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Std 802.1H**

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Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Technical reports and guidelines —

Part 5: Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Réseaux locaux et métropolitains —
Rapports techniques et lignes directrices —*

*Partie 5: Liant de contrôle d'accès aux supports (MAC) de V2.0 Ethernet
dans les réseaux locaux*



Reference number
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Std 802.1H, 1997 edition

Abstract: Extensions to the behavior of ISO/IEC 10038 (IEEE 802.1D) media access control (MAC) Bridges, in order to facilitate interoperability in bridged local area networks (LANs) comprising CSMA/CD networks interconnected with other types of LAN using MAC Bridges, where the CSMA/CD networks contain a mixture of ISO/IEC 8802-3 and Ethernet V2.0 end stations, are specified. Additionally, guidelines are provided for the development of nonstandard 802 protocols, with particular emphasis on conversion of existing Ethernet protocols and the behavior to be expected from a Bridge, for the purpose of avoiding future incompatibilities.

Keywords: carrier sense multiple access with collision detection (CSMA/CD), data processing, Ethernet, fibre distributed data interface (FDDI), information interchange, LAN protocols, local area network (LAN), media access control (MAC) bridges, network interconnection, selective translation, selective translation table

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ANSI/IEEE Std 802.1H, 1997 Edition

**Information technology—
Telecommunications and information exchange
between systems—
Local and metropolitan area networks—
Technical reports and guidelines—**

**Part 5: Media Access Control (MAC)
Bridging of Ethernet V2.0 in Local Area
Networks**

Sponsor

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



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International Organization for Standardization
and by the
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC TR 11802-5, which is a Technical Report of type 3, was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.



ISO/IEC 11802 consists of the following parts, under the general title *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Technical reports and guidelines*:

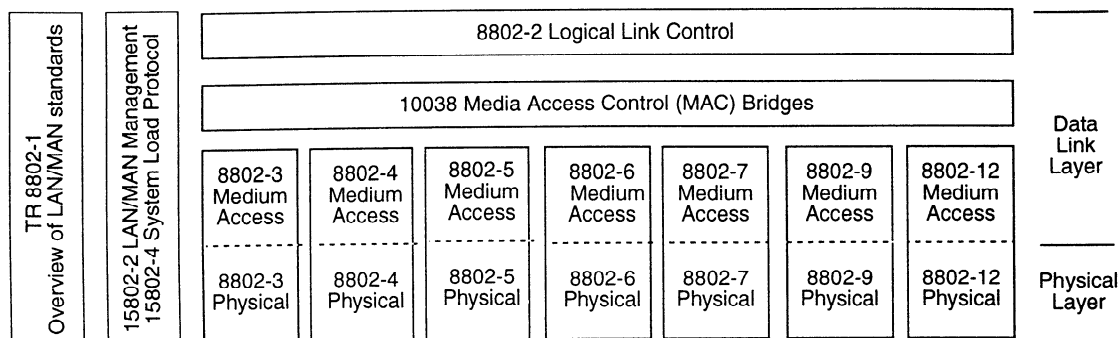
- *Part 1: The structure and coding of Logical Link Control addresses in Local Area Networks* [Technical Report]
- *Part 2: Standard Group MAC Addresses* [Technical Report]
- *Part 4: Token ring access method and physical layer specifications — Fibre optic station attachment*
- *Part 5: Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks*

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ISO/IEC Technical Report 11802-5: 1997

This Technical Report is part of a family of International Standards for Local and Metropolitan Area Networks. The relationship between this Technical Report, which provides extensions to the behavior of ISO/IEC 10038, 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 several 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], a bus utilizing CSMA/CD as the access method.
- ISO/IEC 8802-4 [ANSI/IEEE Std 802.4], a bus utilizing token passing as the access method.
- ISO/IEC 8802-5 [ANSI/IEEE Std 802.5], a ring utilizing token passing as the access method.
- ISO/IEC 8802-6 [ANSI/IEEE Std 802.6], a dual bus utilizing distributed queuing as the access method.
- ISO 8802-7, a ring utilizing slotted ring as the access method.
- ISO/IEC 8802-9 [ANSI/IEEE Std 802.9], a unified access method offering global integrated services to the desktop by accessing a variety of networks.
- ISO/IEC DIS 8802-12 [ANSI/IEEE Std 802.12], a bus utilizing Demand Priority 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], *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], *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], *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], *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 TR 11802-5: 1997 and ANSI/IEEE Std 802.1H, 1997 Edition, standards. ISO and IEEE each has a unique foreword.

