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Recommendation
ITU-T G.8052.1/Y.1346.1 (2021) Amd. 1 (01/2023)

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Packet over Transport aspects – Ethernet over Transport aspects

SERIES Y: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Internet protocol aspects – Transport

Operation, administration, maintenance (OAM) management information and data models for the Ethernet-transport network element

Amendment 1

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Recommendation ITU-T G.8052.1/Y.1346.1

Operation, administration, maintenance (OAM) management information and data models for the Ethernet-transport network element

Amendment 1

Summary

Recommendation ITU-T G.8052.1/Y.1346.1 specifies the management information model and data models for Ethernet transport network element (NE) to support specific interface protocols and specific management control (MC) functions. The information model is interface protocol neutral and specified using the unified modelling language (UML). The information model of this Recommendation is derived through pruning and refactoring from Recommendation ITU-T G.7711/Y.1702 core information model and Recommendation ITU-T G.8052/Y.1346 foundation Ethernet transport NE information model. The data models are interface protocol specific and translated from the information model with the assistance of automated translation tooling. The specific data models considered in this Recommendation include, but are not limited to, YANG data models. The specific MC functions covered by this Recommendation are the ITU-T defined Ethernet operation, administration, and maintenance (OAM) functions, with the set of op codes assigned to the ITU-T and the corresponding OAM protocol data units (PDU) and behaviours specified in Recommendation ITU-T G.8013/Y.1731 and the equipment characteristics in Recommendation ITU-T G.8021/Y.1341. These OAM functions complement the IEEE 802.1 defined connectivity fault management (CFM) functions; and the YANG module defined in this Recommendation augments the IEEE 802.1Q CFM YANG module.

Amendment 1 updates the UML model to support on-demand measurement and proactive measurement.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.8052.1/Y.1346.1	2021-01-13	15	11.1002/1000/14558
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Keywords

CFM, connectivity fault management, Ethernet, information model, OAM, protocol-neutral, transport Ethernet, transport resource, UML, YANG.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Operation, administration, maintenance (OAM) management information and data models for the Ethernet-transport network element

Amendment 1

Editorial note: This is a complete-text publication. Modifications introduced by this amendment are shown in revision marks relative to Recommendation ITU-T G.8052.1/Y.1346.1 (2021).

1 Scope

This Recommendation specifies the management information model and data models for Ethernet transport network element (NE) to support specific interface protocols and specific management-control (MC) functions.

The information model is interface protocol neutral and specified using the unified modelling language (UML). The information model of this Recommendation is derived through pruning and refactoring from [ITU-T G.7711] core information model and [ITU-T G.8052] foundation Ethernet transport NE information model.

The data models are interface protocol specific and translated from the information model with the assistance of automated translation tooling. The specific data models considered in this Recommendation include, but are not limited to, YANG data models.

The specific MC functions covered by this Recommendation are the ITU-T defined Ethernet operation, administration, and maintenance (OAM) functions, with the set of op codes assigned to the ITU-T and the corresponding OAM protocol data units (PDU) and behaviours specified in [ITU-T G.8013] and the equipment characteristics in [ITU-T G.8021]. These OAM functions complement the connectivity fault management (CFM) functions currently specified in clause 12.14 of [IEEE 802.1Q]; and the YANG module defined in this Recommendation augments the IEEE 802.1Q CFM YANG module.

Amendment 1 updates the UML model for On-demand measurement and Proactive measurement.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2020), *Common equipment management function requirements*.

[ITU-T G.7711] Recommendation ITU-T G.7711/Y.1702 (2018), *Generic protocol-neutral information model for transport resources*.

[ITU-T G.8013] Recommendation ITU-T G.8013/Y.1731 (2015), *Operations, administration and maintenance (OAM) functions and mechanisms for Ethernet-based networks*.

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (~~2018~~2022), *Characteristics of Ethernet transport network equipment functional blocks*.

[ITU-T G.8051] Recommendation ITU-T G.8051/Y.1345 (~~2018~~2020), *Management aspects of the Ethernet transport (ET) capable network element*.

[ITU-T G.8052] Recommendation ITU-T G.8052/Y.1346 (2018), *Protocol-neutral management information model for the Ethernet transport capable network element*.

[ITU-T Q.822] Recommendation ITU-T Q.822 (1994), *Stage 1, stage 2 and stage 3 description for the Q3 interface – Performance management*, plus Amendment 1 (2003).

[ITU-T X.739] Recommendation ITU-T X.739 (1993), *Information technology – Open Systems Interconnection – Systems Management: Metric objects and attributes, plus Amendment 1 (1997) and Technical Corrigendum 1 (1998)*.

[IEEE 802.1Q] IEEE 802.1Q (2018), *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks*.

[IEEE 802.1Qcp] IEEE 802.1Qcp (2018), *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks – Amendment 30: YANG Data Model*.

[IEEE 802.1Qcx] IEEE 802.1Q cx (2020), *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks Amendment 33: YANG Data Model for Connectivity Fault Management*.

[IETF RFC 6991] IETF RFC 6991 (2013), *Common YANG Data Types*.

[IETF RFC 7950] IETF RFC 7950 (2016), *The YANG 1.1 Data Modeling Language*.

[IETF RFC 8340] IETF RFC 8340 (2018), *YANG Tree Diagrams*.

[IETF RFC 8342] IETF RFC 8342 (2018), *Network Management Datastore Architecture (NMDA)*.

[IETF RFC 8343] IETF RFC 8343 (2018), *A YANG Data Model for Interface Management*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 dual-ended [ITU-T G.8013]

3.1.2 maintenance entity (ME) [ITU-T G.8013]

3.1.3 maintenance entity group (MEG) [ITU-T G.8013]

3.1.4 MEG end point (MEP) [ITU-T G.8013]

3.1.5 MEG intermediate point (MIP) [ITU-T G.8013]

3.1.6 MEP compound function [ITU-T G.8052]

3.1.7 MIP compound function [ITU-T G.8052]

3.1.8 on-demand measurement [ITU-T G.8052]

3.1.9 on-demand monitoring [ITU-T G.8052]

3.1.10 one-way [ITU-T G.8013]

3.1.11 proactive measurement [ITU-T G.8052]

3.1.12 proactive monitoring [ITU-T G.8052]

3.1.13 single-ended [ITU-T G.8013]

3.1.14 traffic conditioning function [ITU-T G.8051]

3.1.15 traffic shaping function [ITU-T G.8021]

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AIS Alarm Indication Signal

CC Continuity Check

CFM Connectivity Fault Management

ET Ethernet Transport

FM Fault Management

ID Identifier

LM Loss Measurement

MA Maintenance Association

MC Management-Control

MD Maintenance Domain

MEG Maintenance Entity Group

MEP MEG End Point

MIP MEG Intermediate Point

NE Network Element

OAM Operation, Administration, Maintenance

PDU Protocol Data Unit

PM Performance Monitoring

RDI Remote Defect Indication

SDO Standards Developing Organization

UML Unified Modelling Language

VLAN Virtual Local Area Network

5 Conventions

5.1 Information modelling conventions

See clause 5.1 of [ITU-T G.7711].

5.1.1 UML modelling conventions

See clause 5.1 of [ITU-T G.7711].

5.2 Model artefact lifecycle stereotypes conventions

See clause 5.2 of [ITU-T G.7711].

In this Recommendation, the UML model object classes with lifecycle stereotype of *preliminary* or *experimental* are deemed as not mature yet and thus are not translated for the final YANG data model provided in clause 8.1.

5.3 Forwarding entity terminology conventions

See clause 5.3 of [ITU-T G.7711].

5.4 Conditional package conventions

See clause 5.4 of [ITU-T G.7711].

5.5 Pictorial diagram conventions

See clause 5.5 of [ITU-T G.7711].

6 Ethernet OAM functions

This clause identifies the Ethernet transport (ET) OAM functions that are modelled by the information model and data models of this Recommendation.

All the Ethernet OAM OpCodes are owned by IEEE 802.1, with some subsets of the OpCodes have been assigned by IEEE 802.1 to ITU-T SG15, MEF, and IETF. The assignee SDOs are responsible for the OAM PDU specification of their respective assigned OpCodes. The following list is a summary of the OAM categories, SDOs, and their responsible OAM PDU types.

– CFM: IEEE 802.1: CCM

– LB/LT IEEE 802.1: LBM/LBR, LTM/LTR

– Carrier: SG15: GNM/BNM, AIS, LCK, TST, APS, MCC/EDM, LMM/LMR, 1DM, DMM/DMR, EXM/EXR, VSM/VSR, CSF, 1SL, SLM/SLR

– Service: MEF: LLM/LLR, SAT

– Link: IETF: TRILL

Table 6-1 provides a summary of the OpCode, OAM PDU type and applications, and their relevance with MEP and MIP.

Table 6-1 – Ethernet OAM PDU types and applications

OpCode value	OAM PDU type	OAM application	OpCode relevance for MEPs/MIPs
IEEE 802.1 defined			
1	CCM*	CC (Continuity check), Remote defect indication (RDI), Dual-ended proactive loss measurement (LM) (fault 1 s, pm 100 ms, ps 3.33 ms)	MEPs
3	LBM*	Loopback (Unicast and Multicast) Message Throughput	MEPs and MIPs (connectivity verification)
2	LBR*	Loopback (Unicast and Multicast) Reply Throughput	MEPs and MIPs (connectivity verification)
5	LTM	Link trace Message	MEPs and MIPs

Table 6-1 – Ethernet OAM PDU types and applications

OpCode value	OAM PDU type	OAM application	OpCode relevance for MEPs/MIPs
4	LTR	Link trace Reply	MEPs and MIPs
6	RFM		
7	SFM		
ITU-T SG15 defined			
32	GNM	Generic notification Message	MEPs
32-1	BNM	Bandwidth notification Message	MEPs
33	AIS	Alarm indication signal (AIS)	MEPs
35	LCK	Locked signal	MEPs
37	TST	Test, Throughput	MEPs
39	APS	Linear APS	Refer to [ITU-T G.8031]
40	APS	Ring APS	Refer to [ITU-T G.8032]
41	MCC	Maintenance communication channel	MEPs
41-1	EDM	Expected defect Message	MEPs
43	LMM	Single-ended proactive and on-demand LM	MEPs
42	LMR	Single-ended proactive and on-demand LM	MEPs
45	1DM	Dual-ended Delay and Delay variation	MEPs
47	DMM	Single-ended Delay and Delay variation	MEPs
46	DMR	Throughput	MEPs
49	EXM	Experimental Message	Outside the scope of [ITU-T G.8013]
48	EXR	Experimental Reply	Outside the scope of [ITU-T G.8013]
51	VSM	Vendor-specific Message	Outside the scope of [ITU-T G.8013]
50	VSR	Vendor-specific Reply	Outside the scope of [ITU-T G.8013]
52	CSF	Client signal fail	MEPs
53	1SL	Dual-ended Synthetic LM	MEPs
55	SLM	Single-ended Synthetic LM	MEPs
54	SLR	Single-ended Synthetic LM	MEPs
34, 36, 38, 44, 60-63	Reserved		
MEF defined			
56	LLR	Latching Loopback Reply	
57	LLM	Latching Loopback Message	
58	SAT	Service activation test Control Protocol	
59	SAT	Service activation test Control Message	
IETF defined			

Table 6-1 – Ethernet OAM PDU types and applications

OpCode value	OAM PDU type	OAM application	OpCode relevance for MEPs/MIPs
64	TRILL	Path Trace Reply	
65	TRILL	Path Trace Message	
66	TRILL	Multi-destination Tree Verification Reply	
67	TRILL	Multi-destination Tree Verification Message	
68-59	Reserved		

NOTE 1 – The CCM PDU supports multiple applications, namely continuity check (CC), remote defect indication (RDI), and loss measurement (LM) and each application requires different message rate (default rate for fault is 1 second, pm 100 msec, APS 3.33 msec.)

NOTE 2 – There has been agreement among IEEE 802.1, MEF, and ITU-T SG15 that the assignee SDOs will also be responsible for the YANG model of their respective OAM. In ITU-T, the ET OAM (i.e., Carrier-Grade Ethernet OAM) is specified in [ITU-T G.8013] with the equipment functional model in [ITU-T G.8021], the management requirements in [ITU-T G.8051] and information model in [ITU-T G.8052].

NOTE 3 – For some OAM PDUs, such as CCM and LBM/LBR, while the basic PDUs are defined in [IEEE 802.1Q], some of their usages are further enhanced in [ITU-T G.8013] and [ITU-T G.8021] to provide specific OAM application needs. For example, the LBM/LBR PDUs are used to provide the following OAM functionalities:

– LB_Discover: to discover the MAC addresses of the other MEPs in the same MEG.

– LB_Series: to send a series of N LB messages to a particular MEP/MIP and report back the total number of received LBR frames, as well as counts of specific errors.

– LB_Test: to send a series of LB messages carrying a test pattern to a particular MEP; and report back the total number of LBM frames sent, as well as the total number of LBR frames received.

The UML model of these OAM applications are defined in [ITU-T G.8052] and the corresponding pruned/refactored UML and YANG are defined in this Recommendation. The YANG model of this Recommendation augments the [IEEE 802.1Q] base YANG model.

NOTE 4 – OAM messages (requests and responses) are configured and processed at the MEP/MIP. Thus, consistent model/view among the SDOs on MEP/MIP is critical, regardless of whether they have formal UML MEP/MIP model (such as ITU-T SG15 in [ITU-T G.8052]) or not (such as [IEEE 802.1Q]). The base YANG model of MEP/MIP for CFM is defined in [IEEE 802.1Q]. It is used as the base for augmentation for the YANG model of this Recommendation.

The ET OAM functions covered in this Recommendation complements the [IEEE 802.1Q] defined connectivity fault management (CFM) functions.

The UML information model for the ET OAM is defined in clause 7.

The YANG module for the ET OAM is contained in clause 8.1. This YANG module is translated from the ET OAM UML information model and augments the IEEE 802.1Q CFM YANG module ieee802-dot1q-cfm.yang.

To ensure the seamless augmentation of the ET OAM YANG to the [IEEE 802.1Q] CFM YANG, the CMF YANG has been reverse-engineered into UML form to assist the modelling (pruning and refactoring of the base [ITU-T G.8052] UML model). The reverse-engineered UML is contained in clause 7.1.

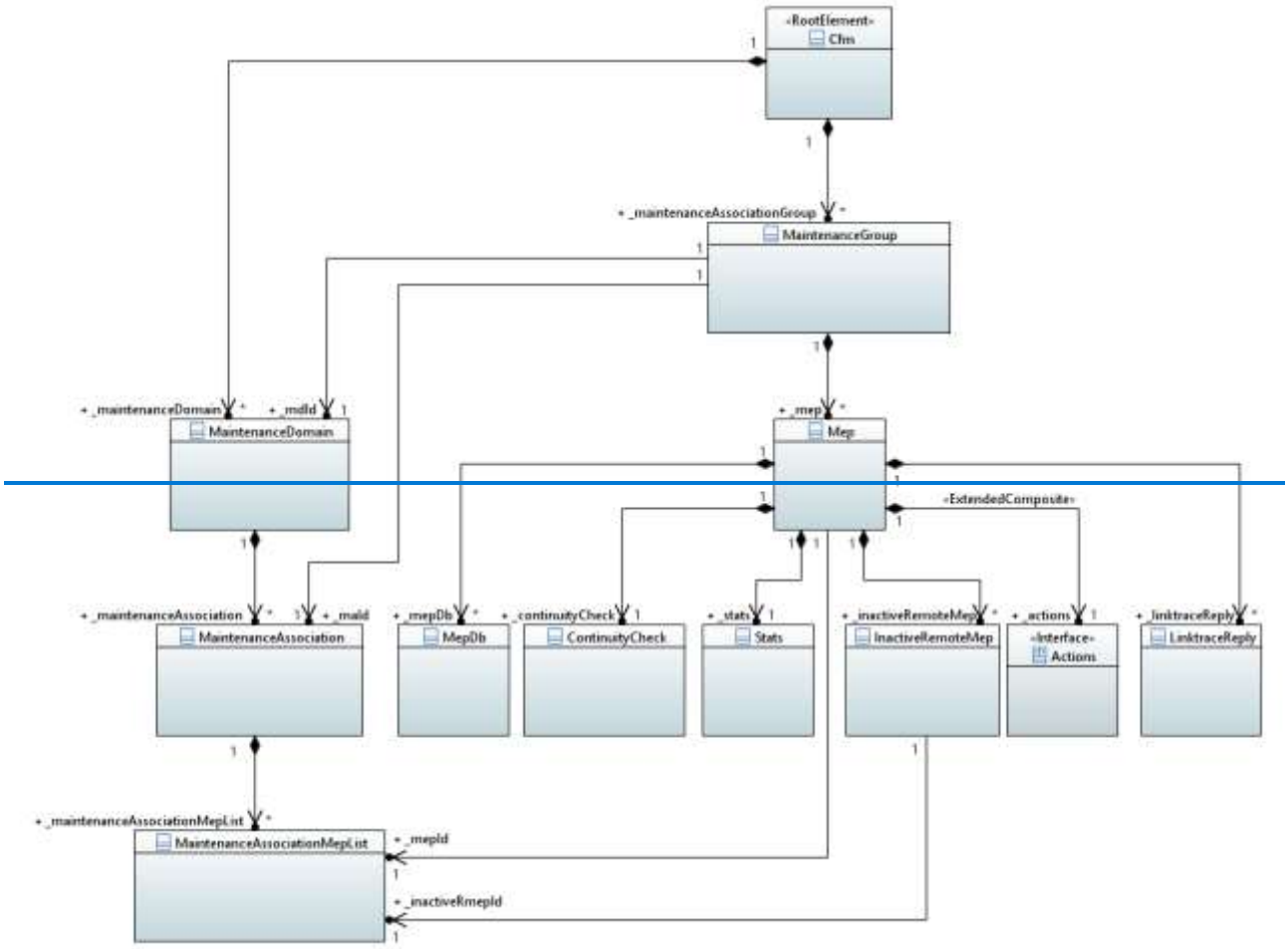
7 Ethernet transport OAM information model

7.1 IEEE CFM UML model ~~R~~reverse-engineered from the CFM YANG

To assist ET OAM UML pruning & refactoring and to ensure that the translated ET OAM YANG can seamlessly augment ~~seamlessly~~ the [IEEE 802.1Q] CFM YANG, the CFM YANG modules have been manually reverse-engineered into UML form. The model files of the CFM UML model are provided in clause 7.3.

Contained in Annex A are the UML diagrams extracted from the CFM UML model. Contained in Appendix I ~~is~~ are the [IEEE 802.1Q] CFM YANG modules.

