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**Information technology — Local and metropolitan  
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**Part 3:**  
Carrier sense multiple access with collision detection  
(CSMA/CD) access method and physical layer  
specifications

*Technologie de l'information — Réseaux locaux et métropolitains —*  
*Partie 3: Accès multiple par surveillance du signal et détection de collision et*  
*spécifications pour la couche physique*



Reference number  
ISO/IEC 8802-3:1993 (E)  
ANSI/IEEE  
Std 802.3, 1993 Edition

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July 8, 1993

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**International Standard ISO/IEC 8802-3 : 1993  
ANSI/IEEE Std 802.3, 1993 Edition**

(This edition contains ANSI/IEEE Std 802.3-1988,  
ANSI/IEEE Std 802.3c-1985, ANSI/IEEE Std 802.3d-1987,  
ANSI/IEEE Std 802.3b-1985, ANSI/IEEE Std 802.3e-1987,  
ANSI/IEEE Std 802.3h-1990, ANSI/IEEE Std 802.3i-1990, and  
corrections resulting from Maintenance Ballot #1)

**Information technology—  
Local and metropolitan area networks—  
Part 3:  
Carrier sense multiple access with  
collision detection (CSMA/CD)  
access method and  
physical layer specifications**

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**Abstract:** This Local and Metropolitan Area Network standard, ISO/IEC 8802-3 : 1993 [ANSI/IEEE Std 802.3, 1993 Edition], specifies the media access control characteristics for the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method. It also specifies the media, Medium Attachment Unit (MAU) and physical layer repeater unit for 10 Mb/s baseband and broadband systems, and it provides a 1 Mb/s baseband implementation. Specifications for MAU types 10BASE5, 10BASE2, FOIRL (fiber optic inter-repeater link), 10BROAD36, 1BASE5, and 10BASE-T are included. System considerations for multisegment 10 Mb/s baseband networks are provided. Layer and sublayer interface specifications are aligned to the ISO Open Systems Interconnection Basic Reference Model and 8802 models. The 8802-3 internal model is defined and used.

**Keywords:** data processing, information interchange, local area networks, mode of data transmission, network interconnection, models



Adopted as an International Standard by the  
International Organization for Standardization  
and by the



International Electrotechnical Commission



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## International Standard ISO/IEC 8802-3 : 1993

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In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

In 1985, IEEE Standard 802.3-1985 was adopted by ISO Technical Committee 97, *Information processing systems*, as draft International Standard ISO/DIS 8802-3. Following the procedures described above, the Standard was subsequently approved by ISO and published as ISO 8802-3 : 1989, incorporating ISO 8802-3/DAD 1 which had resulted from the adoption by ISO in 1987 of ANSI/IEEE Std 802.3a.

A further revision was subsequently approved by ISO/IEC JTC 1 in 1990, incorporating ISO/IEC 8802-3/Amendments 2 and 5.

A third edition, published in 1992, incorporated ISO/IEC 8802-3/Amendments 3 and 4.

This fourth edition cancels and replaces ISO/IEC 8802-3 : 1992 and incorporates ISO/IEC 8802-3/Amendment 6, *Maintenance Ballot*; Amendment 7, *Layer management*; and Amendment 9, *System considerations for multisegment 10 Mb/s baseband networks and Twisted-pair medium attachment unit (MAU) and baseband medium, type 10BASE-T*. These amendments were approved in 1992.

For the purpose of assigning organizationally unique identifiers, the Institute of Electrical and Electronics Engineers, Inc., USA, has been designated by the ISO Council as the Registration Authority. Communications on this subject should be addressed to

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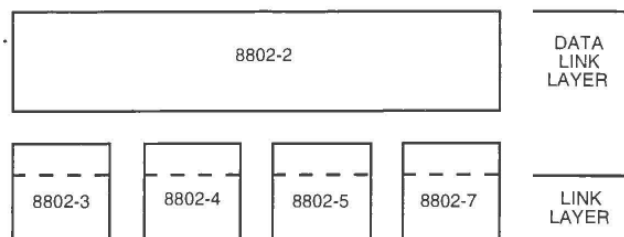
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## Foreword to International Standard ISO/IEC 8802-3 : 1993

This standard is part of a family of standards for Local and Metropolitan Area Networks. The relationship between this standard and the other members of the family is shown below. (The numbers in the figure refer to ISO standard numbers.)



