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Standard

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8802-1Q

**Telecommunications and exchange
between information technology
systems — Requirements for local
and metropolitan area networks —**

Part 1Q:

Bridges and bridged networks

AMENDMENT 35: Congestion isolation

*Télécommunications et échange entre systèmes informatiques —
Exigences pour les réseaux locaux et métropolitains —*

Partie 1Q: Ponts et réseaux pontés

AMENDEMENT 35: Prévention de la congestion

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IEEE Standard for
Local and Metropolitan Area Networks—

Bridges and Bridged Networks

Amendment 35: Congestion Isolation

(This amendment is based on IEEE Std 802.1Q™-2022.)

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italics***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~striking through~~ (to remove old material) and underline (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Deletions and insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this note will not be carried over into future editions because the changes will be incorporated into the base standard.⁶

⁶ Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

1. Overview

1.3 Introduction

Insert new text at the end of 1.3 as follows:

This standard specifies protocols, procedures, and managed objects that support the isolation of congesting data flows within data center environments. This is achieved by enabling systems to individually identify flows creating congestion, isolate those flows to the congesting queue, and signal to neighbors. This mechanism reduces head-of-line blocking for non-congesting flows sharing the same traffic class. Congestion Isolation is used with higher layer protocols that utilize end-to-end congestion control in order to reduce packet loss and latency. To this end, it:

- ct) Defines a means for VLAN-aware Bridges that support congestion isolation to identify flows that are creating congestion.
- cu) Defines a means for adjusting transmission selection for frames of congesting flows.
- cv) Provides a means for discovering peer VLAN-aware Bridges and stations that support congestion isolation.
- cw) Defines a means for signaling congestion isolation to supporting peer Bridges and stations.
- cx) Defines a means for recognizing a system's level and port orientation within the topology relative to the edge.

2. Normative references

Insert the following references into Clause 2 in alphanumeric order:

IEEE Std 802.1CS™, IEEE Standard for Local and Metropolitan Area Networks—Link-local Registration Protocol.^{7, 8}

IETF RFC 768 (STD0006), User Datagram Protocol, August 1980.⁹

IETF RFC 791 (STD0005), Internet Protocol—DARPA Internet Program Protocol Specification, September 1981.

IETF RFC 3168, The Addition of Explicit Congestion Notification (ECN) to IP, September 2001.

IETF RFC 3232, Assigned Numbers: RFC 1700 is Replaced by an On-line Database, January 2002.

IETF RFC 6335, Internet Assigned Numbers Authority (IANA) Procedures for the Management of the Service Name and Transport Protocol Port Number Registry, August 2011.

IETF RFC 8200 (STD0086), Internet Protocol, Version 6 (IPv6) Specification, July 2017.

⁷ The IEEE standards or products referred to in Clause 2 are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated.

⁸ IEEE publications are available from The Institute of Electrical and Electronics Engineers (<https://standards.ieee.org/>).

⁹ IETF RFCs are available from the Internet Engineering Task Force (<https://www.ietf.org/>).

3. Definitions

Insert the following definitions in the appropriate collating sequence, renumbering accordingly:

3.1 congesting flow: A sequence of frames the end-to-end congestion controlled higher layer protocol treats as belonging to a single flow that is experiencing congestion within a congestion isolation aware system.

3.2 congestion isolation aware system: A Bridge component conforming to the congestion isolation provisions of this standard.

3.3 Congestion Isolation Message (CIM): A message transmitted by a congestion isolation aware system, conveying congesting flow information used by the upstream peer congestion isolation aware system.

3.4 Congestion Isolation Point (CIP): A Virtual Local Area Network (VLAN) Bridge or end station Port function that monitors a set of queues for congesting flows, isolates congesting flows to a congesting queue, and can generate Congestion Isolation Messages.

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4. Abbreviations

Insert the following abbreviations into Clause 4, in the appropriate collating sequence:

CI	Congestion Isolation
CIM	Congestion Isolation Message
CIP	Congestion Isolation Point

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5. Conformance

5.4 VLAN Bridge component requirements

5.4.1 VLAN Bridge component options

Insert new list item ag) at the end of the lettered list in 5.4.1 as follows:

- ag) Support for Congestion Isolation (CI) operation (5.4.7).

5.4.1.6 ETS Bridge requirements

Insert new list item a) at the beginning of the lettered list in 5.4.1.6 as follows, renumbering all subsequent items:

- a) Support the ETS algorithm (8.6.8.3).

Insert 5.4.7 after 5.4.6 as follows:

5.4.7 VLAN Bridge requirements for congestion isolation (optional)

A VLAN-aware Bridge implementation that conforms to the provisions of this standard for congestion isolation in Clause 49 shall:

- a) Support, on one or more Ports, the creation of at least one Congestion Isolation Point (49.3.1).
- b) Support Explicit Congestion Notification (ECN) as defined by IETF RFC 3168 and associated updates along with Active Queue Management (AQM) as described in 49.2.1.
- c) Support per-stream classification and metering for CI as specified in 8.6.5.2.3.
- d) Support, at each Congestion Isolation Point, the variables and procedures of the Congestion Isolation Protocol (49.4).
- e) Support the ability to configure the variables controlling the operation of Congestion Isolation (12.33.1), the CI Peer Table (12.33.2), the CI Stream Table (12.33.3), and each CIP (12.33.4).
- f) Conform to the required capabilities of IEEE Std 802.1AB.
- g) Support the use of the Congestion Isolation TLV in LLDP (D.2.15).

A VLAN Bridge implementation that conforms to the provisions of this standard for congestion isolation may:

- h) Support the monitoring of more than one queue on a Bridge Port (49.4.1.2.5).
- i) Support transmission selection algorithms other than strict priority.
- j) Support the de-isolation of congesting flows by means other than the empty status of a congesting queue (49.2.6).
- k) Support the Congestion Isolation YANG model (48.3.8).
- l) Support Topology Recognition (49.5).

Insert 5.32 after 5.31 as follows:

5.32 End station requirements for congestion isolation

An end station implementation that conforms to the provisions of this standard for congestion isolation in Clause 49 shall:

- a) Support Explicit Congestion Notification (ECN) as defined by IETF RFC 3168 and associated updates along with Active Queue Management (AQM) as described in 49.2.1.
- b) Support, at each Congestion Isolation Point, the variables and procedures of the Congestion Isolation Protocol (49.4).
- c) Conform to the required capabilities of IEEE Std 802.1AB.
- d) Support the use of the Congestion Isolation TLV in LLDP (D.2.15).

An end station implementation that conforms to the provisions of this standard for congestion isolation in Clause 49 may:

- e) Support transmission selection algorithms other than strict priority.
- f) Support the de-isolation of congesting flows by means other than the empty status of a congesting queue (49.2.6).
- g) Support the Congestion Isolation YANG model (48.3.8).
- h) Support non-relay end station or server functionality of Topology Recognition (49.5).

6. Support of the MAC Service

6.10 Support of the ISS/EISS by PIPs

6.10.1 Data indications

Change the first paragraph of 6.10.1 as follows:

On receipt of an M_UNITDATA.indication primitive from the PIP-ISS, if the PIP is congestion aware (5.4.1.4) and the initial octets of the mac_service_data_unit contain a valid CNM encapsulation, the received frame is processed according to 32.16. If the PIP is congestion isolation aware (5.4.7) and the initial octets of the mac_service_data_unit contain a valid CIM encapsulation (49.4.3), the received frame is processed according to 49.4.2.6. Otherwise, the received frame shall be discarded if:

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8. Principles of Bridge operation

8.6 The Forwarding Process

8.6.5 Flow classification and metering

Change the text in 8.6.5 as follows:

The Forwarding Process can apply flow classification and metering to frames that are received on a Bridge Port and have one or more potential transmission ports. Bridge Ports and end stations may support Per-Stream Filtering and Policing (PSFP), Asynchronous Traffic Shaping (ATS) filtering and eligibility time assignment, [Congestion Isolation \(CI\)](#), or the general flow classification rules specified in 8.6.5.1.

NOTE—The general flow classification and metering specification was added to this standard by IEEE Std 802.1Q-2005, PSFP by IEEE Std 802.1Qci-2017, ~~and~~ ATS by IEEE Std 802.1Qcr-2020, ~~and CI by IEEE Std 802.1Qcz-2023.~~

PSFP ~~and ATS~~, [ATS](#), ~~and CI~~ share common per-stream classification and metering elements, as shown in Figure 8-13. The Stream identification function specified in IEEE Std 802.1CB can be used to associate received frames with these elements.

Change Figure 8-13 as follows:

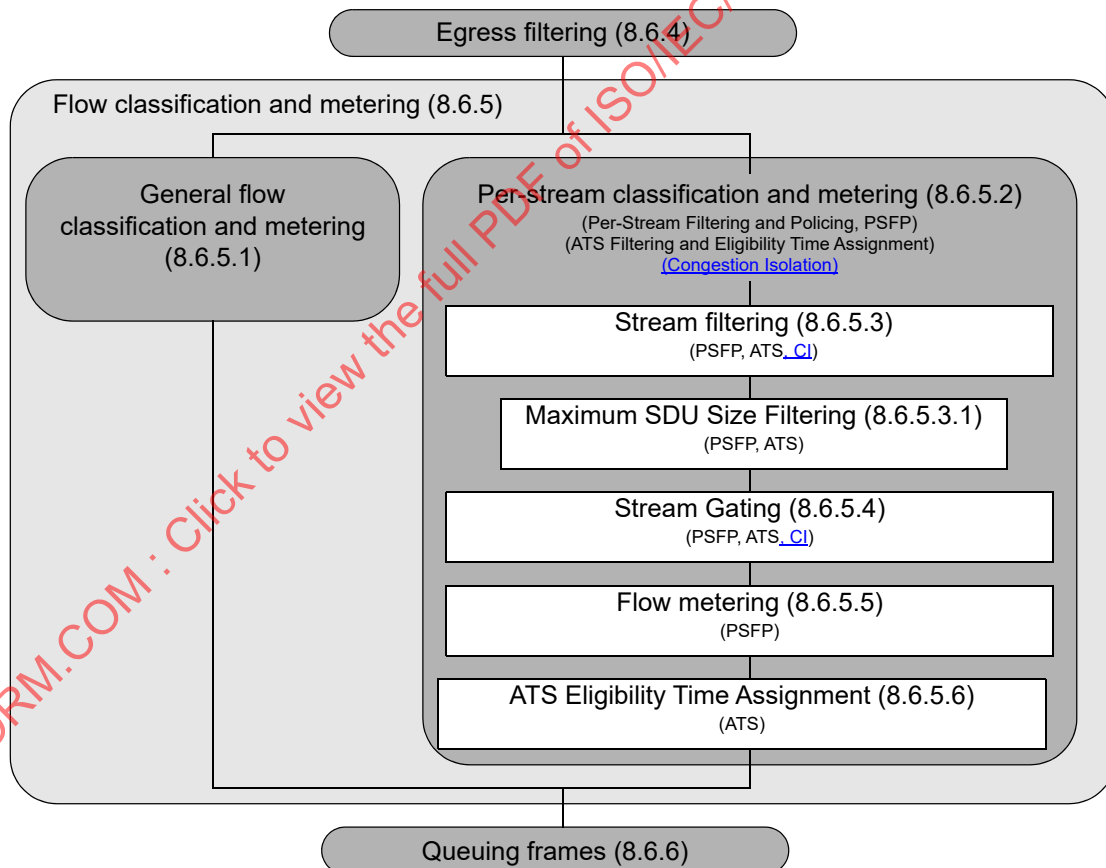


Figure 8-13—Flow classification and metering

8.6.5.2 Per-stream classification and metering

Change the first sentence of 8.6.5.2 as follows:

When Per-Stream Filtering and Policing (PSFP) ~~or Asynchronous Traffic Shaping (ATS)~~, Asynchronous Traffic Shaping (ATS), or Congestion Isolation (CI) is used, filtering and policing decisions for received frames are made, and subsequent queuing (8.6.6) and transmission selection decisions (8.6.8) supported, as follows:

Insert 8.6.5.2.3 after 8.6.5.2.2 as follows:

8.6.5.2.3 CI Support

Each Bridge component or an end station that implements Congestion Isolation supports stream identification and stream gates to allow traffic class modification, with the following:

- A single Stream Filter Instance Table (8.6.5.3).
- A single Stream Gate Instance Table (8.6.5.4).

The relationship between stream filters and stream gates for streams subject to CI processing (as identified by the stream filter) is illustrated by Figure 8-15a for a number of streams.

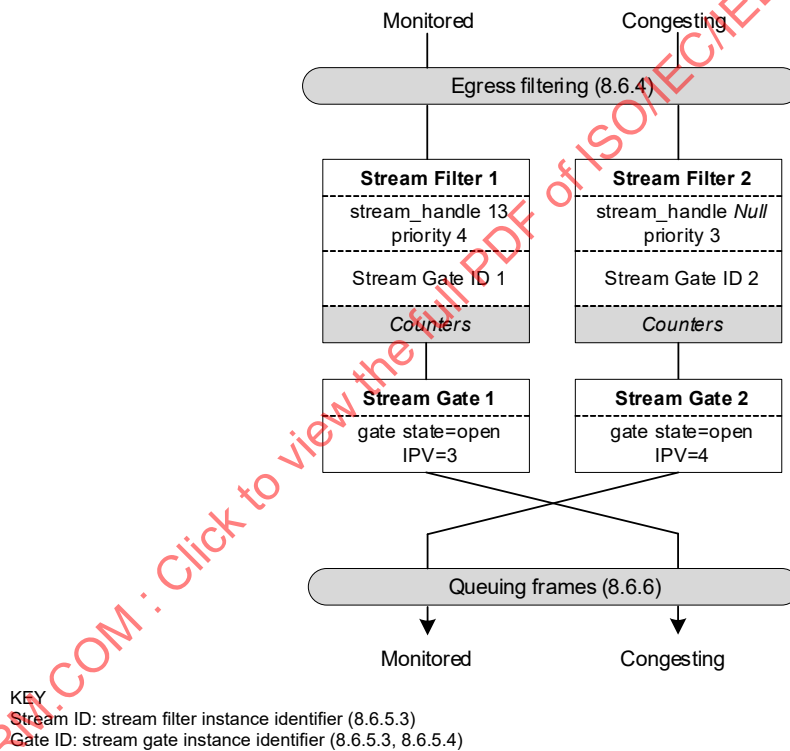


Figure 8-15a—Per-stream classification and assignment for CI

Congestion isolation uses two stream filter instances from the stream filter instance table (8.6.5.3) to select stream gate instances that will modify the priority of flows. One stream filter instance is used to modify the priority of congesting flows from the monitored queue to the congesting queue. The other stream filter instance is used to modify the priority of congesting flows from the congesting queue back to the monitored queue. There are no *filter specifications* used by congestion isolation.

The *stream_handle* and *priority* parameters associated with a received frame select the stream filter instance of congestion isolation for a particular monitored traffic class. The purpose of the stream filter is to select the stream gate instance that will modify the priority of congesting flow frames so they will traverse the congesting queue. The absence of a *stream_handle* and the *priority* parameter associated with a received frame select the stream gate instance that will modify the priority of received frames back to the priority of the monitored queue.

NOTE—Changes to the frame's priority are intended to persist (see 49.2.4 and 49.2.6) by modifying the Priority Code Point (see 6.9.3) or other indicators used to select the traffic class, such as the Differentiated Services Code Point (see IETF RFC 2474). As noted in 6.8.1, modification to a frame will require the FCS to be regenerated. Options for regenerating the FCS are discussed in Annex O.

Congestion isolation uses two stream gate instances from the stream gate instance table (8.6.5.4) to modify the priority of flows. The operational and an administrative *stream_gate_state* (8.6.10.4, 8.6.10.5, 12.31.3) is set to Open for Congestion Isolation and the *GateClosedDueToInvalidRxEnable* and *GateClosedDueToOctetsExceededEnable* parameters are set to FALSE. The internal priority value (IPV) is used in place of the priority value associated with the frame to determine the frame's traffic class, using the Traffic Class Table as specified in 8.6.6. The *stream_gate_control_list* feature is not used by Congestion Isolation and is set to null.

8.6.5.3 Stream filtering

Change second paragraph and associated list in 8.6.5.3 as follows:

Each stream filter comprises the following:

- a) An integer *stream_filter_identifier*.
- b) A *stream_handle* specification, either:
 - 1) A single value, as specified in IEEE Std 802.1CB.
 - 2) A wildcard, that matches any *stream_handle*.
 - 3) If congestion isolation is supported, a null-handle, that matches when no stream_handle is provided.
- c) A *priority* specification, either:
 - 1) A single priority value.
 - 2) A wildcard value that matches any priority value.
- d) Maximum SDU size filtering (8.6.5.3.1) information, comprising:
 - 1) An integer *Maximum SDU size*, in octets. A value of 0 disables maximum SDU size filtering for this stream filter.
 - 2) A boolean *StreamBlockedDueToOversizeFrameEnable* parameter.
 - 3) A boolean *StreamBlockedDueToOversizeFrame* parameter.
- e) An integer *stream_gate_identifier* (8.6.5.4).
- f) An integer *flow_meter_instance_identifier* (8.6.5.5).
If this parameter is absent, frames associated with the stream filter are not subject to flow metering.
- g) An integer *ATS_scheduler_instance_identifier* (8.6.5.6).
If this parameter is absent, frames associated with the stream filter are not subject to ATS scheduling and transmission selection.

8.6.5.4 Stream gating

Change NOTE 1 in 8.6.5.4 as follows:

NOTE 1—The IPV facilitates ATS per-hop delay bound adjustment to satisfy specific networks' end-to-end delay requirements. Annex T (CQF) describes another IPV use case. Another use case is the ability to isolate congesting flows to a congesting flow queue as specified by Congestion Isolation (Clause 49).

8.6.5.5 Flow metering

Insert the following after list item j), renumbering subsequent list items as necessary:

Each frame has a predetermined color for subsequent processing by a flow meter. If this color is determined by the drop_eligible parameter (6.9.1), the color is determined as follows:

- k) If the drop_eligible parameter is FALSE, the color is green.
- l) If the drop_eligible parameter is TRUE, the color is yellow.

8.6.6 Queuing frames

Change the third to last paragraph of 8.6.6 as follows:

In a congestion-aware Bridge (Clause 30) or a congestion isolation aware Bridge (Clause 49), the act of queuing a frame for transmission on a Bridge Port can result in the Forwarding Process generating a CNM or a CIM. The CNM ~~is~~ and CIM are injected back into the Forwarding Process (8.6.1) as if ~~it~~ they had been received on that Bridge Port.

8.6.8 Transmission selection

Insert 8.6.8.6 after 8.6.8.5 as follows:

8.6.8.6 Enhancements for congestion isolation

A Bridge component or an end station may support enhancements to isolate the frames of congesting flows to a designated congesting traffic class. During the isolation of a congesting flow it may be possible for frames of the same flow to queue in both the congesting and non-congesting traffic class. The transmission gate associated with each monitored non-congesting queue and each congesting queue can be used to meet the ordering requirements of 8.6.6. The state of the transmission gate determines whether or not queued frames can be selected for transmission. For a given queue, the transmission gate can be either *Open* or *Closed* as described in 8.6.8.4.

The need to control the transmission gate depends upon the transmission selection algorithm used and the technique for determining when to return a congesting flow to non-congesting status. Congestion isolation specifies that congesting and non-congesting queues use the same Active Queue Management (AQM) approach and the same transmission selection algorithm. Additionally, the congesting queues have lower priority than the monitored non-congesting queues.

When the transmission selection algorithm is strict priority and the technique for returning a congesting flow to non-congesting status is only when the congesting queue is empty, the state of the transmission gate can be set to *Open*. When the transmission selection algorithm is anything other than strict priority or the technique for returning a congesting flow to non-congesting status allows for congesting frames to exist in the congesting queue during the transition, the state of the transmission gate is controlled by the cipGateControl (49.4.1.4.1) variable. An example implementation of setting cipGateControl to provide transmission gate control for the purposes of ensuring ordering can be seen in Annex X.

Congestion isolation controls the transmission gate of the congesting and non-congesting queues to maintain the order of congesting flow frames. As a consequence, transmission gates used for congestion isolation cannot be used for other purposes.

12. Bridge management

12.1 Management functions

12.1.1 Configuration Management

Insert new item m) at the end of the lettered list in 12.1.1 as follows:

- m) The ability to create and delete the functional elements of congestion isolation and to control their operation.

12.2 VLAN Bridge objects

Insert new item s) at the end of the lettered list in 12.2 as follows:

- s) The congestion isolation entities (12.33)

12.31 Managed objects for per-stream classification and metering

12.31.1 The Stream Parameter Table

Change 12.31.1 as follows:

There is one Stream Parameter Table per Bridge component. The table contains a set of parameters that supports PSFP (8.6.5.2.1), ~~and~~ ATS (8.6.5.2.2), and CI (8.6.5.2.3), as detailed in Table 12-34. Tables can be created or removed dynamically in implementations that support dynamic configuration of Bridge components.

Table 12-34—The Stream Parameter Table

Name	Data type	Operations supported ^a	Conformance ^b	References
MaxStreamFilterInstances	integer	R	PSFP, ATS, <u>CI</u>	8.6.5.3, 12.31.2
MaxStreamGateInstances	integer	R	PSFP, ATS, <u>CI</u>	8.6.5.4, 12.31.3
MaxFlowMeterInstances	integer	R	PSFP, ats	8.6.5.5, 12.31.4
SupportedListMax	integer	R	PSFP, ats	8.6.5.4, 12.31.4
MaxSchedulerInstances	integer	R	psfp, ATS	8.6.5.4, 12.31.4
MaxSchedulerGroupInstances	integer	R	psfp, ATS	8.6.5.4, 12.31.4

^aR = Read only access; RW = Read/Write access.

^bPSFP = Required for Bridge, Bridge component, or end station support of PSFP.

psfp = Optional for Bridge, Bridge component, or end station support of PSFP.

ATS = Required for Bridge or Bridge component support of ATS.

ats = Optional for Bridge or Bridge component support of ATS.

CI = Required for Bridge or Bridge component support of CI.

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12.31.2 The Stream Filter Instance Table

Change Table 12-35 as follows:

Table 12-35—Stream Filter Instance Table

Name	Data type	Operations supported ^a	Conformance ^b	References
StreamFilterInstance	integer	R	PSFP, ATS, CI	8.6.5.3
StreamHandleSpec	stream_handle specification	RW	PSFP, ATS, CI	8.6.5.3
PrioritySpec	priority specification	RW	PSFP, ATS, CI	8.6.5.3
MaximumSDUSize	integer	RW	PSFP, ATS	8.6.5.3.1, 12.31.2.5
StreamGateInstanceID	integer	RW	PSFP, ATS, CI	8.6.5.2, 8.6.5.4
FlowMeterInstanceID	integer	RW	PSFP, ats	8.6.5.5, 12.31.2.5
FlowMeterEnable	Boolean	RW	PSFP, ats	
SchedulerInstanceID	integer	RW	psfp, ATS	
SchedulerEnable	Boolean	RW	psfp, ATS	
MatchingFramesCount	counter	R	PSFP, ats, ci	8.6.5.3
PassingFramesCount	counter	R	PSFP, ats	8.6.5.3, 8.6.5.4
NotPassingFramesCount	counter	R	PSFP, ats	8.6.5.3, 8.6.5.4
PassingSDUCount	counter	R	PSFP, ats	8.6.5.3, 8.6.5.3.1
NotPassingSDUCount	counter	R	PSFP, ats	8.6.5.3, 8.6.5.3.1
REDFramesCount	counter	R	PSFP, ats	8.6.5.3
StreamBlockedDueToOversizeFrameEnable	Boolean	RW	PSFP, ATS	8.6.5.3, 8.6.5.3.1
StreamBlockedDueToOversizeFrame	Boolean	RW	PSFP, ATS	8.6.5.3, 8.6.5.3.1

^a R = Read only access; RW = Read/Write access.

^b PSFP = Required for Bridge, Bridge component, or end station support of PSFP.

psfp = Optional for Bridge, Bridge component, or end station support of PSFP.

ATS = Required for Bridge or Bridge component support of ATS.

ats = Optional for Bridge or Bridge component support of ATS.

[CI](#) = Required for Bridge component or end station support of CI.

[ci](#) = Optional for Bridge component or end station support of CI.

12.31.2.2 stream_handle specification data type

Change 12.31.2.2 as follows:

The stream_handle specification data type allows either of the following to be represented:

- a) A stream_handle value, represented as an integer
- b) The wild card value
- c) If congestion isolation is supported, the null-handle value.

12.31.3 The Stream Gate Instance Table

Change Table 12-36 as follows:

Table 12-36—The Stream Gate Instance Table

Name	Data type	Operations supported ^a	Conformance ^b	References
StreamGateInstance	integer	R	PSFP, ATS, CI	8.6.5.4
StreamGateEnabled	Boolean	RW	PSFP, ATS, CI	8.6.9.4.14
StreamGateAdminGateStates	StreamGateStatesValue	RW	PSFP, ATS, CI	8.6.10.4, 12.29.1.2.2
StreamGateOperGateStates	StreamGateStatesValue	R	PSFP, ATS, CI	8.6.10.5, 12.29.1.2.2
StreamGateAdminControlListLength	unsigned integer	RW	PSFP, ats	8.6.9.4.6, 12.31.3.2
StreamGateOperControlListLength	unsigned integer	R	PSFP, ats	8.6.9.4.22, 12.31.3.2
StreamGateAdminControlList	sequence of StreamGateGateControl Entry	RW	PSFP, ats	8.6.9.4.2, 12.31.3.2, 12.31.3.2.2
StreamGateOperControlList	sequence of StreamGateGateControl Entry	R	PSFP, ats	8.6.9.4.18, 12.31.3.2, 12.31.3.2.2
StreamGateAdminCycleTime	RationalNumber	RW	PSFP, ats	8.6.9.4.3, 12.29.1.3
StreamGateOperCycleTime	RationalNumber (seconds)	R	PSFP, ats	8.6.9.4.19, 12.29.1.3
StreamGateAdminCycleTime Extension	Integer (nanoseconds)	RW	PSFP, ats	8.6.9.4.4
StreamGateOperCycleTimeExtension	Integer (nanoseconds)	R	PSFP, ats	8.6.9.4.20
StreamGateAdminBaseTime	PTPtime	RW	PSFP, ats	8.6.9.4.1, 12.29.1.4
StreamGateOperBaseTime	PTPtime	R	PSFP, ats	8.6.9.4.17, 12.29.1.4
StreamGateConfigChange	Boolean	RW	PSFP, ats	8.6.9.4.7
StreamGateConfigChangeTime	PTPtime	R	PSFP, ats	8.6.9.4.9, 12.29.1.4

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Table 12-36—The Stream Gate Instance Table (continued)

Name	Data type	Operations supported ^a	Conformance ^b	References
StreamGateTickGranularity	Integer (tenths of nanoseconds)	R	PSFP, ats	8.6.9.4.16
StreamGateCurrentTime	PTPtime	R	PSFP, ats	8.6.9.4.10, 12.29.1.4
StreamGateConfigPending	Boolean	R	PSFP, ats	8.6.9.3, 8.6.9.4.8
StreamGateConfigChangeError	Integer	R	PSFP, ats	8.6.9.3.1
StreamGateAdminIPV	IPV	RW	PSFP, ATS, CI	8.6.5.4, 8.6.10.6, 12.31.3.3
StreamGateOperIPV	IPV	RW	PSFP, ats, CI	8.6.5.4, 8.6.10.7, 12.31.3.3
StreamGateGateClosedDueToInvalid Rx-Enable	Boolean	RW	PSFP, ats	8.6.5.4
StreamGateGateClosedDueToInvalid Rx	Boolean	RW	PSFP, ats	8.6.5.4
StreamGateGateClosedDueToOctets ExceededEnable	Boolean	RW	PSFP, ats	8.6.5.4
StreamGateGateClosedDueToOctets Exceeded	Boolean	RW	PSFP, ats	8.6.5.4

^a R = Read only access; RW = Read/Write access.

^b PSFP = Required for Bridge, Bridge component, or end station support of PSFP.

psfp = Optional for Bridge, Bridge component, or end station support of PSFP.

ATS = Required for Bridge or Bridge component support of ATS.

ats = Optional for Bridge or Bridge component support of ATS.

[CI](#) = Required for Bridge component or end station support of CI.

Insert 12.33 at the end of Clause 12 as follows:

12.33 Congestion Isolation managed objects

Several variables control the operation of Congestion Isolation in a congestion isolation aware Bridge. The managed objects are as follows:

- CI entity managed object (12.33.1)
- CI Peer Table (12.33.2)
- CI Stream Table (12.33.3)
- CIP entity managed object (12.33.4)

12.33.1 CI entity managed object

A single instance of the CI entity managed object shall be implemented by a Bridge component or end station that is congestion isolation aware. It comprises all the variables included in the CI entity variables (49.4.1.1) as illustrated in Table 12-42.

