

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**

ICS 35.110

National foreword

This British Standard reproduces verbatim ISO/IEC 8802-3:1996 and implements it as the UK national standard. It supersedes BS ISO/IEC 8802-3:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/6, Data communications, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO/IEC title page, pages ii to xxxviii, pages 1 to 433 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been prepared under the direction of the DISC Board, was published under the authority of the Standards Board and comes into effect on 15 May 1997

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INTERNATIONAL STANDARD

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8802-3

ANSI/IEEE
Std 802.3

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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

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

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



Reference number
ISO/IEC 8802-3:1996(E)
ANSI/IEEE
Std 802.3, 1996 Edition

Abstract: This Local and Metropolitan Area Network standard, ISO/IEC 8802-3:1996 [ANSI/IEEE Std 802.3, 1996 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, 10BASE-T, and 10BASE-F are included. System considerations for multisegment 10 Mb/s baseband networks are provided. Layer and sublayer interface specifications are aligned to the ISO/IEC Open Systems Interconnection Basic Reference Model and 8802 models. The 8802-3 internal model is defined and used.

Keywords: attachment unit interface (AUI), data processing, Ethernet, information interchange, local area networks; local area networks, management; mode of data transmission, network interconnection, models, repeater

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



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



Published by
The Institute of Electrical and Electronics Engineers, Inc.



International Standard ISO/IEC 8802-3:1996

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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.

The first international edition of this standard was published as ISO 8802-3:1989. New editions were published in 1990, 1992, and 1993.

This fifth edition cancels and replaces the fourth edition (ISO/IEC 8802-3:1993), which has been technically revised.

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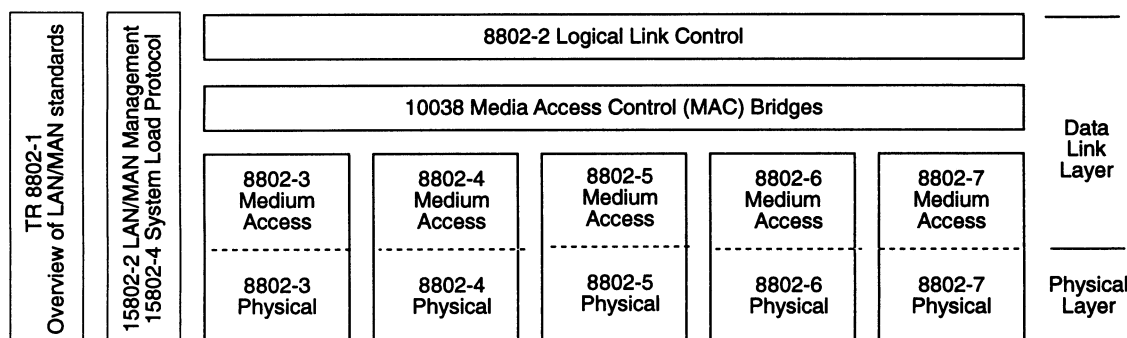


International Organization for Standardization/International Electrotechnical Commission
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Descriptors: Data processing, information interchange, telecommunications, network interconnection, local area networks, metropolitan area networks, data transmission, mode of data transmission, physical layer, management.

Foreword to International Standard ISO/IEC 8802-3:1996

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 Standard numbers.)



This family of International Standards deals with the Physical and Data Link layers as defined by the ISO/IEC Open Systems Interconnection Basic Reference Model (ISO/IEC 7498-1:1994). The access standards define five 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:

- ISO/IEC 8802-3 [ANSI/IEEE Std 802.3, 1996 Edition], a bus utilizing CSMA/CD as the access method.
- ISO/IEC 8802-4 [ANSI/IEEE Std 802.4:1990], a bus utilizing token passing as the access method.
- ISO/IEC 8802-5 [ANSI/IEEE Std 802.5:1992], a ring utilizing token passing as the access method.
- ISO/IEC 8802-6 [ANSI/IEEE Std 802.6, 1994 Edition], a dual bus utilizing distributed queuing as the access method.
- ISO 8802-7, a ring utilizing slotted ring as the access method.

ISO/IEC TR 8802-1 provides an overview of the LAN/MAN standards, along with details of their document numbering.

ISO/IEC 8802-2 [ANSI/IEEE Std 802.2, 1994 Edition], *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 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 level of the logical link control protocol.

ISO/IEC 15802-2 [ANSI/IEEE Std 802.1B, 1995 Edition], *LAN/MAN Management*, defines an Open Systems Interconnection (OSI) management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.

ISO/IEC 15802-4 [ANSI/IEEE Std 802.1E, 1994 Edition], *System Load Protocol*, specifies a set of services and protocol for those aspects of management concerned with the loading of systems in ISO/IEC LAN/MAN environments.

The main body of the International Standard serves for both the ISO/IEC 8802-3:1996 and IEEE Std 802.3, 1996 Edition standards. ISO and IEEE each have a unique foreword.

