

6 **Draft Standard for**
7 **Local and Metropolitan Area Networks—**
8 **Bridges and Bridged Networks**

9 **Amendment 40:**
10 **YANG for the Multiple Spanning Tree**
11 **Protocol**

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

14 Sponsor
LAN/MAN Standards Committee
of the
IEEE Computer Society

18 **This and the following cover pages are not part of the draft.** They provide revision and other information
19 for IEEE 802.1 Working Group members and participants in the IEEE Standards Association ballot process,
20 and will be updated as convenient. The text proper of this draft begins with the [Title page](#).

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2 **Current draft**

3 The text of this draft, following these cover pages and the frontmatter (Important Notices), is that of
4 P802.1Qdy as of the final Working Group Recirculation Ballot with the omission of change bars showing
5 changes from prior drafts. The frontmatter has been updated to include recent pre-publication changes for
6 other amendments, including text dealing with Artificial Intelligence and sensitive terminology. The frontmatter
7 is not the subject of SA Ballot or Working Group deliberation and will be updated to the current IEEE SA text
8 at the time of pre-publication editing..

9 **Base standard**

10 This draft is being submitted to SA Ballot prior to pre-publication editing of another amendment (P802.1Qdx)
11 to the base standard, IEEE Std 802.1Q. There is currently no technical overlap between these amendments,
12 and the editorial interaction is limited to the numbering of minor clauses, figures, and tables.

13 **MIB and YANG modules**

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

- ¹ This page intentionally left blank, to allow for the addition of information (e.g. pointers to changed text) during
- ² the SA Ballot process without the need to renumber the following pages in the draft.

(Amendment to IEEE Std 802.1Q™-2022 as amended by IEEE Std 802.1Qcz™-2023,
IEEE Std 802.1Qcw™-2023, IEEE Std 802.1Qcj™-2023, IEEE Std 802.1Qdj™-2024, and P802.1Qdx/D2.1)

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Sponsor
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2 **Abstract:** This amendment to IEEE Std 802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023,
3 IEEE Std 802.1Qcw-2023, IEEE Std 802.1Qcj-2023, IEEE Std 802.1Qdj-2024, and
4 IEEE Std 802.1Qdx-2024 addresses Multiple Spanning Tree Protocol (MSTP) requirements arising
5 from industrial automation networks. It specifies YANG for bridge and bridge component RSTP and
6 MSTP configuration and status reporting.

7 **Keywords:** Bridged Network, IEEE 802.1Q™, IEEE 802.1Qdy™, LAN, local area network, MAC
8 Bridge, metropolitan area network, MSTP, Multiple Spanning Tree Protocol, MIB, Rapid Spanning
9 Tree Protocol, RSTP, Virtual Bridged Network, virtual LAN, VLAN Bridge, YANG.

10

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1 Introduction

This introduction is not part of IEEE Std 802.1Qdy™-2024, IEEE Standard for Local and metropolitan area networks— Bridges and Bridged Networks—Amendment 40: YANG for Multiple Spanning Trees.

2 IEEE Std 802.1Qdy™-2024: YANG for Multiple Spanning Trees addresses requirements arising from
3 industrial automation networks, specifying YANG for bridge and bridge component MSTP configuration
4 and status reporting.

5 This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution.
6 Revisions are anticipated within the next few years to clarify existing material, to correct possible errors, and
7 to incorporate new related material. Information on the current revision state of this and other IEEE 802
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2 **IEEE Standard for**
3 **Local and metropolitan area networks—**

4 **Bridges and Bridged Networks**

5 **Amendment 40:**
6 **YANG for the Multiple Spanning Tree**
7 **Protocol**

8 [This amendment is based on IEEE Std 802.1Q™-2022 as amended by IEEE Std 802.1Qcz™-2023,
9 IEEE Std 802.1Qcw™-2023, IEEE Std 802.1Qcj™-2023, IEEE Std 802.1Qdj™-2024, and IEEE Std
10 802.1Qdx™-2024.]

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

13 The editing instructions are shown in ***bold italics***. Four editing instructions are used: change, delete, insert, and replace.
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17 and insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is
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19 one. Editing instructions, change markings, and this note will not be carried over into future editions because the
20 changes will be incorporated into the base standard.

1 5. Conformance

2 5.4.1.1 Multiple Spanning Tree (MST) operation (optional)

3 *Insert new list item q) after item p) in 5.4.1.1 as follows:*

- 4 q) Support YANG modules for the management of MSTP (48.6.24).

5

13. Spanning tree protocols

13.25 State machine timers

Change Table 13-5 and the following NOTE as follows:

Table 13-5—Timer and related parameter values

Parameter	Default	Permitted range	Interoperability recommendations
Migrate Time	3.0	— ^a	— ^a
(Bridge) Hello Time	2.0	— ^a	— ^a
Bridge Max Age	20.0	6.0–40.0	20.0
Bridge Forward Delay	15.0	4.0–30.0	15.0
Transmit Hold Count	6	1–10	6
Max Hops	20	6– 40 100	—

All times are in seconds. —^a Not applicable, value is fixed.

NOTE—Changes to Bridge Forward Delay do not affect reconfiguration times, unless the network includes Bridges that do not conform to this revision of this standard. Changes to Bridge Max Age can have an effect, as it is possible for old information to persist in loops in the physical topology for a number of “hops” equal to the value of Max Age in seconds, and thus exhaust the Transmit Hold Count in small loops. [The IEEE Std 802.1Qdy amendment to this standard increased the permitted range of Max Hops to allow a spanning tree to provide initial and remedial connectivity in extended ring topologies whenever physical connectivity is possible. Once configured such networks are not expected to depend on spanning tree for failure protection.](#)

48. YANG Data Models

48.2 IEEE 802.1Q YANG models

Insert 48.2.14 and 48.2.15 as follows:

48.2.14 Rapid Spanning Tree Protocol (RSTP) model

The RSTP model augments the VLAN Bridge component model (48.2.1, Figure 48-4) and the Interface management model for Bridge Ports (48.2.1, Figure 48-5) with nodes common to both RSTP and MSTP. These nodes control the configuration of the CST (and the CIST, when augmented by the Multiple Spanning Trees model, 48.2.15) and report on protocol operation. The RSTP model is illustrated in Figure 48-24.

