P802.1Qdx/D1.4
January 11, 2024

(Amendment to IEEE Std 802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023 IEEE Std 802.1Qcw-2023, and IEEE Std 802.1Qcj-2023)

Draft Standard for Local and Metropolitan Area Networks—

Bridges and Bridged Networks

Amendment 39: YANG Data Models for the Credit-Based Shaper

Prepared by the
Time-Sensitive Networking (TSN) Task Group of IEEE 802.1

Sponsor

LAN/MAN Standards Committee of the IEEE Computer Society

This and the following cover pages are not part of the draft. They provide revision and other information for IEEE 802.1 Working Group members and will be updated as convenient. **New participants: Please read these cover pages**, they contain information that should help you contribute effectively to this standards development project. The Introduction to the current draft should be useful to all readers.

The text proper of this draft begins with the Title page.

IEEE Standards Association
445 Hoes Lane
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This document is a draft amendment to IEEE Std 802.1Q-2022 as updated by published and draft amendments (if, and as, noted on the Title page), the agreed or proposed resolution of Maintenance items (see below), and Technical corrections and Editorial corrections to the description of existing functionality.

These cover pages provide an Introduction to the current draft, an introduction to Participation in 802.1 standards development, a summary of the PAR (Project Authorization Request) and CSD,and a general discussion of Draft development.

These cover pages will be replaced for SA Ballot by a briefer version providing information for that ballot, with space for commentary on, and hyperlinks to, changes that occur in SA Ballot.

Introduction to the current draft[1]

This draft D1.4 has been prepared for Working Group recirculation ballot. It incorporates the resolution of comments received on the Working Group Recirculation Ballot of P802.1Qdx/D1.1 as updated following discussion of the D1.3 interim draft in the Monday 8th January meeting of the TSN Task Group:

https://www.ieee802.org/1/files/private/dx-drafts/d1/802-1Qdx-d1-1-dis-v02.pdf

Maintenance items

This draft does not include proposed or agreed resolutions of maintenance items for the base standard.

Technical corrections

This draft does not include any technical corrections to the base standard beyond the project subject matter.

Editorial corrections

This draft does not include any editorial corrections to the base standard beyond the project subject matter.

MIB and YANG modules

The MIB and YANG modules specified by this standard are attached to the draft pdf as plain text (UTF-8) .mib and .yang files.

MIB and YANG modules

The MIB and YANG modules specified by this standard are attached to the draft pdf as plain text (UTF-8) .mib and .yang files.

Sources

This draft has been prepared from a set of Framemaker files with conditional text that supports the production of an amendment draft and a preliminary rollup of that amendment draft into the text of the base standard, IEEE Std 802.1Q-2022 as amended by prior amendments as of the close of their successful SA ballots.

[1]The whole or parts of the introduction, possibly updated, to past drafts may be retained at the Editor's discretion, with the most recent introduction first. The introduction to each draft may solicit input on specific subjects.

These sources were based on those for P802.1Q-2022-Rev/D1.0. Further changes (not readily apparent in the printed text of this amendment) have been made to those sources as part of an ungoing program of making the 802.1Q Framemaker sources consistent. Further drafts of P802.1Q-2022-Rev should be based on this source set, and not those for D1.0.

For a description of the use of conditional text and other FrameMaker and IEEE Std 802.1Q Style considerations applicable to this draft see the EDITOR-PLEASE-READ-ME file in the FrameMaker books used to generate this draft.

Participation in 802.1 standards development

All participants in IEEE 802.1 activities should be aware of the Working Group Policies and Procedures, and their obligations under the IEEE Patent Policy, the IEEE Standards Association (SA) Copyright Policy, and the IEEE SA Participation Policy. For information on these policies see 1.ieee802.org/rules/ and the slides presented at the beginning of each of our Working Group and Task Group meeting.

The IEEE SA PAR (Project Authorization Request) and CSD is summarized in these cover pages and a link provided to the full text. As part of the IEEE 802® process, the PAR of each project is reviewed regularly to ensure its continued validity. A vote of “Approve” on this draft is also an affirmation that the PAR and CSD is still valid.

Comments on this draft are encouraged. 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 work of IEEE 802.1 requires 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:

http://ieee802.org/1/

Use of the email distribution list is not presently restricted to 802.1 members, and the working group has a policy of considering 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. The email lists exist primarily to allow the members of the working group to develop standards, and are not a general forum. All contributors to the work of 802.1 should familiarize themselves with the IEEE patent policy and anyone using the email distribution list will be assumed to have done so. Information can be found at http://standards.ieee.org/db/patents/

Comments on this draft 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 (TSN) Task Group.

