

**IEEE Standard for
Local and metropolitan area networks—
Common specifications**

**Part 3: Media Access Control (MAC) Bridges—
Amendment 1**

Sponsor

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

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IEEE-SA Standards Board

Abstract: This amendment to IEEE Std 802.1D, 1998 Edition is intended to document maintenance items identified in the text of IEEE Std 802.1D, 1998 Edition (ISO/IEC 15802-3:1998). The document identifies any proposed changes to the text that have arisen as a consequence of maintenance activity. These are documented in the usual form for Amendments to IEEE 802® standards; i.e., as an explicit set of editing instructions that, if correctly applied to the text of ISO/IEC 15802-3:1998, will create a corrected document.

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

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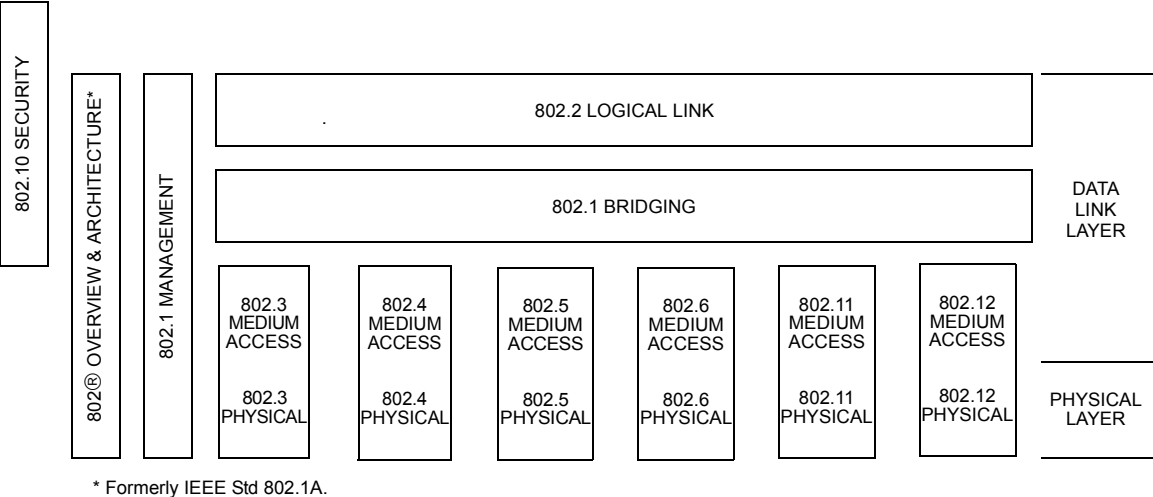
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Introduction

[This introduction is not a part of IEEE Std 802.1t-2001, IEEE Standard for Information Technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Common specifications—Part 3: Media Access Control (MAC) Bridges: Amendment 1.]

This amendment to IEEE 802.1D, 1998 Edition is intended to document maintenance items identified in the text of IEEE Std 802.1D, 1998 Edition (ISO/IEC 15802-3:1998). The document identifies any proposed changes to the text that have arisen as a consequence of maintenance activity. These are documented in the usual form for Amendments to IEEE 802® standards; i.e., as an explicit set of editing instructions that, if correctly applied to the text of ISO/IEC 15802-3:1998, will create a corrected document.

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 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 802¹: *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.

¹The 802 Architecture and Overview Specification, originally known as IEEE Std 802.1A, has been renumbered as IEEE Std 802. This has been done to accommodate recognition of the base standard in a family of standards. References to IEEE Std 802.1A should be considered as references to IEEE Std 802.

