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Standard for Ethernet

Norme pour Ethernet

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IEEE Standard for Ethernet

IEEE Computer Society

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USA

28 December 2012

IEEE Std 802.3™-2012
(Revision of
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IEEE Standard for Ethernet

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Approved 30 August 2012

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Abstract: Ethernet local area network operation is specified for selected speeds of operation from 1 Mb/s to 100 Gb/s using a common media access control (MAC) specification and management information base (MIB). The Carrier Sense Multiple Access with Collision Detection (CSMA/CD) MAC protocol specifies shared medium (half duplex) operation, as well as full duplex operation. Speed specific Media Independent Interfaces (MIIs) allow use of selected Physical Layer devices (PHY) for operation over coaxial, twisted-pair or fiber optic cables. System considerations for multisegment shared access networks describe the use of Repeaters that are defined for operational speeds up to 1000 Mb/s. Local Area Network (LAN) operation is supported at all speeds. Other specified capabilities include various PHY types for access networks, PHYs suitable for metropolitan area network applications, and the provision of power over selected twisted-pair PHY types.

Keywords: 10BASE; 100BASE; 1000BASE; 10GBASE; 40GBASE; 100GBASE; 10 Gigabit Ethernet; 40 Gigabit Ethernet; 100 Gigabit Ethernet; attachment unit interface; AUI; Auto Negotiation; Backplane Ethernet; data processing; DTE Power via the MDI; EPON; Ethernet; Ethernet in the First Mile; Ethernet passive optical network; Fast Ethernet; Gigabit Ethernet; GMII; information exchange; IEEE 802.3; local area network; management; medium dependent interface; media independent interface; MDI; MIB; MII; PHY; physical coding sublayer; Physical Layer; physical medium attachment; PMA; Power over Ethernet; repeater; type field; VLAN TAG; XGMII

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Participants

The following individuals were officers of the IEEE 802.3 working group at the beginning of the working group ballot of this revision:

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Wael William Diab, *Working Group Vice-Chair*
Adam Healey, *Working Group Secretary*
Steven B. Carlson, *Working Group Executive Secretary*
Valerie Maguire, *Working Group Treasurer*

Wael William Diab, *IEEE P802.3 (802.3bh) Task Force Chair and Chief Editor*
Valerie Maguire, *IEEE P802.3 (802.3bh) Task Force Recording Secretary and Clause Editor*
Peter Anslow, *IEEE P802.3 (802.3bh) Task Force Section Editor*
Marek Hajduczenia, *IEEE P802.3 (802.3bh) Task Force Section Editor*

Historical participants

The following individuals participated in the IEEE 802.3 working group during various stages of the standard's development. Since the initial publication, many IEEE standards have added functionality or provided updates to material included in this standard. Included is a historical list of participants who have dedicated their valuable time, energy, and knowledge to the creation of this material:

IEEE Std 802.3 document	Date approved by IEEE and ANSI	Officers at the time of working group ballot
IEEE Std 802.3-1985, Original 10 Mb/s standard, MAC, PLS, AUI, 10BASE5	23 June 1983 (IEEE) 31 December 1984 (ANSI)	**Donald C. Loughry,** *Working Group Chair*
IEEE Std 802.3a-1988 (Clause 10), 10 Mb/s MAU 10BASE2	15 November 1985 (IEEE) 28 December 1987 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Alan Flatman,** *Task Force Chair*
IEEE Std 802.3b-1985 (Clause 11), 10 Mb/s Broadband MAU, 10BROAD36	19 September 1985 (IEEE) 28 February 1986 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Menachem Abraham,** *Task Force Chair*
IEEE Std 802.3c-1985 (9.1–9.8), 10 Mb/s Baseband Repeater	12 December 1985 (IEEE) 4 June 1986 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Geoffrey O. Thompson,** *Task Force Chair*
IEEE Std 802.3d-1987 (9.9), 10 Mb/s Fiber MAU, FOIRL	10 December 1987 (IEEE) 9 February 1989 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Steven Moustakas,** *Task Force Chair*
IEEE Std 802.3e-1987 (Clause 12), 1 Mb/s MAU and Hub 1BASE5	11 June 1987 (IEEE) 15 December 1987 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Robert Galin,** *Task Force Chair*
IEEE Std 802.3h-1990 (Clause 5), 10 Mb/s Layer Management, DTEs	28 September 1990 (IEEE) 11 March 1991 (ANSI)	**Donald C. Loughry,** *Working Group Chair* **Andy J. Luque,** *Task Force Chair*
IEEE Std 802.3i-1990 (Clauses 13 and 14), 10 Mb/s UTP MAU, 10 BASE-T	28 September 1990 (IEEE) 11 March 1991 (ANSI)	**Donald C. Loughry**, *Working Group Chair* **Patricia Thaler,** *Task Force Chair (initial)* **Richard Anderson,** *Task Force Chair (final)*

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IEEE Std 802.3j-1993 (Clauses 15–18), 10 Mb/s Fiber MAUs 10BASE-FP, 10BASE-FB, and 10BASE-FL	15 September 1993 (IEEE) 15 March 1994 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Keith Amundsen,** *Task Force Chair (initial)* **Frederick Scholl,** *Task Force Chair (final)* **Michael E. Lee,** *Technical Editor*
IEEE Std 802.3k-1993 (Clause 19), 10 Mb/s Layer Management, Repeaters	17 September 1992 (IEEE) 8 March 1993 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Joseph S. Skorupa,** *Task Force Chair* **Geoffrey O. Thompson,** *Vice Chair and Editor*
IEEE Std 802.3*l*-1992 (14.10), 10 Mb/s PICS Proforma 10BASE-T MAU	17 September 1992 (IEEE) 23 February 1993 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Mike Armstrong,** *Task Force Chair and Editor* **Paul Nikolich,** *Vice Chair* **William Randle,** *Editorial Coordinator*
IEEE Std 802.3m-1995, Maintenance 2	21 September 1995 (IEEE) 16 July 1996 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
IEEE Std 802.3n-1995, Maintenance 3	21 September 1995 (IEEE) 4 April 1996 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
IEEE Std 802.3p-1993 (Clause 20), Management, 10 Mb/s Integrated MAUs	17 June 1993 (IEEE) 4 January 1994 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Joseph S. Skorupa,** *Task Force Chair* **Geoffrey O. Thompson,** *Vice Chair and Editor*
IEEE Std 802.3q-1993 (Clause 5), 10 Mb/s Layer Management, GDMO Format	17 June 1993 (IEEE) 4 January 1994 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Joseph S. Skorupa,** *Task Force Chair* **Geoffrey O. Thompson,** *Vice Chair and Editor*
IEEE Std 802.3r-1996 (8.8), Type 10BASE5 Medium Attachment Unit PICS proforma	29 July 1996 (IEEE) 6 January 1997 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Imre Juhász**, *Task Force Chair* **William Randle,** *Task Force Editor*
IEEE Std 802.3s-1995, Maintenance 4	21 September 1995 (IEEE) 8 April 1996 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
IEEE Std 802.3t-1995, 120 Ω informative annex to 10BASE-T	14 June 1995 (IEEE) 12 January 1996 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **Jacques Christ,** *Task Force Chair*
IEEE Std 802.3u-1995 (Clauses 21–30), Type 100BASE-T MAC parameters, Physical Layer, MAUs, and Repeater for 100 Mb/s Operation	14 June 1995 (IEEE) 4 April 1996 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **Peter Tarrant,** *Task Force Chair (Phase 1)* **Howard Frazier,** *Task Force Chair (Phase 2)* **Paul Sherer,** *Task Force Editor-in-Chief (Phase 1)* **Howard Johnson,** *Task Force Editor-in-Chief (Phase 2)* **Colin Mick,** *Task Force Comment Editor*
IEEE Std 802.3v-1995, 150 Ω informative annex to 10BASE-T	12 December 1995 (IEEE) 16 July 1996 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **Larry Nicholson,** *Task Force Chair*
IEEE Std 802.3x-1997 and IEEE Std 802.3y-1997 (Revisions to IEEE Std 802.3, Clauses 31 and 32), Full-Duplex Operation and Type 100BASE-T2	20 March 1997 (IEEE) 5 September 1997 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Rich Seifert,** *Task Force Chair and Editor (802.3x)* **J. Scott Carter,** *Task Force Chair (802.3y)* **Colin Mick**, *Task Force Editor (802.3y)*
IEEE Std 802.3z-1998 (Clauses 34–39, 41–42), Type 1000BASE-X MAC Parameters, Physical Layer, Repeater, and Management Parameters for 1000 Mb/s Operation	25 June 1998 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Howard M. Frazier, Jr.,** *Task Force Chair* **Howard W. Johnson,** *Task Force Editor*
IEEE Std 802.3aa-1998, Maintenance 5	25 June 1998 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **Colin Mick**, *Task Force Editor*

