P802.1Qdy - RSTP/MSTP YANG – Reusability across SDOs (version 07)

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Introduction

This presentation

- Highlights a problem in the proposed YANG model for RSTP, MSTP as part of P802.1Qdy that would prevent its reuse in other SDOs like BBF.
- Presents a possible solution that would allow the YANG model to be reused by other SDOs, but at the same time preserve the overall structure and functionality of the YANG from IEEE 802.1 perspective.

The problem (RSTP)

48.6 YANG modules[6 7 8]

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

48.6.26 The ieee802-dot1q-rstp YANG module

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


  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 {
      presence "The presence of this container indicates that RSTP is supported";


  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 {
      presence "The presence of this container indicates that RSTP is supported";
```

The “augments” clause present in the YANG module cannot be overridden and this makes it impossible for other SDOs to use this YANG module since they may not have the notion of Bridge / Component

The problem (MSTP)

48.6.27 The ieee802-dot1q-mstp YANG module

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

  }

  augment "/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst" {
    when "../rstp:rstp";

    description
      "Augment RSTP-capable Bridge component with MSTP configuration and
      management.";

    }
  }
  augment "/if:interfaces/if:interface/dot1q:bridge-port" {
    when "rstp:rstp";
    description
      "Augment RSTP Bridge Port with MSTP configuration";
```

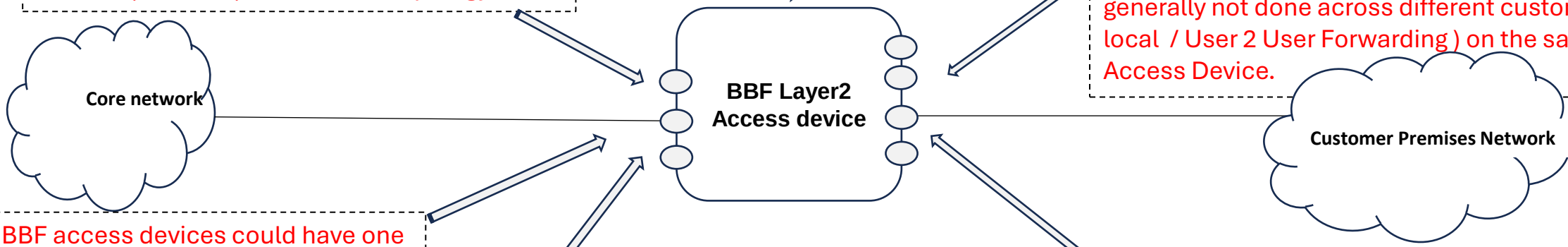
The “augments” clause present in the YANG module cannot be overridden and this makes it impossible for other SDOs to use this YANG module since they may not have the notion of Bridge / Component

About BBF layer-2 access device

BBF access devices are primarily aggregation devices that are multiplexing traffic in the upstream direction from multiple end users / customer ports towards the core network and in the downstream direction, demultiplexing traffic from the core network towards the end users / customer ports.

Network interfaces of BBF layer-2 access node are **IEEE 802.1 & IEEE 802.3** compliant. It can interop with other layer-2 IEEE 802.1 devices (non-BBF) in a network topology.

Each of the customer / end user side ports provide last mile connectivity to Residential or Business users and also e.g. serve as a backhaul connectivity for Mobile base stations. Various Layer 2 Access technologies are used including **xDSL, PON and also Ethernet.**
On the customer premises, the xDSL, PON or ethernet lines are terminated by CPEs/ONTs.
The customer ports on the BBF access devices are logically considered to be different network segments and layer 2 switching / forwarding is generally not done across different customer ports (local / User 2 User Forwarding) on the same Access Device.



The BBF access devices could have one or more network ports connecting to the core network and each of these network ports could be connected to the same or different network segment (Broadcast domain).

Multiple network ports could also be bundled into a LAG interface and connected to a peer device in the core network.
When more than 1 network port / LAG interface is connected to the same network segment (Broadcast domain), then the topology could be a **Ring, Mesh or even a Daisy Chain** and resiliency protocols like **ERPS or RSTP/MSTP would be required to avoid loops**.

When a customer port is used purely to provide end user broadband connectivity, there would be no need for resiliency protocols like ERPS, RSTP/MSTP, etc.
There may be some cases where a customer port, mostly an ethernet port is used as an Uplink / Network port.
(The port type / usage is configurable in BBF). **For such ports, resiliency protocols like ERPS, RSTP/MSTP would become applicable**

BBF Layer-2 Access device and IEEE 802.1 Provider Edge Bridge

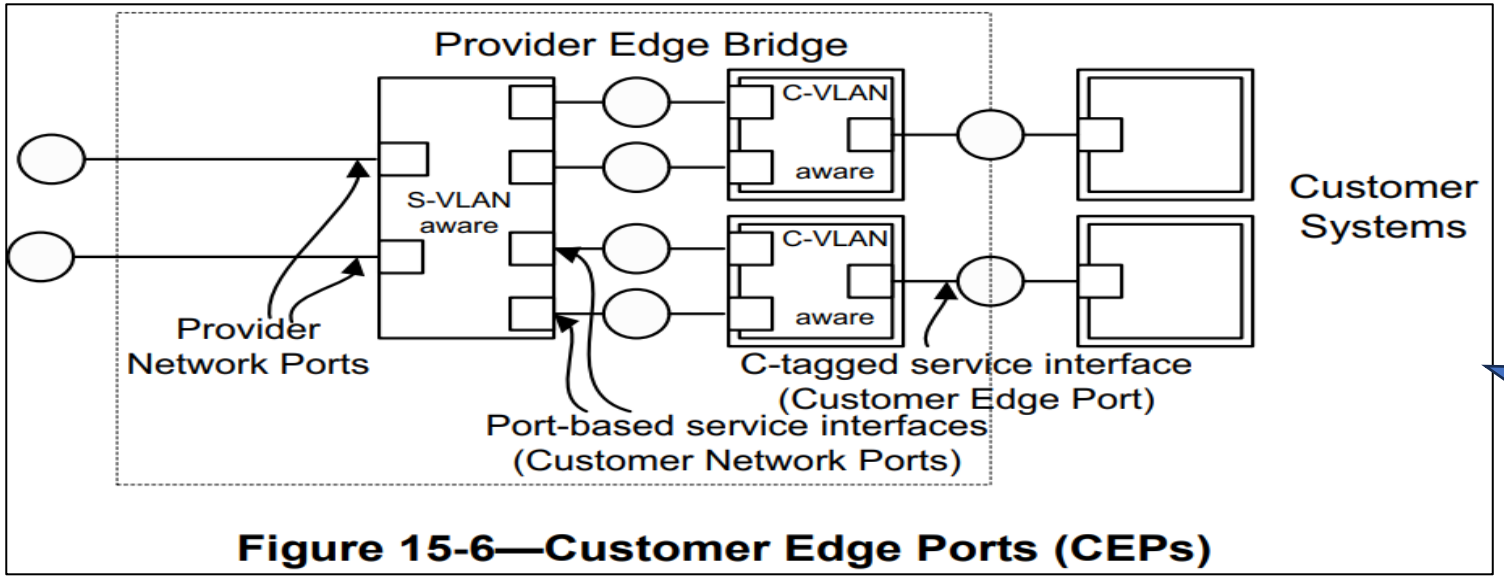


Figure 15-6—Customer Edge Ports (CEPs)

