

FINAL
DRAFT

AMENDMENT **ISO/IEC/IEEE**
8802-3:2021
FDAM 14

Third edition
2021-02

AMENDMENT 14

ISO/IEC JTC 1/SC 6

Secretariat: KATS

Voting begins on:
2022-04-15

Voting terminates on:
2022-09-02

**Telecommunications and exchange
between information technology
systems — Requirements for local and
metropolitan area networks —**

Part 3:

Standard for Ethernet

**AMENDMENT 14: Bidirectional 10 Gb/s,
25 Gb/s, and 50 Gb/s optical access PHYs**

*Télécommunications et échange entre systèmes informatiques —
Exigences pour les réseaux locaux et métropolitains —*

Partie 3: Norme pour Ethernet

AMENDEMENT 14

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.



Reference number
ISO/IEC/IEEE 8802-3:2021/FDAM 14:2022(E)

© IEEE 2021

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC/IEEE 8802-3:2021/FDAmd 14

<https://standards.iteh.ai/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdamd-14>



COPYRIGHT PROTECTED DOCUMENT

© IEEE 2021

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 IEEE at the address below.

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

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.

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/IEC documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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) or the IEC list of patent declarations received (see <https://patents.iec.ch>).

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. In the IEC, see www.iec.ch/understanding-standards.

ISO/IEC/IEEE 8802-3:2021/DAmD 14 was prepared by the LAN/MAN of the IEEE Computer Society (as IEEE 802.3cp-2021) 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 SC 6, *Telecommunications and information exchange between systems*.

A list of all parts in the ISO/IEC/IEEE 8802-3 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

IEEE Std 802.3cp™-2021

(Amendment to IEEE Std 802.3™-2018
as amended by IEEE Std 802.3cb™-2018,
IEEE Std 802.3bt™-2018,
IEEE Std 802.3cd™-2018,
IEEE Std 802.3cn™-2019,
IEEE Std 802.3cg™-2019,
IEEE Std 802.3cq™-2020,
IEEE Std 802.3cm™-2020,
IEEE Std 802.3ch™-2020,
IEEE Std 802.3ca™-2020,
IEEE Std 802.3cr™-2021,
IEEE Std 802.3cu™-2021,
IEEE Std 802.3cv™-2021,
and IEEE Std 802.3ct™-2021)

IEEE Standard for Ethernet

Amendment 14: Bidirectional 10 Gb/s, 25 Gb/s, and 50 Gb/s Optical Access PHYs

<https://standards.ieee.org/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdAmd-14>

Developed by the

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 16 June 2021

IEEE SA Standards Board

Abstract: This amendment to IEEE Std 802.3-2018 adds Physical Layer specifications and management parameters for 10 Gb/s, 25 Gb/s, and 50 Gb/s Ethernet optical interfaces for bidirectional operation over a single strand of single-mode fiber with reaches of at least 10 km, 20 km, and 40 km.

Keywords: 10GBASE-BR10, 10GBASE-BR20, 10GBASE-BR40, 25GBASE-BR10, 25GBASE-BR20, 25GBASE-BR40, 50GBASE-BR10, 50GBASE-BR20, 50GBASE-BR40, bidirectional (BiDi), Ethernet, forward error correction (FEC), IEEE 802.3™, IEEE 802.3cp™, multi-gigabit Ethernet bidirectional Physical Layers, Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer, Physical Medium Dependent (PMD) sublayer

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/IEC/IEEE 8802-3:2021/FDAmd 14](https://standards.iteh.ai/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdamd-14)

<https://standards.iteh.ai/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdamd-14>

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

Copyright © 2021 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 16 July 2021. 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 978-1-5044-7692-8 STD24791
Print: ISBN 978-1-5044-7693-5 STDPD24791

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.

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE Standards documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page (<https://standards.ieee.org/jpr/disclaimers.html>), appear in all standards and may be found under the heading “Important Notices and Disclaimers Concerning IEEE Standards Documents.”