component (name)		
string	name;	// r-w
...		
rstp		
enum	force-protocol-version;	// r-w
uint64	cist-bridge-id;	// r
priority-type	cist-bridge-id-priority;	// r-w
uint64	cist-root-id;	// r
uint32	external-root-path-cost;	// r
port-number-type	cist-root-port-number;	// r
uint8	max-age;	// r
tv-secs-type	hello-time;	// r
uint8	forward-delay;	// r
uint8	bridge-max-age;	// r-w
uint8	bridge-hello-time;	// r
uint8	bridge-forward-delay;	// r-w
int32	tx-hold-count;	// r-w
int32	migrate-time;	// r
uint32	time-since-topology-change;	// r
counter64	topology-change-count;	// r

bridge-port		
leafref	bridge-name;	// r-w
leafref	component-name;	// r-w
...		
rstp		
enum	cist-port-state;	// r
enum	cist-port-role;	// r
bool	restricted-role;	// r
bool	restricted-tcn;	// r
uint16	cist-port-id;	// r
priority-type	cist-port-priority;	// r
int32	external-port-path-cost;	// r-w
uint32	cist-root-id;	// r
int32	cist-external-path-cost;	// r
uint32	designated-bridge-id;	// r
binary	designated-port-id;	// r
bool	port-protocol-migration-check;	//rw
bool	admin-edge-port;	// r-w
bool	oper-edge-port;	// r
bool	auto-edge-port;	// r-w
bool	auto-isolate-port;	// r
bool	isolate-port;	// r



-  VLAN Bridge component and port nodes
-  Objects added or augmented by this model

Figure 48-24—RSTP model

1 48.2.15 Multiple Spanning Tree Protocol (MSTP) model

2 The Multiple Spanning Tree Protocol model augments the bridge-mst container of the VLAN Bridge
3 components model (48.2.1) and the RSTP model (48.2.14) with nodes for MSTP. These nodes control the
4 configuration of the CIST and MSTIs and the assignment of VLANs and VIDs to MSTIs (8.9) within MST
5 Regions. They also report on MSTP protocol operation. The Multiple Spanning Tree Protocol model is
6 illustrated in Figure 48-25.

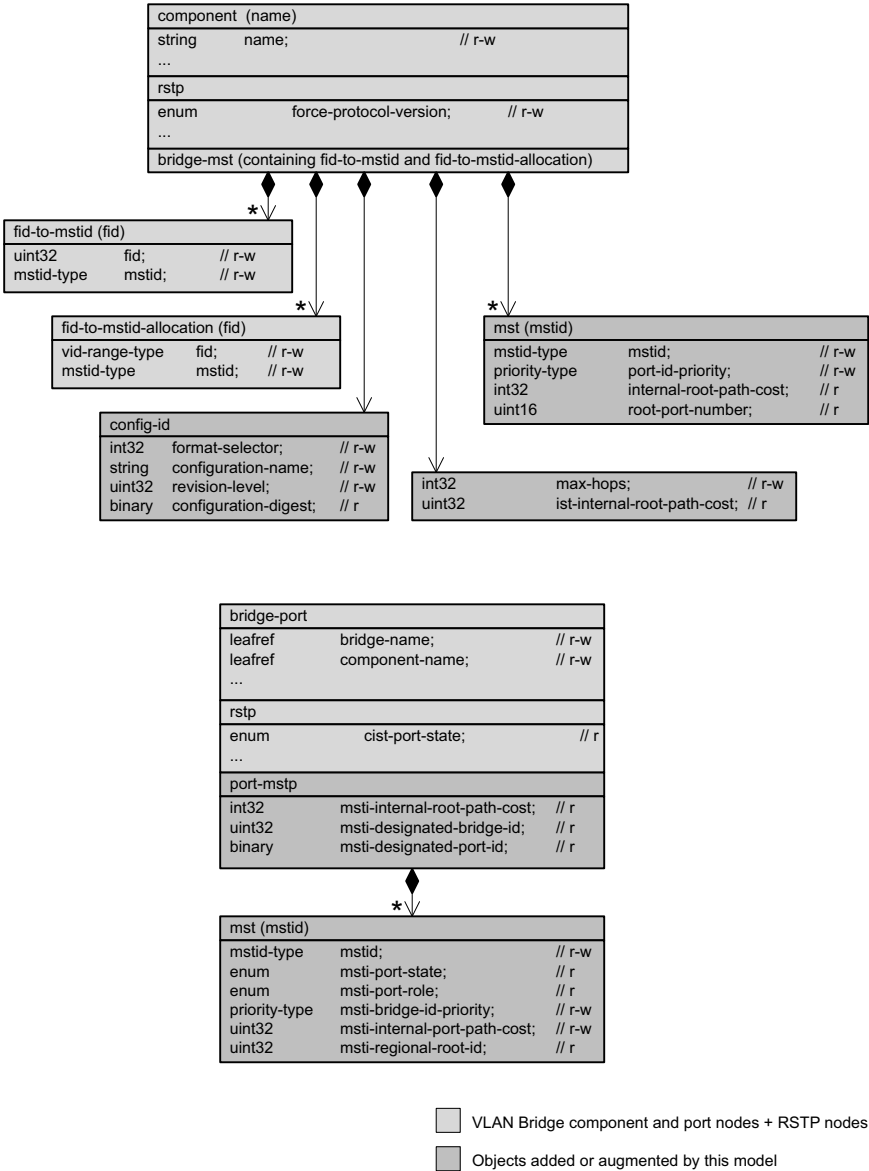


Figure 48-25—MSTP model

48.3 Structure of the YANG models

2

Insert the following row(s) 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-rstp	48.5.26, 48.6.26	8.4, 8.7, 8.8, 8.10 Clause 13	IEEE Std 802.1Qdy Augments Bridge components and Bridge Ports with RSTP parameters.
ieee802-dot1q-mstp	48.5.27, 48.6.27	8.4, 8.7, 8.8, 8.8, 8.9, 8.10 Clause 13	IEEE Std 802.1Qdy Augments Bridge components, Bridge Ports, and the ieee802-dot1q-rstp module with MSTP parameters.

