



**IEEE Standard for
Local and Metropolitan Area Networks—
Time-Sensitive Networking Profile for
Automotive In-Vehicle Ethernet
Communications**

IEEE Computer Society

Developed by the
LAN/MAN Standards Committee

IEEE Std 802.1DG™-2025

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Abstract: Profiles for bounded latency automotive in-vehicle bridged IEEE 802.3 Ethernet networks based on IEEE 802.1 Time-Sensitive Networking (TSN) standards are specified in this standard.

Keywords: automotive in-vehicle Ethernet communications, bridged local area networks, bridges, bridging, IEEE 802[®], IEEE 802.1DG[™], IEEE 802.1Q[™], IEEE 802.3[™], LAN, local area networks, MAC bridges, Time-Sensitive Networking, TSN, virtual bridged local area networks, virtual LANs

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Introduction

This introduction is not part of IEEE Std 802.1DG™-2025, IEEE Standard for Local and Metropolitan Area Networks—Time-Sensitive Networking Profile for Automotive In-Vehicle Ethernet Communications.

This standard defines the time-sensitive networking profile for automotive in-vehicle Ethernet communications.

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 can be obtained from:

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Contents

1.	Overview	14
1.1	Scope	14
1.2	Purpose	14
1.3	Requirements terminology	14
1.4	Introduction	15
1.5	Outline of the document structure	15
1.6	Reference conventions	15
2.	Normative references	16
3.	Definitions	17
4.	Abbreviations	18
5.	Conformance	19
5.1	Introduction	19
5.2	Profile Conformance Statements (PCS)	19
5.3	Physical Layer requirements	19
5.4	Bridge requirements	19
5.4.1	Mandatory bridge requirements	19
5.4.2	Bridge options	20
5.5	End station requirements	20
5.5.1	Mandatory end station ingress requirements	20
5.5.2	Mandatory end station egress requirements	20
5.5.3	End station options	20
5.6	Station requirements A (SR-A)	21
5.7	Station requirements B (SR-B)	21
5.8	Station requirements C (SR-C)	22
5.9	Station requirements D (SR-D)	22
5.10	Station requirements E (SR-E)	22
6.	Asynchronous Traffic Shaper (ATS)	23
6.1	Purpose	23
6.2	ATS configuration parameters	23
6.3	Implicit policing	23
6.4	ATS Traffic class mapping configuration in bridges	24
7.	Credit-based shaper (CBS)	25
7.1	Purpose	25
7.2	Credit-based shaper configuration	25
7.3	Policing configuration	25
7.4	Configuration rules	26
8.	Enhancements for scheduled traffic ([Q] 8.6.8.4)	27
8.1	Purpose	27
8.2	Configuration modes	27
8.3	Bus Mode	27
8.3.1	Bus Mode configuration	28
8.4	Phased Mode	28

8.4.1	Phased Mode configuration	28
8.5	Cyclic queuing and forwarding (CQF)	28
8.6	EST latency and efficiency considerations	28
8.7	Combining EST with other shapers	29
8.7.1	General EST considerations	29
8.7.2	Combining CBS with EST	29
8.7.3	Combining ATS with EST	30
Annex A (normative)	PCS proforma	31
A.1	Introduction	31
A.2	Abbreviations and special symbols	31
A.2.1	Status symbols	31
A.2.2	General abbreviations	32
A.3	Instructions for completing the PCS proforma	32
A.3.1	General structure of the PCS proforma	32
A.3.2	Additional information	32
A.3.3	Exception information	32
A.3.4	Conditional status	33
A.3.4.1	Conditional items	33
A.3.4.2	Predicates	33
A.4	Bridge PCS	34
A.5	End station PCS	35
A.6	Station requirements A (SR-A) PCS	36
A.7	Station requirements B (SR-B) PCS	37
A.8	Station requirements C (SR-C) PCS	37
A.9	Station requirements D (SR-D) PCS	37
A.10	Station requirements E (SR-E) PCS	38
Annex B (informative)	Intentional limitations	39
B.1	Shaper interactions	39
B.2	MACsec [AE]	39
B.3	Frame preemption interactions	39
Annex C (informative)	Terminology.....	40
C.1	Automotive terminology	40
C.2	Automotive stations ([802])	40
C.2.1	Automotive bridge	40
C.2.2	Automotive end station	40
C.3	Automotive electronic control unit (ECU)	40
C.4	Communication aggregates	40
C.5	Frame content as received	40
C.5.1	Packet and frame size	41
C.5.2	Untagged frame ([Q] 3.286)	42
C.5.3	VLAN tagged frame ([Q] 9.5)	42
C.5.4	Priority-tagged frame ([Q] 6.9)	42
C.5.5	MACsec [AE]	42
C.6	Bandwidth	42
C.7	Network traffic classification	43
C.7.1	Automotive network traffic patterns	43
C.7.2	Scheduled traffic	43
C.8	Scheduler vs. shaper	43
C.9	FRER functionality	44