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IEEE Std 802.3ab-1999 (Clause 40), Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4 Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T	26 June 1999 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Robert M. Grow,** *Working Group Secretary* **George Eisler**, *Task Force Chair* **Colin Mick**, *Task Force Editor*
IEEE Std 802.3ac-1998, Frame Extensions for Virtual Bridged Local Area Network (VLAN) Tagging on IEEE 802.3 Networks	16 September 1998 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Andy J. Luque,** *Working Group Secretary* **Ian Crayford,** *Task Force Chair* **Rich Seifert,** *Task Force Editor*
IEEE Std 802.3ad-2000 (Clause 43), Aggregation of Multiple Link Segments	30 March 2000 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Robert M. Grow,** *Working Group Secretary* **Steven Haddock,** *Task Force Chair* **Tony Jeffree,** *Task Force Co-Editor* **Rich Seifert,** *Task Force CoEditor*
IEEE Std 802.3-2002 (IEEE 802.3ag, Maintenance 6, Revision of the base), Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and Physical Layer specifications	14 January 2002 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Robert M. Grow,** *Working Group Secretary*
IEEE Std 802.3ae-2002, (Clauses 44–53) Media Access Control (MAC) Parameters, Physical Layers, and Management Parameters for 10 Gb/s Operation	13 June 2002 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Robert M. Grow,** *Working Group Secretary* **R. Jonathan Thatcher,** *Task Force Chair* **Stephen Haddock,** *Task Force Vice Chair* **Bradley J. Booth,** *Task Force Editor* **Lacreshia Laningham,** *Task Force Assistant Editor* **Benjamin Brown,** *Logic Track Chair* **Walter Thirion,** *Optical Track Chair*
IEEE Std 802.3af-2003, (Clause 33) Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI)	12 June 2003 (IEEE)	**Geoffrey O. Thompson,** *Working Group Chair (Phase 1)* **Robert M. Grow,** *Working Group Chair (Phase 2)* **David J. Law,** *Working Group Vice Chair* **Robert M. Grow,** *Working Group Secretary (Phase 1)* **Steven B. Carlson,** *Working Group Secretary (Phase 2)* **Steven B. Carlson,** *Task Force Chair* **Michael S. McCormack,** *Task Force Editor (Phase 1)* **John J. Jetzt,** *Task Force Editor (Phase 2)* **Chad M. Jones,** *Task Force Comment Editor*
IEEE Std 802.3ah-2004, Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks	6 April 2005 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Steven B. Carlson,** *Working Group Secretary* **Howard Frazier,** *Task Force Chair* **Wael W. Diab,** *Task Force Editor-in-Chief* **Hugh Barrass,** *Task Force Vice-Chair* **Scott Simon,** *Task Force Recording Secretary* **Behrooz Rezvani,** *Task Force Executive Secretary*
IEEE Std 802.3aj-2003, Maintenance 7	11 September 2003 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair, Task Force Chair* **Steven B. Carlson,** *Working Group Secretary* **Catherine K. N. Berger,** *Task Force Editor*
IEEE Std 802.3ak-2004, Physical Layer and Management Parameters for 10Gb/s Operation, Type 10GBASE-CX4	9 February 2004 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Steven B. Carlson,** *Working Group Secretary* **Daniel J. Dove,** *Task Force Chair* **Howard A. Baumer,** *Task Force Editor*

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IEEE Std 802.3-2005 (IEEE 802.3REVam, Revision of the base), Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and Physical Layer specifications	9 June 2005 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Wael W. Diab,** *Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Piers Dawe,** *Review Editor*
IEEE Std 802.3an-2006, Physical Layer and Management Parameter for 10 Gb/s Operation, Type 10GBASE-T	8 June 2006 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Wael William Diab,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Task Force Chair* **Sanjay Kasturia,** *Task Force Editor-in Chief* **George Eisler,** *Task Force Recording Secretary*
IEEE Std 802.3ap-2007, Ethernet Operation over Electrical Backplanes	22 March 2007 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice-Chair* **Wael W. Diab**, *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Working Group Treasurer* **Adam Healey,** *Task Force Chair* **John D'Ambrosia,** *Task Force Secretary* **Schelto vanDoorn,** *Task Force Editor-in-Chief (Phase 1)* **Ilango S. Ganga,** *Task Force Editor-in-Chief (Phase 2)*
IEEE Std 802.3aq-2006, Physical Layer and Management Parameters for 10 Gb/s Operation, Type 10GBASE-LRM	15 September 2006 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair* **Wael William Diab,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **David G. Cunningham,** *Task Force Chair* **Nick Weiner,** *Task Force Editor* **Piers Dawe,** *Task Force Contributing Editor*
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IEEE Std 802.3-2005/Cor 1-2006 (IEEE 802.3au), DTE Power via MDI Isolation corrigendum	8 June 2006 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair, Task Force Editor* **Wael W. Diab**, *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary*
IEEE Std 802.3-2005/Cor 2-2007 (IEEE 802.3aw), 10GBASE-T corrigendum	7 June 2007 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair, Task Force Editor* **Wael W. Diab**, *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Working Group Treasurer*
IEEE Std 802.3-2008 (IEEE 802.3ay), Maintenance #9 (Revision of the base), Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and Physical Layer specifications	26 September 2008 (IEEE)	**Robert M. Grow,** *Working Group Chair* **David J. Law,** *Working Group Vice Chair, Task Force Editor* **Wael William Diab,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Working Group Treasurer*
IEEE Std 802.3at-2009 Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements	11 September 2009 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice Chair* **Adam Healey,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Working Group Treasurer* **Mike McCormack,** *Task Force Chair* **D. Matthew Landry,** *Task Force Chief Editor* **Chad Jones,** *Task Force Comment Editor*

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IEEE Std 802.3 document	Date approved by IEEE and ANSI	Officers at the time of working group ballot
IEEE Std 802.3av-2009 Physical Layer Specifications and Management Parameters for 10 Gb/s Passive Optical Networks	11 September 2009 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice Chair* **Adam Healey,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Bradley Booth,** *Working Group Treasurer* **Glen Kramer,** *Task Force Chair* **Duane Remein,** *Task Force Chief Editor* **Marek Hajduczenia,** *Task Force Assistant Editor*
IEEE Std 802.3az-2010 Media Access Control Parameters, Physical Layers, and Management Parameters for Energy-Efficient Ethernet	30 September 2010 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice Chair* **Steven B. Carlson,** *Working Group Executive Secretary* **Adam Healey,** *Working Group Secretary* **Bradley Booth,** *Working Group Treasurer* **Michael Bennett,** *Task Force Chair* **Sanjay Kasturia,** *Task Force Editor-in-Chief*
IEEE Std 802.3ba Media Access Control Parameters, Physical Layers, and Management Parameters for 40 Gb/s and 100 Gb/s Operation	17 June 2010 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice-Chair* **Steven B. Carlson,** *Working Group Executive Secretary* **Adam Healey,** *Working Group Secretary* **Bradley Booth,** *Working Group Treasurer* **John D'Ambrosia,** *Task Force Chair* **Ilango S. Ganga,** *Task Force Editor-in-Chief*
IEEE Std 802.3-2008/Cor 1-2009 (IEEE 802.3bb) Pause Reaction Delay Corrigendum.	9 December 2009 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice-Chair* **Steven B. Carlson,** *Working Group Executive Secretary* **Adam Healey,** *Working Group Secretary* **Bradley Booth,** *Working Group Treasurer*
IEEE Std 802.3bc-2009 Ethernet Organizationally Specific Type, Length, Value (TLVs)	11 September 2009 (IEEE)	**David J. Law,** *Working Group Chair and Task Force Editor* **Wael W. Diab,** *Working Group Vice Chair, Task Force Chair* **Steven B. Carlson,** *Working Group Executive Secretary* **Adam Healey,** *Working Group Secretary* **Bradley Booth,** *Working Group Treasurer*
IEEE Std 802.3bd-2011 MAC Control Frame for Priority-based Flow Control	16 June 2011 (IEEE)	**Tony Jeffree,** *IEEE 802.1 Working Group Chair* **Paul Congdon,** *IEEE 802.1 Working Group Vice Chair* **David J. Law,** *IEEE 802.3 Working Group Chair* **Wael W. Diab,** *IEEE 802.3 Working Group Vice Chair* **Pat Thaler,** *Data Center Bridging Task Group Chair*
IEEE Std 802.3bf-2011 Media Access Control (MAC) Service Interface and Management Parameters to Support Time Synchronization Protocols	16 May 2011 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice-Chair* **Adam Healey,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Valerie Maguire,** *Working Group Treasurer* **Steven B. Carlson,** *Task Force Chair* **Marek Hajduczenia,** *Task Force Editor-in-Chief*
IEEE Std 802.3bg-2011 Physical Layer and Management Parameters for Serial 40 Gb/s Ethernet Operation Over Single-Mode Fiber	31 March 2011 (IEEE)	**David J. Law,** *Working Group Chair* **Wael William Diab,** *Working Group Vice-Chair* **Adam Healey,** *Working Group Secretary* **Steven B. Carlson,** *Working Group Executive Secretary* **Valerie Maguire,** *Working Group Treasurer* **Mark Nowell,** *Task Force Chair* **Pete Anslow,** *Task Force Editor-in-Chief*

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Introduction

This introduction is not part of IEEE Std 802.3-2012, IEEE Standard for Ethernet.

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 this standard. Each IEEE 802.3 project/amendment is identified with a suffix (e.g., IEEE Std 802.3ba™-2010). A historical listing of all projects that have added to or modified IEEE Std 802.3 follows as a part of this introductory material. The listing is in chronological order of project initiation and for each project describes: subject, clauses added (if any), approval dates, and committee officers.

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 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), 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 802.3-2012 and are not maintained as separate documents.

IEEE Std 802.3-2012

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.

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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 90 and Annex 83A through Annex 86A. 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 89 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 802.3 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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List of special symbols

For the benefit of users who have received this document by electronic means, what follows is a list of special symbols and operators. If any of these symbols or operators fail to print out correctly, the editors apologize and hope that this table will at least help to sort out the meaning of the resulting funny-shaped blobs and strokes.