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

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE SA) Standards Board. IEEE develops its standards through an accredited consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed by volunteers with scientific, academic, and industry-based expertise in technical working groups. Volunteers are not necessarily members of IEEE or IEEE SA, 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 does not warrant or represent the accuracy or completeness 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. In addition, IEEE does not warrant or represent that the use of the material contained in its standards is free from patent infringement. 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: THE NEED TO PROCURE 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.

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 is 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, nor 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 the presenter's views should be considered the personal views of that individual rather than the formal position of IEEE, IEEE SA, the Standards Committee, or the Working Group.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE or IEEE SA. However, **IEEE does not provide interpretations, 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 evaluating comments or in revisions to an IEEE standard is welcome to join the relevant IEEE working group. You can indicate interest in a working group using the Interests tab in the Manage Profile & Interests area of the [IEEE SA myProject system](#). An IEEE Account is needed to access the application.

Comments on standards should be submitted using the [Contact Us](#) form.

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 constitute 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.

Data privacy

Users of IEEE Standards documents should evaluate the standards for considerations of data privacy and data ownership in the context of assessing and using the standards in compliance with applicable laws and regulations.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under US 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.

Photocopies

Subject to payment of the appropriate licensing fees, 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; <https://www.copyright.com/>. 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 10 years. When a document is more than 10 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 [IEEE Xplore](#) or [contact IEEE](#). For more information about the IEEE SA or IEEE's standards development process, visit the IEEE SA Website.

Errata

Errata, if any, for all IEEE standards can be accessed on the [IEEE SA Website](#). Search for standard number and year of approval to access the web page of the published standard. Errata links are located under the Additional Resources Details section. Errata are also available in [IEEE Xplore](#). Users are encouraged to periodically check for errata.

Patents

IEEE Standards are developed in compliance with the [IEEE SA Patent Policy](#).

IMPORTANT NOTICE

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. IEEE Standards development activities consider research and information presented to the standards development group in developing any safety recommendations. Other information about safety practices, changes in technology or technology implementation, or impact by peripheral systems also may be pertinent to safety considerations during implementation of the standard. 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.

Participants

The following individuals were officers and members of the IEEE 802.3 Working Group at the beginning of the IEEE P802.3cp Working Group ballot.

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

Frank Effenberger, *IEEE P802.3cp Bidirectional 10 Gb/s, 25 Gb/s, and 50 Gb/s Optical Access PHYs Task Force Chair*

Duane Remein, *IEEE P802.3cp Bidirectional 10 Gb/s, 25 Gb/s, and 50 Gb/s Optical Access PHYs Task Force Editor-in-Chief, Phase 1*

Yuanqiu Luo, *IEEE P802.3cp Bidirectional 10 Gb/s, 25 Gb/s, and 50 Gb/s Optical Access PHYs Task Force Editor-in-Chief, Phase 2*

