P802.1Qdy – Proposed new YANG model

Martin Mittelberger, Siemens AG
V01
2024-01-19

During comment resolution there was a proposed new YANG model that concentrates the RSTP-relevant nodes.

Comment Text (Comment #59):

“The Multiple Spanning Trees model shown here is separate from the prior Rapid Spanning Tree. This misses a key point of the Clause 13 specification - an MSTP capable implementation will behave exactly as a RSTP implementation on a given port when it finds that its neighbour is not MSTP capable. MSTP is not implemented separately from RSTP, but is an augmentation of an RSTP implementation. It would highly undesirable for a network manager to have to flip between models/configuration/terminology for two bridges which are using a single protocol just because one has additional capabilities.”

Proposed Change:

“Change the MSTP model to comprise be an augmentation of an RSTP augmented bridge and bridge port. To supply a detailed suggested remedy for other comments I have supplied a suitable basic RSTP model at https://www.ieee802.org/1/files/public/docs2024/dy-seaman-rstp-yang-0124-v00.txt and an augment to that at https://www.ieee802.org/1/files/public/docs2024/dy-seaman-mstp-yang-0124-v00.txt. The latter omits the vid-msti mapping which can be taken from the exiting model. I have used .txt rather than .yang extensions to make them easily viewable with web browsers.”

This contribution is intended to agree on the changes to the next Qdy draft.
Changes in RSTP YANG

Original Version of Qdy d1-0

Mick's Proposal

<table>
<thead>
<tr>
<th>Added nodes:</th>
<th>Added nodes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- protocol specification</td>
<td>- protocol-specification</td>
</tr>
<tr>
<td>- version</td>
<td>- version</td>
</tr>
<tr>
<td>- enabled</td>
<td>- enabled</td>
</tr>
<tr>
<td>- designat-ed-cost</td>
<td>- designat-ed-cost</td>
</tr>
<tr>
<td>- forward-transitions</td>
<td>- forward-transitions</td>
</tr>
<tr>
<td>- admin-path-cost</td>
<td>- admin-path-cost</td>
</tr>
<tr>
<td>- restricted-role</td>
<td>- restricted-role</td>
</tr>
<tr>
<td>- restricted-tcn</td>
<td>- restricted-tcn</td>
</tr>
<tr>
<td>- cist-port-role</td>
<td>- cist-port-role</td>
</tr>
<tr>
<td>- cist-port-id</td>
<td>- cist-port-id</td>
</tr>
<tr>
<td>- cist-root-id</td>
<td>- cist-root-id</td>
</tr>
<tr>
<td>- cist-external-path-cost</td>
<td>- cist-external-path-cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Removed nodes:</th>
<th>Removed nodes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- priority</td>
<td>- priority</td>
</tr>
<tr>
<td>- bridge-port</td>
<td>- bridge-port</td>
</tr>
<tr>
<td>- bridge-id</td>
<td>- bridge-id</td>
</tr>
<tr>
<td>- bridge-port-priority</td>
<td>- bridge-port-priority</td>
</tr>
<tr>
<td>- bridge-port-id</td>
<td>- bridge-port-id</td>
</tr>
<tr>
<td>- cist-root-id</td>
<td>- cist-root-id</td>
</tr>
<tr>
<td>- cist-port-id</td>
<td>- cist-port-id</td>
</tr>
<tr>
<td>- cist-external-path-cost</td>
<td>- cist-external-path-cost</td>
</tr>
</tbody>
</table>

dy-mittelberger-rstp-mstp-YANG-v01.docx  2  2024-01-19
Changes in MSTP YANG

Original Version of Qdy d1-0

Mick's Proposal

dy-mittelberger-rstp-mstp-YANG-v01.docx 3 2024-01-19
Proposed RSTP YANG model (Fig. 21)

### VLAN Bridge component and port nodes

<table>
<thead>
<tr>
<th>string name;</th>
<th>// r-w</th>
</tr>
</thead>
</table>

