IEEE 802.1Qcx (CFM) Data Model Overview

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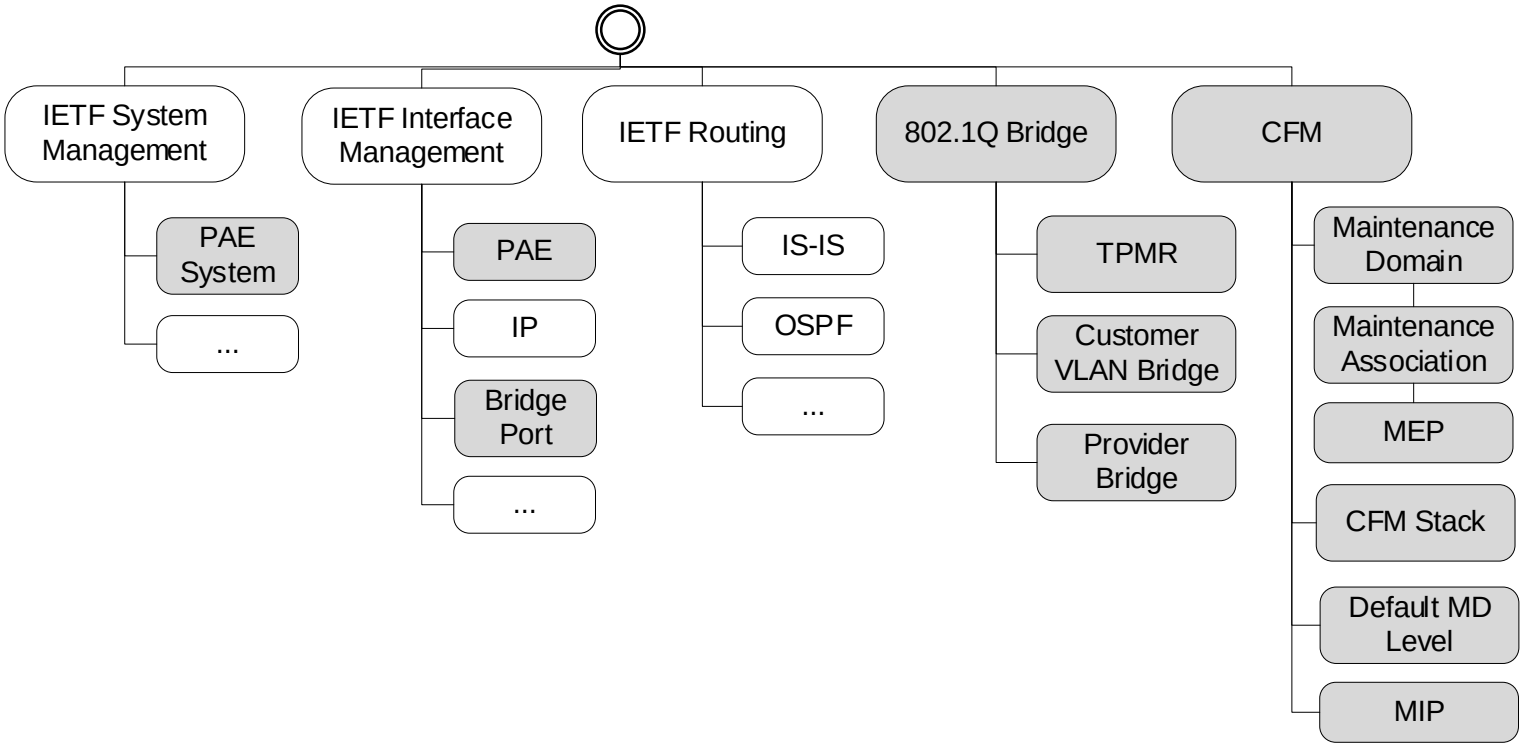
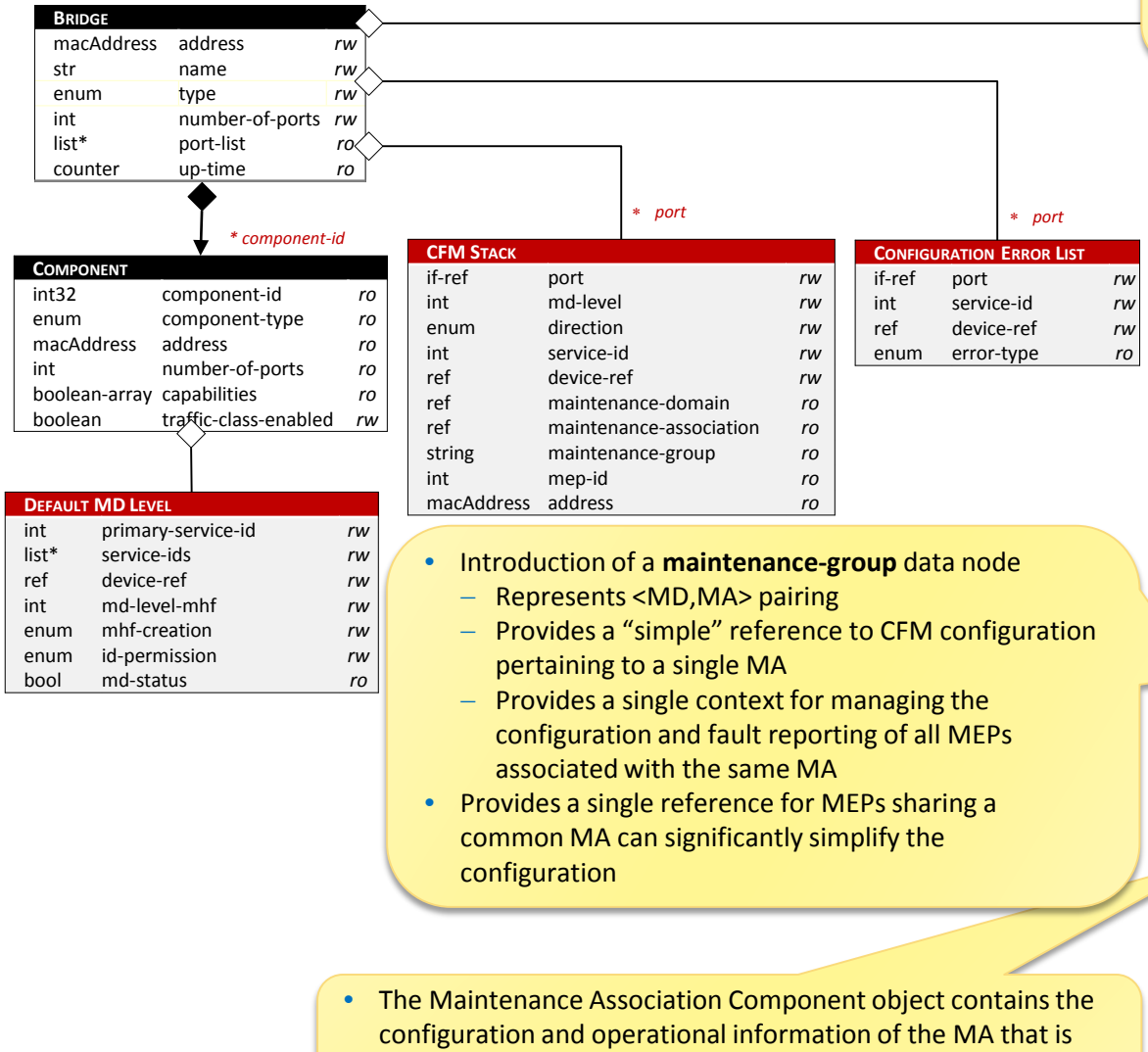
YANG Model Relationships

