

# Five Criteria

Extended EPON Study Group

# Distinct Identity

- » Substantially different from other IEEE 802 standards
  - » One unique solution per problem (not two solutions to a problem)
  - » Easy for the document reader to select the relevant specification
  - » Substantially different from other IEEE 802.3 specifications/solutions.
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- » There is no existing 802 standard or approved project appropriate for operation at up to 10 Gb/s over point-to-multipoint fiber-optic cabling topologies, in symmetric (1/1G, 10/10G) and asymmetric (10/1G) configurations, with power budgets in excess of power classes defined in Clause 60 for 1G-EPON and Clause 75 for 10G-EPON.
  - » The proposed project is an extension to the existing 1G-EPON and 10G-EPON PMD specifications included in IEEE Std 802.3-2008 and IEEE Std 802.3av. For each loss budget and EPON rate, the solution may include only one of the following:
    - > (1) one PMD sublayer specification, or
    - > (2) a method to extend the power budget (i.e., PBEx)

These PMDs or PBEx devices will be designed for operation in symmetric (1/1G, 10/10G) and asymmetric (10/1G) configurations over point-to-multipoint fiber-optic cabling topologies.

- » The proposed amendment to IEEE Std 802.3 will be formatted as a set of new clauses and changes to existing clauses, making it easy for the document reader to select the relevant specification.

# Motion #4

Approve the Distinct Identity criterion, as recorded in ExEPON\_1111\_5Crit\_final.pdf, slide 2.

- » Moved by: Ed Mallette
- » Seconded by: Hesham ElBakoury
  
- » Technical motion,  $\geq 75\%$
- » People in the room: 19
- » Y: 13 N: 0 A: 0
- » Motion passes

# Compatibility

IEEE 802 defines a family of standards. All standards should be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: IEEE 802. Overview and Architecture, IEEE 802.1D, IEEE 802.1Q, and parts of IEEE 802.1F. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1.

Each standard in the IEEE 802 family of standards shall include a definition of managed objects that are compatible with systems management standards.

- a) [Compatibility with IEEE Std 802.3](#)
  - b) [Conformance with the IEEE Std 802.3 MAC](#)
  - c) [Managed object definitions compatible with SNMP](#)
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- » As an amendment to IEEE Std 802.3-2008, as amended by IEEE Std 802.3av-2009, the proposed project will remain in conformance with the IEEE 802 Overview and Architecture, as well as the bridging standards IEEE Std 802.1D and IEEE Std 802.1Q. Moreover, the proposed project will build on 1G-EPON and 10G-EPON architecture, adding support for new loss budget classes.
  - » The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC, as defined in Annex 4A, following the existing 1G-EPON and 10G-EPON specifications, utilizing the same MAC, PCS, and PMA. If specified, the power budget extender (PBEx) will conform to the 802 model of Ethernet devices.
  - » The project will include a protocol independent specification of managed objects with SNMP management capability, provided by IEEE Std 802.3.1-2011.

# Motion #5

Approve the Compatibility criterion, as recorded in ExEPON\_1111\_5Crit\_final.pdf, slide 4.

- » Moved by: Duane Remein
- » Seconded by: Ed Mallette
  
- » Technical motion,  $\geq 75\%$
- » People in the room: 20
- » Y: 13 N: 0 A: 0
- » Motion passes

# Technical Feasibility

- » Demonstrated system feasibility
  - » Proven technology, reasonable testing
  - » Confidence in reliability
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- » Contributions were reviewed, illustrating the technical feasibility of extended power classes for EPON, providing loss budgets in excess of those specified for EPON in IEEE Std 802.3-2008 and IEEE Std 802.3av-2009.
  - » This project builds on proven EPON technology operating in a symmetric (1/1G, 10/10G) or asymmetric (10/1G) modes. Additional methods exist, including active EPON link extension, to increase PON reach and split ratios beyond values specified in IEEE Std 802.3. The technology under consideration is similar to deployed EPON systems and is expected to exhibit similar reliability. Testing of the proposed physical layers for EPON remains identical to existing EPON physical layers and, based on experience gained from existing products, is expected to be straightforward.
  - » Various contributions from component and system vendors demonstrate that the proposed technologies are mature. Reliability data exists which provides a high level of confidence in the reliability of EPON systems.