David Abramson	Ali Ghiasi	Taketo Kumada
Pete Anslow	Joel Goergen	Hans Lackner
Michikazu Aono	Steven Gorshe	Frank Lambrecht
Nobuyasu Araki	Hideki Goto	Mark Laubach
Tim Baggett	Steffen Graber	Greg Le Cheminant
Thananya Baldwin	Olaf Grau	David Lewis
Steven Baumgartner	Robert Grow	Mike-Peng Li
Denis Beaudoin	Martin Gubow	Alex Lin
Gitesh Bhagwat	Mark Gustlin	Robert Lingle
Rich Boyer	Marek Hajduczenia	Hai-Feng Liu
David Brandt	Howard Heck	William Lo
Ralf-Peter Braun	David Hess	Kent Lusted
Theodore Brillhart	Brian Holden	Jeffery Maki
Paul Brooks	Bernd Hormmeyer	David Malicoat
Matthew Brown	Yasuhiro Hyakutake	Eric Maniloff
Leon Bruckman	Jonathan Ingham	Flavio Marques
Jairo Bustos Heredia	Kazuhiko Ishibe	Arthur Marris
Adrian Butter	Hideki Isono	Takeo Masuda
John Calvin	Tom Issenhuth	Mick McCarthy
Clark Carty	Hiroaki Ito	Brett McClellan
David Chalupsky	Kenneth Jackson	Larry McMillan
Jacky Chang	Andrew Jimenez	Greg McSorley
Xin Chang	John Johnson	Richard Mellitz
Chan Chen	Chad Jones	Shimon Muller
Golam Choudhury	Peter Jones	Sean Murphy
Keng Hua Chuang	Lokesh Kabra	James Nadolny
John D'Ambrosia	Haysam Kadry	Edward Nakamoto
Piers J. G. Dawe	Manabu Kagami	Raymond Nering
Fred Dawson	Upen Kareti	Paul Neveux
Gerrit den Besten	Athanasios Kasapi	Gary Nicholl
Claudio DeSanti	Yong Kim	Shawn Nicholl
Curtis Donahue	Mark Kimber	Kevin Noll
Liang Du	Michael Klempa	Mark Nowell
Kathryn Dube	Curtis Knittle	David Ofelt
Mike Dudek	Elizabeth Kochuparambil	Ryo Okabe
David Estes	Sam Kocsis	Tom Palkert
John Ewen	Wojciech Koczwar	Carlos Pardo
Vincent Ferretti	Paul Kolesar	Earl Parsons
Brian Franchuk	Taiji Kondo	Gerald Pepper
Matthias Fritsche	Daniel Koppermueller	Rubén Perez DeAranda Alonso
Takashi Fukuoka	Glen Kramer	David Piehler

Fabio Pittala	Massimo Sorbara	Prasad Venugopal
Christopher Pohl	Edward Sprague	Edward Walter
William Powell	Peter Stassar	Roy Wang
Rick Rabinovich	Heath Stewart	Xuehuan Wang
Parthasarathy Raju	Junqing Sun	James Weaver
Adee Ran	Steve Swanson	Dong Wei
Alon Regev	Tomoo Takahara	Brian Welch
Victor Renteria	Satoshi Takahashi	Matthias Wendt
Thomas Rettig	Tadashi Takahashi	Natalie Wienckowski
Toshiaki Sakai	Kazuya Takayama	Dance Wu
Hamid Salehi	Michael Takefman	Peter Wu
Sam Sambasivan	Masaru Terada	Dayin Xu
Edward Sayre	Geoffrey Thompson	Yu Xu
Matthew Schmitt	Pirooz Tooyserkani	James Young
Hossein Sedarat	Nathan Tracy	Lennart Yseboodt
Masood Shariff	Viet Tran	Conrad Zerna
Masato Shiino	David Tremblay	Xingxin Zhang
Ramin Shirani	Stephen Trowbridge	Chunhui Zhu
Kapil Shrikhande	Mike Tu	Yan Zhuang
Jeff Slavick	Ed Ulrichs	Martin Zielinski
Scott Sommers	Alexander Umnov	George Zimmerman
		Pavel Zivny