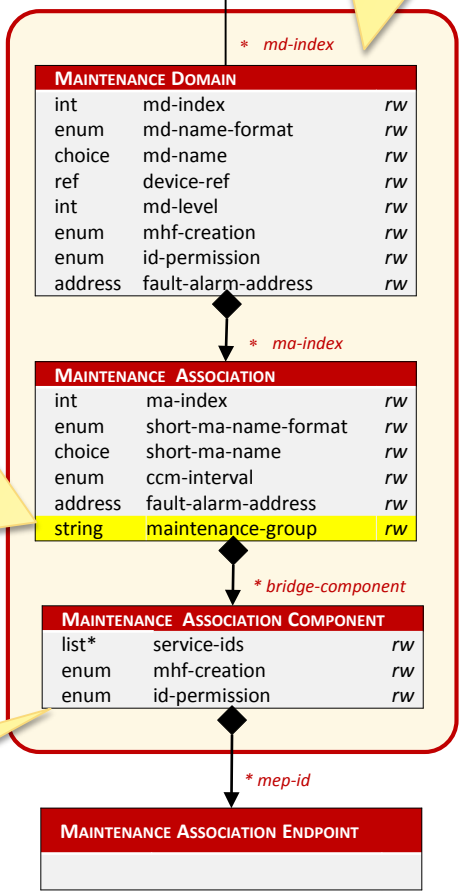
- IEEE 802.1 (P802.1Qcx) CFM related data model objects will be on its own branch of the hierarchy
  - Facilitates utilization of CFM on devices inclusive of 802.1Q Bridges