This family of standards deals with the Physical and Data Link layers as defined by the ISO Open Systems Interconnection Basic Reference Model (ISO 7498 : 1984). The access standards define four 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 these technologies are as follows:

- (1) ISO/IEC 8802-3 [ANSI/IEEE Std 802.3, 1993 Edition], a bus utilizing CSMA/CD as the access method,
- (2) ISO/IEC 8802-4 [ANSI/IEEE Std 802.4-1990], a bus utilizing token passing as the access method,
- (3) ISO/IEC 8802-5 [ANSI/IEEE Std 802.5-1992], a ring utilizing token passing as the access method,
- (4) ISO 8802-7, a ring utilizing slotted ring as the access method.

ISO 8802-2 [ANSI/IEEE Std 802.2-1989], *Logical Link Control protocol*, is used in conjunction with the medium access standards.

ISO/IEC 10038 [ANSI/IEEE Std 802.1D, 1993 Edition], *Media access control (MAC) bridges*, specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.

The reader of this document is urged to become familiar with the complete family of standards.

The main body of this standard serves for both the ISO/IEC 8802-3 and ANSI/IEEE Std 802.3 standards. ISO/IEC and IEEE each have unique foreword sections. The Annex applies to the IEEE standard only. The Appendixes serve as useful reference material to both standards.

## ANSI/IEEE Std 802.3, 1993 Edition

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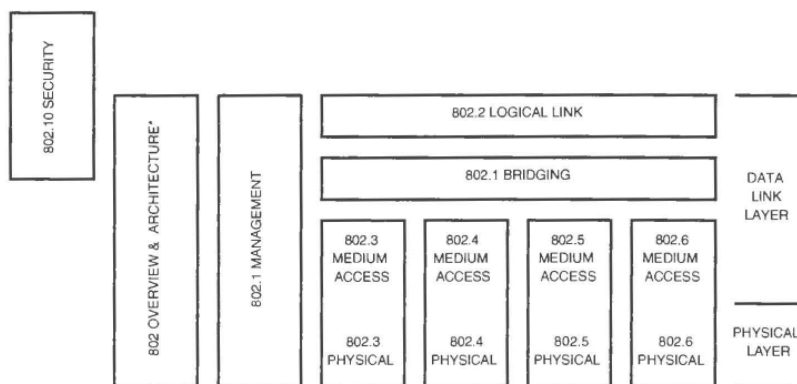
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## Foreword to ANSI/IEEE Std 802.3, 1993 Edition

(This Foreword is not a part of this International Standard or of ANSI/IEEE 802.3, 1993 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.)



\* 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 Basic Reference Model (ISO 7498 : 1984). The access standards define several 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 these technologies are as follows:

- IEEE Std 802<sup>†</sup>: Overview and Architecture. This standard provides an overview to the family of IEEE 802 standards. This document forms part of the 802.1 scope of work.
- IEEE Std 802.1B: LAN/MAN Management. Defines an Open System Interconnection (OSI) management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ISO/IEC 10038 : 1993 [ANSI/IEEE Std 802.1D] MAC Bridging. Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- IEEE Std 802.1E: System Load Protocol. Specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.
- ISO 8802-2 [ANSI/IEEE Std 802.2]: Logical Link Control
- ISO/IEC 8802-3 [ANSI/IEEE Std 802.3]: CSMA/CD Access Method and Physical Layer Specifications

<sup>†</sup>The 802 Architecture and Overview Specification, originally known as IEEE Std 802.1A, has been renumbered as IEEE Std 802. This has been done to accommodate recognition of the base standard in a family of standards. References to IEEE Std 802.1A should be considered as references to IEEE Std 802.