### RSTP

<table>
<thead>
<tr>
<th>enum</th>
<th>force-protocol-version;</th>
<th>// r-w</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint4</td>
<td>cist-bridge-id;</td>
<td>// r</td>
</tr>
<tr>
<td>uint64</td>
<td>cist-root-id;</td>
<td>// r</td>
</tr>
<tr>
<td>uint32</td>
<td>external-root-path-cost</td>
<td>// r</td>
</tr>
<tr>
<td>port-num-type</td>
<td>cist-root-port-number;</td>
<td>// r</td>
</tr>
<tr>
<td>uint8</td>
<td>max-age;</td>
<td>// r</td>
</tr>
<tr>
<td>tv-secs-type</td>
<td>hello-time;</td>
<td>// r</td>
</tr>
<tr>
<td>uint8</td>
<td>forward-delay;</td>
<td>// r</td>
</tr>
<tr>
<td>uint8</td>
<td>bridge-max-age;</td>
<td>// r-w</td>
</tr>
<tr>
<td>uint8</td>
<td>bridge-hello-time;</td>
<td>// r-w</td>
</tr>
<tr>
<td>uint8</td>
<td>bridge-forward-delay;</td>
<td>// r-w</td>
</tr>
<tr>
<td>int32</td>
<td>tx-hold-count;</td>
<td>// r-w</td>
</tr>
<tr>
<td>uint32</td>
<td>migrate-time;</td>
<td>// r</td>
</tr>
<tr>
<td>int32</td>
<td>time-since-topology-change;</td>
<td>// r</td>
</tr>
<tr>
<td>counter64</td>
<td>topology-change-count;</td>
<td>// r</td>
</tr>
</tbody>
</table>

### RSTP

<table>
<thead>
<tr>
<th>enum</th>
<th>cist-port-state;</th>
<th>// r</th>
</tr>
</thead>
<tbody>
<tr>
<td>enum</td>
<td>cist-port-role;</td>
<td>// r</td>
</tr>
<tr>
<td>bool</td>
<td>restricted-role;</td>
<td>// r</td>
</tr>
<tr>
<td>uint16</td>
<td>cist-port-id;</td>
<td>// r</td>
</tr>
<tr>
<td>pri-type</td>
<td>cist-port-priority;</td>
<td>// r</td>
</tr>
<tr>
<td>int32</td>
<td>external-port-path-cost</td>
<td>// r-w</td>
</tr>
<tr>
<td>uint32</td>
<td>cist-root-id;</td>
<td>// r</td>
</tr>
<tr>
<td>int32</td>
<td>cist-external-path-cost</td>
<td>// r</td>
</tr>
<tr>
<td>uint32</td>
<td>designated-bridge-id;</td>
<td>// r</td>
</tr>
<tr>
<td>binary</td>
<td>designated-port-id;</td>
<td>// r</td>
</tr>
<tr>
<td>bool</td>
<td>port-protocol-migration-check; // rw</td>
<td></td>
</tr>
<tr>
<td>bool</td>
<td>admin-edge-port;</td>
<td>// r-w</td>
</tr>
<tr>
<td>bool</td>
<td>open-edge-port;</td>
<td>// r</td>
</tr>
<tr>
<td>bool</td>
<td>auto-edge-port;</td>
<td>// r-w</td>
</tr>
<tr>
<td>bool</td>
<td>auto-isolate-port;</td>
<td>// r</td>
</tr>
<tr>
<td>bool</td>
<td>isolate-port;</td>
<td>// r</td>
</tr>
</tbody>
</table>

- [ ] VLAN Bridge component and port nodes
- [ ] Objects added or augmented by this model
Proposed MSTP YANG model (Fig. 22)

Objects added or augmented by this model

VLAN Bridge component and port nodes + RSTP nodes

- VLAN Bridge component
- Port nodes + RSTP nodes

string name; // r-w

int32 max-hops; // r-w
uint32 ist-internal-root-path-cost; // r

bridge-port

leafref bridge-name; // r-w
leafref component-name; // r-w

rstp

eenum force-protocol-version; // r-w

port-mstp

int32 msti-internal-root-path-cost; // r
uint32 msti-designated-bridge-id; // r
binary msti-designated-port-id; // r

ist (mstid)

uint16 mstid; // r-w
enum msti-port-state; // r
enum msti-port-role; // r
prio-type msti-bridge-id-priority; // r-w
uint32 msti-internal-port-path-cost; // r-w
uint32 msti-regional-root-id; // r

mst (mstid)

uint16 mstid; // r-w
prio-type port-id-priority; // r-w
int32 internal-root-path-cost; // r
uint16 root-port-number; // r
Proposed RSTP YANG model (Tree)

module: ieee802-dot1q-rstp

augment /dot1q:bridges/dot1q:bridge/dot1q:component:
  +--rw rstp {rstp}?
    +--rw force-protocol-version?  enumeration
    +--ro cist-bridge-id?  uint64
    +--rw cist-bridge-id-priority?  dot1qtypes:priority-type
    +--ro cist-root-id?  uint64
    +--ro external-root-path-cost?  uint32
    +--ro cist-root-port-number?  dot1qtypes:port-number-type
    +--ro max-age?  uint8
    +--ro hello-time?  rt-types:timer-value-seconds16
    +--ro forward-delay?  uint8
    +--rw bridge-max-age?  uint8
    +--ro bridge-hello-time?  uint8
    +--rw bridge-forward-delay?  uint8
    +--rw tx-hold-count?  int32
    +--ro migrate-time?  int32
    +--ro time-since-topology-change?  uint32
    +--ro topology-change-count?  yang:counter64

