optional test pattern detection, optional system loopback and optional line loopback are dependent upon the location of the PMA sublayer in the implementation. See figure 83-5

5. A minimum of one PMA sub-layer is required in a PHY (provide loopback opportunity)

6. A maximum of four PMA sub-layers is permitted in a PHY (due to MDC/MDIO addressing restrictions)

Summary

- Clause 83 (PMA)
  - Under 83.2 (PMA Interfaces)
    - define that The PMA, PMA-server, FEC, and PMD abstract service interfaces use the same abstract service interface
    - This service interface enables the use of an optional physical instantiation of the connection between two PMA sub-layers
    - Add statements where appropriate in other clauses (74, 84 – 88) regarding abstract service interface and the optional (nAUI) physical instantiation
  - Under 83.5.5, add sub-clause that architecturally defines nAUI as a retimed interface
    - nAUI is a physical instantiation of the connection between two adjacent PMA sub-layers
      - XLAUI is a 10 Gb/s by 4 lane physical instantiation of the respective 40 Gb/s connection
      - CAUI is a 10 Gb/s by 10 lane physical instantiation of the respective 100 Gb/s connection
    - Add change as recommended on Page 8
    - Add a diagram (similar to Page 4 of this presentation) that illustrates a nAUI between two PMA sublayers with PMA SERVICE INTERFACES illustrated coming out of the top / bottom of the PMA sublayers not connected to the nAUI
    - the electrical interface and mandatory re-timing is the physical instantiation of the connection between two PMA sublayers.
      - Add a “shall” statement for retiming of the Rx path
- Add architectural guidelines in informative annex (See Page 9)