

P802.1Qdy - RSTP/MSTP YANG – Reusability across SDOs
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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.
- Highlights some inconsistencies in the data that could arise and possible solution.

The problem (RSTP)

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;
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24 augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
25   description
26     "Augment Bridge with RSTP configuration.";
27   reference
28     "13.24, 13.25, and 13.26 of IEEE Std 802.1Q.";
29   container rstp {
30     presence "The presence of this container indicates that RSTP is supported";
31   }
32 }
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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)

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;

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.";

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";
```

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

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.

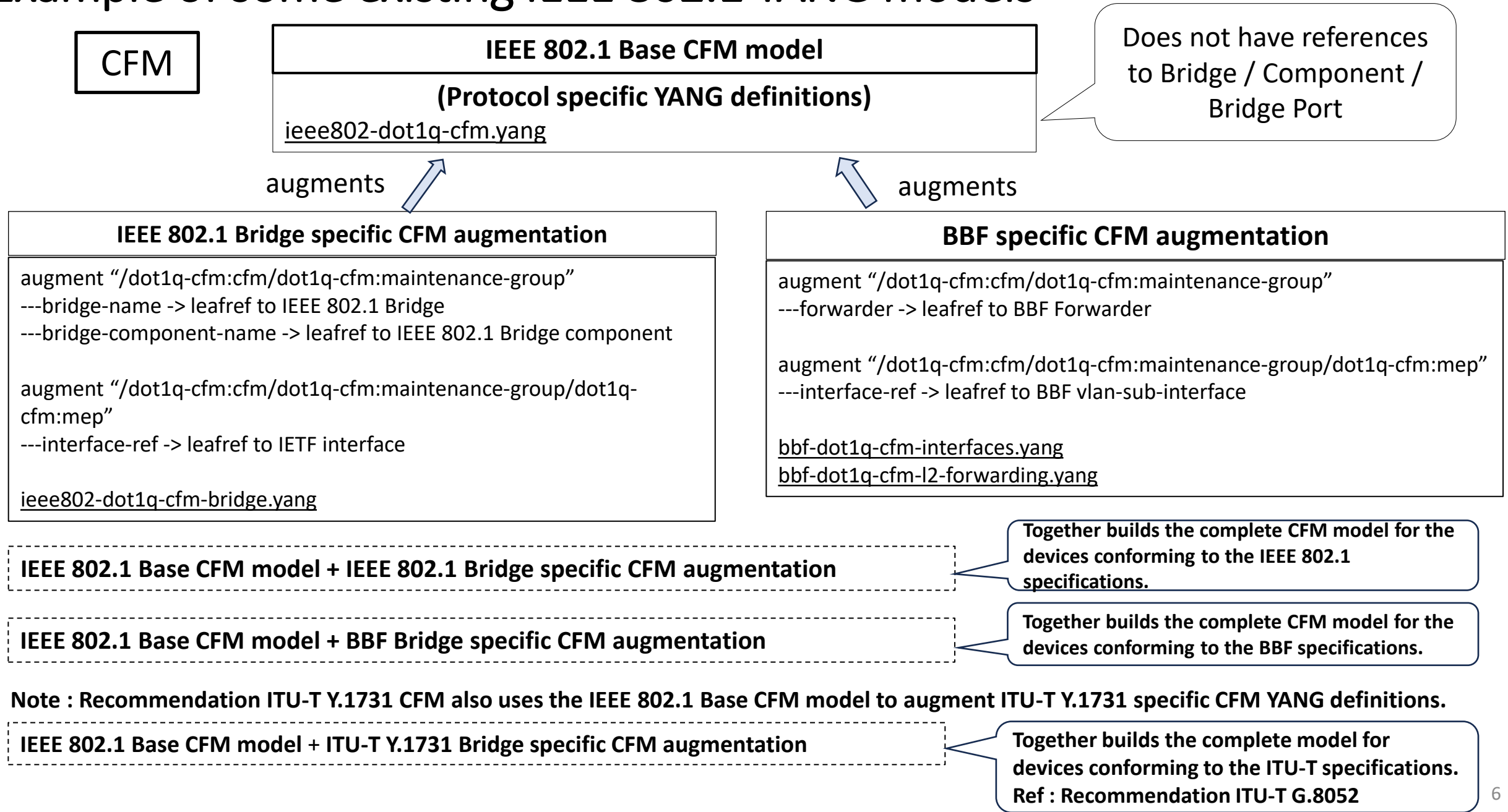
- Split the YANG module into two modules. The Base YANG module would contain the protocol specific YANG definitions and an IEEE 802.1 specific module would augment this base module and contain the “augment” clauses.
- Other SDOs like BBF could then use just the Base YANG module.

