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IEEE Std 802.1AB™-2016
(Revision of
IEEE Std 802.1AB-2009)

IEEE Standard for
Local and metropolitan area networks—

Station and Media Access Control Connectivity Discovery

Sponsor

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

Approved 29 January 2016

IEEE-SA Standards Board

Abstract: A protocol and a set of managed objects that can be used for discovering the physical topology from adjacent stations in IEEE 802® LANs are defined in this document.

Keywords: IEEE 802.1AB™, link layer discovery protocol, management information base, topology discovery, topology information

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Introduction

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— IEEE Std 802.1AB-2009/Cor 1-2013
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Three annexes from the 2009 revision have been deleted:

— Annex D (Using LLDP to detect potential communication problems) was deleted because it was considered to be no longer useful.
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The bibliography (found in Annex G of the 2009 revision) is Annex D in this revision.

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Contents

1. Overview ... 1

1.1 Scope ... 2
1.2 Purpose ... 2

2. Normative references ... 3

3. Definitions and numerical representation ... 5

3.1 Definitions ... 5
3.2 Numerical representation ... 6

4. Acronyms and abbreviations ... 7

5. Conformance ... 9

5.1 Terminology ... 9
5.2 Protocol Implementation Conformance Statement (PICS) ... 9
5.3 Required capabilities ... 9
5.4 Optional capabilities ... 10

6. Principles of operation ... 11

6.1 Transmission and reception ... 12
6.2 LLDP operational modes ... 12
6.3 LLDP information categories ... 13
6.4 TLV selection ... 13
6.5 Transmission principles ... 13
6.6 Reception principles ... 14
6.7 Systems with multiple LLDP Agents ... 14
6.8 LLDP and Link Aggregation ... 18

7. LLDPDU transmission, reception, and addressing ... 19

7.1 Destination address ... 19
7.2 Source address ... 21
7.3 EtherType use and encoding ... 21
7.4 LLDPDU reception ... 22

8. LLDPDU and TLV formats ... 23

8.1 LLDPDU bit and octet ordering conventions ... 23
8.2 LLDPDU format ... 23
8.3 TLV categories ... 24
8.4 Basic TLV format ... 24
8.5 Basic management TLV set formats and definitions ... 26
8.6 Organizationally Specific TLVs ... 34

9. LLDP agent operation ... 37

9.1 Overview ... 37
9.2 State machines ... 40

10. LLDP management ... 57

10.1 Data storage and retrieval ... 57

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10.2 The LLDP management entity's responsibilities 57
10.3 Managed objects 59
10.4 Data types 59
10.5 LLDP variables 59

11. LLDP MIB definitions 62

11.1 Internet Standard Management Framework 62
11.2 Structure of the LLDP MIB 62
11.3 Relationship to other MIBs 67
11.4 Security considerations for LLDP base MIB module 68
11.5 LLDP MIB modules 70

Annex A (normative) PICS proforma 121

Annex B (normative) PTOPO MIB update 127

Annex C (informative) Example LLDP transmission frame formats 128

Annex D (informative) Bibliography 129

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List of figures

Figure 6-1, LLDP agent and its relationship to its LLC entity 11
Figure 6-2, Relationship between LLDP agents, LLC Entities, MSAPs, and the LLDP management entity 15
Figure 6-3, LLDP in a MAC Bridge 16
Figure 6-4, LLDP in an end system with port-based network access control 16
Figure 6-5, LLDP in a MAC Bridge that uses port-based network access control on both ports 17
Figure 6-6, Scope of group MAC addresses 17
Figure 6-7, Multiplexing and demultiplexing using shims 18
Figure 7-1, MSDU format 19
Figure 8-1, LLDPDU format 23
Figure 8-2, Basic TLV format 24
Figure 8-3, End Of LLDPDU TLV format 26
Figure 8-4, Chassis ID TLV format 26
Figure 8-5, Port ID TLV format 28
Figure 8-6, Time To Live TLV format 29
Figure 8-7, Port Description TLV format 29
Figure 8-8, System Name TLV format 30
Figure 8-9, System Description TLV format 31
Figure 8-10, System Capabilities TLV format 31
Figure 8-11, Management Address TLV format 33
Figure 8-12, Basic format for Organizationally Specific TLVs 35
Figure 9-1, Transmit state machine 54
Figure 9-2, Receive state machine 55
Figure 9-3, Transmit timer state machine 56
Figure 11-1, LLDP MIB block diagram 62
Figure C.1, IEEE 802.3 LLDP frame format 128
Figure C.2, IEEE 802.11 LLDP frame format 128