IEEE 802.1Qcx Model

Bridge/Component to CFM Relationships





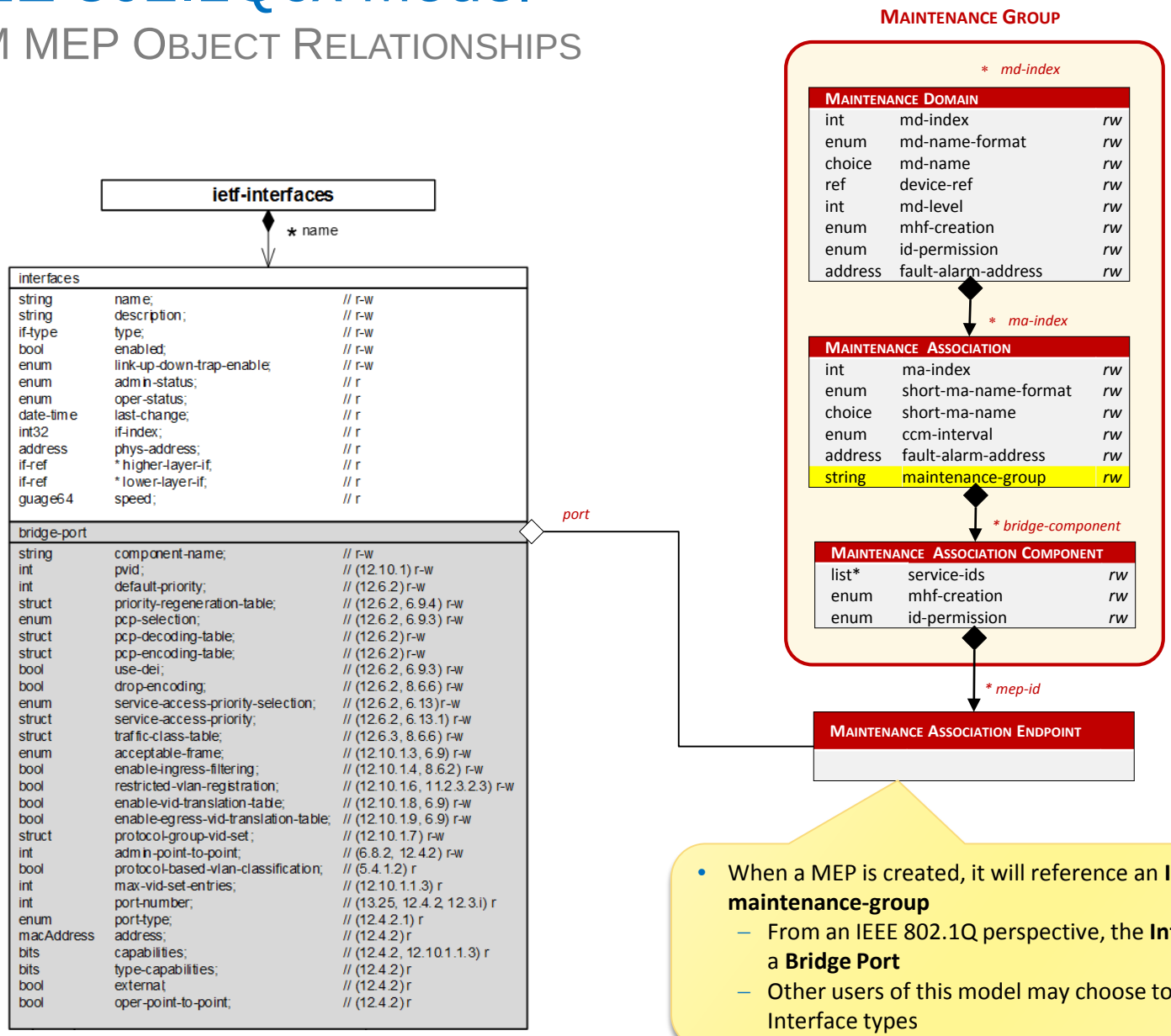
- For ITU-T SG15 Y.1731 modeling,
  - MEG-ID can be supported by setting the **md-name-format** to '*none*', the **ma-name-format** to '*icc-format*', and then fill in the **ma-name** with the *MEG ID value*.

