INTERNATIONAL STANDARD

ISO/IEC/IEEE 8802-3

Second edition
2017-03-01

AMENDMENT 11
2019-02

Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements —

Part 3: Standard for Ethernet

AMENDMENT 11: Physical layer and management parameters for serial 25 Gb/s ethernet operation over single-mode fiber

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseaux locaux et métropolitains — Prescriptions spécifiques —

Partie 3: Norme pour Ethernet

AMENDEMENT 11: Paramètres de couche physique et de gestion pour le fonctionnement Ethernet en 25 Gb/s série sur fibre unimodale

Reference number
ISO/IEC/IEEE 8802-3:2017/Amd.11:2019(E)

© IEEE 2018

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

COPYRIGHT PROTECTED DOCUMENT

© IEEE 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO or IEEE at the respective address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

Email: stds.ipr@ieee.org
Website: www.ieee.org

Published in Switzerland

© IEEE 2018 – All rights reserved

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted (see www.iso.org/directives).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

ISO/IEC/IEEE 8802-3:2017/Amd.11 was prepared by the LAN/MAN of the IEEE Computer Society (as IEEE Std 802.3cc-2017) and drafted in accordance with its editorial rules. It was adopted, under the "fast-track procedure" defined in the Partner Standards Development Organization cooperation agreement between ISO and IEEE, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC6, *Telecommunications and information exchange between systems*.

A list of all parts in the ISO/IEC/IEEE 8802 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© IEEE 2018 – All rights reserved

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Documents
Document Sharing Hub

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.
Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

IEEE Std 802.3cc™-2017
(Amendment to
IEEE Std 802.3™-2015
as amended by
IEEE Std 802.3bw™-2015, IEEE Std 802.3by™-2016,
IEEE Std 802.3bq™-2016, IEEE Std 802.3bp™-2016,
IEEE Std 802.3br™-2016, IEEE Std 802.3bn™-2016,
IEEE Std 802.3bz™-2016, IEEE Std 802.3bu™-2016,
IEEE Std 802.3bv™-2017, IEEE Std 802.3-2015/Cor 1-2017,
and IEEE Std 802.3bs™-2017)

IEEE Standard for Ethernet

Amendment 11: Physical Layer and Management Parameters for Serial 25 Gb/s Ethernet Operation Over Single-Mode Fiber

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 6 December 2017

IEEE-SA Standards Board

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Abstract: This amendment to IEEE Std 802.3-2015 adds Physical Layer (PHY) specifications and management parameters for 25 Gb/s operation over single-mode fiber at reaches of at least 10 km (25GBASE-LR) and 40 km (25GBASE-ER).

Keywords: 25 Gb/s Ethernet, 25GBASE-ER, 25GBASE-LR, 25GBASE-SR, Energy Efficient Ethernet (EEE), Ethernet, Forward Error Correction (FEC), IEEE 802.3™, IEEE 802.3by™, IEEE 802.3cc™, Physical Coding sublayer (PCS), Physical Medium Attachment (PMA) sublayer, Physical Medium Dependent (PMD) sublayer, Reconciliation sublayer (RS), single-mode fiber (SMF)

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2018 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 15 January 2018. Printed in the United States of America.

IEEE and 802 are registered trademarks in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

PDF: ISBN 978-1-5044-4547-4 STD22910
Print: ISBN 978-1-5044-4548-1 STDPD22910

IEEE prohibits discrimination, harassment and bullying. For more information, visit http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed through scientific, academic, and industry-based technical working groups. Volunteers in IEEE working groups are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Copyright © 2018 IEEE. All rights reserved.

Documents
Document Sharing Hub
© IEEE 2018 – All rights reserved

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Xplore at http://ieeexplore.ieee.org/ or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Participants

The following individuals were officers and members of the IEEE 802.3 working group at the beginning of the IEEE P802.3cc working group ballot. Individuals may have not voted or may have voted for approval, disapproval, or abstention on this amendment.