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List of tables

Table 7-1, Group MAC addresses used by LLDP 20
Table 7-2, Support for MAC addresses in different systems 21
Table 7-3, LLDP EtherType 22
Table 8-1, TLV type values 25
Table 8-2, chassis ID subtype enumeration 27
Table 8-3, port ID subtype enumeration 28
Table 8-4, System capabilities 32
Table 9-1, Subclause/operating mode applicability 37
Table 9-2, State machine symbols 41
Table 11-1, MIB object groups and operating mode applicability 63
Table 11-2, LLDP MIB structure and object cross reference 63

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1. Overview

The Link Layer Discovery Protocol (LLDP) specified in this standard allows stations attached to an IEEE 802® LAN to advertise, to other stations attached to the same IEEE 802 LAN, the major capabilities provided by the system incorporating that station, the management address or addresses of the entity or entities that provide management of those capabilities, and the identification of the station's point of attachment to the IEEE 802 LAN required by those management entity or entities.

The information distributed via this protocol is stored by its recipients in a standard Management Information Base (MIB), making it possible for the information to be accessed by a Network Management System (NMS) using a management protocol such as the Simple Network Management Protocol (SNMP).

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1.1 Scope

The scope of this standard is to define a protocol and management elements, suitable for advertising information to stations attached to the same IEEE 802 LAN, for the purpose of populating physical topology and device discovery management information databases. The protocol facilitates the identification of stations connected by IEEE 802 LANs/MANs, their points of interconnection, and access points for management protocols.

This standard defines a protocol that

a) Advertises connectivity and management information about the local station to adjacent stations on the same IEEE 802 LAN.
b) Receives network management information from adjacent stations on the same IEEE 802 LAN.
c) Operates with all IEEE 802 access protocols and network media.
d) Establishes a network management information schema and object definitions that are suitable for storing connection information about adjacent stations.
e) Provides compatibility with the IETF PTOPO MIB (IETF RFC 2922 [B9]).[1]

1.2 Purpose

An IETF MIB (IETF RFC 2922 [B9]) and a number of vendor specific MIBs have been created to describe a network's physical topology and associated systems within that topology.

This standard specifies the necessary protocol and management elements to

a) Facilitate multi-vendor inter-operability and the use of standard management tools to discover and make available physical topology information for network management.
b) Make it possible for network management to discover certain configuration inconsistencies or malfunctions that can result in impaired communication at higher layers.
c) Provide information to assist network management in making resource changes and/or re-configurations that correct configuration inconsistencies or malfunctions identified in b) above.

[1]The numbers in brackets correspond to those in the bibliography in Annex D.

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2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in the text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 802®, IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture.[2, 3]

IEEE Std 802.1AC™, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Service Definition.

IEEE Std 802.1AE™, IEEE Standard for Local and Metropolitan Area Networks—Media Access Control (MAC) Security.

IEEE Std 802.1AX™, IEEE Standard for Local and Metropolitan Area Networks—Link Aggregation.

IEEE Std 802.1Q™, IEEE Standards for Local and Metropolitan Area Networks: Bridges and Bridged Networks.

IEEE Std 802.1X™, IEEE Standard for Local and Metropolitan Area Networks—Port-Based Network Access Control.

IEEE Std 802.3™, IEEE Standard for 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.

IETF RFC 2863, The Interfaces Group MIB, June 2000.[4]

IETF RFC 3046, DHCP Relay Agent Information Option, January 2001.

IETF RFC 3232, Assigned Numbers: RFC 1700 is Replaced by an On-line Database, January 2002.[5]

IETF RFC 3410, Introduction and Applicability Statements for Internet Standard Management Framework, December 2002.

IETF RFC 3417, Transport Mappings for the Simple Network Management Protocol (SNMP), December 2002.

IETF RFC 3418, Management Information Base (MIB) for the Simple Network Management Protocol (SNMP), December 2002.

IETF RFC 3629, UTF-8, a transformation format of ISO 10646, November 2003.

IETF RFC 4502, Remote Network Monitoring Management Information Base Version 2, May 2006.

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[2]IEEE and 802 are registered trademarks in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

[3]IEEE publications are available from The Institute of Electrical and Electronics Engineers (http://standards.ieee.org).

[4]IETF documents (i.e., RFCs) are available for download at http://www.rfc-archive.org/.

[5]The IETF RFC 3232 ianaAddressFamilyNumbers on-line database module is accessible at http://www.iana.org.

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IETF RFC 4639, Cable Device Management Information Base for Data-Over-Cable Service Interface Specification (DOCSIS) Compliant Cable Modems and Cable Modem Termination Systems, December 2006.

IETF RFC 4789, Simple Network Management Protocol (SNMP) over IEEE 802 Networks, November 2006.