- 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 *Media Access Control (MAC) Bridges*. Specifies an architecture and protocol for the [ISO/IEC 15802-3]: 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 systems communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.
- ANSI/IEEE Std 802.1H [ISO/IEC TR 11802-5] *Recommended Practice for Media Access Control (MAC) Bridging of Ethernet V2.0 in IEEE 802 Local Area Networks*.
- ANSI/IEEE Std 802.1Q *Virtual Bridged Local Area Networks*. Defines an architecture for Virtual Bridged LANs, the services provided in Virtual Bridged LANs, and the protocols and algorithms involved in the provision of those services.
- 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 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 802.10: *Interoperable LAN/MAN Security*. Currently approved: Secure Data Exchange (SDE).
- ANSI/IEEE Std 802.11: [ISO/IEC 8802-11] *Wireless LAN Medium Access Control (MAC) Sublayer and Physical Layer Specifications*.
- ANSI/IEEE Std 802.12: [ISO/IEC 8802-12] *Demand Priority Access Method, Physical Layer and Repeater Specification*.
- IEEE Std 802.15: *Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for: Wireless Personal Area Networks*.

- IEEE Std 802.16: *Standard Air Interface for Fixed Broadband Wireless Access Systems.*
- IEEE Std 802.17: *Resilient Packet Ring Access Method and Physical Layer 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 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.

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IEEE Standard for Local and metropolitan area networks— Common specifications

Part 3: Media Access Control (MAC) Bridges— Amendment 1

EDITORIAL NOTE—This amendment to IEEE Std 802.1D, 1998 Edition (ISO/IEC 15802-3:1998) defines the changes necessary in order to address maintenance items that have been brought to the attention of the 802.1 Working Group. These changes are defined as a series of additions to, and modifications of, the existing text of ISO/IEC 15802-3:1998; this supplement therefore assumes all material, including references, abbreviations, definitions, procedures, services and protocols defined in the base text. Text shown in ***bold italics*** in this amendment defines the editing instructions necessary in order to incorporate the modifications and additions into the base text. Three editing instructions are used: ***change***, ***delete***, and ***insert***. ***Change*** is used to make a change to existing material. The editing instruction specifies the location of the change and describes what is being changed either by using ~~striketrough~~ to remove old material or underscore to add new material. ***Delete*** removes existing material. ***Insert*** adds new material without changing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. Editorial notes will not be carried over into future editions of IEEE Std 802.1D.

1. Overview

1.1 Introduction

Insert item d), and change the NOTE, as follows:

- d) Validation of access to the LAN.

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

NOTE 2—Validation of access to the LAN is supported when this standard is used in conjunction with the Port-based access control mechanisms specified in P802.1X.

1.2 Scope

Remove existing item h). Insert additional items g) and h) as shown below, in sequence following item f), and renumber the remaining items:

- g) Establishes the requirements for a protocol between Bridges in a Bridged LAN to configure multicast filtering information, and specifies the means of registering and distributing multicast filtering information by means of the GARP Multicast Registration Protocol (GMRP).
- h) Specifies the encoding of GMRP protocol data units.

2. References

Change all ISO [IEEE] and ISO/IEC [IEEE] references in Clause 2 so that the primary reference for these standards is the IEEE standard number and name, with the ISO standard number retained in parentheses. Change all references to these standards throughout the remaining clauses and subclauses accordingly, so that the IEEE standard number is cited.

Delete the reference to ISO/IEC 15802-2.

Insert a reference to RFC 2233 as follows:

IETF RFC 2233, The Interfaces Group MIB using SMIV2, McCloghrie, K., Kastenholz, F., November 1997.

Insert a reference to RFC 2674 as follows:

IETF RFC 2674, Bell, Smith, Langille, Rijssinghani, McCloghrie, Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions, August 1999.

Change the reference to IGMP, delete footnote 5, renumbering subsequent footnotes, update existing footnote 6 (new footnote 5) to give the current RFC website address and apply new footnote 5 to this IGMP reference, as follows:

~~IETF INTERNET DRAFT, Fenner, Internet Group Management Protocol (IGMP), Version 2, January 20th 1975~~

IETF RFC 2236, Fenner, Internet Group Management Protocol (IGMP), Version 2, November 1975

⁵IETF RFCs are available from the Internet Engineering Task Force website at <http://www.ietf.org/rfc.html>.

Change the wording of footnote 3 as follows:

³IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA. IEEE publications can be ordered on-line from the IEEE Standards Website: <http://www.standards.ieee.org>.

