P802.1DF™/D0.0
Draft Stardard for local and
metropolitan area networks —

Time Sensitive Networking Profile for Service Provider Networks

Individual contribution
Prepared by Tongtong Wang (Tongtong.wang@huawei.com)

Abstract: This standard defines profiles that select features, options, configurations, defaults, protocols, and procedures of bridges and end-stations defined in IEEE Std 802.1Q and IEEE Std 802.1CB that are necessary to provide Time-Sensitive Networking (TSN) quality of service features for non-fronthaul shared service provider networks. The standard also provides use cases, and informative guidance for network operators on how to configure their networks for those use cases.

Keywords: TSN, Time-Sensitive Networking, Bridging, Bridges, Bridged Local Area Networks, IEEE 802®, IEEE 802.1Q™, IEEE 802.1DF™, local area networks (LANs), MAC Bridges, Virtual Bridged Local Area Networks (virtual LANs), Service Provider Networks

•Editor's Foreword

<<Notes>>

<<Throughout this document, all notes such as this one, presented between angle braces, are temporary notes inserted by the Editors for a variety of purposes; these notes and the Editors' Foreword will all be removed prior to publication and are not part of the normative text.>>

<<Comments and participation in 802.1 standards development

Comments on this draft are encouraged. **PLEASE NOTE: All issues related to IEEE standards presentation style, formatting, spelling, etc. are routinely handled between the 802.1 Editor and the IEEE Staff Editors prior to publication, after balloting and the process of achieving agreement on the technical content of the standard is complete.** Readers are urged to devote their valuable time and energy only to comments that materially affect either the technical content of the document or the clarity of that technical content. Comments should not simply state what is wrong, but also what might be done to fix the problem.

Full participation in the development of this draft requires individual attendance at IEEE 802 meetings. Information on 802.1 activities, working papers, and email distribution lists etc. can be found on the 802.1 website:

<div align="center">

http://ieee802.org/1/

</div>

Use of the email distribution list is not presently restricted to 802.1 members, and the working group has had a policy of considering ballot comments from all who are interested and willing to contribute to the development of the draft. Individuals not attending meetings have helped to identify sources of misunderstanding and ambiguity in past projects. Non-members are advised that the email lists exist primarily to allow the members of the working group to develop standards, and are not a general forum. All participants in IEEE standards development have responsibilities under the IEEE patent policy and should familiarize themselves with that policy. See
http://standards.ieee.org/about/sasb/patcom/materials.html.

Comments on this document may be sent to the 802.1 email exploder, to the editors, or to the Chairs of the 802.1 Working Group and Time-Sensitive Networking Task Group.

Xxx
Editor, IEEE P802.1DF
Email

János Farkas   Glenn Parsons
Chair, 802.1 Time-Sensitive Networking Task Group   Chair, 802.1 Working Group
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<<The draft text and accompanying information

This document currently comprises:

— A title page for the proposed standard including an Abstract and Keywords. This title page will be retained following working group approval of this draft, i.e. prior to sponsor ballot.
— The editors' forewords, including this text. These include an unofficial and informal appraisal of history and status, introductory notes to each draft that summarize the progress and focus of each successive draft, and requests for comments and contributions on major issues.
— IEEE boilerplate text.
— A record of participants (not included in early drafts but added prior to publication).
— The introduction to this standard.
— The proposed standard proper.
— An Annex Z comprising the editors' discussion of issues. This annex will be deleted from the document prior to sponsor ballot.

During the early stages of draft development, 802.1 editors have a responsibility to attempt to craft technically coherent drafts from the resolutions of ballot comments and the other discussions that take place in the working group meetings. Preparation of drafts often exposes inconsistencies in editor's instructions or exposes the need to make choices between approaches that were not fully apparent in the meeting. Choices and requests by the editors' for contributions on specific issues will be found in the editors' introductory notes to the current draft, at appropriate points in the draft, and in Annex Z. Significant discussion of more difficult topics will be found in the last of these.

The ballot comments received on each draft, and the editors' proposed and final disposition of comments, are part of the audit trail of the development of the standard and are available, along with all the revisions of the draft on the 802.1 web site (for address see above).

>>

<< Introductory notes to P802.1DF Draft 0.0

Draft 0.0 was prepared by Tongtong Wang to gather all the boiler plate text and start discussing and editing. Everything in this draft can be considered a contribution to the Time-Sensitive Networking Task Group by the editor; nothing has been approved by the Task Group or Working Group.

>>

<< Project Authorization Request, Scope, Purpose, and Five Criteria
A PAR (Project Authorization Request) for P802.1DF was approved by the IEEE Standards Association on February 8, 2019. The following information is taken from the 802.1DF PAR and Criteria for Standards Development.

