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

**Part 1AS:  
Timing and synchronization for time-  
sensitive applications in bridged local  
area networks**

*Technologies de l'information — Télécommunications et échange  
d'information entre systèmes — Réseaux locaux et métropolitains —  
Partie 1AS*



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IEEE Std 802.1AS™-2011

**IEEE Standard for**  
**Local and metropolitan area networks—**  
**Timing and Synchronization for**  
**Time-Sensitive Applications in**  
**Bridged Local Area Networks**

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

Approved 10 February 2011  
**IEEE SA-Standards Board**

**Abstract:** This standard defines a protocol and procedures for the transport of timing over bridged and virtual bridged local area networks. It includes the transport of synchronized time, the selection of the timing source (i.e., best master), and the indication of the occurrence and magnitude of timing impairments (i.e., phase and frequency discontinuities).

**Keywords:** best master, frequency offset, grandmaster, IEEE 802.1AS, phase offset, synchronization, syntonization, time-aware system

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PDF: ISBN 978-0-7381-6536-3 STD97070  
Print: ISBN 978-0-7381-6537-0 STDPD97070

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## Introduction

This introduction is not part of IEEE Std 802.1AS-2011, IEEE Standard for Local and metropolitan area networks—Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks.

This standard specifies the protocol and procedures used to ensure that the synchronization requirements are met for time-sensitive applications, such as audio and video, across bridged and virtual bridged local area networks consisting of LAN media where the transmission delays are fixed and symmetrical; for example, IEEE 802.3™ full-duplex links. This includes the maintenance of synchronized time during normal operation and following addition, removal, or failure of network components and network reconfiguration. It specifies the use of IEEE 1588™ specifications where applicable in the context of IEEE Std 802.1D™-2004 and IEEE Std 802.1Q™-2005.<sup>a</sup> Synchronization to an externally provided timing signal (e.g., a recognized timing standard such as UTC or TAI) is not part of this standard but is not precluded.

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## Contents

1.	Overview.....	1
1.1	Scope.....	1
1.2	Purpose.....	2
2.	Normative references.....	3
3.	Definitions.....	5
4.	Acronyms and abbreviations.....	9
5.	Conformance.....	11
5.1	Requirements terminology.....	11
5.2	Protocol Implementation Conformance Statement (PICS).....	11
5.3	Time-aware Bridge and end station requirements.....	11
5.4	MAC-specific timing and synchronization methods for IEEE 802.3 full-duplex links.....	12
5.5	MAC-specific timing and synchronization methods for IEEE Std 802.11-2007.....	12
5.6	MAC-specific timing and synchronization methods for IEEE 802.3 EPON.....	12
5.7	MAC-specific timing and synchronization methods for coordinated shared network (CSN).....	13
6.	Conventions.....	15
6.1	General.....	15
6.2	Service specification method and notation.....	15
6.3	Data types and on-the-wire formats.....	15
7.	Time synchronization model for a bridged local area network.....	19
7.1	General.....	19
7.2	Architecture of a time-aware bridged local area network.....	19
7.3	Time synchronization.....	21
7.4	Time-aware system architecture.....	24
7.5	Differences between gPTP and PTP.....	25
8.	IEEE 802.1AS concepts and terminology.....	27
8.1	gPTP domain.....	27
8.2	Timescale.....	27
8.3	Communication path asymmetry.....	28
8.4	Messages.....	29
8.5	Ports.....	30
8.6	Time-aware system characterization.....	32
9.	Application interfaces.....	37
9.1	Overview of the interfaces.....	37
9.2	ClockSourceTime interface.....	38
9.3	ClockTargetEventCapture interface.....	38
9.4	ClockTargetTriggerGenerate interface.....	39
9.5	ClockTargetClockGenerator interface.....	40
9.6	ClockTargetPhaseDiscontinuity interface.....	41