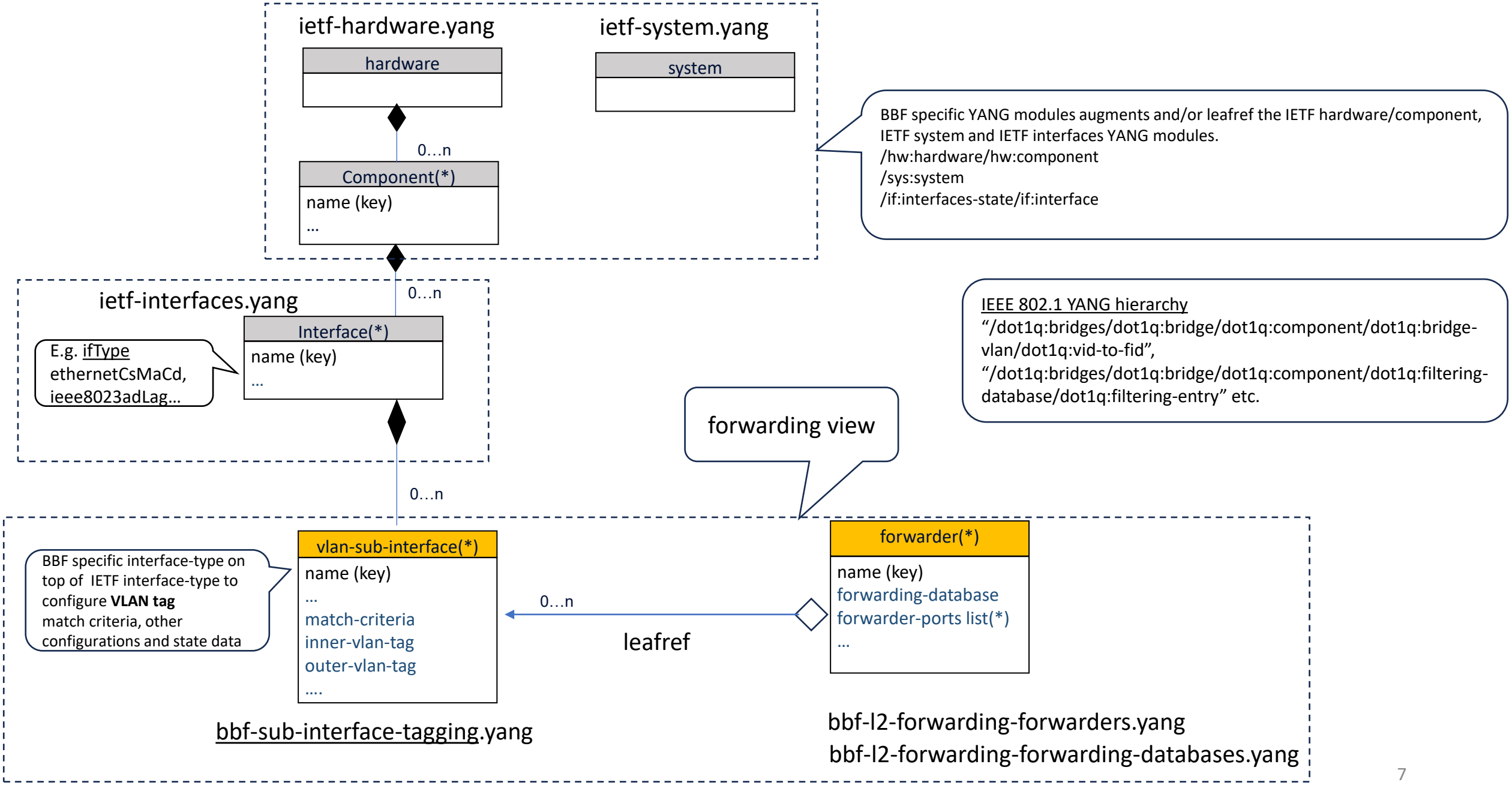
Reference :
IEEE 802.1Q-2022, Section "15.4 C-tagged service interface", Figure 15-6 – Customer Edge Ports (CEP)

BBF Layer-2 Access device possibly like the IEEE 802.1 Provider Edge Bridge

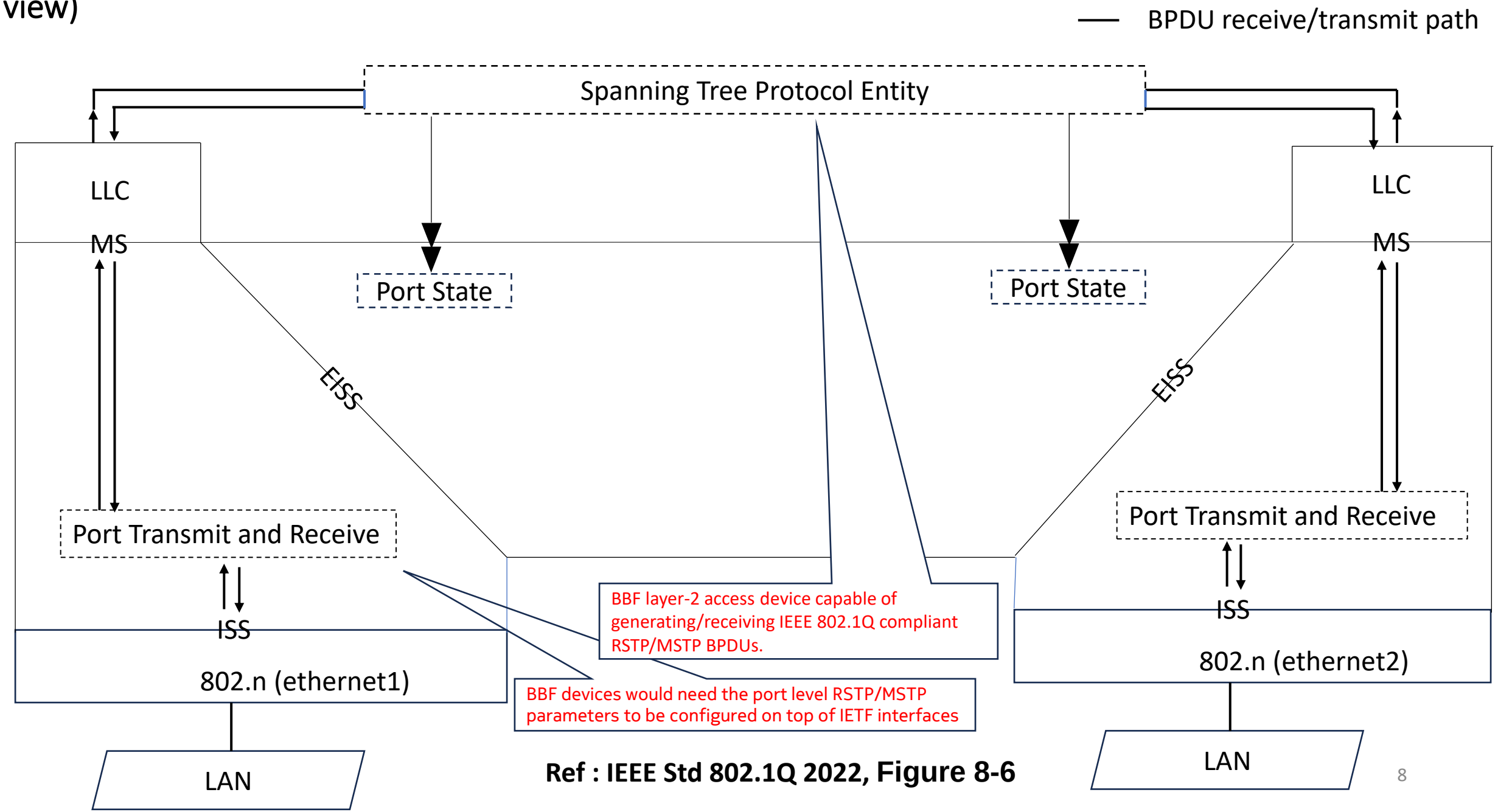
BBF Layer-2 Access device (forwarding)

- In a BBF Layer2 Access device, the SVLAN component and CVLAN components are not logically modelled separately but they have a concept of "forwarder/forwarder-ports/VLAN-sub-interface" and all the SVLAN and CVLAN aware "forwarder-ports" could be part of the same "forwarder".
- VID configuration, traffic classification and the traffic manipulation rules are modelled on top of a BBF specific logical interface called as "VLAN-sub-interface".
- Multiple "VLAN-sub-interface" for example using different VID configuration can be created on top of an IEEE 802.3 physical interface or IEEE 802.1AX LAG interface.
- "forwarder" responsible to route traffic across different "forwarder-ports" which has one to one association with the "VLAN-sub-interface". For example, traffic received with VLAN 100 from a user port, route to the network port with VLAN 200.
- "forwarder" has a view of list VIDs which are needed for the **"MST tree to list of VID"** mapping.

