# Proposed 5 Criteria Responses

IEEE 802.3

Next Generation

40 Gb/s and 100 Gb/s Optical Ethernet

Study Group

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# IEEE 802.3 Five Criteria

The IEEE 802 Criteria for Standards Development (Five Criteria) are defined in subclause 12.5 of the 'IEEE project 802 LAN/MAN Standards Committee (LMSC) operations manual'. These are supplemented by subclause 7.2 'Five Criteria' of the 'Operating Rules of IEEE Project 802 Working Group 802.3, CSMA/CD LANs'.

# Broad Market Potential

**a) Broad sets of applicability.**
**b) Multiple vendors and numerous users.**
**c) Balanced costs (LAN versus attached stations).**

1. Ethernet has become widely deployed as a preferred optical solution. Examples include Data Centers, Enterprise and Telecom Network Equipment for edge, distribution and core connections.
2. Internet, cloud, and higher performance computing applications, along with advances in processors, server virtualization and converged networking, are driving the need for increasing numbers of high throughput LAN connections. As the market for 100 Gb/s LAN connections grows, ~~a~~ lower cost, higher density, and lower power alternatives become necessary.
3. There has been wide attendance and participation (avg 108 persons, 71 companies) in the study group by end users, equipment manufacturers and component suppliers. It is anticipated that there will be sufficient participation to effectively complete the standardization process.
4. 100 Gb/s Ethernet optical PHY types utilizing a 4 x 25 Gb/s electrical interface, and optimized MMF interfaces will reduce cost, size and power for links in the growing Data Center market and provide a balance in cost between network equipment and attached stations.
5. 100 Gb/s Ethernet optical PHY types utilizing a 4 x 25 Gb/s electrical interface, and optimized SMF interfaces will reduce cost, size and power for links in the growing Data Center market and provide a balance in cost between network equipment and attached stations.
6. 40 Gb/s Ethernet has been deployed beyond its originally envisioned application space of server interconnect. Extending the reach of 40 Gb/s Ethernet will allow Ethernet to continue to address markets (such as telecom) as 10 Gb/s links are upgraded to 40 Gb/s.

# 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.**
- **Compatibility with IEEE Std 802.3**
- **Conformance with the IEEE Std 802.3 MAC**
- **Managed object definitions compatible with SNMP**

1. As an amendment to IEEE Std 802.3 (as amended by IEEE Std 802.3ba-2010) the proposed project will remain in conformance with the IEEE 802 Overview and Architecture, the bridging standards IEEE Std 802.1D and IEEE Std 802.1Q. ~~and clause 80 introduced by IEEE Std 802.3ba-2010.~~
2. The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC.
3. The proposed amendment will conform to the 40 Gb/s and 100 Gb/s Media Independent Interfaces (XLGMII and CGMII) specified by IEEE Std 802.3ba-2010.
4. As an amendment to IEEE 802.3, the proposed project will follow the existing format and structure of IEEE 802.3 MIB definitions by providing a protocol-independent specification of managed objects.
5. SNMP management capability to be provided in the future by an amendment to or revision of IEEE Std 802.3.1.

# Distinct Identity (1 of 2)

**a) Substantially different from other IEEE 802 standards.**
**b) One unique solution per problem (not two solutions to a problem).**
**c) Easy for the document reader to select the relevant specification.**
**d) Substantially different from other IEEE 802.3 specifications/solutions.**

1. While IEEE Std 802.3ba-2010 does include specifications for 40 Gb/s and 100 Gb/s Ethernet on MMF and SMF cables there is a demand for reduced power, increased density and reduced cost with respect to these solutions.

2. The proposed 100 Gb/s MMF PHY(s) would use four lanes in each direction, allowing an 8x fiber connection per link (rather than 20x fiber per link used by 100GBASE-SR10) and avoiding the need for a gearbox to/from the 25 Gb/s electrical interconnect.

3. The proposed 100 Gb/s SMF PHY(s) would also use four electrical interconnect lanes in each direction thus removing the gearbox used in current solutions. This allows lower power, higher density, and lower cost.

4. The proposed 40 Gb/s SMF PHY would provide the only Ethernet solution at this rate for operation over distances above 10 km.

# Distinct Identity (2 of 2)

**a) Substantially different from other IEEE 802 standards.**
**b) One unique solution per problem (not two solutions to a problem).**
**c) Easy for the document reader to select the relevant specification.**
**d) Substantially different from other IEEE 802.3 specifications/solutions.**

5. ~~There is also consideration for a lower-cost, shorter reach MMF link to support infrastructure changes in data centers.~~ The amendment will define one or two PMD types over MMF depending whether one PMD type with short reach and a second with longer reach have sufficient cost, density, or power difference to justify two PMD types.

6. The amendment will enable new PHY types over SMF which consist of the existing 100GBASE-LR4 and 100GBASE-ER4 optical PMDs with four electrical interconnect lanes in each direction. The amendment will define a new 100 Gb/s SMF PMD in addition to these if it can be shown that a SMF PMD with a shorter reach than LR4 has sufficient cost, density, or power difference to justify an additional SMF PMD type.

7. The proposed amendment to the existing IEEE 802.3 standard will be formatted as a collection of new clauses and amendments of existing clauses as appropriate, making it easy for the reader to select the relevant specification.

# Technical Feasibility

**a) Demonstrated system feasibility.**
**b) Proven technology, reasonable testing.**
**c) Confidence in reliability.**

1. The operation of Ethernet at 40 Gb/s and 100 Gb/s has been established by deployment of devices compliant with IEEE Std 802.3ba-2010 in operational networks.

2. The proposed project will build on the array of Ethernet fiber-optic component and sub-system design experience, and the broad knowledge base of Ethernet network operation.

3. Component vendors have presented data on the feasibility of the necessary components for this project. Presentations, which either leverage existing technologies or employ new technologies, have been provided.

4. The reliability of Ethernet components and systems can be projected in the target environments with a high degree of confidence based on existing 40 Gb/s and 100 Gb/s deployment experience.

# Economic Feasibility

**a) Known cost factors, reliable data.**
**b) Reasonable cost for performance.**
**c) Consideration of installation costs.**

1. The cost factors for Ethernet components and systems are well known. The proposed project may introduce new cost factors which can be quantified.
2. Prior experience in the development of optical Physical Layer specifications for Ethernet indicates that the specifications developed by this project will entail a reasonable cost for the resulting performance.
3. The proposed 100 Gb/s optical PHYs will make it possible to achieve the desired density, power and cost targets for computer systems and network equipment.
4. The proposed 40 Gb/s optical PHY will enable upgrade of existing 10 Gb/s 40 km links to 40 Gb/s operation at significantly lower cost than current solutions.
5. In consideration of installation costs, the project is expected to use proven and familiar media, including multi-pair MMF, duplex SMF and possibly multi-pair SMF cabling technology.
6. Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.

# Thank You!