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



Example of some existing IEEE 802.1 YANG Models

PSFP

The IEEE 802.1 Bridge specific YANG module has a “uses” statement that augments the “Component” with the “grouping” from the base module

PSFP common reusable YANG definitions

ieee802-dot1q-psfp.yang

Does not have references to Bridge / Component / Bridge Port

The base YANG module uses the “grouping” statement

uses

uses

IEEE 802.1 Bridge specific augmentation

ieee802-dot1q-psfp-bridge.yang

```
augment "/dot1q:bridges/dot1q:bridge/dot1q:component {  
  uses psfp:psfp-parameters  
}
```

Other SDO specific augmentation

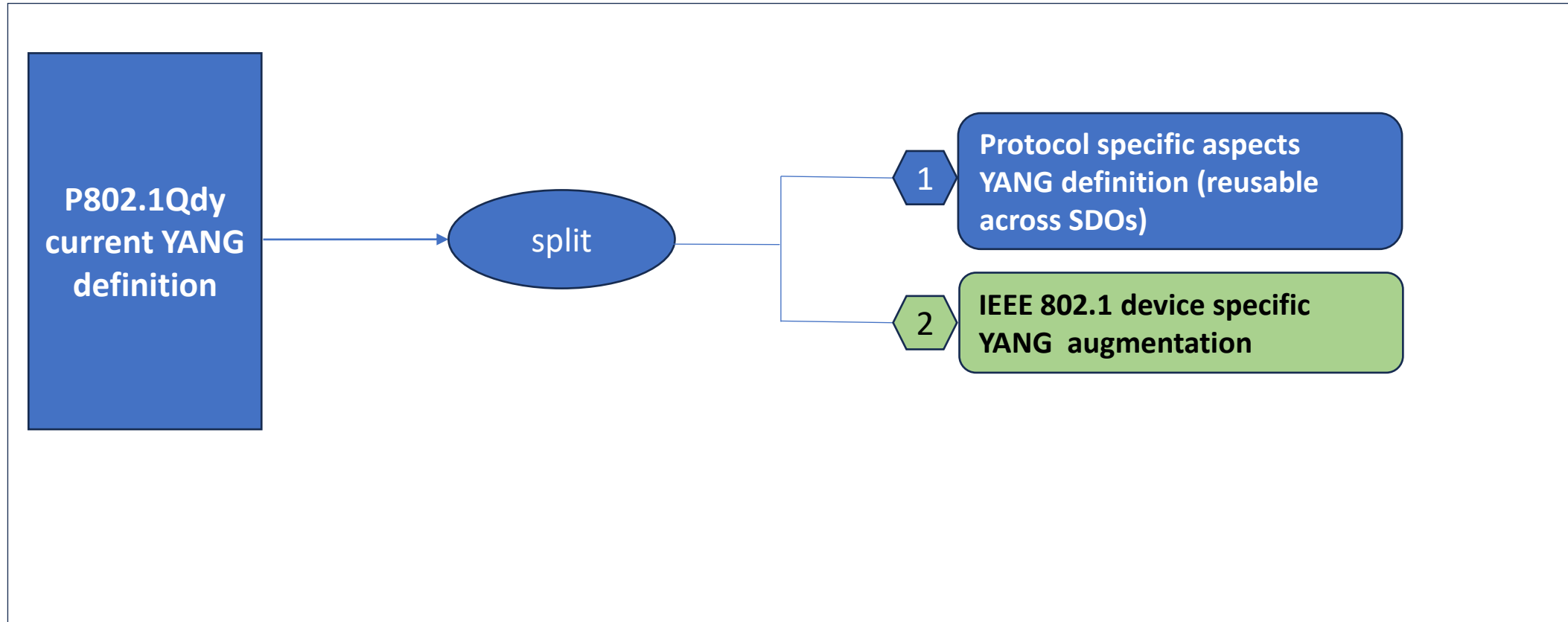
Other SDOs like BBF could also utilize the “uses” statement to include the “grouping”

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

