

# INTERNATIONAL STANDARD

**ISO/IEC  
15802-3**

**ANSI/IEEE  
Std 802.1D**

First edition  
1998-12-01

**Information technology —  
Telecommunications and information  
exchange between systems — Local and  
metropolitan area networks — Common  
specifications —**

**Part 3:  
Media Access Control (MAC) Bridges**

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

*Partie 3: Ponts de contrôle d'accès au support*



Reference number  
ISO/IEC 15802-3:1998(E)  
ANSI/IEEE  
Std 802.1D, 1998 edition

**ISO/IEC 15802-3: 1998  
ANSI/IEEE Std 802.1D, 1998 Edition**  
(Revision and redesignation of  
ISO/IEC 10038: 1993  
[ANSI/IEEE Std 802.1D, 1993 Edition],  
incorporating IEEE supplements  
P802.1p, 802.1j-1996, 802.6k-1992,  
802.11c-1998, and P802.12e)

**Information technology—  
Telecommunications and information exchange  
between systems—  
Local and metropolitan area networks—  
Common specifications—**

## **Part 3: Media Access Control (MAC) Bridges**

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## International Standard ISO/IEC 15802-3:1998(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 15802-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology, Subcommittee SC 6, Telecommunications and information exchange between systems*.

This edition cancels and replaces ISO/IEC 10038:1993.

ISO/IEC 15802 consists of the following parts, under the general title *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Common specifications*:

- Part 1: Medium Access Control (MAC) service definition
- Part 2: LAN/MAN management
- Part 3: Media Access Control (MAC) Bridges
- Part 4: System load protocol
- Part 5: Remote Media Access Control (MAC) bridging

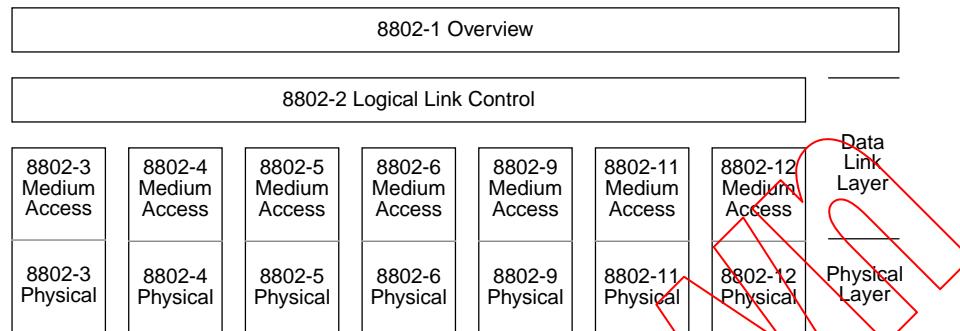
Annexes A, C, D and E form an integral part of this part of ISO/IEC 15802. Annexes B, F, G and H are for information only.



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## Foreword to International Standard ISO/IEC 15802-3: 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 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 15802-3, *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 15802-4, *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 802.1D, 1998 Edition

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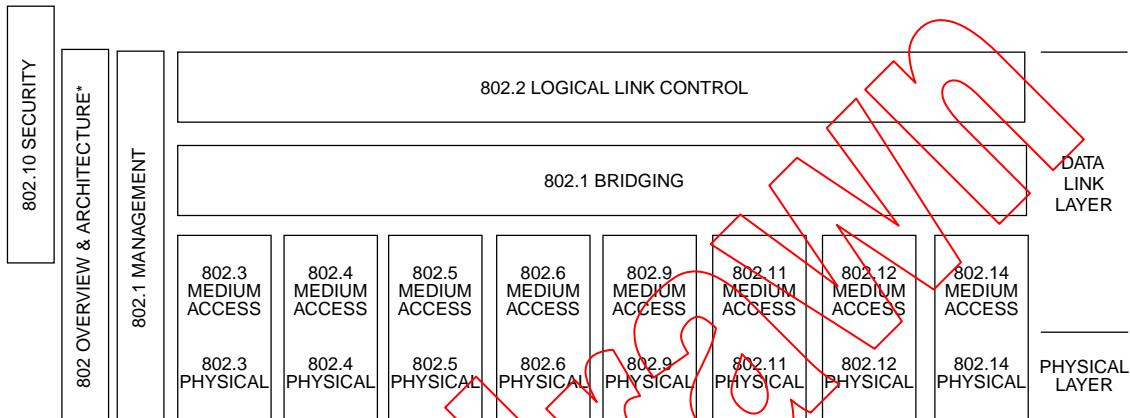
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## Introduction to ANSI/IEEE Std 802.1D, 1998 Edition

[This introduction is not part of ANSI/IEEE Std 802.1D, 1998 Edition, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Common specifications—Part 3: Media Access Control (MAC) Bridges.]