3 *Insert 48.3.14 and 48.3.15 after 48.3.13 (inserted by IEEE Std 802.1Qdx-2024) as follows:*

48.3.14 RSTP model

5 A bridge implementing the RSTP model (48.2.14) implements the YANG modules in Table 48-13.

Table 48-13—RSTP model YANG modules

YANG module
ieee802-types
ieee802-dot1q-types
ieee802-dot1q-bridge
ieee802-dot1q-rstp

48.3.15 MSTP model

7 A bridge implementing the MSTP model (48.2.15) implements the YANG modules in Table 48-14.

Table 48-14—MSTP model YANG modules

YANG module
ieee802-types
ieee802-dot1q-types
ieee802-dot1q-bridge
ieee802-dot1q-rstp
ieee802-dot1q-mstp

8

1 48.4 Security considerations

2 Insert 48.4.14 and 48.4.15 after 48.4.13 (inserted by IEEE Std 802.1Qdx-2024) as follows:

3 48.4.14 Security considerations of the RSTP model

4 All writeable nodes in the ieee802-dot1q-rstp YANG module could be manipulated to interfere with basic
5 networking connectivity.

6 See 48.4.1 for related ieee802-dot1q-bridge YANG model security considerations.

7 48.4.15 Security considerations of the Multiple Spanning Trees model

8 All writeable nodes in the ieee802-dot1q-mstp YANG module could be manipulated to interfere with basic
9 networking connectivity.

10 See 48.4.1 for related ieee802-dot1q-bridge YANG model security considerations.

11

1 48.5 YANG schema tree definitions

2 A simplified graphical representation of the data model is used in this document. The meaning of the
3 symbols in these diagrams is as follows:

- 4 — Brackets “[“ and “]” enclose list keys.
- 5 — Abbreviations before data node names: “rw” means configuration (read-write), and “ro” means state
6 data (read-only).
- 7 — Symbols after data node names: “?” means an optional node, “!” means a presence container, and
8 “*” denotes a list and leaf-list.
- 9 — Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (“:”).
- 10 — Ellipsis (“...”) stands for contents of subtrees that are not shown.

11 *Insert 48.5.26 and 48.5.27 after 48.5.25 (inserted by IEEE Std 802.1Qdx-2024) as follows:*

12 48.5.26 Schema for the ieee802-dot1q-rstp YANG module

```
13 module: ieee802-dot1q-rstp
14
15   augment /dot1q:bridges/dot1q:bridge/dot1q:component:
16     +--rw rstp!
17       +--rw force-protocol-version?      enumeration
18       +--ro cist-bridge-id?              uint64
19       +--rw cist-bridge-id-priority?     dot1qtypes:priority-type
20       +--ro cist-root-id?                uint64
21       +--ro external-root-path-cost?    uint32
22       +--ro cist-root-port-number?      dot1qtypes:port-number-type
23       +--ro max-age?                    uint8
24       +--ro hello-time?                  rt-types:timer-value-seconds16
25       +--ro forward-delay?              uint8
26       +--rw bridge-max-age?              uint8
27       +--ro bridge-hello-time?          uint8
28       +--rw bridge-forward-delay?       uint8
29       +--rw tx-hold-count?               int32
30       +--ro migrate-time?                int32
31       +--ro time-since-topology-change?  uint32
32       +--ro topology-change-count?      yang:counter64
33   augment /if:interfaces/if:interface/dot1q:bridge-port:
34     +--rw rstp!
35       +--ro cist-port-state?              enumeration
36       +--ro cist-port-role?               enumeration
37       +--ro restricted-role?              boolean
38       +--ro restricted-tcn?               boolean
39       +--ro cist-port-id?                 uint16
40       +--rw cist-port-priority?           dot1qtypes:priority-type
41       +--rw external-port-path-cost?     uint32
42       +--ro cist-root-id?                 uint32
43       +--ro cist-external-path-cost?     uint32
44       +--ro designated-bridge-id?        uint32
45       +--ro designated-port-id?          binary
46       +--rw port-protocol-migration-check? boolean
47       +--rw admin-edge-port?             boolean
48       +--ro oper-edge-port?              boolean
49       +--rw auto-edge-port?              boolean
50       +--rw auto-isolate-port?           boolean
51       +--ro isolate-port?                boolean
52
```

1 48.5.27 Schema for the ieee802-dot1q-mstp YANG module

```
2 module: ieee802-dot1q-mstp
3
4   augment /dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst:
5     +--rw mst-config-id!
6       | +--rw format-selector?          int32
7       | +--rw configuration-name?       string
8       | +--rw revision-level?           uint32
9       | +--ro configuration-digest?      binary
10    +--rw bridge-mstp!
11      +--rw max-hops?                    int32
12      +--ro ist-internal-root-path-cost? uint32
13      +--rw mst* [mstid]
14        +--rw mstid                      uint16
15        +--rw port-id-priority?           dot1qtypes:priority-type
16        +--ro internal-root-path-cost?    uint32
17        +--ro root-port-number?          dot1qtypes:port-number-type
18    augment /if:interfaces/if:interface/dot1q:bridge-port:
19      +--rw port-mstp!
20        +--rw mst* [mstid]
21          | +--rw mstid                    uint16
22          | +--ro msti-port-state?         enumeration
23          | +--ro msti-port-role?         enumeration
24          | +--rw msti-bridge-id-priority? dot1qtypes:priority-type
25          | +--rw msti-internal-port-path-cost? uint32
26          | +--ro msti-regional-root-id?   uint32
27          +--ro msti-internal-root-path-cost? uint32
28          +--ro msti-designated-bridge-id? uint32
29          +--ro msti-designated-port-id?   uint32
30
```


1 48.6 YANG modules^{6 7 8}

2 *Insert 48.6.26 after 48.6.25 (inserted by IEEE Std 802.1Qdx-2024) as follows.:*

