INTERNATIONAL STANDARD

**ISO/IEC
8802-3**

IEEE
Std 802.3

Sixth edition
2000-12-15

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

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

Partie 3: Accès multiples par surveillance du signal et détection de collision (CSMA/CD) et spécifications pour la couche physique

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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

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Abstract: The media access control characteristics for the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method for shared medium local area networks are described. The control characteristics for full duplex dedicated channel use are also described. Specifications are provided for MAU types 1BASE5 at 1 Mb/s; Attachment Unit Interface (AUI) and MAU types 10BASE5, 10BASE2, FOIRL (fiber optic inter-repeater link), 10BROAD36, 10BASE-T, 10BASE-FL, 10BASE-FB, and 10BASE-FP at 10 Mb/s; Media Independent Interface (MII) and PHY types 100BASE-T4, 100BASE-TX, 100BASE-FX, and 100BASE-T2 at 100 Mb/s; and the Gigabit MII (GMII) and 1000BASE-X PHY types, 1000BASE-SX, 1000BASE-LX, and 1000BASE-CX, which operate at 1000 Mb/s (Gigabit Ethernet) as well as PHY type 1000BASE-T. Repeater specifications are provided at each speed. Full duplex specifications are provided at the Physical Layer for 10BASE-T, 10BASE-FL, 100BASE-TX, 100BASE-FX, 100BASE-T2, and Gigabit Ethernet. System considerations for multisegment networks at each speed and management information base (MIB) specifications and additions to support Virtual Bridged Local Area Networks (VLANs) as specified in IEEE P802.1Q are also provided. Also specified is an optional Link Aggregation sublayer which multiple physical links to be aggregated together to form a single logical link.

Keywords: Aggregated Link; Aggregator; Auto Negotiation; Category 5; copper; data processing; Ethernet; gigabit; information interchange, Link Aggregation; local area networks, management; MASTER-SLAVE; medium dependent interface; mode of data transmission; models; network interconnection; physical coding sublayer; Physical Layer; physical medium attachment; repeater; type field; VLAN TAG

International Standard ISO/IEC 8802-3:2000 (E)

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International Standard ISO/IEC 8802-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

This sixth edition cancels and replaces the fifth edition (ISO/IEC 8802-3:1996), which has been technically revised.

ISO/IEC 8802 consists of the following parts, under the general title *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements*:

⎯ *Part 1: Overview of Local Area Network Standards*

⎯ *Part 2: Logical link control*

⎯ *Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

⎯ *Part 4: Token-passing bus access method and physical layer specifications*

⎯ *Part 5: Token ring access method and physical layer specifications*

⎯ *Part 6: Distributed Queue Dual Bus (DQDB) access method and physical layer specifications*

⎯ *Part 9: Integrated Services (IS) LAN Interface at the Medium Access Control (MAC) and Physical (PHY) Layers*

⎯ *Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications*

⎯ *Part 12: Demand-Priority access method, physical layer and repeater specifications*

Annexes F to H, 23A, 27A to 28D, 30A to 31B and 43B form a normative part of this part of ISO/IEC 8802. Annexes A to E, 22A to 22C, 23B, 23C, 29A, 29B, 32A, 36A, 36B, 38A, 40A to 40C, 43A and 43C are for information only.

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Introduction to IEEE Std 802.3, 2000 Edition

This standard is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)