~~Figures 7-1 to 7-10 illustrate the UML diagrams extracted from the reverse-engineered CFM UML model. The essences of the diagrams are reflected in the captions of the respective figures.~~



~~Figure 7-1 – IEEE 802.1Q CFM model – High level structure~~

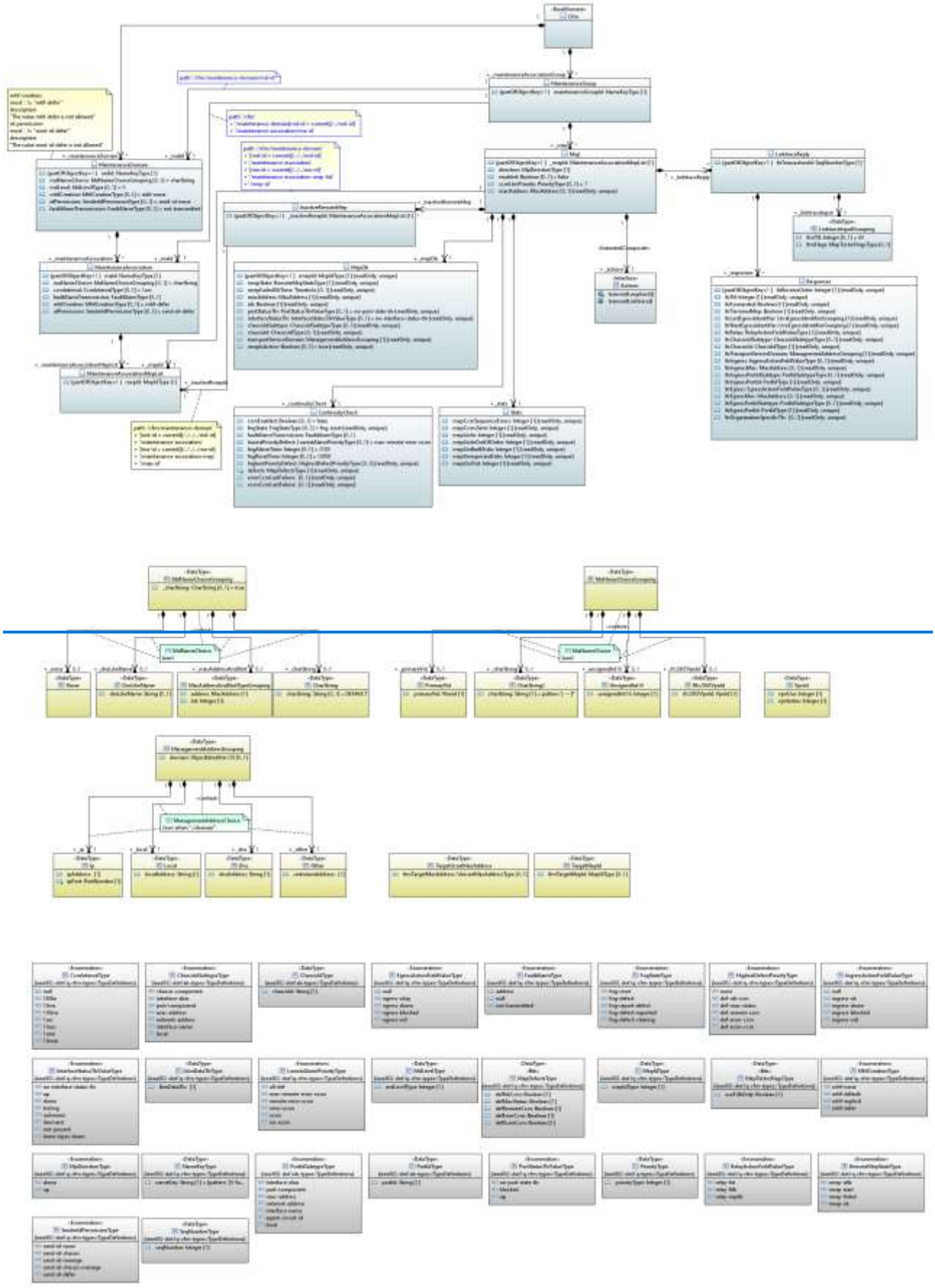


Figure 7-2 – IEEE 802.1Q CFM model – Detail structure

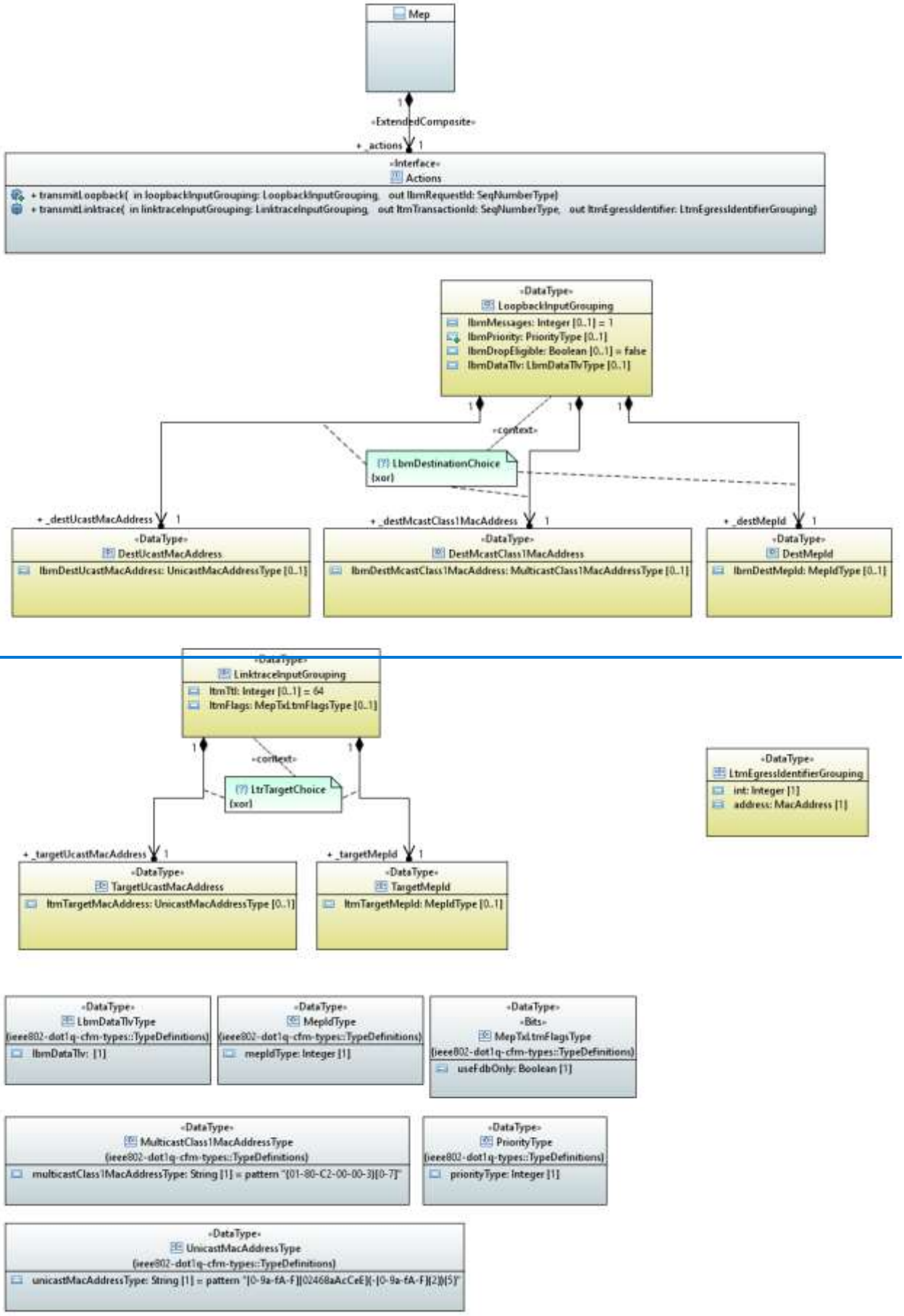


Figure 7-3 – IEEE 802.1Q CFM model – Operations

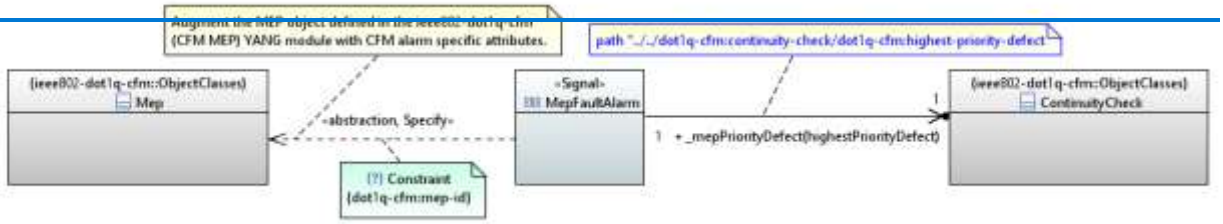


Figure 7-4 – IEEE 802.1Q CFM model – Alarm

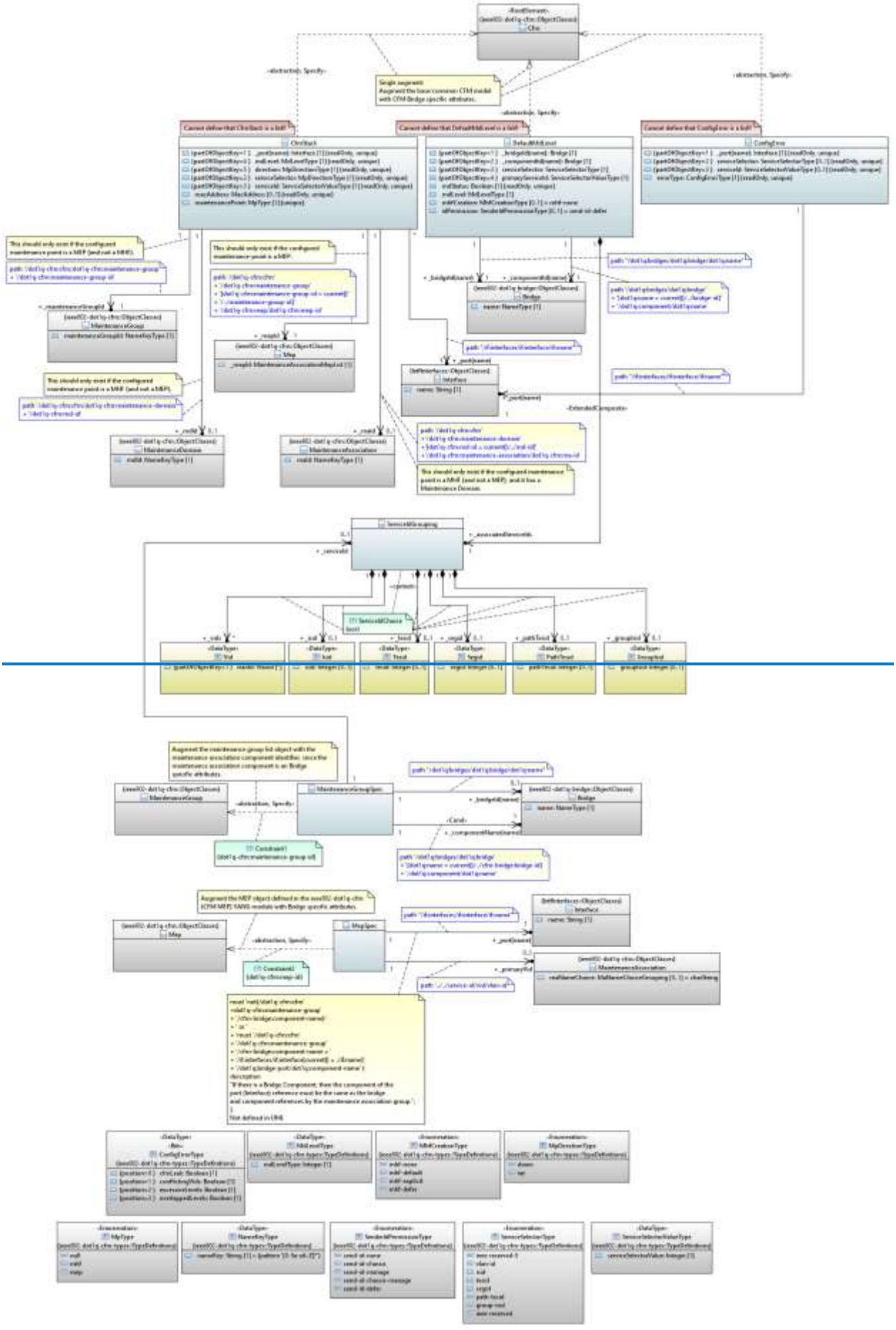


Figure 7-5 – IEEE 802.1Q CFM model – CFM bridge

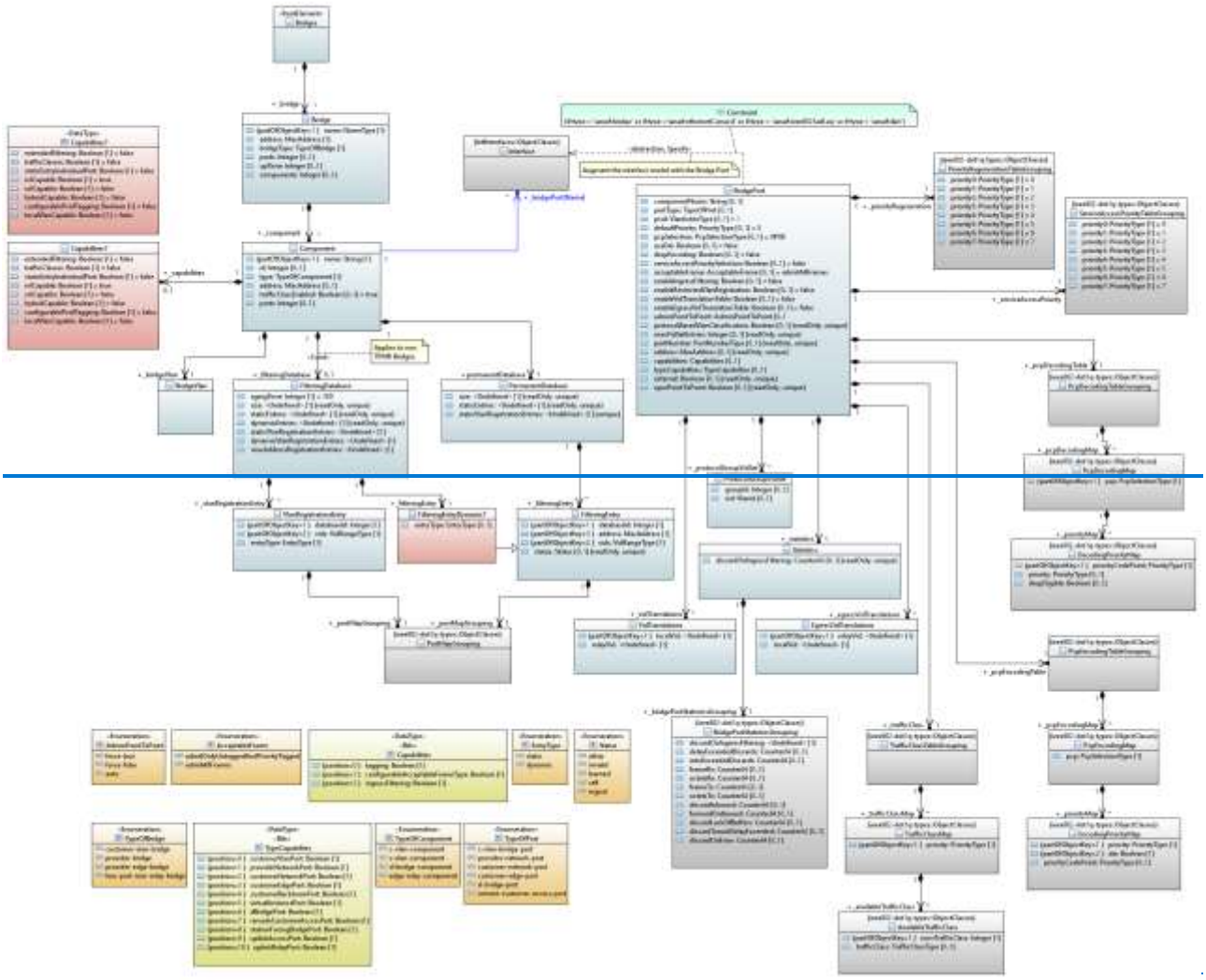


Figure 7-6 – IEEE 802.1Q bridge model

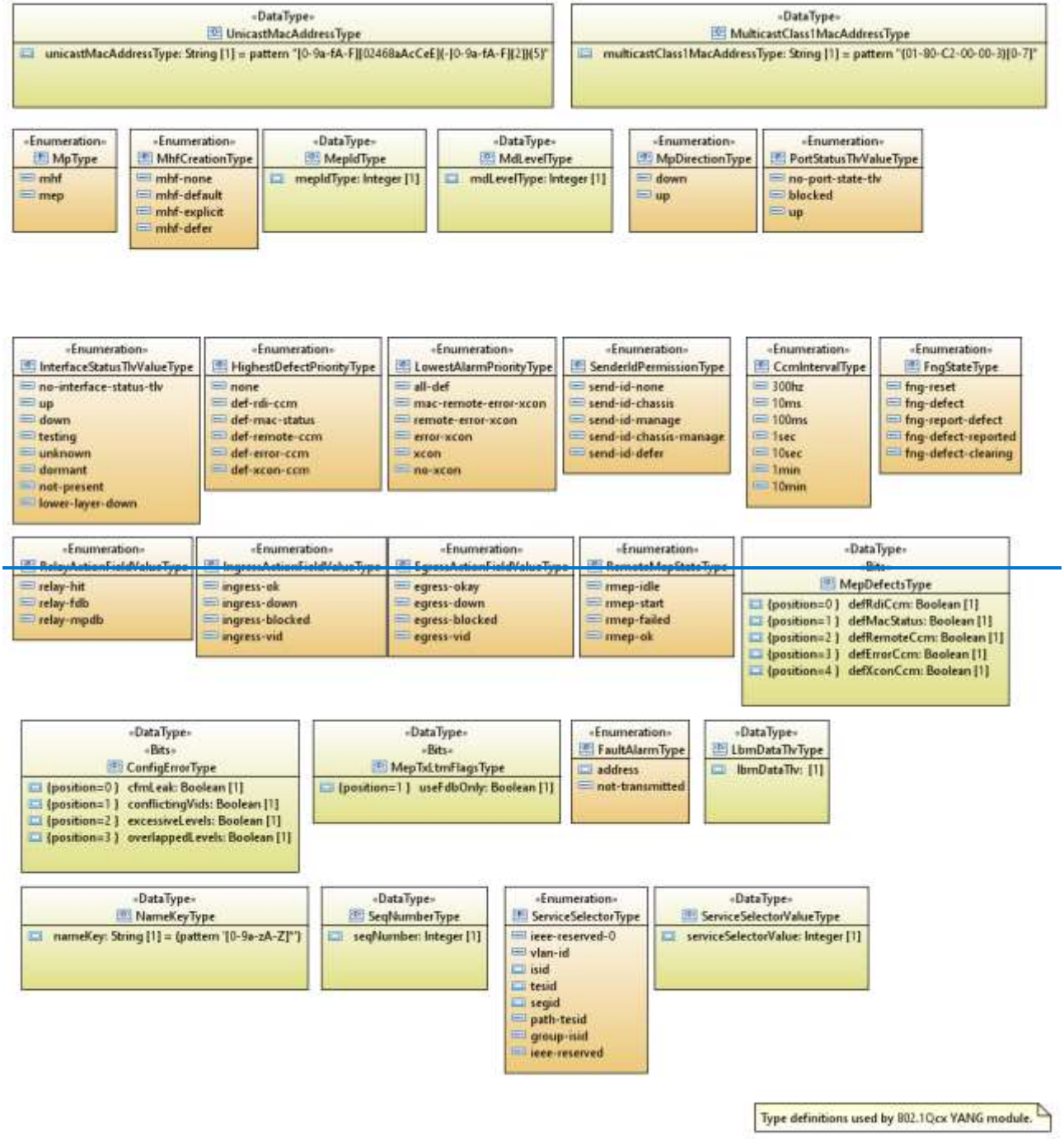


Figure 7-7 – IEEE 802.1Q CFM model – Data types

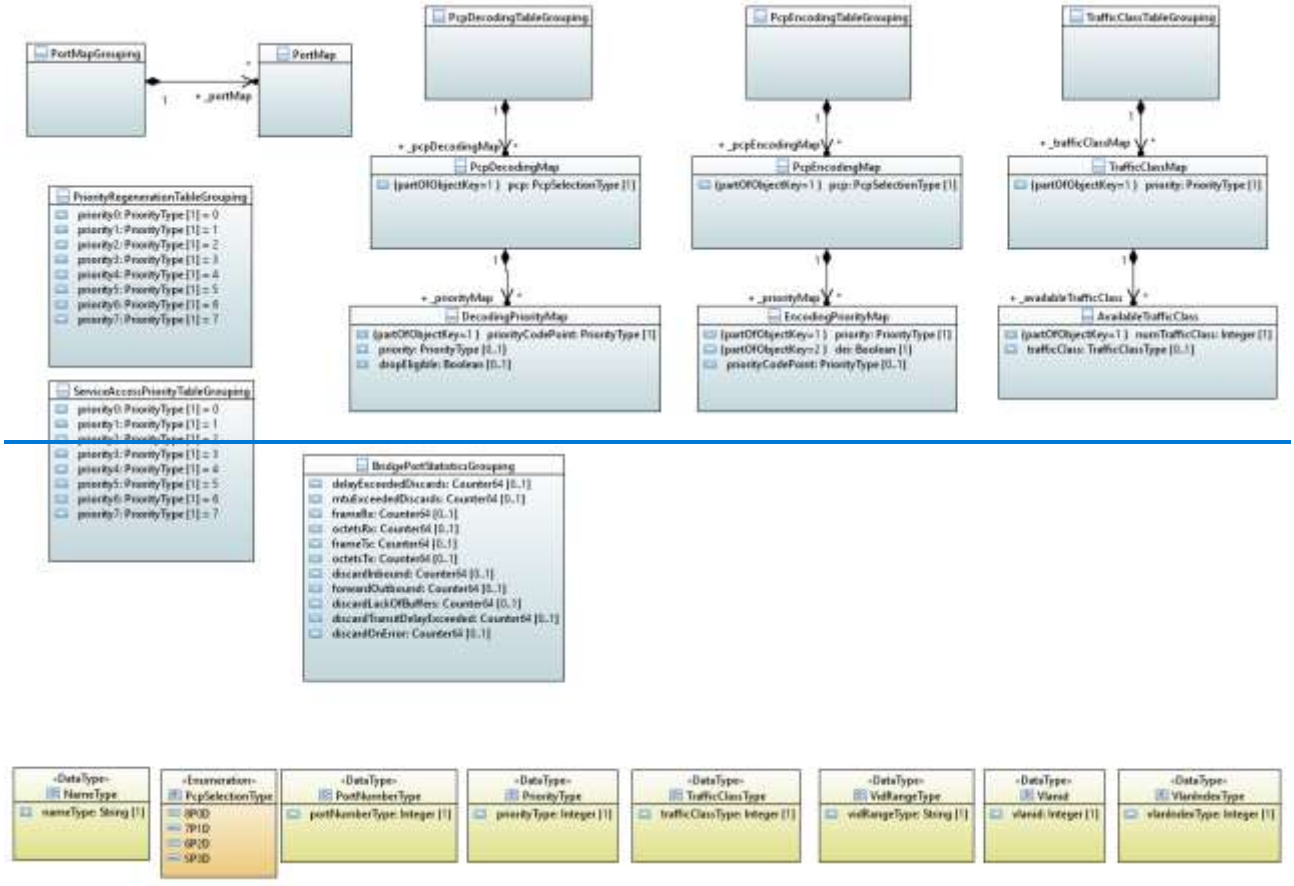


Figure 7-8 – IEEE 802.1Q model – Data types

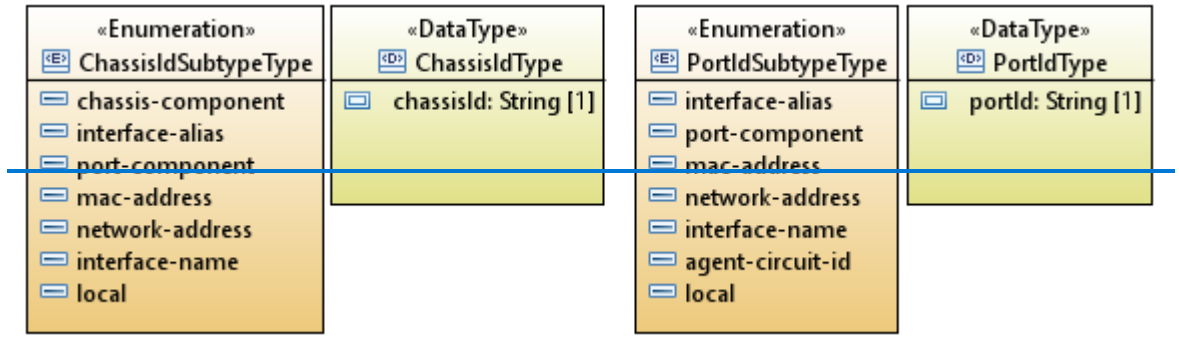


Figure 7-9 – IEEE 802.1AB data types

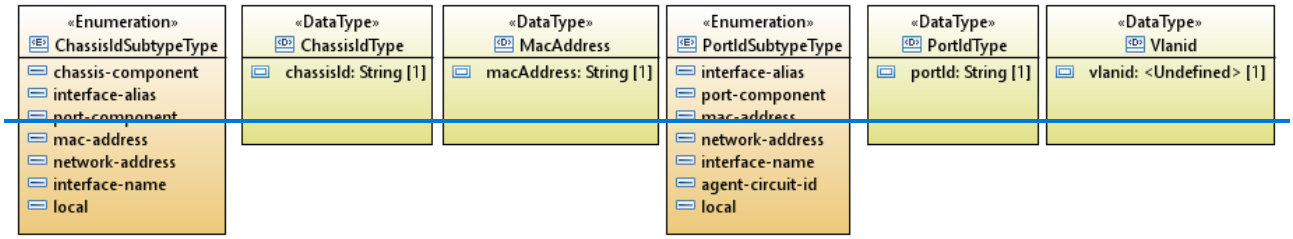


Figure 7-10 – IEEE 802 model – Data types

7.2 Overview of the ET OAM Model~~Ethernet transport OAM UML~~

This clause specifies the UML information model of the ET OAM functions identified in clause 6. This information model is derived through pruning and refactoring the [ITU-T G.7711] core information model and [ITU-T G.8052] foundation ET NE information model.

7.2.1 ITU-T G.8052 base object classes

To manage the ET OAM functions identified in clause 6, the following ITU-T G.8052 object classes are considered for pruning/refactoring to meet the needs of this Recommendation:

– ETH_TrailTerminationPoint/Bidirectional/Sink/Source *and the subordinate Pacs*
– ETH_ConnectionTerminationPoint/Bidirectional/Sink/Source *and the subordinate Pacs*
– Mep/ Bidirectional/Sink/Source
– MipBidirectional
– MepControl
– MipControl
– MeasurementJobControl
– OnDemandMeasurementJob
– OnDemandMeasurementJobControl
– OnDemandDualEndedMeasuremnetJobControlSink
– OnDemandDualEndedMeasuremnetJobControlSource
– OnDemandSingleEndedMeasurementJobControl
– ProActiveMeasurementJobControl
– ProActiveDualEndedMeasurementJobControlSink
– ProActiveDualEndedMeasurementJobControlSource
– ProActiveSingleEndedMeasurementJobControl
– CurrentData/HistoryData
– ProactiveDmCurrent/HistoryData
– ProactiveLmCurrentData/HistoryData
– Proactive1SlCurrentData/HistoryData
– Proactive1DmCurrentData/HistoryData
– ThresholdProfile

Besides the above identified ITU-T G.8052 object classes, additional object classes and interface classes are defined in this Recommendation specifically for augmenting the IEEE 802.1Q CFM base model.

The object classes and interface classes of the UML model of this Recommendation are organized in three modules as follows.

– The itut-eth-oam-bridge module
  • This module consists of object classes for binding the forwarding plane with the MEP and MIP in the case [IEEE 802.1Q] bridges are deployed in the forwarding plane.
  • It consists of the following three object classes
    – *MepBridgePortSpec*: It references the bridge port and augments the MEP
    – *MipBridgePortSpec*: It references the bridge port and augments the MIP
    – *MgBridgeSpec*: It augments the maintenance group (MG)
  • See Figures 7-11 and 7-13 for additional information.

- The itut-eth-oam-am module
  - This module consists of object classes for alarm management. It allows decoupling implementation of alarm management from performance monitoring and maintenance.
  - It consists of the following object classes
    - EthAmSpec: It augments the MEP for alarm severity assignments
    - AlarmSeverityAssignmentProfile: It specifies the alarm severity assignments.
