

# IEEE P802.3.2a™/D0.5

## Draft Standard for Ethernet YANG Data Model Definition

Prepared by the  
**LAN/MAN Standards Committee**  
of the  
**IEEE Computer Society**

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**Abstract:** YANG models for IEEE Std 802.3 are defined in this standard. This standard also publishes these models in a machine-readable format.

**Keywords:** 802.3, 802.3.2, Ethernet, YANG

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# Introduction

**This introduction is not part of IEEE Std 802.3.2a-202x, IEEE Draft Standard for Ethernet YANG Data Model Definitions.**

The YANG modules included in this standard provide YANG versions of attributes defined in IEEE Std 802.3™-2022, Clause 30, as well as derivative attributes defined in other management information bases (e.g., SNMP attributes included in IEEE Std 802.3.1, YANG versions of IETF Etherlike MIB attributes, etc.). The YANG modules defined in this standard accommodate IEEE Std 802.3-2022, excluding any currently published or future amendments.

IEEE Std 802.3 will continue to evolve. New Ethernet capabilities are anticipated to be added within the next few years as amendments to this standard.

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# IEEE Standard for Ethernet YANG Data Model Definitions

## 1. Overview

This standard defines YANG modules for various Ethernet devices specified in IEEE Std 802.3. This includes half-duplex and full-duplex data terminal equipment (DTE) using either Carrier Sense Multiple Access/Collision Detection (CSMA/CD) or Multipoint Control Protocol (MPCP), and Power Sourcing Equipment (PSE).

### 1.1 Scope

This standard defines YANG data models for IEEE Std 802.3 Ethernet.

### 1.2 Purpose

The purpose of the standard is to define YANG modules for IEEE Std 802.3 and publish these modules in a machine-readable format.

### 1.3 Machine-readable YANG modules

The machine-readable files are available for download at the following URL: <https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.3> as text files with a *.yang* extension, e.g., *ieee802-ether-net-interface.yang*. The use of specialized tools to view YANG modules may be useful to create tree, UML image, and HTML outputs from the YANG modules.

Like other languages, YANG (see IETF RFC 7950) has an accepted style for machine-readable files, which was followed during the development of this standard. This formatting may not be preserved when importing the machine-readable YANG modules into the PDF. In case of any formatting discrepancies, the published machine-readable files should be consulted.

### 1.4 Summary of YANG-based management framework

The structure of YANG-based management framework closely resembles the structure of the Internet-Standard Management Framework, described in detail in section 7 of IETF RFC 3410.

Managed objects defined using YANG modeling language are hosted on the managed device and accessed through NETCONF (see IETF RFC 7803) or RESTCONF (see IETF RFC 8040). This standard specifies YANG modules that are compliant to YANG 1.1 (see IETF RFC 7950).

## 1.5 Security considerations

The YANG modules defined in this standard are designed to be accessed via network management protocols, including NETCONF (see IETF RFC 7803) or RESTCONF (see IETF RFC 8040). The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) (see IETF RFC 6242) or TLS (see IETF RFC 8446). The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS (see IETF RFC 8446).

The NETCONF access control model (see IETF RFC 8341) provides the means to restrict access for particular NETCONF or RESTCONF users to a pre-configured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in these YANG modules that are writable/creatable/deletable, i.e., have the config property set to true, which is the default setting. These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations.

Some of the readable data nodes in these YANG modules may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes.

Some of the RPC operations in these YANG modules may be considered sensitive or vulnerable in some network environments. Therefore, it is important to control access to these operations.

## 1.6 YANG module syntax validation

All YANG modules included in this standard are YANG 1.1 (see IETF RFC 7950) compliant and pass automated checks using tools available at the time of publication.

The following open source and/or free versions of YANG validation tools may be used: Pyang (see <https://github.com/mbj4668/pyang>), ConfD (see <http://www.tail-f.com/confd-basic>), as well as other YANG model validation tools listed at <http://www.yangvalidator.com>.

## 2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 802®-2014, IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture.<sup>f, g</sup>

IEEE Std 802d™-2017, IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture Amendment 1: Allocation of Uniform Resource Name (URN) Values in IEEE 802 Standards.

IEEE Std 802.1Q™-2014, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks.

IEEE Std 802.3™-2018, IEEE Standard for Ethernet.

IEEE Std 802.3.1™-2013, IEEE Standard for Management Information Base (MIB) Definitions for Ethernet.

IETF RFC 2819, Remote Network Monitoring Management Information Base, S. Waldbusser, May 2000.<sup>h</sup>

IETF RFC 3410, *Introduction and Applicability Statements for Internet Standard Management Framework*, J. Case, R. Mundy, D. Partain, B. Stewart, December 2002.

IETF RFC 3621, *Power Ethernet MIB*, A. Berger, December 2003

IETF RFC 3635, *Definitions of Managed Objects for the Ethernet-like Interface Types*, J. Flick, September 2003.

IETF RFC 6242, *Using the NETCONF Protocol over Secure Shell (SSH)*, Wasserman M, June 2011.

IETF RFC 6991, *Common YANG Data Types*, Schoenwaelder J., July 2013.

IETF RFC 7803, *Changing the Registration Policy for the NETCONF Capability URNs Registry*, B. Leiba, February 2016.

IETF RFC 7950, *The YANG 1.1 Data Modeling Language*, Bjorklund M., August 2016.

IETF RFC 8040, *RESTCONF Protocol*, Bierman A., Bjorklund M., and Watsen K., January 2017.

IETF RFC 8342, *Network Management Datastore Architecture (NMDA)*, M. Bjorklund, J. Schoenwaelder, P. Shafer, K. Watsen, and R. Wilton, March 2018.

IETF RFC 8341, *Network Configuration Access Control Model*, A. Bierman and M. Bjorklund, March 2018.

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<sup>h</sup>Internet Requests for Comments (RFCs) are available on the World Wide Web at the following ftp site: venera.isi.edu; logon: anonymous; password: user's e-mail address; directory: in-inotes.

1 IETF RFC 8343, *A YANG Data Model for Interface Management*, Bjorklund, M., March 2018.

2  
3 IETF RFC 8407, *Guidelines for Authors and Reviewers of YANG Data Model Documents*, Bierman A.,  
4 October 2018.  
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7 IETF RFC 8446, *The Transport Layer Security (TLS) Protocol Version 1.3*, E. Rescorla, August 2018.  
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### 3. Definitions

For the purposes of this document, the following terms and definitions apply. Some terms used in this document are defined in IEEE Std 802.3, and where alternative definitions occur in the IEEE Standards Dictionary, the IEEE Std 802.3 definition should be used. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.<sup>1</sup>

**3.1 data model:** A data model describes how data is represented and accessed.

**3.2 YANG module:** A YANG module defines a hierarchy of nodes that can be used for NETCONF-based (see IETF RFC 7803) and RESTCONF-based (see IETF RFC 8040) operations. With its definitions and the definitions it imports or includes from elsewhere, a module is self-contained and can be compiled.

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<sup>1</sup>*IEEE Standards Dictionary Online* is available at: <http://dictionary.ieee.org/>.

**4. Abbreviations**

This standard contains the following abbreviations:

CO	Central Office
CPE	Customer Premise Equipment
CSMA/CD	carrier sense multiple access with collision detection
DTE	data terminal equipment
EFM	Ethernet in the First Mile
ELO	Ethernet Link OAM
EPON	Ethernet passive optical networks
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
NETCONF	Network Configuration Protocol
OAM	Operations, Administration, and Maintenance
PoE	Power over Ethernet
RESTCONF	RESTful Configuration Protocol
YANG	Yet Another Next Generation

## 5. Ethernet YANG Module

### 5.1 YANG module structure

Two modules defined in this clause are focused on the configuration and monitoring of IEEE Std 802.3 Ethernet interfaces. The *ieee802-ethernet-interface* YANG module contains definitions of current attributes used widely in the industry in current products, while the *ieee802-ethernet-interface-half-duplex* YANG module contains definitions of half-duplex attributes. The *ieee802-ethernet-lldp* YANG module contains definitions for configuring LLDP for IEEE Std 802.3 compliant interfaces.

This standard does not have a normative requirement for data nodes of the base ietf-interfaces YANG module, but the following data nodes are supported: name, description, type, enabled, admin-status, oper-status, if-index, and phys-address.

### 5.2 Mapping of IEEE Std 802.3, Clause 30 managed objects

This subclause contains the mapping between YANG data nodes included in *ieee802-ethernet-interface* (see Table 5–1), *ieee802-ethernet-interface-half-duplex* (see Table 5–4), and *ieee802-ethernet-lldp* (see Table 5–6) YANG modules, managed objects, and attributes defined in IEEE Std 802.3, Clause 30.

**Table 5–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-interface* YANG data nodes**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-interface</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oAutoNegotiation	acAutoNegAdminControl	30.6.1.2.2	interfaces/interface/ethernet/	auto-negotiation/enable	R/W
	aAutoNegAutoConfig	30.6.1.1.4		negotiation-status	R
N/A	N/A			flow-control/pause/direction	R/W
oMACControlFunctionEntity	aPAUSEMACCtrlFramesReceived	30.3.4.3		flow-control/pause/statistics/in-frames-pause	R
	aPAUSEMACCtrlFramesTransmitted	30.3.4.2		flow-control/pause/statistics/out-frames-pause	R
N/A	dot3HCOOutPFCFrames				
N/A	N/A			flow-control/force-flow-control	R/W
N/A	N/A			speed	R/W
oMACEntity	aDuplexStatus	30.3.1.1.32		duplex	R/W
	aMaxFrameLength	30.3.1.1.37		max-frame-length	R
	aSlowProtocolFrameLimit	30.3.1.1.38		frame-limit-slow-protocol	R
oEXTENSION	aEXTENSIONMACCtrlStatus	30.3.8.3		mac-control-extension-control	R
N/A	N/A			capabilities/auto-negotiation	R

**Table 5–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-interface* YANG data nodes (continued)**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-interface</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oMACEntity	aFramesReceivedOK	30.3.1.1.5	interfaces/interface/ethernet/statistics/frame	in-frames	R
	aMulticastFramesReceivedOK	30.3.1.1.21		in-multicast-frames	R
	aBroadcastFramesReceivedOK	30.3.1.1.22		in-broadcast-frames	R
	aFrameCheckSequenceErrors + aAlignmentErrors	30.4.3.1.6, 30.4.3.1.7		in-error-fcs-frames	R
oMACEntity	aFrameTooLongErrors	30.3.1.1.25		in-error-oversize-frames	R
	aFramesLostDueToIntMACRcvError	30.3.1.1.15		in-error-mac-internal-frames	R
	aFramesTransmittedOK	30.3.1.1.2		out-frames	R
	aMulticastFramesXmittedOK	30.3.1.1.18		out-multicast-frames	R
	aBroadcastFramesXmittedOK	30.3.1.1.19		out-broadcast-frames	R
	aFramesLostDueToIntMACXmitError	30.3.1.1.12		out-error-mac-internal-frames	R
oPHYEntity	aSymbolErrorDuringCarrier	30.3.2.1.5	interfaces/interface/ethernet/statistics/phy	in-error-symbol	R
	aReceiveLPITransitions	30.3.2.1.11	interfaces/interface/ethernet/statistics/phy/lpi	in-lpi-transitions	R
	aReceiveLPIMicroseconds	30.3.2.1.9		in-lpi-time	R
	aTransmitLPITransitions	30.3.2.1.10		out-lpi-transitions	R
	aTransmitLPIMicroseconds	30.3.2.1.8		out-lpi-time	R

**Table 5–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-interface* YANG data nodes (continued)**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-interface</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oMACControlEntity	aUnsupportedOpcodesReceived	30.3.3.5	interfaces/interface/ethernet/statistics/mac-control	in-frames-mac-control-unknown	R
oEXTENSION	aEXTENSIONMACCtrlFramesReceived	30.3.8.2		in-frames-mac-control-extension	R
	aEXTENSIONMACCtrlFramesTransmitted	30.3.8.1		out-frames-mac-control-extension	R

**Table 5–2—Mapping between IETF RFC 2819 managed objects and *ieee802-ethernet-interface* YANG data nodes**

IETF RFC 2819 Attribute(s)	Corresponding <i>ieee802-ethernet-interface</i> YANG data nodes		
	Container(s)	Data node(s)	R/W
no direct object <sup>a</sup>	interfaces/interface/ethernet/statistics/frame	in-total-frames	R
etherStatsOctets		in-total-octets	R
etherStatsUndersizePkts + etherStatsFragments		in-error-undersize-frames	R

<sup>a</sup> Can be calculated as: aFramesReceivedOK + aFrameCheckSequenceErrors + aAlignmentErrors + aFrameTooLongErrors + aFramesLostDueToIntMACRcvError.

**Table 5–3—Mapping between IETF RFC 3635 managed objects and *ieee802-ethernet-interface* YANG data nodes**

ETHERLIKE MIB Attribute(s)	Corresponding <i>ieee802-ethernet-interface</i> YANG data nodes		
	Container(s)	Data node(s)	R/W
dot3HCInPFCFrames	interfaces/interface/ethernet/	flow-control/pfc {ethernet-pfc} / statistics/in-frames-pfc	R
dot3HCOutPFCFrames		flow-control/pfc {ethernet-pfc} / statistics/out-frames-pfc	R

**Table 5–4—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-interface-half-duplex* YANG data nodes**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-interface-half-duplex</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oMACEntity	aRateControlAbility	30.3.1.1.33	interfaces/interface/ethernet	dynamic-rate-control	R/W
			interfaces/interface/ethernet/capability	dynamic-rate-control-supported	R
oPHYEntity	aSQETestErrors	30.3.2.1.4	interfaces/interface/ethernet/statistics/frame/csmacd {csma-cd}	in-errors-sqe-test	R
oMACEntity	aSingleCollisionFrames	30.3.1.1.3		out-frames-collision-single	R
	aMultipleCollisionFrames	30.3.1.1.4		out-frames-collision-multiple	R
	aFramesWithDeferredXmissions	30.3.1.1.9		out-frames-deferred	R
	aFramesAbortedDueToXSColls	30.3.1.1.11		out-frames-collisions-excessive	R
	aLateCollisions	30.3.1.1.10		out-collisions-late	R
	aCarrierSenseErrors	30.3.1.1.13		out-errors-carrier-sense	R
	aCollisionFrames	30.3.1.1.30		collision-histogram/collision-count	R
				collision-histogram/collision-count-frames	R

**Table 5–5—Mapping between IEEE Std 802.3, 30.14 managed objects and *ieee802-ethernet-mac-merge* YANG data nodes**

IEEE Std 802.3, 30.14		Reference	Corresponding <i>ieee802-ethernet-mac-merge</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oMacMergeEntity	aMACMergeSupport	30.14.1.1	Interfaces/interface/ethernet/mac-merge/admin-status	merge-support	R
	aMACMergeStatusVerify	30.14.1.2		verify-status	R
	aMACMergeStatusTx	30.14.1.5		status-tx	R
	aMACMergeEnableTx	30.14.1.3	Interfaces/interface/ethernet/mac-merge/admin-control	merge-enable-tx	R/W
	aMACMergeVerifyDisableTx	30.14.1.4		verify-disable-tx	R/W
	aMACMergeVerifyTime	30.14.1.6		verify-time	R/W
	aMACMergeAddFragSize	30.14.1.7		frag-size	R/W
	aMACMergeFrameAssErrorCount	30.14.1.8	Interfaces/interface/ethernet/mac-merge/statistics	assembly-error-count	R
	aMACMergeFrameSmdErrorCount	30.14.1.9		smd-error-count	R
	aMACMergeFrameAssOkCount	30.14.1.10		assembly-ok-count	R
	aMACMergeFragCountRx	30.14.1.11		fragment-count-rx	R
	aMACMergeFragCountTx	30.14.1.12		fragment-count-tx	R
	aMACMergeHoldCount	30.14.1.13		hold-count	R



**Table 5–6—Mapping between IEEE Std 802.3, 30.14 managed objects and *ieee802-ethernet-lldp* YANG data nodes**

IEEE Std 802.3, 30.14		Reference	Corresponding <i>ieee802-ethernet-lldp</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oLldpXdot3Config	aLldpXdot3PortConfigTLVsTxEnable	30.12.1.1.1	lldp/port	tlvs-port-config-enable	R/W
oLldpXdot3LocSystemsGroup	aLldpXdot3LocPortAutoNegSupported	30.12.2.1.1		auto-negotiation-supported	R
	aLldpXdot3LocPortAutoNegEnabled	30.12.2.1.2		auto-negotiation-enabled	R
	aLldpXdot3LocPortAutoNegAdvertisedCap	30.12.2.1.3		auto-negotiation-cap	R
	aLldpXdot3LocPortOperMauType	30.12.2.1.4		operational-mau-type	R
	aLldpXdot3LocPowerPortClass	30.12.2.1.5		power-port-class	R
	aLldpXdot3LocPowerMDISupported	30.12.2.1.6		mdi-power-supported	R
	aLldpXdot3LocPowerMDIEnabled	30.12.2.1.7		mdi-power-enabled	R
	aLldpXdot3LocPowerPairControllable	30.12.2.1.8		power-pair-controllable	R
	aLldpXdot3LocPowerPairs	30.12.2.1.9		power-pairs	R
	aLldpXdot3LocPowerClass	30.12.2.1.10		local-power-class	R
	aLldpXdot3LocLinkAggStatus	30.12.2.1.11		link-aggregation-status	R
	aLldpXdot3LocLinkAggPortId	30.12.2.1.12		aggregation-port-id	R
	aLldpXdot3LocMaxFrameSize	30.12.2.1.13		local-max-frame-size	R
	aLldpXdot3LocPowerType	30.12.2.1.14		power-type	R
	aLldpXdot3LocPowerSource	30.12.2.1.15		power-source	R
	aLldpXdot3LocPowerPriority	30.12.2.1.16		local-power-priority	R/W
	aLldpXdot3LocPDRequestedPowerValue	30.12.2.1.17		pd-requested-power-value	R
<i>Editorial note (to be removed prior to publication): Continue when YANG has been updated from supporting 802.3-2015 to 802.3-2022</i>					

**Table 5–6—Mapping between IEEE Std 802.3, 30.14 managed objects and *ieee802-ethernet-lldp* YANG data nodes**

IEEE Std 802.3, 30.14		Reference	Corresponding <i>ieee802-ethernet-lldp</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oLldpXdot3RemSystemsGroup	aLldpXdot3RemPortAutoNegSupported	30.12.3.1.1	lldp/port/remote-systems-data	auto-negotiation-supported	R
	aLldpXdot3RemPortAutoNegEnabled	30.12.3.1.2		auto-negotiation-enabled	R
	aLldpXdot3RemPortAutoNegAdvertisedCap	30.12.3.1.3		auto-negotiation-cap	R
	aLldpXdot3RemPortOperMauType	30.12.3.1.4		operational-mau-type	R
	aLldpXdot3RemPowerPortClass	30.12.3.1.5		power-port-class	R
	aLldpXdot3RemPowerMDISupported	30.12.3.1.6		mdi-power-supported	R
	aLldpXdot3RemPowerMDIEnabled	30.12.3.1.7		mdi-power-enabled	R
	aLldpXdot3RemPowerPairControllable	30.12.3.1.8		power-pair-controllable	R
	aLldpXdot3RemPowerPairs	30.12.3.1.9		power-pairs	R
	aLldpXdot3RemPowerClass	30.12.3.1.10		power-class	R
	aLldpXdot3RemLinkAggStatus	30.12.3.1.11		link-aggregation-status	R
	aLldpXdot3RemLinkAggPortId	30.12.3.1.12		aggregation-port-id	R
	aLldpXdot3RemMaxFrameSize	30.12.3.1.13		local-max-frame-size	R
	aLldpXdot3RemPowerType	30.12.3.1.14		power-type	R
	aLldpXdot3RemPowerSource	30.12.3.1.15		power-source	R
	aLldpXdot3RemPowerPriority	30.12.3.1.16		power-priority	R/W
	aLldpXdot3RemPDRrequestedPowerValue	30.12.3.1.17		pd-requested-power-value	R
	<i>Editorial note (to be removed prior to publication): Continue when YANG has been updated from supporting 802.3-2015 to 802.3-2022</i>				

## 5.3 YANG module definition<sup>j</sup>

The YANG module tree hierarchy uses terms defined in IETF RFC 8407.

### 5.3.1 Tree hierarchy

```
module: ieee802-ethernet-interface
  augment /if:interfaces/if:interface:
    +--rw ethernet
      +--rw auto-negotiation!
        | +--rw enable?          boolean
        | +--ro negotiation-status? enumeration
      +--rw duplex?              duplex-type
      +--rw speed?               eth-if-speed-type
      +--rw flow-control
        | +--rw pause {ethernet-pause}?
        | | +--rw direction?    pause-fc-direction-type
        | | +--ro statistics
        | |   +--ro in-frames-pause? yang:counter64
        | |   +--ro out-frames-pause? yang:counter64
        | +--rw pfc {ethernet-pfc}?
        | | +--rw enable?        boolean
        | | +--ro statistics
        | |   +--ro in-frames-pfc? yang:counter64
        | |   +--ro out-frames-pfc? yang:counter64
        | +--rw force-flow-control? boolean
      +--ro max-frame-length?    uint16
      +--ro mac-control-extension-control? boolean
      +--ro frame-limit-slow-protocol? uint64
      +--ro capabilities
        | +--ro auto-negotiation? boolean
      +--ro statistics
        +--ro frame
          | +--ro in-total-frames?          yang:counter64
```

<sup>j</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```

|   +--ro in-total-octets?                yang:counter64
|   +--ro in-frames?                      yang:counter64
|   +--ro in-multicast-frames?            yang:counter64
|   +--ro in-broadcast-frames?            yang:counter64
|   +--ro in-error-fcs-frames?            yang:counter64
|   +--ro in-error-undersize-frames?       yang:counter64
|   +--ro in-error-oversize-frames?       yang:counter64
|   +--ro in-error-mac-internal-frames?    yang:counter64
|   +--ro out-frames?                     yang:counter64
|   +--ro out-multicast-frames?            yang:counter64
|   +--ro out-broadcast-frames?            yang:counter64
|   +--ro out-error-mac-internal-frames?    yang:counter64
+--ro phy
|   +--ro in-error-symbol?    yang:counter64
|   +--ro lpi
|       +--ro in-lpi-transitions?    yang:counter64
|       +--ro in-lpi-time?           decimal64
|       +--ro out-lpi-transitions?    yang:counter64
|       +--ro out-lpi-time?           decimal64
+--ro mac-control
|   +--ro in-frames-mac-control-unknown?    yang:counter64
|   +--ro in-frames-mac-control-extension?  yang:counter64
|   +--ro out-frames-mac-control-extension? yang:counter64

module: ieee802-ethernet-interface-half-duplex
augment /if:interfaces/if:interface/ieee802-eth-if:ethernet:
  +--rw dynamic-rate-control?    dynamic-rate-control-type {dynamic-rate-control}?
augment /if:interfaces/if:interface/ieee802-eth-if:ethernet/ieee802-eth-if:capabilities:
  +--ro dynamic-rate-control-supported?    boolean {dynamic-rate-control}?
  augment /if:interfaces/if:interface/ieee802-eth-if:ethernet/ieee802-eth-if:statistics/ieee802-eth-
if:frame:
  +--ro csma-cd {csma-cd}?
  |   +--ro in-errors-sqe-test?                yang:counter64
  |   +--ro out-frames-collision-single?        yang:counter64
  |   +--ro out-frames-collision-multiple?      yang:counter64
  |   +--ro out-frames-deferred?                yang:counter64

```

```

+--ro out-frames-collisions-excessive? yang:counter64
+--ro out-collisions-late?             yang:counter64
+--ro out-errors-carrier-sense?        yang:counter64
+--ro collision-histogram* [collision-count]
    +--ro collision-count               yang:counter64
    +--ro collision-count-frames?       yang:counter64

```

```

module ieee802-ethernet-mac-merge
  augment /if:interfaces/if:interface/ieee802-eth-if:ethernet:
    +--rw mac-merge {mac-merge}?
      +--rw admin-control
        | +--rw merge-enable-tx?      enumeration
        | +--rw verify-disable-tx?    enumeration
        | +--rw verify-time?          uint16
        | +--rw frag-size?            uint16
      +--ro admin-status
        | +--ro merge-support?        enumeration
        | +--ro verify-status?        enumeration
        | +--ro status-tx?            enumeration
      +--ro statistics
        | +--ro assembly-error-count? yang:counter64
        | +--ro  smd-error-count?     yang:counter64
        | +--ro assembly-ok-count?    yang:counter64
        | +--ro fragment-count-rx?    yang:counter64
        | +--ro fragment-count-tx?    yang:counter64
        | +--ro hold-count?           yang:counter64

```

```

module: ieee802-dot1ab-lldp
  +--rw lldp
    +--rw message-fast-tx?            uint32
    +--rw message-tx-hold-multiplier? uint32
    +--rw message-tx-interval?        uint32
    +--rw reinit-delay?               uint32
    +--rw tx-credit-max?              uint32
    +--rw tx-fast-init?               uint32
    +--rw notification-interval?      uint32

```

```

+--ro remote-statistics
|   +--ro last-change-time?    yang:timestamp
|   +--ro remote-inserts?     yang:zero-based-counter32
|   +--ro remote-deletes?     yang:zero-based-counter32
|   +--ro remote-drops?       yang:zero-based-counter32
|   +--ro remote-ageouts?     yang:zero-based-counter32
+--ro local-system-data
|   +--ro chassis-id-subtype?  ieee:chassis-id-subtype-type
|   +--ro chassis-id?         ieee:chassis-id-type
|   +--ro system-name?        string
|   +--ro system-description?  string
|   +--ro system-capabilities-supported? lldp-types:system-capabilities-map
|   +--ro system-capabilities-enabled?  lldp-types:system-capabilities-map
+--rw port* [name dest-mac-address]
|   +--rw name                if:interface-ref
|   +--rw dest-mac-address    ieee:mac-address
|   +--rw admin-status?      enumeration
|   +--rw notification-enable? boolean
|   +--rw tlvs-tx-enable?    bits
|   +--rw message-fast-tx?   uint32
|   +--rw message-tx-hold-multiplier? uint32
|   +--rw message-tx-interval? uint32
|   +--rw reinit-delay?      uint32
|   +--rw tx-credit-max?     uint32
|   +--rw tx-fast-init?      uint32
|   +--rw notification-interval? uint32
+--rw management-address-tx-port* [address-subtype man-address]
|   +--rw address-subtype    identityref
|   +--rw man-address        lldp-types:man-addr-type
|   +--rw tx-enable?         boolean
|   +--ro addr-len?          uint32
|   +--ro if-subtype?        lldp-types:man-addr-if-subtype
|   +--ro if-id?             uint32
+--ro port-id-subtype?       ieee:port-id-subtype-type
+--ro port-id?               ieee:port-id-type
+--ro port-desc?             string

```

```

+--ro tx-statistics
|   +--ro total-frames?          yang:counter32
|   +--ro total-length-errors?   yang:counter32
+--ro rx-statistics
|   +--ro total-ageouts?         yang:zero-based-counter32
|   +--ro total-discarded-frames? yang:counter32
|   +--ro error-frames?         yang:counter32
|   +--ro total-frames?         yang:counter32
|   +--ro total-discarded-tlvs?  yang:counter32
|   +--ro total-unrecognized-tlvs? yang:counter32
+--ro remote-systems-data* [time-mark remote-index]
|   +--ro time-mark              yang:timeticks
|   +--ro remote-index           uint32
|   +--ro remote-too-many-neighbors? boolean
|   +--ro remote-changes?       boolean
|   +--ro chassis-id-subtype?   ieee:chassis-id-subtype-type
|   +--ro chassis-id?          ieee:chassis-id-type
|   +--ro port-id-subtype?      ieee:port-id-subtype-type
|   +--ro port-id?             ieee:port-id-type
|   +--ro port-desc?           string
|   +--ro system-name?         string
|   +--ro system-description?   string
|   +--ro system-capabilities-supported? lldp-types:system-capabilities-map
|   +--ro system-capabilities-enabled? lldp-types:system-capabilities-map
|   +--ro management-address* [address-subtype address]
|   |   +--ro address-subtype    identityref
|   |   +--ro address           lldp-types:man-addr-type
|   |   +--ro if-subtype?       lldp-types:man-addr-if-subtype
|   |   +--ro if-id?            uint32
|   +--ro remote-unknown-tlv* [tlv-type]
|   |   +--ro tlv-type          uint32
|   |   +--ro tlv-info?        binary
|   +--ro remote-org-defined-info* [info-identifier info-subtype info-index]
|   |   +--ro info-identifier    uint32
|   |   +--ro info-subtype      uint32
|   |   +--ro info-index        uint32

```

		+-ro remote-info?	binary	
	+-ro	ieee802-eth-lldp:auto-negotiation-supported?	boolean	
	+-ro	ieee802-eth-lldp:auto-negotiation-enabled?	boolean	
	+-ro	ieee802-eth-lldp:auto-negotiation-cap?	binary	
	+-ro	ieee802-eth-lldp:operational-mau-type?	int32	
	+-ro	ieee802-eth-lldp:power-port-class?	port-class-type	
	+-ro	ieee802-eth-lldp:mdl-power-supported?	boolean	
	+-ro	ieee802-eth-lldp:mdl-power-enabled?	boolean	
	+-ro	ieee802-eth-lldp:power-pair-controlable?	boolean	
	+-ro	ieee802-eth-lldp:power-pairs?	pse-pinout-type	
	+-ro	ieee802-eth-lldp:power-class?	pse-power-class-type	
	+-ro	ieee802-eth-lldp:link-aggregation-status?	bits	
	+-ro	ieee802-eth-lldp:aggregation-port-id?	int32	
	+-ro	ieee802-eth-lldp:local-max-frame-size?	int32	
	+-ro	ieee802-eth-lldp:power-type?	bits	
	+-ro	ieee802-eth-lldp:power-source?	power-source-type	
	+-ro	ieee802-eth-lldp:power-priority?	power-priority-type	
	+-ro	ieee802-eth-lldp:pd-requested-power-value?	int32	
	+-ro	ieee802-eth-lldp:pse-allocated-power-value?	int32	
	+-ro	ieee802-eth-lldp:tx-system-value?	int32	
	+-ro	ieee802-eth-lldp:tx-system-value-echo?	int32	
	+-ro	ieee802-eth-lldp:rx-system-value?	int32	
	+-ro	ieee802-eth-lldp:rx-system-value-echo?	int32	
	+-ro	ieee802-eth-lldp:fallback-system-value?	int32	
	+-ro	ieee802-eth-lldp:tx-system-fw?	boolean	
	+-ro	ieee802-eth-lldp:tx-system-fw-echo?	boolean	
	+-ro	ieee802-eth-lldp:rx-system-fw?	boolean	
	+-ro	ieee802-eth-lldp:rx-system-fw-echo?	boolean	
	+-ro	ieee802-eth-lldp:preemption-supported?	boolean	
	+-ro	ieee802-eth-lldp:preemption-enabled?	boolean	
	+-ro	ieee802-eth-lldp:preemption-active?	boolean	
	+-ro	ieee802-eth-lldp:additional-fragment-size?	int32	
+-rw		ieee802-eth-lldp:tlvs-port-config-enable?	bits	
+-ro		ieee802-eth-lldp:auto-negotiation-supported?	boolean	
+-ro		ieee802-eth-lldp:auto-negotiation-enabled?	boolean	
+-ro		ieee802-eth-lldp:auto-negotiation-cap?	binary	



+++ro ieee802-eth-lldp:operational-mau-type?	int32
+++ro ieee802-eth-lldp:power-port-class?	port-class-type
+++ro ieee802-eth-lldp:mdi-power-supported?	boolean
+++ro ieee802-eth-lldp:mdi-power-enabled?	boolean
+++ro ieee802-eth-lldp:power-pair-controlable?	boolean
+++ro ieee802-eth-lldp:power-pairs?	pse-pinout-type
+++ro ieee802-eth-lldp:local-power-class?	pse-power-class-type
+++ro ieee802-eth-lldp:link-aggregation-status?	bits
+++ro ieee802-eth-lldp:aggregation-port-id?	int32
+++ro ieee802-eth-lldp:local-max-frame-size?	int32
+++ro ieee802-eth-lldp:power-type?	bits
+++ro ieee802-eth-lldp:power-source?	power-source-type
+++rw ieee802-eth-lldp:local-power-priority?	power-priority-type
+++ro ieee802-eth-lldp:pd-requested-power-value?	int32
+++ro ieee802-eth-lldp:pse-allocated-power-value?	int32
+++ro ieee802-eth-lldp:local-response-time?	int32
+++ro ieee802-eth-lldp:local-system-ready?	boolean
+++ro ieee802-eth-lldp:reduced-operation-power-value?	int32
+++ro ieee802-eth-lldp:tx-system-value?	int32
+++ro ieee802-eth-lldp:tx-system-value-echo?	int32
+++ro ieee802-eth-lldp:rx-system-value?	int32
+++ro ieee802-eth-lldp:rx-system-value-echo?	int32
+++ro ieee802-eth-lldp:fallback-system-value?	int32
+++ro ieee802-eth-lldp:tx-dll-ready?	boolean
+++ro ieee802-eth-lldp:rx-dll-ready?	boolean
+++ro ieee802-eth-lldp:dll-enabled?	boolean
+++ro ieee802-eth-lldp:tx-system-fw?	boolean
+++ro ieee802-eth-lldp:tx-system-fw-echo?	boolean
+++ro ieee802-eth-lldp:rx-system-fw?	boolean
+++ro ieee802-eth-lldp:rx-system-fw-echo?	boolean
+++ro ieee802-eth-lldp:preemption-supported?	boolean
+++ro ieee802-eth-lldp:preemption-enabled?	boolean
+++ro ieee802-eth-lldp:preemption-active?	boolean
+++ro ieee802-eth-lldp:additional-fragment-size?	int32

notifications:

```

+---n remote-table-change
+---ro remote-insert?   -> /lldp/remote-statistics/remote-inserts
+---ro remote-delete?   -> /lldp/remote-statistics/remote-deletes
+---ro remote-drops?    -> /lldp/remote-statistics/remote-drops
+---ro remote-ageouts?  -> /lldp/remote-statistics/remote-ageouts

module: ietf-interfaces
+--rw interfaces
|   +--rw interface* [name]
|       +--rw name                string
|       +--rw description?        string
|       +--rw type                identityref
|       +--rw enabled?            boolean
|       +--rw link-up-down-trap-enable? enumeration {if-mib}?
|       +---ro admin-status        enumeration {if-mib}?
|       +---ro oper-status         enumeration
|       +---ro last-change?        yang:date-and-time
|       +---ro if-index            int32 {if-mib}?
|       +---ro phys-address?       yang:phys-address
|       +---ro higher-layer-if*    interface-ref
|       +---ro lower-layer-if*    interface-ref
|       +---ro speed?             yang:gauge64
|       +---ro statistics
|           +---ro discontinuity-time yang:date-and-time
|           +---ro in-octets?         yang:counter64
|           +---ro in-unicast-pkts?   yang:counter64
|           +---ro in-broadcast-pkts? yang:counter64
|           +---ro in-multicast-pkts? yang:counter64
|           +---ro in-discards?       yang:counter32
|           +---ro in-errors?         yang:counter32
|           +---ro in-unknown-protos? yang:counter32
|           +---ro out-octets?        yang:counter64
|           +---ro out-unicast-pkts?   yang:counter64
|           +---ro out-broadcast-pkts? yang:counter64
|           +---ro out-multicast-pkts? yang:counter64
|           +---ro out-discards?      yang:counter32

```

```

|           +--ro out-errors?                yang:counter32
x--ro interfaces-state
  x--ro interface* [name]
    x--ro name                               string
    x--ro type                               identityref
    x--ro admin-status                       enumeration {if-mib}?
    x--ro oper-status                        enumeration
    x--ro last-change?                       yang:date-and-time
    x--ro if-index                           int32 {if-mib}?
    x--ro phys-address?                      yang:phys-address
    x--ro higher-layer-if*                   interface-state-ref
    x--ro lower-layer-if*                    interface-state-ref
    x--ro speed?                             yang:gauge64
  x--ro statistics
    x--ro discontinuity-time                 yang:date-and-time
    x--ro in-octets?                         yang:counter64
    x--ro in-unicast-pkts?                   yang:counter64
    x--ro in-broadcast-pkts?                 yang:counter64
    x--ro in-multicast-pkts?                 yang:counter64
    x--ro in-discards?                       yang:counter32
    x--ro in-errors?                         yang:counter32
    x--ro in-unknown-protos?                 yang:counter32
    x--ro out-octets?                        yang:counter64
    x--ro out-unicast-pkts?                   yang:counter64
    x--ro out-broadcast-pkts?                 yang:counter64
    x--ro out-multicast-pkts?                 yang:counter64
    x--ro out-discards?                       yang:counter32
    x--ro out-errors?                         yang:counter32

```

```

module: ietf-routing
+--rw routing
| +--rw router-id?                          yang:dotted-quad {router-id}?
| +--ro interfaces
| | +--ro interface* if:interface-ref
| +--rw control-plane-protocols
| | +--rw control-plane-protocol* [type name]

```