augment /if:interfaces/if:interface/dot1q:bridge-port:
  +--rw rstp {rstp}?
    +--ro cist-port-state?  enumeration
    +--ro cist-port-role?  enumeration
    +--ro restricted-role?  boolean
    +--ro restricted-tcn?  boolean
    +--ro cist-port-id?  uint16
    +--rw cist-port-priority?  dot1qtypes:priority-type
    +--ro external-port-path-cost?  int32
    +--ro cist-root-id?  uint32
    +--ro cist-external-path-cost?  int32
    +--ro designated-bridge-id?  uint32
    +--ro designated-port-id?  binary
    +--rw port-protocol-migration-check?  boolean
    +--ro admin-edge-port?  boolean
    +--ro oper-edge-port?  boolean
    +--rw auto-edge-port?  boolean
    +--rw auto-isolate-port?  boolean
    +--ro isolate-port?  boolean

notifications:
  +---n new-root
  +---n topology-change
Proposed MSTP YANG model (Tree)

module: ieee802-dot1q-mstp

augment /dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst:
  +--rw mst-config-id
  |  +--rw format-selector?      int32
  |  +--rw configuration-name?   string
  |  +--rw revision-level?       uint32
  |  +--ro configuration-digest? binary
  +--rw bridge-mstp
    +--rw max-hops?              int32
    +--ro ist-internal-root-path-cost?     uint32
    +--rw mst* [mstid]
      +--rw mstid                uint16
      +--rw port-id-priority?    dot1qtypes:priority-type
      +--ro internal-root-path-cost?     uint32
      +--ro root-port-number?    dot1qtypes:port-number-type
augment /if:interfaces/if:interface/dot1q:bridge-port:
  +--rw port-mstp
    +--rw mst* [mstid]
      +--rw mstid                uint16
      |  +--ro msti-port-state?   enumeration
      |  +--ro msti-port-role?    enumeration
      |  +--rw msti-bridge-id-priority?    dot1qtypes:priority-type
      |  +--rw msti-internal-port-path-cost? uint32
      |  +--ro msti-regional-root-id?     uint32
      +--ro msti-internal-root-path-cost? int32
      +--ro msti-designated-bridge-id?   uint32
      +--ro msti-designated-port-id?    binary
Proposed RSTP YANG model (YANG)

module ieee802-dot1q-rstp {
  yang-version 1.1;
  namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-rstp";
  prefix rstp;

  import ietf-yang-types {
    prefix yang;
  }
  import ietf-interfaces {
    prefix if;
  }
  import ietf-routing-types {
    prefix rt-types;
  }
  import ieee802-dot1q-types {
    prefix dot1qtypes;
  }
  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 management of 802.1Q Bridge components that
     support the Rapid Spanning Tree Algorithm and Protocol (RSTP).

    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 2024-01-06 {
    description
      "Comment on P802.1Qdy/D1.0, supporting material, Mick Seaman."
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 802.1Qdj-2024, IEEE Std 802.1Qdx-2024.
"
}

feature rstp {
  description
  "Rapid Spanning Tree Algorithm and Protocol supported.";
  reference
  "Clause 13, 13.4, and 13.24 of IEEE Std 802.1Q.";
}

augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
  description
  "Augment Bridge with RSTP configuration.";
  reference
  "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
  container rstp {
    if-feature "rstp";
    leaf force-protocol-version {
      type enumeration {
        enum emulate-stp {
          value 0;
        }
        enum withdrawn {
          value 1; // previously assigned to IEEE Std 802.1G-1996 (withdrawn)
        }
        enum rstp-rapid-spanning-tree-protocol {
          value 2;
        }
        enum rstp-mstp {
          value 3;
        }
        enum rstp-spb {
          value 4;
        }
      }
      default "rstp-rapid-spanning-tree-protocol";
      config true;
      description
      "By default RSTP will provide rapid reconfiguration,
      but will interoperate with Bridges using STP as specified in
      IEEE Std 802.1D (now withdrawn). Force Protocol Version can
      force emulation of aspects of STP behavior, slowing reconfiguration
      and ageing of FDB entries. Force Protocol Version can be configured
      to enable MSTP and SPB behavior (if implemented) - interoperability
      with Bridges that support only RSTP or STP will be maintained.";
    }
  }
}
reference
"13.7.2 and item a) of 13.26 of IEEE Std 802.1Q."
}
leaf cist-bridge-id {
  type uint64;
  config false;
  description
  "The Bridge Identifier used by this Bridge for the CIST. Eight octets with the four most significant bits of the first encoding the manageable cist-bridge-id-priority, the next twelve bits being zero, and last six ocets encoding the Bridge Address.";
  reference
}
leaf cist-bridge-id-priority {
  type dot1qtypes:priority-type;
  config true;
  description
  "The priority component of this Bridge's Bridge Identifier for the CIST, encoded in the four most-significant bits of the first octet of the eight octet Bridge Identifier.

