Joint IEEE 802 and ITU-T SG15 Workshop
“Building Tomorrow’s Networks”

ITU-T Information & Data Modeling & Status

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Objectives

- Objectives of this joint workshop session #4
  - Information sharing
    - IEEE
      - IEEE 802.1Qcp (Bridge YANG DM)
      - IEEE 802.1Qcx (CFM YANG DM)
      - IEEE 802.3 Ethernet YANG DM definition
      - IEEE 1588 YANG DM
    - ITU-T
      - ITU-T Information and Data modeling
      - G.8052.1 Transport Ethernet OAM Information Model and Data Model
  - Identify input for the Q14/15 Interim meeting (Tomorrow 28 Jan.)

Objectives

- Objectives of the Q14/15 Interim meeting (28 Jan.)
  - ❖From Q14/15 perspective; *could be updated*
  - – Ensure alignment of the IEEE YANG works with ITU-T G.8052.1
    - Advancing G.8052.1 will entail the creation of an UML OAM model (pruned/refactored from G.8052 and supporting the G.8013/Y.1731-defined OAM) and its translation as a YANG module
    - Alignment of ITU-T YANG with IEEE 802.1Qcp and 802.1Qcx
  - – Identify the anchor point (touch point) of the IEEE 802.1 YANG modules for augmentation by the G.8052.1 YANG module
  - – Identify the G.8052 UML artifacts (object classes, attributes and operations) that should be pruned (e.g., due to out of scope, or available in the 802.1 YANG), kept, or refactored

ITU-T Q14/15 Modeling Work

- Mandate
- Scope
- Modeling Methodology
- UML to YANG Generation
- Status
- Alignment
  - Augmentation
  - Pruning/Refactoring

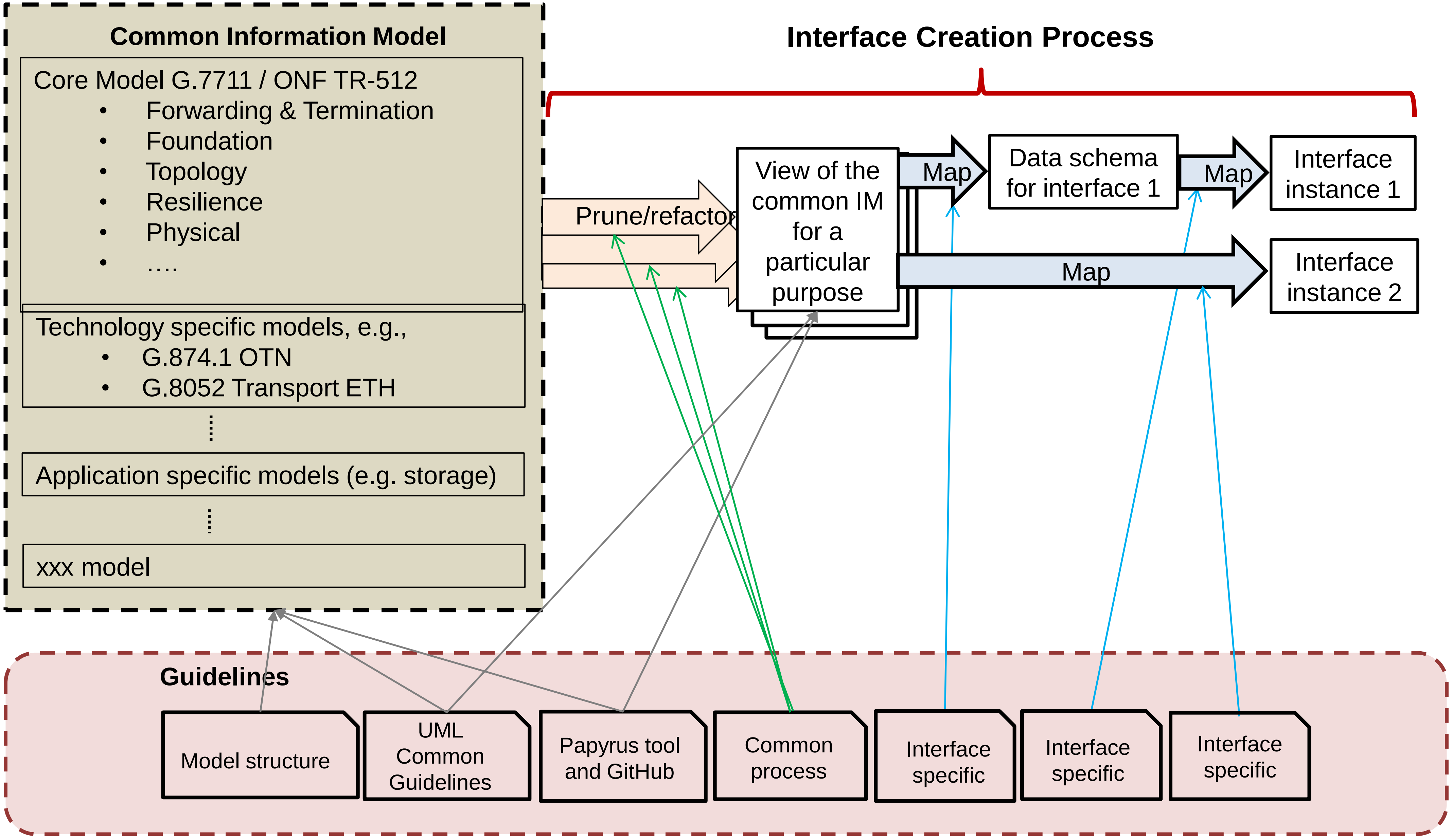
Q14/15 Mandate & Scope

Management and control of transport systems and equipment

- *Technology architecture & function* → Management/Control
  - requirement, information model, data model

		Generic	SDH	OTN (L1)	Carrier Ethernet	MPLS-TP	Media (L0)	Sync
Q10, Q11 Q12, Q13	Transport Architecture	G.800 G.805	G.803	G.872	G.8010	G.8110.1	G.media	G.8265.1 G.8275.1 G.8275.2
	Equipment Function	G.806	G.783	G.798	G.8021	G.8121.x		
Q14	Mgmt/Control Requirement	G.7710	G.784	G.874	G.8051	G.8151	G.media-mgmt	G.sync-mgmt
	Information Model	G.7711	G.774.1-10 (CMISE)	G.874.1	G.8052	G.8152		
	Data Model			*G.874.x*	*G.8052.x (.1 YANG)*	*G.8152.x*		

Model Development Methodology



Common Information Model

Core Model G.7711 / ONF TR-512
- Forwarding & Termination
- Foundation
- Topology
- Resilience
- Physical
- ….

Technology specific models, e.g.,
- G.874.1 OTN
- G.8052 Transport ETH

Application specific models (e.g. storage)

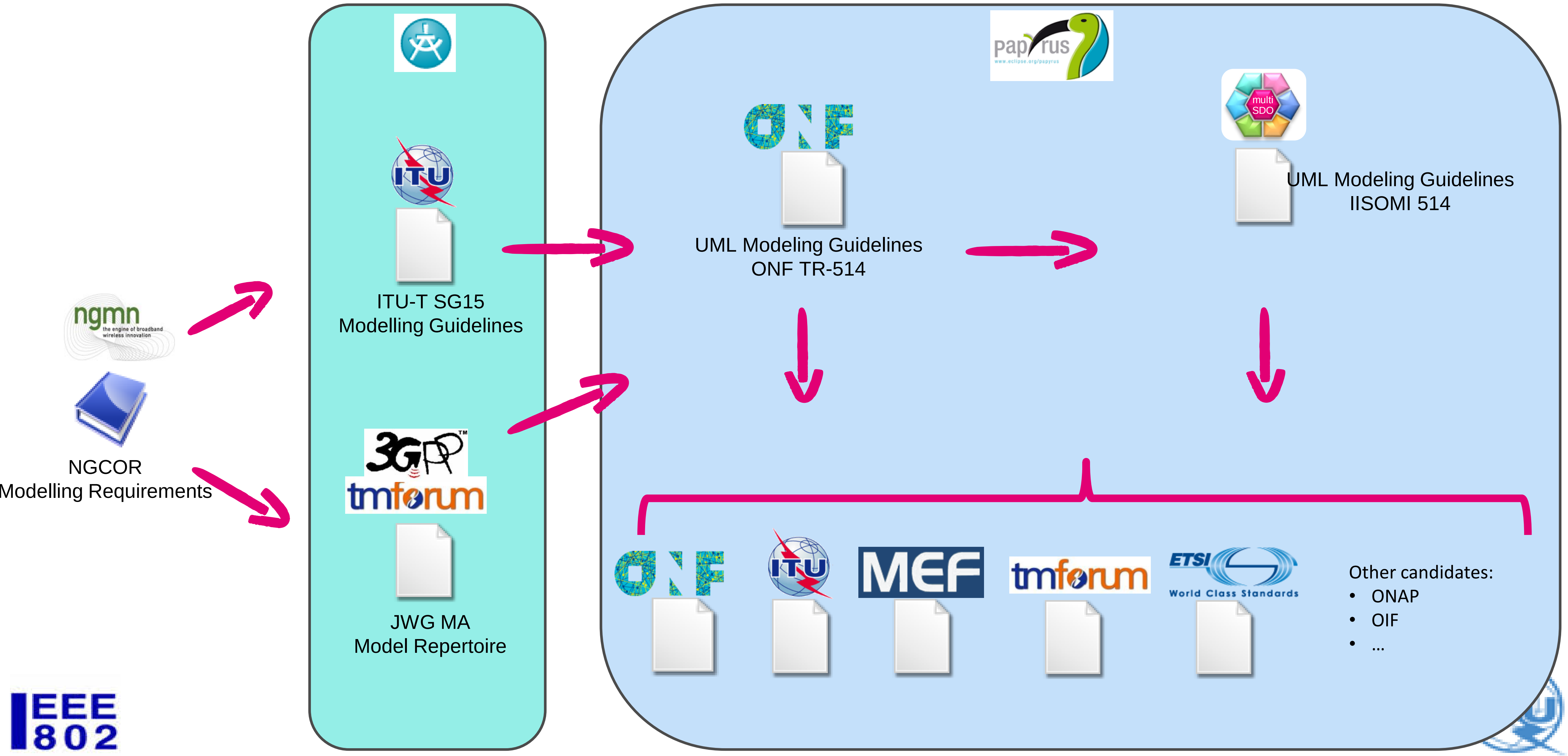
xxx model

Interface Creation Process

Prune/refactor
View of the common IM for a particular purpose
Map
Data schema for interface 1
Map
Interface instance 1
Map
Interface instance 2

Guidelines

UML Modeling Guidelines evolution



NGCOR
Modelling Requirements

ITU-T SG15
Modelling Guidelines

JWG MA
Model Repertoire

UML Modeling Guidelines
ONF TR-514

UML Modeling Guidelines
IISOMI 514

Other candidates:

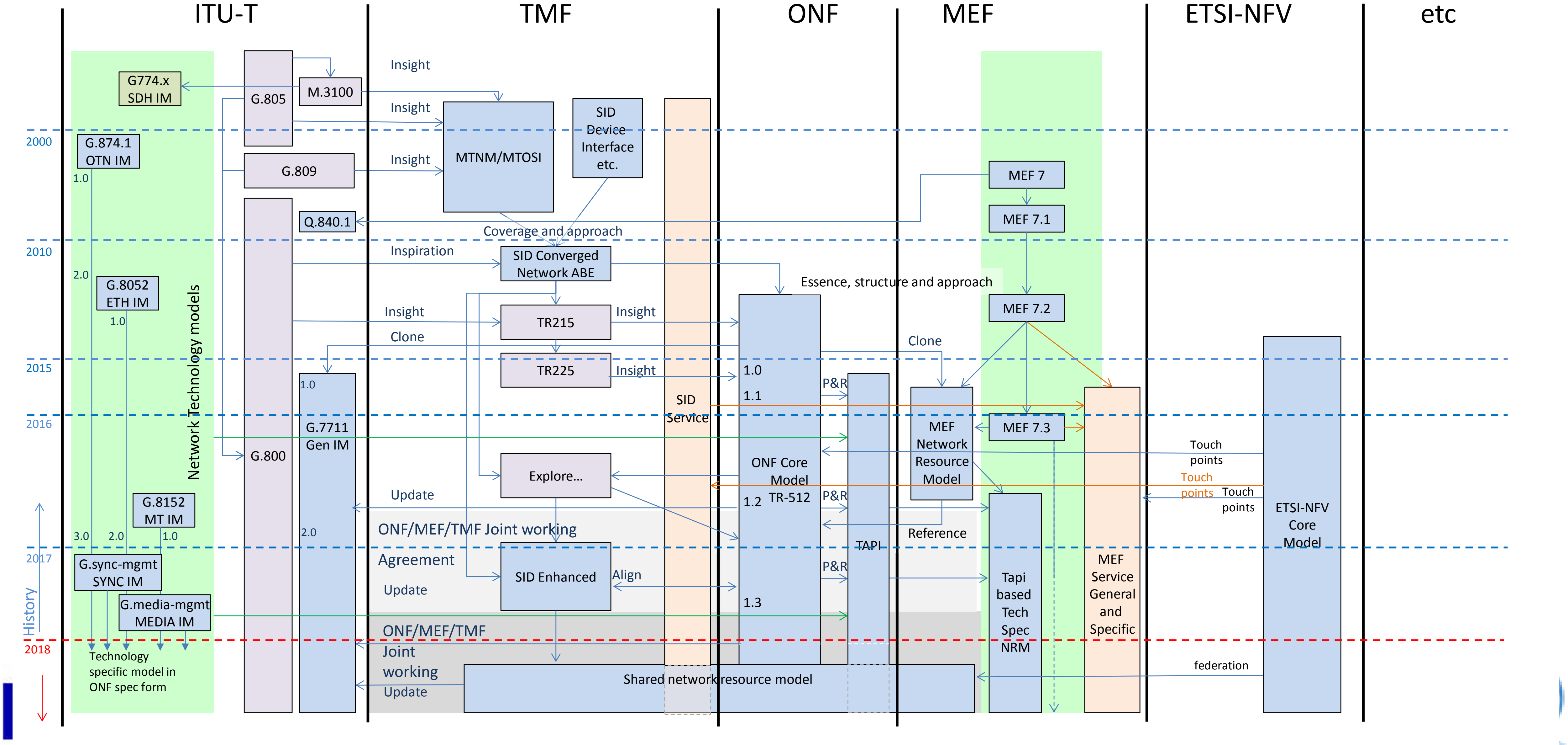
- ONAP
- OIF
- …

Information Model evolution

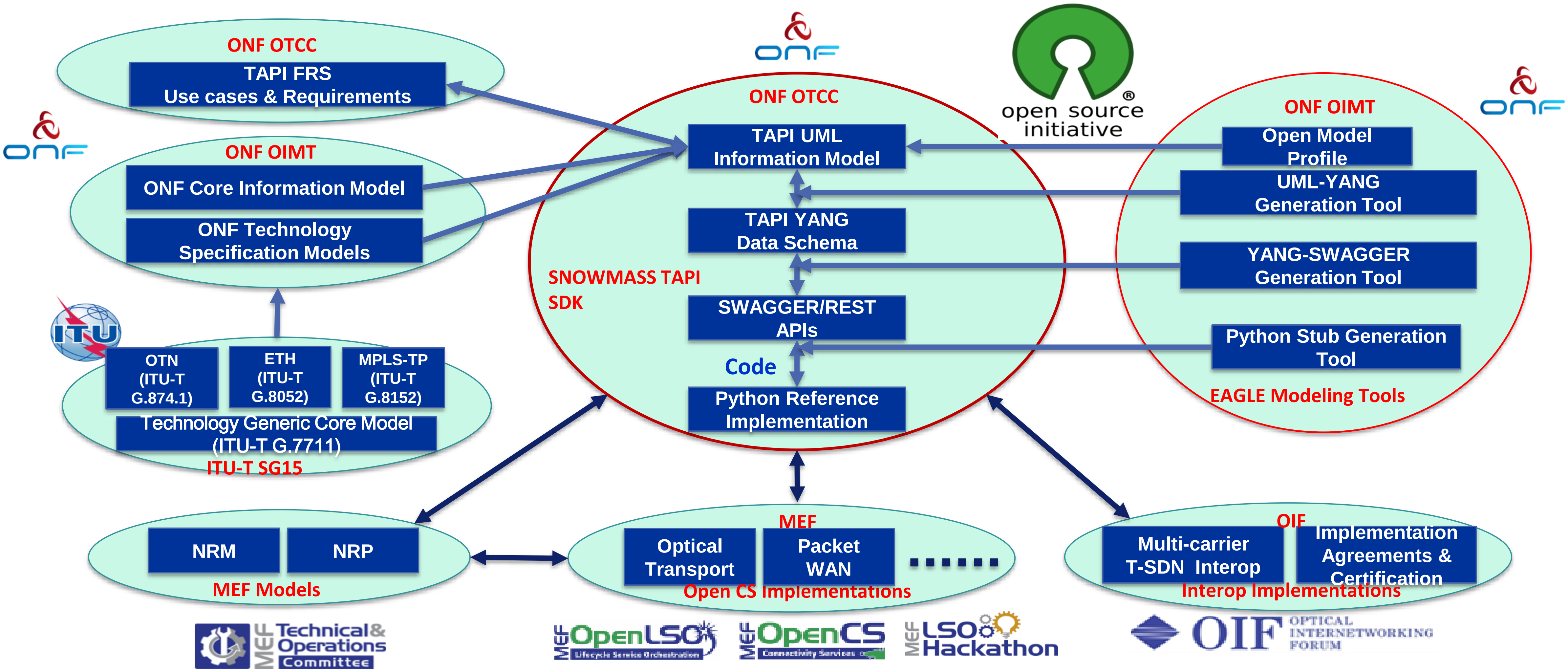
🟦 Formal UML model

⬜ Concepts

🟩 Network Technology Definition



Influence Across Standards and Open Source



ONF OTCC

TAPI FRS
Use cases & Requirements

ONF OIMT

ONF Core Information Model

ONF Technology
Specification Models

OTN
(ITU-T
G.874.1)

ETH
(ITU-T
G.8052)

MPLS-TP
(ITU-T
G.8152)

Technology Generic Core Model
(ITU-T G.7711)

ITU-T SG15

ONF OTCC

TAPI UML
Information Model

TAPI YANG
Data Schema

SWAGGER/REST
APIs

Code

Python Reference
Implementation

SNOWMASS TAPI
SDK

open source
initiative

ONF OIMT

Open Model
Profile

UML-YANG
Generation Tool

YANG-SWAGGER
Generation Tool

Python Stub Generation
Tool

EAGLE Modeling Tools

NRM

NRP

MEF Models

MEF

Optical
Transport

Packet
WAN

Open CS Implementations

OIF

Multi-carrier
T-SDN Interop

Implementation
Agreements &
Certification

Interop Implementations

MEF Technical & Operations Committee

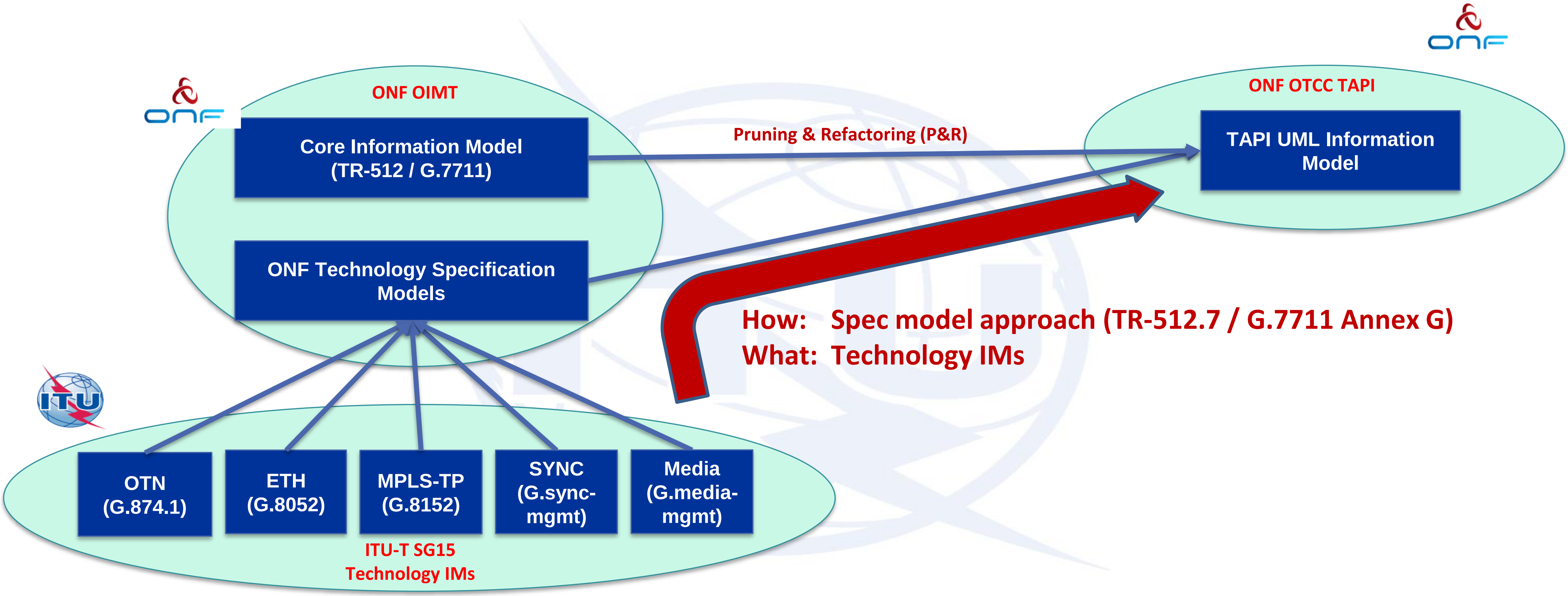
MEF OpenLSO Lifecycle Service Orchestration

MEF OpenCS Connectivity Services

MEF LSO Hackathon

OIF OPTICAL INTERNETWORKING FORUM

Pruning/Refactoring example


ONF OIMT
Core Information Model (TR-512 / G.7711)
ONF Technology Specification Models
Pruning & Refactoring (P&R)
ONF OTCC TAPI
TAPI UML Information Model
OTN (G.874.1)
ETH (G.8052)
MPLS-TP (G.8152)
SYNC (G.sync-mgmt)
Media (G.media-mgmt)
ITU-T SG15 Technology IMs

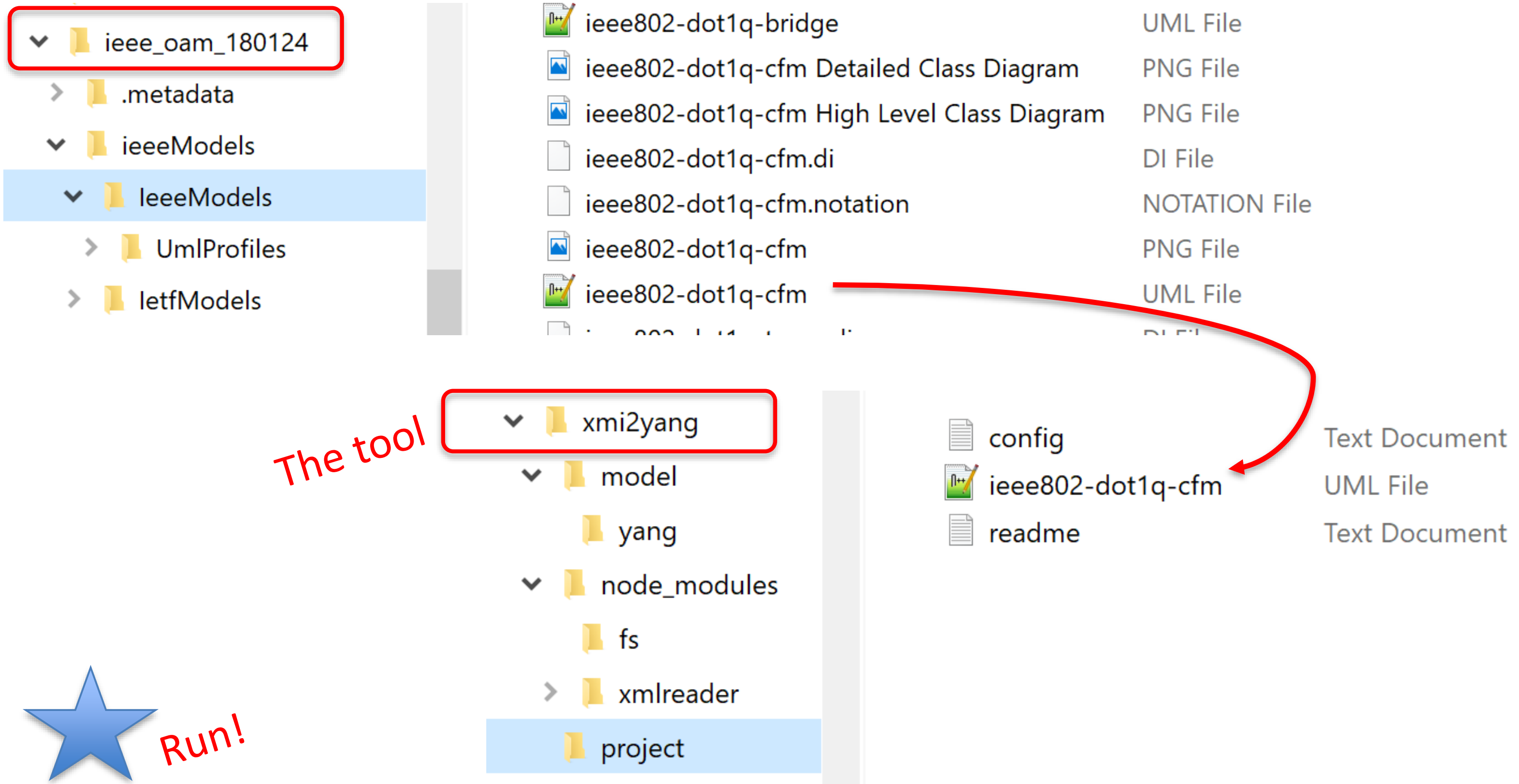
How: Spec model approach (TR-512.7 / G.7711 Annex G)

What: Technology IMs

UML to YANG Mapping Tool

- Open Source Tool: https://github.com/OpenNetworkingFoundation/EAGLE-Open-Model-Profile-and-Tools/tree/ToolChain/UmlYangTools
  - Background:
    - Initially developed by the ONF open source project “EAGLE”
    - Now run by the Informal Inter SDO Open Model Initiative (IISOMI), including active participants from ONF, ITU-T SG15, MEF, TMF, …
  - Mapping Guidelines (rules): IISOMI-531 v1.0
  - Mapping Tool: xmi2yang
    - Programming language: JavaScript
    - Running environment: node.js (downloadable from: https://nodejs.org/en/)
    - How to run:
      1. Copy the UML file of the UML model into the “project” sub-folder of the xmi2yang directory
      2. Run the command “**node main.js**” at the xmi2yang directory
      3. The YANG file will be generated in the “project” sub-folder
      4. Validate the YANG file at http://www.yangvalidator.com/ and get also the YANG Tree.