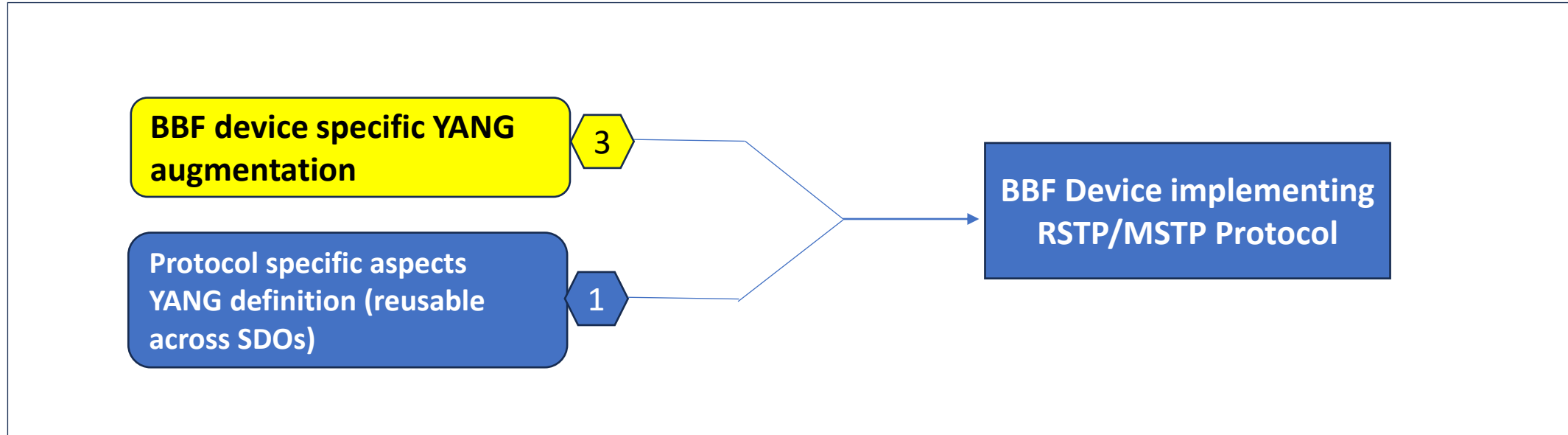
Implementation in a device conforming to IEEE 802.1 specifications



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 :  & 

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

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

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

uses

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 augment

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

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

uses

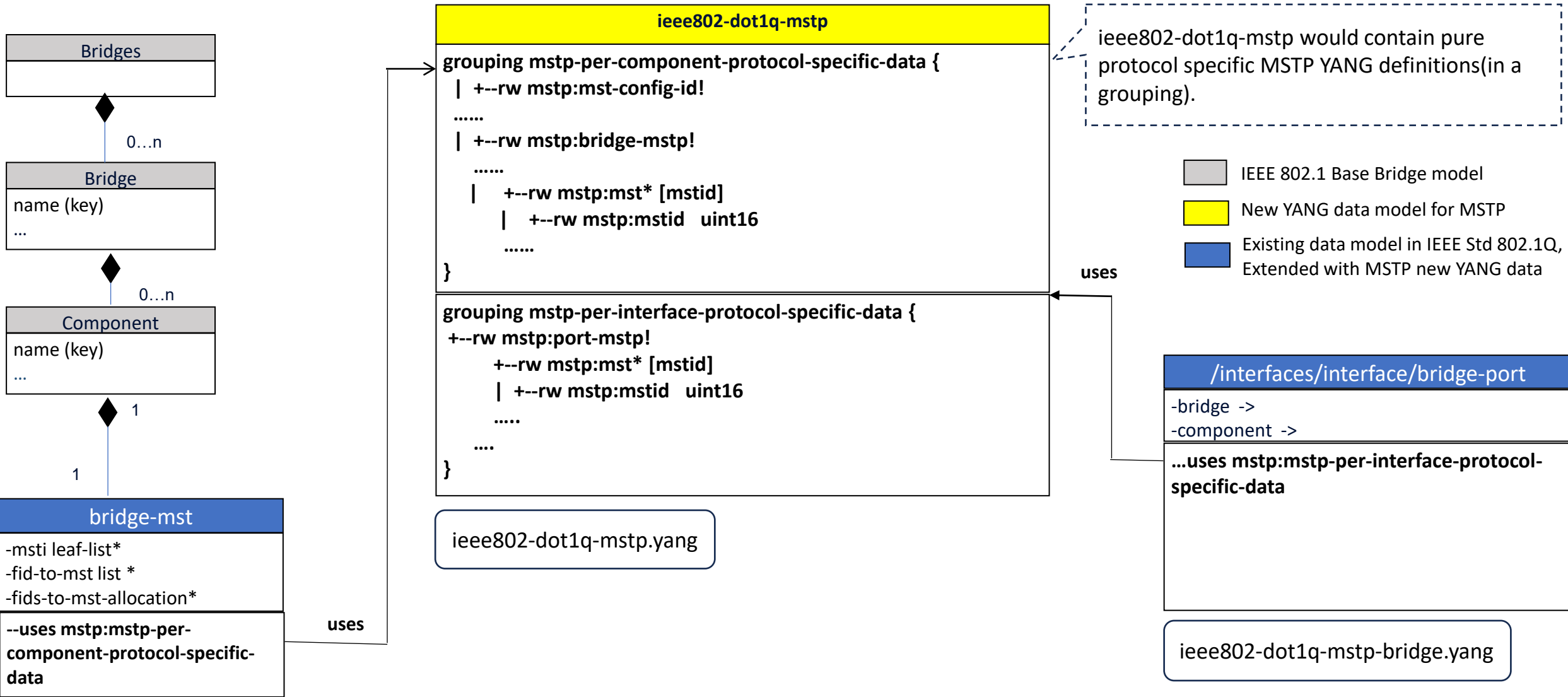
Per interface MSTP YANG data

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



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

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

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.