3 48.6.26 The ieee802-dot1q-rstp YANG module

```
4 module ieee802-dot1q-rstp {
5   yang-version 1.1;
6   namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-rstp";
7   prefix rstp;
8
9   import ietf-yang-types {
10     prefix yang;
11   }
12   import ietf-interfaces {
13     prefix if;
14   }
15   import ietf-routing-types {
16     prefix rt-types;
17   }
18   import ieee802-dot1q-types {
19     prefix dot1qtypes;
20   }
21   import ieee802-dot1q-bridge {
22     prefix dot1q;
23   }
24
25   organization
26     "IEEE 802.1 Working Group";
27   contact
28     "WG-URL: http://www.ieee802.org/1/
29     WG-EMail: stds-802-1-1@ieee.org
30
31     Contact: IEEE 802.1 Working Group Chair
32     Postal: C/O IEEE 802.1 Working Group
33             IEEE Standards Association
34             445 Hoes Lane
35             Piscataway, NJ 08854
36             USA
37
38     E-mail: stds-802-1-chairs@ieee.org";
39   description
40     "This module provides management of 802.1Q Bridge components that
41     support the Rapid Spanning Tree Algorithm and Protocol (RSTP).
42
43     Copyright (C) IEEE (2024).
44
45     This version of this YANG module is part of IEEE Std 802.1Q; see the
46     standard itself for full legal notices.";
47
48   revision 2024-03-26 {
49     description
50       "Published as part of IEEE Std 802.1Qdy-2024.
51
52       The following reference statement identifies each referenced IEEE
53       Standard as updated by applicable amendments.";
54     reference
55       "IEEE Std 802.1Q Bridges and Bridged Networks:
56       IEEE Std 802.1Q-2022, IEEE Std 802.1Qcz-2023, IEEE Std 802.1Qcw-2023,
57       IEEE Std 802.1Qcj-2023, IEEE Std 802.1Qdj-2024, IEEE Std 802.1Qdx-2024,
58       IEEE Std 802.1Qdy-2024.";
59   }
```

⁶ 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.

⁷ 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/>.