Scope of Proposed Project:
This standard defines profiles that select features, options, configurations, defaults, protocols, and

procedures of bridges and end-stations defined in IEEE Std 802.1Q and IEEE Std 802.1CB that are necessary to provide Time-Sensitive Networking (TSN) quality of service features for non-fronthaul shared service provider networks. The standard also provides use cases, and informative guidance for network operators on how to configure their networks for those use cases.

Purpose of Proposed Project:

This standard provides guidance for equipment vendors, designers, and operators of service provider networks that are shared by multiple users and applications, and that need the TSN Quality of Service (QoS) features offered by IEEE Std 802.1Q bridges. These networks have links with a very large bandwidth-delay product. The TSN features include dependable bandwidth and bounded latency.

Need for the Proposed Project:

Next generation transport networks that have more stringent QoS requirements would benefit from TSN QoS features. For example, next generation mobile networks will have an order of magnitude more cells than present networks, making it essential for multiple carriers (applications/users) to share network resources of a physical infrastructure. The fronthaul use cases are already addressed by IEEE Std 802.1CM. QoS partitioning among applications or customers will enable high-value services that have stringent bandwidth and latency requirements to efficiently share the network with best-effort services.

1. IEEE 802 criteria for standards development (CSD)

The CSD documents an agreement between the WG and the Sponsor that provides a description of the project and the Sponsor's requirements more detailed than required in the PAR. The CSD consists of the project process requirements, 1.1, and the 5C requirements, 1.2.

1.1 Project process requirements

1.1.1 Managed objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

a) The definitions will be part of this project.

b) The definitions will be part of a different project and provide the plan for that project or anticipated future project.

c) The definitions will not be developed and explain why such definitions are not needed.

 Item c) The definitions of managed objects will not be developed because the proposed standard will specify only profiles that use managed objects already defined in other IEEE 802 standards.

1.1.2 Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

a) Will the WG create a CA document as part of the WG balloting process as described in Clause 13? (yes/no)

b) If not, explain why the CA document is not applicable.

Item b). A CA document is not applicable because this is not a wireless project

1.2 5C requirements

1.2.1 Broad market potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.

b) Multiple vendors and numerous users.

The market for next generation service provider networks, e.g. mobile networks, will be very large. IEEE 802.1Q can provide bounded latency and zero congestion loss Quality of Service features. This makes it likely that IEEE 802 technologies can gain a significant share of the next generation service provider market.

b) A number of vendors and operators have expressed their support for a non-fronthaul service provider network profile of IEEE 802.1 Time-Sensitive Networking.

1.2.2 Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

a) Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?

b) If the answer to a) is no, supply the response from the IEEE 802.1 WG.

a) Yes, this standard will comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q.
b) Not applicable.
The review and response is not required if the proposed standard is an amendment or revision to an existing standard for which it has been previously determined that compliance with the above IEEE 802 standards is not possible. In this case, the CSD statement shall state that this is the case.

1.2.3 Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

The proposed standard will address service provider networks other than fronthaul networks, which are already addressed by IEEE Std 802.1CM. There are no other 802 standards or approved projects that specify time-sensitive networking for non-fronthaul service provider networks.

1.2.4 Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.
b) Proven similar technology via testing, modeling, simulation, etc.

a) The proposed standard will specify profiles for the use of other IEEE 802 standards for which system feasibility has been demonstrated.

b) The proposed standard will specify profiles for the use of other IEEE 802 standards for which the technology has been proven.

1.2.5 Economic Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) Balanced costs (infrastructure versus attached stations).
b) Known cost factors.
c) Consideration of installation costs.
d) Consideration of operational costs (e.g., energy consumption).
e) Other areas, as appropriate.

a) The well-established cost balance between infrastructure and attached stations will not be changed by the proposed standard.

b) The cost factors are known for the IEEE 802 standards that this specification references.

c) There are no incremental installation costs relative to the IEEE 802 standards that this specification references.

d) There are no incremental operational costs relative to the existing costs associated with the IEEE 802 standards that this specification references.

e) No other areas have been identified.

>>

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<Chair Name>, *Chair*
<Vice-chair Name>, *Vice Chair*

Participant1	Participant4	Participant7
Participant2	Participant5	Participant8
Participant3	Participant6	Participant9

The following members of the <individual/entity> balloting committee voted on this<opt_trial-use><gde./rec. prac./std.>. Balloters may have voted for approval, disapproval, or abstention.