- ISO/IEC 8802-4 [ANSI/IEEE Std 802.4]: Token Bus Access Method and Physical Layer Specifications
- ISO/IEC 8802-5 [ANSI/IEEE Std 802.5]: Token Ring Access Method and Physical Layer Specifications
- IEEE Std 802.6: Metropolitan Area Network Access Method and Physical Layer Specifications
- IEEE Std 802.10: Interoperable Local Area Network Security, *Currently Contains Secure Data Exchange (SDE)*

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

- IEEE Std 802.7: IEEE Recommended Practice for Broadband Local Area Networks

The reader of this document is urged to become familiar with the complete family of standards.

### **Conformance Test Methodology**

Another standards series, identified by the number 1802, has been established to identify the conformance test methodology documents for the 802 family of standards. This makes the correspondence between the various 802 standards and their applicable conformance test requirements readily apparent. Thus the conformance test documents for 802.3 are numbered 1802.3, the conformance test documents for 802.5 will be 1802.5, and so on. Similarly, ISO will use 18802 to number conformance test standards for 8802 standards.

### **ISO/IEC 8802-3 : 1993 (ANSI/IEEE Std 802.3, 1993 Edition)**

This edition of the standard defines 10 Mb/s baseband and broadband implementations and a 1 Mb/s baseband implementation of the Physical Layer using the CSMA/CD access method. It is anticipated that future editions of the standard may provide additional implementations of the physical layer to support different needs (for example, media, and data rates).

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.

Readers wishing to know the state of revisions should contact

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The IEEE 802.3 Working Group acknowledges and appreciates that many concepts embodied in this standard are based largely upon the CSMA/CD access method earlier described in *The Ethernet* specification as written jointly by individuals from Xerox Corporation, Digital Equipment Corporation, and Intel Corporation. Appreciation is also expressed to Robert M. Metcalfe and David R. Boggs for their pioneering work in establishing the original concepts.

## Participants

When the IEEE 802.3 Working Group approved the original standard (ANSI/IEEE Std 802.3-1985) in 1983, it had the following membership:

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Additional individuals who contributed actively in the development of the original standard (ANSI/IEEE Std 802.3-1985) throughout its elaboration were

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The ECMA TC24 Committee on Communication Protocols also provided helpful input in the development of this standard.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3a-1988 (Section 10) in November 1984, it had the following membership:

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ANSI/IEEE Std 802.3-1988 and ANSI/IEEE Std 802.3a-1988 were approved by the American National Standards Institute on January 12, 1989.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3c-1985 (9.1-9.8) in July 1985, it had the following membership:

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Earl J. Whitaker  
Michael Willett  
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Oren Yuen

When the IEEE Standards Board approved ANSI/IEEE Std 802.3c-1985 (9.1-9.8) on December 12, 1985, it had the following membership:

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ANSI/IEEE Std 802.3c-1985 was approved by the American National Standards Institute on June 4, 1986.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3d-1987 (9.9), it had the following membership:

**Donald C. Loughry, Chair**  
**Steven Moustakas, Chair, Task Force**

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Keith Amundsen  
Jean-Pierre Astorg  
R. V. Balakrishnan  
Richard Bennett  
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Robert Campbell  
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Timothy Roek  
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Walter Schruer  
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Luciano Marchitto  
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The IEC TC83 Committee on Information Technology Equipment also provided very helpful input to the development of the FOIRL Standard (9.9).

The following persons were on the balloting committee that approved ANSI/IEEE Std 802.3d-1987 (9.9) for submission to the IEEE Standards Board:

William B. Adams	M. Kezunovic	Gary S. Robinson
S. R. Ahuja	Samuel Kno	Robert Rosenthal
Kit Athul	S. E. Kille	Gian Paolo Rossi
William Ayen	David Kollm	David J. Rypka
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George S. Carson	Wai-Sum Lai	Omri Serlin
Po Chen	Lanse M. Leach	D. Sheppard
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Kilnam Chon	R. C. Lightburn	J. B. Sinclair
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Robert S. Crowder	Joseph F. P. Luhukay	Fred Strauss
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N. I. Dimopoulos	Marco Ajmone Marsan	P. Sugar
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Philip H. Enslow, Jr.	Marco Meli	Daniel T. W. Sze
Judith Estrin	Darrel B. McIndoe	Ahmed N. Tantawi
John W. Fendrich	P. S. McIntosh	H. C. Torng
Harvey A. Freeman	David S. Millman	D. F. Towsley
Patrick S. Gonia	Aditya N. Mishra	Wei-Tek Tsai
R. L. Gordon	David E. Morgan	Stanko Turk
A. Goyal	Mike Morganti	L. David Umbaugh
M. D. Graebner	Kanji Mori	J. T. Vorhies
Maris Graube	David Morris	Pearl S. C. Wang
Joseph L. Hammond	H. H. T. Mouftah	Don Weir
Stephen Harris	Dale N. Murray	Alan J. Weissburger
J. Scott Haugdahl	R. R. Nelson	W. J. Wenker
C. W. Hobbs	J. D. Northcut	Earl J. Whitaker
Paul Hutton	Charles Oestereicher	Bryan Whittle
Richard Illif	Young Oh	Michael Willett
E. D. Jensen	George Parowski	David C. Wood
Guy Juanole	Thomas L. Phinney	Tsong-Hu Wu
Karl H. Kellermayr	J. M. Potucek	Oren Yuen
	Marya Repko	

When the IEEE Standards Board approved ANSI/IEEE Std 802.3d-1987 (9.9) on December 12, 1985, it had the following membership:

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ANSI/IEEE Std 802.3d-1987 was approved by the American National Standards Institute on February 9, 1989.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3b-1985 (Section 11), it had the following membership:

**Donald C. Loughry, Chair**  
**Menachem Abraham, Chair, Type 10BROAD36 Task Force**

Keith Albright  
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William Belknap  
Richard Bennett  
Charles Brill  
Juan Bulnes  
Stephen Cooper  
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John Davidson  
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Paul Eastman  
Phil Edholm  
Gregory Ennis  
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Alan Flatman  
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Robert Galin  
Sharad Gandhi  
Rich Graham  
Richard Gumpertz  
Hacene Hariri  
Guy Harkins  
Gregory Hopkins

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Stephen Janashego  
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John Laynor  
William Livingston  
Terry Lockyer  
Hugh Logan  
Leland Long  
James Lucas  
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Steven Moustakas  
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Aidan Paul  
David Potter  
Eric Rawson  
Eugene Reilly  
Joseph Rickert  
Anthony Rizzolo  
Gary Robinson  
Timothy Rock  
David Roos  
Robert Rosenthal  
Joseph St. Amand  
Walter Schreuer  
Semir Sirazi  
David Smith  
Stephen Soto  
Gary Spencer  
Robert Summers  
Pat Thaler  
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Nathan Tobol  
Wendell Turner  
Marc Warshaw  
David White  
Mo Zonoun

The following persons were on the balloting committee that approved ANSI/IEEE Std 802.3b-1985 (Section 11) for submission to the IEEE Standards Board:

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Henk F. Beley  
George S. Carson  
Po Chen  
L. Y. Cheung  
Kilnam Chon  
T. Ricky Chow  
David Cohen  
Allen F. Conrad  
Ira W. Cotten  
Robert S. Crowder  
Michel Diaz  
Mitchell G. Duncan  
Philip H. Enslaw, Jr.  
Judith Estrin  
John W. Fendrich  
Harvey A. Freeman  
Patrick Gonza  
Ambuj Goyal  
Michael D. Graebner  
Maris Graube  
Nobuhiro Hamada  
Joseph L. Hammond  
Keith W. Harbaugh  
S. M. Harris  
J. Scott Haugdahl  
Sharon Healy  
C. W. Hobbs  
Jim P. Hong  
Paul L. Hutton  
Richard Hiff  
George D. Jelatis