  - Note that alarm management information model is deemed not mature yet and the the classes are marked as either preliminary or experimental in the model, and therefore they are not translated into YANG and are not included in the YANG data model provided in clause 8.1.
- The itut-eth-oam module
  - This module consists of object classes and interface classes for ET OAM performance monitoring, including pro-active monitoring and on-demand monitoring, and maintenance operations.
  - It has the following object classes[1]
    - EthMepOamSpec
      - EthMeaJobPac
        - ProActiveDualEndedMeaJob
          - ProActiveDualEndedMeaJobControlTarget
            - DualEndedCurrentData
              - DualEndedHistoryData
          - ProActiveDualEndedMeaJobControlInitiator
        - ProActiveSingleEndedMeaJob
          - ProActiveSingleEndedMeaJobControl
            - SingleEndedCurrentData
              - SingleEndedHistoryData
        - OnDemandDualEndedMeaJob
          - OnDemandDualEndedMeaJobControlTarget
          - OnDemandDualEndedMeaJobControlInitiator
        - OnDemandSingleEndedMeaJob
          - OnDemandSingleEndedMeaJobControl
    - ThresholdProfile
  - It has the following interface classes
    - EthPmAction
    - EthMaintenaceAction

~~Listed below are these G.8052.1 defined artefacts~~

- ~~Object classes and Pacs~~
  - ~~MaBridgeSpec~~
  - ~~MepBridgePortSpec~~
  - ~~MipBridgePortSpec~~
  - ~~EthMepOamSpec~~
    - ~~EthMeaJobPac~~
      - ~~ProActiveDualEndedMeaJob~~
        - ~~ProActiveDualEndedMeaJobControlTarget~~

[1] Indentation in the listing reflects subordination hierarchy.

- DualEndedCurrentData
  - DualEndedHistoryData
- ProActiveDualEndedMeaJobControlInitiator
- OnDemandDualEndedMeaJob*
  - OnDemandDualEndedMeasurementJobControlSink*
  - OnDemandDualEndedMeasurementJobControlSource*
- ProActiveSingleEndedMeaJob
  - ProActiveSingleEndedMeaJobControl
    - SingleEndedCurrentData
      - SingleEndedHistoryData
- OnDemandSingleEndedMeaJob*
  - OnDemandSingleEndedMeasurementJobControl*
- ThresholdProfile*
- AlarmSeverityAssignmentProfile*
- EthMipSpec
  - Mip

Interface class

- EthMepAction*

NOTE: In the list above, *classes that are noted with an asterisk (*) means that the lifecycle of the class is either preliminary or experimental and they are not deemed as mature yet, therefore they and thus are not translated into for the YANG and are not included in the YANG data model provided in clause 8.1.*

7.2.2 Augmentation to the IEEE CFM reverse-engineered UML

The YANG model described in this Recommendation aims to augment the IEEE 802.1Q CFM YANG for the ETH OAM functionality. In UML form, the ITU-T G.8052.1 UML model aims to augment the IEEE 802.1Q CFM UML.

Figure 7-11 provides an overview of the augmentation relationship between the IEEE 802.1Q classes and those described defined in this Recommendation. It illustrates, at high level, that:

– EthMepOamSpec augments IEEE Mep for the ETH OAM (see Figure 7-14 for details)

– EthMepActionEthMaintenanceAction and EthPmAction* augments IEEE Actions for the ETH OAM operations (see Figure 7-19)

– EthMipSpec augments IEEE MaintenanceDomain for the ETH MIP (see Figure 7-18)

– MepBridgePortSpec augments IEEE Mep and also references IEEE BridgePort to associate the MEP (which that supports the ITU-T ETH OAM functionalitiesy) with the bridge port (see Figure 7-13)

– MipBridgePortSpec augments ITU-T Mip and also references IEEE BridgePort to associate the MIP (which that supports the ITU-T ETH OAM functionalitiesty) with the bridge port (see Figure 7-13)

– MgBridgeSpec augments IEEE MaintenanceGroup for ITU-T OAM fault management support (see Figure 7-13)

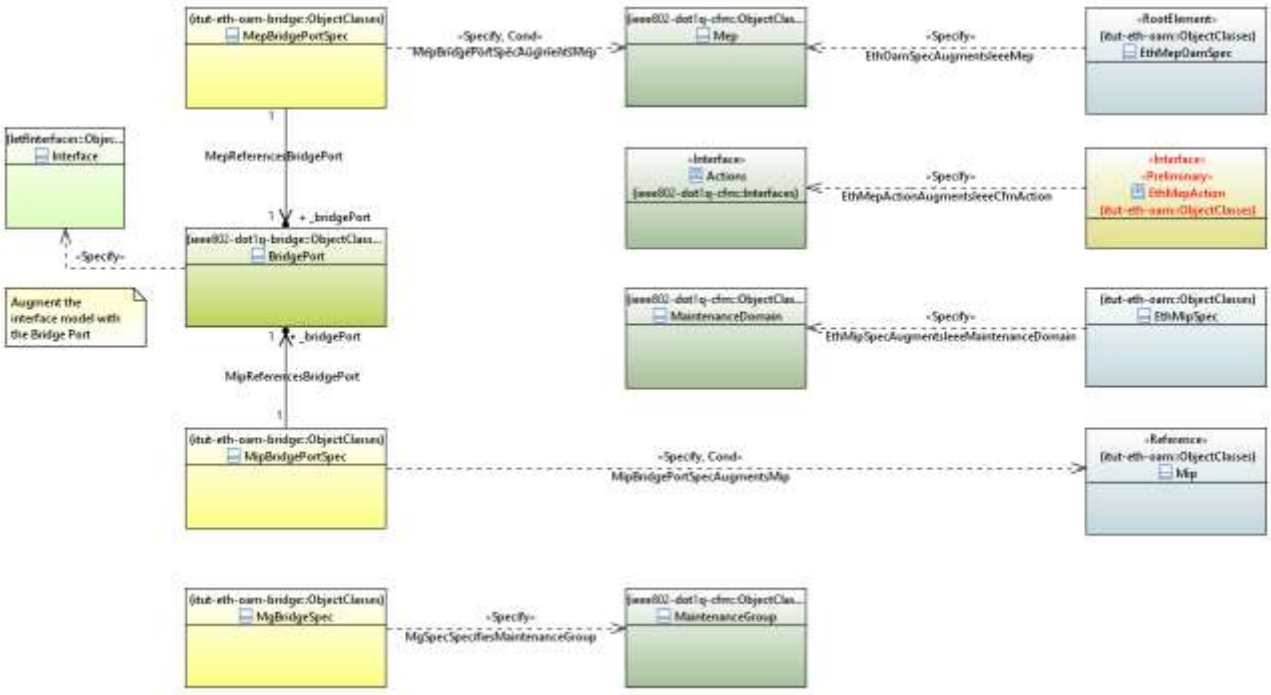


Figure 7-1~~1~~ – IEEE and ITU-T OAM augmentation relationship

7.2.2.1 Maintenance association name choice

Figure 7-~~1~~2 depicts the maintenance association name choice.

