

IEEE Standards for Local and Metropolitan Area Networks:

Supplement to LAN/MAN Management

Discovery and Dynamic Control of Event Forwarding

Sponsor

Technical Committee on Computer Communications
of the
IEEE Computer Society

Approved June 17, 1993

IEEE Standards Board

Abstract: Services and protocol elements that permit the exchange of management information between stations attached to IEEE 802 local and metropolitan area networks are defined. The standard includes the specification of managed objects that permit the operation of the protocol elements to be remotely managed.

Keywords: local area networks, management; metropolitan area networks, management

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345 East 47th Street, New York, NY 10017-2394, USA

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ISBN 1-55937-335-0

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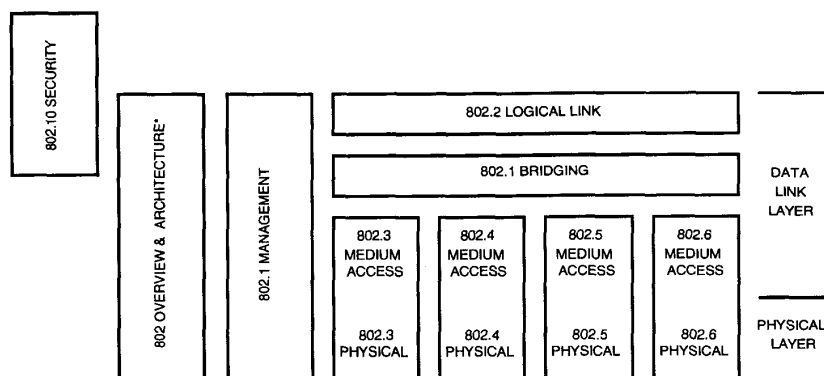
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Introduction

(This introduction is not a part of IEEE Std 802-1k-1993, IEEE Standards for Local and Metropolitan Area Networks: Supplement to LAN/MAN Management: Discovery and Dynamic Control of Event Forwarding.)

This standard is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link layers as defined by the ISO Open Systems Interconnection Basic Reference Model (ISO 7498 : 1984). 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 these technologies 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.
- IEEE Std 802.1B: LAN/MAN Management. Defines an Open Systems Interconnection (OSI) management-compatible architecture, and service and protocol elements for use in a LAN/MAN environment for performing remote management.
- IEEE Std 802.1D: MAC Bridging. Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- 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 on IEEE 802 LANs.

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.

- ISO 8802-2 [ANSI/IEEE Std 802.2]: Logical Link Control
- ISO/IEC 8802-3 [ANSI/IEEE Std 802.3]: CSMA/CD Access Method and Physical Layer Specifications
- ISO/IEC 8802-4 [ANSI/IEEE Std 802.4]: Token Bus Access Method and Physical Layer Specifications
- ISO/IEC 8802-5 [ANSI/IEEE Std 802.5]: Token Ring Access Method and Physical Layer Specifications
- IEEE Std 802.6: Metropolitan Area Network Access Method and Physical Layer Specifications
- IEEE Std 802.10: Interoperable Local Area Network Security, *Currently Contains Secure Data Exchange*

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

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

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. This makes the correspondence between the various 802 standards and their applicable conformance test requirements readily apparent. 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.

IEEE Std 802.1k-1993

This document defines services and protocol elements that permit the exchange of management information between stations attached to IEEE 802 local and metropolitan area networks. The standard includes the specification of managed objects that permit the operation of the protocol elements to be remotely managed.

This standard contains state-of-the-art material. The area covered by this standard is undergoing rapid evolution; revisions are anticipated to this standard within the next two years to clarify existing material and to incorporate new related material.

Information on the current revision state of this standard may be obtained from

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This document, IEEE Std. 802.1k-1993, defines an architecture, services, protocol elements and managed object classes which provide the ability to dynamically control the event forwarding information in agent systems. The protocol incorporates a “discovery” mechanism that allows manager and agent systems to identify their respective capabilities. These mechanisms form a compatible extension to the management services and protocols defined in IEEE Std 802.1B-1993, LAN/MAN Management.

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

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IEEE Standards for Local and Metropolitan Area Networks:

Supplement to LAN/MAN Management

Discovery and Dynamic Control of Event Forwarding

This supplement to IEEE Std 802.1B-1992 defines

- a) An architecture for station discovery and the dynamic control of event forwarding.
- b) Services and protocols that support station discovery and the dynamic control of event forwarding, and that make use of the LAN/MAN Management protocol described in IEEE Std 802.1B-1992.
- c) Managed object classes for station discovery and the dynamic control of event forwarding, documented using the notation provided by ISO/IEC 10165-4 : 1992.
- d) Additions to the PICS proforma for IEEE Std 802.1B-1992 to provide for the protocol and managed object classes. The additions include those that are necessary in order to comply with the requirements of ISO/IEC 9646-2 : 1990.

