Recognized as an
American National Standard

IEEE
Std 802.1E-1990

IEEE Standards for Local and Metropolitan Area Networks:

System Load Protocol

Sponsor

Technical Committee on Computer Communications of the IEEE Computer Society

Approved May 31, 1990

IEEE Standards Board

Approved October 12, 1990

American National Standards Institute

Abstract: IEEE 802.1E-1990, *IEEE Standards for Local and Metropolitan Area Networks: System Load Protocol*, defines services and protocol elements that permit the downloading of memory images to data processing equipment attached to IEEE 802 Local and Metropolitan Area Networks. The protocol makes use of the group addressing capabilities inherent in LAN/MAN technologies to permit simultaneous loading of the same memory image to multiple destination systems. The standard includes the specification of managed objects that permit the operation of the load protocol to be remotely managed.

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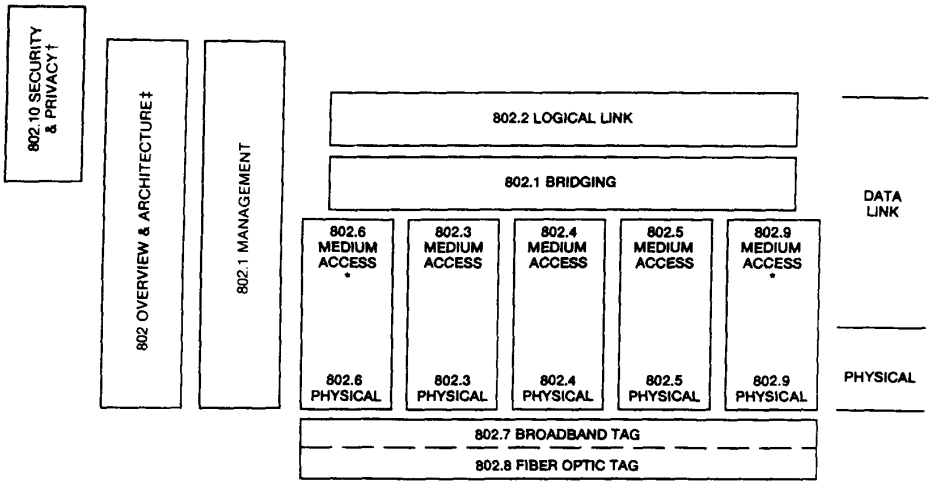
Foreword

(This Foreword is not a part of IEEE Std 802.1E-1990, IEEE Standards for Local and Metropolitan Area Networks: System Load Protocol.)

This standard is part of a family of standards for Local and Metropolitan Area Networks. The relationship between this standard and other members of the family is shown below. (The numbers in the figure refer to IEEE Standard numbers.)



* 802.6 and 802.9 provide services beyond the scope of IEEE Project 802.
† 802.10 is co-sponsored by the Technical Committee on Computer Communications (which sponsors Project 802) and also the Technical Committee on Security and Privacy.
‡ Formerly IEEE Std 802.1A.

Relationship Among IEEE Project 802 Working Groups and Technical Advisory Groups

The family of IEEE 802 Standards includes publications, projects, and activities that define standards, recommended practices, and guidelines in the following areas:

- IEEE Std 802*: Overview and Architecture. This document forms part of the 802.1 scope of work.

*The 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.

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- IEEE 802.1 series: Glossary, Network Management, and Internetworking. These documents, as well as IEEE Std 802, Overview and Architecture, form part of the 802.1 scope of work.
- 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-Passing Bus Access Method and Physical Layer Specifications
- IEEE Std 802.5: Token-Passing Ring Access Method and Physical Layer Specifications
- P802.6: Metropolitan Area Network Access Method and Physical Layer Specifications
- IEEE Std 802.7: Broadband Technical Advisory and Physical Layer Topics and Recommended Practices
- P802.8: Fiber Optic Technical Advisory and Physical Layer Topics
- P802.9: Integrated Voice/Data Access Method and Physical Layer Specifications
- P802.10: Security and Privary Access Method and Physcial Layer Specifications
- P802.11: Wireless Access Method and Physical Layer Specification (activity on this project began as this document went to press)

This document, IEEE Std 802.1E, specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.

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

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.