BBF Layer-2 Access device YANG view (hardware/component/interface/L2-forwarding)

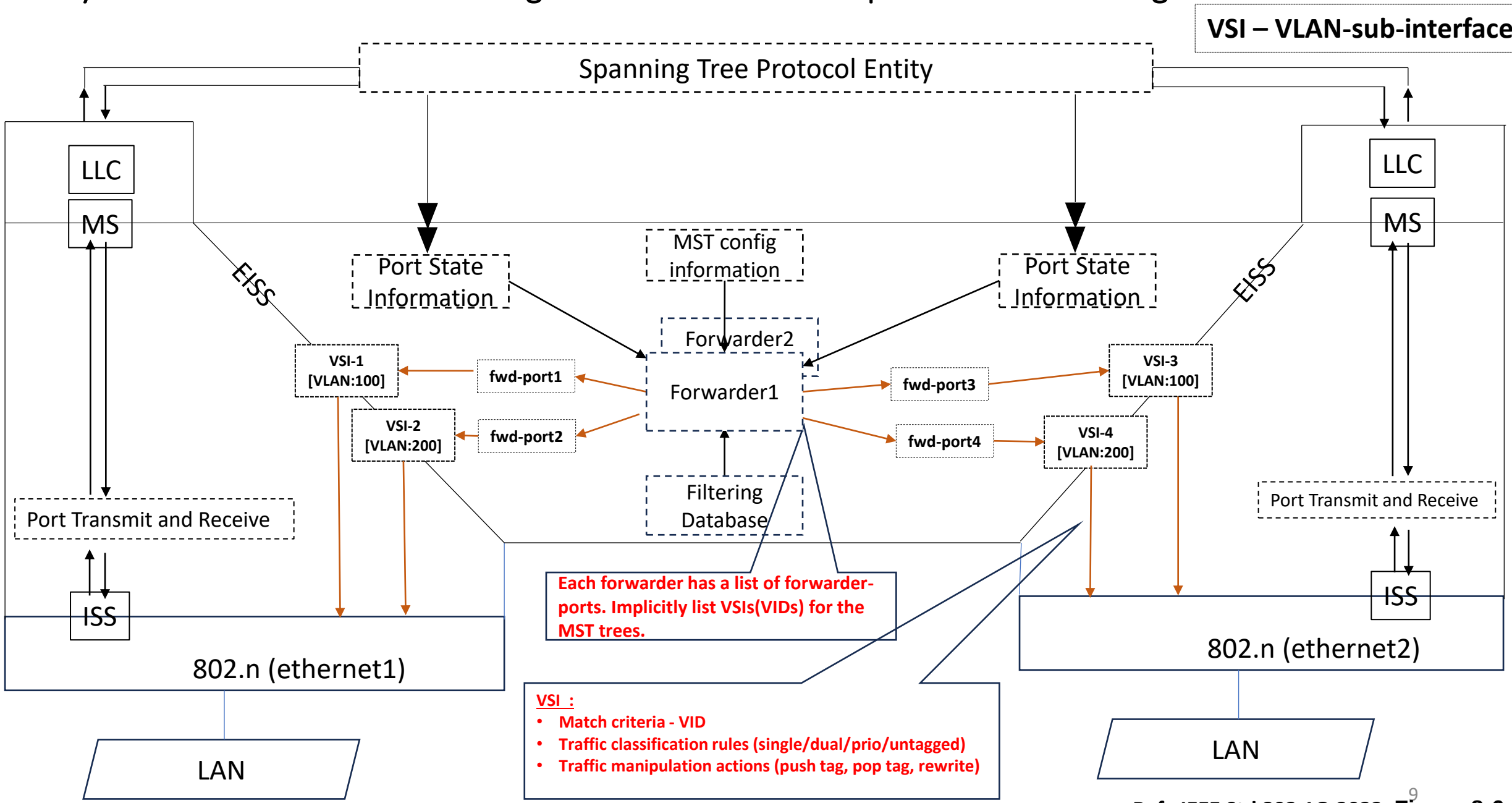


BBF layer-2 access device – Operation of Spanning Tree Protocol Entity (BPDU receive/transmit possible view)



Ref : IEEE Std 802.1Q 2022, Figure 8-6

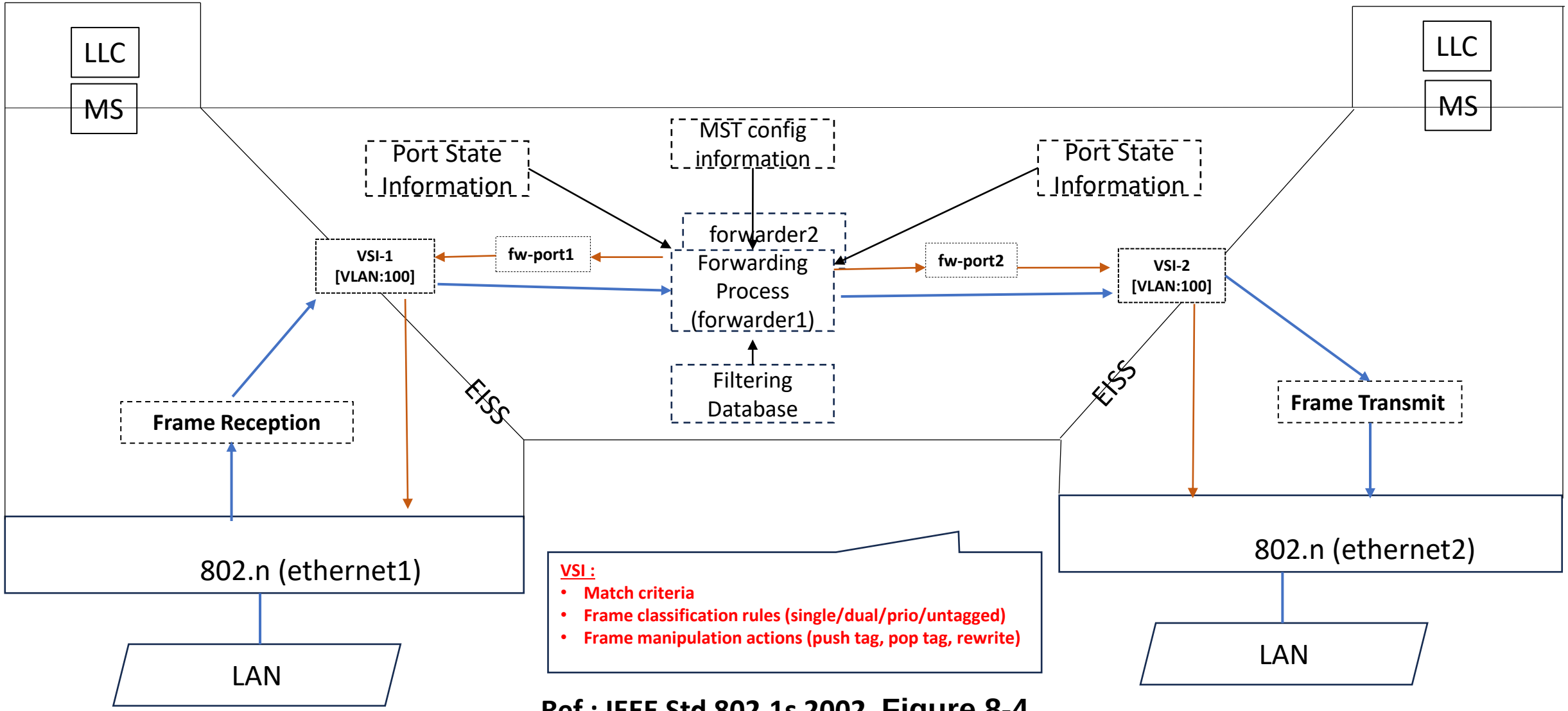
BBF layer-2 access device – forwarding architecture view and possible MSTP config view



Ref : IEEE Std 802.1Q 2022, Figure 8-6

BBF layer-2 access device – Relaying MAC Frames

VSI – VLAN-sub-interface



VSI :

- **Match criteria**
- **Frame classification rules (single/dual/prio/untagged)**
- **Frame manipulation actions (push tag, pop tag, rewrite)**

Ref : IEEE Std 802.1s 2002, Figure 8-4

Frame processing flow

Proven strategy for reusability across SDOs

The YANG module that other SDOs like BBF would use in their devices has to be free of “augment” clauses and references to Bridge / Component / Bridge Port.