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 (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 *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 15802-3] *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 802.1F *Common Definitions and Procedures for IEEE 802 Management Information*
- 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 *Logical link control* [ISO/IEC 8802-2]

- 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 (DQDB) 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*
- ANSI/IEEE Std 802.11 [ISO/IEC DIS 8802-11] *Wireless LAN Medium Access Control (MAC) and physical layer specifications*
- ANSI/IEEE Std 802.12 [ISO/IEC 8802-12] *Demand-priority access method, physical layer and repeater specifications*

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

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

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 802.1D, 1998 Edition

The MAC Bridge standardization activities that resulted in the development of IEEE Std 802.1D-1990 (subsequently republished as ISO/IEC 10038:1993 [IEEE Std 802.1D, 1993 Edition]) specified an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC Service boundary. IEEE Std 802.1D-1990 also introduced the concept of filtering services in Bridged LANs, and mechanisms whereby filtering information in such LANs may be acquired and held in a Filtering Database. This revision of ISO/IEC 10038: 1993 extends this concept of filtering services in order to define additional capabilities in Bridged LANs aimed at the following:

- a) The provision of expedited traffic capabilities, to support the transmission of time-critical information in a LAN environment;
- b) The provision of filtering services that support the dynamic definition and establishment of Groups in a LAN environment, and the filtering of frames by Bridges such that frames addressed to a given

Groups are forwarded only on those LAN segments that are required in order to reach the members of that Group.

To this end, this document incorporates a set of changes and additions to ISO/IEC 10038: 1993 that define the following:

- a) The nature of Filtering Services in Bridged LANs;
- b) The concept of Traffic Classes and the effect on the operation of the Forwarding Process of supporting multiple Traffic Classes in Bridges;
- c) The structure of the Filtering Database that is needed in order to support Dynamic Multicast Filtering services;
- d) The registration protocol that is required in order to provide Dynamic Multicast Filtering Services;
- e) The management services and operations that are required in order to support administration of Dynamic Multicast Filtering Services.

### **Relationship between IEEE Std 802.1D and IEEE P802.1Q**

A further IEEE standard under development, IEEE P802.1Q, extends the concepts of filtering services and MAC Bridging in order to provide a set of capabilities that allow MAC Bridges to support the definition and management of Virtual LANs (VLANs).

The capabilities defined in IEEE P802.1Q include the definition of a VLAN frame format that is able to carry VLAN identification and user priority information over LAN technologies, such as CSMA/CD, that have no inherent capability to signal priority information. This information is carried in an additional header field, known as the *Tag Header*, which is inserted immediately following the Destination MAC Address, and Source MAC Address (and Routing Information field, if present) of the original frame. IEEE P802.1Q extends the priority handling aspects of this standard to make use of the ability of the VLAN frame format to carry user priority information end to end across any set of concatenated underlying MACs.

The VLAN Bridging specification contained in IEEE 802.1Q is independent of this standard, in the sense that IEEE 802.1Q makes a separate and distinct statement of the conformance requirements for VLAN Bridges from the conformance requirements for MAC Bridges defined in this standard. However, IEEE 802.1Q makes use of many of the elements of the specification contained in this standard, in particular

- a) The Bridge architecture;
- b) The Internal Sublayer Service, and the specification of its provision by IEEE 802 LAN MACs;
- c) The major features of the operation of the Forwarding Process;
- d) The Spanning Tree Algorithm and Protocol;
- e) The Generic Attribute Registration Protocol (GARP); and
- f) The GARP Multicast Registration Protocol (GMRP).

## Participants

The following is a list of participants in the Interworking activities of the IEEE 802.1 Working Group. Voting members at the time of publication are marked with an asterisk (\*).

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Kristin M. Dittmann  
*IEEE Standards Project Editor*

## IEEE Std 802.11c-1998

IEEE Std 802.11c-1998 adds the necessary information to map the IEEE 802.11 MAC parameters onto ISO/IEC 15802-3 (IEEE Std 802.1D) parameters.