Table 12-42—CI entity managed object

Name	Data type	Operations supported ^a	Conformance ^b	References
ciMasterEnable	Boolean	RW	CI	49.4.1.1.1
ciCIMTransmitPriority	unsigned integer [0..7]	R	CI	49.4.1.1.2
ciMaxFlowLife	unsigned integer	R	CI	49.4.1.1.3

^a R= Read only access; RW = Read/Write access.

^b CI = Required for Bridge component or end station support of CI.

12.33.2 CI Peer Table

A single instance of the CI Peer Table shall be implemented by a Bridge component or end station that is congestion isolation aware. Each table row contains the parameters needed to assist in the creation of a CIM as illustrated in Table 12-43. There is a row in the table for each port of the Bridge or router that is supporting congestion isolation.

Table 12-43—CI Peer Table entry

Name	Data type	Operations supported ^a	Conformance	References
ciCIMtype	enum {l2, ipv4, ipv6}	R		49.3.6
ciPeerMacAddress	MAC address	R		49.3.6
ciPeerIPv4Address	IPv4 address	R	IETF RFC 791	49.3.6
ciPeerIPv6Address	IPv6 address	R	IETF RFC 8200	49.3.6
ciPeerUDPPort	UDP Port Number	R	IETF RFC 768	49.3.6
ciPeerCIMEncapLen	integer [0..512]	R		49.3.6

^a R= Read only access; RW = Read/Write access.

12.33.3 CI Stream Table

A single instance of the CI Stream Table (49.3.7) shall be implemented by a Bridge component or end station that is congestion isolation aware. Each table row contains stream management variables associated with a tsnStreamIdEntry object created in the IEEE Std 802.1CB Stream identity table. The variables assist in the processes associated with the isolating and de-isolating of congesting flows. There is a row in the table for each congesting flow as illustrated in Table 12-44.

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Table 12-44—CI Stream Table entry

Name	Data type	Operations supported ^a	Conformance ^b	References
ciStreamIdHandle	stream_handle value	R	IEEE Std 802.1CB	49.4.1.5.1
ciCIMCount	integer	RW	CI	49.4.1.5.2
ciCreateTime	sysUpTime (IETF RFC 3418)	R	IETF RFC 3418	49.4.1.5.3
ciStreamCreateMask	2-bit mask	RW	CI	49.4.1.5.4
ciQueueKey	integer	R	CI	49.4.1.5.5
ciDestination_address	MAC address	R	CI	49.4.1.5.6
ciSource_address	MAC address	R	CI	49.4.1.5.7
ciVlan_identifier	12-bit VID	R	CI	49.4.1.5.8
ciMsdu	octet string (size 64..512)	R	CI	49.4.1.5.9

^a R = Read only access; RW = Read/Write access.

^b CI = Required for Bridge component or end station support of CI.

12.33.4 CIP entity managed object

There is one Congestion Isolation Point (CIP) managed object for each CIP in a Bridge component or end station that is congestion isolation aware. The CIP managed object comprises some of the variables included in the CIP variables (49.4.1.2) as illustrated in Table 12-45.

Table 12-45—CIP entity managed object

Name	Data type	Operations supported ^a	Conformance ^b	References
cipMacAddress	MAC address	R	CI	49.4.1.2.1
cipIPv4Address	IPv4 address	R	IETF RFC 791	49.4.1.2.2
cipIPv6Address	IPv6 address	R	IETF RFC 8200	49.4.1.2.3
cipCIMUDPPort	UDP Port Number	R	IETF RFC 768	49.4.1.2.4
cipQueueMap[]	array of integers [−8..8]	RW	CI	49.4.1.2.5
cipMinHeaderOctets	integer	RW	CI	49.4.1.2.6
cipMaxCIM	integer	RW	CI	49.4.1.2.7

^a R = Read only access; RW = Read/Write access.

^b CI = Required for Bridge component or end station support of CI.

30. Principles of congestion notification

30.1 Congestion notification design requirements

Change item x) in the lettered list in 30.1 as follows:

- x) QCN cannot regulate frame transmission by acknowledgments, as does Transmission Control Protocol/Internet Protocol (TCP/IP), [see IETF RFC 791](#) ~~[B18]~~ and [IETF RFC 793](#) [B19].

30.3 Congestion Controlled Flow (CCF)

Change item a) in the lettered list in 30.3 as follows:

- a) The frames carrying data for a single User Datagram Protocol (UDP, IETF RFC 768, STD0006 ~~[B17]~~) connection.

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46. Time-Sensitive Networking (TSN) configuration

46.2 User/network configuration information

46.2.1 Data types

Change the lettered list in 46.2.1 as follows:

- a) Boolean
- b) int8, for a signed 8-bit integer
- c) int16, for a signed 16-bit integer
- d) int32, for a signed 32-bit integer
- e) uint8, for an unsigned 8-bit integer
- f) uint16, for an unsigned 16-bit integer
- g) uint32, for an unsigned 32-bit integer
- h) string
- i) enumeration, for a collection of named values
- j) rational, for a rational number consisting of a uint32 numerator and uint32 denominator
- k) mac-address-type, for an IEEE 802 MAC address
- l) ipv4-address-type, for an IPv4 address (IETF RFC 791 ~~(B18)~~)
- m) ipv6-address-type, for an IPv6 address (IETF RFC 8200 ~~(B46)~~)
- n) sequence of <X>, for a list of zero or more instances of data type <X> (e.g., sequence of uint32)

46.2.3 Talker

46.2.3.4 DataFrameSpecification

46.2.3.4.4 IPv6-tuple

Change the first sentence in 46.2.3.4.4 as follows:

The IPv6-tuple group specifies fields to identify an IPv6 (RFC 8200 ~~(B46)~~) Stream.

48. YANG Data Models

48.2 IEEE 802.1Q YANG models

Insert 48.2.8 (including Figure 48-17) after 48.2.7 as follows:

48.2.8 Congestion Isolation (CI) model

The CI model augments the Bridge component model (48.2.1) and the Interface Management model for Bridge ports (48.3.1) by nodes that represent the following managed objects:

- CI entity managed object (12.33.1)
- CI Peer Table (12.33.2)
- CI Stream Table (12.33.3)
- CIP entity managed object (12.33.4)

The UML representation of the CI model is illustrated in Figure 48-17.

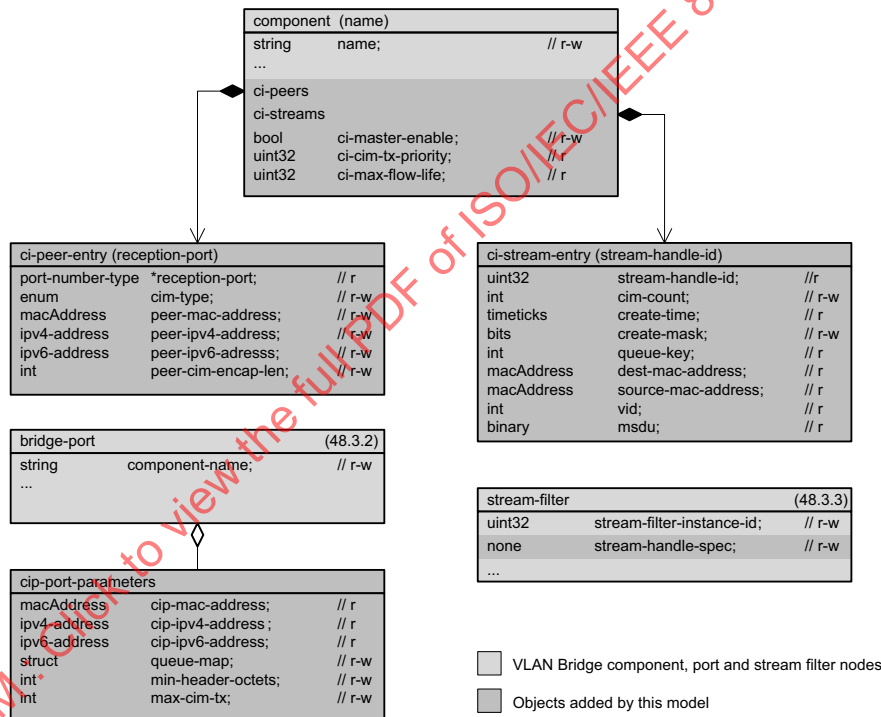


Figure 48-17—Congestion Isolation model

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48.3 Structure of the YANG models

Insert a new row for “ieee802-dot1q-stream-filters-gates-bridge” above the row for “ieee802-dot1q-ats”, change the row for “ieee802-dot1q-ats”, and insert three new rows below it in Table 48-1 as follows (unchanged rows not shown):

Table 48-1—Summary of the YANG modules

Module	References	Managed functionality	Initial YANG specification Notes
ieee802-dot1q-stream-filters-gates-bridge	48.5.12, 48.6.12	8.6, 8.6.5.3, 8.6.5.4	IEEE Std 802.1Qcz Bridge component augmentation with stream filtering and stream gating capabilities.
ieee802-dot1q-ats	48.5.12, 48.6.12 48.5.13, 48.6.13	8.6	IEEE Std 802.1Qcr ATS extensions to ieee802-dot1q-stream-filters-gates and ieee802-dot1q-bridge modules.
ieee802-dot1q-ats-bridge	48.5.14, 48.6.14	8.6	IEEE Std 802.1Qcz Bridge component augmentation with ATS module.
ieee802-dot1q-congestion-isolation	48.5.15, 48.6.15	8.6.5, Clause 49	IEEE Std 802.1Qcz Congestion isolation specific parameters and extensions to the ieee802-dot1q-stream-filters-gates.
ieee802-dot1q-congestion-isolation-bridge	48.5.16, 48.6.16	8.6.5, Clause 49	IEEE Std 802.1Qcz Bridge and Bridge Port extension/augmentation with congestion isolation module.

48.3.7 Asynchronous Traffic Shaping (ATS) model

Change Table 48-7 and Table 48-8 as follows:

Table 48-7—Stream filters and stream gates model YANG modules

YANG module
ieee802-types
ieee802-dot1q-types
ieee802-dot1q-bridge
ieee802-dot1q-stream-filters-gates
ieee802-dot1q-stream-filters-gates-bridge

Table 48-8—ATS model YANG modules

YANG module
ieee802-types
ieee802-dot1q-types
ieee802-dot1q-bridge
ieee802-dot1q-stream-filters-gates
ieee802-dot1q-ats
ieee802-dot1q-ats-bridge

Insert 48.3.8 (including Table 48-9) after 48.3.7 as follows:

48.3.8 Congestion Isolation (CI) model

A system implementing the CI model (48.3.8) implements the YANG modules in Table 48-9.

Table 48-9—CI model YANG modules

YANG module
ieee802-types
ieee802-dot1q-types
ieee802-dot1q-bridge
ieee802-dot1q-stream-filter-gates
ieee802-dot1q-congestion-isolation
ieee802-dot1q-congestion-isolation-bridge

48.4 Security considerations

Insert 48.4.8 after 48.4.7 as follows:

48.4.8 Security considerations of the Congestion Isolation model

There are a number of management objects defined in the ieee802-dot1q-congestion-isolation YANG module that are configurable (i.e., read-write) and/or operational (i.e., read-only). Such objects may be considered sensitive or vulnerable in some network environments. A network configuration protocol, such as NETCONF (IETF RFC 6241 [B41]), can support protocol operations that can edit or delete YANG module configuration data (e.g., edit-config, delete-config, copy-config). If this is done in a non-secure environment without proper protection, then negative effects on the network operation are possible.

The following objects in the ieee802-dot1q-congestion-isolation YANG module could be manipulated to interfere with the operation of MAC status propagation on a TPMR port and, for example, be used to cause network instability:

- bridges/bridge/component/ci-master-enable
- bridges/bridge/component/ci-peers/ci-peer-table
- bridges/bridge/component/ci-streams
- bridges/bridge/component/stream-gates/stream-gate-instance-table
- bridges/bridge/component/stream-filters/stream-filter-instance-table
- bridges/bridge/component/queue-map
- bridges/bridge/component/min-header-octets
- bridges/bridge/component/min-cim-tx

48.5 YANG schema tree definitions

48.5.11 Schema for the ieee802-dot1q-stream-filters-gates YANG module

Change 48.5.11 as follows:

This YANG module does not have a YANG schema tree.

```
module: ieee802-dot1q-stream-filters-gates

augment /dot1q:bridges/dot1q:bridge/dot1q:component:
  +--rw stream-filters
  | +--rw stream-filter-instance-table* [stream-filter-instance-id]
  | | +--rw stream-filter-instance-id uint32
  | | +--rw (stream-handle-spec)?
  | | | +--:(wildcard)
  | | | +--rw wildcard? empty
  | | | +--:(stream-handle)
  | | | +--rw stream-handle uint32
  | | +--rw priority-spec priority-spec-type
  | | +--rw max-sdu-size uint32
  | | +--rw stream-blocked-due-to-oversize-frame-enabled? boolean
  | | +--rw stream-blocked-due-to-oversize-frame? boolean
  | | +--rw stream-gate-ref stream-gate-ref
  | +--ro max-stream-filter-instances? uint32
  +--rw stream-gates
  | +--rw stream-gate-instance-table* [stream-gate-instance-id]
  | | +--rw stream-gate-instance-id uint32
  | | +--rw gate-enable? boolean
  | | +--rw admin-gate-states? gate-state-value-type
  | | +--rw admin-ipv? ipv-spec-type
  | +--ro max-stream-gate-instances? uint32
```

Delete the existing 48.5.12 “Schema for the ieee802-dot1q-ats YANG module”.

Insert new 48.5.12 “Schema for the ieee802-dot1q-stream-filters-gates-bridge YANG module” after 48.5.11 as follows:

48.5.12 Schema for the ieee802-dot1q-stream-filters-gates-bridge YANG module

```
module: ieee802-dot1q-stream-filters-gates-bridge

augment /dot1q:bridges/dot1q:bridge/dot1q:component:
  +--rw stream-gates
  | +--rw stream-gate-instance-table* [stream-gate-instance-id]
  | | +--rw stream-gate-instance-id      uint32
  | | +--rw gate-enable?                  boolean
  | | +--rw admin-gate-states?            gate-state-value-type
  | | +--rw admin-ipv?                    ipv-spec-type
  | +--ro max-stream-gate-instances?      uint32
  +--rw stream-filters
  | +--rw stream-filter-instance-table* [stream-filter-instance-id]
  | | +--rw stream-filter-instance-id      uint32
  | | +--rw (stream-handle-spec)?
  | | | +--:(wildcard)
  | | | | +--rw wildcard?                  empty
  | | | +--:(stream-handle)
  | | | | +--rw stream-handle              uint32
  | | +--rw priority-spec                  priority-spec-type
  | | +--rw max-sdu-size                    uint32
  | | +--rw stream-blocked-due-to-oversize-frame-enabled?  boolean
  | | +--rw stream-blocked-due-to-oversize-frame?          boolean
  | | +--rw stream-gate-ref                  leafref
  +--ro max-stream-filter-instances?      uint32
```

Insert new 48.5.13, 48.5.14, 48.5.15, and 48.5.16 after 48.5.12 as follows:

48.5.13 Schema for the ieee802-dot1q-ats YANG module

```
module: ieee802-dot1q-ats
  +--rw stream-gates
  |   +--rw stream-gate-instance-table* [stream-gate-instance-id]
  |   |   +--rw stream-gate-instance-id      uint32
  |   |   +--rw gate-enable?                 boolean
  |   |   +--rw admin-gate-states?           gate-state-value-type
  |   |   +--rw admin-ipv?                   ipv-spec-type
  |   +--ro max-stream-gate-instances?      uint32
  +--rw stream-filters
  |   +--rw stream-filter-instance-table* [stream-filter-instance-id]
  |   |   +--rw stream-filter-instance-id      uint32
  |   |   +--rw (stream-handle-spec)?
  |   |   |   +--:(wildcard)
  |   |   |   |   +--rw wildcard?              empty
  |   |   |   +--:(stream-handle)
  |   |   |   |   +--rw stream-handle          uint32
  |   |   +--rw priority-spec
  |   |   |   priority-spec-type
  |   |   +--rw max-sdu-size                  uint32
  |   |   +--rw stream-blocked-due-to-oversize-frame-enabled? boolean
  |   |   +--rw stream-blocked-due-to-oversize-frame? boolean
  |   |   +--rw stream-gate-ref               leafref
  |   +--rw schedulers
  |   |   +--rw scheduler-instance-table* [scheduler-instance-id]
  |   |   |   +--rw scheduler-instance-id      uint32
  |   |   |   +--rw committed-information-rate  uint64
  |   |   |   +--rw committed-burst-size       uint32
  |   |   |   +--rw scheduler-group-ref        leafref
  |   |   +--ro max-scheduler-instances?      uint32
  |   +--rw scheduler-groups
  |   |   +--rw scheduler-group-instance-table* [scheduler-group-instance-id]
  |   |   |   +--rw scheduler-group-instance-id  uint32
  |   |   |   +--rw max-residence-time          uint32
  |   |   +--ro max-scheduler-group-instances? uint32
  |   +--rw scheduler-timing-characteristics
  |   |   +--ro scheduler-timing-characteristics-table*
  |   |   |   [reception-port transmission-port]
  |   |   |   +--ro reception-port
  |   |   |   |   dot1qtypes:port-number-type
  |   |   |   +--ro transmission-port
  |   |   |   |   dot1qtypes:port-number-type
  |   |   |   +--ro clock-offset-variation-max  uint32
  |   |   |   +--ro clock-rate-deviation-max   uint32
  |   |   |   +--ro arrival-recognition-delay-max uint32
  |   |   |   +--ro processing-delay-min        uint32
  |   |   |   +--ro processing-delay-max        uint32
  |   +--rw scheduler
  |   |   +--rw scheduler-ref?                 leafref
  |   |   +--rw scheduler-enable?              boolean
  +--ro max-stream-filter-instances?          uint32
```

48.5.14 Schema for the ieee802-dot1q-ats-bridge YANG module

```
module: ieee802-dot1q-ats-bridge
  augment /if:interfaces/if:interface/dot1q:bridge-port:
    +--ro discarded-frames-count? yang:counter64
  augment /dot1q:bridges/dot1q:bridge/dot1q:component:
    +--rw stream-gates
    |   +--rw stream-gate-instance-table* [stream-gate-instance-id]
    |   |   +--rw stream-gate-instance-id      uint32
    |   |   +--rw gate-enable?                 boolean
    |   |   +--rw admin-gate-states?           gate-state-value-type
    |   |   +--rw admin-ipv?                   ipv-spec-type
    |   +--ro max-stream-gate-instances?      uint32
    +--rw stream-filters
```

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```

+--rw stream-filter-instance-table* [stream-filter-instance-id]
| +--rw stream-filter-instance-id          uint32
| | +--rw (stream-handle-spec)?
| | | +--:(wildcard)
| | | | +--rw wildcard?                    empty
| | | +--:(stream-handle)
| | | | +--rw stream-handle                uint32
| +--rw priority-spec
| | priority-spec-type
| +--rw max-sdu-size                        uint32
| +--rw stream-blocked-due-to-oversize-frame-enabled? boolean
| +--rw stream-blocked-due-to-oversize-frame? boolean
| +--rw stream-gate-ref                    leafref
| +--rw schedulers
| | +--rw scheduler-instance-table* [scheduler-instance-id]
| | | +--rw scheduler-instance-id          uint32
| | | | +--rw committed-information-rate    uint64
| | | | +--rw committed-burst-size         uint32
| | | | +--rw scheduler-group-ref          leafref
| | | +--ro max-scheduler-instances?      uint32
| +--rw scheduler-groups
| | +--rw scheduler-group-instance-table*
| | | [scheduler-group-instance-id]
| | | | +--rw scheduler-group-instance-id    uint32
| | | | +--rw max-residence-time            uint32
| | | +--ro max-scheduler-group-instances?  uint32
| +--rw scheduler-timing-characteristics
| | +--ro scheduler-timing-characteristics-table*
| | | [reception-port transmission-port]
| | | | +--ro reception-port
| | | | | dot1qtypes:port-number-type
| | | | +--ro transmission-port
| | | | | dot1qtypes:port-number-type
| | | +--ro clock-offset-variation-max      uint32
| | | +--ro clock-rate-deviation-max        uint32
| | | +--ro arrival-recognition-delay-max   uint32
| | | +--ro processing-delay-min            uint32
| | | +--ro processing-delay-max            uint32
| +--rw scheduler
| | +--rw scheduler-ref?                  leafref
| | +--rw scheduler-enable?              boolean
+--ro max-stream-filter-instances?      uint32

```

48.5.15 Schema for the ieee802-dot1q-congestion-isolation YANG module

```

module: ieee802-dot1q-congestion-isolation
+--rw stream-gates
| +--rw stream-gate-instance-table* [stream-gate-instance-id]
| | +--rw stream-gate-instance-id      uint32
| | +--rw gate-enable?                 boolean
| | +--rw admin-gate-states?           gate-state-value-type
| | +--rw admin-ipv?                   ipv-spec-type
| +--ro max-stream-gate-instances?     uint32
+--rw stream-filters
+--rw stream-filter-instance-table* [stream-filter-instance-id]
| +--rw stream-filter-instance-id      uint32
| | +--rw (stream-handle-spec)?
| | | +--:(wildcard)
| | | | +--rw wildcard?                 empty
| | | +--:(stream-handle)
| | | | +--rw stream-handle             uint32
| | | +--:(null-handle) {congestion-isolation}?
| | | | +--rw null-handle?              empty
| +--rw priority-spec
| | priority-spec-type
| +--rw max-sdu-size                    uint32
| +--rw stream-blocked-due-to-oversize-frame-enabled? boolean
| +--rw stream-blocked-due-to-oversize-frame? boolean
| +--rw stream-gate-ref                  leafref
+--ro max-stream-filter-instances?      uint32

```

48.5.16 Schema for the ieee802-dot1q-congestion-isolation-bridge YANG module

```
module: ieee802-dot1q-congestion-isolation-bridge

augment /dot1q:bridges/dot1q:bridge/dot1q:component:
  +--rw ci-master-enable?          boolean {congestion-isolation-bridge}?
  +--ro ci-cim-tx-priority?        dot1q-types:priority-type
  | {congestion-isolation-bridge}?
  +--ro ci-max-flow-life?          uint32 {congestion-isolation-bridge}?
  +--rw ci-peers {congestion-isolation-bridge}?
  | +--rw ci-peer-table* [reception-port]
  | | +--rw reception-port        dot1q-types:port-number-type
  | | +--rw cim-type?             enumeration
  | | +--rw peer-mac-address?      ieee:mac-address
  | | +--rw peer-ipv4-address?     inet:ipv4-address
  | | +--rw peer-ipv6-address?     inet:ipv6-address
  | | +--rw peer-udp-port?         inet:port-number
  | | +--rw peer-cim-encap-len?    uint16
  | +--ro max-ci-peer-entries?     uint32
  +--rw ci-streams {congestion-isolation-bridge}?
  | +--ro ci-stream-table* [stream-handle-id]
  | | +--ro stream-handle-id      uint32
  | | +--ro cim-count?            uint16
  | | +--ro create-time?          yang:timeticks
  | | +--ro create-mask?          bits
  | | +--ro queue-key?            uint16
  | | +--ro dest-mac-address?      ieee:mac-address
  | | +--ro source-mac-address?    ieee:mac-address
  | | +--ro vid?                  dot1q-types:vlan-index-type
  | | +--ro msdu?                 yang:hex-string
  | +--ro max-ci-stream-entries?   uint32 {congestion-isolation-bridge}?
  +--rw stream-gates {congestion-isolation-bridge}?
  | +--rw stream-gate-instance-table* [stream-gate-instance-id]
  | | +--rw stream-gate-instance-id uint32
  | | +--rw gate-enable?            boolean
  | | +--rw admin-gate-states?      gate-state-value-type
  | | +--rw admin-ipv?              ipv-spec-type
  | +--ro max-stream-gate-instances? uint32
  +--rw stream-filters {congestion-isolation-bridge}?
  | +--rw stream-filter-instance-table* [stream-filter-instance-id]
  | | +--rw stream-filter-instance-id uint32
  | | +--rw (stream-handle-spec)?
  | | | +--:(wildcard)
  | | | | +--rw wildcard?           empty
  | | | +--:(stream-handle)
  | | | | +--rw stream-handle       uint32
  | | | +--:(null-handle) {congestion-isolation-bridge}?
  | | | +--rw null-handle?         empty
  | | +--rw priority-spec
  | | | priority-spec-type
  | | +--rw max-sdu-size            uint32
  | | +--rw stream-blocked-due-to-oversize-frame-enabled? boolean
  | | +--rw stream-blocked-due-to-oversize-frame?      boolean
  | | +--rw stream-gate-ref         leafref
  | +--ro max-stream-filter-instances? uint32
  +--if interfaces/if:interface/dot1q:bridge-port:
  | +--ro cip-mac-address?          ieee:mac-address
  | | {congestion-isolation-bridge}?
  | +--ro cip-ipv4-address?         inet:ipv4-address
  | | {congestion-isolation-bridge}?
  | +--ro cip-ipv6-address?         inet:ipv6-address
  | | {congestion-isolation-bridge}?
  | +--ro cip-cim-port?             inet:port-number
  | | {congestion-isolation-bridge}?
  | +--rw queue-map* [priority] {congestion-isolation-bridge}?
  | | +--rw priority                dot1q-types:priority-type
  | | +--rw abs-traffic-class-plus-one?
  | | | abs-traffic-class-plus-one-type
  | +--rw min-header-octets?        uint16 {congestion-isolation-bridge}?
  +--rw max-cim-tx?                 uint16 {congestion-isolation-bridge}?
```

48.6 YANG modules^{10 11 12}

48.6.2 The ieee802-dot1q-types YANG module

Delete the YANG module in 48.6.2.

Insert the following YANG module in 48.6.2:

```
module ieee802-dot1q-types {
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-types;
  prefix dot1q-types;
  import ietf-yang-types {
    prefix yang;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
    IEEE Standards Association
    445 Hoes Lane
    Piscataway, NJ 08854
    USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "Common types used within dot1Q-bridge modules.

    References in this YANG module to IEEE Std 802.1Q are to IEEE Std
    802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023.

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023, Bridges and Bridged Networks - Congestion
      Isolation.";
  }
  revision 2022-10-29 {
    description
      "Published as part of IEEE Std 802.1Q-2022.";
    reference
      "IEEE Std 802.1Q-2022, Bridges and Bridged Networks.";
  }
  revision 2020-06-04 {
    description
      "Published as part of IEEE Std 802.1Qcx-2020.";
    reference
      "IEEE Std 802.1Qcx-2020, Bridges and Bridged Networks - YANG Data
      Model for Connectivity Fault Management.";
  }
  revision 2018-03-07 {
    description
      "Published as part of IEEE Std 802.1Q-2018.";
```

¹⁰ Copyright release for YANG: Users of this standard may freely reproduce the YANG modules contained in this standard so that they can be used for their intended purpose.

¹¹ An ASCII version of each YANG module is attached to the PDF of this standard and can also be obtained from the IEEE 802.1 Website at <https://1.ieee802.org/yang-modules/>.

¹² References in this standard's YANG module definitions are not clickable, as each module has been incorporated unchanged after development and verification using YANG tools.

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```
reference
    "IEEE Std 802.1Q-2018, Bridges and Bridged Networks.";
}
identity dot1q-vlan-type {
    description
        "Base identity from which all 802.1Q VLAN tag types are derived
        from.";
}
identity c-vlan {
    base dot1q-vlan-type;
    description
        "An 802.1Q Customer VLAN, using the 81-00 EtherType.";
    reference
        "5.5 of IEEE Std 802.1Q";
}
identity s-vlan {
    base dot1q-vlan-type;
    description
        "An 802.1Q Service VLAN, using the 88-A8 EtherType originally
        introduced in 802.1ad, and incorporated into 802.1Q (2011)";
    reference
        "5.6 of IEEE Std 802.1Q";
}
identity transmission-selection-algorithm {
    description
        "Specify the transmission selection algorithms of IEEE Std
        802.1Q Table 8-6";
}
identity strict-priority {
    base transmission-selection-algorithm;
    description
        "Indicates the strict priority transmission selection algorithm.";
    reference
        "Table 8-6 of IEEE Std 802.1Q";
}
identity credit-based-shaper {
    base transmission-selection-algorithm;
    description
        "Indicates the credit based shaper transmission selection
        algorithm.";
    reference
        "Table 8-6 of IEEE Std 802.1Q";
}
identity enhanced-transmission-selection {
    base transmission-selection-algorithm;
    description
        "Indicates the enhanced transmission selection algorithm.";
    reference
        "Table 8-6 of IEEE Std 802.1Q";
}
identity asynchronous-traffic-shaping {
    base transmission-selection-algorithm;
    description
        "Indicates the asynchronous transmission selection algorithm.";
    reference
        "Table 8-6 of IEEE Std 802.1Q";
}
identity vendor-specific {
    base transmission-selection-algorithm;
    description
        "Indicates a vendor specific transmission selection algorithm.";
    reference
        "Table 8-6 of IEEE Std 802.1Q";
}
typedef name-type {
    type string {
        length "0..32";
    }
    description
        "A text string of up to 32 characters, of locally determined
        significance.";
}
```

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```
typedef port-number-type {
    type uint32 {
        range "1..4095";
    }
    description
        "The port number of the Bridge port for which this entry contains
        Bridge management information.";
}
typedef priority-type {
    type uint8 {
        range "0..7";
    }
    description
        "A range of priorities from 0 to 7 (inclusive). The Priority Code
        Point (PCP) is a 3-bit field that refers to the class of service
        associated with an 802.1Q VLAN tagged frame. The field specifies a
        priority value between 0 and 7, these values can be used by quality
        of service (QoS) to prioritize different classes of traffic.";
}
typedef num-traffic-class-type {
    type uint8 {
        range "1..8";
    }
    description
        "The number of traffic classes supported or participating in a
        particular feature. There are between 1 and 8 supported traffic
        classes defined by IEEE Std 802.1Q.";
}
typedef vid-range-type {
    type string {
        pattern
            "([1-9]" +
            "[0-9]{0,3}" +
            "(-[1-9][0-9]{0,3})?" +
            "(, [1-9][0-9]{0,3} (-[1-9][0-9]{0,3})?)*";
    }
    description
        "A list of VLAN Ids, or non overlapping VLAN ranges, in ascending
        order, between 1 and 4094.