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USA

The following is an alphabetical list of participants in the IEEE Project 802.1 Working Group:

William P. Lidinsky, *Chair**
Tony Jeffree, *Chair, Network Management Task Group**

Fumio Akashi
Paul D. Amer
Charles Arnold
Floyd Backes*
Ann Ballard
Richard Bantel
Sy Bederman
Amatzia Ben-Artzi
Robert Bledsoe
Kwame Boakye
Juan Bulnes
Fred Burg
Peter Carbone
Alan Chambers*
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Michael Chernick
Jade Chien
Jim Corrigan
Paul Cowell*
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Kurt Dobbins
Eiji Doi
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Walter Eldon
Eldon D. Feist
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Angus Telfer
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Peter Videcrantz*
Paul Wainright
Scott Wasson*
Daniel Watts
Alan Weissberger
Deborah Wilbert
Igor Zhovnirovsky*
Carolyn Zimmer*
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Eduardo W. Bergamini
Peter I. P. Boulton
Paul W. Campbell
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Chih-Tsai Chen
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Alan J. Weissberger
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IEEE Standards for Local and Metropolitan Area Networks:

System Load Protocol

1. Introduction and Overview

Stations in a network may, from time to time, require a portion of their local addressable memory space to be loaded using information held on a remote station. In multivendor networks, the provision of standardized mechanisms to achieve this functionality is desirable.

In order to accommodate efficient loading of multiple stations with the same information at the same time, it is desirable to provide facilities for performing the load process on a multicast basis as well as on a point-to-point basis. The System Load Protocol provides both capabilities.

The protocol assumes two types of device in any load operation:

(1) Loadable Device (LD), which is capable of accepting a load from a Load Server.

(2) Load Server (LS), which is capable of providing a load for a Loadable Device.

A load operation can be initiated by

(a) An LD requesting data from an LS.

(b) A third party requesting an LD to accept data by means of a management request, using the Load operation specified in Section 9, and specifically in 9.2.1.3, in the description of the Load operation. When an LD accepts such a request, it will then request data from an LS in the normal manner.

The loadable data is termed an image. An image is broken down into Groups that, in turn, consist of blocks. The protocol allows flexibility in the choice of image and block size. It does not state the number of Groups in an image or the number of octets in a block.

The System Load Protocol relies on IEEE 802.2 Logical Link Control (LLC) Type 1 services (see [5][1]) operating over any compatible MAC and Physical Layer.

The System Load Protocol allows the use of P802.1B [2] to manage aspects of its operation. This use is described in 9.3. In addition, the managed objects have been defined in such a way that it is also possible to use CMIP (ISO/IEC 9596 [9]) as the management protocol, as described in 9.4.

The System Load Protocol may be used in conjunction with other management protocols. It provides a load capability not provided by general-purpose management protocols. The general-purpose management protocols provide the capabilities of parameter manipulation, event reporting, and action invocation that

[1] The numbers in brackets correspond to those of the references listed in Section 4.

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support and enhance the load facility. For example, a load of one system might be invoked from another system by means of management intervention.

The following sections describe

(1) The System Load architecture.
(2) The services provided by System Load.
(3) The semantics and syntax of the System Load Protocol, including the state machines that describe the operation of the System Load Protocol machine.
(4) The semantics of the load-related management objects.

A nonbinding appendix provides further information regarding the application of the protocol.

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2. Scope

The System Load Protocol specification defines a protocol to load the memory of data processing equipment installed on IEEE 802 networks. To this end the specification

(1) Defines the protocol data unit (PDU) formats for loading an end system.
(2) Defines the protocol for loading an end system.
(3) Describes the services required of the end system being loaded (Loadable Device or LD) to successfully complete a load operation.
(4) Describes the services required of the end system providing the load (Load Server or LS) to successfully complete a load operation.
(5) Defines the semantic aspects of management objects of the LD and LS that permit manipulation of the operational parameters of the LD and LS state machines, announcement of load servers, and third party initiation of a load.
(6) Defines the syntax used when performing management operations via the LAN/MAN Management Protocol (P802.1B [2]).
(7) Defines the syntax used when performing management operations via the CMIP Systems Management Protocol (ISO/IEC 9596 [9]).

The specification discusses the LS in only as much detail as is necessary to define the loading protocol. Management and LS decisions, such as what to do as a result of LS or LD events or when an LS or Manager fails, are LS and Manager implementation issues and are beyond the scope of this document.