```

| |      +---rw type                identityref
| |      +---rw name                string
| |      +---rw description?       string
| |      +---rw static-routes
| +---rw ribs
|   +---rw rib* [name]
|     +---rw name                  string
|     +---rw address-family        identityref
|     +---ro default-rib?          boolean {multiple-ribs}?
|     +---ro routes
|       +---ro route* []
|         +---ro route-preference? route-preference
|         +---ro next-hop
|           +---ro (next-hop-options)
|             +---:(simple-next-hop)
|               +---ro outgoing-interface? if:interface-ref
|             +---:(special-next-hop)
|               +---ro special-next-hop?  enumeration
|             +---:(next-hop-list)
|               +---ro next-hop-list
|                 +---ro next-hop* []
|                   +---ro outgoing-interface? if:interface-ref
|         +---ro source-protocol        identityref
|         +---ro active?                empty
|         +---ro last-updated?          yang:date-and-time
| +---x active-route
|   +---ro output
|     +---ro route
|       +---ro next-hop
|         +---ro (next-hop-options)
|           +---:(simple-next-hop)
|             +---ro outgoing-interface? if:interface-ref
|           +---:(special-next-hop)
|             +---ro special-next-hop?  enumeration
|           +---:(next-hop-list)
|             +---ro next-hop-list

```

```

|           |           |           +--ro next-hop* []
|           |           |           +--ro outgoing-interface?  if:interface-ref
|           |           +--ro source-protocol  identityref
|           |           +--ro active?          empty
|           |           +--ro last-updated?    yang:date-and-time
|           +--rw description?      string
o--ro routing-state
|   +--ro router-id?                yang:dotted-quad
|   o--ro interfaces
|   |   o--ro interface*  if:interface-state-ref
|   o--ro control-plane-protocols
|   |   o--ro control-plane-protocol* [type name]
|   |   |   o--ro type      identityref
|   |   |   o--ro name      string
|   o--ro ribs
|   |   o--ro rib* [name]
|   |   |   o--ro name          string
|   |   |   +--ro address-family  identityref
|   |   |   o--ro default-rib?    boolean {multiple-ribs}?
|   |   o--ro routes
|   |   |   o--ro route* []
|   |   |   |   o--ro route-preference?  route-preference
|   |   |   |   o--ro next-hop
|   |   |   |   |   +--ro (next-hop-options)
|   |   |   |   |   |   +--:(simple-next-hop)
|   |   |   |   |   |   |   +--ro outgoing-interface?  if:interface-ref
|   |   |   |   |   |   |   +--:(special-next-hop)
|   |   |   |   |   |   |   |   +--ro special-next-hop?  enumeration
|   |   |   |   |   |   |   |   +--:(next-hop-list)
|   |   |   |   |   |   |   |   |   +--ro next-hop-list
|   |   |   |   |   |   |   |   |   |   +--ro next-hop* []
|   |   |   |   |   |   |   |   |   |   +--ro outgoing-interface?  if:interface-ref
|   |   |   |   |   |   |   +--ro source-protocol  identityref
|   |   |   |   |   |   +--ro active?          empty
|   |   |   |   |   +--ro last-updated?    yang:date-and-time
|   o---x active-route

```

```
+--ro output
  o--ro route
    o--ro next-hop
      | +--ro (next-hop-options)
      |   +--:(simple-next-hop)
      |     | +--ro outgoing-interface?   if:interface-ref
      |     +--:(special-next-hop)
      |       | +--ro special-next-hop?    enumeration
      |       +--:(next-hop-list)
      |         +--ro next-hop-list
      |           +--ro next-hop* []
      |             +--ro outgoing-interface?   if:interface-ref
      +--ro source-protocol   identityref
      +--ro active?           empty
      +--ro last-updated?     yang:date-and-time
```

## 5.3.2 YANG module

In the following YANG module definitions, should any discrepancy between the text of the description for individual YANG nodes and the corresponding definition in 5.2 through 5.3 of this clause occur, the definitions and mappings in 5.3 shall take precedence.

An ASCII text version of the Ethernet YANG module can be found at the following URL:<sup>k</sup>  
<https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.3>.

### 5.3.2.1 Ethernet interface module

```
module ieee802-ethernet-interface {  
  yang-version 1.1;  
  
  namespace  
    "urn:ieee:std:802.3:yang:ieee802-ethernet-interface";  
  
  prefix ieee802-eth-if;  
  
  revision 2019-06-21 {  
    description "Initial revision.";  
  }  
  
  import ietf-yang-types {  
    prefix yang;  
    reference "IETF RFC 6991";  
  }  
  
  import ietf-interfaces {  
    prefix if;  
    reference "IETF RFC 8343";  
  }  
  
  import iana-if-type {  
    prefix ianaift;  
    reference "http://www.iana.org/assignments/yang-parameters/  
      iana-if-type@2018-07-03.yang";  
  }  
  
  organization  
    "IEEE Std 802.3 Ethernet Working Group  
    Web URL: http://www.ieee802.org/3/";  
  
  contact  
    "Web URL: http://www.ieee802.org/3/";  
  
  description  
    "This module contains YANG definitions for configuring IEEE Std  
    802.3 Ethernet Interfaces.  
    In this YANG module, 'Ethernet interface' can be interpreted  
    as referring to 'IEEE Std 802.3 compliant Ethernet
```

<sup>k</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```
1     interfaces'.";
2
3     reference "IEEE Std 802.3-2018, unless dated explicitly";
4
5     typedef eth-if-speed-type {
6         type decimal64 {
7             fraction-digits 3;
8         }
9         units "Gb/s";
10        description
11            "Used to represent the configured, negotiated, or actual speed
12            of an Ethernet interface in Gigabits per second (Gb/s),
13            accurate to 3 decimal places (i.e., accurate to 1 Mb/s).";
14    }
15
16    typedef duplex-type {
17        type enumeration {
18            enum full {
19                description
20                    "Full duplex.";
21            }
22            enum half {
23                description
24                    "Half duplex.";
25            }
26            enum unknown {
27                description
28                    "Link is currently disconnected or initializing.";
29            }
30        }
31        default full;
32        description
33            "Used to represent the configured, negotiated, or actual
34            duplex mode of an Ethernet interface.";
35        reference "IEEE Std 802.3, 30.3.1.1.32, aDuplexStatus";
36    }
37
38    typedef pause-fc-direction-type {
39        type enumeration {
40            enum "disabled" {
41                description
42                    "Flow-control disabled in both ingress and egress
43                    directions, i.e., PAUSE frames are not transmitted and
44                    PAUSE frames received in the ingress direction are
45                    discarded without processing.";
46            }
47            enum "ingress-only" {
48                description
49                    "PAUSE frame based flow control is enabled in the ingress
50                    direction only, i.e., PAUSE frames may be transmitted to
51                    reduce the ingress traffic flow, but PAUSE frames received
52                    in the ingress direction are discarded without reducing
53                    the egress traffic rate.";
54            }
55        }
56    }
57
58    }
```



```
1      enum "egress-only" {
2          description
3              "PAUSE frame based flow control is enabled in the egress
4                direction only, i.e., PAUSE frames are not transmitted,
5                but PAUSE frames received in the ingress direction are
6                processed to reduce the egress traffic rate.";
7      }
8
9      enum "bi-directional" {
10         description
11             "PAUSE frame based flow control is enabled in both ingress
12              and egress directions, i.e., PAUSE frames may be
13              transmitted to reduce the ingress traffic flow, and
14              PAUSE frames received on ingress are processed to reduce
15              the egress traffic rate.";
16     }
17
18     enum "undefined" {
19         description
20             "Link is currently disconnected or initializing.";
21     }
22 }
23
24 description
25     "Used to represent the configured, negotiated, or actual
26     PAUSE frame-based flow control setting.";
27
28 reference
29     "IEEE Std 802.3.1, dot3PauseAdminMode and dot3PauseOperMode";
30
31 }
32
33
34 feature ethernet-pfc {
35     description
36         "This device supports Ethernet priority flow-control.";
37 }
38
39
40 feature ethernet-pause {
41     description
42         "This device supports Ethernet PAUSE.";
43 }
44
45
46 augment "/if:interfaces/if:interface" {
47     when "derived-from-or-self(if:type, 'ianaift:ethernetCsmacd')" {
48         description
49             "Applies to all P2P Ethernet interfaces.";
50     }
51 }
52
53 description
54     "Augment interface model with Ethernet interface
55     specific configuration nodes.";
56
57 container ethernet {
58     description
59         "Contains all Ethernet interface related configuration.";
60
61     container auto-negotiation {
62         presence
63             "The presence of this container indicates that
```

```
1         auto-negotiation is supported on this Ethernet
2         interface.";
3     description
4         "Contains auto-negotiation transmission parameters
5
6         This container contains a data node that allows the
7         advertised duplex value in the negotiation to be
8         restricted.
9
10        If not specified then the default behavior for the duplex
11        data node is to negotiate all available values for the
12        particular type of Ethernet PHY associated with the
13        interface.
14
15        If auto-negotiation is enabled, and PAUSE frame based flow
16        control has not been explicitly configured, then the
17        default PAUSE frame based flow control capabilities that
18        are negotiated allow for bi-directional or egress-only
19        PAUSE frame based flow control.
20
21        If auto-negotiation is enabled, and PAUSE frame based flow
22        control has been explicitly configured, then the
23        configuration settings restrict the values that may be
24        negotiated. However, it should be noted that the protocol
25        does not allow only egress PAUSE frame based flow control
26        to be negotiated without also allowing bi-directional
27        PAUSE frame based flow control.";
28     reference
29         "IEEE Std 802.3, Clause 28 and Annexes 28A-D";
30
31     leaf enable {
32         type boolean;
33         default true;
34
35         description
36             "Controls whether auto-negotiation is enabled or
37             disabled.
38             For interface types that support auto-negotiation then
39             it defaults to being enabled.
40
41             For interface types that do not support auto-negotiation,
42             the related configuration data is ignored.";
43     }
44     leaf negotiation-status {
45         when "../enable = 'true'";
46         type enumeration {
47             enum in-progress {
48                 description
49                     "The auto-negotiation protocol is running and
50                     negotiation is currently in-progress.";
51             }
52             enum complete {
53                 description
54                     "The auto-negotiation protocol has completed
```

```
1         successfully.";
2     }
3     enum failed {
4         description
5             "The auto-negotiation protocol has failed.";
6     }
7     enum unknown {
8         description
9             "The auto-negotiation status is not currently known,
10            this could be because it is still negotiating or the
11            protocol cannot run (e.g., if no medium is present).";
12     }
13     enum no-negotiation {
14         description
15             "No auto-negotiation is executed.
16            The auto-negotiation function is either not supported
17            on this interface or has not been enabled.";
18     }
19     }
20     config false;
21     description
22         "The status of the auto-negotiation protocol.";
23     reference
24         "IEEE 802.3, 30.6.1.1.4, aAutoNegAutoConfig";
25 }
26
27 }
28
29 leaf duplex {
30     type duplex-type;
31     description
32         "Operational duplex mode of the Ethernet interface.";
33     reference
34         "IEEE Std 802.3, 30.3.1.1.32 aDuplexStatus";
35 }
36
37 leaf speed {
38     type eth-if-speed-type;
39     units "Gb/s";
40     description
41         "Operational speed (data rate) of the Ethernet interface.
42         The default value is implementation-dependent.";
43 }
44
45 container flow-control {
46     description
47         "Holds the different types of Ethernet PAUSE frame based
48         flow control that can be enabled.";
49     container pause {
50         if-feature "ethernet-pause";
51         description
52             "IEEE Std 802.3 PAUSE frame based PAUSE frame based flow
53             control.";
54         reference
```

```
1         "IEEE Std 802.3, Annex 31B";
2     leaf direction {
3         type pause-fc-direction-type;
4         description
5             "Indicates which direction PAUSE frame based flow
6              control is enabled in, or whether it is disabled.
7              The default flow-control settings are vendor specific.
8              If auto-negotiation is enabled, then PAUSE based
9              flow-control is negotiated by default.
10             The default value is implementation-dependent.";
11     }
12
13     container statistics {
14         config false;
15         description
16             "Contains the number of PAUSE frames received or
17              transmitted.";
18         leaf in-frames-pause {
19             type yang:counter64;
20             units frames;
21             description
22                 "A count of PAUSE MAC Control frames transmitted on
23                  this Ethernet interface.
24
25                 Discontinuities in the values of counters in
26                 this container can occur at re-initialization of the
27                 management system, and at other times as indicated
28                 by the value of the 'discontinuity-time' leaf
29                 defined in the ietf-interfaces YANG module
30                 (IETF RFC 8343).";
31             reference
32                 "IEEE Std 802.3, 30.3.4.3 aPAUSEMACCtrlFramesReceived";
33         }
34         leaf out-frames-pause {
35             type yang:counter64;
36             units frames;
37             description
38                 "A count of PAUSE MAC Control frames transmitted on
39                  this Ethernet interface.
40
41                 Discontinuities in the values of counters in
42                 this container can occur at re-initialization of the
43                 management system, and at other times as indicated
44                 by the value of the 'discontinuity-time' leaf
45                 defined in the ietf-interfaces YANG module
46                 (IETF RFC 8343).";
47             reference
48                 "IEEE Std 802.3, 30.3.4.2
49                  aPAUSEMACCtrlFramesTransmitted";
50         }
51     }
52 }
53
54 container pfc {
```

```
1         if-feature "ethernet-pfc";
2     description
3         "IEEE Std 802.3 Priority-based flow control.";
4     reference
5         "IEEE Std 802.3, Annex 31D";
6
7
8     leaf enable {
9         type boolean;
10
11         description
12             "True indicates that IEEE Std 802.3 priority-based
13              flow control is enabled, false indicates that
14              IEEE Std 802.3 priority-based flow control is disabled.
15              For interfaces that have auto-negotiation,
16              the priority-based flow control is enabled by default.";
17     }
18
19
20
21     container statistics {
22         config false;
23         description
24             "This container collects all statistics for
25              Ethernet interfaces.";
26
27
28         leaf in-frames-pfc {
29             type yang:counter64;
30             units frames;
31             description
32                 "A count of PFC MAC Control frames received on this
33                  Ethernet interface.
34
35                  Discontinuities in the values of counters in
36                  this container can occur at re-initialization of the
37                  management system, and at other times as indicated
38                  by the value of the 'discontinuity-time' leaf
39                  defined in the ietf-interfaces YANG module
40                  (IETF RFC 8343).";
41             reference
42                 "IEEE Std 802.3.1, dot3HCInPFCFrames";
43         }
44
45         leaf out-frames-pfc {
46             type yang:counter64;
47             units frames;
48             description
49                 "A count of PFC MAC Control frames transmitted on
50                  this interface.
51
52                  Discontinuities in the values of counters in
53                  this container can occur at re-initialization of the
54                  management system, and at other times as indicated
55                  by the value of the 'discontinuity-time' leaf
56                  defined in the ietf-interfaces YANG module
57                  (IETF RFC 8343).";
58             reference
59                 "IEEE Std 802.3.1, dot3HCOutPFCFrames";
60         }
61     }
62
63     reference
64         "IEEE Std 802.3.1, dot3HCPFCFrames";
65
```

```
1         "IEEE Std 802.3.1, dot3HCInPFCFrames";
2     }
3 }
4 }
5 }
6
7 leaf force-flow-control {
8     type boolean;
9     default false;
10    description
11        "Explicitly forces the local PAUSE frame based flow control
12         settings regardless of what has been negotiated.
13
14         Since the auto-negotiation of flow-control settings
15         does not allow all sane combinations to be negotiated
16         (e.g., consider a device that is only capable of sending
17         PAUSE frames connected to a peer device that is only
18         capable of receiving and acting on PAUSE frames) and
19         failing to agree on the flow-control settings does not
20         cause the auto-negotiation to fail completely, then it is
21         sometimes useful to be able to explicitly enable
22         particular PAUSE frame based flow control settings on
23         the local device regardless of what is being advertised
24         or negotiated.";
25    reference
26        "IEEE Std 802.3, Table 28B-3";
27 }
28 }
29
30 leaf max-frame-length {
31     type uint16;
32     units octets;
33     config false;
34     description
35         "This indicates the MAC frame length (including FCS bytes)
36          at which frames are dropped for being too long.";
37    reference
38        "IEEE Std 802.3, 30.3.1.1.37 aMaxFrameLength";
39 }
40
41 leaf mac-control-extension-control {
42     type boolean;
43     config false;
44     description
45         "A value that identifies the current EXTENSION MAC Control
46          function, as specified in IEEE Std 802.3, Annex 31C.";
47    reference
48        "IEEE Std 802.3, 30.3.8.3 aEXTENSIONMACCtrlStatus
49         IEEE Std 802.3.1, dot3ExtensionMacCtrlStatus ";
50 }
51
52 leaf frame-limit-slow-protocol {
53     type uint64;
54     units f/s;
55     default 10;
```

```
1      config false;
2      description
3          "The maximum number of Slow Protocol frames of a given
4          subtype that can be transmitted in a one second interval.
5          The default value is 10.";
6      reference
7          "IEEE Std 802.3, 30.3.1.1.38 aSlowProtocolFrameLimit";
8  }
9
10
11  container capabilities {
12      config false;
13      description
14          "Container all Ethernet interface specific capabilities.";
15
16      leaf auto-negotiation {
17          type boolean;
18          description
19              "Indicates whether auto-negotiation may be configured on
20              this interface.";
21      }
22  }
23
24  }
25
26  }
27
28  container statistics {
29      config false;
30      description
31          "Contains statistics specific to Ethernet interfaces.
32
33          Discontinuities in the values of counters in the
34          container can occur at re-initialization of the management
35          system, and at other times as indicated by the value of
36          the 'discontinuity-time' leaf defined in the
37          ietf-interfaces YANG module (IETF RFC 8343).";
38
39      container frame {
40          description
41              "Contains frame statistics specific to Ethernet
42              interfaces.
43
44              All octet frame lengths include the 4 byte FCS.
45
46              Error counters are only reported once ... The count
47              represented by an instance of this object is incremented
48              when the frameCheckError status is returned by the MAC
49              service to the LLC (or other MAC user). Received frames
50              for which multiple error conditions pertain are,
51              according to the conventions of IEEE Std 802.3 Layer
52              Management, counted exclusively according to the error
53              status presented to the LLC.
54
55              A frame that is counted by an instance of this object is
56              also counted by the corresponding instance of 'in-errors'
57              leaf defined in the ietf-interfaces YANG module
58              (IETF RFC 8343).
59
60          }
61      }
62  }
63  }
64  }
65  }
```

```
1
2      Discontinuities in the values of counters in the
3      container can occur at re-initialization of the
4      management system, and at other times as indicated by
5      the value of the 'discontinuity-time' leaf defined in
6      the ietf-interfaces YANG module (IETF RFC 8343).";
7
8
9
10     leaf in-total-frames {
11         type yang:counter64;
12         units frames;
13         description
14             "The total number of frames (including bad frames)
15             received on the Ethernet interface.
16
17             This counter is calculated by summing the following
18             IEEE Std 802.3, Clause 30 counters:
19             aFramesReceivedOK +
20             aFrameCheckSequenceErrors +
21             aAlignmentErrors +
22             aFrameTooLongErrors +
23             aFramesLostDueToIntMACRcvError
24
25             Also see the 'description' statement associated with
26             the parent 'statistics' container for additional
27             common semantics related to this counter.";
28
29         reference
30             "IEEE Std 802.3, Clause 30 counters, as specified
31             in the description above.";
32     }
33
34     leaf in-total-octets {
35         type yang:counter64;
36         units octets;
37         description
38             "The total number of octets of data (including those in
39             bad frames) received on the Ethernet interface.
40
41             Includes the 4-octet FCS.
42
43             Also see the 'description' statement associated with
44             the parent 'statistics' container for additional
45             common semantics related to this counter.";
46
47         reference
48             "IETF RFC 2819, etherStatsOctets";
49     }
50
51     leaf in-frames {
52         type yang:counter64;
53         units frames;
54         description
55             "A count of frames (including unicast, multicast and
56             broadcast) that have been successfully received on the
57
58
59
60
61
62
63
64
65
```



Ethernet interface.

This count does not include frames received with  
frame-too-long, FCS, length or alignment errors, or  
frames lost due to internal MAC sublayer error.

Also see the 'description' statement associated with  
the parent 'statistics' container for additional  
common semantics related to this counter.";

reference

"IEEE Std 802.3, 30.3.1.1.5 aFramesReceivedOK";

}

leaf in-multicast-frames {

type yang:counter64;

units frames;

description

"A count of multicast frames that have been  
successfully received on the Ethernet interface.

This counter represents a subset of the frames counted  
by in-frames.

This count does not include frames received with  
frame-too-long, FCS, length or alignment errors, or  
frames lost due to internal MAC sublayer error.

Also see the 'description' statement associated with  
the parent 'statistics' container for additional  
common semantics related to this counter.";

reference

"IEEE Std 802.3, 30.3.1.1.21 aMulticastFramesReceivedOK";

}

leaf in-broadcast-frames {

type yang:counter64;

units frames;

description

"A count of broadcast frames that have been  
successfully received on the Ethernet interface.

This counter represents a subset of the frames counted  
by in-frames.

This count does not include frames received with  
frame-too-long, FCS, length or alignment errors, or  
frames lost due to internal MAC sublayer error.

Also see the 'description' statement associated with  
the parent 'statistics' container for additional  
common semantics related to this counter.";

```
1         reference
2         "IEEE Std 802.3, 30.3.1.1.22 aBroadcastFramesReceivedOK";
3     }
4
5     leaf in-error-fcs-frames {
6         type yang:counter64;
7         units frames;
8         description
9             "A count of receive frames that are of valid length,
10             but do not pass the FCS check, regardless of whether
11             or not the frames are an integral number of octets in
12             length.
13
14             This count effectively comprises
15             aFrameCheckSequenceErrors and aAlignmentErrors added
16             together.
17
18             Also see the 'description' statement associated with
19             the parent 'statistics' container for additional
20             common semantics related to this counter.";
21
22         reference
23             "IEEE Std 802.3, 30.3.1.1.6 aFrameCheckSequenceErrors;
24             IEEE Std 802.3, 30.3.1.1.7 aAlignmentErrors";
25     }
26
27     leaf in-error-undersize-frames {
28         type yang:counter64;
29         units frames;
30         description
31             "A count of frames received on a particular Ethernet
32             interface that are less than 64 bytes in length, and
33             are discarded.
34
35             This counter is incremented regardless of whether the
36             frame passes the FCS check.
37
38             Also see the 'description' statement associated with
39             the parent 'statistics' container for additional
40             common semantics related to this counter.";
41
42         reference
43             "IETF RFC 2819, etherStatsUndersizePkts and
44             etherStatsFragments";
45     }
46
47     leaf in-error-oversize-frames {
48         type yang:counter64;
49         units frames;
50         description
51             "A count of frames received on a particular Ethernet
52             interface that exceed the maximum permitted frame
53             size, that is specified in max-frame-length, and are
54             discarded.
55
56             This counter is incremented regardless of whether the
57             frame passes the FCS check.
58
59             Also see the 'description' statement associated with
60             the parent 'statistics' container for additional
61             common semantics related to this counter.";
```

```
1
2         This counter is incremented regardless of whether the
3         frame passes the FCS check.
4
5         Also see the 'description' statement associated with
6         the parent 'statistics' container for additional
7         common semantics related to this counter.";
8
9
10        reference "IEEE Std 802.3, 30.3.1.1.25 aFrameTooLongErrors";
11    }
12
13
14    leaf in-error-mac-internal-frames {
15        type yang:counter64;
16        units frames;
17        description
18            "A count of frames for which reception on a particular
19            Ethernet interface fails due to an internal MAC
20            sublayer receive error.
21
22            A frame is only counted by an instance of this object
23            if it is not counted by the corresponding instance of
24            either the in-error-fcs-frames, in-error-undersize-frames,
25            or in-error-oversize-frames. The precise meaning of the
26            count represented by an instance of this object is
27            implementation-specific.
28
29            In particular, an instance of this object may
30            represent a count of receive errors on a particular
31            Ethernet interface that are not otherwise counted.
32
33            Also see the 'description' statement associated with
34            the parent 'statistics' container for additional
35            common semantics related to this counter.";
36
37        reference
38            "IEEE Std 802.3, 30.3.1.1.15
39            aFramesLostDueToIntMACRcvError";
40    }
41
42
43    leaf out-frames {
44        type yang:counter64;
45        units frames;
46        description
47            "A count of frames (including unicast, multicast and
48            broadcast) that have been successfully transmitted on
49            the Ethernet interface.
50
51            Also see the 'description' statement associated with
52            the parent 'statistics' container for additional
53            common semantics related to this counter.";
54
55        reference
56            "IEEE Std 802.3, 30.3.1.1.2 aFramesTransmittedOK";
57    }
58
59
60
61
62
63
64
65
```

```
1
2     leaf out-multicast-frames {
3         type yang:counter64;
4         units frames;
5         description
6             "A count of multicast frames that have been
7             successfully transmitted on the Ethernet interface.
8
9             This counter represents a subset of the frames counted
10            by out-frames.
11
12            Also see the 'description' statement associated with
13            the parent 'statistics' container for additional
14            common semantics related to this counter.";
15
16            reference
17                "IEEE Std 802.3, 30.3.1.1.18 aMulticastFramesXmittedOK";
18        }
19
20     leaf out-broadcast-frames {
21         type yang:counter64;
22         units frames;
23         description
24             "A count of broadcast frames that have been
25             successfully transmitted on the Ethernet interface.
26
27            This counter represents a subset of the frames counted
28            by out-frames.
29
30            Also see the 'description' statement associated with
31            the parent 'statistics' container for additional
32            common semantics related to this counter.";
33
34            reference
35                "IEEE Std 802.3, 30.3.1.1.19 aBroadcastFramesXmittedOK";
36        }
37
38     leaf out-error-mac-internal-frames {
39         type yang:counter64;
40         units frames;
41         description
42             "A count of frames for which transmission on a
43             particular Ethernet interface fails due to an internal
44             MAC sublayer transmit error.
45
46            The precise meaning of the count represented by an
47            instance of this object is implementation-specific. In
48            particular, an instance of this object may represent a
49            count of transmission errors on a particular Ethernet
50            interface that are not otherwise counted.
51
52            Also see the 'description' statement associated with
53            the parent 'statistics' container for additional
54            common semantics related to this counter.";
```

```
1
2         reference
3         "IEEE Std 802.3, 30.3.1.1.12
4         aFramesLostDueToIntMACXmitError";
5     }
6 }
7
8
9
10 container phy {
11     description
12         "Ethernet statistics related to the PHY layer.
13
14         Discontinuities in the values of counters in the
15         container can occur at re-initialization of the
16         management system, and at other times as indicated by
17         the value of the 'discontinuity-time' leaf defined in
18         the ietf-interfaces YANG module (IETF RFC 8343).";
19
20     leaf in-error-symbol {
21         type yang:counter64;
22         units errors;
23         description
24             "A count of the number of symbol errors that have
25             occurred.
26
27             For the precise definition of when the symbol error
28             counter is incremented, please see the 'description'
29             text associated with aSymbolErrorDuringCarrier,
30             specified in IEEE Std 802.3, 30.3.2.1.5.
31
32             Also see the 'description' statement associated with
33             the parent 'phy-statistics' container for additional
34             common semantics related to this counter.";
35         reference
36             "IEEE Std 802.3, 30.3.2.1.5 aSymbolErrorDuringCarrier";
37     }
38
39     container lpi {
40         description
41             "Physical Ethernet statistics for the energy efficiency
42             related low power idle indications.";
43
44         leaf in-lpi-transitions {
45             type yang:counter64;
46             units transitions;
47             description
48                 "A count of occurrences of the transition from
49                 DEASSERT to ASSERT of the LPI_INDICATE
50                 parameter. The indication reflects the state of the
51                 PHY according to the requirements of the RS (see
52                 IEEE Std 802.3, 22.7, 35.4, and 46.4).
53
54                 Also see the 'description' statement associated with
55                 the parent 'phy-statistics' container for additional
56                 common semantics related to this counter.";
```

```
1
2         reference
3         "IEEE Std 802.3, 30.3.2.1.11 aReceiveLPITransitions";
4     }
5
6
7     leaf in-lpi-time {
8         type decimal64 {
9             fraction-digits 6;
10        }
11        units seconds;
12        description
13            "A count reflecting the total amount of time (in
14             seconds) that the LPI_REQUEST parameter has the
15             value ASSERT. The request is indicated to the PHY
16             according to the requirements of the RS (see IEEE Std
17             802.3, 22.7, 35.4, and 46.4).
18
19             Also see the 'description' statement associated with
20             the parent 'phy-statistics' container for additional
21             common semantics related to this counter.";
22
23        reference
24        "IEEE Std 802.3, 30.3.2.1.9 aReceiveLPIMicroseconds";
25    }
26
27    leaf out-lpi-transitions {
28        type yang:counter64;
29        units transitions;
30        description
31            "A count of occurrences of the transition from state
32             LPI_DEASSERTED to state LPI_ASSERTED in the LPI
33             transmit state diagram of the RS. The state
34             transition corresponds to the assertion of the
35             LPI_REQUEST parameter. The request is indicated to
36             the PHY according to the requirements of the RS (see
37             IEEE Std 802.3, 22.7, 35.4, 46.4.)
38
39             Also see the 'description' statement associated with
40             the parent 'phy-statistics' container for additional
41             common semantics related to this counter.";
42
43        reference
44        "IEEE Std 802.3, 30.3.2.1.10 aTransmitLPITransitions";
45    }
46
47    leaf out-lpi-time {
48        type decimal64 {
49            fraction-digits 6;
50        }
51        units seconds;
52        description
53            "A count reflecting the total amount of time (in
54             seconds) that the LPI_INDICATION parameter has the
55             value ASSERT. The request is indicated to the PHY
```

```
1         according to the requirements of the RS (see IEEE
2         802.3, 22.7, 35.4, and 46.4).
3
4         Also see the 'description' statement associated with
5         the parent 'phy-statistics' container for additional
6         common semantics related to this counter.";
7
8
9         reference
10        "IEEE Std 802.3, 30.3.2.1.8 aTransmitLPIMicroseconds";
11    }
12  }
13  }
14  }
15
16  container mac-control {
17    description
18      "A group of statistics specific to MAC Control operation
19      of selected Ethernet interfaces.
20
21      Discontinuities in the values of counters in the
22      container can occur at re-initialization of the
23      management system, and at other times as indicated by
24      the value of the 'discontinuity-time' leaf defined in
25      the ietf-interfaces YANG module (IETF RFC 8343).";
26
27    reference
28      "IEEE Std 802.3.1, dot3ExtensionTable";
29
30    leaf in-frames-mac-control-unknown {
31      type yang:counter64;
32      units frames;
33      description
34        "A count of MAC Control frames with an unsupported
35        opcode received on this Ethernet interface.
36
37        Frames counted against this counter are also counted
38        against in-discards defined in the ietf-interfaces
39        YANG module (IETF RFC 8343).
40
41        Also see the 'description' statement associated with
42        the parent 'mac-control-statistics' container for
43        additional semantics.";
44      reference
45        "IEEE Std 802.3, 30.3.3.5 aUnsupportedOpcodesReceived";
46    }
47
48    leaf in-frames-mac-control-extension {
49      type yang:counter64;
50      units frames;
51      description
52        "The count of Extension MAC Control frames received on
53        this Ethernet interface.
54
55        Also see the 'description' statement associated with
56        the parent 'mac-control-statistics' container for
```

```

1         additional semantics.";
2     reference
3         "IEEE Std 802.3, 30.3.8.2
4         aEXTENSIONMACCtrlFramesReceived";
5     }
6
7
8     leaf out-frames-mac-control-extension {
9         type yang:counter64;
10        units frames;
11        description
12            "The count of Extension MAC Control frames transmitted
13            on this Ethernet interface.
14
15            Also see the 'description' statement associated with
16            the parent 'mac-control-statistics' container for
17            additional semantics.";
18        reference
19            "IEEE Std 802.3, 30.3.8.1
20            aEXTENSIONMACCtrlFramesTransmitted";
21    }
22
23    }
24
25    }
26
27    }
28
29    }
30 }
31

```

### 5.3.2.2 Ethernet interface module (half-duplex)

```

32
33
34 module ieee802-ethernet-interface-half-duplex {
35
36     yang-version 1.1;
37
38     namespace
39         "urn:ieee:std:802.3:yang:ieee802-ethernet-interface-half-duplex";
40
41     prefix ieee802-eth-half-duplex;
42
43     revision 2019-06-21 {
44         description "Initial revision.";
45     }
46
47     import ietf-yang-types {
48         prefix yang;
49         reference "IETF RFC 6991";
50     }
51
52     import ietf-interfaces {
53         prefix if;
54         reference "IETF RFC 8343";
55     }
56
57     import iana-if-type {
58         prefix ianaift;
59         reference "http://www.iana.org/assignments/yang-parameters/";
60     }
61
62
63
64
65

```



```
1      iana-if-type@2018-07-03.yang";
2  }
3
4  import ieee802-ethernet-interface {
5      prefix ieee802-eth-if;
6  }
7
8
9  organization
10     "IEEE Std 802.3 Ethernet Working Group
11     Web URL: http://www.ieee802.org/3/";
12
13
14  contact
15     "Web URL: http://www.ieee802.org/3/";
16
17
18  description
19     "This module contains YANG definitions for configuring Ethernet
20     interfaces that are deprecated, and are no longer
21     widely used in the industry. The definitions are maintained for
22     backwards compatibility purposes, but the general expectation is
23     that this module is not anticipated to be widely implemented.";
24  reference
25     "IEEE Std 802.3-2018, unless dated explicitly";
26
27
28  feature dynamic-rate-control {
29      description
30         "This feature indicates that the device supports Ethernet
31         interfaces lowering the average data rate of the MAC sublayer,
32         with frame granularity, by using Rate Control to dynamically
33         increase the inter-packet gap for some types of Ethernet
34         interface.
35         Only valid for Ethernet interfaces operating at speeds (data
36         rates)
37         above 1000 Mb/s.";
38         reference "IEEE Std 802.3, 30.3.1.1.33 aRateControlAbility";
39     }
40
41  feature csma-cd {
42      description
43         "This feature indicates that the device supports Ethernet
44         interfaces running at half-duplex using CSMA/CD.";
45     }
46
47  typedef dynamic-rate-control-type {
48      type enumeration {
49          enum disabled {
50              description
51                 "Dynamic rate control is disabled";
52          }
53
54          enum "sonet-oc192" {
55              value 2;
56              description
57                 "Dynamic rate control is enabled for a 10 Gb/s Ethernet
58                 interface to SONET/SDH OC192/STM64.";
```

```

1      }
2    }
3    default disabled;
4    description
5      "Allowed values for dynamic-rate-control.";
6    reference
7      "IEEE Std 802.3, 4.4.2 ipgStretchRatio and 30.3.1.1.34
8      aRateControlStatus";
9  }
10
11  augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet" {
12    when "derived-from-or-self(..if:type, 'ianaift:ethernetCsmacd')
13      and ieee802-eth-if:duplex = 'half'" {
14      description
15        "Applies to half-duplex Ethernet interfaces.";
16    }
17
18    description
19      "Augment with Ethernet interface configuration parameters
20      for half-duplex operation.";
21
22    leaf dynamic-rate-control {
23      if-feature "dynamic-rate-control";
24      type dynamic-rate-control-type;
25      description
26        "Enables dynamic rate control and specifies what speed (data
27        rate)
28        the dynamic rate control is operating at. The value of this
29        attribute
30        is constrained by the MAC data rate and hardware support.
31        The default value is implementation-dependent.";
32      reference
33        "IEEE Std 802.3, 30.3.1.1.34 aRateControlStatus";
34    }
35  }
36
37  augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet/" +
38    "ieee802-eth-if:capabilities"{
39    when "derived-from-or-self(..if:type,
40      'ianaift:ethernetCsmacd') and ../ieee802-eth-if:duplex = 'half'" {
41      description "Applies to half-duplex Ethernet interfaces";
42    }
43
44    description
45      "Augment with configuration capabilities for half-duplex
46      Ethernet interface.";
47
48    leaf dynamic-rate-control-supported {
49      if-feature "dynamic-rate-control";
50      type boolean;
51      default false;
52      description
53        "Indicates whether the Ethernet interface supports lowering
54        the average data rate of the MAC sublayer, with frame