E. Douglas Jensen  
Guy Juanelo  
Siegel L. Junker  
Kari H. Kellermayr  
Mladen Kezunovic  
Samuel Khe  
David Kellm  
Sastri L. Kota  
Hirayr M. Kudyan  
Takahiko Kuki  
Lee LaBarre  
Wai-Sum Lai  
Valerie Lasker  
Lanise M. Leach  
Edward Y. S. Lee  
Stephen E. Levin  
F. C. Lim  
Donald C. Loughry  
Joseph F. P. Luhakay  
Wo-Shun Luk  
Marco Marsan  
Joseph Massi  
Darrell B. McIndoe  
Patrick S. McIntosh  
Marco Mell  
David S. Millman  
Aditya N. Mishra  
Richard J. Moff  
David E. Morgan  
Mike Morganti  
Klaji Mori  
D. J. Murriss  
H. T. Moustah  
Dale A. Murray  
Ruth Nelson  
J. Duane Northcutt  
Charles Oestereicher  
David Ofsevit  
Young Oh

George Parowski  
Thomas L. Phinney  
Nikitas Pimopoulos  
David Potter  
John Potvoek  
Gary S. Robinson  
Marya Repke  
Robert Rosenthal  
Gian Paolo Rossi  
David J. Rypka  
S. I. Samoylenko  
Norman F. Schneidewind  
Oscar Sepulveda  
Omri Serlin  
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R. M. Simmons  
David W. Sloyer  
Stephen Soto  
Tom Stack  
Carol M. Stillebroer  
Fred Strauss  
Bart W. Stuck  
Tatsuya Suda  
Peter Sugar  
Efsthathios D. Sykas  
Daniel T. W. See  
Ahmed N. Tantaui  
Mario Tokoro  
H. C. Torng  
Donald F. Towsley  
Wei-Tek Tsai  
M. Tsuchiya  
Richard Tung  
Stanko Turk  
L. David Umbaugh  
James Vorhies  
Pearl S. C. Wang  
Don Weir  
Alan J. Weissberger  
William J. Wenker



Earl J. Whitaker  
Bryan S. Whittle

Michael Willett  
Donald Wittman

George R. Wood  
Tsong-Ho Wu

When the IEEE Standards Board approved ANSI/IEEE Std 802.3b-1985 (Section 11) on September 19, 1985, it had the following membership:

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**Sava I. Sherr, Secretary**

**John P. Riganati, Vice Chair**

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Fletcher J. Buckley  
Rene Castenschiold  
Edward Chelotti  
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Jay Forster  
Daniel L. Goldberg  
Kenneth D. Hendrix  
Irvin N. Howell  
Jack Kinn  
Joseph L. Koepfinger\*  
Irving Kolodny  
R. F. Lawrence

Lawrence V. McCall  
Donald T. Michael\*  
Frank L. Rose  
Clifford O. Swanson  
J. Richard Weger  
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Charles J. Wylie

\*Member emeritus

ANSI/IEEE Std 802.3b-1985 was approved by the American National Standards Institute on February 28, 1986.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3e-1987 (Section 12) in November 1986, it had the following membership:

**Donald C. Loughry, Chair**

**Robert Galin, Chair, Type 1BASE5 Task Force**

Menachem Abraham  
Keith Albright  
Keith Amundsen  
Jean-Pierre Astorg  
R. V. Balakrishnan  
Ian Barker  
Charles Brill  
Juan Bulnes  
Robert Campbell  
Luigi Canavese  
Albert Claessen  
Michael Coden  
Bill Cronin  
Peter Dawe  
Peter Desaulniers  
Raymond Duley  
Jeff Ebeling  
Gianfranco Enrico  
Alan Flatman  
Richard Fransen  
Mark Gerhold  
Adi Gelbert

Rich Graham  
Richard Gumpertz  
Hacene Hariti  
Lloyd Hasley  
Haw Ming Haung  
Charles Hoffner  
Michael Hughes  
Donald Johnson  
Mize Johnson  
Kwi-Yung Jung  
Matt Kaltenbach  
Paul Kellam  
Scott Kessler  
Hiroshi Kobayashi  
Hidetsume Kurokawa  
Michael Lee  
Lee LaBarre  
Terry Lockyer  
James Lucas  
Andy Luque  
Luciano Marchitto  
Steven Moustakas