        This type is used to match an ordered list of VLAN Ids, or
        contiguous ranges of VLAN Ids. Valid VLAN Ids must be in the range
        1 to 4094, and included in the list in non overlapping ascending
        order.

        For example: 1,10-100,250,500-1000";
}
typedef vlanid {
    type uint16 {
        range "1..4094";
    }
    description
        "The vlanid type uniquely identifies a VLAN. This is the 12-bit
        VLAN-ID used in the VLAN Tag header. The range is defined by the
        referenced specification. This type is in the value set and its
        semantics equivalent to the VlanId textual convention of the SMIV2.";
}
typedef vlan-index-type {
    type uint32 {
        range "1..4094 | 4096..4294967295";
    }
    description
        "A value used to index per-VLAN tables. Values of 0 and 4095 are
        not permitted. The range of valid VLAN indices. If the value is
        greater than 4095, then it represents a VLAN with scope local to
        the particular agent, i.e., one without a global VLAN-ID assigned
        to it. Such VLANs are outside the scope of IEEE 802.1Q, but it is
        convenient to be able to manage them in the same way using this
        YANG module.";
    reference
        "9.6 of IEEE Std 802.1Q";
}
```

```
typedef mstid-type {
    type uint32 {
        range "1..4094";
    }
    description
        "In an MSTP Bridge, an MSTID, i.e., a value used to identify a
        spanning tree (or MST) instance";
    reference
        "13.8 of IEEE Std 802.1Q";
}
typedef pcp-selection-type {
    type enumeration {
        enum 8P0D {
            description
                "8 priorities, 0 drop eligible";
        }
        enum 7P1D {
            description
                "7 priorities, 1 drop eligible";
        }
        enum 6P2D {
            description
                "6 priorities, 2 drop eligible";
        }
        enum 5P3D {
            description
                "5 priorities, 3 drop eligible";
        }
    }
    description
        "Priority Code Point selection types.";
    reference
        "12.6.2.5.3, 6.9.3 of IEEE Std 802.1Q";
}
typedef protocol-frame-format-type {
    type enumeration {
        enum Ethernet {
            description
                "Ethernet frame format";
        }
        enum rfc1042 {
            description
                "RFC 1042 frame format";
        }
        enum snap8021H {
            description
                "SNAP 802.1H frame format";
        }
        enum snapOther {
            description
                "Other SNAP frame format";
        }
        enum llcOther {
            description
                "Other LLC frame format";
        }
    }
    description
        "A value representing the frame format to be matched.";
    reference
        "12.10.1.7.1 of IEEE Std 802.1Q";
}
typedef ethertype-type {
    type string {
        pattern "[0-9a-fA-F]{2}-[0-9a-fA-F]{2}";
    }
    description
        "The EtherType value represented in the canonical order defined by
        IEEE 802. The canonical representation uses uppercase characters.";
    reference
        "9.2 of IEEE Std 802-2014";
}
```

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```
typedef dot1q-tag-type {
    type identityref {
        base dot1q-vlan-type;
    }
    description
        "Identifies a specific 802.1Q tag type";
    reference
        "9.5 IEEE Std 802.1Q";
}
typedef traffic-class-type {
    type uint8 {
        range "0..7";
    }
    description
        "This is the numerical value associated with a traffic class in a
        Bridge. Larger values are associated with higher priority traffic
        classes.";
    reference
        "3.273 of IEEE Std 802.1Q";
}
grouping dot1q-tag-classifier-grouping {
    description
        "A grouping which represents an 802.1Q VLAN, matching both the
        EtherType and a single VLAN Id.";
    leaf tag-type {
        type dot1q-tag-type;
        mandatory true;
        description
            "VLAN type";
    }
    leaf vlan-id {
        type vlanid;
        mandatory true;
        description
            "VLAN Id";
    }
}
grouping dot1q-tag-or-any-classifier-grouping {
    description
        "A grouping which represents an 802.1Q VLAN, matching both the
        EtherType and a single VLAN Id or 'any' to match on any VLAN Id.";
    leaf tag-type {
        type dot1q-tag-type;
        mandatory true;
        description
            "VLAN type";
    }
    leaf vlan-id {
        type union {
            type vlanid;
            type enumeration {
                enum any {
                    value 4095;
                    description
                        "Matches 'any' VLAN in the range 1 to 4094 that is not
                        matched by a more specific VLAN Id match";
                }
            }
        }
        mandatory true;
        description
            "VLAN Id or any";
    }
}
grouping dot1q-tag-ranges-classifier-grouping {
    description
        "A grouping which represents an 802.1Q VLAN that matches a range of
        VLAN Ids.";
    leaf tag-type {
        type dot1q-tag-type;
        mandatory true;
        description
```

```

        "VLAN type";
    }
    leaf vlan-ids {
        type vid-range-type;
        mandatory true;
        description
            "VLAN Ids";
    }
}
grouping dot1q-tag-ranges-or-any-classifier-grouping {
    description
        "A grouping which represents an 802.1Q VLAN, matching both the
        EtherType and a single VLAN Id, ordered list of ranges, or 'any' to
        match on any VLAN Id.";
    leaf tag-type {
        type dot1q-tag-type;
        mandatory true;
        description
            "VLAN type";
    }
    leaf vlan-id {
        type union {
            type vid-range-type;
            type enumeration {
                enum any {
                    value 4095;
                    description
                        "Matches 'any' VLAN in the range 1 to 4094.";
                }
            }
        }
        mandatory true;
        description
            "VLAN Ids or any";
    }
}
grouping priority-regeneration-table-grouping {
    description
        "The priority regeneration table provides the ability to map
        incoming priority values on a per Port basis, under management
        control.";
    reference
        "6.9.4 of IEEE Std 802.1Q";
    leaf priority0 {
        type priority-type;
        default "0";
        description
            "Priority 0";
        reference
            "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
    }
    leaf priority1 {
        type priority-type;
        default "1";
        description
            "Priority 1";
        reference
            "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
    }
    leaf priority2 {
        type priority-type;
        default "2";
        description
            "Priority 2";
        reference
            "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
    }
    leaf priority3 {
        type priority-type;
        default "3";
        description
            "Priority 3";
    }
}

```

```

reference
    "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
}
leaf priority4 {
    type priority-type;
    default "4";
    description
        "Priority 4";
    reference
        "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
}
leaf priority5 {
    type priority-type;
    default "5";
    description
        "Priority 5";
    reference
        "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
}
leaf priority6 {
    type priority-type;
    default "6";
    description
        "Priority 6";
    reference
        "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
}
leaf priority7 {
    type priority-type;
    default "7";
    description
        "Priority 7";
    reference
        "12.6.2.3, 6.9.4 of IEEE Std 802.1Q";
}
}
grouping pcg-decoding-table-grouping {
    description
        "The Priority Code Point decoding table enables the decoding of the
        priority and drop-eligible parameters from the PCP.";
    reference
        "6.9.3 of IEEE Std 802.1Q";
    list pcg-decoding-map {
        key "pcp";
        description
            "This map associates the priority code point field found in the
            VLAN with a priority and drop eligible value based upon the
            priority code point selection type.";
        leaf pcg {
            type pcg-selection-type;
            description
                "The priority code point selection type.";
            reference
                "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
        }
        list priority-map {
            key "priority-code-point";
            description
                "This map associates a priority code point value with priority
                and drop eligible parameters.";
            leaf priority-code-point {
                type priority-type;
                description
                    "Priority associated with the pcg.";
                reference
                    "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
            }
            leaf priority {
                type priority-type;
                description
                    "Priority associated with the pcg.";
                reference

```

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```

    "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
}
leaf drop-eligible {
    type boolean;
    description
        "Drop eligible value for pcpc";
    reference
        "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
}
}
}
}
grouping pcpc-encoding-table-grouping {
    description
        "The Priority Code Point encoding table encodes the priority and
        drop-eligible parameters in the PCP field of the VLAN tag.";
    reference
        "12.6.2.9, 6.9.3 of IEEE Std 802.1Q";
    list pcpc-encoding-map {
        key "pcpc";
        description
            "This map associates the priority and drop-eligible parameters
            with the priority used to encode the PCP of the VLAN based upon
            the priority code point selection type.";
        leaf pcpc {
            type pcpc-selection-type;
            description
                "The priority code point selection type.";
            reference
                "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
        }
        list priority-map {
            key "priority dei";
            description
                "This map associates the priority and drop-eligible parameters
                with the priority code point field of the VLAN tag.";
            leaf priority {
                type priority-type;
                description
                    "Priority associated with the pcpc.";
                reference
                    "12.6.2.7, 6.9.3 of IEEE Std 802.1Q";
            }
            leaf dei {
                type boolean;
                description
                    "The drop eligible value.";
                reference
                    "12.6.2, 8.6.6 of IEEE Std 802.1Q";
            }
            leaf priority-code-point {
                type priority-type;
                description
                    "PCP value for priority when DEI value";
                reference
                    "12.6.2.9, 6.9.3 of IEEE Std 802.1Q";
            }
        }
    }
}
}
}
grouping service-access-priority-table-grouping {
    description
        "The Service Access Priority Table associates a received priority
        with a service access priority.";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
    leaf priority0 {
        type priority-type;
        default "0";
        description
            "Service access priority value for priority 0";
        reference

```

```

    "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority1 {
    type priority-type;
    default "1";
    description
        "Service access priority value for priority 1";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority2 {
    type priority-type;
    default "2";
    description
        "Service access priority value for priority 2";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority3 {
    type priority-type;
    default "3";
    description
        "Service access priority value for priority 3";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority4 {
    type priority-type;
    default "4";
    description
        "Service access priority value for priority 4";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority5 {
    type priority-type;
    default "5";
    description
        "Service access priority value for priority 5";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority6 {
    type priority-type;
    default "6";
    description
        "Service access priority value for priority 6";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
leaf priority7 {
    type priority-type;
    default "7";
    description
        "Service access priority value for priority 7";
    reference
        "12.6.2.17, 6.13.1 of IEEE Std 802.1Q";
}
}
grouping traffic-class-table-grouping {
    description
        "The Traffic Class Table models the operations that can be
        performed on, or can inquire about, the current contents of the
        Traffic Class Table (8.6.6) for a given Port.";
    reference
        "12.6.3, 8.6.6 of IEEE Std 802.1Q";
    list traffic-class-map {
        key "priority";
        description
            "The priority index into the traffic class table.";
        leaf priority {
            type priority-type;

```

```

description
    "The priority of the traffic class entry.";
reference
    "8.6.6 of IEEE Std 802.1Q";
}
list available-traffic-class {
    key "num-traffic-class";
    description
        "The traffic class index associated with a given priority
        within the traffic class table.";
    reference
        "8.6.6 of IEEE Std 802.1Q";
    leaf num-traffic-class {
        type uint8 {
            range "1..8";
        }
        description
            "The available number of traffic classes.";
        reference
            "8.6.6 of IEEE Std 802.1Q";
    }
    leaf traffic-class {
        type traffic-class-type;
        description
            "The traffic class index associated with a given traffic
            class entry.";
        reference
            "8.6.6 of IEEE Std 802.1Q";
    }
}
}
grouping transmission-selection-table-grouping {
    description
        "The Transmission Selection Algorithm Table models the operations
        that can be performed on, or can inquire about, the current contents
        of the Transmission Selection Algorithm Table (12.20.2) for a given
        Port.";
    reference
        "12.20.2, 8.6.8 of IEEE Std 802.1Q";
    list transmission-selection-algorithm-map {
        key "traffic-class";
        description
            "The traffic class to index into the transmission selection
            table.";
        leaf traffic-class {
            type traffic-class-type;
            description
                "The traffic class of the entry.";
            reference
                "8.6.6 of IEEE Std 802.1Q";
        }
        leaf transmission-selection-algorithm {
            type identityref {
                base dot1q-types:transmission-selection-algorithm;
            }
            description
                "Transmission selection algorithm";
            reference
                "8.6.8, Table 8-6 of IEEE Std 802.1Q";
        }
    }
}
grouping port-map-grouping {
    description
        "A set of control indicators, one for each Port. A Port Map,
        containing a control element for each outbound Port";
    reference
        "8.8.1, 8.8.2 of IEEE Std 802.1Q";
    list port-map {
        key "port-ref";
        description

```

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```
"The list of entries composing the port map.";  
leaf port-ref {  
  type port-number-type;  
  description  
    "The interface port reference associated with this map.";  
  reference  
    "8.8.1 of IEEE Std 802.1Q";  
}  
choice map-type {  
  description  
    "Type of port map";  
  container static-filtering-entries {  
    description  
      "Static filtering entries attributes.";  
    leaf control-element {  
      type enumeration {  
        enum forward {  
          description  
            "Forwarded, independently of any dynamic filtering  
            information held by the FDB.";  
        }  
        enum filter {  
          description  
            "Filtered, independently of any dynamic filtering  
            information.";  
        }  
        enum forward-filter {  
          description  
            "Forwarded or filtered on the basis of dynamic  
            filtering information, or on the basis of the default  
            Group filtering behavior for the outbound Port (8.8.6)  
            if no dynamic filtering information is present  
            specifically for the MAC address";  
        }  
      }  
    }  
    description  
      "A control element for each outbound Port, specifying that  
      a frame with a destination MAC address, and in the case of  
      VLAN Bridge components, VID that meets this specification.";  
    reference  
      "8.8.1 of IEEE Std 802.1Q";  
  }  
  leaf connection-identifier {  
    type port-number-type;  
    description  
      "A Port MAP may contain a connection identifier (8.8.12)  
      for each outbound port. The connection identifier may be  
      associated with the Bridge Port value maintained in a  
      Dynamic Filtering Entry of the FDB for Bridge Ports.";  
    reference  
      "8.8.11, 8.8.12 of IEEE Std 802.1Q";  
  }  
}  
container static-vlan-registration-entries {  
  description  
    "Static VLAN registration entries.";  
  leaf registrar-admin-control {  
    type enumeration {  
      enum fixed-new-ignored {  
        description  
          "Registration Fixed (New ignored).";  
      }  
      enum fixed-new-propagated {  
        description  
          "Registration Fixed (New propagated).";  
      }  
      enum forbidden {  
        description  
          "Registration Forbidden.";  
      }  
      enum normal {  
        description
```

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```
        "Normal Registration.";
    }
}
description
    "The Registrar Administrative Control values for MVRP and
    MIRP for the VID.";
reference
    "8.8.2 of IEEE Std 802.1Q";
}
leaf vlan-transmitted {
    type enumeration {
        enum tagged {
            description
                "VLAN-tagged";
        }
        enum untagged {
            description
                "VLAN-untagged";
        }
    }
    description
        "Whether frames are to be VLAN-tagged or untagged when
        transmitted.";
    reference
        "8.8.2 of IEEE Std 802.1Q";
}
}
container mac-address-registration-entries {
    description
        "MAC address registration entries attributes.";
    leaf control-element {
        type enumeration {
            enum registered {
                description
                    "Forwarded, independently of any dynamic filtering
                    information held by the FDB.";
            }
            enum not-registered {
                description
                    "Filtered, independently of any dynamic filtering
                    information.";
            }
        }
    }
    description
        "A control element for each outbound Port, specifying that
        a frame with a destination MAC address, and in the case of
        VLAN Bridge components, VID that meets this specification.";
    reference
        "8.8.4 of IEEE Std 802.1Q";
}
}
container dynamic-vlan-registration-entries {
    description
        "Dynamic VLAN registration entries attributes.";
    leaf control-element {
        type enumeration {
            enum registered {
                description
                    "Forwarded, independently of any dynamic filtering
                    information held by the FDB.";
            }
        }
    }
    description
        "A control element for each outbound Port, specifying that
        a frame with a destination MAC address, and in the case of
        VLAN Bridge components, VID that meets this specification.";
    reference
        "8.8.5 of IEEE Std 802.1Q";
}
}
}
container dynamic-reservation-entries {
    description
```

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```

    "Dynamic reservation entries attributes.";
    leaf control-element {
      type enumeration {
        enum forward {
          description
            "Forwarded, independently of any dynamic filtering
            information held by the FDB.";
        }
        enum filter {
          description
            "Filtered, independently of any dynamic filtering
            information.";
        }
      }
      description
        "A control element for each outbound Port, specifying that
        a frame with a destination MAC address, and in the case of
        VLAN Bridge components, VID that meets this specification.";
      reference
        "8.8.7 of IEEE Std 802.1Q";
    }
  }
  container dynamic-filtering-entries {
    description
      "Dynamic filtering entries attributes.";
    leaf control-element {
      type enumeration {
        enum forward {
          description
            "Forwarded, independently of any dynamic filtering
            information held by the FDB.";
        }
      }
      description
        "A control element for each outbound Port, specifying that
        a frame with a destination MAC address, and in the case of
        VLAN Bridge components, VID that meets this specification.";
      reference
        "8.8.3 of IEEE Std 802.1Q";
    }
  }
}

grouping bridge-port-statistics-grouping {
  description
    "Grouping of bridge port statistics.";
  reference
    "12.6.1.1.3 of IEEE Std 802.1Q";
  leaf delay-exceeded-discards {
    type yang:counter64;
    description
      "The number of frames discarded by this port due to excessive
      transit delay through the Bridge. It is incremented by both
      transparent and source route Bridges.";
    reference
      "12.6.1.1.3, 8.6.6 of IEEE Std 802.1Q";
  }
  leaf mtu-exceeded-discards {
    type yang:counter64;
    description
      "The number of frames discarded by this port due to an excessive
      size. It is incremented by both transparent and source route
      Bridges.";
    reference
      "Item g) in 12.6.1.1.3 of IEEE Std 802.1Q";
  }
  leaf frame-rx {
    type yang:counter64;
    description
      "The number of frames that have been received by this port from
      its segment. Note that a frame received on the interface

```

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```

corresponding to this port is only counted by this object if and
only if it is for a protocol being processed by the local
bridging function, including Bridge management frames.";
reference
    "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf octets-rx {
    type yang:counter64;
    description
        "The total number of octets in all valid frames received
        (including BPDUs, frames addressed to the Bridge as an end
        station, and frames that were submitted to the Forwarding
        Process).";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf frame-tx {
    type yang:counter64;
    description
        "The number of frames that have been transmitted by this port to
        its segment. Note that a frame transmitted on the interface
        corresponding to this port is only counted by this object if and
        only if it is for a protocol being processed by the local
        bridging function, including Bridge management frames.";
}
leaf octets-tx {
    type yang:counter64;
    description
        "The total number of octets that have been transmitted by this
        port to its segment.";
}
leaf discard-inbound {
    type yang:counter64;
    description
        "Count of received valid frames that were discarded (i.e.,
        filtered) by the Forwarding Process.";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf forward-outbound {
    type yang:counter64;
    description
        "The number of frames forwarded to the associated MAC Entity
        (8.5).";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf discard-lack-of-buffers {
    type yang:counter64;
    description
        "The count of frames that were to be transmitted through the
        associated Port but were discarded due to lack of buffers.";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf discard-transit-delay-exceeded {
    type yang:counter64;
    description
        "The number of frames discarded by this port due to excessive
        transit delay through the Bridge. It is incremented by both
        transparent and source route Bridges.";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}
leaf discard-on-error {
    type yang:counter64;
    description
        "The number of frames that were to be forwarded on the associated
        MAC but could not be transmitted (e.g., frame would be too large,
        6.5.8).";
    reference
        "12.6.1.1.3 of IEEE Std 802.1Q";
}

```

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}
}
}

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48.6.11 The ieee802-dot1q-stream-filters-gates YANG module

Delete the YANG module in 48.6.11.

Insert the following YANG module in 48.6.11:

```
module ieee802-dot1q-stream-filters-gates {
  yang-version "1.1";
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-stream-filters-gates;
  prefix sfsg;
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
            IEEE Standards Association
            445 Hoes Lane
            Piscataway, NJ 08854
            USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This module provides management of IEEE 802.1Q Bridge components
    that support Stream Filters and Stream Gates.

    References in this YANG module to IEEE Std 802.1Q are to IEEE Std
    802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023.

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    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023 - Bridges and Bridged Networks - Amendment:
      Congestion Isolation.";
  }
  revision 2022-10-29 {
    description
      "Published as part of IEEE Std 802.1Q-2022.";
    reference
      "IEEE Std 802.1Q-2022, Bridges and Bridged Networks.";
  }
  revision 2020-11-06 {
    description
      "Published as part of IEEE Std 802.1Qcr-2020.";
    reference
      "IEEE Std 802.1Qcr-2020, Bridges and Bridged Networks -
      Asynchronous Traffic Shaping.";
  }
  feature closed-gate-state {
    description
      "The bridge component supports gate state closed.";
    reference
      "IEEE Std 802.1Q";
  }
}

/* Types and groupings */
typedef priority-spec-type {
  type enumeration {
    enum zero {
      value 0;
      description
        "Priority 0";
    }
  }
}
```

```

enum one {
    value 1;
    description
        "Priority 1";
}
enum two {
    value 2;
    description
        "Priority 2";
}
enum three {
    value 3;
    description
        "Priority 3";
}
enum four {
    value 4;
    description
        "Priority 4";
}
enum five {
    value 5;
    description
        "Priority 5";
}
enum six {
    value 6;
    description
        "Priority 6";
}
enum seven {
    value 7;
    description
        "Priority 7";
}
enum wildcard {
    description
        "wildcard value";
}
}
description
    "The frame's priority value";
reference
    "8.6.5.2 of IEEE Std 802.1Q";
}
typedef ipv-spec-type {
    type enumeration {
        enum zero {
            value 0;
            description
                "Priority 0";
        }
        enum one {
            value 1;
            description
                "Priority 1";
        }
        enum two {
            value 2;
            description
                "Priority 2";
        }
        enum three {
            value 3;
            description
                "Priority 3";
        }
        enum four {
            value 4;
            description
                "Priority 4";
        }
    }
}

```

```

enum five {
    value 5;
    description
        "Priority 5";
}
enum six {
    value 6;
    description
        "Priority 6";
}
enum seven {
    value 7;
    description
        "Priority 7";
}
enum null {
    description
        "null value";
}
}
description
    "An IPV can be either of the following:
    1) The null value. For a frame that passes through the gate, the
        priority value associated with the frame is used to determine
        the frame's traffic class, using the Traffic Class Table as
        specified in 8.6.6.
    2) An internal priority value. For a frame that passes through
        the gate, the IPV is used, in place of the priority value
        associated with the frame, to determine the frame's traffic
        class, using the Traffic Class Table as specified in 8.6.6.";
reference
    "8.6.5.2 of IEEE Std 802.1Q";
}
typedef gate-state-value-type {
    type enumeration {
        enum closed {
            description
                "Gate closed";
        }
        enum open {
            description
                "Gate open";
        }
    }
}
description
    "The gate-state-value-type indicates a gate state, open or closed,
    for the stream gate.";
reference
    "12.31.3.2.1 of IEEE Std 802.1Q";
}
grouping sfsg-parameters {
    description
        "The grouping of all stream filter and stream gate parameters.";
    container stream-gates {
        description
            "This container encapsulates all nodes related to Stream Gates.";
        list stream-gate-instance-table {
            key "stream-gate-instance-id";
            description
                "Each list entry contains a set of parameters that defines a
                single stream gate (8.6.5.4), as detailed in Table 12-36.
                Entries in the table can be created or removed dynamically in
                implementations that support dynamic configuration of stream
                gates.";
            reference
                "12.31.3 of IEEE Std 802.1Q";
        }
        leaf stream-gate-instance-id {
            type uint32;
            description
                "An integer table index that allows the stream gate to be
                referenced from Stream Filter Instance Table entries.";
            reference

```

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```

"12.31.2.5 of IEEE Std 802.1Q
8.6.5.3 of IEEE Std 802.1Q
8.6.5.4 of IEEE Std 802.1Q";
}
leaf gate-enable {
  type boolean;
  default "false";
  description
    "A Boolean variable that indicates whether the operation of
    the state machines is enabled (TRUE) or disabled (FALSE).
    This variable is set by management. The default value of this
    variable is FALSE.";
  reference
    "8.6.9.4.14 of IEEE Std 802.1Q";
}
leaf admin-gate-states {
  type gate-state-value-type;
  default "open";
  description
    "The administratively set gate state of this gate.";
  reference
    "12.31.3.2.1 of IEEE Std 802.1Q
    8.6.10.4 of IEEE Std 802.1Q";
}
leaf admin-ipv {
  type ipv-spec-type;
  default "null";
  description
    "The administratively set internal priority value
    specification.";
  reference
    "12.31.3.3 of IEEE Std 802.1Q
    8.6.10.6 of IEEE Std 802.1Q
    8.6.5.4 of IEEE Std 802.1Q";
}
}
leaf max-stream-gate-instances {
  type uint32;
  config false;
  description
    "The maximum number of Stream Gate instances supported by this
    Bridge component.";
  reference
    "12.31.1.2 of IEEE Std 802.1Q";
}
}
container stream-filters {
  description
    "This container encapsulates all nodes related to stream filters.";
  reference
    "12.31 of IEEE Std 802.1Q";
  list stream-filter-instance-table {
    key "stream-filter-instance-id";
    description
      "Each list entry contains a set of parameters that defines a
      single stream filter (8.6.5.1) with associated maximum SDU size
      filtering (8.6.5.3.1), as detailed in Table 12-35. Entries can
      be created or removed dynamically in implementations that
      support dynamic configuration of stream filters. The value of
      the stream-handle-spec and priority-spec parameters associated
      with a received frame determine which stream filter is selected
      by the frame, and therefore what combination of filtering and
      policing actions is applied to the frame. If the
      stream-handle-spec and priority-spec parameters associated with
      a received frame match more than one stream filter, the stream
      filter that is selected is the one that appears earliest in the
      ordered list. If a received frame's stream-handle-spec and
      priority-spec does not match any of the stream filters in the
      list, the frame is processed as if stream filters and stream
      gates would not be supported.";
    reference
      "12.31.2 of IEEE Std 802.1Q";
  }
}

```

```

leaf stream-filter-instance-id {
    type uint32;
    mandatory true;
    description
        "An integer index value that determines the place of the
        stream filter in the ordered list of stream filter instances.
        The values are ordered according to their integer value;
        smaller values appear earlier in the ordered list.";
    reference
        "12.31.2.1 of IEEE Std 802.1Q";
}
choice stream-handle-spec {
    description
        "The stream_handle specification data type allows either of
        the following to be represented:
        a) A stream_handle value, represented as an integer.
        b) The wildcard value, which matches any frame";
    reference
        "12.31.2.2 of IEEE Std 802.1Q";

    /* NOTE: The mapping of the wildcard literal is
    *         other than in the MIB definition, where
    *         the wildcard value is mapped to -1.
    */
    case wildcard {
        leaf wildcard {
            type empty;
            description
                "The stream handle specification represents a wildcard
                value.";
        }
    }
    case stream-handle {
        leaf stream-handle {
            type uint32;
            mandatory true;
            description
                "The stream handle specification refers to a
                stream_handle value.";
        }
    }
}
leaf priority-spec {
    type priority-spec-type;
    mandatory true;
    description
        "The priority specification data type allows either of the
        following to be represented:
        a) A priority value, represented as an integer.
        b) The wildcard value, which matches any priority.";
    reference
        "12.31.2.3 of IEEE Std 802.1Q";
}
leaf max-sdu-size {
    type uint32;
    units "octets";
    mandatory true;
    description
        "The allowed maximum SDU size, in octets. If set to 0, any
        SDU size is accepted.";
    reference
        "8.6.5.3.1 of IEEE Std 802.1Q";
}
leaf stream-blocked-due-to-oversize-frame-enabled {
    type boolean;
    default "false";
    description
        "A value of true indicates that
        stream-blocked-due-to-oversize-frame is set to true as soon
        as a frame exceeds max-sdu-size.";
    reference
        "8.6.5.3.1 of IEEE Std 802.1Q";
}

