40/100G Ethernet Aggregation at the Physical Layer

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APL Goals

- Define a mechanism that efficiently “bonds” physical links together to achieve a higher aggregate rate
- Support aggregate rates of 40 G and 100 G
- Keep the mechanism coding independent
- Be compatible with all existing 10 G PHYs
- Be compatible with all existing 10 G sublayer interfaces
- Be compatible with all future n G PHYs
- Support lane counts of 1, 2, 4, 5 and 10
- Support lane rates of 10 G, 20 G, 25 G, 50 G and 100 G
- Accommodate any reasonable amount of lane to lane skew
- Preserve temporal ordering of packets

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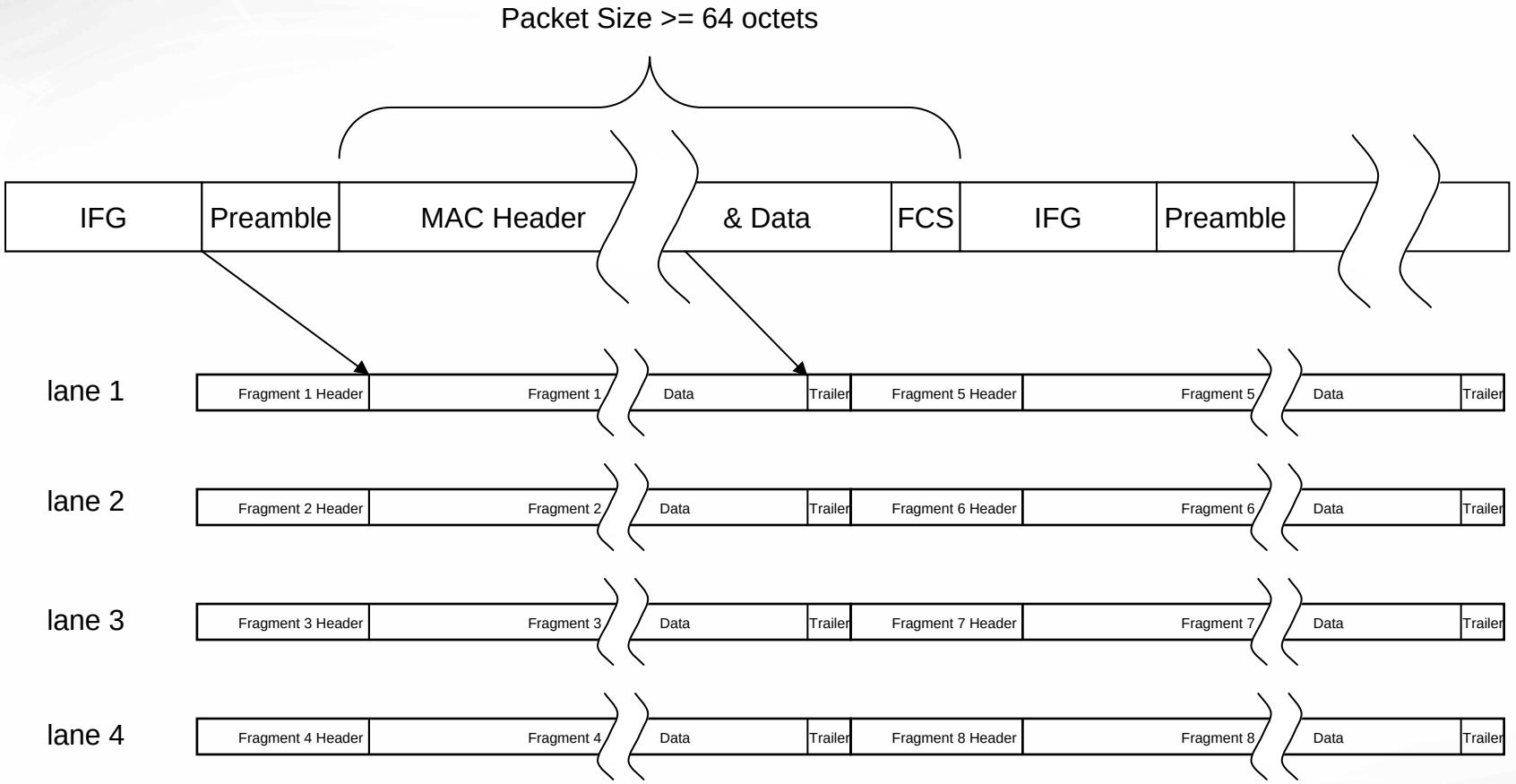
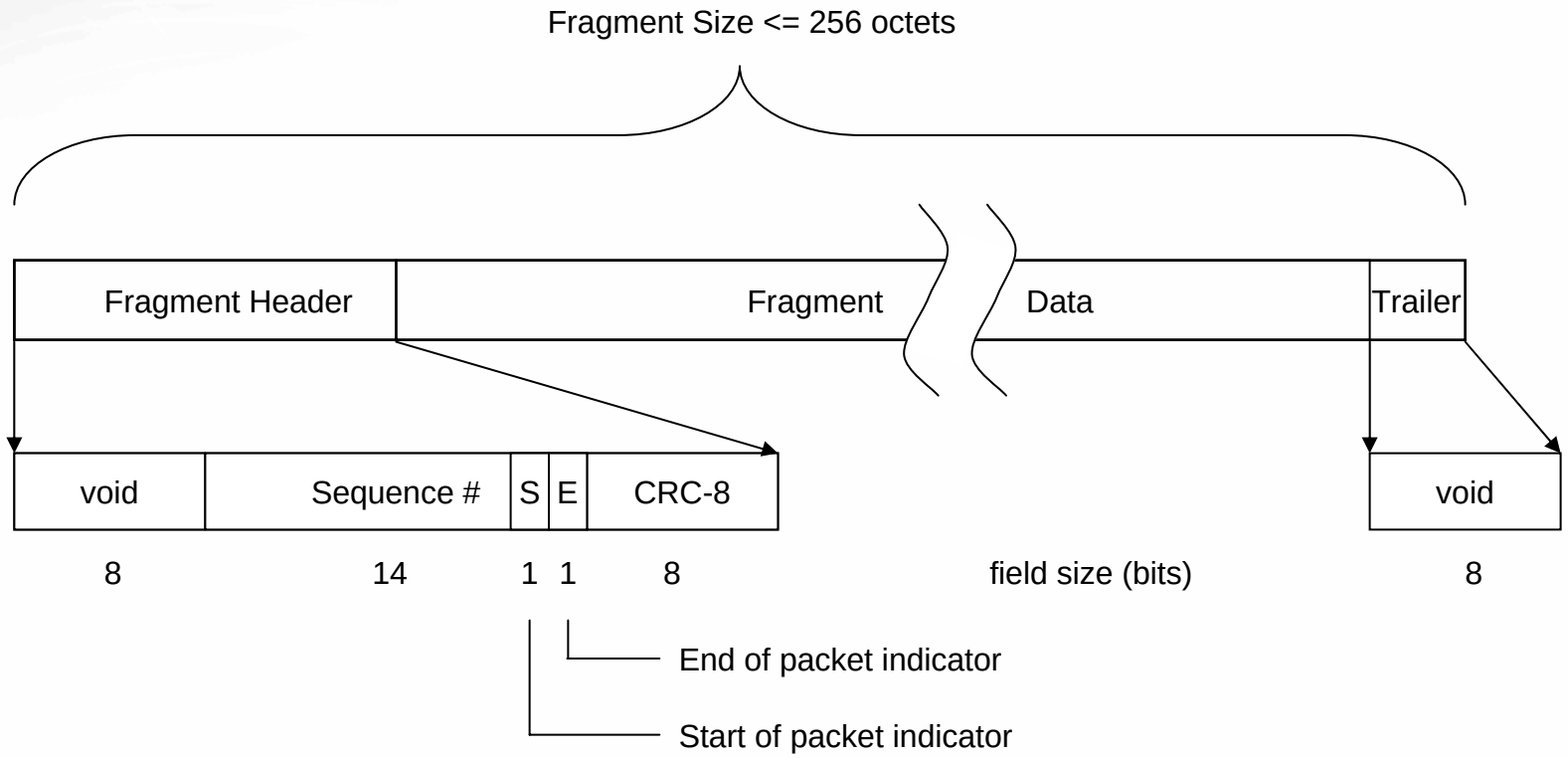
APL Key Concepts