The protocol is specified to convey images consisting of data (in blocks) of unspecified format. The content and format of data blocks are application-specific; this standard does not place any constraints on

(a) The form, content, or meaning of the images that may be conveyed by means of the protocol;
(b) The manner in which data blocks are processed subsequent to their being received by a loadable device.

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3. Definitions

The following terms are used throughout this document in a specialized manner:

Loadable Device (LD). A station on the network that is capable of accepting a load from a Load Server.

Load Server (LS). A station on the network that is capable of providing a load for a Loadable Device.

Image. The data structure contained in the Load Server that the Loadable Device wishes to load.

Other management-specific terms are defined in P802.1B [2].

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4. References

The following publications shall be used in conjunction with this standard. Where they have been updated, the latest version should apply.

[1] IEEE Std 802-1990, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.[2]

[2] Reserved for future use.[3]

[3] Reserved for future use.[4]

[4] ISO/IEC 7498-4:1984, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 4: Management Framework.[5]

[5] ISO 8802-2:1989 [ANSI/IEEE Std 802.2-1989], Information processing systems—Local area network—Part 2: Logical link control.[6]

[6] ISO 8824:1987, Information processing systems—Open Systems Interconnection—Specification of Abstract Syntax Notation One (ASN.1).

[7] ISO 8825:1987, Information processing systems—Open Systems Interconnection—Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).

[8] ISO/IEC 9595:1990 Information processing systems—Open Systems Interconnection—Common management information service definition.

[9] ISO/IEC 9596:1990 Information processing systems—Open Systems Interconnection—Common management information protocol specification.

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[2] IEEE documents are available from the Service Center, Institute of Electrical and Electronics Engineers, P.O. Box 1331, 445 Hoes Lane, Piscataway, NJ 08855-1331.

[3] When the following IEEE project is approved, it will become a part of this reference section: P802.1B, LAN/MAN Management. Available from IEEE Computer Society Documents, c/o AlphaGraphics, ATTN: P. Thrush, 10215 N. 35th Ave., Suite A & B, Phoenix, AZ 85051.

[4] When the following IEEE project is approved, it will become a part of this reference section: P802.1F: Recommended Practices for the Development of IEEE 802 LAN/MAN Management Standards. For availability, see Footnote 3.

[5] ISO and ISO/IEC documents are available from the ISO Central Secretariat, 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse; and from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, USA.

[6] 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 Service Center, Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

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5. Authority

In cases where there are discrepancies between the text descriptions, state diagrams, and the state tables, the state tables are to be considered as the authority.

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6. Architecture

This section contains an overview of the System Load architecture. Figure 1 depicts the architectural components and interfaces. There are three major architectural components involved in System Load:

(1) System Load User (SLU)
(2) System Load Entity (SLE)
(3) System Load Layer Management Entity (SL_LME)

A brief description of each of these components follows:

The SLU is a user of System Load Services. The user of these services may be a provider of load images (LS) or a requester of load images (LD) or both.

In order to perform its function, the SLU may be required to communicate with an SLU in another station. The SLUs intercommunicate in a peer-to-peer manner, using the communication services provided by the SLE. This communication is described in terms of the roles that each SLU and associated SLE plays in a particular instance of communication, either the role of an LD or an LS. These terms are used for descriptive purposes only and do not imply system capabilities in any other context. An LD requests to be loaded with an image. An LS acts on behalf of the requesting LD to provide an image.

The System Load Service is provided by means of the System Load Protocol. Two architectural components are associated with the operation of the protocol. These are the SLE and the SL_LME.

The SLE performs System Load communication functions on behalf of its SLU.

The SL_LME is a specific instance of an LME (described in P802.1B [2]) associated with the SLE. It provides the management functions specific to the management of the local SLE, allowing it to be managed in a manner analogous to managing a layer. It holds information and performs functions related to the SLEs.

The SLE makes use of conventional underlying services in order to convey SL_PDUs. The SLE makes use of the underlying services of IEEE 802 LLC Type 1 [5]. The use of other services is not precluded; however, this standard does not specify any conformance-related aspects of the use of any other services.

The load-specific services of the SLE are described in Section 7.