UML to YANG Mapping Tool - Demo



The model

- ieee_oam_180124
  - .metadata
  - ieeeModels
    - IeeeModels
      - UmlProfiles
    - IetfModels

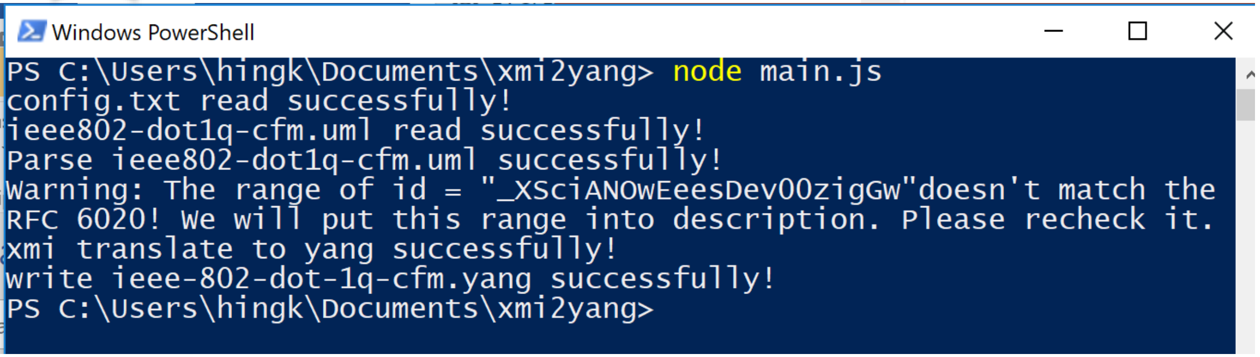
ieee802-dot1q-bridge	UML File
ieee802-dot1q-cfm Detailed Class Diagram	PNG File
ieee802-dot1q-cfm High Level Class Diagram	PNG File
ieee802-dot1q-cfm.di	DI File
ieee802-dot1q-cfm.notation	NOTATION File
ieee802-dot1q-cfm	PNG File
ieee802-dot1q-cfm	UML File

The tool

- xmi2yang
  - model
    - yang
  - node_modules
    - fs
    - xmlreader
  - project

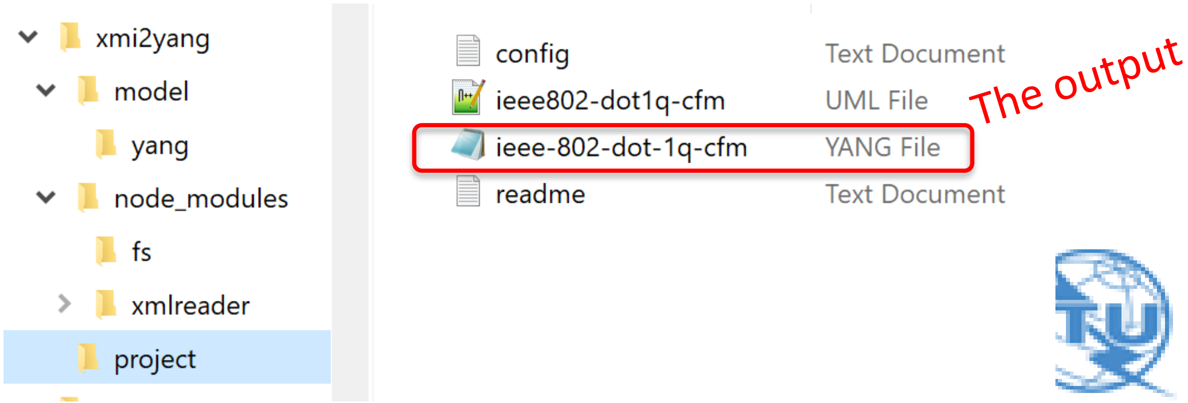
config	Text Document
ieee802-dot1q-cfm	UML File
readme	Text Document

Run!



Windows PowerShell

```
PS C:\Users\hingk\Documents\xmi2yang> node main.js
config.txt read successfully!
ieee802-dot1q-cfm.uml read successfully!
Parse ieee802-dot1q-cfm.uml successfully!
Warning: The range of id = "_XSciANOwEeesDev00zigGw"doesn't match the
RFC 6020! We will put this range into description. Please recheck it.
xmi translate to yang successfully!
write ieee-802-dot-1q-cfm.yang successfully!
PS C:\Users\hingk\Documents\xmi2yang>
```



- xmi2yang
  - model
    - yang
  - node_modules
    - fs
    - xmlreader
  - project

config	Text Document
ieee802-dot1q-cfm	UML File
ieee-802-dot-1q-cfm	YANG File
readme	Text Document

The output

Status of ITU-T Technology-specific and Generic Information Models

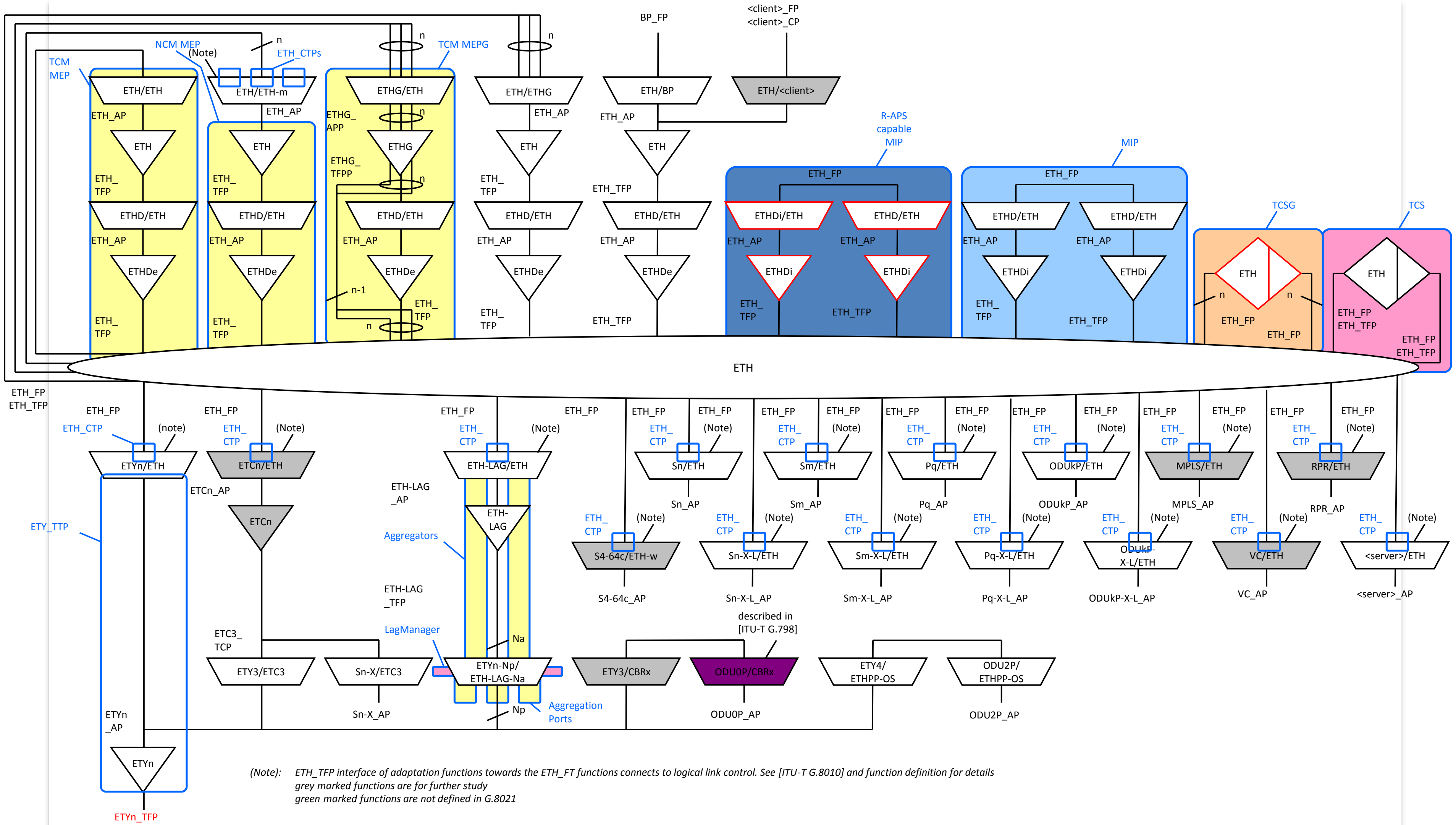
- G.874.1 – OTN (L0, L1)
  - V1 (01/2002); UML using Rational Rose
  - V2 (10/2012); UML using IBM RSA; Same modeling guidelines and profile with G.8052
  - V3 (11/2016); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
  - ❖ Key object classes: OCh/OTU/ODU TTP, CTP, TCM (MEP), SN (FD), SNC (FC), PG (FcSwitch)
- G.8052 – Carrier Ethernet
  - V1 (08/2013); UML using IBM RSA; Same modeling guidelines and profile with G.874.1
  - V2 (11/2016); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
  - ❖ Key object classes: ETH/ETY TTP, CTP, MEP, MIP, Proactive/On-Demand OAM & PM Control
- G.8152 – MPLS-TP
  - V1 (12/2016); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
- G.7711 – Generic, Nodal and Network view
  - V1 (08/2015); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
  - V2 (12/2016); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
  - V2.02 (1/2018); Align with ONF TR-512 v1.3.1-info; For consent at 2/2018 SG15 plenary meeting
  - Same Core Model as ONF TR-512
  - ❖ Key object classes: LTP, LP, Link, LinkPort, FD, FC, FcPort, FcSwitch, FcRoute, …
- G.sync-mgmt – Synchronization management
  - V0.04 (1/2018); Using Papyrus; Same UML Modeling Guidelines and Open Model Profile with IISOMI
- G.media-mgmt – Media layer management

See the backup slides for the analysis of G.8052.1 (draft) and IEEE CFM (draft ieee802-dot1q-cfm) YANG for Alignment

THANK YOU

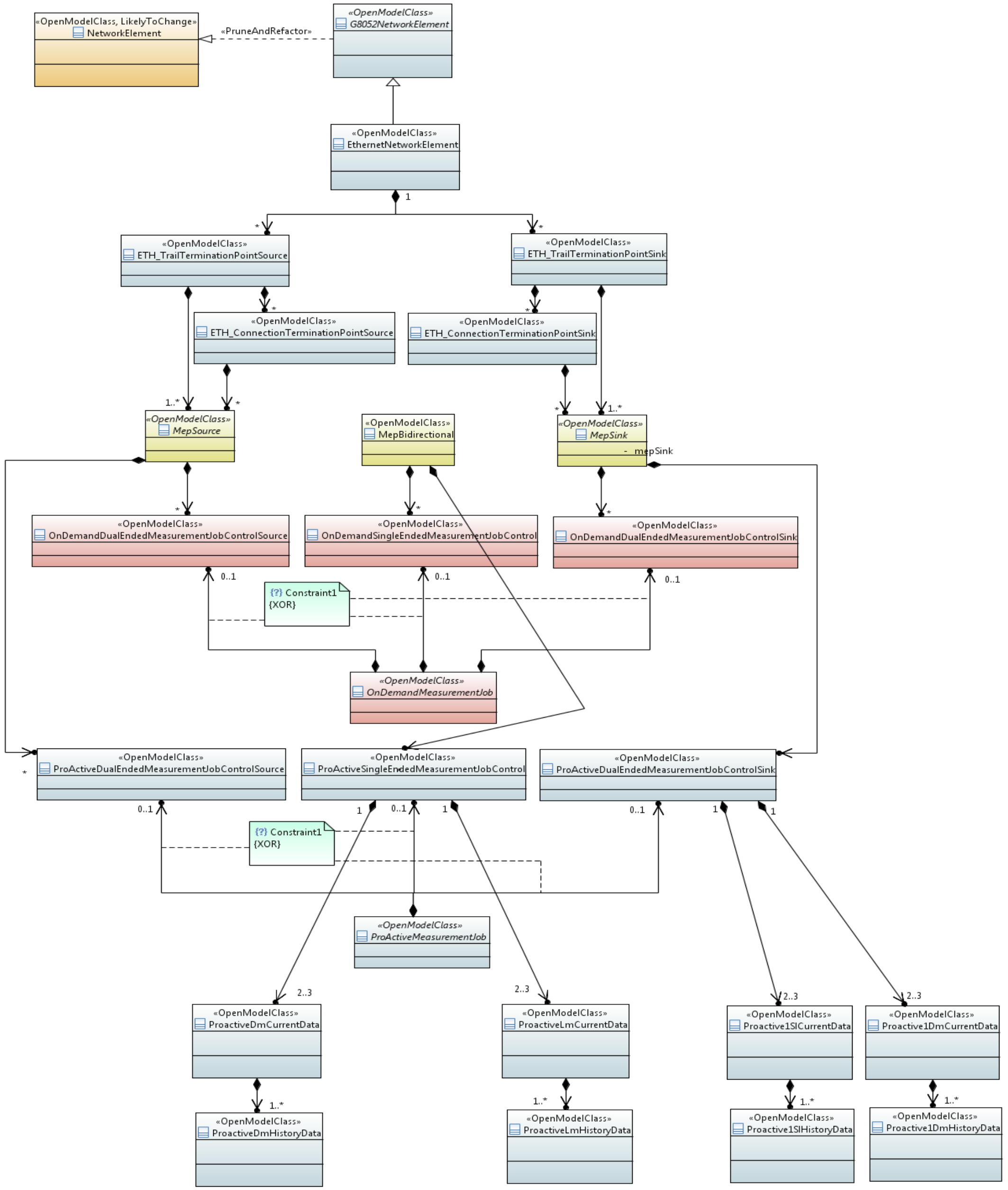
Backup material

Transport Ethernet object class to atomic function mapping (Figure 6-1/G.8052)

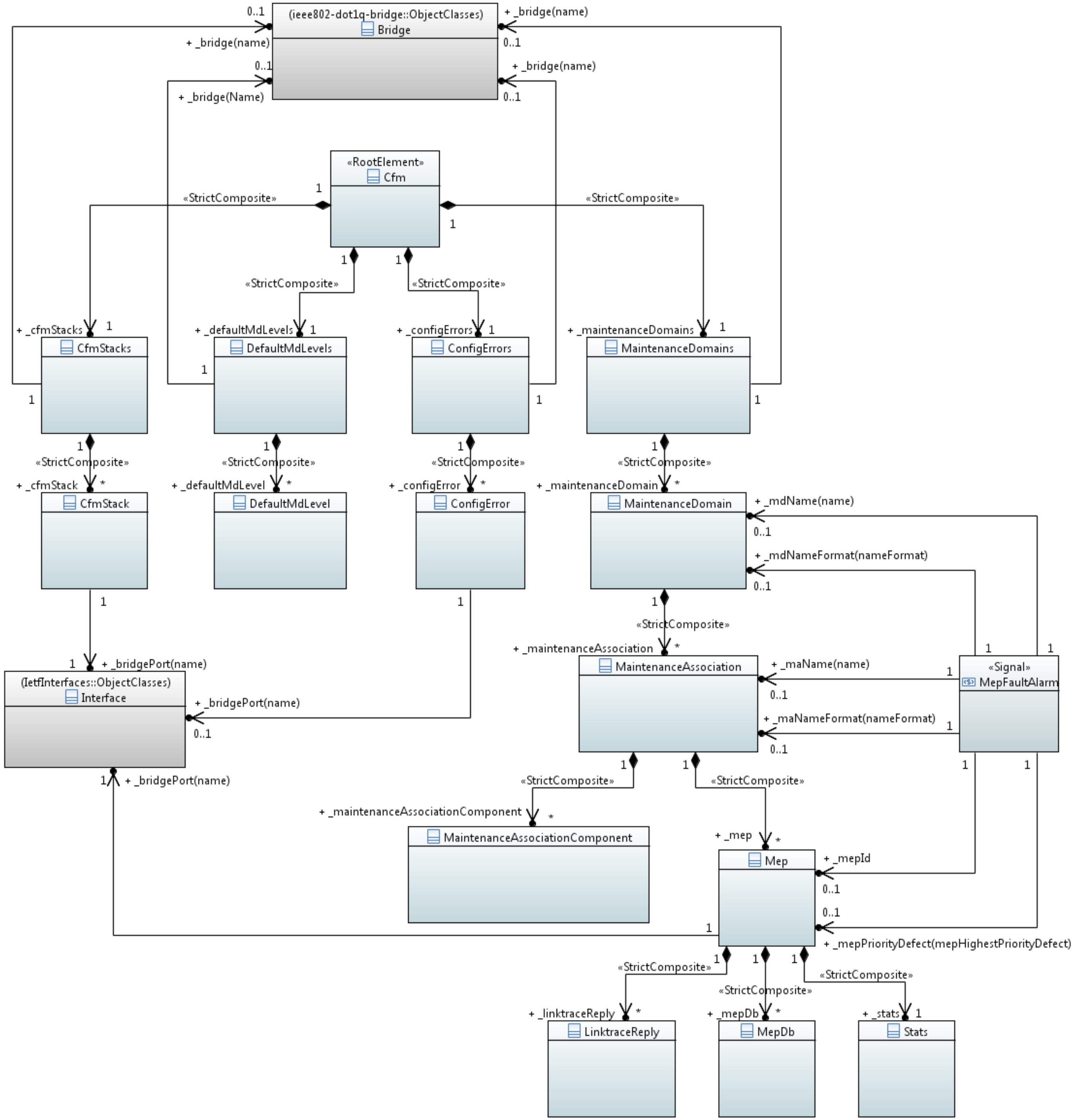


(Note): *ETH_TFP interface of adaptation functions towards the ETH_FT functions connects to logical link control. See [ITU-T G.8010] and function definition for details*
grey marked functions are for further study
green marked functions are not defined in G.8021

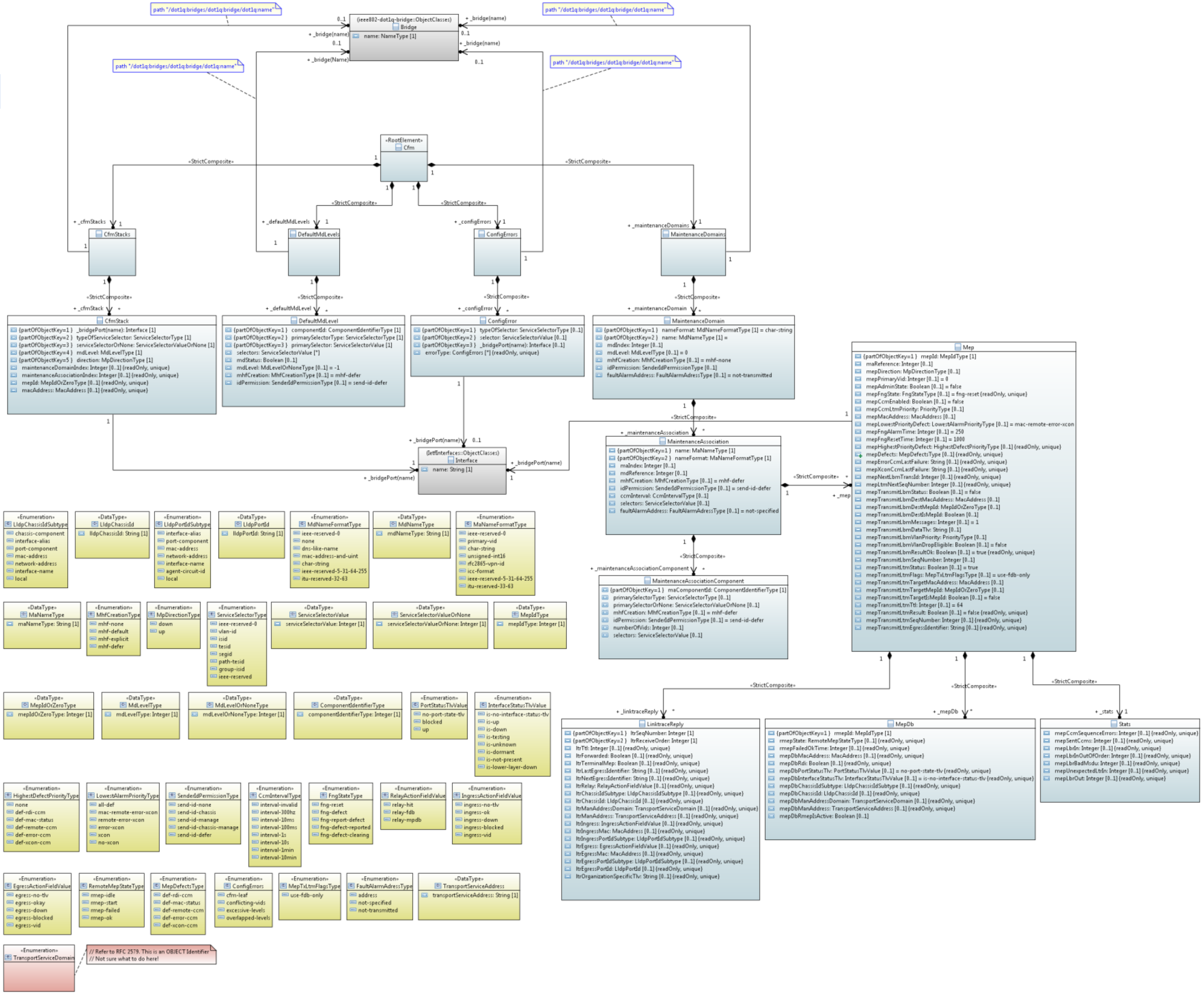
G.8052 OAM Classes for G.8052.1



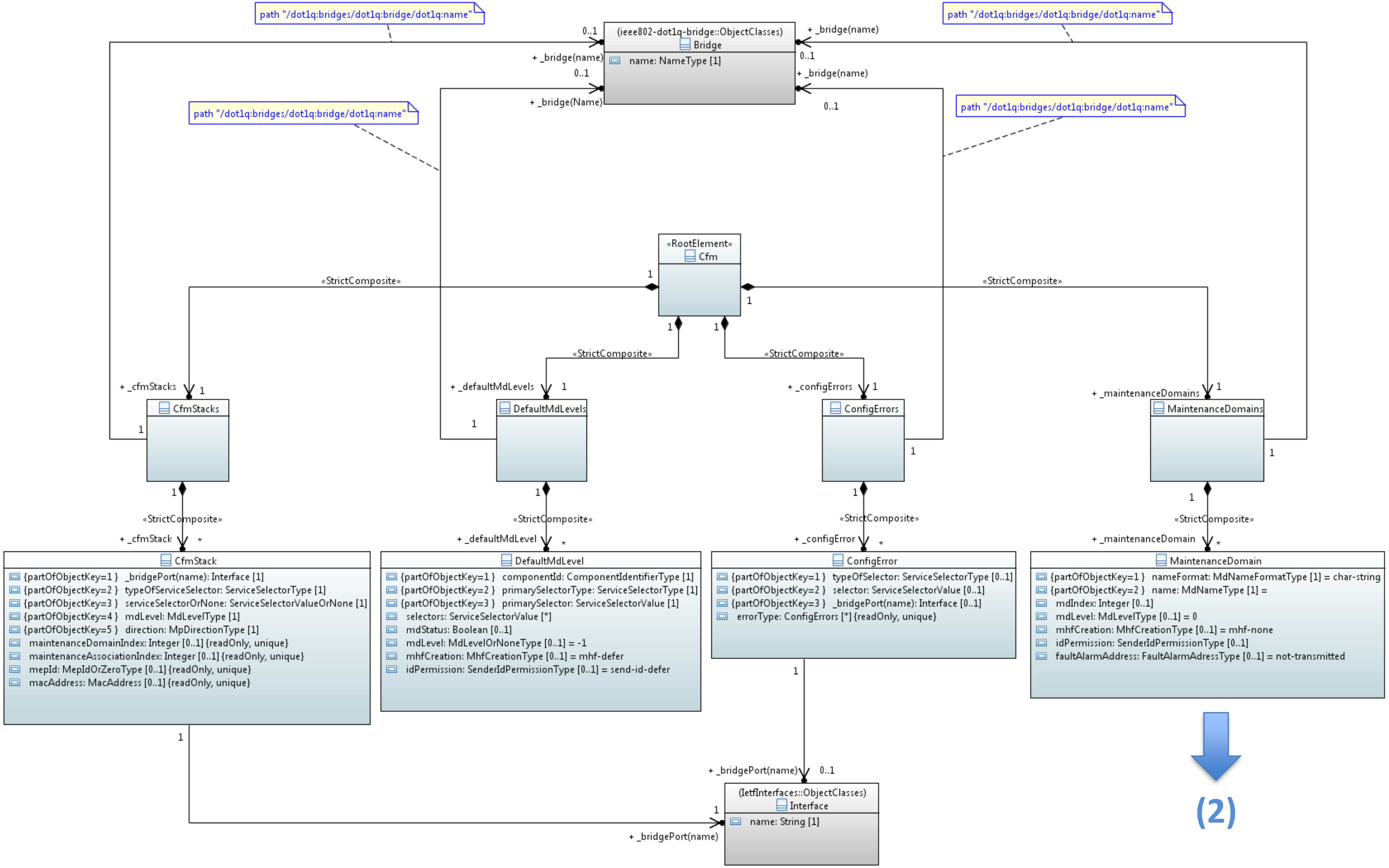
Current Re-engineered UML from IEEE CFM (draft ieee802-dot1q-cfm) YANG