Change the wording of existing footnote 8 as follows:

⁸ISO [IEEE] and ISO/IEC [IEEE] documents are available from ISO Central Secretariat, 1 rue de Varembe, 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. ISO [IEEE] and ISO/IEC [IEEE] documents can be ordered on-line from the IEEE Standards Website: <http://www.standards.ieee.org>.

Insert a reference to 802.1Q, as follows:

IEEE Std 802.1Q-1998, IEEE Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks.

Insert a reference to P802.1X as follows:

IEEE P802.1X (Draft 11, March 2001) Local and Metropolitan Area Networks—Port Based Network Access Control.

Insert a reference to IEEE Std 802.3, 2000 Edition, as follows:

IEEE Std 802.3, 2000 Edition, IEEE Standards for Local and Metropolitan Area Networks, Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications: Aggregation of Multiple Link Segments.

4. Abbreviations

Insert the following abbreviations:

kG/s Kilobit per second
MG/s Megabit per second
TG/s Terabit per second

5. Conformance

5.2 Options

Insert the following as items n) and o):

- n) Support the ability to configure the value of the Restricted_Group_Registration parameter (10.3.2.3) for each Port of the Bridge.
- o) Support the use of the adminEdgePort and operEdgePort parameters (14.8.2), and the operation of the Bridge Detection State Machine (18.2), on one or more Ports.

6. Support of the MAC Service

6.1 Support of the MAC Service

Insert the following paragraph and Note at the end of 6.1:

The operation of MAC Bridges supports the provision of the MAC Service only to devices that are authenticated and authorized for such use. Unauthorized devices may be denied access to the Bridged LAN, other than as necessary to support the protocol exchanges that are required by any authentication process that is supported.

NOTE—Authentication and authorization to access a LAN may be achieved by administrative or management mechanisms, or by means of an active authorization mechanism, such as is defined in P802.1X.

Change the following subclauses of 6.3 as indicated:

6.3 Quality of service maintenance

6.3.1 Service availability

Service availability is measured as that fraction of some total time during which the MAC Service is provided. The operation of a Bridge can increase or lower the service availability.

The service availability can be increased by automatic reconfiguration of the Bridged LAN in order to avoid the use of a failed component (e.g., repeater, cable, or connector) in the data path. The service availability can be lowered by failure of a Bridge itself, through denial of service by the Bridge, or through frame filtering by the Bridge.

A Bridge may deny service and discard frames (6.3.2) in order to preserve other aspects of the MAC Service (6.3.3 and 6.3.4) when automatic reconfiguration takes place. Service may be denied to end stations that do not benefit from the reconfiguration; hence, the service availability is lowered for those end stations. Bridges may filter frames in order to localize traffic in the Bridged LAN. Should an end station move, it may then be unable to receive frames from other end stations until the filtering information held by the Bridges is updated.

A Bridge may deny service and discard frames in order to prevent access to the network by devices that are not authorized for such access.

To maximize the service availability, no loss of service or delay in service provision should be caused by Bridges, except as a consequence of a failure, removal, or insertion of a Bridged LAN component, ~~or~~ as a consequence of the movement of an end station, or as a consequence of an attempt to perform unauthorized access. These are regarded as extraordinary events. The operation of any additional protocol necessary to maintain the quality of the MAC Service is thus limited to the configuration of the Bridged LAN, and is independent of individual instances of service provision.

NOTE—This is true only in circumstances where admission control mechanisms are not present, i.e., where the Bridges provide a “best effort” service. The specification and applicability of admission control mechanisms in Bridges is outside the scope of this standard.

6.3.2 Frame loss

The MAC Service does not guarantee the delivery of Service Data Units. Frames transmitted by a source station arrive, uncorrupted, at the destination station with high probability. The operation of a Bridge introduces minimal additional frame loss.