Special symbols and operators

Printed character	Meaning	Font
*	Boolean AND	Symbol
+	Boolean OR, arithmetic addition	Symbol
^	Boolean XOR	Times New Roman
!	Boolean NOT	Symbol
×	Multiplication	Symbol
<	Less than	Symbol
≤	Less than or equal to	Symbol
>	Greater than	Symbol
≥	Greater than or equal to	Symbol
=	Equal to	Symbol
≈	Approximately equal to	Symbol
≠	Not equal to	Symbol
⇐	Assignment operator	Symbol
∈	Indicates membership	Symbol
∉	Indicates nonmembership	Symbol
±	Plus or minus (a tolerance)	Symbol
°	Degrees	Symbol
∑	Summation	Symbol
√	Square root	Symbol
—	Big dash (em dash)	Times New Roman
–	Little dash (en dash), subtraction	Times New Roman
|	Vertical bar	Times New Roman
†	Dagger	Times New Roman
‡	Double dagger	Times New Roman
α	Lower case alpha	Symbol
β	Lower case beta	Symbol
γ	Lower case gamma	Symbol
δ	Lower case delta	Symbol
ε	Lower case epsilon	Symbol
λ	Lower case lambda	Symbol
μ	Lower case mu	Times New Roman
Π	Upper case pi	Symbol
Ω	Upper case omega	Symbol

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IEEE Standard for Ethernet

SECTION ONE

This section includes Clause 1 through Clause 20, Annex A through Annex H, and Annex 4A.

Contents

1. Introduction 1

1.1 Overview 1
1.1.1 Scope 1
1.1.2 Basic concepts 2
1.1.2.1 Half duplex operation 2
1.1.2.2 Full duplex operation 2
1.1.3 Architectural perspectives 2
1.1.3.1 Architectural rationale 3
1.1.3.2 Compatibility interfaces 3
1.1.4 Layer interfaces 6
1.1.5 Application areas 6
1.2 Notation 6
1.2.1 State diagram conventions 6
1.2.2 Service specification method and notation 7
1.2.2.1 Classification of service primitives 8
1.2.3 Physical Layer and media notation 8

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1.2.4 Physical Layer message notation 9
1.2.5 Hexadecimal notation 9
1.2.6 Accuracy and resolution of numerical quantities 9
1.3 Normative references 9
1.4 Definitions 16
1.5 Abbreviations 44

2. Media Access Control (MAC) service specification 49

2.1 Scope and field of application 49
2.2 Overview of the service 49
2.2.1 General description of services provided by the layer 49
2.2.2 Model used for the service specification 49
2.2.3 Overview of interactions 49
2.2.4 Basic services 50
2.3 Detailed service specification 50
2.3.1 MA_DATA.request 50
2.3.1.1 Function 50
2.3.1.2 Semantics of the service primitive 50
2.3.1.3 When generated 50
2.3.1.4 Effect of receipt 50
2.3.1.5 Additional comments 50
2.3.2 MA_DATA.indication 51
2.3.2.1 Function 51
2.3.2.2 Semantics of the service primitive 51
2.3.2.3 When generated 51
2.3.2.4 Effect of receipt 52
2.3.2.5 Additional comments 52

3. Media Access Control (MAC) frame and packet specifications 53

3.1 Overview 53
3.1.1 Packet format 53
3.1.2 Service interface mappings 54
3.2 Elements of the MAC frame and packet 54
3.2.1 Preamble field 54
3.2.2 Start Frame Delimiter (SFD) field 54
3.2.3 Address fields 54
3.2.3.1 Address designation 55
3.2.4 Destination Address field 55
3.2.5 Source Address field 56
3.2.6 Length/Type field 56
3.2.7 MAC Client Data field 56
3.2.8 Pad field 57
3.2.9 Frame Check Sequence (FCS) field 57
3.2.10 Extension field 57
3.3 Order of bit transmission 58
3.4 Invalid MAC frame 58

4. Media Access Control 59

4.1 Functional model of the MAC method 59
4.1.1 Overview 59
4.1.2 CSMA/CD operation 60

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4.1.2.1 Normal operation ... 60
4.1.2.1.1 Transmission without contention ... 60
4.1.2.1.2 Reception without contention ... 61
4.1.2.2 Access interference and recovery ... 61
4.1.3 Relationships to the MAC client and Physical Layers ... 62
4.2 CSMA/CD Media Access Control (MAC) method: Precise specification ... 62
4.2.1 Introduction ... 62
4.2.2 Overview of the procedural model ... 62
4.2.2.1 Ground rules for the procedural model ... 63
4.2.2.2 Use of Pascal in the procedural model ... 63
4.2.2.3 Organization of the procedural model ... 64
4.2.2.4 Layer management extensions to procedural model ... 64
4.2.3 Packet transmission model ... 64
4.2.3.1 Transmit data encapsulation ... 65
4.2.3.2 Transmit media access management ... 70
4.2.3.2.1 Deference ... 70
4.2.3.2.2 Interpacket gap ... 70
4.2.3.2.3 Collision handling (half duplex mode only) ... 71
4.2.3.2.4 Collision detection and enforcement (half duplex mode only) ... 71
4.2.3.2.5 Collision backoff and retransmission (half duplex mode only) ... 71
4.2.3.2.6 Full duplex transmission ... 72
4.2.3.2.7 Packet bursting (half duplex mode only) ... 72
4.2.3.3 Minimum frame size ... 72
4.2.3.4 Carrier extension (half duplex mode only) ... 73
4.2.4 Frame reception model ... 73
4.2.4.1 Receive data decapsulation ... 73
4.2.4.1.1 Address recognition ... 73
4.2.4.1.2 Frame check sequence validation ... 74
4.2.4.1.3 Frame disassembly ... 74
4.2.4.2 Receive media access management ... 74
4.2.4.2.1 Framing ... 74
4.2.4.2.2 Collision filtering ... 74
4.2.5 Preamble generation ... 75
4.2.6 Start frame sequence ... 75
4.2.7 Global declarations ... 75
4.2.7.1 Common constants, types, and variables ... 75
4.2.7.2 Transmit state variables ... 77
4.2.7.3 Receive state variables ... 78
4.2.7.4 State variable initialization ... 78
4.2.8 Frame transmission ... 79
4.2.9 Frame reception ... 86
4.2.10 Common procedures ... 89
4.3 Interfaces to/from adjacent layers ... 90
4.3.1 Overview ... 90
4.3.2 MAC service ... 90
4.3.2.1 MAC client transmit interface state diagram ... 90
4.3.2.1.1 Variables ... 90
4.3.2.1.2 Functions ... 91
4.3.2.1.3 Messages ... 91
4.3.2.1.4 MAC client transmit interface state diagram ... 91
4.3.2.2 MAC client receive interface state diagram ... 92
4.3.2.2.1 Variables ... 92
4.3.2.2.2 Functions ... 92
4.3.2.2.3 Messages ... 92

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4.3.2.2.4 MAC client receive interface state diagram ... 93
4.3.3 Services required from the Physical Layer ... 93
4.4 Specific implementations ... 95
4.4.1 Compatibility overview ... 95
4.4.2 MAC parameters ... 96
4.4.3 Configuration guidelines ... 97

5. Layer Management ... 99

5.1 Introduction ... 99
5.1.1 Systems Management overview ... 99
5.1.2 Layer Management model ... 99
5.1.3 Packages ... 100
5.1.4 Conformance requirements ... 100
5.2 Management facilities ... 100
5.2.1 Introduction ... 100
5.2.2 DTE MAC Sublayer Management facilities ... 100
5.2.2.1 DTE MAC sublayer attributes ... 102
5.2.2.1.1 aMACID ... 102
5.2.2.1.2 aFramesTransmittedOK ... 102
5.2.2.1.3 aSingleCollisionFrames ... 102
5.2.2.1.4 aMultipleCollisionFrames ... 102
5.2.2.1.5 aFramesReceivedOK ... 103
5.2.2.1.6 aFrameCheckSequenceErrors ... 103
5.2.2.1.7 aAlignmentErrors ... 103
5.2.2.1.8 aOctetsTransmittedOK ... 103
5.2.2.1.9 aFramesWithDeferredXmissions ... 104
5.2.2.1.10 aLateCollisions ... 104
5.2.2.1.11 aFramesAbortedDueToXSColls ... 104
5.2.2.1.12 aFramesLostDueToIntMACXmitError ... 104
5.2.2.1.13 aCarrierSenseErrors ... 105
5.2.2.1.14 aOctetsReceivedOK ... 105
5.2.2.1.15 aFramesLostDueToIntMACRcvError ... 105
5.2.2.1.16 aPromiscuousStatus ... 105
5.2.2.1.17 aReadMulticastAddressList ... 106
5.2.2.1.18 aMulticastFramesXmittedOK ... 106
5.2.2.1.19 aBroadcastFramesXmittedOK ... 106
5.2.2.1.20 aFramesWithExcessiveDeferral ... 106
5.2.2.1.21 aMulticastFramesReceivedOK ... 107
5.2.2.1.22 aBroadcastFramesReceivedOK ... 107
5.2.2.1.23 aInRangeLengthErrors ... 107
5.2.2.1.24 aOutOfRangeLengthField ... 107
5.2.2.1.25 aFrameTooLongErrors ... 108
5.2.2.1.26 aMACEnableStatus ... 108
5.2.2.1.27 aTransmitEnableStatus ... 108
5.2.2.1.28 aMulticastReceiveStatus ... 108
5.2.2.1.29 aReadWriteMACAddress ... 109
5.2.2.1.30 aCollisionFrames ... 109
5.2.2.2 DTE MAC Sublayer actions ... 109
5.2.2.2.1 acInitializeMAC ... 109
5.2.2.2.2 acAddGroupAddress ... 109
5.2.2.2.3 acDeleteGroupAddress ... 110
5.2.2.2.4 acExecuteSelfTest ... 110
5.2.2.3 ResourceTypeID Managed Object Class ... 110