- Introduction of a **maintenance-group** data node
  - Represents <MD,MA> pairing
  - Provides a "simple" reference to CFM configuration pertaining to a single MA
  - Provides a single context for managing the configuration and fault reporting of all MEPs associated with the same MA
- Provides a single reference for MEPs sharing a common MA can significantly simplify the configuration

- The Maintenance Association Component object contains the configuration and operational information of the MA that is variable across Bridges (or across components within a Bridge) within the MD.

IEEE 802.1Qcx Model

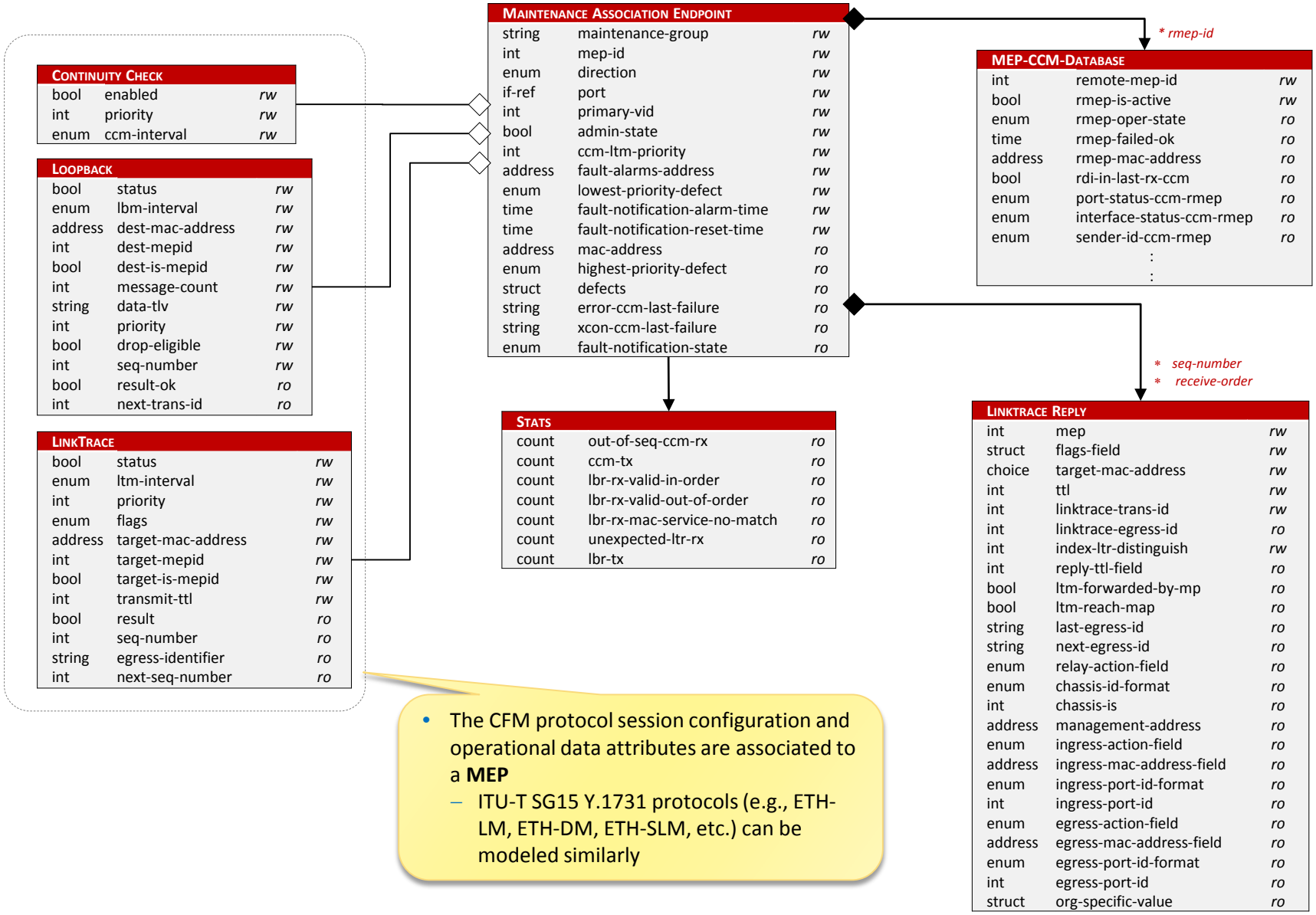
CFM MEP Object Relationships



- When a MEP is created, it will reference an **Interface** and a **maintenance-group**
  - From an IEEE 802.1Q perspective, the **Interface** would be a **Bridge Port**
  - Other users of this model may choose to use different Interface types

IEEE 802.1Qcx Model

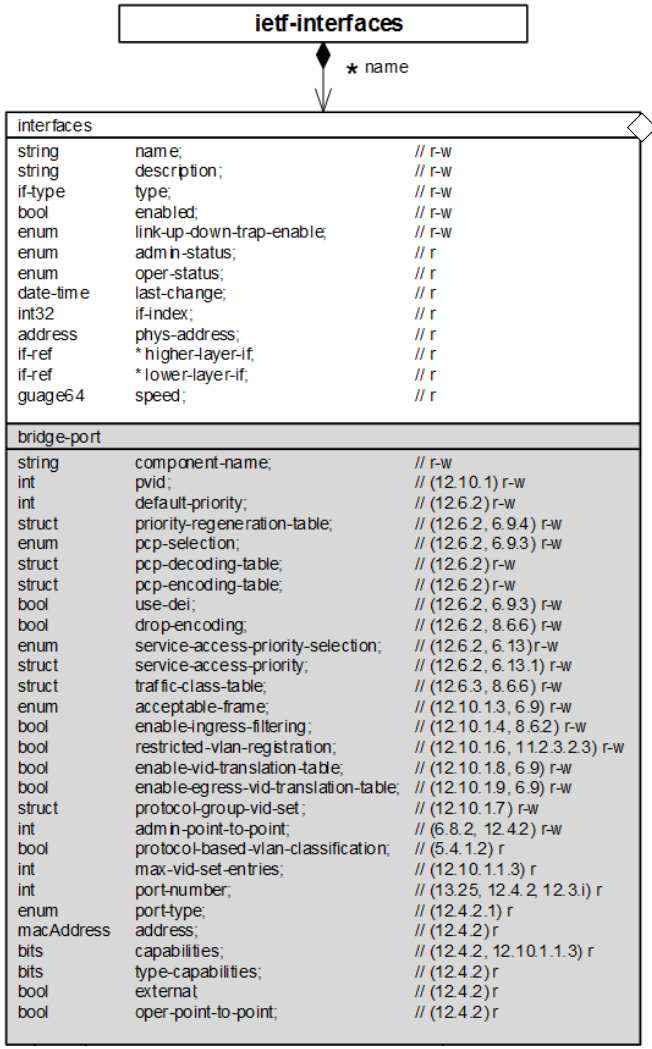
CFM MEP Object Relationships



- The CFM protocol session configuration and operational data attributes are associated to a **MEP**
  - ITU-T SG15 Y.1731 protocols (e.g., ETH-LM, ETH-DM, ETH-SLM, etc.) can be modeled similarly