```

```

1      granularity, by using Rate Control to dynamically increase
2      the inter-packet gap.
3      Only valid for Ethernet interfaces operating at speeds (data
4      rates)
5      above 1000 Mb/s.";
6      reference
7      "IEEE Std 802.3, 30.3.1.1.33 aRateControlAbility";
8  }
9  }
10
11  augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet/" +
12  "ieee802-eth-if:statistics/ieee802-eth-if:frame" {
13    when "derived-from-or-self(..../if:type,
14      'ianaift:ethernetCsmacd') and ..../ieee802-eth-if:duplex = 'half'"
15  {
16    description
17      "Applies to half-duplex Ethernet interfaces.";
18  }
19  description
20    "Augment with statistics for half-duplex Ethernet interface.";
21
22  container "csma-cd" {
23    if-feature "csma-cd";
24    description
25      "Holds counters that are specific to CDMA/CD half-duplex
26      operation of Ethernet interfaces.
27      Discontinuities in the values of the counters in this
28      container can occur at re-initialization of the management
29      system, and at other times as indicated by the value of the
30      'discontinuity-time' leaf defined in the ietf-interfaces
31      YANG module (IETF RFC 8343).";
32
33    leaf in-errors-sqe-test {
34      type yang:counter64;
35      units errors;
36      description
37        "A count of times that the SQE TEST ERROR is received on a
38        particular interface. The SQE TEST ERROR is set in
39        accordance with the rules for verification of the SQE
40        detection mechanism in the PLS Carrier Sense Function as
41        described in IEEE Std 802.3, 7.2.4.6.
42        This counter does not increment on Ethernet interfaces
43        operating at speeds (data rates) greater than 10 Mb/s, or on
44        Ethernet interfaces operating in full-duplex mode.
45        Discontinuities in the value of this counter can occur at
46        re-initialization of the management system, and at other
47        times as indicated by the value of the
48        'discontinuity-time' leaf defined in the ietf-interfaces
49        YANG module (IETF RFC 8343).";
50      reference
51        "IEEE Std 802.3, 7.2.4.6, and 30.3.2.1.4 aSQETestErrors";
52    }
53
54    leaf out-frames-collision-single {

```

```
1      type yang:counter64;
2      units frames;
3      description
4          "A count of frames that are involved in a single collision,
5          and are subsequently transmitted successfully. A frame
6          that is counted by an instance of this object is also
7          counted by the corresponding instance of either
8          'out-unicast-frames', 'out-broadcast-frames', or
9          'out-multicast-frames', and is not counted by the
10         corresponding instance of the
11         'out-frames-collision-multiple'."
12
13         This counter does not increment when the Ethernet
14         interface is operating in full-duplex mode.
15         Discontinuities in the value of this counter can occur at
16         re-initialization of the management system, and at other
17         times as indicated by the value of the
18         'discontinuity-time' leaf defined in the ietf-interfaces
19         YANG module (IETF RFC 8343).";
20     reference
21         "IEEE Std 802.3, 30.3.1.1.3 aSingleCollisionFrames";
22 }
23
24 leaf out-frames-collision-multiple {
25     type yang:counter64;
26     units frames;
27     description
28         "A count of frames that are involved in multiple
29         collisions, and are subsequently transmitted
30         successfully. A frame that is counted by an instance of
31         this object is also counted by the corresponding instance
32         of either 'out-unicast-frames', 'out-broadcast-frames', or
33         'out-multicast-frames', and is not counted by the
34         corresponding instance of the 'out-frames-collision-single'.
35         This counter does not increment when the Ethernet
36         interface is operating in full-duplex mode.
37         Discontinuities in the value of this counter can occur at
38         re-initialization of the management system, and at other
39         times as indicated by the value of the
40         'discontinuity-time' leaf defined in the ietf-interfaces
41         YANG module (IETF RFC 8343).";
42     reference
43         "IEEE Std 802.3, 30.3.1.1.4 aMultipleCollisionFrames";
44 }
45
46 leaf out-frames-deferred {
47     type yang:counter64;
48     units frames;
49     description
50         "A count of frames for which the first transmission attempt
51         on a particular Ethernet interface is delayed because the
52         medium is busy.
53         A deferred frame that is not subject to any number of
54         collisions is not counted by an instance of
```

```
1         'out-frames-collision-single' or
2         'out-frames-collision-multiple' objects.
3         This counter does not increment when the Ethernet
4         interface is operating in full-duplex mode.
5         Discontinuities in the value of this counter can occur at
6         re-initialization of the management system, and at other
7         times as indicated by the value of the
8         'discontinuity-time' leaf defined in the ietf-interfaces
9         YANG module (IETF RFC 8343).";
10        reference
11        "IEEE Std 802.3, 30.3.1.1.9 aFramesWithDeferredXmissions";
12    }
13
14    leaf out-frames-collisions-excessive {
15        type yang:counter64;
16        units frames;
17        description
18            "A count of frames for which transmission on a particular
19            Ethernet interface fails due to excessive collisions.
20
21            This counter does not increment when the Ethernet
22            interface is operating in full-duplex mode.
23            Discontinuities in the value of this counter can occur at
24            re-initialization of the management system, and at other
25            times as indicated by the value of the
26            'discontinuity-time' leaf defined in the ietf-interfaces
27            YANG module (IETF RFC 8343).";
28        reference
29        "IEEE Std 802.3, 30.3.1.1.11 aFramesAbortedDueToXSColls";
30    }
31
32    leaf out-collisions-late {
33        type yang:counter64;
34        units collisions;
35        description
36            "The number of times that a collision is detected on a
37            particular Ethernet interface later than one slotTime into
38            the transmission of a packet.
39            A (late) collision included in a count represented by an
40            instance of this object is also considered as a (generic)
41            collision for purposes of other collision-related
42            statistics.
43            This counter does not increment when the Ethernet
44            interface is operating in full-duplex mode.
45            Discontinuities in the value of this counter can occur at
46            re-initialization of the management system, and at other
47            times as indicated by the value of the
48            'discontinuity-time' leaf defined in the ietf-interfaces
49            YANG module (IETF RFC 8343).";
50        reference
51        "IEEE Std 802.3, 30.3.1.1.10 aLateCollisions";
52    }
53
54    leaf out-errors-carrier-sense {
```

```
1      type yang:counter64;
2      units errors;
3      description
4          "The number of times that the carrier sense condition was
5           lost or never asserted when attempting to transmit a frame
6           on a particular Ethernet interface.
7           The count represented by an instance of this object is
8           incremented at most once per transmission attempt, even if
9           the carrier sense condition fluctuates during a
10          transmission attempt.
11          This counter does not increment when the Ethernet
12          interface is operating in full-duplex mode.
13          Discontinuities in the value of this counter can occur at
14          re-initialization of the management system, and at other
15          times as indicated by the value of the
16          'discontinuity-time' leaf defined in the ietf-interfaces
17          YANG module (IETF RFC 8343).";
18      reference
19          "IEEE Std 802.3, 30.3.1.1.13 aCarrierSenseErrors";
20  }
21
22  list collision-histogram {
23      key collision-count;
24      description
25          "A collection of collision histograms for a particular
26           interface.";
27      reference
28          "IEEE Std 802.3, 30.3.1.1.30 aCollisionFrames";
29      leaf collision-count {
30          type yang:counter64;
31          units collisions;
32          description
33              "The number of per-frame media collisions for which a
34               particular collision histogram cell represents the
35               frequency on a particular interface.";
36      }
37      leaf collision-count-frames {
38          type yang:counter64;
39          units frames;
40          description
41              "A count of individual MAC frames for which the
42               transmission (successful or otherwise) on a particular
43               interface occurs after the frame has experienced exactly
44               the number of collisions in the associated dot3CollCount
45               object.
46               For example, a frame which is transmitted on an
47               interface after experiencing exactly 4 collisions would
48               be indicated by incrementing only collision-count-frames
49               object associated with the collision-count value of
50               4. No other instance of collision-count-frames would be
51               incremented in this example.
52               This counter does not increment when the interface is
53               operating in full-duplex mode.
54               Discontinuities in the value of this counter can occur
```

```
1         at re-initialization of the management system, and at
2         other times as indicated by the value of the
3         'discontinuity-time' leaf defined in the ietf-interfaces
4         YANG module (IETF RFC 8343).";
```

```
5     }
6   }
7 }
8 }
9 }
10 }
11 }
```

### 5.3.2.3 Ethernet MAC merge module

```
16 module ieee802-ethernet-mac-merge {
17   yang-version "1.1";
18   namespace "urn:ieee:std:802.3:yang:ieee802-ethernet-mac-merge";
19   prefix "mac-merge";
20
21   import ietf-yang-types {
22     prefix yang;
23     reference "IETF RFC 6991";
24   }
25
26   import ietf-interfaces {
27     prefix if;
28     reference "IETF RFC 8343";
29   }
30
31   import ieee802-ethernet-interface {
32     prefix ieee802-eth-if;
33     reference "IEEE Std 802.3.2-2019";
34   }
35
36   organization
37     "IEEE Std 802.3 Ethernet Working Group
38     Web URL: http://www.ieee802.org/3/";
39
40   contact
41     "Web URL: http://www.ieee802.org/3/";
42
43   description
44     "The Yang model for managing devices that support the MAC merge sub-
45     layer as defined in Clause 99.
46     Unless otherwise indicated, the references in this model module are
47     to IEEE Std 802.3-2018.";
48
49   revision 2023-04-29 {
50     description
51       "Initial version.";
52     reference
53       "IEEE Std 802.3-2018";
54   }
55
56   feature mac-merge {
```

```

1      description
2      "Each Port supports the MAC merge sublayer.";
3      reference
4      "IEEE Std 802.3-2018";
5  }
6
7
8  augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet" {
9      if-feature mac-merge;
10     container mac-merge {
11         container admin-control {
12             leaf merge-enable-tx {
13                 type enumeration {
14                     enum "Disabled" {
15                         description
16                             "Transmit preemption is disabled";
17                     }
18                     enum "Enabled" {
19                         description
20                             "Transmit preemption is enabled";
21                     }
22                 }
23             default "Disabled";
24             description
25                 "This attribute indicates (when accessed via a GET
26 operation) the status of the MAC
27 Merge sublayer on the given device in the transmit direction. The status
28 of the
29 MAC Merge sublayer may be modified to the indicated value via a SET
30 operation.
31 This attribute maps to the variable pEnable (see 99.4.7.3).";
32             reference
33                 "30.14.1.3";
34         }
35         leaf verify-disable-tx {
36             type enumeration {
37                 enum "Disabled" {
38                     description
39                         "Verify is disabled";
40                 }
41                 enum "Enabled" {
42                     description
43                         "Verify is enabled";
44                 }
45             }
46             default "Disabled";
47             description
48                 "This attribute indicates (when accessed via a
49 GET operation) the status of the
50 Verify function of MAC Merge sublayer on the given device in the trans-
51 mit direction. The status of the Verify function may be modified to the
52 indicated value via a SET operation. This attribute maps to the variable
53 disableVerify (see 99.4.7.3).";
54             reference
55                 "30.14.1.4";
56         }
57     }
58 }

```



```

1
2         }
3     leaf verify-time {
4         type uint16 {
5             range "1..128";
6         }
7         default "10";
8         description
9             "The value of this attribute defines the nominal
10            wait time between verification
11            attempts in milliseconds. Valid range is 1 to 128 inclusive. The default
12            value is 10. This attribute maps to the variable verifyTime (see
13            99.4.7.3).";
14
15            reference
16                "30.14.1.6";
17        }
18        leaf frag-size {
19            type uint16 {
20                range "0..3";
21            }
22            default "0";
23            description
24                "A 2-bit integer value used to indicate the value
25                of addFragSize variable used by
26                the Transmit Processing State Diagram (see Figure 99?).";
27
28            reference
29                "30.14.1.7";
30        }
31    }
32    container admin-status {
33        config false;
34        leaf merge-support {
35            type enumeration {
36                enum "Supported" {
37                    description
38                        "MAC Merge sublayer is supported on
39                        the device";
40                }
41                enum "Not Supported" {
42                    description
43                        "MAC Merge sublayer is not supported
44                        on the device";
45                }
46            }
47
48            description
49                "This attribute indicates (when accessed via a
50                GET operation) whether the given
51                device supports a MAC Merge sublayer. The SET operation shall have no
52                effect on a
53                device.";
54
55            reference
56                "30.14.1.1";
57        }
58    }
59
60
61
62
63
64
65

```

```

1         leaf verify-status {
2             type enumeration {
3                 enum "unknown" {
4                     description
5                         "Verification status is unknown";
6                 }
7                 enum "initial" {
8                     description
9                         "The Verify State diagram (Figure 99?)
10 is in the state
11
12                     INIT_VERIFICATION";
13                 }
14                 enum "verifying" {
15                     description
16                         "The Verify State diagram is in the state
17 VERIFICATION_IDLE,
18
19                     SEND_VERIFY or WAIT_FOR_RESPONSE";
20                 }
21                 enum "succeeded" {
22                     description
23                         "Indicates that the Verify State diagram
24 is in the state VERIFIED";
25                 }
26                 enum "failed" {
27                     description
28                         "The Verify State diagram is in the state
29 VERIFY_FAIL";
30                 }
31                 enum "disabled" {
32                     description "Verification of preemption oper-
33 ation is disabled";
34                 }
35             }
36             description
37                 "This attribute indicates (when accessed via a
38 GET operation) the status of the
39 MAC Merge sublayer verification on the given device. The SET operation
40 shall have
41 no effect on a device.";
42             reference
43                 "30.14.1.2";
44         }
45     leaf status-tx {
46         type enumeration {
47             enum "unknown" {
48                 description
49                     "transmit preemption status is unknown";
50             }
51             enum "inactive" {
52                 description
53                     "transmit preemption is inactive";
54             }
55             enum "active" {
56                 description

```

```

1             "transmit preemption is active";
2         }
3     }
4     description
5         "This attribute indicates (when accessed via a
6 GET operation) the status of the
7 MAC Merge sublayer on the given device in the transmit direction. The
8 SET
9 operation shall have no effect on a device. This attribute maps to the
10 variable
11 preempt (see 99.4.7.3).";
12     reference
13         "30.14.1.5";
14 }
15 }
16
17 container statistics {
18     config false;
19     leaf assembly-error-count {
20         type yang:counter64;
21         description
22             "A count of MAC frames with reassembly errors.
23 The counter is incremented by one
24 every time the ASSEMBLY_ERROR state in the Receive Processing
25 State Diagram is
26 entered";
27         reference
28             "30.14.1.8";
29     }
30     leaf smd-error-count {
31         type yang:counter64;
32         description
33             "A count of received MAC frames / MAC frame frag-
34 ments rejected due to unknown SMD
35 value or arriving with an SMD-C when no frame is in progress. The
36 counter is
37 incremented by one every time the BAD_FRAG state in the Receive Pro-
38 cessing State
39 Diagram is entered and every time the WAIT_FOR_DV_FALSE state is
40 entered due to
41 the invocation of the SMD_DECODE function returning the value ERR";
42         reference
43             "30.14.1.9";
44     }
45     leaf assembly-ok-count {
46         type yang:counter64;
47         description
48             "count of MAC frames that were successfully reas-
49 sembled and delivered to MAC. The
50 counter is incremented by one every time the FRAME_COMPLETE state in
51 the Receive
52 Processing state diagram (see Figure 99-6) is entered if the state
53 CHECK_FOR_RESUME was previously entered while processing the packet";
54         reference
55

```

```

1           "30.14.1.10";
2       }
3       leaf fragment-count-rx {
4           type yang:counter64;
5           description
6               "A count of the number of additional mPackets
7               received due to preemption. The
8               counter is incremented by one every time the state CHECK_FRAG_CNT in
9               the Receive
10              Processing State Diagram (see Figure 99-6) is entered";
11              reference
12                  "30.14.1.11";
13          }
14          leaf fragment-count-tx {
15              type yang:counter64;
16              description
17                  "A count of the number of additional mPackets
18                  transmitted due to preemption. This
19                  counter is incremented by one every time the SEND_SMD_C state in the
20                  Transmit
21                  Processing State Diagram (see Figure 99-5) is entered.";
22                  reference
23                      "30.14.1.12";
24              }
25              leaf hold-count {
26                  type yang:counter64;
27                  description
28                      "A count of the number of times the variable hold
29                      (see 99.4.7.3) transitions from
30                      FALSE to TRUE.";
31                  reference
32                      "30.14.1.13";
33              }
34          }
35      }
36  }
37  }
38  }
39  }
40  }
41  }
42  }
43  }
44  }
45  }
46  }

```

#### 5.3.2.4 Ethernet LLDP module

```

47
48 module ieee802-ethernet-lldp {
49     yang-version 1.1;
50     namespace "urn:ieee:std:802.3:yang:ieee802-ethernet-lldp";
51     prefix ieee802-eth-lldp;
52
53     import ieee802-dot1ab-lldp {
54         prefix lldp;
55         reference
56             "IEEE Std 802.1ABcu-2021";
57     }
58
59     organization
60         "IEEE Std 802.3 Ethernet Working Group
61

```

```
1      Web URL: http://www.ieee802.org/3/";
2  contact
3      "Web URL: http://www.ieee802.org/3/";
4  description
5      "This module contains YANG definitions for configuring LLDP for
6      802.3 Ethernet Interfaces.
7      In this YANG module, 'Ethernet interface' can be interpreted
8      as referring to 'IEEE Std 802.3 compliant Ethernet
9      interfaces'.";
10
11  revision 2023-07-01 {
12      description
13          "Initial revision.";
14      reference
15          "IEEE Std 802.3.2a, unless dated explicitly";
16  }
17
18  typedef port-class-type {
19      type enumeration {
20          enum p-class-pse {
21              value 0;
22              description
23                  "Power Sourcing Equipment";
24          }
25          enum p-class-pd {
26              value 1;
27              description
28                  "Powered Device";
29          }
30      }
31      description
32          "Enumeration for the power port class";
33      reference
34          "30.12.2.1.5 of IEEE Std 802.3-2022";
35  }
36
37  typedef pse-pinout-type {
38      type enumeration {
39          enum signal {
40              value 0;
41              description
42                  "PSE Pinout Alternative A";
43          }
44          enum spare {
45              value 1;
46              description
47                  "PSE Pinout Alternative B";
48          }
49      }
50      description
51          "Enumeration for the pinout alternatives used for PD detection and
52          power ";
53      reference
54          "30.9.1.1.4 of IEEE Std 802.3-2022";
55  }
```

```
1      }
2
3      typedef pse-power-class-type {
4          type enumeration {
5              enum class0 {
6                  value 0;
7                  description
8                      "Class 0 PD";
9              }
10             enum class1 {
11                 value 1;
12                 description
13                     "Class 1 PD";
14             }
15             enum class2 {
16                 value 2;
17                 description
18                     "Class 2 PD";
19             }
20             enum class3 {
21                 value 3;
22                 description
23                     "Class 3 PD";
24             }
25             enum class4 {
26                 value 4;
27                 description
28                     "Class 4 PD";
29             }
30             description
31                 "Enumeration for the PD class";
32             reference
33                 "30.9.1.1.6 of IEEE Std 802.3-2022";
34         }
35     }
36
37     typedef power-priority-type {
38         type enumeration {
39             enum low {
40                 value 0;
41                 description
42                     "low priority PD";
43             }
44             enum high {
45                 value 1;
46                 description
47                     "high priority PD";
48             }
49             enum critical {
50                 value 2;
51                 description
52                     "critical priority PD";
53             }
54             enum unknown {
```

```
1         value 3;
2         description
3             "priority unknown";
4     }
5 }
6 }
7 description
8     "Enumeration for possible priorities of a PD system";
9 reference
10     "30.12.2.1.16 of IEEE Std 802.3-2022";
11 }
12
13
14 typedef power-source-type {
15     type enumeration {
16         enum pse-primary {
17             value 0;
18             description
19                 "PSE powered by a primary power source";
20         }
21         enum pse-backup {
22             value 1;
23             description
24                 "PSE powered by a backup power source";
25         }
26         enum pse-unknown {
27             value 2;
28             description
29                 "PSE powered by an unknown power source";
30         }
31         enum pd-pse-and-local {
32             value 3;
33             description
34                 "PD powered by a PSE and locally";
35         }
36         enum pd-local-only {
37             value 4;
38             description
39                 "PD powered only locally";
40         }
41         enum pd-pse-only {
42             value 5;
43             description
44                 "PD powered by PD only";
45         }
46         enum pd-unknown {
47             value 6;
48             description
49                 "PD powered by an unknown source";
50         }
51     }
52     description
53         "Enumeration for the power sources of the
54         remote system. When the remote system is a PSE, it indicates
55         whether it is being powered by a primary power source; a
56         backup
57         backup
58         backup
59         backup
60         backup
61         backup
62         backup
63         backup
64         backup
65         backup
```

```
1         power source; or unknown. When the remote system is a PD, it
2         indicates whether it is being powered by a PSE and locally;
3         locally only; by a PSE only; or unknown.";
4     reference
5         "30.12.2.1.15 of IEEE Std 802.3-2022";
6 }
7
8
9 augment "/lldp:lldp/lldp:port" {
10     description
11         "Augments port with 802.3 port config tlvs";
12     leaf tlvs-port-config-enable {
13         type bits {
14             bit mac-phy-config-status {
15                 position 0;
16                 description
17                     "30.12.1.1.1 of IEEE Std 802.3-2022";
18             }
19             bit power-via-mdi {
20                 position 1;
21                 description
22                     "30.12.1.1.1 of IEEE Std 802.3-2022";
23             }
24             bit unused {
25                 position 2;
26                 description
27                     "30.12.1.1.1 of IEEE Std 802.3-2022";
28             }
29             bit max-frame-size {
30                 position 3;
31                 description
32                     "30.12.1.1.1 of IEEE Std 802.3-2022";
33             }
34             bit eee-tlv {
35                 position 4;
36                 description
37                     "30.12.1.1.1 of IEEE Std 802.3-2022";
38             }
39             bit eee-fast-wake-tlv {
40                 position 5;
41                 description
42                     "30.12.1.1.1 of IEEE Std 802.3-2022";
43             }
44             bit additional-ethernet-capabilities-tlv {
45                 position 6;
46                 description
47                     "30.12.1.1.1 of IEEE Std 802.3-2022";
48             }
49         }
50     }
51     description
52         "Bitmap that corresponds to an IEEE 802.3 subtype associated
53         with a specific IEEE 802.3 port config TLV";
54     reference
55         "30.12.1.1.1 of IEEE Std 802.3-2022";
56 }
57
58 }
```



```
1     leaf auto-negotiation-supported {
2         type boolean;
3         config false;
4         description
5             "True if the port supports Auto-negotiation";
6         reference
7             "30.12.2.1.1 of IEEE Std 802.3-2022";
8     }
9
10    leaf auto-negotiation-enabled {
11        type boolean;
12        config false;
13        description
14            "True if Auto-negotiation is enabled";
15        reference
16            "30.12.2.1.2 of IEEE Std 802.3-2022";
17    }
18
19    leaf auto-negotiation-cap {
20        type binary {
21            length "2";
22        }
23        config false;
24        description
25            "A read-only 2-octet value that contains the value (bitmap) of
26            the ifMauAutoNegCapAdvertisedBits object (defined in IETF RFC 4836)
27            which is associated with the given port on the local sys-
28            tem.";
29        reference
30            "30.12.2.1.3 of IEEE Std 802.3-2022";
31    }
32
33    leaf operational-mau-type {
34        type int32;
35        config false;
36        description
37            "32-bit integer value that indicates the operational MAU type of
38            the given port";
39        reference
40            "30.12.2.1.4 of IEEE Std 802.3-2022";
41    }
42
43    leaf power-port-class {
44        type port-class-type;
45        config false;
46        description
47            "A read-only value that identifies the port Class of the given
48            port";
49        reference
50            "30.12.2.1.5 of IEEE Std 802.3-2022";
51    }
52
53    leaf mdi-power-supported {
54        type boolean;
55        config false;
56        description
57            "True if MDI power is supported";
58        reference
59            "30.12.2.1.6 of IEEE Std 802.3-2022";
60    }
61
62
63
64
65
```

```
1      }
2      leaf mdi-power-enabled {
3          type boolean;
4          config false;
5          description
6              "True if MDI power is enabled";
7          reference
8              "30.12.2.1.7 of IEEE Std 802.3-2022";
9      }
10     }
11     leaf power-pair-controlable {
12         type boolean;
13         config false;
14         description
15             "True if the pair selection can be controlled";
16         reference
17             "30.12.2.1.8 of IEEE Std 802.3-2022";
18     }
19     }
20     leaf power-pairs {
21         type pse-pinout-type;
22         config false;
23         description
24             "Indicates which pinout alternative is used for PD detection and
25 power";
26         reference
27             "30.12.2.1.9 of IEEE Std 802.3-2022";
28     }
29     }
30     leaf local-power-class {
31         type pse-power-class-type;
32         config false;
33         description
34             "PD Power Class";
35         reference
36             "30.12.2.1.10 of IEEE Std 802.3-2022";
37     }
38     }
39     leaf link-aggregation-status {
40         type bits {
41             bit aggregation-capability {
42                 position 0;
43                 description
44                     "79.3.3.1 of IEEE Std 802.3-2022";
45             }
46             bit aggregation-status {
47                 position 1;
48                 description
49                     "79.3.3.1 of IEEE Std 802.3-2022";
50             }
51         }
52         config false;
53         description
54             "The bitmap value which contains the link aggregation capabilities
55 and the current aggregation
56 status of the link";
57         reference
58             "30.12.2.1.11 of IEEE Std 802.3-2022";
59     }
```

```
1      }
2      leaf aggregation-port-id {
3          type int32;
4          config false;
5          description
6              "The unique identifier allocated to this Aggregation Port by the
7              local System.";
8          reference
9              "30.12.2.1.12 of IEEE Std 802.3-2022";
10     }
11     leaf local-max-frame-size {
12         type int32;
13         config false;
14         description
15             "An integer value indicating the maximum supported frame size in
16             octets on the given port of the local system.";
17         reference
18             "30.12.2.1.13 of IEEE Std 802.3-2022";
19     }
20     leaf power-type {
21         type bits {
22             bit type1-or-type2 {
23                 position 0;
24                 description
25                     "0-type1, 1-type2";
26             }
27             bit pse-or-pd {
28                 position 1;
29                 description
30                     "0-pse, 1-pd";
31             }
32         }
33         config false;
34         description
35             "A bit string indicating whether the local system is a PSE or a
36             PD and whether it is Type 1 or Type 2. The first bit indicates Type 1 or
37             Type 2.
38             The second bit indicates PSE or PD.";
39         reference
40             "30.12.2.1.14 of IEEE Std 802.3-2022";
41     }
42     leaf power-source {
43         type power-source-type;
44         config false;
45         description
46             "Indicates the power sources of the local system. A PSE indicates
47             whether it is being powered by a primary power source; a backup power
48             source; or unknown. A PD indicates whether it is being powered by a PSE
49             and locally; by a PSE only; or
50             unknown.;";
51         reference
52             "30.12.2.1.15 of IEEE Std 802.3-2022";
53     }
54     leaf local-power-priority {
```

```
1      type power-priority-type;
2      description
3          "Priority of a PD system. For a PSE, this is the priority that the
4 PSE assigns to the PD.
5          For a PD, this is the priority that the PD requests from
6 the PSE";
7      reference
8          "30.12.2.1.16 of IEEE Std 802.3-2022";
9  }
10 leaf pd-requested-power-value {
11     type int32;
12     config false;
13     description
14         "PD requested power value. For a PD, it is the power value that
15 the PD has currently requested from the remote system.
16         For a PSE, it is the power value that the PSE mirrors
17 back to the remote system";
18     reference
19         "30.12.2.1.17 of IEEE Std 802.3-2022";
20 }
21 leaf pse-allocated-power-value {
22     type int32;
23     config false;
24     description
25         "PSE allocated power value. For a PSE, it is the power value that
26 the PSE has currently allocated to the remote system.
27         For a PD, it is the power value that the PD mirrors back
28 to the remote system";
29     reference
30         "30.12.2.1.18 of IEEE Std 802.3-2022";
31 }
32 leaf local-response-time {
33     type int32;
34     config false;
35     description
36         "The maximum time required to update pse-allocated-power-value";
37     reference
38         "30.12.2.1.19 of IEEE Std 802.3-2022";
39 }
40 leaf local-system-ready {
41     type boolean;
42     config false;
43     description
44         "Initialization status of the Data Link Layer classification
45 engine on the local system";
46     reference
47         "30.12.2.1.20 of IEEE Std 802.3-2022";
48 }
49 leaf reduced-operation-power-value {
50     type int32;
51     config false;
52     description
53         "Reduced operation power value. For a PD, it is a power value that
```

```
1         is lower than the currently requested power value. This
2 reduced operation power value represents
3         a power state in which the PD could continue to operate,
4 but with less functionality than at the
5         current PD requested power value. The PSE could optionally
6 use this information in the event that
7         the PSE subsequently requests a lower PD power value than
8 the PD requested power value. For a
9         PSE, it is a power value that the PSE could ask the PD to
10 move to if the PSE wants the PD to move
11         to a lower power state.";
12
13     reference
14         "30.12.2.1.21 of IEEE Std 802.3-2022";
15 }
16
17 leaf tx-system-value {
18     type int32;
19     config false;
20     description
21         "Returns the value of Tw_sys_tx that the local system can support
22 in the transmit direction.";
23     reference
24         "30.12.2.1.22 of IEEE Std 802.3-2022";
25 }
26
27 leaf tx-system-value-echo {
28     type int32;
29     config false;
30     description
31         "Returns the value of Tw_sys_tx that the emote system is adver-
32 tising that it can support in the transmit direction and is echoed by the
33 local system under the control of the EEE DLL receiver state diagram.";
34     reference
35         "30.12.2.1.23 of IEEE Std 802.3-2022";
36 }
37
38 leaf rx-system-value {
39     type int32;
40     config false;
41     description
42         "Returns the value of Tw_sys_tx that the local system is request-
43 ing in the receive direction.";
44     reference
45         "30.12.2.1.24 of IEEE Std 802.3-2022";
46 }
47
48 leaf rx-system-value-echo {
49     type int32;
50     config false;
51     description
52         "Returns the value of Tw_sys_tx that the remote system is adver-
53 tising that it is requesting in the receive direction and is echoed by
54 the local system under the control of the EEE DLL transmitter state dia-
55 gram.";
56     reference
57         "30.12.2.1.25 of IEEE Std 802.3-2022";
58 }
59
60 leaf fallback-system-value {
```

```
1         type int32;
2         config false;
3         description
4             "Returns the value of the fallback Tw_sys_tx that the local sys-
5             tem is advertising to the remote system.";
6         reference
7             "30.12.2.1.26 of IEEE Std 802.3-2022";
8     }
9     leaf tx-dll-ready {
10         type boolean;
11         config false;
12         description
13             "Returns the initialization status of the IEEE transmit Data Link
14             Layer management function on the local system.";
15         reference
16             "30.12.2.1.27 of IEEE Std 802.3-2022";
17     }
18     leaf rx-dll-ready {
19         type boolean;
20         config false;
21         description
22             "Returns the initialization status of the IEEE receive Data Link
23             Layer management function on the local system.";
24         reference
25             "30.12.2.1.28 of IEEE Std 802.3-2022";
26     }
27     leaf dll-enabled {
28         type boolean;
29         config false;
30         description
31             "Returns the status of the IEEE capability negotiation on the
32             local system.";
33         reference
34             "30.12.2.1.29 of IEEE Std 802.3-2022";
35     }
36     leaf tx-system-fw {
37         type boolean;
38         config false;
39         description
40             "Returns the value of LPI_FW that the local system can support in
41             the transmit direction.";
42         reference
43             "30.12.2.1.30 of IEEE Std 802.3-2022";
44     }
45     leaf tx-system-fw-echo {
46         type boolean;
47         config false;
48         description
49             "Returns the value of LPI_FW that the remote system is advertis-
50             ing that it can support in the transmit direction and is echoed by the
51             local system under the control of the IEEE DLL receiver state diagram.";
52         reference
53             "30.12.2.1.31 of IEEE Std 802.3-2022";
54     }
55 }
```

```
1     leaf rx-system-fw {
2         type boolean;
3         config false;
4         description
5             "Returns the value of LPI_FW that the local system is requesting
6 in the receive direction.";
7         reference
8             "30.12.2.1.32 of IEEE Std 802.3-2022";
9     }
10    leaf rx-system-fw-echo {
11        type boolean;
12        config false;
13        description
14            "Returns the value of LPI_FW that the remote system is advertis-
15ing that it is requesting in the receive direction and is echoed by the
16local system under the control of the IEEE DLL transmitter state dia-
17gram.";
18        reference
19            "30.12.2.1.33 of IEEE Std 802.3-2022";
20    }
21    leaf preemption-supported {
22        type boolean;
23        config false;
24        description
25            "Indicates whether the given port (associated with the local Sys-
26tem) supports the preemption capability.";
27        reference
28            "30.12.2.1.34 of IEEE Std 802.3-2022";
29    }
30    leaf preemption-enabled {
31        type boolean;
32        config false;
33        description
34            "Indicates whether the preemption capability is enabled on the
35given port associated with the local System.";
36        reference
37            "30.12.2.1.35 of IEEE Std 802.3-2022";
38    }
39    leaf preemption-active {
40        type boolean;
41        config false;
42        description
43            "Indicates whether the preemption capability is active on the
44given port associated with the local System.";
45        reference
46            "30.12.2.1.36 of IEEE Std 802.3-2022";
47    }
48    leaf additional-fragment-size {
49        type int32;
50        config false;
51        description
52            "Indicate the minimum size of non-final fragments supported by
53the receiver on the given port associated with the local System. This
54value is expressed in units of 64 octets of additional fragment length.";
```

```
1         reference
2         "30.12.2.1.37 of IEEE Std 802.3-2022";
3     }
4 }
5
6
7 augment "/lldp:lldp/lldp:port/lldp:remote-systems-data" {
8     leaf auto-negotiation-supported {
9         type boolean;
10        config false;
11        description
12            "True if the port supports Auto-negotiation";
13        reference
14            "30.12.3.1.1 of IEEE Std 802.3-2022";
15    }
16    leaf auto-negotiation-enabled {
17        type boolean;
18        config false;
19        description
20            "True if Auto-negotiation is enabled";
21        reference
22            "30.12.3.1.2 of IEEE Std 802.3-2022";
23    }
24    leaf auto-negotiation-cap {
25        type binary {
26            length "2";
27        }
28        config false;
29        description
30            "A read-only 2-octet value that contains the value (bitmap) of
31            the ifMauAutoNegCapAdvertisedBits object (defined in IETF RFC 4836)
32            which is associated with the given port on the local sys-
33            tem.";
34        reference
35            "30.12.3.1.3 of IEEE Std 802.3-2022";
36    }
37    leaf operational-mau-type {
38        type int32;
39        config false;
40        description
41            "32-bit integer value that indicates the operational MAU type of
42            the given port";
43        reference
44            "30.12.3.1.4 of IEEE Std 802.3-2022";
45    }
46    leaf power-port-class {
47        type port-class-type;
48        config false;
49        description
50            "A read-only value that identifies the port Class of the given
51            port";
52        reference
53            "30.12.3.1.5 of IEEE Std 802.3-2022";
54    }
55    leaf mdi-power-supported {
```



```
1      type boolean;
2      config false;
3      description
4          "True if MDI power is supported";
5      reference
6          "30.12.3.1.6 of IEEE Std 802.3-2022";
7  }
8
9  leaf mdi-power-enabled {
10     type boolean;
11     config false;
12     description
13         "True if MDI power is enabled";
14     reference
15         "30.12.3.1.7 of IEEE Std 802.3-2022";
16 }
17
18 leaf power-pair-controlable {
19     type boolean;
20     config false;
21     description
22         "True if the pair selection can be controlled";
23     reference
24         "30.12.3.1.8 of IEEE Std 802.3-2022";
25 }
26
27 leaf power-pairs {
28     type pse-pinout-type;
29     config false;
30     description
31         "Indicates which pinout alternative is used for PD detection and
32 power";
33     reference
34         "30.12.3.1.9 of IEEE Std 802.3-2022";
35 }
36
37 leaf power-class {
38     type pse-power-class-type;
39     config false;
40     description
41         "PD Power Class";
42     reference
43         "30.12.3.1.10 of IEEE Std 802.3-2022";
44 }
45
46 leaf link-aggregation-status {
47     type bits {
48         bit aggregation-capability {
49             position 0;
50             description
51                 "79.3.3.1 of IEEE Std 802.3-2022";
52         }
53         bit aggregation-status {
54             position 1;
55             description
56                 "79.3.3.1 of IEEE Std 802.3-2022";
57         }
58         bit bit2-reserved {
59             position 2;
```

```
1         description
2             "79.3.3.1 of IEEE Std 802.3-2022";
3     }
4     bit bit3-reserved {
5         position 3;
6         description
7             "79.3.3.1 of IEEE Std 802.3-2022";
8     }
9     bit bit4-reserved {
10        position 4;
11        description
12            "79.3.3.1 of IEEE Std 802.3-2022";
13    }
14    bit bit5-reserved {
15        position 5;
16        description
17            "79.3.3.1 of IEEE Std 802.3-2022";
18    }
19    bit bit6-reserved {
20        position 6;
21        description
22            "79.3.3.1 of IEEE Std 802.3-2022";
23    }
24    bit bit7-reserved {
25        position 7;
26        description
27            "79.3.3.1 of IEEE Std 802.3-2022";
28    }
29    }
30    config false;
31    description
32        "The bitmap value which contains the link aggregation capabilities and the current aggregation
33        status of the link";
34    reference
35        "30.12.3.1.11 of IEEE Std 802.3-2022";
36    }
37    leaf aggregation-port-id {
38        type int32;
39        config false;
40        description
41            "The unique identifier allocated to this Aggregation Port by the
42            local System.";
43        reference
44            "30.12.3.1.12 of IEEE Std 802.3-2022";
45    }
46    leaf local-max-frame-size {
47        type int32;
48        config false;
49        description
50            "An integer value indicating the maximum supported frame size in
51            octets on the given port of the local system.";
52        reference
53            "30.12.3.1.13 of IEEE Std 802.3-2022";
54    }
55    }
```

```
1      }
2      leaf power-type {
3          type bits {
4              bit type1-or-type2 {
5                  position 0;
6                  description
7                      "0-type1, 1-type2";
8              }
9              bit pse-or-pd {
10                 position 1;
11                 description
12                     "0-pse, 1-pd";
13             }
14         }
15         config false;
16         description
17             "A bit string indicating whether the local system is a PSE or a
18             PD and whether it is Type 1 or Type 2. The first bit indicates Type 1 or
19             Type 2.
20             The second bit indicates PSE or PD.";
21         reference
22             "30.12.3.1.14 of IEEE Std 802.3-2022";
23     }
24     leaf power-source {
25         type power-source-type;
26         config false;
27         description
28             "Indicates the power sources of the remote system. A PSE indi-
29             cates whether it is being powered by a primary power source; a backup
30             power source; or unknown. A PD indicates whether it is being powered by a
31             PSE and locally; by a PSE only; or
32             unknown.;";
33         reference
34             "30.12.3.1.15 of IEEE Std 802.3-2022";
35     }
36     leaf power-priority {
37         type power-priority-type;
38         description
39             "the priority of the PD system received from the remote system";
40         reference
41             "30.12.3.1.16 of IEEE Std 802.3-2022";
42     }
43     leaf pd-requested-power-value {
44         type int32;
45         config false;
46         description
47             "PD requested power value that was used by the remote system to
48             compute the power value that is has currently allocated to the PD.";
49         reference
50             "30.12.3.1.17 of IEEE Std 802.3-2022";
51     }
52     leaf pse-allocated-power-value {
53         type int32;
54         config false;
```

```
1      description
2      "PSE allocated power value. For a PSE, it is the power value that
3      the PSE has currently allocated to the remote system.
4      For a PD, it is the power value that the PD mirrors back
5      to the remote system";
6      reference
7      "30.12.3.1.18 of IEEE Std 802.3-2022";
8  }
9
10     leaf tx-system-value {
11         type int32;
12         config false;
13         description
14             "Returns the value of Tw_sys_tx that the remote system can sup-
15             port in the transmit direction.";
16         reference
17             "30.12.3.1.19 of IEEE Std 802.3-2022";
18     }
19
20     leaf tx-system-value-echo {
21         type int32;
22         config false;
23         description
24             "Returns the value of Tw_sys_tx that the local system is adver-
25             tising that it can support in the transmit direction and is echoed by the
26             local system under the control of the IEEE DLL receiver state diagram.";
27         reference
28             "30.12.3.1.20 of IEEE Std 802.3-2022";
29     }
30
31     leaf rx-system-value {
32         type int32;
33         config false;
34         description
35             "Returns the value of Tw_sys_tx that the remote system is
36             requesting in the receive direction.";
37         reference
38             "30.12.3.1.21 of IEEE Std 802.3-2022";
39     }
40
41     leaf rx-system-value-echo {
42         type int32;
43         config false;
44         description
45             "Returns the value of Tw_sys_tx that the local system is adver-
46             tising that it is requesting in the receive direction and is echoed by
47             the local system under the control of the IEEE DLL transmitter state dia-
48             gram.";
49         reference
50             "30.12.3.1.22 of IEEE Std 802.3-2022";
51     }
52
53     leaf fallback-system-value {
54         type int32;
55         config false;
56         description
57             "Returns the value of the fallback Tw_sys_tx that the remote sys-
58             tem is advertising to the remote system.";
59         reference
```

```
1      "30.12.3.1.23 of IEEE Std 802.3-2022";
2  }
3  leaf tx-system-fw {
4      type boolean;
5      config false;
6      description
7          "Returns the value of LPI_FW that the remote system can support
8  in the transmit direction.";
9      reference
10         "30.12.3.1.24 of IEEE Std 802.3-2022";
11  }
12  leaf tx-system-fw-echo {
13      type boolean;
14      config false;
15      description
16          "Returns the value of LPI_FW that the local system is advertising
17  that it can support in the transmit direction and is echoed by the local
18  system under the control of the EEE DLL receiver state diagram.";
19      reference
20         "30.12.3.1.25 of IEEE Std 802.3-2022";
21  }
22  leaf rx-system-fw {
23      type boolean;
24      config false;
25      description
26          "Returns the value of LPI_FW that the remote system is requesting
27  in the receive direction.";
28      reference
29         "30.12.3.1.26 of IEEE Std 802.3-2022";
30  }
31  leaf rx-system-fw-echo {
32      type boolean;
33      config false;
34      description
35          "Returns the value of LPI_FW that the local system is advertising
36  that it is requesting in the receive direction and is echoed by the local
37  system under the control of the EEE DLL transmitter state diagram.";
38      reference
39         "30.12.3.1.27 of IEEE Std 802.3-2022";
40  }
41  leaf preemption-supported {
42      type boolean;
43      config false;
44      description
45          "Indicates whether the given port (associated with the remote
46  System) supports the preemption capability.";
47      reference
48         "30.12.3.1.28 of IEEE Std 802.3-2022";
49  }
50  leaf preemption-enabled {
51      type boolean;
52      config false;
53      description
```

```
1         "Indicates whether the preemption capability is enabled on the
2 given port associated with the remote System.";
3     reference
4         "30.12.3.1.29 of IEEE Std 802.3-2022";
5     }
6     leaf preemption-active {
7         type boolean;
8         config false;
9         description
10            "Indicates whether the preemption capability is active on the
11 given port associated with the remote System.";
12     reference
13         "30.12.3.1.30 of IEEE Std 802.3-2022";
14     }
15     leaf additional-fragment-size {
16         type int32;
17         config false;
18         description
19            "Indicate the minimum size of non-final fragments supported by
20 the receiver on the given port associated with the remote System. This
21 value is expressed in units of 64 octets of additional fragment length.";
22     reference
23         "30.12.3.1.31 of IEEE Std 802.3-2022";
24     }
25 }
26
27
28
29
30
31
32
33
34
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```

## 6. YANG module for Ethernet data terminal equipment (DTE) power via medium dependent interface (MDI) and Power over Data Lines (PoDL)

### 6.1 Introduction

This clause defines a YANG module to manage power via MDI Power Sourcing Equipment (PSE) and Power over Data Line (PoDL) PSE.

IEEE Std 802.3 defines the hardware registers that allow management interfaces to be built for a DTE Power via MDI and Power over Data Line device. The YANG module defined in this clause extends the Ethernet-interface YANG data modules defined in Clause 5 with the management objects required for the management of PoE and PoDL devices and ports.

### 6.2 YANG module structure

The *ieee802-ethernet-pse* YANG module of this clause is focused on the configuration and monitoring of the Power over Ethernet (PoE) function defined in IEEE Std 802.3, including power via MDI, as well as Power over Data Line which can also be considered as the single pair PoE. The module augments the *ieee802-ethernet-interface* YANG module with attributes for the PoE function. The module is partitioned into two major containers.

The PoE PSE container describes a multi-pair PSE, while the PoDL PSE describes a single-pair PSE.

### 6.3 Security considerations for Ethernet data terminal equipment (DTE) power via medium dependent interface (MDI) and Power over Data Line Module

There are a number of data nodes defined in this YANG module that are configurable as read-write. Such data nodes may be considered sensitive or vulnerable in some network environments. The support for configuration operations in a non-secure environment without proper protection can have a negative effect on network operations.

Setting the following data nodes to incorrect values can result in improper operation of the PSE, including the possibility that the Powered Device (PD) does not receive power from the PSE port:

- `pse-enable`
- `powering-pairs`

Some of the readable operational states in this module may be considered sensitive or vulnerable in some network environments. These are as follows:

- `pairs-control-ability`
- `classifications`
- `pd-power-class`
- `pse-type`
- `detected-pd-type`

It is thus important to control GET access to these data nodes and to possibly encrypt their values when sending them over the network.

### 6.4 Mapping of IEEE Std 802.3, Clause 30 managed objects

This subclause contains the mapping between YANG data nodes included in *ieee802-ethernet-pse* (see Table 6-1) YANG module, managed objects, and attributes defined in IEEE Std 802.3, Clause 30.

**Table 6–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-pse* YANG data nodes**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-pse</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
N/A	N/A		interfaces/interface/ethernet/pse	supported-pse-type	R
oPSE	aPSEAdminState	30.9.1	interfaces/interface/ethernet/pse/multi-pair	pse-enable	R
	aPSEPowerPairs			powering-pairs	R/W
	aPSEPowerPairsControlAbility			pairs-control-ability	R
	aPSEPowerDetectionStatus			detection-status	R
	aPSEPowerClassification			classifications	R
	aPSEActualPower			actual-power	R
	aPSEPowerAccuracy			power-accuracy	R
	aPSEInvalidSignatureCounter		interfaces/interface/ethernet/pse/multi-pair/statistics	invalid-signature	R
	aPSEPowerDeniedCounter			power-denied	R
	aPSEOverLoadCounter			overload	R
	aPSEShortCounter			short	R
	aPSEMPSAbsentCounter			mps-absent	R
	aPSECumulativeEnergy			cumulative-energy	R



**Table 6–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-pse* YANG data nodes (continued)**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-pse</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oPoDLPSE	aPoDLPSEAdminState	30.15	interfaces/interface/ethernet/pse/single-pair	pse-enable	R
	aPoDLPSEPowerDetectionStatus			detection-status	R
	aPoDLPSEType			podl-type	R
	aPoDLPSEDetectedPDType			detected-pd-type	R
	aPoDLPSEDetectedPDPowerClass			pd-power-class	R
	aPoDLPSEActualPower			actual-power	R
	aPoDLPSEPowerAccuracy			power-accuracy	R
	aPoDLPSEInvalidSignatureCounter		interfaces/interface/ethernet/pse/single-pair/statistics	invalid-signature	R
	aPoDLPSEInvalidClassCounter			invalid-class	R
	aPoDLPSEPowerDeniedCounter			power-denied	R
	aPoDLPSEOverLoadCounter			overload	R
	aPoDLPSEMaintainFullVoltageSignatureAbsentCounter			fvs-absent	R
	aPoDLPSECumulativeEnergy			cumulative-energy	R

## 6.5 YANG module definition<sup>1</sup>

The YANG module tree hierarchy uses terms defined in IETF RFC 8407.

### 6.5.1 Tree hierarchy