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5.2.2.3.1 ResourceTypeID 110
5.2.3 DTE Physical Sublayer Management facilities 110
5.2.3.1 DTE Physical Sublayer attributes 110
5.2.3.1.1 aPHYID 110
5.2.3.1.2 aSQETestErrors 110
5.2.4 DTE Management procedural model 111
5.2.4.1 Common constants and types 111
5.2.4.2 Transmit variables and procedures 111
5.2.4.3 Receive variables and procedures 113
5.2.4.4 Common procedures 115

6. Physical Signaling (PLS) service specifications 117

6.1 Scope and field of application 117
6.2 Overview of the service 117
6.2.1 General description of services provided by the layer 117
6.2.2 Model used for the service specification 117
6.2.3 Overview of interactions 117
6.2.4 Basic services and options 118
6.3 Detailed service specification 118
6.3.1 Peer-to-peer service primitives 118
6.3.1.1 PLS_DATA.request 118
6.3.1.1.1 Function 118
6.3.1.1.2 Semantics of the service primitive 118
6.3.1.1.3 When generated 118
6.3.1.1.4 Effect of receipt 118
6.3.1.2 PLS_DATA.indication 119
6.3.1.2.1 Function 119
6.3.1.2.2 Semantics of the service primitive 119
6.3.1.2.3 When generated 119
6.3.1.2.4 Effect of receipt 119
6.3.2 Sublayer-to-sublayer service primitives 119
6.3.2.1 PLS_CARRIER.indication 119
6.3.2.1.1 Function 119
6.3.2.1.2 Semantics of the service primitive 119
6.3.2.1.3 When generated 119
6.3.2.1.4 Effect of receipt 119
6.3.2.2 PLS_SIGNAL.indication 120
6.3.2.2.1 Function 120
6.3.2.2.2 Semantics of the service primitive 120
6.3.2.2.3 When generated 120
6.3.2.2.4 Effect of receipt 120
6.3.2.3 PLS_DATA_VALID.indication 120
6.3.2.3.1 Function 120
6.3.2.3.2 Semantics of the service primitive 120
6.3.2.3.3 When generated 120
6.3.2.3.4 Effect of receipt 120

7. Physical Signaling (PLS) and Attachment Unit Interface (AUI) specifications 121

7.1 Scope 121
7.1.1 Definitions 121
7.1.2 Summary of major concepts 121
7.1.3 Application 122

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7.1.4 Modes of operation 122
7.1.5 Allocation of function 122
7.2 Functional specification 122
7.2.1 PLS–PMA (DTE–MAU) Interface protocol 122
7.2.1.1 PLS to PMA messages 123
7.2.1.1.1 output message 123
7.2.1.1.2 output_idle message 124
7.2.1.1.3 normal message 124
7.2.1.1.4 isolate message (optional) 124
7.2.1.1.5 mau_request message (optional) 124
7.2.1.2 PMA to PLS interface 126
7.2.1.2.1 input message 126
7.2.1.2.2 input_idle message 128
7.2.1.2.3 signal_quality_error message 128
7.2.1.2.4 mau_available message 128
7.2.1.2.5 mau_not_available message (optional) 128
7.2.2 PLS interface to MAC and management entities 129
7.2.2.1 PLS–MAC interface 129
7.2.2.1.1 OUTPUT_UNIT 129
7.2.2.1.2 OUTPUT_STATUS 129
7.2.2.1.3 INPUT_UNIT 129
7.2.2.1.4 CARRIER_STATUS 129
7.2.2.1.5 SIGNAL_STATUS 130
7.2.2.1.6 DATA_VALID_STATUS 130
7.2.2.2 PLS–management entity interface 130
7.2.2.2.1 RESET_REQUEST 130
7.2.2.2.2 RESET_RESPONSE 131
7.2.2.2.3 MODE_CONTROL 131
7.2.2.2.4 SQE_TEST 131
7.2.3 Frame structure 131
7.2.3.1 Silence 132
7.2.3.2 Preamble 132
7.2.3.3 Start of Frame Delimiter (SFD) 132
7.2.3.4 Data 132
7.2.3.5 End of transmission delimiter 132
7.2.4 PLS functions 132
7.2.4.1 Reset and Identify function 133
7.2.4.2 Mode function 133
7.2.4.3 Output function 134
7.2.4.4 Input function 134
7.2.4.5 Error Sense function 134
7.2.4.6 Carrier Sense function 135
7.3 Signal characteristics 135
7.3.1 Signal encoding 135
7.3.1.1 Data encoding 135
7.3.1.2 Control encoding 139
7.3.2 Signaling rate 140
7.3.3 Signaling levels 140
7.4 Electrical characteristics 140
7.4.1 Driver characteristics 140
7.4.1.1 Differential output voltage, loaded 140
7.4.1.2 Requirements after idle 142
7.4.1.3 AC common-mode output voltage 142
7.4.1.4 Differential output voltage, open circuit 142

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7.4.1.5 DC common-mode output voltage ... 142
7.4.1.6 Fault tolerance ... 143
7.4.2 Receiver characteristics ... 143
7.4.2.1 Receiver threshold levels ... 143
7.4.2.2 AC differential input impedance ... 144
7.4.2.3 AC common-mode range ... 144
7.4.2.4 Total common-mode range ... 144
7.4.2.5 Idle input behavior ... 145
7.4.2.6 Fault tolerance ... 145
7.4.3 AUI cable characteristics ... 145
7.4.3.1 Conductor size ... 146
7.4.3.2 Pair-to-pair balanced crosstalk ... 146
7.4.3.3 Differential characteristic impedance ... 146
7.4.3.4 Transfer impedance ... 146
7.4.3.5 Attenuation ... 146
7.4.3.6 Timing jitter ... 146
7.4.3.7 Delay ... 146
7.5 Functional description of interchange circuits ... 147
7.5.1 General ... 147
7.5.2 Definition of interchange circuits ... 147
7.5.2.1 Circuit DO–Data Out ... 148
7.5.2.2 Circuit DI–Data In ... 148
7.5.2.3 Circuit CO–Control Out (optional) ... 148
7.5.2.4 Circuit CI–Control In ... 148
7.5.2.5 Circuit VP–Voltage Plus ... 149
7.5.2.6 Circuit VC–Voltage Common ... 149
7.5.2.7 Circuit PG–Protective Ground ... 149
7.5.2.8 Circuit shield terminations ... 149
7.6 Mechanical characteristics ... 149
7.6.1 Definition of mechanical interface ... 149
7.6.2 Line interface connector ... 149
7.6.3 Contact assignments ... 150

8. Medium Attachment Unit and baseband medium specifications, type 10BASE5 ... 153

8.1 Scope ... 153
8.1.1 Overview ... 153
8.1.1.1 Medium Attachment Unit ... 153
8.1.1.2 Repeater unit ... 154
8.1.2 Definitions ... 154
8.1.3 Application perspective: MAU and MEDIUM objectives ... 154
8.1.3.1 Object ... 154
8.1.3.2 Compatibility considerations ... 154
8.1.3.3 Relationship to PLS and AU interface ... 155
8.1.3.4 Modes of operation ... 155
8.2 MAU functional specifications ... 155
8.2.1 MAU Physical Layer functions ... 155
8.2.1.1 Transmit function requirements ... 155
8.2.1.2 Receive function requirements ... 156
8.2.1.3 Collision Presence function requirements ... 157
8.2.1.4 Monitor function requirements (optional) ... 157
8.2.1.5 Jabber function requirements ... 158
8.2.2 MAU interface messages ... 158
8.2.2.1 DTE Physical Layer to MAU Physical Layer messages ... 158

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8.2.2.2 MAU Physical Layer to DTE Physical Layer 159
8.2.2.2.1 input message 159
8.2.2.2.2 input_idle message 159
8.2.2.2.3 mau_available message 159
8.2.2.2.4 signal_quality_error message 159
8.2.3 MAU state diagrams 160
8.3 MAU–medium electrical characteristics 160
8.3.1 MAU-to-coaxial cable interface 160
8.3.1.1 Input impedance 160
8.3.1.2 Bias current 161
8.3.1.3 Coaxial cable signaling levels 161
8.3.1.4 Transmit output levels symmetry 167
8.3.1.5 Collision detect thresholds 167
8.3.2 MAU electrical characteristics 167
8.3.2.1 Electrical isolation 167
8.3.2.2 Power consumption 168
8.3.2.3 Reliability 168
8.3.3 MAU–DTE electrical characteristics 168
8.3.4 MAU–DTE mechanical connection 168
8.4 Characteristics of the coaxial cable 168
8.4.1 Coaxial cable electrical parameters 168
8.4.1.1 Characteristic impedance 168
8.4.1.2 Attenuation 168
8.4.1.3 Velocity of propagation 169
8.4.1.4 Edge jitter, untapped cable 169
8.4.1.5 Transfer impedance 169
8.4.1.6 Cable dc loop resistance 169
8.4.2 Coaxial cable properties 170
8.4.2.1 Mechanical requirements 170
8.4.2.1.1 General construction 170
8.4.2.1.2 Center conductor 170
8.4.2.1.3 Dielectric material 170
8.4.2.1.4 Shielding system 170
8.4.2.1.5 Overall jacket 170
8.4.2.2 Jacket marking 171
8.4.3 Total segment dc loop resistance 171
8.5 Coaxial trunk cable connectors 171
8.5.1 Inline coaxial extension connector 171
8.5.2 Coaxial cable terminator 172
8.5.2.1 Termination 172
8.5.2.2 Earthing 172
8.5.3 MAU-to-coaxial cable connection 172
8.5.3.1 Electrical requirements 172
8.5.3.2 Mechanical requirements 173
8.5.3.2.1 Connector housing 173
8.5.3.2.2 Contact reliability 173
8.5.3.2.3 Shield probe characteristics 174
8.6 System considerations 174
8.6.1 Transmission system model 174
8.6.2 Transmission system requirements 175
8.6.2.1 Cable sectioning 175
8.6.2.2 MAU placement 175
8.6.2.3 Trunk cable system grounding 175
8.6.3 Labeling 176

