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

![Diagram of YANG Model Relationships]
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
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
- int mep-id
- enum interval
- choice target-address
- int lbm-tx-number
- str data
- bool data-tlv
- int priority
- int dei
- bool lbm-result-ok
- int loopback-trans-id

### TRANSMIT-LINKTRACE()

- string maintenance-group
- int mep-id
- enum interval
- choice target-address
- int ltm-flags
- str ltm-ttl
- bool ltm-result-ok
- int ltm-seq-number
- string ltm-egress-identifier

**Notification (Traps/Alarms) for MEP FAULT ALARM**
Configuration Examples

XML Representation

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.
Example Customer VLAN Bridge Configuration

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

```xml
<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

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)

```xml
<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*)

```xml
<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*)

```xml
<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

```xml
<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

```xml
<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)

```xml
<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)

```xml
<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

```xml
<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

```xml
<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>
```
CFM YANG (ieee802-dot1q-cfm)

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