ANSI/IEEE Std 8802-3, 1996 Edition

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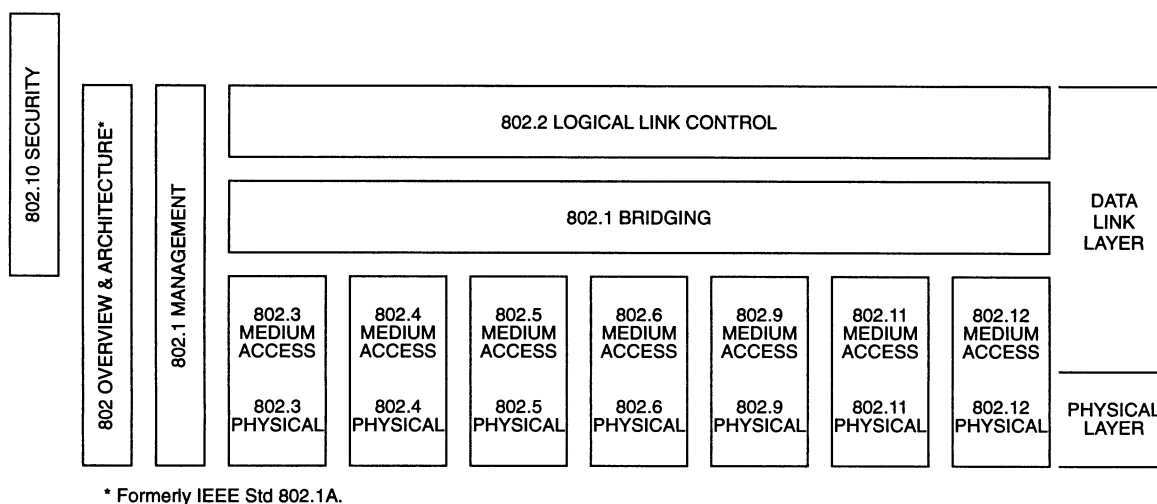
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Foreword to ANSI/IEEE Std 8803-3, 1996 Edition

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.)



This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) Open Systems Interconnection Basic Reference Model (ISO/IEC 7498-1:1994). 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 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. This document forms part of the 802.1 scope of work.
- ANSI/IEEE Std 802.1B and 802.1k [ISO/IEC 15802-2] *LAN/MAN Management.* Defines an Open Systems Interconnection (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] *MAC Bridging.* 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 802.2 [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 DIS 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*
- ANSI/IEEE Std 802.12 *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 groups have authorized standards projects under development:

- IEEE 802.11 *Wireless LAN Medium Access Control (MAC) Sublayer and Physical Layer Specifications*
- IEEE 802.14 *Standard Protocol for Cable-TV Based Broadband Communication Network*

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

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, 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.

ANSI/IEEE Std 802.3, 1996 Edition

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.

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

Working group members

The following individuals participated in the 802.3 working group during various stages of the standard's development. The superscripted letters by each name indicate the document(s) each participant worked on (a = 802.3a, b = 802.3b, etc.). The superscripted letter "o" indicates the original standard (ANSI/IEEE Std 802.3:1985). Complete identification of the documents is included in the officer listing on pages xii-xiii. Note that working group participation for IEEE Std 802.3r:1995 or 802.3u:1995 is not included in this edition, nor for the maintenance revisions 2, 3, or 4 (802.3m, n, and s).

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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 the original standard. The IEC TC83 Committee on Information Technology Equipment also provided very helpful input to the development of the FOIRL standard (802.3d:1987, 9.9).

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 , <i>Working Group Chair</i>
802.3a:1988 (clause 10), 10 Mb/s MAU 10BASE2	15 November 1985 (IEEE) 28 December 1987 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Alan Flatman , <i>Task Force Chair</i>
802.3b:1985 (clause 11), 10 Mb/s Broadband MAU, 10BROAD36	19 September 1985 (IEEE) 28 February 1986 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Menachem Abraham , <i>Task Force Chair</i>
802.3c:1985 (9.1 – 9.8), 10 Mb/s Baseband Repeater	12 December 1985 (IEEE) 4 June 1986 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Geoffrey O. Thompson , <i>Task Force Chair</i>
802.3d:1987 (9.9), 10 Mb/s Fiber MAU, FOIRL	10 December 1987 (IEEE) 9 February 1989 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Steven Moustakas , <i>Task Force Chair</i>
802.3e:1987 (clause 12), 1 Mb/s MAU and Hub 1BASE5	11 June 1987 (IEEE) 15 December 1987 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Robert Galin , <i>Task Force Chair</i>
802.3h:1990 (clause 5), 10 Mb/s Layer Management, DTEs	28 September 1990 (IEEE) 11 March 1991 (ANSI)	Donald C. Loughry , <i>Working Group Chair</i> Andy J. Luque , <i>Task Force Chair</i>
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 , <i>Working Group Chair</i> Patricia Thaler , <i>Task Force Chair (initial)</i> Richard Anderson , <i>Task Force Chair (final)</i>
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 , <i>Working Group Chair</i> Keith Amundsen , <i>Task Force Chair (initial)</i> Frederick Scholl , <i>Task Force Chair (final)</i> Michael E. Lee , <i>Technical Editor</i>
802.3k:1993 (clause 19), 10 Mb/s Layer Management, Repeaters	17 September 1992 (IEEE) 8 March 1993 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Joseph S. Skorupa , <i>Task Force Chair</i> Geoffrey O. Thompson , <i>Vice Chair and Editor</i>

ANSI/IEEE Std 802.3 document	Date approved by IEEE and ANSI	Officers at the time of working group ballot
802.3l:1992 (14.10), 10 Mb/s PICS Proforma 10BASE-T MAU	17 September 1992 (IEEE) 23 February 1993 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Mike Armstrong , <i>Task Force Chair and Editor</i> Paul Nikolich , <i>Vice Chair</i> William Randle , <i>Editorial Coordinator</i>
802.3m:1995, Maintenance 2	21 September 1995 (IEEE) 16 July 1996 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Gary Robinson , <i>Maintenance Chair</i>
802.3n:1995, Maintenance 3	21 September 1995 (IEEE) 4 April 1996 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Gary Robinson , <i>Maintenance Chair</i>
802.3p:1993 (clause 20), Management, 10 Mb/s Integrated MAUs	17 June 1993 (IEEE) 4 January 1994 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Joseph S. Skorupa , <i>Task Force Chair</i> Geoffrey O. Thompson , <i>Vice Chair and Editor</i>
802.3q:1993 (clause 5), 10 Mb/s Layer Management, GDMO Format	17 June 1993 (IEEE) 4 January 1994 (ANSI)	Patricia Thaler , <i>Working Group Chair</i> Joseph S. Skorupa , <i>Task Force Chair</i> Geoffrey O. Thompson , <i>Vice Chair and Editor</i>
802.3s:1995, Maintenance 4	21 September 1995 (IEEE) 8 April 1996 (ANSI)	Geoffrey O. Thompson , <i>Working Group Chair</i> Gary Robinson , <i>Maintenance Chair</i>
802.3t:1995, 120 Ω informative annex to 10BASE-T	14 June 1995 (IEEE) 12 January 1996 (ANSI)	Geoffrey O. Thompson , <i>Working Group Chair</i> Jacques Christ , <i>Task Force Chair</i>
802.3v:1995, 150 Ω informative annex to 10BASE-T	12 December 1995 (IEEE) 16 July 1996 (ANSI)	Geoffrey O. Thompson , <i>Working Group Chair</i> Larry Nicholson , <i>Task Force Chair</i>

Two other supplements, IEEE Std 802.3u:1995, *Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation, Type 100BASE-T and 802.3r:1995, Protocol Implementation Conformance Statement (PICS) Proforma, Type 10BASE5 MAU*, have been approved by IEEE but are not included in this edition.

Balloting group members

On the following pages, members of balloting groups for the parts of IEEE Std 802.3 included in this edition are listed. Note that balloting groups for maintenance revisions 2, 3, and 4 (802.3m, n, and s) are not included.

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802.3i-1990

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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 clauses of this International Standard.

This is a comprehensive International Standard for Local Area Networks (LANs) employing CSMA/CD as the access method. This International 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 International Standard provides the necessary specifications for 10 Mb/s baseband and broadband systems, a 1 Mb/s baseband system, and a repeater unit.

NOTE Additional specifications for a 100 Mb/s system have been approved by the IEEE and are being considered by ISO/IEC at the time of publication of this International Standard.

1.1.2 Architectural perspectives

There are two important ways to view local area network (LAN) design corresponding to

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

This International 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 Figure 1-1). See ISO/IEC 7498-1:1994. 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 Architectural rationale

An architectural organization of the International Standard has two main advantages:

- a) *Clarity*. A clean overall division of the design along architectural lines makes the standard clearer.
- b) *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 LAN standards.

The architectural model is based on a set of interfaces that may be different from those emphasized in implementations. One critical aspect of the design, however, shall be addressed largely in terms of the implementation interfaces: compatibility.

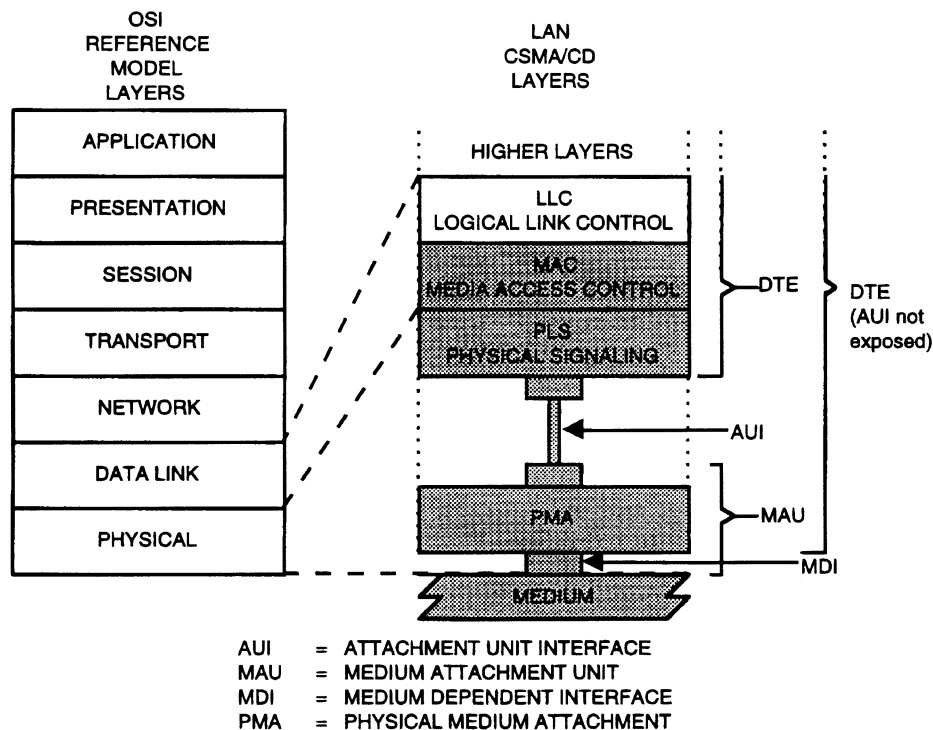


Figure 1-1 — ISO/IEC 8802-3 relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model

1.1.2.2 Compatibility interfaces

Two important compatibility interfaces are defined within what is architecturally the Physical Layer.

- Medium-Dependent Interface (MDI)*. To communicate in a compatible manner, all stations shall adhere rigidly to the exact specification of physical media signals defined in clause 8 (and beyond) in this International Standard, and to the procedures that define correct behavior of a station. The medium-independent aspects of the LLC sublayer and the MAC sublayer should not be taken as detracting from this point; communication by way of the ISO/IEC 8802-3 [ANSI/IEEE 802.3] LAN requires complete compatibility at the Physical Medium interface (that is, the coaxial cable interface).
- Attachment Unit Interface (AUI)*. It is anticipated that most DTEs will be located some distance from their connection to the coaxial cable. A small amount of circuitry will exist in the Medium Attachment Unit (MAU) directly adjacent to the coaxial cable, while the majority of the hardware and all of the software will be placed within the DTE. The AUI is defined as a second compatibility interface. While conformance with this interface is not strictly necessary to ensure communication, it is highly recommended, since it allows maximum flexibility in intermixing MAUs and DTEs. The AUI may be optional or not specified for some implementations of this International Standard that are expected to be connected directly to the medium and so do not use a separate MAU or its inter-connecting AUI cable. The PLS and PMA are then part of a single unit, and no explicit AUI specification is required.

1.1.3 Layer interfaces

In the architectural model used here, the layers interact by way of well defined interfaces, providing services as specified in clauses 2 and 6. In general, the interface requirements are as follows:

- The interface between the MAC sublayer and the LLC sublayer includes facilities for transmitting and receiving frames, and provides per-operation status information for use by higher-layer error recovery procedures.
- The interface between the MAC sublayer and the Physical Layer includes signals for framing (carrier sense, transmit initiation) and contention resolution (collision detect), facilities for passing a pair of serial bit streams (transmit, receive) between the two layers, and a wait function for timing.

These interfaces are described more precisely in 4.3. Additional interfaces are necessary to allow higher level network management facilities to interact with these layers to perform operation, maintenance, and planning functions. Network management functions will be discussed in clause 5.

1.1.4 Application areas

The applications environment for the LAN is intended to be commercial and light industrial. Use of CSMA/CD LANs in home or heavy industrial environments, while not precluded, is not considered within the scope of this International Standard.

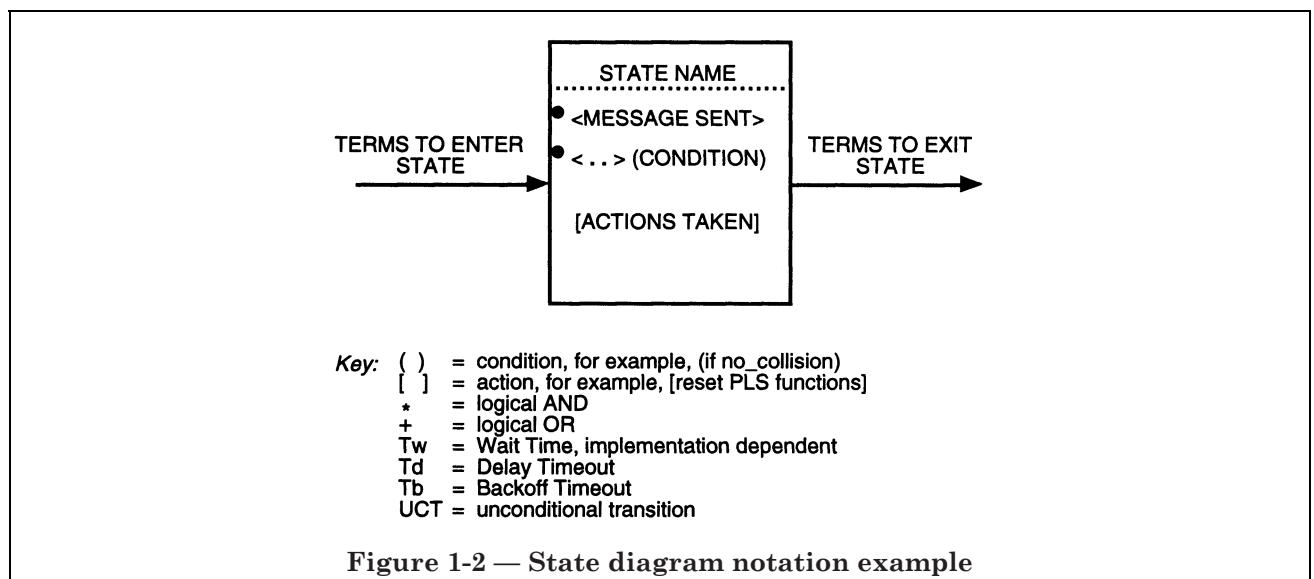
1.2 Notation

1.2.1 State diagram conventions

The operation of a protocol can be described by subdividing the protocol into a number of interrelated functions. The operation of the functions can be described by state diagrams. Each diagram represents the domain of a function and consists of a group of connected, mutually exclusive states. Only one state of a function is active at any given time (see Figure 1-2).

Each state that the function can assume is represented by a rectangle. These are divided into two parts by a horizontal line. In the upper part the state is identified by a name in capital letters. The lower part contains the name of any ON signal that is generated by the function. Actions are described by short phrases and enclosed in brackets.

All permissible transitions between the states of a function are represented graphically by arrows between them. A transition that is global in nature (for example, an exit condition from all states to the IDLE or RESET state) is indicated by an open arrow. Labels on transitions are qualifiers that must be fulfilled before the transition will be taken. The label UCT designates an unconditional transition. Qualifiers described by short phrases are enclosed in parentheses.



State transitions and sending and receiving of messages occur instantaneously. When a state is entered and the condition to leave that state is not immediately fulfilled, the state executes continuously, sending the messages and executing the actions contained in the state in a continuous manner.

Some devices described in this International Standard (e.g., repeaters) are allowed to have two or more ports. State diagrams capable of describing the operation of devices with an unspecified number of ports, required qualifier notation that allows testing for conditions at multiple ports. The notation used is a term that includes a description in parentheses of which ports must meet the term for the qualifier to be satisfied (e.g., ANY and ALL). It is also necessary to provide for term-assignment statements that assign a name to a port that satisfies a qualifier. The following convention is used to describe a term-assignment statement that is associated with a transition:

- a) The character ":" (colon) is a delimiter used to denote that a term assignment statement follows.

b) The character “←”(left arrow) denotes assignment of the value following the arrow to the term preceding the arrow.

The state diagrams contain the authoritative statement of the functions they depict; when apparent conflicts between descriptive text and state diagrams arise, the state diagrams are to take precedence. This does not override, however, any explicit description in the text that has no parallel in the state diagrams. The models presented by state diagrams are intended as the primary specifications of the functions to be provided. It is important to distinguish, however, between a model and a real implementation. The models are optimized for simplicity and clarity of presentation, while any realistic implementation may place heavier emphasis on efficiency and suitability to a particular implementation technology. It is the functional behavior of any unit that must match the International Standard, not its internal structure. The internal details of the model are useful only to the extent that they specify the external behavior clearly and precisely.

1.2.2 Service specification method and notation

The service of a layer or sublayer is the set of capabilities that it offers to a user in the next higher (sub)layer. Abstract services are specified here by describing the service primitives and parameters that characterize each service. This definition of service is independent of any particular implementation (see Figure 1-3).

