

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Closing Report

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IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group

Study Group information

Study Group Organization

Mabud Choudhury, IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Chair

Guangcan Mi, IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Secretary

Study Group charter

Move that the IEEE 802.3 Working Group request the formation of a Study Group to explore the potential market requirements and feasibility of addressing AI/Data Center networks, and to develop a Project Authorization Request (PAR) and Criteria for Standards Development (CSD) responses for 200 Gb/s per wavelength MMF optical PHYs

Study Group web and reflector information

Reflector information: <https://ieee802.org/3/200GMMF/reflector.html>

Home page: <https://ieee802.org/3/200GMMF/index.html>

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Activities this week

Met Tuesday AM1 and PM3

Reviewed and discussed 4 technical contributions

Met Wednesday AM1

Resolved comments against PAR and CSD from 802.1, 802.11, and 802.15 SCM:

https://www.ieee802.org/3/200GMMF/public/Plenary_Nov_11-2025/PAR_CSD_comments_responses_200gmmf_01a_2511.pdf

Approved updated PAR and CSD based on resolved comments:

Current status

Updated Draft PAR: <https://mentor.ieee.org/802-ec/dcn/25/ec-25-0216-02-LMSC-draft-ieee-p802-3ds-par.pdf>

Updated Draft CSD: <https://mentor.ieee.org/802-ec/dcn/25/ec-25-0217-02-LMSC-draft-ieee-p802-3ds-csd.pdf>

Draft Objectives: https://ieee802.org/3/200GMMF/objectives_200gmmf_01_250917.pdf

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802.11 & 802.15 SCM Comments & Responses, PAR

802.11 comment and response:

Document	Section	Comment	Response	Change
PAR	5.5 Need	suggest change: “per lane short reach” to “per lane short reach (≤ 100 m)”	Accept in principle. “Short reach” is an ambiguous term. We did not have a consensus on exact distance value, so we removed “short reach” term.	from “200 Gb/s signaling per lane short reach optical links” to “200 Gb/s signaling per lane optical links over multimode fiber ”

802.15 SCM comment and response:

Document	Section	Comment	Response	Change
PAR	5.5 Need	"This project is necessary to provide solutions to meet the growing bandwidth needs for 200 Gb/s signaling per lane short reach optical links for Artificial Intelligence (AI) back-end compute clusters and for front-end/traditional Ethernet networks." What is short reach?	Accept in principle. “Short reach” is an ambiguous term. We did not have a consensus on exact distance value, so we removed “short reach” term.	from “200 Gb/s signaling per lane short reach optical links” to “200 Gb/s signaling per lane optical links over multimode fiber ”

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P802.3ds PAR

ec-25-0216-02-LMSC



P802.3ds

Type of Project: Amendment to IEEE Standard 802.3-2022
Project Request Type: Initiation / Amendment
PAR Request Date:
PAR Approval Date:
PAR Expiration Date:
PAR Status: Draft
Root Project: 802.3-2022

1.1 Project Number: P802.3ds
1.2 Type of Document: Standard
1.3 Life Cycle: Full Use

2.1 Project Title: IEEE Standard for Ethernet Amendment: Physical Layer Specifications and Management Parameters for 200 Gb/s and greater Operation over Multimode Fiber using 200 Gb/s signaling

3.1 Working Group: Ethernet Working Group(C/LAN/MAN/802.3 WG)
3.1.1 Contact Information for Working Group Chair:
Name: David Law
Email Address: david_law@ieee.org
3.1.2 Contact Information for Working Group Vice Chair:
Name: Adam Healey
Email Address: adam.healey@broadcom.com
3.2 Society and Committee: IEEE Computer Society/LAN/MAN Standards Committee(C/LAN/MAN)
3.2.1 Contact Information for Standards Committee Chair:
Name: James Gilb
Email Address: gilb_ieee@tuta.com
3.2.2 Contact Information for Standards Committee Vice Chair:
Name: David Halasz
Email Address: dave.halasz@ieee.org
3.2.3 Contact Information for Standards Representative:
Name: George Zimmerman
Email Address: george@cmephyconsulting.com

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P802.3ds PAR

4.1 Type of Ballot: Individual

4.2 Expected Date of submission of draft to the IEEE SA for Initial Standards Committee Ballot:
Nov 2026

4.3 Projected Completion Date for Submittal to RevCom: Aug 2027

5.1 Approximate number of people expected to be actively involved in the development of this project: 50

5.2.a Scope of the complete standard: This standard defines Ethernet local area, access and metropolitan area networks. Ethernet is specified at selected speeds of operation; and uses a common media access control (MAC) specification and management information base (MIB). The Carrier Sense Multiple Access with Collision Detection (CSMA/CD) MAC protocol specifies shared medium (half duplex) operation, as well as full duplex operation. Speed specific Media Independent Interfaces (MIIs) provide an architectural and optional implementation interface to selected Physical Layer entities (PHY). The Physical Layer encodes frames for transmission and decodes received frames with the modulation specified for the speed of operation, transmission medium and supported link length. Other specified capabilities include: control and management protocols, and the provision of power over selected twisted pair PHY types.