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NOTE: Comments whose distribution is restricted in any way cannot be considered, and may not be acknowledged.

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

As part of our IEEE 802 process, the text of the PAR and CSD (Criteria for Standards Development, formerly referred to as the 5 Criteria or 5C's) is reviewed on a regular basis in order to ensure their continued validity. A vote of “Approve” on this draft is also an affirmation by the balloter that the PAR is still valid.

PAR (Project Authorization Request) and CSD

Extracts from the PAR, as approved by IEEE NesCom June 5th, 2023:

https://development.standards.ieee.org/myproject-web/public/view.html#pardetail/10544

and the CSD (Criteria for Standards Development):

https://www.ieee802.org/1/files/public/docs2023/dx-CSD-0323-v01.pdf

follow.

The Scope and Purpose of the base standard remains unchanged from that for IEEE Std 802.1Q-2022.

PAR Scope of the Project:

This amendment specifies a Unified Modeling Language (UML)-based information model and YANG modules that allow configuration and status reporting for bridges and end stations (as specified by the base standard) with the capabilities currently specified for the credit-based shaper algorithm (8.6.8.2) of the base standard for the per-traffic class queues. It further defines the relationship between the information and data model, and models for the other management capabilities specified in this standard. Additionally, this amendment addresses errors or omissions related to the feature described above.

PAR Need for the Project:

YANG (RFC 7950) is a formalized data modeling language that is widely accepted and can be used to simplify network configuration. The ability to manage the credit-based shaper algorithm via YANG modules is needed for compatibility with modern network management systems.

PAR Possible registration activity related to this project:

The YANG Data Model will be assigned a Uniform Resource Name (URN) based on the IEEE Registration Authority (RA) URN tutorial and IEEE Std 802d.

CSD managed objects:

This project is a management project that specifies YANG data models for management of the credit-based shaper algorithm specified by IEEE Std 802.1Q.

Draft development

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 from 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' Introduction to the current draft and at appropriate points in the draft.

Any text with a Cyan background (as in this sentence) is temporary, with conditional tag 'Editor comment', inserted by the Editors to solicit comment, suggest a future change, or act simply as an aide memoire. Text can also highlighted to be draw it to the readers' attention, using conditional tag 'Editor highlight'. In both these case conditional tagging helps location, and eventual removal, of text or highlighting and can control whether or not it is displayed.

The ballot comments received on each draft, and the editors' proposed and final disposition of comments on working group drafts, 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 website (for address see above).

During the early stages of draft development the proposed text can be moved around a great deal, and even minor rearrangement can lead to a lot of 'change', not all of which is noteworthy from the point of the reviewer, so the use of automatic change bars is not very effective. In early drafts change bars may be omitted or applied manually, with a view to drawing the readers attention to the most significant areas of change.

Readers interested in viewing every change are encouraged to use Adobe Acrobat to compare the document with their selected prior draft. Note that the FrameMaker change bar feature is useless when it comes to indicating changes to Figures.

This draft has been prepared from a set of Framemaker files with conditional text that supports the production of an amendment draft and a preliminary roll up of that amendment draft into the text of the base standard, i.e. IEEE Std 802.1Q as of the last Revision as amended by prior amendments (usually as of the close of their successful SA ballots) as noted on the Title Page and the first Cover Page. The editor may make preliminary roll ups available to check consistency with the base standard and cross-references to text that does not appear in this amendment. Roll ups may also be recorded as part of the approved P802.1Q Revision project.

For a description of the use of conditional text and other FrameMaker and IEEE Std 802.1Q Style considerations applicable to this draft see the EDITOR-PLEASE-READ-ME file in the FrameMaker books used to generate these drafts.

There are generally multiple amendments under development at any time, and while they will add or amend different clauses in the base standard, there are some clauses (notably Clauses 12, 48, and the PICS Annexes that all are likely to change). They need to be fully integrated before or during SA Ballot, and complete that ballot in serial order to avoid future problems.

Records of participants in the development of the standard are added after SA Ballot, as part of pre-publication editing by IEEE Staff.

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Sponsor
LAN/MAN Standards Committee
of the
IEEE Computer Society

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445 Hoes Lane
Piscataway, NJ 08854, USA

Abstract: This amendment to IEEE Std 802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023, IEEE Std 802.1Qcw-2023, and IEEE Std 802.1Qcj-2023 specifies a YANG data model that supports configuration and status reporting for credit-based shaper algorithm capabilities in bridges and end stations.

Keywords: Bridged Network, IEEE 802.1Q™, LAN, local area network, MAC Bridge, metropolitan area network, credit-based shaper algorithm, YANG.