- Transport all of a packet, including the preamble
- Decimate packets into fragments at the transmitter
- Fragments are delimited just like packets on any given interface
- Distribute fragments across the available lanes
- Tag fragments with a sequence number so that temporal order of packets can be preserved
- Reassemble fragments at the receiver

APL Fragmentation



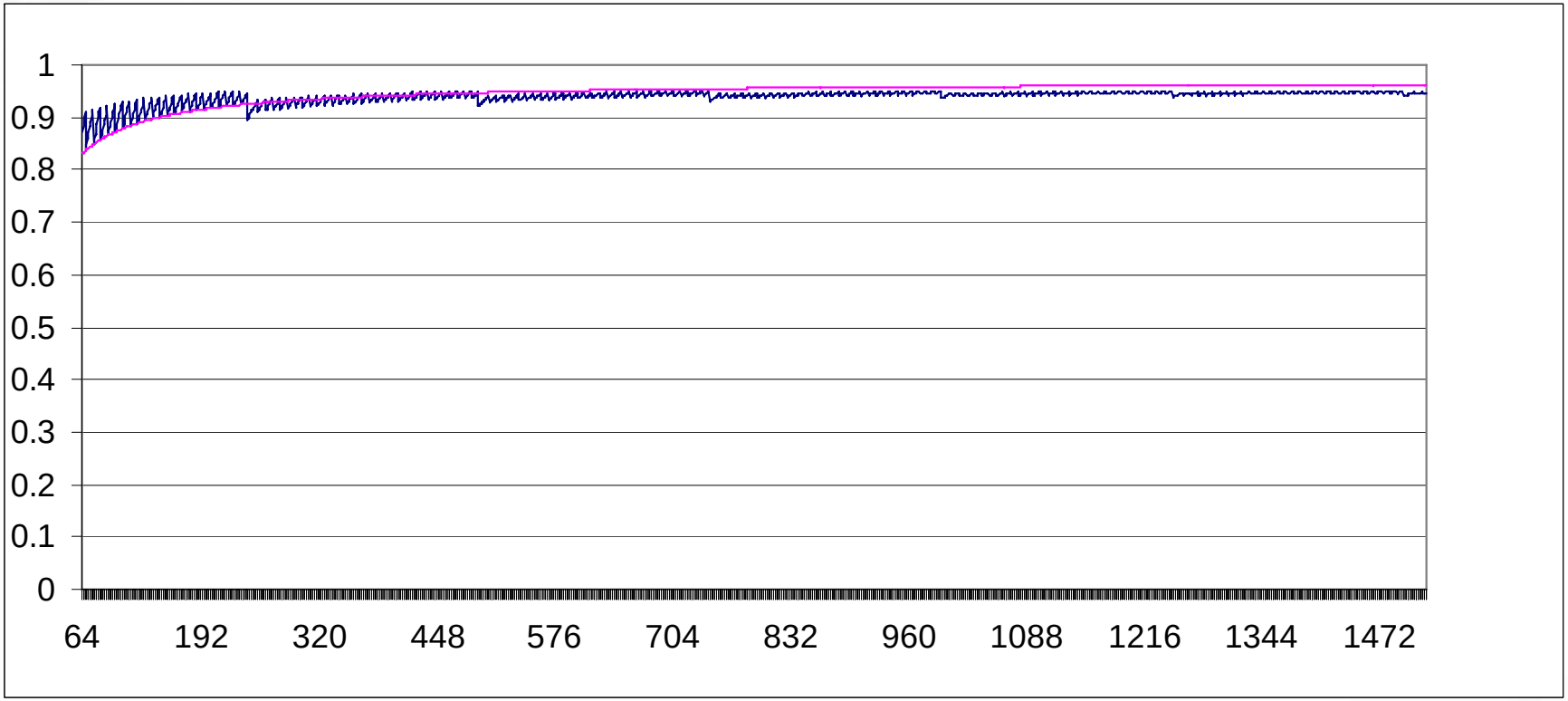
APL Fragment Format



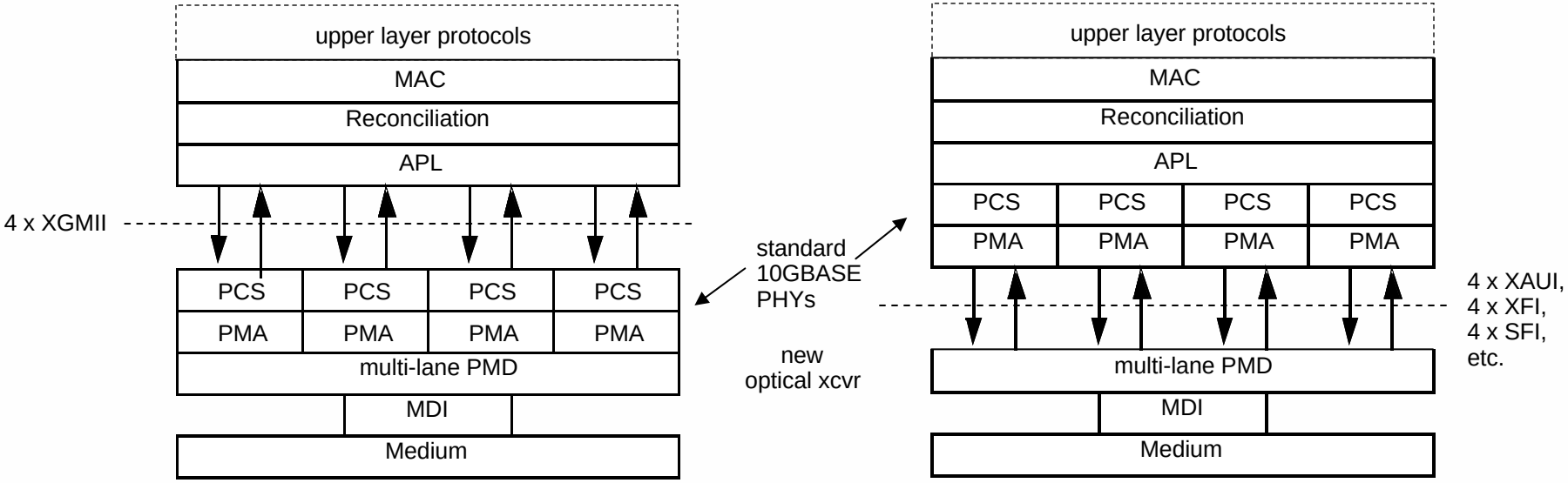
Decimation

- The bulk of a packet is always decimated into the largest size (256 octet) fragments
- The tail of a packet is decimated into a single fragment with a maximum size of 256 octets, a minimum size of 16 octets, that is a multiple of 8 octets in length