C.10	Frame loss	44
Annex D (informative) IEEE 802.1 features		45
D.1	Purpose	45
D.2	Bridge processing	45
D.3	End station receive path processing order (ingress)	46
D.4	End station transmission path processing order (egress)	46
D.5	Time synchronization	46
D.6	MACsec processing ([AE])	47
D.7	Acceptable frame types ([Q] 6.9 c))	47
D.8	Port-based VLAN classification ([Q] 6.9.1 f))	47
D.9	Priority Code Point decoding ([Q] 6.9.3)	47
D.10	Priority regeneration ([Q] 6.9.4)	47
D.11	Ingress Stream identification function(s) ([CB] 6.2)	48
D.11.1	Stream identification function(s) for bridges	48
D.11.2	Stream identification function(s) for end stations	48
D.11.3	Identification mask length ([CBdb])	48
D.12	Active topology enforcement ([Q] 8.6.1)	48
D.13	Ingress filtering ([Q] 8.6.2)	49
D.14	The Learning Process ([Q] 8.7)	49
D.15	Frame filtering ([Q] 8.6.3)	49
D.15.1	Introduction to frame filtering	49
D.15.2	Reserved addresses (01-80-C2-...)	49
D.15.3	Bridge Protocol Data Units (BPDUs) ([Q] 14)	49
D.16	Stream filter ([Q] 8.6.5.3)	49
D.17	Maximum SDU size filtering	50
D.17.1	Introduction to SDU size filtering	50
D.17.2	Service data unit (SDU) size	50
D.17.3	Per stream filter maximum SDU size ([Q] 8.6.5.3.1)	50
D.17.4	Per traffic class maximum SDU size ([Q] 8.6.8.4)	50
D.18	Stream gates ([Q] 8.6.5.4)	50
D.18.1	Static IPV configuration	50
D.18.2	Time dependent gate states	51
D.19	Flow metering ([Q] 8.6.5.5)	51
D.20	Queuing frames ([Q] 8.6.6)	51
D.21	Transmission selection	52
D.21.1	Per TC-queue transmission selection ([Q] 8.6.8 a))	52
D.21.2	Port transmission selection ([Q] 8.6.8 b))	52
D.22	Transmission gates ([Q] 8.6.8.4)	52
D.23	VID translation ([Q] 6.9 f) and g))	52
D.24	Frame discard	52
D.25	Frame preemption	53
D.25.1	Preemptable MAC ([Q] 6.7.1 a))	53
D.25.2	Express MAC ([Q] 6.7.1 b))	53
D.26	Egress filtering ([Q] 8.6.4)	53
D.27	ATS scheduler groups	53
Annex E (informative) Congestion		54
E.1	Purpose	54
E.2	Definitions	54
E.3	Congestion separation	54
E.4	Causes for congested traffic	54
E.5	Causes for congesting traffic	55

Annex F (informative)	Stream identification.....	56
Annex G (informative)	Non-real-time capable protocols.....	57
Annex H (informative)	Egress shaping in end stations	58
Annex I (informative)	Bibliography	59

IEEE Standard for Local and Metropolitan Area Networks— Time-Sensitive Networking Profile for Automotive In-Vehicle Ethernet Communications

1. Overview

1.1 Scope

This standard specifies profiles for bounded latency automotive in-vehicle bridged IEEE 802.3 Ethernet networks based on IEEE 802.1 Time-Sensitive Networking (TSN) standards.

1.2 Purpose

This standard provides profiles for designers and implementers of automotive IEEE 802.3 Ethernet networks that support a wide range of in-vehicle applications.

1.3 Requirements terminology

“Supported”—The capability is available.

“Activated”—The capability is available (i.e., it is supported) and enabled.

The following terminology is used in Clause 5 and Annex A:

- a) The word “shall” indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (“shall” equals “is required to”).
- b) The word “should” indicates that among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (“should” equals “is recommended that”, but not required).
- c) The word “may” is used to indicate a course of action permissible within the limits of the standard (“may” equals “is permitted to”).

All other clauses than Clause 5 and the clauses of Annex A use the following terminology:

- d) The words “might” or “can” are used for statements of possibility (“might”/“can” mean “there is a possibility that”).
- e) The neutral words “is” or “does” are used to describe a capability, procedure, or behavior; independent of it being required, prohibited, recommended, discouraged, or permitted.
- f) “Not activated”—The capability is available but not enabled.