```
module: ieee802-ethernet-pse
  augment /if:interfaces/if:interface/ieee802-eth-if:ethernet:
    +--rw pse
      +--ro supported-pse-type?    identityref
      +--rw multi-pair!
        | +--rw pse-enable?        boolean
        | +--rw powering-pairs?    identityref
        | +--ro pairs-control-ability? boolean
        | +--ro detection-status?  multi-pair-detection-state
        | +--ro classifications?   power-class
        | +--ro statistics
        | | +--ro power-denied?    yang:counter64
        | | +--ro invalid-signature? yang:counter64
        | | +--ro mps-absent?      yang:counter64
        | | +--ro overload?        yang:counter64
        | | +--ro short?           yang:counter64
        | | +--ro cumulative-energy? yang:counter64
        | +--ro actual-power?      decimal64
        | +--ro power-accuracy?    int64
      +--rw single-pair!
        +--rw pse-enable?        boolean
        +--ro detection-status?   single-pair-detection-state
        +--ro podl-type?          enumeration
        +--ro detected-pd-type?   enumeration
        +--ro pd-power-class?     power-class
        +--ro statistics
        | +--ro power-denied?      yang:counter64
        | +--ro invalid-signature? yang:counter64
        | +--ro invalid-class?     yang:counter64
        | +--ro overload?          yang:counter64
        | +--ro fvs-absence?       yang:counter64
        | +--ro cumulative-energy?   yang:counter64
        +--ro actual-power?        decimal64
        +--ro power-accuracy?      int64
```

<sup>1</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

## 6.5.2 YANG module

In the following YANG module definition, should any discrepancy between the text of the description for individual YANG nodes and the corresponding definition in 6.2 through 6.5 of this clause occur, the definitions and mappings in 6.5 shall take precedence.

An ASCII text version of the YANG module can be found at the following URL:<sup>m</sup> <https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.3>.

```
module ieee802-ethernet-pse{
  yang-version 1.1;
  namespace "urn:ieee:std:802.3:yang:ieee802-ethernet-pse";
  prefix ieee802-pse;

  revision 2019-06-21 {
    description "Initial revision.";
  }

  import ietf-interfaces {
    prefix "if";
    reference "IETF RFC 8343";
  }

  import ietf-yang-types {
    prefix yang;
    reference "IETF RFC 6991";
  }

  import ieee802-ethernet-interface {
    prefix ieee802-eth-if;
  }

  organization
    "IEEE 802.3 Ethernet Working Group
    Web URL: http://www.ieee802.org/3/";

  contact
    "Web URL: http://www.ieee802.org/3/";

  description
    "This module contains YANG definitions for configuring and
    managing ports with Power Over Ethernet feature defined by
    IEEE 802.3. It provides functionality roughly equivalent to
    that of the POWER-ETHERNET-MIB defined in IETF RFC 3621.";

  reference
    "IEEE Std 802.3-2018, unless dated explicitly";

  typedef multi-pair-detection-state {
    type enumeration {
      enum disabled {
        value 1;
      }
    }
  }
```

<sup>m</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```
1      description "PSE disabled.";
2    }
3    enum searching {
4      value 2;
5      description "PSE is searching.";
6    }
7    enum deliveringPower {
8      value 3;
9      description "PSE is delivering power.";
10   }
11   enum fault {
12     value 4;
13     description "PSE fault detected.";
14   }
15   enum test {
16     value 5;
17     description "PSE test mode.";
18   }
19   enum otherFault {
20     value 6;
21     description "PSE implementation specific fault detected.";
22   }
23 }
24
25 description
26   "Detection state of a multi-pair PSE.";
27 reference
28   "IEEE Std 802.3, 30.9.1.1.5";
29 }
30
31 typedef single-pair-detection-state{
32   type enumeration {
33     enum unknown {
34       value 1;
35       description "True detection state unknown.";
36     }
37     enum disabled {
38       value 2;
39       description "PoDL PSE is disabled.";
40     }
41     enum searching {
42       value 3;
43       description "PoDL PSE is searching.";
44     }
45     enum deliveringPower {
46       value 4;
47       description "PoDL PSE is delivering power.";
48     }
49     enum sleep {
50       value 5;
51       description "PoDL PSE is in sleep state.";
52     }
53     enum idle {
54       value 6;
55       description "PoDL PSE is idle.";
56     }
57   }
58 }
```

```
1      }
2      enum error {
3          value 7;
4          description "PoDL PSE error.";
5      }
6  }
7
8
9  description
10     "Detection state of a PoDL PSE.";
11  reference
12     "IEEE Std 802.3, 30.15.1.1.3";
13 }
14
15
16 typedef power-class {
17     type enumeration {
18         enum class0 {
19             value 1;
20             description "Class 0";
21         }
22         enum class1 {
23             value 2;
24             description "Class 1";
25         }
26         enum class2 {
27             value 3;
28             description "Class 2";
29         }
30         enum class3 {
31             value 4;
32             description "Class 3";
33         }
34         enum class4 {
35             value 5;
36             description "Class 4";
37         }
38         enum class5 {
39             value 6;
40             description "Class 5 (for PoDL-only)";
41         }
42         enum class6 {
43             value 7;
44             description "Class 6 (for PoDL-only)";
45         }
46         enum class7 {
47             value 8;
48             description "Class 7 (for PoDL-only)";
49         }
50         enum class8 {
51             value 9;
52             description "Class 8 (for PoDL-only)";
53         }
54         enum class9 {
55             value 10;
56             description "Class 9 (for PoDL-only)";
57         }
58     }
59 }
```

```
1      }
2      enum unknown {
3          value 11;
4          description
5              "Initializing, true Power Class not yet known
6              (only for PoDL PSE).";
7      }
8  }
9  }
10 }
11 description
12     "Power class.";
13 reference
14     "IEEE Std 802.3, 30.9.1.1.6 aPSEPowerClassification and
15     IEEE Std 802.3, 30.15.1.1.6 aPoDLPSEDetectedPDPowerClass.";
16 }
17
18
19 identity pse-type {
20     description "Base type for PSE.";
21 }
22
23
24 identity multi-pair {
25     base pse-type;
26     description "PSE supports IEEE Std 802.3, Clause 33.";
27 }
28
29
30 identity single-pair {
31     base pse-type;
32     description "PSE support IEEE Std 802.3, Clause 104.";
33 }
34
35
36 identity powering-pairs {
37     description "Base type for powering pairs.";
38 }
39
40 identity signal {
41     base powering-pairs;
42     description "The signal pair is in use.";
43 }
44
45 identity spare {
46     base powering-pairs;
47     description "The spare pair is in use.";
48 }
49
50 augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet" {
51     description
52         "Augments ethernet interface configuration model with
53         nodes specific to DTE Power via MDI devices and ports";
54
55
56     container pse {
57         description
58             "DTE Power via MDI port configuration";
59         reference
60             "IEEE Std 802.3, 30.9.1 PoE PSE & IEEE Std 802.3, 30.15.1 PoDL
61             PSE";
62
63
64         leaf supported-pse-type {
65
```

```
1      type identityref {
2          base ieee802-pse:pse-type ;
3      }
4      config false;
5      description
6          "PSE may support IEEE Std 802.3, Clause 33 or
7           IEEE Std 802.3, Clause 104.";
8      }
9
10
11
12  container multi-pair {
13      presence "PSE port supports IEEE Std 802.3, Clause 33.";
14
15      description
16          "PSE port configuration in IEEE Std 802.3, 30.9.1.";
17
18      leaf pse-enable {
19          type boolean;
20          default false;
21          description
22              "When true enables the PSE function on the interface,
23               when false disables the PSE function on the interface.";
24          reference
25              "IEEE Std 802.3, 30.9.1.1.2 aPSEAdminState";
26      }
27
28      leaf powering-pairs {
29          type identityref {
30              base powering-pairs;
31          }
32          description
33              "Describes or controls the PSE pairs in use. If the value of
34               pairs-control-ability is true, this object is
35               writeable.";
36          reference
37              "IEEE Std 802.3, 30.9.1.1.4 aPSEPowerPairs";
38      }
39
40      leaf pairs-control-ability {
41          type boolean;
42          default true;
43          config false;
44          description
45              "Describes the ability to control switching the
46               power sourcing pins of the PSE.";
47          reference
48              "IEEE Std 802.3, 30.9.1.1.3 aPSEPowerPairsControlAbility";
49      }
50
51      leaf detection-status {
52          type multi-pair-detection-state;
53          config false;
54          description
55              "Describes the operational status of the port
```

```
1         PD detection.";
2     reference
3         "IEEE Std 802.3, 30.9.1.1.5 aPSEPowerDetectionStatus";
4     }
5
6
7     leaf classifications {
8         when "../detection-status = 'deliveringPower'" {
9             description
10                "This node only applies when the detection status is
11                delivering power.";
12            }
13        }
14        type power-class;
15        config false;
16        description
17            "The power class of the PSE port.";
18        reference
19            "IEEE Std 802.3, 30.9.1.1.6 aPSEPowerClassification";
20    }
21
22
23    container statistics {
24        config false;
25        description
26            "statistics information of the multi-pair port.";
27
28
29        leaf power-denied {
30            type yang:counter64;
31            description
32                "This counter is incremented when the PSE state diagram
33                enters the POWER_DENIED state, per IEEE Std 802.3,
34                Figure 33-9.";
35            reference
36                "IEEE Std 802.3, 30.9.1.1.8 aPSEPowerDeniedCounter";
37        }
38
39
40        leaf invalid-signature {
41            type yang:counter64;
42            description
43                "This counter is incremented when the PSE state diagram
44                enters the SIGNATURE_INVALID state per IEEE Std 802.3,
45                Figure 33-9.";
46            reference
47                "IEEE Std 802.3, 30.9.1.1.7 aPSEInvalidSignatureCounter";
48        }
49
50
51        leaf mps-absent {
52            type yang:counter64;
53            description
54                "This counter is incremented when the PSE
55                transitions directly from the POWER_ON state to the
56                IDLE state due to tmpdo_timer_done being asserted,
57                per IEEE Std 802.3, Figure 33-9.";
58            reference
59                "IEEE Std 802.3, 30.9.1.1.11 aPSEMPSAbsentCounter";
60        }
61    }
62
63
64
65
```



```
1
2     leaf overload {
3         type yang:counter64;
4         description
5             "This counter is incremented when the PSE state diagram
6             enters the ERROR_DELAY state due to the ovld_detected
7             variable being TRUE, per IEEE Std 802.3, Figure 33-9.";
8         reference
9             "IEEE Std 802.3, 30.9.1.1.9 aPSEOverLoadCounter";
10    }
11
12
13
14    leaf short {
15        type yang:counter64;
16        description
17            "This counter is incremented when the PSE state diagram
18            enters the ERROR_DELAY state due to the short_detected
19            variable being TRUE, per IEEE Std 802.3, Figure 33-9.";
20        reference
21            "IEEE Std 802.3, 30.9.1.1.10 aPSEShortCounter";
22    }
23
24
25
26    leaf cumulative-energy {
27        type yang:counter64;
28        units millijoules;
29        description
30            "The cumulative energy supplied by the PSE as measured at
31            the MDI in millijoules.";
32
33
34        reference
35            "IEEE Std 802.3, 30.9.1.1.14 aPSECumulativeEnergy";
36    }
37
38
39
40
41
42    leaf actual-power {
43        type decimal64 {
44            fraction-digits 4;
45        }
46
47
48        units milliwatts;
49        config false;
50        description
51            "The actual power drawn by a PD over the port.";
52        reference
53            "IEEE Std 802.3, 30.9.1.1.12 aPSEActualPower";
54    }
55
56
57
58    leaf power-accuracy {
59        type int64;
60        units milliwatts;
61        config false;
62        description
63            "An integer value indicating the accuracy
64            associated with power-accuracy in +/- milliwatts.";
65    }
```

```
1         reference
2         "IEEE Std 802.3, 30.9.1.1.13 aPSEPowerAccuracy";
3     }
4
5
6 }
7
8 container single-pair {
9     presence "PSE port working in PoDL.";
10
11
12     description
13         "PoDL PSE configuration as defined in
14         IEEE Std 802.3, 30.15.1.";
15
16     leaf pse-enable {
17         type boolean;
18         default false;
19         description
20             "When true enables the PSE function on the interface,
21             when false disables the PSE function on the interface.";
22         reference
23             "IEEE Std 802.3, 30.15.1.1.2 aPoDLPSEAdminState";
24     }
25
26
27     leaf detection-status {
28         type single-pair-detection-state;
29         config false;
30         description
31             "Indicates the current status of the PoDL PSE.";
32         reference
33             "IEEE Std 802.3, 30.15.1.1.3 aPoDLPSEPowerDetectionStatus";
34     }
35
36
37     leaf podl-type {
38         type enumeration {
39             enum unknown {
40                 description "Unknown PSE type.";
41             }
42             enum typeA {
43                 description "TypeA";
44             }
45             enum typeB {
46                 description "TypeB";
47             }
48             enum typeC {
49                 description "TypeC";
50             }
51             enum typeD {
52                 description "TypeD";
53             }
54         }
55         config false;
56         description "PSE type specified in IEEE Std 802.3, 104.4.1.";
57     }
58
59
60 }
61
62
63
64
65
```

```
1      leaf detected-pd-type {
2          when "../detection-status = 'deliveringPower'" {
3              description
4                  "This node only applies when the detection status is
5                  delivering power.";
6              }
7          }
8
9      type enumeration {
10         enum unknown {
11             description "Unknown";
12         }
13         enum typeA {
14             description "TypeA";
15         }
16         enum typeB {
17             description "TypeB";
18         }
19         enum typeC {
20             description "TypeC";
21         }
22         enum typeD {
23             description "TypeD";
24         }
25     }
26     config false;
27     description
28         "Indicates the Type of the detected PoDL PD as specified in
29         IEEE Std 802.3, 104.5.1.";
30
31     reference
32         "IEEE Std 802.3, 30.15.1.1.5 aPoDLPSEDetectedPDType";
33 }
34
35 leaf pd-power-class {
36
37     when "../detection-status = 'deliveringPower'" {
38         description
39             "This node only applies when the detection status is
40             delivering power.";
41     }
42
43     type power-class;
44     config false;
45     description
46         "Power class of the PD detected on the PSE port.";
47     reference
48         "IEEE Std 802.3, 30.15.1.1.6 aPoDLPSEDetectedPDPowerClass";
49 }
50
51 container statistics {
52     config false;
53     description "Statistics information of the single-pair PSE";
54
55     leaf power-denied {
```

```
1         type yang:counter64;
2         description
3             "This counter is incremented when the PoDL PSE state
4             diagram variable power_available transitions from true
5             to false (see IEEE Std 802.3, 104.4.3.3).";
6         reference
7             "IEEE Std 802.3, 30.15.1.1.9 aPoDLPSEPowerDeniedCounter";
8     }
9
10
11     leaf invalid-signature {
12         type yang:counter64;
13         description
14             "This counter is incremented when the PSE state diagram
15             enters the SIGNATURE_INVALID state per
16             IEEE Std 802.3, Figure 33-9.";
17         reference
18             "IEEE Std 802.3, 30.15.1.1.7
19             aPoDLPSEInvalidSignatureCounter";
20     }
21
22
23     leaf invalid-class {
24         type yang:counter64;
25         description
26             "This counter is incremented when the PoDL PSE state
27             diagram variable tclass_timer_done transitions from false
28             to true or when the valid_class variable transitions from
29             true to false (see IEEE Std 802.3, 104.4.3.3).";
30         reference
31             "IEEE Std 802.3, 30.15.1.1.8 aPoDLPSEInvalidClassCounter";
32     }
33
34
35     leaf overload {
36         type yang:counter64;
37         description
38             "This counter is incremented when the PSE state diagram
39             variable overload_held transitions from false to true
40             (see IEEE Std 802.3, 104.4.3.3).";
41         reference
42             "IEEE Std 802.3, 30.15.1.1.10 aPoDLPSEOverLoadCounter";
43     }
44
45
46     leaf fvs-absence {
47         type yang:counter64;
48         description
49             "Maintain Full Voltage Signature absent counter.
50             This counter is incremented when the PoDL PSE state
51             diagram variable mfvs_timeout transitions from false to
52             true (see IEEE Std 802.3, 104.4.3.3).";
53         reference
54             "IEEE Std 802.3, 30.15.1.1.11
55             aPoDLPSEMaintainFullVoltageSignatureAbsentCounter";
56     }
57
58
59
60
61
62
63
64
65
```

```
1
2
3     leaf cumulative-energy {
4         type yang:counter64;
5         units millijoules;
6         description
7             "A count of the cumulative energy supplied by the PoDL
8             PSE, measured at the MDI, and expressed in units of
9             millijoules.";
10        reference
11            "IEEE Std 802.3, 30.15.1.1.14 aPoDLPSECumulativeEnergy";
12    }
13
14
15
16
17
18
19
20
21    leaf actual-power {
22        type decimal64 {
23            fraction-digits 4;
24        }
25
26
27
28        units milliwatts;
29        config false;
30        description
31            "An integer value indicating present (actual) power being
32            supplied by the PoDL PSE as measured at the MDI in
33            milliwatts.";
34        reference
35            "IEEE Std 802.3, 30.15.1.1.12 aPoDLPSEActualPower";
36    }
37
38
39
40
41
42
43
44    leaf power-accuracy {
45        type int64;
46        units milliwatts;
47        config false;
48        description
49            "A signed integer value indicating the accuracy associated
50            with power-accuracy in milliwatts.";
51        reference
52            "IEEE Std 802.3, 30.15.1.1.13 aPoDLPSEPowerAccuracy";
53    }
54
55
56
57
58
59
60
61
62
63
64
65
```

1   **7. YANG module for Ethernet Passive Optical Network (EPON)**

2  
3  
4   **7.1 Introduction**

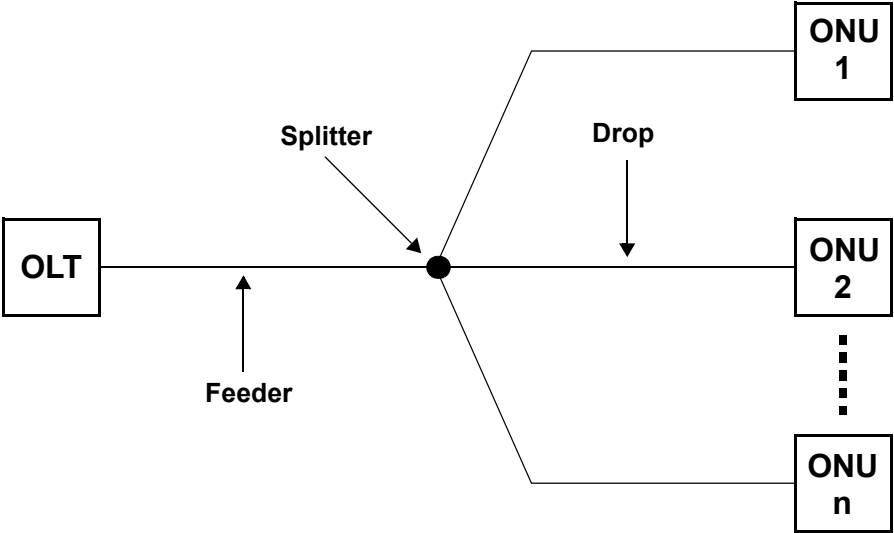
5  
6  
7   This clause defines a YANG module to manage Ethernet Passive Optical Network (EPON).

8  
9  
10   **7.2 YANG module structure**

11  
12   The *ieee802-ethernet-pon* YANG module of this clause is focused on the configuration and monitoring of  
13   EPON.

14  
15  
16   **7.2.1 Introduction**

17  
18   EPON is defined in IEEE Std 802.3, covering Physical Layers and Media Access Control sublayers. The  
19   Passive Optical Network (PON) is comprised of sections of single-mode fiber connected with passive opti-  
20   cal splitter/coupler devices, forming a passive optical tree, as shown in Figure 7–1. Individual branches of  
21   the PON are terminated with the Optical Line Terminal (OLT) in the Central Office or at remote optical  
22   nodes, and Optical Network Units (ONUs) near the subscribers. ONUs can be located either in some remote  
23   location (e.g., basement in a multi-dwelling unit) or directly at the subscriber premises. Various types of  
24   Customer Premises Equipment (CPE) can be connected to ONUs or even integrated with such devices.  
25   Figure 7–1 presents an example PON topology.



50  
51  
52   **Figure 7–1—PON topology example**

53  
54   The following clauses in IEEE Std 802.3 define 1G-EPON:

- 55  
56  
57  
58  
59  
60
- Clause 60: Physical Medium Dependent (PMD) sublayer for 1G-EPON
  - Clause 64: MPCP (Multipoint Control Protocol) for 1G-EPON
  - Clause 65: Reconciliation Sublayer (RS), Physical Coding Sublayer (PCS), and Physical Media Attachment (PMA) sublayers for 1G-EPON

61  
62   The following clauses in IEEE Std 802.3 define 10G-EPON:

- 63  
64  
65
- Clause 75: PMD sublayer for 10G-EPON
  - Clause 76: RS, PCS, and PMA sublayers for 10G-EPON

— Clause 77: MPCP for 10G-EPON

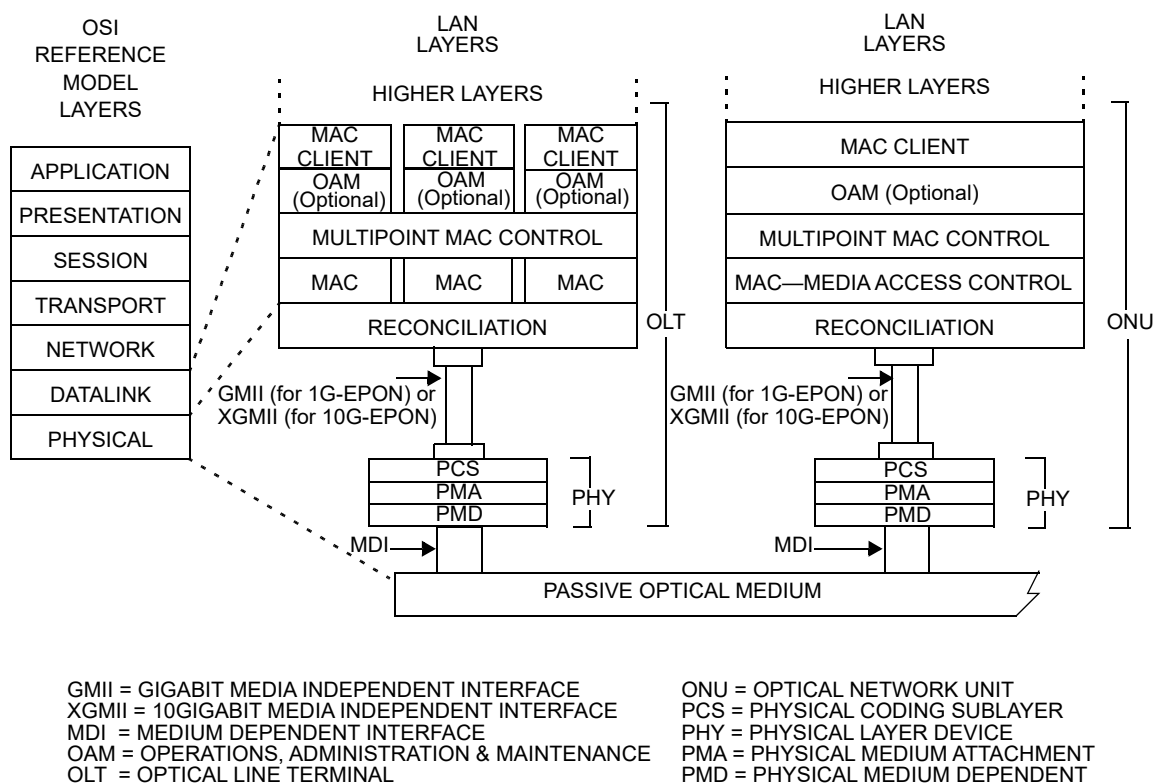
Additionally, IEEE Std 802.3, Clause 30 and Clause 45 are also applicable to EPON.

## 7.2.2 Principles of operation

The EPON specification extended the specification of Gigabit Ethernet (in case of 1G-EPON) or 10 Gigabit Ethernet (in case of 10G-EPON) as described in IEEE Std 802.3. The Ethernet MAC operates at the data rate of 1 Gb/s (in 1G-EPON) or 10 Gb/s (in 10G-EPON) and it is connected to a media dependent interface through the GMII (in 1G-EPON) or XGMII (in 10G-EPON) interface. The EPON PCS layer extended the Ethernet PCS, adding burst-mode operation capabilities and EPON-specific forward error correction (FEC). The following new, EPON-specific layers were added:

- MPCP is placed in the MAC control layer, providing EPON media access, station discovery, and registration protocol.
- Functionality of the reconciliation sublayer (RS) was extended, creating logical links over shared passive optical medium, providing private transmission channels to each of the connected ONU.
- FEC functionality (optional in 1G-EPON, mandatory in 10G-EPON) located in the PCS was added, extending the Ethernet PCS layer, enhancing reach and split performance of the EPON optical link.

Figure 7–2 presents the EPON layering model.



**Figure 7–2—Relationship of Multipoint MAC Control and the OSI protocol stack**

### 7.2.3 Physical media

The physical link in EPON comprises single-mode fiber. The OLT and ONUs are connected through a passive optical network comprising sections of single-mode fiber interconnected with passive splitter/coupler devices.

The term *downstream* denotes transmission from the OLT to all connected ONUs, while the term *upstream* denotes transmission from the connected ONUs (one at the time) to the OLT. Upstream and downstream transmissions are wavelength division multiplexed (WDM) into a single strand of single-mode fiber, sharing the same physical link.

The downstream transmission channel is continuously available to the OLT, thus Time Division Multiplexing (TDM) is used. Transmissions from the OLT arrive at all of the connected ONUs and the individual ONUs filter data from the OLT's transmission based on the logical link identifiers (LLID) assigned to them during the registration and discovery process.

The upstream transmission channel is shared among a number of connected and registered ONUs using time-division multiple access (TDMA). Access to the upstream channel is controlled via the Multipoint Control Protocol (MPCP), where the OLT plays the role of the master and ONUs play the role of slave devices. An ONU upon registration remains silent until registered and once registered, it transmits data towards OLT only when granted a transmission opportunity (slot).

### 7.2.4 PMD specifications

The EPON PMD specifications are based on a wavelength plan defined in IEEE Std 802.3, Clause 60 (1G-EPON) and Clause 75 (10G-EPON). The OLT and ONU optical parameters were derived in part from applicable Ethernet PMD specifications, with the addition of WDM capabilities, and burst mode operation for ONU transmitters and the OLT receiver.

The upstream burst mode operation capability corresponds directly to the TDMA operation in the upstream direction, where queued data is burst from individual ONUs at full data rate for the duration of the allocated transmission period. Once completed, the ONU goes silent and another ONU starts transmitting its data.