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┌──────────┬──────────────────┬──────────────┬──────────────────────────────────────────────────────────────────────┬──────────────┐
│          │                  │              │           802.2 LOGICAL LINK CONTROL                                   │              │
│ 802.10   │  802 OVERVIEW    │  802.1       ├──────────────────────────────────────────────────────────────────────┤ DATA         │
│ SECURITY │  & ARCHITECTURE* │  MANAGEMENT  │           802.1 BRIDGING                                               │ LINK         │
│          │                  │              │                                                                        │ LAYER        │
│          │                  │   ┌──────────┬──────────┬──────────┬──────────┬──────────┬──────────┐                 │
│          │                  │   │ 802.3    │ 802.4    │ 802.5    │ 802.6    │ 802.11   │ 802.12   │                 │
│          │                  │   │ MEDIUM   │ MEDIUM   │ MEDIUM   │ MEDIUM   │ MEDIUM   │ MEDIUM   │                 │
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│          │                  │   ├──────────┼──────────┼──────────┼──────────┼──────────┼──────────┤  PHYSICAL       │
│          │                  │   │ 802.3    │ 802.4    │ 802.5    │ 802.6    │ 802.11   │ 802.12   │  LAYER          │
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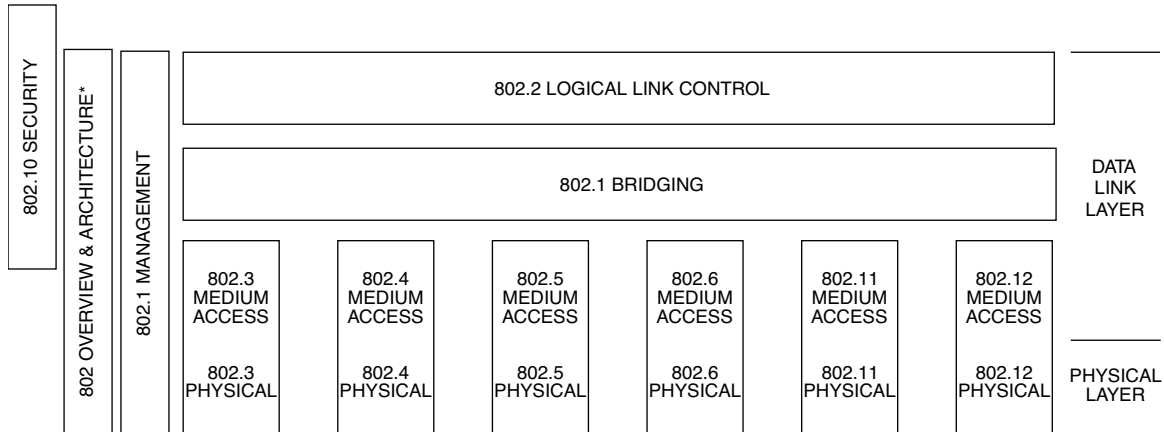
* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1: 1994). The access standards define seven types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The standards defining the technologies noted above are as follows:

- IEEE Std 802   *Overview and Architecture*. This standard provides an overview to the family of IEEE 802 Standards.

- ANSI/IEEE Std 802.1B   *LAN/MAN Management*. Defines an OSI management-compatible
  and 802.1k   architecture, and services and protocol elements for use in a LAN/MAN
  [ISO/IEC 15802-2]   environment for performing remote management.

- ANSI/IEEE Std 802.1D   *Media Access Control (MAC) Bridges*. Specifies an architecture and protocol
                         for the interconnection of IEEE 802 LANs below the MAC service boundary.

- ANSI/IEEE Std 802.1E   *System Load Protocol*. Specifies a set of services and protocol for those aspects
  [ISO/IEC 15802-4]   of management concerned with the loading of systems on IEEE 802 LANs.

- ANSI/IEEE Std 802.1F   *Common Definitions and Procedures for IEEE 802 Management Information*.

- ANSI/IEEE Std 802.1G   *Remote Media Access Control (MAC) Bridging*. Specifies extensions for the
  [ISO/IEC 15802-5]   interconnection, using non-LAN communication technologies, of geographically
                         separated IEEE 802 LANs below the level of the logical link control protocol.

- IEEE Std 802.1H   *Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area*
  [ISO/IEC TR 11802-5] *Networks*.

- ANSI/IEEE Std 802.2   *Logical Link Control*.
  [ISO/IEC 8802-2]

- ANSI/IEEE Std 802.3   *CSMA/CD Access Method and Physical Layer Specifications*.