  The value of this object MUST be retained across reinitializations of the management system.";
  reference
  "13.26.2, 14.2.5, and item e) in 13.26 of IEEE Std 802.1Q."
}
leaf cist-root-id {
  type uint64;
  config false;
  description
  "The CIST Root Identifier, i.e. the Bridge Identifier of the Common and Internal Spanning Tree calculated by RSTP and of the logical continuation of that connectivity calculate by MSTP, as determined by this node.";
  reference
  "13.9, 14.1.2, and item f) in 13.26 of IEEE Std 802.1Q."
}
leaf external-root-path-cost {
  type uint32;
  config false;
  description
  "The External Root Path Cost (MSTP) or Root Path Cost (RSTP) calculated by this Bridge after the addition of the receiving Port Path Cost.";
  reference
  "13.9, 13.10, 13.5.3, and item i) in 13.26 of IEEE Std 802.1Q."
}
leaf cist-root-port-number {
  type dot1qtypes:port-number-type;
  config false;
description
"The port number of the Root Port for the RSTP and for the CIST Root Port (MSTP), i.e. the Port Identifier for the port that offers the lowest cost path from this Bridge to the (CIST) Root.";
reference
"13.4, 13.5, 13.26.9, and item h) in 13.26 of IEEE Std 802.1Q."
}
leaf max-age {
  type uint8;
  units "seconds";
  config false;
  description
  "For the CIST, the whole seconds (most-significant octet) part of the maximum age of the spanning tree information (Max Age) currently used by this Bridge. Set to the bridge-max-age if the Bridge is the CIST Root, and to the whole seconds part of the value received on the CIST Root Port otherwise.";
  reference
  "13.15, 13.20, 13.25, item l) in 13.28, and item g) in 13.26 of IEEE Std 802.1Q."
}
leaf hello-time {
  type rt-types:timer-value-secs16;
  units "seconds";
  config false;
  description
  "The interval (Hello Time) between the periodic transmission of Configuration Bridge PDUs on Designated Ports. Set to bridge-hello-time if the Bridge is currently acting as the CIST Root, and to the value received on the CIST Root Port otherwise.";
  reference
  "Table 13-5, 13.25.3, and 13.28.11 of IEEE Std 802.1Q."
}
leaf forward-delay {
  type uint8;
  units "seconds";
  config false;
  description
  "If a Port is using STP rather than RSTP, either as a result of setting force-protocol-version to be less than 2 or because STP BPDUs have been received, this Forward Delay parameter determines the time spent in the Listening and Learning Port States when transitioning from Discarding to Forwarding, and also controls rapid ageing of FDB entries after a topology change. Set to bridge-forward-delay if the Bridge is currently acting as the CIST Root, and to the whole seconds part of the value received on the CIST Root Port otherwise. If RSTP, MSTP, or SPB is used, Port State transitions and FDB flushing are rapid and not controlled by this parameter.";
  reference
  "Table 13-5, 13.25.2, 13.28.10, and item g) in 13.26.4 of IEEE Std 802.1Q.";}
leaf bridge-max-age {
  type uint8 {
    range "6..40";
  }
  default "20";
  units "seconds";
  config true;
  description
  "The value of the whole seconds part of Max Age when this Bridge is
  acting as the CIST Root. The fractional part, conveyed in the
  less-significant octet of each BPDU's Max Age field, will be zero.
  The value of this object MUST be retained across reinitializations
  of the management system.";
  reference
  "Table 13-5, 13.26.4, and item g) in 13.26 of IEEE Std 802.1Q.";
}
leaf bridge-hello-time {
  type uint8;
  default "2";
  units "seconds";
  config false;
  description
  "The value that this Bridge uses for HelloTime when acting as the
  CIST Root.";
  reference
  "Table 13-5, 13.25.3, and 13.28.11 of IEEE Std 802.1Q.";
}
leaf bridge-forward-delay {
  type uint8 {
    range "4..30";
  }
  default "15";
  units "seconds";
  config true;
  description
  "The value of the whole seconds part of Message Age when this
  Bridge is acting as the CIST Root. The fractional part, conveyed in
  the less-significant octet of each BPDU's Max Age field, will be
  zero.
  The value of this object MUST be retained across reinitializations
  of the management system.";
  reference
  "Table 13-5, 13.26.4, and item g) in 13.26 of IEEE Std 802.1Q.";
}
leaf tx-hold-count {
  type int32 {
    range "1..10";
  }
}
default "6";
config true;
description
"Limits the rate of BPDU transmission. If the variable txCount
(which is incremented on each transmission and decremented once a
second) reaches TxHoldCount, transmission is delayed.

