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Partie 3-2: Norme pour les définitions des modèles de données YANG Ethernet

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Institute of Electrical and Electronics Engineers, Inc
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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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Adam Healey, *IEEE 802.3 Working Group Vice-Chair*
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Valerie Maguire, *IEEE 802.3 Working Group Treasurer*

Yan Zhuang, *IEEE P802.3.2 (IEEE 802.3cf)YANG Data Model Definitions Task Force Chair*
Marek Hajduczenia, *IEEE P802.3.2 (IEEE 802.3cf) YANG Data Model Definitions Task Force Editor-in-Chief*

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Dale Amason
Ali Angha
Eric Baden
Amrik Bains
Thananya Baldwin
Denis Beaudoin
Piergiorgio Beruto
Mark Bohm
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Yong Guo
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Introduction

This introduction is not part of IEEE Std 802.3.2-2019, IEEE 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™-2018, 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 802.3-2018, excluding any currently published or future amendments. As IEEE Std 802.3 continues to evolve, new revisions of this standard may be published in the future to address new technologies and features.

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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-ethernet-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.

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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.

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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.[3]

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.

[1]The IEEE standards or products referred to in this clause are trademarks owned by the Institute of Electrical and Electronics Engineers, Incorporated.

[2]IEEE publications are available from the Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).

[3]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.

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

IETF RFC 8407, *Guidelines for Authors and Reviewers of YANG Data Model Documents*, Bierman A., October 2018.

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.[4]

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.

[4]*IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org/.

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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

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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.

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) and *ieee802-ethernet-interface-half-duplex* (see Table 5–4) YANG modules, managed objects, and attributes defined in IEEE Std 802.3, Clause 30.

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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 *ieee802-ethernet-interface* 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	dot3HCOutPFCFrames				
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

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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 *ieee802-ethernet-interface* 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

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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 *ieee802-ethernet-interface* 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 *ieee802-ethernet-interface* YANG data nodes		
	Container(s)	Data node(s)	R/W
no direct object[a]	interfaces/interface/ethernet/statistics/frame	in-total-frames	R
etherStatsOctets		in-total-octets	R
etherStatsUndersizePkts + etherStatsFragments		in-error-undersize-frames	R

[a] Can be calculated as: aFramesReceivedOK + aFrameCheckSequenceErrors + aAlignmentErrors + aFrameTooLongErrors + aFramesLostDueToIntMACRcvError.

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

ETHERLIKE MIB Attribute(s)	Corresponding *ieee802-ethernet-interface* 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 *ieee802-ethernet-interface-half-duplex* 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

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5.3 YANG module definition[5]

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
```

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```
|  +--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
```


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```
+--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
```


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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:[6]
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
```

[6]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.

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```
   interfaces'.";

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

typedef eth-if-speed-type {
  type decimal64 {
    fraction-digits 3;
  }
  units "Gb/s";
  description
    "Used to represent the configured, negotiated, or actual speed
     of an Ethernet interface in Gigabits per second (Gb/s),
     accurate to 3 decimal places (i.e., accurate to 1 Mb/s).";
}

typedef duplex-type {
  type enumeration {
    enum full {
      description
        "Full duplex.";
    }
    enum half {
      description
        "Half duplex.";
    }
    enum unknown {
      description
        "Link is currently disconnected or initializing.";
    }
  }
  default full;
  description
    "Used to represent the configured, negotiated, or actual
     duplex mode of an Ethernet interface.";
  reference "IEEE Std 802.3, 30.3.1.1.32, aDuplexStatus";
}