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8.7 Environmental specifications ... 176
8.7.1 General safety requirements ... 176
8.7.2 Network safety requirements ... 176
8.7.2.1 Installations ... 176
8.7.2.2 Grounding ... 177
8.7.2.3 Safety ... 177
8.7.2.4 Breakdown path ... 177
8.7.2.5 Isolation boundary ... 177
8.7.2.6 Installation and maintenance guidelines ... 177
8.7.3 Electromagnetic environment ... 178
8.7.3.1 Susceptibility levels ... 178
8.7.3.2 Emission levels ... 178
8.7.4 Temperature and humidity ... 178
8.7.5 Regulatory requirements ... 178
8.8 Protocol implementation conformance statement (PICS) proforma for Clause 8, Medium Attachment Unit and baseband medium specifications, type 10BASE5 ... 179
8.8.1 Overview ... 179
8.8.2 Abbreviations and special symbols ... 179
8.8.2.1 Status symbols ... 179
8.8.2.2 Abbreviations ... 179
8.8.3 Instructions for completing the PICS proforma ... 179
8.8.3.1 General structure of the PICS proforma ... 179
8.8.3.2 Additional information ... 180
8.8.3.3 Exception information ... 180
8.8.3.4 Conditional items ... 180
8.8.4 Identification ... 181
8.8.4.1 Implementation identification ... 181
8.8.4.2 Protocol summary ... 181
8.8.5 Global statement of conformance ... 181
8.8.6 PICS proforma tables for MAU ... 182
8.8.6.1 MAU compatibility ... 182
8.8.6.2 Transmit function ... 182
8.8.6.3 Receive function ... 183
8.8.6.4 Collision function ... 184
8.8.6.5 Monitor function ... 184
8.8.6.6 Jabber function ... 185
8.8.6.7 MAU to coaxial cable interface ... 186
8.8.6.8 MAU electrical characteristics ... 187
8.8.6.9 MAU-DTE requirements ... 187
8.8.6.10 MAU to coaxial cable connection ... 188
8.8.6.11 Safety requirements ... 188
8.8.7 PICS proforma tables for MAU AUI characteristics ... 189
8.8.7.1 Signal characteristics ... 189
8.8.7.2 DI and CI driver characteristics ... 189
8.8.7.3 DO receiver characteristics ... 190
8.8.7.4 CO receiver characteristics ... 191
8.8.7.5 Circuit termination ... 191
8.8.7.6 Mechanical characteristics ... 192
8.8.8 PICS proforma tables for 10BASE5 coaxial cable ... 193
8.8.8.1 10BASE5 coaxial cable characteristics ... 193

9. Repeater unit for 10 Mb/s baseband networks ... 195

9.1 Overview ... 195

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9.2 References ... 196
9.3 Definitions ... 196
9.4 Compatibility interface ... 196
9.4.1 AUI compatibility ... 196
9.4.2 Mixing segment compatibility ... 196
9.4.2.1 Direct coaxial cable attachment compatibility ... 196
9.4.2.2 “N” connector compatibility ... 196
9.4.2.3 BNC compatibility ... 196
9.4.2.4 BFOC/2.5 (10BASE-FP) compatibility ... 196
9.4.3 Link segment compatibility ... 197
9.4.3.1 Vendor-dependent IRL ... 197
9.4.3.2 Fiber optic FOIRL compatibility ... 197
9.4.3.3 Twisted-pair jack compatibility ... 197
9.4.3.4 Fiber optic 10BASE-FB and 10BASE-FL compatibility ... 197
9.5 Basic functions ... 197
9.5.1 Repeater set network properties ... 197
9.5.2 Signal amplification ... 197
9.5.3 Signal symmetry ... 197
9.5.4 Signal retiming ... 198
9.5.5 Data handling ... 198
9.5.5.1 Start-of-packet propagation delays ... 198
9.5.5.2 Start-of-packet variability ... 198
9.5.6 Collision handling ... 199
9.5.6.1 Collision presence ... 199
9.5.6.2 Jam generation ... 199
9.5.6.3 Collision-jam propagation delays ... 199
9.5.6.4 Transmit recovery time ... 200
9.5.6.5 Carrier recovery time ... 200
9.5.7 Electrical isolation ... 200
9.6 Detailed repeater functions and state diagrams ... 201
9.6.1 State diagram notation ... 201
9.6.2 Data and collision handling ... 204
9.6.3 Preamble regeneration ... 204
9.6.4 Fragment extension ... 204
9.6.5 MAU Jabber Lockup Protection ... 205
9.6.6 Auto-Partitioning/Reconnection (optional) ... 205
9.6.6.1 Overview ... 205
9.6.6.2 Detailed auto-partition/reconnection algorithm state diagram ... 205
9.7 Electrical isolation ... 208
9.7.1 Environment A requirements ... 208
9.7.2 Environment B requirements ... 208
9.8 Reliability ... 208
9.9 Medium attachment unit and baseband medium specification for a vendor-independent FOIRL ... 209
9.9.1 Scope ... 209
9.9.1.1 Overview ... 209
9.9.1.2 Application perspective: FOMAU and medium objectives ... 211
9.9.1.3 Compatibility considerations ... 211
9.9.1.4 Relationship to AUI ... 211
9.9.1.5 Mode of operation ... 211
9.9.2 FOMAU functional specifications ... 211
9.9.2.1 Transmit function requirements ... 212
9.9.2.2 Receive function requirements ... 213
9.9.2.3 Collision Presence function requirements ... 213

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9.9.2.4 Jabber function requirements ... 214
9.9.2.5 Low Light Level Detection function requirements ... 214
9.9.2.6 Repeater Unit to FOMAU Physical Layer messages ... 215
9.9.2.7 FOMAU Physical Layer to repeater unit messages ... 215
9.9.2.7.1 input message ... 215
9.9.2.7.2 input_idle message ... 215
9.9.2.7.3 fomau_available message ... 215
9.9.2.7.4 signal_quality_error message ... 215
9.9.2.8 FOMAU state diagrams ... 216
9.9.3 FOMAU electrical characteristics ... 217
9.9.3.1 Electrical isolation ... 217
9.9.3.2 Power consumption ... 217
9.9.3.3 Reliability ... 218
9.9.3.4 FOMAU/Repeater unit electrical characteristics ... 218
9.9.3.5 FOMAU/Repeater unit mechanical connection ... 218
9.9.4 FOMAU/Optical medium interface ... 218
9.9.4.1 Transmit optical parameters ... 218
9.9.4.1.1 Wavelength ... 218
9.9.4.1.2 Spectral width ... 218
9.9.4.1.3 Optical modulation ... 218
9.9.4.1.4 Optical idle signal ... 218
9.9.4.1.5 Transmit optical logic polarity ... 218
9.9.4.1.6 Optical rise and fall times ... 220
9.9.4.1.7 Transmit optical pulse edge jitter ... 220
9.9.4.1.8 Peak coupled optical power ... 221
9.9.4.2 Receive optical parameters ... 221
9.9.4.2.1 Receive peak optical power range ... 221
9.9.4.2.2 Receive optical pulse edge jitter ... 221
9.9.4.2.3 Receive optical logic polarity ... 221
9.9.5 Characteristics of the optical fiber cable link segment ... 221
9.9.5.1 Optical fiber medium ... 222
9.9.5.2 Optical medium connector plug and socket ... 222
9.9.6 System requirements ... 222
9.9.6.1 Optical transmission system considerations ... 222
9.9.6.2 Timing considerations ... 223
9.9.7 Environmental specifications ... 224
9.9.7.1 Safety requirements ... 224
9.9.7.1.1 Electrical safety ... 224
9.9.7.1.2 Optical source safety ... 224
9.9.7.2 Electromagnetic environment ... 224
9.9.7.2.1 Susceptibility levels ... 224
9.9.7.2.2 Emission levels ... 224
9.9.7.3 Temperature and humidity ... 225

10. Medium attachment unit and baseband medium specifications, type 10BASE2 ... 227

10.1 Scope ... 227
10.1.1 Overview ... 227
10.1.1.1 Medium attachment unit (normally contained within the data terminal equipment [DTE]) ... 228
10.1.1.2 Repeater unit ... 228
10.1.2 Definitions ... 228
10.1.3 Application perspective: MAU and medium objectives ... 228
10.1.3.1 Object ... 228