5.2.b Scope of the project: The scope of this project is the definition of physical layer specifications and management parameters for the transfer of Ethernet format frames at MAC data rates of 200 Gb/s and greater using 200 Gb/s signaling per lane technology over multimode fiber.

5.3 Is the completion of this standard contingent upon the completion of another standard? No

5.4 Purpose: This document will not include a purpose clause.

5.5 Need for the Project: This project is necessary to provide solutions to meet the growing bandwidth needs for 200 Gb/s signaling per lane ~~short reach~~ optical links [over multimode fiber](#) for Artificial Intelligence (AI) back-end compute clusters and for front-end/traditional Ethernet networks.

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P802.3ds PAR

5.6 Stakeholders for the Standard: Stakeholders include users and producers of Ethernet systems and components for high-bandwidth applications, such as networks for compute clusters used in AI data centers, AI servers, AI accelerators, network storage, networking systems, enterprise and cloud-scale data centers, service providers, and high-performance computing.

6.1 Intellectual Property

6.1.1 Is the Standards Committee aware of any copyright permissions needed for this project?

No

6.1.2 Is the Standards Committee aware of possible registration activity related to this project?

No

7.1 Are there other standards or projects with a similar scope? No

7.2 Is it the intent to develop this document jointly with another organization? No

8.1 Additional Explanatory Notes:

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group WG Motion - PAR

Move that the IEEE 802.3 Working Group approve the IEEE P802.3ds 200 Gb/s per Wavelength MMF PHYs PAR, in
<https://mentor.ieee.org/802-ec/dcn/25/ec-25-0216-02-LMSC-draft-ieee-p802-3ds-par.pdf>

M: Mabud Choudhury

S: Guangcan Mi

(Technical $\geq 75\%$)

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802.1 Comments & Responses, CSD

Document	Section	Comment	Response	Change
CSD	Page 4	•Final Bullet point under Multiple vendors and numerous users: Suggest changing “representatives” to “participants”	Accept	from “including representatives from end-users” to “including <u>participants</u> from end-users”
CSD	Page 5	•The relationship between the per-lane data rate (200Gb/s and above per lane in 5.2.b of the PAR) and the data rates of 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s per the compatibility statement of the CSD should be clarified. •Insert "MAC data rate" to align with PAR. •Please spell out MAC on first use.	Accept	from “defined for 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s operation” to “defined for <u>Media Access Control (MAC) data rates of 200 Gb/s and greater using 200 Gb/s signaling per lane</u> operation”
CSD	Page 7	•Please spell out PMD & PHY on first use.	Accept	from “per lane PHY operation” to “per lane <u>Physical Layer (PHY)</u> operation” from “different PMD types” to “different <u>Physical Medium Dependent (PMD)</u> types”

IEEE 802.3 Criteria for Standards Development (CSD)

The IEEE 802 Criteria for Standards Development (CSD) are defined in Clause 14 of the IEEE 802 LAN/MAN Standards Committee (LMSC) Operations Manual. The criteria include project process requirements (“Managed Objects”) and 5 Criteria (5C) requirements. The 5C are supplemented by subclause 4.5 ‘Criteria for Standards Development’ of the ‘IEEE 802.3 Ethernet Working Group Operations Manual’.

The following are the CSD Responses in relation to the IEEE P802.3ds PAR

Items required by the IEEE 802 CSD are shown in Black text and supplementary items required by IEEE 802.3 are shown in **blue** text.

Managed Objects

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

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

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.

- Broad Sets of Applicability:
 - Electrical signaling data rates on both switches and compute devices are moving to 200 Gb/s per lane.
 - Presentations have been submitted to the study group illustrating that short reach, lower cost Vertical Cavity Surface Emitting Laser (VCSEL)-Multimode Fiber (MMF) links using 200 Gb/s signaling can serve as low-cost interconnects between switch and compute devices over tens of meters in artificial intelligence AI/machine learning clusters, cloud data centers, high-performance computing applications, and in large enterprise and carrier data centers.
 - The trend in building AI clusters favors architectures with many short reach interconnects between switch and/or compute devices which can require longer reaches (10's of meters) than can be supported by passive copper cables (~1m)
 - VCSEL-MMF links using 200 Gb/s signaling can also serve as low-cost interconnects for a significant portion of switch-to-switch links in cloud data centers
- Multiple vendors and numerous users:
 - At the Call For Interest, 51 individuals from 36 companies indicated participation in this project.
 - It is anticipated that there will be sufficient participation to effectively complete the standardization process including **representatives** [participants](#) from end-users, equipment manufacturers and component suppliers.

Compatibility

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 Standards Committee.

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~~ Media Access Control (MAC) data rates of 200 Gb/s and greater using 200 Gb/s signaling per lane 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

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 operation over multimode fiber using 200 Gb/s signaling per lane.