typedef pause-fc-direction-type {
  type enumeration {
    enum "disabled" {
      description
        "Flow-control disabled in both ingress and egress
         directions, i.e., PAUSE frames are not transmitted and
         PAUSE frames received in the ingress direction are
         discarded without processing.";
    }
    enum "ingress-only" {
      description
        "PAUSE frame based flow control is enabled in the ingress
         direction only, i.e., PAUSE frames may be transmitted to
         reduce the ingress traffic flow, but PAUSE frames received
         in the ingress direction are discarded without reducing
         the egress traffic rate.";
    }
```


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```
      enum "egress-only" {
        description
          "PAUSE frame based flow control is enabled in the egress
           direction only, i.e., PAUSE frames are not transmitted,
           but PAUSE frames received in the ingress direction are
           processed to reduce the egress traffic rate.";
      }
      enum "bi-directional" {
        description
          "PAUSE frame based flow control is enabled in both ingress
           and egress directions, i.e., PAUSE frames may be
           transmitted to reduce the ingress traffic flow, and
           PAUSE frames received on ingress are processed to reduce
           the egress traffic rate.";
      }
      enum "undefined" {
        description
          "Link is currently disconnected or initializing.";
      }
    }
    description
      "Used to represent the configured, negotiated, or actual
       PAUSE frame-based flow control setting.";

    reference
      "IEEE Std 802.3.1, dot3PauseAdminMode and dot3PauseOperMode";
  }

  feature ethernet-pfc {
    description
      "This device supports Ethernet priority flow-control.";
  }

  feature ethernet-pause {
    description
      "This device supports Ethernet PAUSE.";
  }

  augment "/if:interfaces/if:interface" {
    when "derived-from-or-self(if:type, 'ianaift:ethernetCsmacd')" {
      description
        "Applies to all P2P Ethernet interfaces.";
    }
    description
      "Augment interface model with Ethernet interface
       specific configuration nodes.";

    container ethernet {
      description
        "Contains all Ethernet interface related configuration.";

      container auto-negotiation {
        presence
          "The presence of this container indicates that
```


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```
    auto-negotiation is supported on this Ethernet
    interface.";
  description
    "Contains auto-negotiation transmission parameters

    This container contains a data node that allows the
    advertised duplex value in the negotiation to be
    restricted.

    If not specified then the default behavior for the duplex
    data node is to negotiate all available values for the
    particular type of Ethernet PHY associated with the
    interface.

    If auto-negotiation is enabled, and PAUSE frame based flow
    control has not been explicitly configured, then the
    default PAUSE frame based flow control capabilities that
    are negotiated allow for bi-directional or egress-only
    PAUSE frame based flow control.

    If auto-negotiation is enabled, and PAUSE frame based flow
    control has been explicitly configured, then the
    configuration settings restrict the values that may be
    negotiated. However, it should be noted that the protocol
    does not allow only egress PAUSE frame based flow control
    to be negotiated without also allowing bi-directional
    PAUSE frame based flow control.";
  reference
    "IEEE Std 802.3, Clause 28 and Annexes 28A-D";

  leaf enable {
    type boolean;
    default true;

    description
      "Controls whether auto-negotiation is enabled or
       disabled.
       For interface types that support auto-negotiation then
       it defaults to being enabled.

       For interface types that do not support auto-negotiation,
       the related configuration data is ignored.";
  }
  leaf negotiation-status {
    when "../enable = 'true'";
    type enumeration {
      enum in-progress {
        description
          "The auto-negotiation protocol is running and
           negotiation is currently in-progress.";
      }
      enum complete {
        description
          "The auto-negotiation protocol has completed
```


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```
            successfully.";
        }
        enum failed {
          description
            "The auto-negotiation protocol has failed.";
        }
        enum unknown {
          description
            "The auto-negotiation status is not currently known,
             this could be because it is still negotiating or the
             protocol cannot run (e.g., if no medium is present).";
        }
        enum no-negotiation {
          description
            "No auto-negotiation is executed.
             The auto-negotation function is either not supported
             on this interface or has not been enabled.";
        }
      }
      config false;
      description
        "The status of the auto-negotiation protocol.";
      reference
        "IEEE 802.3, 30.6.1.1.4, aAutoNegAutoConfig";
    }

  }

  leaf duplex {
    type duplex-type;
    description
      "Operational duplex mode of the Ethernet interface.";
    reference
      "IEEE Std 802.3, 30.3.1.1.32 aDuplexStatus";
  }

  leaf speed {
    type eth-if-speed-type;
    units "Gb/s";
    description
      "Operational speed (data rate) of the Ethernet interface.
       The default value is implementation-dependent.";
  }

  container flow-control {
    description
      "Holds the different types of Ethernet PAUSE frame based
       flow control that can be enabled.";
    container pause {
      if-feature "ethernet-pause";
      description
        "IEEE Std 802.3 PAUSE frame based PAUSE frame based flow
         control.";
      reference
```