- Split the YANG module into two modules. The Base YANG module would contain the protocol specific YANG definitions and an IEEE 802.1 specific module would augment this base module and contain the “augment” clauses.
- Other SDOs like BBF could then use just the Base YANG module.

Following are some examples of existing IEEE 802.1 YANG models that are reusable

(Path : https://github.com/YangModels/yang/blob/main/standard/ieee/published/802.1)

Domain	**Common reusable YANG** **These base modules are reusable in other SDOs**	**IEEE 802.1 Bridge specific YANG** **These IEEE 802.1 specific modules augment the base module by adding the “augment” and/or leafref clauses that link the base module to Bridge/Component/Bridge Port**
CFM	ieee802-dot1q-cfm.yang	ieee802-dot1q-cfm-bridge.yang
Scheduler	ieee802-dot1q-sched.yang	ieee802-dot1q-sched-bridge.yang
PSFP	ieee802-dot1q-psfp.yang	ieee802-dot1q-psfp-bridge.yang
Stream Filters and Gates	ieee802-dot1q-stream-filters-gates.yang	ieee802-dot1q-stream-filters-gates-bridge.yang
Preemption	ieee802-dot1q-preemption.yang	ieee802-dot1q-preemption-bridge.yang
Congestion-isolation	ieee802-dot1q-congestion-isolation.yang	ieee802-dot1q-congestion-isolation-bridge.yang

Example of some existing IEEE 802.1 YANG models

CFM

IEEE 802.1 Base CFM model

(Protocol specific YANG definitions)

ieee802-dot1q-cfm.yang

Does not have references to Bridge / Component / Bridge Port

augments

augments

IEEE 802.1 Bridge specific CFM augmentation

augment "/dot1q-cfm:cfm/dot1q-cfm:maintenance-group"
---bridge-name -> leafref to IEEE 802.1 Bridge
---bridge-component-name -> leafref to IEEE 802.1 Bridge component

augment "/dot1q-cfm:cfm/dot1q-cfm:maintenance-group/dot1q-cfm:mep"
---interface-ref -> leafref to IETF interface

ieee802-dot1q-cfm-bridge.yang

BBF specific CFM augmentation

augment "/dot1q-cfm:cfm/dot1q-cfm:maintenance-group"
---forwarder -> leafref to BBF Forwarder

augment "/dot1q-cfm:cfm/dot1q-cfm:maintenance-group/dot1q-cfm:mep"
---interface-ref -> leafref to BBF vlan-sub-interface

bbf-dot1q-cfm-interfaces.yang
bbf-dot1q-cfm-l2-forwarding.yang

IEEE 802.1 Base CFM model + IEEE 802.1 Bridge specific CFM augmentation

Together builds the complete CFM model for the devices conforming to the IEEE 802.1 specifications.

IEEE 802.1 Base CFM model + BBF specific CFM augmentation

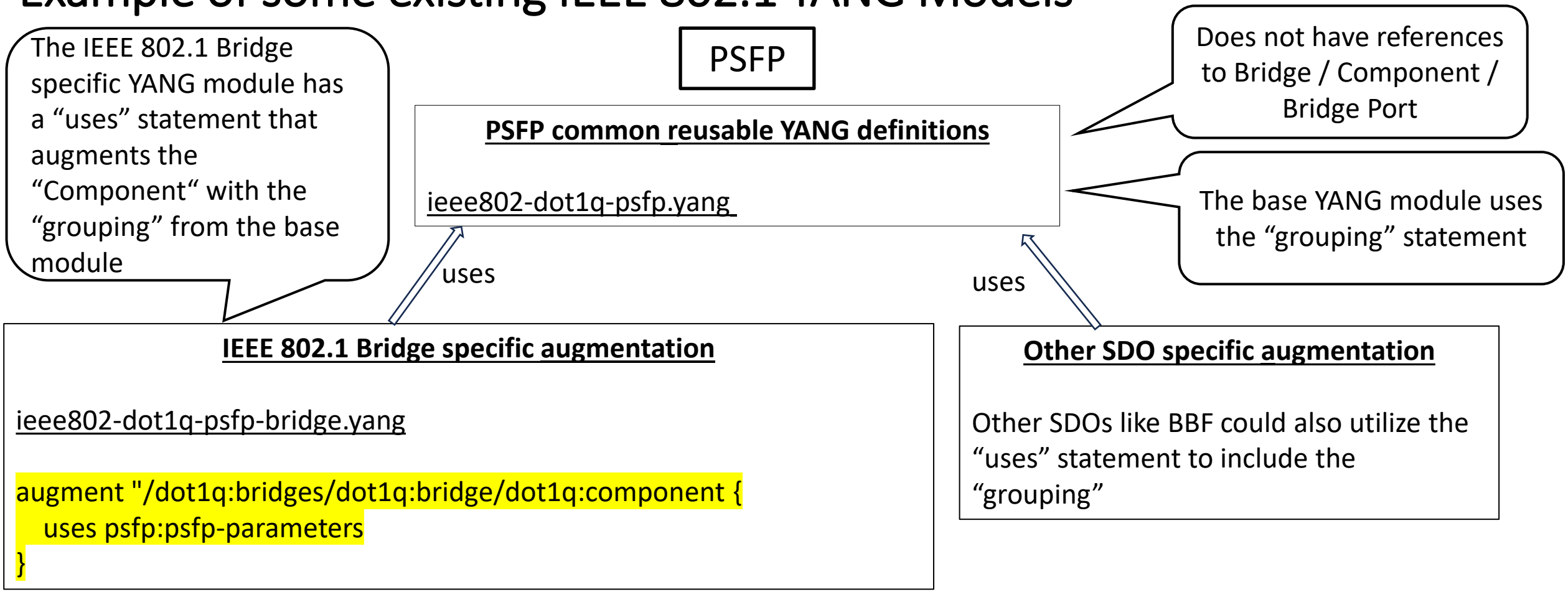
Together builds the complete CFM model for the devices conforming to the BBF specifications.

Note : Recommendation ITU-T Y.1731 CFM also uses the IEEE 802.1 Base CFM model to augment ITU-T Y.1731 specific CFM YANG definitions.

IEEE 802.1 Base CFM model + ITU-T Y.1731 specific CFM augmentation

Together builds the complete model for devices conforming to the ITU-T specifications. Ref : Recommendation ITU-T G.8052

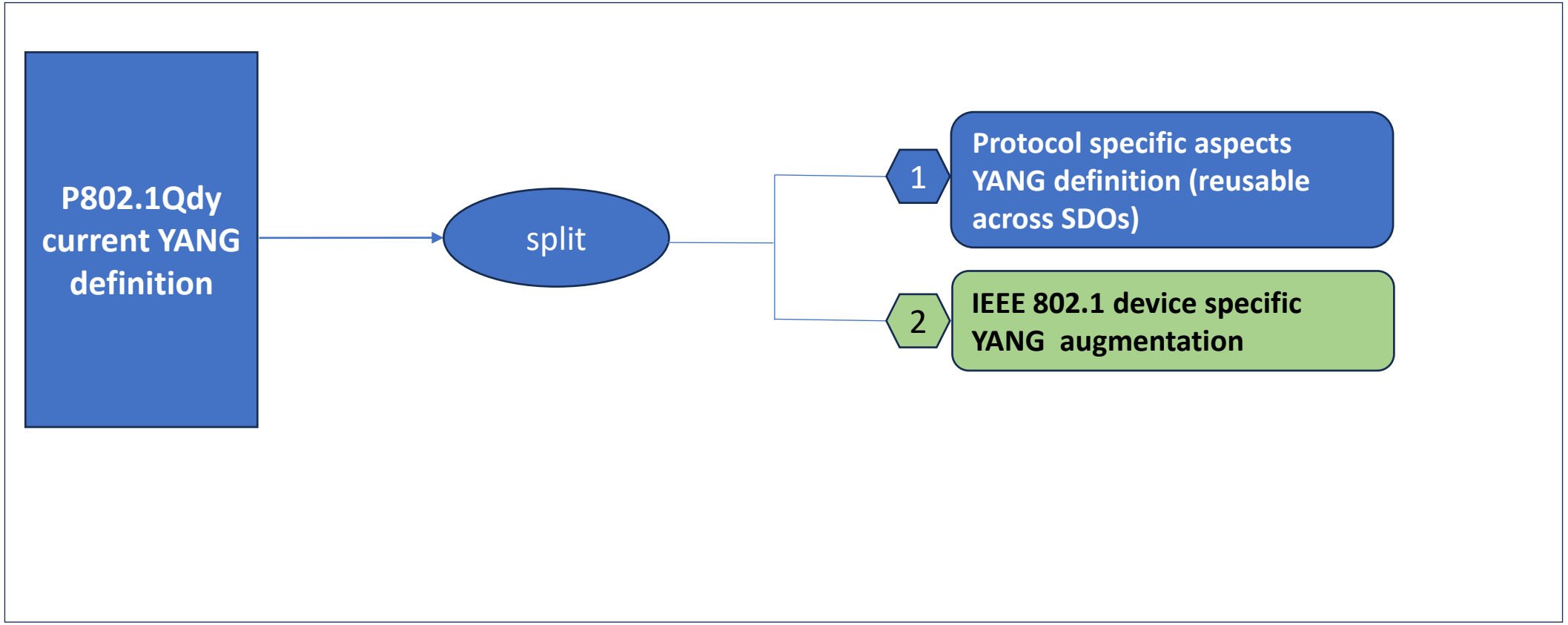
Example of some existing IEEE 802.1 YANG Models