The value of this object MUST be retained across
reinitializations of the management system.";
reference
"Table 13-5, 13.27.75, 13.26.12, and item b) in 13.26 of
IEEE Std 802.1Q.";
}
leaf migrate-time {
  type int32;
  default "3";
  units "seconds";
  config false;
description
"Management can force the transmission of RST (or MST or SPT) BPDUs
for MigrateTime to check that all STP Bridges have been removed
from a specified port's attached LAN, so RST/MST/SPT BPDU
transmission can persist. Fixed value of 3 seconds.";
reference
"Table 13-5, 13.27.38, and item c) in 13.26 of IEEE Std 802.1Q.";
}
leaf time-since-topology-change {
  type uint32;
  units "seconds";
  config false;
description
"The time (in seconds) since the Topology Change timer, tcWhile, for
any port on this Bridge was last running - i.e. since
Topology Change Notification (TCN) Messages were last transmitted.";
reference
"13.25.9 of IEEE Std 802.1Q.";
}
leaf topology-change-count {
  type yang:counter64;
  units "topology change count";
  config false;
description
"The number of times (since the management entity was last
reset or initialized) that at least one port's Topology Change timer
(tcWhile) has been non-zero.

Discontinuities in the value of the counter can occur at
re-initialization of the management system, and at other times as
indicated by the value of 'discontinuity-time'.";
reference
"13.25.9 of IEEE Std 802.1Q.";
augment "/if:interfaces/if:interface/dot1q:bridge-port" {
  description
    "Augment Bridge Port with RSTP configuration";
  reference
    "13.24, 13.25, and 13.27 of IEEE Std 802.1Q."
  container rstp {
    if-feature "rstp";
    leaf cist-port-state {
      type enumeration {
        enum discarding {
          value 1;
        }
        enum learning {
          value 2;
        }
        enum forwarding {
          value 3;
        }
      }
      config false;
      description
        "The port's Port State, summarizing the application of learning to received frames, and the forwarding of relayed frames, for all frames (for RSTP) or for frames assigned to the CIST (for MSTP). The Port State is Discarding if both learning and forwarding are both false, Learning if only learning, and Forwarding if both learning and forwarding are true. The Discarding state encompasses all reasons for not forwarding, including MAC_Operational false (if:oper-status not up) and MAC_Enabled false (if:admin-status not up)."
        reference
        "8.4, 13.4, item aw) and item ba) in 13.27 of IEEE Std 802.1Q.";
      }
    
    leaf cist-port-role {
      type enumeration {
        enum disabled-port {
          value 1;
        }
        enum root-port {
          value 2;
        }
        enum designated-port {
          value 3;
        }
        enum alternate-port {
          value 4;
        }
        enum backup-port {
          value 5;
        }
      }
    }
value 5;

leaf restricted-role {
  type boolean;
  default "false";
  config false;
  description
  "The port's Port Role for the CIST. Disabled Port, Root Port,
  Designated Port, Alternate Port, or Backup Port.";
  reference
  "13.4, 13.5, 13.12, 13.24, 13.27.66, and item bn) in 13.27 of
  IEEE Std 802.1Q.";
}

leaf restricted-tcn {
  type boolean;
  default "false";
  config false;
  reference
  "13.20, 13.27.65, 13.29.34, 16.2, 16.3, 26.5, 27.6, 27.20,
  item t) in 13.27 of IEEE Std 802.1Q.";
}

leaf cist-port-id {
  type uint16;
  config false;
  description
  "The Port Identifier used by this Bridge Port for the CIST. Two
  octets with the four most-significant bits of the first encoding the
  manageable cist-port-id-priority, and the next twelve bits encoding
  the port's port-number.";
  reference
  "13.27.46, 14.1.2, item bd) in 13.27 of IEEE Std 802.1Q.";
}

leaf cist-port-priority {
  type dot1qtypes:prioity-type;
  config true;
  description
  "The priority component of this Port's Port Identifier for the
  CIST, encoded in the four most-significant bits of the first octet
  of the two octet Port Identifier.