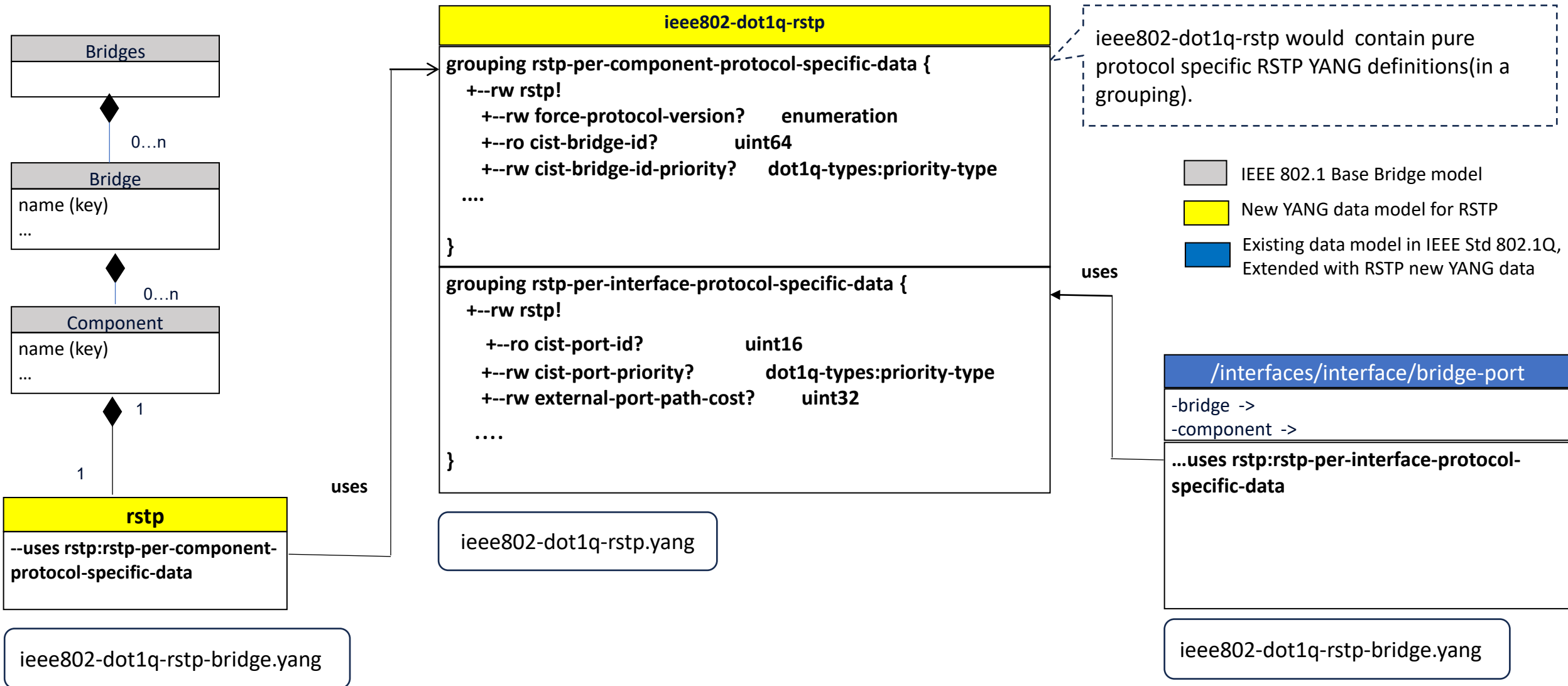
Per interface RSTP YANG data

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



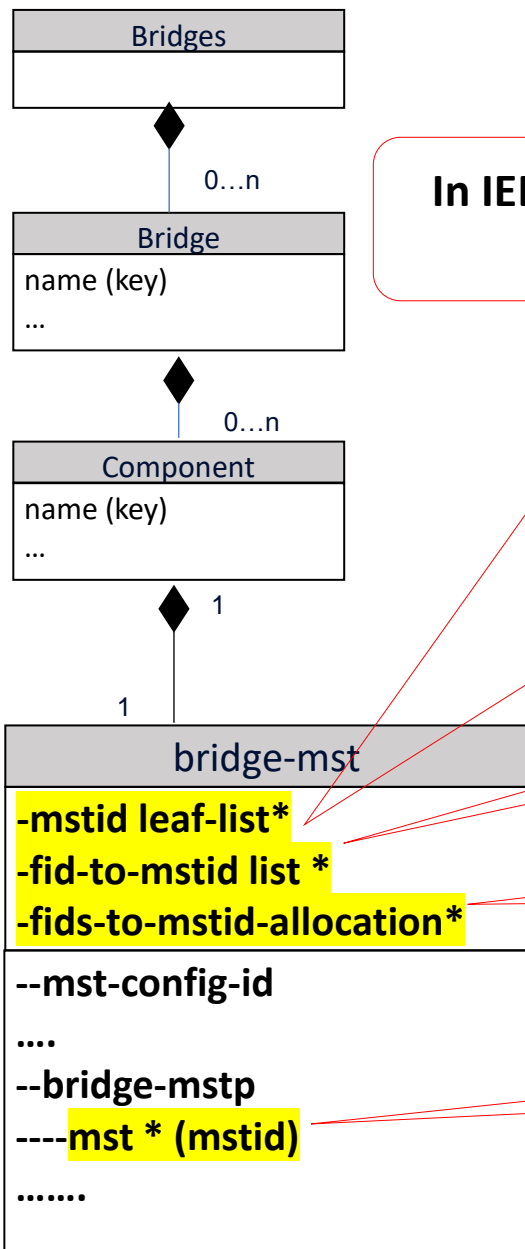
Note : Only the YANG is restructured considering reusability. The resultant YANG tree/functionality is the same as that on page 19 of [802-1Qdy-d2-0.pdf](#).

Some observations on configuration/data consistency

- By using the YANG definitions for MSTP specified/proposed across IEEE P802.1Q-2022-REV and P802.1Qdy, there exists possibilities of the resultant configuration being inconsistent.
- Value(s) for one (set of) YANG object(s) could differ from another (set of) YANG object(s) that are otherwise supposed to have the same value(s).
- Even if the values are same/aligned between the different YANG objects, it would still mean that there are redundant objects in the YANG tree , i.e. two or more XPATHS pointing to essentially the same configuration.
- Details are explained in subsequent slides.

Some observations on configuration/data consistency

Possible inconsistencies



In IEEE P802.1Q-2022-REV , a container “bridge-mst” is defined with an object “mstid” which is a leaflist (/bridges/bridge/component/bridge-mst/mstid)

In IEEE P802.1Q-2022-REV, a container “bridge-mst” is defined which has a list “fid-to-mstid” that also has an object mstid /bridges/bridge/component/bridge-mst/fid-to-mstid/mstid

In IEEE P802.1Q-2022-REV, a container “bridge-mst” is defined which has a list “fid-to-mstid-allocation” that also has an object mstid /bridges/bridge/component/bridge-mst/fid-to-mstid-allocation/mstid

In P802.1Qdy, another list for the mst instance is introduced (/bridges/bridge/component/bridge-mst/bridge-mstp/mst)

Since all the above objects refer to the same MST Instance ID, there could be a different set of values in each of these lists

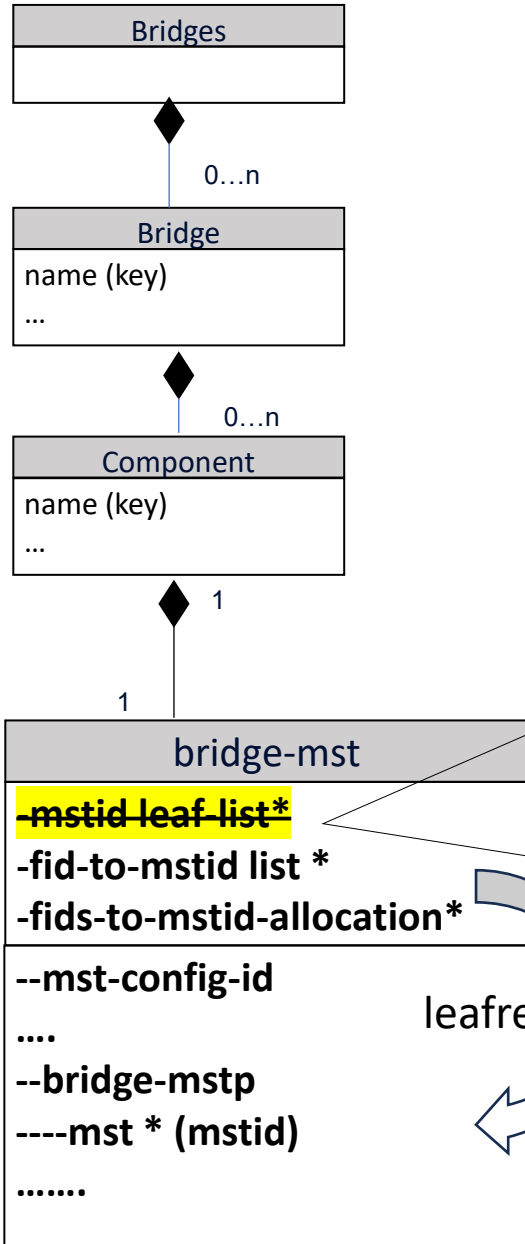
Some observations on configuration/data consistency

Possible inconsistencies

XPATHS	Example configured values (mstid)
<code>(leaf-list) /bridges/bridge/component/bridge-mst/mstid</code>	{100, 101, 102, 103}
<code>(list) /bridges/bridge/component/bridge-mst/fid-to-mstid {fid, mstid}</code>	{1, 100}, {2, 109}, {3, 103}