Current Re-engineered UML from IEEE CFM (draft ieee802-dot1q-cfm) YANG – detailed


path "/dot1q:bridges/dot1q:bridge/dot1q:name"
path "/dot1q:bridges/dot1q:bridge/dot1q:name"
path "/dot1q:bridges/dot1q:bridge/dot1q:name"
path "/dot1q:bridges/dot1q:bridge/dot1q:name"
(ieee802-dot1q-bridge::ObjectClasses)
Bridge
name: NameType [1]
+ _bridge(name)
+ _bridge(Name)
0..1
«RootElement»
Cfm
«StrictComposite»
1
+ _cfmStacks
CfmStacks
+ _defaultMdLevels
DefaultMdLevels
+ _configErrors
ConfigErrors
+ _maintenanceDomains
MaintenanceDomains
+ _cfmStack
CfmStack
{partOfObjectKey=1 } _bridgePort(name): Interface [1]
{partOfObjectKey=2 } typeOfServiceSelector: ServiceSelectorType [1]
{partOfObjectKey=3 } serviceSelectorOrNone: ServiceSelectorValueOrNone [1]
{partOfObjectKey=4 } mdLevel: MdLevelType [1]
{partOfObjectKey=5 } direction: MpDirectionType [1]
maintenanceDomainIndex: Integer [0..1] {readOnly, unique}
maintenanceAssociationIndex: Integer [0..1] {readOnly, unique}
mepId: MepIdOrZeroType [0..1] {readOnly, unique}
macAddress: MacAddress [0..1] {readOnly, unique}
+ _defaultMdLevel
DefaultMdLevel
{partOfObjectKey=1 } componentId: ComponentIdentifierType [1]
{partOfObjectKey=2 } primarySelectorType: ServiceSelectorType [1]
{partOfObjectKey=3 } primarySelector: ServiceSelectorValue [1]
selectors: ServiceSelectorValue [*]
mdStatus: Boolean [0..1]
mdLevel: MdLevelOrNoneType [0..1] = -1
mhfCreation: MhfCreationType [0..1] = mhf-defer
idPermission: SenderIdPermissionType [0..1] = send-id-defer
+ _configError
ConfigError
{partOfObjectKey=1 } typeOfSelector: ServiceSelectorType [0..1]
{partOfObjectKey=2 } selector: ServiceSelectorValue [0..1]
{partOfObjectKey=3 } _bridgePort(name): Interface [0..1]
errorType: ConfigErrors [*] {readOnly, unique}
+ _maintenanceDomain
MaintenanceDomain
{partOfObjectKey=1 } nameFormat: MdNameFormatType [1] = char-string
{partOfObjectKey=2 } name: MdNameType [1] =
mdIndex: Integer [0..1]
mdLevel: MdLevelType [0..1] = 0
mhfCreation: MhfCreationType [0..1] = mhf-none
idPermission: SenderIdPermissionType [0..1]
faultAlarmAddress: FaultAlarmAdressType [0..1] = not-transmitted
+ _bridgePort(name)
(IetfInterfaces::ObjectClasses)
Interface
name: String [1]
+ _maintenanceAssociation
MaintenanceAssociation
{partOfObjectKey=1 } name: MaNameType [1]
{partOfObjectKey=2 } nameFormat: MaNameFormatType [1]
maIndex: Integer [0..1]
mdReference: Integer [0..1]
mhfCreation: MhfCreationType [0..1] = mhf-defer
idPermission: SenderIdPermissionType [0..1] = send-id-defer
ccmInterval: CcmIntervalType [0..1]
selectors: ServiceSelectorValue [0..1]
faultAlarmAddress: FaultAlarmAdressType [0..1] = not-specified
+ _maintenanceAssociationComponent
MaintenanceAssociationComponent
{partOfObjectKey=1 } maComponentId: ComponentIdentifierType [1]
primarySelectorType: ServiceSelectorType [0..1]
primarySelectorOrNone: ServiceSelectorValueOrNone [0..1]
mhfCreation: MhfCreationType [0..1] = mhf-defer
idPermission: SenderIdPermissionType [0..1] = send-id-defer
numberOfVids: Integer [0..1]
selectors: ServiceSelectorValue [0..1]
+ _mep
Mep
{partOfObjectKey=1 } mepId: MepIdType [1]
maReference: Integer [0..1]
mepDirection: MpDirectionType [0..1]
mepPrimaryVid: Integer [0..1] = 0
mepAdminState: Boolean [0..1] = false
mepFngState: FngStateType [0..1] = fng-reset {readOnly, unique}
mepCcmEnabled: Boolean [0..1] = false
mepCcmLtmPriority: PriorityType [0..1]
mepMacAddress: MacAddress [0..1]
mepLowestPriorityDefect: LowestAlarmPriorityType [0..1] = mac-remote-error-xcon
mepFngAlarmTime: Integer [0..1] = 250
mepFngResetTime: Integer [0..1] = 1000
mepHighestPriorityDefect: HighestDefectPriorityType [0..1] {readOnly, unique}
mepDefects: MepDefectsType [0..1] {readOnly, unique}
mepErrorCcmLastFailure: String [0..1] {readOnly, unique}
mepXconCcmLastFailure: String [0..1] {readOnly, unique}
mepNextLbmTransId: Integer [0..1] {readOnly, unique}
mepLtmNextSeqNumber: Integer [0..1] {readOnly, unique}
mepTransmitLbmStatus: Boolean [0..1] = false
mepTransmitLbmDestMacAddress: MacAddress [0..1]
mepTransmitLbmDestMepId: MepIdOrZeroType [0..1]
mepTransmitLbmDestIsMepId: Boolean [0..1]
mepTransmitLbmMessages: Integer [0..1] = 1
mepTransmitLbmDataTlv: String [0..1]
mepTransmitLbmVlanPriority: PriorityType [0..1]
mepTransmitLbmVlanDropEligible: Boolean [0..1] = false
mepTransmitLbmResultOk: Boolean [0..1] = true {readOnly, unique}
mepTransmitLbmSeqNumber: Integer [0..1]
mepTransmitLtmStatus: Boolean [0..1] = true
mepTransmitLtmFlags: MepTxLtmFlagsType [0..1] = use-fdb-only
mepTransmitLtmTargetMacAddress: MacAddress [0..1]
mepTransmitLtmTargetMepId: MepIdOrZeroType [0..1]
mepTransmitLtmTargetIsMepId: Boolean [0..1] = false
mepTransmitLtmTtl: Integer [0..1] = 64
mepTransmitLtmResult: Boolean [0..1] = false {readOnly, unique}
mepTransmitLtmSeqNumber: Integer [0..1] {readOnly, unique}
mepTransmitLtmEgressIdentifier: String [0..1] {readOnly, unique}
+ _linktraceReply
LinktraceReply
{partOfObjectKey=1 } ltrSeqNumber: Integer [1]
{partOfObjectKey=2 } ltrReceiveOrder: Integer [1]
ltrTtl: Integer [0..1] {readOnly, unique}
ltrForwarded: Boolean [0..1] {readOnly, unique}
ltrTerminalMep: Boolean [0..1] {readOnly, unique}
ltrLastEgressIdentifier: String [0..1] {readOnly, unique}
ltrNextEgressIdentifier: String [0..1] {readOnly, unique}
ltrRelay: RelayActionFieldValue [0..1] {readOnly, unique}
ltrChassisIdSubtype: LldpChassisIdSubtype [0..1] {readOnly, unique}
ltrChassisId: LldpChassisId [0..1] {readOnly, unique}
ltrManAddressDomain: TransportServiceDomain [0..1] {readOnly, unique}
ltrManAddress: TransportServiceAddress [0..1] {readOnly, unique}
ltrIngress: IngressActionFieldValue [0..1] {readOnly, unique}
ltrIngressMac: MacAddress [0..1] {readOnly, unique}
ltrIngressPortIdSubtype: LldpPortIdSubtype [0..1] {readOnly, unique}
ltrEgress: EgressActionFieldValue [0..1] {readOnly, unique}
ltrEgressMac: MacAddress [0..1] {readOnly, unique}
ltrEgressPortIdSubtype: LldpPortIdSubtype [0..1] {readOnly, unique}
ltrEgressPortId: LldpPortId [0..1] {readOnly, unique}
ltrOrganizationSpecificTlv: String [0..1] {readOnly, unique}
+ _mepDb
MepDb
{partOfObjectKey=1 } rmepId: MepIdType [1]
rmepState: RemoteMepStateType [0..1] {readOnly, unique}
rmepFailedOkTime: Integer [0..1] {readOnly, unique}
mepDbMacAddress: MacAddress [0..1] {readOnly, unique}
mepDbRdi: Boolean [0..1] {readOnly, unique}
mepDbPortStatusTlv: PortStatusTlvValue [0..1] = no-port-state-tlv {readOnly, unique}
mepDbInterfaceStatusTlv: InterfaceStatusTlvValue [0..1] = is-no-interface-status-tlv {readOnly, unique}
mepDbChassisIdSubtype: LldpChassisIdSubtype [0..1] {readOnly, unique}
mepDbChassisId: LldpChassisId [0..1] {readOnly, unique}
mepDbManAddressDomain: TransportServiceDomain [0..1] {readOnly, unique}
mepDbManAddress: TransportServiceAddress [0..1] {readOnly, unique}
mepDbRmepIsActive: Boolean [0..1]
+ _stats
Stats
mepCcmSequenceErrors: Integer [0..1] {readOnly, unique}
mepSentCcms: Integer [0..1] {readOnly, unique}
mepLbrIn: Integer [0..1] {readOnly, unique}
mepLbrInOutOfOrder: Integer [0..1] {readOnly, unique}
mepLbrBadMsdu: Integer [0..1] {readOnly, unique}
mepUnexpectedLtrIn: Integer [0..1] {readOnly, unique}
mepLbrOut: Integer [0..1] {readOnly, unique}
«Enumeration» LldpChassisIdSubtype: chassis-component, interface-alias, port-component, mac-address, network-address, interface-name, local
«DataType» LldpChassisId: lldpChassisId: String [1]
«Enumeration» LldpPortIdSubtype: interface-alias, port-component, mac-address, network-address, interface-name, agent-circuit-id, local
«DataType» LldpPortId: lldpPortId: String [1]
«Enumeration» MdNameFormatType: ieee-reserved-0, none, dns-like-name, mac-address-and-uint, char-string, ieee-reserved-5-31-64-255, itu-reserved-32-63
«DataType» MdNameType: mdNameType: String [1]
«Enumeration» MaNameFormatType: ieee-reserved-0, primary-vid, char-string, unsigned-int16, rfc2865-vpn-id, icc-format, ieee-reserved-5-31-64-255, itu-reserved-33-63
«DataType» MaNameType: maNameType: String [1]
«Enumeration» MhfCreationType: mhf-none, mhf-default, mhf-explicit, mhf-defer
«Enumeration» MpDirectionType: down, up
«Enumeration» ServiceSelectorType: ieee-reserved-0, vlan-id, isid, tesid, segid, path-tesid, group-isid, ieee-reserved
«DataType» ServiceSelectorValue: serviceSelectorValue: Integer [1]
«DataType» ServiceSelectorValueOrNone: serviceSelectorValueOrNone: Integer [1]
«DataType» MepIdType: mepIdType: Integer [1]
«DataType» MepIdOrZeroType: mepIdOrZeroType: Integer [1]
«DataType» MdLevelType: mdLevelType: Integer [1]
«DataType» MdLevelOrNoneType: mdLevelOrNoneType: Integer [1]
«DataType» ComponentIdentifierType: componentIdentifierType: Integer [1]
«Enumeration» PortStatusTlvValue: no-port-state-tlv, blocked, up
«Enumeration» InterfaceStatusTlvValue: is-no-interface-status-tlv, is-up, is-down, is-testing, is-unknown, is-dormant, is-not-present, is-lower-layer-down
«Enumeration» HighestDefectPriorityType: none, def-rdi-ccm, def-mac-status, def-remote-ccm, def-error-ccm, def-xcon-ccm
«Enumeration» LowestAlarmPriorityType: all-def, mac-remote-error-xcon, remote-error-xcon, error-xcon, xcon, no-xcon
«Enumeration» SenderIdPermissionType: send-id-none, send-id-chassis, send-id-manage, send-id-chassis-manage, send-id-defer
«Enumeration» CcmIntervalType: interval-invalid, interval-300hz, interval-10ms, interval-100ms, interval-1s, interval-10s, interval-1min, interval-10min
«Enumeration» FngStateType: fng-reset, fng-defect, fng-report-defect, fng-defect-reported, fng-defect-clearing
«Enumeration» RelayActionFieldValue: relay-hit, relay-fdb, relay-mpdb
«Enumeration» IngressActionFieldValue: ingress-no-tlv, ingress-ok, ingress-down, ingress-blocked, ingress-vid
«Enumeration» EgressActionFieldValue: egress-no-tlv, egress-okay, egress-down, egress-blocked, egress-vid
«Enumeration» RemoteMepStateType: rmep-idle, rmep-start, rmep-failed, rmep-ok
«Enumeration» MepDefectsType: def-rdi-ccm, def-mac-status, def-remote-ccm, def-error-ccm, def-xcon-ccm
«Enumeration» ConfigErrors: cfm-leaf, conflicting-vids, excessive-levels, overlapped-levels
«Enumeration» MepTxLtmFlagsType: use-fdb-only
«Enumeration» FaultAlarmAdressType: address, not-specified, not-transmitted
«DataType» TransportServiceAddress: transportServiceAddress: String [1]
«Enumeration» TransportServiceDomain
// Refer to RFC 2579. This is an OBJECT Identifier
// Not sure what to do here!

Current Re-engineered UML from IEEE CFM (draft ieee802-dot1q-cfm) YANG – detailed (1)



path "/dot1q:bridges/dot1q:bridge/dot1q:name"

path "/dot1q:bridges/dot1q:bridge/dot1q:name"

path "/dot1q:bridges/dot1q:bridge/dot1q:name"

path "/dot1q:bridges/dot1q:bridge/dot1q:name"

(ieee802-dot1q-bridge::ObjectClasses)
Bridge
name: NameType [1]

«RootElement»
Cfm

CfmStacks

DefaultMdLevels

ConfigErrors

MaintenanceDomains

CfmStack
{partOfObjectKey=1 } _bridgePort(name): Interface [1]
{partOfObjectKey=2 } typeOfServiceSelector: ServiceSelectorType [1]
{partOfObjectKey=3 } serviceSelectorOrNone: ServiceSelectorValueOrNone [1]
{partOfObjectKey=4 } mdLevel: MdLevelType [1]
{partOfObjectKey=5 } direction: MpDirectionType [1]
maintenanceDomainIndex: Integer [0..1] {readOnly, unique}
maintenanceAssociationIndex: Integer [0..1] {readOnly, unique}
mepId: MepIdOrZeroType [0..1] {readOnly, unique}
macAddress: MacAddress [0..1] {readOnly, unique}

DefaultMdLevel
{partOfObjectKey=1 } componentId: ComponentIdentifierType [1]
{partOfObjectKey=2 } primarySelectorType: ServiceSelectorType [1]
{partOfObjectKey=3 } primarySelector: ServiceSelectorValue [1]
selectors: ServiceSelectorValue [*]
mdStatus: Boolean [0..1]
mdLevel: MdLevelOrNoneType [0..1] = -1
mhfCreation: MhfCreationType [0..1] = mhf-defer
idPermission: SenderIdPermissionType [0..1] = send-id-defer

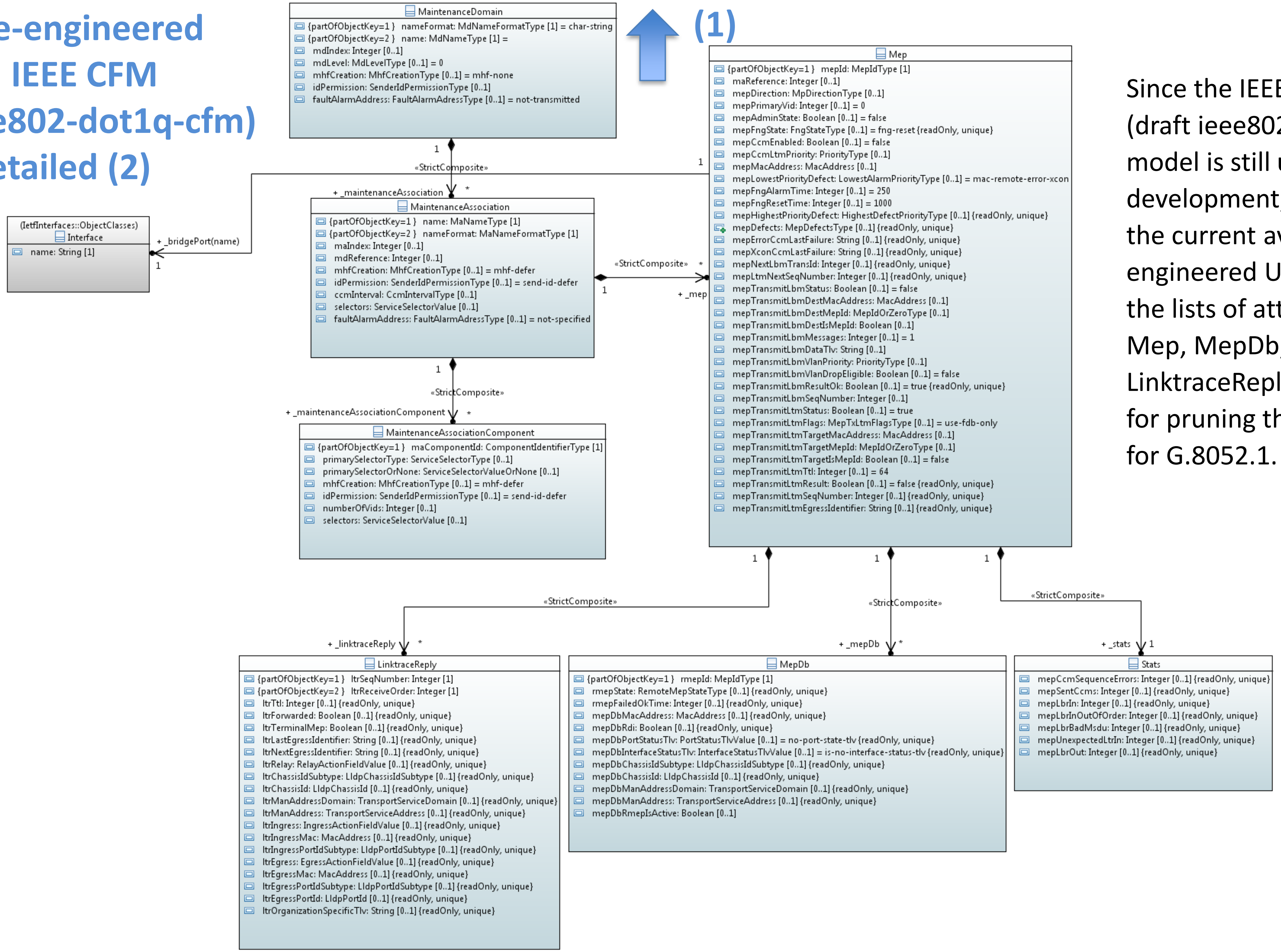
ConfigError
{partOfObjectKey=1 } typeOfSelector: ServiceSelectorType [0..1]
{partOfObjectKey=2 } selector: ServiceSelectorValue [0..1]
{partOfObjectKey=3 } _bridgePort(name): Interface [0..1]
errorType: ConfigErrors [*] {readOnly, unique}

MaintenanceDomain
{partOfObjectKey=1 } nameFormat: MdNameFormatType [1] = char-string
{partOfObjectKey=2 } name: MdNameType [1] =
mdIndex: Integer [0..1]
mdLevel: MdLevelType [0..1] = 0
mhfCreation: MhfCreationType [0..1] = mhf-none
idPermission: SenderIdPermissionType [0..1]
faultAlarmAddress: FaultAlarmAdressType [0..1] = not-transmitted

(IetfInterfaces::ObjectClasses)
Interface
name: String [1]

(2)

Current Re-engineered UML from IEEE CFM (draft ieee802-dot1q-cfm) YANG – detailed (2)



MaintenanceDomain
- {partOfObjectKey=1 } nameFormat: MdNameFormatType [1] = char-string
- {partOfObjectKey=2 } name: MdNameType [1] =
- mdIndex: Integer [0..1]
- mdLevel: MdLevelType [0..1] = 0
- mhfCreation: MhfCreationType [0..1] = mhf-none
- idPermission: SenderIdPermissionType [0..1]
- faultAlarmAddress: FaultAlarmAdressType [0..1] = not-transmitted

(IetfInterfaces::ObjectClasses) Interface
- name: String [1]

MaintenanceAssociation
- {partOfObjectKey=1 } name: MaNameType [1]
- {partOfObjectKey=2 } nameFormat: MaNameFormatType [1]
- maIndex: Integer [0..1]
- mdReference: Integer [0..1]
- mhfCreation: MhfCreationType [0..1] = mhf-defer
- idPermission: SenderIdPermissionType [0..1] = send-id-defer
- ccmInterval: CcmIntervalType [0..1]
- selectors: ServiceSelectorValue [0..1]
- faultAlarmAddress: FaultAlarmAdressType [0..1] = not-specified

MaintenanceAssociationComponent
- {partOfObjectKey=1 } maComponentId: ComponentIdentifierType [1]
- primarySelectorType: ServiceSelectorType [0..1]
- primarySelectorOrNone: ServiceSelectorValueOrNone [0..1]
- mhfCreation: MhfCreationType [0..1] = mhf-defer
- idPermission: SenderIdPermissionType [0..1] = send-id-defer
- numberOfVids: Integer [0..1]
- selectors: ServiceSelectorValue [0..1]

Mep
- {partOfObjectKey=1 } mepId: MepIdType [1]
- maReference: Integer [0..1]
- mepDirection: MpDirectionType [0..1]
- mepPrimaryVid: Integer [0..1] = 0
- mepAdminState: Boolean [0..1] = false
- mepFngState: FngStateType [0..1] = fng-reset {readOnly, unique}
- mepCcmEnabled: Boolean [0..1] = false
- mepCcmLtmPriority: PriorityType [0..1]
- mepMacAddress: MacAddress [0..1]
- mepLowestPriorityDefect: LowestAlarmPriorityType [0..1] = mac-remote-error-xcon
- mepFngAlarmTime: Integer [0..1] = 250
- mepFngResetTime: Integer [0..1] = 1000
- mepHighestPriorityDefect: HighestDefectPriorityType [0..1] {readOnly, unique}
- mepDefects: MepDefectsType [0..1] {readOnly, unique}
- mepErrorCcmLastFailure: String [0..1] {readOnly, unique}
- mepXconCcmLastFailure: String [0..1] {readOnly, unique}
- mepNextLbmTransId: Integer [0..1] {readOnly, unique}
- mepLtmNextSeqNumber: Integer [0..1] {readOnly, unique}
- mepTransmitLbmStatus: Boolean [0..1] = false
- mepTransmitLbmDestMacAddress: MacAddress [0..1]
- mepTransmitLbmDestMepId: MepIdOrZeroType [0..1]
- mepTransmitLbmDestIsMepId: Boolean [0..1]
- mepTransmitLbmMessages: Integer [0..1] = 1
- mepTransmitLbmDataTlv: String [0..1]
- mepTransmitLbmVlanPriority: PriorityType [0..1]
- mepTransmitLbmVlanDropEligible: Boolean [0..1] = false
- mepTransmitLbmResultOk: Boolean [0..1] = true {readOnly, unique}
- mepTransmitLbmSeqNumber: Integer [0..1]
- mepTransmitLtmStatus: Boolean [0..1] = true
- mepTransmitLtmFlags: MepTxLtmFlagsType [0..1] = use-fdb-only
- mepTransmitLtmTargetMacAddress: MacAddress [0..1]
- mepTransmitLtmTargetMepId: MepIdOrZeroType [0..1]
- mepTransmitLtmTargetIsMepId: Boolean [0..1] = false
- mepTransmitLtmTtl: Integer [0..1] = 64
- mepTransmitLtmResult: Boolean [0..1] = false {readOnly, unique}
- mepTransmitLtmSeqNumber: Integer [0..1] {readOnly, unique}
- mepTransmitLtmEgressIdentifier: String [0..1] {readOnly, unique}