Other YANG models **“Scheduler, Stream Filters and Gates, Preemption and Congestion-isolation”** also follow the same approach.
The Base module has a **“grouping”** statement and the SDO specific module achieves the augmentation with the **“uses”** statement.

P802.1Qdy decoupling proposal – overall strategy

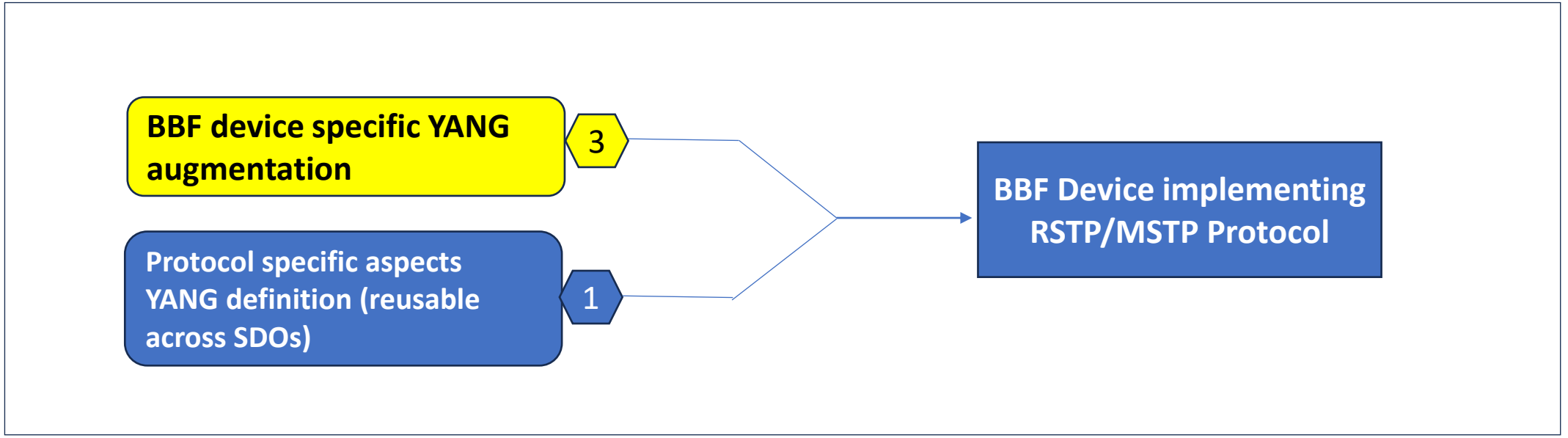
Implementation in a device conforming to IEEE 802.1 specifications



Device conforming to IEEE 802.1 specifications would implement the YANG model of : 1 & 2

P802.1Qdy decoupling proposal – overall strategy

Implementation in other SDOs



Device conforming to BBF specifications would implement the YANG model of : 1 & 3

P802.1Qdy decoupling proposal – more details

MSTP

IEEE 802.1Qdy current YANG definition

split

IEEE 802.1 device specific YANG module which uses Base YANG module

Can be reused in other SDOs like BBF

IEEE 802.1 device specific augments YANG definition

Per component MSTP augment

YANG module "ieee802-dot1q-mstp-bridge.yang" :

- augment "/dotq:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst":
  - uses mstp-per-component-protocol-specific-data

Per interface MSTP augment

YANG module "ieee802-dot1q-mstp-bridge.yang" :

- augment "/if:interfaces/if:interface/dot1q:bridge-port" :
  - uses mstp-per-interface-protocol-specific-data

uses

uses

Base YANG module – MSTP protocol specific YANG definitions as YANG grouping

Per component MSTP YANG data

YANG module "ieee802-dot1q-mstp.yang" :

- YANG "Grouping" (mstp-per-component-protocol-specific-data) :
  - MSTP YANG configuration/state data which are per component specific.

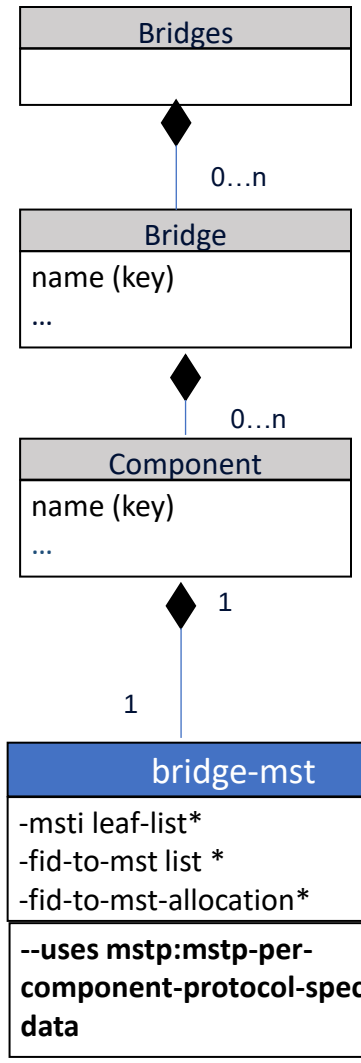
Per interface MSTP YANG data

YANG module "ieee802-dot1q-mstp.yang" :

- YANG "Grouping" (mstp-per-interface-protocol-specific-data) :
  - MSTP YANG configuration/state data which are per interface specific.

P802.1Qdy decoupling proposal – MSTP YANG

IEEE 802.1 UML-like view



uses

ieee802-dot1q-mstp-bridge.yang

ieee802-dot1q-mstp

```
grouping mstp-per-component-protocol-specific-data {
  |  +--rw mstp:mst-config-id!
  ……
  |  +--rw mstp:bridge-mstp!
     ……
    |    +--rw mstp:mst* [mstid]
         |    +--rw mstp:mstid   uint16
         ……
}
```

```
grouping mstp-per-interface-protocol-specific-data {
 +--rw mstp:port-mstp!
       +--rw mstp:mst* [mstid]
        |  +--rw mstp:mstid   uint16
        …..
    ….
}
```

ieee802-dot1q-mstp.yang

ieee802-dot1q-mstp would contain pure protocol specific MSTP YANG definitions(in a grouping).

IEEE 802.1 Base Bridge model

New YANG data model for MSTP

Existing data model in IEEE Std 802.1Q, Extended with MSTP new YANG data

uses

/interfaces/interface/bridge-port

-bridge ->
-component ->

…uses mstp:mstp-per-interface-protocol-specific-data

ieee802-dot1q-mstp-bridge.yang

Note : Only the YANG is restructured considering reusability. The resultant YANG tree/functionality is the same as that on page 20 of 802-1Qdy-d2-0.pdf

P802.1Qdy decoupling proposal – MSTP YANG

Resultant YANG tree (IEEE 802.1 Bridge component)

```
module: ieee802-dot1q-mstp-bridge

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?         dot1q-types:priority-type
       +--ro internal-root-path-cost?  uint32
       +--ro root-port-number?         dot1q-types:port-number-type
```

The config / state parameters augmented using ieee802-dot1q-mstp.yang grouping.

