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PEOPLE'S REPUBLIC OF CHINA**

GB/T 45278.1-2025

Information technology - Time aware network - Part 1: Protocol

信息技术 时间明晰网络 第1部分：协议

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting. This document is part 1 of GB/T 45278 "Information Technology Time-Explicit Network". GB/T 45278 has been published as follows part.

1. Protocol. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed and coordinated by the National Information Technology Standardization Technical Committee (SAC/TC28). This document was drafted by: Beijing Enyitong Technology Development Co., Ltd., China Electronics Technology Standardization Institute, Shenzhen CESI Information Technology Co., Ltd., China Mobile Communications Corporation Research Institute, China Electronics Technology Standardization Institute East China Branch, Yanshan University, University of Electronic Science and Technology of China Jiangsu Zhongtian Technology Co., Ltd., Wuxi Internet of Things Industry Research Institute, Shanghai Tianchen Micro-Nano Technology Co., Ltd., China United Network Communications Co., Ltd. Research Institute, Chongqing Industrial Big Data Innovation Center Co., Ltd., Jingfeng Technology (Shenzhen) Co., Ltd., Guangdong Power Grid Foshan Power Supply Bureau Limited Liability Company. The main drafters of this document are: Wang Shuaibing, Wang Ting, Yang Hong, Chen Qiang, Zhuo Lan, Guo Xiong, Qu Wenming, Su Jingru, Zhang Chi, Cai Tingxiao, Wei Anni, Fu Genli, An Gang, Yang Bohan, Wu Haijiang, Ge Yongxin, Li Xiaoyu, Yuan Yazhou, Xie Shuhong, Wu Mingjuan, Ma Kai, Liu Lanhui, Ren Junmin, Deng Fei, Zhou Lixiong, Wei Ziyuan, and Chen Jinrong.

GB/T 45278 "Information Technology Time-Explicit Network" is a basic standard in the field of Ethernet network applications. The relevant criteria for establishing a MAC layer switching network with strict time requirements and data fault-tolerant transmission capabilities are proposed to consist of the following parts.

1. Protocol. The purpose is to specify the protocol specifications for time-explicit networks. Clock synchronization and the definition of time-delay transmission, data exchange and transmission can be defined, so that users can understand the time-clear network coordination. The main mechanisms and methods of the meeting.

2. Technical requirements and test methods for switching equipment. The purpose is to clarify the technical requirements for network switching equipment within a specified time and testing methods. Part 1 is a protocol specification for time-explicit networks, which defines the frame structure of the time-explicit network protocol, as well as clock synchronization and the workflow and mechanism of the main capabilities such as data time tag processing, data exchange and transmission. Part 2 is the implementation of time-explicit network Unified technical requirements and test methods for switching equipment, providing technical specifications and design specifications for the interconnection and interoperability of switching equipment. Information Technology Time Clear Network Part

1 Scope

GB/T 45278.1-2025 is the first part of the Chinese standard on the time aware network, and

it specifies the protocol. A time aware network is one in which every device shares a common notion of time accurate to sub-microsecond level and in which transmission is scheduled against that time rather than contended for, which is what allows an Ethernet network to carry motion control, protection signalling or synchronised measurement with a bounded, provable latency. The document specifies the protocol: the time synchronisation mechanism and the message formats it uses, the establishment and maintenance of the time base, the scheduling of transmission against it, the frame formats and the fields that carry the timing information, the state machines at each end, and the procedures for joining, leaving and recovering. It is the base part on which the later parts, on interfaces, on testing and on profiles, build. For an industrial network vendor, a device maker or a systems integrator working to Chinese requirements, this is the protocol specification.

This document specifies the structure of the Time Explicit Network (TAN) control layer data frame, TAN control layer clock synchronization and transmission with definable delays. Transmission control, TAN control layer data exchange and transmission, etc. This document is applicable to the development and application of MAC layer switching equipment with strict time requirements and data fault-tolerant transmission capabilities.

2 Normative references

The contents of the following documents constitute essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 9387.1-1998 Information technology Open Systems Interconnection Basic Reference Model Part

3 Terms and definitions

The following terms and definitions apply to this document.

- 3.1 timeawarenetwork A network based on Ethernet and clock synchronization that time-stamps and schedules data and transmits it in a fault-tolerant manner.
- 3.2 TAN switch equipmentTANswitch Equipment capable of exchanging TAN frames.
- 3.3 TAN fieldTAN field A network domain consisting entirely of time TAN switching equipment.
- 3.4 Data terminal equipmentdataterminalequipment Any data source device or data destination device connected to the TAN.
- 3.5 Accumulateddelay The sum of the time taken by all TAN switching devices through which the TAN clock synchronization frame has passed.

3.6 Network access time networkaccesstime The moment when the TAN switching device receives data on the Ethernet interface.

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