Technical Feasibility

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.**

- IEEE 802.3 has already established 200 Gb/s, 400 Gb/s, 800 Gb/s and 1.6Tb/s MAC specifications suitable for 200 Gb/s per lane ~~PHY~~ Physical Layer (PHY) operation in previous IEEE 802.3 projects.
- The principle of supporting different ~~PMD~~ Physical Medium Dependent (PMD) types from a common MAC specification has been amply demonstrated in IEEE 802.3. 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.
- The proposed project will build on the array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation
 - Individuals affiliated with component vendors have presented data on the technical feasibility of the necessary components for 200 Gb/s VCSEL-based multimode links. Supporting material, which either leverages existing technologies or employs new technologies, has been provided.
- 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

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.

- The cost factors for Ethernet components and systems are well known. Re-use of common technologies from prior Ethernet projects will allow economies of scale to reduce cost.
- In consideration of installation costs, the project is expected to use proven and enhanced MMF media.
- The historical low cost and low power advantages associated with VCSEL-MMF links are expected to be preserved when increasing the optical lane rate from 100Gb/s to 200Gb/s.
- Higher speed 200 Gb/s signaling over MMF will lead to reduced lane counts to support the same Ethernet MAC rate, reduced fiber and component counts, reduced complexity, and lower cost than previously standardized PMDs based on 100 Gb/s signaling per lane. One example is replacing 800GBASE-SR8 for 800Gb/s Ethernet PMD with a four-lane PMD.
- Use of transceivers developed for this project will promote re-use of the installed base of MMF cabling.
- Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group WG Motion - CSD

Move that the IEEE 802.3 Working Group approve the IEEE P802.3ds 200 Gb/s per Wavelength MMF PHYs CSD “Managed Objects”, “Coexistence”, “Broad Market Potential”, “Compatibility”, “Distinct Identity”, “Technical Feasibility”, and “Economic Feasibility” responses, as per <https://mentor.ieee.org/802-ec/dcn/25/ec-25-0217-02-LMSC-draft-ieee-p802-3ds-csd.pdf>

M: Mabud Choudhury

S: Roberto Rodes

(Technical $\geq 75\%$)

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Draft Objectives

200GMMF SG Approved Objectives (1 of 3)

- **Non-Rate Specific**

- Support full-duplex operation only
- Preserve the Ethernet frame format utilizing the Ethernet MAC
- Preserve minimum and maximum FrameSize of current IEEE 802.3 standard
- Support a BER of better than or equal to 10^{-13} at the MAC/PLS service interface (or the frame loss ratio equivalent)

Objectives Adopted by IEEE 802.3 200GMMF SG on 17 Sept 2025
Pending IEEE 802.3 WG Approval

1

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Draft Objectives

200GMMF SG Approved Objectives (2 of 3)

- **200 Gb/s Related**

- Support a MAC data rate of 200 Gb/s
- Define a physical layer specification that supports 200 Gb/s operation:
 - over 1 pair of MMF with lengths up to at least 30 m
 - over 1 pair of MMF with lengths up to at least 50 m

- **400 Gb/s Related**

- Support a MAC data rate of 400 Gb/s
- Define a physical layer specification that supports 400 Gb/s operation:
 - over 2 pairs of MMF with lengths up to at least 30 m
 - over 2 pairs of MMF with lengths up to at least 50 m

Objectives Adopted by IEEE 802.3 200GMMF SG on 17 Sept 2025
Pending IEEE 802.3 WG Approval

2

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group Draft Objectives

200GMMF SG Approved Objectives (3 of 3)

- **800 Gb/s Related**

- Support a MAC data rate of 800 Gb/s
- Define a physical layer specification that supports 800 Gb/s operation:
 - over 4 pairs of MMF with lengths up to at least 30 m
 - over 4 pairs of MMF with lengths up to at least 50 m

- **1.6 Tb/s Related**

- Support a MAC data rate of 1.6 Tb/s
- Define a physical layer specification that supports 1.6 Tb/s operation:
 - over 8 pairs of MMF with lengths up to at least 30 m
 - over 8 pairs of MMF with lengths up to at least 50 m

Objectives Adopted by IEEE 802.3 200GMMF SG on 17 Sept 2025
Pending IEEE 802.3 WG Approval

3

IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group WG Motion - Objectives

Move that the IEEE 802.3 Working Group approve the IEEE P802.3ds 200 Gb/s per Wavelength MMF PHYs objectives, as per https://ieee802.org/3/200GMMF/objectives_200gmmf_01_250917.pdf

M: Mabud Choudhury

S: Eric Bernier

(Technical $\geq 75\%$)

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WG Motion – 1st Recharter Study Group

Move that the IEEE 802.3 Working Group request 1st rechartering of IEEE 802.3 200 Gb/s per Wavelength MMF PHYs Study Group

Moved by Mabud Choudhury on behalf of the study group
(Technical $\geq 75\%$)

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Next Steps

Move to Task Force!

Questions?

Thank you!