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The Missing Link for P2P Fiber Access

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Others.....

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IEEE 802.3ah risks defining inadequate standards for P2P fiber access!

Why?

Because IEEE 802.3ah does not really consider the way public Ethernet access networks are being built today

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Market Potential: EFM is happening now!

- Ethernet access networks are being built today
  - Where?
    - In Europe: Iceland, Norway, Sweden, Finland, Netherlands, Austria and Italy
    - New Zealand and China among interesting new markets
  - Mainly new entrant operators, but several incumbents too
- Today's Ethernet access networks
  - Everything is P2P switched, either Fiber or Cat5 Copper
  - Applying mostly IEEE standardized PHYs & PMDs
  - A whole new public access infrastructure, **separate** from PSTN
  - Commonly a dense network structure (short reach standards)

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EFM P2P Fiber: Current Market Projections

- Marketplace maturing as we speak (pilots go ~5 years back)
- Expect up to 250,000 lines installed by Q4 2002
- 1M lines world-wide in 2-3 years (maybe even before IEEE 802.3ah is approved standard)

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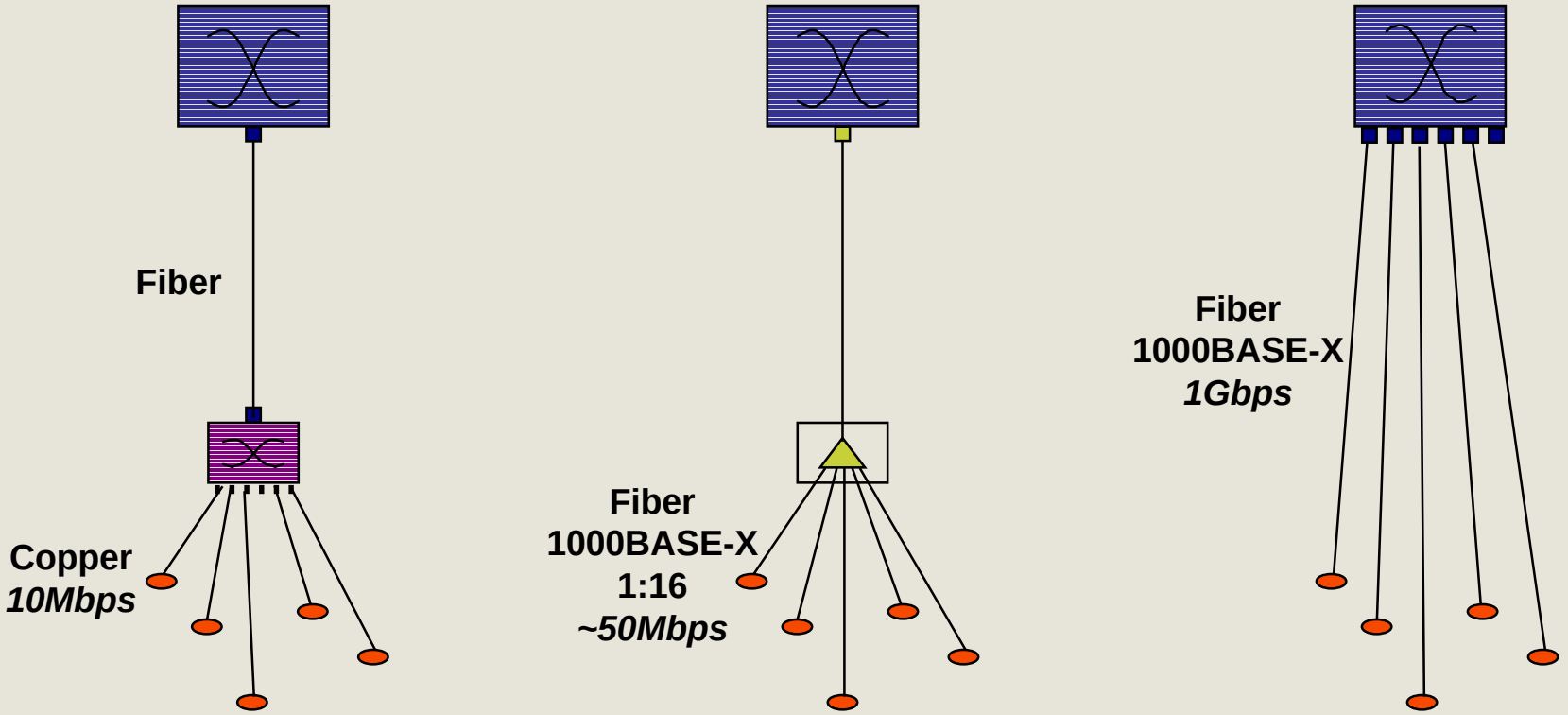
Three Solutions Identified by IEEE 802.3ah