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[1] Available at: https://development.standards.ieee.org/myproject-web/public/view.html#landing.
[2] Available at: https://standards.ieee.org/content/ieee-standards/en/about/contact/index.html.

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[3] Available at: https://ieeexplore.ieee.org/browse/standards/collection/ieee.
[4] Available at: https://standards.ieee.org/standard/index.html.
[5] Available at: https://standards.ieee.org/about/sasb/patcom/materials.html.

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Participants

<<The following lists will be updated in the usual way prior to publication>>

At the time this standard was submitted to the IEEE-SA Standards Board for approval, the IEEE 802.1 Working Group had the following membership:

Glenn Parsons, *Chair*
Jessy V. Rouyer, *Vice Chair*
János Farkas, *Chair, Time-Sensitive Networking Task Group*
Craig Gunther, *Vice Chair, Time-Sensitive Networking Task Group*
Abdul Jabbar, *Editor*

<<TBA>>

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

<<TBA>>

When the IEEE-SA Standards Board approved this standard on XX Month 20xx, it had the following membership:

<<TBA>>

<<TBA>>

*Member Emeritus

Introduction

This introduction is not part of IEEE Std 802.1Qdx™-2024, IEEE Standard for Local and Metropolitan Area Networks— Bridges and Bridged Networks—Amendment 38: YANG Data Models for the Credit-Based Shaper.

IEEE Std 802.1Qdx™-2024: YANG Data Models for the Credit-Based Shaper addresses the need to manage the credit-based shaper algorithm via a YANG model compatible with modern management systems.

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

Secretary, IEEE-SA Standards Board
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Tables

IEEE Standard for
Local and Metropolitan Area Networks—

Bridges and Bridged Networks

Amendment 39:
YANG Data Models for the Credit-Based Shaper

(This amendment is based on IEEE Std 802.1Q™-2022 as amended by IEEE Std 802.1Qcz™-2023, IEEE Std 802.1Qcw™-2023, and IEEE Std 802.1Qcj™-2023.)

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italics***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strikethrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Deletions and insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this note will not be carried over into future editions because the changes will be incorporated into the base standard. [6]

[6] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

48. YANG Data Models

48.2 IEEE 802.1Q YANG models

Insert 48.12.13 at the end of 48.2 as follows:

48.2.13 Credit-based shaper algorithm model

The credit-based shaper algorithm model augments the Bridge Port model (48.2.1) with nodes that represent the managed objects of credit-based shaper algorithm in Table 12-4.

The credit-based shaper algorithm model is illustrated in Figure 48-23.

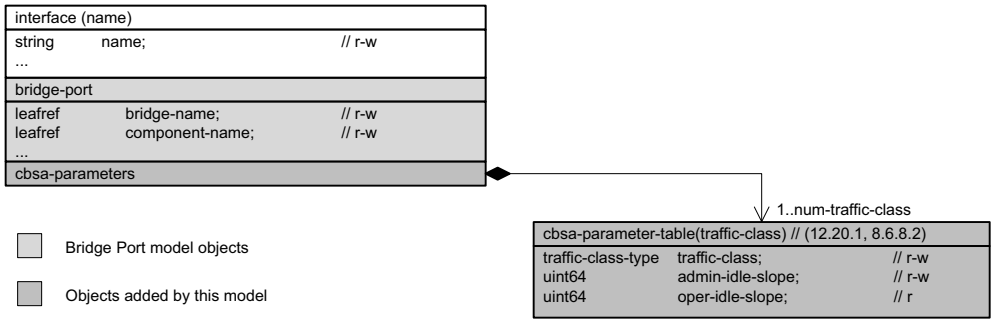

Figure 48-23—Credit-based shaper algorithm model

48.3 Structure of the YANG models

Insert the following rows at the end of Table 48-1 as follows (unchanged rows not shown):

Table 48-1—Summary of the YANG modules

Module	References	Managed functionality	Initial YANG specification Notes
ieee802-dot1q-cbsa	48.6.24	8.6.8.2	IEEE Std 802.1Qdx credit-based shaper algorithm module
ieee802-dot1q-cbsa-bridge	48.6.25	8.6.8.2	IEEE Std 802.1Qdx Augments Bridge Port with credit-based shaper algorithm module.

Insert 48.3.13 at the end of 48.3 as follows:

48.3.13 Credit-based shaper algorithm model

A bridge implementing the credit-based shaper algorithm model (48.2.13) implements the YANG modules in Table 48-14.

