PHY Baseline proposal for EFM copper

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What is the purpose of EFM Copper?

- From the PAR:
  - 10. Purpose of Proposed Project
  - **To expand the application of Ethernet to include subscriber access networks in order to provide a significant increase in performance while minimizing equipment, operation, and maintenance costs**
- PHY must be accepted for use in public networks
  - Meet PSTN and government regulations
  - Approved by international standards
  - Spectrally compatible
- PHY should provide significant performance increase

Single PHY for all objectives?

- There are 3 rate/reach objectives
  - There is no single DSL that meets all 3 objectives (shown in previous presentations)
- 802.3ah can create a glue layer above standard DSLs (like SHDSL, ADSL, VDSL)
  - This meets all the reach/rate objectives
  - Allows the market to decide the best technology for the particular deployment
  - Does not preclude any deployment scenario, thus supporting broad market potential
- Can we do this? Will a generic glue layer be accepted as an 802.3 standard?

What if we must choose one PHY?

- If we must choose a single DSL PMD
  - Define Ethernet glue function so as to be re-useable for other xDSL, both current and future
  - We meet PAR requirement of creating broad market potential
  - The PHY meets international spectrum management standards

PAR 1 Requirements

- Broad Market Potential
  - a) Broad sets of applicability
  - b) Multiple vendors and numerous users
  - c) Balanced costs (LAN versus attached stations)
- VDSL
  - Existing EoVDSL exists in several markets
  - Applicability for MxU and Local Loops
  - Multiple vendors and numerous users
  - Balanced costs (competitive vs HW and installation of others)

PAR 2 Requirements

- Compatibility
  - a) Conformance with 802 overview and architecture
  - b) Conformance with 802.1D, 802. 1Q, 802.1f
  - c) Compatible managed object definitions
- VDSL
  - Definitions to be done
  - Lower layers are complete

PAR 3 Requirements

- Distinct Identity
  - a) Substantially different from other IEEE 802 standards
  - b) One unique solution per problem (no two solutions to a problem)
  - c) Easy for the document reader to select the relevant specification

There is no existing 802 standard or approved project appropriate for wireline access using the Ethernet access protocol and frame format, with the exception of certain combinations of operating speed and media defined in various supplements to IEEE Std 802.3. This project will expand that set to include new media.

While the proposed project includes a choice of physical media and operating speeds, it will specify only one solution for each media at a given operating speed range.

The proposed project will be formatted as a supplement to IEEE Std 802. 3, making it easy for the document reader to select the EFM specification.

Distinct Identity

- VDSL
  - EoVDSL varies from 10BaseT and 100BaseT
    - Longer reach, telephony cable
  - Single solution to the problem?
    - Meets rate/reach for short to medium range
    - Still requires long range capability
  - Easy to document
  - Single solution for Copper media for a given operating speed range

PAR 4 Requirements

- Technical Feasibility
  - a) Demonstrated system feasibility
  - b) Proven technology, reasonable testing
  - c) Confidence in reliability

Ethernet systems (comprising interface controllers, bridges, routers, management systems, and other devices) represent the most widely deployed networking technology in history. The proposed project will build on the vast array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation.

The proposed project will, to the extent possible, re-use specifications developed by other standards bodies and develop new specifications in accordance with the rigorous standards of proof applied to 802.3 projects.

The reliability of Ethernet components and systems can be extrapolated in the target environments with a high degree of confidence.

Technical Feasibility

- VDSL
  - With existing installations:
    - Demonstrated feasibility
    - Proven technology with reasonable testing
  - Reliability confidence is quite high with number of installations providing extensive statistics
  - Reuse of ITU and ANSI VDSL standards for the PMD with Ethernet upper layers

PAR 5 Requirements

- Economic Feasibility
  - a) Known cost factors, reliable data
  - b) Reasonable cost for performance
  - c) Consideration of installation costs

The cost factors for Ethernet components and systems are well known. The proposed project may introduce new cost factors which can be quantified.

