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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: Temporisation et synchronisation pour les applications
sensibles au temps des réseaux locaux pontés*



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Abstract: Protocols, procedures, and managed objects for the transport of timing over local area networks are defined in this standard. 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 Clock, Grandmaster PTP Instance, PTP End Instance, PTP Relay Instance, IEEE 802.1AS™, phase offset, synchronization, syntonization, time-aware system

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Introduction

This introduction is not part of IEEE Std 802.1AS-2020, IEEE Standard for Local and Metropolitan Area Networks—Timing and Synchronization for Time-Sensitive Applications.

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Information on the current revision state of this and other IEEE 802[®] standards may be obtained from

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IEEE Standard for Local and Metropolitan Area Networks— Timing and Synchronization for Time-Sensitive Applications

1. Overview

1.1 Scope

This standard specifies protocols, procedures, and managed objects used to ensure that the synchronization requirements are met for time-sensitive applications, such as audio, video, and time-sensitive control, across networks, for example, IEEE 802 and similar media. 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 802.1Q™-2018.¹ Synchronization to an externally provided timing signal [e.g., a recognized timing standard such as Coordinated Universal Time (UTC) or International Atomic Time (TAI)] is not part of this standard but is not precluded.

1.2 Purpose

This standard enables systems to meet the respective jitter, wander, and time-synchronization requirements for time-sensitive applications, including those that involve multiple streams delivered to multiple end stations. To facilitate the widespread use of packet networks 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.

¹ Information on references can be found in Clause 2.

2. Normative references

The following referenced documents are indispensable for the application of this standard (i.e., they must be understood and used; therefore, 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 Std 754™-2008, IEEE Standard for Floating-Point Arithmetic.^{2, 3}

IEEE Std 802®-2014, IEEE Standard for Local and Metropolitan Area Networks—Overview and Architecture.

IEEE Std 802c™-2017, IEEE Standard for Local and Metropolitan Area Networks—Overview and Architecture—Amendment 2: Local Medium Access Control (MAC) Address Usage.

IEEE Std 802.1AC™-2016, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Service Definition.

IEEE Std 802.1AX™-2014, IEEE Standard for Local and metropolitan area networks—Link Aggregation.

IEEE Std 802.1Q™-2018, IEEE Standard for Local and Metropolitan Area Networks—Bridges and Bridged Networks.

IEEE Std 802.3™-2018, IEEE Standard for Ethernet.

IEEE Std 802.11™-2016, 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™-2019, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

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IETF RFC 2863 (June 2000), The Interfaces Group MIB, K. McCloghrie and F. Kastenholz.⁴

IETF RFC 3410 (Dec. 2002), Introduction and Applicability Statements for Internet Standard Management Framework, J. Case, R. Mundy, D. Partain, and B. Stewart.

IETF RFC 3418 (Dec. 2002), Management Information Base (MIB) for the Simple Network Management Protocol (SNMP), R. Presuhn, ed.

ISO 80000-3:2006, Quantities and units — Part 3: Space and time.⁵

² IEEE publications are available from The Institute of Electrical and Electronics Engineers (<https://standards.ieee.org>).

³ The IEEE standards or products referenced in this clause are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated.

⁴ IETF Requests for Comments (RFCs) are available from the Internet Engineering Task Force (<https://www.rfc-editor.org>).

⁵ ISO publications are available from the International Organization for Standardization (<https://www.iso.org>) and the American National Standards Institute (<https://www.ansi.org>).

ITU-T Recommendation G.984.3, Amendment 2, Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification—Time-of-day distribution and maintenance updates and clarifications.⁶

ITU-T Recommendation G.9960, Unified high-speed wire-line based home networking transceivers—System architecture and physical layer specification [with ITU-T G.9961, commonly referred to as “G.hn”].

ITU-T Recommendation G.9961, Data link layer (DLL) for unified high-speed wire-line based home networking transceivers [with ITU-T G.9960, commonly referred to as “G.hn”].

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

⁶ ITU-T publications are available from the International Telecommunications Union (<https://www.itu.int>).

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