```

```

}
leaf stream-blocked-due-to-oversize-frame {
  type boolean;
  default "false";
  description
    "Indicates by value true that frames are permanently
    discarded as a result of an initial frame exceeding
    max-sdu-size. The value of
    stream-blocked-due-to-oversize-frame can be administratively
    reset to false.";
  reference
    "8.6.5.3.1 of IEEE Std 802.1Q";
}
leaf stream-gate-ref {
  type leafref {
    path
      '..'+
      '/..' +
      '/..' +
      '/stream-gates'+
      '/stream-gate-instance-table'+
      '/stream-gate-instance-id';
  }
  mandatory true;
  description
    "This node refers to the stream gate (12.31.3) that is
    associated with the stream filter. The relationship between
    stream filters and stream gates is many to one; a given
    stream filter can be associated with only one stream gate,
    but there can be multiple stream filters associated with a
    given stream gate.";
  reference
    "12.31.3.1 of IEEE Std 802.1Q";
}
}
leaf max-stream-filter-instances {
  type uint32;
  config false;
  description
    "The maximum number of stream filter instances supported by
    this Bridge component.";
  reference
    "12.31.1.1, 8.6.5.1 of IEEE Std 802.1Q";
}
}
}
}

```

Delete 48.6.12 “The ieee802-dot1q-ats YANG module”

Insert new 48.6.12 “ieee802-dot1q-stream-filters-gates-bridge YANG module” after 48.6.11 as follows:

48.6.12 The ieee802-dot1q-stream-filters-gates-bridge YANG module

```
module ieee802-dot1q-stream-filters-gates-bridge {
  yang-version "1.1";
  namespace
    urn:ieee:std:802.1Q:yang:ieee802-dot1q-stream-filters-gates-bridge;
  prefix sfsg-bridge;
  import ieee802-dot1q-bridge {
    prefix dot1q;
  }
  import ieee802-dot1q-stream-filters-gates {
    prefix sfsg;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: https://1.ieee802.org/
    WG-Email: stds-802-1@ieee.org
    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
            IEEE Standards Association
            445 Hoes Lane
            Piscataway, NJ 08855
            USA

    E-mail: STDS-802-1-CHAIRS@LISTSERV.IEEE.ORG";
  description
    "This module provides management of IEEE 802.1Q Bridge components
    that support Stream Filters and Stream Gates."

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023 - Bridges and Bridged Networks - Amendment:
      Congestion Isolation.";
  }
  augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
    description
      "Augments the Bridge component with stream filters and stream
      gates.";
    uses sfsg:sfsg-parameters;
  }
}
```

Insert 48.6.13 after 48.6.12 as follows:

48.6.13 The ieee802-dot1q-ats YANG module

```
module ieee802-dot1q-ats {
  yang-version "1.1";
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-ats;
  prefix ats;
  import ietf-yang-types {
    prefix yang;
  }
  import ieee802-dot1q-types {
    prefix dot1qtypes;
  }
  import ieee802-dot1q-stream-filters-gates {
    prefix sfsg;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
            IEEE Standards Association
            445 Hoes Lane
            Piscataway, NJ 08854
            USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This module provides management of IEEE 802.1Q Bridge components
    that support Asynchronous Traffic Shaping (ATS).

    References in this YANG module to IEEE Std 802.1Q are to IEEE Std
    802.1Q-2022 as amended by IEEE Std 802.1Q-2023.

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023, Bridges and Bridged Networks - Congestion
      Isolation.";
  }
  revision 2022-01-19 {
    description
      "Published as part of IEEE Std 802.1Q-2022.";
    reference
      "IEEE Std 802.1Q-2022, Bridges and Bridged Networks.";
  }
  revision 2020-11-06 {
    description
      "Published as part of IEEE Std 802.1Qcr-2020.";
    reference
      "IEEE Std 802.1Qcr-2020, Bridges and Bridged Networks -
      Asynchronous Traffic Shaping.";
  }
  grouping ats-port-parameters {
    description
      "This container comprises all ATS per-Port parameters.";
    leaf discarded-frames-count {
      type yang:counter64;
      config false;
      description
        "A counter of frames discarded by ATS scheduler instances
        associated with the Bridge Port.";
    }
  }
}
```

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```
reference
  "12.31.7.2 of IEEE Std 802.1Q";
}
}
grouping ats-parameters {
  description
    "System specific configuration for ATS includes:
    a) ATS schedulers
    b) ATS scheduler groups";
  container schedulers {
    description
      "This container comprises all nodes related to ATS schedulers.";
    list scheduler-instance-table {
      key "scheduler-instance-id";
      description
        "Each list entry comprises a set of parameters that defines a
        single ATS scheduler instance, as detailed in Table 12-38.";
      reference
        "12.31.5 of IEEE Std 802.1Q";
      leaf scheduler-instance-id {
        type uint32;
        mandatory true;
        description
          "A unique index identifying this ATS scheduler instance.";
        reference
          "12.31.5.1, 8.6.5.6 of IEEE Std 802.1Q";
      }
      leaf committed-information-rate {
        type uint64;
        units "bits/second";
        mandatory true;
        description
          "The committed information rate parameter of this ATS
          scheduler instance.";
        reference
          "12.31.5.3, 8.6.5.6 of IEEE Std 802.1Q";
      }
      leaf committed-burst-size {
        type uint32;
        units "bits";
        mandatory true;
        description
          "The committed burst size parameter of this ATS scheduler
          instance.";
        reference
          "12.31.5.2, 8.6.5.6 of IEEE Std 802.1Q";
      }
      leaf scheduler-group-ref {
        type leafref {
          path
            '\.4+
            \.6+
            \.7+
            /scheduler-groups'+
            /scheduler-group-instance-table'+
            /scheduler-group-instance-id';
        }
        mandatory true;
        description
          "A reference to the scheduler group (12.31.5.4) associated
          with this ATS scheduler instance. Multiple ATS scheduler
          instances can be associated to one scheduler group, as
          detailed in 8.6.5.6.";
        reference
          "12.31.5.4, 8.6.5.6 of IEEE Std 802.1Q";
      }
    }
  }
  leaf max-scheduler-instances {
    type uint32;
    config false;
    description
      "The maximum number of ATS scheduler instances supported by
```

```

        this Bridge component.";
    reference
        "12.31.1.5 of IEEE Std 802.1Q";
}
container scheduler-groups {
    description
        "This container comprises all ATS scheduler group related nodes.";
    list scheduler-group-instance-table {
        key "scheduler-group-instance-id";
        description
            "Each list entry comprises a set of parameters that defines a
            single ATS scheduler group instance.";
        reference
            "12.31.6, 8.6.5.6 of IEEE Std 802.1Q";
        leaf scheduler-group-instance-id {
            type uint32;
            description
                "A unique index identifying this ATS scheduler group
                instance.";
            reference
                "12.31.6.1, 8.6.5.6 of IEEE Std 802.1Q";
        }
        leaf max-residence-time {
            type uint32;
            units "nanoseconds";
            mandatory true;
            description
                "The maximum residence time parameter of the ATS scheduler
                group.";
            reference
                "12.31.6.2, 8.6.5.6 of IEEE Std 802.1Q";
        }
    }
    leaf max-scheduler-group-instances {
        type uint32;
        config false;
        description
            "The maximum number of ATS scheduler group instances supported
            by this Bridge component.";
        reference
            "12.31.1.6, 8.6.5.6 of IEEE Std 802.1Q";
    }
    container scheduler-timing-characteristics {
        description
            "This container comprises all ATS scheduler timing
            characteristics related nodes.";
        list scheduler-timing-characteristics-table {
            key "reception-port transmission-port";
            config false;
            description
                "Each list entry comprises the timing characteristics of a
                reception Port transmission Port pair, as detailed in Table
                12-41.";
            reference
                "12.31.8, 8.6.11 of IEEE Std 802.1Q";
            leaf reception-port {
                type dot1qttype:port-number-type;
                config false;
                mandatory true;
                description
                    "A reference to the associated reception Port.";
                reference
                    "12.31.8.1 of IEEE Std 802.1Q";
            }
            leaf transmission-port {
                type dot1qttype:port-number-type;
                config false;
                mandatory true;
                description
                    "A reference to the associated transmission Port.";
                reference

```

```

    "12.31.8.2 of IEEE Std 802.1Q";
}
leaf clock-offset-variation-max {
    type uint32;
    units "nanoseconds";
    config false;
    mandatory true;
    description
        "The maximum clock offset variation associated with the
        reception Port transmission Port pair.";
    reference
        "12.31.8.3 of IEEE Std 802.1Q";
}
leaf clock-rate-deviation-max {
    type uint32;
    units "ppm";
    config false;
    mandatory true;
    description
        "The maximum clock rate deviation associated with the
        reception Port transmission Port pair.";
    reference
        "12.31.8.4 of IEEE Std 802.1Q";
}
leaf arrival-recognition-delay-max {
    type uint32;
    units "nanoseconds";
    config false;
    mandatory true;
    description
        "The maximum arrival time recognition delay associated with
        the reception Port transmission Port pair.";
    reference
        "12.31.8.5 of IEEE Std 802.1Q";
}
leaf processing-delay-min {
    type uint32;
    units "nanoseconds";
    config false;
    mandatory true;
    description
        "The minimum processing delay associated with the reception
        Port transmission Port pair.";
    reference
        "12.31.8.6 of IEEE Std 802.1Q";
}
leaf processing-delay-max {
    type uint32;
    units "nanoseconds";
    config false;
    mandatory true;
    description
        "The maximum processing delay associated with the reception
        Port transmission Port pair.";
    reference
        "12.31.8.7 of IEEE Std 802.1Q";
}
}
}
}
}
}
uses sfsg:sfsg-parameters {
    augment "stream-filters/stream-filter-instance-table" {
        description
            "Augments the system stream filter for ATS schedulers.";
        uses ats:ats-parameters;
        container scheduler {
            description
                "This container encapsulates ATS scheduler nodes.";
            leaf scheduler-ref {
                type leafref {
                    path

```

```

        '\..' +
        '\/' ..' +
        '\schedulers' +
        '\scheduler-instance-table' +
        '\scheduler-instance-id';
    }
    description
        "A reference to the ATS scheduler associated with this stream
        filter.";
    }
    leaf scheduler-enable {
        type boolean;
        default "false";
        description
            "If TRUE, this stream filter has an associated ATS scheduler
            referenced by scheduler-ref. If FALSE, no ATS scheduler is
            associated with this stream filter (scheduler-ref is
            ignored).";
    }
}
}
}
}
}

```

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Insert 48.6.14 after 48.6.13 as follows:

48.6.14 The ieee802-dot1q-ats-bridge YANG module

```
module ieee802-dot1q-ats-bridge {
  yang-version "1.1";
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-ats-bridge;
  prefix ats-bridge;
  import ietf-interfaces {
    prefix if;
  }
  import ieee802-dot1q-bridge {
    prefix dot1q;
  }
  import ieee802-dot1q-ats {
    prefix ats;
  }
  import ieee802-dot1q-stream-filters-gates {
    prefix sfsg;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
            IEEE Standards Association
            445 Hoes Lane
            Piscataway, NJ 08854
            USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This module provides management of IEEE 802.1Q Bridge components
    that support Asynchronous Traffic Shaping (ATS).

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023, Bridges and Bridged Networks - Congestion
      Isolation.";
  }
  augment "/if:interfaces/if:interface/dot1q:bridge-port" {
    description
      "Augments Bridge Ports by ATS per-Port parameters.";
    uses ats:ats-port-parameters;
  }
  augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
    description
      "Augments the Bridge component with ATS parameters.";
    uses sfsg:sfsg-parameters {
      augment "stream-filters/stream-filter-instance-table" {
        description
          "Augments the Bridge component stream filter for ATS
          schedulers.";
        uses ats:ats-parameters;
        container scheduler {
          description
            "This container encapsulates ATS scheduler nodes.";
          leaf scheduler-ref {
            type leafref {
              path
                '..'+
                '/../'+
            }
          }
        }
      }
    }
  }
}
```

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```
        '/schedulers'+
        '/scheduler-instance-table'+
        '/scheduler-instance-id';
    }
    description
        "A reference to the ATS scheduler associated with this
        stream filter.";
    }
    leaf scheduler-enable {
        type boolean;
        default "false";
        description
            "If TRUE, this stream filter has an associated ATS
            scheduler referenced by scheduler-ref. If FALSE, no ATS
            scheduler is associated with this stream filter
            (scheduler-ref is ignored).";
    }
}
}
}
}
```

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Insert 48.6.15 after 48.6.14 as follows:

48.6.15 The ieee802-dot1q-congestion-isolation YANG module

```
module ieee802-dot1q-congestion-isolation {
  yang-version "1.1";
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-congestion-isolation;
  prefix dot1q-ci;
  import ietf-yang-types {
    prefix yang;
  }
  import ieee802-types {
    prefix ieee;
  }
  import ieee802-dot1q-stream-filters-gates {
    prefix sfsg;
  }
  import ieee802-dot1q-types {
    prefix dot1q-types;
  }
  import ietf-inet-types {
    prefix inet;
  }
  organization
    "Institute of Electrical and Electronics Engineers";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org
    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
    IEEE Standards Association
    445 Hoes Lane
    Piscataway, NJ 08854
    USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This YANG module augments the configuration and operational state
    data for interfaces for Congestion Isolation.

    References in this YANG module to IEEE Std 802.1Q are to IEEE Std
    802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023.

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023";
  }

  /*-----*/
  /* Feature */
  /*-----*/
  feature congestion-isolation {
    description
      "Feature Congestion Isolation";
  }

  /*-----*/
  /* Typedefs */
  /*-----*/
  typedef abs-traffic-class-plus-one-type {
    type enumeration {
      enum monitored-queue-tc-1 {
        value 1;
        description
          "Traffic class 0 of monitored queue.";
      }
    }
  }
```

```

}
enum monitored-queue-tc-2 {
    value 2;
    description
        "Traffic class 1 of monitored queue.";
}
enum monitored-queue-tc-3 {
    value 3;
    description
        "Traffic class 2 of monitored queue.";
}
enum monitored-queue-tc-4 {
    value 4;
    description
        "Traffic class 3 of monitored queue.";
}
enum monitored-queue-tc-5 {
    value 5;
    description
        "Traffic class 4 of monitored queue.";
}
enum monitored-queue-tc-6 {
    value 6;
    description
        "Traffic class 5 of monitored queue.";
}
enum monitored-queue-tc-7 {
    value 7;
    description
        "Traffic class 6 of monitored queue.";
}
enum monitored-queue-tc-8 {
    value 8;
    description
        "Traffic class 7 of monitored queue.";
}
enum congesting-queue-tc-1 {
    value -1;
    description
        "Traffic class 0 of congesting queue.";
}
enum congesting-queue-tc-2 {
    value -2;
    description
        "Traffic class 1 of congesting queue.";
}
enum congesting-queue-tc-3 {
    value -3;
    description
        "Traffic class 2 of congesting queue.";
}
enum congesting-queue-tc-4 {
    value -4;
    description
        "Traffic class 3 of congesting queue.";
}
enum congesting-queue-tc-5 {
    value -5;
    description
        "Traffic class 4 of congesting queue.";
}
enum congesting-queue-tc-6 {
    value -6;
    description
        "Traffic class 5 of congesting queue.";
}
enum congesting-queue-tc-7 {
    value -7;
    description
        "Traffic class 6 of congesting queue.";
}
enum congesting-queue-tc-8 {

```

```

    value -8;
    description
        "Traffic class 7 of congesting queue.";
}
enum not-participating-congestion-isolation {
    value 0;
    description
        "Traffic class not participating in congestion isolation.";
}
}
description
    "Specifies a value that can be translated to the numeric value of
    the traffic class to be used as either the congesting or monitored
    queue. The absolute value of the enumerated value is the value of
    the traffic class plus 1. A value of 0 indicates the traffic class
    is not participating in congestion isolation. For example, the
    enumerated value congesting-queue-tc-5 specifies that traffic class
    4 is used as the congesting queue.";
}
grouping cip-port-parameters {
    description
        "The bridge port specific configuration for Congestion Isolation.";
    leaf cip-mac-address {
        type ieee:mac-address;
        config false;
        description
            "The source MAC address of a CIM, belonging to the system
            transmitting the CIM.";
        reference
            "49.4.1.2.1 of IEEE Std 802.1Q";
    }
    leaf cip-ipv4-address {
        type inet:ipv4-address;
        config false;
        description
            "The source IPv4 address of a CIM, belonging to the system
            transmitting the IPv4 layer-3 CIM.";
        reference
            "49.4.1.2.2 of IEEE Std 802.1Q";
    }
    leaf cip-ipv6-address {
        type inet:ipv6-address;
        config false;
        description
            "The source IPv6 address of a CIM, belonging to the system
            transmitting the IPv6 layer-3 CIM.";
        reference
            "49.4.1.2.3 of IEEE Std 802.1Q";
    }
    leaf cip-cim-port {
        type inet:port-number;
        config false;
        description
            "The UDP port number to be used by a peer transmitting a layer-3
            CIM. This value will be sent to the peer via LLDP in the CI TLV.";
        reference
            "49.4.1.2.4 of IEEE Std 802.1Q";
    }
    list queue-map {
        key "priority";
        description
            "An array of integers, one entry for each traffic class, 0
            through 7, specifying a value that can be translated to the
            numeric value of the traffic class to be used as either the
            congesting traffic class or the monitored traffic class for the
            traffic class specified by the index. The integers range in value
            from -8 to 8. A value of 0 in the table specifies that the
            traffic class is not participating in congestion isolation. A
            positive number specifies a traffic class for a monitored queue
            that is one less than the value (e.g., a value of 5 represents
            traffic class 4). A negative number specifies a traffic class for
            a congesting queue that is one less than the absolute value (e.g.,

```

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```

    a value of -4 represents traffic class 3).";
reference
    "49.4.1.2.5 of IEEE Std 802.1Q";
leaf priority {
    type dot1q-types:priority-type;
    description
        "There are eight values of Priority that map to an absolute
        value that is a traffic class plus one, or the value 0 which
        indicates the traffic class is not used by congestion
        isolation.";
    reference
        "49.4.1.2.5 of IEEE Std 802.1Q";
}
leaf abs-traffic-class-plus-one {
    type abs-traffic-class-plus-one-type;
    description
        "A value that can be translated to represent a traffic class or
        an indication of non-use. A value of 0 specifies that the
        traffic class is not participating in congestion isolation. A
        positive number specifies a traffic class for a monitored
        queue, and a negative number specifies a traffic class for a
        congesting queue.";
    reference
        "49.4.1.2.5 of IEEE Std 802.1Q";
}
}
leaf min-header-octets {
    type uint16;
    description
        "The minimum number of octets to include in the Encapsulated MSDU
        field of each CIM generated. The default value is 48.";
    reference
        "49.4.1.2.6 of IEEE Std 802.1Q";
}
leaf max-cim-tx {
    type uint16;
    description
        "The maximum number of times a CIM PDU will be sent for a
        congesting flow. The default value is 3.";
    reference
        "49.4.1.2.7 of IEEE Std 802.1Q";
}
}
grouping cip-parameters {
    description
        "The system specific configuration for Congestion Isolation.";
    leaf ci-master-enable {
        type boolean;
        description
            "Specifies whether CI is enabled in this system.";
        reference
            "49.4.1.1.1 of IEEE Std 802.1Q";
    }
    leaf ci-cim-tx-priority {
        type dot1q-types:priority-type;
        config false;
        description
            "Specifies the priority value to be used when transmitting CIMS
            from the system. The default is 6.";
        reference
            "49.4.1.1.2 of IEEE Std 802.1Q";
    }
}
leaf ci-max-flow-life {
    type uint32;
    config false;
    description
        "Specifies the maximum number of centiseconds that a congesting
        flow entry, created by the receipt of a CIM, can remain in the CI
        Stream Table after the congesting queue has transitioned from
        congested back to non-congested. The default value is 100.";
    reference
        "49.4.1.1.3 of IEEE Std 802.1Q";
}

```

```

}
container ci-peers {
  description
    "Contains information about an immediate peer obtained from a
    received LLDP Congestion Isolation TLV.";
  list ci-peer-table {
    key "reception-port";
    description
      "Contains entries for each participating immediate peer and
      provides the information needed to generate a CIM for
      transmission to the peer.";
    reference
      "49.3.6 of IEEE Std 802.1Q";
    leaf reception-port {
      type dot1q-types:port-number-type;
      description
        "The port number where the immediate congestion isolation
        participating peer is attached.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
    leaf cim-type {
      type enumeration {
        enum l2 {
          description
            "Layer 2 CIM encapsulation.";
        }
        enum ipv4 {
          description
            "IPv4 CIM encapsulation.";
        }
        enum ipv6 {
          description
            "IPv6 CIM encapsulation.";
        }
      }
      description
        "The format of the CIM expected by the peer.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
    leaf peer-mac-address {
      type ieee:mac-address;
      description
        "The destination MAC address to use when generating a CIM for
        the peer.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
    leaf peer-ipv4-address {
      type inet:ipv4-address;
      description
        "The destination IPv4 address to use when generating an IPv4
        layer-3 CIM for the peer.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
    leaf peer-ipv6-address {
      type inet:ipv6-address;
      description
        "The destination IPv6 address to use when generating an IPv6
        layer-3 CIM for the peer.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
    leaf peer-udp-port {
      type inet:port-number;
      description
        "The UDP port number to use when generating a layer-3 CIM for
        the peer.";
      reference
        "49.3.6 of IEEE Std 802.1Q";
    }
  }
}

```

```

    }
    leaf peer-cim-encap-len {
        type uint16 {
            range "0..512";
        }
        description
            "The number of octets from the MSDU to include in the
            Encapsulated MSDU field of the CIM PDU";
        reference
            "49.3.6 of IEEE Std 802.1Q";
    }
}
leaf max-ci-peer-entries {
    type uint32;
    config false;
    description
        "Specifies the maximum number of CI peer entries that can be
        stored.";
    reference
        "49.3.6 of IEEE Std 802.1Q";
}
}
container ci-streams {
    description
        "Contains control information to manage congestion flows.";
    list ci-stream-table {
        key "stream-handle-id";
        config false;
        description
            "Contains entries for each congesting flow and has a 1:1
            mapping to entries in the IEEE Std 802.1CB Stream Identity
            Table.";
        reference
            "49.3.7 of IEEE Std 802.1Q";
        leaf stream-handle-id {
            type uint32;
            config false;
            description
                "There is a unique stream handle ID for each congesting flow
                stored in the CI Stream Table.";
            reference
                "49.4.1.5.1 of IEEE Std 802.1Q";
        }
    }
    leaf cim-count {
        type uint16;
        config false;
        description
            "Contains a count of the number of CIMs sent for a congesting
            flow.";
        reference
            "49.4.1.5.2 of IEEE Std 802.1Q";
    }
    leaf create-time {
        type yang:timeticks;
        config false;
        description
            "The time (SysUpTime, IETF RFC 3418) at which the CI Stream
            Table entry was created.";
        reference
            "49.4.1.5.3 of IEEE Std 802.1Q";
    }
    leaf create-mask {
        type bits {
            bit local-create {
                position 0;
                description
                    "CI Stream entry was created because congestion was
                    detected locally by the AQM.";
            }
        }
        bit cim-create {
            position 1;
            description

```

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```

        "CI Stream entry was created because of the receipt of a
        CIM.";
    }
}
config false;
description
    "Indicates the reason for creating or updating the CI Stream
    Table entry. The LSB indicates that the entry was created or
    updated because the AQM determined that a forwarded frame is
    part of a congesting flow. The MSB indicates that the entry
    was created or updated because of the receipt of a CIM.";
reference
    "49.4.1.5.4 of IEEE Std 802.1Q";
}
}
leaf queue-key {
    type uint16;
    config false;
    description
        "Represents the unique queue identity of a congesting queue at
        an egress port that a congesting flow is traversing. The key is
        calculated by the product of the congesting traffic class
        number plus one and the port number.";
    reference
        "49.4.1.5.5 of IEEE Std 802.1Q";
}
leaf dest-mac-address {
    type ieee:mac-address;
    config false;
    description
        "The destination MAC address of a congesting flow.";
    reference
        "49.4.1.5.6 of IEEE Std 802.1Q";
}
leaf source-mac-address {
    type ieee:mac-address;
    config false;
    description
        "The source MAC address of a congesting flow.";
    reference
        "49.4.1.5.7 of IEEE Std 802.1Q";
}
leaf vid {
    type dot1q-types:vlan-index-type;
    config false;
    description
        "The VID of a congesting flow.";
    reference
        "49.4.1.5.8 of IEEE Std 802.1Q";
}
leaf msdu {
    type yang:hex-string;
    config false;
    description
        "The initial octets of the MSDU of a congesting flow. The number
        of octets to keep in the CI Stream Table entry is specified by
        the peer CIM encapsulation length of the CI Peer Table.";
    reference
        "49.4.1.5.9 of IEEE Std 802.1Q";
}
}
leaf max-ci-stream-entries {
    type uint32;
    config false;
    description
        "Specifies the maximum number of CI stream entries that can be
        stored.";
    reference
        "49.4.1.5 of IEEE Std 802.1Q";
}
}
}

```

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```
/*-----*/
/* Configuration Data */
/*-----*/
uses sfsg:sfsg-parameters {
  augment
    "stream-filters/stream-filter-instance-table/stream-handle-spec" {
      if-feature "congestion-isolation";
      description
        "Dot1q Congestion Isolation";
      case null-handle {
        description
          "Congestion isolation specific stream_handle specifications.";
        leaf null-handle {
          type empty;
          description
            "The stream_handle specification represents the value when no
            stream_handle is provided.";
        }
      }
    }
  }
}
```

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Insert 48.6.16 as follows:

48.6.16 The ieee802-dot1q-congestion-isolation-bridge YANG module

```

module ieee802-dot1q-congestion-isolation-bridge {
  yang-version "1.1";
  namespace
    urn:ieee:std:802.1Q:yang:ieee802-dot1q-congestion-isolation-bridge;
  prefix ci-bridge;
  import ietf-interfaces {
    prefix if;
  }
  import ieee802-dot1q-bridge {
    prefix dot1q;
  }
  import ieee802-dot1q-congestion-isolation {
    prefix ci;
  }
  import ieee802-dot1q-stream-filters-gates {
    prefix sfsg;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: https://1.ieee802.org/
    WG-EMail: stds-802-1@ieee.org
    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
            IEEE Standards Association
            445 Hoes Lane
            Piscataway, NJ 08855
            USA

    E-mail: stds-802-1-chairs@listserv.ieee.org";
  description
    "This module provides management of IEEE 802.1Q Bridge components
    that support Congestion Isolation.

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
  revision 2023-07-03 {
    description
      "Published as part of IEEE Std 802.1Qcz-2023.";
    reference
      "IEEE Std 802.1Qcz-2023 - Bridges and Bridged Networks - Amendment:
      Congestion Isolation.";
  }
  feature congestion-isolation-bridge {
    description
      "Feature Congestion Isolation in Bridges";
  }
  augment "/dot1q:bridges/dot1q:bridge/dot1q:component" {
    if-feature "congestion-isolation-bridge";
    description
      "Augments the Bridge component with stream filters and stream
      gates.";
    uses ci:cip-parameters;
    uses sfsg:sfsg-parameters {
      augment
        "stream-filters/stream-filter-instance-table/stream-handle-spec" {
          if-feature "congestion-isolation-bridge";
          description
            "Dot1q Congestion Isolation";
          case null-handle {
            description
              "Congestion isolation specific stream_handle specifications.";
            leaf null-handle {
              type empty;
              description
            }
          }
        }
    }
  }
}

```

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```
        "The stream_handle specification represents the value when  
        no stream_handle is provided.";  
    }  
}  
}  
}  
augment "/if:interfaces/if:interface/dot1q:bridge-port" {  
    if-feature "congestion-isolation-bridge";  
    description  
        "Augment a bridge port with Congestion Isolation specific  
        configuration.";  
    uses ci:cip-port-parameters;  
}  
}
```

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Insert new Clause 49 “Congestion Isolation” after Clause 48 as follows:

49. Congestion Isolation

Congestion Isolation (CI) mitigates head-of-line blocking caused by the frequent use of PFC in lossless networks and reduces frame loss in lossy networks that are not using PFC. CI identifies the flows that are most likely causing congestion, isolates them to a separate lower priority traffic class and signals to the upstream peer to do the same. CI effectively moves the congesting flows out of the way, temporarily delaying the delivery of congesting frames, while the higher layer congestion control feedback loop has time to take effect.

This clause introduces the concepts and protocols essential to congestion isolation as follows:

- The objectives for congestion isolation (49.1).
- Principles of congestion isolation (49.2).
- Congestion Isolation Aware Forwarding Process (49.3).
- Congestion Isolation Protocol (49.4).
- Topology Recognition (49.5).

In current data center networks, traffic can be a mix of various multi-tenant TCP and UDP flows across both the physical underlay and virtual overlay network. Intermittent congestion within the network can occur from an unfortunate mix of flows across the network. For example, a small number of long duration ‘elephant’ flows can align in such a way to create queuing delays for the larger number of short, but critical, ‘mice’ flows. In this case, the ‘elephant’ flows would be considered congesting flows to the ‘mice’ flows. Any flow can become a congesting flow when it contributes to congestion in the network.