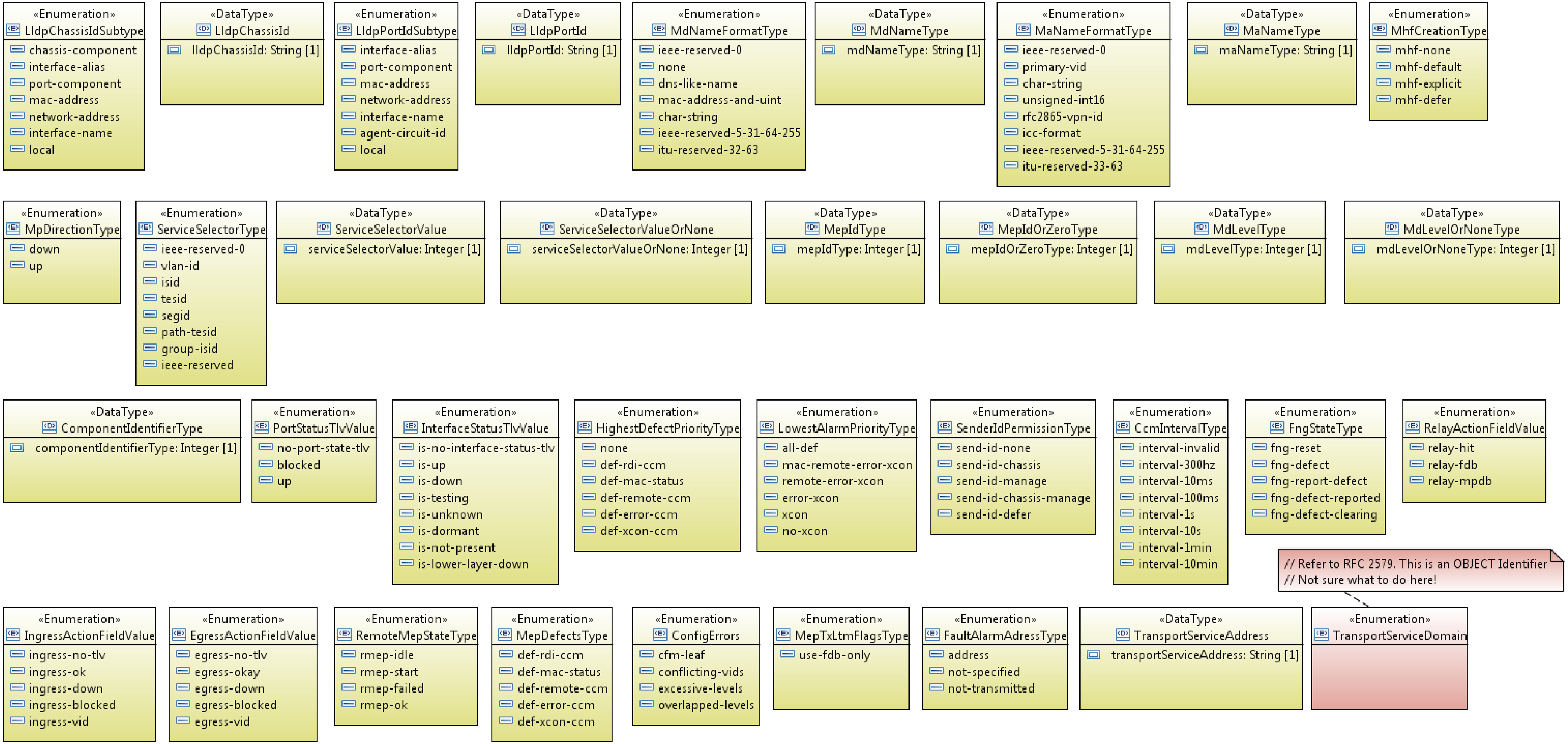
LinktraceReply
- {partOfObjectKey=1 } ltrSeqNumber: Integer [1]
- {partOfObjectKey=2 } ltrReceiveOrder: Integer [1]
- ltrTtl: Integer [0..1] {readOnly, unique}
- ltrForwarded: Boolean [0..1] {readOnly, unique}
- ltrTerminalMep: Boolean [0..1] {readOnly, unique}
- ltrLastEgressIdentifier: String [0..1] {readOnly, unique}
- ltrNextEgressIdentifier: String [0..1] {readOnly, unique}
- ltrRelay: RelayActionFieldValue [0..1] {readOnly, unique}
- ltrChassisIdSubtype: LldpChassisIdSubtype [0..1] {readOnly, unique}
- ltrChassisId: LldpChassisId [0..1] {readOnly, unique}
- ltrManAddressDomain: TransportServiceDomain [0..1] {readOnly, unique}
- ltrManAddress: TransportServiceAddress [0..1] {readOnly, unique}
- ltrIngress: IngressActionFieldValue [0..1] {readOnly, unique}
- ltrIngressMac: MacAddress [0..1] {readOnly, unique}
- ltrIngressPortIdSubtype: LldpPortIdSubtype [0..1] {readOnly, unique}
- ltrEgress: EgressActionFieldValue [0..1] {readOnly, unique}
- ltrEgressMac: MacAddress [0..1] {readOnly, unique}
- ltrEgressPortIdSubtype: LldpPortIdSubtype [0..1] {readOnly, unique}
- ltrEgressPortId: LldpPortId [0..1] {readOnly, unique}
- ltrOrganizationSpecificTlv: String [0..1] {readOnly, unique}

MepDb
- {partOfObjectKey=1 } rmepId: MepIdType [1]
- rmepState: RemoteMepStateType [0..1] {readOnly, unique}
- rmepFailedOkTime: Integer [0..1] {readOnly, unique}
- mepDbMacAddress: MacAddress [0..1] {readOnly, unique}
- mepDbRdi: Boolean [0..1] {readOnly, unique}
- mepDbPortStatusTlv: PortStatusTlvValue [0..1] = no-port-state-tlv {readOnly, unique}
- mepDbInterfaceStatusTlv: InterfaceStatusTlvValue [0..1] = is-no-interface-status-tlv {readOnly, unique}
- mepDbChassisIdSubtype: LldpChassisIdSubtype [0..1] {readOnly, unique}
- mepDbChassisId: LldpChassisId [0..1] {readOnly, unique}
- mepDbManAddressDomain: TransportServiceDomain [0..1] {readOnly, unique}
- mepDbManAddress: TransportServiceAddress [0..1] {readOnly, unique}
- mepDbRmepIsActive: Boolean [0..1]

Stats
- mepCcmSequenceErrors: Integer [0..1] {readOnly, unique}
- mepSentCcms: Integer [0..1] {readOnly, unique}
- mepLbrIn: Integer [0..1] {readOnly, unique}
- mepLbrInOutOfOrder: Integer [0..1] {readOnly, unique}
- mepLbrBadMsdu: Integer [0..1] {readOnly, unique}
- mepUnexpectedLtrIn: Integer [0..1] {readOnly, unique}
- mepLbrOut: Integer [0..1] {readOnly, unique}

Since the IEEE CFM YANG (draft ieee802-dot1q-cfm) model is still under development, we will just use the current available re-engineered UML (in particular the lists of attributes of the Mep, MepDb, and LinktraceReply) as the base for pruning the G.8052 model for G.8052.1.

Current Re-engineered UML from IEEE CFM (draft ieee802-dot1q-cfm) YANG – data types (3)



«Enumeration» LldpChassisIdSubtype
- chassis-component
- interface-alias
- port-component
- mac-address
- network-address
- interface-name
- local

«DataType» LldpChassisId
- lldpChassisId: String [1]

«Enumeration» LldpPortIdSubtype
- interface-alias
- port-component
- mac-address
- network-address
- interface-name
- agent-circuit-id
- local

«DataType» LldpPortId
- lldpPortId: String [1]

«Enumeration» MdNameFormatType
- ieee-reserved-0
- none
- dns-like-name
- mac-address-and-uint
- char-string
- ieee-reserved-5-31-64-255
- itu-reserved-32-63

«DataType» MdNameType
- mdNameType: String [1]

«Enumeration» MaNameFormatType
- ieee-reserved-0
- primary-vid
- char-string
- unsigned-int16
- rfc2865-vpn-id
- icc-format
- ieee-reserved-5-31-64-255
- itu-reserved-33-63

«DataType» MaNameType
- maNameType: String [1]

«Enumeration» MhfCreationType
- mhf-none
- mhf-default
- mhf-explicit
- mhf-defer

«Enumeration» MpDirectionType
- down
- up

«Enumeration» ServiceSelectorType
- ieee-reserved-0
- vlan-id
- isid
- tesid
- segid
- path-tesid
- group-isid
- ieee-reserved

«DataType» ServiceSelectorValue
- serviceSelectorValue: Integer [1]

«DataType» ServiceSelectorValueOrNone
- serviceSelectorValueOrNone: Integer [1]

«DataType» MepIdType
- mepIdType: Integer [1]

«DataType» MepIdOrZeroType
- mepIdOrZeroType: Integer [1]

«DataType» MdLevelType
- mdLevelType: Integer [1]

«DataType» MdLevelOrNoneType
- mdLevelOrNoneType: Integer [1]

«DataType» ComponentIdentifierType
- componentIdentifierType: Integer [1]

«Enumeration» PortStatusTlvValue
- no-port-state-tlv
- blocked
- up

«Enumeration» InterfaceStatusTlvValue
- is-no-interface-status-tlv
- is-up
- is-down
- is-testing
- is-unknown
- is-dormant
- is-not-present
- is-lower-layer-down

«Enumeration» HighestDefectPriorityType
- none
- def-rdi-ccm
- def-mac-status
- def-remote-ccm
- def-error-ccm
- def-xcon-ccm

«Enumeration» LowestAlarmPriorityType
- all-def
- mac-remote-error-xcon
- remote-error-xcon
- error-xcon
- xcon
- no-xcon

«Enumeration» SenderIdPermissionType
- send-id-none
- send-id-chassis
- send-id-manage
- send-id-chassis-manage
- send-id-defer

«Enumeration» CcmIntervalType
- interval-invalid
- interval-300hz
- interval-10ms
- interval-100ms
- interval-1s
- interval-10s
- interval-1min
- interval-10min

«Enumeration» FngStateType
- fng-reset
- fng-defect
- fng-report-defect
- fng-defect-reported
- fng-defect-clearing

«Enumeration» RelayActionFieldValue
- relay-hit
- relay-fdb
- relay-mpdb

// Refer to RFC 2579. This is an OBJECT Identifier
// Not sure what to do here!

«Enumeration» IngressActionFieldValue
- ingress-no-tlv
- ingress-ok
- ingress-down
- ingress-blocked
- ingress-vid

«Enumeration» EgressActionFieldValue
- egress-no-tlv
- egress-okay
- egress-down
- egress-blocked
- egress-vid

«Enumeration» RemoteMepStateType
- rmep-idle
- rmep-start
- rmep-failed
- rmep-ok

«Enumeration» MepDefectsType
- def-rdi-ccm
- def-mac-status
- def-remote-ccm
- def-error-ccm
- def-xcon-ccm

«Enumeration» ConfigErrors
- cfm-leaf
- conflicting-vids
- excessive-levels
- overlapped-levels

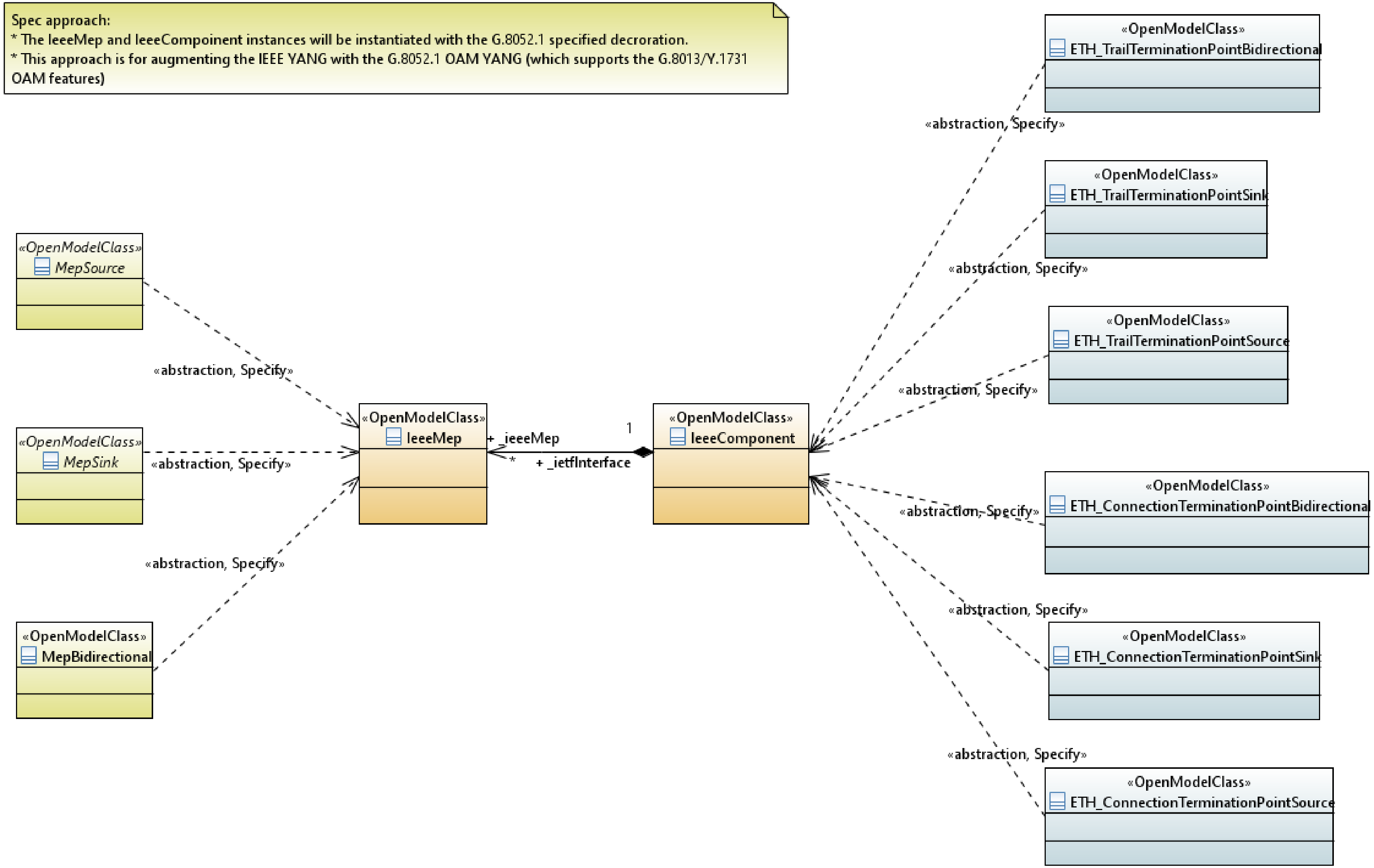
«Enumeration» MepTxLtmFlagsType
- use-fdb-only

«Enumeration» FaultAlarmAdressType
- address
- not-specified
- not-transmitted

«DataType» TransportServiceAddress
- transportServiceAddress: String [1]

«Enumeration» TransportServiceDomain

Touch Point Model Sketch – 1: Spec approach



Spec approach:
* The IeeeMep and IeeeCompoinent instances will be instantiated with the G.8052.1 specified decoration.
* This approach is for augmenting the IEEE YANG with the G.8052.1 OAM YANG (which supports the G.8013/Y.1731 OAM features)

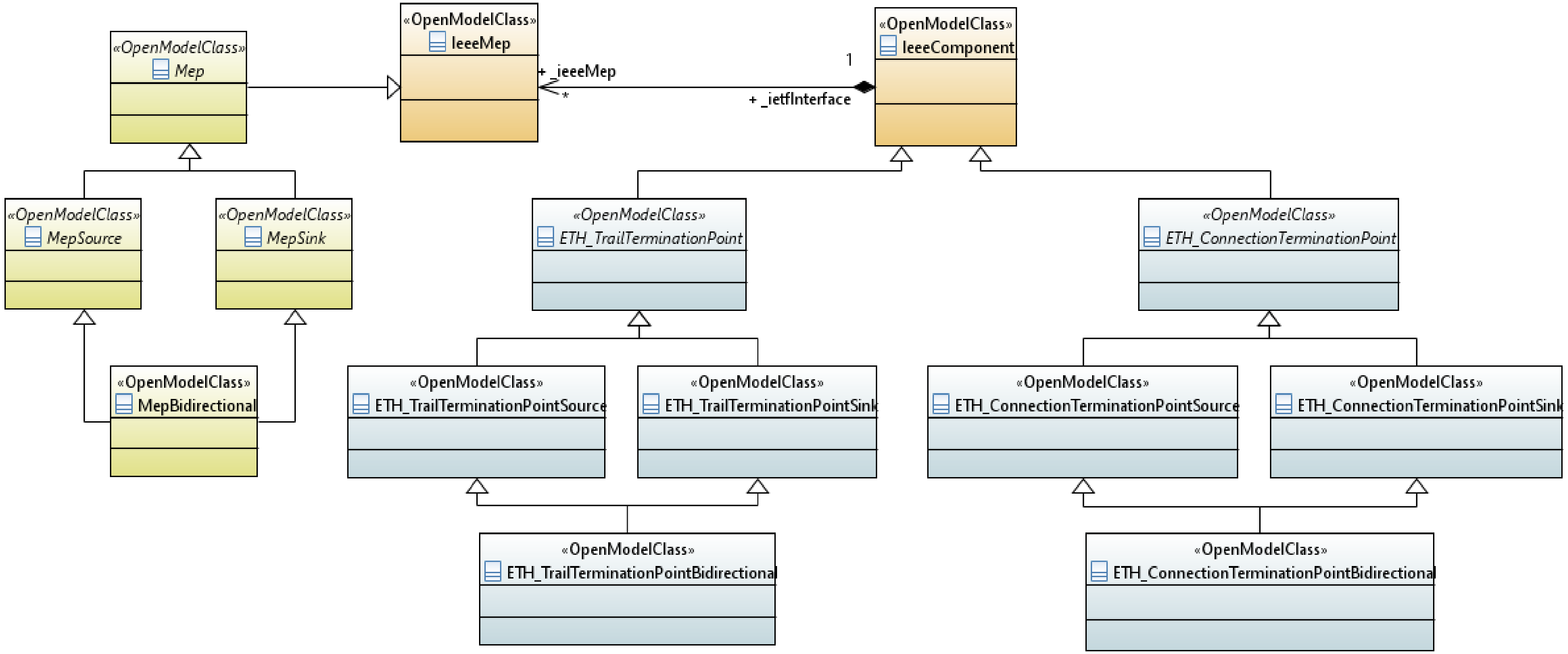
«OpenModelClass» MepSource
«OpenModelClass» MepSink
«OpenModelClass» MepBidirectional
«abstraction, Specify»
«abstraction, Specify»
«abstraction, Specify»
«OpenModelClass» IeeeMep
+ _ieeeMep
*
1
+ _ietfInterface
«OpenModelClass» IeeeComponent
«OpenModelClass» ETH_TrailTerminationPointBidirectional
«OpenModelClass» ETH_TrailTerminationPointSink
«OpenModelClass» ETH_TrailTerminationPointSource
«OpenModelClass» ETH_ConnectionTerminationPointBidirectional
«OpenModelClass» ETH_ConnectionTerminationPointSink
«OpenModelClass» ETH_ConnectionTerminationPointSource
«abstraction, Specify»
«abstraction, Specify»
«abstraction, Specify»
«abstraction, Specify»
«abstraction, Specify»
«abstraction, Specify»

Touch Point Model Sketch – 2: Subclassing approach

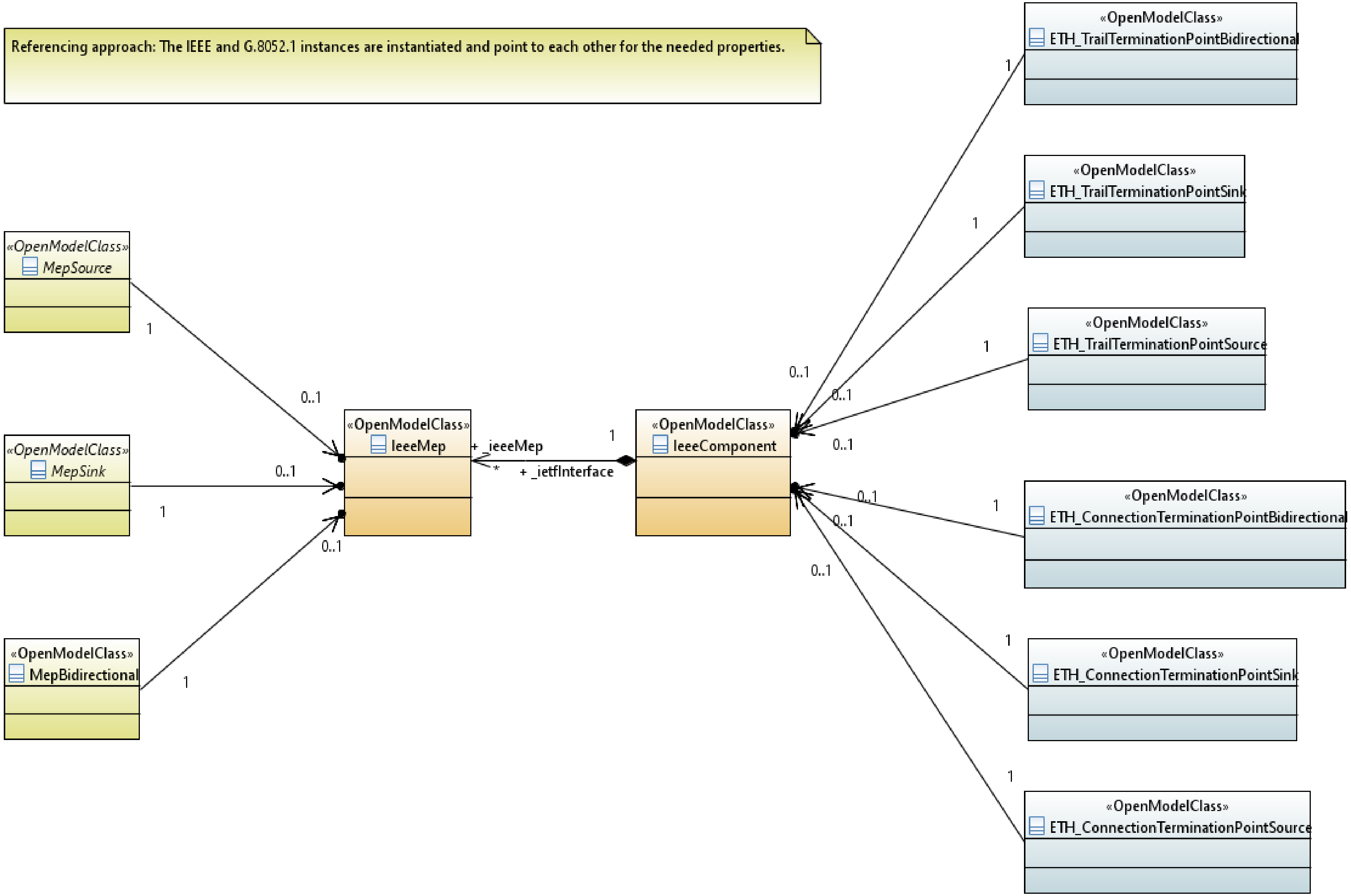
Subclassing approach: The G.8052.1 Mep classes are subclasses of IEEE Mep, and G.8052.1 ETH TPs are subclasses of IEEE Component

* The G.8052.1 MEP and TP instances will be instantiated with the inherited properties from the IEEE and IETF superclasses.

* This gives same effect as augmenting the G.8052.1 MEP and TP YANG with the IEEE and IETF properties.

