INTERNATIONAL STANDARD

ISO/IEC 8802-2

ANSI/IEEE Std 802.2

Third edition
1998-06-01

Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements —

Part 2: Logical link control

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

Partie 2: Contrôle de liaison logique

Reference number
ISO/IEC 8802-2:1998(E)
ANSI/IEEE
Std 802.2, 1998 edition

Abstract: This standard is part of a family of standards for local area networks (LANs) and metropolitan area networks (MANs) that deals with the physical and data link layers as defined by the ISO Open Systems Interconnection Basic Reference Model. The functions, features, protocol, and services of the Logical Link Control (LLC) sublayer, which constitutes the top sublayer in the data link layer of the ISO/IEC 8802 LAN protocol, are described. The services required of, or by, the LLC sublayer at the logical interfaces with the network layer, the medium access control (MAC) sublayer, and the LLC sublayer management function are specified. The protocol data unit (PDU) structure for data communication systems is defined using bit-oriented procedures, as are three types of operation for data communication between service access points. In the first type of operation, PDUs are exchanged between LLCs without the need for the establishment of a data link connection. In the second type of operation, a data link connection is established between two LLCs prior to any exchange of information-bearing PDUs. In the third type of operation, PDUs are exchanged between LLCs without the need for the establishment of a data link connection, but stations are permitted to both send data and request the return of data simultaneously.
Keywords: local area networks, protocols; logical link control

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The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, USA

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ANSI/IEEE Std 802.2, 1998 edition
(Incorporating ANSI/IEEE Stds 802.2c-1997,
802.2f-1997, and 802.2h-1997)

Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements—

Part 2: Logical Link Control

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International Standard ISO/IEC 8802-2:1998(E)

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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.

International Standard ISO/IEC 8802-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

This third edition cancels and replaces the second edition (ISO/IEC 8802-2:1994), which has been technically revised. It also incorporates Amendment 3:1995.

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*

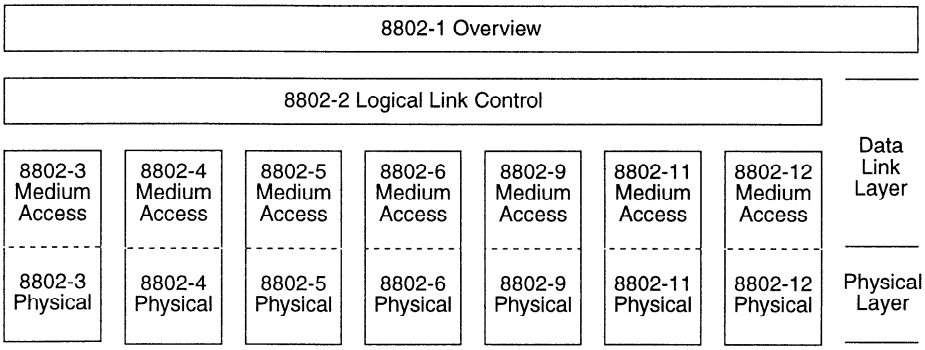
— *Part 12: Demand-priority access method, physical layer and repeater specifications*

Annexes A and E form an integral part of this part of ISO/IEC 8802. Annexes B to D are for information only.

International Organization for Standardization/International Electrotechnical Commission
Case postale 56 • CH-1211 Genève 20 • Switzerland

Foreword to International Standard ISO/IEC 8802-2 : 1998

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



This family of International Standards deals with the Physical and Data Link layers as defined by the ISO/IEC 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 International Standards defining the access technologies are as follows:

a) ISO/IEC 8802-3, utilizing carrier sense multiple access with collision detection (CSMA/CD) as the access method.
b) ISO/IEC 8802-4, utilizing token passing bus as the access method.
c) ISO/IEC 8802-5, utilizing token passing ring as the access method.
d) ISO/IEC 8802-6, utilizing distributed queuing dual bus as the access method.
e) ISO/IEC 8802-9, a unified access method offering integrated services for backbone networks.
f) ISO/IEC DIS 8802-11, a wireless LAN utilizing carrier sense multiple access with collision avoidance (CSMA/CA) as the access method.
g) ISO/IEC DIS 8802-12, utilizing Demand Priority as the access method.