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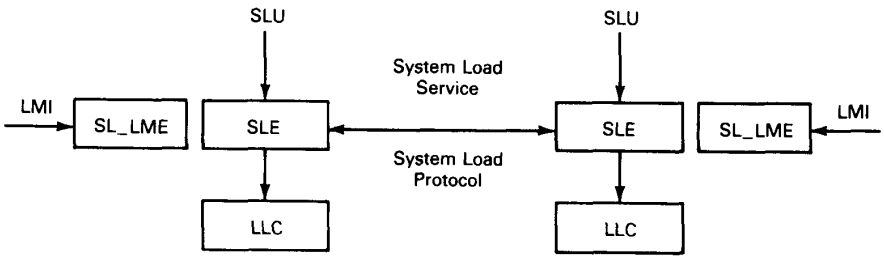

Fig 1
System Load Architecture

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7. Service Definition

This section defines the services provided by the System Load Entity (SLE) to the System Load User (SLU) at the System Load Service Boundary.

The following primitives are defined for the SLU to request service from the SLE:

(1) SYSTEM_LOAD.request, by which the SLU requests that a load operation be performed.
(2) SYSTEM_LOAD.confirm, by which the SLE confirms the success or failure of the corresponding request.
(3) SYSTEM_LOAD.indication, by which the SLE informs the SLU that an image is required in order to perform a requested load operation.
(4) SYSTEM_LOAD.response, by which the SLU returns the required image or reason for not providing the image.

The time sequence of these service primitives is shown in the Fig 2.

In addition, general-purpose management services provided by LAN/MAN Management (P802.1B [2]) and the CMIS/CMIP standards (ISO/IEC 9595 [8] and 9596 [9]) support the load facility:

(a) Parameters affecting the operation of the protocol may be manipulated.
(b) Notification of events such as the availability of an LS may be effected.
(c) Actions such as the initiation of the load of a system may be effected.

NOTE: The definition of the System Load Service in terms of these primitives and their associated parameters is for clarity only, and should not be construed as placing constraints on the nature of real implementations.

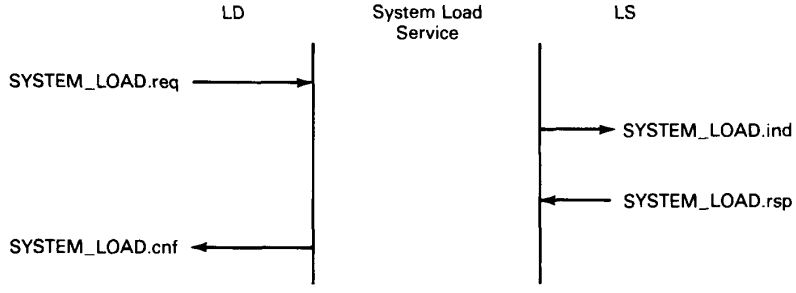

Fig 2
Sequence of SYSTEM_LOAD Primitives

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7.1 SYSTEM_LOAD.request

This primitive is the service request primitive for the System Load Service.

7.1.1 Semantics of the Service Primitive

```
SYSTEM_LOAD.request (
                     load_info,
                     load_reason
                     )
```

- load_info specifies information that may be used to determine the image to be loaded.
- load_reason specifies the reason that the load is desired. The load reason parameter shall have one of the following values:

Unspecified:	No reason is specified.
PowerUp:	The system or some part of it has had power restored.
ForcedLoad:	The load has been forced remotely via a systems management action.
OperationalFailure:	An operational failure has occurred resulting in the necessity for a load.
LoadFailure:	A previous load attempt has failed.
Reconfiguration:	A configuration change requiring load has occurred.
Private Reason:	An implementation-specific reason.

7.1.2 When Generated. This primitive is used by the SLU whenever it needs to have part or all of its system loaded.

7.1.3 Effect of Receipt. The effect of this primitive is that the SLE shall request the load from one or more load servers.

7.2 SYSTEM_LOAD.indication.

This primitive is the service indication primitive for the System Load Service.

7.2.1 Semantics of the Service Primitive

```
SYSTEM_LOAD.indication (
                        load_info,
                        load_reason
                        )
```

- load_info specifies information that may be used to determine the image to be loaded. The load_info parameter shall take the value provided in the corresponding SYSTEM_LOAD.request primitive.
- load_reason specifies the reason that the load is desired. The load_reason parameter shall take the value provided in the corresponding SYSTEM_LOAD.request primitive.

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