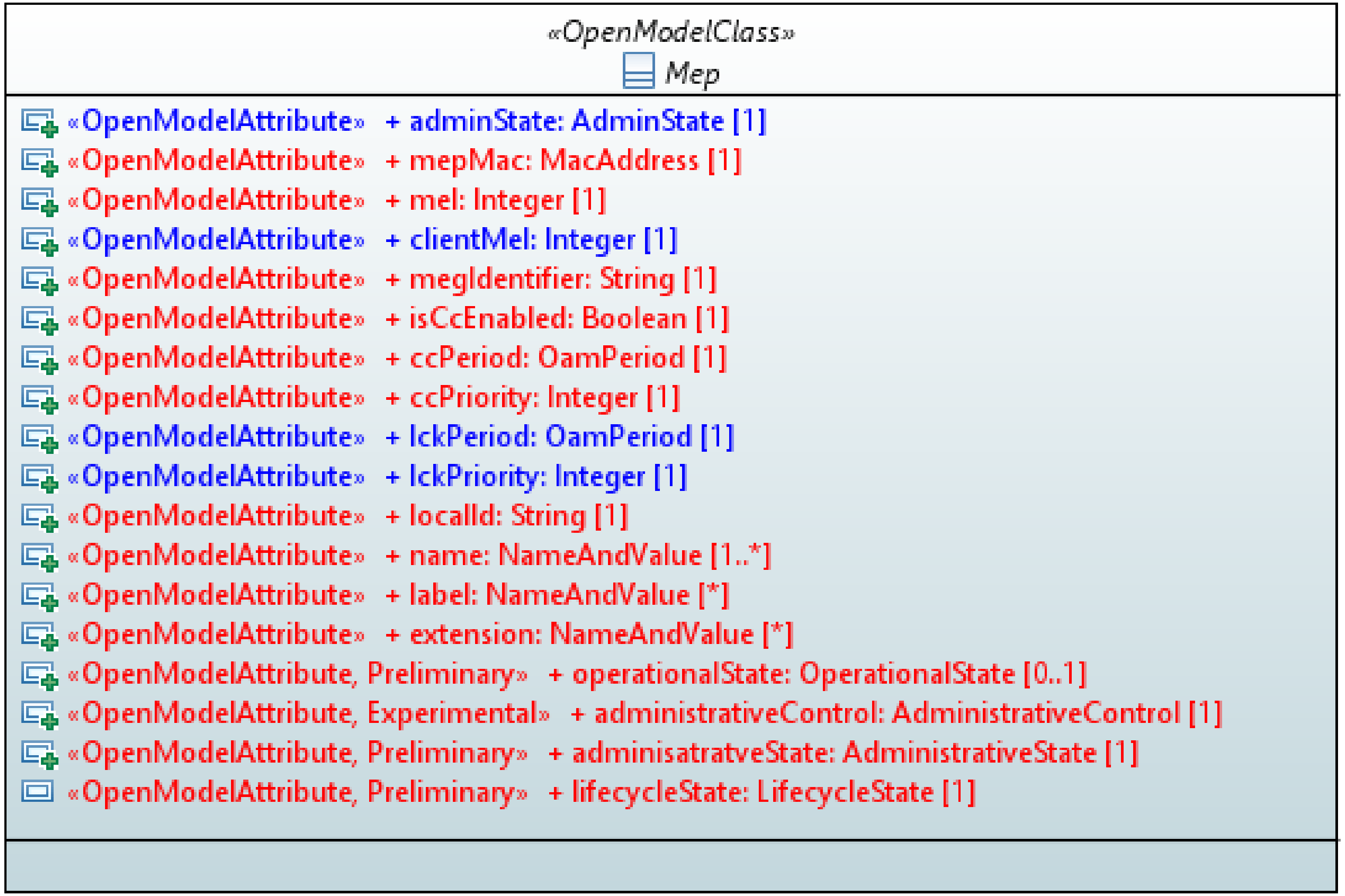

«OpenModelClass» Mep
«OpenModelClass» IeeeMep
«OpenModelClass» IeeeComponent
+ _ieeeMep
*
1
+ _ietfInterface
«OpenModelClass» MepSource
«OpenModelClass» MepSink
«OpenModelClass» MepBidirectional
«OpenModelClass» ETH_TrailTerminationPoint
«OpenModelClass» ETH_ConnectionTerminationPoint
«OpenModelClass» ETH_TrailTerminationPointSource
«OpenModelClass» ETH_TrailTerminationPointSink
«OpenModelClass» ETH_ConnectionTerminationPointSource
«OpenModelClass» ETH_ConnectionTerminationPointSink
«OpenModelClass» ETH_TrailTerminationPointBidirectional
«OpenModelClass» ETH_ConnectionTerminationPointBidirectional

Touch Point Model Sketch – 3: Referencing approach



Referencing approach: The IEEE and G.8052.1 instances are instantiated and point to each other for the needed properties.

P&R Model Sketch – 1: G.8052 MEP Pruning & Refactoring

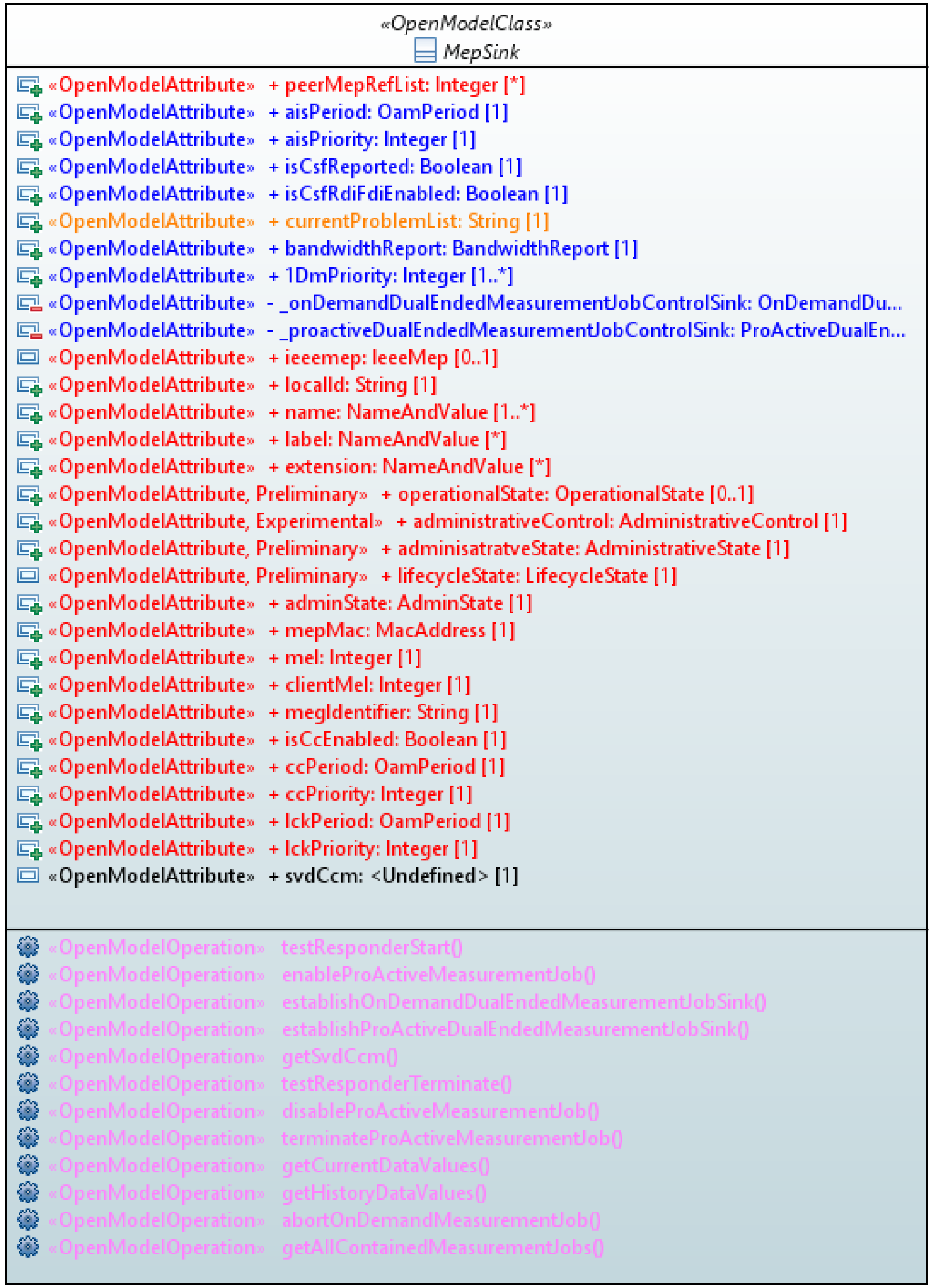


«OpenModelClass»
Mep

«OpenModelAttribute» + adminState: AdminState [1]
«OpenModelAttribute» + mepMac: MacAddress [1]
«OpenModelAttribute» + mel: Integer [1]
«OpenModelAttribute» + clientMel: Integer [1]
«OpenModelAttribute» + megIdentifier: String [1]
«OpenModelAttribute» + isCcEnabled: Boolean [1]
«OpenModelAttribute» + ccPeriod: OamPeriod [1]
«OpenModelAttribute» + ccPriority: Integer [1]
«OpenModelAttribute» + lckPeriod: OamPeriod [1]
«OpenModelAttribute» + lckPriority: Integer [1]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]

Color code:
* Red means remove
* Blue means keep
* Black means more thought required
* Purple means refactor
* Brown means aim to augment IEEE YANG list

P&R Model Sketch – 1: G.8052 MEP Sink Pruning & Refactoring



«OpenModelClass»
MepSink

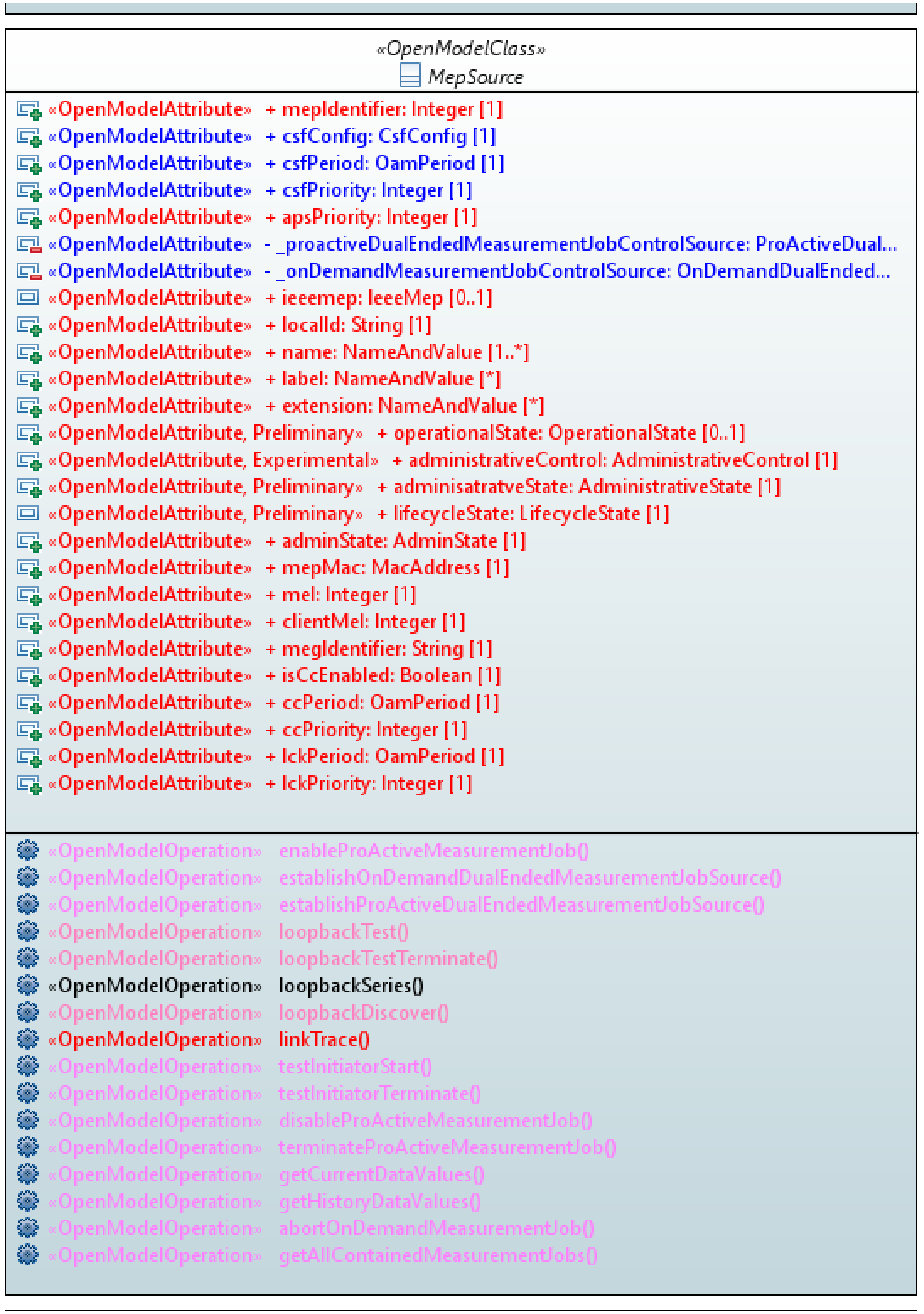
```
«OpenModelAttribute»  + peerMepRefList: Integer [*]
«OpenModelAttribute»  + aisPeriod: OamPeriod [1]
«OpenModelAttribute»  + aisPriority: Integer [1]
«OpenModelAttribute»  + isCsfReported: Boolean [1]
«OpenModelAttribute»  + isCsfRdiFdiEnabled: Boolean [1]
«OpenModelAttribute»  + currentProblemList: String [1]
«OpenModelAttribute»  + bandwidthReport: BandwidthReport [1]
«OpenModelAttribute»  + 1DmPriority: Integer [1..*]
«OpenModelAttribute»  - _onDemandDualEndedMeasurementJobControlSink: OnDemandDu...
«OpenModelAttribute»  - _proactiveDualEndedMeasurementJobControlSink: ProActiveDualEn...
«OpenModelAttribute»  + ieeemep: IeeeMep [0..1]
«OpenModelAttribute»  + localId: String [1]
«OpenModelAttribute»  + name: NameAndValue [1..*]
«OpenModelAttribute»  + label: NameAndValue [*]
«OpenModelAttribute»  + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary»  + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental»  + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary»  + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary»  + lifecycleState: LifecycleState [1]
«OpenModelAttribute»  + adminState: AdminState [1]
«OpenModelAttribute»  + mepMac: MacAddress [1]
«OpenModelAttribute»  + mel: Integer [1]
«OpenModelAttribute»  + clientMel: Integer [1]
«OpenModelAttribute»  + megIdentifier: String [1]
«OpenModelAttribute»  + isCcEnabled: Boolean [1]
«OpenModelAttribute»  + ccPeriod: OamPeriod [1]
«OpenModelAttribute»  + ccPriority: Integer [1]
«OpenModelAttribute»  + lckPeriod: OamPeriod [1]
«OpenModelAttribute»  + lckPriority: Integer [1]
«OpenModelAttribute»  + svdCcm: <Undefined> [1]

«OpenModelOperation»  testResponderStart()
«OpenModelOperation»  enableProActiveMeasurementJob()
«OpenModelOperation»  establishOnDemandDualEndedMeasurementJobSink()
«OpenModelOperation»  establishProActiveDualEndedMeasurementJobSink()
«OpenModelOperation»  getSvdCcm()
«OpenModelOperation»  testResponderTerminate()
«OpenModelOperation»  disableProActiveMeasurementJob()
«OpenModelOperation»  terminateProActiveMeasurementJob()
«OpenModelOperation»  getCurrentDataValues()
«OpenModelOperation»  getHistoryDataValues()
«OpenModelOperation»  abortOnDemandMeasurementJob()
«OpenModelOperation»  getAllContainedMeasurementJobs()
```

Question: Does IEEE YANG have a place where we can augment the defects (i.e., the ones in Table 2 of WD14-29, 12/2017 London, such as cDEG, cLOC, cUNL, cMMG, cUNM, cUNP, cUNPr, cRDI)

The operations Establish/Enable/Disable/Terminate/Abort OnDemand/ProActive Single/Dual Ended MeasurementJob Sink/Source will be normalized to the creation/deletion/setting of instance of MeasuremnetJobControl Sink/Source (and the creation/deletion of Current/History Data in case of ProActive measurement job).
The operations getCurrent/HistoryDataValues operations will be normalized into retrieving the attributes of the Current/HistoryData objects.

The operations testResponderStart and testResponderTerminate (at the Sink function of the MEP) will be refactored into an attribute "testResponder" with complex data type with fields:
* active (Boolean, true means start, false means terminate)
* macAddress
* testPattern (enum)
* testResult (4 sub-fields: # rec, #crc, #ber, #OOO), reset to all zero when active, replaced with the test result when de-activated.
There should be an autonomours notification to report the value of the test result, sent at least 5 seconds after the deactivation.

P&R Model Sketch – 1: G.8052 MEP Source Pruning & Refactoring



«OpenModelClass»
MepSource

- «OpenModelAttribute» + mepIdentifier: Integer [1]
- «OpenModelAttribute» + csfConfig: CsfConfig [1]
- «OpenModelAttribute» + csfPeriod: OamPeriod [1]
- «OpenModelAttribute» + csfPriority: Integer [1]
- «OpenModelAttribute» + apsPriority: Integer [1]
- «OpenModelAttribute» - _proactiveDualEndedMeasurementJobControlSource: ProActiveDual...
- «OpenModelAttribute» - _onDemandMeasurementJobControlSource: OnDemandDualEnded...
- «OpenModelAttribute» + ieeemep: IeeeMep [0..1]
- «OpenModelAttribute» + localId: String [1]
- «OpenModelAttribute» + name: NameAndValue [1..*]
- «OpenModelAttribute» + label: NameAndValue [*]
- «OpenModelAttribute» + extension: NameAndValue [*]
- «OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
- «OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
- «OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
- «OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
- «OpenModelAttribute» + adminState: AdminState [1]
- «OpenModelAttribute» + mepMac: MacAddress [1]
- «OpenModelAttribute» + mel: Integer [1]
- «OpenModelAttribute» + clientMel: Integer [1]
- «OpenModelAttribute» + megIdentifier: String [1]
- «OpenModelAttribute» + isCcEnabled: Boolean [1]
- «OpenModelAttribute» + ccPeriod: OamPeriod [1]
- «OpenModelAttribute» + ccPriority: Integer [1]
- «OpenModelAttribute» + lckPeriod: OamPeriod [1]
- «OpenModelAttribute» + lckPriority: Integer [1]

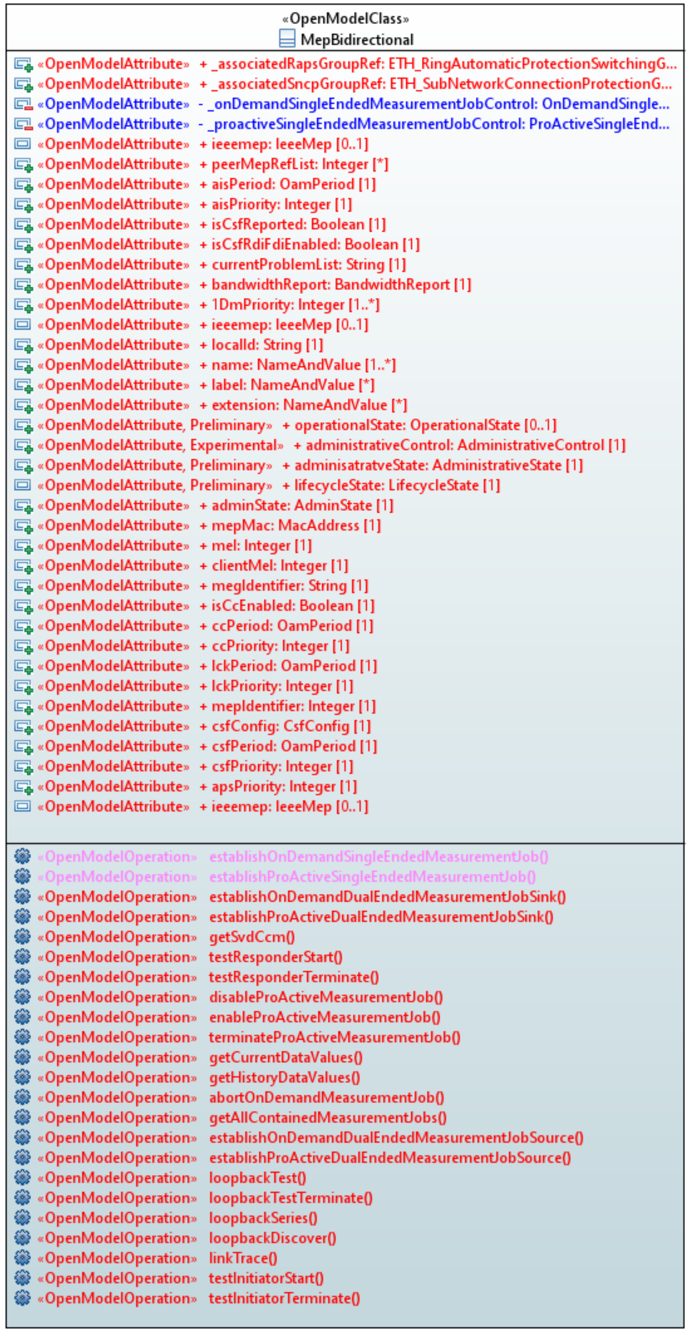
- «OpenModelOperation» enableProActiveMeasurementJob()
- «OpenModelOperation» establishOnDemandDualEndedMeasurementJobSource()
- «OpenModelOperation» establishProActiveDualEndedMeasurementJobSource()
- «OpenModelOperation» loopbackTest()
- «OpenModelOperation» loopbackTestTerminate()
- «OpenModelOperation» loopbackSeries()
- «OpenModelOperation» loopbackDiscover()
- «OpenModelOperation» linkTrace()
- «OpenModelOperation» testInitiatorStart()
- «OpenModelOperation» testInitiatorTerminate()
- «OpenModelOperation» disableProActiveMeasurementJob()
- «OpenModelOperation» terminateProActiveMeasurementJob()
- «OpenModelOperation» getCurrentDataValues()
- «OpenModelOperation» getHistoryDataValues()
- «OpenModelOperation» abortOnDemandMeasurementJob()
- «OpenModelOperation» getAllContainedMeasurementJobs()

The operations testInitiatorStart and testInitiatorTerminate (at the Source function of the MEP) will be refactored into an attribute "testInitiator" with complex data type with fields:
* active (Boolean, true means start, false means terminate)
* destination macAddress
* dropEligibility: Boolean
* priority: Integer
* dataTlvLength: Integer
* period: OamPeriod
* testPattern: Enum
* numberOfTestFramesSent: Integer. (This field is reset to zero when active, and will be replaced with the number of test frames has been sent when de-activated. There should be an autonomours notification to report the value of the value of the numberOfTestFramesSent.)

The operations loopbackTest, loopbackterminate, loopbakSeries, and loopbackDiscover will be normalized into 3 attributes, each of which will have complex data type to represent the input and output parameters of the original operations

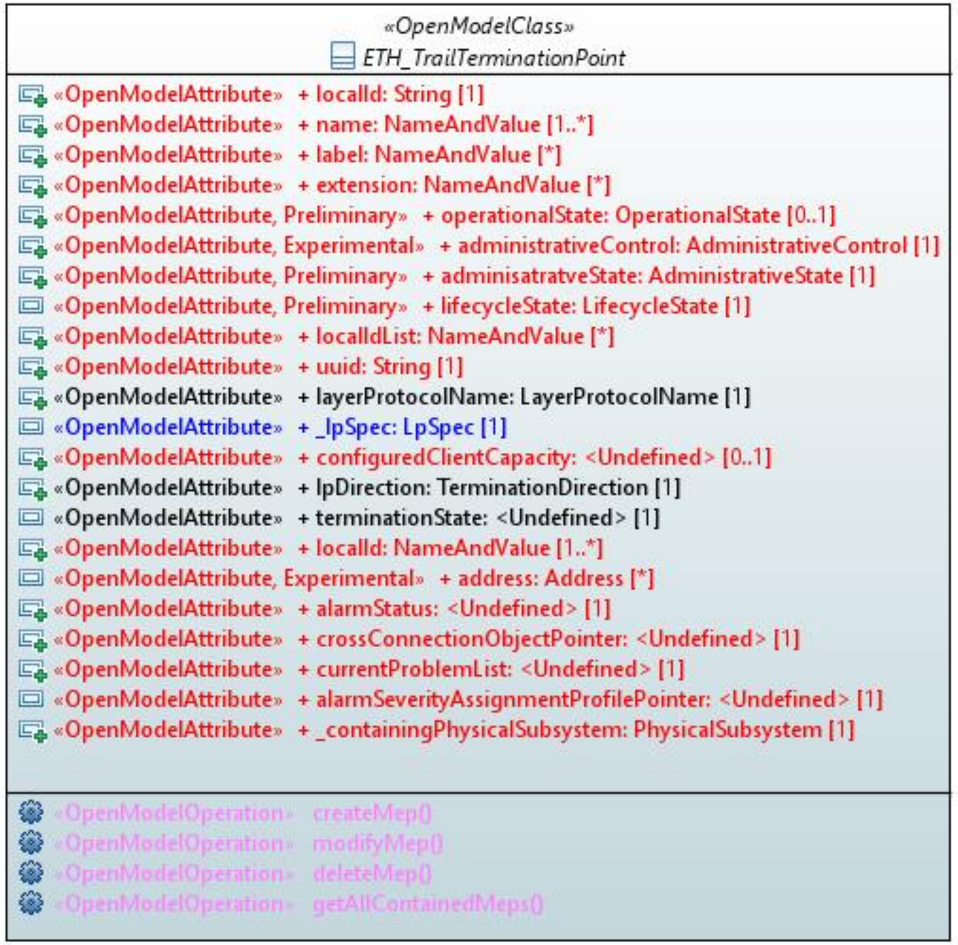
The IEEE Yang module's LtrEntry is the linkTrace. It has been re-engineered into Bernd's UML.