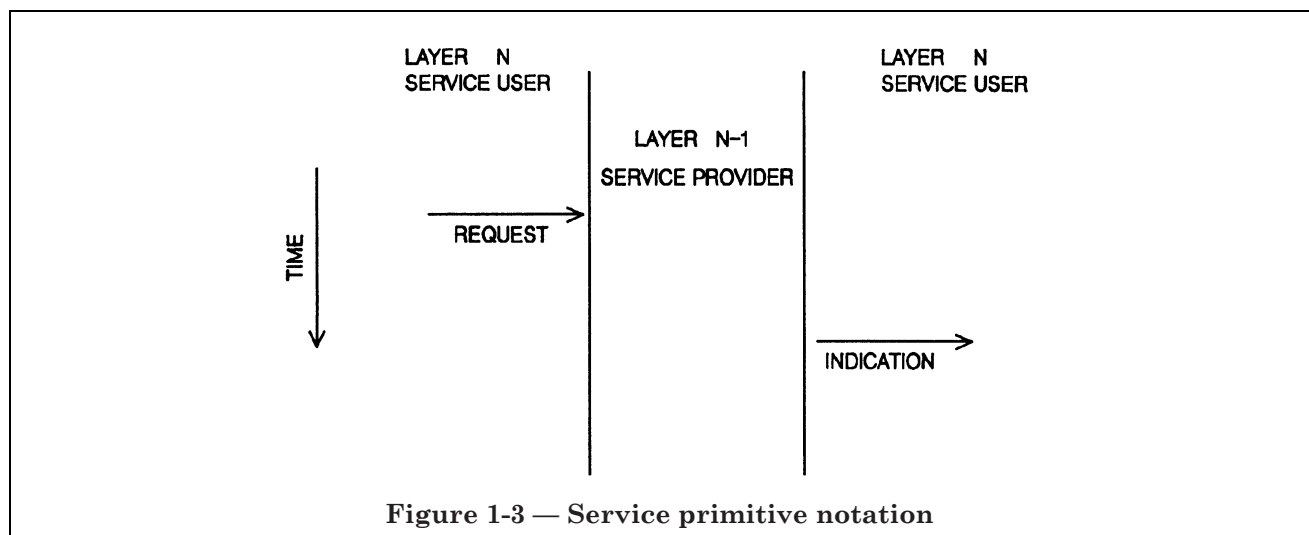


Figure 1-3 — Service primitive notation

Specific implementations may also include provisions for interface interactions that have no direct end-to-end effects. Examples of such local interactions include interface flow control, status requests and indications, error notifications, and layer management. Specific implementation details are omitted from this service specification both because they will differ from implementation to implementation and because they do not impact the peer-to-peer protocols.

1.2.2.1 Classification of service primitives

Primitives are of two generic types:

- REQUEST.** The request primitive is passed from layer N to layer N-1 to request that a service be initiated.
- INDICATION.** The indication primitive is passed from layer N-1 to layer N to indicate an internal layer N-1 event that is significant to layer N. This event may be logically related to a remote service request, or may be caused by an event internal to layer N-1.

The service primitives are an abstraction of the functional specification and the user-layer interaction. The abstract definition does not contain local detail of the user/provider interaction. For instance, it does not indicate the local mechanism that allows a user to indicate that it is awaiting an incoming call. Each primitive has a set of zero or more parameters, representing data elements that shall be passed to qualify the functions invoked by the primitive. Parameters indicate information available in a user/provider interaction; in any particular interface, some parameters may be explicitly stated (even though not explicitly defined in the primitive) or implicitly associated with the service access point. Similarly, in any particular protocol specification, functions corresponding to a service primitive may be explicitly defined or implicitly available.

1.2.3 Physical Layer and media notation

Users of this International Standard need to reference which particular implementation is being used or identified. Therefore, a means of identifying each implementation is given by a simple, three-field, type notation that is explicitly stated at the beginning of each relevant clause. In general, the Physical Layer type is specified by these fields:

<data rate in Mb/s> <medium type> <maximum segment length ($\times 100$ m)>

For example, the International Standard contains a 10 Mb/s baseband specification identified as "TYPE 10BASE5," meaning a 10 Mb/s baseband medium whose maximum segment length is 500 m. Each successive Physical Layer specification will state its own unique TYPE identifier along similar lines.

1.2.4 Physical Layer message notation

Messages generated within the Physical Layer, either within or between PLS and the MAU (that is, PMA circuitry), are designated by an italic type to designate either form of physical or logical message used to execute the physical layer signaling process (for example, *input_idle* or *mau_available*).

1.3 References

The following standards contain provisions which, through references in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Local and national standards such as those supported by ANSI, EIA, IEEE, MIL, NFPA and UL are not a formal part of the ISO/IEC 8802-3 standard except where equivalent International Standards do not exist.

Reference to local or national standards that may be useful resource material are identified by a bracketed number and located in Annex A.

CISPR 22:1993, *Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment*¹⁾.

IEC 60, *High-voltage test techniques*²⁾.

IEC 68, *Basic environmental testing procedures*.

IEC 96-1:1986, *Radio-frequency cables, Part 1: General requirements and measuring methods and Amendment No. 2 (1993)*.

IEC 169-8 and IEC 169-16, *Radio-frequency connectors, Part 8: Radio-frequency coaxial connectors with inner diameter of outer conductor 6.5 mm (0.256 in) with bayonet lock — Characteristic impedance 50 ohms (Type BNC); Part 16: Radio-frequency coaxial connectors with inner diameter of outer conductor 7 mm (0.276 in) with screw coupling — Characteristic impedance 50 ohms (75 ohms) (Type N)*.