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```
      "IEEE Std 802.3, Annex 31B";
    leaf direction {
      type pause-fc-direction-type;
      description
        "Indicates which direction PAUSE frame based flow
         control is enabled in, or whether it is disabled.
         The default flow-control settings are vendor specific.
         If auto-negotiation is enabled, then PAUSE based
         flow-control is negotiated by default.
         The default value is implementation-dependent.";
    }

    container statistics {
      config false;
      description
        "Contains the number of PAUSE frames received or
         transmitted.";
      leaf in-frames-pause {
        type yang:counter64;
        units frames;
        description
          "A count of PAUSE MAC Control frames transmitted on
           this Ethernet interface.

           Discontinuities in the values of counters in
           this container can occur at re-initialization of the
           management system, and at other times as indicated
           by the value of the 'discontinuity-time' leaf
           defined in the ietf-interfaces YANG module
           (IETF RFC 8343).";
        reference
          "IEEE Std 802.3, 30.3.4.3 aPAUSEMACCtrlFramesReceived";
      }
      leaf out-frames-pause {
        type yang:counter64;
        units frames;
        description
          "A count of PAUSE MAC Control frames transmitted on
           this Ethernet interface.

           Discontinuities in the values of counters in
           this container can occur at re-initialization of the
           management system, and at other times as indicated
           by the value of the 'discontinuity-time' leaf
           defined in the ietf-interfaces YANG module
           (IETF RFC 8343).";
        reference
          "IEEE Std 802.3, 30.3.4.2
           aPAUSEMACCtrlFramesTransmitted";
      }
    }
  }

  container pfc {
```


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```
if-feature "ethernet-pfc";
description
  "IEEE Std 802.3 Priority-based flow control.";
reference
  "IEEE Std 802.3, Annex 31D";

leaf enable {
  type boolean;

  description
    "True indicates that IEEE Std 802.3 priority-based
     flow control is enabled, false indicates that
     IEEE Std 802.3 priority-based flow control is disabled.
     For interfaces that have auto-negotiation,
     the priority-based flow control is enabled by default.";
}

container statistics {
  config false;
  description
    "This container collects all statistics for
     Ethernet interfaces.";

  leaf in-frames-pfc {
    type yang:counter64;
    units frames;
    description
      "A count of PFC MAC Control frames received on this
       Ethernet interface.

       Discontinuities in the values of counters in
       this container can occur at re-initialization of the
       management system, and at other times as indicated
       by the value of the 'discontinuity-time' leaf
       defined in the ietf-interfaces YANG module
       (IETF RFC 8343).";
    reference
      "IEEE Std 802.3.1, dot3HCInPFCFrames";
  }

  leaf out-frames-pfc {
    type yang:counter64;
    units frames;
    description
      "A count of PFC MAC Control frames transmitted on
       this interface.

       Discontinuities in the values of counters in
       this container can occur at re-initialization of the
       management system, and at other times as indicated
       by the value of the 'discontinuity-time' leaf
       defined in the ietf-interfaces YANG module
       (IETF RFC 8343).";
    reference
```


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```
            "IEEE Std 802.3.1, dot3HCInPFCFrames";
        }
      }
    }

    leaf force-flow-control {
      type boolean;
      default false;
      description
        "Explicitly forces the local PAUSE frame based flow control
         settings regardless of what has been negotiated.