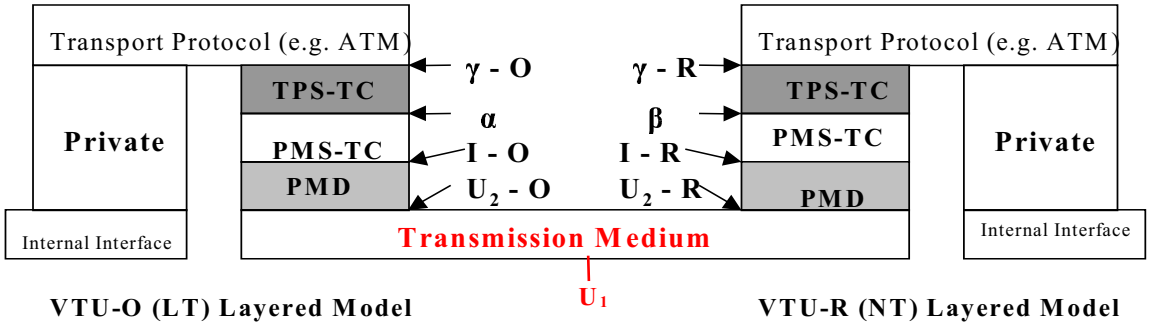
Ethernet consistently demonstrates the most attractive cost/ performance ratio of any networking technology, at any operating speed. This fact is well established in the enterprise networking application space, and the goal of this project is to extend the same cost/ performance advantage to the access application space.

Installation costs, as well as maintenance and operations costs, should be reduced when compared to competing technologies through a combination of higher manufacturing volume, broader competition, a broader labor pool, simpler configurations and a more optimal system architecture.

Cost Factors

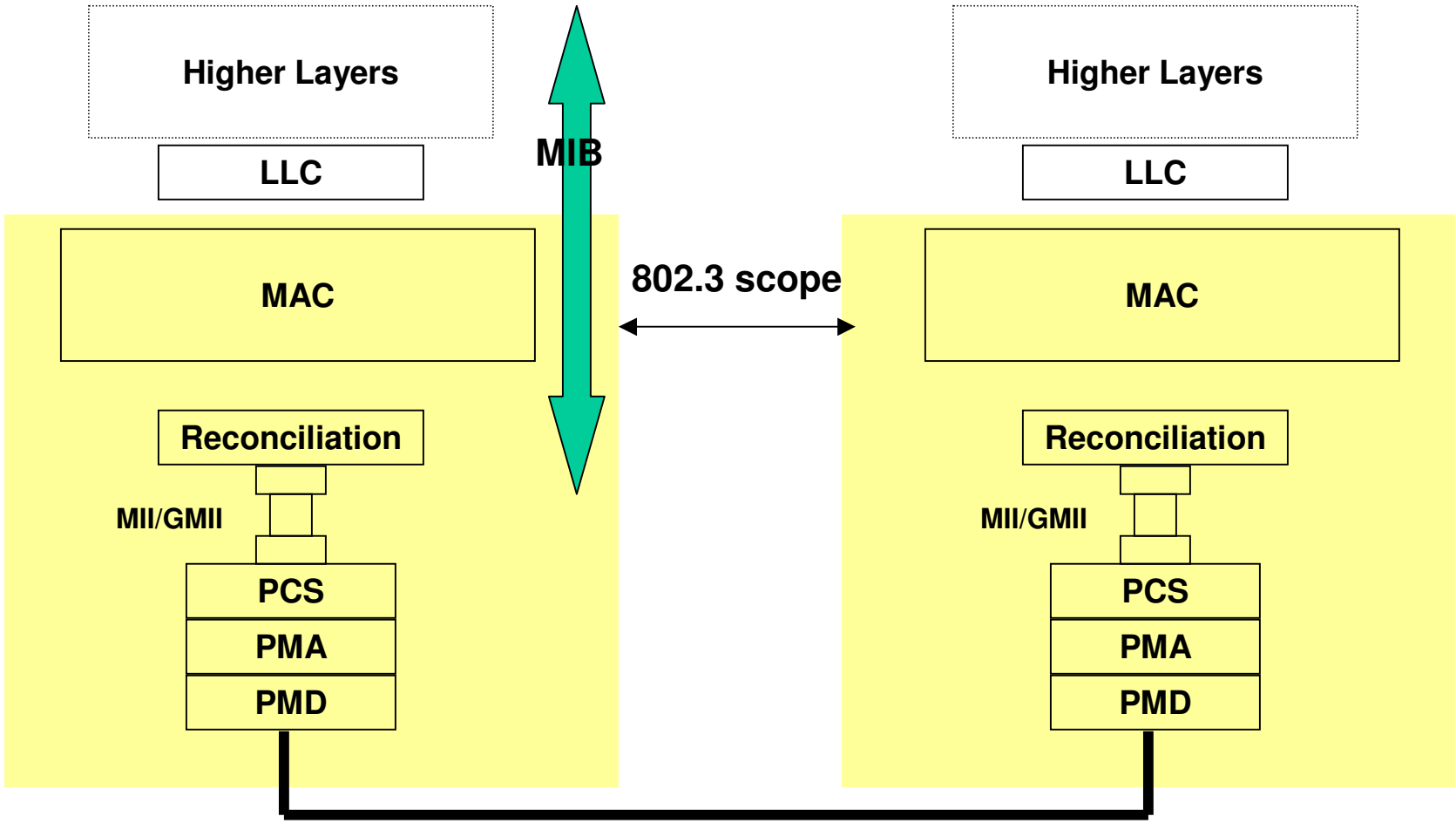
- VDSL
  - Cost factors for EoVDSL are known
  - Reasonable cost for performance
    - Based on market data from existing
  - Consideration of installation costs
    - Reduced installation costs with reuse of telephony infrastructure
  - EoVDSL already in use in access applications as cost effective service versus other DSLs