Lloyd Oliver  
Roy Pierce  
Bill Postan  
Eric Rawson  
Joseph Rickert  
Gary Robinson  
Timothy Rock  
David Roos  
Ed Sakaguchi  
Walter Schreuer  
Semir Sirazi  
David Smith  
Robert Summers  
Peter Tarrant  
Mark Taylor  
Pat Thaler  
Geoff Thompson  
Nathan Tobel  
Carlos Tomaszewski  
Jayshree Ullal  
Joseph Wisneco  
Bruce Williams

The following persons were on the balloting committee that approved ANSI/IEEE Std 802.3e-1987 (Section 12) for submission to the IEEE Standards Board:

Marshall D. Abrams	Richard Duff	J. M. Potucek
William B. Adams	E. D. Jenson	Marya Repko
S. R. Ahuja	Guy Juanole	Gary S. Robinson
P. D. Amer	S. L. Junker	Robert Rosenthal
Kit Athul	Karl H. Kellermayr	Gian Paolo Rossi
William Ayen	M. Kezunovic	David J. Rypka
Eduardo W. Bergamini	Samuel Kho	S. I. Samaylenko
H. F. Boley	S. E. Kille	Norman F. Schneidewind
Paul W. Campbell, Jr.	David Kollm	Omri Serlin
George S. Carson	Takahiko Kuki	D. Sheppard
Po Chen	Lee LaBarre	Ron Simmons
L. Y. Cheung	Wai-Sum Lai	J. B. Sinclair
Kilnam Chon	Lanase M. Leach	L. Sintonen
W. F. Chow	Edward Y. Lee	Stephen H. Soto
Michael Codan	S. E. Levin	Tom Stack
A. F. Conrad	R. C. Lighthurn	Carel M. Stillebroer
Ira Cotton	F. C. Lim	Fred Strauss
D. E. Crotty	William D. Livingston	Bart W. Stuck
Robert S. Crowder	Don C. Loughry	Tatsuya Suda
Michel Diaz	Joseph F. P. Luhukay	P. Sugar
N. I. Dimopoulos	Wo-Shun Luk	Efstathios D. Sykas
M. G. Duncan	Marco Ajmone Marsan	Daniel T. W. Sze
P. M. Elliot	Joseph Massi	Ahmed N. Tantawi
Phillip H. Enslow, Jr.	Marco Meli	H. C. Torng
Judith Estrin	Darrel B. McIndoe	D. F. Towsley
John W. Fendrich	P. S. McIntosh	Wei-Tek Tsai
G. A. Foggiato	David S. Millman	Masahiro Tsuchiya
Harvey A. Freeman	Aditya N. Mishra	Stanko Turk
Robert J. Gagliano	David E. Morgan	L. David Umbaugh
T. F. Gannon III	Mike Morganti	J. T. Vorhies
Patrick S. Gonja	Kanji Mori	Pearl S. C. Wang
R. L. Gordon	David Morris	Don Weir
A. Goyal	H. H. T. Mouftah	Alan J. Weissburger
M. D. Graebnar	Dale N. Murray	W. J. Wenker
Maris Graube	R. R. Nelson	Earl J. Whitaker
Joseph L. Hammond	J. D. Northcut	Bryan Whittle
Stephen Harris	Charles Oestereicher	Michael Willett
J. Scott Haugdahl	Young Oh	David C. Wood
C. W. Hobbs	George Parowski	Tsong-Hu Wu
Paul Hutton	Thomas L. Phinney	Oren Yuan
	David Pottar	

When the IEEE Standards Board approved ANSI/IEEE Std 802.3e-1987 (Section 12) on June 11, 1987, it had the following membership:

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Marshall L. Cain	Irving Kolodny	Gary S. Robinson
James M. Daly	Joseph L. Koepfinger*	Frank L. Rose
Stephen R. Dillon	Edward Lohse	Robert E. Rountree
Eugene P. Fogarty	John May	Sava I. Sherr*
Jay Forster	Lawrence V. McCall	William R. Tackaberry
Kenneth D. Hendrix	L. Bruce McClung	William B. Wilkens
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\*Member emeritus