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10.1.3.2 Compatibility considerations ... 229
10.1.3.3 Relationship to PLS and AUI ... 229
10.1.3.4 Mode of operation ... 229
10.2 References ... 229
10.3 MAU functional specifications ... 229
10.3.1 MAU Physical Layer functional requirements ... 230
10.3.1.1 Transmit function requirements ... 230
10.3.1.2 Receive function requirements ... 231
10.3.1.3 Collision Presence function requirements ... 231
10.3.1.4 Jabber functional requirements ... 232
10.3.2 MAU interface messages ... 232
10.3.2.1 DTE to MAU messages ... 232
10.3.2.2 MAU to DTE messages ... 232
10.3.2.2.1 input message ... 234
10.3.2.2.2 input_idle message ... 234
10.3.2.2.3 mau_available message ... 234
10.3.2.2.4 signal_quality_error (SQE) message ... 234
10.3.3 MAU state diagrams ... 234
10.4 MAU–medium electrical characteristics ... 235
10.4.1 MAU-to-coaxial cable interface ... 235
10.4.1.1 Input impedance ... 235
10.4.1.2 Bias current ... 235
10.4.1.3 Coaxial cable signaling levels ... 235
10.4.1.4 Transmit output levels symmetry ... 237
10.4.1.5 Collision detect thresholds ... 237
10.4.2 MAU electrical characteristics ... 237
10.4.2.1 Electrical isolation ... 237
10.4.2.2 Power consumption ... 237
10.4.2.3 Reliability ... 238
10.4.3 MAU–DTE electrical characteristics ... 238
10.5 Characteristics of coaxial cable system ... 238
10.5.1 Coaxial cable electrical parameters ... 238
10.5.1.1 Characteristic impedance ... 238
10.5.1.2 Attenuation ... 238
10.5.1.3 Velocity of propagation ... 238
10.5.1.4 Edge jitter; entire segment without DTEs attached ... 238
10.5.1.5 Transfer impedance ... 239
10.5.1.6 Cable dc loop resistance ... 239
10.5.2 Coaxial cable physical parameters ... 239
10.5.2.1 Mechanical requirements ... 239
10.5.2.1.1 General construction ... 240
10.5.2.1.2 Center conductor ... 240
10.5.2.1.3 Dielectric material ... 240
10.5.2.1.4 Shielding system ... 240
10.5.2.1.5 Overall jacket ... 240
10.5.2.2 Jacket marking ... 240
10.5.3 Total segment dc loop resistance ... 240
10.6 Coaxial trunk cable connectors ... 241
10.6.1 In-line coaxial extension connector ... 241
10.6.2 Coaxial cable terminator ... 242
10.6.3 MAU-to-coaxial cable connection ... 242
10.7 System considerations ... 242
10.7.1 Transmission system model ... 242
10.7.2 Transmission system requirements ... 244

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10.7.2.1 Cable sectioning 244
10.7.2.2 MAU placement 244
10.7.2.3 Trunk cable system earthing 244
10.7.2.4 Static discharge path 244
10.7.2.4.1 Installation environment 244
10.8 Environmental specifications 245
10.8.1 Safety requirements 245
10.8.1.1 Installations 245
10.8.1.2 Earthing 245
10.8.2 Electromagnetic environment 245
10.8.2.1 Susceptibility levels 245
10.8.2.2 Emission levels 245
10.8.3 Regulatory requirements 245

11. Broadband medium attachment unit and broadband medium specifications, type 10BROAD36 247

11.1 Scope 247
11.1.1 Overview 247
11.1.2 Definitions 249
11.1.3 MAU and medium objectives 249
11.1.4 Compatibility considerations 250
11.1.5 Relationship to PLS and AUI 250
11.1.6 Mode of operation 250
11.2 MAU functional specifications 250
11.2.1 MAU functional requirements 250
11.2.1.1 Transmit function requirements 250
11.2.1.2 Receive function requirements 251
11.2.1.3 Collision Detection function requirements 251
11.2.1.3.1 Collision enforcement transmitter requirements 252
11.2.1.3.2 Collision enforcement detection requirements 252
11.2.1.4 Jabber function requirements 252
11.2.2 DTE PLS to MAU and MAU to DTE PLS messages 253
11.2.2.1 DTE Physical Layer to MAU Physical Layer messages 253
11.2.2.2 MAU Physical Layer to DTE Physical Layer messages 253
11.2.2.2.1 input message 253
11.2.2.2.2 input_idle message 253
11.2.2.2.3 mau_available message 253
11.2.2.3 signal_quality_error message 253
11.2.3 MAU state diagrams 254
11.2.3.1 MAU state diagram messages 254
11.2.3.2 MAU state diagram signal names 254
11.3 MAU characteristics 257
11.3.1 MAU-to-coaxial cable interface 257
11.3.1.1 Receive interface 257
11.3.1.1.1 Receive input impedance 257
11.3.1.1.2 Receiver squelch requirements 257
11.3.1.1.3 Receive level requirements 258
11.3.1.1.4 Receiver selectivity and linearity requirements 258
11.3.1.1.5 Receive input mechanical requirements 258
11.3.1.2 Transmit interface 258
11.3.1.2.1 Transmit output impedance 258
11.3.1.2.2 Transmitted RF packet format 258
11.3.1.2.3 Transmit spectrum and group delay characteristics 259
11.3.1.2.4 Transmit out-of-band spectrum 261

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11.3.1.2.5 Transmit level requirements 261
11.3.1.2.6 Nontransmitting signal leakage requirement 261
11.3.1.2.7 Transmit spurious output requirement 261
11.3.1.2.8 Collision enforcement signal leakage requirement 262
11.3.1.2.9 Transmit output mechanical requirements 262
11.3.2 MAU frequency allocations 262
11.3.2.1 Single-cable systems frequency allocations 262
11.3.2.2 Dual-cable systems frequency allocations 263
11.3.3 AUI electrical characteristics 263
11.3.3.1 Electrical isolation requirements 263
11.3.3.2 Current consumption 263
11.3.3.3 Driver and receiver requirements 264
11.3.3.4 AUI mechanical connection 264
11.3.4 MAU transfer characteristics 264
11.3.4.1 AUI to coaxial cable framing characteristics 264
11.3.4.1.1 Scrambler and differential encoding requirements 265
11.3.4.2 Coaxial cable to AUI framing characteristics 266
11.3.4.3 Circuit DO to circuit DI framing characteristics 267
11.3.4.4 AUI to coaxial cable delay characteristics 267
11.3.4.4.1 Circuit DO to RF data signal delay 267
11.3.4.4.2 Circuit DO to CE RF output delay 267
11.3.4.4.3 Transmit postamble to SQE test signal delay 267
11.3.4.4.4 SQE test signal length 267
11.3.4.5 Coaxial cable to AUI delay characteristics 267
11.3.4.5.1 Received RF to circuit DI delay 268
11.3.4.5.2 Received RF to CE RF output and circuit CI delay 268
11.3.4.5.3 Collision enforcement to circuit CI delay 268
11.3.4.5.4 Receive data to SQE test delay 268
11.3.4.6 Delay from circuit DO to circuit DI 269
11.3.4.7 Interpacket gap requirement 270
11.3.4.8 Bit error ratio 270
11.3.5 Reliability 270
11.4 System considerations 271
11.4.1 Delay budget and network diameter 271
11.4.2 MAU operation with packets shorter than 512 bits 271
11.5 Characteristics of the coaxial cable system 272
11.5.1 Electrical requirements 272
11.5.2 Mechanical requirements 272
11.5.3 Delay requirements 272
11.6 Frequency translator requirements for the single-cable version 273
11.6.1 Electrical requirements 273
11.6.2 Mechanical requirements 273
11.7 Environmental specifications 273
11.7.1 Safety requirements 273
11.7.2 Electromagnetic environment 274
11.7.2.1 Susceptibility levels 274
11.7.2.2 Emission levels 274
11.7.3 Temperature and humidity 274

12. Physical signaling, medium attachment, and baseband medium specifications, type 1BASE5 275

12.1 Introduction 275
12.1.1 Overview 275

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12.1.2 Scope ... 275
12.1.3 Definitions ... 275
12.1.4 General characteristics ... 275
12.1.5 Compatibility ... 276
12.1.6 Objectives of type 1BASE5 specification ... 276
12.2 Architecture ... 276
12.2.1 Major concepts ... 276
12.2.2 Application perspective ... 277
12.2.3 Packet structure ... 277
12.2.3.1 Silence ... 278
12.2.3.2 Preamble ... 278
12.2.3.3 Start-of-frame delimiter ... 279
12.2.3.4 Data ... 279
12.2.3.5 End-of-transmission delimiter ... 279
12.3 DTE physical signaling (PLS) specification ... 280
12.3.1 Overview ... 280
12.3.1.1 Summary of major concepts ... 280
12.3.1.2 Application perspective ... 280
12.3.2 Functional specification ... 281
12.3.2.1 PLS-PMA interface ... 281
12.3.2.1.1 output message ... 281
12.3.2.1.2 output_idle message ... 281
12.3.2.1.3 input message ... 281
12.3.2.1.4 input_idle message ... 281
12.3.2.2 PLS-MAC interface ... 282
12.3.2.2.1 OUTPUT_UNIT ... 282
12.3.2.2.2 OUTPUT_STATUS ... 282
12.3.2.2.3 INPUT_UNIT ... 282
12.3.2.2.4 CARRIER_STATUS ... 282
12.3.2.2.5 SIGNAL_STATUS ... 282
12.3.2.3 PLS functions ... 283
12.3.2.3.1 State diagram variables ... 283
12.3.2.3.2 Output function ... 283
12.3.2.3.3 Input function ... 284
12.3.2.3.4 Error Sense function ... 284
12.3.2.3.5 Carrier Sense function ... 285
12.3.2.4 Signal encoding ... 285
12.3.2.4.1 Data transmission rate ... 285
12.3.2.4.2 Data symbol encoding ... 285
12.3.2.4.3 Collision presence encoding ... 285
12.3.2.4.4 Idle line encoding ... 286
12.4 Hub specification ... 287
12.4.1 Overview ... 287
12.4.1.1 Summary of major concepts ... 288
12.4.1.2 Application perspective ... 288
12.4.2 Hub structure ... 288
12.4.2.1 Upward side ... 288
12.4.2.2 Downward side ... 288
12.4.3 Hub PLS functional specification ... 289
12.4.3.1 Hub PLS to PMA interface ... 289
12.4.3.2 Hub PLS functions ... 289
12.4.3.2.1 State diagram variables ... 289
12.4.3.2.2 Upward Signal Transfer function ... 290
12.4.3.2.3 Jabber function ... 290