P802.1Qdy decoupling proposal – MSTP YANG

Resultant YANG tree (IEEE 802.1 Bridge Port)

```
module: ieee802-dot1q-mstp-bridge

augment /if:interfaces/if:interface/dot1q:bridge-port:
   +--rw port-mstp!
      +--rw mst* [mstid]
      |  +--rw mstid
      |  +--ro msti-port-state?              enumeration
      |  +--ro msti-port-role?               enumeration
      |  +--rw msti-bridge-id-priority?      dot1q-types:priority-type
      |  +--rw msti-internal-port-path-cost?  uint32
      |  +--ro msti-regional-root-id?        uint32
      +--ro msti-internal-root-path-cost?   uint32
      +--ro msti-designated-bridge-id?      uint32
      +--ro msti-designated-port-id?        uint32
```

The config / state parameters augmented using ieee802-dot1q-mstp.yang grouping.

P802.1Qdy decoupling proposal – more details

RSTP

IEEE 802.1Qdy current YANG definition

split

IEEE 802.1 device specific YANG module which uses Base YANG module

Can be reused in other SDOs like BBF

IEEE 802.1 device specific augments YANG definition

Per component RSTP augment

YANG module "ieee802-dot1q-rstp-bridge.yang" :

- augment "/dotq:bridges/dot1q:bridge/dot1q:component" :
  - uses rstp-per-component-protocol-specific-data

uses

Base YANG module – RSTP protocol specific YANG definitions as YANG grouping

Per component RSTP YANG data

YANG module "ieee802-dot1q-rstp.yang" :

- YANG "Grouping" (rstp-per-component-protocol-specific-data) :
  - RSTP YANG configuration/state data which are per component specific.

Per interface RSTP augment

YANG module "ieee802-dot1q-rstp-bridge.yang" :

- augment "/if:interfaces/if:interface/dot1q:bridge-port" :
  - uses rstp-per-interface-protocol-specific-data

uses

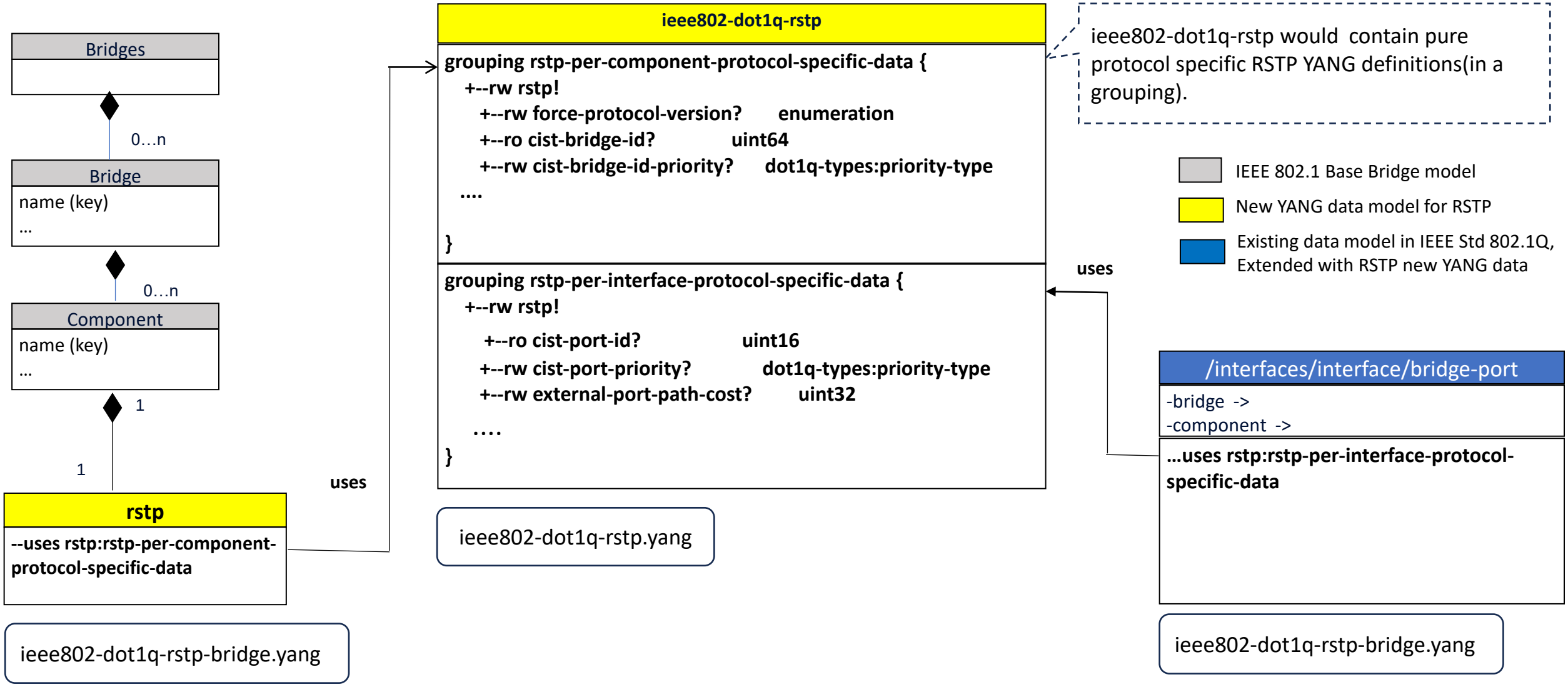
Per interface RSTP YANG data

YANG module "ieee802-dot1q-rstp.yang" :

- YANG "Grouping"(rstp-per-interface-protocol-specific-data) :
  - RSTP YANG configuration/state data which are per interface specific.

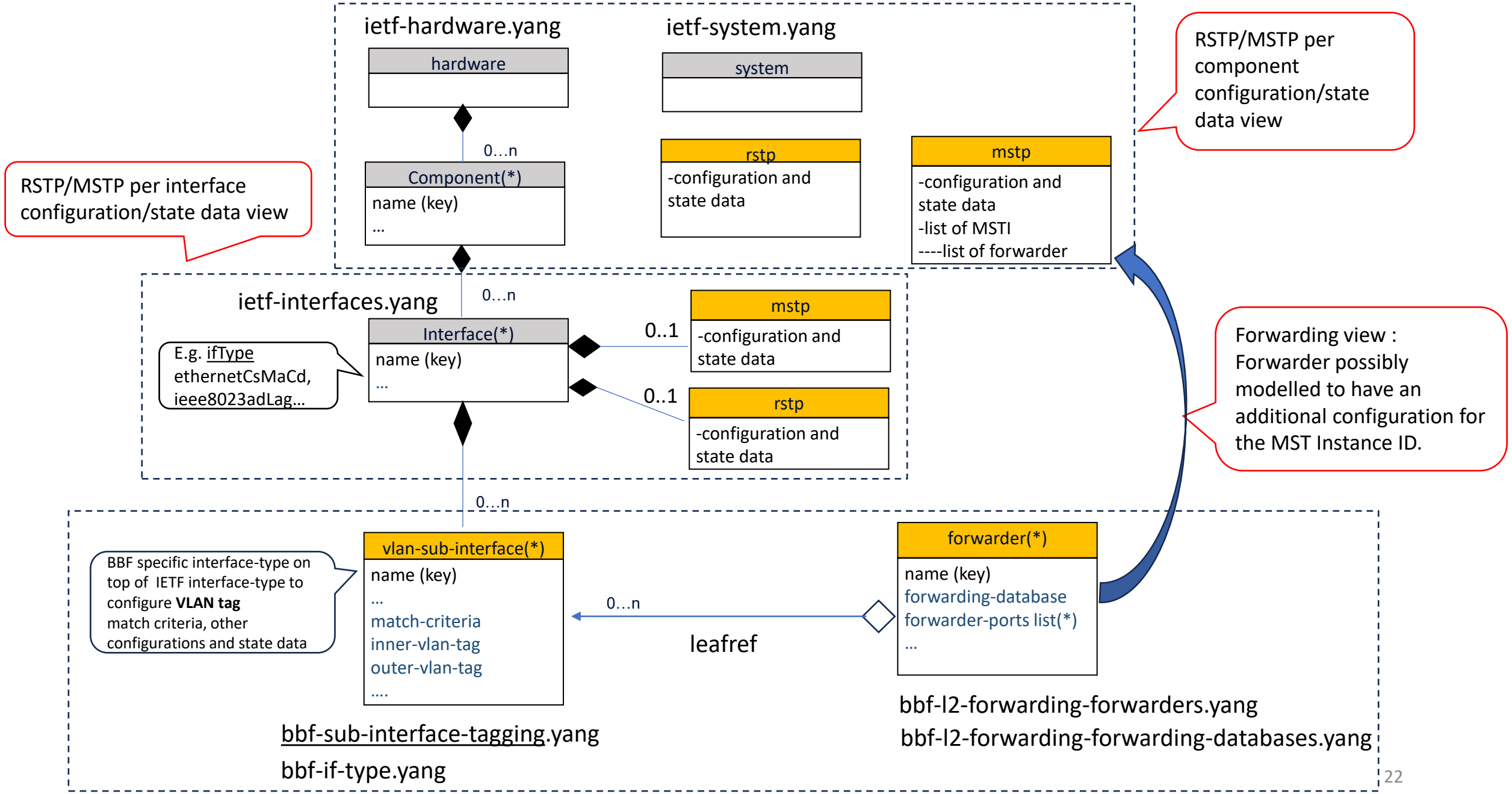
P802.1Qdy decoupling proposal – RSTP YANG