ANSI/IEEE Std 802.3e-1987 was approved by the American National Standards Institute on December 15, 1987.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3h-1990 (Section 5), it had the following membership:

**Donald C. Loughry, Chair**  
**Andy J. Luque, Chair, Layer Management Task Force**

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John R. Agee	Stephen Haughey	Tony Peatfield
Richard Anderson	Carl G. Hayssen	Peter Rautenberg
Ekkehard Antz	Ariel Hendel	Bill Reysen
Keith Amundsen	Chip Hicks	Gary Robinson
Susie Armstrong	William Hingston	Steven Robinson
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Mark Bohrer	Ernie Jensen	Fred Sammartino
Richard Brand	Clarence Joh	Stan Sassower
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Luca Cafiero	Donald C. Johnson	Ronald Schmidt
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Luigi Canavese	Scott Kesler	Frederick Scholl
Jacques Christ	Bob Kilgore	Ron Shani
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Bill Cronin	John Kincaid	David A. Smith
Peter Cross	Tadayoshi Kitayama	Bob Smith
John DeCramer	Paul Kopera	Steve Smith
Ian Crayford	David Kung	Robert Snyder
Nabil Damouny	Michael Lee	Graham Starkins
Sanjay Dhawan	Richard Lena	David E. Stein
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Paul Eastman	Wayne Lindquist	Mark Taylor
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Alan V. Flatman	Luciano Marchitto	Carlos Tomaszewski
Ingrid Fromm	Charles Marsh	Iherbert Uhl
Mel Gable	Bob Matthys	Steven Ulrich
Bob Galin	Steven Moustakas	John Visser
Mark Gerhold	Narayan Murthy	William Wager
Rich Graham	Darcy Nelson	Joseph A. Wiencko, Jr.
Andreas Gulle	Bob Norton	Bruce Williams
Richard Gumpertz	Mike O'Connor	Richard Williams
Clive Hallatt	Chris Oliver	Roger Wilmarth
Kevin Hamilton	Lloyd Oliver	Mike Wincn
Benny Hanigal	Kazuyuki Ozawa	Mark Wingrove
Lloyd Hasley		Nobushige Yokota

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William Adams	Maris Graube	Darrell B. McIndoe
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William E. Ayen	Stephen Harris	David S. Millman
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George S. Carson	C.W.L. Hobbs	John E. Montague
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Michael H. Coden	Richard J. Hliff	Kinji Mori
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R. S. Crowder	M. Kezunovic	M. T. Mouftah
Andrew Davidson	Samuel Kho	Arne A. Nilsson
Luis F. M. De Moraes	Tom Kurihara	Charles Oestereicher
N. I. Dimopoulos	Lee Labarre	Young Oh
Mitchell Duncan	Anthony B. Lake	Thomas L. Phinney
John E. Emrich	Mike Lawler	Rafat Pirzada
John W. Fendrich	Jaiyong Lee	Udo Pooch
Harold C. Folts	F. C. Lim	Robert S. Printis
Harvey Freeman	Randolph S. Little	Marya S. Repko
Ingrid Fromm	William Livingston	John P. Riganati
D. G. Gan	Joseph Loo	Gary S. Robinson
Patrick Gonia	Donald C. Loughry	N. F. Schneidewind
Julio Gonzalez Sanz	Andy J. Luque	Manfred H. Seifert
Michael Graebner	Kelly C. McDonald	D. A. Sheppard

Glan Sherwood  
R. M. Simmons  
Leo Sintonen  
Harry P. Solomon  
Robert K. Southard  
John Spragins  
C. M. Stillebroer

Frank J. Strauss  
E. D. Sykas  
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When the IEEE Standards Board approved ANSI/IEEE Std 802.3h-1990 on September 28, 1990, it had the following membership:

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ANSI/IEEE Std 802.3h-1990 was approved by the American National Standards Institute on March 11, 1991.