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12.4.3.2.4 Downward Signal Transfer function ... 291
12.4.3.2.5 Retiming (jitter removal) ... 293
12.4.3.2.6 Header hub wrap-around ... 293
12.4.3.2.7 Collision presence startup ... 293
12.4.3.3 Reliability ... 294
12.5 Physical medium attachment (PMA) specification ... 294
12.5.1 Overview ... 294
12.5.2 PLS–PMA interface ... 294
12.5.3 Signal characteristics ... 295
12.5.3.1 Transmitter characteristics ... 295
12.5.3.1.1 Differential output voltage ... 295
12.5.3.1.2 Output timing jitter ... 298
12.5.3.1.3 Transmitter impedance balance ... 298
12.5.3.1.4 Common-mode output voltage ... 299
12.5.3.1.5 Common-mode tolerance ... 299
12.5.3.1.6 Transmitter fault tolerance ... 300
12.5.3.2 Receiver characteristics ... 300
12.5.3.2.1 Differential input voltage ... 300
12.5.3.2.2 Input timing jitter ... 300
12.5.3.2.3 Idle input behavior ... 300
12.5.3.2.4 Differential input impedance ... 301
12.5.3.2.5 Common-mode rejection ... 301
12.5.3.2.6 Noise immunity ... 302
12.5.3.2.7 Receiver fault tolerance ... 302
12.6 Medium Dependent Interface (MDI) specification ... 302
12.6.1 Line interface connector ... 302
12.6.2 Connector contact assignments ... 303
12.6.3 Labeling ... 303
12.7 Cable medium characteristics ... 304
12.7.1 Overview ... 304
12.7.2 Transmission parameters ... 304
12.7.2.1 Attenuation ... 304
12.7.2.2 Differential characteristic impedance ... 304
12.7.2.3 Medium timing jitter ... 304
12.7.2.4 Dispersion ... 305
12.7.3 Coupling parameters ... 305
12.7.3.1 Pair-to-pair crosstalk ... 305
12.7.3.2 Multiple-disturber crosstalk ... 305
12.7.3.3 Balance ... 306
12.7.4 Noise environment ... 306
12.7.4.1 Impulse noise ... 306
12.7.4.2 Crosstalk ... 307
12.8 Special link specification ... 307
12.8.1 Overview ... 307
12.8.2 Transmission characteristics ... 307
12.8.3 Permitted configurations ... 307
12.9 Timing ... 307
12.9.1 Overview ... 307
12.9.2 DTE timing ... 308
12.9.3 Medium timing ... 308
12.9.4 Special link timing ... 308
12.9.5 Hub timing ... 308
12.10 Safety ... 309
12.10.1 Isolation ... 309

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12.10.2 Telephony voltages 310

13. System considerations for multisegment 10 Mb/s baseband networks 311

13.1 Overview 311
13.1.1 Repeater usage 312
13.2 Definitions 312
13.3 Transmission System Model 1 312
13.4 Transmission System Model 2 319
13.4.1 Round-trip collision delay 319
13.4.1.1 Worst-case path delay value (PDV) selection 319
13.4.1.2 Worst-case PDV calculation 319
13.4.2 Interpacket gap (IPG) shrinkage 320
13.4.2.1 Worst-case path variability value (PVV) selection 321
13.4.2.2 Worst-case path variability value (PVV) calculation 321
13.5 Full duplex topology limitations 321

14. Twisted-pair medium attachment unit (MAU) and baseband medium, type 10BASE-T including type 10BASE-Te 323

14.1 Scope 323
14.1.1 Overview 323
14.1.1.1 Medium Attachment Unit (MAU) 323
14.1.1.2 Repeater unit 324
14.1.1.3 Twisted-pair media 324
14.1.2 Definitions 324
14.1.3 Application perspective 325
14.1.3.1 Objectives 325
14.1.3.2 Compatibility considerations 326
14.1.3.3 Modes of operation 326
14.1.4 Relationship to PLS and AUI 326
14.2 MAU functional specifications 326
14.2.1 MAU functions 327
14.2.1.1 Transmit function requirements 328
14.2.1.2 Receive function requirements 328
14.2.1.3 Loopback function requirements (half duplex mode only) 329
14.2.1.4 Collision Presence function requirements (half duplex mode only) 329
14.2.1.5 signal_quality_error Message (SQE) Test function requirements 329
14.2.1.6 Jabber function requirements 329
14.2.1.7 Link Integrity Test function requirements 330
14.2.1.8 Auto-Negotiation 331
14.2.2 PMA interface messages 331
14.2.2.1 PLS to PMA messages 331
14.2.2.1.1 PMA to PLS messages 331
14.2.2.2 PMA to twisted-pair link segment messages 332
14.2.2.3 Twisted-pair link segment to PMA messages 332
14.2.2.4 Interface message time references 332
14.2.3 MAU state diagrams 332
14.2.3.1 State diagram variables 332
14.2.3.2 State diagram timers 338
14.3 MAU electrical specifications 338
14.3.1 MAU-to-MDI interface characteristics 338
14.3.1.1 Isolation requirement 338
14.3.1.2 Transmitter specifications 339

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14.3.1.2.1 Differential output voltage 340
14.3.1.2.2 Transmitter differential output impedance 343
14.3.1.2.3 Output timing jitter 344
14.3.1.2.4 Transmitter impedance balance 344
14.3.1.2.5 Common-mode output voltage 344
14.3.1.2.6 Transmitter common-mode rejection 345
14.3.1.2.7 Transmitter fault tolerance 345
14.3.1.3 Receiver specifications 346
14.3.1.3.1 Receiver differential input signals 346
14.3.1.3.2 Receiver differential noise immunity 346
14.3.1.3.3 Idle input behavior 347
14.3.1.3.4 Receiver differential input impedance 347
14.3.1.3.5 Common-mode rejection 347
14.3.1.3.6 Receiver fault tolerance 347
14.3.2 MAU-to-AUI specification 347
14.3.2.1 MAU-AUI electrical characteristics 347
14.3.2.2 MAU–AUI mechanical connection 348
14.3.2.3 Power consumption 348
14.4 Characteristics of the simplex link segment 349
14.4.1 Overview 349
14.4.2 Transmission parameters 349
14.4.2.1 Insertion loss 349
14.4.2.2 Differential characteristic impedance 349
14.4.2.3 Medium timing jitter 349
14.4.2.4 Delay 350
14.4.3 Coupling parameters 350
14.4.3.1 Differential near-end crosstalk (NEXT) loss 350
14.4.3.1.1 Twenty-five-pair cable and twenty-five-pair binder groups 350
14.4.3.1.2 Four-pair cable 350
14.4.3.1.3 Other cables 350
14.4.3.2 Multiple-disturber NEXT (MDNEXT) loss 350
14.4.4 Noise environment 351
14.4.4.1 Impulse noise 351
14.4.4.2 Crosstalk noise 351
14.5 MDI specification 351
14.5.1 MDI connectors 351
14.5.2 Crossover function 352
14.6 System considerations 353
14.7 Environmental specifications 354
14.7.1 General safety 354
14.7.2 Network safety 354
14.7.2.1 Installation 354
14.7.2.2 Grounding 354
14.7.2.3 Installation and maintenance guidelines 354
14.7.2.4 Telephony voltages 354
14.7.3 Environment 355
14.7.3.1 Electromagnetic emission 355
14.7.3.2 Temperature and humidity 355
14.8 MAU labeling 355
14.9 Timing summary 356
14.10 Protocol implementation conformance statement (PICS) proforma for Clause 14, Twisted-pair medium attachment unit (MAU) and baseband medium, type 10BASE-T and type 10BASE-Te 357
14.10.1 Introduction 357

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Full document details: ISO/IEC/IEEE 8802-3-2014