P&R Model Sketch – 1: G.8052 MEP Bidirectional Pruning & Refactoring



```
«OpenModelClass»
MepBidirectional

«OpenModelAttribute»  + _associatedRapsGroupRef: ETH_RingAutomaticProtectionSwitchingG...
«OpenModelAttribute»  + _associatedSncpGroupRef: ETH_SubNetworkConnectionProtectionG...
«OpenModelAttribute»  - _onDemandSingleEndedMeasurementJobControl: OnDemandSingle...
«OpenModelAttribute»  - _proactiveSingleEndedMeasurementJobControl: ProActiveSingleEnd...
«OpenModelAttribute»  + ieeemep: IeeeMep [0..1]
«OpenModelAttribute»  + peerMepRefList: Integer [*]
«OpenModelAttribute»  + aisPeriod: OamPeriod [1]
«OpenModelAttribute»  + aisPriority: Integer [1]
«OpenModelAttribute»  + isCsfReported: Boolean [1]
«OpenModelAttribute»  + isCsfRdiFdiEnabled: Boolean [1]
«OpenModelAttribute»  + currentProblemList: String [1]
«OpenModelAttribute»  + bandwidthReport: BandwidthReport [1]
«OpenModelAttribute»  + 1DmPriority: Integer [1..*]
«OpenModelAttribute»  + ieeemep: IeeeMep [0..1]
«OpenModelAttribute»  + localId: String [1]
«OpenModelAttribute»  + name: NameAndValue [1..*]
«OpenModelAttribute»  + label: NameAndValue [*]
«OpenModelAttribute»  + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary»  + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental»  + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary»  + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary»  + lifecycleState: LifecycleState [1]
«OpenModelAttribute»  + adminState: AdminState [1]
«OpenModelAttribute»  + mepMac: MacAddress [1]
«OpenModelAttribute»  + mel: Integer [1]
«OpenModelAttribute»  + clientMel: Integer [1]
«OpenModelAttribute»  + megIdentifier: String [1]
«OpenModelAttribute»  + isCcEnabled: Boolean [1]
«OpenModelAttribute»  + ccPeriod: OamPeriod [1]
«OpenModelAttribute»  + ccPriority: Integer [1]
«OpenModelAttribute»  + lckPeriod: OamPeriod [1]
«OpenModelAttribute»  + lckPriority: Integer [1]
«OpenModelAttribute»  + mepIdentifier: Integer [1]
«OpenModelAttribute»  + csfConfig: CsfConfig [1]
«OpenModelAttribute»  + csfPeriod: OamPeriod [1]
«OpenModelAttribute»  + csfPriority: Integer [1]
«OpenModelAttribute»  + apsPriority: Integer [1]
«OpenModelAttribute»  + ieeemep: IeeeMep [0..1]

«OpenModelOperation»  establishOnDemandSingleEndedMeasurementJob()
«OpenModelOperation»  establishProActiveSingleEndedMeasurementJob()
«OpenModelOperation»  establishOnDemandDualEndedMeasurementJobSink()
«OpenModelOperation»  establishProActiveDualEndedMeasurementJobSink()
«OpenModelOperation»  getSvdCcm()
«OpenModelOperation»  testResponderStart()
«OpenModelOperation»  testResponderTerminate()
«OpenModelOperation»  disableProActiveMeasurementJob()
«OpenModelOperation»  enableProActiveMeasurementJob()
«OpenModelOperation»  terminateProActiveMeasurementJob()
«OpenModelOperation»  getCurrentDataValues()
«OpenModelOperation»  getHistoryDataValues()
«OpenModelOperation»  abortOnDemandMeasurementJob()
«OpenModelOperation»  getAllContainedMeasurementJobs()
«OpenModelOperation»  establishOnDemandDualEndedMeasurementJobSource()
«OpenModelOperation»  establishProActiveDualEndedMeasurementJobSource()
«OpenModelOperation»  loopbackTest()
«OpenModelOperation»  loopbackTestTerminate()
«OpenModelOperation»  loopbackSeries()
«OpenModelOperation»  loopbackDiscover()
«OpenModelOperation»  linkTrace()
«OpenModelOperation»  testInitiatorStart()
«OpenModelOperation»  testInitiatorTerminate()
```

P&R Model Sketch – 1: G.8052 TP Pruning & Refactoring



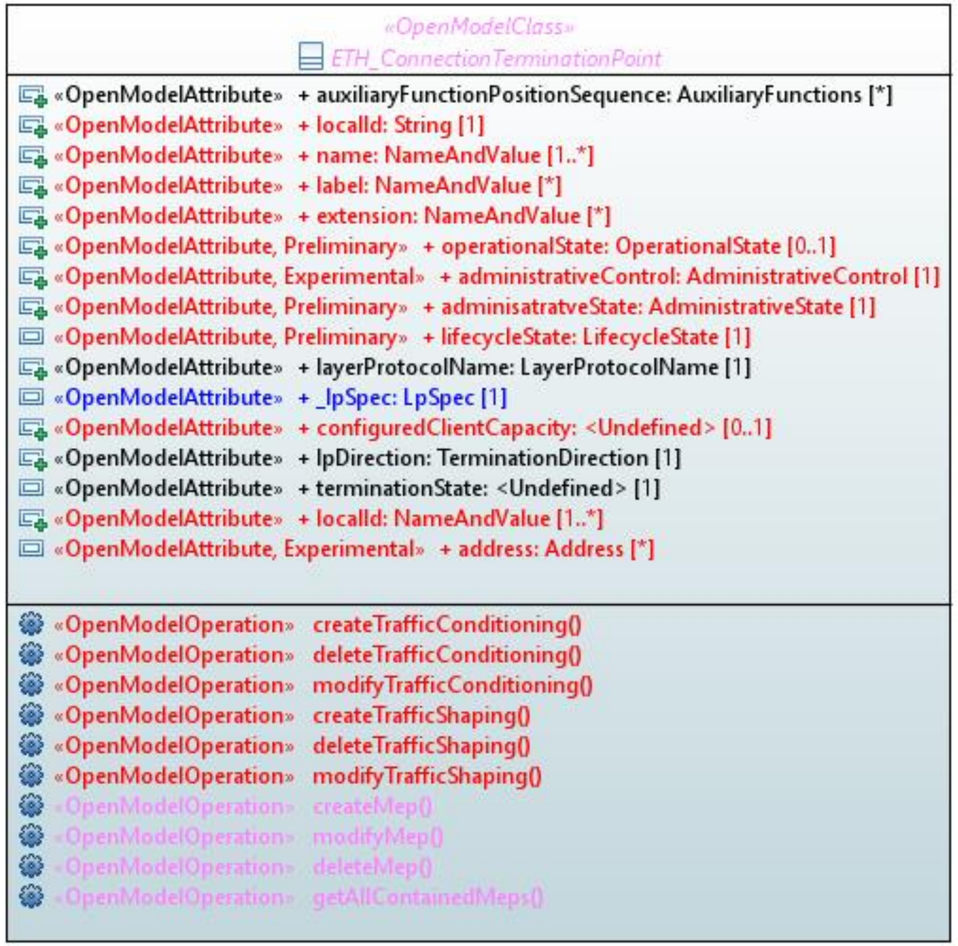
```
«OpenModelClass»
ETH_TrailTerminationPoint
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + localIdList: NameAndValue [*]
«OpenModelAttribute» + uuid: String [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + alarmStatus: <Undefined> [1]
«OpenModelAttribute» + crossConnectionObjectPointer: <Undefined> [1]
«OpenModelAttribute» + currentProblemList: <Undefined> [1]
«OpenModelAttribute» + alarmSeverityAssignmentProfilePointer: <Undefined> [1]
«OpenModelAttribute» + _containingPhysicalSubsystem: PhysicalSubsystem [1]
«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()
```

Need to check if the auxiliaryFunctionPositionSequence should be kept or not.

Need to check if IEEE YANG already has support for lpDirection and terminationState and layerProtocolName

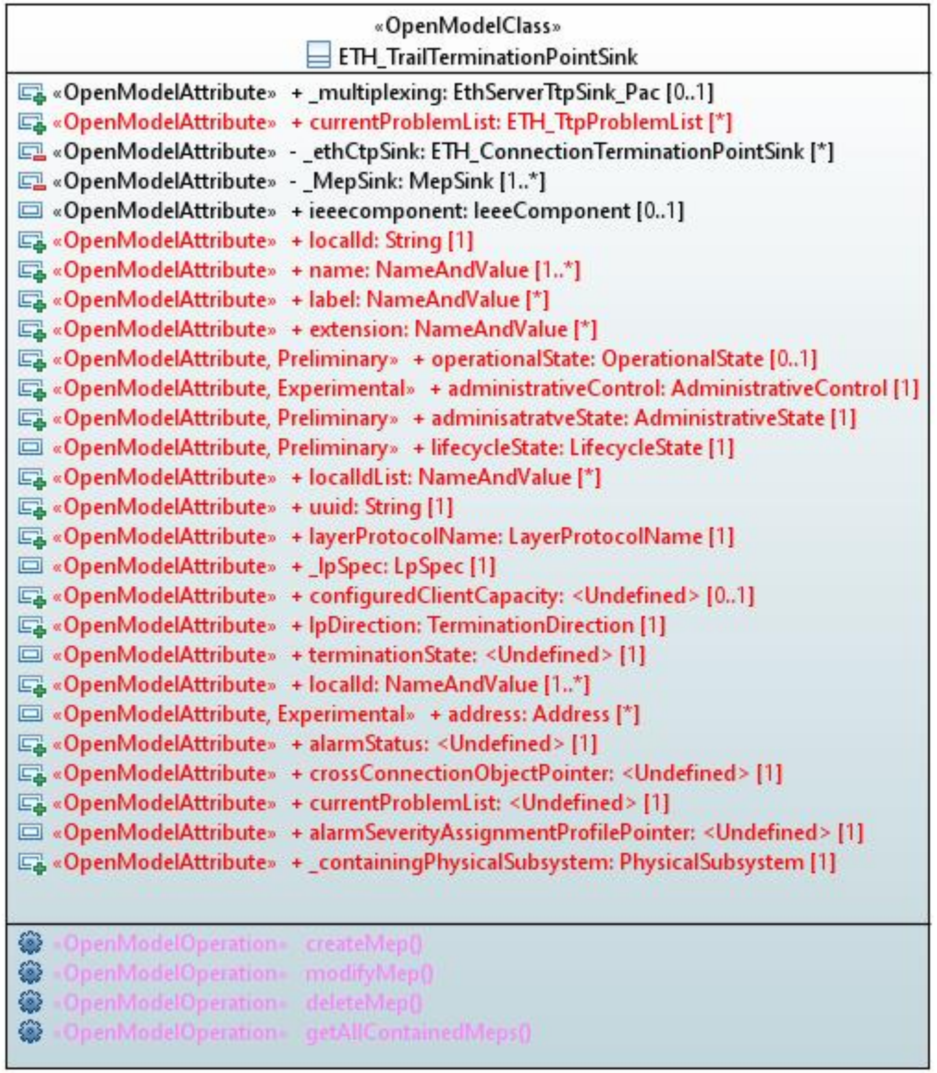
Prunned out the alarm related attributes of TTP (i.e., alarmStatus, currentProblemList, and alarmSeverityAssignmentProfliePointer). OAM related alarm is covered by the fault causes at the MEP, such as cUNP, cMMG, etc.)

Normalize the create/modify/delete/ getAllContained MEP operation into management of MEP instance



```
«OpenModelClass»
ETH_ConnectionTerminationPoint
«OpenModelAttribute» + auxiliaryFunctionPositionSequence: AuxiliaryFunctions [*]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelOperation» createTrafficConditioning()
«OpenModelOperation» deleteTrafficConditioning()
«OpenModelOperation» modifyTrafficConditioning()
«OpenModelOperation» createTrafficShaping()
«OpenModelOperation» deleteTrafficShaping()
«OpenModelOperation» modifyTrafficShaping()
«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()
```

P&R Model Sketch – 1: G.8052 TP Sink Pruning & Refactoring

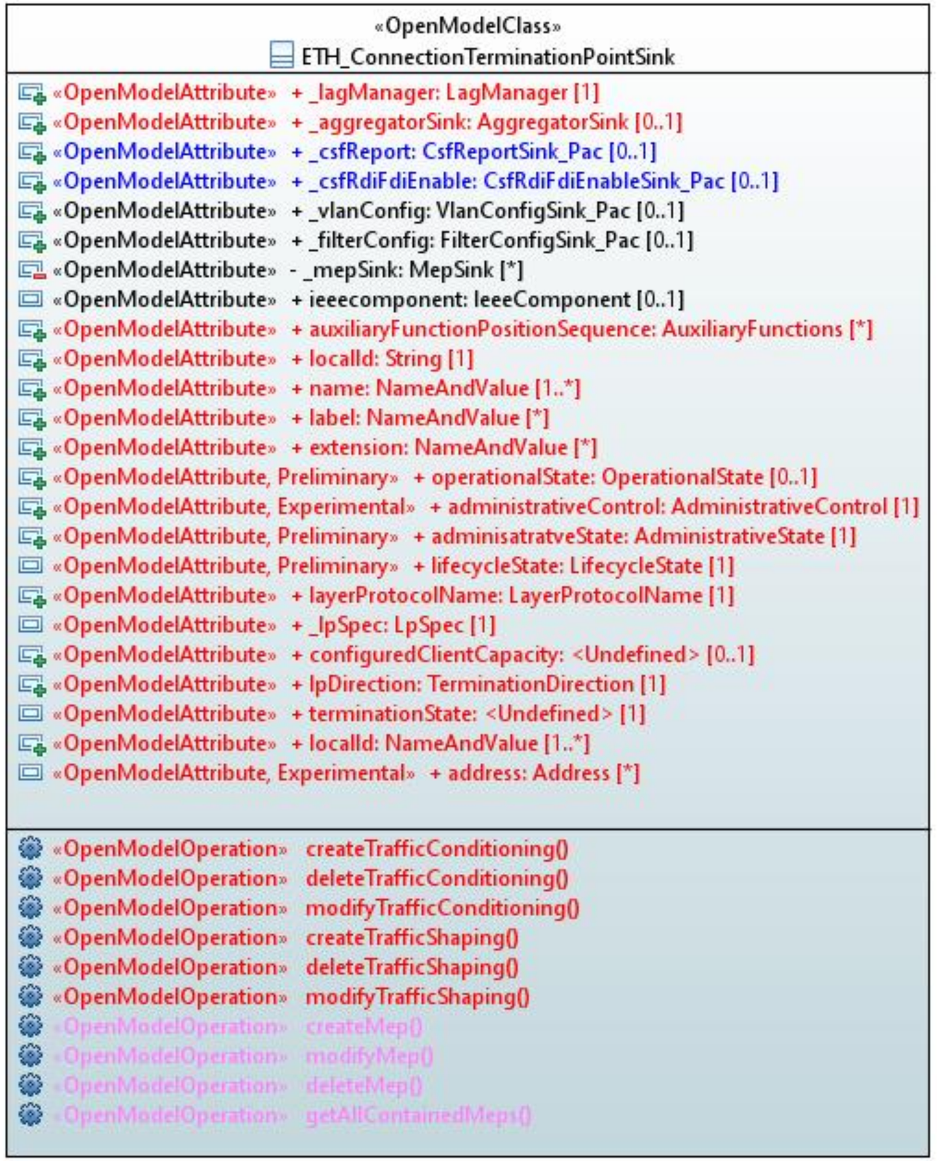


«OpenModelClass»
ETH_TrailTerminationPointSink

- «OpenModelAttribute» + _multiplexing: EthServerTtpSink_Pac [0..1]
- «OpenModelAttribute» + currentProblemList: ETH_TtpProblemList [*]
- «OpenModelAttribute» - _ethCtpSink: ETH_ConnectionTerminationPointSink [*]
- «OpenModelAttribute» - _MepSink: MepSink [1..*]
- «OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
- «OpenModelAttribute» + localId: String [1]
- «OpenModelAttribute» + name: NameAndValue [1..*]
- «OpenModelAttribute» + label: NameAndValue [*]
- «OpenModelAttribute» + extension: NameAndValue [*]
- «OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
- «OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
- «OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
- «OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
- «OpenModelAttribute» + localIdList: NameAndValue [*]
- «OpenModelAttribute» + uuid: String [1]
- «OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
- «OpenModelAttribute» + _lpSpec: LpSpec [1]
- «OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
- «OpenModelAttribute» + lpDirection: TerminationDirection [1]
- «OpenModelAttribute» + terminationState: <Undefined> [1]
- «OpenModelAttribute» + localId: NameAndValue [1..*]
- «OpenModelAttribute, Experimental» + address: Address [*]
- «OpenModelAttribute» + alarmStatus: <Undefined> [1]
- «OpenModelAttribute» + crossConnectionObjectPointer: <Undefined> [1]
- «OpenModelAttribute» + currentProblemList: <Undefined> [1]
- «OpenModelAttribute» + alarmSeverityAssignmentProfilePointer: <Undefined> [1]
- «OpenModelAttribute» + _containingPhysicalSubsystem: PhysicalSubsystem [1]

- «OpenModelOperation» createMep()
- «OpenModelOperation» modifyMep()
- «OpenModelOperation» deleteMep()
- «OpenModelOperation» getAllContainedMeps()

Need to verify if the attributes _multiplexing, _ethCtpSink, _MepSink, _vlanConfig, _filterConfig, and ieeecompoinet are covered in the IEEE bridge DM.
For example, the _multiplexing attribute consists of:
PriorityRegenerate, portVid, priorityCodePointConfig, etc.

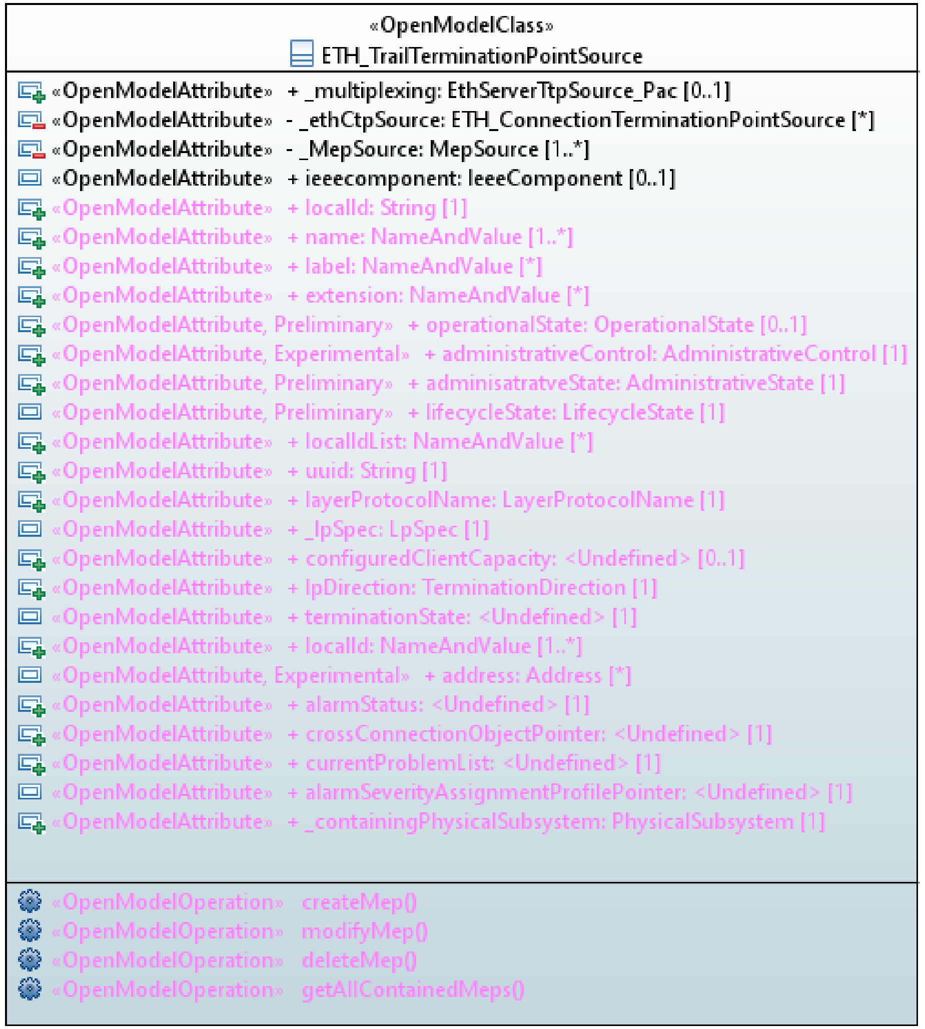


«OpenModelClass»
ETH_ConnectionTerminationPointSink

- «OpenModelAttribute» + _lagManager: LagManager [1]
- «OpenModelAttribute» + _aggregatorSink: AggregatorSink [0..1]
- «OpenModelAttribute» + _csfReport: CsfReportSink_Pac [0..1]
- «OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSink_Pac [0..1]
- «OpenModelAttribute» + _vlanConfig: VlanConfigSink_Pac [0..1]
- «OpenModelAttribute» + _filterConfig: FilterConfigSink_Pac [0..1]
- «OpenModelAttribute» - _mepSink: MepSink [*]
- «OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
- «OpenModelAttribute» + auxiliaryFunctionPositionSequence: AuxiliaryFunctions [*]
- «OpenModelAttribute» + localId: String [1]
- «OpenModelAttribute» + name: NameAndValue [1..*]
- «OpenModelAttribute» + label: NameAndValue [*]
- «OpenModelAttribute» + extension: NameAndValue [*]
- «OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
- «OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
- «OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
- «OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
- «OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
- «OpenModelAttribute» + _lpSpec: LpSpec [1]
- «OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
- «OpenModelAttribute» + lpDirection: TerminationDirection [1]
- «OpenModelAttribute» + terminationState: <Undefined> [1]
- «OpenModelAttribute» + localId: NameAndValue [1..*]
- «OpenModelAttribute, Experimental» + address: Address [*]

- «OpenModelOperation» createTrafficConditioning()
- «OpenModelOperation» deleteTrafficConditioning()
- «OpenModelOperation» modifyTrafficConditioning()
- «OpenModelOperation» createTrafficShaping()
- «OpenModelOperation» deleteTrafficShaping()
- «OpenModelOperation» modifyTrafficShaping()
- «OpenModelOperation» createMep()
- «OpenModelOperation» modifyMep()
- «OpenModelOperation» deleteMep()
- «OpenModelOperation» getAllContainedMeps()

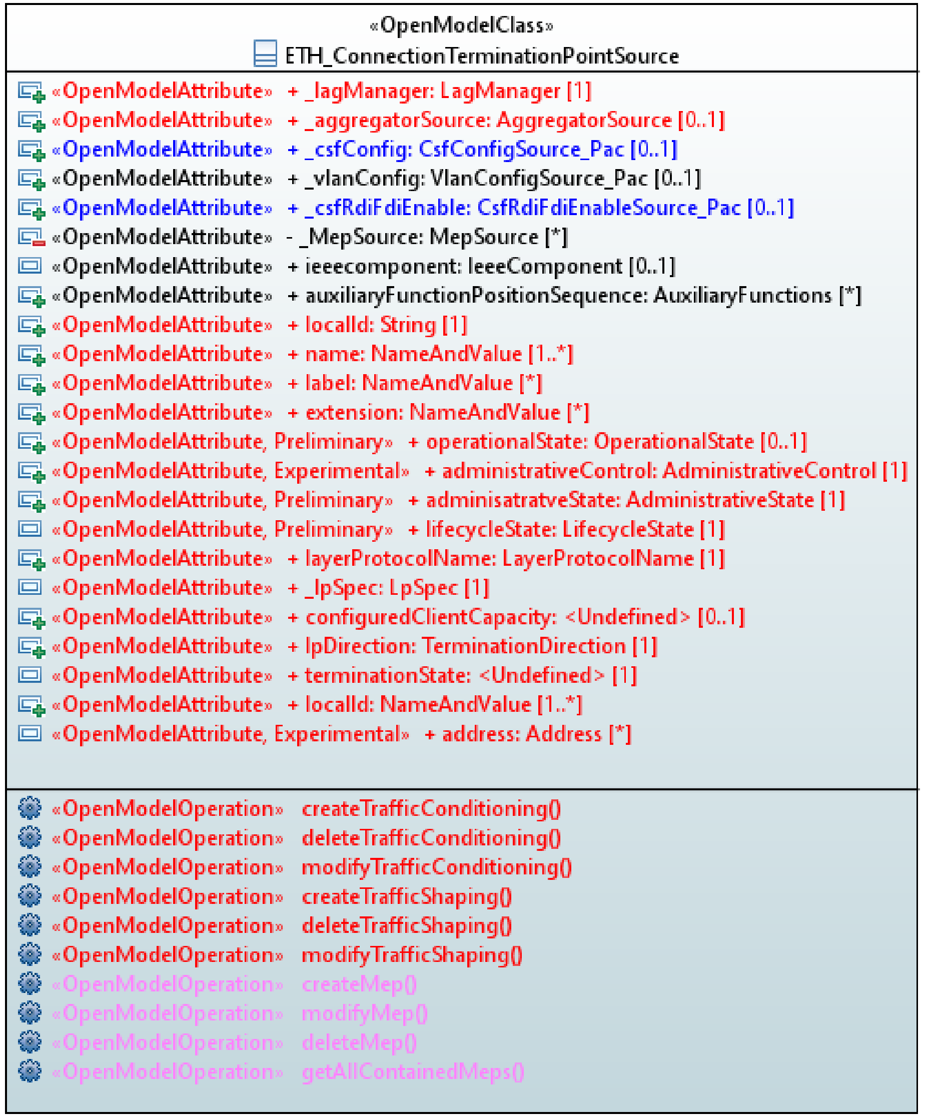
P&R Model Sketch – 1: G.8052 TP Source Pruning & Refactoring