Table 48-14—Credit-based shaper algorithm model YANG modules

YANG Module
ieee802-types
ieee802-dot1q-types
ieee-802-dot1q-tsn-types
ieee802-dot1q-bridge
ieee802-dot1q-cbsa
ieee802-dot1q-cbsa-bridge

48.4 Security considerations

Insert 48.4.13 at the end of 48.4 as follows:

48.4.13 Security considerations of the credit-based shaper algorithm model

The following objects in the ieee802-dot1q-cbsa YANG module could be manipulated to interfere with the operation of the credit-based shaper algorithm. This could, for example, be used to force a reinitialization of credit-based shaper algorithm state, thus causing network instability.

interfaces/interface/bridge-port/cbsa-parameters/cbsa-parameter-table

48.5 YANG schema tree definitions

Insert 48.5.24 at the end of 48.5 as follows:

48.5.24 Schema for the ieee802-dot1q-cbsa YANG module

This YANG module does not have a YANG schema tree.

Insert 48.5.25 as follows:

48.5.25 Schema for the ieee802-dot1q-cbsa-bridge YANG module

```
module: ieee802-dot1q-cbsa-bridge

  augment /if:interfaces/if:interface/dot1q:bridge-port:
    +--rw cbsa-parameters {credit-based-shaper-algorithm}?
       +--rw cbsa-parameter-table* [traffic-class]
          +--rw traffic-class       dot1q-types:traffic-class-type
          +--rw admin-idle-slope?   uint64
          +--ro oper-idle-slope?    uint64
```

48.6 YANG modules[7] [8] [9]

Insert 48.6.24 at the end of 48.6, renumbering as necessary, as follows:

48.6.24 The ieee802-dot1q-cbsa YANG module

```
module ieee802-dot1q-cbsa {
  namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-cbsa";
  prefix cbsa;

  import ieee802-dot1q-types {
    prefix dot1q-types;
  }

  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://www.ieee802.org/1/
    WG-EMail: stds-802-1-L@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
    IEEE Standards Association
    445 Hoes Lane
    Piscataway, NJ 08854
    USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This module provides for management of IEEE Std 802.1Q components
    that support the credit-based shaper algorithm.

    Copyright (C) IEEE (2024)

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";

  revision 2024-01-11 {
    description
      "Published as part of IEEE Std 802.1Qdx-2024.

      The following reference statement identifies each referenced IEEE
      Standard as updated by applicable amendments.";
    reference
      "IEEE Std 802.1Q Bridges and Bridged Networks:
      IEEE Std 802.1Q-2022, IEEE Std 802.1Qcz-2023, IEEE Std 802.1Qcw-2023,
      IEEE Std 802.1Qcj-2023, IEEE Std 802.1Qdx-2024.";
  }

  grouping cbsa-config {
    description
      "cbsa-config comprises all the parameters associated
      with the credit-based shaper algorithm.";
    container cbsa-parameters {
      description
        "This container comprises all credit-based shaper algorithm related
        nodes.";
      list cbsa-parameter-table {
        key "traffic-class";
        description
          "There is one cbsa-parameter-table list per Port. Each list entry
          corresponds to the set of parameters (12.20.1)for each traffic class
          configured for use with the credit-based shaper algorithm (8.6.8.2).
```

[7] Copyright release for YANG: Users of this standard may freely reproduce the YANG modules contained in this standard so that they can be used for their intended purpose.

[8] An ASCII version of each YANG module is attached to the PDF of this standard and can also be obtained from the IEEE 802.1 Website at https://1.ieee802.org/yang-modules/.

[9] References in this standard's YANG module definitions are not clickable, as each module has been incorporated unchanged after development and verification using YANG tools.

```
          The cbsa-parameter-table list is valid for a Bridge Port only when
          used in the absence of the stream reservation protocol.";
        reference
          "8.6.8.2, 34.3, 34.6, and 12.20.1 of IEEE Std 802.1Q.";
        leaf traffic-class {
          type dot1q-types:traffic-class-type;
          description
            "An 802.1 traffic class value. This is the numerical value
            associated with a traffic class. Larger values are associated with
                      higher priority traffic classes.";
          reference
            "8.6.8 of IEEE Std 802.1Q.";
        }
        leaf admin-idle-slope {
          type uint64;
          units "bits/second";
          default "0";
          description
            "The bandwidth, in bits per second, that has been requested by
            management to be reserved for use by the queue associated with
            this traffic class.

            If the stream reservation protocol is in operation for this traffic
            class, this parameter has no effect.

            If the stream reservation protocol is not in operation for this
            traffic class, then the value of oper-idle-slope is equal to the
            value of admin-idle-slope.";
          reference
            "34.3 of IEEE Std 802.1Q.";
        }
        leaf oper-idle-slope {
          type uint64;
          units "bits/second";
          default "0";
          config false;
          description
            "The actual bandwidth, in bits per second, that is currently
            reserved for use by the queue associated with this traffic class
            (see 34.6.1 and 34.6.2).";
          reference
            "34.3, 34.6.1, and 34.6.2 of IEEE Std 802.1Q.";
        }
      }
    }
  }
}
```

