

802.3 Closing Plenary Report

Extended EPON Study Group

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Email reflector and web

- » Currently 90 subscribers on Extended EPON SG reflector
- » To subscribe to Extended EPON SG reflector, send email to: listserv@ieee.org and include this line in the body of the message:
subscribe stds-802-3-EXTND-EPON firstname lastname
- » Detailed information is available at:
[http://www.ieee802.org/3/EXTND EPON/reflector.html](http://www.ieee802.org/3/EXTND_EPON/reflector.html)
- » Study Group web page URL:
[http://www.ieee802.org/3/EXTND EPON/index.html](http://www.ieee802.org/3/EXTND_EPON/index.html)

This week's progress

- » Held meetings on Tuesday morning, Wednesday, and Thursday morning (2 days in total).
- » Attendance around ~23 on average, in lines with numbers polled at the CFI back in July.
- » Examined 6 technical contributions addressing AIs taken out of September interim and additional contributions related with 5 Critters, Project Objectives and overview of the Project PAR form responses.
- » Approved 5 Critters (individually), PAR and Objectives
- » SG authorized the Chair to extend the ExEPON Study Group to allow us to meet in January

Project documentation

» All posted documents with motions to approve:

> Project Objectives

+ http://www.ieee802.org/3/EXTND_EPON/public/1111/ExEPON_1111_objectives_final.pdf

> Project PAR

+ http://www.ieee802.org/3/EXTND_EPON/public/1111/ExEPON_1111_PAR_final.pdf

> 5 Critters

+ http://www.ieee802.org/3/EXTND_EPON/public/1111/ExEPON_1111_5Crit_final.pdf

> Closing Motions for this meeting

+ http://www.ieee802.org/3/EXTND_EPON/public/1111/ExEPON_1111_closing_motions.pdf

Project Objectives

- » Support subscriber access networks using point-to-multipoint topologies on SM optical fiber
- » EPON PHY(s) to have a BER better than or equal to 10^{-12} at the MAC/PLS service interface
- » Provide physical layer specifications:
 - > for 1G-EPON supporting a downstream channel insertion loss of 29dB, compatible with PR(X)30 upstream channel insertion loss;
 - > for 1G-EPON supporting a split ratio of at least 1:64 at a distance of at least 20 km;
 - > for 10G-EPON, supporting a split ratio of at least 1:64 at a distance of at least 20 km;
- » Changes to be confined to the PMD layer; PCS and MPCP are to be reused as is.
- » Maintain coexistence among 1G-EPON and 10G-EPON (i.e. support the same loss budget classes for 1G-EPON and 10G-EPON).

Approved in SG - Y: 16 N: 1 A: 3

Motion 1

Move that 802.3 Working Group approve the Extended EPON Study Group objectives, as per 1111_EXTEPON_close_report.pdf, page 5

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

Passed by voice vote without opposition.

PAR - Title

Standard for Information technology--Telecommunications and information exchange between systems--Local and metropolitan area networks--Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment: **Physical Layer Specifications and Management Parameters for Extended Ethernet Passive Optical Networks**

PAR - Scope

The scope of this project is to amend IEEE Std 802.3 to add at least one physical layer specification, possibly power budget extenders, and management parameters necessary for EPON to support loss budgets in excess of those specified in IEEE Std 802.3-2008 and IEEE Std 802.3av-2009.

PAR - Purpose

The purpose of this project is to extend the loss budgets supported by Ethernet Passive Optical Networks to support higher density and longer reach applications, while optimizing costs of ownership.

PAR – Need for the Project

The project is needed to enable broadband service providers to utilize Ethernet Passive Optical Networks (EPON) at longer reach, higher split ratios or both for more cost-effective scaling.

The project will allow for the expansion of the EPON service area and reduced cost per subscriber.

Additional benefits include reduction of the footprint and power consumption of central office equipment, as well as minimization of service upgrade and fiber deployment costs, while increasing customer density per central office and allowing central office consolidation

5 Critters – Broad Market Potential

- » Broad set of applications
- » Multiple vendors, multiple users
- » Balanced cost, LAN vs. attached stations

- » In excess of *1.2 Million*¹ 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 2

Move that 802.3 Working Group approve the Extended EPON Study Group Broad Market Potential Criterion, as per 1111_EXTEPON_close_report.pdf, page 11

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 52 N: 1 A: 9

Motion passed

5 Critters – 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](#)
-
- » As an amendment to IEEE Std 802.3 (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 3

Move that 802.3 Working Group approve the Extended EPON Study Group Compatibility Criterion, as per 1111_EXTEPON_close_report.pdf, page 13

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 51 N: 1 A: 4

Motion passed

5 Critters – 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.**
-
- » 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

Move that 802.3 Working Group approve the Extended EPON Study Group Distinct Identity Criterion, as per 1111_EXTEPON_close_report.pdf, page 15

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 55 N: 0 A: 5

Motion passed

5 Critters – Technical Feasibility

- » Demonstrated system feasibility
- » Proven technology, reasonable testing
- » Confidence in reliability

- » 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 5

Move that 802.3 Working Group approve the Extended EPON Study Group Technical Feasibility Criterion, as per 1111_EXTEPON_close_report.pdf, page 17

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 53 N: 0 A: 3

Motion passed

5 Critters – Economic Feasibility

- » Known cost factors, reliable data
 - » Reasonable cost for performance
 - » Consideration of installation costs
-
- » EPON is a cost-effective solution at speeds up to 10 Gb/s and has been commercially deployed in large numbers. 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 6

Move that 802.3 Working Group approve the Extended EPON Study Group Economic Feasibility Criterion, as per 1111_EXTEPON_close_report.pdf, page 19

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 50 N: 0 A: 7

Motion passed

Motion 7

Move that 802.3 Working Group approve the Extended EPON Study Group PAR, as recorded in EPON_1111_PAR_final.pdf

(posted online at

http://www.ieee802.org/3/EXTND_EPON/public/1111/ExEPON_1111_PAR_final.pdf)

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 52 N: 0 A: 2

Motion passed

Motion 8

Move that 802.3 Working Group submit the IEEE P802.3bk PAR and 5 Criteria to the 802 Executive Committee for consideration at the March 2012 Plenary Session.

Technical motion, $\geq 75\%$

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 54 N: 0 A: 1

Motion passed

Motion 9

Move that 802.3 Working Group request to the EC to extend the Extended EPON Study Group.

Procedural motion, > 50%

Moved by Marek Hajduczenia, on behalf of Study Group

802.3 voters: Y: 56 N: 0 A: 0

Motion passed

Thank You!