IEEE 802.1Qcx Model

CFM MIP Object Relationships



- OPTIONAL:
  - We can support an "**explicit**" MIP creation model
  - The **MIP** is associated with an **Interface** (e.g., **Bridge Port**)
  - This mode is not an uncommon configuration practice within the industry

IEEE 802.1Qcx Model

CFM Transmit Commands and Notifications

Transmit-Loopback-Message and **Transmit-Linktrace-Message** commands can (also) be implemented by RPCs (Remote Procedure Calls)

Transmit-Loopback()		
string	maintenance-group	*rw*
int	mep-id	*rw*
enum	interval	*rw*
choice	target-address	*rw*
int	lbm-tx-number	*rw*
str	data	*rw*
bool	data-tlv	*rw*
int	priority	*rw*
int	dei	*rw*
bool	lbm-result-ok	*ro*
int	loopback-trans-id	*ro*

Transmit-Linktrace()		
string	maintenance-group	*rw*
int	mep-id	*rw*
enum	interval	*rw*
choice	target-address	*rw*
int	ltm-flags	*rw*
str	ltm-ttl	*rw*
bool	ltm-result-ok	*ro*
int	ltm-seq-number	*ro*
string	ltm-egress-identifier	*ro*

Notification (Traps/Alarms) for **MEP Fault Alarm**

MEP Fault Alarm	
string	maintenance-group
enum	md-name-format
choice	md-name
enum	ma-name-format
choice	ma-name
int	mep-id
enum	mep-priority-defect

NOTE: There is much detail missing from the configuration example. The intent is to illustrate the flow of the configuration steps based upon the current proposed model structure.

Configuration Examples

XML Representation

Example Customer VLAN Bridge Configuration

- Configuration example of a **Customer VLAN Bridge** with two bridge ports

1

```
<bridges xc:operation="create">
  <bridge>
    <name>my-bridge</name>
    <address>01-12-23-34-45-AF</address>
    <bridge-type>customer-vlan-bridge</bridge-type>
    <component>
      <name>my-component</name>
      <id>1</id>
      <type>c-vlan-component</type>
      <address>01-12-23-34-45-56</address>
    </component>
    <bridge-vlan>
      <vlan>
        <vid>1001</vid>
        <name>vid1001</name>
      </vlan>
    </bridge-vlan>
  </bridge>
</bridges>
```

a) Bridge and associated C-VLAN Component created as a result of configuration

b) Configure VLANs supported by the Bridge

Example Customer VLAN Bridge Configuration

2

```
<interfaces xc:operation="create">
  <interface>
    <name>port-1</name>
    <type>ethernetCsmacd</type>
    <bridge-port>
      <component-name>my-component</component-name>
      <port-type>cvlan-bridge-port</port-type>
    </bridge-port>
  </interface>
  <interface>
    <name>port-2</name>
    <type>ethernetCsmacd</type>
    <bridge-port>
      <component-name>my-component</component-name>
      <port-type>cvlan-bridge-port</port-type>
    </bridge-port>
  </interface>
</interfaces>
```

c) CVLAN Bridge Ports are created and associated with the C-VLAN Component

Example MEG ID Configuration

- Configuration example of a **Maintenance Entity Group ID (MEGID)** associated with a Bridge (*my-bridge*)

3

```
<cfm xc:operation="create">
  <bridge>my-bridge</bridge>
  <maintenance-domains>
    <maintenance-domain>
      <index>1</index>
      <name-format>none</name-format>
      <md-level>4</md-level>
      <maintenance-association>
        <index>1</index>
        <name-format>icc-format</name-format>
        <name>my-meg-id-val</name>
        <maintenance-group>maintenance-group-1</maintenance-group>
      </maintenance-association>
    </maintenance-domain>
  </maintenance-domains>
</cfm>
```

Example MAID Configuration

- Configuration example of a **Maintenance Association ID (MAID)** associated with a Bridge (*my-bridge*)