David J. Law, *IEEE 802.3 Working Group Chair*
Adam Healey, *IEEE 802.3 Working Group Vice-Chair*
Pete Anslow, *IEEE 802.3 Working Group Secretary*
Steven B. Carlson, *IEEE 802.3 Working Group Executive Secretary*
Valerie Maguire, *IEEE 802.3 Working Group Treasurer*

David Lewis, *IEEE P802.3cc 25 Gb/s Ethernet over Single-Mode Fiber Task Force Chair*
Kohichi R. Tamura, *IEEE P802.3cc 25 Gb/s Ethernet over Single-Mode Fiber Task Force Editor-in-Chief*

Justin Abbott
David Abramson
Shadi Abughazaleh
Mohammad Ahmed
Dale Amason
Eric Baden
Amrik Bains
Denis Beaudoin
Christian Beia
Vipul Bhatt
William Bliss
Brad Booth
Martin Bouda
David Brandt
Ralf-Peter Braun
Theodore Brillhart
Paul Brooks
Alan Brown
Matthew Brown
Phillip Brownlee
Chris Bullock
Jairo Bustos Heredia
Adrian Butter
Francesco Caggioni
Anthony Calbone
Clark Carty
Craig Chabot
Geoffrey Chacon Simon
Mandeep Chadha
David Chalupsky
Jacky Chang
Xin Chang
Weiying Cheng
Ahmad Chini
Keng Hua Chuang
Christopher R. Cole
John D'Ambrosia
Yair Darshan
Piers Dawe
Fred Dawson
Eric DiBiaso
John Dillard
Chris Diminico
Curtis Donahue
Dan Dove
Mike Dudek
Frank Effenberger
Hesham Elbakoury
David Estes
John Ewen
Ramin Farjad
Shahar Feldman
James Fife
Alan Flatman
Matthias Fritsche
Richard Frosch
Andrew Gardner
Claude Gauthier
Ali Ghiasi
Volker Goetzfried
Zhigang Gong
Steven Gorshe
Robert Grow
Yong Guo
Mark Gustlin
Marek Hajduczenia
Takehiro Hayashi
Rajmohan Hegde
David Hess
Yasuo Hidaka
David Hoglund
Rita Horner
Bernd Horrmeyer
Xi Huang
Yasuhiro Hyakutake
Jonathan Ingham
Kazuhiko Ishibe
Hideki Isono
Tom Issenhuth
Kenneth Jackson
Andrew Jimenez
John Johnson
Chad Jones
Peter Jones
Manabu Kagami
Upen Kareti
Keisuke Kawahara
Yasuaki Kawatsu
Michael Kelsen
Yong Kim
Eric Kimber
Scott Kipp
Michael Klempa
Curtis Knittle
Shigeru Kobayashi
Paul Kolesar
Tom Kolze
Glen Kramer
Toshihiko Kusano
Hans Lackner
Mark Laubach
Greg Le Cheminant
Han Hyub Lee
Jon Lewis
Mike Peng Li
Jane Lim
Dekun Liu
Hai-Feng Liu
Zhenyu Liu
William Lo
Moiz Lokhandwala
Miklos Lukacs
Kent Lusted
Jeffery Maki
David Malicoat
Arthur Marris
Takeo Masuda
Kirsten Matheus
Erdem Matoglu
Naoki Matsuda
Mick McCarthy
Brett Mcclellan
Thomas Mcdermott

Copyright © 2018 IEEE. All rights reserved.
© IEEE 2018 – All rights reserved
Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.
Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