ISO/IEC TR 8802-1, *Overview of Local Area Network Standards*, provides an overview of the series of ISO/IEC 8802 standards.

ISO/IEC 8802-2, *Logical Link Control*, is used in conjunction with the medium access standards to provide the data link layer service to network layer protocols.

ISO/IEC 15802-1, *Medium Access Control (MAC) service definition*, specifies the characteristics of the common MAC Service provided by all IEEE 802 LAN MACs. The service is defined in terms of primitives that can be passed between peer service users, their parameters, their interrelationship and valid sequences, and the associated events of the service.

ISO/IEC 15802-2, *LAN/MAN Management*, defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.

ISO/IEC 10038, *Media Access Control (MAC) bridges*, specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the level of the logical link control protocol (to be renumbered 15802-3).

ISO/IEC 15802-4, *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/IEC 15802-5, *Remote Media Access Control (MAC) bridging*, specifies extensions for the interconnection, using non-LAN communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.

ANSI/IEEE Std 802.2, 1998 Edition

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USA

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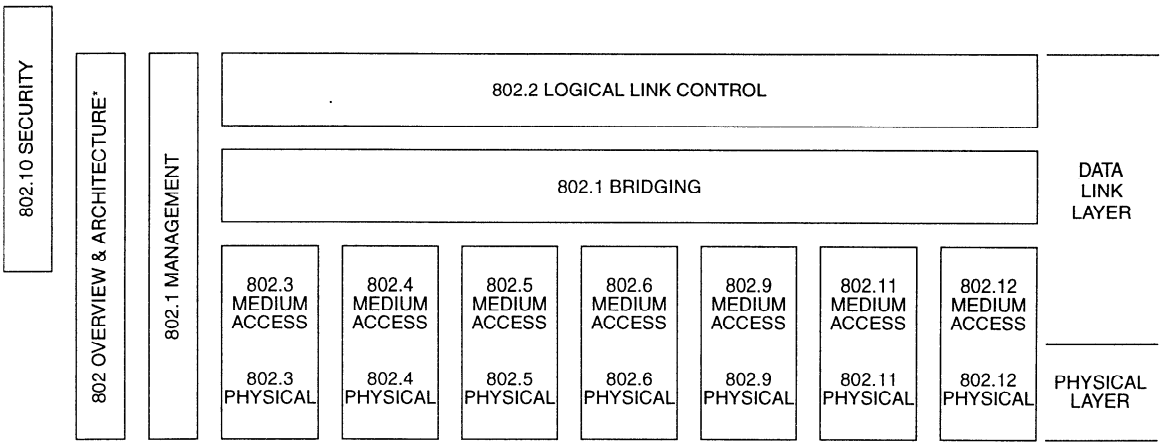
Introduction to ANSI/IEEE Std 802.2, 1998 Edition

(This introduction is not a part of ANSI/IEEE Std 802.2, 1998 Edition or of ISO/IEC 8802-2 : 1998.)

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 (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 and 802.1k [ISO/IEC 15802-2] — *LAN/MAN Management.* Defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ANSI/IEEE Std 802.1D [ISO/IEC 10038] — *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 [ISO/IEC 15802-4] — *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.
- ANSI/IEEE Std 802.1G [ISO/IEC 15802-5] — *Remote Media Access Control (MAC) Bridging.* Specifies extensions for the interconnection, using non-LAN communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.
- ANSI/IEEE Std 802.2 [ISO/IEC 8802-2] — *Logical Link Control*
- ANSI/IEEE Std 802.3 [ISO/IEC 8802-3] — *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 802.9 [ISO/IEC 8802-9] — *Integrated Services (IS) LAN Interface at the Medium Access Control (MAC) and Physical (PHY) Layers*
- ANSI/IEEE Std 802.10 — *Interoperable LAN/MAN Security*
- 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 DIS 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*

The following additional working group has authorized standards projects under development:

- IEEE 802.14 — *Standard Protocol for Cable-TV Based Broadband Communication Network*

Conformance test methodology

An additional standards series, identified by the number 1802, has been established to identify the conformance test methodology documents for the 802 family of standards. Thus the conformance test documents for 802.3 are numbered 1802.3.

ANSI/IEEE Std 802.2, 1998 Edition [ISO/IEC 8802-2 : 1998]

This edition of the standard incorporates three supplements: 802.2c-1997, *Conformance Requirements* (ISO/IEC Amendment 3); 802.2f-1997, *Managed Objects Definition for Logical Link Control (LLC)* (ISO/IEC Amendment 6) along with Technical Corrigendum 001; and 802.2h-1997, *Optional Toleration of Duplicate Information Transfer Format Protocol Data Units* (ISO/IEC Amendment 7). In the previous edition, the following supplements were incorporated: 802.2a-1993, *Standard for Flow Control Techniques for Bridged Local Area Networks* (ISO/IEC Amendment 1); 802.2b-1993, *Standard for Acknowledged Connectionless-Mode Service and Protocol* (Type 3 Operation) (ISO/IEC Amendment 2); 802.2d-1993, *Editorial Changes and Technical Corrections* (ISO/IEC Amendment 4); 802.2e-1993, *Bit Delivery Referencing* (ISO/IEC Defect Report 001); and 802.5p-1993, *Standard for Route Determination Entity* (ISO/IEC Amendment 5). The base standard with supplements incorporated into the 1994 edition was reaffirmed by IEEE on 16 September 1997.

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are possible within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Information on the current revision state of this and other IEEE 802 standards may be obtained from

Secretary, IEEE Standards Board
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
USA

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AlphaGraphics #35 Attn: P. Thrush
10201 N. 35th Avenue
Phoenix, AZ 85051
USA

Participants

The following individuals were participants in the work of this IEEE Project 802.2 Working Group:

David E. Carlson, *Chair*

Om Agrawal
Phil Arneth
Jeff Bobzin
Mark Bauer
Le Biu
Clyde Boenke
Bob Bowen
Bob Bridge*
Chuck Brill
Wayne Brodd*
Fred Burg***
Werner Bux
Jim Campbell
Tony Capel
Ron Cates
Rao Cherukuri
Po Chen***
Jade Chien
Mike Clader
Jerry Clancy*
Rich Collins
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Mike Coy**
Bob Crowder*
Kirit Dave
John Davidson
Em Delahostria*
Jan Dolphin
Bob Donnan
Bob Douglas
Bill Durrenberger
Rich Fabbri
Eldon Feist*
James Fields*
Larry Foltzer
Ron Floyd
Ingrid Fromm***
Darrell Furlong
Mel Gable
Mike Garvey
Bud Glick
Arie Goldberg
Pat Gonia***
Larry Green***
Gordon Griffiths
Bob Grow
Maris Graube
Ed Harada
Lo Hsieh
Karen Hsing
Kevin Hughes
Marco Hurtado
Bob Husak
Dittmar Janetzky
Ross Jaibaji
George Jelatis
Gabor Kardos
Peggy Karp*
Hal Keen***
Kristin Kocan
Zak Kong*
Sy Korowitz
George Koshy
Don Kotas
Tony Kozlik
Mike Kryskow*
Dave Laffitte
Terry Lawell*
Ron Leuchs
Peter Lin
Jim Lindgren
Laurie Lindsey*
Bill Livingston
Then Tang Liu
Don C. Loughry
Don J. Loughry
Bruce Loyer
Jerry Lurtz
Arthur Miller***
Bill Miller
Ken Miller
Lou Mitta
Bob Moles
Jim Mollenauer
Ware Myers
Lee Neitzel**
Gene Nines
Bill Northup
Brian O'Neil*
Kul Padda
Mahendra Patel
Tom Phinney*
Juan Pimentel
Lavern Pope
Dave Potter
Denis Quy
James Ragsdale**
John Rance
Dan Ratner
Richard Read
Ted Rebenko
John Ricketson
Edouard Rocher
Rob Rosenthal*
Chip Schnarel
Walter Schreuer
Gerard Segarra
Dennis Sosnoski
Robert C. Smith
Mark Stahlman
Monica Stahl
Steve Stearns
Garry Stephens*
Mark Steiglitz*
Kathleen Sturgis
Bob Stover*
Bart Stuck
Dave Sweeton*
Dan Sze*
Vic Tarassov***
Angus Telfer*
Dave Thompson
Fouad Tobagi
Jean-Marie Tourret
Bo Viklund
Bruce Watson
Don Weir*
Dan Sendling
Walter Wheeler
Hugh White
Steve Whiteside
Earl Whitaker*
Ping Wu
Esin Ulug
Hiroshi Yoshida
Wayne Zakowski***
Hank Zannini

*Principal contributors to Project 802.2 at time of initial approval (1989).
**Members of Project 802.2 at time of 1993 supplements' approval.
***Members of Project 802.2 at time of 1997 supplements' approval and reaffirmation of base text.

Additional individuals who made significant contributions were the following:

Don Andrews
Phil Arst
Ron Crane
Walt Elden
Atul Garg
Bryan Hoover
Andrew Huang
Tony Lauck
Andy Luque
Dan Maltbie
Jane Munn
Wendell Nakamine
Liston Neely
Dan Pitt
Robert Printis
Stephen Soto
Joshua Weiss

The following persons were on the original balloting committee that approved this document for submission to the IEEE Standards Board:

William B. Adams
Kit Athul
Chih-Tsai Chen
Michael H. Coden
Robert S. Crowder
George S. Curon
Mitchell Duncan
John E. Emrich
John W. Fendrich
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Patrick Gonia
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Stig Nilsson
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* Member emeritus

IEEE Std 802.2-1989 was approved by the American National Standards Institute on 12 January 1990.

The following persons were on the balloting committee that approved supplements 802.2a, 802.2b, 802.2d, and 802.2e for submission to the IEEE Standards Board:

William B. Adams
Don Aelmore
Hasan Alkhatib
Kit Athul
Yong Myung Baeg
Alan L. Bridges
Richard Caasi
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Robert A. Ciampa
Michael H. Coden
Robert Crowder
Jose A. Cueto
Andrew M. Dunn
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Changxin Fan
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Patrick Gonia
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Thad L. D. Regulinski
Gary S. Robinson
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Gregory D. Schumacher
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Robert Tripi
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James T. Vorhies
Donald F. Wier
Raymond Wenig
Earl J. Whitaker
Paul A. Willis
Jen-Kun Yang
Oren Yuen
Stephen Zebrowski

*Did not vote on 802.2a.

Those who participated in the development of IEEE Std 802.5p were as follows:

Robert A. Donnan, *Chair, 802.5*
Phillip Emer, *Chair, Route Determination Entity Task Group*

Floyd Backes
Robert Barrett
Stephen Belisle
Laura Bridge
Fred Burg
Dave Carlson
Claude A. Cartee
Alan Chambers
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Magnus Stallknecht
Richard Sweatt
Andre Szczepanek
Peter Tan
Jeff Tong
Ric Waller
Chang-Jung Wang
Robert Wu
Amnon Yacoby
Carolyn Zimmer

The following persons were on the balloting committee that approved supplement 802.5p for submission to the IEEE Standards Board:

William B. Adams
Ian F. Akyildiz
Bernhard Albert
Hasan S. Alkhatib
Pat J. Angarano
Kit Athul
William E. Ayen
Tim Batten
George Carson
George C. Chachis
Robert A. Ciampa
Robert Crowder
Robert Donnan
John Emrich
Philip H. Enslow
John W. Fendrich
Harvey A. Freeman
Robert Gagliano
Isaac Ghansah
Patrick Gonia
Scott J. Haugdahl
Richard J. Iliff
Raj Jain
Gary C. Kessler
Farrokh Khatibi
Youngbum Kim
Randolph S. Little
Donald C. Loughry
Joseph F. P. Luhukay
William McDonald
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Kinji Mori
David J. Morris
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R. I. Prince
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Floyd E. Ross
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IEEE Std 802.5p-1993 was approved by the American National Standards Institute on 24 February 1994. IEEE Stds 802.2a-1993, 802.2b-1993, 802.2d-1993, and 802.2e-1993 were approved by the American National Standards Institute on 3 June 1994.

The following persons were on the balloting committees of 802.2c, 802.2f, and 802.2h. The superscripted letters c, f, and h, corresponding to the supplement letter, indicate that the individual balloted only those documents. Those listed without any superscripted letter balloted all three supplements.

William B. Adams
Don Aelmore[c]
Paul D. Amer[c]
Kit Athul[cf]
William E. Ayen
Thomas W. Bailey[cf]
Frederic Bauchot
Manuel J. Betancor[cf]
Kathleen L. Briggs
Peter K. Campbell
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David E. Carlson
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Frederick N. Chase[c]
Robert S. Crowder
Edward A. Dunlop[c]
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Paul S. Eastman[ch]
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Maris Graube[c]
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John E. Montague
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Bongnam Noh[c]
Charles Oestereicher[cf]
Robert O'Hara[fh]
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Joerg Ottensmeyer[fh]
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Qian-li Yang[c]
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Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements

Part 2: Logical Link Control

1. Overview

1.1 Scope and purpose

This International Standard is one of a set of international standards produced to facilitate the interconnection of computers and terminals on a Local Area Network (LAN). It is related to the other international standards by the Reference Model for Open Systems Interconnection (OSI).

NOTE—The exact relationship of the layers described in this International Standard to the layers defined by the OSI Reference Model is under study.

This International Standard describes the functions, features, protocol, and services of the Logical Link Control (LLC) sublayer in the ISO/IEC 8802 LAN Protocol. The LLC sublayer constitutes the top sublayer in the data link layer (see figure 1) and is common to the various medium access methods that are defined and supported by the ISO/IEC 8802 activity. Separate International Standards describe each medium access method individually and indicate the additional features and functions that are provided by the Medium Access Control (MAC) sublayer in each case to complete the functionality of the data link layer as defined in the LAN architectural reference model.

This International Standard describes the LLC sublayer service specifications to the network layer (Layer 3), to the MAC sublayer, and to the LLC sublayer management function. The service specification to the network layer provides a description of the various services that the LLC sublayer, plus underlying layers and sublayers, offer to the network layer, as viewed from the network layer. The service specification to the MAC sublayer provides a description of the services that the LLC sublayer requires of the MAC sublayer. These services are defined so as to be independent of the form of the medium access methodology, and of the nature of the medium itself. The service specification to the LLC sublayer management function provides a description of the management services that are provided to the LLC sublayer. All of the above service specifications are given in the form of primitives that represent in an abstract way the logical exchange

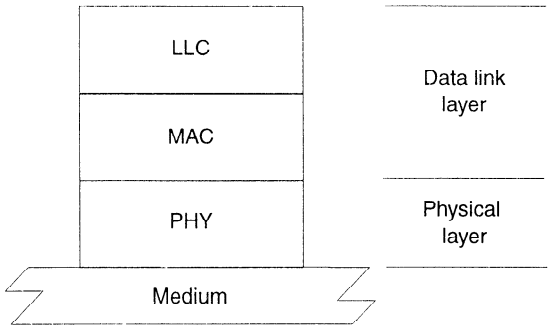

Figure 1—Relationship to LAN reference model

of information and control between the LLC sublayer and the identified service function (network layer, MAC sublayer, or LLC sublayer management function). They do not specify or constrain the implementation of entities or interfaces.

This International Standard provides a description of the peer-to-peer protocol procedures that are defined for the transfer of information and control between any pair of data link layer service access points on a LAN. The LLC procedures are independent of the type of medium access method used in the particular LAN.

To satisfy a broad range of potential applications, three types of data link control operation are included (see clause 4). The first type of operation (see clause 6) provides a data-link-connectionless-mode service across a data link with minimum protocol complexity. This type of operation may be useful when higher layers provide any essential recovery and sequencing services so that these do not need replicating in the data link layer. In addition, this type of operation may prove useful in applications where it is not essential to guarantee the delivery of every data link layer data unit. This type of service is described in this International Standard in terms of "logical data links." The second type of operation (see clause 7) provides a data-link-connection-mode service across a data link comparable to existing data link control procedures provided in International Standards such as HDLC (see ISO/IEC 13239 : 1997[1]). This service includes support of sequenced delivery of data link layer data units, and a comprehensive set of data link layer error recovery techniques. This second type of service is described in this International Standard in terms of "data link connections." The third type of operation (see clause 8) provides an acknowledged-connectionless-mode data unit exchange service, which permits a station to both send data and request the return of data at the same time. Although the exchange service is connectionless, in-sequence delivery is guaranteed for data sent by the initiating station.

This International Standard identifies four distinct "classes" of LLC operation. Class I provides data-link-connectionless-mode service only. Class II provides data-link-connection-mode service plus data-link-connectionless-mode service. Class III provides acknowledged-connectionless-mode service plus data-link-connectionless-mode service. Class IV provides acknowledged-connectionless-mode service plus data-link-connection-mode service plus data-link-connectionless-mode service. Any one of these classes of operation may be supported.

The basic protocols described herein are peer protocols for use in multistation, multiaccess environments. Because of the multistation, multiaccess environment, it shall be possible for a station to be involved in a multiplicity of peer protocol data exchanges with a multiplicity of different stations over a multiplicity of different logical data links and/or data link connections that are carried by a single physical layer (PHY) over a single physical medium. Each unique to-from pairing at the data link layer shall define a separate logical

[1]Information about references can be found in 1.3.

data link or data link connection with separate logical parameters and variables. Except where noted, the procedures described shall relate to each data link layer logical data link or data link connection separately and independently from any other logical data link or data link connection that might exist at the stations involved.

ISO/IEC 10038 : 1993, annex C, provides additional services to allow the MAC service user the ability to determine and use multiple routes through a bridged LAN. This International Standard specifies the provision for an optional Route Determination Entity (RDE) within the LLC sublayer. This entity provides for the discovery and selection of a path (bridged route) for each required data link through the bridged LAN. It does not preclude the LLC service user from providing its own method of discovery and selection of routes.

To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options have been implemented. Such a statement is called a Protocol Implementation Conformance Statement (PICS), as defined in ISO/IEC 9646-1 : 1994. This International Standard provides such a PICS proforma (Annex A) in compliance with the relevant requirements, and in accordance with the relevant guidance given in ISO/IEC 9646-2 : 1994.

1.2 Standards compatibility

The peer protocol procedures defined in clause 5 utilize some of the concepts and principles, as well as commands and responses, of the balanced data link control procedures known as Asynchronous Balanced Mode (ABM), as defined in ISO/IEC 13239 : 1997. (The ABM procedures provided the basis upon which the ITU-T Recommendation X.25 Level 2 LAPB procedures were defined.) The frame structure defined for the data link layers procedures as a whole is defined in part in clause 3 of this International Standard and in part in those International Standards that define the various MAC procedures. The combination of a MAC sublayer address and an LLC sublayer address is unique to each data link layer service access point in the LAN.

NOTE—This division of data link layer addressing space into separate MAC and LLC address fields is not presently a part of any present ISO data link layer International Standard.

The RDE procedures defined in clause 9 utilize some of the concepts and principles as defined in ISO/IEC 10038 : 1993, annex C.

1.3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 8802. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 8802 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60955 : 1989, Process data highway, Type C (PROWAY C), for distributed process control systems.[2]

ISO/IEC 7498-1 : 1994, Information technology—Open Systems Interconnection—Basic Reference Model—The Basic Model.[3]

ISO/IEC 7498-4 : 1989, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 4: Management framework.

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[2]IEC publications are available from IEC Sales Department, Case Postale 131, 3 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse. IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[3]ISO and ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse. ISO and ISO/IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

ISO 8824 : 1990, Information technology—Open Systems Interconnection—Specification of Abstract Syntax Notation One (ASN. 1) (provisionally retained edition).

ISO/IEC 8886 : 1996, Information technology—Open Systems Interconnection—Data link service definition.

ISOIIEC 9595 : 1991, Information technology—Open Systems Interconnection—Common management information service definition.

ISO/IEC 9596-1 : 1991, Information technology—Open Systems Interconnection—Common management information protocol—Part 1: Specification.

ISO/IEC 9646-1 : 1994, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 1: General concepts.

ISO/IEC 9646-2 : 1994, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 2: Abstract Test Suite specification.

ISO/IEC 10038 : 1993 [ANSI/IEEE Std 802.1D, 1993 Edition], Information technology—Telecommunications and information exchange between systems—Local area networks—Media access control (MAC) bridges.[4]

ISO/IEC 10040 : 1992, Information technology—Open Systems Interconnection—Systems management overview.

ISO/IEC 10164-1 : 1993, Information technology—Open Systems Interconnection—Systems Management: Object Management Function.

ISO/IEC 10164-2 : 1993, Information technology—Open Systems Interconnection—Systems Management: State Management function.

ISO/IEC 10164-3 : 1993, Information technology—Open Systems Interconnection—Systems Management: Attributes for representing relationships.

ISO/IEC 10164-4 : 1992, Information technology—Open Systems Interconnection—Systems management: Alarm reporting function.

ISO/IEC 10164-5 : 1993, Information technology—Open Systems Interconnection—Systems management: Event Report Management Function.

ISO/IEC 10164-6 : 1993, Information technology—Open Systems Interconnection—Systems Management: Log control function.

ISO/IEC 10165-1 : 1993, Information technology—Open Systems Interconnection—Management information services—Structure of management information: Management Information Model.

ISO/IEC 10165-2 : 1992, Information technology—Open Systems Interconnection—Structure of management information: Definition of management information.

ISO/IEC 10165-4 : 1992, Information technology—Open Systems Interconnection—Structure of management information—Part 4: Guidelines for the definition of managed objects.

[4]This publication is available from the ISO Central Secretariat. It is also available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

ISO/IEC 10165-5 : 1994, Information technology—Open Systems Interconnection—Structure of management information: Generic management information.

ISO/IEC TR 10171 : 1994, Information technology—Telecommunications and information exchange between systems—List of standard data link layer protocols that utilize high-level data link control (HDLC) classes of procedures and list of standardized XID format identifiers and private parameter set identification values.

ISO/IEC 10742 : 1994, Information technology—Telecommunications and information exchange between systems—Elements of management information related to OSI Data Link Layer standards.

ISO/IEC 11575 : 1995, Information technology—Telecommunications and information exchange between systems—Protocol mappings for the OSI Data Link service.

ISO/IEC 13239 : 1997, Information technology—Telecommunications and information exchange between systems—High-level data link control (HDLC) procedures.

ITU-T Recommendation X.25, Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.[5]

ITU-T Recommendation X.200, Reference model on open systems interconnection for CCITT applications.

[5]All ITU-T publications are available from the International Telecommunications Union, Sales Section, Place des Nations, CH-1211, Genève 20, Switzerland/Suisse. They are also available in the United States from the U.S. Department of Commerce, Technology Administration, National Technical Information Service (NTIS), Springfield, VA 22161, USA.