### Participants

At the time the draft of IEEE Std 802.11c was sent to sponsor ballot, the IEEE 802.11 working group had the following voting members:

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Major contributions were received from Henri Moelard.

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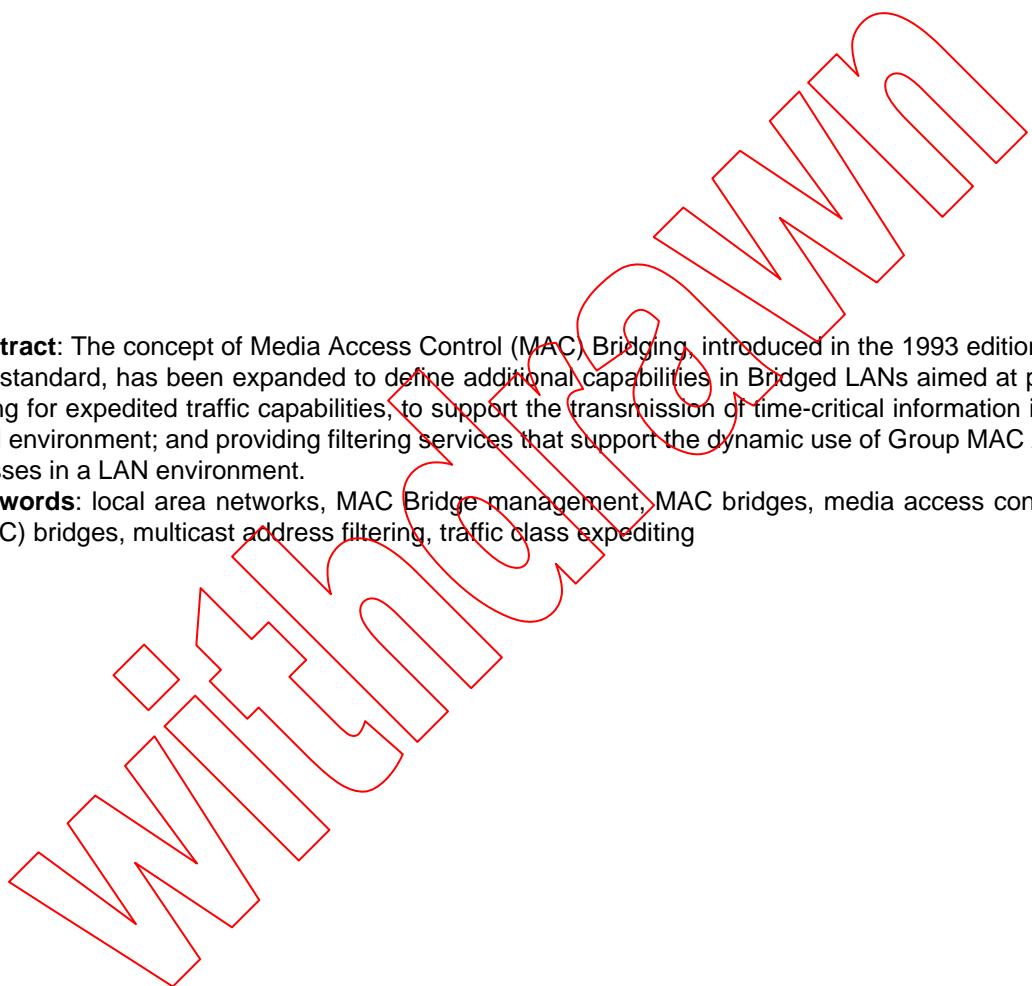
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*IEEE Standards Project Editor*

**Abstract:** The concept of Media Access Control (MAC) Bridging, introduced in the 1993 edition of this standard, has been expanded to define additional capabilities in Bridged LANs aimed at providing for expedited traffic capabilities; to support the transmission of time-critical information in a LAN environment; and providing filtering services that support the dynamic use of Group MAC Addresses in a LAN environment.

**Keywords:** local area networks, MAC Bridge management, MAC bridges, media access control (MAC) bridges, multicast address filtering, traffic class expediting



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# Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Common specifications—

## Part 3: Media Access Control (MAC) Bridges

### 1. Overview

#### 1.1 Introduction

IEEE 802 Local Area Networks (or LANs; see 3.4) of all types can be connected together using MAC Bridges. Each individual LAN has its own independent MAC. The Bridged LAN created allows the interconnection of stations attached to separate LANs as if they were attached to a single LAN, although they are in fact attached to separate LANs each with its own MAC. A MAC Bridge operates below the MAC Service Boundary, and is transparent to protocols operating above this boundary, in the Logical Link Control (LLC) sublayer or Network Layer (ISO/IEC 7498-1: 1994<sup>1</sup>). The presence of one or more MAC Bridges can lead to differences in the Quality of Service provided by the MAC sublayer; it is only because of such differences that MAC Bridge operation is not fully transparent.