### 7.2.5 Principles of the MPCP

The EPON standard comprises a mechanism for media access control, referred to as Multipoint Control Protocol (MPCP). An access network architecture is different from a typical LAN environment, primarily in terms of network provisioning. An access network is an administrated environment, with an operator providing services and subscribers consuming it depending on service provisioning contracts. The operator controls the network, manages traffic and medium access, and enforces the service level agreements. For instance, the available bandwidth is controlled and subscribers may be billed for services. In this sense, the access network (and EPON specifically) requires a media access control protocol that provides a mechanism for station discovery and registration as well as bandwidth provisioning capabilities.

In the MPCP, the OLT is considered to be the master, controlling a series of connected ONUs (slave devices). The OLT manages the network and controls access to network resources from individual slave devices. The MPCP is also used for provisioning upstream channel access to individual slave devices via a MPCPDU pair i.e., GATE and REPORT. The MPCP is part of the MAC control layer and MPCPDUs are considered MAC control messages, carrying a specific Ethertype of 0x8808. These messages are not forwarded outside of the EPON domain and are used to manage the EPON link only.

A concept of time exists in the MPCP in order to schedule the upstream transmission. A timestamp, which is transmitted in the MPCPDUs downstream by the OLT and received by the connected ONUs, is used to synchronize slave devices to the master device clock. This coordinates upstream transmissions from individual



ONUs so that the transmissions arrive at the OLT at the precisely anticipated time, and thus data from different ONUs do not overlap.

The MPCP plane is also used to measure the round-trip time (RTT) for each connected ONU. Each MPCPDU carries a generalized timestamp field, which is filled in by the transmitting station with the current value of its MPCP clock at the time when the given MPCPDU is transmitted. The RTT is measured first during the discovery and registration process and then updated regularly upon each exchange of MPCPDUs between the OLT and one of the ONUs. RTT is used by the OLT bandwidth scheduler to schedule upstream transmission slots for individual ONUs in a non-overlapping manner. The IEEE 802.3 EPON standard provides support for the network diameter (distance between the OLT and the farthest ONU) of nominally up to 20 km, which corresponds to the RTT of approximately 200  $\mu$ s. However, nothing in the standard precludes support for larger network diameters.

The TDMA control is performed using a pair of MPDPUs, namely GATE generated by the OLT to indicate a future transmission opportunity to an ONU and REPORT generated by the ONU with information on the current queue status (bandwidth demand). Internal structure and possible encoding of GATE and REPORT MPCPDUs are defined in IEEE Std 802.3, Clause 64 (for 1G-EPON) and Clause 77 (for 10G-EPON).

A scheduling algorithm at the OLT, which is not defined in IEEE Std 802.3, is responsible for dividing the bandwidth and controlling the transmission delay of each ONU according to its service level agreement. The MPCP defines a closed loop operation in order for this algorithm to be efficient. The MPCP allows the ONUs to report on the amount of bandwidth they require for transmission using a special REPORT message. This allows allocating bandwidth to an ONU only when requested, relying on the statistical burst property of the traffic, and allowing different peak bandwidths for different ONUs at different times; hence, allowing oversubscription of the bandwidth. The REPORT message reports the amount of data waiting in the ONU queues.

In addition, the MPCP defines a protocol of auto-discovery and registration of ONUs.

The MPCP registration process is presented in Figure 7–3, while details are described in IEEE Std 802.3, Clause 64 (for 1G-EPON) and Clause 77 (for 10G-EPON). Note that MPCP for 10G-EPON supports the coexistence mode, i.e., simultaneous operation of 1G-EPON and 10G-EPON devices on the same fiber plant, through time sharing the upstream transmission channel.

A new ONU requests to register during a special upstream window (called Discovery Window), sending the REGISTER\_REQ MPCPDU. More than one ONU may attempt registration during that window, which means that their REGISTER\_REQ MPCPDUs can potentially collide at the OLT receiver, since the ONU-specific RTT is not yet known and transmissions from individual ONUs cannot be scheduled in a non-overlapping manner. A random backoff mechanism was therefore developed and is used to increase the registration success probability.

When the OLT receives a REGISTER\_REQ MPCPDU from an ONU, a decision a non-overlapping on registration is taken and an LLID is assigned to that ONU. Next, the OLT sends a REGISTER MPCPDU to that ONU, informing the given slave device whether it is admitted to network or not. The registration process is completed with the ONU sending REGISTER\_ACK MPCPDU to the OLT, confirming assigned parameters and registration in the network. From that point onward, the OLT can schedule transmissions from that ONU using its LLID and the measured RTT so that its transmissions do not collide with other ONUs.

Additional higher layer protocols may be employed to authenticate the ONU and allow it to participate in the network; however, their specification is outside the scope of IEEE Std 802.3.

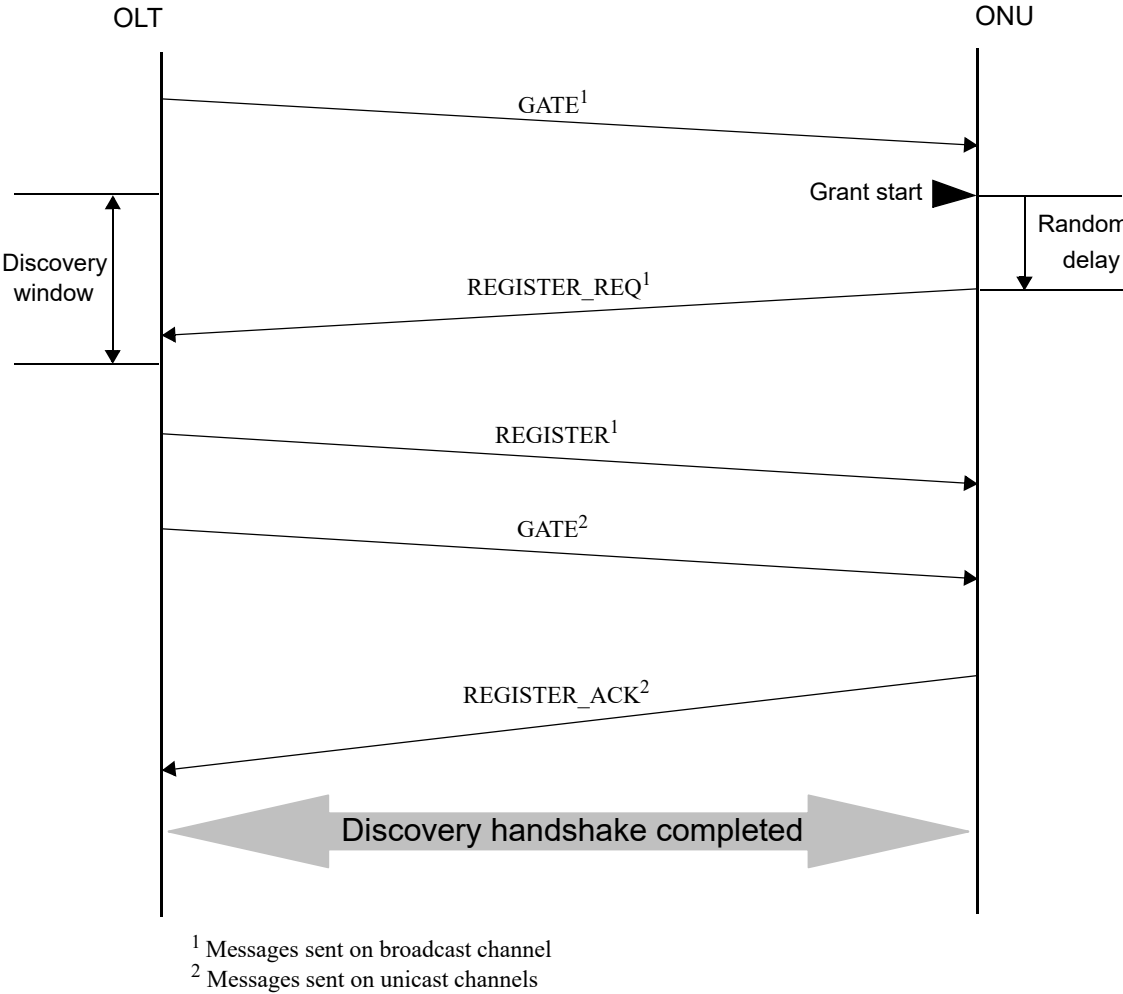


Figure 7-3—Discovery handshake message exchange

7.2.6 Forward error correction (FEC)

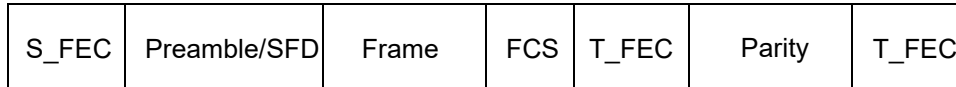
The FEC mechanism is optional for 1G-EPON and is defined to enhance the 1G-EPON link budget. All the passive components of the fiber plant attenuate the optical signal, thus the target distance (network diameter) and the number of supported splits is limited by the available link budget. The optional FEC mechanism increases the available link budget by improving the link BER from 10<sup>-4</sup> to 10<sup>-12</sup> (the target BER at the MAC), effectively increasing the target network diameter and/or split ratio. The target use of the increased power budget remains at the sole discretion of the network architects and is out of the scope of IEEE Std 802.3.

The optional FEC used in 1G-EPON is frame-based, meaning that parity information is added at the end of each Ethernet packet. Extra space between individual Ethernet packets is provided by the MAC rate adaptation function, while extra idle symbols were replaced within the FEC function.

The start and end of packet codewords also define the FEC boundaries, and they are outside the FEC protection. They are replaced by a series of symbols to reduce their vulnerability to link errors.

Figure 7–4 presents the structure of an FEC-protected 1G-EPON frame.

The optional FEC function is added to the extended Gigabit Ethernet PCS per 65.2 in IEEE Std 802.3. The added, optional FEC function introduces a fixed delay in receive path and transmit path.



**Figure 7–4—1G-EPON FEC-protected frame**

The FEC mechanism is mandatory for 10G-EPON, and similarly to 1G-EPON – defined to enhance the EPON link budget. The mandatory FEC mechanism increases the available link budget by improving the link BER from  $2 \times 10^{-3}$  to  $10^{-12}$  (the target BER at the MAC), effectively increasing the target network diameter and/or split ratio. The target use of the increased power budget remains at the sole discretion of the network architects and is out of the scope of IEEE Std 802.3. The mandatory FEC used in 10G-EPON is stream-based, meaning that 32 parity symbols are inserted into the bit stream at regular intervals (every 223 information symbols). Details of the FEC encoding process in 10G-EPON are described in IEEE Std 802.3, 76.3.2.4, including the structure of the resulting frame and the resulting bit ordering shown in IEEE Std 802.3, Figure 76-12.

### 7.2.7 Management architecture

All of the EPON layers are accompanied by a management interface that is controlled through mechanisms defined in Clause 30 of IEEE Std 802.3. Since IEEE Std 802.3 specifications may be used for different applications (and hence are extensible), and some of the clauses may be used separately, the management clause allocates a separate package for each independent layer. The structure of the modules follows this separation.

Figure 7–5 presents the relation of the module groups to the individual IEEE Std 802.3 layers.

The association is straightforward for the ONU interface. There is one logical and one physical interface, and a single copy of each layer can be remotely queried by the OLT.

The OLT has a single physical interface and N logical interfaces, one for each logical link connected to an ONU. There is also one logical interface for the single copy broadcast link. Per layering diagram in Figure 7–5, the MAC sublayer is virtually replicated. Therefore, in this clause it was elected that management of logical interfaces is performed in the manner identical to management of any physical interfaces—an interface index is allocated for each one of the logical links, and an additional interface index is allocated for the OLT.

Each row in the tables is indexed according to the ifIndex; specifically, there is a row for each logical link. There are some control objects that are shared and are the same for the logical interfaces (and they should have the same value for each ifIndex), but most of the objects have different values for N+1 logical interfaces at the OLT. This is done for each YANG group. It is different from the EPON layering diagram, which presents the P2MP layer as a single layer, while duplicating the MAC and MAC client layers (please see Figure 7–5). However, from a management perspective, it is more convenient to partition the management of the layers for the logical links, as the atomic managed entity is the logical link. It is also convenient to use the interface index of the logical link for that purpose, as it is already used to index the rows of the logical links at the Interface, MAU, and Ethernet-like interface YANG module.

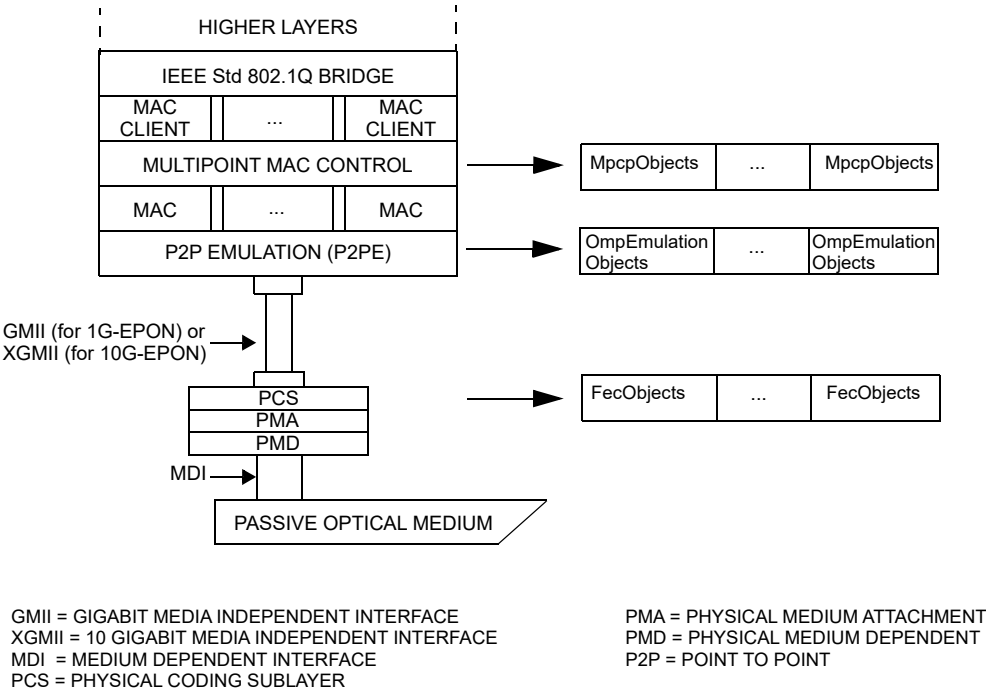


Figure 7–5—Relationship of the YANG module to the EPON sublayers

7.3 Mapping of IEEE Std 802.3, Clause 30 managed objects

This sub-clause contains the mapping between YANG data nodes included in *ieee802-ethernet-pon* (see Table 7–1) YANG module, managed objects, and attributes defined in IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB.

**Table 7–1—Mapping between IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB managed objects and *ieee802-ethernet-pon* YANG data nodes**

IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB		Corresponding <i>ieee802-ethernet-pon</i> YANG data nodes		
Managed object(s)	Attribute(s)	Container(s)	Data node(s)	R/W
dot3EponFecTable	dot3EponFecMode		fec-mode	R/W
	dot3EponFecPCSCodingViolation	statistics-pon-fec	fec-code-group-violations	R
	dot3EponFecAbility		fec-capability	R
	dot3EponFecCorrectedBlocks	statistics-pon-fec	fec-code-word-corrected-errors	R
	dot3EponFecUncorrectableBlocks	statistics-pon-fec	fec-code-word-uncorrected-errors	R
	dot3EponFecBufferHeadCodingViolation	statistics-pon-fec	fec-buffer-head-coding-violation	R
dot3MpcpControl Table	dot3MpcpAdminState		mpcp-admin-state	R/W
	dot3MpcpMode		mpcp-mode	R
	dot3MpcpLinkID		mpcp-logical-link-id	R
	dot3MpcpRemoteMACAddress		mpcp-remote-mac-address	R
	dot3MpcpRegistrationState		mpcp-logical-link-state	R
	dot3MpcpSyncTime		mpcp-sync-time	R
	dot3MpcpTransmitElapsed		mpcp-elapsed-time-out	R
	dot3MpcpReceiveElapsed		mpcp-elapsed-time-in	R
	dot3MpcpRoundTripTime		mpcp-round-trip-time	R
	dot3MpcpMaximumPendingGrants		mpcp-maximum-grant-count	R

**Table 7–1—Mapping between IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB managed objects and *ieee802-ethernet-pon* YANG data nodes (continued)**

IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB		Corresponding <i>ieee802-ethernet-pon</i> YANG data nodes		
Managed object(s)	Attribute(s)	Container(s)	Data node(s)	R/W
dot3ExtPkgQueueSets Table	dot3QueueSetIndex	mpcp-queue-thresholds	mpcp-queue-set-index	R/W
	dot3ExtPkgObjectReportThreshold		mpcp-queue-set-threshold	R/W
	dot3QueueIndex	mpcp-queues	mpcp-queue-index	R/W
	dot3ExtPkgObjectReportNumThreshold		mpcp-queue-threshold-count	R/W
	dot3ExtPkgObjectReportMaximumNumThreshold		mpcp-queue-threshold-count-max	R
	dot3ExtPkgStatTxFramesQueue		in-mpcp-queue-frames	R
	dot3ExtPkgStatRxFramesQueue		out-mpcp-queue-frames	R
	dot3ExtPkgStatDroppedFramesQueue		mpcp-queue-frames-drop	R
dot3ExtPkgControl Table	dot3ExtPkgObjectReset dot3MpcpOperStatus		mpcp-logical-link-admin-state	R/W
	dot3ExtPkgObjectNumberOfLLIDs		mpcp-logical-link-count	R
	dot3ExtPkgObjectReportMaximumNumQueues		mpcp-maximum-queue-count-per-report	R
dot3RecognizedMulticast-IDs Table	dot3RecognizedMulticastID	multicast-IDs	multicast-ID	R/W

**Table 7–1—Mapping between IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB managed objects and *ieee802-ethernet-pon* YANG data nodes (continued)**

IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB		Corresponding <i>ieee802-ethernet-pon</i> YANG data nodes		
Managed object(s)	Attribute(s)	Container(s)	Data node(s)	R/W
dot3OmpEmulation Table	dot3OmpEmulationType	statistics-ompe	ompe-mode	R
	dot3OmpEmulationSLDErrors		in-ompe-frames-errored-sld	R
	dot3OmpEmulationCRC8Errors		in-ompe-frames-errored-crc8	R
	dot3OmpEmulationBadLLID		in-ompe-frames-with-bad-llid	R
	dot3OmpEmulationGoodLLID		in-ompe-frames-with-good-llid	R
	dot3OmpEmulationBroadcastBitNotOnuLlid		in-ompe-frames-not-match-onu-llid-broadcast	R
	dot3OmpEmulationOnuLLIDNotBroadcast		in-ompe-frames-match-onu-llid-not-broadcast	R
	dot3OmpEmulationBroadcastBitPlusOnuLlid		in-ompe-frames-match-onu-llid-broadcast	R
	dot3OmpEmulationNotBroadcastBitNotOnuLlid		in-ompe-frames-not-match-onu-llid-not-broadcast	R
			in-ompe-frames	R
			ompe-onu-frames-with-good-llid-good-crc8	
			ompe-olt-frames-with-good-llid-good-crc8	

**Table 7–1—Mapping between IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB managed objects and *ieee802-ethernet-pon* YANG data nodes (continued)**

IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB		Corresponding <i>ieee802-ethernet-pon</i> YANG data nodes		
Managed object(s)	Attribute(s)	Container(s)	Data node(s)	R/W
dot3MpcpStat Table	dot3MpcpMACCtrlFramesTransmitted	statistics-mpcp	out-mpcp-mac-ctrl-frames	R
	dot3MpcpMACCtrlFramesReceived		in-mpcp-mac-ctrl-frames	R
	dot3MpcpDiscoveryWindowsSent		mpcp-discovery-window-count	R
	dot3MpcpDiscoveryTimeout		mpcp-discovery-timeout-count	R
	dot3MpcpTxRegRequest		out-mpcp-register-req	R
	dot3MpcpRxRegRequest		in-mpcp-register-req	R
	dot3MpcpTxRegAck		out-mpcp-register-ack	R
	dot3MpcpRxRegAck		in-mpcp-register-ack	R
	dot3MpcpTxReport		out-mpcp-report	R
	dot3MpcpRxReport		in-mpcp-report	R
	dot3MpcpTxGate		out-mpcp-gate	R
	dot3MpcpRxGate		in-mpcp-gate	R
	dot3MpcpTxRegister		out-mpcp-register	R
	dot3MpcpRxRegister		in-mpcp-register	R



**Table 7–1—Mapping between IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB managed objects and *ieee802-ethernet-pon* YANG data nodes (continued)**

IEEE Std 802.3.1, IEEE8023-DOT3-EPON-MIB		Corresponding <i>ieee802-ethernet-pon</i> YANG data nodes		
Managed object(s)	Attribute(s)	Container(s)	Data node(s)	R/W
dot3ExtPkgOptIf Table	dot3ExtPkgOptIfLowerInputPowerThreshold	thresholds-trx	in-trx-power-low-threshold	R/W
	dot3ExtPkgOptIfUpperInputPowerThreshold		in-trx-power-high-threshold	R/W
	dot3ExtPkgOptIfLowerOutputPowerThreshold		out-trx-power-low-threshold	R/W
	dot3ExtPkgOptIfUpperOutputPowerThreshold		out-trx-power-high-threshold	R/W
	dot3ExtPkgOptIfSignalDetect		in-trx-power-signal-detect	R
	dot3ExtPkgOptIfInputPower		in-trx-power	R
	dot3ExtPkgOptIfLowInputPower		in-trx-power-low-15-minutes-bin	R
	dot3ExtPkgOptIfHighInputPower		in-trx-power-high-15-minutes-bin	R
	dot3ExtPkgOptIfTransmitEnable		out-trx-power-signal-detect	R/W
	dot3ExtPkgOptIfOutputPower		out-trx-power	R
	dot3ExtPkgOptIfLowOutputPower		out-trx-power-low-15-minutes-bin	R
	dot3ExtPkgOptIfHighOutputPower		out-trx-power-high-15-minutes-bin	R
	dot3ExtPkgOptIfSuspectedFlag		trx-data-reliable	R

## 7.4 YANG module definition<sup>n</sup>

The YANG module tree hierarchy uses terms defined in IETF RFC 8407.

### 7.4.1 Tree hierarchy

```

module: ieee802-ethernet-pon
  augment /if:interfaces/if:interface/ieee802-eth-if:ethernet:
    +--rw fec-mode?                fec-mode {fec-supported}?
    +--rw mpcp-admin-state?        mpcp-admin-state
    +--ro mpcp-logical-link-admin-state? mpcp-logical-link-admin-state
    +--rw trx-transmit-admin-state? trx-admin-state {trx-power-level-reporting-supported}?
    +--ro capabilities
      | +--ro mpcp-supported?      mpcp-supported
    +--ro statistics-mpcp
      | +--ro out-mpcp-mac-ctrl-frames? yang:counter64
      | +--ro in-mpcp-mac-ctrl-frames?  yang:counter64
      | +--ro mpcp-discovery-window-count? yang:counter64
      | +--ro mpcp-discovery-timeout-count? yang:counter64
      | +--ro out-mpcp-register-req?     yang:counter64
      | +--ro in-mpcp-register-req?      yang:counter64
      | +--ro out-mpcp-register-ack?     yang:counter64
      | +--ro in-mpcp-register-ack?      yang:counter64
      | +--ro out-mpcp-report?           yang:counter64
      | +--ro in-mpcp-report?            yang:counter64
      | +--ro out-mpcp-gate?             yang:counter64
      | +--ro in-mpcp-gate?              yang:counter64
      | +--ro out-mpcp-register?         yang:counter64
      | +--ro in-mpcp-register?          yang:counter64
    +--rw statistics-ompe
      | +--ro in-ompe-frames-errored-sld? yang:counter64
      | +--ro in-ompe-frames-errored-crc8? yang:counter64
      | +--ro ompe-onu-frames-with-good-llid-good-crc8? yang:counter64

```

<sup>n</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```

1      |      +--ro      ompe-olt-frames-with-good-llid-good-crc8?
2  yang:counter64
3      |      +--ro      in-ompe-frames-with-bad-llid?
4  yang:counter64
5      |      +--ro      in-ompe-frames-with-good-llid?
6  yang:counter64
7      |  +--ro in-ompe-frames?                                yang:count-
8  er64
9
10     |      +--ro      in-ompe-frames-not-match-onu-llid-broadcast?
11  yang:counter64
12     |      +--ro      in-ompe-frames-match-onu-llid-not-broadcast?
13  yang:counter64
14     |      +--ro      in-ompe-frames-match-onu-llid-broadcast?
15  yang:counter64
16     |      +--ro      in-ompe-frames-not-match-onu-llid-not-broadcast?
17  yang:counter64
18
19  +--rw thresholds-trx {trx-power-level-reporting-supported}?
20     |  +--rw in-trx-power-low-threshold?          int32 {trx-power-level-
21  reporting-supported}?
22     |  +--rw in-trx-power-high-threshold?         int32 {trx-power-level-
23  reporting-supported}?
24     |  +--rw out-trx-power-low-threshold?         int32 {trx-power-level-
25  reporting-supported}?
26     |  +--rw out-trx-power-high-threshold?       int32 {trx-power-level-
27  reporting-supported}?
28     |  +--rw out-trx-power-high-threshold?       int32 {trx-power-level-
29  reporting-supported}?
30
31  +--rw statistics-trx {trx-power-level-reporting-supported}?
32     |  +--ro in-trx-power-signal-detect?          boolean
33     |  +--ro in-trx-power?                        int32
34     |  +--ro in-trx-power-low-15-minutes-bin?     int32
35     |  +--ro in-trx-power-high-15-minutes-bin?   int32
36     |  +--ro out-trx-power-signal-detect?        boolean
37     |  +--ro out-trx-power?                      int32
38     |  +--ro out-trx-power-low-15-minutes-bin?   int32
39     |  +--ro out-trx-power-high-15-minutes-bin?  int32
40     |  +--ro out-trx-power-high-15-minutes-bin?  int32
41     |  +--ro trx-data-reliable?                  boolean {trx-power-
42  level-reporting-supported}?
43
44  +--ro statistics-pon-fec {fec-supported}?
45     |  +--ro fec-code-group-violations?          yang:counter64
46     |  +--ro fec-buffer-head-coding-violations?  yang:counter64
47     |  +--ro fec-code-word-corrected-errors?     yang:counter64
48     |  +--ro fec-code-word-uncorrected-errors?   yang:counter64
49
50  +--rw mpcp-logical-link-admin-actions
51     |  +---x state-change-action-type
52     |  |  +---w input
53     |  |  +---w state-change-action-type?      identityref
54     |  +---x reset-action-type
55     |  |  +---w input
56     |  |  +---w reset-action-type?              identityref
57     |  +---x register-type
58     |  |  +---w input
59     |  |  +---w register-type?                  identityref
60
61  +--rw mpcp-queues* [mpcp-queue-index]
62     |  +--rw mpcp-queue-index                    uint8
63     |  +--rw mpcp-queue-threshold-count?         uint8
64
65

```

```

1      |  +--ro mpcp-queue-threshold-count-max?   uint8
2      |  +--rw mpcp-queue-thresholds* [mpcp-queue-set-index]
3      |    |  +--rw mpcp-queue-set-index         uint8
4      |    |  +--rw mpcp-queue-set-threshold?    uint64
5      |  +--ro in-mpcp-queue-frames?             yang:counter64
6      |  +--ro out-mpcp-queue-frames?            yang:counter64
7      |  +--ro mpcp-queue-frames-drop?           yang:counter64
8      +--rw multicast-IDs* [multicast-ID]
9      |  +--rw multicast-ID                       uint32
10     +--ro fec-capability?                       fec-capability
11     +--ro mpcp-mode?                             mpcp-mode
12     +--ro mpcp-sync-time?                         uint64
13     +--ro mpcp-logical-link-id?                   mpcp-supported
14
15
16
17
18
19

```

**Editor's Note (to be removed prior to publication):**

Leaf mpcp-remote-mac-address was modified per Maintenance Request 1380 (see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```

23     +--ro mpcp-remote-mac-address?               ieee:mac-address
24     +--ro mpcp-logical-link-state?               mpcp-logical-link-state
25     +--ro mpcp-elapsed-time-out?                 uint64
26     +--ro mpcp-elapsed-time-in?                  uint64
27     +--ro mpcp-round-trip-time?                  uint16
28     +--ro mpcp-maximum-grant-count?               uint8
29     +--ro mpcp-logical-link-count?               mpcp-llid-count
30     +--ro mpcp-maximum-queue-count-per-report?   mpcp-maximum-queue-
31 count-per-report
32     +--ro ompe-mode?                             ompe-mode
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
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55
56
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58
59
60
61
62
63
64
65

```

## 7.4.2 YANG module

In the following YANG module definition, should any discrepancy between the text of the description for individual YANG nodes and the corresponding definition in 7.2 through 7.4 of this clause occur, the definitions and mappings in 7.4 shall take precedence.

An ASCII text version of the YANG module can be found at the following URL:<sup>o</sup> <https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.3>.

```
module ieee802-ethernet-pon {  
  yang-version 1.1;  
  
  namespace "urn:ieee:std:802.3:yang:ieee802-ethernet-pon";  
  
  prefix "ieee802-eth-pon";  
  
  revision 2019-06-21 {  
    description "Initial revision.";  
  }  
}
```

***Editor's Note (to be removed prior to publication):***

New 'ieee' prefix import was added per Maintenance Request 1380 (see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```
import ieee802-types {  
  prefix "ieee";  
  reference "IEEE 802 types";  
}  
  
import ietf-yang-types {  
  prefix "yang";  
  reference "IETF RFC 6991";  
}  
  
import ietf-interfaces {  
  prefix "if";  
  reference "IETF RFC 8343";  
}  
  
import ieee802-ethernet-interface {  
  prefix "ieee802-eth-if";  
}  
  
organization  
  "IEEE 802.3 Ethernet Working Group  
  Web URL: http://www.ieee802.org/3/";  
  
contact  
  "Web URL: http://www.ieee802.org/3/";  
  