10.	Media-independent layer specification .....	43
	10.1 Overview .....	43
	10.2 Time-synchronization state machines .....	44
	10.3 Best master clock selection and announce interval setting state machines .....	67
	10.4 Message attributes .....	85
	10.5 Message formats .....	87
	10.6 Protocol timing characterization .....	95
11.	Media-dependent layer specification for full-duplex, point-to-point links .....	99
	11.1 Overview .....	99
	11.2 State machines for MD entity specific to full-duplex, point-to-point links .....	105
	11.3 Message attributes .....	122
	11.4 Message formats .....	124
	11.5 Protocol timing characterization .....	131
12.	Media-dependent layer specification for IEEE 802.11 links .....	133
	12.1 Overview .....	133
	12.2 Messages .....	135
	12.3 Determination of asCapable .....	135
	12.4 State machines .....	136
	12.5 Format of VendorSpecific information element .....	143
	12.6 Synchronization message interval .....	144
13.	Media-dependent layer specification for interface to IEEE 802.3 Ethernet passive optical network link .....	145
	13.1 Overview .....	145
	13.2 Message attributes .....	149
	13.3 Message format .....	149
	13.4 Determination of asCapable .....	151
	13.5 Layering for IEEE 802.3 EPON links .....	151
	13.6 Service interface definitions .....	152
	13.7 MD entity global variables .....	154
	13.8 State machines .....	154
	13.9 Message transmission intervals .....	158
14.	Timing and synchronization management .....	159
	14.1 General .....	159
	14.2 Default Parameter Data Set .....	159
	14.3 Current Parameter Data Set .....	161
	14.4 Parent Parameter Data Set .....	164
	14.5 Time Properties Parameter Data Set .....	165
	14.6 Port Parameter Data Set .....	166
	14.7 Port Parameter Statistics .....	170
	14.8 Acceptable Master Table Parameter Data Set .....	173
15.	Managed object definitions .....	175
	15.1 Internet Standard Management Framework .....	175
	15.2 Structure of the MIB .....	175
	15.3 Security considerations .....	175
	15.4 Textual conventions defined in this MIB .....	179
	15.5 IEEE 802.1AS MIB module .....	179

Annex A (normative) Protocol Implementation Conformance Statement (PICS) proforma .....	231
A.1 Introduction.....	231
A.2 Abbreviations and special symbols.....	231
A.3 Instructions for completing the PICS proforma.....	232
A.4 PICS proforma for IEEE Std 802.1AS-2011 .....	233
A.5 Major capabilities .....	235
A.6 Media access control methods .....	236
A.7 Minimal time-aware system.....	236
A.8 Signalling .....	237
A.9 Best master clock .....	238
A.10 Grandmaster-capable system .....	239
A.11 Media-independent master .....	240
A.12 Media-dependent, full-duplex, point-to-point link.....	241
A.13 Media-dependent IEEE 802.11 link.....	243
A.14 Media-dependent IEEE 802.3 EPON link .....	243
A.15 Media-dependent CSN link.....	244
A.16 Media-dependent MoCA link .....	244
A.17 Media-dependent ITU-T G.hn link .....	244
Annex B (normative) Performance requirements.....	245
B.1 LocalClock requirements.....	245
B.2 Time-aware system requirements .....	249
B.3 End-to-end time-synchronization performance .....	250
B.4 End-to-end jitter and wander performance.....	250
Annex C (informative) Time-scales and epochs.....	253
C.1 Overview.....	253
C.2 TAI and UTC .....	253
C.3 NTP and GPS.....	254
C.4 Time-scale conversions.....	255
C.5 Time zones and GMT.....	256
Annex D (normative) State diagram notation.....	257
Annex E (normative) Media-dependent layer specification for CSN Network.....	259
E.1 Overview.....	259
E.2 Coordinated Shared Network characteristics.....	259
E.3 Layering for CSN links.....	260
E.4 Path delay measurement over a CSN backbone .....	262
E.5 Synchronization messages .....	265
E.6 Specific CSN requirements.....	268
E.7 Grandmaster capability.....	269
E.8 CSN clock and node requirements.....	269
Annex F (informative) PTP profile included in this standard .....	271
F.1 Identification .....	271
F.2 PTP attribute values .....	271
F.3 PTP options.....	271
F.4 LocalClock and time-aware system performance requirements.....	272
Annex G (informative) Bibliography .....	273
Annex H (informative) IEEE list of participants .....	274