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

Rob Aekins	Yasuhiro Hyakutake	Arumugam Paventhan
Robert Aiello	Osamu Ishida	Michael Peters
Thomas Alexander	Hideki Isono	David Pichler
Philip E. Beecher	Tom Issenhuth	Rick Pimpinella
Rich Boyer	Raj Jain	Fabio Pittala
Ralf-Peter Braun	Jack Jewell	Adee Ran
Jairo Bustos Heredia	Peter Jones	R. K. Rannow
William Byrd	Lokesh Kabra	Maximilian Riegel
Steven B. Carlson	Stuart Kerry	Benjamin Rolfe
Juan Carreon	Yong Kim	Olindo Savi
Clark Carty	Glen Kramer	Scott Sommers
Aniruddha Chandra	Frank Lambrecht	Peter Stassar
Pin Chang	Mark Laubach	Walter Struppler
Chan Chen	David J. Law	David Tepen
David Chen	Pi-Cheng Law	James Theodoras
Charles Cook	Han Hyub Lee	Nathan Tracy
Piers J. G. Dawe	Hyeong Ho Lee	David Tremblay
John Deandrea	David Lewis	Mark-Rene Uchida
Christopher Diminico	Jon Lewis	Alexander Umnov
Frank Effenberger	Yuanqiu Luo	Dmitri Varsanofiev
Avraham Freedman	Valerie Maguire	Ruoxu Wang
Matthias Fritsche	Jeffery Maki	James Weaver
Limin Geng	Scott Mansfield	Stephen Webb
Marek Hajduczenia	Brett McClellan	Karl Weber
Xiang He	Jonathon McLendon	Matthias Wendt
Adam Healey	Richard Mellitz	Andreas Wolf
Marco Hernandez	Raymond Nering	Peter Wu
David Hess	Satoshi Obara	James Young
Werner Hoelzl	Carlos Pardo	Yu Yuan
Gergely Huszak	Bansi Patel	Oren Yuen

When the IEEE SA Standards Board approved this standard on 16 June 2021, it had the following membership:

Gary Hoffman, *Chair*
Jon Walter Rosdahl, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Edward A. Addy
Doug Edwards
Ramy Ahmed Fathy
J. Travis Griffith
Thomas Koshy
Joseph L. Koepfinger*
David J. Law

Howard Li
Daozhuang Lin
Kevin Lu
Daleep C. Mohla
Chenhui Niu
Damir Novosel
Annette Reilly
Dorothy Stanley

Mehmet Ulema
Lei Wang
F. Keith Waters
Karl Weber
Sha Wei
Howard Wolfman
Daidi Zhong

*Member Emeritus

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/IEC/IEEE 8802-3:2021/FDAmd 14](https://standards.iteh.ai/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdamd-14)

<https://standards.iteh.ai/catalog/standards/sist/dd3fb582-0a1c-49a8-9be3-31b349c6cfd1/iso-iec-ieee-8802-3-2021-fdamd-14>

Introduction

This introduction is not part of IEEE Std 802.3cp-2021, IEEE Standard for Ethernet—Amendment 14: Bidirectional 10 Gb/s, 25 Gb/s, and 50 Gb/s Optical Access PHYs.

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 802.3-2018 and are not maintained as separate documents.

At the date of IEEE Std 802.3cp-2021 publication, IEEE Std 802.3 was composed of the following documents:

IEEE Std 802.3-2018

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 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 include 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.

Section Seven—Includes Clause 96 through Clause 115 and Annex 97A through Annex 115A. Clause 96 through Clause 98, Clause 104, and associated annexes, specify Physical Layers and optional features for 100 Mb/s and 1000 Mb/s operation over a single twisted pair. Clause 100 through Clause 103, as well as associated annexes, specify Physical Layers for the operation of the EPON protocol over coaxial distribution networks. Clause 105 through Clause 114 and associated annexes include general information on 25 Gb/s operation as well as 25 Gb/s Physical Layer specifications. Clause 99 specifies a MAC merge sublayer for the interspersing of express traffic. Clause 115 and its associated annex specify a Physical Layer for 1000 Mb/s operation over plastic optical fiber.

Section Eight—Includes Clause 116 through Clause 126 and Annex 119A through Annex 120E. Clause 116 through Clause 124 and associated annexes include general information on 200 Gb/s and 400 Gb/s operation as well the 200 Gb/s and 400 Gb/s Physical Layer specifications. Clause 125 and Clause 126 include general information on 2.5 Gb/s and 5 Gb/s operation as well as 2.5 Gb/s and 5 Gb/s Physical Layer specifications.