<code>(list) /bridges/bridge/component/bridge-mst/fids-to-mstid-allocation {fids, mstid}</code>	{500, 110}, {501, 100}, {502, 111}
<code>(list) /bridges/bridge/component/bridge-mst/bridge-mstp/mst {mstid, config/state parameters}</code>	{100, 200}
Highlighted in RED are misconfigurations w.r.t <code>/bridges/bridge/component/bridge-mst/mstid</code> leaf-list configuration	

Some observations on configuration/data consistency

Possible solution



Avoiding inconsistent configuration and/or redundant data may require modifying the YANG objects specified in IEEE Std 802.1Q-2022 under “/bridges/bridge/component/bridge-mst”.

- Would it be acceptable to remove the “mstid” leaf-list from IEEE Std 802.1Q ?
- The list /bridges/bridge/component/bridge-mst/bridge-mstp/mst proposed as part of P802.1Qdy should be sufficient to configure the MST instances. This list would be the main list/configuration for the set of MST instances in each Bridge component.
- If there is a need to refer/specify the “mstid” anywhere else in the YANG tree, a “leafref” type could be used.
- E.g. In the two lists “fid-to-mstid” and “fid-to-mstid-allocation”, the definition of “leaf mstid” could be changed from “type dot1qtypes:mstid-type” to “type leafref”.
- Also, these two lists would need to be moved to the newly proposed IEEE 802.1 specific YANG module “ieee802-dot1q-mstp-bridge” (since these would need to be augmented to Bridge-component).

Some observations on configuration/data consistency

Possible solution

Module ieee802-dot1q-bridge

```
leaf-list mstid {  
  type dot1qtypes:mstid type;  
  description  
    "The list of MSTID values that are currently supported by the  
    Bridge";  
}
```

Remove the "mstid" leaf-list
from IEEE Std 802.1Q

Some observations on configuration/data consistency

Possible solution

Module ieee802-dot1q-bridge

```
list fid-to-mstid {
  key "fid";
  description
    "The FID to MSTID allocation table.";
  reference
    "12.12.2 of IEEE Std 802.1Q";
  leaf fid {
    type uint32;
    description
      "The Filtering Database identifier.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
  leaf mstid {
    type dot1qtypes:mstid-type;