1.4 Introduction

This Time-Sensitive Networking (TSN) profile for automotive in-vehicle Ethernet communications standard addresses the use of features from IEEE 802.1 standards to meet the bandwidth, latency, and synchronization needs for communications within automotive vehicles. The profile introduces the subtleties of the operation of the IEEE 802.1 standards and the side-effects of the choices made when configuring various features from IEEE 802.1 standards. The goal of this standard is to provide information to automotive vendors and suppliers to help them with the design of vehicular systems enabling bounded latency in automotive in-vehicle networks. As IEEE 802.1 standards are broad and intended for use in a variety of environments, this standard narrows the focus from the broad set of standardized features to those that are applicable to in-vehicle networks (IVN). This standard determines the features from IEEE 802.1 standards that are directly applicable to IVNs and explains how these features are used, including recommendations about how to configure optional parameters.

1.5 Outline of the document structure

This standard specifies bridge and end station requirements and options in Clause 5. All conformance language is aggregated in Clause 5. Clause 6 through Clause 8 describe the TSN features in more detail and provide references to the base standards.

1.6 Reference conventions

Because this standard makes frequent references to specific sections, clauses, or subclauses in several other standards and amendments, it uses the notations described in Table 1-1.

Table 1-1—Conventions for references

Reference shorthand notation	Complete reference
[AC] x.y	subclause x.y in IEEE Std 802.1AC-2016
[AE] x.y	subclause x.y in IEEE Std 802.1AE-2018 ([B6])
[BA] x.y	subclause x.y in IEEE Std 802.1BA-2021 ([B5])
[CB] x.y	subclause x.y in IEEE Std 802.1CB-2017
[CBdb] x.y	subclause x.y in IEEE Std 802.1CBdb-2021
[DC] x.y	subclause x.y in IEEE Std 802.1DC-2024
[Q] x.y	subclause x.y in IEEE Std 802.1Q-2022
[B##] x.y	section or subclause x.y in any document from the Bibliography in Annex I
[802] x.y	subclause x.y in IEEE Std 802-2014
[802.3]x.y	subclause x.y in IEEE Std 802.3-2022
x.y	subclause x.y in this standard

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 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. Non-normative references (i.e., that provide additional information not required for the application of this document) are given in Annex I.

NOTE—The inclusion of a document in this list of normative references indicates that information in that document is necessary to implement this standard. It does not imply that any other part of that referenced document is required to be implemented by a system conformant to this standard.⁶

IEEE Std 802[®]-2014, IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture.^{7, 8, 9}

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

IEEE Std 802.1CB™-2017, IEEE Standard for Local and metropolitan area networks—Frame Replication and Elimination for Reliability.

IEEE Std 802.1CBdb™-2021, IEEE Standard for Local and metropolitan area networks—Frame Replication and Elimination for Reliability—Amendment 2: Extended Stream Identification Functions.

IEEE Std 802.1DC™-2024, IEEE Standard for Local and Metropolitan Area Networks—Quality of Service Provision by Network Systems.

IEEE Std 802.1Q™-2022, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks.

IEEE Std 802.3™-2022, IEEE Standard for Ethernet.

⁶ Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

⁷ IEEE 802.1 standards can be downloaded through the IEEE GET Program: <https://standards.ieee.org/products-programs/ieee-get-program/>.

⁸ IEEE publications are available from the Institute of Electrical and Electronics Engineers, (<http://standards.ieee.org/>).

⁹ The IEEE standards or products referred to in Clause 2 are trademarks of the Institute of Electrical and Electronics Engineers, Incorporated.

3. 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.¹⁰

This standard makes use of the following terms defined in IEEE Std 802 ([802]):

- bridge
- end station
- station

This standard makes use of the following terms defined in IEEE Std 802.3 ([802.3]):

- frame
- packet

This standard makes use of the following terms defined in IEEE Std 802.1Q ([Q]):

- C-VLAN

¹⁰ The *IEEE Standards Dictionary Online* is available at: <https://dictionary.ieee.org>. An IEEE Account is required for access to the dictionary, and one can be created at no charge on the dictionary sign-in page.

4. Abbreviations

This standard uses the following abbreviations:

ATS	Asynchronous Traffic Shaper
BE	best effort
CBS	credit-based shaper
CQF	cyclic queuing and forwarding
ECU	electronic control unit
EISS	Enhanced Internal Sublayer Service
EST	enhancements for scheduled traffic
FRER	Frame Replication and Elimination for Reliability
ICV	integrity check value
IPG	interpacket gap
IPV	internal priority value
ISS	Internal Sublayer Service
IVN	in-vehicle network
MSDU	MAC Service Data Unit
PCS	Profile Conformance Statements
RSTP	Rapid Spanning Tree Protocol
SDU	service data unit
SFD	start of frame delimiter
SotA	software over the air update
TC	traffic class
TDMA	time division multiple access
TSN	Time-Sensitive Networking