ANSI/IEEE Std 802.1H, 1997 Edition

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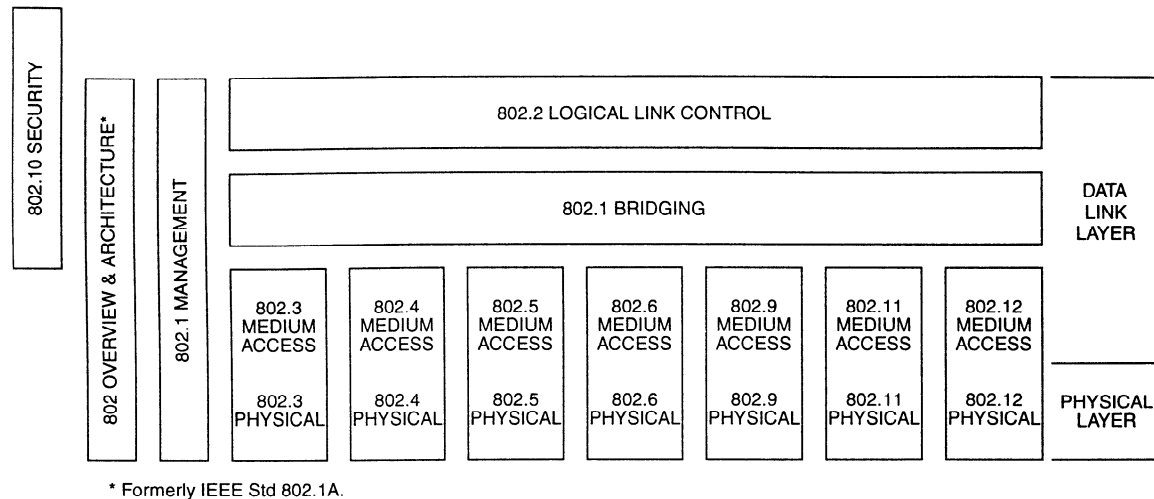
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Foreword to ANSI/IEEE Std 802.1H, 1997 Edition

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 access technologies 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 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 *Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*
- 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 group has authorized standards projects under development:

- 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.

ANSI/IEEE Std 802.1H, 1997 Edition

This document specifies extensions to the behavior of ISO/IEC 10038 (IEEE Std 802.1D) MAC Bridges for use in dealing with Ethernet V2.0 frames.

ISO/IEC 8802-3 (IEEE 802.3) and Ethernet V2.0 frames often share the same LAN media, but the two kinds of frames do not have the same structure. Specifically, Ethernet V2.0 defines the two octets following the MAC addresses as a type, and ISO/IEC 8802-3 defines these same octets as a length. Footnote 7 in 3.2.6 of ISO/IEC 8802-3 : 1993 (footnote 6 in earlier editions) alludes to this difference and points out a way by which ISO/IEC 8802-3 and Ethernet V2.0 MAC frames may be distinguished.

The difference in frame structure means that Ethernet V2.0 frames cannot be directly forwarded by a Bridge to a different type of IEEE 802 LAN (e.g., token ring or FDDI), although they can be forwarded between pairs of LANs that both support Ethernet V2.0 (as, in practice, almost all ISO/IEC 8802-3 LANs do). The Internet Engineering Task Force (IETF) has specified, in RFC1042, a mechanism for conveying the Ethernet-based Internet Protocol (IP) and related protocols over IEEE 802 LANs. This uses the Subnetwork

Access Protocol (SNAP) mechanism specified in IEEE Std 802, with the Ethernet-type values encapsulated in the protocol identifier values of SNAP PDUs. Subsequently, other (non-IP) uses of the RFC1042 mechanism have occurred that were incompatible with the IP protocol suite, and have caused interoperability problems for Bridges wanting to support both.

This recommended practice specifies extensions to the behavior of Bridges in order to facilitate restoration of the interoperability that was lost by such conflicting uses of the RFC1042 mechanism. It also provides guidelines to protocol designers so that they can migrate old Ethernet-based protocols, and design new IEEE 802-based protocols, in such a way that they will interoperate smoothly with Bridges.

