

# The 5 Criteria for EPoC



Broad  
Market  
Potential



Compatibility



Distinct  
Identity



Technical  
Feasibility



Economic  
Feasibility

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# Contributors and Supporters

## (alphabetical by first name)

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- Jack S. Burton, Cablevision
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- Joe Solomon, Comcast
- John Bevilacqua, Comcast
- John Dickinson, Bright House Networks
- Kevin Noll, Time Warner Cable
- Kirk Erichsen, Time Warner Cable
- Matt Schmitt, CableLabs
- Michel Allard, Cogeco Cable
- Mike Darling, Shaw Communications
- Saif Raman, Comcast
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# Broad Market Potential

- I. Broad sets of applicability
- II. Multiple vendors and numerous users
- III. Balanced costs (LAN versus attached stations)

# Broad Market Potential (I)

## **“Broad sets of applicability”**

- The proposed project would result in a new PHY with worldwide applicability to cable multiple system operators (MSOs) and other service providers operating point-to-multipoint access networks using mixed fiber-optic and coaxial cabling technologies.
- Service providers worldwide have deployed DOCSIS as a transport platform for a variety of IP-based offerings, supporting both residential and business applications in a broad range of deployment scenarios.
- Service providers have seen an unabated growth in both offered capacity and consumption of broadband IP services over the course of over 15 years for residential and recently business services
- Given the success of DOCSIS-based services, service providers are looking for cost-effective, high performance means to provide higher data capacity, addressing their growing CapEx and OpEx, market competition and future-proofing their existing coaxial plant, while expanding service portfolios for business and residential customers.

# Broad Market Potential (II)

## **“Multiple vendors and numerous users”**

- Interest and support from a broad array of operators, system vendors, optical and RF component manufacturers, and silicon suppliers has already been achieved for the CFI, including:
  - North American MSOs: their research arm CableLabs, and individually by BrightHouse, Cablevision, Cogeco, Comcast, Cox, Rogers, Shaw and Time Warner
  - Chinese MSOs via their research arm SARTF
  - System vendors: Alcatel-Lucent, Aurora Networks, Calix, Harmonic, Huawei, Motorola and ZTE
  - Optical component manufacturers: Finisar, Hisense-Ligent, Neophotonics, Sumitomo, Titan and Wuhan Yangtze Optical Technologies
  - Silicon suppliers: Broadcom, Entropic, Qualcomm/Atheros, and PMC-Sierra
- Additional participants joining the Study Group and even more expected to join the effort if the Task Force is approved.

# Broad Market Potential (III)

## **“Balanced costs (LAN versus attached stations)”**

- The proposed project will result in the reuse of existing EPON architecture and devices by extending their capabilities to support point-to-multipoint access networks using mixed fiber-optic and coaxial cabling technologies, through addition of new class of devices performing adaptation function between two types of media.
- This approach will allow to maintain the optimum cost balance between the network infrastructure components and attached stations in the EPoC network, while increasing flexibility and capability of such access network infrastructure.

# 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.

- I. Compatibility with IEEE Std 802.3
- II. Conformance with the IEEE Std 802.3 MAC
- III. Managed object definitions compatible with SNMP

# Compatibility (I)

## “Compatibility with IEEE Std 802.3”

- 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, extending coverage of EPON Multi Point Control Protocol (MPCP) to mixed outside plant, comprising optical fiber and coaxial cable.



# Compatibility (II)

## “Conformance with the IEEE Std 802.3 MAC”

- The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC, as defined in Annex 4A, following the selection of MAC type in the existing 1G-EPON and 10G-EPON specifications.
- The proposed amendment will conform to the 1 Gbit/s Media Independent Interface (GMII) and 10 Gbit/s Media Independent Interface (XGMII) specifications.
- EPoC will reuse the MAC, MAC Control, and OAM as defined in IEEE Std 802.3-2008 for 1G-EPON and IEEE Std 802.3av for 10G-EPON with necessary backward compatible extensions, while developing new specifications for PCS, PMA and PMD layers.

# Compatibility (III)

## “Managed object definitions compatible with SNMP”

- The project will include a protocol independent specification of managed objects with SNMP management capability, provided by IEEE Std 802.3.1-2011.

# Distinct Identity

- I. Substantially different from other IEEE 802 standards
- II. One unique solution per problem (not two solutions to a problem)
- III. Easy for the document reader to select the relevant specification
- IV. Substantially different from other IEEE 802.3 specifications/solutions.

# Distinct Identity (I & IV)

**“Substantially different from other IEEE 802 standards”**

**“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 mixed outside plant comprising fiber-optic cabling and coaxial cabling topologies, in symmetric and asymmetric configurations.