IEC 380, *Safety of electrically energized office machines*.

IEC 435, *Safety of data processing equipment*.

IEC 793-1:1992, *Optical fibres — Part 1: Generic specification*.

¹⁾ CISPR documents are available from the International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH 1211, Genève 20, Switzerland/Suisse. CISPR documents 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.

²⁾ IEC publications are available from IEC Sales Department, Case Postale 131, 3 rue de Varembe, 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.

- IEC 793-2:1992, *Optical fibres — Part 2: Product specifications*.
- IEC 794-1:1993, *Optical fibre cables — Part 1: Generic specification*.
- IEC 794-2:1989, *Optical fibre cables — Part 2: Product specifications*.
- IEC 807-2:1992, *Rectangular connectors for frequencies below 3 MHz, Part 2: Detail specification for a range of connectors with assessed quality, with trapezoidal shaped metal shells and round contacts — Fixed solder contact types*.
- IEC 825:1993, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide*.
- IEC 874-1:1993, *Connectors for optical fibres and cables — Part 1: Generic specification*.
- IEC 874-2:1993, *Connectors for optical fibres and cables — Part 2: Sectional specification for fibre optic connector type F-SMA*.
- IEC 874-10:1992, *Connectors for optical fibres and cables — Part 10: Sectional specification, Fibre optic connector type BFOC/2,5*.
- IEC 950:1991, *Safety of Information Technology Equipment, Including Electrical Business Equipment*.
- IEEE Std 802:1990, *IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture (ANSI)*³⁾.
- IEEE Std 802.1F:1993, *IEEE Standards for Local and Metropolitan Area Networks: Common Definitions and Procedures for IEEE 802 Management Information (ANSI)*.
- ISO 2382-9:1984, *Data processing — Vocabulary — Part 09: Data communication*⁴⁾.
- ISO/IEC 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*.
- ISO/IEC 7498-4:1989, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 4: Management Framework*.
- ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1)*.
- ISO/IEC 8825:1990, *Information technology — Open Systems Interconnection — Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)*.
- ISO/IEC 8877:1992, *Information technology — Telecommunications and information exchange between systems — Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T*.
- ISO/IEC 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 10040:1992, *Information technology — Open Systems Interconnection — Systems management overview*.
- ISO/IEC 10164-1:1992, *Information technology — Open Systems Interconnection — Systems management — Part 1: Object Management Function*.
- ISO/IEC 10165-1:1993, *Information technology — Open Systems Interconnection — Management information services — Structure of management information — Part 1: Management Information Model*.
- ISO/IEC 10165-2:1992, *Information technology — Open Systems Interconnection — Management information services — Structure of management information — Part 2: Definition of management information*.

³⁾ IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

⁴⁾ ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse. ISO 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/IEC 10165-4:1992, *Information technology — Open Systems Interconnection — Management information services — Structure of management information — Part 4: Guidelines for the definition of managed objects.*

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 11801:1995, *Information technology — Generic cabling for customer premises.*

ISO/IEC 15802-2:1995 [ANSI/IEEE Std 802.1B-1992 and IEEE Std 802.1k-1993], *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Common specifications — Part 2: LAN/MAN Management.*