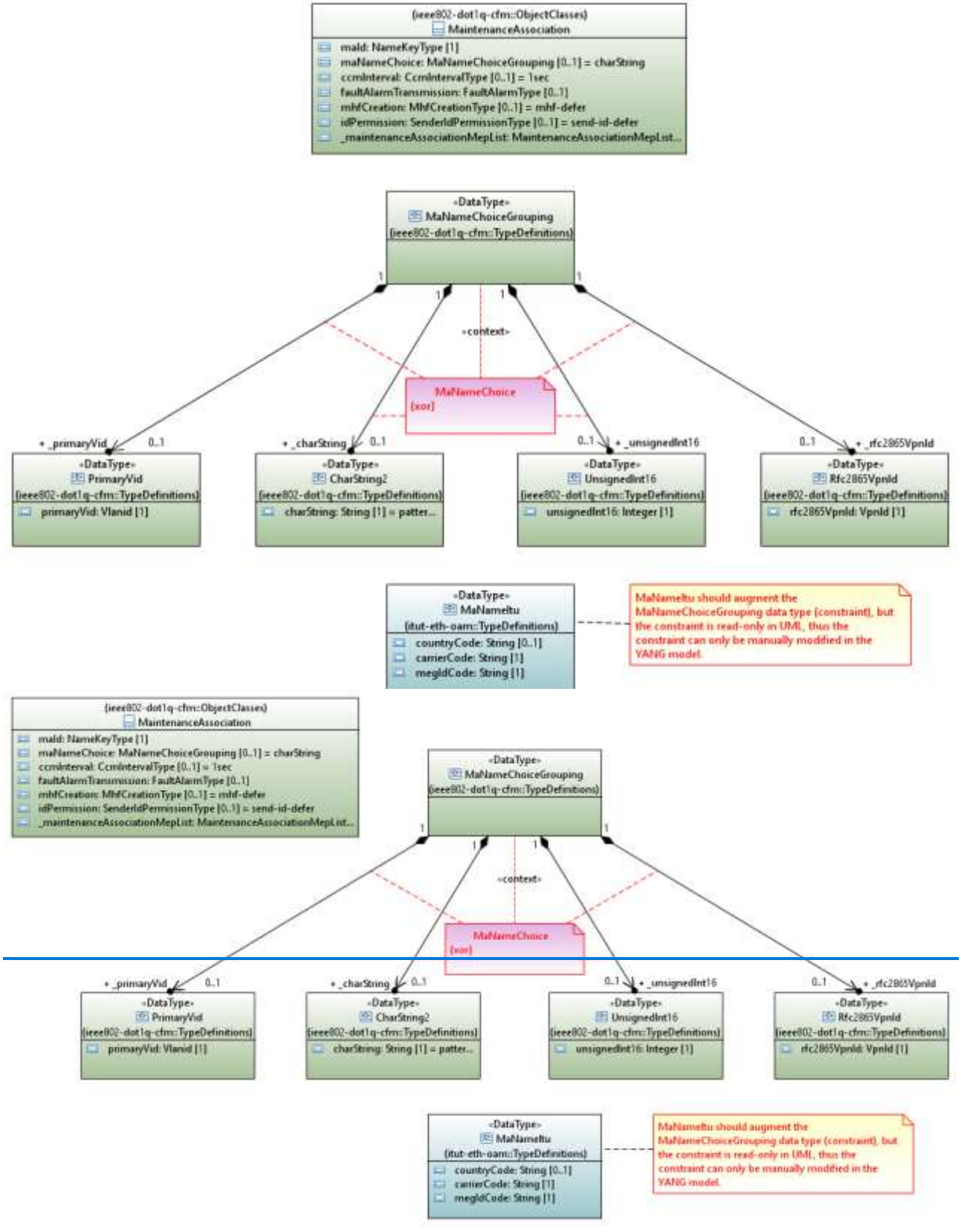


Figure 7-12 – Maintenance association name choice

7.2.2.2 Forwarding plane binding

For the ITU-T G.8013 ETH OAM functions to be supported in the Ethernet network, the MEP and MIP instances need to be associated with the forwarding plane of the Ethernet network. Thus, in the

case IEEE 802.1Q bridges are deployed in the Ethernet network, the MEPs and MIPs need to be associated with the IEEE 802.1Q bridge ports. The maintenance group (i.e., MEG) needs to be augmented with the VLAN ID information for those VLANs that the MEG is monitoring.

Figure 7-~~1~~3 shows the MEP, MIP, and maintenance group augmentation structure. The MepBridgePortSpec object described in this Recommendation augments the IEEE 802.1Q Mep object and references the IEEE 802.1Q BridgePort. Similarly, the MipBridgePortSpec object of this Recommendation augments the Mip object and references the IEEE 802.1Q BridgePort. The MgBridgeSpec augments the IEEE 802.1Q MaintenanceGroup with the VLAN IDs.

NOTE – For other Ethernet network, the forwarding plane termination point will be augmented by an EthernetTpSpec, which prunes/refactors the ITU-T G.8052 ETH TTP and CTP object classes. However, this scenario is outside the scope of the current edition of this Recommendation.

In [IEEE 802.1Q] CFM, MIPs are implicitly created and thus no MIP object class is defined in [IEEE 802.1Q]. In Ethernet transport network, MIP could be explicitly created. In this Recommendation, the MIP object class is specified. It is defined through pruning/refactoring from the ITU-T G.8052 MIP base object class. It allows explicit instantiation of MIP instances in the ITU-T G.8013 ET OAM environment.

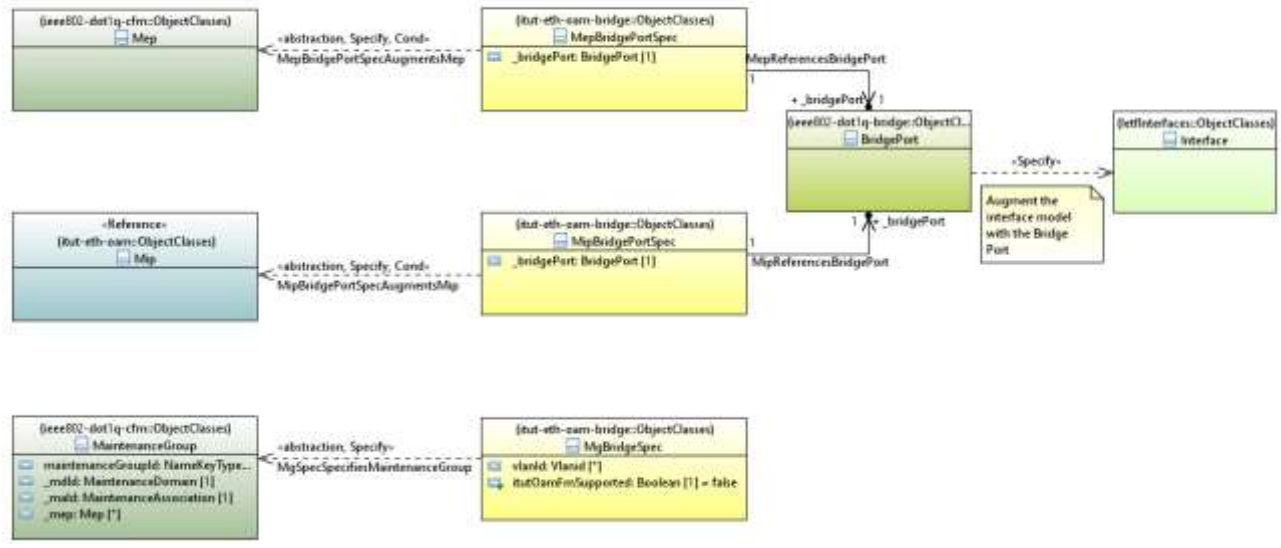


Figure 7-~~1~~3 – Augmentation for bridge information

7.2.2.3 MEP and measurement jobs

The Mep object class of the reverse-engineered IEEE 802.1Q CFM UML is the touch point for ETH MEP OAM augmentation. It represents the IEEE 802.1Q CFM mep YANG node. The IEEE 802.1Q CFM Mep UML class is augmented with the EthMepOamSpec class of this Recommendation. Figure 7-~~1~~4 shows the MEP OAM augmentation structure, which is organized according to the MEP OAM functions (OpCode per se). This organization is preferred over the alternative way, which organizes according to MEP Bi/Sink/Source.

The EthMepOamSpec object class of this Recommendation contains the EthMeaJobPac and the following OAM attributes:

– tcmMep
– clientMel
– ethAis
– ethLck
– ethCsf*

– ethBw*

– ethAps*

~~– ethAlarm*~~

~~– _asap*~~

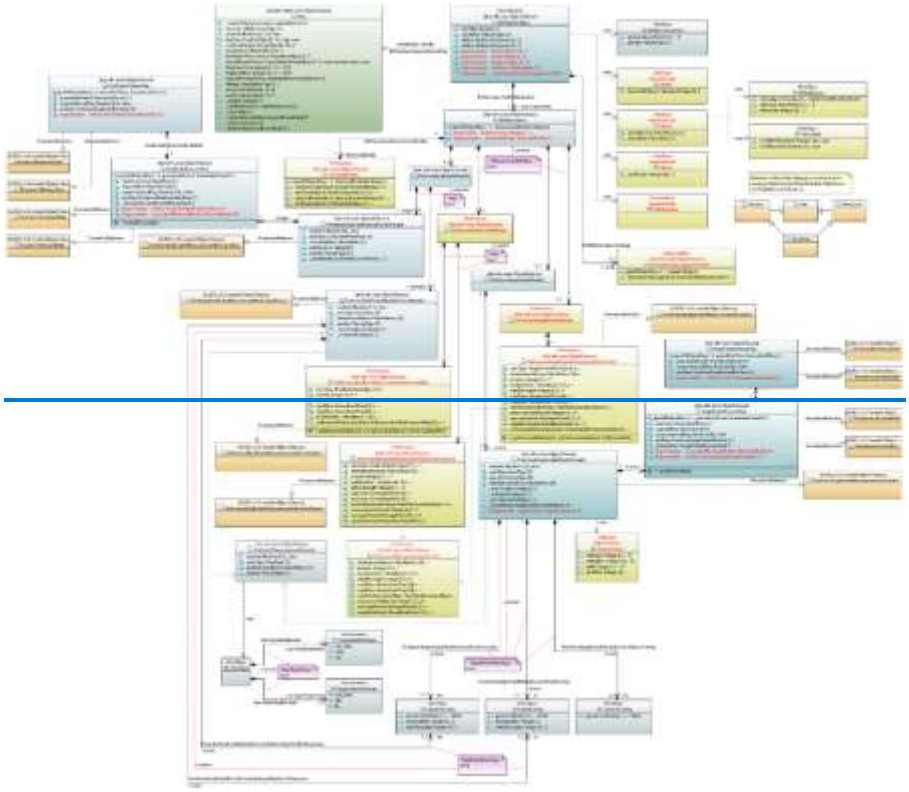
The OAM attributes are defined through pruning/refactoring from the ITU-T G.8052 Mep, MepSink, MepSource, and MepBidirectional classes, as shown in Table II-2 ~~of Appendix II~~.

The EthMepOamSpec contains zero or more instances of EthMeaJobPac. Each EthMeaJobPac contains ~~zero or more instances of ThresholdProfile* and~~ an instance of measurement job~~. The ETH measurement jobs could be categorized~~ according to the measurement purpose (i.e., application) and the control mechanism as shown in Table 7-2.1.

Table 7-2.1 – ETH measurement job and control

Purpose (application)	**Control**	**Measurement job class**	**Needed control classes**
Performance monitoring	*Dual ended*	ProActiveDualEndedMeaJob	ProActiveDualEndedMeaJobControlInitiator *at the initiating MEP*
			ProActiveDualEndedMeaJobControlTarget *at the responding MEP*
	Single ended	ProActiveSingleEndedMeaJob	ProActiveSingleEndedMeaJobControl *at the initiating MEP*
Maintenance	*Dual ended*	OnDemanDualEndedMeaJob*	OnDemandDualEndedMeaJobControlSource* *at the initiating MEP*
			OnDemandDualEndedMeaJobControlSink* *at the responding MEP*
	Single ended	OnDemandSingleEndedMeaJob*	OnDemandSingleEndedMeaJobControl* *at the initiating MEP*

~~The measurement job control classes and measurement current/history data classes are pruned and refactored from the corresponding classes from [ITU-T G.8052].~~



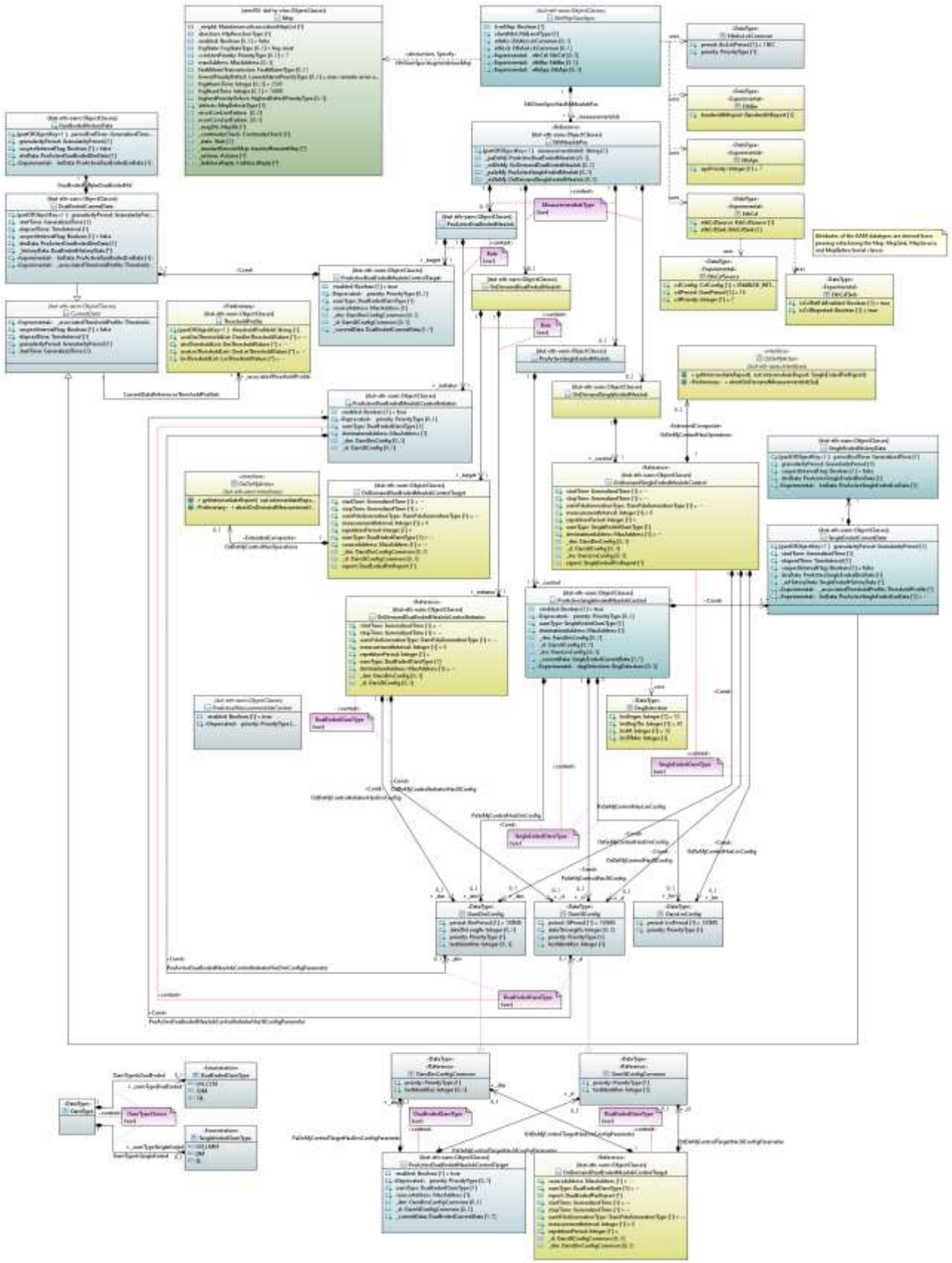


Figure 7-14 – CMF MEP augmentation with ETH MEP OAM

The measurement job control classes and measurement current/history data classes are pruned and refactored from the corresponding classes defined in [ITU-T G.8052].

Figure 7-5 shows the pruning and refactoring relationship.

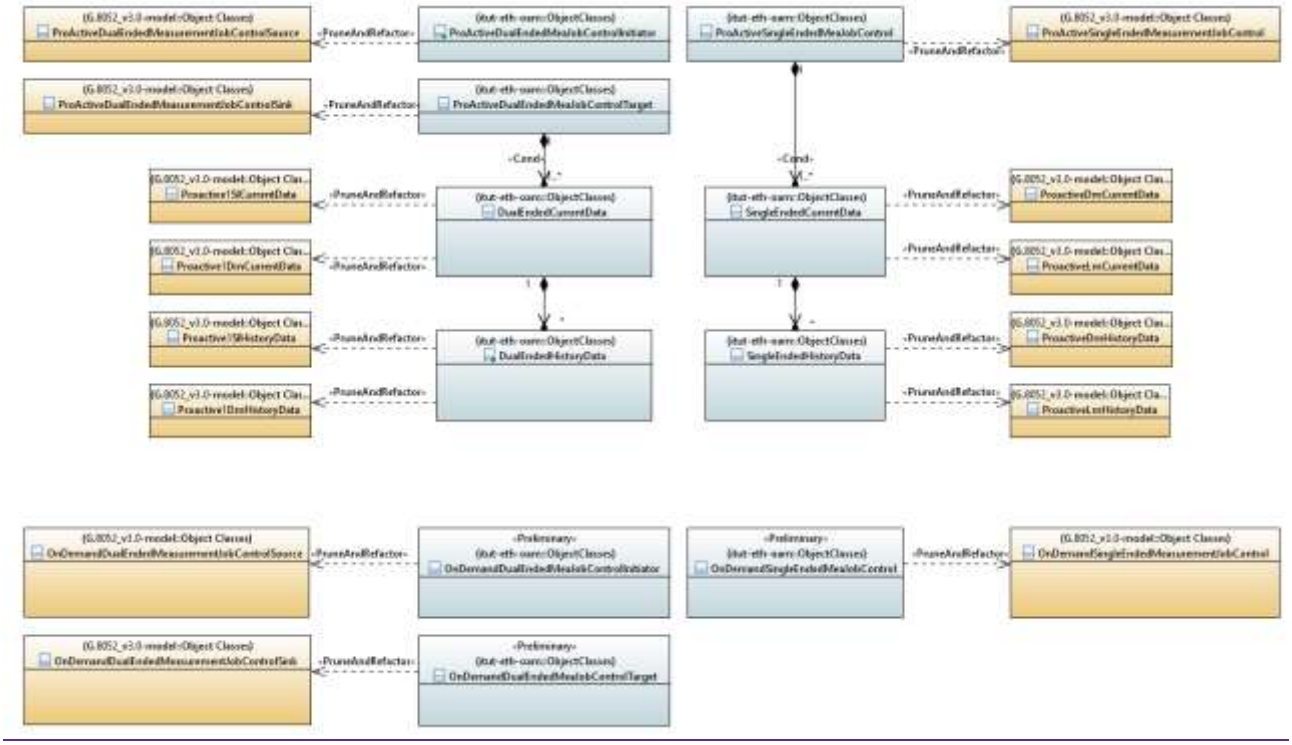


Figure 7-5 – PM pruning and refactoring relationship

Table II.1 ~~of Appendix II~~ contains the analysis of pruning/refactoring the attributes of the [ITU-T G.8052] MEP object classes for this Recommendation.