John McDonough
Larry McMillan
Richard Mellitz
Phil Miguelez
Bryan Moffitt
Paul Mooney
Ron Muir
Dale Murray
Henry Muyshondt
James Nadolny
Edward Nakamoto
Gary Nicholl
Kevin Noll
Mark Nowell
David Ofelt
Tom Palkert
Sesha Panguluri
Earl Parsons
Vasu Parthasarathy
Gerald Pepper
Ruben Perez De Aranda Alonso
Michael Peters
Phong Pham
Jean Picard
William Powell
Rick Rabinovich
Adee Ran
Alon Regev
Duane Remein
Victor Renteria
Salvatore Rotolo
Toshiaki Sakai
Jorge Salinger
Sam Sambasivan
Dieter Schicketanz
Fred Schindler
Hossein Sedarat
Naoshi Serizawa
Masood Shariff
Kapil Shrikhande
Tom Skaar
Jeff Slavick
Daniel Smith
Scott Sommers
Yoshiaki Sone
Bryan Sparrowhawk
Atul Srivastava
Peter Stassar
Heath Stewart
Robert Stone
David Stover
Ken-Ichi Suzuki
Steve Swanson
Andre Szczepanek
William Szeto
Bharat Tailor
Takayuki Tajima
Tomoo Takahara
Satoshi Takahashi
Geoffrey Thompson
Pirooz Tooyserkani
Nathan Tracy
Matthew Traverso
David Tremblay
Albert Tretter
Stephen Trowbridge
Yoshihiro Tsukamoto
Ed Ulrichs
Alexander Umnov
Sterling A. Vaden
Stefano Valle
Paul Vanderlaan
Robert Wagner
Dylan Walker
Haifei Wang
Roy Wang
Tongtong Wang
Xinyuan Wang
Matthias Wendt
Oded Wertheim
Natalie Wienckowski
Ludwig Winkel
Peter Wu
Dayin Xu
Yu Xu
Lennart Yseboodt
Hayato Yuki
Andrew Zambell
Qiwen Zhong
Yan Zhuang
George Zimmerman
Helge Zinner
Pavel Zivny

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

The following members of the individual balloting committee voted on this amendment. Balloters may have voted for approval, disapproval, or abstention.

Shadi Abughazaleh
Thomas Alexander
Pete Anslow
Butch Anton
Amrik Bains
Ralf-Peter Braun
Nancy Bravin
Theodore Brillhart
Matthew Brown
Demetrio Jr Bucaneg
Jairo Bustos Heredia
William Byrd
Steven B. Carlson
Juan Carreon
Mandeep Chadha
Keith Chow
Keng Hua Chuang
Charles Cook
Piers J. G. Dawe
Stephen Didde
Michael Dudek
Sourav Dutta
Matthias Fritsche
Yukihiro Fujimoto
Joel Goergen
Zhigang Gong
Eric W Gray
Randall Groves
Robert Grow
Michael Gundlach
Adam Healey
Marco Hernandez
David Hess
Werner Hoelzl
Rita Horner
C Huntley
Noriyuki Ikeuchi
Osamu Ishida
Atsushi Ito
Raj Jain
SangKwon Jeong
Peter Jones
Manabu Kagami
Piotr Karocki
Stuart Kerry
Yongbum Kim
Jonathan King
Paul Kolesar
Mark Laubach
David J. Law
David Lewis
Jon Lewis
Elvis Maculuba
Valerie Maguire
Jeffery Maki
Arthur Marris
Mick McCarthy
Brett Mcclellan
Thomas Mcdermott
Richard Mellitz
Jeffrey Moore
Charles Moorwood
Michael Newman
Nick S.A. Nikjoo
Paul Nikolich
Mark Nowell
Satoshi Obara
Bansi Patel
Arumugam Paventhan
Michael Peters
David Piehler
Rick Pimpinella
R. K. Rannow
Alon Regev
Maximilian Riegel
Robert Robinson
Benjamin Rolfe
Daniel Smith
Thomas Starai
Peter Stassar
Walter Struppler
Mitsutoshi Sugawara
Patricia Thaler
Geoffrey Thompson
Steven Tilden
David Tremblay
Mark-Rene Uchida
Alexander Umnov
Paul Vanderlaan
Lorenzo Vangelista
George Vlantis
Khurram Waheed
Lisa Ward
Andreas Wolf
Chun Yu Charles Wong
Peter Wu
Jun Xu
Oren Yuen
Zhen Zhou

When the IEEE-SA Standards Board approved this amendment on 6 December 2017, it had the following membership:

Jean-Philippe Faure, *Chair*
Gary Hoffman, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Chuck Adams
Masayuki Ariyoshi
Ted Burse
Stephen Dukes
Doug Edwards
J. Travis Griffith
Michael Janezic
Thomas Kochy
Joseph L. Koepfinger*
Kevin Lu
Daleep Mohla
Damir Novosel
Ronald C. Petersen
Annette D. Reilly
Robby Robson
Dorothy Stanley
Adrian Stephens
Mehmet Ulema
Phil Wennblom
Howard Wolfman
Yu Yuan

*Member Emeritus

Copyright © 2018 IEEE. All rights reserved.
© IEEE 2018 – All rights reserved
Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.
Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

Introduction

This introduction is not part of IEEE Std 802.3cc-2017, IEEE Standard for Ethernet—Amendment 11: Physical Layer and Management Parameters for Serial 25 Gb/s Ethernet Operation Over Single-Mode Fiber.