PHY Layers defined in the VDSL standard

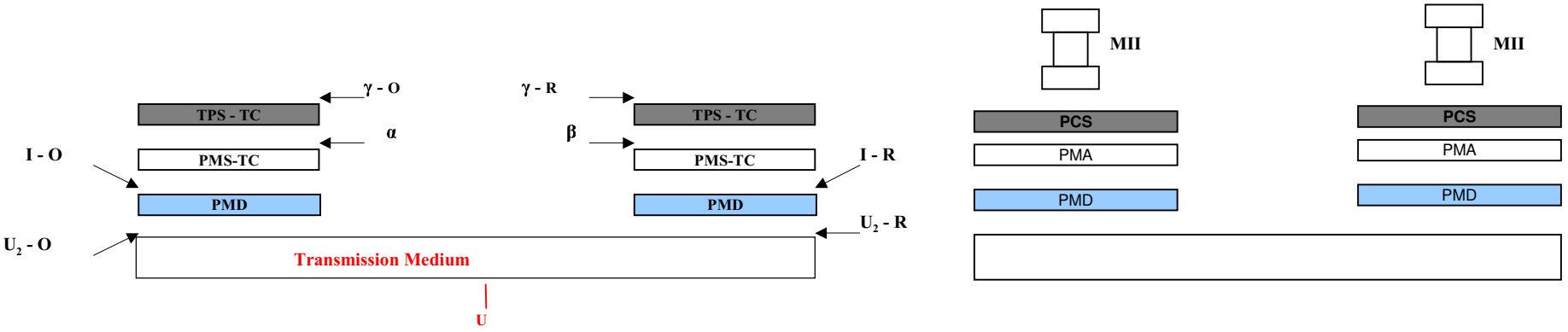


- The PMD performs line coding and modulation functions
- The PMS-TC performs VDSL specific framing functions
- The TPS-TC performs transport protocol specific functions
- The U, I and α/β interfaces are common to all transport protocols and modulations
- γ-interface is transport protocol specific
  - Defined in G.993.1 for Packet Transport Mode (PTM)