4

```
<cfm xc:operation="create">
  <maintenance-domains>
    <maintenance-domain>
      <index>2</index>
      <name-format>char-string</name-format>
      <name>my-domain</name>
      <md-level>4</md-level>
      <maintenance-association>
        <index>2</index>
        <name-format>char-string</name-format>
        <name>my-association</name>
        <maintenance-group>maintenance-group-2</maintenance-group>
      </maintenance-association>
    </maintenance-domain>
  </maintenance-domains>
</cfm>
```

Example MEP Creation Configuration

- Configuration example of a **Maintenance Association End Point (MEP)** on Bridge Port (*port-1*)

5

```
<cfm>
  <mep xc:operation="create">
    <port>port-1</port>
    <maintenance-group>maintenance-group-1</maintenance-group>
    <mep-id>100</mep-id>
    <direction>up</direction>
    <admin-state>true</admin-state>
  </mep>
</cfm>
```

  - The MEP is associated with the maintenance-group identifier. This provides a pointer to all the maintenance-domain and maintenance-association (or in ITU-T case, the MEG ID) information to be used by this MEP

Example Loopback Session Configuration

- Configuration example of a **Loopback Session** associated with a MEP

6

```
<cfm>
  <loopback>
    <mep-id>100</mep-id>
    <dest-mac-address>01-AB-BC-CD-DE-EE</dest-mac-address>
    <count>3</count>
    <priority>5</priority>
    <interval>1sec</interval>
    <status>true</status>
  </loopback>
</cfm>
```

Example CCM Session Configuration

- Configuration example of a **Continuity Check Message Session** associated with a MEP

7

```
<cfm>
  <continuity-check>
    <ccm-enabled>true</ccm-enabled>
    <mep-id>100</mep-id>
    <priority>7</priority>
    <interval>1sec</interval>
  </continuity-check>
</cfm>
```

Example MIP Configuration

- Configuration example of a **Maintenance Association Intermediate Point (MIP)** (explicit mode)

8

```
<cfm>
  <mip>
    <port>port-2</port>
    <service-type>vlan-id</service-type>
    <service-id>
      <vid>1001</vid>
    </service-id>
    <md-level>4</md-level>
  </mip>
</cfm>
```

Example MIP Configuration

- Configuration example of a **Maintenance Association Intermediate Point (MIP)** (indirect mode)

9

```
<cfm>
  <default-md-levels>
    <default-md-level>
      <component-id>1</component-id>
      <primary-service-id>
        <vid>1001</vid>
      </primary-service-id>
    </default-md-level>
  </default-md-levels>
</cfm>
```

Example Remote MEP Configuration

- Configuration example of a **Remote MEP**

10

```
<cfm>
 <mep>
    <port>port-1</port>
    <maintenance-group>maintenance-group-1</maintenance-group>
    <active-rmeps>5101</active-rmeps>
  </mep>
</cfm>
```

Example MEP Stats Retrieval Configuration

- Configuration example for retrieving **MEP Stats**

11

```
<rpc message-id="99">
  <get-config>
    <source>
      <running/>
    </source>
    <filter type="subtree>
      <top>
        <cfm>
          <mep>
            <port>port-1</port>
            <maintenance-group>maintenance-group-1</maintenance-group>
            <stats/>
          </mep>
        </cfm>
      </top>
    </filter>
  </get-config>
</rpc>
```

```
<rpc-reply message-id="99">
  <data>
    <top>
      <cfm>
        <mep>
          <port>port-1</port>
          <maintenance-group>maintenance-group-1</maintenance-group>
          <stats>
            <mep-ccm-sequence-errors>0</mep-ccm-sequence-errors>
            <mep-ccms-sent>0</mep-ccms-sent>
            <mep-lbr-in>0</mep-lbr-in>
              :
            <mep-lbr-out>0</mep-lbr-out>
          </stats>
        </mep>
      </cfm>
    </top>
  </data>
</rpc-reply>
```

GitHub

CFM YANG (*ieee802-dot1q-cfm*)

https://github.com/YangModels/yang/blob/master/standard/ieee/802.1/draft/ieee802-dot1q-cfm.yang