         Since the auto-negotiation of flow-control settings
         does not allow all sane combinations to be negotiated
         (e.g., consider a device that is only capable of sending
         PAUSE frames connected to a peer device that is only
         capable of receiving and acting on PAUSE frames) and
         failing to agree on the flow-control settings does not
         cause the auto-negotiation to fail completely, then it is
         sometimes useful to be able to explicitly enable
         particular PAUSE frame based flow control settings on
         the local device regardless of what is being advertised
         or negotiated.";
      reference
        "IEEE Std 802.3, Table 28B-3";
    }
  }

  leaf max-frame-length {
    type uint16;
    units octets;
    config false;
    description
      "This indicates the MAC frame length (including FCS bytes)
       at which frames are dropped for being too long.";
    reference
      "IEEE Std 802.3, 30.3.1.1.37 aMaxFrameLength";
  }

  leaf mac-control-extension-control {
    type boolean;
    config false;
    description
      "A value that identifies the current EXTENSION MAC Control
       function, as specified in IEEE Std 802.3, Annex 31C.";
    reference
      "IEEE Std 802.3, 30.3.8.3 aEXTENSIONMACCtrlStatus
       IEEE Std 802.3.1, dot3ExtensionMacCtrlStatus ";
  }

  leaf frame-limit-slow-protocol {
    type uint64;
    units f/s;
    default 10;
```


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```
    config false;
    description
      "The maximum number of Slow Protocol frames of a given
       subtype that can be transmitted in a one second interval.
       The default value is 10.";
    reference
      "IEEE Std 802.3, 30.3.1.1.38 aSlowProtocolFrameLimit";
  }

  container capabilities {
    config false;
    description
      "Container all Ethernet interface specific capabilities.";

    leaf auto-negotiation {
      type boolean;
      description
        "Indicates whether auto-negotiation may be configured on
         this interface.";
    }

  }

  container statistics {
    config false;
    description
      "Contains statistics specific to Ethernet interfaces.

       Discontinuities in the values of counters in the
       container can occur at re-initialization of the management
       system, and at other times as indicated by the value of
       the 'discontinuity-time' leaf defined in the
       ietf-interfaces YANG module (IETF RFC 8343).";

    container frame {
      description
        "Contains frame statistics specific to Ethernet
         interfaces.

         All octet frame lengths include the 4 byte FCS.

         Error counters are only reported once ... The count
         represented by an instance of this object is incremented
         when the frameCheckError status is returned by the MAC
         service to the LLC (or other MAC user). Received frames
         for which multiple error conditions pertain are,
         according to the conventions of IEEE Std 802.3 Layer
         Management, counted exclusively according to the error
         status presented to the LLC.

         A frame that is counted by an instance of this object is
         also counted by the corresponding instance of 'in-errors'
         leaf defined in the ietf-interfaces YANG module
         (IETF RFC 8343).
```


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```
     Discontinuities in the values of counters in the
     container can occur at re-initialization of the
     management system, and at other times as indicated by
     the value of the 'discontinuity-time' leaf defined in
     the ietf-interfaces YANG module (IETF RFC 8343).";

  leaf in-total-frames {
    type yang:counter64;
    units frames;
    description
      "The total number of frames (including bad frames)
       received on the Ethernet interface.

       This counter is calculated by summing the following
       IEEE Std 802.3, Clause 30 counters:
       aFramesReceivedOK +
       aFrameCheckSequenceErrors +
       aAlignmentErrors +
       aFrameTooLongErrors +
       aFramesLostDueToIntMACRcvError

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

    reference
      "IEEE Std 802.3, Clause 30 counters, as specified
       in the description above.";
  }

  leaf in-total-octets {
    type yang:counter64;
    units octets;
    description
      "The total number of octets of data (including those in
       bad frames) received on the Ethernet interface.

       Includes the 4-octet FCS.

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

    reference
      "IETF RFC 2819, etherStatsOctets";
  }

  leaf in-frames {
    type yang:counter64;
    units frames;
    description
      "A count of frames (including unicast, multicast and
       broadcast) that have been successfully received on the
```


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```
        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.";
```


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```
    reference
      "IEEE Std 802.3, 30.3.1.1.22 aBroadcastFramesReceivedOK";
  }

  leaf in-error-fcs-frames {
    type yang:counter64;
    units frames;
    description
      "A count of receive frames that are of valid length,
       but do not pass the FCS check, regardless of whether
       or not the frames are an integral number of octets in
       length.