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This standard was approved by the American National Standards Institute on 12 January 1996.

Note that editorial changes were made to the IEEE standard to accommodate concerns raised during the ISO/IEC JTC 1 balloting process. These are indicated in the text by a change bar (such as shown at the left of this paragraph).

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Information technology—

**Telecommunications and information exchange
between systems—**

Local and metropolitan area networks—

Technical reports and guidelines—

Part 5: Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks

1. Overview

ISO/IEC 10038: 1993¹ defines a standard for interconnecting ISO/IEC 8802 Local Area Networks (LANs) using media access control (MAC) Bridges. That standard provides facilities for the interconnection of stations attached to ISO/IEC 8802 LANs of different MAC types. This Technical Report extends those facilities to include the interconnection of nonstandard LANs to ISO/IEC 8802 LANs. The nonstandard LAN described is Ethernet (see Annex D).

(See Clause 3 for definitions used in this clause and elsewhere in this standard.)

1.1 Scope

For the purpose of facilitating the interoperability of ISO/IEC 10038 MAC Bridges and end stations in bridged LANs comprising CSMA/CD networks containing a mixture of ISO/IEC 8802-3 and Ethernet end stations and other types of LANs, this Technical Report specifies extensions to the behavior of MAC Bridges. To this end this Technical Report

- a) Extends the Bridge service interface model to support multiple MAC services on a single LAN and to add a Bridge-Tunnel service interface.
- b) Defines the Selective Translation Algorithm used by a Bridge to convert between Ethernet and ISO/IEC 8802 frame formats.
- c) Defines the protocols used by a Bridge to convey Ethernet frames across ISO/IEC 8802 LANs, the Bridge-Tunnel Encapsulation Protocol, and the RFC1042 Encapsulation Protocol.

¹Information on references can be found in Clause 2.

Additionally, for the purpose of avoiding future incompatibilities, this Technical Report provides guidelines for the development of nonstandard ISO/IEC 8802 protocols, with particular emphasis on conversion of existing Ethernet protocols and the behavior to be expected from a Bridge.

1.2 Purpose

The following are the express goals of this Technical Report:

- a) Preservation of full interoperability between ISO/IEC 8802 LANs.
- b) Enhancement of interoperability between ISO/IEC 8802 LANs and nonstandard LANs (i.e., Ethernet).
- c) Encouragement of vendors to migrate to ISO/IEC 8802-based protocols.
- d) Preservation of existing interoperability mechanisms between ISO/IEC 8802 LANs and nonstandard LANs.
- e) Engendering the design of new ISO/IEC 8802 protocols, and the migration of existing Ethernet protocols, in a fashion that is compatible with Bridges and ISO/IEC 8802 end stations.

The following is *not* a goal of this Technical Report: Providing communication between two end stations, with the same physical LAN protocol, which are otherwise not capable of communicating when attached to a single LAN.

2. References

The following specifications contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

IEEE Std 802-1990, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture (ANSI).²

ISO/IEC 8802-2: 1994 [ANSI/IEEE 802.2, 1994 Edition], Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 2: Logical link control.³

ISO/IEC 8802-3: 1996 [ANSI/IEEE Std 802.3, 1996 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.

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.

ISO/IEC 8802-5: 1995 [ANSI/IEEE Std 802.5-1995], Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 5: Token ring access method and physical layer specifications.

² IEEE publications are available from the Institute of Electrical and Electronic Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

³ ISO/IEC publications are available from the ISO Central Secretariat, 1 rue de Varembe, Case Postale 56, CH-1211 Genève 20, Switzerland. In the USA, they are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, New York, NY 10036, USA. ISO/IEC 8802 standards (standards for Local and Metropolitan Area Networks) are also available from IEEE.

ISO 9314-2: 1989, Information processing systems—Fibre Distributed Data Interface (FDDI), Part 2: Token Ring Media Access Control (MAC).

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.

RFC1042, Postel & Reynolds, A Standard for the Transmission of IP Datagrams over IEEE 802 Networks, February 1988.⁴

RFC1103, Katz, A Proposed Standard for the Transmission of IP Datagrams over FDDI Networks, June 1989.

⁴Internet RFCs are retrievable by FTP at ds.internic.net/rfcnnn.txt (where nnn is a standard's publication number, such as 783 or 906), or call InterNIC at 1-800-444-4345 for information about receiving copies through the mail.