    description
      "The MSTID to which the FID is to be allocated.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
}
```

Change the type of "mstid"
in list "fid-to-mstid"

Module ieee802-dot1q-bridge

```
list fid-to-mstid {
  key "fid";
  description
    "The FID to MSTID allocation table.";
  reference
    "12.12.2 of IEEE Std 802.1Q";
  leaf fid {
    type uint32;
    description
      "The Filtering Database identifier.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
  leaf mstid {
    type leafref { path '../dot1q-mstp:bridge-
      mstp/dot1q-mstp:mst/dot1q-mstp:mstid'; }
    description
      "The MSTID to which the FID is to be allocated.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
}
```

Some observations on Configuration/Data consistency

Possible Solution

Module ieee802-dot1q-bridge

```
list fid-to-mstid-allocation {
  key "fids";
  description
    "The FID to MSTID allocation table";
  leaf fids {
    type dot1qtypes:vid-range-type;
    description
      "Range of FIDs.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
  leaf mstid {
    type dot1qtypes:mstid-type;
    description
      "The MSTID to which the FID is allocated.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
}
```

Change the type of "mstid"
in list "fid-to-mstid-
allocation"

Module ieee802-dot1q-bridge

```
list fid-to-mstid-allocation {
  key "fids";
  description
    "The FID to MSTID allocation table";
  leaf fids {
    type dot1qtypes:vid-range-type;
    description
      "Range of FIDs.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
  leaf mstid {
    type leafref { path '.././dot1q-mstp:bridge-mstp/dot1q-
      mstp:mst/dot1q-mstp:mstid'; }
    description
      "The MSTID to which the FID is allocated.";
    reference
      "12.12.2 of IEEE Std 802.1Q";
  }
}
```

Example of an existing IEEE 802.1 CFM YANG approach preventing configuration/data inconsistency

Module `ieee802-dot1q-cfm`

```
container cfm {  
  ....  
  list maintenance-domain {  
    key "md-id";  
    .....  
    list maintenance-association {  
      key "ma-id";  
      ...  
      list maintenance-association-mep {  
        key mep-id;  
        .....  