14.10.1.1 Scope ... 357
14.10.1.2 Reference ... 357
14.10.1.3 Definitions ... 357
14.10.1.4 Conformance ... 357
14.10.2 Identification of implementation ... 358
14.10.2.1 Supplier information ... 358
14.10.2.2 Implementation information ... 358
14.10.3 Identification of the protocol ... 358
14.10.4 PICS proforma for 10BASE-T ... 359
14.10.4.1 Abbreviations ... 359
14.10.4.2 PICS Completion instructions and implementation statement ... 359
14.10.4.3 Additional information ... 359
14.10.4.4 References ... 359
14.10.4.5 PICS proforma tables for MAU ... 360
14.10.4.5.1 MAU functions ... 360
14.10.4.5.2 Transmit function ... 361
14.10.4.5.3 Receive function ... 361
14.10.4.5.4 Loopback function ... 362
14.10.4.5.5 Collision Detect function ... 362
14.10.4.5.6 signal_quality_error Message Test function ... 363
14.10.4.5.7 Jabber function ... 363
14.10.4.5.8 Link Integrity Test function ... 364
14.10.4.5.9 MAU state diagram requirements ... 365
14.10.4.5.10 AUI requirements ... 365
14.10.4.5.11 Isolation requirements ... 365
14.10.4.5.12 Transmitter specification ... 366
14.10.4.5.13 Receiver specification ... 367
14.10.4.5.14 MDI requirements ... 368
14.10.4.5.15 Safety requirements ... 368
14.10.4.6 PICS proforma tables for MAU AUI characteristics ... 369
14.10.4.6.1 Signal characteristics ... 369
14.10.4.6.2 DI and CI driver characteristics ... 369
14.10.4.6.3 DO receiver characteristics ... 370
14.10.4.6.4 Power consumption ... 370
14.10.4.6.5 Circuit termination ... 371
14.10.4.6.6 Mechanical characteristics ... 371
14.10.4.7 PICS proforma tables for 10BASE-T link segment ... 372
14.10.4.7.1 10BASE-T link segment characteristics ... 372
14.10.4.8 PICS proforma tables for Auto-Negotiation able MAUs ... 373

15. Fiber optic medium and common elements of medium attachment units and star, type 10BASE-F ... 375

15.1 Scope ... 375
15.1.1 Overview ... 375
15.1.1.1 Fiber optic medium attachment units (MAUs) ... 375
15.1.1.2 Fiber optic passive star ... 375
15.1.1.3 Repeater unit ... 376
15.1.2 Definitions ... 377
15.1.3 Applications perspective: MAUs, stars, and fiber optic medium ... 377
15.1.3.1 Objectives ... 377
15.1.3.2 Compatibility considerations ... 377
15.1.3.3 Relationship to PLS and AUI ... 378
15.1.3.4 Guidelines for implementation of systems ... 379

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15.1.3.5 Modes of operation 379
15.2 MDI optical characteristics 380
15.2.1 Transmit optical parameters 380
15.2.1.1 Center wavelength 380
15.2.1.2 Spectral width 380
15.2.1.3 Optical modulation extinction ratio 380
15.2.1.4 Optical Idle Signal amplitude 380
15.2.1.5 Optical transmit pulse logic polarity 380
15.2.1.6 Optical transmit pulse rise and fall times 380
15.2.1.7 Optical transmit pulse overshoot and undershoot 380
15.2.1.8 Optical transmit pulse edge jitter 380
15.2.1.9 Optical transmit pulse duty cycle distortion 382
15.2.1.10 Optical transmit average power range 382
15.2.1.11 Optical transmit signal templates 382
15.2.1.11.1 10BASE-FP optical transmit signal template 383
15.2.1.11.2 10BASE-FB optical transmit signal template 384
15.2.1.11.3 10BASE-FL Optical transmit signal template 386
15.2.2 Receive optical parameters 387
15.2.2.1 Optical receive average power range 387
15.2.2.2 Optical receive pulse edge jitter 387
15.2.2.3 Optical receive pulse logic polarity 388
15.2.2.4 Optical receive pulse rise and fall times 388
15.3 Characteristics of the fiber optic medium 388
15.3.1 Optical fiber and cable 388
15.3.1.1 Attenuation 388
15.3.1.2 Modal bandwidth 388
15.3.1.3 Propagation delay 388
15.3.2 Optical medium connector plug and socket 389
15.3.2.1 Optical connector insertion loss 389
15.3.2.2 Optical connector return loss 389
15.3.3 Fiber optic medium insertion loss 390
15.3.3.1 10BASE-FP segment insertion loss 390
15.3.3.2 10BASE-FB and 10BASE-FL segment insertion loss 390
15.3.4 Electrical isolation 390
15.4 MAU reliability 390
15.5 MAU–AUI specification 390
15.5.1 MAU–AUI electrical characteristics 390
15.5.2 MAU–AUI mechanical connections 391
15.5.3 Power consumption 391
15.5.4 MAU–AUI messages 391
15.5.4.1 PLS to PMA messages 391
15.5.4.2 PMA to PLS messages 391
15.5.4.2.1 signal_quality_error message 391
15.6 Environmental specifications 392
15.6.1 Safety requirements 392
15.6.2 Electromagnetic environment 392
15.6.3 Other environmental requirements 393
15.7 MAU labeling 393
15.7.1 10BASE-FP star labeling 393
15.8 Protocol implementation conformance statement (PICS) proforma for Clause 15, Fiber optic medium and common elements of medium attachment units and star, type 10BASE-F 394
15.8.1 Introduction 394
15.8.2 Abbreviations and special symbols 394

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15.8.2.1 Status symbols 394
15.8.2.2 Abbreviations 394
15.8.3 Instructions for completing the pics proforma 394
15.8.3.1 General structure of the PICS proforma 394
15.8.3.2 Additional information 395
15.8.3.3 Exception information 395
15.8.3.4 Conditional items 396
15.8.4 Identification 396
15.8.4.1 Implementation identification 396
15.8.4.2 Protocol summary 396
15.8.5 Major capabilities/options 397
15.8.6 PICS Proforma for the fiber optic medium 397
15.8.6.1 Characteristics of the fiber optic medium 397
15.8.6.2 Optical medium connector plug and socket 398
15.8.6.3 Fiber optic medium insertion loss 398
15.8.6.4 Electrical isolation requirements 398

16. Fiber optic passive star and medium attachment unit, type 10BASE-FP 399

16.1 Scope 399
16.1.1 Overview 399
16.1.1.1 10BASE-FP medium attachment unit 399
16.1.1.2 10BASE-FP Star 399
16.1.1.3 Repeater unit 399
16.2 PMA interface messages 400
16.2.1 PMA-to-MDI interface signal encodings 400
16.2.2 PMA-to-MDI OTD messages 400
16.2.2.1 OTD_output 400
16.2.2.2 *OTD_idle* *400*
16.2.2.3 *OTD_manch_violation* 401
16.2.3 MDI ORD-to-PMA messages 401
16.2.3.1 *ORD_input* 401
16.2.3.2 *ORD_idle* 402
16.2.3.3 *ORD_crv* 402
16.3 10BASE-FP MAU functional specifications 402
16.3.1 Transmit function requirements 402
16.3.1.1 Preamble encoding 403
16.3.1.1.1 Synchronization pattern 403
16.3.1.1.2 Packet header code rule violation 403
16.3.1.1.3 Unique word 403
16.3.1.2 Data transmit 403
16.3.1.3 Collision encoding (unique word jam) 404
16.3.2 Receive function requirements 404
16.3.2.1 Preamble reconstruction and alignment 404
16.3.2.2 Data receive 404
16.3.2.3 Signal presence during collision 404
16.3.3 Loopback function requirements 404
16.3.4 Collision presence function requirements 405
16.3.4.1 CI Circuit signaling 405
16.3.4.2 Collision detection 405
16.3.4.3 End of collision 406
16.3.5 signal_quality_error Message (SQE) Test function requirements 406
16.3.6 Jabber function requirements 406
16.3.7 Link fault detection and low light function requirements 407

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16.3.8 Interface message time references 408
16.3.9 MAU state diagram 408
16.3.9.1 MAU state diagram variables 408
16.3.9.2 MAU state diagram timers 410
16.3.9.3 MAU state diagram counters 411
16.4 Timing summary 416
16.5 10BASE-FP Star functional specifications 416
16.5.1 Star functions 416
16.5.1.1 Number of ports 416
16.5.1.2 Optical power division 416
16.5.1.3 Configuration 417
16.5.1.4 Reliability 417
16.5.2 Star optical characteristics 417
16.5.2.1 Star insertion loss 417
16.5.2.2 Star single output port uniformity 417
16.5.2.3 Star directivity 417
16.6 Protocol implementation conformance statement (PICS) proforma for Clause 16, Fiber optic passive star and medium attachment unit, type 10BASE-FP 418
16.6.1 Introduction 418
16.6.2 Abbreviations and special symbols 418
16.6.2.1 Status symbols 418
16.6.2.2 Abbreviations 418
16.6.3 Instructions for completing the PICS proforma 418
16.6.3.1 General structure of the PICS proforma 418
16.6.3.2 Additional information 419
16.6.3.3 Exception information 419
16.6.3.4 Conditional items 420
16.6.4 Identification 420
16.6.4.1 Implementation identification 420
16.6.4.2 Protocol summary 420
16.6.5 Major capabilities/options 421
16.6.6 PICS proforma for the type 10BASE-FP MAU 421
16.6.6.1 Compatibility considerations 421
16.6.6.2 Optical transmit parameters 422
16.6.6.3 Optical receive parameters 423
16.6.6.4 Optical medium connector plug and socket 423
16.6.6.5 MAU functions 423
16.6.6.6 PMA interface messages 423
16.6.6.7 PMA to MDI OTD messages 424
16.6.6.8 MDI ORD to PMA messages 424
16.6.6.9 Transmit functions 424
16.6.6.10 Collision Encoding (Unique Word Jam) function 425
16.6.6.11 Receive functions 425
16.6.6.12 Preamble reconstruction and alignment function 426
16.6.6.13 Data receive function 426
16.6.6.14 Signal presence during collision 426
16.6.6.15 Loopback function 427
16.6.6.16 Collision presence function 427
16.6.6.17 signal_quality_error Message (SQE) test function 428
16.6.6.18 Jabber function 428
16.6.6.19 Link Fault Detect function 428
16.6.6.20 MAU state diagram requirements 429
16.6.6.21 MAU-to-AUI signal characteristics 429
16.6.6.22 MAU-to-AUI DI and CI driver characteristics 429

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