## List of figures

Figure 7-1—Time-aware network example.....	20
Figure 7-2—Time-aware network of Figure 7-1 after an access network link failure .....	21
Figure 7-3— Example delay measurement .....	22
Figure 7-4—Time-aware system model .....	24
Figure 8-1—Propagation asymmetry.....	28
Figure 8-2—Definition of message timestamp point, reference plane, timestamp measurement plane, and latency constants .....	30
Figure 9-1—Application interfaces .....	37
Figure 10-1—Model for media-independent layer of time-aware system.....	44
Figure 10-2—Time-synchronization state machines—overview and interrelationships.....	46
Figure 10-3—SiteSyncSync state machine.....	56
Figure 10-4—PortSyncSyncReceive state machine .....	58
Figure 10-5—ClockMasterSyncSend state machine .....	60
Figure 10-6—ClockMasterSyncOffset state machine .....	61
Figure 10-7—ClockMasterSyncReceive state machine .....	63
Figure 10-8—PortSyncSyncSend state machine .....	65
Figure 10-9—ClockSlaveSync state machine .....	67
Figure 10-10—Example master/slave hierarchy of time-aware systems .....	69
Figure 10-11—Best master clock selection state machines—overview and interrelationships .....	74
Figure 10-12—PortAnnounceReceive state machine .....	79
Figure 10-13—PortAnnounceInformation state machine.....	80
Figure 10-14—PortRoleSelection state machine.....	83
Figure 10-15—PortAnnounceTransmit state machine.....	84
Figure 10-16—AnnounceIntervalSetting state machine.....	85
Figure 11-1—Propagation delay measurement using peer delay mechanism.....	100
Figure 11-2—Transport of time-synchronization information.....	102
Figure 11-3—Model for time-aware system with full-duplex, point-to-point links.....	105
Figure 11-4—Detail of MD entity time-synchronization state machines for full-duplex, point-to-point links .....	106
Figure 11-5—Peer delay mechanism state machines—overview and interrelationships.....	106
Figure 11-6—MDSyncReceiveSM state machine.....	111
Figure 11-7—MDSyncSendSM state machine.....	114
Figure 11-8—MDPdelayReq state machine.....	118
Figure 11-9—MDPdelayResp state machine .....	120
Figure 11-10—LinkDelaySyncIntervalSetting state machine .....	121
Figure 12-1—Timing measurement procedure for IEEE 802.11 links .....	134
Figure 12-2—Media-dependent and lower entities in stations with IEEE 802.11 links .....	135
Figure 12-3—Master state machine.....	137
Figure 12-4—Slave state machine .....	141
Figure 12-5—Format of VendorSpecific information element when Type = 0 .....	143
Figure 13-1—IEEE 802.3 EPON time-synchronization interfaces .....	148
Figure 13-2—IEEE 802.3 EPON interface model.....	152
Figure 13-3—State machine for IEEE 802.3 EPON requester.....	156
Figure 13-4—State machine for IEEE 802.3 EPON responder.....	157
Figure B.1—Wander generation (TDEV) requirement for LocalClock entity.....	247
Figure B.2—ADEV limit corresponding to wander generation requirement of Figure B.1 .....	248
Figure B.3—PTPDEV limit corresponding to wander generation requirement of Figure B.1 .....	249
Figure B.4—MTIE masks met for maximum endpoint filter bandwidths of Table B.4 .....	251
Figure E.1—Example of CSN backbone in an AVB LAN .....	260
Figure E.2—Media-dependent and lower entities in CSN nodes .....	261
Figure E.3—Path types over CSN as IEEE 802.1AS backbone.....	262

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Figure E.4—Propagation delay and residence time over a CSN Backbone ..... 262  
Figure E.5—CSN node-to-node path delay measurement..... 263  
Figure E.6—IEEE 802.1AS Sync Message Propagation over the CSN backbone ..... 265