P2P Cu PON, P2MP P2P Fiber

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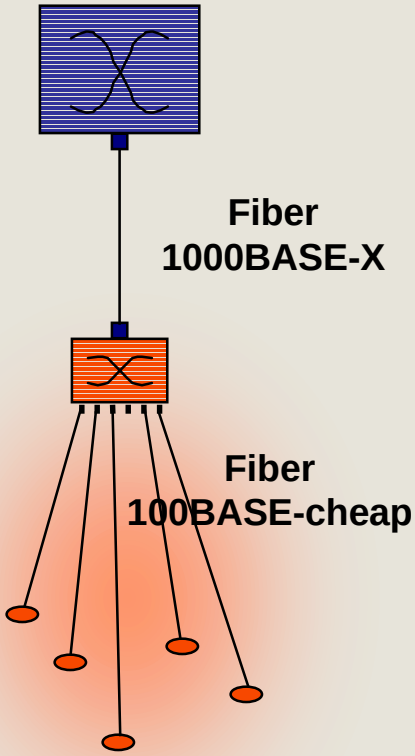
The Missed EFM Link

- The most straightforward solution not covered by EFM objectives:

The fiber drop based on low-cost P2P optical components



P2P Fiber Drop

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Justification of the P2P Fiber Drop

- This is how many Ethernet access networks already are and will be deployed
- Low-cost solution
  - Possible to relax PMD requirements
  - May make use of already commercially available equipment
  - Simple technology, high yield in manufacturing
  - Basically the same as standard LAN optics

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P2P ≠ P2MP

- Currently the P2P solution is very much associated with PON P2MP
- This does not take full advantage of the inherently simple network design of a P2P solution
- No need to incorporate the PON complexity in a P2P PMD
  - No burst mode requirements
  - Much more relaxed power budget
  - Less need for tight wavelength spec
  - More issues on detail level

- ***P2P fiber must be treated separately from PON P2MP!***

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What P2P PMD Specs Should We Look For?

- Low-cost initial build, possible upgrade paths
  - Keep extended temperature as an option (adds 30 - 40% on transceiver price)
  - Reach of 10km more than enough for ‘first mile’
  - Dual fiber vs. single fiber: Issues are cost, cost, cost, availability of components, wavelength plans, logistics, and ease of maintenance
- Minimize EFM efforts; incorporate suitable existing PMD
  - FDDI 100Mbps SMF is primary candidate
  - SONET OC-3 possible second candidate
  - In any case, look for cost saving relaxation of specs!

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100Mbps vs. 1Gbps

- Millions of subscriber lines expected within a few years
  - Gigabit throughput => Expensive access network => Must have revenues to cover -- *Where is the traffic?*
  - Fast Ethernet will be sufficient for a decade or more; build this by default to households, SOHO & SME
- Merits of currently proposed 1000BASE-X
  - EFM subscribers' aggregation
    - For P2P Copper, upstream from EDSLAM switch
    - For P2P Fiber in dense areas and/or long distances
  - High-end Enterprise EFM