       This count effectively comprises
       aFrameCheckSequenceErrors and aAlignmentErrors added
       together.

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

    reference
      "IEEE Std 802.3, 30.3.1.1.6 aFrameCheckSequenceErrors;
       IEEE Std 802.3, 30.3.1.1.7 aAlignmentErrors";
  }

  leaf in-error-undersize-frames {
    type yang:counter64;
    units frames;
    description
      "A count of frames received on a particular Ethernet
       interface that are less than 64 bytes in length, and
       are discarded.

       This counter is incremented regardless of whether the
       frame passes the FCS check.

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

    reference
      "IETF RFC 2819, etherStatsUndersizePkts and
       etherStatsFragments";
  }

  leaf in-error-oversize-frames {
    type yang:counter64;
    units frames;
    description
      "A count of frames received on a particular Ethernet
       interface that exceed the maximum permitted frame
       size, that is specified in max-frame-length, and are
       discarded.
```


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```
        This counter is incremented regardless of whether the
        frame passes the FCS check.

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

    reference "IEEE Std 802.3, 30.3.1.1.25 aFrameTooLongErrors";
  }

  leaf in-error-mac-internal-frames {
    type yang:counter64;
    units frames;
    description
      "A count of frames for which reception on a particular
       Ethernet interface fails due to an internal MAC
       sublayer receive error.

       A frame is only counted by an instance of this object
       if it is not counted by the corresponding instance of
      either the in-error-fcs-frames, in-error-undersize-frames,
       or in-error-oversize-frames.  The precise meaning of the
       count represented by an instance of this object is
       implementation-specific.

       In particular, an instance of this object may
       represent a count of receive errors on a particular
       Ethernet interface that are not otherwise counted.

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

    reference
      "IEEE Std 802.3, 30.3.1.1.15
       aFramesLostDueToIntMACRcvError";
  }

  leaf out-frames {
    type yang:counter64;
    units frames;
    description
      "A count of frames (including unicast, multicast and
       broadcast) that have been successfully transmitted on
       the Ethernet interface.

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

    reference
      "IEEE Std 802.3, 30.3.1.1.2 aFramesTransmittedOK";
  }
```


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```
leaf out-multicast-frames {
  type yang:counter64;
  units frames;
  description
    "A count of multicast frames that have been
     successfully transmitted on the Ethernet interface.

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

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

  reference
    "IEEE Std 802.3, 30.3.1.1.18 aMulticastFramesXmittedOK";
}

leaf out-broadcast-frames {
  type yang:counter64;
  units frames;
  description
    "A count of broadcast frames that have been
     successfully transmitted on the Ethernet interface.

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

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

  reference
    "IEEE Std 802.3, 30.3.1.1.19 aBroadcastFramesXmittedOK";
}

leaf out-error-mac-internal-frames {
  type yang:counter64;
  units frames;
  description
    "A count of frames for which transmission on a
     particular Ethernet interface fails due to an internal
     MAC sublayer transmit error.

     The precise meaning of the count represented by an
     instance of this object is implementation-specific. In
     particular, an instance of this object may represent a
     count of transmission errors on a particular Ethernet
     interface that are not otherwise counted.

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


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```
      reference
        "IEEE Std 802.3, 30.3.1.1.12
         aFramesLostDueToIntMACXmitError";
    }
  }

  container phy {
    description
      "Ethernet statistics related to the PHY layer.

       Discontinuities in the values of counters in the
       container can occur at re-initialization of the
       management system, and at other times as indicated by
       the value of the 'discontinuity-time' leaf defined in
       the ietf-interfaces YANG module (IETF RFC 8343).";

    leaf in-error-symbol {
      type yang:counter64;
      units errors;
      description
        "A count of the number of symbol errors that have
         occurred.

         For the precise definition of when the symbol error
         counter is incremented, please see the 'description'
         text associated with aSymbolErrorDuringCarrier,
         specified in IEEE Std 802.3, 30.3.2.1.5.