# Distinct Identity (II)

**“One unique solution per problem  
(not two solutions to a problem)”**

- The proposed project is an evolutionary extension of the coverage of EPON Multi Point Control Protocol (MPCP) and MAC, specified for 1G-EPON and 10G-EPON in IEEE Std 802.3 - 2008 and IEEE Std 802.3av, respectively, into mixed outside plant comprising fiber-optic and coaxial cabling technologies.
- The solution may include at most one Physical Media Dependent sublayer specification for each medium type.
- New PHY will be designed for operation at the data rate of up to 10 Gbit/s in symmetric and asymmetric configurations over mixed outside plant comprising fiber-optic cabling and coaxial cabling topologies

# Distinct Identity (III)

**“Easy for the document reader to  
select the relevant specification”**

- The proposed amendment to the existing 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.

# Technical Feasibility

- I. Demonstrated System Feasibility
- II. Proven Technology
- III. Confidence in reliability

# Technical Feasibility (I)

## **“Demonstrated System Feasibility”**

### **“Proven Technology”**

- Widely deployed QAM-based data transport technology in the form of DOCSIS & Digital Video services demonstrates the capacity of coaxial networks to support multi-gigabit/second data rates over existing infrastructure when sufficient spectrum is allocated.
- Full Band Capture Technology, as demonstrated to the Study Group, is being mass-deployed in low cost Cable Modems and Cable Set-top Boxes and supports wide-range tuning to multiple carrier channels to further support channel bonding for multi-gigabit/second data rates.
- Channel bonding technique can provide necessary granularity and flexibility of bandwidth assignment in upstream and downstream.



# Technical Feasibility (II)

## **“Confidence in reliability”**

- Millions of successfully deployed and operating 1G-EPON & 10G-EPON devices clearly demonstrate the reliability factor of MAC and PHY layers standardized by 802.3.
- Millions of Cable Modems deployed and operating demonstrate the reliability of high speed data over access cable plants.

# Economic Feasibility

- I. Known cost factors, reliable data
- II. Reasonable cost for performance
- III. Consideration of installation costs

# Economic Feasibility (I)

## **“Known cost factors, reliable data”**

- The cost factors for EPON components and systems are well known and there is a broad and healthy industry ecosystem associated with these technologies.
- EPoC components should include the same OLT used in EPON, and CNU's developed for RF networks which should have comparable cost structure and similar healthy ecosystem as EPON ONU's
- The proposed project might introduce new cost factors which can be quantified and accounted for during the course of the project.
- EPON cost evolution should be directly related to future EPoC cost trends under comparable volumes.

# Economic Feasibility (II)

## **“Reasonable cost for performance”**

- EPON has been established as the most attractive access technology in terms of cost/performance, capable of operating at 1 Gbps and 10 Gbps speeds.
- This project is intended to bring these benefits to RF access networks comprising a combination of fiber and coax cable.
- EPoC is expected to follow the same cost/performance trend line, established for all major Ethernet technologies developed by 802.3 in the past.
- The resulting PHYs will combine a proven, well-known point-to-multipoint network architecture of EPON with mixed outside plant comprising fiber and coax cable to address known cost/performance limitations of other access technologies.

# Economic Feasibility (III)

## **“Consideration of installation costs”**

- Installation costs, as well as maintenance and operations costs for the new technology, are expected to be similar when compared with DOCSIS equipment.
  - OLT costs are generally lower than DOCSIS CMTS costs, but installation costs should be comparable
  - CNU costs are expected to be similar to DOCSIS cable modem costs, and installation costs should be comparable
  - Additional outside plant equipment costs should be comparable to other hybrid fiber-coax equipment capital and installation costs
- A combination of high equipment production volumes, broader competition, and simplicity thanks to reuse of EPON protocols and system-level operating principles should further contribute to reduction of equipment and installation costs, especially as compared to existing DOCSIS equipment costs

# Motion

Approve the response to Broad Market Potential criteria as shown on slides 4-6 in EPoC-5Criteria-IEEE120313.pdf

Moved by: Jorge Salinger

Seconded by:

Yes:

No:

Abstain:

# Motion

Approve responses to Compatibility criteria as shown on slides 8-10 in EPoC-5Criteria-IEEE120313.pdf

Moved by: Marek Hajduczenia

Seconded by:

Yes:

No:

Abstain:

# Motion

Approve the response to Distinct Identity criteria as shown on slides 12-14 in EPoC-5Criteria-IEEE120313.pdf

Moved by: Marek Hajduczenia

Seconded by:

Yes:

No:

Abstain:



# Motion

Approve the response to Technical Feasibility criteria as shown on slides 16-17 in EPoC-5Criteria-IEEE120313.pdf

Moved by: Ed Boyd

Seconded by:

Yes:

No:

Abstain:

# Motion

Approve the response to Economic Feasibility criteria as shown on slides 19-21 in EPoC-5Criteria-IEEE120313.pdf

Moved by: Jorge Salinger

Seconded by:

Yes:

No:

Abstain: