Proposal to adopt additional objectives to better support HPC/AI/ML applications - Part 2

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Updates to CSD and PAR

CSD & PAR

Do we need to modify the Criteria for Standards Development (CSD) or PAR to support the addition of new objectives?

- Current PAR: https://www.ieee802.org/3/dj/projdoc/P802d3dj_PAR.pdf
- Current CSD: https://mentor.ieee.org/802-ec/dcn/22/ec-22-0256-00-ACSD-p802-3dj.pdf
- Current Objectives: https://www.ieee802.org/3/dj/projdoc/objectives_P802d3dj_230518.pdf

General conclusion – current CSD and PAR remain appropriate and inclusive of the proposal. However, it would be more representative of the latest market dynamics to make some updates.

Managed Objects

No Change

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

a) **The definitions will be part of this project.**
b) **The definitions will be part of a different project and provide the plan for that project or anticipated future project.**
c) **The definitions will not be developed and explain why such definitions are not needed.**

- ❑ The definition of protocol independent managed objects, to be included in Clause 30 of IEEE Std 802.3, will be part of this project.

Coexistence

No Change

A WG proposing a wireless project shall prepare a Coexistence Assessment (CA) document unless it is not applicable.

a) **Will the WG create a CA document as part of the WG balloting process as described in Clause 13? (yes/no)**
b) **If not, explain why the CA document is not applicable.**

- No. A CA document is not applicable because the proposed project is not a wireless project.

Broad Market Potential

Revise

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.
b) Multiple vendors and numerous users.

- The principle of building equipment that supports IEEE 802.3 networks operating at different Ethernet rates has been amply demonstrated by a broad set of product offerings.
- Per the IEEE 802.3 2020 Bandwidth Assessment Report, by 2025 the bandwidth requirements of various applications will grow between 2.3 to 55.4 times relative to their 2017 levels. For these key application areas: cloud-scale data centers (including High-Performance Computing/Artificial Intelligence/Machine Learning (HPC/AI/ML) clusters), internet exchanges, co-location services, content-delivery networks, wireless infrastructure, service provider and operator networks, and video distribution infrastructure:
  - the definition of higher density 800 Gb/s Ethernet will address the cost and power considerations.
  - The definition of 1.6 Tb/s Ethernet will address the growing diverse bandwidth requirements cost considerations.
- Presentations have been submitted to the study group that illustrate the market adoption of Ethernet ports addressing multiple rates and medias for use with duplex and parallel infrastructures.
- Evolving needs of computing applications will be enabled by parallel solutions targeting noted high–bandwidth applications.
- There has been wide attendance and participation in the study group by subject matter experts familiar with the needs of end users, equipment manufacturers and component suppliers. It is anticipated that there will be sufficient participation to effectively complete the standardization process.

Compatibility

No Change

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

a) **Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?**
b) **If the answer to a) is "no", supply the response from the IEEE 802.1 WG.**
c) **Compatibility with IEEE Std 802.3**
d) **Conformance with the IEEE Std 802.3 MAC**

- As an amendment to IEEE Std 802.3 the proposed project shall comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q.
- As was the case in previous IEEE Std 802.3 amendments, new physical layers will be defined for 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s operation.
- As an amendment to IEEE Std 802.3, the proposed project will conform to the full-duplex operating mode of the IEEE 802.3 MAC.
- By utilizing the existing IEEE Std 802.3 MAC protocol, this proposed amendment will maintain compatibility with the installed base of Ethernet nodes.
- The definition of protocol independent managed objects, to be included in Clause 30 of IEEE Std 802.3, will be part of this project.

Distinct Identity

No Change

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

Substantially different from other IEEE 802.3 specifications/solutions.

- The proposed amendment will be the first IEEE 802.3 standard defining 1.6 Tb/s Ethernet.
- The proposed amendment will be the first IEEE 802.3 standard defining 200 Gb/s, 400 Gb/s, and 800 Gb/s Ethernet physical layer specifications based on 200 Gb/s or greater per lane signaling technologies.