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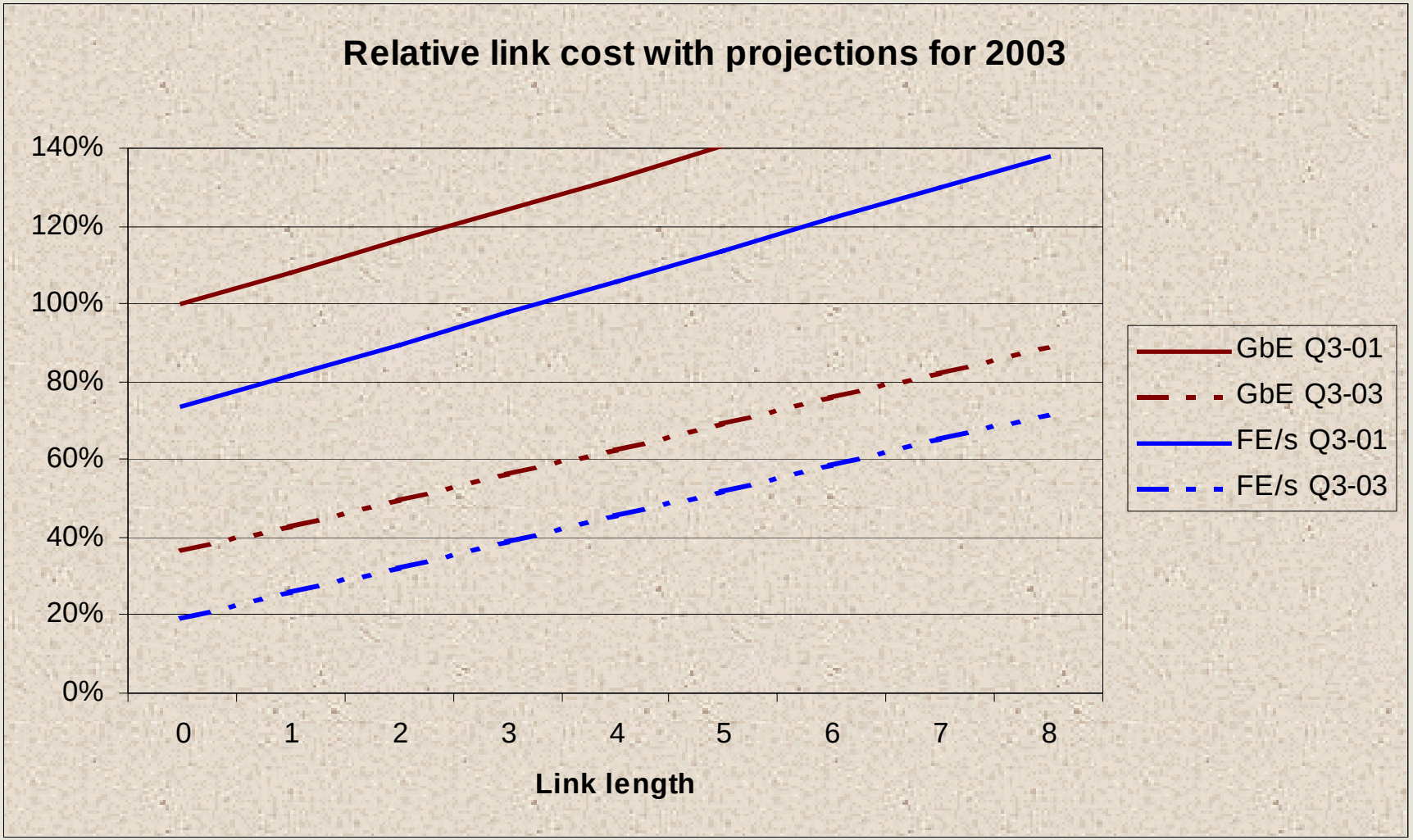
Current EFM GbE Single Fiber vs. FE Single Fiber