These items are defined as a series of changes and additions to the existing text of IEEE Std 802.1B-1992; the text therefore assumes all material, including references, abbreviations, definitions, services and protocols contained in the base text. The clause and subclause numbering in the following clauses correspond to the clause and subclause numbering in the final document (i.e., when these additions are incorporated). Text shown in ***bold italics*** in the remainder of this document defines the editing instructions necessary to incorporate the changes and additions into IEEE Std 802.1B-1992.

1. Scope

Add the following text at the end of clause 1, before the Notes:

“This standard provides the PICS proforma for the System Load Protocol in compliance with the relevant requirements, and in accordance with the relevant guidance, given in ISO/IEC 9646-2 : 1990.”

Add the following text as Note 3 at the end of clause 1:

“3—To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options have been implemented for a given protocol. Such a statement is called a Protocol Implementation Conformance Statement (PICS). Annex A to this standard contains the PICS proforma for the LAN/MAN Management Protocol.”

2. References

Add the following to the list of references:

“ISO/IEC 9646-1 : 1991, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 1: General concepts.

ISO/IEC 9646-2 : 1991, Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 2: Abstract test suite specification.”

3. Definitions

Add the following text as a new subclause 3.10, renumbering existing subclauses 3.10 and 3.11 to be 3.11 and 3.12, respectively:

“3.10 Conformance testing definitions

This standard uses the following terms defined in ISO/IEC 9646-1 : 1990:

- a) PICS proforma
- b) protocol implementation conformance statement (PICS)
- c) static conformance review”

8. LAN/MAN Management managed object definitions

Replace the Note in the LMM ASN.1 module in subclause 8.8.2 as follows:

-- **Note:** The encoding used for the defaultTimeout REAL value shall be restricted to
-- use only the NR2 form, as defined in ISO 6093 : 1985. The use of this encoding within
-- the Basic Encoding Rules is defined in ISO/IEC 8825 : 1990.”

10. Conformance

Change the last sentence of subclause 10.1.4, Options, as follows:

“For managed object classes, support is optional as defined in clauses 8, 11.5, and 11.6.1.”

Add the following to the end of subclause 10.1.4, Options:

“For an implementation claiming support of the DEFED protocol, support of the protocol specified in 11.4 is required.”

Add the following after item b) of subclause 10.3, Dynamic conformance:

- “c) Where applicable, the mechanisms for discovery and event forwarding enable/disable specified in clause 11.”

Add the following text to form new clauses 11 and 12:

11. Discovery and dynamic control of event forwarding

Management of stations within a LAN or MAN is generally based on responsibilities assigned to management stations with respect to managed objects within agent stations. As stations in a network can appear and disappear over time (for example, as a result of physical relocation, power down, and power up), and managed objects associated with stations can be dynamically created and deleted, the set of stations and managed objects that fall within the scope of a given manager's responsibility can also change over time.

IEEE Std 802.1B-1992 defines services and protocols for management that can be used in circumstances where manager and agent stations have *a priori* knowledge of each other's existence, responsibilities, and capabilities, and that can also be used in a number of ways to establish that knowledge in a dynamic manner. This supplement to IEEE Std 802.1B-1992 describes a standardized mechanism that permits manager and agent stations to dynamically

- a) Announce and/or discover each other's existence in the network.
- b) Exchange information with respect to managed objects that are available to be managed in an agent station and that fall within the scope of a manager's responsibility.
- c) Establish the correct information in, or remove obsolete information from, an agent station's Notification Type table and Event Report destination table.

The mechanism described makes use of the LAN/MAN Management Service (LMMS) defined in clause 6 and represents an optional addition to the functionality described in clauses 6–10. Other mechanisms for establishing and manipulating management knowledge and event forwarding information can be used in addition to or in place of the ones described here; however, the availability and use of a standardized mechanism will promote intervendor interoperability.

11.1 Scope

This subclause of IEEE Std 802.1B-1992 describes a mechanism that permits the dynamic discovery of manager and agent stations within a LAN/MAN environment, the exchange of management knowledge information between manager and agent stations, and the manipulation of notification type and event destination table information in agent stations. To this end, it

- a) Describes an architecture for discovery and dynamic control of event forwarding.
- b) Defines services that enable manager and agent stations to establish shared management knowledge (as defined in 5.4.4 of ISO/IEC 10040 : 1992) and to manipulate notification type table and event destination table entries.
- c) Specifies protocol elements that provide those services.
- d) Defines managed object classes and associated management information that support the provision and management of those services.

11.2 Architecture

11.2.1 Requirements addressed

The LMMS provides service primitives and managed object classes that allow Managers to monitor and control managed objects in Agents, and for Agents to send event reports to Managers. In a statically configured network, the information required by Manager and Agent stations in order for one to manage or be managed by the other can be established by *a priori* mechanisms, the details of which are outside the scope

of standardization. In a dynamically configured network, where stations may come and go over time, and where the managed objects that they contain may be created and deleted dynamically, it is necessary to provide mechanisms that allow the details of any reconfiguration to be communicated between Manager and Agent stations. Specifically, Manager stations require

- a) Knowledge of the existence of Agent stations in the network that may fall within the scope of their management responsibility.
- b) Knowledge of the set of managed object instances that such stations contain.
- c) Knowledge of changes resulting from the appearance or disappearance of Agent stations, or their managed object instances.
- d) Mechanisms that allow them to establish or remove event report forwarding information in Agent stations having gained such knowledge.