IEEE Std 802.3™ was first published in 1985. Since the initial publication, many projects have added functionality or provided maintenance updates to the specifications and text included in the standard. Each IEEE 802.3 project/amendment is identified with a suffix (e.g., IEEE Std 802.3ba™-2010).

The half duplex Media Access Control (MAC) protocol specified in IEEE Std 802.3-1985 is Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This MAC protocol was key to the experimental Ethernet developed at Xerox Palo Alto Research Center, which had a 2.94 Mb/s data rate. Ethernet at 10 Mb/s was jointly released as a public specification by Digital Equipment Corporation (DEC), Intel and Xerox in 1980. Ethernet at 10 Mb/s was approved as an IEEE standard by the IEEE Standards Board in 1983 and subsequently published in 1985 as IEEE Std 802.3-1985. Since 1985, new media options, new speeds of operation, and new capabilities have been added to IEEE Std 802.3. A full duplex MAC protocol was added in 1997.

Some of the major additions to IEEE Std 802.3 are identified in the marketplace with their project number. This is most common for projects adding higher speeds of operation or new protocols. For example, IEEE Std 802.3u™ added 100 Mb/s operation (also called Fast Ethernet), IEEE Std 802.3z added 1000 Mb/s operation (also called Gigabit Ethernet), IEEE Std 802.3ae added 10 Gb/s operation (also called 10 Gigabit Ethernet), IEEE Std 802.3ah™ specified access network Ethernet (also called Ethernet in the First Mile) and IEEE Std 802.3ba added 40 Gb/s operation (also called 40 Gigabit Ethernet) and 100 Gb/s operation (also called 100 Gigabit Ethernet). These major additions are all now included in and are superseded by IEEE Std 802.3-2015 and are not maintained as separate documents.

At the publication date of IEEE Std 802.3cc-2017, IEEE Std 802.3 is composed of the following documents:

IEEE Std 802.3-2015

Section One—Includes Clause 1 through Clause 20 and Annex A through Annex H and Annex 4A. Section One includes the specifications for 10 Mb/s operation and the MAC, frame formats and service interfaces used for all speeds of operation.

Section Two—Includes Clause 21 through Clause 33 and Annex 22A through Annex 33E. Section Two includes management attributes for multiple protocols and speed of operation as well as specifications for providing power over twisted pair cabling for multiple operational speeds. It also includes general information on 100 Mb/s operation as well as most of the 100 Mb/s Physical Layer specifications.

Section Three—Includes Clause 34 through Clause 43 and Annex 36A through Annex 43C. Section Three includes general information on 1000 Mb/s operation as well as most of the 1000 Mb/s Physical Layer specifications.

Section Four—Includes Clause 44 through Clause 55 and Annex 44A through Annex 55B. Section Four includes general information on 10 Gb/s operation as well as most of the 10 Gb/s Physical Layer specifications.

Section Five—Includes Clause 56 through Clause 77 and Annex 57A through Annex 76A. Clause 56 through Clause 67 and Clause 75 through Clause 77, as well as associated annexes, specify subscriber access and other Physical Layers and sublayers for operation from 512 kb/s to 10 Gb/s, and defines services and protocol elements that enable the exchange of IEEE Std 802.3 format frames between

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

stations in a subscriber access network. Clause 68 specifies a 10 Gb/s Physical Layer specification. Clause 69 through Clause 74 and associated annexes specify Ethernet operation over electrical backplanes at speeds of 1000 Mb/s and 10 Gb/s.

Section Six—Includes Clause 78 through Clause 95 and Annex 83A through Annex 93C. Clause 78 specifies Energy-Efficient Ethernet. Clause 79 specifies IEEE 802.3 Organizationally Specific Link Layer Discovery Protocol (LLDP) type, length, and value (TLV) information elements. Clause 80 through Clause 95 and associated annexes includes general information on 40 Gb/s and 100 Gb/s operation as well the 40 Gb/s and 100 Gb/s Physical Layer specifications. Clause 90 specifies Ethernet support for time synchronization protocols.