         Also see the 'description' statement associated with
         the parent 'phy-statistics' container for additional
         common semantics related to this counter.";
      reference
        "IEEE Std 802.3, 30.3.2.1.5 aSymbolErrorDuringCarrier";
    }

    container lpi {
      description
        "Physical Ethernet statistics for the energy efficiency
         related low power idle indications.";

      leaf in-lpi-transitions {
        type yang:counter64;
        units transitions;
        description
          "A count of occurrences of the transition from
           DEASSERT to ASSERT of the LPI_INDICATE
           parameter. The indication reflects the state of the
           PHY according to the requirements of the RS (see
           IEEE Std 802.3, 22.7, 35.4, and 46.4).

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


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```
    reference
      "IEEE Std 802.3, 30.3.2.1.11 aReceiveLPITransitions";
  }

  leaf in-lpi-time {
    type decimal64 {
      fraction-digits 6;
    }
    units seconds;
    description
      "A count reflecting the total amount of time (in
       seconds) that the LPI_REQUEST parameter has the
       value ASSERT.  The request is indicated to the PHY
       according to the requirements of the RS (see IEEE Std
       802.3, 22.7, 35.4, and 46.4).

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

    reference
      "IEEE Std 802.3, 30.3.2.1.9 aReceiveLPIMicroseconds";
  }

  leaf out-lpi-transitions {
    type yang:counter64;
    units transitions;
    description
      "A count of occurrences of the transition from state
       LPI_DEASSERTED to state LPI_ASSERTED in the LPI
       transmit state diagram of the RS. The state
       transition corresponds to the assertion of the
       LPI_REQUEST parameter. The request is indicated to
       the PHY according to the requirements of the RS (see
       IEEE Std 802.3, 22.7, 35.4, 46.4.)

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

    reference
      "IEEE Std 802.3, 30.3.2.1.10 aTransmitLPITransitions";
  }

  leaf out-lpi-time {
    type decimal64 {
      fraction-digits 6;
    }
    units seconds;
    description
      "A count reflecting the total amount of time (in
       seconds) that the LPI_INDICATION parameter has the
       value ASSERT.  The request is indicated to the PHY
```


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```
            according to the requirements of the RS (see IEEE
            802.3, 22.7, 35.4, and 46.4).

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

        reference
          "IEEE Std 802.3, 30.3.2.1.8 aTransmitLPIMicroseconds";
      }
    }
  }

  container mac-control {
    description
      "A group of statistics specific to MAC Control operation
       of selected Ethernet interfaces.

       Discontinuities in the values of counters in the
       container can occur at re-initialization of the
       management system, and at other times as indicated by
       the value of the 'discontinuity-time' leaf defined in
       the ietf-interfaces YANG module (IETF RFC 8343).";

    reference
      "IEEE Std 802.3.1, dot3ExtensionTable";

    leaf in-frames-mac-control-unknown {
      type yang:counter64;
      units frames;
      description
        "A count of MAC Control frames with an unsupported
         opcode received on this Ethernet interface.

         Frames counted against this counter are also counted
         against in-discards defined in the ietf-interfaces
         YANG module (IETF RFC 8343).

         Also see the 'description' statement associated with
         the parent 'mac-control-statistics' container for
         additional semantics.";
      reference
        "IEEE Std 802.3, 30.3.3.5 aUnsupportedOpcodesReceived";
    }

    leaf in-frames-mac-control-extension {
      type yang:counter64;
      units frames;
      description
        "The count of Extension MAC Control frames received on
         this Ethernet interface.

         Also see the 'description' statement associated with
         the parent 'mac-control-statistics' container for
```


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```
            additional semantics.";
          reference
            "IEEE Std 802.3, 30.3.8.2
             aEXTENSIONMACCtrlFramesReceived";
        }

        leaf out-frames-mac-control-extension {
          type yang:counter64;
          units frames;
          description
            "The count of Extension MAC Control frames transmitted
             on this Ethernet interface.