# Motion #6

Approve the Technical Feasibility criterion, as recorded in ExEPON\_1111\_5Crit\_final.pdf, slide 6.

- » Moved by: Alan Brown
- » Seconded by: Kevin Noll
  
- » Technical motion,  $\geq 75\%$
- » People in the room: 21
- » Y: 17 N: 0 A: 0
- » Motion passes

# Broad Market Potential

- » Broad set of applications
- » Multiple vendors, multiple users
- » Balanced cost, LAN vs. attached stations
  
- » In excess of *1.2 Million*<sup>1</sup> super-compliant EPON ports (~29 dBm ChIL optics) have been shipped from multiple system vendors to multiple operators worldwide. These systems provide split ratios and reach beyond what is specified in 802.3 Clause 60. It is anticipated that suppliers will enhance their offerings to include the new standard PMD classes.
- » Extended EPON is specifically attractive for networking environments supporting bandwidth-intensive applications that require fast, reliable, scalable, first-mile connections at distance and split ratios not supported by existing EPON PMDs (802.3 Clause 60 and Clause 75). Specific transport applications for ExEPON include:
  - > Fiber constrained first mile deployments requiring higher split ratios than currently supported by EPON at 20 km distance.
  - > Rural area deployments requiring high split ratios at distances greater than currently supported by EPON.
  - > Coexistence of 1G-EPON, 10G-EPON, and RFoG on the same ODN with higher split ratios than currently supported by EPON at 20km.
  - > Collapsed Central Office deployments that increase the distance between the OLT and nearest split, and thus requiring high split ratios at distances greater than supported by EPON.
- » In a response to the Call For Interest during the July 2011 IEEE 802 LMSC plenary meeting in San Francisco, CA, USA, attendees voted 41 to 0 with 34 abstaining to form an Extended EPON Study Group. Among those represented were **12** companies including optical component manufacturers, equipment vendors, and service providers and **16** individuals who expressed interest in participating in the activities of Extended EPON Study Group and consequent Task Force.
- » Millions of additional subscribers could be cost-effectively reached by EPON with higher split ratios and longer reach.
- » In the case where suppliers are already producing super-compliant optics, the cost of those optics (e.g. “PX20+”, “PX20-E” PMDs) is comparable to PX20 PMDs, and the expected cost of standardized interfaces will be similar, given the market value and manufacturing capabilities.
- » Following the 802.3 PHY layer design methodology and open standard development process, it can be asserted that the new PHY interfaces will result in a similar cost balance as existing EPON standard PMDs.



# Motion #7

Approve the Market criterion, as recorded in ExEPON\_1111\_5Crit\_final.pdf, slide 8.

- » Moved by: Alan Brown
- » Seconded by: Ed Mallette
  
- » Technical motion,  $\geq 75\%$
- » People in the room: 20
- » Y: 17 N: 0 A: 1
- » Motion passes

# Economic Feasibility

- » Known cost factors, reliable data
  - » Reasonable cost for performance
  - » Consideration of installation costs
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- » EPON is a cost-effective solution at speeds up to 10 Gb/s and have been commercially deployed en mass. The cost factors for the components and systems are well known, and there is a broad and healthy industry ecosystem associated with these technologies.
  - » EPON with higher split ratio and / or longer reach will allow a lower cost per subscriber, further enhancing the economic benefits of EPON systems. Point-to-multipoint topology is optimal for access networks, and this new standard will provide further opportunities for consolidation of subscriber traffic, head-end equipment and central offices.
  - » The resulting PHYs will use proven, well-known point-to-multipoint single-mode fiber architecture, maintaining backward compatibility with existing EPON deployments, with similar installation costs.
  - » Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.

# Motion #8

Approve the Economic Feasibility criterion, as recorded in ExEPON\_1111\_5Crit\_final.pdf, slide 10.

- » Moved by: Ed Mallette
- » Seconded by: Valy Ossman
  
- » Technical motion,  $\geq 75\%$
- » People in the room: 20
- » Y: 14 N: 1 A: 1
- » Motion passes