description  
  "This module contains a collection of YANG definitions for
```

<sup>o</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```
1      managing the Multi Point Control Protocol for Ethernet PON (EPON),
2      as defined in IEEE Std 802.3, Clause 64 and Clause 77.
3
4      This YANG module augments the 'ethernet' module.";
5
6  reference
7      "IEEE Std 802.3-2018, Clause 64 and Clause 77, unless dated explicitly
8      IEEE Std 802.3.1-2013, Clause 9, unless dated explicitly";
9
10
11  typedef mpcp-supported {
12      type boolean;
13
14      description
15          "This object indicates that the given interface supports MPCP,
16          i.e., it is an Ethernet PON (EPON) interface.";
17  }
18
19  typedef mpcp-llid {
20      type uint64 {
21          range "0 .. 32767";
22      }
23
24      description
25          "Logical Link Identifiers (LLIDs) are used to identify a single
26          MAC from a number of MACs which may be present in the
27          EPON OLT or ONU. LLIDs between the value of 0x07FFE
28          and 0x7FFF are assigned for ONU discovery and registration.
29          Other LLIDs are dynamically assigned by the OLT during the
30          registration process. For a complete description of how the
31          LLID is used in an EPON device, see IEEE Std 802.3, Clause 65
32          for 1G-EPON and Clause 76 for 10G-EPON.";
33
34      reference
35          "IEEE Std 802.3, 65.1.3.3 for 1G-EPON and 76.2.6.1.3 for 10G-EPON";
36  }
37
38  typedef mpcp-maximum-queue-count-per-report {
39      type uint8 {
40          range "0..7";
41      }
42
43      default "0";
44
45      description
46          "Defines the maximum number of queues (0-7) in the REPORT
47          MPCPDU as defined in IEEE Std 802.3, Clause 64 and Clause 77.";
48  }
49
50  typedef mpcp-llid-count {
51      type uint64 {
52          range "0 .. 32767";
53      }
54
55      description
56          "Indicates the number of registered LLIDs. The initialization
57          value is 0. This is applicable for an OLT with the same value
58          for all logical interfaces and for an ONU.";
59
60      reference
```

```
1      "IEEE Std 802.3, 65.1.3.3 for 1G-EPON and 76.2.6.1.3 for 10G-EPON";
2
3  }
4
5  typedef mpcp-admin-state {
6      type enumeration {
7
8          enum enabled {
9              description
10                 "When selecting the value of 'enabled', the MultiPoint
11                 Control Protocol sublayer on the OLT / ONU is enabled.";
12             }
13
14             enum disabled {
15                 description
16                     "When selecting the value of 'disabled', the MultiPoint
17                     Control Protocol sublayer on the OLT / ONU is disabled.";
18             }
19         }
20     }
21
22     description
23         "Enumeration of valid administrative states for a MultiPoint MAC
24         Control sublayer on the OLT or ONU.";
25
26     reference
27         "IEEE Std 802.3, 30.3.5.2.1";
28 }
29
30 typedef mpcp-mode {
31     type enumeration {
32         enum olt {
33             description
34                 "MPCP mode: olt";
35         }
36
37         enum onu {
38             description
39                 "MPCP mode: onu";
40         }
41     }
42
43     description
44         "Enumeration of valid MPCP modes for EPON interfaces.";
45
46     reference
47         "IEEE Std 802.3, 30.3.5.1.3";
48 }
49
50 typedef mpcp-logical-link-state {
51     type enumeration {
52         enum unregistered {
53             description
54                 "MPCP registration state: logical link is NOT registered.";
55         }
56
57         enum registering {
58             description
59                 "MPCP registration state: logical link is currently in the
60                 process of registering.";
61         }
62     }
63 }
64
65
```

```
1      }
2
3      enum registered {
4          description
5              "MPCP registration state: logical link is currently
6              registered.";
7      }
8  }
9  }
10
11  description
12      "Enumeration of valid MPCP registration states for EPON
13      interfaces.";
14
15  reference
16      "IEEE Std 802.3, 30.3.5.1.6";
17  }
18
19  typedef mpcp-logical-link-admin-state {
20      type enumeration {
21          enum reset {
22              description
23                  "When read, the value of 'reset' indicates that the given
24                  logical link on the OLT / ONU has been reset.";
25          }
26          enum operate {
27              description
28                  "When read, the value of 'operate' indicates that the
29                  given logical link on the OLT / ONU has moved into
30                  operating mode.";
31          }
32          enum unknown {
33              description
34                  "When read, the value of 'unknown' indicates that the
35                  status of the given logical link on the OLT / ONU is
36                  currently not known.";
37          }
38          enum registered {
39              description
40                  "When read, the value of 'registered' indicates that the
41                  given logical link on the OLT / ONU has been registered.";
42          }
43          enum deregistered {
44              description
45                  "When read, the value of 'deregistered' indicates that the
46                  given logical link on the OLT / ONU has been deregistered.";
47          }
48          enum reregistered {
49              description
50                  "When read, the value of 'reregistered' indicates that the
51                  given logical link on the OLT / ONU has been reregistered.";
52          }
53      }
54      description
55          "Enumeration of valid administrative states for a logical link
56          on the OLT or ONU.";
57  }
58
59  typedef ompe-mode {
60      type enumeration {
```



```
1      enum unknown {
2          description
3              "omp-emulation mode: unknown = system is initializing";
4      }
5
6      enum olt {
7          description
8              "omp-emulation mode: olt";
9      }
10
11     enum onu {
12         description
13             "omp-emulation mode: onu";
14     }
15 }
16
17 description
18     "Enumeration of valid OMP-Emulation modes for EPON
19     interfaces.";
20
21 reference
22     "IEEE Std 802.3, 30.3.7.1.2";
23 }
24
25 typedef fec-capability {
26     type enumeration {
27         enum unknown {
28             description
29                 "FEC capability: unknown = system is initializing.";
30         }
31
32         enum supported {
33             description
34                 "FEC capability: supported.";
35         }
36
37         enum "not supported" {
38             description
39                 "FEC capability: not supported.";
40         }
41     }
42 }
43
44 description
45     "Enumeration of valid FEC capability values for EPON
46     interfaces with enabled MPCP.";
47
48 reference
49     "IEEE Std 802.3, 30.5.1.1.15";
50 }
51
52 typedef fec-mode {
53     type enumeration {
54         enum unknown {
55             description
56                 "FEC mode: unknown = system is initializing.";
57         }
58
59         enum disabled {
60             description
61                 "FEC mode: disabled = system is initializing.";
62         }
63     }
64 }
65
```

```
1         "FEC mode: disabled = FEC is disabled for the given
2         logical link (both Tx and Rx directions).";
3     }
4
5     enum enabled-Tx-Rx {
6         description
7             "FEC mode: enabled-Tx-Rx = FEC is enabled for the given
8             logical link in both Tx and Rx directions.";
9     }
10
11     enum enabled-Tx-only {
12         description
13             "FEC mode: enabled-Tx-only = FEC is enabled for
14             the given logical link but only in Tx direction.";
15     }
16
17     enum enabled-Rx-only {
18         description
19             "FEC mode: enabled-Rx-only = FEC is enabled for
20             the given logical link but only in Rx direction.";
21     }
22 }
23
24 description
25     "Enumeration of valid FEC modes for EPON interfaces.";
26
27 reference
28     "IEEE Std 802.3, 30.5.1.1.16";
29
30 }
31
32 typedef trx-admin-state {
33     type enumeration {
34         enum enabled {
35             description
36                 "When read as 'enabled', the transmitter is enabled and
37                 operating under the control of the logical control protocol.
38                 When set to 'enabled', the transmitter is enabled to
39                 operate under the control of the logical control protocol.";
40         }
41
42         enum disabled {
43             description
44                 "When read as 'disabled', the transmitter is currently
45                 disabled (not transmitting). When set to 'disabled', the
46                 transmitter is expected to be disabled (to stop transmitting).";
47         }
48     }
49
50     description
51         "Enumeration of valid administrative states for an optical
52         transceiver.";
53
54     reference
55         "IEEE Std 802.3.1, dot3ExtPkgOptIfTransmitEnable";
56 }
57
58 feature trx-power-level-reporting-supported {
59     description
```

```
1      "This object indicates the support for optical transceiver power
2      level monitoring and reporting capability. When 'true', the
3      given interface supports the optical power level monitoring
4      and reporting function. Otherwise, the value is 'false.'";
5  }
6
7  feature
8  fec-supported {
9      description
10         "This object indicates the support of operation of the optional
11         FEC sublayer of the 1G-EPON PHY specified in IEEE Std 802.3,
12         65.2. The value of 'unknown' is reported in the initialization,
13         for non FEC support state or type not yet known. The value of
14         'not supported' is reported when the sublayer is not supported.
15         The value of 'supported' is reported when the sublayer is
16         supported. This object is applicable for an OLT, with the
17         same value for all logical links, and for an ONU.";
18
19     reference
20         "IEEE Std 802.3, 30.5.1.1.15";
21 }
22
23 identity state-change-action-type {
24     description
25         "Type of interface state change requested.";
26 }
27
28 identity power-down {
29     base state-change-action-type;
30     description
31         "Power down the EPON logical interface.
32         Power-down actions are applicable for the OLT and ONU. A
33         power down of a specific logical interface affects only
34         the logical interface (and not the physical interface).
35         the logical interface will be unavailable while the
36         power-down occurs and data may be lost. Other logical
37         interface are unaffected by power-down.
38
39         This action is relevant when the admin state is active.";
40 }
41
42 identity power-up {
43     base state-change-action-type;
44     description
45         "Exit EPON logical interface power-down state.";
46 }
47
48 identity reset-action-type {
49     description
50         "Type of reset action requested.";
51 }
52
53 identity reset-interface {
54     base reset-action-type;
55     description
56         "Reset the EPON logical interface. Resetting an interface
57         can lead an interruption of service for the users connected
58         to the respective EPON interface.
59
60         This object is applicable for an OLT and an ONU. At the
61         OLT, it has a distinct value for each logical interface.
```

```
1      A reset for a specific logical interface resets only
2      this logical interface and not the physical interface.
3
4      Thus, a logical link that is malfunctioning can be
5      reset without affecting the operation of other logical
6      interfaces.
7
8      The reset can cause Discontinuities in the values of the
9      counters of the interface, similar to re-initialization
10     of the management system.";
11
12 }
13 identity register-type {
14     description
15         "Type of registration requested.";
16 }
17 identity register {
18     base register-type;
19     description
20         "Register indicates a request to register an LLID.
21         This action applies to an OLT or ONU logical interface.";
22 }
23 identity reregister {
24     base register-type;
25     description
26         "Re-register indicates an request to re-register an LLID.
27         This action applies to an OLT or ONU logical interface.";
28 }
29 identity deregister {
30     base register-type;
31     description
32         "De-register indicates an request to de-register an LLID.
33         This action applies to an OLT or ONU logical interface.
34         Deregister may result in an interruption of service to
35         users connected to the respective EPON interface.";
36 }
37
38 augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet" {
39     description
40         "Augments the definition of Ethernet interface (/if:interfaces/
41         if:interface/ieee802-eth-if:ethernet) module with nodes
42         specific to Ethernet PON (EPON).";
43
44     leaf fec-mode {
45         if-feature "fec-supported";
46
47         type fec-mode;
48
49         description
50             "This object reflects the current administrative state of the
51             FEC function for the given logical link on an ONU or OLT.
52
53             When reading the value of 'disabled', the FEC function on the
54             given logical link is disabled.
55
56             When reading the value of 'enabled-Tx-Rx', the FEC function on
57             the given logical link is enabled in both Tx and Rx directions.
58
59             When reading the value of 'enabled-Tx-only', the FEC function
```

```
1         on the given logical link is enabled in Tx direction only.
2
3         When reading the value of 'enabled-Rx-only', the FEC function
4         on the given logical link is enabled in Rx direction only.
5
6         When reading the value of 'unknown', the state of the FEC
7         function on the given logical link is unknown or the FEC
8         function is currently initializing.
9
10        This object is applicable for an OLT and an ONU. This object has
11        the same value for each logical link.";
12
13
14        reference
15            "IEEE Std 802.3, 30.5.1.1.16";
16    }
17
18    leaf mpcp-admin-state {
19        type mpcp-admin-state;
20
21
22        description
23            "This object reflects the current administrative state of the
24            MultiPoint MAC Control sublayer, as defined in IEEE Std 802.3,
25            Clause 64 and Clause 77, for the OLT / ONU.
26
27            When reading the value of 'enabled', the MultiPoint Control
28            Protocol on the OLT / ONU is enabled.
29
30            When reading the value of 'disabled', the MultiPoint Control
31            Protocol on the OLT / ONU is disabled.
32
33            This object is applicable for an OLT and an ONU. It has the
34            same value for all logical links.";
35
36
37        reference
38            "IEEE Std 802.3, 30.3.5.1.2";
39    }
40
41    leaf mpcp-logical-link-admin-state {
42        type mpcp-logical-link-admin-state;
43        config false;
44        description
45            "This object reflects the current administrative state of a
46            logical link on an ONU or OLT.
47
48            When reading the value of 'reset', the given logical link is
49            undergoing a reset.
50
51            When reading the value of 'unknown', the current status of the
52            given logical link is unknown and the link might be undergoing
53            initialization.
54
55            When reading the value of 'operate', the given logical link is
56            operating normally.
57
58            When reading the value of 'registered', the given logical link
59            was requested to perform registration.
60
61            When reading the value of 'deregistered', the given logical
62            link was requested to perform deregistration.
```

```
1
2     When reading the value of 'reregistered', the given logical
3     link was requested to perform reregistration.
4
5     This object is applicable for an OLT and an ONU. It has a
6     distinct value for each logical link.";
7
8     reference
9         "IEEE Std 802.3.1, dot3ExtPkgObjectRegisterAction";
10 }
11
12
13 leaf trx-transmit-admin-state {
14     when
15         "../../../ieee802-eth-if:ethernet/
16             ieee802-eth-pon:mpcp-admin-state = 'enabled'";
17
18     if-feature "trx-power-level-reporting-supported";
19
20     type trx-admin-state;
21
22     description
23         "This object reflects the current status of the transmitter in
24         the optical transceiver.
25
26         When read as 'enabled', the optical transmitter is enabled and
27         operating under the control of the logical control protocol.
28
29         When read as 'disabled', the optical transmitter is disabled.
30
31         This object is applicable for an OLT and an ONU. At the OLT, this
32         object has a distinct value for each logical link.
33
34         The value of this object is only reliable when
35         /if:interfaces-state/if:interface/ieee802-eth-if:ethernet/
36         'mpcp-admin-state' is equal to 'enabled'.";
37
38     reference
39         "IEEE Std 802.3.1, dot3ExtPkgOptIfTransmitEnable";
40 }
41
42
43 container capabilities {
44
45     config false;
46     description
47         "This container includes all EPON interface-specific capabilities.";
48
49     leaf mpcp-supported {
50         type mpcp-supported;
51
52         default
53             "true";
54         description
55             "This object indicates that the given interface supports MPCP,
56             i.e., it is an Ethernet PON (EPON) interface.";
57     }
58 }
59
60
61 container statistics-mpcp {
62     config false;
```

```
1      description
2          "This container defines a set of MPCP-related statistics
3            counters of an EPON interface, as defined in
4            IEEE Std 802.3, Clause 64 and Clause 77.";
5
6      leaf out-mpcp-mac-ctrl-frames {
7          type yang:counter64;
8
9
10         units frames;
11
12         config false;
13
14         description
15             "A count of MPCP frames passed to the MAC sublayer for
16               transmission.
17
18               This counter is incremented when a MA_CONTROL.request
19               service primitive is generated within the MAC control
20               sublayer with an opcode indicating an MPCP frame.
21
22               This object is applicable for an OLT and an ONU. It has a
23               distinct value for each logical link.
24
25               Discontinuities of this counter can occur at
26               re-initialization of the management system, and at other
27               times, as indicated by the value of the 'discontinuity-time'
28               leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
29
30         reference
31             "IEEE Std 802.3, 30.3.5.1.7";
32     }
33
34     leaf in-mpcp-mac-ctrl-frames {
35         type yang:counter64;
36
37
38         units frames;
39
40         config false;
41
42         description
43             "A count of MPCP frames passed by the MAC sublayer to the
44               MAC Control sublayer.
45
46               This counter is incremented when a frame is received at the
47               interface which is an MPCP frame or has a Length/Type Ethernet
48               header field value equal to the Type assigned for
49               802.3_MAC_Control as specified in IEEE Std 802.3, 31.4.1.3.
50
51               This object is applicable for an OLT and an ONU. It has a
52               distinct value for each logical link.
53
54               Discontinuities in the value of this counter can occur at
55               re-initialization of the management system, and at other times
56               as indicated by the value of the 'discontinuity-time' leaf
57               defined in the ietf-interfaces YANG module (IETF RFC 8343).";
58
59         reference
60             "IEEE Std 802.3, 30.3.5.1.8";
61     }
62
63
64
65 }
```

```
1
2     leaf mpcp-discovery-window-count {
3         when "../ompe-mode = 'olt'";
4         type yang:counter64;
5
6         units "discovery windows";
7
8         config false;
9
10        description
11            "A count of discovery windows generated by the OLT.
12
13            The counter is incremented by one for each generated
14            discovery window.
15
16            This object is applicable for an OLT and has the same value
17            for each logical link.
18
19            Discontinuities in the value of this counter can occur at
20            re-initialization of the management system, and at other times
21            as indicated by the value of the 'discontinuity-time' leaf
22            defined in the ietf-interfaces YANG module (IETF RFC 8343).";
23
24        reference
25            "IEEE Std 802.3, 30.3.5.1.22";
26    }
27
28    leaf mpcp-discovery-timeout-count {
29        when "../ompe-mode = 'olt'";
30        type yang:counter64;
31
32        units "discovery timeouts";
33
34        config false;
35
36        description
37            "A count of the number of times a discovery timeout occurs.
38
39            This counter is incremented by one for each discovery
40            processing state-machine reset resulting from timeout
41            waiting for message arrival.
42
43            This object is applicable for an OLT and has the same value
44            for each logical link.
45
46            Discontinuities in the value of this counter can occur at
47            re-initialization of the management system, and at other times
48            as indicated by the value of the 'discontinuity-time' leaf
49            defined in the ietf-interfaces YANG module (IETF RFC 8343).";
50
51        reference
52            "IEEE Std 802.3, 30.3.5.1.23";
53    }
54
55    leaf out-mpcp-register-req {
56        when "../ompe-mode = 'onu'";
57        type yang:counter64;
58
59        units frames;
```



```
1      config false;
2
3
4      description
5          "A count of the number of times a REGISTER_REQ MPCP frame
6            transmission occurs.
7
8            This counter is incremented by one for each REGISTER_REQ MPCP
9            frame transmitted as defined in IEEE Std 802.3,
10           Clause 64 and Clause 77.
11
12           This object is applicable for an ONU and has the same value
13           for each logical link.
14
15           Discontinuities in the value of this counter can occur at
16           re-initialization of the management system, and at other times
17           as indicated by the value of the 'discontinuity-time' leaf
18           defined in the ietf-interfaces YANG module (IETF RFC 8343).";
19
20
21
22      reference
23          "IEEE Std 802.3, 30.3.5.1.12";
24  }
25
26  leaf in-mpcp-register-req {
27      when "../ompe-mode = 'olt'";
28      type yang:counter64;
29
30      units frames;
31
32      config false;
33
34      description
35          "A count of the number of times a REGISTER_REQ MPCP frame
36            reception occurs.
37
38            This counter is incremented by one for each REGISTER_REQ MPCP
39            frame received as defined in IEEE Std 802.3,
40            Clause 64 and Clause 77.
41
42            This object is applicable for an OLT and has the same value
43            for each logical link.
44
45            Discontinuities in the value of this counter can occur at
46            re-initialization of the management system, and at other times
47            as indicated by the value of the 'discontinuity-time' leaf
48            defined in the ietf-interfaces YANG module (IETF RFC 8343).";
49
50
51
52      reference
53          "IEEE Std 802.3, 30.3.5.1.17";
54  }
55
56
57  leaf out-mpcp-register-ack {
58      when "../ompe-mode = 'onu'";
59      type yang:counter64;
60
61      units frames;
62
63      config false;
64
65
```

```
1      description
2          "A count of the number of times a REGISTER_ACK MPCP frame
3            transmission occurs.
4
5          This counter is incremented by one for each REGISTER_ACK MPCP
6            frame transmitted as defined in IEEE Std 802.3,
7            Clause 64 and Clause 77.
8
9          This object is applicable for an ONU and has a distinct value
10         for each logical link.
11
12         Discontinuities in the value of this counter can occur at
13         re-initialization of the management system, and at other times
14         as indicated by the value of the 'discontinuity-time' leaf
15         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
16
17     reference
18         "IEEE Std 802.3, 30.3.5.1.10";
19     }
20
21 leaf in-mpcp-register-ack {
22     when "../ompe-mode = 'olt'";
23     type yang:counter64;
24
25     units frames;
26
27     config false;
28
29     description
30         "A count of the number of times a REGISTER_ACK MPCP frame
31           reception occurs.
32
33         This counter is incremented by one for each REGISTER_ACK MPCP
34           frame received as defined in IEEE Std 802.3,
35           Clause 64 and Clause 77.
36
37         This object is applicable for an OLT and has a distinct
38         value for each logical link.
39
40         Discontinuities of this counter can occur at
41         re-initialization of the management system and at other
42         times, as indicated by the value of the 'discontinuity-time'
43         leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
44
45     reference
46         "IEEE Std 802.3, 30.3.5.1.15";
47 }
48
49 leaf out-mpcp-report {
50     when "../ompe-mode = 'onu'";
51     type yang:counter64;
52
53     units frames;
54
55     config false;
56
57     description
58         "A count of the number of times a REPORT MPCP frame
59           transmission occurs.
```

```
1
2     This counter is incremented by one for each REPORT MPCP frame
3     transmitted as defined in IEEE Std 802.3,
4     Clause 64 and Clause 77.
5
6     This object is applicable for an ONU and has a distinct value for
7     each logical link.
8
9
10    Discontinuities of this counter can occur at
11    re-initialization of the management system and at other
12    times, as indicated by the value of the 'discontinuity-time'
13    leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
14
15    reference
16        "IEEE Std 802.3, 30.3.5.1.13";
17    }
18
19    leaf in-mpcp-report {
20        when "../ompe-mode = 'olt'";
21        type yang:counter64;
22
23        units frames;
24
25        config false;
26
27        description
28            "A count of the number of times a REPORT MPCP frame
29            reception occurs.
30
31            This counter is incremented by one for each REPORT MPCP frame
32            received as defined in IEEE Std 802.3,
33            Clause 64 and Clause 77.
34
35            This object is applicable for an OLT and has a distinct
36            value for each logical link.
37
38            Discontinuities in the value of this counter can occur at
39            re-initialization of the management system, and at other times
40            as indicated by the value of the 'discontinuity-time' leaf
41            defined in the ietf-interfaces YANG module (IETF RFC 8343).";
42
43        reference
44            "IEEE Std 802.3, 30.3.5.1.18";
45    }
46
47    leaf out-mpcp-gate {
48        when "../ompe-mode = 'olt'";
49        type yang:counter64;
50
51        units frames;
52
53        config false;
54
55        description
56            "A count of the number of times a GATE MPCP frame
57            transmission occurs.
58
59            This counter is incremented by one for each GATE MPCP frame
60            transmitted as defined in IEEE Std 802.3,
```

```
1      Clause 64 and Clause 77.
2
3      This object is applicable for an OLT and has a distinct
4      value for each logical link.
5
6      Discontinuities of this counter can occur at
7      re-initialization of the management system and at other
8      times, as indicated by the value of the 'discontinuity-time'
9      leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
10
11
12      reference
13      "IEEE Std 802.3, 30.3.5.1.9";
14  }
15
16  leaf in-mpcp-gate {
17      when "../ompe-mode = 'onu'";
18      type yang:counter64;
19
20      units frames;
21
22      config false;
23
24      description
25          "A count of the number of times a GATE MPCP frame reception
26          occurs.
27
28          This counter is incremented by one for each GATE MPCP frame
29          received as defined in IEEE Std 802.3,
30          Clause 64 and Clause 77.
31
32          This object is applicable for an ONU and has a distinct value
33          for each logical link.
34
35          Discontinuities of this counter can occur at
36          re-initialization of the management system and at other
37          times, as indicated by the value of the 'discontinuity-time'
38          leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
39
40      reference
41      "IEEE Std 802.3, 30.3.5.1.14";
42  }
43
44  leaf out-mpcp-register {
45      when "../ompe-mode = 'olt'";
46      type yang:counter64;
47
48      units frames;
49
50      config false;
51
52      description
53          "A count of the number of times a REGISTER MPCP frame
54          transmission occurs.
55
56          This counter is incremented by one for each REGISTER MPCP
57          frame transmitted as defined in IEEE Std 802.3,
58          Clause 64 and Clause 77.
59
60          This object is applicable for an OLT and has a distinct
```

```
1         value for each logical link.
2
3         Discontinuities of this counter can occur at
4         re-initialization of the management system and at other
5         times, as indicated by the value of the 'discontinuity-time'
6         leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
7
8
9     reference
10        "IEEE Std 802.3, 30.3.5.1.11";
11    }
12
13    leaf in-mpcp-register {
14        when "../..//ompe-mode = 'onu'";
15        type yang:counter64;
16
17        units frames;
18
19        config false;
20
21        description
22            "A count of the number of times a REGISTER MPCP frame
23            reception occurs.
24
25            This counter is incremented by one for each REGISTER MPCP
26            frame received as defined in IEEE Std 802.3,
27            Clause 64 and Clause 77.
28
29            This object is applicable for an ONU and has a distinct value
30            for each logical link.
31
32            Discontinuities of this counter can occur at
33            re-initialization of the management system and at other
34            times, as indicated by the value of the 'discontinuity-time'
35            leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
36
37        reference
38            "IEEE Std 802.3, 30.3.5.1.16";
39    }
40
41    }
42
43    }
44
45    container statistics-ompe {
46        description
47            "This container defines a set of OMP-Emulation-related
48            statistics counters of an EPON interface, as defined in
49            IEEE Std 802.3, Clause 65 and Clause 76.";
50
51        reference
52            "IEEE Std 802.3.1, dot3OmpEmulationStatEntry";
53
54        leaf in-ompe-frames-errored-sld {
55            type yang:counter64;
56
57            units frames;
58
59            config false;
60
61            description
62                "A count of frames received that do not contain a valid SLD
63                field as defined in IEEE Std 802.3, 65.1.3.3.1 or
64                field as defined in IEEE Std 802.3, 65.1.3.3.1 or
65                field as defined in IEEE Std 802.3, 65.1.3.3.1 or
```

```
1         76.2.6.1.3.1, as appropriate.
2
3         This object is applicable for an OLT and an ONU. It has a
4         distinct value for each logical link.
5
6         Discontinuities in the value of this counter can occur at
7         re-initialization of the management system, and at other times
8         as indicated by the value of the 'discontinuity-time' leaf
9         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
10
11     reference
12         "IEEE Std 802.3, 30.3.7.1.3";
13     }
14
15     leaf in-ompe-frames-errored-crc8 {
16         type yang:counter64;
17
18         units frames;
19
20         config false;
21
22         description
23             "A count of frames received that contain a valid SLD field,
24             as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1 as
25             appropriate, but do not pass the CRC-8 check as defined in
26             IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3 as appropriate.
27
28             This object is applicable for an OLT and an ONU. It has a
29             distinct value for each logical link.
30
31             Discontinuities of this counter can occur at
32             re-initialization of the management system and at other
33             times, as indicated by the value of the 'discontinuity-time'
34             leaf defined in the ietf-interfaces YANG module (IETF RFC 8343).";
35
36         reference
37             "IEEE Std 802.3, 30.3.7.1.4";
38     }
39
40     leaf ompe-onu-frames-with-good-llid-good-crc8 {
41         when "../ompe-mode = 'onu'";
42         type yang:counter64;
43         units frames;
44         config false;
45         description
46             "A count of frames received that 1) contain a valid SLD field
47             in an ONU, 2) meet the rule for frame acceptance, and
48             3) pass the CRC-8 check.
49
50             The SLD is defined in IEEE Std 802.3, 65.1.3.3.1 or
51             76.2.6.1.3.1, as appropriate.
52
53             The rules for LLID acceptance are defined in IEEE Std 802.3,
54             65.1.3.3.2 or 76.2.6.1.3.2, as appropriate.
55
56             The CRC-8 check is defined in IEEE Std 802.3,
57             65.1.3.3.3 or 76.2.6.1.3.3, as appropriate.
58
59             This object is applicable for an ONU and has a distinct value
```

```
1         for each logical link.
2
3         Discontinuities in the value of this counter can occur at
4         re-initialization of the management system, and at other
5         times as indicated by the value of the
6         'discontinuity-time' leaf defined in the ietf-interfaces
7         YANG module (IETF RFC 8343).";
8     reference
9         "IEEE Std 802.3, 30.3.7.1.6";
10 }
11
12
13 leaf ompe-olt-frames-with-good-llid-good-crc8 {
14     when "../ompe-mode = 'olt'";
15     type yang:counter64;
16     units frames;
17     config false;
18     description
19         "A count of frames received that 1) contain a valid SLD field
20         in an OLT, and 2) pass the CRC-8 check.
21
22         The SLD is defined in IEEE Std 802.3, 65.1.3.3.1 or
23         76.2.6.1.3.1, as appropriate.
24
25         The frame acceptance are defined in IEEE Std 802.3,
26         65.1.3.3.2 or 76.2.6.1.3.2, as appropriate.
27
28         The CRC-8 check is defined in IEEE Std 802.3,
29         65.1.3.3.3 or 76.2.6.1.3.3, as appropriate.
30
31         This object is applicable for an OLT and has a distinct
32         value for each logical link.
33
34         Discontinuities in the value of this counter can occur at
35         re-initialization of the management system, and at other
36         times as indicated by the value of the
37         'discontinuity-time' leaf defined in the ietf-interfaces
38         YANG module (IETF RFC 8343).";
39     reference
40         "IEEE Std 802.3, 30.3.7.1.6";
41 }
42
43 leaf in-ompe-frames-with-bad-llid {
44     when "../ompe-mode = 'olt'";
45     type yang:counter64;
46
47     units frames;
48
49     config false;
50
51     description
52         "A count of frames received that contain a valid SLD field, as
53         defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
54         appropriate, and pass the CRC-8 check as defined in IEEE Std
55         802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate, but are
56         discarded due to the LLID check.
57
58         This object is applicable for an OLT and has a distinct value
59         for each logical link.
```

```
1
2     Discontinuities in the value of this counter can occur at
3     re-initialization of the management system, and at other times
4     as indicated by the value of the 'discontinuity-time' leaf
5     defined in the ietf-interfaces YANG module (IETF RFC 8343).";
6
7     reference
8         "IEEE Std 802.3, 30.3.7.1.8";
9
10 }
11
12 leaf in-ompe-frames-with-good-llid {
13     type yang:counter64;
14
15     units frames;
16
17     config false;
18
19     description
20         "A count of frames received that contain a valid SLD field,
21         as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1 as
22         appropriate, but do not pass the CRC-8 check as defined in
23         IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3 as appropriate.
24
25         This object is applicable for an OLT and an ONU. It has a
26         distinct value for each logical link.
27
28         Discontinuities in the value of this counter can occur at
29         re-initialization of the management system, and at other times
30         as indicated by the value of the 'discontinuity-time' leaf
31         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
32
33     reference
34         "IEEE Std 802.3, 30.3.7.1.4";
35
36 }
37
38 leaf in-ompe-frames {
39     type yang:counter64;
40
41     units frames;
42
43     config false;
44
45     description
46         "A count of frames received that contain a valid SLD field,
47         as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
48         appropriate, and pass the CRC-8 check as defined in
49         IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate.
50
51         This object is applicable for an OLT and an ONU. It has a
52         distinct value for each logical link.
53
54         Discontinuities in the value of this counter can occur at
55         re-initialization of the management system, and at other times
56         as indicated by the value of the 'discontinuity-time' leaf
57         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
58
59     reference
60         "IEEE Std 802.3, 30.3.7.1.6 (ONU) and 30.3.7.1.7 (OLT)";
61
62 }
63
64
65
```



```
1
2     leaf in-ompe-frames-not-match-onu-llid-broadcast {
3         when "../ompe-mode = 'onu'";
4
5         type yang:counter64;
6
7         units frames;
8
9         config false;
10
11        description
12            "A count of frames received that contain a valid SLD field,
13             as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
14             appropriate, pass the CRC-8 check, as defined in
15             IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate,
16             and contain the broadcast bit in the LLID and not the ONU's
17             LLID (frame accepted) as defined in IEEE Std 802.3,
18             Clause 65 and Clause 76, as appropriate.
19
20             This object is applicable for an ONU only.
21
22             Discontinuities in the value of this counter can occur at
23             re-initialization of the management system, and at other times
24             as indicated by the value of the 'discontinuity-time' leaf
25             defined in the ietf-interfaces YANG module (IETF RFC 8343).";
26
27        reference
28            "IEEE Std 802.3.1, dot3OmpEmulationBroadcastBitNotOnuLlid";
29    }
30
31    leaf in-ompe-frames-match-onu-llid-not-broadcast {
32        when "../ompe-mode = 'onu'";
33
34        type yang:counter64;
35
36        units frames;
37
38        config false;
39
40        description
41            "A count of frames received that contain a valid SLD field,
42             as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
43             appropriate, pass the CRC-8 check, as defined in
44             IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate,
45             and contain the ONU's LLID (frame accepted) as defined in
46             IEEE Std 802.3, Clause 65 and Clause 76, as appropriate.
47
48             This object is applicable for an ONU only.
49
50             Discontinuities in the value of this counter can occur at
51             re-initialization of the management system, and at other times
52             as indicated by the value of the 'discontinuity-time' leaf
53             defined in the ietf-interfaces YANG module (IETF RFC 8343).";
54
55        reference
56            "IEEE Std 802.3.1, dot3OmpEmulationOnuLLIDNotBroadcast";
57    }
58
59    leaf in-ompe-frames-match-onu-llid-broadcast {
```

```
1      when "../..//ompe-mode = 'onu'";
2
3      type yang:counter64;
4
5      units frames;
6
7      config false;
8
9
10     description
11       "A count of frames received that contain a valid SLD field,
12        as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
13        appropriate, pass the CRC-8 check, as defined in
14        IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate,
15        and contain the broadcast bit in the LLID and the ONU's LLID
16        (frame accepted) as defined in IEEE Std 802.3, Clause 65 and
17        Clause 76, as appropriate.
18
19        This object is applicable for an ONU only.
20
21        Discontinuities in the value of this counter can occur at
22        re-initialization of the management system, and at other times
23        as indicated by the value of the 'discontinuity-time' leaf
24        defined in the ietf-interfaces YANG module (IETF RFC 8343).";
25
26     reference
27       "IEEE Std 802.3.1, dot3OmpEmulationBroadcastBitPlusOnuLlid";
28   }
29
30   leaf in-ompe-frames-not-match-onu-llid-not-broadcast {
31     when "../..//ompe-mode = 'onu'";
32
33     type yang:counter64;
34
35     units frames;
36
37     config false;
38
39
40     description
41       "A count of frames received that contain a valid SLD field,
42        as defined in IEEE Std 802.3, 65.1.3.3.1 or 76.2.6.1.3.1, as
43        appropriate, pass the CRC-8 check, as defined in
44        IEEE Std 802.3, 65.1.3.3.3 or 76.2.6.1.3.3, as appropriate,
45        do not contain the broadcast bit in the LLID and do not
46        contain the ONU's LLID (frame is NOT accepted) as defined in
47        IEEE Std 802.3, Clause 65 and Clause 76, as appropriate.
48
49        This object is applicable for an ONU only.
50
51        Discontinuities in the value of this counter can occur at
52        re-initialization of the management system, and at other times
53        as indicated by the value of the 'discontinuity-time' leaf
54        defined in the ietf-interfaces YANG module (IETF RFC 8343).";
55
56     reference
57       "IEEE Std 802.3.1, dot3OmpEmulationNotBroadcastBitNotOnuLlid";
58   }
59 }
60
61 container thresholds-trx {
62   if-feature "trx-power-level-reporting-supported";
63 }
```

```
1
2     description
3         "This container defines a set of optical transceiver
4         thresholds of an EPON interface as defined in
5         IEEE Std 802.3, Clause 60 and Clause 75.";
6
7     reference
8         "IEEE Std 802.3.1, dot3ExtPkgOptIfEntry";
9
10
11     leaf in-trx-power-low-threshold {
12         if-feature "trx-power-level-reporting-supported";
13
14         type int32;
15
16         units "0.1 dBm";
17
18         description
19             "This object reflects the current setting of low alarm
20             threshold for the input power into the optical receiver.
21             If the value reported in 'in-trx-power' object drops below
22             the value set in 'in-trx-power-low-threshold', a
23             'in-trx-power-low-threshold-crossing' event is generated.
24
25             This object is applicable for an OLT and an ONU. It has a
26             distinct value for each logical link.";
27
28         reference
29             "IEEE Std 802.3.1, dot3ExtPkgOptIfLowerInputPowerThreshold";
30     }
31
32
33     leaf in-trx-power-high-threshold {
34         if-feature "trx-power-level-reporting-supported";
35
36         type int32;
37
38         units "0.1 dBm";
39
40         description
41             "This object reflects the current setting of high alarm
42             threshold for the input power into the optical receiver. If
43             the value reported in 'in-trx-power' object exceeds the
44             value set in 'in-trx-power-high-threshold', a
45             'in-trx-power-high-threshold-crossing' event is generated.
46
47             This object is applicable for an OLT and an ONU. It has a
48             distinct value for each logical link.";
49
50         reference
51             "IEEE Std 802.3.1, dot3ExtPkgOptIfUpperInputPowerThreshold";
52     }
53
54
55     leaf out-trx-power-low-threshold {
56         if-feature "trx-power-level-reporting-supported";
57
58         type int32;
59
60         units "0.1 dBm";
61
62         description
```

```
1      "This object reflects the current setting of low alarm
2      threshold for the output power out of the optical
3      transmitter. If the value reported in 'out-trx-power' object
4      drops below the value set in 'out-trx-power-low-threshold',
5      a 'out-trx-power-low-threshold-crossing' event is generated.
6
7      This object is applicable for an OLT and an ONU. It has a
8      distinct value for each logical link.";
9
10
11     reference
12       "IEEE Std 802.3.1, dot3ExtPkgOptIfLowerOutputPowerThreshold";
13   }
14
15   leaf out-trx-power-high-threshold {
16     if-feature "trx-power-level-reporting-supported";
17
18     type int32;
19
20     units "0.1 dBm";
21
22     description
23       "This object reflects the current setting of high alarm
24       threshold for the output power out of the optical
25       transmitter. If the value reported in 'out-trx-power' object
26       exceeds the value set in 'out-trx-power-high-threshold', a
27       'out-trx-power-high-threshold-crossing' event is generated.
28
29       This object is applicable for an OLT and an ONU. It has a
30       distinct value for each logical link.";
31
32     reference
33       "IEEE Std 802.3.1, dot3ExtPkgOptIfUpperOutputPowerThreshold";
34   }
35 }
36
37 container statistics-trx {
38   if-feature "trx-power-level-reporting-supported";
39
40   description
41     "This container defines a set of optical transceiver
42     statistics counters of an EPON interface as defined in
43     IEEE Std 802.3, Clause 60 and Clause 75.";
44
45     reference
46       "IEEE Std 802.3.1, dot3ExtPkgOptIfEntry";
47
48     leaf in-trx-power-signal-detect {
49       type boolean;
50
51       config false;
52
53       description
54         "This object indicates whether a valid optical signal was
55         detected (when read as 'true') or not (when read as 'false')
56         at the input to the optical transceiver.
57
58         This object is applicable for an OLT and an ONU. It has a
59         distinct value for each logical link.";
60
61     reference
```

```
1      "IEEE Std 802.3.1, dot3ExtPkgOptIfSignalDetect";
2    }
3
4    leaf in-trx-power {
5      type int32;
6
7      units "0.1 dBm";
8
9      config false;
10
11     description
12       "This object reflects the value of the input power, as
13        measured at the optical transceiver, expressed in units of
14        0.1 dBm.
15
16        At the ONU, the measurement is performed in a continuous
17        manner.
18
19        At the OLT, the measurement is performed in a burst-mode
20        manner, for each incoming data burst.
21
22        This object is applicable for an OLT and an ONU. It has a
23        distinct value for each logical link.";
24
25     reference
26       "IEEE Std 802.3.1, dot3ExtPkgOptIfInputPower";
27   }
28
29   leaf in-trx-power-low-15-minutes-bin {
30     type int32;
31
32     units "0.1 dBm";
33
34     config false;
35
36     description
37       "This object reflects the lowest value of the input power
38        during the period of the last 15 minutes, as measured at the
39        optical transceiver, and expressed in units of 0.1 dBm.
40
41        At the ONU, the measurement is performed in a continuous
42        manner and stored in a rolling 15-minutes' long observation
43        bin.
44
45        At the OLT, the measurement is the average power for each
46        incoming data burst, and stored in a rolling 15-minutes'
47        long observation bin.
48
49        This object is applicable for an OLT and an ONU. It has a
50        distinct value for each logical link.";
51
52     reference
53       "IEEE Std 802.3.1, dot3ExtPkgOptIfLowInputPower";
54   }
55
56   leaf in-trx-power-high-15-minutes-bin {
57     type int32;
58
59     units "0.1 dBm";
```

```
1      config false;
2
3      description
4      "This object reflects the highest value of the input power
5      during the period of the last 15 minutes, as measured at the
6      optical transceiver, and expressed in units of 0.1 dBm.
7
8      At the ONU, the measurement is performed in a continuous
9      manner and stored in a rolling 15-minutes' long observation
10     bin.
11
12     At the OLT, the measurement is the average power for each
13     incoming data burst, and stored in a rolling 15-minutes'
14     long observation bin.
15
16     This object is applicable for an OLT and an ONU. It has a
17     distinct value for each logical link.";
18
19     reference
20     "IEEE Std 802.3.1, dot3ExtPkgOptIfHighInputPower";
21 }
22
23 leaf out-trx-power-signal-detect {
24     type boolean;
25
26     config false;
27
28     description
29     "This object indicates whether a valid optical signal was
30     detected (when read as 'true') or not (when read as 'false')
31     at the output from the optical transceiver.
32
33     This object is applicable for an OLT and an ONU. It has a
34     distinct value for each logical link.";
35
36     reference
37     "IEEE Std 802.3.1, dot3ExtPkgOptIfTransmitAlarm";
38 }
39
40 leaf out-trx-power {
41     type int32;
42
43     units "0.1 dBm";
44
45     config false;
46
47     description
48     "This object reflects the value of the output power, as
49     measured at the optical transceiver, expressed in units of
50     0.1 dBm.
51
52     At the ONU, the measurement is performed in a burst-mode
53     manner for each outgoing data burst.
54
55     At the OLT, the measurement is performed in a continuous
56     manner.
57
58     This object is applicable for an OLT and an ONU. It has a
```

```
1         distinct value for each logical link.";
2
3     reference
4         "IEEE Std 802.3.1, dot3ExtPkgOptIfOutputPower";
5 }
6
7 leaf out-trx-power-low-15-minutes-bin {
8     type int32;
9
10    units "0.1 dBm";
11
12    config false;
13
14    description
15        "This object reflects the lowest value of the output power
16        during the period of the last 15 minutes, as measured at the
17        optical transceiver, and expressed in units of 0.1 dBm.
18
19        At the ONU, the measurement is performed in a burst-mode
20        manner and stored in a rolling 15-minutes' long observation
21        bin.
22
23        At the OLT, the measurement is the average power for each
24        incoming data burst, and stored in a rolling 15-minutes'
25        long observation bin.
26
27        This object is applicable for an OLT and an ONU. It has a
28        distinct value for each logical link.";
29
30    reference
31        "IEEE Std 802.3.1, dot3ExtPkgOptIfLowOutputPower";
32 }
33
34 leaf out-trx-power-high-15-minutes-bin {
35     type int32;
36
37    units "0.1 dBm";
38
39    config false;
40
41    description
42        "This object reflects the highest value of the output power
43        during the period of the last 15 minutes, as measured at the
44        optical transceiver, and expressed in units of 0.1 dBm.
45
46        At the ONU, the measurement is performed in a burst-mode
47        manner and stored in a rolling 15-minutes' long observation
48        bin.
49
50        At the OLT, the measurement is the average power for each
51        incoming data burst, and stored in a rolling 15-minutes'
52        long observation bin.
53
54        This object is applicable for an OLT and an ONU. It has a
55        distinct value for each logical link.";
56
57    reference
58        "IEEE Std 802.3.1, dot3ExtPkgOptIfHighOutputPower";
59 }
```

```
1
2     leaf trx-data-reliable {
3         if-feature "trx-power-level-reporting-supported";
4
5         type boolean;
6
7         config false;
8
9         description
10            "This object indicates whether data contained in individual
11             counters in 'statistics-trx' container are reliable
12             (when read as 'true') or not (when read as 'false')."
13
14            This object is applicable for an OLT and an ONU. It has a
15            distinct value for each logical link.";
16
17         reference
18            "IEEE Std 802.3.1, dot3ExtPkgOptIfSuspectedFlag";
19     }
20 }
21
22
23
24
25 container statistics-pon-fec {
26     when
27         "(../fec-capability = 'supported') and
28         (../fec-mode = 'enabled-Tx-Rx')";
29
30     if-feature "fec-supported";
31
32     config false;
33
34     description
35         "This container defines a set of FEC-related statistics
36         counters of an EPON interface, as defined in
37         IEEE Std 802.3, Clause 65 and Clause 76.";
38
39     reference
40         "IEEE Std 802.3.1, dot3OmpEmulationStatEntry";
41
42     leaf fec-code-group-violations {
43         type yang:counter64;
44
45         units code-group;
46
47         config false;
48
49         description
50             "For 1G-EPON this is a count of the number of events that
51              cause the PHY to indicate 'Data reception error' or
52              'Carrier Extend Error' on the GMII (see IEEE Std 802.3,
53              Table 35-1). The contents of this counter is undefined when
54              FEC is operating. For 10G-EPON this object is not applicable.
55
56              This object is applicable for an OLT and an ONU. At the
57              OLT, it has a distinct value for each logical link.
58
59              Discontinuities in the value of this counter can occur at
60              re-initialization of the management system, and at other times
61              as indicated by the value of the 'discontinuity-time' leaf
62
63
64
65
```



```
1         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
2
3     reference
4         "IEEE Std 802.3, 30.5.1.1.14";
5 }
6
7 leaf fec-buffer-head-coding-violations {
8     type yang:counter64;
9
10
11     units code-group;
12
13     config false;
14
15     description
16         "For 1G-EPON PHY, this object represents the count of the
17         number of invalid code-groups received directly from the
18         link when FEC is enabled. When FEC is disabled this
19         counter stops counting.
20
21         For 10G-EPON PHYs, this object is set to zero.
22
23         This object is applicable for an OLT and an ONU. It has a
24         distinct value for each logical link.
25
26         Discontinuities in the value of this counter can occur at
27         re-initialization of the management system, and at other times
28         as indicated by the value of the 'discontinuity-time' leaf
29         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
30
31     reference
32         "IEEE Std 802.3.1, dot3EponFecBufferHeadCodingViolation";
33 }
34
35 leaf fec-code-word-corrected-errors {
36     type yang:counter64;
37
38
39     units code-group;
40
41     config false;
42
43     description
44         "For 1G-EPON or 10G-EPON PHYs, this object represents a count
45         of corrected FEC blocks.
46
47         This counter increments by one for each received FEC block
48         that contained detected errors and was corrected by the FEC
49         function in the PHY.
50
51         This object is applicable for an OLT and an ONU. It has a
52         distinct value for each logical link.
53
54         Discontinuities in the value of this counter can occur at
55         re-initialization of the management system, and at other times
56         as indicated by the value of the 'discontinuity-time' leaf
57         defined in the ietf-interfaces YANG module (IETF RFC 8343).";
58
59     reference
60         "IEEE Std 802.3, 30.5.1.1.17";
61 }
62
63
64
65
```

```

1
2     leaf fec-code-word-uncorrected-errors {
3         type yang:counter64;
4
5         units code-group;
6
7         config false;
8
9         description
10            "For 1G-EPON or 10G-EPON PHYs, this object represents a count of
11            uncorrectable FEC blocks.
12
13            This counter increments by one for each received FEC block
14            that contained detected errors and was not corrected by the
15            FEC function in the PHY.
16
17            This object is applicable for an OLT and an ONU. It has a
18            distinct value for each logical link.
19
20            Discontinuities in the value of this counter can occur at
21            re-initialization of the management system, and at other times
22            as indicated by the value of the 'discontinuity-time' leaf
23            defined in the ietf-interfaces YANG module (IETF RFC 8343).";
24
25            reference
26                "IEEE Std 802.3, 30.5.1.1.18";
27        }
28    }
29
30    container mpcp-logical-link-admin-actions {
31        description
32            "Container of actions.";
33        action state-change-action-type {
34            description
35                "Request a state change on the interface.";
36            input {
37                leaf state-change-action-type {
38                    type identityref {
39                        base state-change-action-type;
40                    }
41                }
42            }
43            description
44                "Type of interface state change requested.";
45        }
46    }
47
48    action reset-action-type {
49        description
50            "Request a reset-action of the interface.";
51        input {
52            leaf reset-action-type {
53                type identityref {
54                    base reset-action-type;
55                }
56            }
57        }
58        description
59            "Type of reset action requested of the interface.";
60    }
61
62    }
63
64    }
65    action register-type {