«OpenModelClass»
ETH_TrailTerminationPointSource

«OpenModelAttribute» + _multiplexing: EthServerTtpSource_Pac [0..1]
«OpenModelAttribute» - _ethCtpSource: ETH_ConnectionTerminationPointSource [*]
«OpenModelAttribute» - _MepSource: MepSource [1..*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + localIdList: NameAndValue [*]
«OpenModelAttribute» + uuid: String [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + alarmStatus: <Undefined> [1]
«OpenModelAttribute» + crossConnectionObjectPointer: <Undefined> [1]
«OpenModelAttribute» + currentProblemList: <Undefined> [1]
«OpenModelAttribute» + alarmSeverityAssignmentProfilePointer: <Undefined> [1]
«OpenModelAttribute» + _containingPhysicalSubsystem: PhysicalSubsystem [1]

«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()

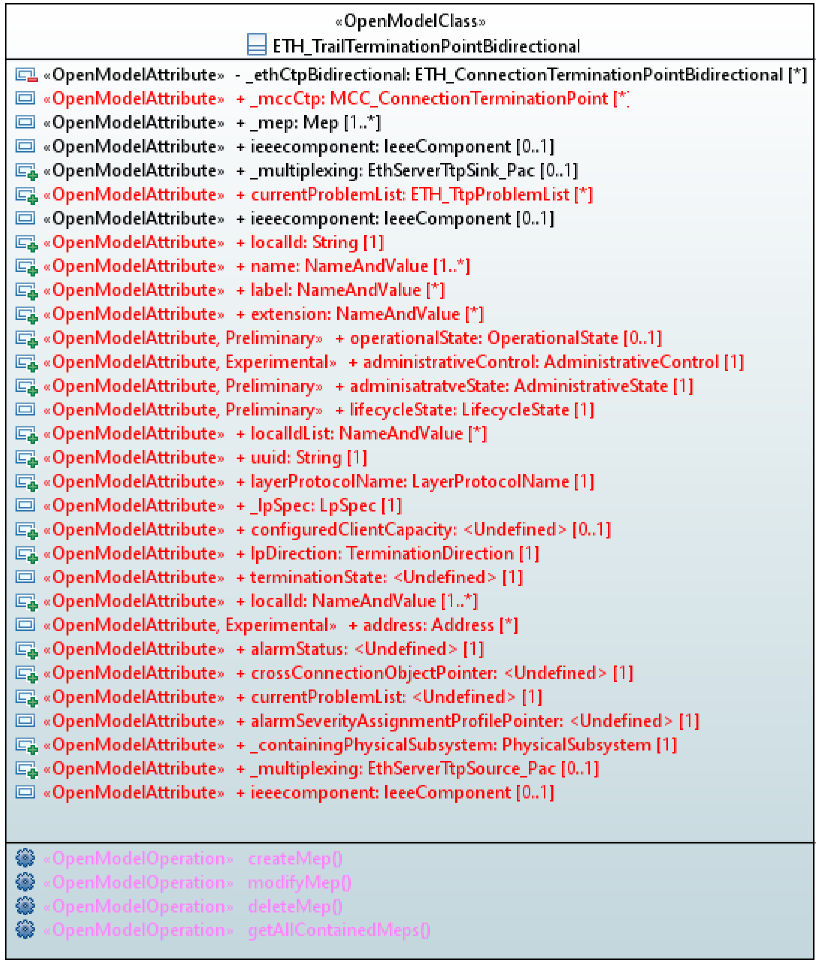


«OpenModelClass»
ETH_ConnectionTerminationPointSource

«OpenModelAttribute» + _lagManager: LagManager [1]
«OpenModelAttribute» + _aggregatorSource: AggregatorSource [0..1]
«OpenModelAttribute» + _csfConfig: CsfConfigSource_Pac [0..1]
«OpenModelAttribute» + _vlanConfig: VlanConfigSource_Pac [0..1]
«OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSource_Pac [0..1]
«OpenModelAttribute» - _MepSource: MepSource [*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + auxiliaryFunctionPositionSequence: AuxiliaryFunctions [*]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]

«OpenModelOperation» createTrafficConditioning()
«OpenModelOperation» deleteTrafficConditioning()
«OpenModelOperation» modifyTrafficConditioning()
«OpenModelOperation» createTrafficShaping()
«OpenModelOperation» deleteTrafficShaping()
«OpenModelOperation» modifyTrafficShaping()
«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()

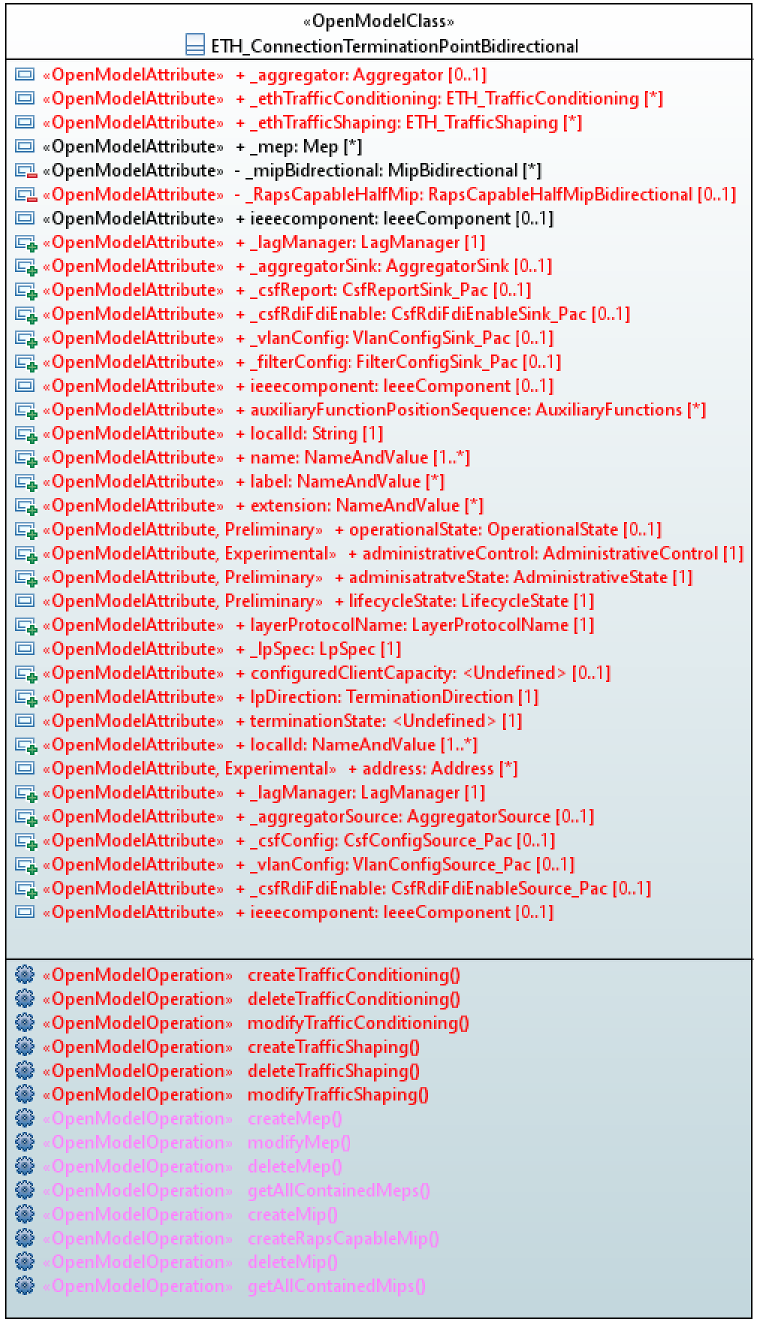
P&R Model Sketch – 1: G.8052 TP Bidirectional Pruning & Refactoring



«OpenModelClass»
ETH_TrailTerminationPointBidirectional

«OpenModelAttribute» - _ethCtpBidirectional: ETH_ConnectionTerminationPointBidirectional [*]
«OpenModelAttribute» + _mccCtp: MCC_ConnectionTerminationPoint [*
«OpenModelAttribute» + _mep: Mep [1..*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + _multiplexing: EthServerTtpSink_Pac [0..1]
«OpenModelAttribute» + currentProblemList: ETH_TtpProblemList [*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + localIdList: NameAndValue [*]
«OpenModelAttribute» + uuid: String [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + alarmStatus: <Undefined> [1]
«OpenModelAttribute» + crossConnectionObjectPointer: <Undefined> [1]
«OpenModelAttribute» + currentProblemList: <Undefined> [1]
«OpenModelAttribute» + alarmSeverityAssignmentProfilePointer: <Undefined> [1]
«OpenModelAttribute» + _containingPhysicalSubsystem: PhysicalSubsystem [1]
«OpenModelAttribute» + _multiplexing: EthServerTtpSource_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]

«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()

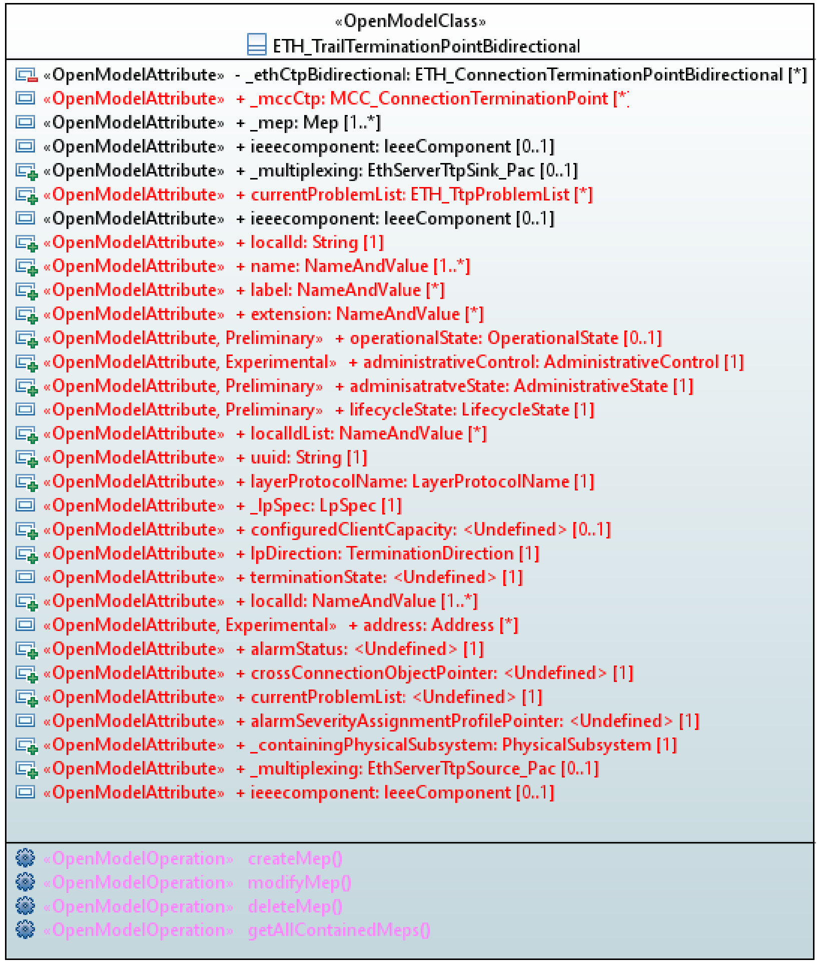


«OpenModelClass»
ETH_ConnectionTerminationPointBidirectional

«OpenModelAttribute» + _aggregator: Aggregator [0..1]
«OpenModelAttribute» + _ethTrafficConditioning: ETH_TrafficConditioning [*]
«OpenModelAttribute» + _ethTrafficShaping: ETH_TrafficShaping [*]
«OpenModelAttribute» + _mep: Mep [*]
«OpenModelAttribute» - _mipBidrectional: MipBidirectional [*]
«OpenModelAttribute» - _RapsCapableHalfMip: RapsCapableHalfMipBidirectional [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + _lagManager: LagManager [1]
«OpenModelAttribute» + _aggregatorSink: AggregatorSink [0..1]
«OpenModelAttribute» + _csfReport: CsfReportSink_Pac [0..1]
«OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSink_Pac [0..1]
«OpenModelAttribute» + _vlanConfig: VlanConfigSink_Pac [0..1]
«OpenModelAttribute» + _filterConfig: FilterConfigSink_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + auxiliaryFunctionPositionSequence: AuxiliaryFunctions [*]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + _lagManager: LagManager [1]
«OpenModelAttribute» + _aggregatorSource: AggregatorSource [0..1]
«OpenModelAttribute» + _csfConfig: CsfConfigSource_Pac [0..1]
«OpenModelAttribute» + _vlanConfig: VlanConfigSource_Pac [0..1]
«OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSource_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]

«OpenModelOperation» createTrafficConditioning()
«OpenModelOperation» deleteTrafficConditioning()
«OpenModelOperation» modifyTrafficConditioning()
«OpenModelOperation» createTrafficShaping()
«OpenModelOperation» deleteTrafficShaping()
«OpenModelOperation» modifyTrafficShaping()
«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()
«OpenModelOperation» createMip()
«OpenModelOperation» createRapsCapableMip()
«OpenModelOperation» deleteMip()
«OpenModelOperation» getAllContainedMips()

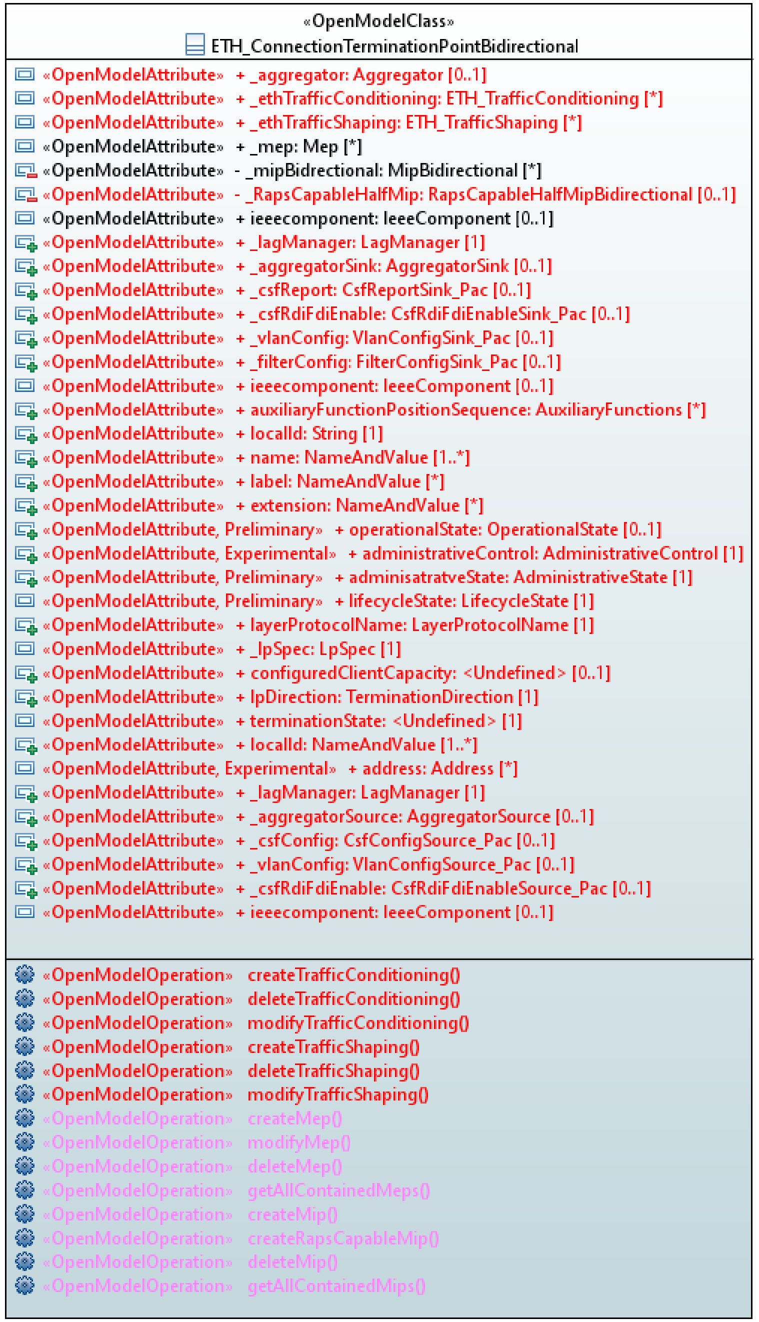
P&R Model Sketch – 1: G.8052 TP Bidirectional Pruning & Refactoring



«OpenModelClass»
ETH_TrailTerminationPointBidirectional

«OpenModelAttribute» - _ethCtpBidirectional: ETH_ConnectionTerminationPointBidirectional [*]
«OpenModelAttribute» + _mccCtp: MCC_ConnectionTerminationPoint [*
«OpenModelAttribute» + _mep: Mep [1..*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + _multiplexing: EthServerTtpSink_Pac [0..1]
«OpenModelAttribute» + currentProblemList: ETH_TtpProblemList [*]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + localIdList: NameAndValue [*]
«OpenModelAttribute» + uuid: String [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + alarmStatus: <Undefined> [1]
«OpenModelAttribute» + crossConnectionObjectPointer: <Undefined> [1]
«OpenModelAttribute» + currentProblemList: <Undefined> [1]
«OpenModelAttribute» + alarmSeverityAssignmentProfilePointer: <Undefined> [1]
«OpenModelAttribute» + _containingPhysicalSubsystem: PhysicalSubsystem [1]
«OpenModelAttribute» + _multiplexing: EthServerTtpSource_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]

«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()



«OpenModelClass»
ETH_ConnectionTerminationPointBidirectional

«OpenModelAttribute» + _aggregator: Aggregator [0..1]
«OpenModelAttribute» + _ethTrafficConditioning: ETH_TrafficConditioning [*]
«OpenModelAttribute» + _ethTrafficShaping: ETH_TrafficShaping [*]
«OpenModelAttribute» + _mep: Mep [*]
«OpenModelAttribute» - _mipBidrectional: MipBidirectional [*]
«OpenModelAttribute» - _RapsCapableHalfMip: RapsCapableHalfMipBidirectional [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + _lagManager: LagManager [1]
«OpenModelAttribute» + _aggregatorSink: AggregatorSink [0..1]
«OpenModelAttribute» + _csfReport: CsfReportSink_Pac [0..1]
«OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSink_Pac [0..1]
«OpenModelAttribute» + _vlanConfig: VlanConfigSink_Pac [0..1]
«OpenModelAttribute» + _filterConfig: FilterConfigSink_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]
«OpenModelAttribute» + auxiliaryFunctionPositionSequence: AuxiliaryFunctions [*]
«OpenModelAttribute» + localId: String [1]
«OpenModelAttribute» + name: NameAndValue [1..*]
«OpenModelAttribute» + label: NameAndValue [*]
«OpenModelAttribute» + extension: NameAndValue [*]
«OpenModelAttribute, Preliminary» + operationalState: OperationalState [0..1]
«OpenModelAttribute, Experimental» + administrativeControl: AdministrativeControl [1]
«OpenModelAttribute, Preliminary» + adminisatratveState: AdministrativeState [1]
«OpenModelAttribute, Preliminary» + lifecycleState: LifecycleState [1]
«OpenModelAttribute» + layerProtocolName: LayerProtocolName [1]
«OpenModelAttribute» + _lpSpec: LpSpec [1]
«OpenModelAttribute» + configuredClientCapacity: <Undefined> [0..1]
«OpenModelAttribute» + lpDirection: TerminationDirection [1]
«OpenModelAttribute» + terminationState: <Undefined> [1]
«OpenModelAttribute» + localId: NameAndValue [1..*]
«OpenModelAttribute, Experimental» + address: Address [*]
«OpenModelAttribute» + _lagManager: LagManager [1]
«OpenModelAttribute» + _aggregatorSource: AggregatorSource [0..1]
«OpenModelAttribute» + _csfConfig: CsfConfigSource_Pac [0..1]
«OpenModelAttribute» + _vlanConfig: VlanConfigSource_Pac [0..1]
«OpenModelAttribute» + _csfRdiFdiEnable: CsfRdiFdiEnableSource_Pac [0..1]
«OpenModelAttribute» + ieeecomponent: IeeeComponent [0..1]

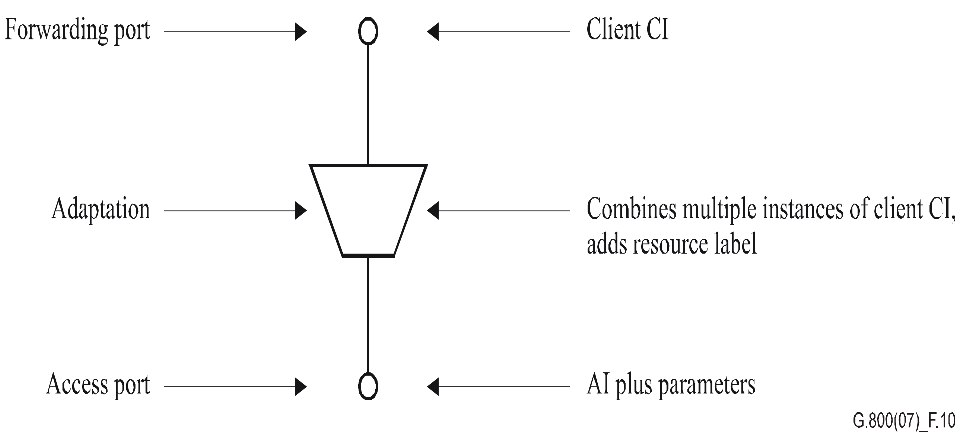
«OpenModelOperation» createTrafficConditioning()
«OpenModelOperation» deleteTrafficConditioning()
«OpenModelOperation» modifyTrafficConditioning()
«OpenModelOperation» createTrafficShaping()
«OpenModelOperation» deleteTrafficShaping()
«OpenModelOperation» modifyTrafficShaping()
«OpenModelOperation» createMep()
«OpenModelOperation» modifyMep()
«OpenModelOperation» deleteMep()
«OpenModelOperation» getAllContainedMeps()
«OpenModelOperation» createMip()
«OpenModelOperation» createRapsCapableMip()
«OpenModelOperation» deleteMip()
«OpenModelOperation» getAllContainedMips()