Agent stations require

- a) The ability to advertise the managed objects that they support to Manager stations in the network that may wish to manage them.
- b) The ability to respond to requests for management knowledge from Managers that may wish to manage them.
- c) Mechanisms that allow them to establish event report forwarding information at the request of a Manager, or to remove event report forwarding information either at the request of a Manager or as the result of a unilateral decision on the part of the Agent.

11.2.2 The model

The requirements described in 11.2.1 are modelled as mechanisms that fall into two categories:

- a) Discovery mechanisms
- b) Event forwarding enable/disable mechanisms

These mechanisms are modelled as an initial information exchange, followed for some mechanisms by one, or a set of, responding information exchanges. Each exchange occurs between an originating station, which can be a Manager or an Agent station, and a set of receiving stations, which are Agent stations or Manager stations, respectively. The information exchanges are defined in terms of service primitives, for the *discovery service* (11.3.1) and the *event forwarding enable/disable service* (11.3.2). These services are provided by means of the protocol specified in 11.4. The exchanges involved in the event forwarding enable/disable mechanisms are associated with changes to the contents of the notification type and event report destination tables (see 8.6 and 8.7) in the Agent system(s) that are participating in the exchanges.

The set of receiving stations in an information exchange can be either a group of stations, identified in the LAN/MAN environment by a group MAC address, or a single individual station, identified in the LAN/MAN environment by an individual MAC address (see IEEE Std 802-1990). For each mechanism, the choice of addressing is restricted, as described below.

NOTES

1—It is possible that a group of stations could be empty at the time when an exchange is initiated; for example, if no Manager station is active when an Agent station originates an exchange addressed to the Manager's group.

2—In figures 11-1 through 11-5 below, the arrows between Manager and Agent boxes indicate the direction of flow of information between originating and receiving stations. Where the set of receiving stations (Manager or Agent) is represented by multiple boxes, the information exchange can use either individual or group addressing; otherwise, it uses individual addressing. Where the originating station is represented by multiple boxes, the receiving station can receive information from a number of originating stations belonging to a group (this occurs only for a responding exchange that follows an initial group addressed exchange; see figure 11-2).

11.2.2.1 Discovery

Discovery can be initiated by an Agent, either to announce the fact that the station that contains it has been installed in the network (for example, as a result of station power-on or connection of a new station) or to announce the instantiation of a managed object or objects. In both cases, the information provided by the Agent is directed either to an individual Manager station or to a group of Manager stations, and can include configuration information detailing the managed object instances that the Agent station currently supports. Figure 11-1 illustrates this situation.

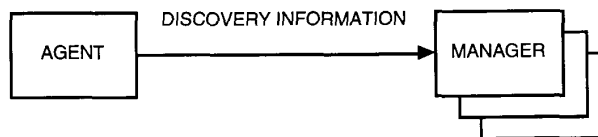


Figure 11-1—Agent-initiated discovery

Discovery can be initiated by a Manager when it is installed in the network (for example, as a result of station power-on or connection of a new station) in order to establish its initial view of the network, or at a later stage to verify that its current view of the state of the network is valid. In both cases, the information provided by the Manager is directed either to an individual Agent station or to a group of Agent stations, and can include information detailing the managed object classes and/or instances that the Manager station is interested in managing. Manager-initiated discovery also prompts the Agent station(s) to respond by giving information on their configuration, at the Agent's discretion. Figure 11-2 illustrates this situation.

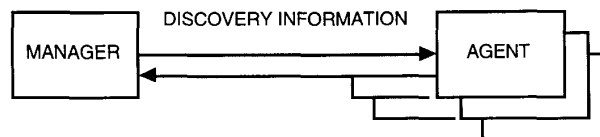


Figure 11-2—Manager-initiated discovery

11.2.2.2 Event forwarding enable/disable

Event forwarding enable and disable exchanges can be initiated by a Manager, either to cause event reports from particular Agent stations to be sent to it, or to stop event reports from being sent. In the case of enable exchanges, the information provided by the Manager is directed to a single Agent station; disable exchanges can be directed either to an individual Agent station or to a group of Agent stations. In all cases, the information can detail the managed object instances whose notifications are the subject of the exchange. If the information exchange requests event report enabling and the Agent station is prepared to comply, the exchange results in the inclusion of appropriate entries in the Agent's Notification Type table and Event Report Destination table. The Agent responds, indicating to what extent it was able to comply with the enable request. If the exchange requests event report disabling, any corresponding entries in the Agent's tables are removed. Figure 11-3 illustrates this situation for enabling; figure 11-4 for disabling.