```

```

1      description
2          "Request a registration action.";
3      input {
4          leaf register-type {
5              type identityref {
6                  base register-type;
7              }
8          }
9          description
10             "Type of registration action requested of the interface.";
11        }
12    }
13 }
14 }
15
16 list mpcp-queues {
17     key mpcp-queue-index;
18
19     description
20         "An instance of this object for each value of
21         'mpcp-queue-index' is created when a new logical link is
22         registered and deleted when the logical link is deregistered.
23
24         All instances of this object in the ONU associated with the
25         given logical link are then mapped to a REPORT MPCPDU, when
26         generated.
27
28         +-----+
29         |          Destination Address          |
30         +-----+
31         |          Source Address              |
32         +-----+
33         |          Length/Type                 |
34         +-----+
35         |          OpCode                     |
36         +-----+
37         |          TimeStamp                   |
38         +-----+
39         |          Number of Queue Sets        |
40         +-----+
41         |          Report bitmap               |
42         +-----+
43         |          Queue 0 report              |
44         +-----+
45         |          Queue 1 report              |
46         +-----+
47         |          Queue 2 report              |
48         +-----+
49         |          Queue 3 report              |
50         +-----+
51         |          Queue 4 report              |
52         +-----+
53         |          Queue 5 report              |
54         +-----+
55         |          Queue 6 report              |
56         +-----+
57         |          Queue 7 report              |
58         +-----+
59         |          Pad/reserved                |
60         +-----+
61
62         -|
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```

1          |          FCS          |
2          +-----+
3
4          The 'Queue N report' field reports the current occupancy of
5          each upstream transmission queue associated with the given
6          logical link.
7
8          The 'Number of Queue Sets' field defines the number of
9          reported 'Queue N report' sets.
10
11          For each Queue Set, the 'Report bitmap' field defines which
12          upstream transmission queues are present in the REPORT MPCPDU.
13          Although the REPORT MPCPDU can report current occupation for
14          up to 8 upstream transmission queues in a single REPORT MPCPDU
15          , the actual number is flexible. The 'mpcp-queue-group'
16          grouping has a variable size that is limited by value of
17          'mpcp-maximum-queue-count-per-report' object, allowing ONUs
18          report the occupancy of fewer upstream transmission queues, as
19          needed.
20
21          This object is applicable for an OLT and an ONU. At the OLT,
22          this object has a distinct value for each logical link and
23          every queue. At the ONU, it has a distinct value for
24          every queue.";
25
26          reference
27          "IEEE Std 802.3.1, dot3ExtPkgQueueEntry";
28
29          leaf mpcp-queue-index {
30              type uint8 {
31                  range "0 .. 7" {
32                      description
33                          "This object indicates the identity (index) of a queue in
34                          the ONU. It can have a value between 0 and 7, limited by
35                          the value stored in the
36                          'mpcp-maximum-queue-count-per-report' object.";
37
38                      reference
39                          "See 'mpcp-maximum-queue-count-per-report' object";
40                  }
41              }
42          }
43
44          description
45              "An object represents the index of an upstream transmission
46              queue storing subscriber packets. The size (occupancy) of
47              the upstream transmission queue identified by this object is
48              then reported within REPORT MPCPDU, defined in
49              IEEE Std 802.3, Clause 64 and Clause 77.
50
51              This object indicates the identity (index) of a queue in the
52              ONU. It can have a value between 0 and 7, limited by the value
53              stored in the 'mpcp-maximum-queue-count-per-report' object.
54
55              This object is applicable for an OLT and an ONU. It has a
56              distinct value for each logical link and each queue.
57              At the ONU, it has a distinct value for each queue.";
58
59          reference
60          "IEEE Std 802.3.1, dot3QueueIndex";
61
62
63
64
65

```

```
1      }
2
3      leaf mpcp-queue-threshold-count {
4          type uint8 {
5              range "0 .. 7" {
6                  description
7                      "This object indicates the identity (index) of a queue in
8                       the ONU. It can have a value between 0 and 7, limited by
9                       the value stored in the
10                      'mpcp-maximum-queue-count-per-report' object.";
11
12
13                  reference
14                      "See 'mpcp-queue-threshold-count-max' object";
15              }
16          }
17
18      description
19          "This object reflects the number of reporting thresholds for
20           the specific upstream transmission queue, reflected in the
21           REPORT MPCPDU, as defined in IEEE Std 802.3,
22           Clause 64 and Clause 77.
23
24           Each 'Queue set' provides information for the specific
25           upstream transmission queue occupancy of frames below the
26           matching reporting threshold.
27
28           A read of this object reflects the number of reporting
29           thresholds for the specific upstream transmission queue.
30
31           This object is applicable for an OLT and an ONU. It has a
32           distinct value for each logical link and each queue.
33           At the ONU, it has a distinct value for each queue.";
34
35      reference
36          "IEEE Std 802.3.1, dot3ExtPkgObjectReportNumThreshold";
37  }
38
39  leaf mpcp-queue-threshold-count-max {
40      type uint8 {
41          range "0 .. 7" {
42              description
43                  "This object can have a value between 0 and 7.";
44          }
45      }
46      config false;
47      description
48          "This object reflects the maximum number of reporting
49           thresholds for the specific upstream transmission queue,
50           reflected in the REPORT MPCPDU, as defined in
51           IEEE Std 802.3, Clause 64 and Clause 77.
52
53           A read of this object reflects the maximum number of
54           reporting thresholds for the specific upstream transmission
55           queue.
56
57           This object is applicable for an OLT and an ONU. It has a
58           distinct value for each logical link and each queue.
59           At the ONU, it has a distinct value for each queue.";
```

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logical link.

The 'Number of Queue Sets' field defines the number of reported 'Queue N report' sets.

For each Queue Set, the 'Report bitmap' field defines which upstream transmission queues are present in the REPORT MPCPDU. Although the REPORT MPCPDU can report current occupation for up to 8 upstream transmission queues in a single REPORT MPCPDU, the actual number is flexible.

The 'mpcp-queue-group' grouping has a variable size that is limited by value of 'mpcp-maximum-queue-count-per-report' object, allowing ONUs to report the occupancy of fewer upstream transmission queues, as needed.

This object is applicable for an OLT and an ONU. It has a distinct value for each logical link and every queue. At the ONU, it has a distinct value for every queue.";

reference

"IEEE Std 802.3.1, dot3ExtPkgQueueSetsEntry";

leaf mpcp-queue-set-index {

type uint8 {

range "0 .. 7" {

description

"This object indicates the identity (index) of a queue in the ONU. It can have a value between 0 and 7, limited by the value stored in the 'mpcp-maximum-queue-count-per-report' object.";

reference

"See 'mpcp-maximum-queue-count-per-report' object";

}

}

description

"This object represents the index of the Queue Set for the 'mpcp-queue-set-group' grouping. The size (occupancy) of the upstream transmission queues belonging to the given Queue Set is then reported within REPORT MPCPDU, defined in IEEE Std 802.3, Clause 64 and Clause 77.

This object can have a value between 0 and 7, limited by the value stored in the 'mpcp-queue-threshold-count-max' object.";

reference

"IEEE Std 802.3.1, dot3QueueSetIndex";

}

leaf mpcp-queue-set-threshold {

type uint64;

units "TQ";

default "0";

```
1      description
2          "This object defines the value of a reporting threshold
3           for each Queue Set stored in REPORT MPCPDU defined in
4           IEEE Std 802.3, Clause 64 and Clause 77.
5
6           The number of Queue Sets for each upstream transmission
7           queue is defined in the 'mpcp-queue-threshold-count'
8           object.
9
10          Within REPORT MPCPDU, each Queue Set provides information
11          on the current upstream transmission queue occupancy for
12          frames below the matching threshold.
13
14          The value stored in this object is expressed in the units
15          of Time quanta (TQ), where 1 TQ = 16 ns.
16
17          A read of this object provides the current threshold value
18          for the specific upstream transmission queue.
19
20          This object is applicable for an OLT and an ONU. At the
21          OLT, it has a distinct value for each logical link, each
22          queue, and each Queue Set.
23
24          At the ONU, it has a distinct value for each queue and
25          each Queue Set.";
```

```
26      reference
27          "IEEE Std 802.3.1, dot3ExtPkgObjectReportThreshold";
28    }
29  }
30
31  leaf in-mpcp-queue-frames {
32      type yang:counter64;
33
34      config false;
35
36      description
37          "A count of the number of times a frame reception event
38           results in a frame being queued in (for ONUs) or received
39           from (for OLTs) the corresponding queue. This object is
40           incremented by one for each frame written to (in the case
41           of the ONU) or received for (in case of the OLT) the
42           associated queue.
43
44           The queue index matches the queue number in REPORT MPCPDU,
45           as defined in IEEE Std 802.3, Clause 64 and Clause 77.
46
47           This object is applicable for an OLT and an ONU. At the OLT,
48           it has a distinct value for each logical link and each queue.
49           At the ONU, it has a distinct value for each queue.
50
51           Discontinuities in the value of this counter can occur at
52           re-initialization of the management system, and at other times
53           as indicated by the value of the 'discontinuity-time' leaf
54           defined in the ietf-interfaces YANG module (IETF RFC 8343).";
55
56      reference
57          "IEEE Std 802.3.1, dot3ExtPkgStatRxFramesQueue";
58    }
```



```
1
2     leaf out-mpcp-queue-frames {
3         when "../../mpcp-mode = 'onu'";
4
5         type yang:counter64;
6
7         config false;
8
9         description
10            "This object reflects the number of frame transmission
11             events from the corresponding upstream transmission queue.
12             This object is incremented by one for each frame transmitted
13             , when it is output from the associated queue.
14
15             The queue index matches the queue number in REPORT MPCPDU,
16             as defined in IEEE Std 802.3, Clause 64 and Clause 77.
17
18             This object is applicable for an ONU only. At the ONU, it
19             has a distinct value for each queue.
20
21             Discontinuities in the value of this counter can occur at
22             re-initialization of the management system, and at other times
23             as indicated by the value of the 'discontinuity-time' leaf
24             defined in the ietf-interfaces YANG module (IETF RFC 8343).";
25
26         reference
27             "IEEE Std 802.3.1, dot3ExtPkgStatTxFramesQueue";
28     }
29
30     leaf mpcp-queue-frames-drop {
31         when "../../mpcp-mode = 'onu'";
32
33         type yang:counter64;
34
35         config false;
36
37         description
38            "This object reflects the number of frame drop events from
39             the corresponding upstream transmission queue. This object
40             is incremented by one for each frame dropped in the
41             associated queue.
42
43             The queue index matches the queue number in REPORT MPCPDU,
44             as defined in IEEE Std 802.3, Clause 64 and Clause 77.
45
46             This object is applicable for an ONU only. At the ONU, it
47             has a distinct value for each queue.
48
49             Discontinuities in the value of this counter can occur at
50             re-initialization of the management system, and at other times
51             as indicated by the value of the 'discontinuity-time' leaf
52             defined in the ietf-interfaces YANG module (IETF RFC 8343).";
53
54         reference
55             "IEEE Std 802.3.1, dot3ExtPkgStatDroppedFramesQueue";
56     }
57
58     list multicast-IDs {
```

```
1      key multicast-ID;
2      description
3          "Multicast-IDs list of multicast IDs
4           to be recognized by the device.";
5      leaf multicast-ID {
6          type uint32;
7          description
8              "Multicast-IDs to be recognized by the device.";
9      reference
10         "IEEE Std 802.3, 30.3.5.1.25";
11     }
12 }
13
14
15 leaf fec-capability {
16     type fec-capability;
17
18     config false;
19
20     description
21         "This object is used to identify whether the given interface
22          is capable of supporting FEC or not.";
23 }
24
25
26 leaf mpcp-mode {
27     type mpcp-mode;
28
29     config false;
30
31     description
32         "This object is used to identify the operational state of the
33          MultiPoint MAC Control sublayer as defined in
34          IEEE Std 802.3, Clause 64 and Clause 77.
35
36          Reading 'olt' for an OLT (controller) mode and 'onu' for an ONU
37          (client) mode.
38
39          This object is used to identify the operational mode for the
40          MPCP objects.
41
42          This object is applicable for an OLT, with the same value for
43          all logical links, and for an ONU.";
44
45     reference
46         "IEEE Std 802.3, 30.3.5.1.3";
47 }
48
49
50
51 leaf mpcp-sync-time {
52     type uint64;
53
54     units "TQ (16ns)";
55
56     config false;
57
58     description
59         "This object reports the 'sync lock time' of the OLT
60          receiver in units of Time Quanta (TQ; 1 TQ = 16 ns; see
61          IEEE Std 802.3, Clause 64 and Clause 77).
62
63          The value returned is equal to [sync lock time ns]/16,
```

```
1         rounded up to the nearest TQ. If this value exceeds
2         4,294,967,295 TQ, the value 4,294,967,295 TQ is returned.
3
4         This object is applicable for an OLT, with distinct values for
5         all logical links, and for an ONU.";
6
7     reference
8         "IEEE Std 802.3.1, dot3MpcpSyncTime";
9 }
10
11 leaf mpcp-logical-link-id {
12     type mpcp-supported;
13
14     config false;
15
16     description
17         "This object is used to identify the operational state of the
18         MultiPoint MAC Control sublayer as defined in
19         IEEE Std 802.3, Clause 64 and Clause 77.
20
21         Reading 'olt' for an OLT (controller) mode and 'onu' for an ONU
22         (client) mode.
23
24         This object is used to identify the operational mode for the
25         MPCP objects.
26
27         This object is applicable for an OLT, with the same value for
28         all logical links, and for an ONU.";
29
30     reference
31         "IEEE Std 802.3, 30.3.5.1.3";
32 }
33
34
35
36
37
```

**Editor's Note (to be removed prior to publication):**

Leaf mpcp-remote-mac-address was modified per Maintenance Request 1380  
(see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```
44 leaf mpcp-remote-mac-address {
45     type ieee:mac-address;
46
47     config false;
48
49     description
50         "This object identifies the source_address parameter of the
51         last MPCPDUs passed to the MAC Control. This value is updated
52         on reception of a valid frame with:
53
54         1) a destination Field equal to the multicast address assigned
55         for MAC Control as specified in IEEE Std 802.3, Annex 31A;
56
57         2) the lengthOrType field value equal to the Type assigned for
58         MAC Control as specified in IEEE Std 802.3, Annex 31A;
59
60         3) an MPCP Control opcode value equal to the subtype assigned
61         for MPCP as specified in IEEE Std 802.3, Annex 31A.
62
63
64
65
```

```
1      This object is applicable for an OLT and an ONU. It has a
2      distinct value for each logical link.
3
4      The value reflects the MAC address of the remote entity and
5      therefore the OLT holds a value for each LLID, which is
6      the MAC address of the ONU.
7
8      The ONU has a single value that is the OLT MAC address.";
9
10     reference
11       "IEEE Std 802.3, 30.3.5.1.5";
12   }
13
14   leaf mpcp-logical-link-state {
15     type mpcp-logical-link-state;
16
17     config false;
18
19     description
20       "This object identifies the registration state of the
21       MultiPoint MAC Control sublayer as defined in
22       IEEE Std 802.3, Clause 64 and Clause 77.
23
24       When this object has the enumeration 'unregistered', the
25       interface is unregistered and may be used for registering
26       a link partner.
27
28       When this object has the enumeration 'registering',
29       the interface is in the process of registering a link-partner.
30
31       When this object has the enumeration 'registered', the
32       interface has an established link-partner.
33
34       This object is applicable for an OLT and an ONU. It has a
35       distinct value for each logical link.";
36
37     reference
38       "IEEE Std 802.3, 30.3.5.1.6";
39   }
40
41   leaf mpcp-elapsed-time-out {
42     type uint64;
43
44     units "TQ (16ns)";
45
46     config false;
47
48     description
49       "This object reports the interval from the last MPCP frame
50       transmission in increments of Time Quanta (TQ; 1 TQ = 16 ns;
51       see IEEE Std 802.3, Clause 64 and Clause 77).
52
53       The value returned is equal to [interval from last MPCP
54       frame transmission on this EPON interface, expressed
55       in ns]/16. If this value exceeds 4,294,967,295 TQ, the value
56       4,294,967,295 TQ is returned.
57
58       This object is applicable for an OLT and an ONU. It has a
59       distinct value for each logical link.";
```

```
1
2     reference
3         "IEEE Std 802.3, 30.3.5.1.19";
4 }
5
6 leaf mpcp-elapsed-time-in {
7     type uint64;
8
9     units "TQ (16ns)";
10
11     config false;
12
13     description
14         "This object reports the interval from the last MPCP frame
15         reception in increments of Time Quanta (TQ; 1 TQ = 16 ns; see
16         IEEE Std 802.3, Clause 64 and Clause 77).
17
18         The value returned is equal to [interval from last MPCP
19         frame reception on this EPON interface, expressed in
20         ns]/16. If this value exceeds 4,294,967,295 TQ, the value
21         4,294,967,295 TQ is returned.
22
23         This object is applicable for an OLT and an ONU. It has a
24         distinct value for each logical link.";
25
26     reference
27         "IEEE Std 802.3, 30.3.5.1.20";
28 }
29
30 leaf mpcp-round-trip-time {
31     when "../ompe-mode = 'olt'";
32     type uint16;
33
34     units "TQ (16ns)";
35
36     config false;
37
38     description
39         "This object reports the MPCP round trip time in increments
40         of Time Quanta (TQ; 1 TQ = 16 ns; see IEEE Std 802.3,
41         Clause 64 and Clause 77).
42
43         The value returned is equal to [round trip time in ns]/16.
44         If this value exceeds 65,535 TQ, the value 65,535 TQ is
45         returned.
46
47         This object is applicable for an OLT. It has a distinct value
48         for each logical link.";
49
50     reference
51         "IEEE Std 802.3, 30.3.5.1.21";
52 }
53
54 leaf mpcp-maximum-grant-count {
55     when "../ompe-mode = 'onu'";
56     type uint8;
57
58     config false;
59
60     reference
61         "IEEE Std 802.3, 30.3.5.1.22";
62 }
63
64 leaf mpcp-maximum-grant-count {
65     when "../ompe-mode = 'onu'";
66     type uint8;
67
68     config false;
```

```
1      description
2          "This object reports the maximum number of grants that an
3          ONU can store for handling. The maximum number of grants that
4          an ONU can store for handling has a range of 0 to 255.
5
6          This object is applicable for an ONU and has a distinct value
7          for each logical link.";
8
9
10     reference
11         "IEEE Std 802.3, 30.3.5.1.24";
12 }
13
14 leaf mpcp-logical-link-count {
15     type mpcp-llid-count;
16
17     units LLID;
18
19     config false;
20
21     description
22         "This object reflects the number of logical links registered
23         on the OLT / ONU. The LLID field, as defined in the
24         IEEE Std 802.3, Clause 65 and Clause 76, is a 2-byte register
25         (15-bit field and a broadcast bit) limiting the number of
26         logical links to 32,768.
27
28         This object is initialized to the value of 0 when the
29         OLT / ONU is powered up.
30
31         This object is applicable for an OLT and an ONU. It has the same
32         value for all logical links.";
33
34     reference
35         "IEEE Std 802.3.1, dot3ExtPkgObjectNumberOfLLIDs";
36 }
37
38 leaf mpcp-maximum-queue-count-per-report {
39     when "../ompe-mode = olt";
40     type mpcp-maximum-queue-count-per-report;
41
42     config false;
43
44     description
45         "This object reflects the maximum number of queues (0-7) that can
46         be accepted by the OLT in a single REPORT MPCPDU, as defined in
47         IEEE Std 802.3, Clause 64 and Clause 77.
48
49         This object is applicable for an OLT and has a distinct value
50         for each logical link.";
51
52     reference
53         "IEEE Std 802.3.1, dot3ExtPkgObjectReportMaximumNumQueues";
54 }
55
56 leaf ompe-mode {
57     type ompe-mode;
58
59     config false;
60
61     description
62         "This object reflects the maximum number of queues (0-7) that can
63         be accepted by the OLT in a single REPORT MPCPDU, as defined in
64         IEEE Std 802.3, Clause 64 and Clause 77.
65         This object is applicable for an OLT and has a distinct value
66         for each logical link.";
```

```
1      description
2          "This object indicates the mode of operation of the
3            Reconciliation Sublayer for Point-to-Point Emulation (see
4            IEEE Std 802.3, 65.1 or 76.2 as appropriate).
5
6            The value of 'unknown' is assigned in initialization; true
7            state or type is not yet known.
8
9            The value of 'olt' is assigned when the sublayer is operating
10           in OLT mode.
11
12           The value of 'onu' is assigned when the sublayer is operating
13           in ONU mode.
14
15           This object is applicable for an OLT and an ONU. It has the same
16           value for each logical link.";
17
18      reference
19          "IEEE Std 802.3, 30.3.7.1.2";
20  }
21  }
22  }
```

## 8. YANG module for Ethernet Link OAM (ELO)

### 8.1 Introduction

IEEE Std 802.3, Clause 57 includes management capabilities for Ethernet-like interfaces to provide some basic operations, administration and maintenance (OAM) functions. The defined functionality includes discovery, error signaling, loopback, and link monitoring. This clause defines a portion of the YANG module for use with NETCONF or RESTCONF to manage these Ethernet-like interface capabilities.

### 8.2 Overview

Ethernet OAM is composed of a core set of functions and a set of optional functional groups as described in Clause 57 of IEEE Std 802.3. The core functions include discovery operations (determining if the other end of the link is OAM capable and what OAM functions it supports), state machine implementation, and some critical event flows.

Ethernet OAM provides single-hop functionality in that it works only between two directly connected Ethernet stations. Ethernet OAM has three functional objectives, which are detailed in 8.2.1 through 8.2.3. The definition of a basic Ethernet OAM protocol data unit is given in 8.2.4.

#### 8.2.1 Remote fault indication

Remote fault indication provides a mechanism for one end of an Ethernet link to signal the other end that the receive path is non-operational. Some Ethernet Physical Layers offer mechanisms to signal this condition at the Physical Layer. Ethernet OAM added a mechanism so that some Ethernet Physical Layers can operate in unidirectional mode, allowing frames to be transmitted in one direction even when the other direction is non-operational. Traditionally, Ethernet PHYs do not allow frame transmission in one direction if the other direction is not operational. Using this mode, Ethernet OAM allows frame-based signaling of remote fault conditions while still not allowing higher layer applications to be aware of the unidirectional capability. This clause includes mechanisms for capturing that fault information and reflecting such information in data nodes and notifications within the NETCONF management framework.

#### 8.2.2 Link monitoring

Ethernet OAM includes event signaling capability so that one end of an Ethernet link can indicate the occurrence of certain important events to the other end of the link. This happens via layer 2 protocols. This clause defines methods for incorporating the occurrence of these events, at both the local end and the far end of the link, into the YANG-based management framework.

Ethernet OAM also includes mechanisms for one Ethernet station to query another directly connected Ethernet station about the status of its Ethernet interface variables and status. This clause does not include mechanisms for controlling how one Ethernet endpoint may use this functionality to query the status or statistics of a peer Ethernet entity.

#### 8.2.3 Remote loopback

Remote loopback is a link state where the peer Ethernet entity echoes every received packet (without modifications) back onto the link. Remote loopback is intrusive in that the other end of the link is not forwarding traffic from higher layers out over the link. This clause defines data nodes controlling loopback operation and reading the status of the loopback state.



## 8.2.4 Ethernet OAM protocol data units

An Ethernet OAM protocol data unit (OAMPDU) is a valid Ethernet frame with a destination Media Access Control (MAC) address equal to the MAC address assigned for Slow Protocols (see IEEE Std 802.3, Annex 57A), a lengthOrType field equal to the Type assigned for Slow Protocols, and a Slow Protocols subtype equal to that of the subtype assigned for Ethernet OAM.

OAMPDU is used throughout this clause as an abbreviation for Ethernet OAM protocol data unit. OAMPDUs are the mechanism by which two directly connected Ethernet interfaces exchange OAM information.

## 8.3 Security considerations for Ethernet operations, administration, and maintenance (OAM) module

The readable data nodes in this module can provide information about network traffic, and therefore, they may be considered sensitive. In particular, OAM provides mechanisms for reading the Clause 30 IEEE 802.3 management attributes from a link partner via a layer 3 protocol. IEEE Std 802.3 OAM does not include encryption or authentication mechanisms. It should not be used in environments where this interface information is considered sensitive, and where the facility terminations are unprotected. By default, OAM is disabled on Ethernet-like interfaces and is therefore not a risk.

IEEE Std 802.3 OAM is designed to support deployment in access and enterprise networks. In access networks, one end of a link is the CO-side, and the other is the CPE-side, and the facilities are often protected in wiring cages or closets. In such deployments, it is often the case that the CO-side is protected from access from the CPE-side. Within IEEE Std 802.3 OAM, this protection from remote access is accomplished by configuring the CPE-side in passive mode using the mode leaf. This prevents the CPE from accessing functions and information at the CO-side of the connection. In enterprise networks, read-only interface information is often considered non-sensitive.

The frequency of OAM PDUs on an Ethernet interface does not adversely affect data traffic, as OAM is a slow protocol with very limited bandwidth potential, and it is not required for normal link operation. Although there are a number of objects in this module with read-write or read-create MAX-ACCESS, they have limited effects on user data.

The loopback capability of OAM can have potentially disruptive effects; when remote loopback is enabled, the remote station automatically transmits all received traffic back to the local station except for OAM traffic. This completely disrupts all higher layer protocols such as bridging, IP, and NETCONF/RESTCONF.

The administrative state and mode are also configuration nodes. Disabling OAM can interrupt management activities between peer devices, potentially causing serious problems. Setting the mode node to an undesired value can allow access to Ethernet monitoring, events, and functions that may not be acceptable in a particular deployment scenario. In addition to loopback functionality, Ethernet interface statistics and events can be accessed via the OAM protocol, which may not be desired in some circumstances.

OAM event configuration also contains configuration nodes. These nodes control whether events are sent, and at what thresholds. Note that the frequency of event communication is limited by the frequency limits of Slow Protocols on Ethernet interfaces. Also, the information available via OAM events is also available via OAM Variable Requests. Access to this information via either OAM events or Variable Requests is controlled by the admin and mode nodes. As mentioned previously, inadequate protection of these variables can result in access to link information and functions.

## 8.4 Mapping of IEEE 802.3 managed objects

This subclause contains the mapping between the YANG data nodes defined in this clause and the attributes defined in IEEE Std 802.3, Clause 30. Table 8–1 provides the mapping between the *ieee802-ethernet-link-oam* module data nodes and the OAM attributes of IEEE Std 802.3, Clause 30.

**Table 8–1—Mapping between IEEE Std 802.3, Clause 30 managed objects and *ieee802-ethernet-link-oam* YANG data nodes**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-link-oam</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
oOAM	aOAMAdminState	30.3.6.1.2	interfaces/interface/ethernet/link-oam	admin	R/W
	dot3OamOperStatus aOAMDiscoveryState aOAMLocalFlagsField aOAMRemoteFlagsField	IEEE Std 802.3.1 30.3.6.1.4 30.3.6.1.10 30.3.6.1.11	interfaces/interface/ethernet/link-oam/ discovery-info/local	operational-status	R
	aOAMLocalState	30.3.6.1.14		loopback-mode	R
	aOAMMode	30.3.6.1.3		mode	RW
	aOAMLocalRevision	30.3.6.1.12		revision	R
	aOAMLocalPDUConfiguration	30.3.6.1.8		oammtu	R
	aOAMLocalConfiguration	30.3.6.1.6	interfaces/interface/ethernet/link-oam/ discovery-info/remote/functions-sup- ported	uni-directional-link-fault	R/W
				loopback	R/W
				mib-retrieval	R/W
		aOAMLocalCon- figuration	interfaces/interface/ethernet/link-oam/ discovery-info/local/functions-sup- ported/link-monitor	link-monitoring	R/W
	aOAMLocalErrSymPeriodConfig aOAMLocalErrFrameConfig aOAMLocalErrFramePeriodConfig aOAMLocalErrFrameSecsSummaryConfig aOAMLocalErrSymPeriodConfig	30.3.6.1.34 30.3.6.1.36 30.3.6.1.38 30.3.6.1.40 30.3.6.1.42	interfaces/interface/ethernet/link-oam/ link-monitor/event-type	threshold-type window threshold	R/W R/W R/W
	aOAMRemoteMACAddress	30.3.6.1.5	interfaces/interface/ethernet/link-oam/ discovery-info/remote	mac-address	R
	aOAMRemoteVendorOUI	30.3.6.1.16		vendor-oui	R
	aOAMRemoteVendorSpecificInfo	30.3.6.1.17		vendor-info	R

**Table 8–1—Mapping between IEEE Std 802.3, Clause 30 managed objects  
and *ieee802-ethernet-link-oam* YANG data nodes (continued)**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-link-oam</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
OAM	aOAMLocalConfiguration	30.3.6.1.6	interfaces/interface/ethernet/link-oam/ discovery-info/local/functions-sup- ported	uni-directional-link-fault	R
				loopback	R
				link-monitoring	R
				mib-retrieval	R
	dot3OamEventLogEntry	IEEE Std 802.3.1	interfaces-state/ interface/ethernet/ link-oam/event-log/event-log-entry	index	R
				oui	R
				timestamp	R
				location	R
				event-type	R
				running-total	R
				event-total	R
	aOAMLocalErrSymPeriodEvent aOAMLocalErrFrameEvent aOAMLocalErrFramePeriodConfig aOAMLocalErrFrameSecsSummaryEvent aOAMRemoteErrSymPeriodEvent aOAMRemoteErrFrameEvent aOAMRemoteErrFramePeriodEvent aOAMRemoteErrFrameSecsSummaryEvent	30.3.6.1.35 30.3.6.1.37 30.3.6.1.38 30.3.6.1.41 30.3.6.1.42 30.3.6.1.43 30.3.6.1.44 30.3.6.1.45	interfaces/interface/ethernet/link-oam/ event-log/event-log-entry/threshold	threshold-event-type window threshold value	R R R R
	Dot3OamStatsEntry	RFC-4878	interfaces/interface/ethernet/link-oam/ statistics	out-information	R
	aOAMInformationTx	30.3.6.1.20			
	aOAMInformationRx	30.3.6.1.21		in-information	R

**Table 8–1—Mapping between IEEE Std 802.3, Clause 30 managed objects  
and *ieee802-ethernet-link-oam* YANG data nodes (continued)**

IEEE Std 802.3, Clause 30		Reference	Corresponding <i>ieee802-ethernet-link-oam</i> YANG data nodes		
Managed object(s)	Attribute(s)		Container(s)	Data node(s)	R/W
OAM	aOAMVariableRequestRx	30.3.6.1.29	interfaces/interface/ethernet/link-oam/ statistics	variable-requeste-rx	R
	aOAMVariableResponseTx	30.3.6.1.30		out-variable-response	R
	aOAMVariableResponseRx	30.3.6.1.31		in-variable-response	R
	aOAMOrganizationSpecificTx	30.3.6.1.32		out-org-specific	R
	aOAMOrganizationSpecificRx	30.3.6.1.33		in-org-specific	R
	aOAMUnsupportedCodesTx	30.3.6.1.18		unsupported-condes-tx	R
	aOAMUnsupportedCodesRx	30.3.6.1.19		in-unsupported-codes	R
	aFramesLostDueToOAMError	30.3.6.1.46		frames-lost-due-to-oam	R
	aOAMLocalErrSymPeriodEvent, Errored Symbols	30.3.6.1.35		local-error-symbol-period-log-entries	R
	aOAMLocalErrFrameEvent, Errored Frames	30.3.6.1.37		local-error-frame-log-entries	R
	aOAMLocalErrFramePeriodEvent, Errored Frames	30.3.6.1.39		local-error-frame-period-log-entries	R
	aOAMLocalErrFrameSecsSummaryEvent, Errored Frame Seconds Summary	30.3.6.1.41		local-error-frame-second-log-entries	R
	aOAMRemoteErrSymPeriodEvent, Errored Symbols	30.3.6.1.42		remote-error-symbol-period-log-entries	R
	aOAMRemoteErrFrameEven, Errored Frames	30.3.6.1.43		remote-error-frame-log-entries	R
	aOAMRemoteErrFramePeriodEvent, Errored Frames	30.3.6.1.44		remote-error-frame-period-log-entries	R
	aOAMRemoteErrFrameSecsSummaryEvent, Errored Frame Seconds Summary	30.3.6.1.45		remote-error-frame-second-log-entries	R

## 8.5 YANG module definition<sup>P</sup>

The YANG module tree hierarchy uses terms defined in IETF RFC 8407.

### 8.5.1 Tree hierarchy