⁸ 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.

```
1
2 augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
3   description
4     "Augment Bridge with RSTP configuration.";
5   reference
6     "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
7   container rstp {
8     presence "The presence of this container indicates that RSTP is supported";
9     leaf force-protocol-version {
10      type enumeration {
11        enum emulate-stp {
12          value 0;
13        }
14        enum withdrawn {
15          value 1; // previously assigned to IEEE Std 802.1G-1996 (withdrawn)
16        }
17        enum rstp-rapid-spanning-tree-protocol {
18          value 2;
19        }
20        enum rstp-mstp {
21          value 3;
22        }
23        enum rstp-spb {
24          value 4;
25        }
26      }
27      default "rstp-rapid-spanning-tree-protocol";
28      description
29        "By default RSTP will provide rapid reconfiguration,
30         but will interoperate with Bridges using STP as specified in
31         IEEE Std 802.1D (now withdrawn). Force Protocol Version can
32         force emulation of aspects of STP behavior, slowing reconfiguration
33         and ageing of FDB entries. Force Protocol Version can be configured
34         to enable MSTP and SPB behavior (if implemented) - interoperability
35         with Bridges that support only RSTP or STP will be maintained.";
36      reference
37        "13.7.2 and item a) of 13.26 of IEEE Std 802.1Q.";
38    }
39    leaf cist-bridge-id {
40      type uint64;
41      config false;
42      description
43        "The Bridge Identifier used by this Bridge for the CIST. Eight
44         octets with the four most significant bits of the first encoding the
45         manageable cist-bridge-id-priority, the next twelve bits being zero,
46         and last six octets encoding the Bridge Address.";
47      reference
48        "13.26.2, 14.1.2, and item e) in 13.26 of IEEE Std 802.1Q.";
49    }
50    leaf cist-bridge-id-priority {
51      type dot1qtypes:priority-type;
52      description
53        "The priority component of this Bridge's Bridge Identifier for the
54         CIST, encoded in the four most-significant bits of the first octet
55         of the eight octet Bridge Identifier.
56
57         The value of this object MUST be retained across reinitializations
58         of the management system.";
59      reference
60        "13.26.2, 14.2.5, and item e) in 13.26 of IEEE Std 802.1Q.";
61    }
62    leaf cist-root-id {
63      type uint64;
64      config false;
65      description
66        "The CIST Root Identifier, i.e. the Bridge Identifier of the
67         Common and Internal Spanning Tree calculated by RSTP and of the
68         logical continuation of that connectivity calculate by MSTP, as
69         determined by this node.";
70      reference
71        "13.9, 14.1.2, and item f) in 13.26 of IEEE Std 802.1Q.";
72    }
73  }
```

```
1 leaf external-root-path-cost {
2     type uint32;
3     config false;
4     description
5         "The External Root Path Cost (MSTP) or Root Path Cost (RSTP)
6         calculated by this Bridge after the addition of the receiving
7         Port Path Cost.";
8     reference
9         "13.9, 13.10, 13.5.3, and item i) in 13.26 of IEEE Std 802.1Q.";
10 }
11 leaf cist-root-port-number {
12     type dot1qt-types:port-number-type;
13     config false;
14     description
15         "The port number of the Root Port for the RSTP and for the CIST
16         Root Port (MSTP), i.e. the Port Identifier for the port that offers
17         the lowest cost path from this Bridge to the (CIST) Root.";
18     reference
19         "13.4, 13.5, 13.26.9, and item h) in 13.26 of IEEE Std 802.1Q.";
20 }
21 leaf max-age {
22     type uint8;
23     units "seconds";
24     config false;
25     description
26         "For the CIST, the whole seconds (most-significant octet) part of
27         the maximum age of the spanning tree information (Max Age) currently
28         used by this Bridge. Set to the bridge-max-age if the Bridge is the
29         CIST Root, and to the whole seconds part of the value received on
30         the CIST Root Port otherwise.";
31     reference
32         "13.15, 13.20, 13.25, item l) in 13.28, and item g) in 13.26 of
33         IEEE Std 802.1Q.";
34 }
35 leaf hello-time {
36     type rt-types:timer-value-seconds16;
37     units "seconds";
38     config false;
39     description
40         "The interval (Hello Time) between the periodic transmission of
41         Configuration Bridge PDUs on Designated Ports. Set to
42         bridge-hello-time if the Bridge is currently acting as the CIST Root,
43         and to the value received on the CIST Root Port otherwise.";
44     reference
45         "Table 13-5, 13.25.3, and 13.28.11 of IEEE Std 802.1Q.";
46 }
47 leaf forward-delay {
48     type uint8;
49     units "seconds";
50     config false;
51     description
52         "If a Port is using STP rather than RSTP, either as a result of
53         setting force-protocol-version to be less than 2 or because STP BPDUs
54         have been received, this Forward Delay parameter determines the time
55         spent in the Listening and Learning Port States when transitioning
56         from Discarding to Forwarding, and also controls rapid ageing of FDB
57         entries after a topology change. Set to bridge-forward-delay if the
58         Bridge is currently acting as the CIST Root, and to the whole seconds
59         part of the value received on the CIST Root Port otherwise. If RSTP,
60         MSTP, or SPB is used, Port State transitions and FDB flushing are
61         rapid and not controlled by this parameter.";
62     reference
63         "Table 13-5, 13.25.2, 13.28.10, and item g) in 13.26.4 of
64         IEEE Std 802.1Q.";
65 }
66 leaf bridge-max-age {
67     type uint8 {
68         range "6..40";
69     }
70     default "20";
71     units "seconds";
72     description
```

```
1      "The value of the whole seconds part of Max Age when this Bridge is
2      acting as the CIST Root. The fractional part, conveyed in the
3      less-significant octet of each BPDU's Max Age field, will be zero.
4
5      The value of this object MUST be retained across reinitializations
6      of the management system.";
7      reference
8      "Table 13-5, 13.26.4, and item g) in 13.26 of IEEE Std 802.1Q.";
9  }
10 leaf bridge-hello-time {
11     type uint8;
12     default "2";
13     units "seconds";
14     config false;
15     description
16         "The value that this Bridge uses for HelloTime when acting as the
17         CIST Root.";
18     reference
19         "Table 13-5, 13.25.3, and 13.28.11 of IEEE Std 802.1Q.";
20 }
21 leaf bridge-forward-delay {
22     type uint8 {
23         range "4..30";
24     }
25     default "15";
26     units "seconds";
27     description
28         "The value of the whole seconds part of Message Age when this
29         Bridge is acting as the CIST Root. The fractional part, conveyed in
30         the less-significant octet of each BPDU's Max Age field, will be
31         zero.
32
33         The value of this object MUST be retained across reinitializations
34         of the management system.";
35     reference
36         "Table 13-5, 13.26.4, and item g) in 13.26 of IEEE Std 802.1Q.";
37 }
38 leaf tx-hold-count {
39     type int32 {
40         range "1..10";
41     }
42     default "6";
43     description
44         "Limits the rate of BPDU transmission. If the variable txCount
45         (which is incremented on each transmission and decremented once a
46         second) reaches TxHoldCount, transmission is delayed.
47
48         The value of this object MUST be retained across
49         reinitializations of the management system.";
50     reference
51         "Table 13-5, 13.27.75, 13.26.12, and item b) in 13.26 of
52         IEEE Std 802.1Q.";
53 }
54 leaf migrate-time {
55     type int32;
56     default "3";
57     units "seconds";
58     config false;
59     description
60         "Management can force the transmission of RST (or MST or SPT) BPDUs
61         for MigrateTime to check that all STP Bridges have been removed
62         from a specified port's attached LAN, so RST/MST/SPT BPDU
63         transmission can persist. Fixed value of 3 seconds.";
64     reference
65         "Table 13-5, 13.27.38, and item c) in 13.26 of IEEE Std 802.1Q.";
66 }
67 leaf time-since-topology-change {
68     type uint32;
69     units "seconds";
70     config false;
71     description
72         "The time (in seconds) since the Topology Change timer, tcWhile, for
```

```

1      any port on this Bridge was last running - i.e. since
2      Topology Change Notification (TCN) Messages were last transmitted.";
3      reference
4      "13.25.9 of IEEE Std 802.1Q.";
5  }
6  leaf topology-change-count {
7      type yang:counter64;
8      units "topology change count";
9      config false;
10     description
11     "The number of times (since the management entity was last
12     reset or initialized) that at least one port's Topology Change timer
13     (tcWhile) has been non-zero.
14
15     Discontinuities in the value of the counter can occur at
16     re-initialization of the management system, and at other times as
17     indicated by the value of 'discontinuity-time'.";
18     reference
19     "13.25.9 of IEEE Std 802.1Q.";
20 }
21 }
22 }
23
24 augment "/if:interfaces/if:interface/dot1q:bridge-port" {
25     description
26     "Augment Bridge Port with RSTP configuration";
27     reference
28     "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
29     container rstp {
30         presence "The presence of this container indicates that RSTP is supported";
31         leaf cist-port-state {
32             type enumeration {
33                 enum discarding {
34                     value 1;
35                 }
36                 enum learning {
37                     value 2;
38                 }
39                 enum forwarding {
40                     value 3;
41                 }
42             }
43             config false;
44             description
45             "The port's Port State, summarizing the application of learning to
46             received frames, and the forwarding of relayed frames, for all frames
47             (for RSTP) or for frames assigned to the CIST (for MSTP). The
48             Port State is Discarding if both learning and forwarding are both
49             false, Learning if only learning, and Forwarding if both learning and
50             forwarding are true. The Discarding state encompasses all reasons for
51             not forwarding, including MAC_Operational false (if:oper-status not
52             up) and MAC_Enabled false (if:admin-status not up).";
53             reference
54             "8.4, 13.4, item aw) and item ba) in 13.27 of IEEE Std 802.1Q.";
55         }
56         leaf cist-port-role {
57             type enumeration {
58                 enum disabled-port {
59                     value 1;
60                 }
61                 enum root-port {
62                     value 2;
63                 }
64                 enum designated-port {
65                     value 3;
66                 }
67                 enum alternate-port {
68                     value 4;
69                 }
70                 enum backup-port {
71                     value 5;
72                 }

