

# IEEE Standard for Ethernet

## Amendment 1: Physical Layer Specifications and Management Parameters for 2.5 Gb/s and 5 Gb/s Operation over Backplane

IEEE Computer Society

Sponsored by the  
LAN/MAN Standards Committee

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Sponsor

**LAN/MAN Standards Committee  
of the  
IEEE Computer Society**

Approved 27 September 2018  
**IEEE-SA Standards Board**

**Abstract:** Ethernet Media Access Control (MAC) parameters, Physical Layer specifications, and management objects for the serial transfer of Ethernet format frames at 2.5 Gb/s and 5 Gb/s over electrical backplanes are defined in this amendment to IEEE Std 802.3-2018.

**Keywords:** 2.5 Gigabit Ethernet, 5 Gigabit Ethernet, 2.5GBASE-KX, 2.5GBASE-X, 5GBASE-KR, 5GBASE-R, amendment, AN, Auto-Negotiation, Backplane Ethernet, BASE-R, BASE-X, EEE, Energy Efficient Ethernet, Ethernet, IEEE 802.3™, IEEE 802.3cb™

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

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PDF: ISBN 978-1-5044-5278-6 STD23391  
Print: ISBN 978-1-5044-5279-3 STDPD23391

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**Adam Healey**, *IEEE 802.3 Working Group Vice-Chair*  
**Peter 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*

**Yong Kim**, *IEEE P802.3cb Task Force Chair, Phase 1\**  
**Daniel F. Smith**, *IEEE P802.3cb Task Force Chair, Phase 2*  
**William Lo**, *IEEE P802.3cb Task Force Editor-in-Chief, Phase 1*  
**Daniel F. Smith**, *IEEE P802.3cb Task Force Editor-in-Chief, Phase 2*  
**Jim Hatfield**, *IEEE P802.3cb Task Force Editor, Phase 2\**

Justin Abbott	John Dillard	Uyen Kashi
David Abramson	Daniel Dillow	Keisuke Kawahara
Shadi Abughazaleh	Thuyen Dinh	Yoshiaki Kawatsu
Mohammad Ahmed	Curtis Donahue	Michael Kelsen
Eric Baden	Dan Dove	Scott Kipp
Amrik Bains	Mike Dudek	Michael Klempa
Thananya Baldwin	David Dwelley	Curtis Knittle
Denis Beaudoin	Frank Effenberger	Shigeru Kobayashi
Christian Beia	Hesham Elbakoury	Daniel Koehler
Michael Bennett	David Estes	Paul Kolesar
Vipul Bhatt	John Ewen	Tom Kolze
William Bliss	Ramin Farje	Glen Kramer
Brad Booth	Shahar Feldman	Hans Lackner
Martin Bouda	James Fife	Jeffrey Lapak
Ralf-Peter Braun	Alan Flatman	Mark Laubach
Theodore Brillhart	Mathias Fricke	Han Hyub Lee
Paul Brooks	Richard Frosch	David Lewis
Alan Brown	Andrew Gardner	Jon Lewis
Matthew Brown	Claude Gauthier	Mike Peng Li
Chris Bullock	Ali Ghiasi	Jane Lim
Jairo Bustos Heredia	Joel Goergen	Dekun Liu
Adrian Butter	Volker Goetzfried	Hai-Feng Liu
Francesco Caggioni	Zhigang Gong	Miklos Lukacs
Anthony Calbone	Steven Gorshe	Kent Lusted
Clark Carty	Robert Grow	Jeffery Maki
Craig Chabot	Mark Gustlin	David Malicoat
Geoffrey Chace	Marek Hajduczenia	Yonatan Malkiman
Mandeep Chadha	Takehiro Hayashi	Arthur Marris
David Chagnosky	Yasuo Hidaka	Takeo Masuda
Jacky Chang	Rita Horner	Erdem Matoglu
Xin Chang	Bernd Hormmeyer	Naoki Matsuda
Ahmad Chini	Victor Hou	Mick McCarthy
Feng Hua Chuang	Yasuhiro Hyakutake	Brett McClellan
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John D'Ambrosia	Tom Issenhuth	John McDonough
Yair Darshan	Kenneth Jackson	Larry McMillan
Piers Dawe	Andrew Jimenez	Richard Mei
Fred Dawson	Chad Jones	Richard Mellitz
Wael Diab	Peter Jones	Bryan Moffitt
Eric DiBiao	Manabu Kagami	Ardeshir Mohammadian
		Paul Mooney

\* Not a member of the IEEE 802.3 working group at the beginning of the working group ballot.

Dale Murray  
Henry Muysshondt  
James Nadolny  
Edward Nakamoto  
Gary Nicholl  
Kevin Noll  
Mark Nowell  
David Ofelt  
Thomas Palkert  
Hui Pan  
Sesha Panguluri  
Vasu Parthasarathy  
Petar Pepeljugoski  
Gerald Pepper  
Ruben Perez De Aranda Alonso  
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Phong Pham  
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Adee Ran  
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Duane Remein  
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Dieter Schicketanz  
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Ken-Ichi Suzuki  
Steve Swanson  
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Satoshi Takahashi  
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Geoffrey Thompson

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Albert Tretter  
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Ed Ulrichs  
Alexander Umnov  
Sterling A. Vaden  
Stefano Valle  
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Haifei Wang  
Roy Wang  
Tongtong Wang  
Xinyuan Wang  
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Oded Werth  
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Ludwig Winkel  
Peter Wu  
Jun Xu  
Yan Xue  
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Lennart Yseboodt  
Hayato Yuki  
Andrew Zambell  
Yan Zhuang  
George Zimmerman

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Butch Anton  
Amrik Bains  
Ralf-Peter Braun  
Nancy Bravin  
Theodore Brillhart  
Matthew Brown  
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Adam Healey

Marco Hernandez  
David Hess  
Werner Hoelzl  
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Tom Hundley  
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Raj Jain  
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Mark Laubach  
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Elvis Maculuba  
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Michael Newman  
Nick S. A. Nikjoo  
Paul Nikolich  
Satoshi Obara

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Rick Pimpinella  
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Maximilian Riegel  
Robert Robinson  
Benjamin Rolfe  
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Thomas Starai  
Walter Struppeler  
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## Introduction

This introduction is not part of IEEE Std 802.3cb-2018, IEEE Standard for Ethernet—Amendment 1: Physical Layer Specifications and Management Parameters for 2.5 Gb/s and 5 Gb/s Operation over Backplane.

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 publication for IEEE Std 802.3cb-2018, IEEE Std 802.3 was composed of the following documents:

### IEEE Std 802.3-2018

**Section One**—Includes Clause 4 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 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.

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.

Two companion documents exist, IEEE Std 802.3.1 and IEEE Std 802.3.2. IEEE Std 802.3.1 describes Ethernet management information base (MIB) modules for use with the Simple Network Management Protocol (SNMP). IEEE Std 802.3.2 describes YANG data models for Ethernet. IEEE Std 802.3.1 and IEEE Std 802.3.2 are updated to add management capability for enhancements to IEEE Std 802.3 after approval of those 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.

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# IEEE Standard for Ethernet

## Amendment 1: Physical Layer Specifications and Management Parameters for 2.5 Gb/s and 5 Gb/s Operation over Backplane

[This amendment is based on IEEE Std 802.3™-2018.]

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in bold italic. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~striketrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Deletions and insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

Cross references that refer to clauses, tables, equations, or figures not covered by this amendment are highlighted in green.<sup>1</sup>

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<sup>1</sup> Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.