Figure 7-~~15~~ 6 shows the model of controlling the ETH proactive and on-demand measurement jobs.

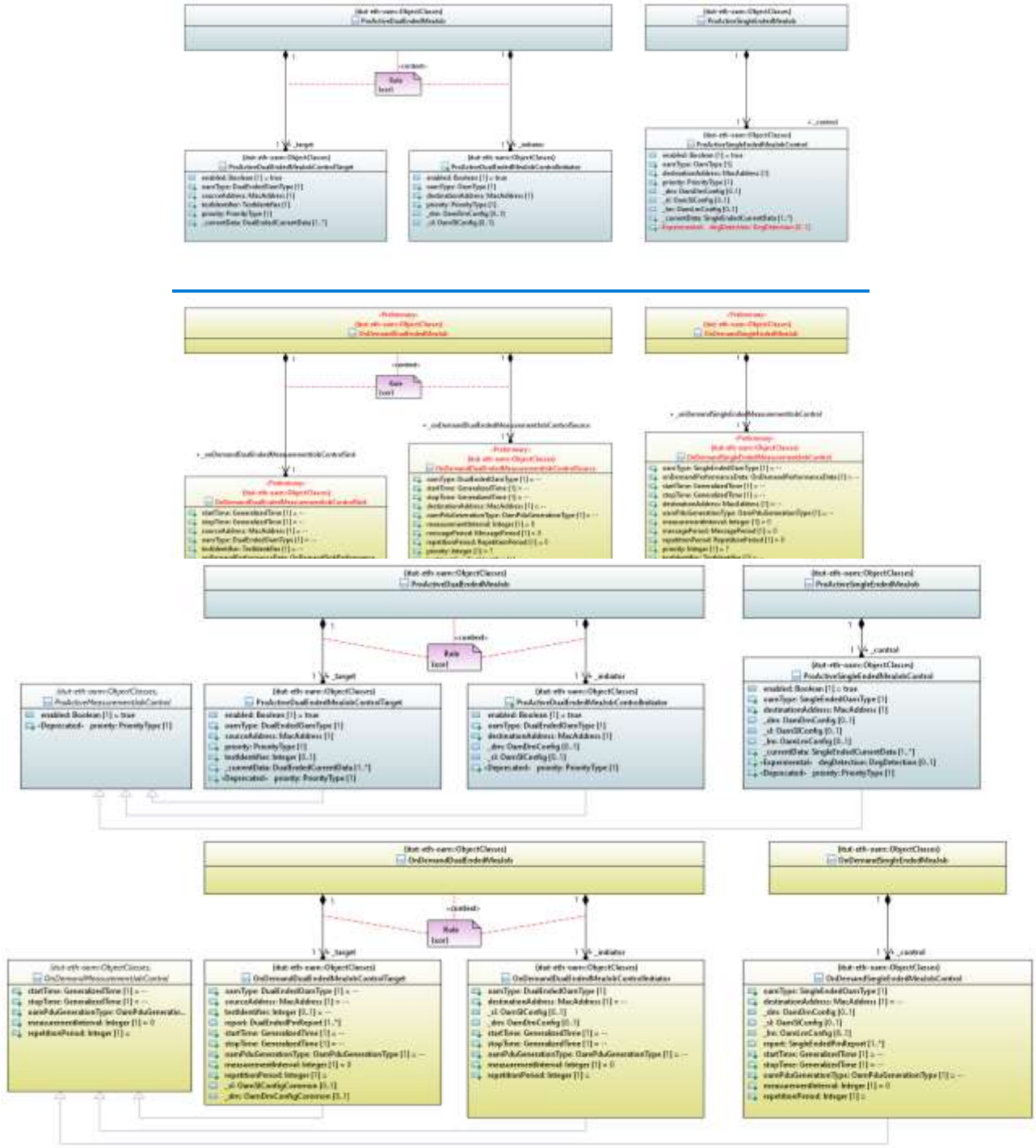


Figure 7-~~15~~ 6 – Measurement job control

Figure 7-~~16~~ 7 shows the ETH CurrentData and ThresholdProfile object classes for ETH performance monitoring measurement thresholding.

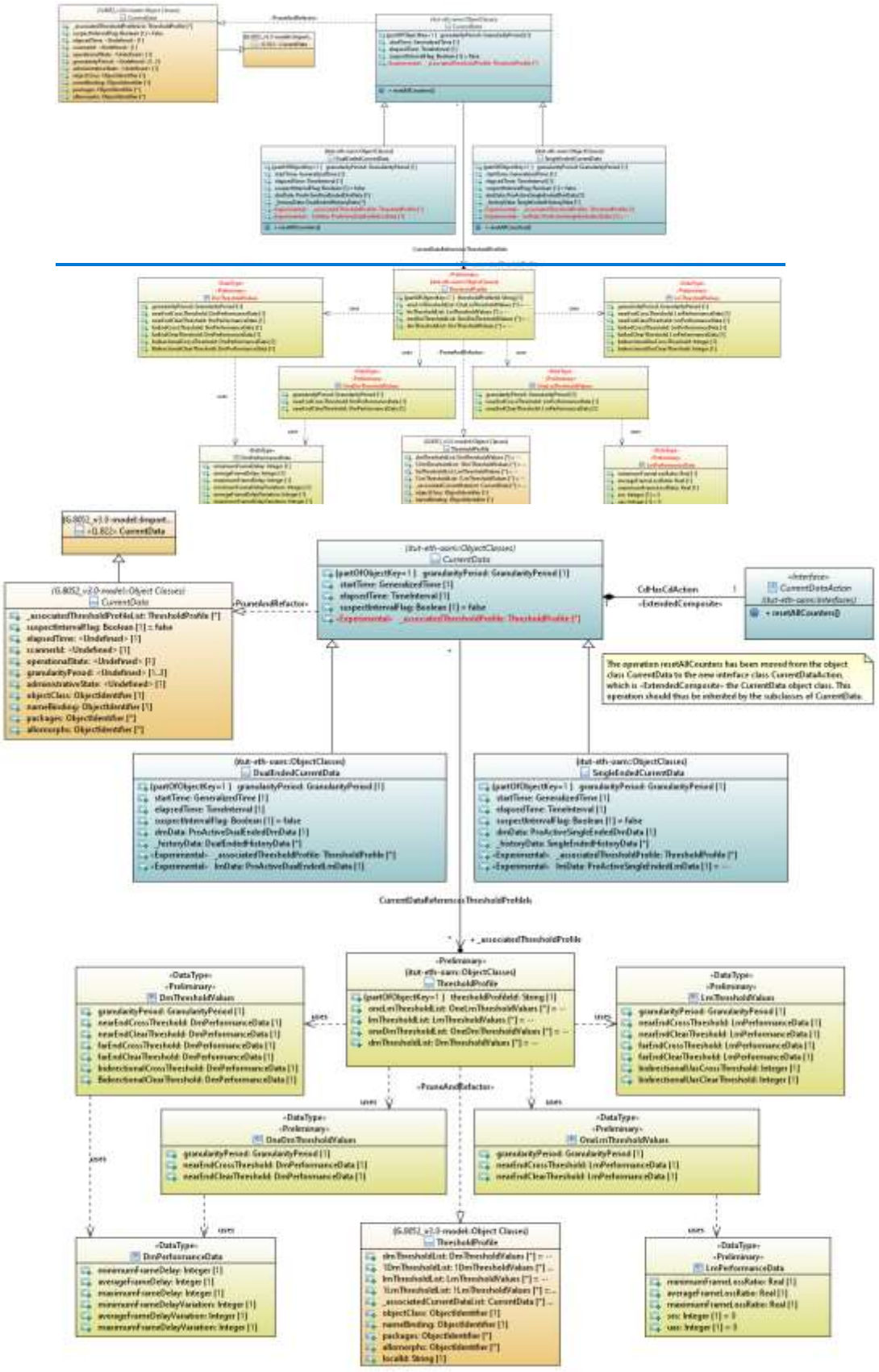


Figure 7-~~16~~ 7 – ETH PM current data and thresholding

Figure 7-~~17~~ 8 shows the pruning and refactoring of the ITU-T G.8052 HistoryData to derive the ETH CMF HistorytData and subclasses.

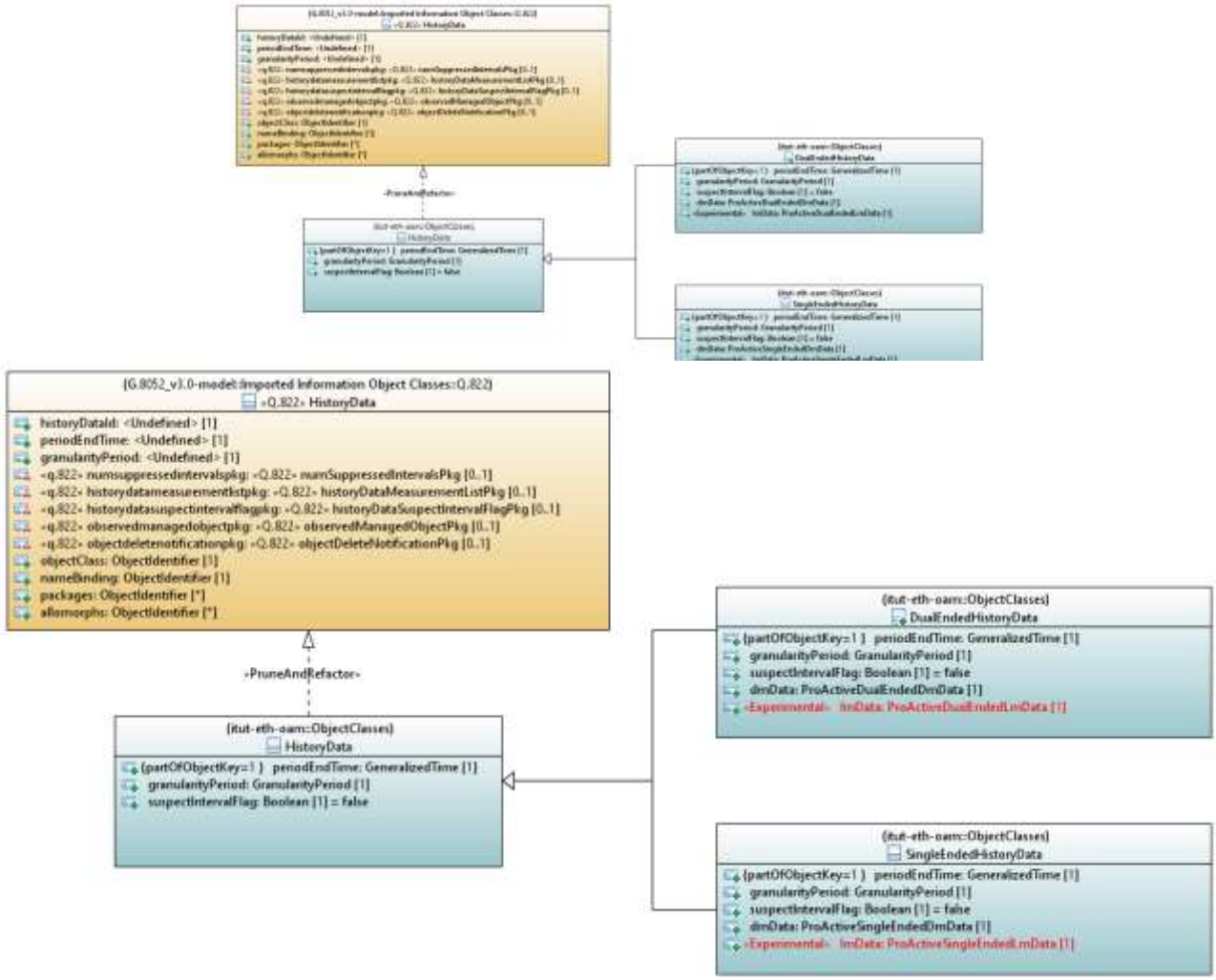


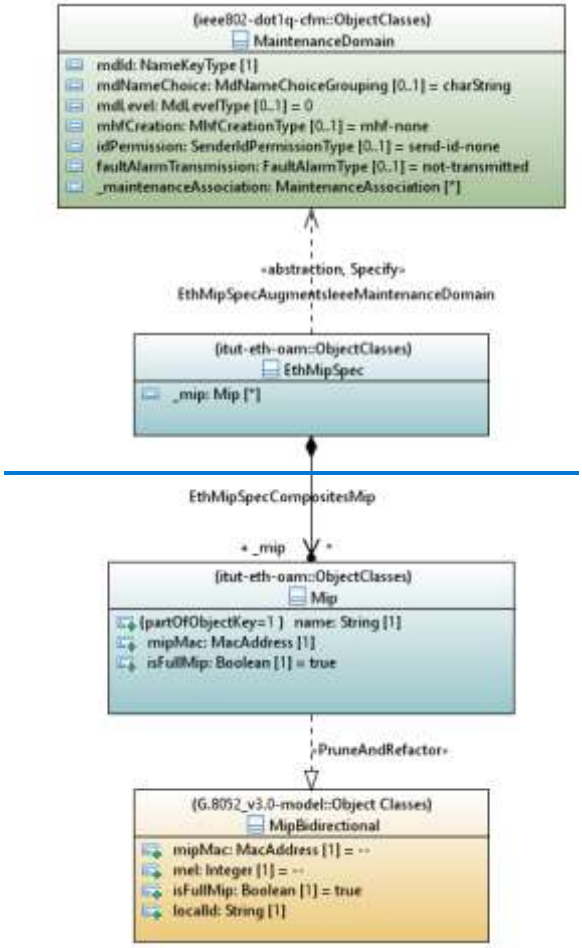
Figure 7-~~17~~ 8 – ETH PM history data

7.2.2.4 MIP

~~The EthMipSpec object class specified in this Recommendation augments the IEEE 802.1Q CFM MaintenanceDomain.~~ Figure 7-~~18~~ 9 shows the EthMipSpec object class augmenting the [IEEE 802.1Q] CFM MaintenanceDomain~~augmentation~~.

The EthMipSpec instance contains zero or more instances of Mip, which is pruned from ITU-T G.8052 MipBirectional object class.

Table II-2 ~~of Appendix II~~ contains the analysis of pruning/refactoring the attributes of the ITU-T G.8052 MIP object classes for this Recommendation~~-~~.


(ieee802-dot1q-cfm::ObjectClasses)
MaintenanceDomain
mdId: NameKeyType [1]
mdNameChoice: MdNameChoiceGrouping [0..1] = charString
mdLevel: MdLevelType [0..1] = 0
mhfCreation: MhfCreationType [0..1] = mhf-none
idPermission: SenderIdPermissionType [0..1] = send-id-none
faultAlarmTransmission: FaultAlarmType [0..1] = not-transmitted
_maintenanceAssociation: MaintenanceAssociation [*]
«abstraction, Specify»
EthMipSpecAugmentsIeeeMaintenanceDomain
(itut-eth-oam::ObjectClasses)
EthMipSpec
_mip: Mip [*]
EthMipSpecCompositesMip
+ _mip
*
(itut-eth-oam::ObjectClasses)
Mip
{partOfObjectKey=1 } name: String [1]
mipMac: MacAddress [1]
isFullMip: Boolean [1] = true
«PruneAndRefactor»
(G.8052_v3.0-model::Object Classes)
MipBidirectional
mipMac: MacAddress [1] = --
mel: Integer [1] = --
isFullMip: Boolean [1] = true
localId: String [1]

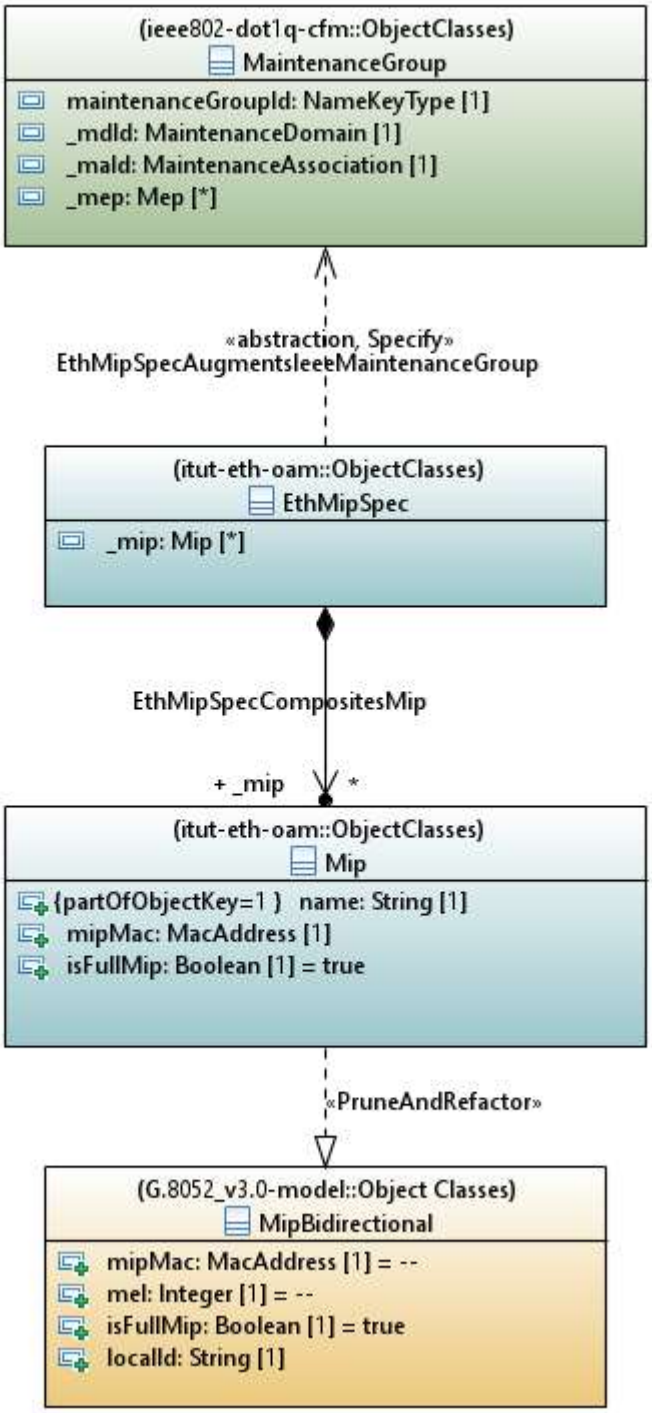


Figure 7-~~18~~ 9 – ETH MIP augmentation and pruning/refactoring

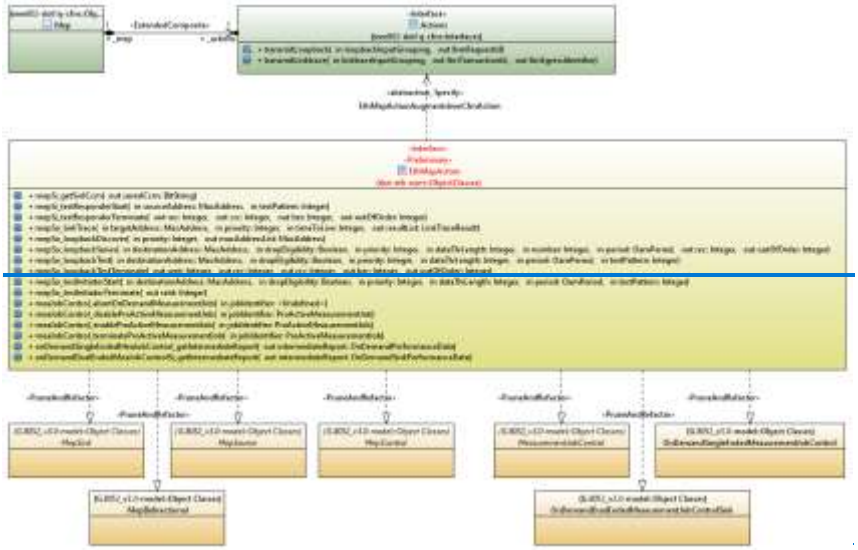
7.2.2.5 Operations

The reverse-engineered IEEE 802.1Q CFM UML Actions interface class is the touch point for ETH MEP OAM operation augmentation. This Actions interface class contains the IEEE 802.1Q CFM Transmit Loopback and Transmit Link Trace operations. . It is augmented with the [ITU-T G.8052.1] Eth~~Mep~~MaintenanceAction and EthPmAction interface classes for the ETH OAM maintenance operations and performance monitoring operations.