```

```
1      }
2      config false;
3      description
4          "The port's Port Role for the CIST. Disabled Port, Root Port,
5          Designated Port, Alternate Port, or Backup Port.";
6      reference
7          "13.4, 13.5, 13.12, 13.24, 13.27.66, and item bn) in 13.27 of
8          IEEE Std 802.1Q.";
9  }
10 leaf restricted-role {
11     type boolean;
12     default "false";
13     config false;
14     reference
15         "13.20, 13.27.65, 13.29.34, 16.2, 16.3, 26.5, 27.6, 27.20,
16         item t) in 13.27 of IEEE Std 802.1Q.";
17 }
18 leaf restricted-tcn {
19     type boolean;
20     default "false";
21     config false;
22     reference
23         "13.20, 13.27.64, 13.29.25, 16.2, 16.3, item s) in 13.27 of
24         IEEE Std 802.1Q.";
25 }
26 leaf cist-port-id {
27     type uint16;
28     config false;
29     description
30         "The Port Identifier used by this Bridge Port for the CIST. Two
31         octets with the four most-significant bits of the first encoding the
32         manageable cist-port-id-priority, and the next twelve bits encoding
33         the port's port-number.";
34     reference
35         "13.27.46, 14.1.2, item bd) in 13.27 of IEEE Std 802.1Q.";
36 }
37 leaf cist-port-priority {
38     type dot1qttype:priority-type;
39     description
40         "The priority component of this Port's Port Identifier for the
41         CIST, encoded in the four most-significant bits of the first octet
42         of the two octet Port Identifier.
43
44         The value of this object MUST be retained across reinitializations
45         of the management system.";
46     reference
47         "13.27.47, 14.2.7, and item be) in 13.27 of IEEE Std 802.1Q.";
48 }
49 leaf external-port-path-cost {
50     type uint32 {
51         range "0..2000000000";
52     }
53     description
54         "The administratively assigned value for the port's contribution to
55         the External Root Path Cost for the Bridge, when the port is the
56         CST Root Port (for RSTP and MSTP) or the CIST Master Port (for MSTP
57         and ISIS-SPB).
58
59         The value of this object MUST be retained across reinitializations
60         of the management system.";
61     reference
62         "13.27.25, Table 13-4, and item g) of 13.27 of IEEE Std 802.1Q.";
63 }
64 leaf cist-root-id {
65     type uint32;
66     config false;
67     description
68         "The CIST Root Identifier in Configuration BPDUs transmitted by the
69         Designated Bridge for the attached LAN.";
70     reference
71         "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
72 }
```

```
1 leaf cist-external-path-cost {
2     type uint32;
3     config false;
4     description
5         "The External Path Cost advertised in BPDUS by the Designated Bridge
6         for the attached LAN.";
7     reference
8         "27.6, 14.1.2, 13.27.20, and item ar) in 13.27 of IEEE Std 802.1Q.";
9 }
10 leaf designated-bridge-id {
11     type uint32;
12     config false;
13     description
14         "The Bridge Identifier of the Bridge that this port considers to be
15         the Designated Bridge for the attached LAN.";
16     reference
17         "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
18 }
19 leaf designated-port-id {
20     type binary {
21         length "2";
22     }
23     config false;
24     description
25         "The Port Identifier of the Bridge Port that this port considers to
26         be the Designated Port for the attached LAN.";
27     reference
28         "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
29 }
30 leaf port-protocol-migration-check {
31     type boolean;
32     description
33         "Writing true(1) to port-protocol-migration-check (mcheck)
34         forces transmission of RST (or MST or SPT) BPDUs for migrate-time to
35         check that all STP Bridges have been removed from the port's attached
36         LAN, so RST/MST/SPT BPDUs transmission can persist. Has no effect if
37         force-protocol-version is emulate-stp(0) or withdrawn(1). Always
38         returns false(2) when read.";
39     reference
40         "13.27.38, 13.32, and item j) in 13.27 of IEEE Std 802.1Q.";
41 }
42 leaf admin-edge-port {
43     type boolean;
44     default "false";
45     description
46         "Set if the port is to be identified as an Edge Port immediately
47         on initialization without a delay to detect other Bridges attached
48         to the LAN. Recommended default false(2). The operational value,
49         oper-edge-port, will become false(2) if a BPDU has been received.
50
51         The value of this object MUST be retained across reinitializations
52         of the management system.";
53     reference
54         "13.33, and item a) in 13.27 of IEEE Std 802.1Q.";
55 }
56 leaf oper-edge-port {
57     type boolean;
58     config false;
59     description
60         "Set if the port is currently identified as an Edge Port.
61         Initialized to the value of admin-edge-port, and controlled by the
62         Bridge Detection state machine.";
63     reference
64         "13.33, and item l) in 13.27 of IEEE Std 802.1Q.";
65 }
66 leaf auto-edge-port {
67     type boolean;
68     default "true";
69     description
70         "Administratively set true(1) to allow the value of oper-edge-port
71         is to be maintained automatically, with continuous monitoring of
72         the presence or absence of other Bridges attached to the LAN.
```

```
1
2     The value of this object MUST be retained across reinitializations
3     of the management system.";
4     reference
5         "13.33, 13.27.18, and item c) in 13.27 of IEEE Std 802.1Q.";
6 }
7 leaf auto-isolate-port {
8     type boolean;
9     default "false";
10    description
11        "Administratively set true(1) to allow automatic setting of
12        isolate-port, causing a Designated Port to transition to Discarding
13        if both admin-edge-port and auto-edge-port are false, but the other
14        Bridge presumed attached to the same point-to-point LAN appears
15        unable to transmit BPDUs, indicating failure of a Spanning Tree
16        Protocol Entity or of transmission and/or reception.
17
18        The value of this object MUST be retained across reinitializations
19        of the management system.";
20    reference
21        "13.23, 13.27.19, 13.33, and item d) in 13.27 of IEEE Std 802.1Q.";
22 }
23 leaf isolate-port {
24     type boolean;
25     config false;
26    description
27        "Set by the Bridge Detection state machine when the Spanning Tree
28        Protocol Entity of a neighboring Bridge has apparently failed.";
29    reference
30        "13.23, 13.27.27, 13.33, and item i) in 13.27 of IEEE Std 802.1Q.";
31 }
32 }
33 }
34 }
35
36
```