```

module: ieee802-ethernet-link-oam
  augment /if:interfaces/if:interface:
    +--rw link-oam!
      +--rw admin?                               admin-state
      +--rw discovery-info
        | +--rw local
        | | +--ro operational-status             operational-state
        | | +--ro loopback-mode                 loopback-status {remote-loopback-initiate or
remote-loopback-respond}?
        | | +--rw mode?                         mode
        | | +--rw functions-supported
        | | | +--rw uni-directional-link-fault?  boolean {uni-directional-link-fault}?
        | | | +--rw loopback?                   boolean {remote-loopback-initiate}?
        | | | +--rw link-monitor {link-monitoring-remote or
link-monitoring-local}?
        | | | | +--rw link-monitoring?          boolean
        | | | | +--rw event-type* [threshold-type] {link-monitoring-local}?
        | | | |   +--rw threshold-type          threshold-event-enum
        | | | |   +--rw window?                 uint64
        | | | |   +--rw threshold?              uint64
        | | | +--rw mib-retrieval?               boolean {remote-mib-retrieval-initiate or
remote-mib-retrieval-respond}?
        | | +--ro revision?                     uint64
        | +--ro oammtu?                         uint16

```

<sup>P</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

| +--ro remote

**Editor's Note (to be removed prior to publication):**

Leaf mac-address was modified per Maintenance Request 1380 (see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```

|      +--ro mac-address?          ieee:mac-address
|      +--ro vendor-oui?           vendor-oui
|      +--ro vendor-info?          uint64
|      +--ro loopback-mode         loopback-status
|      +--ro mode?                 mode
|      +--ro functions-supported
|      |  +--ro uni-directional-link-fault?  boolean
|      |  +--ro loopback?                 boolean
|      |  +--ro link-monitoring?           boolean
|      |  +--ro mib-retrieval?             boolean
|      +--ro revision?               uint64
|      +--ro oammtu?                 uint16
+--ro event-log
|  +--ro event-log-entry* [index]
|      +--ro index                  uint64
|      +--ro oui                    vendor-oui
|      +--ro timestamp              uint64
|      +--ro location               event-location
|      +--ro event-type             identityref
|      +--ro running-total          yang:counter64
|      +--ro event-total            yang:counter64
|      +--ro threshold {link-monitoring-local or
link-monitoring-remote}?
|          +--ro threshold-event-type  threshold-event-enum
|          +--ro window                uint64
|          +--ro threshold              uint64
|          +--ro value                  uint64
+--ro statistics
|  +--ro out-information              yang:counter64

```

```

|   +---ro in-information                               yang:counter64
|   +---ro out-unique-event-notification              yang:counter64 {link-monitoring-local}?
|   +---ro in-unique-event-notification              yang:counter64 {link-monitoring-remote}?
|   +---ro out-duplicate-event-notification          yang:counter64 {link-monitoring-local}?
|   +---ro in-duplicate-event-notification          yang:counter64 {link-monitoring-remote}?
|   +---ro out-loopback-control                     yang:counter64 {remote-loopback-initiate}?
|   +---ro in-loopback-control                     yang:counter64 {remote-loopback-respond}?
|   +---ro out-variable-request                     yang:counter64 {remote-mib-retrieval-initiate}?
|   +---ro in-variable-request                     yang:counter64 {remote-mib-retrieval-respond}?
|   +---ro out-variable-response                   yang:counter64 {remote-mib-retrieval-respond}?
|   +---ro in-variable-response                   yang:counter64 {remote-mib-retrieval-initiate}?
|   +---ro out-org-specific                         yang:counter64
|   +---ro in-org-specific                         yang:counter64
|   +---ro out-unsupported-codes                    yang:counter64
|   +---ro in-unsupported-codes                    yang:counter64
|   +---ro frames-lost-due-to-oam                   yang:counter64
|   +---ro local-error-symbol-period-log-entries    yang:counter64
|   +---ro local-error-frame-log-entries            yang:counter64
|   +---ro local-error-frame-period-log-entries     yang:counter64
|   +---ro local-error-frame-second-log-entries     yang:counter64
|   +---ro remote-error-symbol-period-log-entries   yang:counter64 {link-monitoring-remote}?
|   +---ro remote-error-frame-log-entries           yang:counter64 {link-monitoring-remote}?
|   +---ro remote-error-frame-period-log-entries    yang:counter64 {link-monitoring-remote}?
|   +---ro remote-error-frame-second-log-entries    yang:counter64 {link-monitoring-remote}?
+---x remote-loopback {remote-loopback-initiate}?
|   +---w input
|   |   +---w enable      boolean
|   +---ro output
|       +---ro success      boolean
|       +---ro error-message? string
+---x reset-stats
|   +---ro output
|       +---ro success      boolean
|       +---ro error-message? string
+---n non-threshold-event
|   +---- oui                vendor-oui

```



```

| +---- timestamp          uint64
| +---- location           event-location
| +---- event-type         identityref
| +---- running-total      yang:counter64
| +---- event-total        yang:counter64
+---n threshold-event {link-monitoring-local or
link-monitoring-remote}?
    +---- oui              vendor-oui
    +---- timestamp        uint64
    +---- location         event-location
    +---- event-type       identityref
    +---- running-total    yang:counter64
    +---- event-total      yang:counter64
    +---- threshold {link-monitoring-local or
link-monitoring-remote}?
        +---- threshold-event-type    threshold-event-enum
        +---- window                  uint64
        +---- threshold                uint64
        +---- value                    uint64

```

## 8.5.2 YANG module

In the following YANG module definition, should any discrepancy between the text of the description for individual YANG nodes and the corresponding definition in 8.2 through 8.5 of this clause occur, the definitions in 8.2 through 8.5 shall take precedence.

An ASCII text version of the YANG module can be found at the following URL:<sup>9</sup> <https://github.com/YangModels/yang/tree/master/standard/ieee/published/802.3>.

```
module ieee802-ethernet-link-oam {  
    yang-version 1.1;  
    namespace "urn:ieee:std:802.3:yang:ieee802-ethernet-link-oam";  
    prefix "ieee802-link-oam";  
    revision 2019-06-21 {  
        description "Initial revision.";  
    }
```

**Editor's Note (to be removed prior to publication):**

New 'ieee' prefix import was added per Maintenance Request 1380 (see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```
import ietf-yang-types {  
    prefix yang;  
    reference "IETF RFC 6991";  
}  
  
import iana-if-type {  
    prefix ianaift;  
    reference "http://www.iana.org/assignments/yang-parameters/  
        iana-if-type@2018-07-03.yang";  
}  
  
import ietf-interfaces {  
    prefix if;  
    reference "IETF RFC 8343";  
}  
  
organization  
    "IEEE 802.3 Ethernet Working Group  
    Web URL: http://www.ieee802.org/3/";  
contact  
    "Web URL: http://www.ieee802.org/3/";  
  
description  
    "This module contains a collection of YANG definitions
```

<sup>9</sup>Copyright release for YANG modules: Users of this standard may freely reproduce the YANG module contained in this subclause so that it can be used for its intended purpose.

```
1      for managing the Ethernet Link OAM feature defined by IEEE
2      802.3. It provides functionality roughly equivalent to that of
3      the DOT3-OAM-MIB defined in IETF RFC 4878.";
4
5  reference
6      "IEEE Std 802.3-2018, unless dated explicitly";
7
8
9  feature uni-directional-link-fault {
10      description
11          "This feature means the device supports Uni Directional Link
12          Fault detection.";
13      reference
14          "IEEE Std 802.3, 57.1.2:a, 30.3.6.1.6 aOAMLocalConfiguration and
15          30.3.6.1.7 aOAMRemoteConfiguration";
16  }
17
18  feature remote-loopback-initiate {
19      description
20          "This feature means the device supports being the initiator
21          of remote loopback.";
22      reference
23          "IEEE Std 802.3, 57.1.2:b, 30.3.6.1.6 aOAMLocalConfiguration";
24  }
25
26  feature remote-loopback-respond {
27      description
28          "This feature means the device supports responding to remote
29          loopback control OAMPDUs received from the peer";
30      reference
31          "IEEE Std 802.3, 57.1.2:b, 30.3.6.1.7 aOAMRemoteConfiguration";
32  }
33
34  feature link-monitoring-local {
35      description
36          "This feature means the device monitors the link at the local
37          side and can generate Link Event OAMPDUs to the peer device.";
38      reference
39          "IEEE Std 802.3, 57.1.2:c:1, 30.3.6.1.6 aOAMLocalConfiguration,
40          and 30.3.6.1.7 aOAMRemoteConfiguration";
41  }
42
43  feature link-monitoring-remote {
44      description
45          "This feature means the device can process Link Event OAMPDUs
46          received from the peer device and report itself about this
47          event on its own management interface.";
48      reference
49          "IEEE Std 802.3, 57.1.2:c:1, 30.3.6.1.6 aOAMLocalConfiguration,
50          and 30.3.6.1.7 aOAMRemoteConfiguration";
51  }
52
53  feature remote-mib-retrieval-initiate {
54      description
55          "This feature means the device supports data retrieval from
56          the peer device. I.e. the device can send Variable Requests
57          OAMPDUs to the peer side and process the received Variable
58          Response OAMPDUs.";
59      reference
60          "IEEE Std 802.3, 57.1.2:c:2, 30.3.6.1.6 aOAMLocalConfiguration,
```

```
1         and 30.3.6.1.7 aOAMRemoteConfiguration";
2     }
3     feature remote-mib-retrieval-respond {
4         description
5             "This feature means the device allows the peer device to
6             retrieve data from the managed device. I.e. the device can
7             process received Variable Requests OAMPDUs and respond with
8             Variable Response OAMPDUs.";
9         reference
10            "IEEE Std 802.3, 57.1.2:c:2, 30.3.6.1.6 aOAMLocalConfiguration,
11            and 30.3.6.1.7 aOAMRemoteConfiguration";
12    }
13    typedef threshold-event-enum {
14        type enumeration {
15            enum symbol-period-event {
16                value 1;
17                description
18                    "Errored symbol period event.";
19            }
20            enum frame-period-event {
21                value 2;
22                description
23                    "Errored frame period event.";
24            }
25            enum frame-event {
26                value 3;
27                description
28                    "Errored frame event";
29            }
30            enum frame-seconds-event {
31                value 4;
32                description
33                    "Errored frame seconds event.";
34            }
35        }
36        description
37            "Enumeration of the valid threshold event types.";
38        reference
39            "IEEE Std 802.3, 57.5.3";
40    }
41
42    identity event-type {
43        description
44            "Base identity for all Link OAM event types.";
45    }
46
47    identity threshold-event-type {
48        base event-type;
49        description
50            "Event type for a Link Monitoring threshold event.";
51    }
52
53    identity link-fault-event {
54        base event-type;
55        if-feature "uni-directional-link-fault";
56        description
```

```
1      "Event type for a uni-directional link fault event.";
2      reference
3      "IEEE Std 802.3, 57.2.10.1";
4  }
5  identity dying-gasp-event {
6      base event-type;
7      description
8          "Event type for a dying gasp event.";
9      reference
10         "IEEE Std 802.3, 57.2.10.1";
11  }
12  identity critical-event {
13      base event-type;
14      description
15          "Event type for a critical event.";
16      reference
17          "IEEE Std 802.3, 57.2.10.1";
18  }
19  typedef mode {
20      type enumeration {
21          enum passive {
22              value 0;
23              description
24                  "Ethernet Link OAM Passive mode.";
25          }
26          enum active {
27              value 1;
28              description
29                  "Ethernet Link OAM Active mode.";
30          }
31      }
32      description
33          "Enumeration of the valid modes in which Link OAM may run.";
34      reference
35          "IEEE Std 802.3, 57.2.9 and 30.3.6.1.3.";
36  }
37
38  typedef event-location {
39      type enumeration {
40          enum event-location-local {
41              value 1;
42              description
43                  "A local event.";
44          }
45          enum event-location-remote {
46              value 2;
47              description
48                  "A remote event.";
49          }
50      }
51      description
52          "The location of the event that caused a log entry.";
53  }
```

```
1
2 typedef loopback-status{
3     type enumeration {
4         enum none {
5             value 1;
6             description
7                 "Loopback is not being performed.";
8         }
9         enum initiating {
10            value 2;
11            description
12                "Initiating master loopback.";
13        }
14        enum master-loopback {
15            value 3;
16            description
17                "In master loopback mode.";
18        }
19        enum terminating {
20            value 4;
21            description
22                "Terminating master loopback mode.";
23        }
24        enum local-loopback {
25            value 5;
26            description
27                "In slave loopback mode.";
28        }
29        enum unknown {
30            value 6;
31            description
32                "Parser and multiplexer combination unexpected.";
33        }
34    }
35    description
36        "The loopback mode of an OAM interface.";
37    reference
38        "IEEE Std 802.3, 57.2.11";
39 }
40
41 typedef operational-state {
42     type enumeration {
43         enum disabled {
44             value 1;
45             description
46                 "IEEE Std 802.3 OAM is disabled.";
47         }
48         enum link-fault {
49             value 2;
50             description
51                 "IEEE Std 802.3 OAM has encountered a link fault.";
52         }
53         enum passive-wait {
54             value 3;
55             description
```

```
1         "Passive OAM entity waiting to see if peer is
2         OAM capable.";
3     }
4     enum active-send-local {
5         value 4;
6         description
7             "Active OAM entity trying to determine if peer
8             is OAM capable.";
9     }
10    enum send-local-and-remote {
11        value 5;
12        description
13            "OAM discovered peer but still to accept or
14            reject peer configuration.";
15    }
16    enum send-local-and-remote-ok {
17        value 6;
18        description
19            "OAM peering is allowed by local device.";
20    }
21    enum peering-locally-rejected {
22        value 7;
23        description
24            "OAM peering rejected by local device.";
25    }
26    enum peering-remotely-rejected {
27        value 8;
28        description
29            "OAM peering rejected by remote device.";
30    }
31    enum operational {
32        value 9;
33        description
34            "IEEE Std 802.3 OAM is operational.";
35    }
36    enum operational-half-duplex {
37        value 10;
38        description
39            "IEEE Std 802.3 OAM is operating in half-duplex mode.";
40    }
41    }
42    description
43        "Operational state of an interface.";
44    reference
45        "IETF RFC 4878, dot3OamOperStatus; IEEE Std 802.3, 30.3.6.1.4,
46        30.3.6.1.10, and 30.3.6.1.11";
47    }
48
49    typedef vendor-oui {
50        type string {
51            length 6;
52        }
53        description
54            "24-bit Organizationally Unique Identifier.";
```

```
1      reference
2        "IEEE Std 802-2014, Clause 9";
3    }
4
5
6    typedef admin-state {
7      type enumeration {
8        enum enabled {
9          value 1;
10         description
11           "IEEE Std 802.3, Clause 57 OAM is in the
12            enabled admin state.";
13         }
14       enum disabled {
15         value 2;
16         description
17           "IEEE Std 802.3, Clause 57 OAM is in the
18            disabled admin state.";
19       }
20     }
21   }
22   description
23     "Admin state of the OAM function on an interface.";
24   reference
25     "IEEE Std 802.3, 30.3.6.1.2 and 30.3.6.2";
26 }
27
28
29
30
31 grouping event-details {
32   description
33     "Nodes describing an event, used in the event log and in
34     notifications.";
35   reference
36     "IETF RFC 4878, Dot3OamEventLogEntry";
37   leaf oui {
38     type vendor-oui;
39     mandatory true;
40     description
41       "Organizationally Unique Identifier for the device that
42       generated the event.";
43   }
44   leaf timestamp {
45     type uint64;
46     units "milliseconds";
47     mandatory true;
48     description
49       "Timestamp in milliseconds since Unix epoch for when the
50       event occurred.";
51   }
52   leaf location {
53     type event-location;
54     mandatory true;
55     description
56       "Where the event occurred (local or remote).";
57   }
58   leaf event-type {
59     type identityref {
60
```



```
1         base event-type;
2     }
3     mandatory true;
4     description
5         "Type of event that occurred.";
6     reference
7         "IEEE Std 802.3, 30.3.6.1.10 and 30.3.6.11";
8 }
9
10 leaf running-total {
11     type yang:counter64;
12     mandatory true;
13     description
14         "The running total number of errors seen since OAM was
15         enabled on the interface. For threshold events, this is the
16         total number of times that particular type of error (e.g.
17         symbol error) has occurred, which may be greater than the
18         number of threshold-crossing event notifications of that
19         type generated during that time (which is conveyed by the
20         event-total leaf).";
21 }
22
23 leaf event-total {
24     type yang:counter64;
25     mandatory true;
26     description
27         "Total number of times this event has occurred since OAM was
28         enabled on the interface. For threshold events this is the
29         number of events generated of this type (as opposed to the
30         total number of errors of that type, which may be greater,
31         and is conveyed by the running-total leaf.";
32 }
33 }
34
35 grouping threshold-event-details {
36     description
37         "Nodes describing a threshold event, used in the event
38         log and in notifications";
39     reference
40         "IETF RFC 4878, Dot3OamEventLogEntry";
41
42     container threshold {
43         when "../event-type = 'threshold-event-type'" {
44             description
45                 "These nodes only apply to threshold event types";
46         }
47         if-feature "link-monitoring-local or
48         link-monitoring-remote";
49         description
50             "Nodes specific to threshold (link monitoring) events";
51
52         leaf threshold-event-type {
53             type threshold-event-enum;
54             mandatory true;
55             description
56                 "The type of threshold event";
57         }
58     }
59 }
```

```
1         reference
2             "IEEE Std 802.3, 57.5.3";
3     }
4     leaf window {
5         type uint64;
6         mandatory true;
7         description
8             "Size of the window in which the event was generated.
9             Units are dependent on the threshold event type.";
10    }
11    leaf threshold {
12        type uint64;
13        mandatory true;
14        description
15            "Size of the threshold that was breached during the
16            window. Units are dependent on the threshold
17            event type.";
18    }
19    leaf value {
20        type uint64;
21        mandatory true;
22        description
23            "Breaching value. Units are dependent on the
24            threshold event type, and match that
25            of the threshold.";
26    }
27 }
28
29 grouping statistics-common {
30     description
31         "Collection of Link OAM event/packet counters.";
32     reference
33         "IETF RFC 4878, Dot3OamStatsEntry";
34
35     leaf out-information {
36         type yang:counter64;
37         mandatory true;
38         description
39             "Number of information OAMPDUs transmitted.";
40         reference
41             "IEEE Std 802.3, 30.3.6.1.20";
42     }
43     leaf in-information {
44         type yang:counter64;
45         mandatory true;
46         description
47             "Number of information OAMPDUs received.";
48         reference
49             "IEEE Std 802.3, 30.3.6.1.21";
50     }
51     leaf out-unique-event-notification {
52         if-feature "link-monitoring-local";
53         type yang:counter64;
```

```
1      mandatory true;
2      description
3          "Number of unique event notification OAMPDUs transmitted.";
4      reference
5          "IEEE Std 802.3, 30.3.6.1.22";
6  }
7
8  leaf in-unique-event-notification {
9      if-feature "link-monitoring-remote";
10     type yang:counter64;
11     mandatory true;
12     description
13         "Number of unique event notification OAMPDUs received.";
14     reference
15         "IEEE Std 802.3, 30.3.6.1.24";
16 }
17
18 leaf out-duplicate-event-notification {
19     if-feature "link-monitoring-local";
20     type yang:counter64;
21     mandatory true;
22     description
23         "Number of duplicate event notification OAMPDUs
24         transmitted.";
25     reference
26         "IEEE Std 802.3, 30.3.6.1.23";
27 }
28
29 leaf in-duplicate-event-notification {
30     if-feature "link-monitoring-remote";
31     type yang:counter64;
32     mandatory true;
33     description
34         "Number of duplicate event notification OAMPDUs
35         received.";
36     reference
37         "IEEE Std 802.3, 30.3.6.1.25";
38 }
39
40 leaf out-loopback-control {
41     if-feature "remote-loopback-initiate";
42     type yang:counter64;
43     mandatory true;
44     description
45         "Number of loopback control OAMPDUs transmitted.";
46     reference
47         "IEEE Std 802.3, 30.3.6.1.26";
48 }
49
50 leaf in-loopback-control {
51     if-feature "remote-loopback-respond";
52     type yang:counter64;
53     mandatory true;
54     description
55         "Number of loopback control OAMPDUs received.";
56     reference
57         "IEEE Std 802.3, 30.3.6.1.27";
58 }
59
60 leaf out-variable-request {
```

```
1      if-feature "remote-mib-retrieval-initiate";
2      type yang:counter64;
3      mandatory true;
4      description
5          "Number of variable request OAMPDUs transmitted.";
6      reference
7          "IEEE Std 802.3, 30.3.6.1.28";
8  }
9
10 leaf in-variable-request {
11     if-feature "remote-mib-retrieval-respond";
12     type yang:counter64;
13     mandatory true;
14     description
15         "Number of variable request OAMPDUs received.";
16     reference
17         "IEEE Std 802.3, 30.3.6.1.29";
18 }
19
20 leaf out-variable-response {
21     if-feature "remote-mib-retrieval-respond";
22     type yang:counter64;
23     mandatory true;
24     description
25         "Number of variable response OAMPDUs transmitted.";
26     reference
27         "IEEE Std 802.3, 30.3.6.1.30";
28 }
29
30 leaf in-variable-response {
31     if-feature "remote-mib-retrieval-initiate";
32     type yang:counter64;
33     mandatory true;
34     description
35         "Number of variable response OAMPDUs received.";
36     reference
37         "IEEE Std 802.3, 30.3.6.1.31";
38 }
39
40 leaf out-org-specific {
41     type yang:counter64;
42     mandatory true;
43     description
44         "Number of organization specific OAMPDUs transmitted.";
45     reference
46         "IEEE Std 802.3, 30.3.6.1.32";
47 }
48
49 leaf in-org-specific {
50     type yang:counter64;
51     mandatory true;
52     description
53         "Number of organization specific OAMPDUs received.";
54     reference
55         "IEEE Std 802.3, 30.3.6.1.33";
56 }
57
58 leaf out-unsupported-codes {
59     type yang:counter64;
60     mandatory true;
```

```
1      description
2        "Number of OAMPDUs with unsupported codes transmitted.";
3      reference
4        "IEEE Std 802.3, 30.3.6.1.18";
5    }
6  leaf in-unsupported-codes {
7    type yang:counter64;
8    mandatory true;
9    description
10     "Number of OAMPDUs with unsupported codes received.";
11    reference
12     "IEEE Std 802.3, 30.3.6.1.19";
13  }
14  leaf frames-lost-due-to-oam {
15    type yang:counter64;
16    mandatory true;
17    description
18     "A count of the number of frames that were dropped by the OAM
19     multiplexer. Since the OAM multiplexer has multiple inputs
20     and a single output, there may be cases where frames are
21     dropped due to transmit resource contention. This counter
22     is incremented whenever a frame is dropped by the OAM
23     layer.";
24    reference
25     "IEEE Std 802.3, 30.3.6.1.46";
26  }
27 }
28
29 grouping discovery-remote {
30   description
31     "Nodes describing the discovery process remote end of a link.";
32   leaf mode {
33     type mode;
34     description
35       "Mode (passive/active).";
36     reference
37       "IEEE Std 802.3, 30.3.6.1.3";
38   }
39 }
40
41 container functions-supported {
42   description
43     "The Link OAM functions supported by this interface.";
44   reference
45     "IEEE Std 802.3, 30.3.6.1.7";
46   leaf uni-directional-link-fault {
47     type boolean;
48     description
49       "Unidirectional link fault support.";
50   }
51   leaf loopback {
52     type boolean;
53     description
54       "Remote Loopback support.";
55   }
56   leaf link-monitoring {
```

```
1         type boolean;
2         description
3             "Link monitoring support.";
4     }
5     leaf mib-retrieval {
6         type boolean;
7         description
8             "MIB variable retrieval support.";
9     }
10 }
11 }
12 }
13 leaf revision {
14     type uint64;
15     config false;
16     description "Configuration revision.";
17     reference
18         "IEEE Std 802.3, 30.3.6.1.12 and 30.3.6.1.13";
19 }
20 }
21 leaf oammtu {
22     type uint16;
23     units octets;
24     config false;
25     description "The maximum OAMPDU size.";
26     reference
27         "IEEE Std 802.3, 30.3.6.1.8 and 30.3.6.1.9";
28 }
29 }
30 }
31 }
32 }
33 grouping discovery-local {
34     description
35         "Nodes describing the local end discovery process of a link.";
36     leaf mode {
37         type mode;
38         description
39             "Mode (passive/active)
40             The default value is implementation-dependent.";
41         reference
42             "IEEE Std 802.3, 30.3.6.1.3";
43     }
44 }
45 }
46 }
47 container functions-supported {
48     description
49         "The Link OAM functions supported by this interface.";
50     reference
51         "IEEE Std 802.3, 30.3.6.1.7";
52     leaf uni-directional-link-fault {
53         if-feature "uni-directional-link-fault";
54         type boolean;
55         description
56             "Unidirectional link fault support.
57             This affects the setting of the 'Unidirectional Support'
58             bit in the OAM configuration field put in the
59             Information OAMPDU.
60             This bit indicates to the peer device that it can send
61             OAM PDUs on links that are operating in unidirectional
62             mode (traffic flowing in one direction only).";
63     }
64 }
65 }
```

```
1      }
2      leaf loopback {
3          if-feature "remote-loopback-initiate";
4          type boolean;
5          default true;
6          description
7              "Remote Loopback support.";
8      }
9
10     container link-monitor {
11         if-feature "link-monitoring-remote or
12             link-monitoring-local";
13         description
14             "Configure link monitor parameters.";
15         reference
16             "IEEE Std 802.3, 57.1.2:c";
17
18         leaf link-monitoring {
19             type boolean;
20             default true;
21             description
22                 "Enable or disable monitoring.
23                 This affects the setting of the 'Link Events' bit in the
24                 OAM configuration field put in the Information OAMPDU.
25                 This bit indicates to the peer device that the OAM
26                 entity can send and receive Event Notification OAMPDUs.";
27         }
28
29         list event-type {
30             if-feature "link-monitoring-local";
31             key threshold-type;
32             description
33                 "A list containing at most one entry for each of the
34                 threshold event types. If there is no entry for a
35                 particular event type, the default values are used for
36                 both window size and threshold.";
37             leaf threshold-type {
38                 type threshold-event-enum;
39                 description
40                     "The type of threshold event for which this list entry
41                     is specifying the configuration.";
42                 reference
43                     "IEEE Std 802.3, 57.5.3";
44             }
45
46             leaf window {
47                 type uint64;
48                 description
49                     "The size of the window to use when monitoring for
50                     this threshold event. The units, default and upper
51                     and lower bounds depend on the threshold type as
52                     follows:
53
54                     Symbol Period:
55                     Units:    number of symbols
```

```
1           Default: number of symbols in one second for the
2               underlying physical layer
3           Min:    number of symbols in one second for the
4               underlying physical layer
5           Max:    number of symbols in one minute for the
6               underlying physical layer
7
8
9           Frame:
10              Units:    deciseconds
11              Default: 1 second
12              Min:      1 second
13              Max:      1 minute
14
15
16           Frame Period:
17              Units:    number of frames
18              Default: number of minFrameSize frames in one
19                      second for the underlying physical layer
20              Min:      number of minFrameSize frames in one
21                      second for the underlying physical layer
22              Max:      number of minFrameSize frames in one
23                      minute for the underlying physical layer
24
25
26           Frame Seconds:
27              Units:    deciseconds
28              Default: 60 seconds
29              Min:      10 seconds
30              Max:      900 seconds";
31
32           reference
33           "IEEE Std 802.3, 30.3.6.1.34, 30.3.6.1.36, 30.3.6.1.38,
34           and 30.3.6.1.40";
35
36       }
37
38
39       leaf threshold {
40           type uint64 {
41               range "1..max";
42           }
43           default 1;
44           description
45               "The threshold value to use when determining whether to
46               generate an event given the number of errors that
47               occurred in a given window. The units depend on the
48               threshold type as follows:
49
50               Symbol Period: number of errored symbols
51               Frame:         number of errored frames
52               Frame Period:  number of errored frames
53               Frame Seconds: number of seconds containing at least
54                           1 frame error";
55           reference
56               "IEEE Std 802.3, 30.3.6.1.34, 30.3.6.1.36, 30.3.6.1.38,
57               and 30.3.6.1.40";
58       }
59
60   }
61
62   }
63
64   }
65
```



```
1
2     leaf mib-retrieval {
3         if-feature "remote-mib-retrieval-initiate or
4             remote-mib-retrieval-respond";
5         type boolean;
6         description
7             "MIB variable retrieval support.
8             This affects the setting of the 'Variable Retrieval' bit
9             in the OAM configuration field put in the Information
10            OAMPDU. This bit indicates to the peer device that the OAM
11            entity can send and receive Variable Request and Response
12            OAMPDUs.";
13        }
14    }
15
16    leaf revision {
17        type uint64;
18        config false;
19        description
20            "Configuration revision.";
21        reference
22            "IEEE Std 802.3, 30.3.6.1.12 and 30.3.6.1.13";
23    }
24
25    leaf oammtu {
26        type uint16;
27        units octets;
28        config false;
29        description
30            "The maximum OAMPDU size.";
31        reference
32            "IEEE Std 802.3, 30.3.6.1.8 and 30.3.6.1.9";
33    }
34
35    }
36
37    grouping discovery-info {
38        description
39            "Information relating to the discovery process.";
40
41        container local {
42            description
43                "Properties of the local device.";
44
45            leaf operational-status {
46                type operational-state;
47                config false;
48                mandatory true;
49                description
50                    "Operational status.";
51                reference
52                    "IETF RFC 4878, dot3OamOperStatus; IEEE Std 802.3,
53                    30.3.6.1.4, 30.3.6.1.10, and 30.3.6.1.11";
54            }
55
56            leaf loopback-mode {
57                if-feature "remote-loopback-initiate or
```

```
1         remote-loopback-respond";
2     type loopback-status;
3     config false;
4     mandatory true;
5     description
6         "The loopback mode the interface is in.";
7     reference
8         "IEEE Std 802.3, 30.3.6.1.14";
9 }
10
11 uses discovery-local;
12
13 }
14
15 container remote {
16     config false;
17     description
18         "Properties of the remote (peer) device.";
19 }
```

**Editor's Note (to be removed prior to publication):**

Type mac-address was modified per Maintenance Request 1380 (see [https://www.ieee802.org/3/maint/requests/maint\\_1380.pdf](https://www.ieee802.org/3/maint/requests/maint_1380.pdf))

```
28
29     leaf mac-address {
30         type ieee:mac-address;
31         description
32             "Remote MAC address.";
33         reference
34             "IEEE Std 802.3, 30.3.6.1.5";
35     }
36
37     leaf vendor-oui {
38         type vendor-oui;
39         description
40             "Remote vendor OUI.";
41         reference
42             "IEEE Std 802.3, 30.3.6.1.16";
43     }
44
45     leaf vendor-info {
46         type uint64;
47         description
48             "Remote vendor info. The semantics of this value are
49             proprietary and specific to the vendor.";
50         reference
51             "IEEE Std 802.3, 30.3.6.1.17";
52     }
53
54     leaf loopback-mode {
55         type loopback-status;
56         mandatory true;
57         description
58             "The loopback mode the interface is in.";
59         reference
60             "IEEE Std 802.3, 30.3.6.1.15";
61     }
62
63 }
```

```

1      uses discovery-remote;
2    }
3  }
4
5
6  augment '/if:interfaces/if:interface' {
7    when
8      "derived-from-or-self(if:type, 'ianaift:ethernetCsmacd') or
9      derived-from-or-self(if:type, 'ianaift:ptm') " {
10     description
11       "Augments the interface model with nodes
12       specific to Ethernet Link OAM.";
13     }
14     description
15       "Augments Ethernet interface model with nodes
16       specific to Ethernet Link OAM.";
17
18     container link-oam {
19       presence
20         "Implies Link OAM is configured on the interface.";
21       description
22         "Interface operational state for Ethernet Link OAM.";
23
24       leaf admin {
25         type admin-state;
26         default disabled;
27         description
28           "This object is used to provision the default
29           administrative OAM mode for this interface. This object
30           represents the desired state of OAM for this interface.
31           It starts in the disabled state until an explicit
32           management action or configuration information retained by
33           the system causes a transition to the enabled(1) state.
34           When enabled(1), Ethernet OAM will attempt to operate over
35           this interface. The default value is
36           implementation-dependent.";
37       }
38
39       container discovery-info {
40         description
41           "Information relating to the discovery process.";
42         uses discovery-info;
43       }
44
45       container event-log {
46         config false;
47         description
48           "List of Ethernet Link OAM event log entries on the
49           interface.";
50
51         list event-log-entry {
52           key "index";
53           description
54             "Ethernet Link OAM event log entry.";
55           leaf index {

```

```
1         type uint64;
2         description
3             "Index of this event in the event log.";
4     }
5     uses event-details;
6     uses threshold-event-details;
7 }
8
9 }
10
11 container statistics {
12     config false;
13     description
14         "Statistics for an 802.3 OAM interface.";
15
16     uses statistics-common;
17
18     leaf local-error-symbol-period-log-entries {
19         type yang:counter64;
20         mandatory true;
21         description
22             "Number of local error symbol period log entries.";
23     }
24     leaf local-error-frame-log-entries {
25         type yang:counter64;
26         mandatory true;
27         description
28             "Number of local error frame log entries.";
29     }
30     leaf local-error-frame-period-log-entries {
31         type yang:counter64;
32         mandatory true;
33         description
34             "Number of local error frame period log entries.";
35     }
36     leaf local-error-frame-second-log-entries {
37         type yang:counter64;
38         mandatory true;
39         description
40             "Number of local error frame second log entries.";
41     }
42     leaf remote-error-symbol-period-log-entries {
43         if-feature "link-monitoring-remote";
44         type yang:counter64;
45         mandatory true;
46         description
47             "Number of remote error symbol period log entries.";
48     }
49     leaf remote-error-frame-log-entries {
50         if-feature "link-monitoring-remote";
51         type yang:counter64;
52         mandatory true;
53         description
54             "Number of remote error frame log entries.";
55     }
56 }
57
58 }
```

```
1      leaf remote-error-frame-period-log-entries {
2          if-feature "link-monitoring-remote";
3          type yang:counter64;
4          mandatory true;
5          description
6              "Number of remote error frame period log entries.";
7      }
8
9      leaf remote-error-frame-second-log-entries {
10         if-feature "link-monitoring-remote";
11         type yang:counter64;
12         mandatory true;
13         description
14             "Number of remote error frame second log entries.";
15     }
16 }
17
18
19
20 action remote-loopback {
21     if-feature "remote-loopback-initiate";
22     description
23         "Start/stop remote loopback on the specified interface.";
24     reference
25         "IEEE Std 802.3, 57.1.2:b";
26     input {
27         leaf enable {
28             type boolean;
29             mandatory true;
30             description
31                 "Whether to enable or disable remote loopback.";
32         }
33     }
34 }
35
36
37 output {
38     leaf success {
39         type boolean;
40         mandatory true;
41         description
42             "True if the operation was successful,
43             false otherwise.";
44     }
45
46     leaf error-message {
47         type string;
48         description
49             "If the operation failed, optionally used to
50             provide extra details.";
51     }
52 }
53
54 }
55
56
57 action reset-stats {
58     description
59         "Reset Ethernet Link OAM statistics on this interface.";
60     output {
61         leaf success {
62             type boolean;
63             mandatory true;
64         }
65     }
```

```
1         description
2             "True if the operation was successful,
3             false otherwise.";
4     }
5     leaf error-message {
6         type string;
7         description
8             "If the operation failed, optionally used to provide
9             extra details.";
10    }
11 }
12 }
13 }
14 }
15 }
16
17 notification non-threshold-event {
18     description
19         "This notification is sent when a local or remote
20         non-threshold crossing event is detected.";
21     uses event-details {
22         refine event-type {
23             must ". != 'threshold-event-type'" {
24                 description
25                     "This leaf is not set to
26                     'threshold-event-type'.";
27             }
28         }
29     }
30 }
31 }
32 }
33 }
34
35 notification threshold-event {
36     if-feature "link-monitoring-local or
37     link-monitoring-remote";
38     description
39         "This notification is sent when a local or remote
40         threshold crossing event is detected.";
41     uses event-details {
42         refine event-type {
43             must ". = 'threshold-event-type'" {
44                 description
45                     "This leaf is set to 'threshold-event-type'.";
46             }
47         }
48     }
49 }
50 }
51 }
52     uses threshold-event-details;
53 }
54 }
55 }
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```

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