Links to ITU-T Recommendations

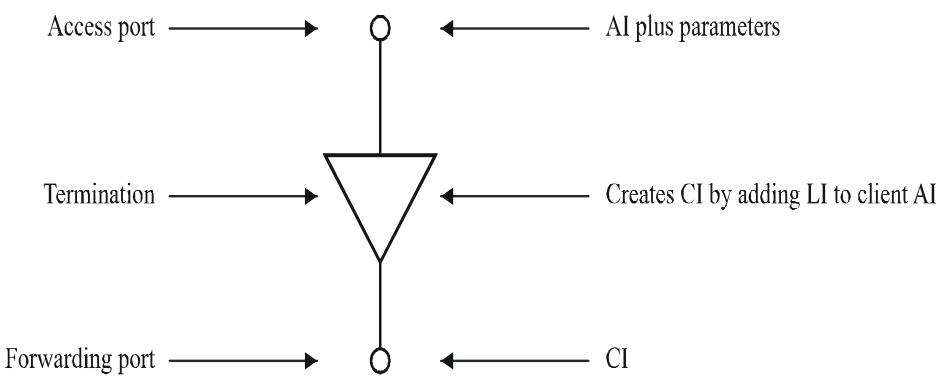
- G.774 “SDH: Management information model for the network element view” http://www.itu.int/rec/T-REC-G.774/en
- G.783 “Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks” http://www.itu.int/rec/T-REC-G.783/en
- G.784 “Management aspects of synchronous digital hierarchy (SDH) transport network elements” http://www.itu.int/rec/T-REC-G.784/en
- G.798 “Characteristics of optical transport network hierarchy equipment functional blocks” http://www.itu.int/rec/T-REC-G.798/en
- G.800 “Unified functional architecture of transport networks” http://www.itu.int/rec/T-REC-G.800/en
- G.803 “Architecture of transport networks based on the synchronous digital hierarchy (SDH)” http://www.itu.int/rec/T-REC-G.803/en
- G.805 “Generic functional architecture of transport networks” http://www.itu.int/rec/T-REC-G.805/en
- G.806 “Characteristics of transport equipment - Description methodology and generic functionality” http://www.itu.int/rec/T-REC-G.806/en
- G.809 “Functional architecture of connectionless layer networks” http://www.itu.int/rec/T-REC-G.809/en
- G.872 “Architecture of optical transport networks” http://www.itu.int/rec/T-REC-G.872/en
- G.874 “Management aspects of optical transport network elements” http://www.itu.int/rec/T-REC-G.874/en
- **G.874.1** “OTN: Protocol-neutral management information model for the network element view” http://www.itu.int/rec/T-REC-G.874.1/en
- G.7710 “Common equipment management function requirements” http://www.itu.int/rec/T-REC-G.7710/en
- **G.7711** “Generic protocol-neutral information model for transport resources” http://www.itu.int/rec/T-REC-G.7711/en
- G.8010 “Architecture of Ethernet layer networks” http://www.itu.int/rec/T-REC-G.8010/en
- G.8021 “Characteristics of Ethernet transport network equipment functional blocks” http://www.itu.int/rec/T-REC-G.8021/en
- G.8051 “Management aspects of the Ethernet transport (ET) capable network element” http://www.itu.int/rec/T-REC-G.8051/en
- **G.8052** “Protocol-neutral management information model for the Ethernet transport capable network element” http://www.itu.int/rec/T-REC-G.8052/en
- G.8110.1 “Architecture of the Multi-Protocol Label Switching transport profile layer network” http://www.itu.int/rec/T-REC-G.8110.1/en
- G.8121 “Characteristics of MPLS-TP equipment functional blocks” http://www.itu.int/rec/T-REC-G.8121/en
- G.8151 “Management aspects of the MPLS-TP network element” http://www.itu.int/rec/T-REC-G.8151/en
- **G.8152** “Protocol-neutral management information model for the MPLS-TP network element” (Draft in progress)
- M.3100 “Generic network information model” http://www.itu.int/rec/T-REC-M.3100/en
- Q.840.1 “Requirements and analysis for NMS-EMS management interface of Ethernet over Transport and Metro Ethernet Network (EoT/MEN)” http://www.itu.int/rec/T-REC-Q.840.1/en

Functional Architecture of Transport Networks

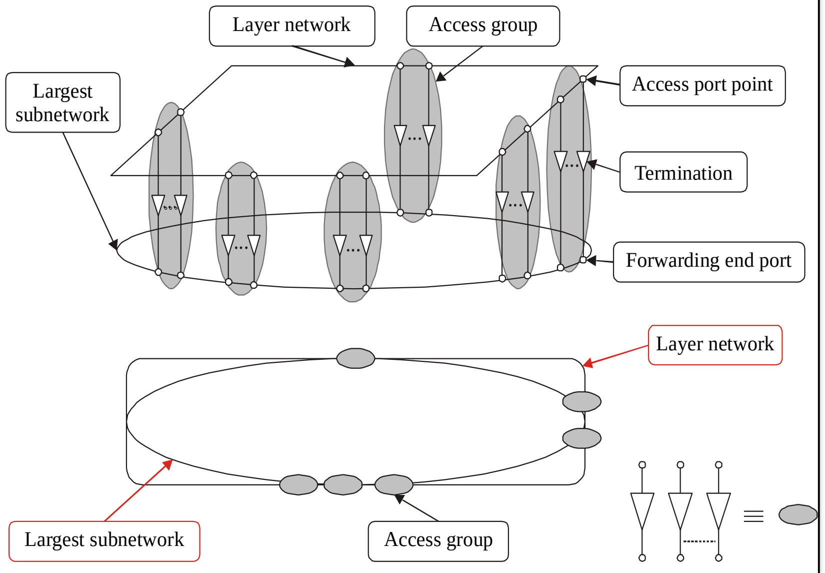
- G.800 / G.805 functional model
  - Adaptation, Termination, Link, Subnetwork, Layer network, Recursion, Partitioning



G.800(07)_F.10

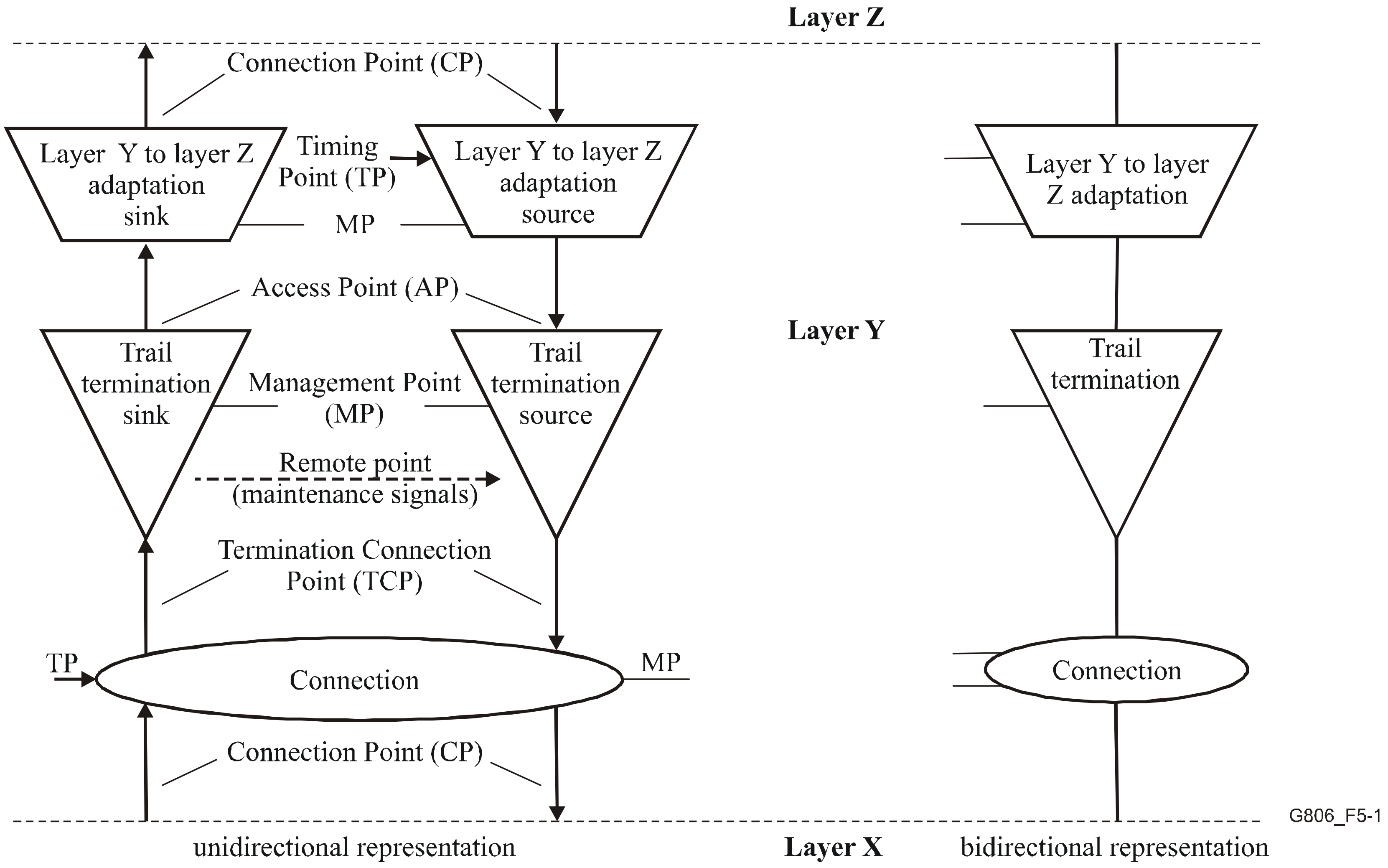


G.800(07)_F.11

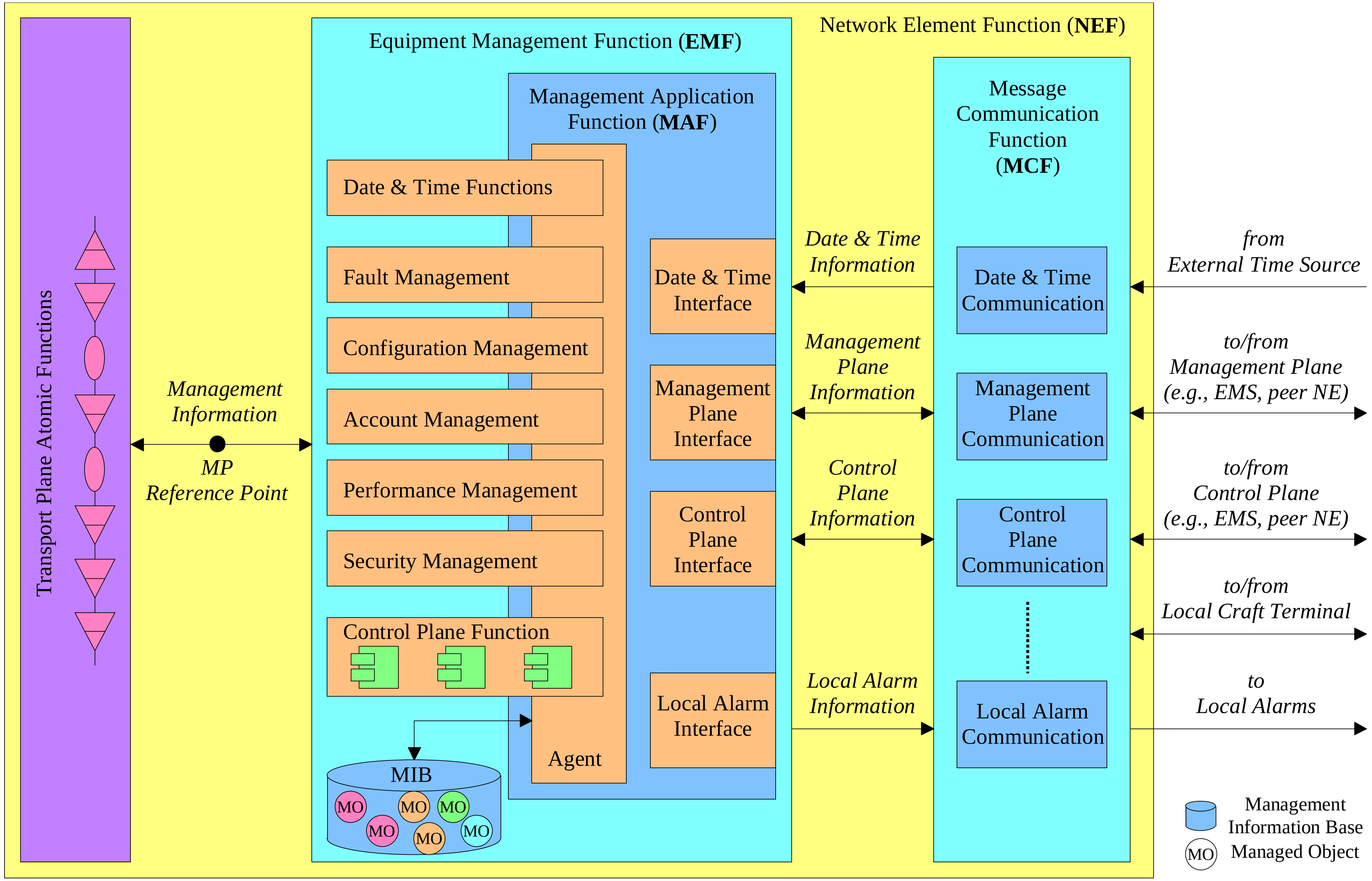


G.800-Amd.1(09)_F06

G.806 atomic functions and MCC input/output


Layer Z
Connection Point (CP)
Layer Y to layer Z adaptation sink
Timing Point (TP)
Layer Y to layer Z adaptation source
MP
Layer Y to layer Z adaptation
Access Point (AP)
Layer Y
Trail termination sink
Management Point (MP)
Trail termination source
Trail termination
Remote point (maintenance signals)
Termination Connection Point (TCP)
TP
Connection
MP
Connection
Connection Point (CP)
G806_F5-1
unidirectional representation
Layer X
bidirectional representation

Equipment management architecture/G.7710



Network Element Function (**NEF**)

Transport Plane Atomic Functions

Management Information

MP Reference Point

Equipment Management Function (**EMF**)

Management Application Function (**MAF**)

Date & Time Functions

Fault Management

Configuration Management

Account Management

Performance Management

Security Management

Control Plane Function

Agent

MIB

MO

Date & Time Interface

Management Plane Interface

Control Plane Interface

Local Alarm Interface

Date & Time Information

Management Plane Information

Control Plane Information

Local Alarm Information

Message Communication Function (**MCF**)

Date & Time Communication

Management Plane Communication

Control Plane Communication

Local Alarm Communication

from External Time Source

to/from Management Plane (e.g., EMS, peer NE)

to/from Control Plane (e.g., EMS, peer NE)

to/from Local Craft Terminal

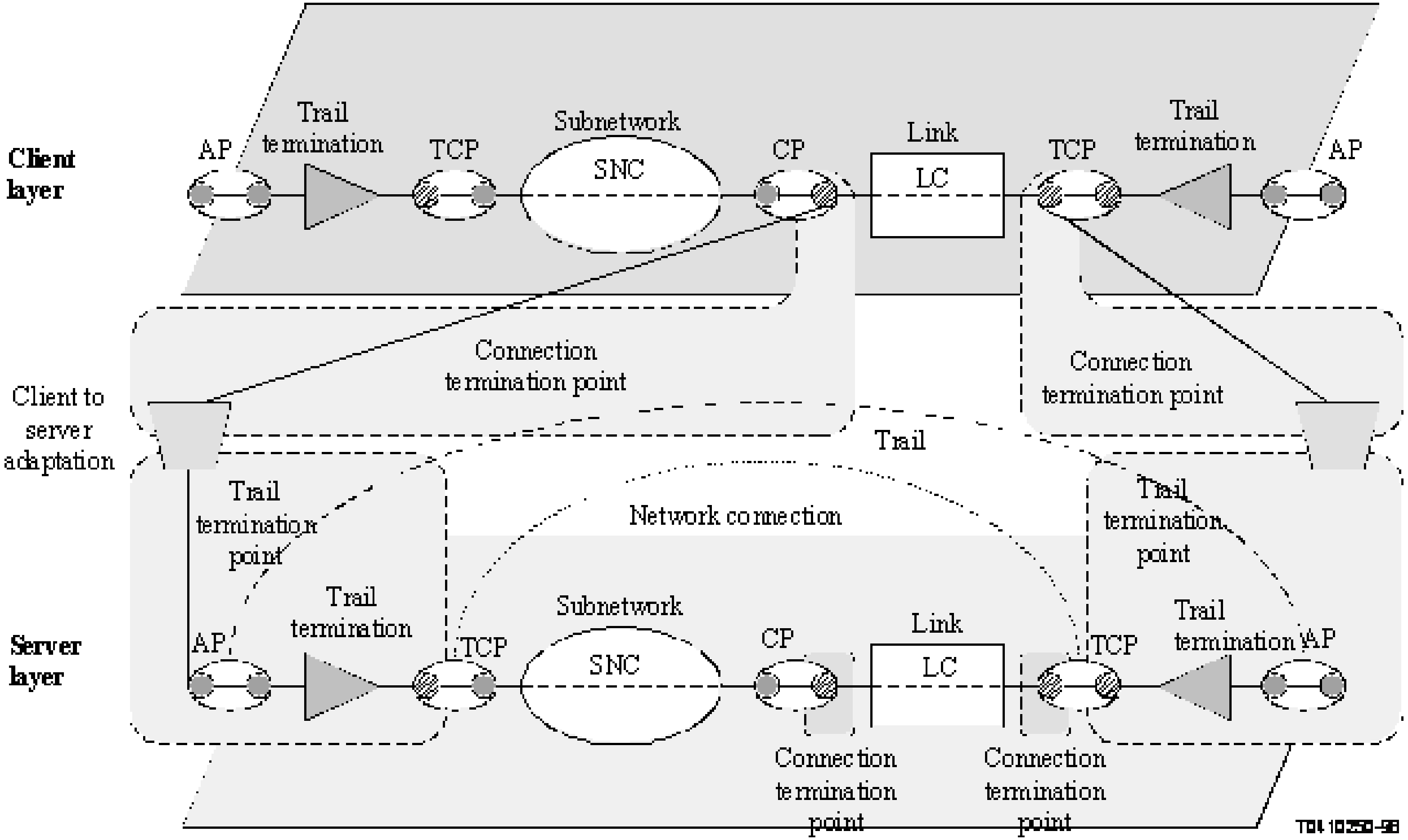
to Local Alarms

Management Information Base

MO Managed Object

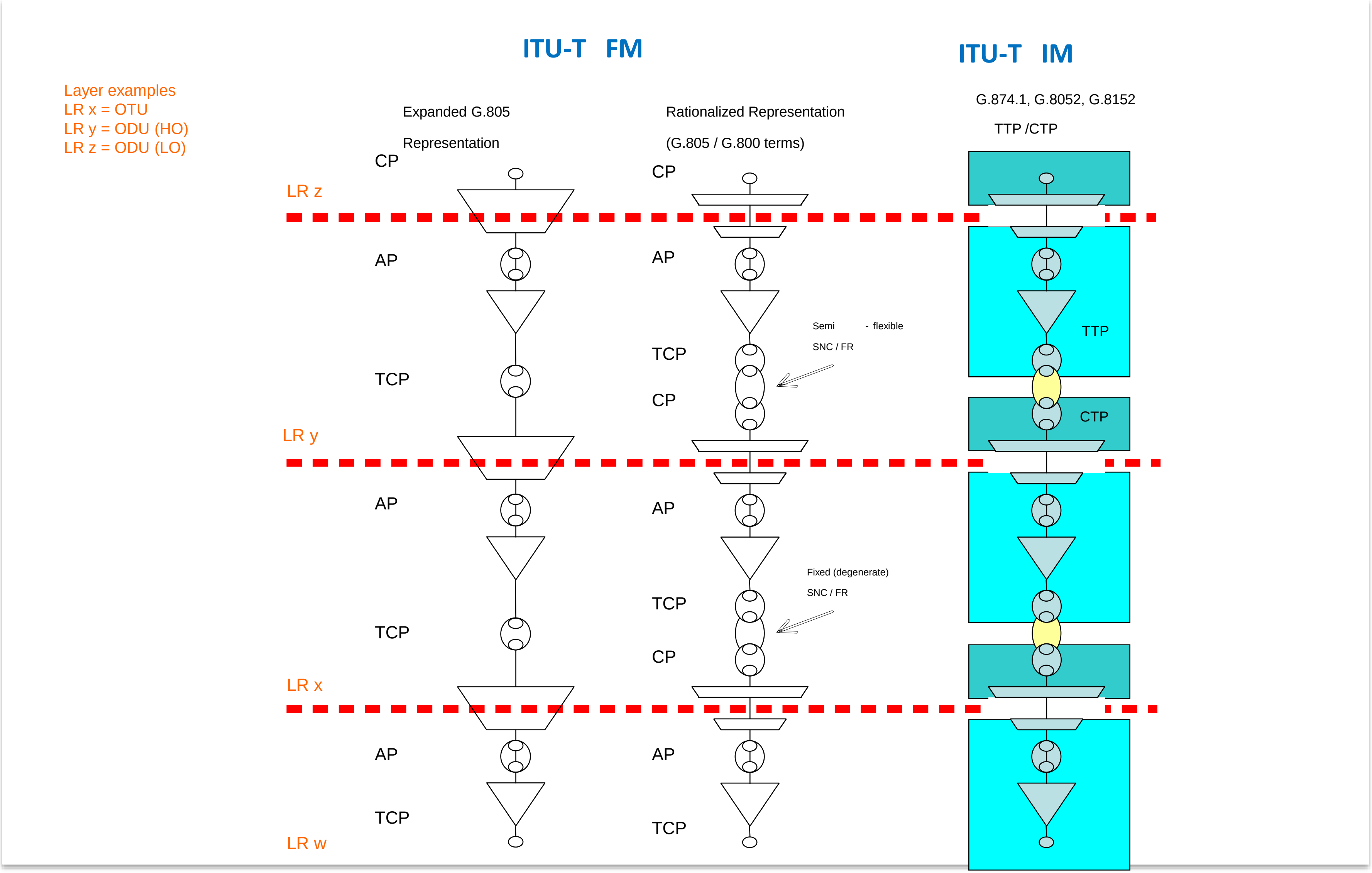
G.805 atomic function to Management Entity Mapping

Figure 2/G.852.2

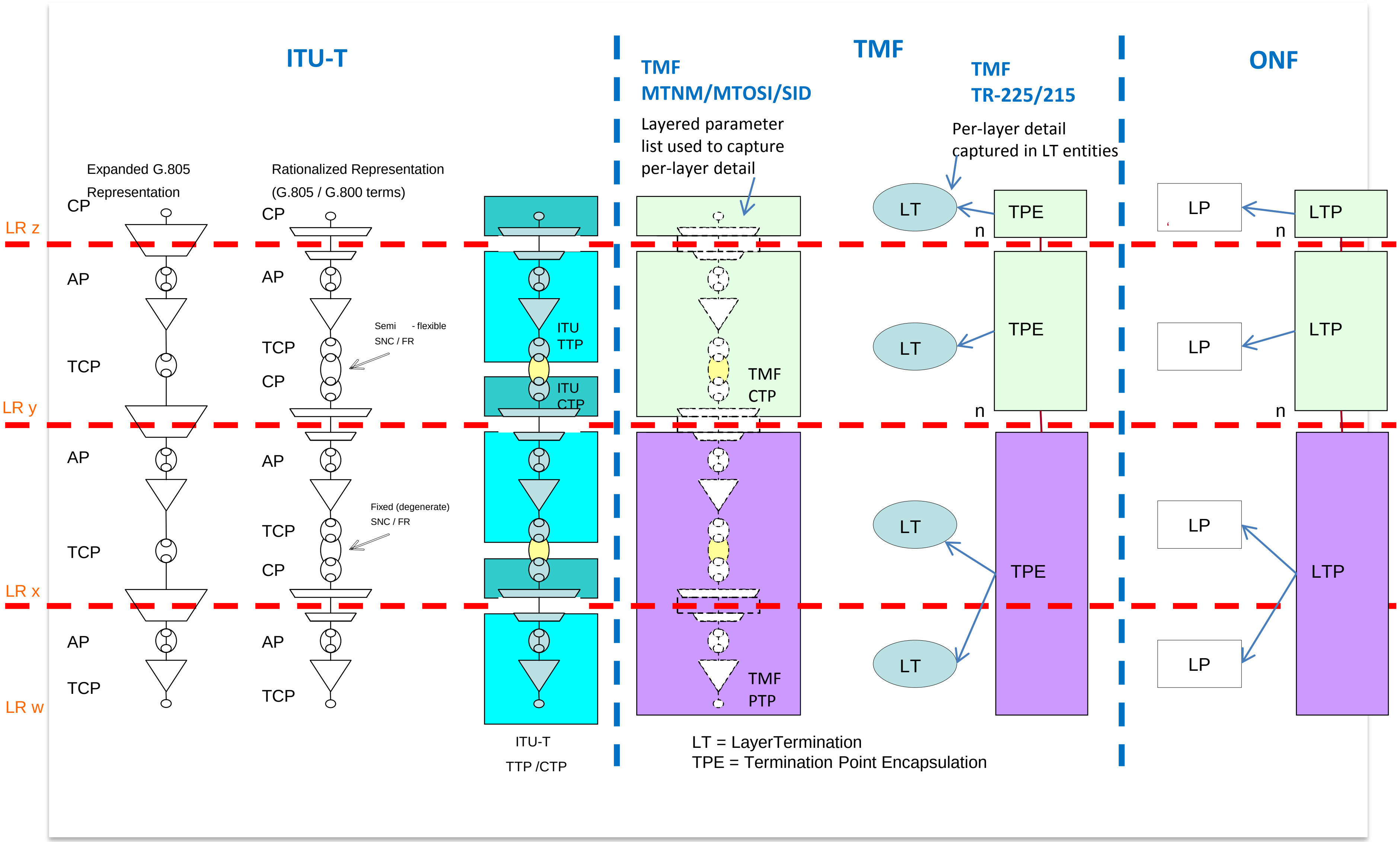


▨ Port defined in Recommendation G.805

Transport Functional Model (FM) to Information Model (IM) modeling



Derivation of LTP & LP from TTP & CTP


ITU-T
TMF
TMF
MTNM/MTOSI/SID
TMF
TR-225/215
ONF
Layered parameter list used to capture per-layer detail
Per-layer detail captured in LT entities
Expanded G.805 Representation
Rationalized Representation (G.805 / G.800 terms)
LR z
LR y
LR x
LR w
CP
AP
TCP
AP
TCP
AP
TCP
CP
AP
TCP
CP
AP
TCP
CP
AP
TCP
Semi - flexible SNC / FR
Fixed (degenerate) SNC / FR
ITU TTP
ITU CTP
ITU-T TTP /CTP
TMF CTP
TMF PTP
LT
LT
LT
LT
TPE
TPE
TPE
n
n
LP
LP
LP
LP
LTP
LTP
LTP
n
n

LT = LayerTermination
TPE = Termination Point Encapsulation

THANK YOU