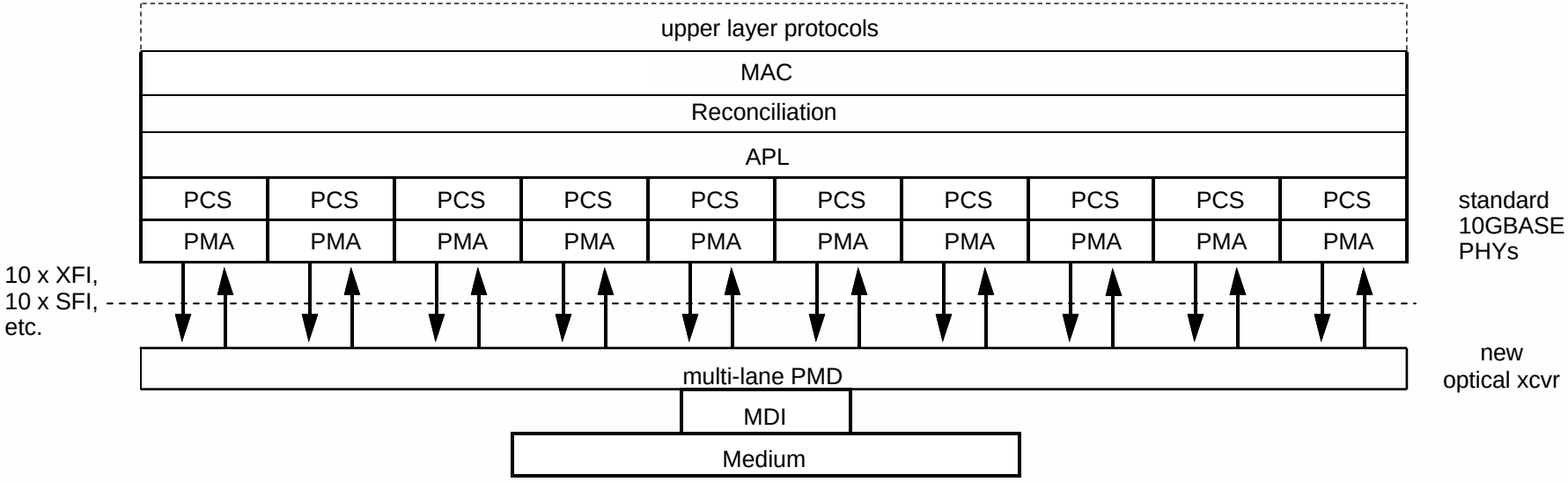
APL Transport Efficiency



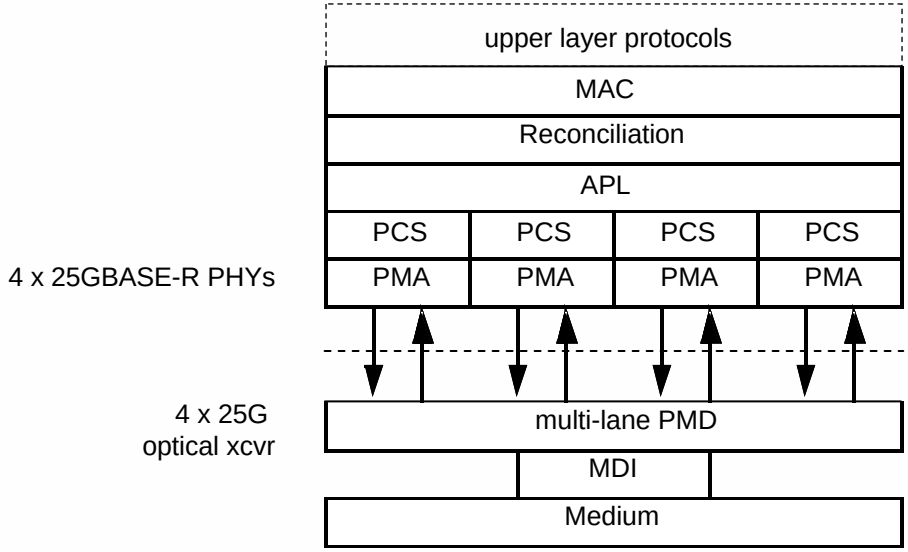
Using APL to achieve 40 G



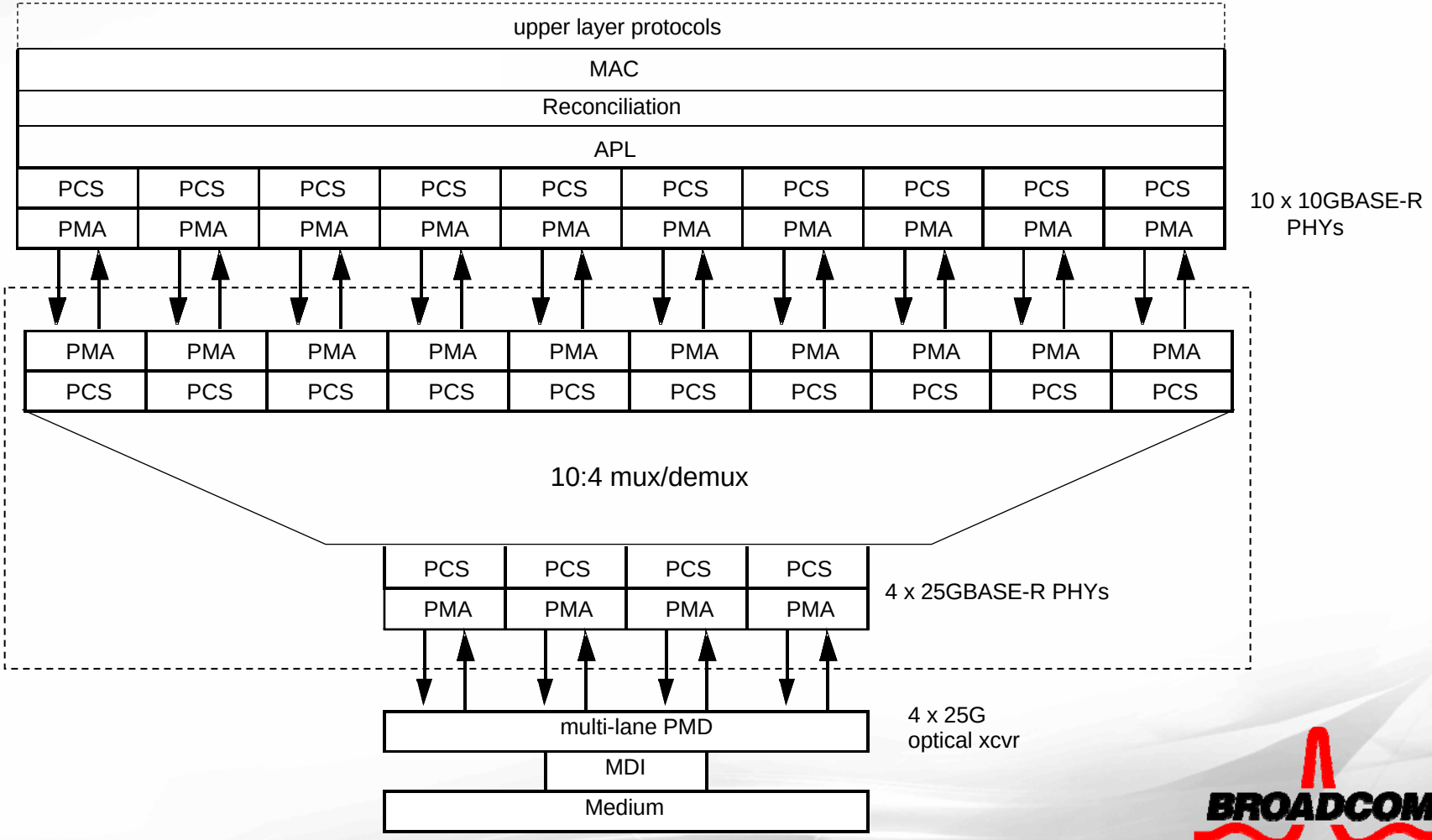
Using APL to achieve 100 G (10 x 10)



Using APL to achieve 100 G (4 x 25)



10 x 10 into 4 x 25



APL Summary

- Efficient bonding mechanism that supports 40 G and 100 G aggregation of lower speed PHYs
- Compatible with all existing 10 G PHYs and sublayer interfaces
- Future proof mechanism that can be used with any future physical layer (e.g. 4 x 100 G, 10 x 100 G)

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