PCS/PMA interfaces for 10Gb/s Ethernet

Richard Dugan

Hewlett-Packard, ICBD

802.3 Meeting, Coure D'Alene, Idaho

June 1999

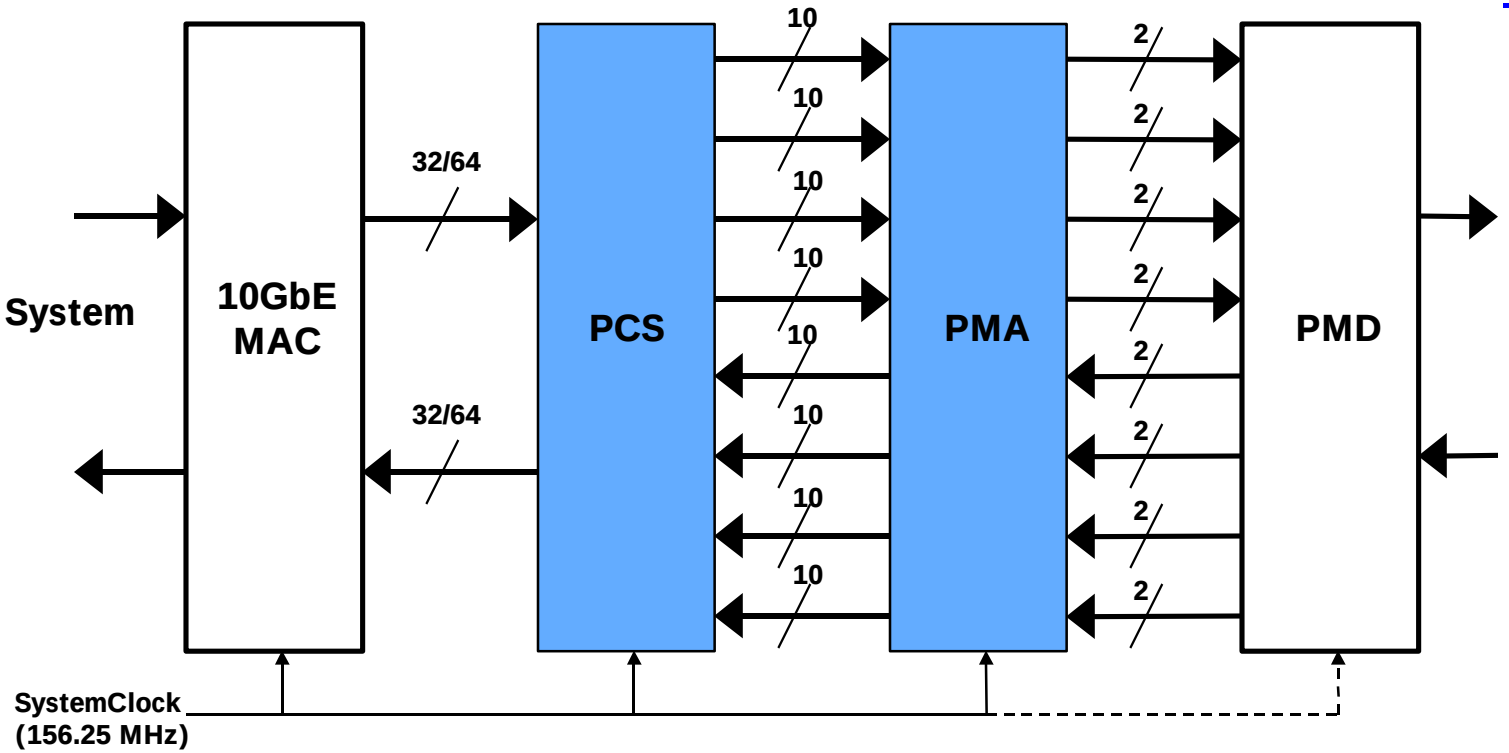
Motivation

- Provide a PCS/PMA interface suitable for a wide variety of applications (PMD's)
  - Optics:
    - Serial transceivers
    - WDM transceivers
    - Parallel fiber
  - Copper:
    - Backplanes
    - Cable jumpers