- ANSI/IEEE Std 802.4 [ISO/IEC 8802-4]   *Token Passing Bus Access Method and Physical Layer Specifications.*

- ANSI/IEEE Std 802.5 [ISO/IEC 8802-5]   *Token Ring Access Method and Physical Layer Specifications.*

- ANSI/IEEE Std 802.6 [ISO/IEC 8802-6]   *Distributed Queue Dual Bus Access Method and Physical Layer Specifications.*

- ANSI/IEEE Std 802.10   *Interoperable LAN/MAN Security.*

- ANSI/IEEE Std 802.11 [ISO/IEC DIS 8802-11]   *Wireless LAN Medium Access Control (MAC) and Physical Layer Specifications.*

- ANSI/IEEE Std 802.12 [ISO/IEC 8802-12]   *Demand Priority Access Method, Physical Layer and Repeater Specifications.*

In addition to the family of standards, the following is a recommended practice for a common Physical Layer technology:

- IEEE Std 802.7   *IEEE Recommended Practice for Broadband Local Area Networks.*

Conformance test methodology

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An additional standard, 1802.3 provides conformance test information for 10BASE-T.

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IEEE Std 802.3, 2000 Edition

ISO/IEC 8802-3:2000

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated to this standard within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Details on the contents of this standard are provided on the following pages.

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Leonard Young
Nariman Yousefi
Ben Yu
Hong Yu
Mark Yu
Nick Zades
Jamie Zartman
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Mo R. Zonoun

Officers

The following individuals served as officers of IEEE 802.3 during the development of the standard:

ANSI/IEEE Std 802.3 document	Date approved by IEEE and ANSI	Officers at the time of working group ballot
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*
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*
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*
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*
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*
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*
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*
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)*
802.3j-1993 (Clauses 15–18), 10 Mb/s Fiber MAUs 10BASE-FP, FB, and 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*
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*
802.3l-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*
802.3m-1995, Maintenance 2	21 September 1995 (IEEE) 16 July 1996 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
802.3n-1995, Maintenance 3	21 September 1995 (IEEE) 4 April 1996 (ANSI)	**Patricia Thaler,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
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*
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*

ANSI/IEEE Std 802.3 document	Date approved by IEEE and ANSI	Officers at the time of working group ballot
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*
802.3s-1995, Maintenance 4	21 September 1995 (IEEE) 8 April 1996 (ANSI)	**Geoffrey O. Thompson,** *Working Group Chair* **Gary Robinson,** *Maintenance Chair*
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*
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,** *Editor-in-Chief (Phase 1)* **Howard Johnson,** *Editor-in-Chief (Phase 2)* **Colin Mick,** *Comment Editor*
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*
802.3x-1997 and 802.3y-1997 (Revisions to 802.3, Clauses 31 and 32), Full Duplex Operation and Type 100BASE-T2	20 March 1997 (IEEE) 5 September 1997 (ANSI)	**Geoffrey O. Thompson,** *Chair* **David J. Law,** *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)*
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,** *Chair* **David J. Law,** *Vice Chair* **Howard M. Frazier, Jr.,** *Task Force Chair and Editor* **Howard W. Johnson,** *Task Force Editor*
802.3aa-1998, Maintenance 5	25 June 1998 (IEEE)	**Geoffrey O. Thompson,** *Chair* **Colin Mick**, *Task Force Editor (100BASE-T Maintenance)*
802.3ac-1998, Frame Extensions for Virtual Bridged Local Area Network (VLAN) Tagging on 802.3 Networks	16 September 1998 (IEEE)	**Geoffrey O. Thompson,** *Chair* **David J. Law,** *Vice Chair* **Andy J. Luque,** *Secretary* **Ian Crayford,** *Task Force Chair* **Rich Seifert,** *Task Force Editor*
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 July 1999 (IEEE)	**Geoffrey O. Thompson,** *Chair* **David J. Law,** *Vice Chair* **Robert M. Grow,** *Secretary* **George Eisler**, *Task Force Chair* **Colin Mick**, *Task Force Editor*
802.3ad-2000 (Clause 43), Aggregation of Multiple Link Segments	30 March 2000 (IEEE)	**Geoffrey O. Thompson,** *Chair* **David J. Law,** *Vice Chair* **Robert M. Grow,** *Secretary* **Steven Haddock,** *Task Force Chair* **Tony Jeffree,** *Co-Editor* **Rich Seifert,** *CoEditor*

Catherine Berger was the IEEE Standards Project Editor who prepared this edition.