             Also see the 'description' statement associated with
             the parent 'mac-control-statistics' container for
             additional semantics.";
          reference
            "IEEE Std 802.3, 30.3.8.1
             aEXTENSIONMACCtrlFramesTransmitted";
        }
      }
    }
  }
}
```

5.3.2.2 Ethernet interface module (half-duplex)

```
module ieee802-ethernet-interface-half-duplex {

  yang-version 1.1;

  namespace
    "urn:ieee:std:802.3:yang:ieee802-ethernet-interface-half-duplex";

  prefix ieee802-eth-half-duplex;

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";
  }
```


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

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 Ethernet
   interfaces that are deprecated, and are no longer
   widely used in the industry. The definitions are maintained for
   backwards compatibility purposes, but the general expectation is
   that this module is not anticipated to be widely implemented.";
reference
  "IEEE Std 802.3-2018, unless dated explicitly";

feature dynamic-rate-control {
  description
    "This feature indicates that the device supports Ethernet
     interfaces lowering the average data rate of the MAC sublayer,
     with frame granularity, by using Rate Control to dynamically
     increase the inter-packet gap for some types of Ethernet
     interface.
     Only valid for Ethernet interfaces operating at speeds (data rates)
     above 1000 Mb/s.";
  reference "IEEE Std 802.3, 30.3.1.1.33 aRateControlAbility";
}

feature csma-cd {
  description
    "This feature indicates that the device supports Ethernet
     interfaces running at half-duplex using CSMA/CD.";
}

typedef dynamic-rate-control-type {
  type enumeration {
    enum disabled {
      description
        "Dynamic rate control is disabled";
    }

    enum "sonet-oc192" {
      value 2;
      description
        "Dynamic rate control is enabled for a 10 Gb/s Ethernet
         interface to SONET/SDH OC192/STM64.";
    }
  }
  default disabled;
  description
    "Allowed values for dynamic-rate-control.";
  reference
    "IEEE Std 802.3, 4.4.2 ipgStretchRatio and 30.3.1.1.34
     aRateControlStatus";
```


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```
}

 augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet" {
 when "derived-from-or-self(../if:type, 'ianaift:ethernetCsmacd')
    and ieee802-eth-if:duplex = 'half'" {
    description
      "Applies to half-duplex Ethernet interfaces.";
  }

  description
    "Augment with Ethernet interface configuration parameters
     for half-duplex operation.";

  leaf dynamic-rate-control {
    if-feature "dynamic-rate-control";
    type dynamic-rate-control-type;
    description
      "Enables dynamic rate control and specifies what speed (data rate)
       the dynamic rate control is operating at. The value of this attribute
       is constrained by the MAC data rate and hardware support.
       The default value is implementation-dependent.";
    reference
      "IEEE Std 802.3, 30.3.1.1.34 aRateControlStatus";
  }
}

augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet/" +
  "ieee802-eth-if:capabilities"{
   when  "derived-from-or-self(../../if:type,
     'ianaift:ethernetCsmacd') and ../ieee802-eth-if:duplex = 'half'" {
     description "Applies to half-duplex Ethernet interfaces";
  }

  description
    "Augment with configuration capabilities for half-duplex
     Ethernet interface.";

  leaf dynamic-rate-control-supported {
    if-feature "dynamic-rate-control";
    type boolean;
    default false;
    description
      "Indicates whether the Ethernet interface supports lowering
       the average data rate of the MAC sublayer, with frame
       granularity, by using Rate Control to dynamically increase
       the inter-packet gap.
       Only valid for Ethernet interfaces operating at speeds (data rates)
       above 1000 Mb/s.";
    reference
      "IEEE Std 802.3, 30.3.1.1.33 aRateControlAbility";
  }
}

augment "/if:interfaces/if:interface/ieee802-eth-if:ethernet/" +
  "ieee802-eth-if:statistics/ieee802-eth-if:frame" {
  when "derived-from-or-self(../../../if:type,
    'ianaift:ethernetCsmacd') and ../../ieee802-eth-if:duplex = 'half'" {
    description
      "Applies to half-duplex Ethernet interfaces.";
```


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