Withdrawn

## List of tables

Table 6-1—Primitive data types .....	15
Table 8-1—Illustration of formation of clockIdentity from EUI-48 .....	31
Table 8-2—Default values for priority1, for the respective media.....	33
Table 8-3—timeSource enumeration.....	36
Table 10-1—Port role definitions .....	68
Table 10-2—Destination address for Announce and Signaling messages .....	86
Table 10-3—Ethertype for Announce and Signaling messages .....	86
Table 10-4—PTP message header .....	88
Table 10-5—Values for messageType field .....	88
Table 10-6—Values of flag bits.....	89
Table 10-7—Announce message fields .....	90
Table 10-8—Path trace TLV .....	91
Table 10-9—Signaling message fields .....	92
Table 10-10—Message interval request TLV .....	93
Table 10-11—Interpretation of special values of linkDelayInterval .....	94
Table 10-12—Interpretation of special values of timeSyncInterval .....	94
Table 10-14—Definitions of bits of flags field of message interval request TLV.....	95
Table 10-13—Interpretation of special values of announceInterval.....	95
Table 11-1—Destination address for Sync, Follow_Up, Pdelay_Req, Pdelay_Resp, and Pdelay_Resp_Follow_Up messages .....	123
Table 11-2—Ethertype for Sync, Follow_Up, Pdelay_Req, Pdelay_Resp, and Pdelay_Resp_Follow_Up messages .....	123
Table 11-4—Values of flag bits.....	125
Table 11-3—Values for messageType field.....	125
Table 11-6—References for sequenceId value exceptions.....	126
Table 11-7—Value of control field .....	126
Table 11-5—Value of correction field.....	126
Table 11-8—Sync message fields.....	127
Table 11-9—Follow_Up message fields .....	127
Table 11-10—Follow_Up information TLV.....	128
Table 11-11—Pdelay_Req message fields .....	129
Table 11-12—Pdelay_Resp message fields.....	130
Table 11-13—Pdelay_Resp_Follow_Up message fields .....	130
Table 12-1—Parameters of MLME-TIMINGMSMT.request .....	139
Table 12-2—Parameters of MLME-TIMINGMSMT.confirm .....	140
Table 12-3—Parameters of MLME-TIMINGMSMT.indication .....	143
Table 12-4—Values of the Type field in the VendorSpecific information element.....	144
Table 13-1—TIMESYNC message fields .....	150
Table 14-1—Default Parameter Data Set Table .....	162
Table 14-2—Current Parameter Data Set Table.....	163
Table 14-3—Parent Parameter Data Set Table.....	165
Table 14-4—Time Properties Parameter Data Set Table .....	166
Table 14-5—portRole enumeration .....	167
Table 14-6—Port Parameter Data Set Table .....	170
Table 14-7—Port Parameter Statistics Table.....	173
Table 14-8—Acceptable Master Table Parameter Data Set Table.....	174
Table 15-1—IEEE8021-AS MIB structure and object cross reference.....	177
Table B.1—Wander generation TDEV requirement for LocalClock entity.....	246
Table B.2—ADEV limit corresponding to wander generation requirement of Table B.1 .....	247
Table B.3—PTPDEV limit corresponding to wander generation requirement of Table B.1 .....	248

Table B.4—Maximum endpoint filter bandwidths needed to meet respective MTIE masks and peak-to-peak jitter limits.....	250
Table B.5—Breakpoints for Mask 1.....	251
Table B.6—Breakpoints for Mask 2.....	251
Table B.7—Breakpoints for Mask 3.....	251
Table C.1—Time-scale parameters.....	253
Table C.2—Time-scale conversions.....	255
Table D.1—State machine symbols.....	258
Table E.1—CSN TLV.....	267
Table E.2—Definitions and option selections per link technology.....	268

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# IEEE Standard for Local and metropolitan area networks— Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks

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## 1. Overview

### 1.1 Scope

This standard specifies the protocol and procedures used to ensure that the synchronization requirements are met for time-sensitive applications, such as audio and video, across bridged and virtual bridged local area networks consisting of local area network (LAN) media where the transmission delays are fixed and symmetrical; for example, IEEE 802.3™ full-duplex links. This includes the maintenance of synchronized time during normal operation and following addition, removal, or failure of network components and network reconfiguration. It specifies the use of IEEE 1588™ specifications where applicable in the context of IEEE Std 802.1D™-2004 and IEEE Std 802.1Q™-2005.<sup>1</sup> Synchronization to an externally provided timing signal (e.g., a recognized timing standard such as UTC or TAI) is not part of this standard but is not precluded.