Queuing delays deter the end-to-end congestion control loop, and in a lossless environment, cannot prevent Priority-based Flow Control (PFC) from being invoked (see Clause 36). When buffers fill and eventual flow-control kicks in (for lossless networks), non-congesting flows can be blocked by the backlog of frames from congesting flows. If PFC is not being used, frame loss for non-congesting flows can result in long retransmission timeouts, significantly penalizing such flows, which are often used for application control and synchronization.

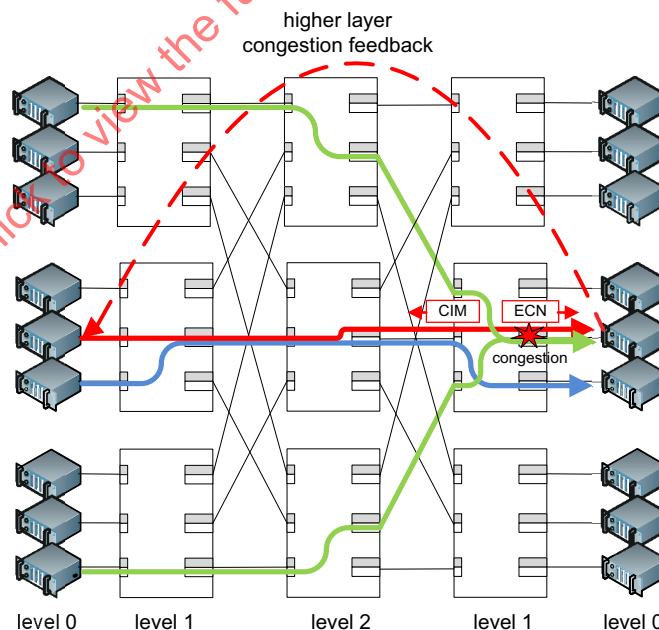


Figure 49-1—Congestion Isolation example operation

Figure 49-1 shows an example operation of CI. In the figure, all of the relay systems are layer-3 routers and are congestion isolation aware systems. The example shows a network of layer-3 routers, but congestion isolation also applies to Bridged Networks. Each system is showing two queues on each port; a monitored queue and a congesting queue. Server-to-server traffic is flowing from left to right across a data center network. When congestion is detected CI attempts to identify the congesting flows (49.2.1). For each identified congesting flow (e.g. the red flow in Figure 49-1), the congestion isolation aware system takes local actions to isolate the congesting flow, sends a Congestion Isolation Message (CIM) upstream if the congesting queue is congested, and sends Explicit Congestion Notification (ECN) downstream.

The local actions taken by a congestion isolation aware system deprioritize frames from the congesting flow and place them in a dedicated congesting flow queue (49.2.3). An entry is made in the IEEE Std 802.1CB Stream identity table of the local system so that subsequent frames from the congesting flow can be identified and deprioritized (49.2.2).

When a flow is isolated the deprioritized frames are queued in the congesting flow queue. When that queue becomes congested (49.2.1) and the upstream peer is congestion isolation aware, the CI functionality signals to the immediate upstream peer using a CIM (49.2.5).

The CIM contains flow description information necessary for the upstream peer to identify the same congesting flow. The upstream peer creates a Stream identity table entry using the contents of the CIM (49.2.2). The table entry is used to isolate the same flow by identifying subsequent frames and deprioritizing those frames to the congested flow queue.

The IP packets in frames of the congesting flows are marked with higher layer congestion signals such as those defined by the IETF RFC 3168 for Explicit Congestion Notification (ECN). Since CI is performed within the network it is essential that end-to-end higher layer congestion control is combined with CI so the sending sources will reduce their rate of transmission in response to the congestion signals. ECN operates by marking packets where they encounter queuing delay as they travel towards the destination. At the IP destination, feedback is signaled to the source system, so it takes time for the signals to propagate and ultimately impact the transmission rate of the source system.

The frames in the congesting flow queue are serviced at a lower priority than other non-congesting queues, so if congestion persists, the congesting flow queue may fill. When the congesting flow queue fills, the ingress port feeding that queue can issue PFC for the lower priority queue to avoid frame loss (49.2.4). In this case, PFC only acts on the lower priority congesting flow queues and other well-behaved flows continue through the network via non-congesting priority queues.

49.1 Congestion isolation objectives

The operation, procedures, and protocols of congestion isolation are designed to meet the following objectives by category:

Functionality

- a) With high probability, identify the flows that are causing congestion.
- b) Avoid head-of-line blocking of non-congesting flows locally by quickly adjusting the traffic class of congesting flows.
- c) Avoid head-of-line blocking of non-congesting flows upstream by signaling to upstream peers the information needed to isolate the same congesting flows.
- d) Reduce the frequency of invoking PFC in a lossless environment.

Compatibility

- e) Work in legacy environments by automatically detecting legacy peers and disabling CIM signaling.
- f) Work in existing lossless environments using PFC without requiring additional traffic classes.

- g) Work in conjunction with higher layer end-to-end congestion control protocols (e.g. Explicit Congestion Notification (ECN), Remote Direct Memory Access (RDMA) over Converged Ethernet (RoCE), Data Center Quantized Congestion Notification (DCQCN [B68])).
- h) Work in both layer-2 and layer-3 networks.
- i) Coexist with existing traffic scheduling paradigms on other traffic classes.

Performance

- j) Reduce average flow completion time across the data center network.
- k) Reduce the amount of time frames are paused when PFC is enabled.
- l) Reduce overall frame loss when PFC is not enabled.
- m) Reduce head-of-line blocking of victim flows at upstream peers from PFC.
- n) Reduce overall congestion control signaling.
- o) Increase link utilization.

Scale

- p) Work in arbitrary data center network topologies with a mix of link speeds.
- q) Limit messaging overhead by restricting message propagation to hop-by-hop.
- r) Reduce Stream identity table requirements by only requiring the registration of congesting flows and providing facilities to rapidly remove flows that are no longer congesting.

Implementation complexity

- s) Limit the impact of existing traffic selection algorithms.
- t) Achieve the benefits of congestion isolation without additional buffer requirements.
- u) Support implementations of existing traffic classes.
- v) Leverage existing standard functionality for congesting flow identification and stream identification.

Manageability

- w) Only require a small set of configuration parameters that are consistent across multiple Bridge deployments.
- x) Limit the ability to configure an inoperable environment.
- y) Provide auto discovery of peer capabilities using existing LLDP messages and without creating additional hello and auto-configuration protocols.

49.2 Principles of congestion isolation

This subclause introduces the principles of congestion isolation. Items a) through f) describe the life of a congesting flow from identification through isolation to returning the flow to non-congesting status. Item g) describes a mechanism for determining a device's level in the data center topology that can be used to ensure compatibility and proper operation of existing protocols. Item h) compares and contrasts congestion isolation with Congestion Notification (see Clause 30).

The following items describe the principles of congestion isolation:

- a) Congesting flow identification (49.2.1).
- b) IEEE Std 802.1CB stream identification (49.2.2).
- c) Flow priority modification (49.2.3).
- d) Priority-based Flow Control interaction (49.2.4)
- e) Congestion isolation signaling (49.2.5).
- f) Congesting to non-congesting status change (49.2.6).
- g) System topology and port orientation (49.2.7).
- h) Comparison to Congestion Notification (49.2.8).

49.2.1 Congesting flow identification

An essential step in the process of CI is identifying congesting flows by an Active Queue Management (AQM) scheme that supports Explicit Congestion Notification (ECN) specified in IETF RFC 3168. There are many potential methods of identifying congesting flows and interoperable implementations can exist using different approaches. The CIP Congestion Detection function (49.3.1) of the Congestion Isolation Aware Forwarding Process (49.3) is responsible for implementing the AQM. This standard defines the CP algorithm (30.2.1) for detecting Congestion Controlled Flows (CCFs) in congestion aware Bridges. This approach may be used to detect congesting flows in a CI aware system. A number of other possible approaches, including those that support the end-to-end ECN congestion control, are discussed in IETF RFC 7567 [B45].

Many modern data centers utilize encapsulated overlay networks, such as those described in IETF RFC 8014 [B46]. An overlay network can carry multiple encapsulated flows within a single encapsulation flow. The congesting and non-congesting flows identified by CI are the outer encapsulation flow as seen by the underlay network. The inner encapsulated flows might not be visible to the Bridges and routers within the data center network, and are therefore not separated into congesting and non-congesting flows.

49.2.2 IEEE Std 802.1CB stream identification

Subsequent frames of congesting flows are identified by matching in the IEEE Std 802.1CB Stream identity table. Congesting flow entries are added to and removed from the Stream identity table as `tsnStreamIdEntry` objects using the managed object interface specified in Clause 9 of IEEE Std 802.1CB-2017. The `tsnStreamIdIdentificationType` for these objects is IP stream identification. The contents for an IP stream `tsnStreamIdEntry` come from the received frame that has been identified as causing congestion or from the parameters in the CIM PDU (49.4.3.4) from a peer. Flows matching in the Stream identity table will provide a `stream_handle` for congesting flows to the EISS. The `stream_handle` for congesting flows is used as the `tsnStreamIdHandle` entity of the `tsnStreamIdEntry` object.

Congestion isolation uses `stream_handles` to identify frames of congesting and non-congesting flows. This use prohibits `stream_handles` from being used by other functionality requiring `stream_handles` on a port where congestion isolation operates.

49.2.3 Flow priority modification

CI uses the facilities of per-stream classification and metering (8.6.5.2) to modify the priority of congesting flow frames. The `stream_handle`, available as part of the `connection_identifier`, is provided by the Stream identification function and accompanies frames of congesting flows as they pass through a relay. This `stream_handle` is used to select a stream filter instance and stream gate instance that will modify the priority of the frame for congesting flows. A single stream filter instance from the stream filter instance table (8.6.5.2.3), with a wildcard match on the `stream_handle`, is used to select a stream gate instance that contains the new internal priority value (IPV). Configuration of the stream filter instance table and stream gate instance table is described in 8.6.5.

The process of modifying the priority of subsequent frames of a congesting flow brings with it the risk of misordering. There may be a period of time where frames for the same flow exist in multiple queues at the same time. Strict priority transmission selection can ensure ordering is maintained for congesting flows because the monitored queue is higher priority than the congesting queue. However, other transmission selection algorithms may be desired. Congestion isolation implementations need to ensure that misordering (6.5.3) remains negligible. Annex W discusses possible approaches for ensuring ordering.

49.2.4 Priority-based Flow Control interaction

Priority-based Flow Control (PFC) (Clause 36) is used in data centers to create lossless traffic classes in the data center network. PFC allows link flow control to be performed on a per-priority basis. For PFC to operate properly, it is imperative that the downstream system can determine the priority of the frame when it egresses the upstream peer. The Priority Code Point (PCP—see 6.9.3) field of a VLAN tag encodes a

frame's priority. Since an upstream congestion isolation aware system modifies the priority of congesting frames, it must also modify the PCP so the downstream system can assert PFC, if needed, on the correct priority. Therefore all frames must be VLAN tagged when operating CI with PFC in a lossless environment. Additional design considerations for the interaction of PFC and CI are discussed in W.2.

49.2.5 Congestion isolation signaling

Once a flow has been isolated and subsequent frames are forwarded through the congesting queue and the congesting queue becomes congested, it is useful to inform the upstream peer of this event by signaling a Congestion Isolation Message (CIM). Upon receiving a CIM, the upstream peer can isolate the same flow by creating an entry in the IEEE Std 802.1CB Stream identity table. The benefit of isolating a flow upon the directive of a peer is that the congesting flow can be moved out of the way of other non-congesting flows and the potential for head-of-line blocking can be reduced.

The CIM contains parameters and a portion of the received frame so the upstream peer can identify the congesting flow and create an entry in its Stream identity table. The parameters and portion of the received frame included in the CIM must be the same as those of the frame sent by the upstream peer in order for that peer to identify the same flow. Features such as the VID translation table (6.9) can change the frame's parameters from what was sent by the upstream peer and should not be used with CI.

The CIM is addressed to the upstream peer. The system generating the CIM must locate CIM format information and the address parameters of the upstream peer by indexing into the CI Peer Table (49.3.6) using the reception port as the index. The CI Peer Table is built using information provided by LLDP and the Congestion Isolation TLV (D.2.15).

By default, a CIM contains the first 64 bytes of the congesting frame's `mac_service_data_unit`. Systems encapsulating and decapsulating flows for overlay networks may request the peer to include up to 512 octets of the received frame in the CIM. This allows the systems to access and identify encapsulated flows within the congesting flow encapsulation.

49.2.6 Congesting to non-congesting status change

Flows that are no longer causing congestion may be removed from the Stream identity table. Many methods of determining that a flow is no longer causing congestion are possible, but at a minimum, all flows in the Stream identity table for the port can be removed when the congesting queue for that port becomes empty. Waiting until the congesting queue is empty can cause congesting flows to remain in the congesting state longer than necessary, but it allows an implementation to easily abide by the frame misordering requirements of (6.5.3). Other approaches can react quickly and independently of other congesting flows, but may bring the risk of misordering. Implementations need to ensure that misordering is negligible. An example approach for avoiding misordering when returning a flow to non-congesting status can be seen in Annex W.

Frames from congesting flows received downstream from the root of congestion may be safely returned to the non-congesting traffic class. These frames are easily identified downstream because they are received on the congesting traffic class, but do not have a matching entry in the Stream identity table and will therefore not have a `stream_handle` parameter when passed through relay. These frames are isolated to the congesting queue by an upstream peer and the traffic class, as well as the associated Priority Code Point (PCP—see 6.9.3) or other indicators used to select a traffic class, such as the Differentiated Services Code Point (DSCP—see IETF RFC 2474) are modified upstream to indicate they are part of a congesting flow. Downstream from the congestion, however, these frames can be safely forwarded through the monitored queue. A second stream filter instance is used to return these frames to the monitored queue and update the PCP or other indicators used to select a traffic class. This stream filter is defined to match on the absence of

a stream handle and the priority for the congesting queue. The end-to-end ECN congestion markings remain unchanged and the congestion indications in the higher layer protocols will be noted at the source of the flow once the feedback is propagated.

NOTE—As noted in 6.8.1, modification to a frame's PCP or other indicators used to select a traffic class, will require the FCS to be regenerated. Options for regenerating the FCS are discussed in Annex O.

49.2.7 System topology and port orientation

Figure 49-1 shows an example of a popular data center topology. Other topologies are possible, but they all can be described as having devices positioned at levels within the topology. The topology levels are distinguished by considering the number of link hops from any interior system to non-relay end stations or servers at the edge of the network. By this definition, end stations and servers are at level 0. The immediate attached device would be at level 1 and further interior only systems could be at level 2 or higher depending on the connectivity of the topology.

A port's orientation is distinguished by considering the level in the topology a port is facing. A port facing a lower level has an orientation of a downlink, while a port facing a higher level has an orientation of an uplink. A port facing a system at the same level has an orientation of a crosslink.

Congestion isolation benefits from knowing a system's level in the topology. Recognizing the level is automated by the use of the LLDP Topology Recognition TLV (D.2.16) and the procedures defined in 49.5.3. During the process of isolating a congesting flow, the frame's priority may be changed from its original value. The corresponding Priority Code Point (PCP—see 6.9.3) or Differentiated Services Code Point (DSCP—see IETF RFC 2474) received at the destination may be different than the value provided by the original sender. To avoid complications with unexpected PCP or DSCP values, the Bridge or router at level 1 in the topology may change the PCP or DSCP back to the original value for the monitored queue.

In addition to avoiding complications with changed PCP or DSCP values, knowing a system's level in the topology can assist in identifying the type of congestion experienced and consequentially a strategy for mitigating it. Ports of Bridges or routers at level 1 in the topology are connected to non-relay end stations or servers. Congestion on these ports can often be attributed to incast traffic patterns. Congestion on links of systems that are at level 2 or higher in the topology may be experiencing in-network congestion. It has been shown that load balancing techniques, which may alleviate in-network congestion, are counter productive at addressing incast congestion [B60].

Lossless networks enabled by PFC have been shown, in certain circumstances, to have circular buffer dependencies that can cause deadlocks when traffic is re-routed due to link failures [B5]. Again, knowing the position in the topology assists in knowing when traffic has been re-routed and can be used to break circular buffer dependent deadlocks [B4].

49.2.8 Comparison to Congestion Notification

Congestion Isolation and Congestion Notification (Clause 30) share common aspects but are distinctly different. Both generate congestion messages and send them upstream, but CN directs the message across the Bridged Network to the source station, while CI directs the message to the immediate peer. CI is intended to operate in layer 3 and layer 2 networks with higher layer end-to-end congestion control supported by the end stations to regulate the rate of traffic injection into the network. CN is designed to operate across a large layer 2 domain where reaction points in end-station network adapters regulate traffic injection. CI isolates congesting flows by reclassifying their traffic class. CN does not modify the traffic class of frames.

49.3 The Congestion Isolation Aware Forwarding Process

This subclause specifies the architecture of the Congestion Isolation Point (CIP) in the Forwarding Process of a congestion isolation aware Bridge. In this architecture, a router is as a higher layer entity that relays frames using layer-3 information but uses the forwarding process of the underlying congestion isolation aware Bridge to deliver frames to peers and end stations.

The models of operation in this clause provide a basis for specifying the externally observable behavior of CI, and are not intended to place additional constraints on implementations; these can adopt any internal model of operation compatible with the externally observable behavior specified. Conformance of equipment to this standard is purely in respect of observable protocol.

Figure 8-12 illustrates the Bridge Forwarding Process at its highest conceptual level. Figure 8-16 shows the specific filtering and assignment functions of the flow classification and metering elements in the Forwarding Process of a congestion isolation aware Bridge. Figure 49-2 focuses on the operation of a single Bridge Port and the relationship of new elements to the queuing and classification functions. Five new elements and two new managed tables are specified for a CI aware Bridge as follows:

- CIP Congestion Detection (49.3.1).
- CIP transmission gates (49.3.2).
- CIM Demultiplexer (49.3.3).
- Congesting flow identification (49.3.4).
- CIM Multiplexer (49.3.5).
- CI Peer Table (49.3.6).
- CI Stream Table (49.3.7).

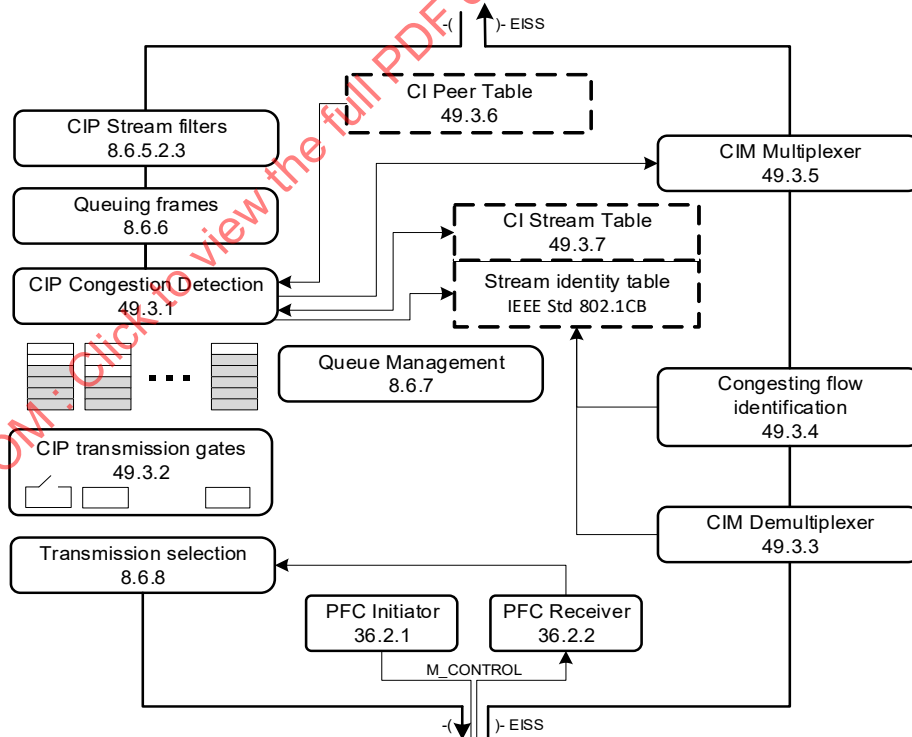


Figure 49-2—Congestion Isolation reference diagram

49.3.1 CIP Congestion Detection

CIP Congestion Detection identifies frames of a congesting flow, inserts frames passed by the Queuing Frames entity (8.6.6) into the appropriate queue or discards them and can generate a CIM based on the contents of the frame. CIP Congestion Detection is also responsible for creating entries in the Stream identity table and the CI Stream Table (49.3.7) for newly identified congesting flows. As described in 49.2.1, frames of a congesting flow are identified by a suitable AQM implemented by CIP Congestion Detection, such as the algorithm specified by a CP in 30.2.1.

Frames given to CIP Congestion Detection by the Queuing Frames entity (8.6.6) in an EM_UNITDATA.request (49.4.2.2) may be identified by the AQM as being part of a congesting flow. CIP Congestion Detection creates a new entry in the Stream identity table and the CI Stream Table for congesting flows received on a monitored queue. A CIM may be generated from the parameters obtained with the received frame and values from the CI Peer Table entry for the source port of the received frame. The CIM is delivered to the upstream peer via the CIM Multiplexer.

On each EM_UNITDATA.request, CIP Congestion Detection and its associated AQM indicate to the CIP procedures (49.4) whether a monitored or congesting queue is empty, congested, or not congested. The AQM or other means can be used to provide the queue status.

49.3.2 CIP transmission gates

CIP transmission gates control whether or not a queued frame can be selected for transmission by the transmission selection algorithm. The purpose of controlling a queue's availability to traffic selection is to allow the CI implementation a means to preserve order of congesting flow frames. The need to preserve order is dependent upon the transmission selection algorithm configured for the congesting and monitored queues. When the transmission selection algorithm is strict priority, the state of the transmission gate is permanently *open*. When the transmission selection algorithm is anything other than strict priority the implementation is responsible for ensuring order. An example approach is discussed in Annex W.

49.3.3 CIM Demultiplexer

The CIM Demultiplexer identifies CIMS received from the LAN and uses the content of the CIM PDU (49.4.3.4) to create an entry in the IEEE Std 802.1CB Stream identity table. A CIM PDU may be encapsulated by three different CIM encapsulations; layer-2, IPv4, or IPv6. Implementations supporting IPv4 and IPv6 encapsulations must be able to identify and validate IPv4 and/or IPv6 packets in the CIM Demultiplexer. The rules for validating received CIMS are specified in 49.4.3.5.

49.3.4 Congesting flow identification

Frames received from the LAN belonging to congesting flows are identified by the Stream identification function of IEEE Std 802.1CB. The Stream identification function provides a stream_handle subparameter in the connection_identifier parameter of an EM_UNITDATA.indication for frames of congesting flows and does not provide a stream_handle for frames of non-congesting flows. The presence or non-presence of the stream_handle is used to match a stream filter instance in the per-stream classification and metering function to modify the frame's priority (8.6.5.2.3).

49.3.5 CIM Multiplexer

The CIM Multiplexer inserts CIMS generated by the CIP Congestion Detection element among frames received from the LAN. Layer-2 encapsulated CIMS (49.4.3.1) are delivered to the upstream peer through the Bridge relay. Layer-3 encapsulated CIMS (49.4.3.2 and 49.4.3.3) are routed to the upstream peer by a higher-layer routing function that is beyond the scope of this standard.

49.3.6 CI Peer Table

The CI Peer Table (12.33.2) contains entries for each participating immediate peer and provides the information needed to generate a CIM for transmission to the peer. The entries are indexed by port number. An entry contains the format type of the CIM needed to reach the peer as well as the addressing information needed to generate the message. This includes the MAC address to use as the destination address and optionally an IPv4 or IPv6 address. The entry provides the UDP port number to use when the CIM encapsulation is a layer-3. An entry also contains the number of bytes of the received congesting flow frame to encapsulate in the CIM PDU itself. The contents of the entry are obtained from the LLDP Congestion Isolation TLV (D.2.15) received from participating peers.

49.3.7 CI Stream Table

The CI Stream Table (12.33.3) contains entries for each congesting flow and has a 1:1 mapping to entries in the IEEE Std 802.1CB Stream identity table. The entries are indexed by the stream_handle provided as a subparameter of the connection_identifier in EM_UNITDATA.request (49.4.2.2) invocations at the EISS. Each entry contains controlling variables (49.4.1.5) that allow an implementation to manage a congesting flow. This includes a means of identifying the congesting queue used to isolate the congesting flow. It also maintains a count of the CIMs sent on behalf of the congesting flow as well as an indication of why the entry was created or updated.

49.4 Congestion Isolation Protocol

Congestion isolation aware systems control forwarding elements, participate in congestion isolation protocols, and act upon the LLDP Congestion Isolation TLV as specified in this subclause. This includes:

- a) Variables controlling operation (49.4.1).
- b) CIP procedures (49.4.2).
- c) Encoding of the CIM PDU and CIM encapsulations (49.4.3).
- d) LLDP Congestion Isolation TLV (49.4.4).

49.4.1 Variables controlling operation

The congestion isolation variables control the operation of the CI entity and the CIP entity.

49.4.1.1 CI entity variables

Every congestion isolation aware system has a set of CI entity variables to control the overall operation of CI. These variables are included in the CI entity managed object (12.33.1). These include the following:

- a) ciMasterEnable (49.4.1.1.1).
- b) ciCIMTransmitPriority (49.4.1.1.2).
- c) ciMaxFlowLife (49.4.1.1.3).

49.4.1.1.1 ciMasterEnable

A boolean value specifying whether CI is enabled in this system. If ciMasterEnable is FALSE all congestion isolation activity is disabled; CIMs and LLDP Congestion Isolation TLVs are not generated and are ignored on receipt. If ciMasterEnable is TRUE the other managed objects and variables specified in the clause control the operation of CI.

49.4.1.1.2 ciCIMTransmitPriority

An integer specifying the priority value to be used when transmitting CIMs from the system. The default is 6.

49.4.1.1.3 ciMaxFlowLife

An unsigned integer specifying the maximum number of centiseconds that a congesting flow entry, created by the receipt of a CIM, can remain in the CI Stream Table beyond the time indicated by the per-port per-queue variable cipNonCongestedTime (49.4.1.4.2). The default value is 100.

49.4.1.2 CIP entity variables

The following variables control the operation of a CIP:

- a) cipMacAddress (49.4.1.2.1)
- b) cipIPv4Address (49.4.1.2.2)
- c) cipIPv6Address (49.4.1.2.3)
- d) cipCIMUDPPort (49.4.1.2.4)
- e) cipQueueMap[] (49.4.1.2.5)
- f) cipMinHeaderOctets (49.4.1.2.6)

49.4.1.2.1 cipMacAddress

The MAC address, belonging to the system transmitting the CIM (49.4.3), used as the source_address of CIMs sent from the CIP.

49.4.1.2.2 cipIPv4Address

The IPv4 address, belonging to the system transmitting the IPv4 layer-3 CIM (49.4.3.2), used as the IPv4 source address in the IPv4 header (IETF RFC 791) of IPv4 layer-3 CIMs sent from the CIP. The cipIPv4Address is included in the LLDP Congestion Isolation TLV (D.2.15) to allow peers to properly generate IPv4 layer-3 CIMs that can be received by the system.

49.4.1.2.3 cipIPv6Address

The IPv6 address, belonging to the system transmitting the IPv6 layer-3 CIM (49.4.3.3), used as the IPv6 source address in the IPv6 header (IETF RFC 8200) of IPv6 layer-3 CIMs sent from the CIP. The cipIPv6Address is included in the LLDP Congestion Isolation TLV (D.2.15) to allow peers to properly generate IPv6 layer-3 CIMs that can be received by the system.

49.4.1.2.4 cipCIMUDPPort

The destination UDP port number in the UDP header (IETF RFC 768) of IPv4 and IPv6 layer-3 CIMs sent by peers. The value is also used as the UDP source port number in layer-3 CIMs sent to peers. The UDP port number must be selected from the range of dynamic port numbers, between 49152 and 65535, as specified in IETF RFC 6335. The port number must be currently available for use by the implementation. For example, an implementation may use UDP port 58622, if it is not currently being used by any other application in the system.

49.4.1.2.5 cipQueueMap[]

An array of integers, one entry for each traffic class, 0 through 7, specifying a value that can be translated to the numeric value of the traffic class to be used as either the congesting traffic class or the monitored traffic class for the traffic class specified by the index. The integers range in value from –8 to 8. A value of 0 in the table specifies that the traffic class is not participating in congestion isolation. A positive number specifies a traffic class for a monitored queue that is one less than the value (e.g., a value of 5 represents traffic class 4). A negative number specifies a traffic class for a congesting queue that is one less than the absolute value (e.g., a value of –4 represents traffic class 3).

NOTE—Configuration of the cipQueueMap[] is flexible, allowing the arrangement of multiple monitored and congesting queue sets.