      }  
    }  
  }  
  list maintenance-group {  
    key "maintenance-group-id";  
    ....  
    leaf md-id {  
      type leafref { path '/cfm/maintenance-domain/md-id';  
    }  
  }  
  leaf ma-id {  
    type leafref {  
      path '/cfm'  
        + '/maintenance-domain[md-id = current()/../md-id]/maintenance-association/ma-id';  
    }  
  }  
  list mep {  
    key "mep-id";  
    leaf mep-id {  
      type leafref {  
        path '/cfm/maintenance-domain[md-id = current()/../md-id]'  
          + '/maintenance-association[ma-id = current()/../ma-id]/maintenance-association-mep/mep-id';  
      }  
    }  
  }  
  ....  
}
```

Ref : [ieee802-dot1q-cfm.yang](#)

The CFM list (`/cfm/maintenance-group/mep/mep-id`) for the local MEP configuration refers the main list (`/cfm/maintenance-domain/maintenance-association/maintenance-association-mep/mep-id`) using **leafref** YANG type.

By using YANG leafref type approach, configuration/data inconsistency problem avoided between the main list and the local MEP configuration list.

Similarly,

- the “md-id” leaf configuration in the “maintenance-group” also defined with **leafref** YANG type to the main list “`/cfm/maintenance-domain/md-id`”.
- the “ma-id” leaf configuration in the “maintenance-group” also defined with **leafref** YANG type to the main list “`/cfm/maintenance-domain/maintenance-association/ma-id`”.

leafref

Some observations on configuration/data consistency

Possible solution

- If the lists “fid-to-mstid” and “fid-to-mstid-allocation” are updated, then these need to be placed in the IEEE 802.1 specific YANG module that has been proposed “ieee802-dot1q-mstp-bridge”, since these are linked to Bridge-component that may not be used by other SDOs.
- We could also decide to not disturb the existing objects “leaf-list mstid”, list “fid-to-mstid” and list “fid-to-mstid-allocation” and leave it to equipment vendors or even service provides / operators to ensure that an actual device configuration does not have inconsistencies.
- But it may be preferable to have the consistency checks inherent in the YANG model.

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.

YANG modules definition and tree

File name :

“dy-balraj-reusability-across-sdos-yang-without-inconsistencies-0624.v01.zip”

Scope:

- **De-coupling proposal for reusability**
- **Solution for avoiding configuration inconsistency**

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.yang => IEEE 802.1 Bridge Base model.
Container “bridge-mst” removed from this module and redefined in ieee802-dot1q-mstp-bridge.yang module.
ieee802-dot1q-bridge.tree => Resultant IEEE 802.1 Bridge Base YANG tree

Backup slides

P802.1Qdy - existing YANG view

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



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.


RSTP


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



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.