IEEE Std 802.3bw™-2015

Amendment 1—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 96. This amendment adds 100 Mb/s Physical Layer (PHY) specifications and management parameters for operation on a single balanced twisted-pair copper cable.

IEEE Std 802.3by™-2016

Amendment 2—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 105 through Clause 112, Annex 109A, Annex 109B, Annex 109C, Annex 110A, Annex 110B, and Annex 110C. This amendment adds MAC parameters, Physical Layers, and management parameters for the transfer of IEEE 802.3 format frames at 25 Gb/s.

IEEE Std 802.3bq™-2016

Amendment 3—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 113 and Annex 113A. This amendment adds new Physical Layers for 25 Gb/s and 40 Gb/s operation over balanced twisted-pair structured cabling systems.

IEEE Std 802.3bp™-2016

Amendment 4—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 97 and Clause 98. This amendment adds point-to-point 1 Gb/s Physical Layer (PHY) specifications and management parameters for operation on a single balanced twisted-pair copper cable in automotive and other applications not utilizing the structured wiring plant.

IEEE Std 802.3br™-2016

Amendment 5—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 99. This amendment adds a MAC Merge sublayer and a MAC Merge Service Interface to support for Interspersing Express Traffic over a single link.

IEEE Std 802.3bn™-2016

Amendment 6—This amendment adds the Physical Layer specifications and management parameters for symmetric and/or asymmetric operation of up to 10 Gb/s on point-to-multipoint Radio Frequency (RF) distribution plants comprising either amplified or passive coaxial media. It also extends the operation of Ethernet Passive Optical Networks (EPON) protocols, such as Multipoint Control Protocol (MPCP) and Operation Administration and Management (OAM).

Copyright © 2018 IEEE. All rights reserved.
© IEEE 2018 – All rights reserved
Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.
Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019

IEEE Std 802.3bz™-2016

Amendment 7—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 125 and Clause 126. This amendment adds new rates of 2.5 Gb/s and 5 Gb/s and new Physical Layers for operation at 2.5 Gb/s and 5 Gb/s over balanced twisted-pair structured cabling systems.

IEEE Std 802.3bu™-2016

Amendment 8—This amendment includes changes to IEEE Std 802.3-2015 to define a methodology for the provision of power via a single twisted pair to connected Data Terminal Equipment (DTE) with IEEE 802.3 single twisted-pair interfaces.

IEEE Std 802.3bv™-2017

Amendment 9—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 115 and Annex 115A. This amendment adds point-to-point 1000 Mb/s Physical Layer (PHY) specifications and management parameters for operation on duplex plastic optical fiber (POF) targeting use in automotive, industrial, home-network, and other applications.

IEEE Std 802.3™-2015/Cor 1-2017

This corrigendum clarifies which lane of the media dependent interface (MDI) of a multi-lane Physical Layer entity (PHY) is used as the timestamping reference point.

IEEE Std 802.3bs™-2017

Amendment 10—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 116 through Clause 124 and Annex 119A through Annex 120E. This amendment adds MAC parameters, Physical Layers, and management parameters for the transfer of IEEE 802.3 format frames at 200 Gb/s and 400 Gb/s.

IEEE Std 802.3cc™-2017

Amendment 11—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 114. This amendment adds 25 Gb/s Physical Layer specifications and management parameters for operation over single-mode fiber.

A companion document IEEE Std 802.3.1 describes Ethernet management information base (MIB) modules for use with the Simple Network Management Protocol (SNMP). IEEE Std 802.3.1 is updated to add management capability for enhancements to IEEE Std 802.3 after approval of the enhancements.

IEEE Std 802.3 will continue to evolve. New Ethernet capabilities are anticipated to be added within the next few years as amendments to this standard.

Copyright © 2018 IEEE. All rights reserved.

© IEEE 2018 – All rights reserved

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 26,2026 at 08:45:02 UTC from IEEE Xplore. Restrictions apply.

Full document details: ISO/IEC/IEEE 8802-3-2017/Amd 11-2019