Frames from flows that the AQM determines are causing congestion and are currently transferring through the monitored traffic class specified by the index into this table may have their priority remapped to the translated traffic class specified by the entry in the `cipQueueMap[]`. Frames from flows that have an entry in the Stream identity table have a `stream_handle` that specifies a stream filter to remap the priority to the IPV. Frames that are transferring through a congesting traffic class and do not have a `stream_handle` match on the null-handle stream filter entry to have their priority remapped to the monitored traffic class specified in the IPV.

The `cipQueueMap[]` is included in the LLDP Congestion Isolation TLV (D.2.15) to inform peers of the system's configuration. Mismatched configurations can be detected by comparing the queue map received in the TLV with configured `cipQueueMap[]`.

49.4.1.2.6 `cipMinHeaderOctets`

The minimum number of octets that the CIP is to return in the Encapsulated MSDU field of each CIM generated. The default value is 48. The `cipMinHeaderOctets` is included in the LLDP Congestion Isolation TLV (D.2.15) to inform peers of the required minimum. The `cipMinHeaderOctets` value from peers is stored in the CI Peer Table (49.3.6) and used to generate CIMs to be transmitted to the peer.

49.4.1.2.7 `cipMaxCIM`

The maximum number of times a CIM PDU will be sent for a congesting flow. The default value is 3. A larger value provides more resilience to lost CIMs, but generates more traffic on the network.

49.4.1.3 CIP entity per-port variables

For each port in a congestion isolation aware system there is the following set of variables:

- a) `ciRxPort` (49.4.1.3.1)
- b) `ciAddDel` (49.4.1.3.2)

49.4.1.3.1 `ciRxPort`

A local variable holding the reception port number for a congesting flow. The CI Stream Table (12.33.3) is indexed by this local variable during the construction of a CIM. The value may be loaded during an `EM_UNITDATA.request` or when entries are being removed from the CI Stream Table and IEEE Std 802.1CB Stream identity table.

49.4.1.3.2 `ciAddDel`

A local variable holding an enumeration `{add, delete}` that provides an indication of the reason to build and send a CIM. The Add/Del field of the CIM PDU informs the peer that a congesting flow is either being added or deleted. The `ciAddDel` variable is used by the common `buildAndSendCim()` procedure (49.4.2.5) to parameterize and properly set the Add/Del field.

49.4.1.4 CIP entity per-port per-traffic class variables

For each port and monitored or congesting queue in a congestion isolation aware system there is the following set of variables:

- a) `cipGateControl` (49.4.1.4.1)
- b) `cipNonCongestedTime` (49.4.1.4.2)
- c) `cipCongesting` (49.4.1.4.3)

49.4.1.4.1 cipGateControl

Determines the state of the transmission gate for a monitored or congesting queue. There is an instance of cipGateControl for each queue that is participating in congestion isolation. The transmission gate allows implementations to maintain frame order when isolating a congesting flow. The value of the cipGateControl variable is either *open* or *closed*. It is directly tied to the state of the transmission gate of the monitored queues and the congesting queue. When the transmission selection algorithm is strict priority, the cipGateControl shall be *open* for all queues. Other transmission selection algorithms may require that order is maintained by controlling the values of cipGateControl. An example implementation approach for a traffic selection algorithm other than strict priority is described in Annex W.

49.4.1.4.2 cipNonCongestedTime

The time (SysUpTime, IETF RFC 3418) at which the queue last transitioned from congested to non-congested. This timestamp is used by the background periodicTableCleanup() procedure (49.4.2.10) to remove stale CI Stream Table entries that were created because of the receipt of a CIM and still remain in the table for a period longer than the ciMaxFlowLife (49.4.1.1.3).

49.4.1.4.3 cipCongesting

A boolean value that is set during the processing of a frame by the EM_UNITDATA.request (49.4.2.2) procedure. The value is set true when the AQM indicates that the monitored queue is no longer congested or the congesting queue is empty. The variable is initialized to false.

49.4.1.5 CIP entity per-stream variables

For each tsnStreamIdEntry object created in the IEEE Std 802.1CB Stream identity table there is a corresponding entry in the CI Stream Table (12.33.3). The entry contains per-stream variables that identify the congesting queue for a congesting flow, count the number of CIMs that have been transmitted for the congesting flow, and register the reasons for creating or updating the tsnStreamIdEntry object. Each entry contains the following variables:

- a) ciStreamIdHandle (49.4.1.5.1)
- b) ciCIMCount (49.4.1.5.2)
- c) ciCreateTime (49.4.1.5.3)
- d) ciStreamCreateMask (49.4.1.5.4)
- e) ciQueueKey (49.4.1.5.5)
- f) ciDestination_address (49.4.1.5.6)
- g) ciSource_address (49.4.1.5.7)
- h) ciVlan_identifier (49.4.1.5.8)
- i) ciMsdu (49.4.1.5.9)

49.4.1.5.1 ciStreamIdHandle

The stream_handle value used to create the tsnStreamIdEntry object in the IEEE Std 802.1CB Stream identity table. This variable provides the 1:1 mapping of the CI Stream Table entry with the tsnStreamIdEntry object.

49.4.1.5.2 ciCIMCount

An integer containing a count of the number of CIMs sent for the congesting flow. The count is reset when a frame from a congesting flow is received on a monitored queue.

49.4.1.5.3 ciCreateTime

The time (SysUpTime, IETF RFC 3418) at which the CI Stream Table entry was created.

49.4.1.5.4 ciStreamCreateMask

A 2-bit mask indicating the reason for creating or updating the CI Stream Table entry. The LSB indicates that the entry was created or updated because the AQM determined that a forwarded frame is part of a congesting flow. The MSB indicates that the entry was created or updated because of the receipt of a CIM. The ciStreamCreateMask allows an implementation to take different actions when de-isolating a congesting flow.

49.4.1.5.5 ciQueueKey

An integer that represents the unique queue identity of a congesting queue at an egress port that a congesting flow is traversing. The key is calculated by the product of the congesting traffic class number plus one and the port number. The key is used to help find all congesting flows using the same queue so the flushCongestingFlows() procedure (49.4.2.9) can efficiently remove them.

49.4.1.5.6 ciDestination_address

A MAC address obtained from the destination_address parameter of an EM_UNITDATA.indication for a congesting flow or from the destination_address field of a received CIM PDU.

49.4.1.5.7 ciSource_address

A MAC address obtained from the source_address parameter of an EM_UNITDATA.indication for a congesting flow or from the source_address field of a received CIM PDU.

49.4.1.5.8 ciVlan_identifier

A VLAN Identifier obtained from the vlan_identifier parameter of an EM_UNITDATA.indication for a congesting flow or from the vlan_identifier field of a received CIM PDU.

49.4.1.5.9 ciMsdu

An octet string containing an MSDU obtained from the mac_service_data_unit parameter of an EM_UNITDATA.indication for a congesting flow or from the Encapsulated MSDU field of a received CIM PDU.

49.4.2 CIP procedures

Congestion isolation is implemented through the procedures of a CIP. These include the following:

- a) ciInitialize() (49.4.2.1)
- b) EM_UNITDATA.request (parameters) (49.4.2.2)
- c) condTransmitCimAddPdu() (49.4.2.3)
- d) transmitCimDelPdu() (49.4.2.4)
- e) buildAndSendCim() (49.4.2.5)
- f) processCimPdu() (49.4.2.6)
- g) addCongestingFlow() (49.4.2.7)
- h) delCongestingFlow() (49.4.2.8)
- i) flushCongestingFlows() (49.4.2.9)
- j) periodicTableCleanup() (49.4.2.10)

49.4.2.1 cilnitialize()

Initializes CI support (8.6.5.2.3) for per-stream classification and metering (8.6.5.2) including the creation of stream filter instances and stream gate instances needed for CI operation. At initialization time the procedure performs the following:

- a) For each entry in the ciQueueMap[] table do the following:
 - 1) If the value of the entry in ciQueueMap[] is 0, do nothing and move on to the next entry.
 - 2) If the value of the entry in ciQueueMap[] is positive, the index specifies a monitored queue and the value can be translated to a congesting queue. Create a stream gate and stream filter as follows:
 - i) Allocate a new StreamGateInstance.
 - ii) Set the StreamGateEnable attribute to TRUE.
 - iii) Set the StreamGateAdminGateStates to open.
 - iv) Set the StreamGateAdminIPV to the value of the entry minus one.
 - v) Allocate a new StreamFilterInstance.
 - vi) Set the StreamHandleSpec to the wildcard.
 - vii) Set the PrioritySpec to the index of the entry.
 - viii) Set the StreamGateInstanceID to the StreamGateInstance.
 - 3) If the value of the entry in ciQueueMap[] is negative, the index specifies a congesting queue and the value can be translated to a monitored queue. Create a stream gate and stream filter as follows:
 - i) Allocate a new StreamGateInstance.
 - ii) Set the StreamGateEnable attribute to TRUE.
 - iii) Set the StreamGateAdminGateStates to open.
 - iv) Set the StreamGateAdminIPV to the absolute value of the entry minus one.
 - v) Allocate a new StreamFilterInstance.
 - vi) Set the StreamHandleSpec to none.
 - vii) Set the PrioritySpec to the index of the entry.
 - viii) Set the StreamGateInstanceID to the StreamGateInstance.
 - 4) Set cipCongesting for the queue to false.

49.4.2.2 EM_UNITDATA.request (parameters)

A CIP offers an instance of the EISS (6.8) to the Queuing frames function (8.6.6). When called upon to enqueue a frame the priority parameter specifies the target queue that represents the received priority of the frame. The CIP determines if the target queue is a congesting queue or a monitored queue by indexing into the cipQueueMap[] table using the priority parameter.

If the cipQueueMap[priority] value is 0 then the target queue is not participating in congestion isolation and the frame can be enqueued on the target queue with no further processing.

If the cipQueueMap[priority] value is positive then the target queue is a monitored queue. The value from the cipQueueMap[] table determines the congesting queue that will be used for isolating congesting flows from the monitored queue. The congesting queue for this monitored queue is one less than the value of cipQueueMap[priority]

If the cipQueueMap[priority] value is negative then the target queue is a congesting queue. The value from the cipQueueMap[] table determines the monitored queue that will be used for de-isolating congesting flows from the congesting queue. The monitored queue for this congesting queue is one less than the absolute value of cipQueueMap[priority].

The CIP determines if the frame belongs to a flow that has been causing congestion by first checking for the presence of a stream_handle parameter. Frames with the stream_handle parameter are known to be from congesting flows. If the frame does not have a stream_handle and the target queue is a monitored queue, the

CIP interacts with the AQM to determine if the frame is part of a flow that is creating congestion in the monitored queue. Newly identified congesting flows will cause entries to be created in the Stream identity table. If the frame does not have a `stream_handle` and the target queue is a congesting queue, the CIP remaps the priority to the monitored queue by using the translated value from the `cipQueueMap[]` table.

Frames that have a `stream_handle` parameter or have been determined by the AQM (see 49.2.1) to be creating congestion may cause a CIM to be transmitted. The conditions by which a CIM is transmitted are described in `condTransmitCimAddPdu()`.

The CIP uses the same AQM for both the congesting and monitored queues to ensure consistent end-to-end congestion control for frames from a common flow that traverse both queues.

For each frame that is presented for queuing, the CIP performs the following:

- a) Determine if the target queue is a monitored queue, a congesting queue or not participating in CI by indexing into the `cipQueueMap[]` table using the priority parameter and translating the contents as described above.
- b) If the target queue is a monitored queue and the `stream_handle` is not present, then determine if the AQM indicates the frame is from a flow causing congestion in the monitored queue.
 - 1) If the monitored queue is congested:
 - i) Set the LSB and clear the MSB of the `ciStreamCreateMask` to indicate an entry is being created because congestion has been detected locally by the AQM.
 - ii) Call `addCongestingFlow()` to create an entry in the IEEE Std 802.1CB Stream identification function and the CI Stream Table and initialize the `ciCIMCount` variable to 0.
 - iii) Call `condTransmitCimAddPdu()` to conditionally generate and transmit a CIM to the peer.
 - iv) Modify the frame's PCP to indicate the priority of the congesting queue.
 - v) Enqueue the frame on the congesting queue.
 - vi) Set `cipCongesting` true.
 - 2) If the monitored queue is not congested, enqueue the frame on the monitored queue.
- c) If the target queue is a monitored or a congesting queue and the `stream_handle` is present, the frame is from a congesting flow. Determine from the AQM if the congesting queue is empty, congested, or not congested.
 - 1) If the congesting queue is empty, call `flushCongestingFlows()` to remove all flows from the IEEE Std 802.1CB Stream identification function and the CI Stream Table for the target queue.
 - 2) If the congesting queue is congested:
 - i) Load the `ciCIMCount` variable with the value from the CI Stream Table.
 - ii) Call `condTransmitCimAddPdu()` to conditionally generate and transmit a CIM to the peer.
 - 3) If the congesting queue is not congested, then optionally:
 - i) Call `delCongestingFlow()` to remove the flow from the IEEE Std 802.1CB Stream identification function and the CI Stream Table.
 - ii) Ensure the `cipGateControl` variable for the monitored and congesting queues are properly set to ensure ordering requirements for the transmission selection algorithm in use.
 - iii) Modify the frame's PCP to indicate the priority of the monitored queue.
 - iv) Enqueue the frame on the monitored queue.
 - 4) If the target queue is a monitored queue, reset the `ciCIMCount` variable in the CI Stream Table.
- d) If the target queue is a congesting queue and the `stream_handle` is not present, the frame is from a flow that may be congesting upstream, but is not congesting locally. The frame priority can be remapped back to the monitored queue.
 - i) The PCP is modified to indicate the priority of the monitored queue.
 - ii) The frame is enqueued on the monitored queue.

- e) Check if the congesting queue is empty and call `flushCongestingFlows()` to remove all flows from the IEEE Std 802.1CB Stream identification function and the CI Stream Table for the congesting queue.

49.4.2.3 `condTransmitCimAddPdu()`

This is called by the CIP to conditionally generate and transmit a CIM instructing the peer to add a congesting flow. A CIM will be generated and transmitted if fewer than `ciMaxCIM` messages have been sent since the `ciCIMCount` was last reset and the AQM has determined that the congesting queue is congested. The `ciCIMCount` variable is loaded prior to invoking `condTransmitCimAddPdu()`.

NOTE—Implementations may have additional conditions to restrict or allow the creation of CIMs for adding congesting flows without risking interoperability.

The procedure performs the following:

- a) If the `ciCIMCount` is less than `ciMaxCIM` and the AQM indicates the congesting queue is congested then do the following:
 - 1) Set `ciAddDel` to *add*
 - 2) Call `buildAndSendCim()`

49.4.2.4 `transmitCimDelPdu()`

This is called by the CIP to generate and transmit a CIM instructing the peer that a congesting flow is being removed from the IEEE Std 802.1CB Stream identity table and the CI Stream Table.

The procedure performs the following:

- a) Set `ciAddDel` to *delete*
- b) Call `buildAndSendCim()`

49.4.2.5 `buildAndSendCim()`

This is a common procedure shared by `condTransmitCimAddPdu()` and `transmitCimDelPdu()` to construct and send the CIM. To properly generate the CIM, the CI Peer Table must be searched to retrieve the type of CIM and the address information of the peer that will receive the CIM. There are three formats for a CIM; layer-2, IPv4, and IPv6. All of the formats encapsulate a common CIM PDU. The CIM is constructed in the space provided by the parameters of the `EM_UNITDATA.indication`. The local variables holding the parameters from an `EM_UNITDATA.request` are expected to be loaded before the procedure is invoked, whether those parameters came from an actual `EM_UNITDATA.request` or were loaded from the CI Stream Table. The local `ciAddDel` variable determines the contents of the Add/Del field of the CIM PDU. The local `ciRxPort` determines the source port of the congesting flow that is represented in the CIM.

The procedure performs the following:

- a) Search the CI Peer Table (12.33.2) using `ciRxPort` as an index to obtain the `ciCIMType`, `ciPeerMacAddress`, and `ciPeerCIMEncapLen` for the peer. If the `ciCIMType` is `ipv4` then obtain the `ciPeerIPv4Address` and `ciPeerUDPPort` from the entry. If the `ciCIMType` is `ipv6` then obtain the `ciPeerIPv6Address` and `ciPeerUDPPort` from the entry. If the entry is not found the procedure does nothing; no further processing takes place and no CIM will be generated or transmitted.
- b) Fill the Version (49.4.3.4.1) field of the CIM PDU with 0.
- c) If `ciAddDel` is *add* then set the Add/Del bit to 1 otherwise set the Add/Del bit to 0.
- d) Set the `destination_address` (49.4.3.4.4) of the CIM PDU to the value of the `destination_address`.
- e) Set the `source_address` (49.4.3.4.5) of the CIM PDU to the value of the `source_address`.
- f) Set the `vlan_identifier` (49.4.3.4.6) of the CIM PDU to the value of the `vlan_identifier`.

- g) Fill the Encapsulated MSDU (49.4.3.4.8) field with the first octets of the `mac_service_data_unit`. The Encapsulated MSDU field should be filled with the lesser of `ciPeerCIMEncapLen` or the length of the `mac_service_data_unit`.
- h) Set the Encapsulated MSDU length (49.4.3.4.7) to the number of octets filled into the Encapsulated MSDU field.
- i) The format of the CIM constructed in the `mac_service_data_unit` of the `EM_UNITDATA.indication` depends upon the `ciCIMType` variable as follows:
 - 1) If the `ciCIMType` is l2:
 - i) Insert the CIM PDU EtherType (Table 49-1) encapsulation at the beginning of the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - ii) Fill the Version (49.4.3.1.1) field of the layer 2 CIM encapsulation with 0.
 - iii) Fill the Subtype (49.4.3.1.2) field of the layer 2 CIM encapsulation with 0.
 - 2) If the `ciCIMType` is ipv4:
 - i) Insert the IPv4 EtherType (Figure 49-4) encapsulation at the beginning of the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - ii) Use the `ciPeerIPv4Address` as the destination IPv4 address, the `ciPeerIPv4Address` as the source IPv4 address, and the value 17 as the IP protocol field to construct and insert an IETF RFC 791 compliant IPv4 header after the IPv4 EtherType in the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - iii) Use the `ciPeerUDPPort` as the UDP destination port number and the `ciPeerUDPPort` as the source port number to construct and insert an IETF RFC 768 compliant UDP header after the IPv4 header in the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - 3) If the `ciCIMType` is ipv6:
 - i) Insert the IPv6 EtherType (Figure 49-5) encapsulation at the beginning of the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - ii) Use the `ciPeerIPv6Address` as the destination IPv6 address, the `ciPeerIPv6Address` as the source IPv6 address, and the value 17 as the next header field to construct and insert an IETF RFC 8200 compliant IPv6 header after the IPv6 EtherType in the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
 - iii) Use the `ciPeerUDPPort` as the UDP destination port number and the `ciPeerUDPPort` as the source port number to construct and insert an IETF RFC 768 compliant UDP header after the IPv6 header in the `mac_service_data_unit` of the `EM_UNITDATA.indication`.
- j) Use the `ciPeerMacAddress` as the destination address of the `EM_UNITDATA.indication` for the CIM.
- k) Use the `ciPeerMacAddress` (49.4.1.2.1) as the source address of the `EM_UNITDATA.indication` for the CIM.
- l) Set the priority parameter of the `EM_UNITDATA.indication` for the CIM to the value of the `ciCIMTransmitPriority` (49.4.1.1.2) variable.
- m) Pass the CIM as an `EM_UNITDATA.indication` to the CIM Multiplexer (49.3.5) for transmission to the peer.

49.4.2.6 processCimPdu()

The CIM Demultiplexer (49.3.3) receives CIMs from peers and invokes processCimPdu() to process the CIM and either create entries in the IEEE Std 802.1CB Stream identification function and CI Stream Table or remove entries from the tables. The procedure performs the following actions upon receipt of a CIM:

- a) The CIM is validated according to 49.4.3.5 and is discarded if invalid.
- b) If the Add/Del bit is set do the following:
 - 1) Clear the LSB and set the MSB of the ciStreamCreateMask to indicate an entry is being created because of a received CIM.
 - 2) Extract the parameters and the Encapsulated MSDU from the CIM PDU and call addCongestingFlow().
- c) If the Add/Del bit is clear then do the following:
 - 1) Search the CI Stream Table for an entry that matches the destination_address, source_address, vlan_identifier, and Encapsulated MSDU fields of the CIM.
 - 2) If no entry is found, then processing is done.
 - 3) If the MSB of the ciStreamCreateMask is set, then clear it. Otherwise processing is done.
 - 4) If the LSB of the ciStreamCreateMask is set, then update the CI Stream Table entry with the updated ciStreamCreateMask and processing is done.
 - 5) If the LSB of the ciStreamCreateMask is clear then call delCongestingFlow().

49.4.2.7 addCongestingFlow()

Registers a flow with the IEEE Std 802.1CB Stream identification function as described in 49.2.2. A tsnStreamIdEntry is created by using initialized variables and the contents of the mac_service_data_unit that is obtained from the received frame or the encapsulated header of a received CIM. The set of managed objects that make up the tsnStreamIdEntry are created as follows:

- a) Set the tsnStreamIdHandle object to newly allocated and unique stream_handle.
- b) Set the tsnStreamIdOutFacInputPortList include the list of all ports in the system.
- c) Set the tsnStreamIdOutFacOutputPortList, tsnStreamIdInFacInputPortList, and tsnStreamIdInFacOutputPortList to null.
- d) Set the tsnStreamIdIdentificationType to IP stream identification as specified in IEEE Std 802.1CB.
- e) Set the tsnStreamIdParameters for an IP stream identification type as follows:
 - 1) Set the tsnCpeIpIdDestMac to the destination_address of the received frame or parameter from the CIM.
 - 2) Set the tsnCpeIpIdTagged to the value **all** as specified in IEEE Std 802.1CB.
 - 3) Set the tsnCpeIpIdVlan to the vlan_identifier of the received frame or parameter from the CIM.
 - 4) Set the tsnCpeIpIdIpSource to the IPv4 (IETF RFC 791) or IPv6 (IETF RFC 8200) source address parameter that is contained within the mac_service_data_unit.
 - 5) Set the tsnCpeIpIdIpDestination to the IPv4 (IETF RFC 791) or IPv6 (IETF RFC 8200) destination address parameter that is contained within the mac_service_data_unit.
 - 6) Set the tsnCpeIpIdDscp to a value of 64 decimal to ignore the DSCP (IETF RFC 2474) code point when matching received frames.
 - 7) Set the tsnCpeIpIdNextProtocol to UDP (IETF RFC 768) if the mac_service_data_unit contains a UDP packet, TCP (IETF RFC 793) if it contains a TCP packet, or SCTP (IETF RFC 4960) if it contains an SCTP packet. If the mac_service_data_unit contains another non-supported IP protocol by the implementation then set the tsnCpeIpIdNextProtocol to none and the tsnCpeIpIdSourcePort and tsnCpeIpIdDestinationPort will be ignored.
 - 8) Set the tsnCpeIpIdSourcePort to the UDP, TCP, or SCTP source port number from the mac_service_data_unit. Set the tsnCpeIpIdSourcePort to 0 if the tsnCpeIpIdNextProtocol field is none.

- 9) Set the `tsnCpeIpIdDestinationPort` to the UDP, TCP, or SCTP destination port number from the `mac_service_data_unit`. Set the `tsnCpeIpIdDestinationPort` to 0 if the `tsnCpeIpIdNextProtocol` field is none.
- f) Write the `tsnStreamIdEntry` to the IEEE Std 802.1CB Stream identity table using the specified management operations.
- g) Create a new entry in the CI Stream Table:
 - 1) Set the entry `ciStreamHandleId` index to the `stream_handle`.
 - 2) Set the entry `ciCIMCount` to 0.
 - 3) Set the entry `ciStreamCreateMask` to the variable `ciStreamCreateMask`.
 - 4) Set the entry `ciQueueKey` to the product of the congesting queue plus one and the port number that the queue is supporting.
 - 5) Set the entry `ciDestination_address` to the `destination_address`.
 - 6) Set the entry `ciSource_address` to the `source_address`.
 - 7) Set the entry `ciVlan_identifier` to the `vlan_identifier`.
 - 8) Fill the entry `ciMsdu` with the first octets of the `mac_service_data_unit`. The number of octets to fill the `ciMsdu` attribute with is determined by the lesser of `ciPeerCIMEncapLen` or the length of the `mac_service_data_unit`.
 - 9) Set the entry `ciCreateTime` to `sysUpTime` as specified by IETF RFC 3418.

49.4.2.8 delCongestingFlow()

Removes entries from the IEEE Std 802.1CB Stream identification function and the CI Stream Table as discussed in 49.2.6. The procedure performs the following:

- a) Load the `destination_address`, `source_address`, `vlan_identifier`, and `mac_service_data_unit` parameters from the entry `ciDestination_address`, `ciSource_address`, `ciVlan_identifier`, and `ciMsdu`, respectively.
- b) Call `transmitCimDelPdu()` to inform the peer that a congesting flow is no longer congesting.
- c) Set the `tsnStreamIdHandle` object to the `stream_handle` parameter of the frame triggering the deletion.
- d) Remove the `tsnStreamIdEntry` associated with the `tsnStreamIdHandle` in the IEEE Std 802.1CB Stream identification function.
- e) Remove the CI Stream Table entry.
- f) if `ciCongesting` is true, set `ciCongesting` false and set `ciNonCongestedTime` to `sysUpTime`.

49.4.2.9 flushCongestingFlows()

Removes all entries from the IEEE Std 802.1CB Stream identification function that were not created because of the receipt of a CIM and are associated with the current congesting queue at the egress port as discussed in 49.2.6. The procedure performs the following:

- a) Calculate the `ciQueueKey` by taking the product of the congesting traffic class plus one and the egress port number.
- b) For each entry in the CI Stream Table with the same `ciQueueKey` and the MSB of the `ciCreateMask` in the entry is not set:
 - 1) Load the `destination_address`, `source_address`, `vlan_identifier`, and `mac_service_data_unit` parameters from the entry `ciDestination_address`, `ciSource_address`, `ciVlan_identifier`, and `ciMsdu`, respectively.
 - 2) Call `transmitCimDelPdu()` to inform the peer that a congesting flow is no longer congesting.
 - 3) Set the `tsnStreamIdHandle` object to the `ciStreamIdHandle`.
 - 4) Remove the `tsnStreamIdEntry` associated with the `tsnStreamIdHandle` in the IEEE Std 802.1CB Stream identification function.
 - 5) Remove the CI Stream Table entry.

- c) if `cipCongesting` is true, set `cipCongesting` false and set `cipNonCongestedTime` to `sysUpTime`.

49.4.2.10 periodicTableCleanup()

A background procedure that calculates the number of centiseconds between the creation time of a CI Stream Table entry (49.4.1.5.3) and the `cipNonCongestedTime` (49.4.1.4.2), and removes any entries with only the MSB of the `ciStreamCreateMask` (49.4.1.5.4) set that have a calculated value greater than `ciMaxFlowLife` (49.4.1.1.3). The procedure should be invoked at least once every `ciMaxFlowLife` time intervals. The procedure performs the following:

- a) For each entry in the CI Stream Table with the MSB set and the LSB clear in the `ciStreamCreateMask`:
 - 1) Calculate the difference between the `cipNonCongestedTime` for the queue specified by the `ciQueueKey` and the entry `ciCreateTime`.
 - 2) If the difference is greater than `ciMaxFlowLife`:
 - i) Load the `destination_address`, `source_address`, `vlan_identifier`, and `mac_service_data_unit` parameters from the entry `ciDestination_address`, `ciSource_address`, `ciVlan_identifier`, and `ciMsdu`, respectively.
 - ii) Call `transmitCimDelPdu()` to inform the peer that a congesting flow is no longer congesting.
 - iii) Set the `tsnStreamIdHandle` object to the `ciStreamIdHandle`.
 - iv) Remove the `tsnStreamIdEntry` associated with the `tsnStreamIdHandle` in the IEEE Std 802.1CB Stream identification function.
 - v) Remove the CI Stream Table entry.

49.4.3 Encoding of the CIM PDU

This subclause specifies the method of encoding Congestion Isolation Message (CIM) PDUs. There are three ways of encapsulating CIM PDUs; a layer-2 CIM PDU encapsulation that can be delivered to peers via the Bridge relay and IPv4 and IPv6 layer-3 CIM PDU encapsulations that can be delivered to peers via a higher layer entity above Bridge relay such as a router. All CIMs contain an integral number of octets.

The octets in a Congestion Isolation Message PDU are numbered starting from 1 and increasing in the order they are put into the MSDU that accompanies a request to or indication from the instance of the MAC Internal Sublayer Service (ISS or EISS) used by a congestion isolation entity. The bits in an octet are numbered from 1 to 8 in order of increasing bit significance, where 1 is the LSB in the octet.

Where octets and bits within a Congestion Isolation Message PDU are represented using a diagram, octets shown higher on the page than subsequent octets and octets shown to the left of subsequent octets at the same height on the page are lower numbered; bits shown to the left of other bits within the same octet are higher numbered.