Figure 7-1~~9~~0 shows the operation augmentation structure.

The EthMepAction interface class consists of operations that are pruned/refactored from the ITU-T G.8052 MepBidirectional, MepSink, MepSource, MepControl, MeasurementJobControl, OnDemandSingleEndedMeasurementJobControl, and OnDemandDualEndedMeasurementJobControlSink object classes.

Table II.3 ~~of Appendix II~~ contains the analysis of pruning/refactoring the attributes of the ITU-T G.8052 ETH operations for this Recommendation.



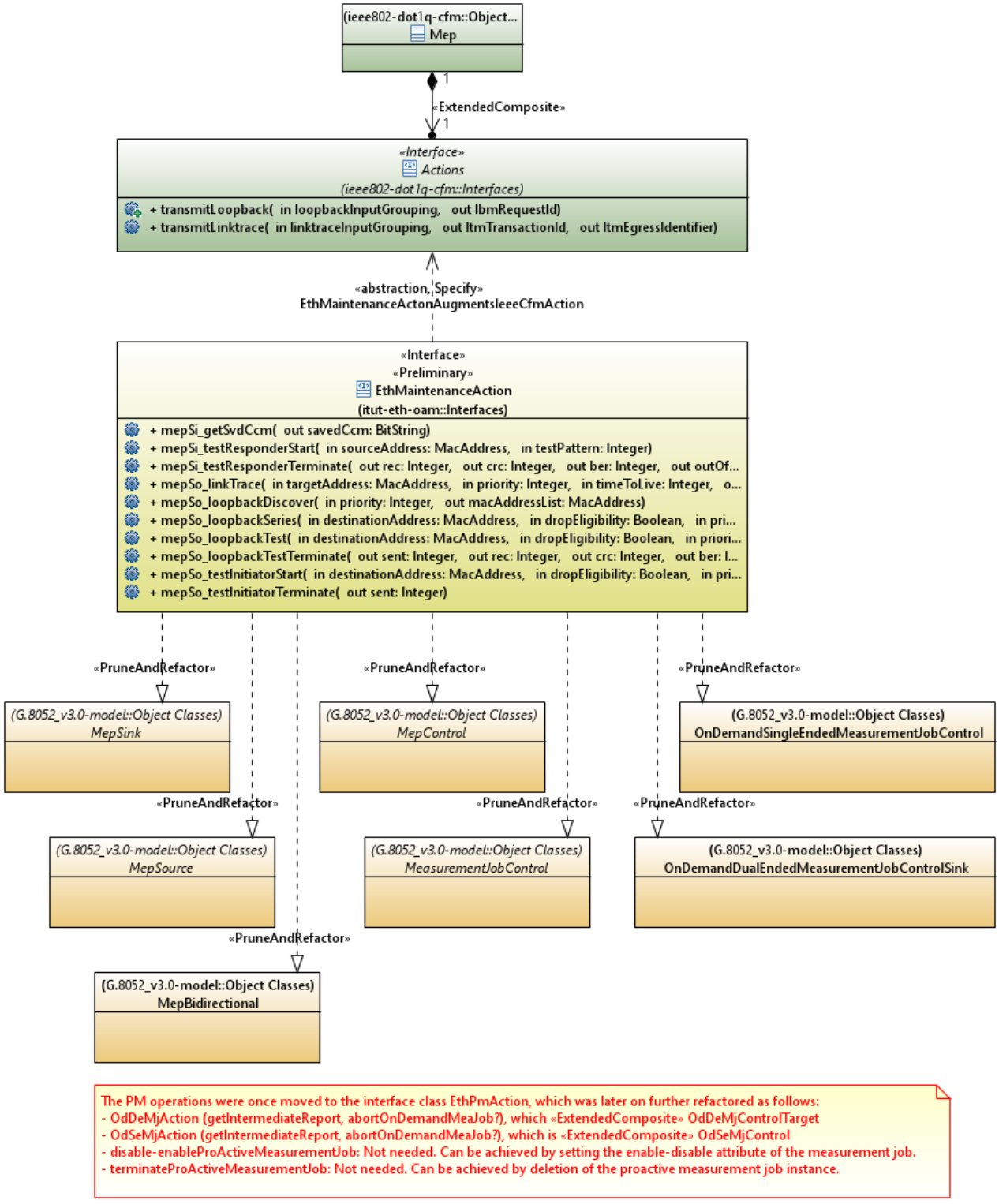


Figure 7-~~19~~ 10 – Operation pruning/refactoring augmentation structure

7.3 UML model files

The UML model for this Recommendation developed using the Papyrus open-source modelling tool can be found at: https://www.itu.int/ITU-T/formal-language/itu-t/g/g8052.1/2023/g8052.1v1.1_uml.zip.

The model files include the following folders:

– The uml model for this Recommendation, which ~~consists~~ contains~~of~~ the following files:
  – The papyrus project file;
    – project.
  – The .di, .notation, and .uml files of the itut-eth-oam module:
    – itut-eth-oam.di;
    – itut-eth-oam.notation;
    – itut-eth-oam.uml.
  – The .di, .notation, and .uml files of the itut-eth-oam-bridge module:
    – itut-eth-oam-bridge.di;
    – itut-eth-oam-bridge.notation;
    – itut-eth-oam-bridge.uml.

– The. di, .notation, and .uml files of the itut-eth-oam-am module
  • itut-eth-oam-am.di
  • itut-eth-oam-am.notation
  • itut-eth-oam-am.uml

– The gdITUTemplate-8052.1.docx file, which can be used to generate the data dictionary form of the G.8052.1 UML model

– The UmlProfiles sub-folder, which contains the UML Profiles that defines the properties of the UML artifacts.

~~The UML Profiles, which defines the properties of the UML artefacts:~~
  – The OpenModelProfile folder, which contains the .di, .notation, and uml of the open model profile;
  – The OpenInterfaceModelProfile folder, which contains the .di, .notation, and uml of the open model interface profile;
  – The ProfileLifecycleProfile folder, which contains the .di, .notation, and uml of the profile lifecycle profile.
  – The ClassDiagramStyleSheet.css style sheet.

– The diagrams sub-folder, which contains the PNG images of all the class diagrams.

– The G.7711 folder, which contains the [ITU-T G.7711] Core ~~UML~~ model~~s~~ that ~~are~~ is needed (i.e., imported) by the G.8052.1 model.

– The G.8052 folder, which contains the [ITU-T G.8052] Ethernet base model.

– The IeeeModels folder, which contains the IEEE UML models that are reverse-engineered from the IEEE Yang data models.

– The IetfModels folder, which contains the IETF UML models that is reverse-engineered from the IETF Yang data model.

~~G.7711 core information model~~
~~G.8052 base Ethernet information model~~
~~IEEE models, i.e., the UML models that are re-engineered from the IEEE Yang data models~~
~~IETF model, i.e., the UML models that is re-engineered from the IETF Yang data model~~

NOTE 1 – If the imported model has been up-versioned or the module name has changed, then the xmi code of the ITU-T G.8052.1 modules will need to be updated.

To load the ITU-T G.8052.1 UML model into an Eclipse Papyrus workspace, follow the steps below:

- In the *Project Explorer* / right click / *Import* / *General* / *Projects from Folder or Archive* / *Next* / *Archive* / *Select* the G.8052.1 zip file / *Open* / *Select* the folders of the models to be loaded (Note 1) / *Finish*

NOTE 2 – If a supporting (i.e., to be imported by G.8052.1) model already exists in the workspace, do not select it for loading.

NOTE 3 – The ITU-T G.8052.1/Y.1356.1 UML information models and the open model profile are specified using the Papyrus opensource modelling tool. In order to view and further extend or modify the information model, one will need to install the opensource Eclipse software and the Papyrus tool, which is available at [b Eclipse Papyrus]. The installation guide for Eclipse and Papyrus can be found in [b-ONF TR-515].

NOTE 4 – The ITU-T G.8052.1/Y.1356.1 UML information models expressed in a data dictionary form has been produced for the convenience of readers who do not have access to the Papyrus tool. The data dictionary presents the model artifacts in tabular format. The G.8052.1 data dictionary is available at https://www.itu.int/ITU-T/formal-language/itu-t/g/g8052.1/2023/g8052.1v1.1_dd.zip.

8 ~~Carrier~~ Ethernet Transport OAM data models

This clause contains the interface-protocol-specific data models of the carrier Ethernet OAM functions identified in clause 6. These data models are translated from the interface-protocol-neutral UML information specified in clause 7.

8.1 ~~Carrier~~ Ethernet Transport OAM YANG data model

This clause contains the YANG data model of this Recommendation.

The YANG data models defined in this version of the Recommendation uses the YANG 1.1 language defined in [IETF RFC 7950]. The tree format defined in [IETF RFC 8340] is used for the YANG data model tree representation. The YANG data model(s) defined in this Recommendation conforms to the network management datastore architecture in [IETF RFC 8342].

The YANG module of this Recommendation is for augmenting/extending the IEEE 802.1Qcx CFM YANG module to support the [ITU-T G.8013/Y.1731] OAM functionalities. The IEEE 802.1Qcx YANG data model for CFM is available in clause 48 of [IEEE 802.1Qcx], which includes the YANG data modules in clause 48.6.

The YANG model of this Recommendation is translated from the interface-protocol-neutral UML information provided in clause 7.3. The translation is done with the assistance of the Open Source translation tooling xmi2yang, which is developed according to [b-ONF TR-531] mapping guidelines.

At the time of publication of this Recommendation, the xmi2yang mapping tool is still a work in progress. Therefore, manual modifications on the tool-generated yang are necessary.

The yang ~~with such manual modification~~schema and tree files of the YANG modules can be found at ~~https://www.itu.int/ITU-T/formal-language/itu-t/g/g8052.1/2021/g8052.1_v1.00_yang.zip~~ https://www.itu.int/ITU-T/formal-language/itu-t/g/g8052.1/2023/g8052.1v1.1_yang.zip.

Annex A

CFM UML model reverse-engineered from IEEE CFM YANG

(This annex forms an integral part of this Recommendation.)

Figures A.1 to A.10 contain the UML diagrams extracted from the CFM UML model, which is provided in clause 7.3 and was reverse-engineered from the IEEE 802.1Q CFM YANG. The essences of the diagrams are reflected in the captions of the respective figures.