IEEE Std 802.3cb™-2018

Amendment 1—This amendment includes changes to IEEE Std 802.3-2018 and its amendments, and adds Clause 127 through Clause 130, Annex 127A, Annex 128A, Annex 128B, and Annex 130A. This amendment adds new Physical Layers for operation at 2.5 Gb/s and 5 Gb/s over electrical backplanes.

IEEE Std 802.3bt™-2018

Amendment 2—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 145, Annex 145A, Annex 145B, and Annex 145C. This amendment adds power delivery using all four pairs in the structured wiring plant, resulting in greater power being available to end devices. This amendment also allows for lower standby power consumption in end devices and adds a mechanism to better manage the available power budget.

IEEE Std 802.3cd™-2018

Amendment 3—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 131 through Clause 140 and Annex 135A through Annex 136D. This amendment adds MAC parameters, Physical Layers, and management parameters for the transfer of IEEE 802.3 format frames at 50 Gb/s, 100 Gb/s, and 200 Gb/s.

IEEE Std 802.3cn™-2019

Amendment 4—This amendment includes changes to IEEE Std 802.3-2018 and adds 50 Gb/s, 200 Gb/s, and 400 Gb/s Physical Layer specifications and management parameters for operation over single-mode fiber with reaches of at least 40 km.

IEEE Std 802.3cg™-2019

Amendment 5—This amendment includes changes to IEEE Std 802.3-2018 and its amendments and adds Clause 146 through Clause 148 and Annex 146A and Annex 146B. This amendment adds 10 Mb/s Physical Layer specifications and management parameters for operation on a single balanced pair of conductors.

IEEE Std 802.3cq™-2020

Amendment 6—This amendment includes editorial and technical corrections, refinements, and clarifications to Clause 33 and related portions of the standard.

IEEE Std 802.3cm™-2020

Amendment 7—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 150. This amendment adds Physical Layer (PHY) specifications and management parameters for 400 Gb/s operation on four pairs (400GBASE-SR4.2) and eight pairs (400GBASE-SR8) of multimode fiber, over reaches of at least 100 m.

IEEE Std 802.3ch™-2020

Amendment 8—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 149, Annex 149A, Annex 149B, and Annex 149C. This amendment adds physical layer specifications and management parameters for operation at 2.5 Gb/s, 5 Gb/s, and 10 Gb/s over a single balanced pair of conductors.

IEEE Std 802.3ca™-2020

Amendment 9—This amendment to IEEE Std 802.3-2018 extends the operation of Ethernet passive optical networks (EPONs) to multiple channels of 25 Gb/s providing both symmetric and asymmetric operation for the following data rates (downstream/upstream): 25/10 Gb/s, 25/25 Gb/s, 50/10 Gb/s, 50/25 Gb/s, and 50/50 Gb/s. This amendment specifies the 25 Gb/s EPON Multi-Channel Reconciliation Sublayer (MCRS), Nx25G-EPON Physical Coding Sublayers (PCSs), Physical Media Attachment (PMA) sublayers, and Physical Medium Dependent (PMD) sublayers that support both symmetric and asymmetric data rates while maintaining backward compatibility with already deployed 10 Gb/s EPON equipment. The EPON operation is defined for distances of at least 20 km, and for a split ratio of at least 1:32.

IEEE Std 802.3cr™-2021

Amendment 10—This amendment includes changes to IEEE Std 802.3-2018 and adds Annex J. This amendment replaces references to the IEC 60950 series of standards (including IEC 60950-1 “Information technology equipment—Safety—Part 1: General requirements”) with appropriate references to the IEC 62368 “Audio/video, information and communication technology equipment” series and makes appropriate changes to the standard corresponding to the new references.

IEEE Std 802.3cu™-2021

Amendment 11—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 151. This amendment adds Physical Layer (PHY) specifications and management parameters for 100 Gb/s and 400 Gb/s operation over single-mode fiber, based on 100 Gb/s per wavelength optical signaling.