IEEE 802.1 UML-like view



Note : Only the YANG is restructured considering reusability. The resultant YANG tree/functionality is the same as that on page 19 of 802-1Qdy-d2-0.pdf.

BBF Layer-2 Access device : RSTP/MSTP Implementation - possible UML-like view



BBF layer-2 access device : RSTP/MSTP interface augmentation (possible view)

YANG module : bbf-dot1q-mstp

```
augment "/if:interfaces/if:interface" {
  when
    "bbf-dot1q-rstp:rstp and
    derived-from-or-self(if:type, 'ianaift:ieee8023adLag') or
    derived-from-or-self(if:type, 'ianaift:ethernetCsmacd')" {
    description
     "Augments the link aggregation and ethernet interface
     model with MSTP config and state data.";
  }
  description
    "Augment RSTP Bridge Port with MSTP configuration and
    state data.";
  reference
    "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
  uses mstp:mstp-interface-aug-data;
}
```

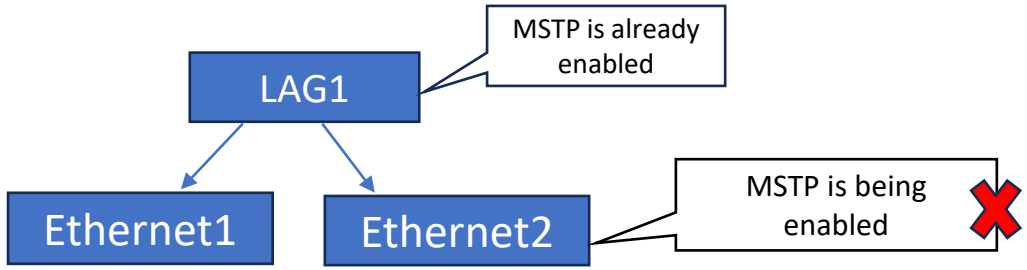
YANG module : bbf-dot1q-rstp

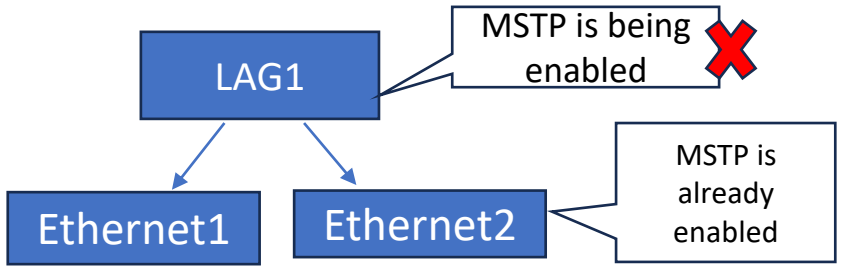
```
augment "/if:interfaces/if:interface" {
  when
    "derived-from-or-self(if:type, 'ianaift:ieee8023adLag') or
    derived-from-or-self(if:type, 'ianaift:ethernetCsmacd')" {
    description
      "Augments the link aggregation and ethernet interface
      model with RSTP config and state data.";
  }
  description
    "Augment ethernet/lag interface with the RSTP configuration
    and state data.";
  reference
    "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
  uses rstp:rstp-interface-aug-data;
}
```

BBF Layer-2 access device could also possibly introduce interface type applicability checks like IEEE Std 802.1Q “ Page 1783 - IETF interface augment clause with the ‘when’ condition for the ‘bridge-port’ container”.

RSTP/MSTP interface augmentation – safe checks

A LAG interface can have more than one ethernet interfaces as member ports.





Scenario1

Step-1 : MSTP configuration applied on LAG1
Member ports : {Ethernet1, Ethernet2}
Step-2 : Trying to apply MSTP configuration on one of its member ports. Example : Ethernet2.

Scenario2

Step-1 : MSTP configuration applied on Ethernet2 which was not part of LAG1.
Step-2 : Trying to associate Ethernet2 interface as member port of LAG1.

✘ Invalid configuration.

When the YANG for 802.1AX is defined, possibility of introducing safe guards could be considered.
Till then or if such a safe guard is not realizable in YANG, then a device implementation would have to take care of such safeguards.

P802.1Qdy – RSTP/MSTP resultant YANG files

YANG modules definition and tree

File name :

“dy-balraj-reusability-across-sdos-yang-0624-v01.zip”

Scope:

- **De-coupling proposal for reusability**

Includes :

ieee802-dot1q-mstp.yang => MSTP Base module
ieee802-dot1q-mstp-bridge.yang => MSTP IEEE 802.1 specific module
ieee802-dot1q-mstp-bridge.tree => MSTP IEEE 802.1 specific module YANG tree
ieee802-dot1q-rstp.yang => RSTP Base module
ieee802-dot1q-rstp-bridge.yang => RSTP IEEE 802.1 specific module
ieee802-dot1q-rstp-bridge.tree => RSTP IEEE 802.1 specific module YANG tree
ieee802-dot1q-bridge.tree => Resultant IEEE 802.1 Bridge Base YANG tree

No change proposed for the IEEE Base YANG file “ieee802-dot1q-bridge.yang”. The ”bridge-mst” container definition considered as such.