Technical Feasibility

No Change

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.
b) Proven similar technology via testing, modeling, simulation, etc.
c) Confidence in reliability.

- The principle of scaling the IEEE 802.3 MAC to higher speeds has been well established by previous work within IEEE.
- The principle of building equipment that supports IEEE 802.3 networks operating at different Ethernet rates has been amply demonstrated by a broad set of product offerings.
- Systems with an aggregate bandwidth of greater than or equal to 1.6 Tb/s have been demonstrated and deployed in operational networks.
- The proposed project will build on the array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation.
  - Contributions have been made that presented data at 800 Gb/s and 1.6 Tb/s over copper and single-mode fiber based on 200 Gb/s or greater per lane signaling technologies. Proposals, which either leverage existing technologies or employ new technologies, have been provided.
  - The experience gained in the development and deployment of technologies since the start of the development of 40 Gigabit Ethernet and 100 Gigabit Ethernet (IEEE 802.3ba) starting in 2008, is applicable to the development of specifications for components at higher speeds. For example, some combination of the following approaches could be used to address 800 Gb/s and 1.6 Tb/s Ethernet, as well as to address reduced lane count solutions for 200 Gb/s and 400 Gb/s Ethernet: pulse-amplitude modulation, parallel transmission techniques, forward error correction, optical coherent signaling, and wavelength-division multiplexing
- Based on prior experience with developing higher speed solutions, the reliability of Ethernet components and systems is understood and can be projected in the target environments with a high degree of confidence.

Economic Feasibility

No Change

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) Known cost factors.
b) Balanced cost factors.
c) Consideration of installation costs.
d) Consideration of operational costs (e.g., energy consumption).
e) Other areas, as appropriate.

- Prior experience scaling IEEE 802.3 indicates the cost distribution between servers, switches, routers, and the infrastructure will remain acceptably balanced for 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s Ethernet.
- The cost factors for Ethernet components and systems are well known. The proposed project may introduce new cost factors which can be quantified.
- The deployment of 800 Gb/s and 1.6 Tb/s Ethernet standards and derivatives at 200 Gb/s and 400 Gb/s will allow economies of scale to reduce cost for all solutions.
- In consideration of installation costs, the project is expected to use proven and familiar media, including twin-axial copper cables~~,~~ and single-mode optical fiber cabling.
- Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.
- In consideration of operational costs associated with power consumption, the project will examine alternatives that trade off physical medium dependent (PMD) sublayer complexity, power, latency, and implementation constraints.

PAR

No Change recommended

2.1 Project Title: Standard for Ethernet
Amendment: Media Access Control Parameters for 1.6 Tb/s and Physical Layers and Management Parameters for 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s Operation

5.2.b Scope of the project: Define Ethernet MAC parameters for 1.6 Tb/s. Define physical layer specifications, and management parameters for the transfer of Ethernet format frames at 800 Gb/s and 1.6 Tb/s over copper and single-mode fiber physical medium dependent (PMD) sublayers based on 200 Gb/ s or greater per lane signaling technologies.

Using these new definitions for 800 Gb/s and 1.6 Tb/s, define physical layer specifications and management parameters for the transfer of Ethernet format frames at 200 Gb/s and 400 Gb/s, when applicable.

5.5 Need for the Project: The project is necessary to provide higher density solutions to meet the growing bandwidth needs for computing and network interconnect application areas, such as cloud-scale data centers, internet exchanges, co-location services, content delivery networks, wireless infrastructure, service provider and operator networks, and video distribution infrastructure.

5.6 Stakeholders for the Standard: Stakeholders include users and producers of systems and components for high-bandwidth applications, such as cloud-scale data centers, internet exchanges, co- location services, content delivery networks, wireless infrastructure, service provider and operator networks, and video distribution infrastructure.

Thank you!