A Bridged LAN can provide for

- a) The interconnection of stations attached to LANs of different MAC types;
- b) An effective increase in the physical extent, the number of permissible attachments, or the total performance of a LAN;
- c) Partitioning of the physical LAN for administrative or maintenance reasons.

NOTE—Scope, definitions, references, and conformance requirements relating to the operation of Source-Routing Transparent Bridge operation can be found in Annex C.1.

#### 1.2 Scope

For the purpose of compatible interconnection of data processing equipment using the IEEE 802 MAC Service supported by interconnected IEEE 802 LANs (see 3.4) using different or identical Media Access Control methods, this standard specifies a general method for the operation of MAC Bridges. To this end it

- a) Positions the bridging function within an architectural description of the MAC Sublayer.
- b) Defines the principles of operation of the MAC Bridge in terms of the support and preservation of the MAC Service, and the maintenance of Quality of Service.
- c) Specifies the MAC Internal Sublayer Service provided by individual LANs to the Media Access Method Independent Functions that provide frame relay in the Bridge.
- d) Identifies the functions to be performed by Bridges, and provides an architectural model of the internal operation of a Bridge in terms of Processes and Entities that provide those functions.
- e) Establishes the requirements for a protocol between the Bridges in a Bridged LAN to configure the network, and specifies the distributed computation of a Spanning Tree active topology.
- f) Specifies the encoding of the Bridge Protocol Data Units (BPDUs).
- g) Establishes the requirements for Bridge Management in the Bridged LAN, identifying the managed objects and defining the management operations.

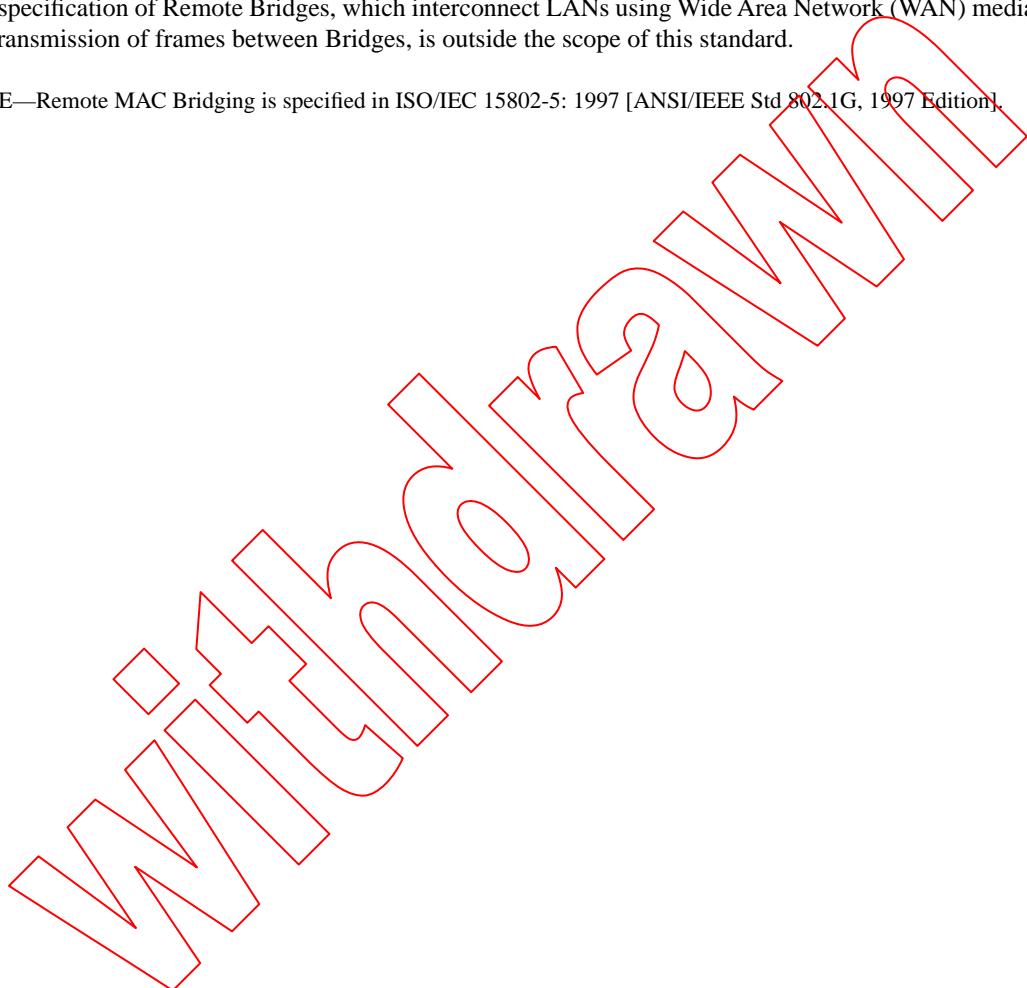
<sup>1</sup>Information about references can be found in Clause 2.