  The value of this object MUST be retained across reinitializations
  of the management system.";
  reference
  "13.27.47, 14.2.7, and item be) in 13.27 of IEEE Std 802.1Q.";
}
leaf external-port-path-cost {
    type int32 {
        range "0..200000000";
    }
    config true;
    description "The administratively assigned value for the port's contribution to
    the External Root Path Cost for the Bridge, when the port is the
    CST Root Port (for RSTP and MSTP) or the CIST Master Port (for MSTP
    and ISIS-SPB)."
    reference "13.27.25, Table 13-4, and item g) of 13.27 of IEEE Std 802.1Q.";
}
leaf cist-root-id {
    type uint32;
    config false;
    description "The CIST Root Identifier in Configuration BPDUs transmitted by the
    Designated Bridge for the attached LAN.";
    reference "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
}
leaf cist-external-path-cost {
    type int32;
    config false;
    description "The External Path Cost advertised in BPDUs by the Designated Bridge
    for the attached LAN.";
    reference "27.6, 14.1.2, 13.27.20, and item ar) in 13.27 of IEEE Std 802.1Q.";
}
leaf designated-bridge-id {
    type uint32;
    config false;
    description "The Bridge Identifier of the Bridge that this port considers to be
    the Designated Bridge for the attached LAN.";
    reference "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q.";
}
leaf designated-port-id {
    type binary {
        length "2";
    }
    config false;
    description "The Port Identifier of the Bridge Port that this port considers to
    be the Designated Port for the attached LAN.";
reference
"13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q."
}
leaf port-protocol-migration-check {
  type boolean;
  config true;
  description
  "Writing true(1) to port-protocol-migration-check (mcheck)
  forces transmission of RST (or MST or SPT) BPDUs for migrate-time to
  check that all STP Bridges have been removed from the port's attached
  LAN, so RST/MST/SPT BPDU transmission can persist. Has no effect if
  force-protocol-version is emulate-stp(0) or withdrawn(1). Always
  returns false(2) when read."
  reference
  "13.27.38, 13.32, and item j) in 13.27 of IEEE Std 802.1Q."
}
leaf admin-edge-port {
  type boolean;
  default "false";
  config true;
  description
  "Set if the port is to be identified as an Edge Port immediately
  on initialization without a delay to detect other Bridges attached
  to the LAN. Recommended default false(2). The operational value,
  oper-edge-port, will become false(2) if a BPDU has been received.

  The value of this object MUST be retained across reinitializations
  of the management system."
  reference
  "13.33, and item a) in 13.27 of IEEE Std 802.1Q."
}
leaf oper-edge-port {
  type boolean;
  config false;
  description
  "Set if the port is currently identified as an Edge Port.
  Initialized to the value of admin-edge-port, and controlled by the
  Bridge Detection state machine."
  reference
  "13.33, and item l) in 13.27 of IEEE Std 802.1Q."
}
leaf auto-edge-port {
  type boolean;
  default "true";
  config true;
  description
  "Administratively set true(1) to allow the value of oper-edge-port
  is to be maintained automatically, with continuous monitoring of
  the presence or absence of other Bridges attached to the LAN.

  The value of this object MUST be retained across reinitializations
of the management system.

reference
"13.33, 13.27.18, and item c) in 13.27 of IEEE Std 802.1Q.");

} leaf auto-isolate-port {
type boolean;
default "false";
config true;
description
"Administratively set true(1) to allow automatic setting of isolate-port, causing a Designated Port to transition to Discarding if both admin-edge-port and auto-edge-port are false, but the other Bridge presumed attached to the same point-to-point LAN appears unable to transmit BPDUs, indicating failure of a Spanning Tree Protocol Entity or of transmission and/or reception.
The value of this object MUST be retained across reinitializations of the management system.");

reference
"13.23, 13.27.19, 13.33, and item d) in 13.27 of IEEE Std 802.1Q.");

} leaf isolate-port {
type boolean;
config false;
description
"Set by the Bridge Detection state machine when the Spanning Tree Protocol Entity of a neighboring Bridge has apparently failed.");

reference
"13.23, 13.27.27, 13.33, and item i) in 13.27 of IEEE Std 802.1Q.");

}

notification new-root {
description
"The new-root notification indicates that the sending agent has become the new root of the Spanning Tree; the notification is sent by a Bridge soon after its election as the new root, e.g., upon expiration of the Topology Change Timer, immediately subsequent to its election.");