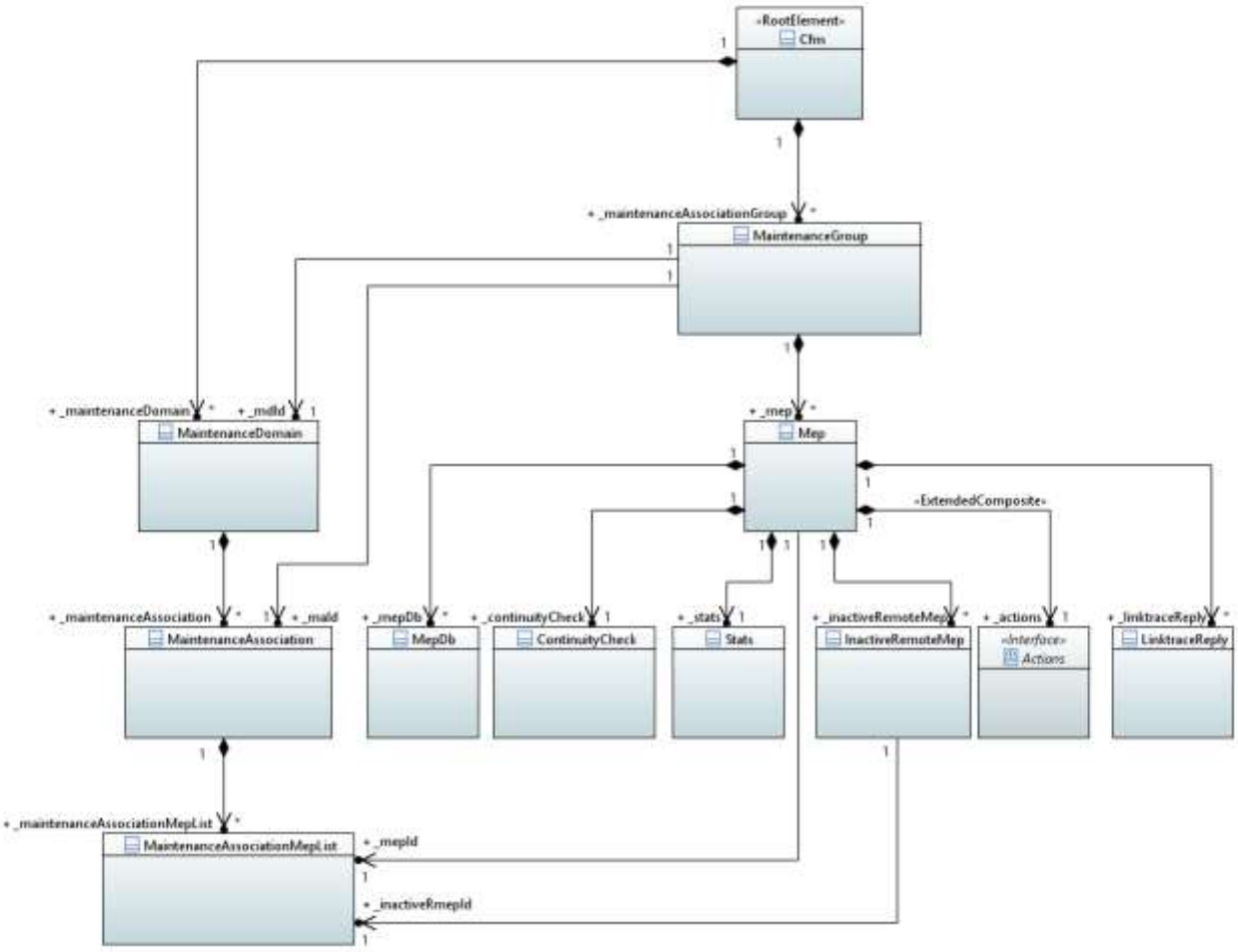


Figure A.1 – IEEE 802.1Q CFM model – High level overview

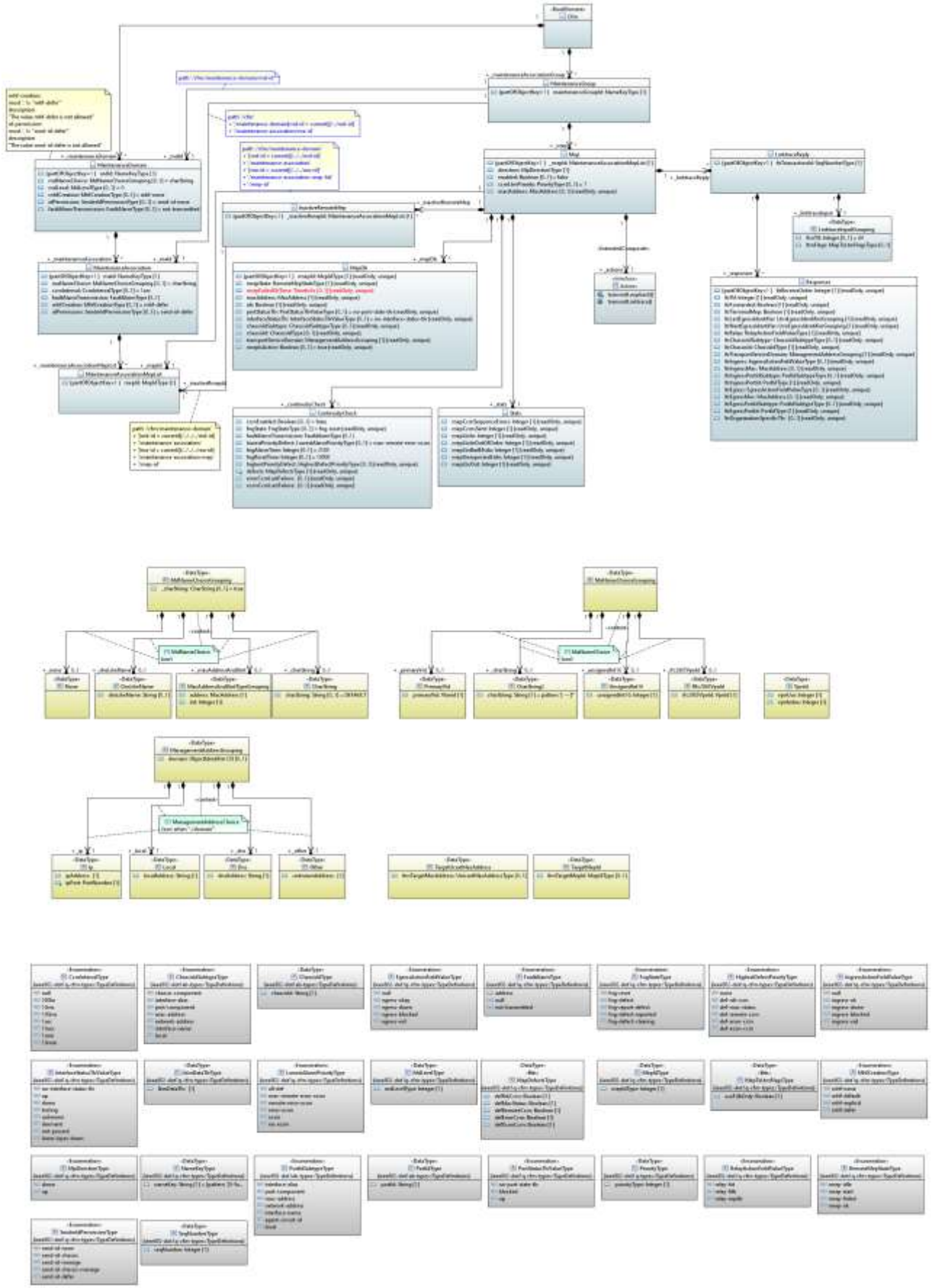


Figure A.2 – IEEE 802.1Q CFM model – Detail view

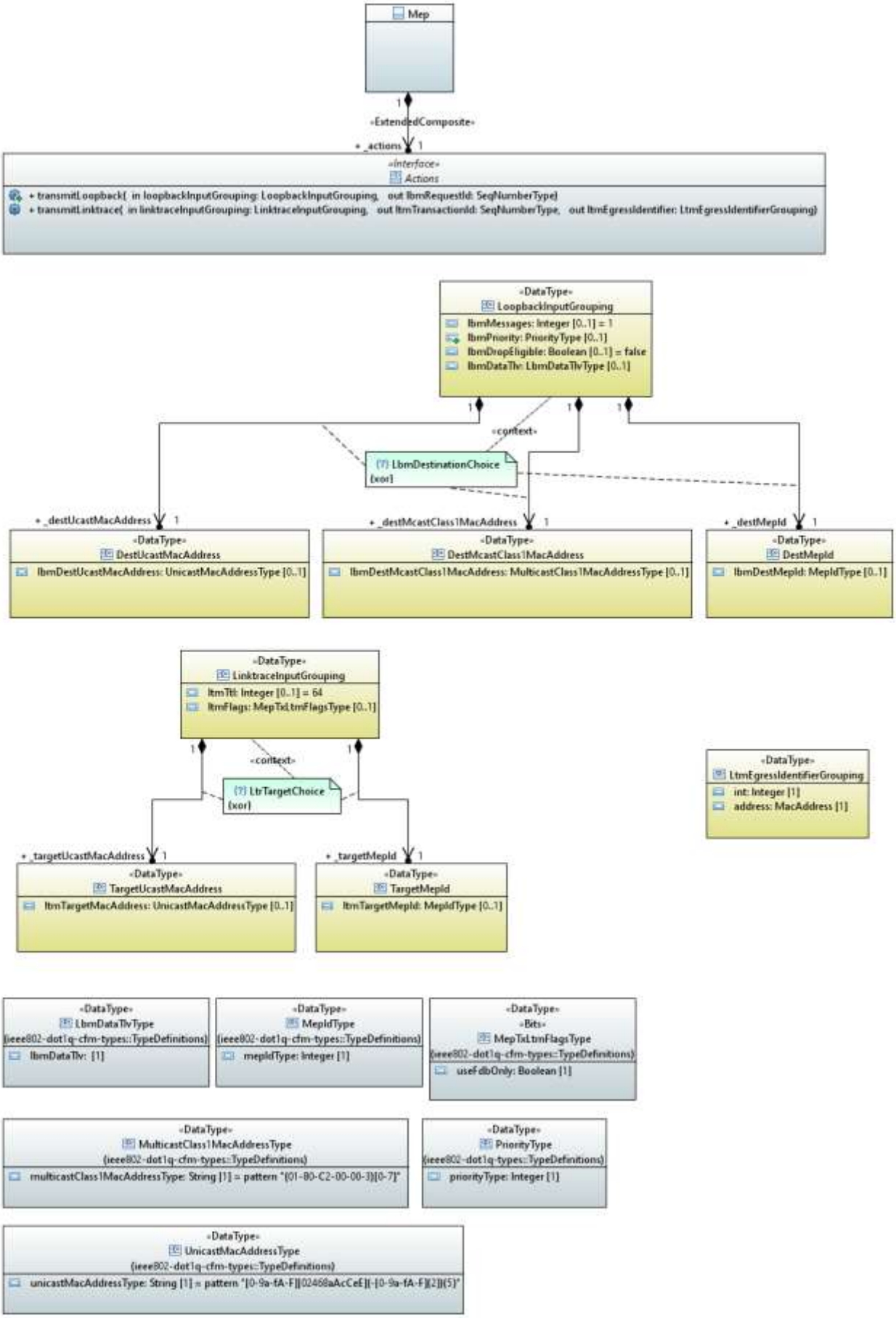


Figure A.3 – IEEE 802.1Q CFM model – Operations

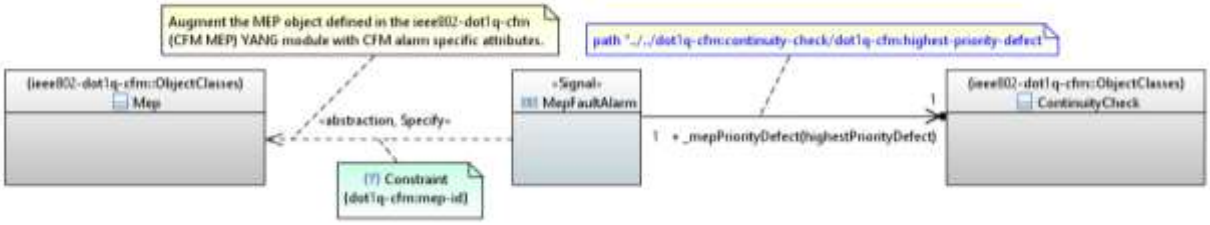


Figure A.4 – IEEE 802.1Q CFM model – Alarm

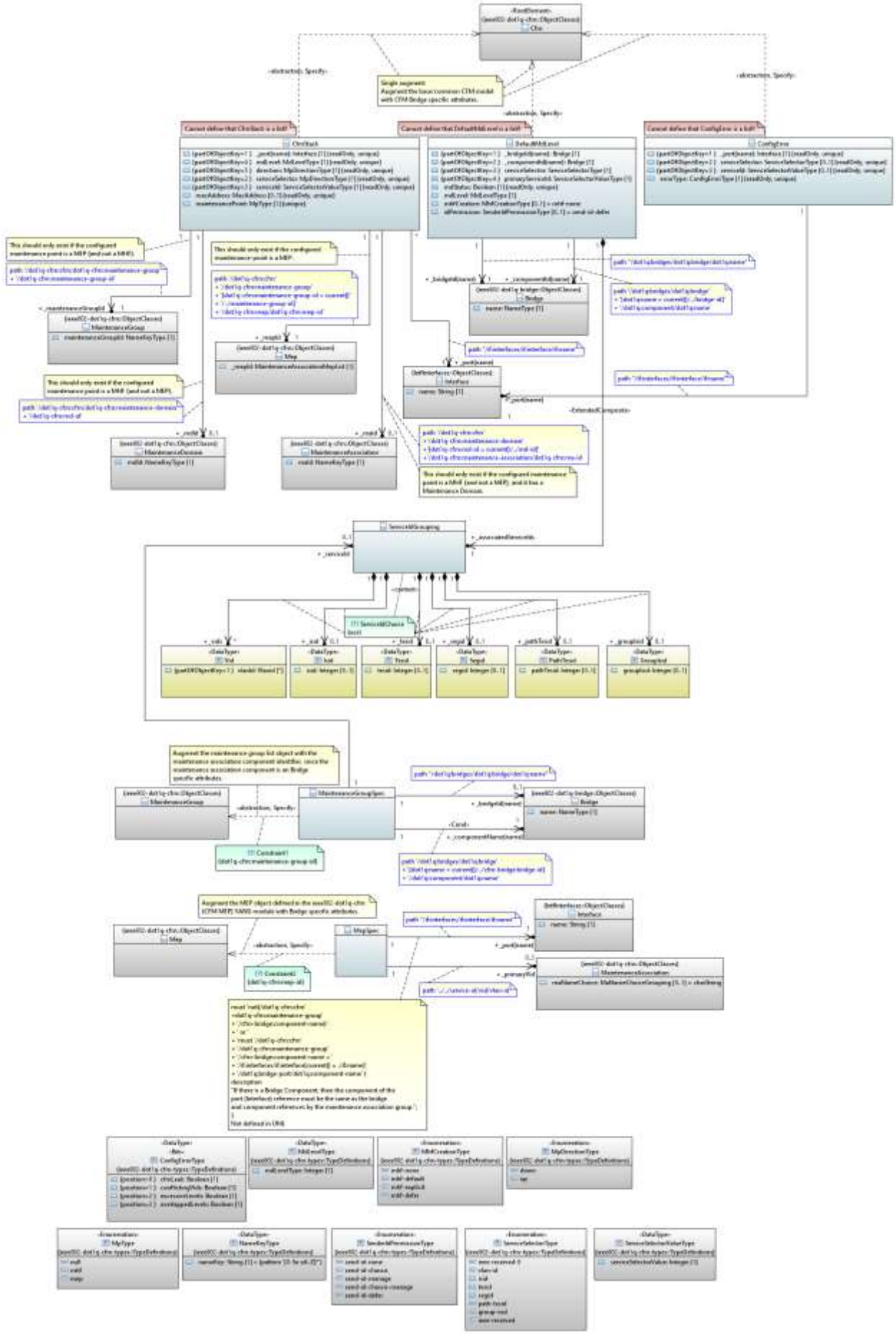


Figure A.5 – IEEE 802.1Q CFM model – CFM bridge

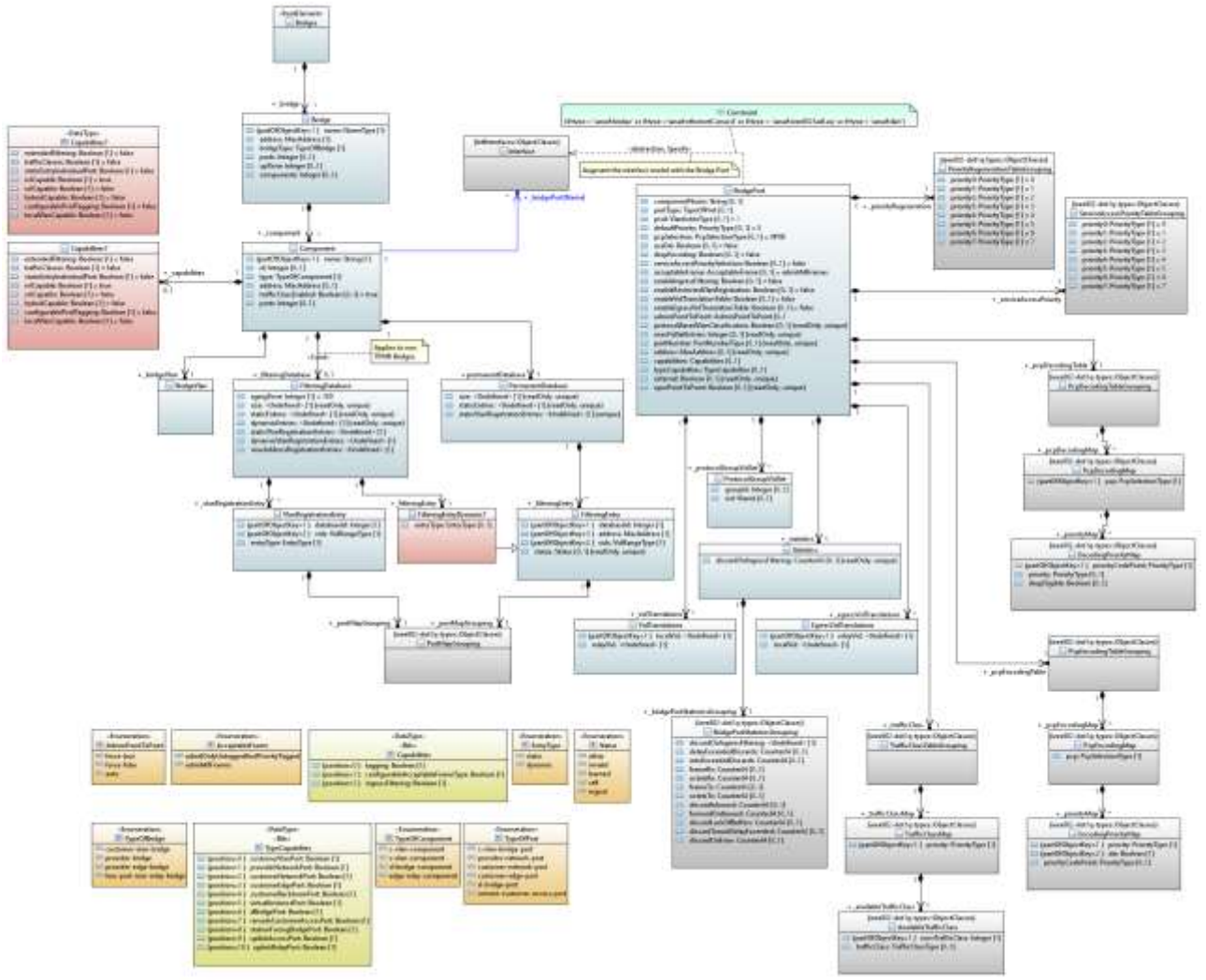


Figure A.6 – IEEE 802.1Q bridge model

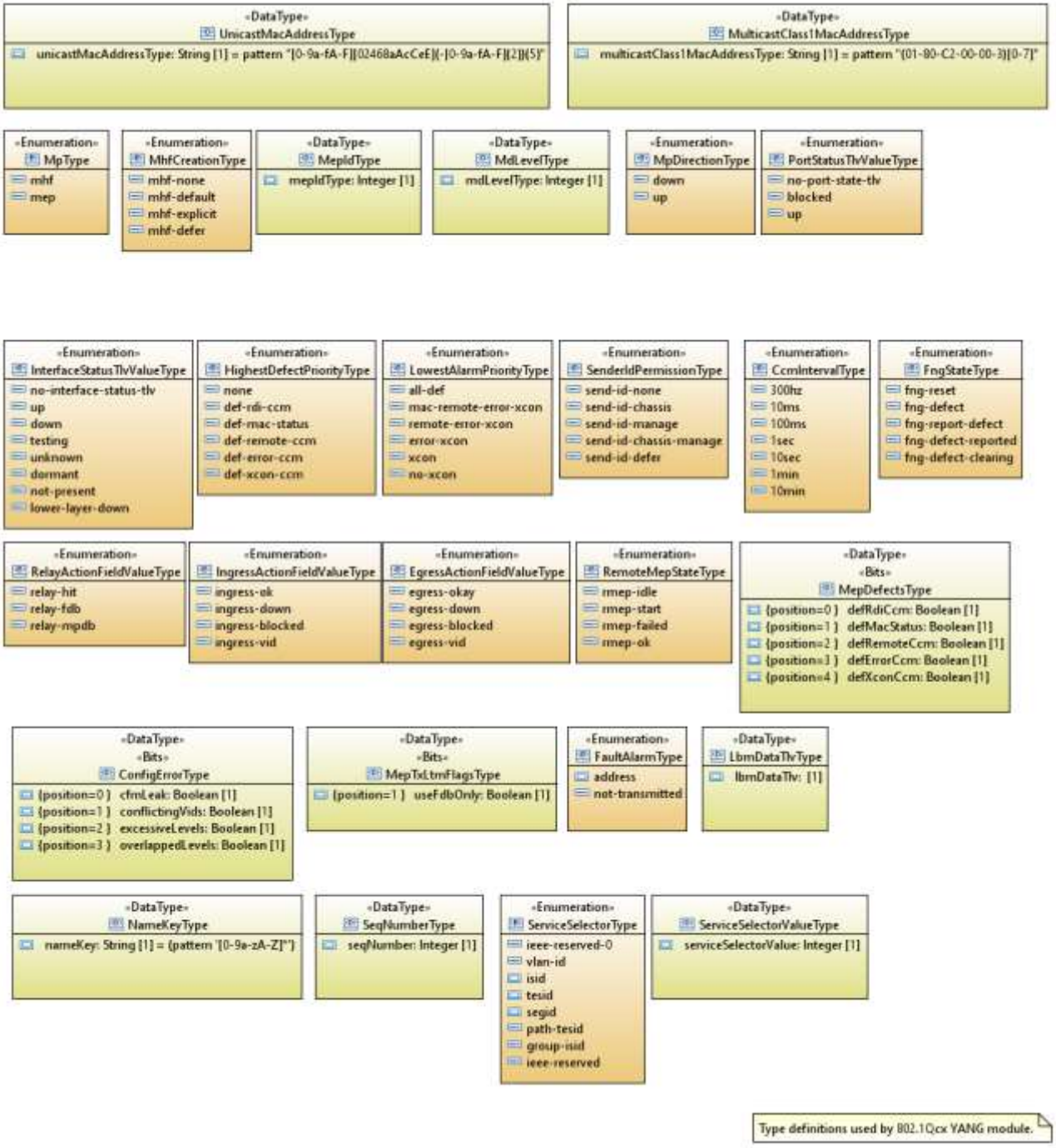


Figure A.7 – IEEE 802.1Q CFM model – Data types

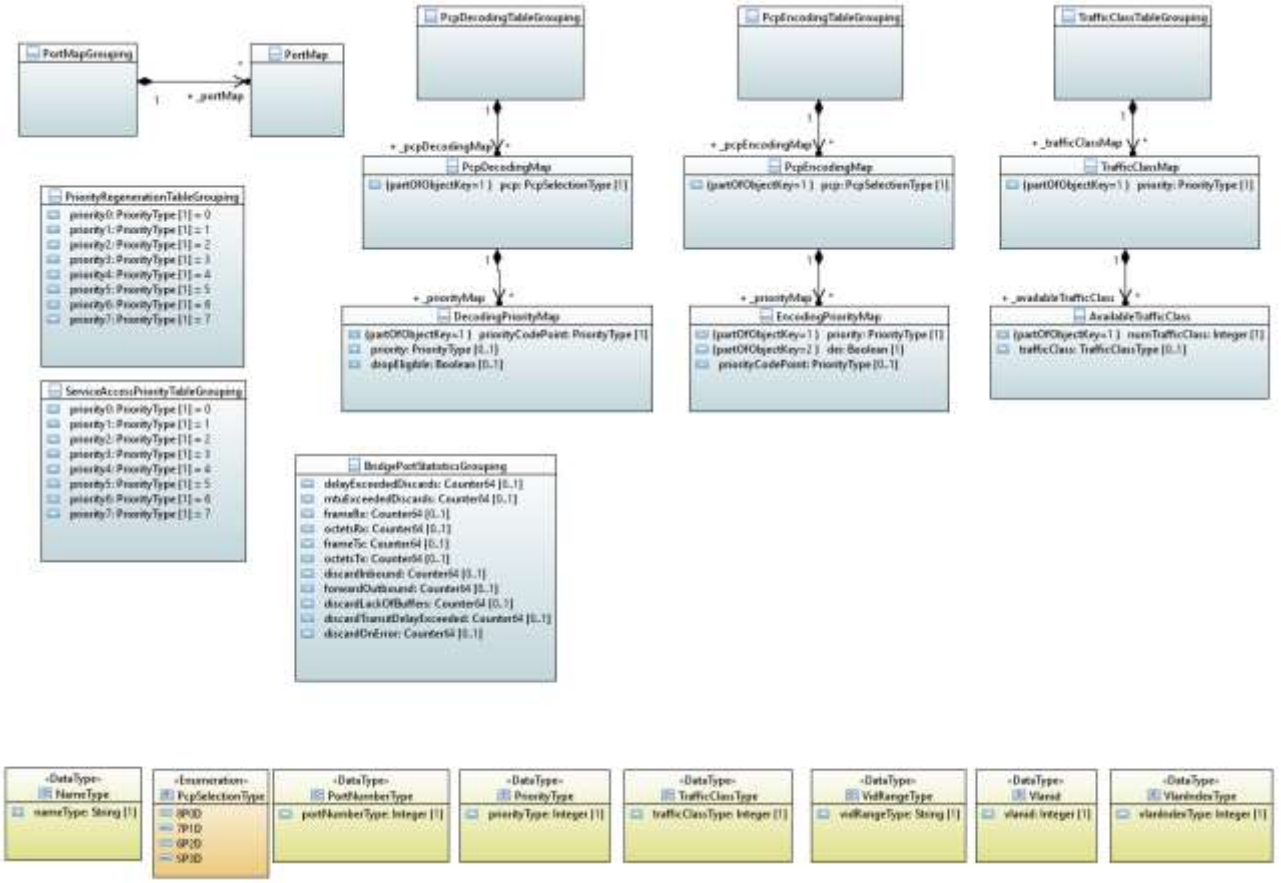


Figure A.8 – IEEE 802.1Q model – Data types

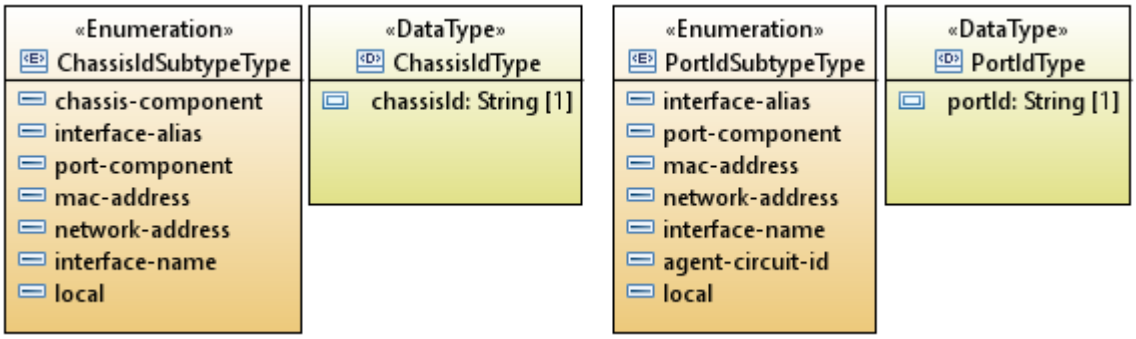


Figure A.9 – IEEE 802.1AB Data types

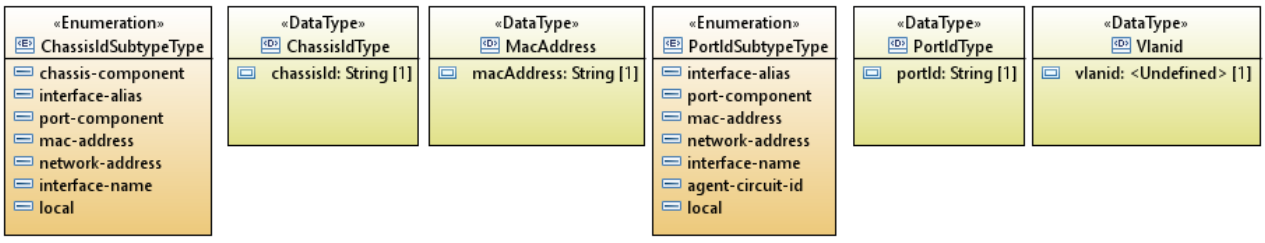


Figure A.10 – IEEE 802 model – Data types

Appendix I

IEEE 802.1Q CFM and related YANG

(This appendix does not form an integral part of this Recommendation.)

The IEEE 802.1Q CFM YANG module is available at the following link:

– https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.1

Appendix II

Analysis of ITU-T G.8052 attributes and operations for ITU-T G.8052.1

(This appendix does not form an integral part of this Recommendation.)

This appendix summarizes the analysis and disposition of the attributes and operations of the base [ITU-T G.8052] model on whether they should be retained, refactored or pruned for [ITU-T G.8052.1], and the rationale of doing so.

Table II.1 – Ethernet MEP classes pruning/refactoring

Source artefact	P&R	Rationale
G8052LocalClass::localId	pruned	Available in IEEE::Mep
MEP		
Mep::adminState	pruned	Available in IEEE::Mep::adminState
Mep::mepMac	pruned	Available in IEEE::Mep::macAddress
Mep::mel	pruned	Available in IEEE::MaintenanceDomain::mdLevel
Mep::clientMel	refactored	Moved to (refactored into) to the datatype EthAis, EthLck, EthBw
Mep::megIdentifier	pruned	Available in IEEE::MaintenanceGroup::maintenanceGroupId
Mep::isCcEnabled	pruned	Available in IEEE::ContinuityCheck::ccmEnabled
Mep::ccPeriod	pruned	Available in IEEE::MaintenanceAssociation::ccmInterval
Mep::ccPriority	pruned	Available in IEEE Note: there is no ccm priority, although there is IEEE::Mep::ccmLtmPriority
Mep::lckPeriod	refactored	Moved to (refactored into) to datatype EthLck
Mep::lckPriority	refactored	Moved to (refactored into) to datatype EthLck
MEP Sink		
MepSink::peerMepRefList	pruned	Note: Seems indirectly from Mep through the association to MaintenanceAssociationMepList to the peer Mep; but the cardinality is only 1
MepSink::aisPeriod	refactored	Moved to (refactored into) to datatype EthAis

Table II.1 – Ethernet MEP classes pruning/refactoring

Source artefact	P&R	Rationale
MepSink::aisPriority	refactored	Moved to (refactored into) to datatype EthAis
MepSink::isCsfReported	refactored	Moved to (refactored into) to datatype EthCsf
MepSink::isCsfRdiFdiEnabled	refactored	Moved to (refactored into) to datatype EthCsf
MepSink::currentProblemList	refactored	Moved to (refactored into) to datatype EthMepAlarm
MepSink::bandwidthReport	refactored	Moved to (refactored into) to datatype EthBw
MepSink::1DmPriority	EthMeaJobPac	Moved to (refactored into) to EthMeaJobPac Removed.
MepSink::_onDemandDualEndedMeasurementJobControlSink	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MepSink::_proactiveDualEndedMeasurementJobControlSink	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MEP Source		
MepSource::mepIdentifier	pruned	Available in IEEE::Mep::_mepId
MepSource::csfConfig	refactored	Moved to (refactored into) to datatype EthCsf
MepSource::csfPeriod	refactored	Moved to (refactored into) to datatype EthCsf
MepSource::csfPriority	refactored	Moved to (refactored into) to datatype EthCsf
MepSource::apsPriority	refactored	Moved to (refactored into) to datatype EthAps
MepSource::_proactiveDualEndedMeasurementJobControlSource	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the

Table II.1 – Ethernet MEP classes pruning/refactoring

Source artefact	P&R	Rationale
		Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MepSource::_onDemandMeasurementJobControlSource	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MEP Bidirectional		
MepBidirectional::_associatedRapsGroupRef	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MepBidirectional::_associatedSncpGroupRef	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MepBidirectional::_onDemandSingleEndedMeasurementJobControl	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.
MepBidirectional::_proactiveSingleEndedMeasurementJobControl	pruned	ITU-T G.8052.1 augments the IEEE::Mep using the Spec model approach. The model structure is now difference from [ITU-T G.8052]. So, the navigable attributes from the Mep/MepSink/MepSource/MepBidirectional are no longer applicable.

Table II.2 – Ethernet MIP classes pruning/refactoring

Source artefact	To be pruned or moved to	Rationale
MIP Bidirectional		
MipBidirectional::mipMac	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipPac
MipBidirectional::mel	pruned	The IEEE MIP has attribute mdLevel. An ITU-T MEG is equivalent to an IEEE MD which contains only one IEEE MA.
MipBidirectional::isFullMip	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipPac
G8052LocalClass::localId	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipPac
Raps Capable Half MIP Bidirectional		
RapsCapableHalfMipBidirectional::mipMac	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipRapsCapablePac
RapsCapableHalfMipBidirectional::mel	pruned	The IEEE MIP has attribute mdLevel. An ITU-T MEG is equivalent to an IEEE MD which contains only one IEEE MA
RapsCapableHalfMipBidirectional::rapsPriority	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipRapsCapablePac
G8052LocalClass::localId	retained	Not in IEEE::Mip. Moved (re-factored) to EthMipPac

Table II~~I~~.3 – Ethernet operations pruning/refactoring

Source artefact	P&R	Rationale
EthMepInterface		
mepBi_establishOnDemandSingleEndedMeasurementJob	pruned	Achieved via object creation of an instance of OnDemandSingleEndedMeaJob and a subtending OnDemandSingleEndedMeasurementJobControl instance
mepBi_establishProActiveSingleEndedMeasurementJob	pruned	Achieved via object creation of an instance of ProActiveSingleEndedMeasurementJob and a subtending ProActiveSingleEndedMeasurementJobControl instance

Table II~~I~~.3 – Ethernet operations pruning/refactoring

Source artefact	P&R	Rationale
mepSi_establishOnDemandDualEndedMeasurementJobSink	pruned	Achieved via object creation of an instance of OnDemandDualEndedMeasurementJob and a subtending OnDemandDualEndedMeasurementJobControlSink instance
mepSi_establishProActiveDualEndedMeasurementJobSink	pruned	Achieved via object creation of an instance of ProActiveDualEndedMeasurementJob and a subtending ProActiveDualEndedMeasurementJobControlSink instance
mepSi_getSvdCcm	retained	No equivalence in IEEE CFM