Backup slides

P802.1Qdy - existing YANG view

RSTP

```
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
```

Ref : 802-1Qdy-d2-0.pdf, Page 19

VLAN Bridge component and port nodes + RSTP nodes

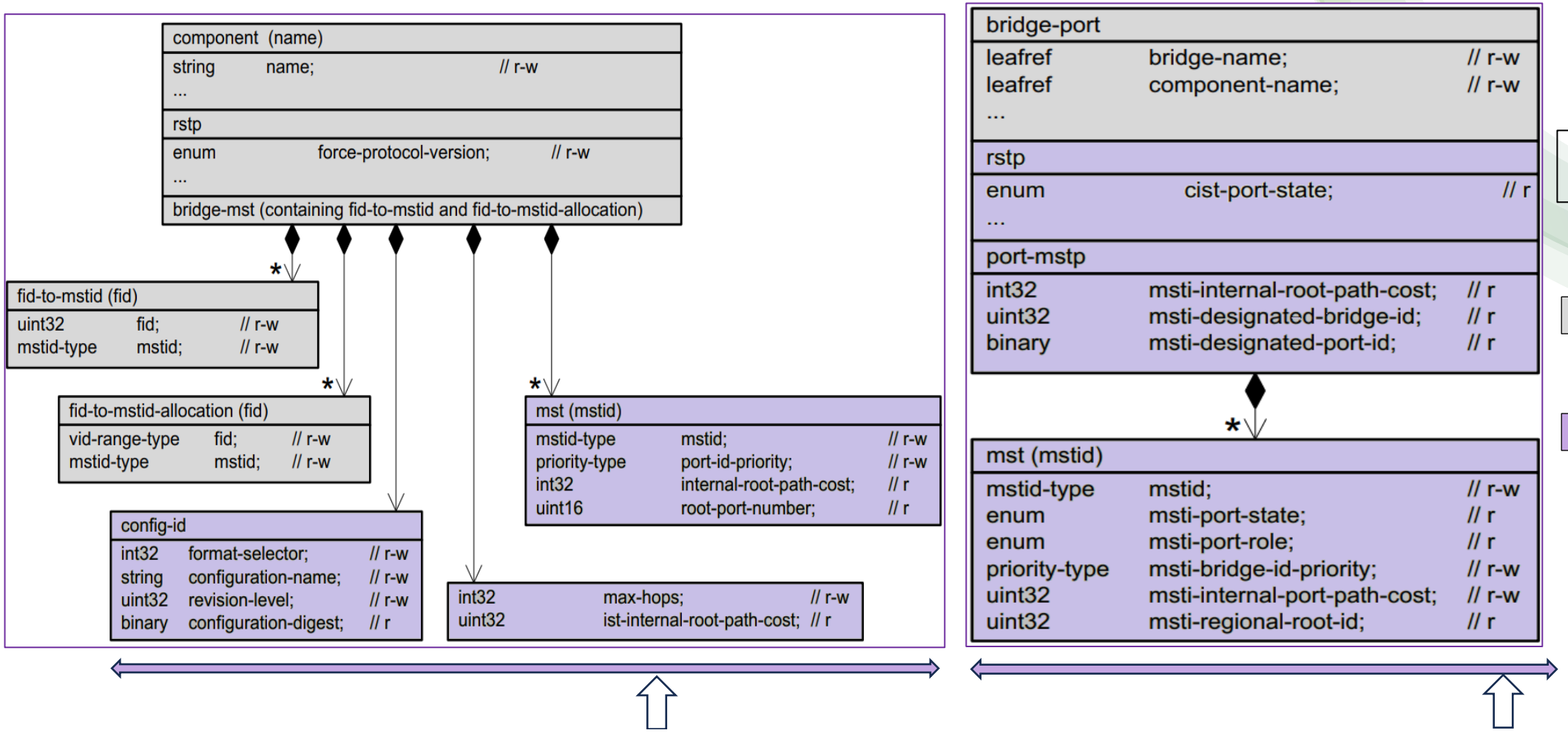
Objects added or augmented by this model

These RSTP protocol specific configuration and state data directly augment "/bridges/bridge/component".
A non-IEEE 802.1 device cannot import this YANG module due to the direct augmentation.

These RSTP protocol specific interface configuration and state data directly augment "/interface/interface/bridge-port".
A non-IEEE 802.1 device cannot import this YANG module due to the direct augmentation.

P802.1Qdy - existing YANG view

MSTP



Ref : 802-1Qdy-d2-0.pdf, **Page 20**

VLAN Bridge component and port nodes + RSTP nodes

Objects added or augmented by this model

These MSTP protocol specific configuration and state data directly augment "/bridges/bridge/component".
A non-IEEE 802.1 device cannot import this YANG module due to the direct augmentation.

These MSTP protocol specific interface configuration and state data directly augment "/interface/interface/bridge-port".
A non-IEEE 802.1 device cannot import this YANG module due to the direct augmentation.

P802.1Qdy decoupling proposal – more details

ieee802-dot1q-mstp.yang

YANG "Grouping" - Group MSTP Protocol specific configurations and state data.

A grouping for MSTP protocol configuration and state data parameters which are component specific.

A grouping for MSTP protocol configuration and state data parameters which are interface specific.

ieee802-dot1q-rstp.yang

YANG "Grouping" - Group RSTP Protocol specific configurations and state data.

A grouping for RSTP protocol configuration and state data parameters which are component specific.

A grouping for RSTP protocol configuration and state data parameters which are interface specific.

ieee802-dot1q-rstp-bridge.yang

Augments IEEE 802.1 Bridge Component/Bridge-port with RSTP YANG definitions from ieee802-dot1q-rstp.yang.

ieee802-dot1q-mstp-bridge.yang

Augments IEEE 802.1 Bridge Component/Bridge-port with MSTP YANG definitions from ieee802-dot1q-mstp.yang.

P802.1Qdy decoupling proposal – MSTP YANG

Base YANG module view

```
module ieee802-dot1q-mstp {
  .....
  .....
  grouping mstp-per-component-protocol-specific-data {

    description
      "Grouping for MSTP configuration and state data";
    ......
    ......

  }// End of grouping mstp-per-component-protocol-specific-data


  grouping mstp-per-interface-protocol-specific-data {

    description
      "Grouping for MSTP configuration and state data augment under the interface";
    ......
    ......

  }// End of grouping mstp-per-interface-protocol-specific-data

}
```

P802.1Qdy decoupling proposal – MSTP YANG

Augmenting Bridge component/Bridge port with MSTP YANG objects

```
module ieee802-dot1q-mstp-bridge {

 augment "/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-mst" {
    when "../dot1q-rstp:rstp";
    description
      "Augment RSTP-capable Bridge component with MSTP configuration and
       management.";
    reference
      "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
    uses mstp:mstp-per-component-protocol-specific-data;
 }

 augment "/if:interfaces/if:interface/dot1q:bridge-port" {
    when “dot1q-rstp:rstp";
    description
      "Augment RSTP Bridge Port with MSTP configuration";
    reference
      "13.24, 13.25, and 13.27 of IEEE Std 802.1Q.";
    uses mstp:mstp-per-interface-protocol-specific-data;
 }
}
```

P802.1Qdy decoupling proposal – RSTP YANG

Resultant YANG tree (IEEE 802.1 Bridge component)

module: ieee802-dot1q-rstp-bridge

```
augment /dot1q:bridges/dot1q:bridge/dot1q:component:
  +--rw rstp!
     +--rw force-protocol-version?       enumeration
     +--ro cist-bridge-id?               uint64
     +--rw cist-bridge-id-priority?      dot1q-types:priority-type
     +--ro cist-root-id?                 uint64
     +--ro external-root-path-cost?      uint32
     +--ro cist-root-port-number?        dot1q-types: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
```

The config / state parameters augmented from ieee802-dot1q-rstp.yang grouping.

P802.1Qdy decoupling proposal – RSTP YANG

Resultant YANG tree (IEEE 802.1 Bridge Port)

module: ieee802-dot1q-rstp-bridge

```
augment /if:interfaces/if:interface/dot1q:bridge-port:
  +--rw 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?           dot1q-types:priority-type
     +--rw external-port-path-cost?      uint32
     +--ro cist-root-id?                 uint32
     +--ro cist-external-path-cost?      uint32
     +--ro designated-bridge-id?         uint32
     +--ro designated-port-id?           binary
     +--rw port-protocol-migration-check?  boolean
     +--rw admin-edge-port?              boolean
     +--ro oper-edge-port?               boolean
     +--rw auto-edge-port?               boolean
     +--rw auto-isolate-port?            boolean
     +--ro isolate-port?                 boolean
```

The config / state parameters augmented from ieee802-dot1q-rstp.yang grouping.

P802.1Qdy decoupling proposal – RSTP YANG

Base YANG module view

```
module ieee802-dot1q-rstp {
  .....
  .....
  grouping rstp-per-component-protocol-specific-data {

    description
      "Grouping for RSTP configuration and state data";
    ......
    ......

  }// End of grouping rstp-per-component-protocol-specific-data


  grouping rstp-per-interface-protocol-specific-data {

    description
      "Grouping for RSTP configuration and state data augment under the interface";
    ......
    ......

  }// End of grouping rstp-per-interface-protocol-specific-data

}
```

P802.1Qdy decoupling proposal – RSTP YANG

Augmenting Bridge component/Bridge port with RSTP YANG objects

```
module ieee802-dot1q-rstp-bridge {

 augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
    description
      "Augment RSTP configuration and state data.";
    reference
      "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
    uses rstp:rstp-per-component-protocol-specific-data;
  }

  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.";
    uses rstp:rstp-per-interface-protocol-specific-data;
  }
}
```

MSTP Topology