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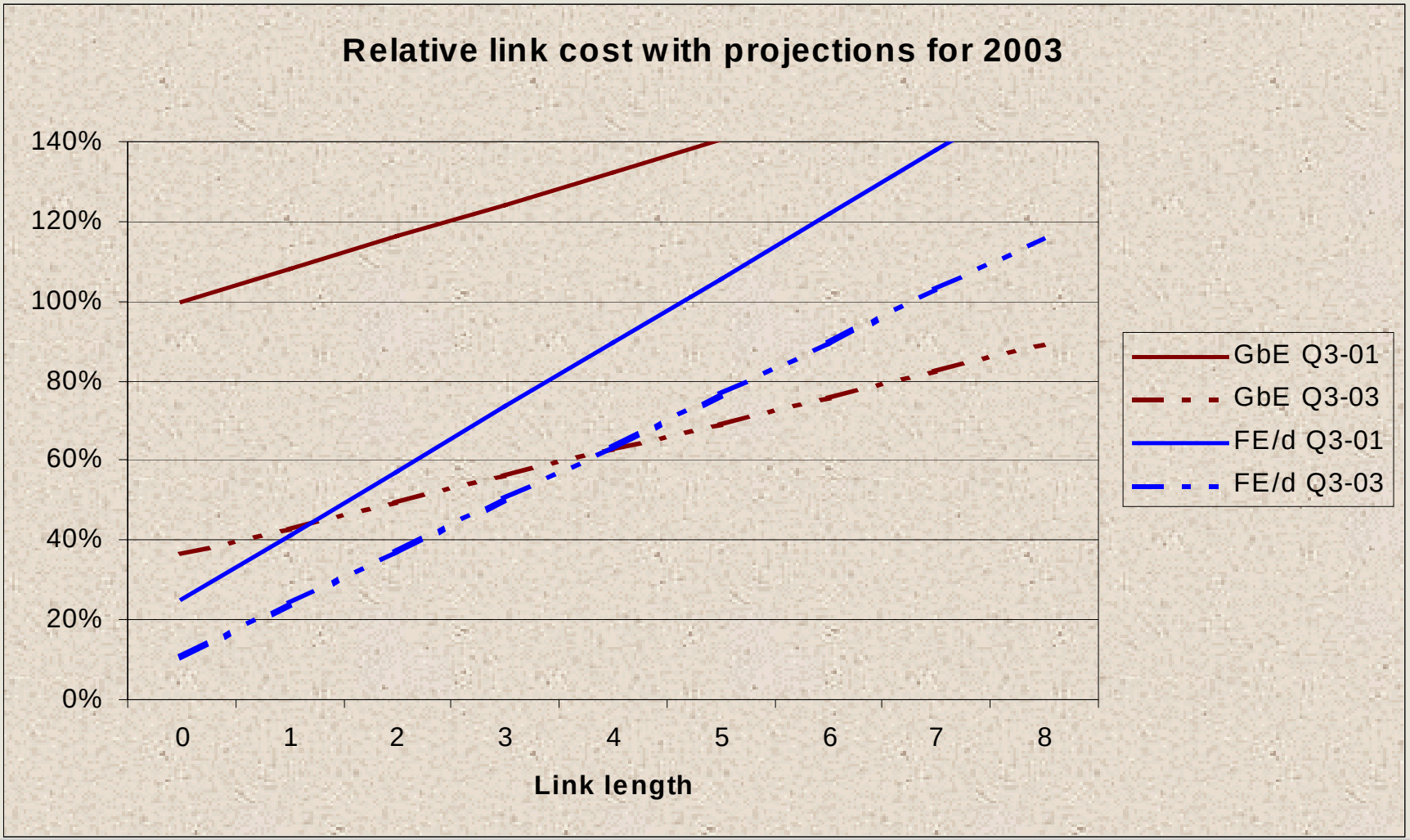
Current EFM GbE Single Fiber vs. FE Dual Fiber



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Dual Fiber Considerations

- Majority of all lines are within a couple of miles
- At short distances:

  Cost of extra fiber << Cost of WDM equipment

- Fiber cost is small compared to complete installation cost
  - Civil works is dominant cost in most real deployments
  - Operators are likely to bury/hang several fibers anyway