1 *Insert 48.6.27 as follows:*

2 **48.6.27 The ieee802-dot1q-mstp YANG module**

```
3 module ieee802-dot1q-mstp {
4   yang-version 1.1;
5   namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-mstp";
6   prefix mstp;
7
8   import ietf-interfaces {
9     prefix if;
10  }
11  import ieee802-dot1q-types {
12    prefix dot1qtypes;
13  }
14  import ieee802-dot1q-bridge {
15    prefix dot1q;
16  }
17  import ieee802-dot1q-rstp {
18    prefix rstp;
19  }
20
21  organization
22    "IEEE 802.1 Working Group";
23  contact
24    "WG-URL: http://www.ieee802.org/1/
25     WG-EMail: stds-802-1-1@ieee.org
26
27     Contact: IEEE 802.1 Working Group Chair
28     Postal: C/O IEEE 802.1 Working Group
29             IEEE Standards Association
30             445 Hoes Lane
31             Piscataway, NJ 08854
32             USA
33
34     E-mail: stds-802-1-chairs@ieee.org";
35  description
36    "This module provides management of 802.1Q Bridge components that
37     support the Multiple Spanning Tree Algorithm and Protocol (MSTP).
38
39     Copyright (C) IEEE (2024).
40
41     This version of this YANG module is part of IEEE Std 802.1Q; see the
42     standard itself for full legal notices.";
43
44  revision 2024-03-26 {
45    description
46      "Published as part of IEEE Std 802.1Qdy-2024.
47
48      The following reference statement identifies each referenced IEEE
49      Standard as updated by applicable amendments.";
50    reference
51      "IEEE Std 802.1Q Bridges and Bridged Networks:
52       IEEE Std 802.1Q-2022, IEEE Std 802.1Qcz-2023, IEEE Std 802.1Qcw-2023,
53       IEEE Std 802.1Qcj-2023, IEEE Std 802.1Qdj-2024, IEEE Std 802.1Qdx-2024,
54       IEEE Std 802.1Qdy-2024.";
55  }
56
57  augment "/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst" {
58    when "../rstp:rstp";
59
60    description
61      "Augment RSTP-capable Bridge component with MSTP configuration and
62       management.";
63    reference
64      "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
65
66    container mst-config-id {
67      presence "The presence of this container indicates that MSTP is supported";
68      description
69        "Containing the MST Configuration Identifier of a Bridge.";
```

```
1  reference
2  "Item d) in 13.26.";
3  leaf format-selector {
4      type int32 {
5          range "0";
6      }
7      default "0";
8      description
9          "In an MSTP Bridge, the MST Configuration Identifier's
10         Configuration Identifier Format Selector. This has a value of 0
11         indicating the format specified in IEEE Std 802.1Q.";
12     reference
13         "Item a) in 13.8 of IEEE Std 802.1Q.";
14 }
15 leaf configuration-name {
16     type string {
17         length "1..32";
18     }
19     description
20         "The Configuration Name in the MST Configuration Identifier.";
21     reference
22         "Item b) in 13.8:2 of IEEE Std 802.1Q.";
23 }
24 leaf revision-level {
25     type uint32 {
26         range "0..65535";
27     }
28     description
29         "The Revision Level in the MST Configuration Identifier.";
30     reference
31         "Item c) in 13.8 of IEEE Std 802.1Q.";
32 }
33 leaf configuration-digest {
34     type binary;
35     config false;
36     description
37         "The Configuration Digest in the MST Configuration Identifier
38         (16 octets).";
39     reference
40         "Item d) in 13.8 of IEEE Std 802.1Q.";
41 }
42 }
43
44 container bridge-mstp {
45     presence "The presence of this container indicates that MSTP is supported";
46     description
47         "Per-Bridge configuration and management parameters for the IST
48         and each MSTI in an MST Region.";
49     reference
50         "Clause 13, 13.26 of IEEE Std 802.1Q.";
51     leaf max-hops {
52         type int32 {
53             range "6..100";
54         }
55         default "20";
56         description
57             "In an MSTP Bridge, the MaxHops parameter for the IST, also used
58             for each of the MSTIs.
59
60             The value of this object MUST be retained across reinitializations
61             of the management system.";
62         reference
63             "Clause 13, Table 13-5, 13.26.4, item g) in 13.26 of
64             IEEE Std 802.1Q.";
65     }
66     leaf ist-internal-root-path-cost {
67         type uint32;
68         config false;
69         description
70             "The Internal Root Path Cost for the IST calculated by this
71             Bridge after the addition of the Internal Port Path Cost for the
72             Root Port (or Master Port) for this IST (MSTID 0) or MST.";
```

```
1      reference
2      "13.9, 13.10, 13.5.3, 13.26.10 and item i) in 13.26 of
3      IEEE Std 802.1Q.";
4  }
5  list mst {
6      key "mstid";
7      description
8          "Per-Bridge configuration and management parameters for each MST,
9          with an MSTID in the range allocated for MSTP configuration.";
10     reference
11         " ";
12     leaf mstid {
13         type uint16 {
14             range "1..4091";
15         }
16         description
17             "MSTIDs allocated for use by MSTP (1..4091) to identify MSTIs.
18             Other MSTIDs in the 12-bit range are reserved [for use in
19             the MST Configuration Table, whose configuration is identified
20             by the Configuration Digest in the MST Configuration Identifier
21             (mst-config-id/configuration-digest)] for the CIST-MSTID,
22             SPBM-MSTID, SPBV-MSTID, TE-MSTID, and SPVID-Poll-MSTID.";
23         reference
24             "8.4, 8.6.1, 8.9.3, 13.2.1 of IEEE Std 802.1Q.";
25     }
26     leaf port-id-priority {
27         type dot1qttype:priority-type;
28         description
29             "The priority component of this Bridge Port's Port Identifier for
30             the MSTI, encoded in the four most-significant bits of octet 15 of
31             the MSTI Configuration Message.
32
33             The value of this object MUST be retained across reinitializations
34             of the management system.";
35         reference