Insert 48.6.25 at the end of 48.6, renumbering as necessary, as follows:

48.6.25 The ieee802-dot1q-cbsa-bridge YANG module

```
module ieee802-dot1q-cbsa-bridge {
  namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-cbsa-bridge";
  prefix cbsa-bridge;

  import ietf-interfaces {
    prefix if;
  }
  import ieee802-dot1q-cbsa {
    prefix cbsa;
  }
  import ieee802-dot1q-bridge {
    prefix dot1q;
  }

  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://www.ieee802.org/1/
    WG-EMail: stds-802-1-L@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
    IEEE Standards Association
    445 Hoes Lane
    Piscataway, NJ 08854
    USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This module provides for management of IEEE Std 802.1Q Bridges
    that support the credit-based shaper algorithm.

    Copyright (C) IEEE (2024).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";

  revision 2024-01-11 {
    description
      "Published as part of IEEE Std 802.1Qdx-2024.

      The following reference statement identifies each referenced IEEE
      Standard as updated by applicable amendments.";
    reference
      "IEEE Std 802.1Q Bridges and Bridged Networks:
      IEEE Std 802.1Q-2022, IEEE Std 802.1Qcz-2023, IEEE Std 802.1Qcw-2023,
      IEEE Std 802.1Qcj-2023, IEEE Std 802.1Qdx-2024.";
  }

  feature credit-based-shaper-algorithm {
    description
      "Credit-based shaper algorithm supported.";
    reference
      "8.6.8.2 of IEEE Std 802.1Q.";
  }

  augment "/if:interfaces/if:interface/dot1q:bridge-port" {
    if-feature "credit-based-shaper-algorithm";
    description
      "Augment dot1q:bridge-port with credit-based shaper algorithm
      configuration.";
    uses cbsa:cbsa-config;
  }
}
```

Annex A

(normative)

PICS proforma—Bridge implementations[10]

A.5 Major capabilities

Insert the following row at the end of the table in A.5 (unchanged rows not shown):

Item	Feature	Status	References	Support	
CBSA	Does the implementation support the credit-based shaper algorithm?	O	8.6.8.2	Yes [ ]	No [ ]

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A.47 YANG

Insert the following rows at the end of the table in A.47 (unchanged rows not shown):

Item	Feature	Status	References	Support
YANG-CBSA	Is the *ieee802-dot1q-cbsa* module supported?	CBSA:O	48.6.25	Yes [ ] No [ ]
YANG-CBSA-BRIDGE	Is the *ieee802-dot1q-cbsa-bridge* module supported?	CBSA:O	48.6.24	Yes [ ] No [ ]

Insert A.55 at the end of Annex A, as follows:

A.55 Credit-based shaper algorithm

Item	Feature	Status	References	Support
	If CBSA is not supported, mark N/A and ignore the remainder of this table.			N/A[ ]
CBSA-1	Does the implementation support the algorithm and associated parameters specified in 8.6.8.2?	CBSA:M	8.6.8.2	Yes [ ] No [ ]
CBSA-2	Does the implementation support the management parameters adminIdleSlope and operIdleSlope as defined in 12.20.1?	CBSA:M	12.20.1	Yes [ ] No [ ]

Annex B

(normative)

PICS proforma—End station implementations[11]

B.5 Major capabilities

Insert the following rows at the end of the table in B.5 (unchanged rows not shown):

Item	Feature	Status	References	Support	
CBSA	Does the implementation support the credit-based shaper algorithm?	O	8.6.8.2	Yes [ ]	No [ ]

Insert B.21 at the end of Annex B, as follows:

B.21 Credit-based shaper algorithm

Item	Feature	Status	References	Support
	If the credit-based shaper algorithm is not supported, mark N/A and ignore the remainder of this table.			N/A[ ]
CBSA-1	Does the implementation support the credit based shaper algorithm and associated parameters specified in 8.6.8.2?	CBSA:M	8.6.8.2	Yes [ ] No [ ]
CBSA-2	Does the implementation support the management parameters adminIdleSlope and operIdleSlope as defined in 12.20.1?	CBSA:M	12.20.1	Yes [ ] No [ ]

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