A frame transmitted by a source station can fail to reach its destination station as a result of

- a) Frame corruption during physical layer transmission or reception.
- b) Frame discard by a Bridge because
 - 1) It is unable to transmit the frame within some maximum period of time and, hence, must discard the frame to prevent the maximum frame lifetime (6.3.6) from being exceeded.
 - 2) It is unable to continue to store the frame due to exhaustion of internal buffering capacity as frames continue to arrive at a rate in excess of that at which they can be transmitted.
 - 3) The size of the service data unit carried by the frame exceeds the maximum supported by the MAC procedures employed on the LAN to which the frame is to be relayed.
 - 4) Changes in the connected topology of the Bridged LAN necessitate frame discard for a limited period of time to maintain other aspects of Quality of Service.
 - 5) The device attached to the Port is not authorized for access to the network.

6.3.9 Priority

In Note 2 and in the footnote at the bottom of the page, the footnote number is incorrect, as footnote number 8 has already been used on page 4. Change “8” to “9” in the reference and the footnote.

6.4 Internal Sublayer Service provided within the MAC Bridge

Change 6.4 as indicated, splitting the existing text into a new subclause 6.4.1 and adding subclause 6.4.2:

The Internal Sublayer Service provided by a MAC entity to the MAC Relay Entity within a Bridge is that provided by the individual MAC for the LAN Port. This observes the appropriate MAC procedures and protocol for the LAN to which it attaches. No control frames, i.e., frames that do not convey MAC user data, are forwarded on any LAN other than that on which they originated.

The Internal Sublayer Service is derived from the MAC Service defined by ISO/IEC 15802-1 by augmenting that specification with elements necessary to the performance of the relay function. Within the attached end station, these additional elements can be considered to be either below the MAC Service boundary, and pertinent only to the operation of the service provider; or local matters not forming part of the peer-to-peer nature of the MAC Service. Three parameters are added to the list of parameters associated with the MA_UNITDATA.request and MA_UNITDATA.indication primitives defined by ISO/IEC 15802-1. These are frame_type, MAC_action, and frame_check_sequence. The definition of the Internal Sublayer Service does not add any new service primitives to those defined by the LAN MAC Service Definition.

6.4.1 Service primitives

The Internal Sublayer Service excludes MAC-specific features and procedures whose operation is confined to that of the individual LANs. The unit-data primitives that describe this service are

```
M_UNITDATA.indication    (
                           frame_type,
                           mac_action,
                           destination_address,
                           source_address,
                           mac_service_data_unit,
                           user_priority,
                           frame_check_sequence
                           )
```

Each ~~M_UNITDATA.indication~~ M_UNITDATA.indication primitive corresponds to the receipt of an error-free MAC frame from an individual LAN.

NOTE—Detailed specifications of error conditions in received frames are contained in the relevant MAC standards; for example, FCS errors, length errors, non integral number of octets.

The **frame_type** parameter indicates the class of frame. The value of this parameter is one of user_data_frame, mac_specific_frame, or reserved_frame.

The **mac_action** parameter indicates the action requested of a MAC entity receiving the indication. If the value of the frame_type parameter is user_data_frame, then the mac_action parameter is one of request_with_response, request_with_no_response, or response. For mac_specific_frames and reserved_frames, this parameter does not apply.

The **destination_address** parameter is either the address of an individual MAC entity or a group of MAC entities.

The **source_address** parameter is the individual address of the source MAC entity.

The **mac_service_data_unit** parameter is the service user data.

The **user_priority** parameter is the priority requested by the originating service user. The value of this parameter is in the range 0 through 7.

NOTE 1—The default user_priority value is 0. Values 1 through 7 form an ordered sequence of user_priorities, with 1 being the lowest value and 7 the highest. See 7.7.3 and H.2 for further explanation of the use of user_priority values and how they map to traffic classes.

Bridges have the capability to regenerate user priority from the user priority information contained in the data indication and the User Priority Regeneration Table for the reception Port, as specified in 7.5.1. The user_priority parameter takes the value of the Regenerated user_priority. In the case of IEEE 802 LAN MAC types that are not able to signal priority, the user_priority parameter takes the value of the Default User Priority for the Port on which the indication was received. The default value of Default User Priority is 0 for all Ports of the Bridge; the value for a given Port may be modified by means of the management functionality described in Clause 14 if such management functionality is supported.