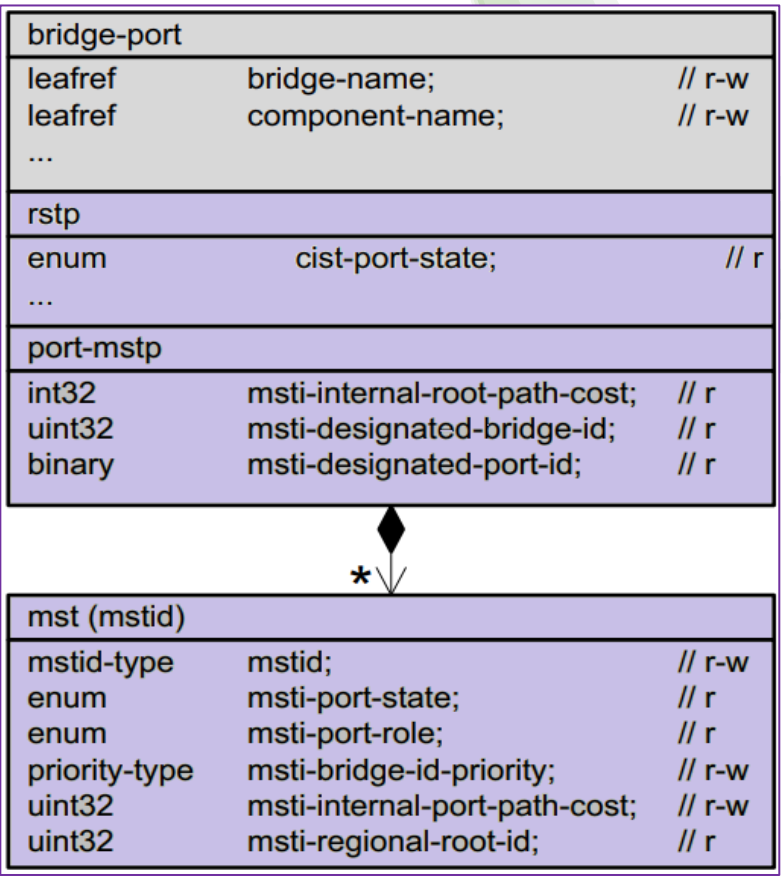
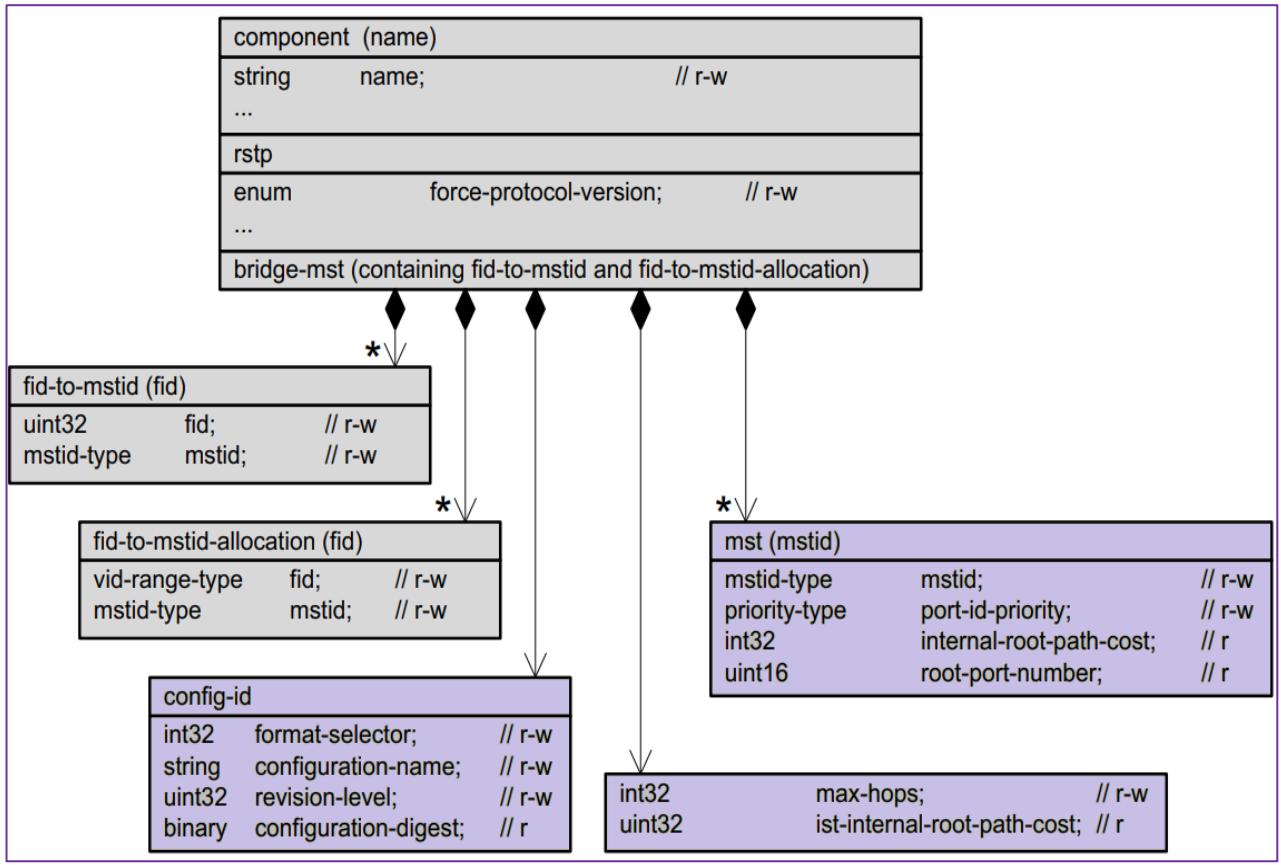
Ref : [802-1Qdy-d2-0.pdf](#),
 Page 19

 VLAN Bridge component and port nodes + RSTP nodes

 Objects added or augmented by this model

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;  
  }  
}
```