}

notification topology-change {
description
"A topology-change notification is sent by a Bridge when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Blocking state. The notification is not sent if a ieee8021SpanningTreeNewRoot notification is sent for the same transition.");

}
Proposed MSTP YANG model (YANG)

module ieee802-dot1q-mstp {
  yang-version 1.1;
  namespace "urn:ieee:std:802.1Q:yang:ieee802-dot1q-mstp";
  prefix mstp;

  import ietf-interfaces {
    prefix if;
  }
  import ieee802-dot1q-types {
    prefix dot1qtypes;
  }
  import ieee802-dot1q-bridge {
    prefix dot1q;
  }
  import ieee802-dot1q-rstp {
    prefix rstp;
  }

  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 management of 802.1Q Bridge components that
  support the Multiple Spanning Tree Algorithm and Protocol (MSTP).

  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 2024-01-08 {
    description
    "Comment on P802.1Qdy/D1.0, supporting material, Mick Seaman. At present
    fragments of the required specification, but all the important leaves
    and structure should be here. Occurrences of //!! mark
    reference statements that need to be updated, or at least checked. Use
    of the feature and if-feature statements needs to be addressed to ensure
this module augments a Bridge and Bridge Ports that have been augmented by the RSTP module.

The following reference statement identifies each referenced IEEE Standard as updated by applicable amendments.

```
feature mstp {
  if-feature rstp:rstp;
  description
    "Multiple Spanning Tree Algorithm and Protocol supported.";
  reference
    "Clause 13, 13.5, and 13.24 of IEEE Std 802.1Q.";
}
```

```
augment "/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst" {
  description
    "Augment RSTP-capable Bridge component with MSTP configuration and management.";
  reference
    "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
}
```

```
container mst-config-id {
  description
    "Containing the MST Configuration Identifier of a Bridge.";
  reference
    "Item d) in 13.26.";
  leaf format-selector {
    type int32 {
      range "0";
    }
    config true;
    description
      "In an MSTP Bridge, the MST Configuration Identifier Format Selector. This has a value of 0 indicating the format specified in IEEE Std 802.1Q.";
    reference
      "Item a) in 13.8 of IEEE Std 802.1Q.";
  }
  leaf configuration-name {
    type string {
      length "32";
    }
    config true;
    description
      "The Configuration Name in the MST Configuration Identifier.";
  }
```
leaf revision-level {
  type uint32 {
    range "0..65535";
  }
  config true;
  description "The Revision Level in the MST Configuration Identifier.";
  reference "Item c) in 13.8 of IEEE Std 802.1Q.";
}

leaf configuration-digest {
  type binary {
    length "16";
  }
  config false;
  description "The Configuration Digest in the MST Configuration Identifier.";
  reference "Item d) in 13.8 of IEEE Std 802.1Q.";
}

container bridge-mstp {
  description "Per-Bridge configuration and management parameters for the IST and each MSTI in an MST Region.";
  reference "Clause 13, 13.26 of IEEE Std 802.1Q.";
  leaf max-hops {
    type int32 {
      range "6..100";
    }
    default "20";
    config true;
    description "In an MSTP Bridge, the MaxHops parameter for the IST, also used for each of the MSTIs.
    The value of this object MUST be retained across reinitializations of the management system.";
    reference "Clause 13, Table 13-5, 13.26.4, item g) in 13.26 of IEEE Std 802.1Q.";
  }
  leaf ist-internal-root-path-cost {
    type uint32;
    config false;
    description
"The Internal Root Path Cost for the IST calculated by this Bridge after the addition of the Internal Port Path Cost for the Root Port (or Master Port) for this IST (MSTID 0) or MST.”;
reference
"13.9, 13.10, 13.5.3, 13.26.10 and item i) in 13.26 of IEEE Std 802.1Q.";
}
list mst {
  key "mstid";
  description
  "Per-Bridge configuration and management parameters for each MST, with an MSTID in the range allocated for MSTP configuration.”;
  reference
  " ";
  leaf mstid {
    type uint16 {
      range "1..4091";
    }
    description
    "MSTIDs allocated for use by MSTP (1..4091) to identify MSTIs. Other MSTIDs in the 12-bit range are reserved [for use in the MST Configuration Table, whose configuration is identified by the Configuration Digest in the MST Configuration Identifier (mst-config-id/configuration-digest) for the CIST-MSTID, SPBM-MSTID, SPBV-MSTID, TE-MSTID, and SPVID-Poll-MSTID.”;
    reference
    "8.4, 8.6.1, 8.9.3, 13.2.1 of IEEE Std 802.1Q.";
  }
  leaf port-id-priority {
    type dot1qtypes:priority-type;
    config true;
    description
    "The priority component of this Bridge Port's Port Identifier for the MSTI, encoded in the four most-significant bits of octet 15 of the MSTI Configuration Message.