- h) Specifies how the management operations are made available to a remote manager using the protocol and architectural description provided by ISO/IEC 15802-2: 1995.
- i) Specifies performance requirements and recommends default values and applicable ranges for the operational parameters of a Bridge.
- j) Specifies the requirements to be satisfied by equipment claiming conformance to this standard.
- k) Specifies criteria for the use of MAC-specific bridging methods.

This standard specifies the operation of MAC Bridges that attach directly to IEEE 802 LANs, as specified in the relevant MAC standards for the MAC technology or technologies implemented.

The specification of Remote Bridges, which interconnect LANs using Wide Area Network (WAN) media for the transmission of frames between Bridges, is outside the scope of this standard.

NOTE—Remote MAC Bridging is specified in ISO/IEC 15802-5: 1997 [ANSI/IEEE Std 802.1G, 1997 Edition].



## 2. References

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 15802. 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 15802 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ANSI X3.159-1989, American National Standards for Information Systems—Programming Language—C.<sup>2</sup>

IEEE Std 802-1990, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.<sup>3</sup>

IEEE Std 802.1F-1993, IEEE Standards for Local and Metropolitan Area Networks: Common Definitions and Procedures for IEEE 802 Management Information.

IEEE Std 802.3, 1998 Edition, 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.

IEEE Std 802.9a-1995, IEEE Standards for Local and Metropolitan Area Networks: Supplement to Integrated Services (IS) LAN Interface at the Medium Access Control (MAC) and Physical (PHY) Layers: Specification of ISLAN 16-T.

IEEE Std 802.11-1997, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.<sup>4</sup>

IETF INTERNET DRAFT, Internet Group Management Protocol (IGMP), Version 2, January 20th 1997<sup>5</sup>.

IETF RFC 1493, Decker, Langille, Rjisinghani and McCloghrie, Definitions of Managed Objects for Bridges, July 1993<sup>6</sup>.

ISO 6937-2: 1983, Information processing—Coded character sets for text communication—Part 2: Latin alphabetic and non-alphabetic graphic characters.<sup>7</sup>

ISO/IEC 7498-1: 1994, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 1: The Basic Model.

<sup>2</sup>ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

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

<sup>4</sup>A draft International Standard (ISO/IEC DIS 8802-11) is under way for this standard. For information about the status of this DIS, contact the ISO Central Secretariat, 1 rue de Varembe, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse; or the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

<sup>5</sup>Internet Drafts are retrievable at the IETF Web site, <http://www.ietf.cnri.reston.va.us/home.html>, or call InterNIC at 1-800-444-4345 for information about receiving copies through the mail.

<sup>6</sup>Internet RFCs are retrievable by FTP at <ds.internic.net/rfc/rfcnnnn.txt> (where nnnn is a standard's publication number such as 1493), or call InterNIC at 1-800-444-4345 for information about receiving copies through the mail.

<sup>7</sup>ISO and ISO/IEC documents are available from the ISO Central Secretariat, 1 rue de Varembe, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse; and from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

ISO/IEC 15802-3: 1998(E)  
ANSI/IEEE Std 802.1D, 1998 Edition

LOCAL AND METROPOLITAN AREA NETWORKS:

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ISO/IEC 8802-4: 1990 [ANSI/IEEE Std 802.4-1990], Information processing systems—Local area networks—Part 4: Token-passing bus access method and physical layer specifications.

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<sup>8</sup>ISO [IEEE] and ISO/IEC [IEEE] documents are available from ISO Central Secretariat, 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse; and from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

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