Strategy

- Pick 10GMII interface (MAC to PCS)
  - 32 or 64 bit wide for Tx and Rx bus
  - 156.25 MHz system clock
- PCS to PMA interface
  - Use four channels at 2.5 Gb/s each
  - Channels are “byte striped”
  - 8 or 10 bit bus per channel, dependent on coding
- PMA to PMD interface
  - 4 serialized, differential channels at 2.5 Gb/s each

PCS and PMA interface



PCS requirements (Endec)

- Encode/decode data
  - DC balance, maximum run length limit must still be met
  - Either block encoding (8b/10b, etc) or scrambling could be used
    - 8b/10b has advantages in leveraging work done for 802.3z, and low run length limit
    - Scrambling has advantages in reducing signal overhead

PCS requirements (Packet distribution)

- PCS must distribute 10GbE packet from MAC across four channels
  - Packet may be byte-striped across channels for a single 10G MAC. (Could also use aggregation as in 802.3ad or NGIO MLX)
  - Each channel should have a unique marker to allow skew control at PCS receiver
    - 8b/10b could use special control characters
    - Scramblers could correlate channels based on scrambling sequence

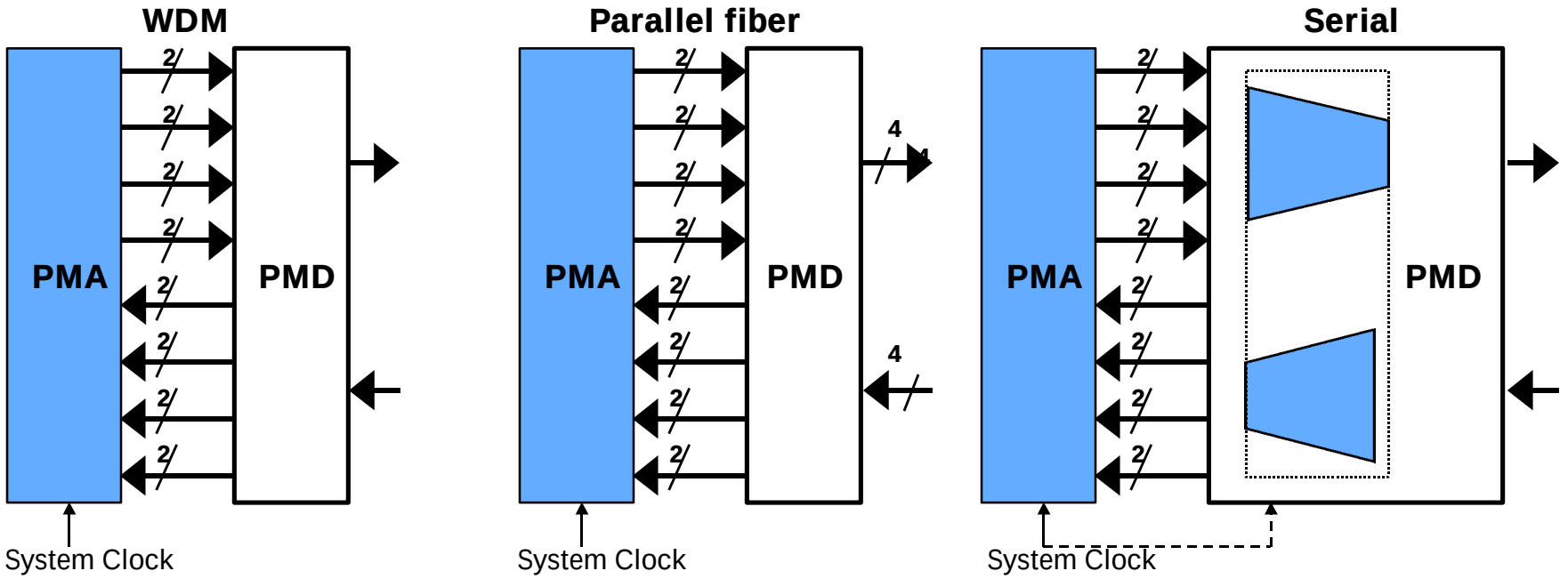
PCS requirements (Skew control)

- Must handle arbitrary skew (~1byte ?) between all four channels
  - Skew control allows many different applications to use common architectures (low cost)
    - Parallel fiber (including PCB routing)
    - Backplane applications with relatively long PCB connections (~24 inches) through multiple layers and connectors
    - Cable jumpers (10-20m) with low cost twinax bundles
- FIFO's in each channel at PCS receiver can handle skew once a maximum is chosen