1.4 Definitions

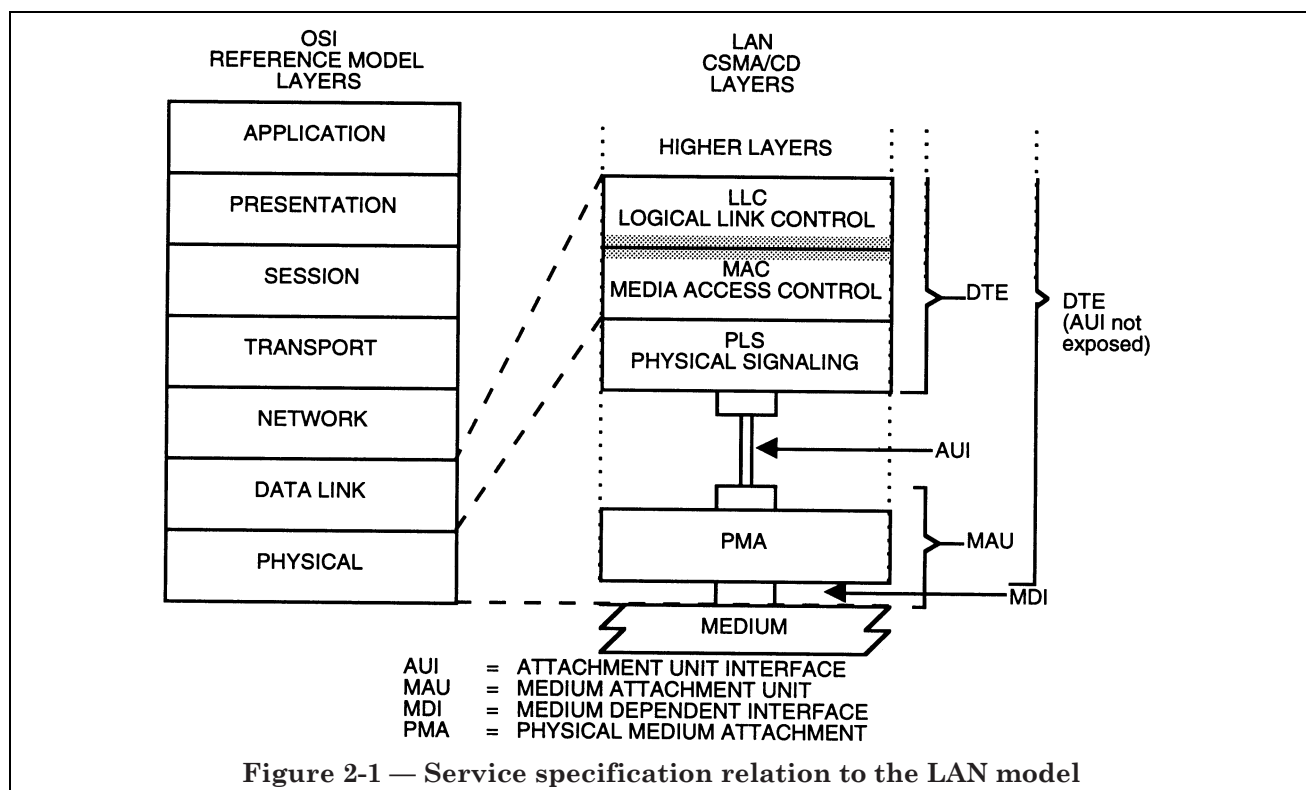
The definitions used in this International Standard are consistent with ISO 2382-9:1984.

EDITORIAL NOTE — A more specific part 25 pertaining to LAN systems has been approved since the definitions in this International Standard were established. This International Standard is ISO/IEC 2382-25:1992, *Information technology — Vocabulary — Part 25: Local area networks.*

2 Media Access Control (MAC) service specification

2.1 Scope and field of application

This clause specifies the services provided by the Media Access Control (MAC) sublayer to the Logical Link Control (LLC) sublayer for the ISO/IEC LAN International Standard (see Figure 2-1). The services are described in an abstract way and do not imply any particular implementation, or any exposed interface. There is not necessarily a one-to-one correspondence between the primitives and the formal procedures and interfaces described in 4.2 and 4.3.



2.2 Overview of the service

2.2.1 General description of services provided by the layer

The services provided by the MAC sublayer allow the local LLC sublayer entity to exchange LLC data units with peer LLC sublayer entities. Optional support may be provided for resetting the MAC sublayer entity to a known state.

2.2.2 Model used for the service specification

The model used in this service specification is identical to that used in 1.2.

2.2.3 Overview of interactions

MA_DATA.request
MA_DATA.indication

2.2.4 Basic services and options

The MA_DATA.request and MA_DATA.indication service primitives described in this clause are considered mandatory.

2.3 Detailed service specification

2.3.1 MA_DATA.request

2.3.1.1 Function

This primitive defines the transfer of data from a local LLC sublayer entity to a single peer LLC entity or multiple peer LLC entities in the case of group addresses.

2.3.1.2 Semantics of the service primitive

The semantics of the primitive are as follows:

```
MA_DATA.request    (
                    destination_address,
                    m_sdu,
                    service_class
                    )
```

The destination_address parameter may specify either an individual or a group MAC entity address. It must contain sufficient information to create the DA field that is appended to the frame by the local MAC sublayer entity and any physical information. The m_sdu parameter specifies the MAC service data unit to be transmitted by the MAC sublayer entity. There is sufficient information associated with m_sdu for the MAC sublayer entity to determine the length of the data unit. The service_class parameter indicates a quality of service requested by LLC or higher layer (see 2.3.1.5).

2.3.1.3 When generated

This primitive is generated by the LLC sublayer entity whenever data shall be transferred to a peer LLC entity or entities. This can be in response to a request from higher protocol layers or from data generated internally to the LLC sublayer, such as required by Type 2 service.

2.3.1.4 Effect of receipt

The receipt of this primitive will cause the MAC entity to append all MAC specific fields, including DA, SA, and any fields that are unique to the particular media access method, and pass the properly formed frame to the lower protocol layers for transfer to the peer MAC sublayer entity or entities.

2.3.1.5 Additional comments

The CSMA/CD MAC protocol provides a single quality of service regardless of the service_class requested.

2.3.2 MA_DATA.indication

2.3.2.1 Function

This primitive defines the transfer of data from the MAC sublayer entity to the LLC sublayer entity or entities in the case of group addresses.