Layers in 802.3 standards



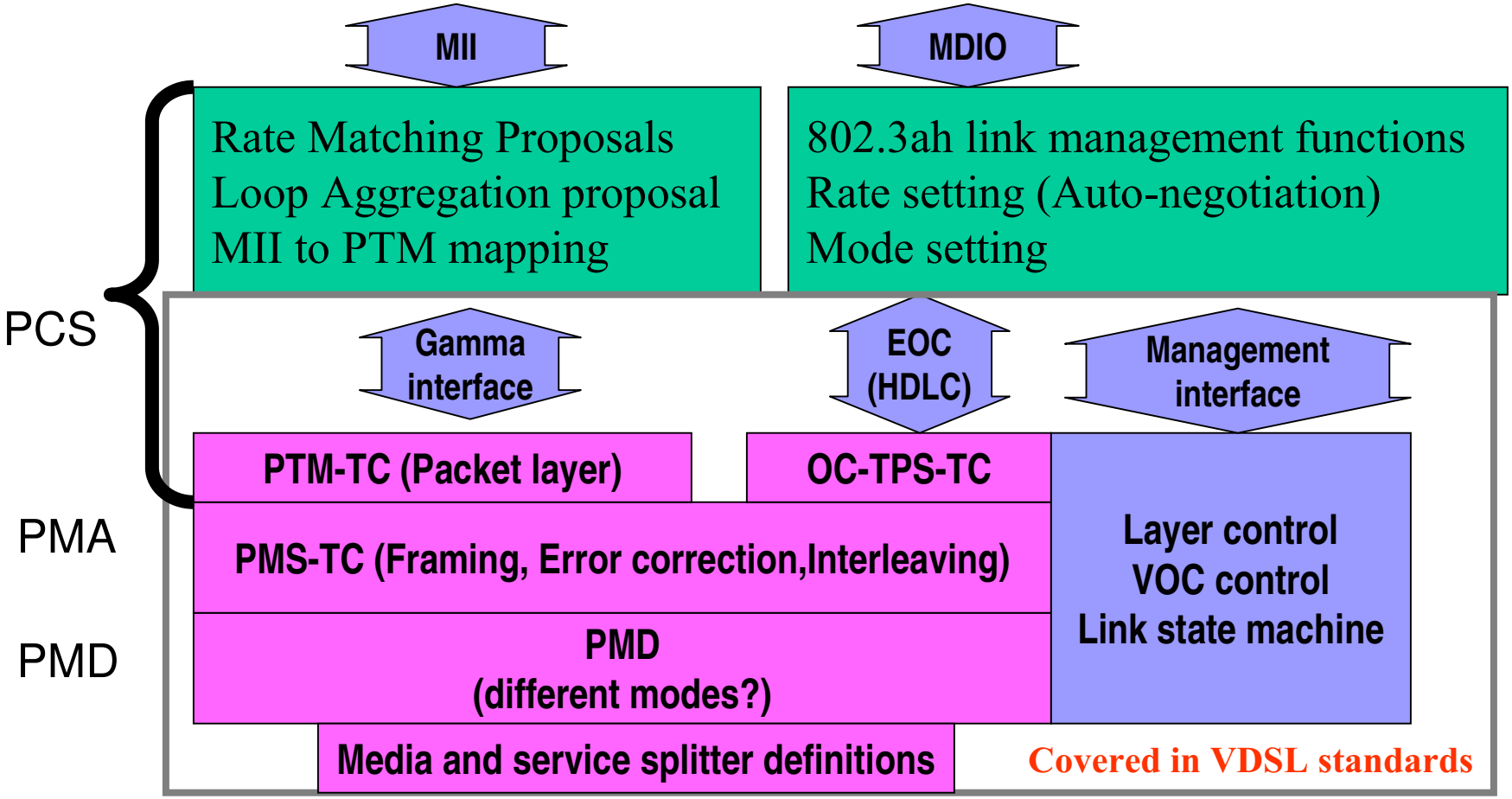
Mapping layers: VDSL <-> 802.3



- The PMD maps straight across – using I and U interfaces
- The PMS-TC maps to PMA – uses I and α/β interfaces
- The TPS-TC maps to PCS – uses α/β and MII interfaces
- The γ interface may be preserved within PCS

- Note: These layers can be mapped to any standard DSL

VDSL as a superset of EFM needs



Proposed motion

- The EFM baseline proposal will define a set of upper layer functions that will operate over standardized xDSL.