Where two or more consecutive octets are represented as hexadecimal values, lower numbered octet(s) are shown to the left and each octet following the first is preceded by a hyphen, for example, 01-80-C2-00-00-00. When consecutive octets are used to encode a binary number, the lower octet number has the more significant value. When consecutive bits within an octet are used to encode a binary number, the higher bit number has the most significant value. When bits within consecutive octets are used to encode a binary number, the lower octet number composes the more significant bits of the number. A flag is encoded as a single bit, and is set (TRUE) if the bit takes the value 1, and clear (FALSE) otherwise. The remaining bits within the octet can be used to encode other protocol fields.

49.4.3.1 Layer-2 CIM PDU encapsulation

The means for identifying layer-2 encapsulated CIM PDUs consists of two octets containing the EtherType value shown (in hexadecimal notation) in Table 49-1.

Table 49-1—Congestion Isolation Message EtherType

Name	Value
IEEE 802.1Q Congestion Isolation Message (CIM)	89-A2

The layer-2 CIM PDU encapsulation is shown in Figure 49-3.

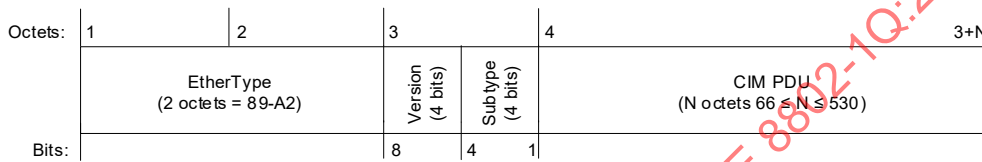


Figure 49-3—Layer-2 CIM encapsulation

49.4.3.1.1 .Version

This field, 4 bits in length, shall be transmitted with the value 0 in this standard. If two Version fields are interpreted as unsigned binary numbers, the greater identifies the more recently defined Version. The Version field occupies the most significant bits of the first octet of the layer-2 CIM encapsulation.

49.4.3.1.2 Subtype

This field, 4 bits in length, shall be transmitted with the value 0 to indicate an encapsulated CIM PDU. The Subtype field occupies the least significant 4 bits of the first octet of the layer-2 CIM encapsulation.

49.4.3.2 IPv4 layer-3 CIM PDU encapsulation

The means of identifying IPv4 layer-3 encapsulated CIM PDUs consist of 2 octets containing the EtherType value for IPv4 packets (08-00) as well as the associated IPv4 header decoding for a UDP datagram carrying the CIM PDU. The encoding of an IPv4 header is defined in IETF RFC 791. IP options are not included in the IPv4 layer-3 encapsulated CIM PDU. The IP protocol field in the IPv4 header consists of 1 octet and identifies the UDP datagram with the value 17. The encoding of a UDP header is defined in IETF RFC 768. The destination port field of the UDP header consists of 2 octets and identifies the encapsulated CIM PDU with the value from the ciPeerUDPPort field of the CI Peer Table (12.33.2) for the row associated with the port of the receiving upstream peer. The source port field of the UDP header is the value of the ciPCIMUDPPort variable. The IPv4 encapsulation is shown in Figure 49-4.

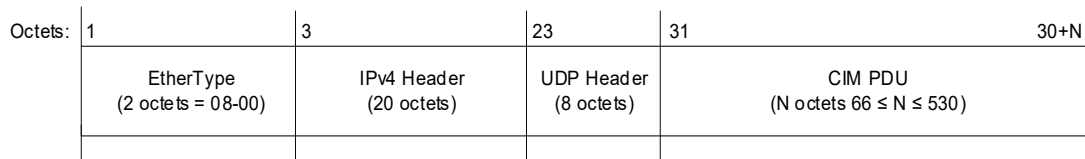


Figure 49-4—IPv4 layer-3 CIM encapsulation

49.4.3.3 IPv6 layer-3 CIM PDU encapsulation

The means of identifying IPv6 layer-3 encapsulated CIM PDUs consist of 2 octets containing the EtherType value for IPv6 packets (86-DD) as well as the associated IPv6 header decoding for a UDP datagram carrying the CIM PDU. The encoding of an IPv6 header is defined in IETF RFC 8200. IPv6 Extension Headers are not used in the IPv6 layer-3 encapsulated CIM PDU. The next header field in the IPv6 headers indicates the upper layer protocol field and consists of 1 octet identifying the UDP datagram with the value 17. The encoding of a UDP header is defined in RFC 768. The destination port field of the UDP header consists of 2 octets and identifies the encapsulated CIM PDU with the value from the ciPeerUDPPort field of the CI Peer Table (12.33.2) for the row associated with the port of the receiving upstream peer. The source port field of the UDP header is the value of the cipCIMUDPPort variable. The IPv6 encapsulation is shown in Figure 49-5.

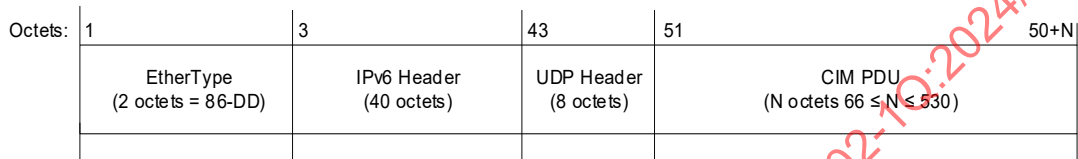


Figure 49-5—IPv6 layer-3 CIM encapsulation

49.4.3.4 Congestion Isolation Message PDU format

The format of a Congestion Isolation Message (CIM) PDU is illustrated in Figure 49-6.

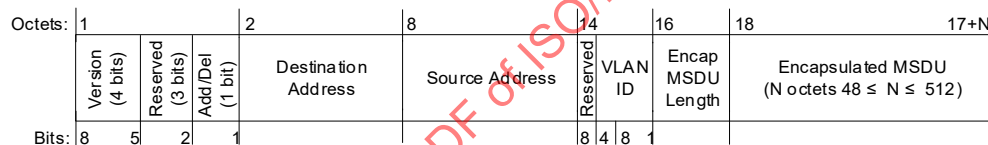


Figure 49-6—CIM PDU

49.4.3.4.1 Version

This field, 4 bits in length, shall be transmitted with the value 0 in this standard. If two Version fields are interpreted as unsigned binary numbers, the greater identifies the more recently defined Version. The Version field occupies the most significant bits of the first octet of the CIM PDU.

49.4.3.4.2 Reserved

This field, 3 bits in length, shall be transmitted as 0 and ignored on receipt.

49.4.3.4.3 Add/Del

This field, 1 bit in length, instructs the peer to add a congesting flow entry to the IEEE Std 802.1CB Stream identity table and the CI Stream Table, or to remove an entry. When the bit is set, the peer is instructed to add, and when the bit is clear, the peer is instructed to delete. The Add/Del bit occupies the least significant bit of the first octet of the CIM PDU.

49.4.3.4.4 destination_address

This field, 6 octets in length, contains the destination MAC address of the frame triggering the transmission of this CIM.

49.4.3.4.5 source_address

This field, 6 octets in length, contains the source MAC address of the frame triggering the transmission of this CIM.

49.4.3.4.6 vlan_identifier

This field, 12 bits in length, contains the VLAN Identifier for the frame triggering the transmission of this CIM.

49.4.3.4.7 Encapsulated MSDU length

This field, 2 octets in length, contains the number of octets returned in the Encapsulated MSDU field. The minimum value is 48. The maximum value is 512.

49.4.3.4.8 Encapsulated MSDU

This field, a maximum of 512 octets in length, contains the initial octets of the mac_service_data_unit of the frame that triggered the transmission of this CIM.

49.4.3.5 CIM Validation

A CIM PDU received by a CIM Demultiplexer (49.3.3) shall be considered invalid and be discarded if:

- a) There are fewer than 48 octets in the mac_service_data_unit or greater than 512.
- b) The Encapsulated MSDU length is less than 48 or greater than 512.

The following condition shall not cause a received CIM PDU to be considered invalid:

- c) There are nonzero bits in the Version (49.4.3.4.1) field.

49.4.4 LLDP Congestion Isolation TLV

The Congestion Isolation TLV (D.2.15) is used to advertise support for Congestion Isolation to peers on the network. It informs the peers of the configuration of local monitored queues and the congesting queue in order to detect potential misconfiguration. It also advertises the desired length of the encapsulated headers sent in a CIM. The source address of a received LLDPDU is used to populate the CI Peer Table (49.3.6) in order to properly form a CIM.

49.4.4.1 LLDP Congestion Isolation TLV procedures

When the congestion isolation aware LLDP agent detects a change in the set of TLVs advertised by a peer it will invoke the relevant LLDP TLV procedures to add or delete entries in the CI Peer Table (12.33.2). The congestion isolation TLV procedures include:

- a) addCiPeer() (49.4.4.1.1)
- b) delCiPeer() (49.4.4.1.2)

49.4.4.1.1 addCiPeer()

This creates or updates a CI Peer Table entry. The entry is indexed by the port number of the received LLDPDU. The procedure performs the following:

- a) Set the table index to the port of the received LLDPDU.
- b) Set the ciPeerMacAddress to the MAC Address field (D.2.15.5) of the Congestion Isolation TLV.
- c) If the Address Family field (D.2.15.7) of the Congestion Isolation TLV is 1, set the ciPeerIPv4Address to the IP Address field (D.2.15.8) of the Congestion Isolation TLV.
- d) If the Address Family field (D.2.15.7) of the Congestion Isolation TLV is 2, set the ciPeerIPv6Address to the IP Address field (D.2.15.8) of the Congestion Isolation TLV.
- e) Set the ciPeerUDPPort to the UDP Port Number field (D.2.15.6) of the Congestion Isolation TLV.
- f) Set the ciPeerCIMEncapLen to the CIM Encap Length field (D.2.15.4) of the Congestion Isolation TLV.
- g) Write the CI Peer Table entry into the CI Peer Table at the table index.

49.4.4.1.2 delCiPeer()

This deletes a CI Peer Table entry. The entry is indexed by the port number of the received LLDPDU that indicates a congestion isolation peer is no longer present or enabled. The procedure performs the following:

- a) Set the table index to the port where the missing or disabled CI peer is detected.
- b) Delete the CI Peer Table entry at the table index.

49.5 Topology Recognition

Bridges, routers, and end stations in the data center network can determine their level and port orientation within the topology through the use of the LLDP Topology Recognition TLV (D.2.16) and the manipulation of associated managed objects. The level in the topology is relative to non-relay end stations or servers at the edge of the network. Non-relay end stations or servers are at level 0. Bridges or routers attached to non-relay end stations or servers are at level 1 or higher. Virtualization environments, including those that support an edge relay defined by this standard (Clause 40), are end stations that contain a relay and appear at level 1 or higher in the topology. The virtual stations within the virtualization environment appear at level 0.

The systems can determine their level in the topology and the receiving port's orientation by examining the current state of the Topology Recognition (TR) variables and manipulating them based on the received values in the LLDP Topology Recognition TLV. This subclause specifies how to determine a system's level and a port's orientation within the topology. It includes:

- a) TR theory of operation (49.5.1)
- b) TR variables controlling operation (49.5.2)
- c) TR procedures (49.5.3)

49.5.1 TR theory of operation

The TR functionality is supported by a set of procedures and controlling variables that map to attributes of the LLDP Topology Recognition TLV. Changes to the controlling variables will update the associated objects in the IEEE 802.1/LLDP extension MIB (D.5) and the trSet() procedure defined in this clause will cause the transmission of an LLDPDU to occur by invoking the somethingChangedLocal() procedure defined in IEEE Std 802.1AB. When attributes of a received LLDP Topology Recognition TLV change, the somethingChangedRemote() procedure in IEEE Std 802.1AB is invoked and control is passed to the trUpdate() procedure to process the changes. The TR procedures that act upon the changes ensure that the values of the controlling variables converge to a set of consistent values that represent the topology level and port orientation of all participating devices in the network.

The LLDP Topology Recognition TLV contains three attributes that enable the recognition process; the device type, the currently known topology level, and the currently known port orientation. The device type includes non-relay end stations or servers, Bridges, and routers. The topology level attribute contains the level number (0 through 254) or the value of unknown (255). The port orientation indicates whether the port is facing an *uplink*, *downlink*, *crosslink*, or whether the orientation is *unknown*. The trDeviceType variable holds the device type of a system and is a known factory setting of the device. The initial value of the level is held in the trLevel variable and the initial value of the port orientation is held in the trPortOrientation variable. These values are known by non-relay end stations or servers because they are at the edge of the network and are always at level 0 with a port orientation of *uplink*. Bridges and routers initially do not know their level or port orientation, but will recognize them when they receive LLDP Topology Recognition TLVs from peers that have non-relay end stations or servers attached. There is a single trLevel variable for the system, but each port contains a trPortOrientation. As TLVs are exchanged and changes are processed by the procedures, the contents of trLevel and trPortOrientation are updated to converge upon the representation of the stable state of the active topology.

49.5.2 TR variables controlling operation

The TR variables controlling operation hold the contents of attributes sent in the LLDP Topology Recognition TLV and can be updated by the TR procedures. The TR variables include:

- a) trDeviceType (49.5.2.1)
- b) trLevel (49.5.2.2)
- c) trPortOrientation (49.5.2.3)

49.5.2.1 trDeviceType

The trDeviceType is a read-only variable that contains the contents of the Device Type field of the LLDP Topology Recognition TLV. The possible values of the trDeviceType are assigned as a factory setting and are specified in Table D-13a.

49.5.2.2 trLevel

A single octet integer holding the currently known level of the system in the topology. Non-relay end stations or servers shall set this variable to 0. Other systems shall initialize this variable to 255 indicating unknown and can set the variable to values between 1 and 254 as determined by the TR procedures (49.5.3). The content of the trLevel variable is used for the Topology Level field of the LLDP Topology Recognition TLV.

49.5.2.3 trPortOrientation

Each port in a participating system has a trPortOrientation variable that holds the contents of the currently known Port Orientation of the LLDP Topology Recognition TLV. The possible values of the trPortOrientation variable are specified in Table D-13b. Non-relay end stations or servers shall set the trPortOrientation variable to *uplink*. Other systems shall initialize this variable to *unknown* and will update the variable to either *uplink*, *downlink*, or *crosslink* as determined by the TR procedures (49.5.3).

49.5.3 TR procedures

The TR procedures process changes and cause the transmission of LLDP Topology Recognition TLVs. The procedures modify the TR variables and implement the algorithm that allows topology level and port orientation recognition to converge upon a stable set of variables in the topology. The procedures include:

- a) trInit() (49.5.3.1)
- b) trSet() (49.5.3.2)
- c) trUpdate() (49.5.3.3)

49.5.3.1 trInit()

The trInit() procedure initializes the controlling variables to a known state after system initialization or a restart of the TR functionality. The procedure performs the following:

- a) If trDeviceType is 0, specifying a non-relay end station or server then:
 - 1) Set trLevel to 0.
 - 2) Set trPortOrientation to *uplink*.
- b) If trDeviceType is not 0:
 - 1) Set trLevel to 255, specifying *unknown*.
 - 2) Set trPortOrientation to 255, specifying *unknown*.
- c) Call trSet() to cause the transmission of an LLDPDU to peers.

49.5.3.2 trSet()

This calls the somethingChangedLocal() procedure defined in IEEE Std 802.1AB, which causes the transmission of an LLDPDU. The trLevel and trPortOrientation variables map to objects in the IEEE 802.1/LLDP extension MIB (D.5). A change to the single system wide trLevel variable causes the transmission of an LLDPDU on each participating port. A change to the per-port trPortOrientation variable causes the transmission of an LLDPDU on the associated port.

49.5.3.3 trUpdate()

The trUpdate() procedure is invoked when the somethingChangedRemote() procedure, defined in IEEE Std 802.1AB, determines that fields of a received LLDP Topology Recognition TLV have changed. The procedure is responsible for updating the local TR variables and calling trSet() according to the following algorithm:

- a) If trDeviceType is 0, the receiving system is a non-relay end station or server and no action is required. The procedure exits.
- b) If trDeviceType is not 0, the following steps are taken depending upon the current state of trLevel and trPortOrientation for the receiving port:
 - 1) If the received Topology Level is *unknown*, the peer is not providing additional information and no further action is required and the procedure exits.
 - 2) If the received Topology Level is known with a value of L , where L is the current value of trLevel:
 - i) If trPortOrientation is *crosslink*, no further action is required and the procedure exits.
 - ii) Set trPortOrientation of the receiving port to *crosslink*.
 - 3) If the received Topology Level is known with a value of $L + 1$, where L is the current value of trLevel:
 - i) If trPortOrientation is *uplink*, no further action is required and the procedure exits.
 - ii) Set trPortOrientation of the receiving port to *uplink*.
 - 4) If the received Topology Level is known with a value of $L - 1$, where L is the current value of trLevel:
 - i) If trPortOrientation is *downlink*, no further action is required and the procedure exits.
 - ii) Set trPortOrientation of the receiving port to *downlink*.
 - 5) If the received Topology Level is known and is less than trLevel – 1 or trLevel is *unknown*:
 - i) Set trLevel to the received Topology Level plus one.
 - ii) Set trPortOrientation of the receiving port to *downlink*.
 - iii) Set trPortOrientation of all other ports to *unknown*.
- 6) Call trSet().

Annex A

(normative)

PICS proforma—Bridge implementations¹³

A.5 Major capabilities

Insert the following row at the end of the table in A.5 (unchanged rows not shown):

Item	Feature	Status	References	Support
CI	Does the implementation support Congestion Isolation?	O	5.4.7, Clause 49	Yes [] No []

A.7 Relay and filtering of frames

Insert the following rows at the end of the table in A.7 (unchanged rows not shown):

Item	Feature	Status	References	Support
RLY-21	Does the implementation assign colors to frames before processing by flow meters according to 8.6.5.5?	PSFP:M ~PSFP:O	8.6.5.5	Yes [] No []
RLY-22	Is the frame color assigned according to 8.6.5.5, items k) and l)?	RLY-21:M	8.6.5.5, items k) and l)	Yes [] N/A []
RLY-23	State the algorithm by which the color of frames prior to processing by flow meters according to 8.6.5.5 is assigned.	~RLY-22:M	8.6.5.5	A1:Algorithm

¹³ Copyright release for PICS proformas: Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

A.14 Bridge management

Insert the following row at the end of the table in A.14 (unchanged rows not shown):

Item	Feature	Status	References	Support
MGT-252	Does the implementation support the management entities defined for congestion isolation in 12.33?	CI: M	5.4.7 item e), 12.33, 49.4	Yes [] N/A []

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A.47 YANG

Insert a row for “YANG-STREAMS-BRIDGE” before the row for “YANG-ATS”, change the row for “YANG-ATS”, and insert three rows at the end of the table in A.47 (unchanged rows not shown):

Item	Feature	Status	References	Support	
YANG-STREAMS-BRIDGE	Is the <i>ieee802-dot1q-stream-filters-gates-bridge</i> module supported?	ATS:O	48.6.12	Yes ☐	No ☐
YANG-ATS	Is the <i>ieee802-dot1q-ats</i> module supported?	ATS:O	48.6.12 48.6.13	Yes ☐	No ☐
YANG-ATS-BRIDGE	Is the <i>ieee802-dot1q-ats-bridge</i> module supported?	ATS:O	48.6.14	Yes ☐	No ☐
YANG-CI	Is the <i>ieee802-dot1q-congestion-isolation</i> module supported?	CI:O	48.6.15	Yes ☐	No ☐
YANG-CI-BRIDGE	Is the <i>ieee802-dot1q-congestion-isolation-bridge</i> module supported?	CI:O	48.6.16	Yes ☐	No ☐

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Insert A.53 after A.52 as follows:

A.53 Congestion Isolation

Item	Feature	Status	References	Support
	If the functionality of Congestion Isolation (CI of A.5) is not supported, mark N/A and ignore the remainder of this table.		5.4.7, 8.6.5.2.3, 8.6.5.3, 8.6.8.6, 12.33, Clause 49	N/A []
CI-1	Does the Bridge support the creation of at least one CIP on at least one Port?	BRG1 AND CI:M	5.4.7 item a), 49.3	Yes []
CI-2	Does the implementation support IETF RFC 3168 Explicit Congestion Notification?	CI:M	49.2.1, IETF RFC 3168	Yes []
CI-3	Does the implementation support per-stream classification and metering for CI as specified in 8.6.5.2.3?	CI:M	5.4.7 item c), 8.6.5.2.3	Yes []
CI-4	Does the implementation support the variables and procedures of the Congestion Isolation Protocol?	CI:M	49.4	Yes []
CI-5	Does the implementation support the ability to configure the variables controlling the operation of Congestion Isolation?	CI:M	12.33	Yes []
CI-6	Does the implementation support LLDP?	CI:M	IEEE Std 802.1AB	Yes []
CI-7	Does the implementation support the Congestion Isolation TLV in LLDP?	CI:M	D.2.15	Yes []
CI-8	Does the implementation support the ability to monitor more than one queue on a Bridge Port?	CI:O	49.4.1.2.5	Yes [] No []
CI-9	Does the implementation support transmission selection algorithms other than strict priority?	CI:O	49.2.3, 49.3.2	Yes [] No []
CI-10	Does the implementation support the ability to return a flow to non-congesting status when the congesting queue is not empty?	CI:O	49.2.6	Yes [] No []
CI-11	Does the implementation support Topology Recognition?	CI:O	49.5	Yes [] No []

Annex B

(normative)

PICS proforma—End station implementations¹⁴

B.5 Major capabilities

Insert the following row at the end of the table in B.5 (unchanged rows not shown):

Item	Feature	Status	References	Support
CI-S	Does the implementation support the functionality of a Congestion Isolation?	O	5.32, Clause 49	Yes [] No []

Insert B.19 after B.18 as follows:

B.19 Congestion Isolation

Item	Feature	Status	References	Support
	If Congestion Isolation (CI-S in B.5) is not supported, mark N/A and ignore the remainder of this table.			N/A []
CI-S-1	Does the implementation support IETF RFC 3168 Explicit Congestion Notification?	CI-S:M	49.2.1, IETF RFC 3168	Yes []
CI-S-2	Does the implementation support the variables and procedures of the Congestion Isolation Protocol?	CI-S:M	49.4	Yes []
CI-S-3	Does the implementation support LLDP?	CI-S:M	IEEE Std 802.1AB	Yes []
CI-S-4	Does the implementation support the Congestion Isolation TLV in LLDP?	CI-S:M	D.2.15	Yes []
CI-S-5	Does the implementation support transmission selection algorithms other than strict priority?	CI-S:O	49.2.3, 49.3.2	Yes [] No []
CI-S-6	Does the implementation support the ability to return a flow to non-congesting status when the congesting queue is not empty?	CI-S:O	49.2.6	Yes [] No []
CI-S-7	Is the <i>ieee802-dot1q-congestion-isolation</i> module supported?	CI-S AND YANG:O	48.2.8	Yes [] N/A [] No []
CI-S-8	Does the implementation support Topology Recognition	CI-S:O	49.5	Yes [] No []

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Annex D

(normative)

IEEE 802.1 Organizationally Specific TLVs

D.1 Requirements of the IEEE 802.1 Organizationally Specific TLV sets

*Insert new rows at the end of Table D-1 as follows (unchanged rows not shown):***Table D-1—IEEE 802.1 Organizationally Specific TLVs**

IEEE 802.1 subtype	TLV name	TLV set name	TLV reference	Feature clause reference
11	LRP ECP Discovery TLV	lrpSet	IEEE Std 802.1CS	IEEE Std 802.1CS
12	LRP TCP Discovery TLV	lrpSet	IEEE Std 802.1CS	IEEE Std 802.1CS
13	Congestion Isolation TLV	ciSet	D.2.15	49.4.4
14	Topology Recognition TLV	trSet	D.2.16	49.5

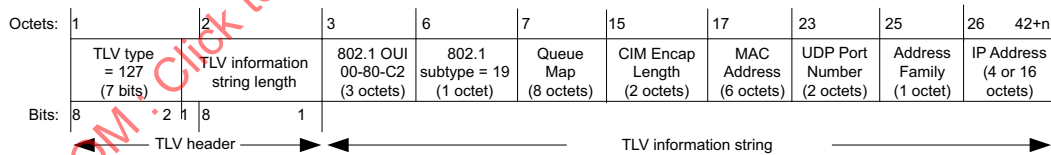
D.2 Organizationally Specific TLV definitions

Insert D.2.15 and D.2.16 after D.2.14 as follows:

D.2.15 Congestion Isolation TLV

The Congestion Isolation TLV is an optional TLV that allows an IEEE 802.1Q-compliant Bridge and an IEEE 802.1Q-compatible IEEE 802 LAN station to discover each other and exchange configuration information for congestion isolation.

Figure D-15 shows the Congestion Isolation TLV format.

**Figure D-15—Congestion Isolation TLV format**

D.2.15.1 TLV type

A 7-bit integer value occupying the most-significant bits of the first octet of the TLV. Always contains the value 127.

D.2.15.2 TLV information string length

The TLV information string length field of the Congestion Isolation TLV depends on the Address Family specified for the IP Address field and shall contain the value 25 if the Address Family is 1 (IPv4), the value 37 if the Address Family is 2 (IPv6), or the value 21 if the Address Family is anything other than 1 or 2.

D.2.15.3 Queue Map

Eight octets, one for each traffic class supported by the Bridge or end station. The least significant octet represents traffic class 0 and the most significant octet represents traffic class 7. The content of each octet specifies a signed numeric value that can be translated to the value of the traffic class to be used as either the congesting queue or the monitored queue for the represented traffic class. The contents of each octet is a signed numeric value between -8 and 8 . A value of 0 specifies that there is no mapping for the traffic class and that it is not participating in congestion isolation. A positive number specifies a traffic class for a monitored queue that is one less than the value (e.g., a value of 5 represents traffic class 4). A negative number specifies a traffic class for a congesting queue that is one less than the absolute value (e.g., a value of -4 represents traffic class 3).

D.2.15.4 CIM Encap Length

A 2-octet unsigned integer representing the requested length in octets of the data from the frame of a congesting flow to be encapsulated into a CIM by a peer. The default and minimum required value is 48. The maximum value is 512.

D.2.15.5 MAC Address

The 6-octet MAC address that can be used as the destination MAC address for a CIM to the Bridge or end station sending this TLV.

D.2.15.6 UDP Port Number

An integer value indicating the UDP port number to be used by the peer when creating a layer-3 CIM. The value of the UDP port number is within the dynamic port number range of 49152 to 65535 as specified by IETF RFC 6335 (e.g., 58622).

D.2.15.7 Address Family

An integer value indicating the type of address that is listed in the address field. Enumeration for this field is contained in the `ianaAddressFamilyNumbers` module of the IETF RFC 3232 on-line database that is accessible through a web page (<http://www.iana.org>). Only two types are recognized with the following definitions; 1=IPv4 and 2=IPv6.

D.2.15.8 IP Address

An octet string with length of 0, 4, or 16 octets dependent upon the Address Family specified. If the Address Family is 1, the address shall be an IPv4 address as specified in IETF RFC 791. If the Address Family is 2, the address shall be an IPv6 address as specified in IETF RFC 8200. No address shall be provided for any other Address Families.

NOTE—If the CIM PDU is layer 2 encapsulated, the MAC address field is already provided and the Address Family should be anything other than 1 or 2. For layer 2 encapsulated CIM PDUs, it is recommended to use the Address Family value of 6 for IEEE 802 addresses.

D.2.15.9 Congestion Isolation TLV usage rules

The priority of a congesting queue shall be lower than the priority of all monitored queues.

D.2.16 Topology Recognition TLV

The Topology Recognition TLV is an optional TLV that allows an IEEE 802.1Q-compliant Bridge and an IEEE 802.1Q-compatible IEEE 802 LAN station to discover and determine the position of the system in the data center topology. End-stations are always at level 0 and Bridges or routers are at levels greater than 0 depending upon the number of links between the Bridge or router and the end-station.

Figure D-16 shows the Topology Recognition TLV format:

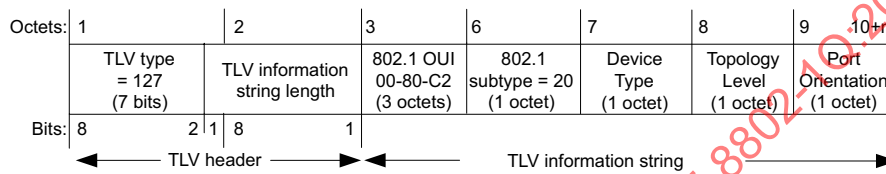


Figure D-16—Topology Recognition TLV Format

D.2.16.1 TLV Type

A 7-bit integer value occupying the most-significant bits of the first octet of the TLV. Always contains the value 127.

D.2.16.2 TLV information string length

The TLV information string length field of the Congestion Isolation TLV is fixed and shall contain the value 7.

D.2.16.3 Device Type

The Device Type field indicates what type of device is sending the Topology Recognition TLV. End-stations or servers that are non-relay systems are at the edge of the topology and shall use the value 0. Table D-13a specifies valid values for the Device Type field.

Table D-13a—Device Type field values

Device Type	Value/meaning
0	end-station/server
1	bridge
2	router
3–254	reserved
255	unknown

D.2.16.4 Topology Level

An integer indicating the system's understanding of its current level in the topology. The value of 0 indicates the edge of the topology and the value 255 indicates the level is currently unknown. Other non-zero values indicate the minimum number of links between the system and the edge of the topology. Initially systems may not know their position in the topology and will use the value of unknown by default. As systems discover the device type and topology level of their peers the topology level of the sending system may change. The procedures that implement the recognition of the topology level are described in 49.5.3.