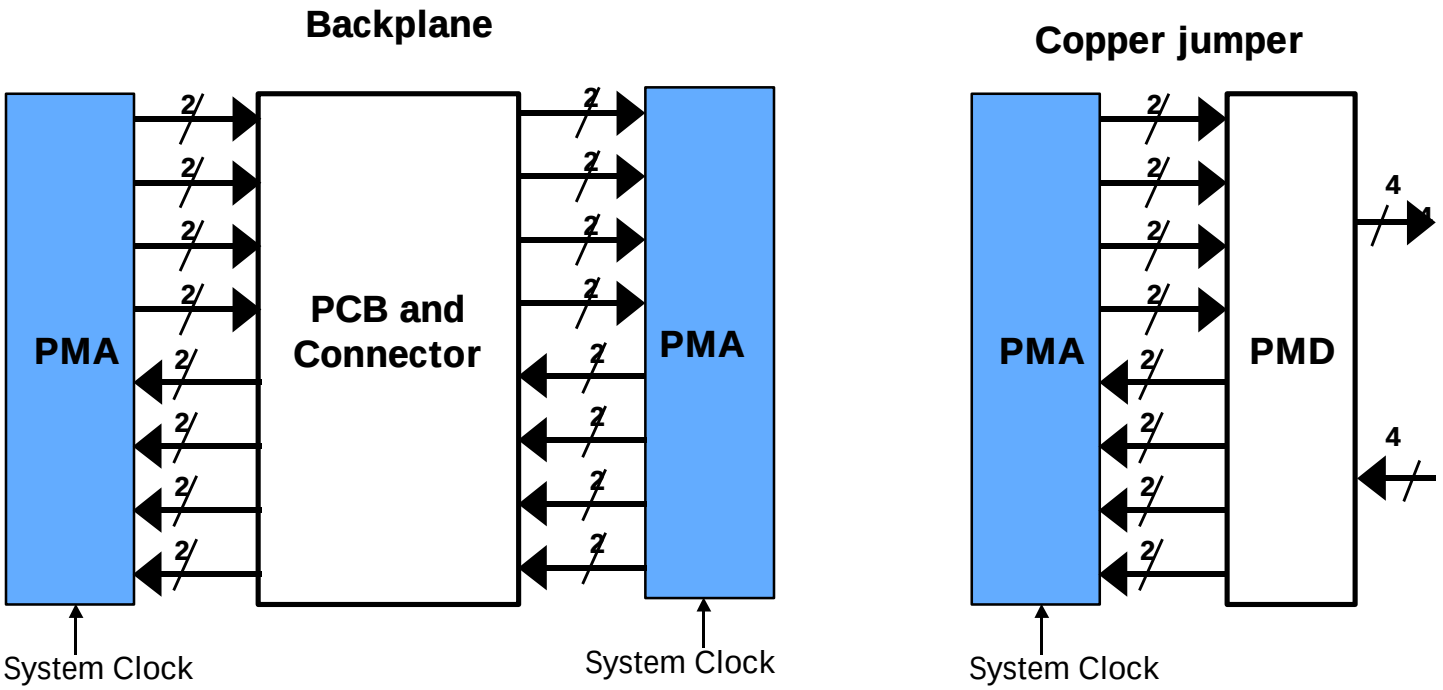
PCS requirements (Channel identification)

- Allow received packets to begin on any of the four links
  - PCS Rx can find start-of-packet delimiter on any of the four channels
  - After packet start is found, remaining bytes are assumed to be round-robin
- This allows simple bit mux/dmux implementation in high speed serial (10Gb/s) application

Optic PMA/PMD interfaces



Copper PMA/PMD interfaces



PCS/PMA Summary

- Four channels of 2.5 Gb/s data is the most flexible implementation of the 10Gbs Ethernet system
  - Allows for multiple optical and copper PMD's including serial optics
  - Longer-term possibility for full integration of PCS/PMA is maintained
  - Signal integrity on system boards is feasible with current FR4 materials and low-cost connectors
- Skew control within PCS layer provides a single point of de-skew for entire phy link