The **frame_check_sequence** parameter is explicitly provided as a parameter of the primitive so that it can be used as a parameter to a related request primitive without recalculation.

The identification of the LAN from which particular frames are received is a local matter and is not expressed as a parameter of the service primitive.

```
M_UNITDATA.request      (
    frame_type,
    mac_action,
    destination_address,
    source_address,
    mac_service_data_unit,
    user_priority,
    access_priority,
    frame_check_sequence
)
```

A data request primitive is invoked to transmit a frame to an individual LAN.

The **frame_type** parameter indicates the class of frame.

The **mac_action** parameter indicates the action requested of the destination MAC entity.

The **destination_address** parameter is either the address of an individual MAC entity, or a group of MAC entities.

The **source_address** parameter is the individual address of the source MAC entity.

The **mac_service_data_unit** parameter is the service user data.

The **user_priority** parameter is the priority requested by the originating service user. The value of this parameter is in the range 0 through 7.

NOTE 2—The default user_priority value is 0. Values 1 through 7 form an ordered sequence of user_priorities, with 1 being the lowest value and 7 the highest. See 7.7.3 and H.2 for further explanation of the use of user_priority values and how they map to traffic classes.

The **access_priority** parameter is the priority used by the local service provider to convey the request. It can be used to determine the priority attached to the transmission of frames queued by the local MAC Entity,

both locally and among other stations attached to the same individual LAN—if the MAC method permits. The value of this parameter, if specified, is in the range 0 (lowest) through 7 (highest).

The **frame_check_sequence** parameter is explicitly provided as a parameter of the primitive so that it can be used without recalculation.

The identification of the LAN to which a frame is to be transmitted is a local matter and is not expressed as a parameter of the service primitive.

6.4.2 MAC status parameters

In addition to the unit-data service primitives described, the Internal Sublayer Service provided by a MAC entity to the MAC Relay Entity within a Bridge makes available a pair of status parameters that permit inspection of, and control over, the administrative and operational state of the MAC entity by the MAC Relay Entity. These parameters are defined as follows:

MAC_Enabled: The value of this parameter is TRUE if the MAC entity is permitted to be used; its value is otherwise FALSE. The value of this parameter is determined by the specific MAC procedures, as specified in 6.5.

MAC_Operational: The value of this parameter is TRUE if the MAC entity is in a functioning state and MAC_Enabled is also TRUE; i.e., the MAC entity is capable of being used to transmit and/or receive frames, and its use is permitted by management. Its value is otherwise FALSE. The value of this parameter is determined by the specific MAC procedures, as specified in 6.5.

NOTE—The intent here is to allow a common approach across MACs for handling the fact that:

- a) A MAC can inherently be working or not (indicated by MAC_Operational);
- b) If the MAC is operational, there may be the need to override its operational state for administrative reasons, preventing any users from making use of its services (by means of MAC_Enabled).

6.5 Support of the Internal Sublayer Service by specific MAC procedures

Change 6.5.1 as indicated.

6.5.1 Support by IEEE Std 802.3 (CSMA/CD)

The CSMA/CD access method is specified in IEEE Std 802.3. Clause 3 of that standard specifies the MAC frame structure, and Clause 4 specifies the MAC method.

On receipt of an M_UNITDATA.request primitive, the local MAC Entity performs Transmit Data Encapsulation, assembling a frame using the parameters supplied as specified below. It prepends a preamble and a Start Frame Delimiter before handing the frame to the Transmit Media Access Management Component in the MAC Sublayer for transmission (IEEE Std 802.3, 4.2.3).

On receipt of a MAC frame by Receive Media Access Management, the MAC frame is passed to Receive Data Decapsulation, which validates the FCS and disassembles the frame, as specified below, into the parameters that are supplied with an M_UNITDATA.indication primitive (IEEE Std 802.3, 4.2.4).

The **frame_type** parameter takes only the value **user_data_frame** and is not explicitly encoded in MAC frames.