

**IEEE Standard for Information technology—  
Telecommunications and information exchange between systems—  
Local and metropolitan area networks—  
Specific requirements**

**Part 3: Carrier Sense Multiple Access with  
Collision Detection (CSMA/CD) Access Method  
and Physical Layer Specifications**

**Amendment:**

**Physical Layer Specifications and Management Parameters for  
10 Gb/s Passive Optical Networks**

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

Approved xxx yyy zzz

[B1]

**IEEE-SA Standards Board**

**Abstract:** This amendment to IEEE Std 802.3–2008 provides physical layer specifications and management parameters for symmetric and/or asymmetric operation at 10 Gb/s on point-to-multipoint passive optical networks.

**Keywords:** 802.3av, 10 Gigabit per second point-to-multipoint, passive optical networks, physical medium dependent (PMD),

---

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

Copyright © 2006 by the Institute of Electrical and Electronics Engineers, Inc.  
All rights reserved. Published 16 October 2006. 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.

Print: ISBN 0-7381-5227-7 SH95573  
PDF: ISBN 0-7381-5228-5 SS95573

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.

**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.

Use of an IEEE Standard is wholly voluntary. The IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other IEEE Standard document.

The IEEE does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. IEEE Standards documents are supplied “**AS IS**.”

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. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, 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 publishing and making this document available, the IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other IEEE Standards document, should rely upon the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

**Interpretations:** Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received 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 interpretation requests except in those cases where the matter has previously received formal consideration. 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, explanation, or interpretation of the IEEE.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Comments on standards and requests for interpretations should be addressed to:

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

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, 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.

## Introduction

**This introduction is not part of IEEE Std 802.3av–2008, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements CSMA/CD Access Method and Physical Layer Specifications, Amendment: Physical Layer Specifications and Management Parameters for 10 Gb/s Passive Optical Networks.**

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 802.3av–2008). A historical listing of projects that have added to or modified IEEE Std 802.3 is included in IEEE Std 802.3–2008.

The media access control (MAC) protocol specified in IEEE Std 802.3 is Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This MAC protocol was included in the experimental Ethernet developed at Xerox Palo Alto Research Center. While the experimental Ethernet had a 2.94 Mb/s data rate, IEEE Std 802.3–1985 specified operation at 10 Mb/s. Since 1985 new media options, new speeds of operation, and new protocol capabilities have been added to IEEE Std 802.3.

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 802.3x™ specified full duplex operation and a flow control protocol, 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) and IEEE Std 802.3ah™ specified access network Ethernet (also called Ethernet in the First Mile). These major additions are all now included in IEEE Std 802.3–2008 and are not maintained as separate documents. This amendment adds additional capabilities for 10 Gb/s operation.

At the date of IEEE Std 802.3av–2008 publication, IEEE Std 802.3 is comprised of the following documents:

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. It also includes specification of 802.3 link aggregation.

Section Four—Includes Clause 44 through Clause 54 and Annex 44A through Annex 50A. 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 67 and Annex 58A through Annex 67A. Section Five includes subscriber access physical layers and sublayers for operation from 512 kb/s to 1000 Mb/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.

## IEEE Std 802.3–2005/Cor 1–2006

This corrigendum clarifies and corrects isolation text for twisted pair Ethernet physical interfaces, including harmonization for both powered and unpowered Medium Dependent interfaces.

## IEEE Std 802.3an™–2006

This amendment includes changes to IEEE Std 802.3–2005 and adds Clause 55 and Annex 55A and Annex 55B. This amendment adds a new Physical Layer for 10 Gb/s operation over balanced twisted-pair structured cabling systems.

## IEEE Std 802.3aq–2006

This amendment includes changes to IEEE Std 802.3–2005 and adds Clause 68. This amendment adds a new Physical Layer for 10 Gb/s operation over installed multimode fiber.

## IEEE Std 802.3as™–2006

This amendment includes changes to IEEE Std 802.3–2005. It extends the size of the IEEE 802.3 frame format with an envelope frame.

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.

## Conformance test methodology

An additional standard, IEEE Std 1802.3™-2001, provides conformance test information for 10BASE-T.

## Notice to users

### Errata

Errata, if any, for this and all other standards can be accessed at the following URL:  
<http://standards.ieee.org/reading/ieee/updates/errata/index.html>.

Users are encouraged to check this URL for errata periodically.

### Downloads

Portions of this standard can be downloaded from the Internet. Material include PICS tables, data tables, and code. URLs are listed in the text in the appropriate sections.

### Interpretations

Current interpretations can be accessed at the following URL:  
<http://standards.ieee.org/reading/ieee/interp/index.html>.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

**Patents**

Attention is called to the possibility that implementations of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention. A patent holder or patent applicant has filed a statement of assurance that it will grant licenses under these rights without compensation or under reasonable rates and nondiscriminatory, reasonable terms and conditions to applicants desiring to obtain such licenses. The IEEE makes no representation as to the reasonableness of rates, terms and conditions of the license agreements offered by patent holders or patent applicants. Further information may be obtained from the IEEE Standards Department.

## Participants

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

**David J. Law**, *Working Group Chair*

**Wael W. Diab**, *Working Group Vice Chair*

**Adam Healy**, *Working Group Secretary*

**Steven B. Carlson**, *Working Group Executive Secretary*

**Glen Kramer**, *Chair, 10GEPON Task Force*

**Duane R. Remein**, *Chief Editor, 10GEPON Task Force*

**Marek Hajduczenia**, *Assistant Editor, 10GEPON Task Force*

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

**Glen Kramer, *Web Master, 10GEPON Task Force***

xxx



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

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

xxx

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

xxx

When the IEEE-SA Standards Board approved this standard on 15 September 2006, it had the following membership:

**xxx**, *Chair*  
**xxx**, *Vice Chair*  
**xxx**, *Past Chair*  
**xxx**, *Secretary*

xxx

\*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Satish K. Aggarwal, *NRC Representative*  
Richard DeBlasio, *DOE Representative*  
Alan H. Cookson, *NIST Representative*

Michelle Turner  
*IEEE Standards Program Manager, Document Development*

Michael D. Kipness  
*IEEE Standards Program Manager, Technical Program Development*