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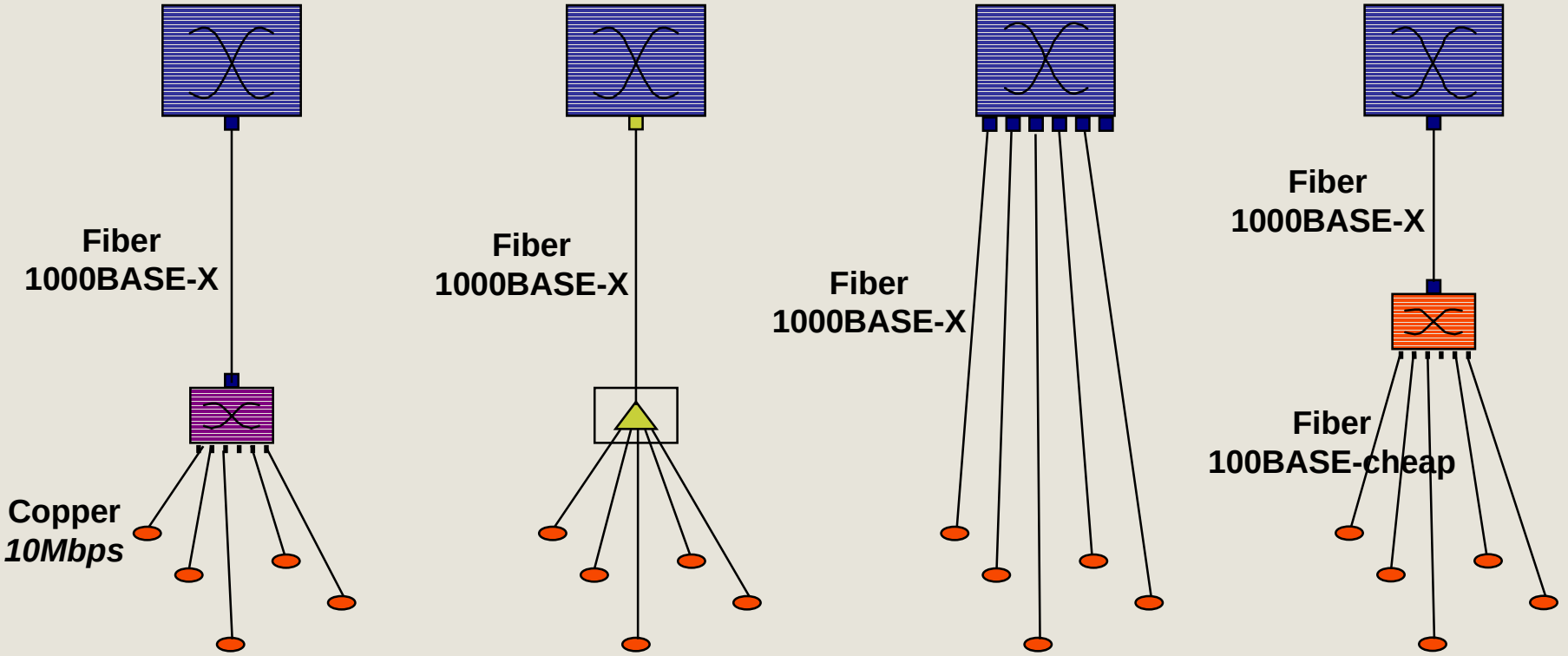
EFM Objectives: A more adequate view



P2P Cu | PON, P2MP | P2P Fiber | P2P Fiber Drop

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Conclusion

- One of the main EFM applications is missing:
  The fiber drop based on low-cost optical components
- Currently proposed EFM optical PMD inadequate for P2P fiber
- P2P fiber must be treated separately from PON P2MP
- 100Mbps sufficient to the CPE
- 1Gbps for aggregate traffic
- Consider the use of dual fiber on the subscriber lines