mepSi_testResponderStart	retained	No equivalence in IEEE CFM. TST is ITU-T OAM
mepSi_testResponderTerminate	retained	No equivalence in IEEE CFM. TST is ITU-T OAM
mepSo_establishOnDemandDualEndedMeasurementJobSource	pruned	Achieved via object creation of an instance of OnDemandDualEndedMeasurementJob and a subtending OnDemandDualEndedMeasurementJobControlSource instance
mepSo_establishProActiveDualEndedMeasurementJobSource	pruned	Achieved via object creation of an instance of ProActiveDualEndedMeasurementJob and a subtending ProActiveDualEndedMeasurementJobControlSource instance
mepSo_linkTrace	Undecided	For further study. CFM and ITU-T G.8013 LT parameters are not the same.
mepSo_loopbackDiscover	retained	No equivalence in IEEE CFM. LB Discover is ITU-T OAM
mepSo_loopbackSeries	retained	No equivalence in IEEE CFM. LB Series is ITU-T OAM
mepSo_loopbackTest	retained	No equivalence in IEEE CFM. LB Test is ITU-T OAM
mepSo_loopbackTestTerminate	retained	No equivalence in IEEE CFM. LB Test is ITU-T OAM
mepSo_testInitiatorStart	retained	No equivalence in IEEE CFM. TST is ITU-T OAM
mepSo_testInitiatorTerminate	retained	No equivalence in IEEE CFM. TST is ITU-T OAM
mepControl_createMep	pruned	Achieved via object creation of an instance of Mep

Table II~~I~~.3 – Ethernet operations pruning/refactoring

Source artefact	P&R	Rationale
mepControl_deleteMep	pruned	Achieved via object deletion of an instance of Mep
mepControl_getAllContainedMeps	pruned	Achieved via retrieval of all object instances of Mep
mepControl_modifyMep	pruned	Achieved via object modification of an instance of Mep
meaJobControl_abortOnDemandMeasurementJob	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
meaJobControl_disableProActiveMeasurementJob	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
meaJobControl_enableProActiveMeasurementJob	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
meaJobControl_getAllContainedMeasurementJobs	pruned	Achieved via retrieval of all contained measurement job object instances
meaJobControl_getCurrentDataValues	pruned	Achieved via retrieval of CurrentData object instances.
meaJobControl_getHistoryDataValues	pruned	Achieved via retrieval of HistoryData object instances.
meaJobControl_terminateProActiveMeasurementJob	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
onDemandSingleEndedMeaJobControl_getIntermediateReport	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
onDemandDualEndedMeaJobControlSi_getIntermediateReport	retained	No equivalence in IEEE CFM. Measurement is ITU-T OAM
EthMipInterface		
mipControl_createMip	pruned	Achieved via object creation of an instance of Mip
mipControl_createRapsCapableMip	pruned	Achieved via object creation of an instance of RAPS Capable Mip
mipControl_deleteMip	pruned	Achieved via object deletion of an instance of Mip
mipControl_getAllContainedMips	pruned	Achieved via retrieval of all contained instances of Mip

Appendix III

Client and server implementation compatibility

(This appendix does not form an integral part of this Recommendation.)

Client and server implementation scenarios.

	IEEE client ieee yang	ITU client ieee yang + itu yang
IEEE server ieee yang	A **ieee yang**	C **ieee yang**
ITU server ieee yang + itu yang	B **ieee yang** *Note*: – The client will only configure the ieee yang – The itu yang will be ignored by the client	D **ieee yang + itu yang**

Appendix IV

Mapping of the IEEE 802.1Qcx CFM and ITU-T G.8013 parameters

(This appendix does not form an integral part of this Recommendation.)

This appendix analyses and summarizes the comparison and mapping between the IEEE 802.1Qcx CFM parameters (i.e., the leaf nodes) and [ITU-T G.8021] parameters (i.e., MI signal values).

ieee802-dot1q-cfm.yang	**ITU-T G.8021 parameter**
cfm/maintenance-group/mep/mep-db/**rmep-failed-ok-time**: ro mandatory	Not supported in ITU-T. Need to agree on what value the ITU-T server to put into this leaf when encoding the value (to indicate it is not supported).
cfm/maintenance-group/mep/mep-db/**mac-address**: ro mandatory	Not supported in ITU-T.
cfm/maintenance-group/mep/mep-db/**port-status-tlv**: ro optional	Not supported in ITU-T. It is optional.
cfm/maintenance-group/mep/mep-db/**interface-status-tlv**: ro optional	Not supported in ITU-T. It is optional. ~~Not support is fine.~~
cfm/maintenance-group/mep/continuity-check/**defect**: *5 bits*: def-rdi-ccm, def-mac-status, def-remote-ccm, def-error-ccm, def-xcon-ccm	No cDEG, no cUNPr. xcon-ccm is composition of cUNL and cMMG. error-ccm is composition of cUNP and cUNM. Proposal solution: define an itu-defects leaf, with typedef ..., and describe the relationship of some of the bits with the 802.1 mep-defect-type.
cfm/maintenance-group/mep/action: transmit-loopback/**input: loopback-input-grouping: case dest-mep-id**	Case dest-mep-id is not supported.
cfm/maintenance-group/mep/action: transmit-loopback/**output: leaf lbm-request-id**	To check and verify whether this is Transaction ID/Sequence Number (see Figure 9.3-1 of [ITU-T G.8013])
cfm/maintenance-group/mep/action: transmit-linktrace/**input: linktrace-input-grouping: case target-mep-id**	Case target-mep-id is not supported? To check and verify whether this is TargetMAC Address (see Figure 9.5-1 of [ITU-T G.8013])
cfm/maintenance-group/mep/action: transmit-linktrace/**input: linktrace-input-grouping: leaf ltm-flags**	To check and verify whether this is Flags (see Figure 9.5-1 of [ITU-T G.8013])
cfm/maintenance-group/mep/action: transmit-linktrace/**output: ltm-transaction-id**	To check and verify whether this is Transaction ID (see Figure 9.5-1 of [ITU-T G.8013])
cfm/maintenance-group/mep/action: transmit-linktrace/**output: ltm-egress-identifier**	To check and verify whether this is Egress Identifier (see Figure 9.5-3 of [ITU-T G.8013])

ieee802-dot1q-cfm.yang	ITU-T G.8021 parameter
cfm/maintenance-group/mep/linktrace-reply/responses/**ltr-receive-order**	This SHOULD be a stamp assigned by the Linktrace initiator to the received LTR frame, not a field inside the LTR frame. This SHOULD belong to [ITU-T G.8021] (the process at the sink function of the initiator MEP), instead of [ITU-T G.8013]. Currently [ITU-T G.8021] bundles all of the LTR results into a single "Results" parameter, it does not say how the different responses are distinguished within this. This will require update to [ITU-T G.8021].
cfm/maintenance-group/mep/linktrace-reply/responses/**ltr-forwarded**	To check and verify whether this is the FwdYes flag (see Figure 9.6-2 of [ITU-T G.8013])
cfm/maintenance-group/mep/linktrace-reply/responses/**ltr-terminal-mep**	To check and verify whether this is the TerminalMEP flag (see Figure 9.6-2 of [ITU-T G.8013])
cfm/maintenance-group/mep/linktrace-reply/responses/**ltr-relay**	To check and verify whether this is the RelayAction field (see Figure 9.6-1 of [ITU-T G.8013])

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