### 1.2 Purpose

This standard enables stations attached to bridged LANs to meet the respective jitter, wander, and time synchronization requirements for time-sensitive applications. This includes applications that involve

<sup>1</sup>Information on references can be found in Clause 2.

multiple streams delivered to multiple endpoints. To facilitate the widespread use of bridged LANs for these applications, synchronization information is one of the components needed at each network element where time-sensitive application data are mapped or demapped or a time-sensitive function is performed. This standard leverages the work of the IEEE 1588 Working Group by developing the additional specifications needed to address these requirements.

Withdrawn

## 2. Normative references

The following referenced documents are indispensable for the application of this standard (i.e., they must be understood and used, so each referenced document is cited in 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 P802.11v<sup>TM</sup> (D15.0, September 2010), Draft Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications—Amendment 8: IEEE 802.11<sup>TM</sup> Wireless Network Management.<sup>2</sup>

IEEE Std 802.1D<sup>TM</sup>-2004, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Bridges.<sup>3, 4</sup>

IEEE Std 802.1Q<sup>TM</sup>-2005, IEEE Standard for Local and metropolitan area networks—Virtual Bridged Local Area Networks.

IEEE Std 802.1ag<sup>TM</sup>-2007, IEEE Standard for Local and metropolitan area networks—Virtual Bridged Local Area Networks—Amendment 5: Connectivity Fault Management.

IEEE Std 802.3<sup>TM</sup>-2008, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area network—Specific requirements, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

IEEE Std 802.3av<sup>TM</sup>-2009, IEEE Standard for Information technology—Part 3: Amendment 1: Physical Layer Specifications and Management Parameters for 10 Gb/s Passive Optical Networks.

IEEE Std 802.11<sup>TM</sup>-2007, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications.

IEEE Std 1588<sup>TM</sup>-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

IETF RFC 3410 (December 2002), Introduction and Applicability Statements for Internet Standard Management Framework, Case, J., Mundy, R., Partain, D, and Stewart, B.<sup>5</sup>

ITU-T Recommendation G.9960 (ex. G.hn), Unified high-speed wire-line based home networking transceivers—System architecture and physical layer specification, June 2010.<sup>6</sup>

ITU-T Recommendation G.9961, Data link layer (DLL) for unified high-speed wire-line based home networking transceivers, June 2010.

<sup>2</sup>IEEE P802.11v/D16 (November 2010) was approved by the IEEE-SA Standards Board on 2 February 2011. It was published as IEEE Std 802.11v-2011 on 9 February 2011 and is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org>).

<sup>3</sup>IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org>).

<sup>4</sup>The IEEE standards or products referred to in Clause 2 are trademarks owned by the Institute of Electrical and Electronics Engineers, Incorporated.

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

<sup>6</sup>ITU-T publications are available from the International Telecommunications Union, Place des Nations, CH-1211, Geneva 20, Switzerland/Suisse (<http://www.itu.int/>).

IEEE  
Std 802.1AS-2011

IEEE STANDARD FOR LOCAL AND METROPOLITAN AREA NETWORKS—

ITU-T Recommendation G.984.3, Amendment 2 (2009-11) Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification—Time-of-day distribution and maintenance updates and clarifications, November 2009.

MoCA<sup>®</sup> MAC/PHY Specification v2.0, MoCA-M/P-SPEC-V2.0-20100507, Multimedia over Coax Alliance (MoCA).<sup>7</sup>

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<sup>7</sup>MoCA specifications are available from the Multimedia over Coax Alliance at <http://www.mocalliance.org/specs>.