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Balloter1	Balloter4	Balloter7
Balloter2	Balloter5	Balloter8
Balloter3	Balloter6	Balloter9

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Konstantinos Karachalios, *Secretary*

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SBMember2	SBMember5	SBMember8
SBMember3	SBMember6	SBMember9

*Member Emeritus

1 Introduction to IEEE P802.1DF/D0.0

This introduction is not part of IEEE P802.1DF, IEEE Standards for Local and Metropolitan Area Networks — Draft Standard for Local and metropolitan area networks —Time-Sensitive Networking Profile for Service Provider Networks

This Standard defines the Time-Sensitive Networking Profile for Service Provider Networks.

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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Local and metropolitan area networks—

Time-Sensitive Networking Profile for Service Provider Networks

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1. Overview

1.1 Scope

This standard defines profiles of IEEE Std 802.1Q and IEEE Std 802.1CB that provide Time-Sensitive Networking (TSN) quality of service features for non-fronthaul shared service provider networks. The standard also provides use cases, and informative guidance for network operators on how to configure their networks for those use cases.

1.2 Purpose

Service provider networks often support multiple users and applications, and can benefit from TSN Quality of Service (QoS) bridging features defined in IEEE Std 802.1Q. This standard provides guidance for configuration of QoS features to provide dependable bandwidth and bounded latency.

1.3 Introduction

Service provider networks often support multiple users and applications, and can benefit from TSN Quality of Service (QoS) bridging features defined in IEEE Std 802.1Q. This standard provides guidance for configuration of QoS features to provide dependable bandwidth and bounded latency.

<< Editor's note: This clause will be expanded as necessary. Discussion of this clause will help >>

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.

IEEE Std 802™, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.[1,2]

IEEE Std 802.1Q™-2018, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks.

IEEE Std 802.1Qcr™-2019, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks—Amendment: Asynchronous Traffic Shaping.

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

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. [1]

4. Abbreviations

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[1]*IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org

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5. Conformance

5.1 Introduction

<< Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

Possible content could include:
1. Requirements terminology (explains shall, must, should)
2. PCS: describes use of PCS in Annex
3. Bridge in Service provider networks

>>

6. Service Provider Networks

6.1 Introduction

<< Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

This clause will list a few representative use cases for service provider networks, and classify them from requirement perspective,

1. Bounded latency
2. Bounded jitter
   a) Isolation
   b) Slicing
3. Reliability

>>

7. Security

7.1 Introduction

<< Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

Security over SP Network is important and shall be discussed seriously in dedicated standard groups and documents.

>>

8. Asynchronous Model

8.1 Introduction

<< Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

RFC 1633 IntServ,

IEEE TSN 802.1Qav, 802.1Qcr, etc

Network calculus will be helpful in delay calculation;

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9. Synchronous Model

9.1 Introduction

<< Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

IEEE Std802.1Qbv, IEEE Std802.1Qch
CQF Variants, e.g. Paternoster

Discussion on requirements for use cases in Service provider networks may cause changes to clause 8 and 9, since it may not be necessary to use synchronized model in large scale networks.
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18 10. Interface with DetNet

19 10.1 Introduction

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22 << Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider
23 Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

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25 Control plane interface for resource reservation;

26 Data plane interface:
27 --Flow identification, flow aggregation; etc.
28 IETF DetNet has started working on the data plane;

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11. Synchronized time

11.1 Introduction

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29 << Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider
30 Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf
31
32 Precision Time Protocol, Pick a profile and options
33 Robust and Secure PTP, Certainly, 802.1AS-2019 will be useful.
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31 **12. Topology and redundancy**

32 **12.1 Introduction**

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34 << Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider
35 Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

36
37 Typical hierarchical network topology consist of access level, aggregation level and backbone level;
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39 Frame Replication and Elimination for Reliability (FRER)
40 ■ If not necessary end to end, enabling on network node?
41 Customer End station duplication.
42 ■ Impact on the network, relationship to FRER.
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38 13. Profiles

39 13.1 Introduction

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41 << Editor's Note: This clause is a suggestion based on the presentation Suggestions for Service Provider
42 Networks. http://www.ieee802.org/1/files/public/docs2019/df-wangtt-SP-prof-outline-0519.pdf

43
44 One or two profiles, for devices conformant to Clause 5, that will meet the needs of a significant market.

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Annex A

(Informative)

<< Editor's Note: This clause may set an example on how to use profiles defined in this standard to setup a network to satisfy a certain use cases, such as smart grid or Cloud VR applications.

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1   **Annex B**

2   **Bibliography**

3   Bibliographical references are resources that provide additional or helpful material but do not need to be
4   understood or used to implement this standard. Reference to these resources is made for informational use
5   only.

6