IETF RFC 6933, Entity MIB (Version 4), May 2013.

ISO/IEC 8824-1 [ITU-T Rec. X.680 (2002)], Abstract Syntax Notation One (ASN.1): Specification of Basic Notation.[6]

[6]ASN.1 standards are available at http://asn1.elibel.tm.fr/en/standards/index.htm#asn1.

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3. Definitions and numerical representation

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[7]

alpha-numeric information: Information that is encoded using the 8-bit Universal Character Set (UCS)/ Unicode Transformation Format (UTF-8) octet sequence [IETF RFC 3629].

chassis: A physical component incorporating one or more IEEE 802® LAN stations and their associated application functionality.

chassis identifier: An administratively assigned name that identifies the particular chassis within the context of an administrative domain that comprises one or more networks.

IEEE 802® LAN: Local area network (LAN) technologies that provide a media access control (MAC) Service equivalent to the MAC Service defined in IEEE Std 802.1AC.

IEEE 802® LAN station: An IEEE 802-compatible entity that incorporates all the necessary mechanisms to participate in media access control of an IEEE 802 LAN, and that is at least capable of providing the MAC service plus the mandatory capabilities of the LLC.

NOTE 1—For example, routers and host computers are stations in a bridged network. Bridges, in addition to their relay function, also include station capabilities.[8]

Link Layer Discovery Protocol (LLDP): A media-independent protocol capable of running on all IEEE 802® LAN stations and to allow an LLDP agent to learn the connectivity and management information from adjacent stations.

LLDP agent: The protocol entity that implements LLDP for a particular MSAP associated with a Port.

MAC service access point (MSAP): The access point for MAC services provided to the LLC sublayer.

MSAP identifier: The identifier of a MAC service access point.

NOTE 2—In this standard, the concatenation of the chassis identifier and the port identifier is used by LLDP as an MSAP identifier, to identify the port associated with an IEEE 802® LAN station.

management entity: The protocol entity that implements a particular network management protocol and that provides access support to a MIB associated with the protocol and implemented on a host chassis.

Management Information Base (MIB): The instantiation of all MIB modules in a managed entity (e.g., system or device).

Management Information Base module (MIB module): The specification or schema for a data base that can be populated with the information required to support a network management information system.

network: An interconnected group of systems, each comprising one or more IEEE 802® LAN stations.

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[7] *IEEE Standards Dictionary Online* subscription is available at: http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

[8] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

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Network Management System (NMS): A management system that is capable of utilizing the information in a MIB.

object identifier (OID): An identifier used to name an object. Structurally, an OID consists of a node in a hierarchically-assigned namespace, formally defined in ISO/IEC 8824-1, Abstract Syntax Notation 1 (ASN.1). OIDs are used in this standard to identify MIB modules and the objects they contain.

physical network topology: The identification of systems, of IEEE 802® LAN stations that compose each system, and of the IEEE 802 LAN stations that attach to the same IEEE 802 LAN.

port: The entity in a chassis/system to support an MSAP. A port incorporates one and only one MSAP and identifies the collection of manageable entities that provide the MAC Service at the MSAP.

port identifier: An administratively assigned name that identifies the particular port within the context of a system, where the identification is convenient, local to the system, and persistent for the system's use and management (whereas the MAC address that globally identifies the MSAP can not be).

system: A managed collection of hardware and software components incorporating one or more chassis, stations and ports.

station only: A non-forwarding IEEE 802® LAN station such as a user workstation, network file server, or print server.

type, length, value (TLV): A short, variable length encoding of an information element consisting of sequential type, length, and value fields where the type field identifies the type of information, the length field indicates the length of the information field in octets, and the value field contains the information, itself.

3.2 Numerical representation

Decimal, hexadecimal, and binary numbers are used within this document. For clarity, decimal numbers are generally used to represent counts, hexadecimal numbers are used to represent addresses, and binary numbers are used to describe bit patterns within binary fields.

Decimal numbers are represented in their usual 0, 1, 2, … format. Hexadecimal numbers are represented by a string of one or more hexadecimal (0–9, A–F) digits followed by the subscript 16, except in C-code contexts, where they are written as `0x123EF2`, etc. Binary numbers are represented by a string of one or more binary (0,1) digits, followed by the subscript 2. Thus the decimal number "26" may also be represented as "$1A_{16}$" or "11010_2".

MAC addresses, EtherType values, and OUI/EUI values are represented as strings of 8-bit hexadecimal numbers separated by hyphens and without a subscript, as, for example, "01-80-C2-00-00-15" or "AA-55-11", using the hexadecimal representation defined in IEEE Std 802.

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