36             "13.26.3, 13.11, 14.4.1, and
37             item f) in 13.26 of IEEE Std 802.1Q."; ///!!
38     }
39     leaf internal-root-path-cost {
40         type uint32;
41         config false;
42         description
43             "The Internal Root Path Cost for this MSTI calculated by this
44             Bridge after the addition of the Internal Port Path Cost for the
45             Root Port (or Master Port) for this MSTI.";
46         reference
47             "13.9, 13.10, 13.5.3, 13.26.10 and item i) in 13.26 of
48             IEEE Std 802.1Q.";
49     }
50     leaf root-port-number {
51         type dot1qttype:port-number-type;
52         config false;
53         description
54             "The port number of the Root Port for this MSTI.";
55         reference
56             "13.4, 13.5, 13.26.9, and item h) in 13.26 of IEEE Std 802.1Q."; ///!!
57     }
58 }
59 }
60 }
61 augment "/if:interfaces/if:interface/dot1q:bridge-port" {
62     when "rstp:rstp";
63     description
64         "Augment RSTP Bridge Port with MSTP configuration";
65     reference
66         "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
67     container port-mstp {
68         presence "The presence of this container indicates that MSTP is supported";
69         description
70             "Per-Bridge Port configuration and management parameters for the IST
71             and each MSTI in an MST Region.";
72         list mst {
```

```
1     key "mstid";
2     description
3         "Per-Bridge Port configuration and management parameters for each MST,
4         with an MSTID in the range allocated for MSTP configuration.";
5     reference
6         " ";
7     leaf mstid {
8         type uint16 {
9             range "1..4091";
10        }
11        description
12            "MSTIDs allocated for use by MSTP (1..4091) to identify MSTIs.";
13        reference
14            "8.4, 8.6.1, 8.9.3, 13.2.1 of IEEE Std 802.1Q.";
15    }
16    leaf msti-port-state {
17        type enumeration {
18            enum discarding {
19                value 1;
20            }
21            enum learning {
22                value 2;
23            }
24            enum forwarding {
25                value 3;
26            }
27        }
28        config false;
29        description
30            "The port's Port State, summarizing the application of learning to
31            received frames, and the forwarding of relayed frames, for frames
32            assigned to this MSTI.";
33        reference
34            "8.4, 13.4, item aw) and item ba) in 13.27 of IEEE Std 802.1Q.";
35    }
36    leaf msti-port-role {
37        type enumeration {
38            enum disabled-port {
39                value 1;
40            }
41            enum root-port {
42                value 2;
43            }
44            enum designated-port {
45                value 3;
46            }
47            enum alternate-port {
48                value 4;
49            }
50            enum backup-port {
51                value 5;
52            }
53            enum master-port {
54                value 6;
55            }
56        }
57        config false;
58        description
59            "The port's Port Role for the MSTI. Disabled Port, Root Port,
60            Designated Port, Alternate Port, Backup Port, or Master Port.";
61        reference
62            "13.4, 13.5, 13.12, 13.24, 13.27.66, and item bn) in 13.27 of
63            IEEE Std 802.1Q.";//!!
64    }
65    leaf msti-bridge-id-priority {
66        type dot1qttype:priority-type;
67        description
68            "The priority component of this Bridge's Bridge Identifier for the
69            MSTI, encoded in the four most-significant bits of octet 14 of the
70            MSTU Configuration Message.
71
72            The value of this object MUST be retained across reinitializations
```

```
1         of the management system.";
2     reference
3         "13.26.3, 13.11, 14.4.1, and item f) in 13.26 of IEEE Std 802.1Q.";
4     }
5     leaf msti-internal-port-path-cost {
6         type uint32;
7         description
8             "The Internal Port Path Cost for this Bridge Port and MSTI.";
9         reference
10            "Item b) of 13.2.1, and item ay) in 13.27 of IEEE Std 802.1Q.";
11    }
12    leaf msti-regional-root-id {
13        type uint32;
14        config false;
15        description
16            "The MSTI Regional Root Identifier in Configuration BPDUs transmitted
17            by the Designated Bridge for the attached LAN and this MSTI.";
18        reference
19            "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
20    }
21 }
22 leaf msti-internal-root-path-cost {
23     type uint32;
24     config false;
25     description
26         "The MSTI Internal Path Cost advertised in BPDUs by the Designated
27         Bridge for the attached LAN and this MSTI.";
28     reference
29         "27.6, 14.4.1, 13.27.20, 14.4.1, and item ar) in 13.27 of
30         IEEE Std 802.1Q."; ///
31 }
32 leaf msti-designated-bridge-id {
33     type uint32;
34     config false;
35     description
36         "The Bridge Identifier of the Bridge that this port considers to be
37         the Designated Bridge for the attached LAN and this MSTI.";
38     reference
39         "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
40 }
41 leaf msti-designated-port-id {
42     type uint32;
43     config false;
44     description
45         "The Port Identifier of the Bridge Port that this port considers to
46         be the Designated Port for the attached LAN and this MSTI.";
47     reference
48         "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
49 }
50 }
51 }
52 }
53
54
```

¹ Annex A

² (normative)

³ PICS proforma—Bridge implementations⁹

⁴ 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-RSTP	Is the <i>ieee802-dot1q-rstp</i> module supported?	RSTP:O	48.6.26	Yes [] N/A []	No []
YANG-MSTP	Is the <i>ieee802-dot1q-mstp</i> module supported?	MSTP:O	48.6.27	Yes [] N/A []	No []

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