    The value of this object MUST be retained across reinitializations of the management system.”;
    reference
    "13.26.3, 13.11, 14.4.1, and item f) in 13.26 of IEEE Std 802.1Q."; //!!
  }
  leaf internal-root-path-cost {
    type uint32;
    config false;
    description
    "The Internal Root Path Cost for this MSTI calculated by this Bridge after the addition of the Internal Port Path Cost for the Root Port (or Master Port) for this MSTI.”;
    reference
    "13.9, 13.10, 13.5.3, 13.26.10 and item i) in 13.26 of
IEEE Std 802.1Q.

leaf root-port-number {
  type dot1qtypes:port-number-type;
  config false;
  description
  "The port number of the Root Port for this MSTI."
  reference
  "13.4, 13.5, 13.26.9, and item h) in 13.26 of IEEE Std 802.1Q."; //!!
}

augment "/if:interfaces/if:interface/dot1q:bridge-port" {
  description
  "Augment RSTP Bridge Port with MSTP configuration"
  reference
  "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
  container port-mstp {
    description
    "Per-Bridge Port configuration and management parameters for the IST and each MSTI in an MST Region.";
    list mst {
      key "mstid";
      description
      "Per-Bridge Port configuration and management parameters for each MST, with an MSTID in the range allocated for MSTP configuration."
      reference
      "";
      leaf mstid {
        type uint16 {
          range "1..4091";
        }
        description
        "MSTIDs allocated for use by MSTP (1..4091) to identify MSTIs.";
        reference
        "8.4, 8.6.1, 8.9.3, 13.2.1 of IEEE Std 802.1Q.";
      }
      leaf msti-port-state {
        type enumeration {
          enum discarding {
            value 1;
          }
          enum learning {
            value 2;
          }
          enum forwarding {
            value 3;
          }
        }
        config false;
      }
    }
  }
}
description
"The port's Port State, summarizing the application of learning to received frames, and the forwarding of relayed frames, for frames assigned to this MSTI."
reference
"8.4, 13.4, item aw) and item ba) in 13.27 of IEEE Std 802.1Q."
}
leaf msti-port-role {
  type enumeration {
    enum disabled-port {
      value 1;
    }
    enum root-port {
      value 2;
    }
    enum designated-port {
      value 3;
    }
    enum alternate-port {
      value 4;
    }
    enum backup-port {
      value 5;
    }
    enum master-port {
      value 6;
    }
  }
  config false;
  description
  "The port's Port Role for the MSTI. Disabled Port, Root Port, Designated Port, Alternate Port, Backup Port, or Master Port."
  reference
  "13.4, 13.5, 13.12, 13.24, 13.27.66, and item bn) in 13.27 of IEEE Std 802.1Q.";!!
}
leaf msti-bridge-id-priority {
  type dot1qtypes:priority-type;
  config true;
  description
  "The priority component of this Bridge's Bridge Identifier for the MSTI, encoded in the four most-significant bits of octet 14 of the MSTU Configuration Message.

  The value of this object MUST be retained across reinitializations of the management system.";
  reference
  "13.26.3, 13.11, 14.4.1, and item f) in 13.26 of IEEE Std 802.1Q.";
}
leaf msti-internal-port-path-cost {
  type uint32;
config true;
description "The Internal Port Path Cost for this Bridge Port and MSTI."
reference "Item b) of 13.2.1, and item ay) in 13.26 of IEEE Std 802.1Q."
}
leaf msti-regional-root-id {
type uint32;
config false;
description "The MSTI Regional Root Identifier in Configuration BPDUs transmitted by the Designated Bridge for the attached LAN and this MSTI."
reference "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q."
}
leaf msti-internal-root-path-cost {
type int32;
config false;
description "The MSTI Internal Path Cost advertised in BPDUs by the Designated Bridge for the attached LAN and this MSTI."
reference "27.6, 14.4.1, 13.27.20, 14.4.1, and item ar) in 13.27 of IEEE Std 802.1Q."
!!}
leaf msti-designated-bridge-id {
type uint32;
config false;
description "The Bridge Identifier of the Bridge that this port considers to be the Designated Bridge for the attached LAN and this MSTI."
reference "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q."
}
leaf msti-designated-port-id {
type binary {
    length "2";
}
config false;
description "The Port Identifier of the Bridge Port that this port considers to be the Designated Port for the attached LAN and this MSTI."
reference "13.27.20, 13.10, and item ar) in 13.27 of IEEE Std 802.1Q."
}