When the IEEE 802.3 Working Group approved ANSI/IEEE Std 802.3i-1990 (Sections 13 and 14), it had the following membership:

**Donald C. Loughry, *Chair*\***

**Patricia Thaler, *Chair, Type 10BASE-T Task Force*†**

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Kevin Cone  
Robert Conte  
Neil Coote  
Ian Crayford  
Bill Cronin  
Peter Cross  
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Mel Gable  
Robert Galin  
Mark Gerhold  
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Steven Moustakas  
Narayan Murthy  
Darry Nelson  
Bob Norton  
Mike O'Connor  
Chris Oliver  
Lloyd Oliver  
Keith Onodera  
Kazuyuki Ozawa  
Charles Palanzo  
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Peter Rautenberg  
Bill Reysen  
Gary Robinson  
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\*Patricia Thaler, *Current Chair*

†Richard Anderson, *Current Chair*

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Moni Samaan  
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Graham Starkins  
David E. Stein  
Peter Tarrant  
Mark Taylor  
Douglas Thompson  
Geoffrey Thompson  
Nathan Tobol

Carlos Tomaszewski  
Herbert Uhl  
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Richard Williams  
Roger Wilmarth  
Mike Winen  
Mark Wingrove  
Nobuhide Yokota

The following persons were on the balloting committee for ANSI/IEEE Std 802.3i-1990:

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William B. Adams  
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Hasan S. Alkhatib  
Jonathan Allan  
Sule Arslander  
Kit Athul  
Michael Atkinson  
William E. Ayen  
Yong Myung Baeg  
Subhash Bhatia  
Asa O. Bishop  
Alan L. Bridges  
Richard Canai  
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Anthony L. Carrato  
George S. Carson  
Brian J. Casey  
George C. Chachis  
Chih-Tsai Chen  
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# Information technology—Local and metropolitan area networks—

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

### 1. Introduction

#### 1.1 Overview

**1.1.1 Basic Concepts.** The Carrier Sense Multiple Access with Collision Detection (CSMA/CD) media access method is the means by which two or more stations share a common transmission medium. To transmit, a station waits (defers) for a quiet period on the medium (that is, no other station is transmitting) and then sends the intended message in bit-serial form. If, after initiating a transmission, the message collides with that of another station, then each transmitting station intentionally sends a few additional bytes to ensure propagation of the collision throughout the system. The station remains silent for a random amount of time (backoff) before attempting to transmit again. Each aspect of this access method process is specified in detail in subsequent sections of this standard.

This is a comprehensive standard for Local Area Networks employing CSMA/CD as the access method. This standard is intended to encompass several media types and techniques for signal rates of from 1 Mb/s to 20 Mb/s. This edition of the standard provides the necessary specifications for 10 Mb/s baseband and broadband systems, a 1 Mb/s baseband system, and a Repeater Unit.

**1.1.2 Architectural Perspectives.** There are two important ways to view local area network design corresponding to

- (1) *Architecture.* Emphasizing the logical divisions of the system and how they fit together.
- (2) *Implementation.* Emphasizing actual components, their packaging and interconnection.

This standard is organized along architectural lines, emphasizing the large-scale separation of the system into two parts: the Media Access Control (MAC) sublayer of the Data Link Layer, and the Physical Layer. These layers are intended to correspond closely to the lowest layers of the ISO Model for Open Systems Interconnection (see Fig 1-1). See ISO 7498:1984 [10].<sup>1</sup> The Logical Link Control (LLC) sublayer and MAC sublayer together encompass the functions intended for the Data Link Layer as defined in the OSI model.

**1.1.2.1** An architectural organization of the standard has two main advantages:

- (1) *Clarity.* A clean overall division of the design along architectural lines makes the standard clearer.
- (2) *Flexibility.* Segregation of medium-dependent aspects in the Physical Layer allows the LLC and MAC sublayers to apply to a family of transmission media.

Partitioning the Data Link Layer allows various media access methods within the family of Local Area Network standards.

<sup>1</sup> The numbers in brackets correspond to those of the references listed in 1.3; when preceded by A, they correspond to those listed in the Annex.