D.2.16.5 Port Orientation

The Port Orientation field indicates whether the port is facing an *uplink*, *downlink*, *crosslink*, or the orientation is *unknown*. An *uplink* is a port that is facing a system that is deeper in the topology (i.e., has a Topology Level greater than the sending system). A *downlink* is a port that is facing a system closer to the edge of the topology (i.e., has a Topology Level less than the sending system). A *crosslink* is a port that is facing a system at the same level of the topology. Initially systems may not know whether the port orientation is an *uplink*, *downlink*, or *crosslink* and will use the value of *unknown* by default. The procedures that implement the recognition of the Port Orientation are described in 49.5.3. Table D-13b specifies valid values for the Port Orientation field.

Table D-13b—Port Orientation field values

Port Orientation	Value/meaning
0	uplink
1	downlink
2	crosslink
3–254	reserved
255	unknown

D.3 IEEE 802.1 Organizationally Specific TLV management

D.3.2 IEEE 802.1 managed objects—TLV variables

Insert D.3.2.11 and D.3.2.12 after D.3.2.10 as follows:

D.3.2.11 Congestion Isolation TLV managed objects

- queue map:** see D.2.15.3.
- CIM Encap Length:** see D.2.15.4.
- MAC Address:** see D.2.15.5.
- Address Family:** see D.2.15.7.
- IP Address:** see D.2.15.8.

D.3.2.12 Topology Recognition TLV managed objects

- Device Type:** see D.2.16.3.
- Topology Level:** see D.2.16.4.
- Port Orientation:** see D.2.16.5.

D.4 PICS proforma for IEEE 802.1 Organizationally Specific TLV extensions^{15 16}

D.4.3 Major capabilities and options

Insert the following rows at the end of the table in D.4.3 (unchanged rows not shown):

Item	Feature	Status	References	Support
ciSet	Is the IEEE 802.1 Organizationally Specific TLV ciSet implemented?	O.1	D.2.15, Table D-1	Yes [] No []
ciQueuePri	Are the monitored queues higher priority than the congesting queue?	ciSet:M	D.2.15.3	Yes [] N/A []
trSet	Is the IEEE 802.1 Organizationally Specific TLV trSet implemented?	O.1	D.2.16, Table D-1	Yes [] No []

¹⁵ Instructions for completing the PICS proforma are given in A.3.

¹⁶ *Copyright release for PICS proformas:* Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

D.5 IEEE 802.1/LLDP extension MIB

D.5.2 Structure of the IEEE 802.1/LLDP extension MIB

Insert new rows at the end of Table D-14 as follows (unchanged rows not shown):

Table D-14—IEEE 802.1 extension MIB object group conformance requirements

MIB group	Rx mode	Tx mode	Tx/Rx mode
lldpXdot1CiGroup	CI:M	CI:M	CI:M
lldpXdot1TrGroup	TR:M	TR:M	TR:M

Insert the following entries at the end of each group in Table D-15. The group headings are shown (in italic) in Table D-15 for reference (other unchanged rows not shown):

Table D-15—IEEE 802.1/LLDP extension MIB object cross reference

MIB table	MIB object	LLDP reference
<i>Configuration group</i>		
lldpXdot1CiConfigCiTable		Augments lldpV2PortConfigEntry
	lldpXdot1CiConfigCiTxEnable	Normal LLPDUs, 9.1.2.1 of IEEE Std 802.1AB
<i>Local system information</i>		
lldpXdot1LocCiBasicTable		D.2.15
	lldpV2LocPortIfIndex	(Table index)
	lldpXdot1LocCiCIMEncapLen	D.2.15.4
	lldpXdot1LocCiMacAddress	D.2.15.5
	lldpXdot1LocCiNetAddressType	D.2.15.7
	lldpXdot1LocCiNetAddress	D.2.15.8
lldpXdot1CiLocQueueMapTable		D.2.15.3
	lldpV2LocPortIfIndex	(Table index)
	lldpXdot1LocCiQueueId	(Table index)
	lldpXdot1LocCiQueueType	D.2.15.3
	lldpXdot1LocCiMappedQueue	D.2.15.3

Table D-15—IEEE 802.1/LLDP extension MIB object cross reference (continued)

MIB table	MIB object	LLDP reference
<i>Remote system information</i>		
lldpXdot1RemCiBasicTable		D.2.15
	lldpV2RemTimeMark	(Table index)
	lldpV2RemLocalIfIndex	(Table index)
	lldpV2RemLocalDestMACAddress	(Table index)
	lldpV2RemIndex	(Table index)
	lldpXdot1RemCiCIMEncapLen	D.2.15.4
	lldpXdot1RemCiMacAddress	D.2.15.5
	lldpXdot1RemCiNetAddressType	D.2.15.7
	lldpXdot1RemCiNetAddress	D.2.15.8
lldpXdot1CiRemQueueMapTable		D.2.15
	lldpV2RemTimeMark	(Table index)
	lldpV2RemLocalIfIndex	(Table index)
	lldpV2RemLocalDestMACAddress	(Table index)
	lldpV2RemIndex	(Table index)
	lldpXdot1RemCiQueueId	(Table index)
	lldpXdot1RemCiQueueType	D.2.15.3
	lldpXdot1RemCiMappedQueue	D.2.15.3

D.5.4 Security considerations for IEEE 802.1 LLDP extension MIB module

Change list items g) and h) in D.5.4 as follows:

- g) MIB objects that are related to the transmit mode:
 - 1) lldpV2Xdot1LocPortVlanId
 - 2) lldpV2Xdot1LocProtoVlanSupported
 - 3) lldpV2Xdot1LocProtoVlanEnabled
 - 4) lldpV2Xdot1LocVlanName
 - 5) lldpV2Xdot1LocProtocolId
 - 6) lldpV2Xdot1LocVidUsageDigest
 - 7) lldpV2Xdot1LocManVidTxEnable
 - 8) lldpV2Xdot1LocLinkAggStatus
 - 9) lldpV2Xdot1LocLinkAggPortId
 - 10) lldpXdot1dcbxConfigETSConfigurationEntry
 - 11) lldpXdot1dcbxConfigPFCTable
 - 12) lldpXdot1dcbxLocETSTBasicConfigurationTable
 - 13) lldpXdot1dcbxLocETSConPriorityAssignmentTable
 - 14) lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmTable
 - 15) lldpXdot1dcbxLocPFCBasicTable
 - 16) lldpXdot1dcbxLocPFCEnableTable
 - 17) lldpXdot1dcbxAdminETSTBasicConfigurationTable

- 18) IldpXdot1dcbxAdminETSTConPriorityAssignmentTable
 - 19) IldpXdot1dcbxAdminETSTRecoTrafficSelectionAlgorithmTable
 - 20) IldpXdot1dcbxAdminPFCBasicTable
 - 21) IldpXdot1dcbxAdminPFCEnableTable
 - 22) IldpXdot1dcbxLocApplicationPriorityAppTable
 - 23) IldpXdot1dcbxLocApplicationVlanAppTable
 - 24) IldpXdot1dcbxAdminApplicationPriorityAppTable
 - 25) IldpXdot1dcbxAdminApplicationVlanAppTable
 - 26) [IldpXdot1LocCiBasicTable](#)
 - 27) [IldpXdot1CiLocQueueMapTable](#)
 - 28) [IldpXdot1LocTrTable](#)
- h) MIB objects that are related to the receive mode:
- 1) IldpV2Xdot1RemPortVlanId
 - 2) IldpV2Xdot1RemProtoVlanSupported
 - 3) IldpV2Xdot1RemProtoVlanEnabled
 - 4) IldpV2Xdot1RemVlanName
 - 5) IldpV2Xdot1RemProtocolId
 - 6) IldpV2Xdot1RemVidUsageDigest
 - 7) IldpV2Xdot1RemManVidTxEnable
 - 8) IldpV2Xdot1RemLinkAggStatus
 - 9) IldpV2Xdot1RemLinkAggPortId
 - 10) IldpXdot1dcbxConfigETSTConfigurationEntry
 - 11) IldpXdot1dcbxConfigPFCTable
 - 12) IldpXdot1dcbxRemETSTBasicConfigurationTable
 - 13) IldpXdot1dcbxRemETSTConPriorityAssignmentTable
 - 14) IldpXdot1dcbxRemETSTRecoTrafficSelectionAlgorithmTable
 - 15) IldpXdot1dcbxRemPFCBasicTable
 - 16) IldpXdot1dcbxRemPFCEnableTable
 - 17) IldpXdot1dcbxAdminETSTBasicConfigurationTable
 - 18) IldpXdot1dcbxAdminETSTConPriorityAssignmentTable
 - 19) IldpXdot1dcbxAdminETSTRecoTrafficSelectionAlgorithmTable
 - 20) IldpXdot1dcbxAdminPFCBasicTable
 - 21) IldpXdot1dcbxAdminPFCEnableTable
 - 22) IldpXdot1dcbxRemApplicationPriorityAppTable
 - 23) IldpXdot1dcbxRemApplicationVlanAppTable
 - 24) IldpXdot1dcbxAdminApplicationPriorityAppTable
 - 25) IldpXdot1dcbxAdminApplicationVlanAppTable
 - 26) [IldpXdot1RemCiBasicTable](#)
 - 27) [IldpXdot1CiRemQueueMapTable](#)
 - 28) [IldpXdot1RemTrTable](#)

D.5.5 IEEE 802.1 LLDP extension MIB module—version 2^{17 18}

Change D.5.5 as follows:

In the following MIB definition, should any discrepancy between the DESCRIPTION text and the corresponding definition in D.2.1 through D.5 occur, the definition in D.2.1 through D.5 shall take precedence.

LLDP-EXT-DOT1-V2-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY,
OBJECT-TYPE,
Unsigned32
FROM SNMPv2-SMI
TruthValue,
TEXTUAL-~~CONVENTION~~CONVENTION,
MacAddress
FROM SNMPv2-TC
SnmpAdminString
FROM SNMP-FRAMEWORK-MIB
MODULE-COMPLIANCE,
OBJECT-GROUP
FROM SNMPv2-CONF
ifGeneralInformationGroup
FROM IF-MIB
lldpV2Extensions,
lldpV2LocPortIfIndex,
lldpV2RemTimeMark,
lldpV2RemLocalIfIndex,
lldpV2RemLocalDestMACAddress,
lldpV2RemIndex,
lldpV2PortConfigEntry
FROM LLDP-V2-MIB
VlanId
FROM Q-BRIDGE-MIB
IEEE8021PriorityValue
FROM IEEE8021-TC-~~MIB~~MIB
InetPortNumber
FROM INET-ADDRESS-MIB
AddressFamilyNumbers
FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB;

lldpV2Xdot1MIB MODULE-IDENTITY

LAST-UPDATED ~~"202211080000Z"~~ ~~November 8, 2022~~ "202306050000Z" -- June 5, 2023

ORGANIZATION "IEEE 802.1 Working Group"

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DESCRIPTION

"The LLDP Management Information Base extension module for IEEE 802.1 organizationally defined discovery information.

In order to ensure the uniqueness of the LLDP-V2-MIB, lldpV2Xdot1MIB is branched from lldpV2Extensions using an Organizationally Unique Identifier (OUI) value as the node.

¹⁷ Copyright release for MIBs: Users of this standard may freely reproduce the MIB modules in this standard so that they can be used for their intended purpose.

¹⁸ An ASCII version of this MIB module is attached to the PDF version of this standard, and can be obtained by Web browser from the IEEE 802.1 Website at <https://1.ieee802.org/mib-modules/>.

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An OUI is a 24 bit globally unique number assigned by the IEEE Registration Authority - see:

<http://standards.ieee.org/develop/regauth/oui/index.html>

Unless otherwise indicated, the references in this MIB module are to IEEE Std 802.1Q-2022 as amended by IEEE Std 802.1Qcz-2023.

Copyright (C) IEEE (~~2022~~2023).
This version of this MIB module is part of IEEE Std 802.1Q;
see that standard for full legal notices."

REVISION "202306050000Z" -- June 5, 2023

DESCRIPTION

"Published as part of IEEE Std 802.1Qcz-2023.
Congestion Isolation objects added."

REVISION "202211080000Z" -- November 8, 2022

DESCRIPTION

"Published as part of IEEE Std 802.1Q-2022.
Cross references and contact information updated."

REVISION "201807010000Z" -- July 1, 2018

DESCRIPTION

"Published as part of IEEE Std 802.1Q 2018 revision.
Cross references updated and corrected.
Changes introduced by IEEE Std 802.1Qcd-2015 and
IEEE Std 802.1Q-2014 Cor 1-2015 merged. "

REVISION "201502160000Z" -- February 16, 2015

DESCRIPTION

"Published as part of IEEE Std 802.1Q 2014 Cor-1.
Updated as a result of maintenance items #0132 and #0152"

REVISION "201502160000Z" -- February 16, 2015

DESCRIPTION

"Published as part of IEEE Std 802.1Qcd.
Adds Application VLAN TLV objects to the DCBX groups of
the MIB module."

REVISION "201412150000Z" -- December 15, 2014

DESCRIPTION

"Published as part of IEEE Std 802.1Q 2014 revision.
Cross references updated and corrected.
New tables lldpV2Xdot1RemVidUsageDigestV2Table
and lldpV2Xdot1RemManVidV2Table inserted; old
versions deprecated. New versions add an index for
lldpV2RemIndex. "

REVISION "201103250000Z" -- March 25, 2011

DESCRIPTION

"Published as part of IEEE Std 802.1Qaz-2011. Adds the DCBX
objects to the MIB module"

REVISION "201103230000Z" -- March 23, 2011

DESCRIPTION

"Published as part of IEEE Std 802.1Q-2011 revision.
This revision contains changes associated with
relocating the extension MIB from IEEE Std 802.1AB to
IEEE Std 802.1Q, minor tweaks to the text of the
DESCRIPTION statement above to fix references to
IEEE Std 802.1Q, updating of references to refer to
Annex D, and addition of object definitions for
Congestion Notification TLVs and corresponding
compliance statements."

REVISION "200906080000Z" -- June 08, 2009

DESCRIPTION

"Published as part of IEEE Std 802.1AB-2009 revision.
This revision incorporated changes to the MIB to
support the use of LLDP with multiple destination MAC
addresses, and to import the Link Aggregation TLV

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```
from the IEEE 802.3 extension MIB"

-- OUI for IEEE 802.1 is 32962 (00-80-C2)
::= { lldpV2Extensions 32962 }

-----
--
-- Organizational Information Extension - IEEE 802.1
-- Definitions to support the basicSet TLV set (Table D-1)
--
-----

lldpV2Xdot1Objects OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 1 }

-- LLDP IEEE 802.1 extension MIB groups
lldpV2Xdot1Config OBJECT IDENTIFIER ::= { lldpV2Xdot1Objects 1 }
lldpV2Xdot1LocalData OBJECT IDENTIFIER ::= { lldpV2Xdot1Objects 2 }
lldpV2Xdot1RemoteData OBJECT IDENTIFIER ::= { lldpV2Xdot1Objects 3 }

-----
-- Textual Convention definitions
-----

LldpV2XLinkAggStatusMap ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "This TC describes the link aggregation status.

        The bit 'aggCapable(0)' indicates the link is capable of being
        aggregated if 1, not capable if 0.

        The bit 'aggEnabled(1)' indicates the link is currently in
        an aggregation if 1, not in an aggregation if 0.

        The bits 'portTypeLS(1)' and 'portTypeMS(2)' form the LS
        and MS bits of a Port Type value respectively:
        00 = no port type specified
        01 = transmitted from Aggregation Port
        10 = transmitted from Aggregator
        11 = transmitted from an Aggregator with a single
            Aggregation Port.

        The remaining bits are reserved for future standardization."
    SYNTAX      BITS {
        aggCapable(0),
        aggEnabled(1),
        portTypeLS(2),
        portTypeMS(3)
    }

-----
-- IEEE 802.1 Configuration for the basicSet TLV set
-----

--
-- lldpV2Xdot1ConfigPortVlanTable : configure the transmission of the
--                               Port VLAN-ID TLVs on set of ports.

lldpV2Xdot1ConfigPortVlanTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1ConfigPortVlanEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table that controls selection of LLDP Port VLAN-ID TLVs
        to be transmitted on individual ports."
    ::= { lldpV2Xdot1Config 1 }

lldpV2Xdot1ConfigPortVlanEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1ConfigPortVlanEntry
```

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MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"LLDP configuration information that controls the transmission of IEEE 802.1 organizationally defined Port VLAN-ID TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of the LLDP-MIB, therefore it is only present along with the port configuration defined by the associated lldpV2PortConfigEntry entry.

Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2PortConfigEntry }
::= { lldpV2Xdot1ConfigPortVlanTable 1 }

LldpV2Xdot1ConfigPortVlanEntry ::= SEQUENCE {
 lldpV2Xdot1ConfigPortVlanTxEnable TruthValue
}

lldpV2Xdot1ConfigPortVlanTxEnable OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION

"The lldpV2Xdot1ConfigPortVlanTxEnable, which is defined as a truth value and configured by the network management, determines whether the IEEE 802.1 organizationally defined port VLAN TLV transmission is allowed on a given LLDP transmission-capable port.

The value of this object is restored from non-volatile storage after a re-initialization of the management system."

REFERENCE

"9.1.2.1 of IEEE Std 802.1AB"

DEFVAL { false }
::= { lldpV2Xdot1ConfigPortVlanEntry 1 }

--

-- lldpV2Xdot1ConfigVlanNameTable: configure the transmission of the
-- VLAN name instances on set of ports.
--

lldpV2Xdot1ConfigVlanNameTable OBJECT-TYPE

SYNTAX SEQUENCE OF LldpV2Xdot1ConfigVlanNameEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"The table that controls selection of LLDP VLAN name TLV instances to be transmitted on individual ports."

::= { lldpV2Xdot1Config 2 }

lldpV2Xdot1ConfigVlanNameEntry OBJECT-TYPE

SYNTAX LldpV2Xdot1ConfigVlanNameEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"LLDP configuration information that specifies the set of ports (represented as a PortList) on which the Local System VLAN name instance is transmitted.

This configuration object augments the lldpV2LocVlanEntry, therefore it is only present along with the VLAN Name instance contained in the associated lldpV2LocVlanNameEntry entry.

Each active lldpV2Xdot1ConfigVlanNameEntry is restored from non-volatile storage (along with the corresponding

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lldpV2Xdot1LocVlanNameEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2Xdot1LocVlanNameEntry }

::= { lldpV2Xdot1ConfigVlanNameTable 1 }

lldpV2Xdot1ConfigVlanNameEntry ::= SEQUENCE {
 lldpV2Xdot1ConfigVlanNameTxEnable TruthValue
}

lldpV2Xdot1ConfigVlanNameTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The boolean value that indicates whether the corresponding Local System VLAN name instance is transmitted on the port defined by the given lldpV2Xdot1LocVlanNameEntry.

 The value of this object is restored from non-volatile storage after a re-initialization of the management system."
REFERENCE
 "9.1.2.1 of IEEE Std 802.1AB"
DEFVAL { false }
::= { lldpV2Xdot1ConfigVlanNameEntry 1 }

--
-- lldpV2Xdot1ConfigProtoVlanTable : configure the transmission of the
-- protocol VLAN instances on set
-- of ports.
--

lldpV2Xdot1ConfigProtoVlanTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1ConfigProtoVlanEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The table that controls selection of LLDP Port And Protocol VLAN ID TLV instances to be transmitted on individual ports."
::= { lldpV2Xdot1Config 3 }

lldpV2Xdot1ConfigProtoVlanEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1ConfigProtoVlanEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "LLDP configuration information that specifies the set of ports (represented as a PortList) on which the Local System Protocol VLAN instance is transmitted.

 This configuration object augments the lldpV2Xdot1LocVlanEntry, therefore it is only present along with the Port and Protocol VLAN ID instance contained in the associated lldpV2Xdot1LocVlanEntry entry.

 Each active lldpV2Xdot1ConfigProtoVlanEntry is restored from non-volatile storage (along with the corresponding lldpV2Xdot1LocProtoVlanEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2Xdot1LocProtoVlanEntry }

::= { lldpV2Xdot1ConfigProtoVlanTable 1 }

LldpV2Xdot1ConfigProtoVlanEntry ::= SEQUENCE {
 lldpV2Xdot1ConfigProtoVlanTxEnable TruthValue
}

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```
lldpV2Xdot1ConfigProtoVlanTxEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The boolean value that indicates whether the corresponding
        Local System Port and Protocol VLAN instance is
        transmitted on the port defined by the given
        lldpV2Xdot1LocProtoVlanEntry.

        The value of this object is restored from non-volatile
        storage after a re-initialization of the management system."
    REFERENCE
        "9.1.2.1 of IEEE Std 802.1AB"
    DEFVAL { false }
    ::= { lldpV2Xdot1ConfigProtoVlanEntry 1 }

--
-- lldpV2Xdot1ConfigProtocolTable : configure the transmission of the
--                               protocol instances on set
--                               of ports.
--

lldpV2Xdot1ConfigProtocolTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1ConfigProtocolEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The table that controls selection of LLDP Protocol
        TLV instances to be transmitted on individual ports."
    ::= { lldpV2Xdot1Config 4 }

lldpV2Xdot1ConfigProtocolEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1ConfigProtocolEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "LLDP configuration information that specifies the set of
        ports (represented as a PortList) on which the Local System
        Protocol instance is transmitted.

        This configuration object augments the
        lldpV2Xdot1LocProtoEntry, therefore it is only present
        along with the Protocol instance contained in the
        associated lldpV2Xdot1LocProtoEntry entry.

        Each active lldpV2Xdot1ConfigProtocolEntry is restored
        from non-volatile storage (along with the corresponding
        lldpV2Xdot1LocProtocolEntry) after a re-initialization of
        the management system."
    AUGMENTS { lldpV2Xdot1LocProtocolEntry }
    ::= { lldpV2Xdot1ConfigProtocolTable 1 }

LldpV2Xdot1ConfigProtocolEntry ::= SEQUENCE {
    lldpV2Xdot1ConfigProtocolTxEnable TruthValue
}

lldpV2Xdot1ConfigProtocolTxEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The boolean value that indicates whether the corresponding
        Local System Protocol Identity instance is transmitted
        on the port defined by the given
        lldpV2Xdot1LocProtocolEntry.

        The value of this object is restored from non-volatile
        storage after a re-initialization of the management
        system."
```

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```
REFERENCE
    "9.1.2.1 of IEEE Std 802.1AB"
DEFVAL { false }
::= { lldpV2Xdot1ConfigProtocolEntry 1 }

--
-- lldpV2Xdot1ConfigVidUsageDigestTable: configure the transmission
-- of the VID Usage Digest TLVs on set of ports.
--
lldpV2Xdot1ConfigVidUsageDigestTable OBJECT-TYPE
    SYNTAX SEQUENCE OF LldpV2Xdot1ConfigVidUsageDigestEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A table that controls selection of LLDP VID Usage Digest
        TLVs to be transmitted on individual ports."
    ::= { lldpV2Xdot1Config 5 }

lldpV2Xdot1ConfigVidUsageDigestEntry OBJECT-TYPE
    SYNTAX LldpV2Xdot1ConfigVidUsageDigestEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "LLDP configuration information that specifies the set of
        ports (represented as a PortList) on which the local
        system VID Usage Digest instance will be transmitted.
        This configuration object augments the
        lldpLocVidUsageDigestEntry, therefore it is only present
        along with the VID Usage Digest instance
        contained in the associated lldpV2Xdot1LocVidUsageDigestEntry
        entry. Each active lldpConfigVidUsageDigestEntry must be
        restored from non-volatile storage and re-created (along with
        the corresponding lldpV2Xdot1LocVidUsageDigestEntry) after
        a re-initialization of the management system."
    AUGMENTS { lldpV2Xdot1LocVidUsageDigestEntry }
    ::= { lldpV2Xdot1ConfigVidUsageDigestTable 1 }

LldpV2Xdot1ConfigVidUsageDigestEntry ::= SEQUENCE {
    lldpV2Xdot1ConfigVidUsageDigestTxEnable TruthValue
}

lldpV2Xdot1ConfigVidUsageDigestTxEnable OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "The boolean value that indicates whether the corresponding
        Local System VID Usage Digest instance will be transmitted
        on the port defined by the given
        lldpV2Xdot1LocVidUsageDigestEntry. The value of this object
        must be restored from non-volatile storage after a
        reinitialization of the management system."
    REFERENCE
        "9.1.2.1 of IEEE Std 802.1AB"
    DEFVAL { false }
    ::= { lldpV2Xdot1ConfigVidUsageDigestEntry 1 }

--
-- lldpV2Xdot1ConfigManVidTable : configure the transmission of the
-- Management VID TLVs on set of ports.
--
lldpV2Xdot1ConfigManVidTable OBJECT-TYPE
    SYNTAX SEQUENCE OF LldpV2Xdot1ConfigManVidEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A table that controls selection of LLDP Management VID
        TLVs to be transmitted on individual ports."
    ::= { lldpV2Xdot1Config 6 }

lldpV2Xdot1ConfigManVidEntry OBJECT-TYPE
```

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```
SYNTAX LldpV2Xdot1ConfigManVidEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "LLDP configuration information that specifies the set of
    port/destination address pairs on which the Local
    System Management VID will be transmitted.
    This configuration object augments the
    lldpV2Xdot1LocManVidEntry, therefore it is
    only present along with the Management VID contained
    in the associated lldpV2Xdot1LocManVidEntry entry.
    Each active lldpV2Xdot1ConfigManVidEntry must be
    restored from non-volatile storage (along with the
    corresponding lldpV2Xdot1LocManVidEntry) after a
    re-initialization of the management system."
AUGMENTS { lldpV2Xdot1LocManVidEntry }
::= { lldpV2Xdot1ConfigManVidTable 1 }

LldpV2Xdot1ConfigManVidEntry ::= SEQUENCE {
    lldpV2Xdot1ConfigManVidTxEnable TruthValue
}

lldpV2Xdot1ConfigManVidTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
    "The lldpV2Xdot1ConfigManVidTxEnable, which is defined as a
    truth value and configured by the network management,
    determines whether the IEEE 802.1 organizationally
    defined Management VID TLV transmission is allowed on a given
    LLDP transmission-capable port.
    The value of this object must be restored from
    non-volatile storage after a re-initialization of the
    management system."
REFERENCE
    "9.1.2.1 of IEEE Std 802.1AB"
DEFVAL { false }
::= { lldpV2Xdot1ConfigManVidEntry 1 }

-----
-- IEEE 802.1 - Local System Information
-----

--
-- lldpV2Xdot1LocTable - indexed by ifIndex.
--

lldpV2Xdot1LocTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1LocEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "This table contains one row per port for IEEE 802.1
    organizationally defined LLDP extension on the local system
    known to this agent."
::= { lldpV2Xdot1LocalData 1 }

lldpV2Xdot1LocEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1LocEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "Information about IEEE 802.1 organizationally defined
    LLDP extension."
INDEX { lldpV2LocPortIfIndex }
::= { lldpV2Xdot1LocTable 1 }

LldpV2Xdot1LocEntry ::= SEQUENCE {
    lldpV2Xdot1LocPortVlanId Unsigned32
}
```

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```
lldpV2Xdot1LocPortVlanId OBJECT-TYPE
    SYNTAX      Unsigned32(0|1..4094)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The integer value used to identify the port's VLAN
        identifier Identifier associated with the local system. A value
        of zero shall be used if the system either does not know
        the PVID or does
        not support Port-based VLAN operation."
    REFERENCE
        "D.2.1.1"
    ::= { lldpV2Xdot1LocEntry 1 }

--
-- lldpV2Xdot1LocProtoVlanTable: Port and Protocol VLAN information
-- re-indexed by ifIndex.
--

lldpV2Xdot1LocProtoVlanTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF lldpV2Xdot1LocProtoVlanEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one or more rows per Port and Protocol
        VLAN information about the local system."
    ::= { lldpV2Xdot1LocalData 2 }

lldpV2Xdot1LocProtoVlanEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1LocProtoVlanEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Port and protocol VLAN ID Information about a particular
        port component. There may be multiple port and protocol
        VLANs, identified by a particular
        lldpV2Xdot1LocProtoVlanId, configured on the given port."
    INDEX       { lldpV2LocPortIfIndex,
                  lldpV2Xdot1LocProtoVlanId }
    ::= { lldpV2Xdot1LocProtoVlanTable 1 }

LldpV2Xdot1LocProtoVlanEntry ::= SEQUENCE {
    lldpV2Xdot1LocProtoVlanId      Unsigned32,
    lldpV2Xdot1LocProtoVlanSupported TruthValue,
    lldpV2Xdot1LocProtoVlanEnabled TruthValue
}

lldpV2Xdot1LocProtoVlanId OBJECT-TYPE
    SYNTAX      Unsigned32(0|1..4094)
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The integer value used to identify the port and protocol
        VLANs associated with the given port associated with the
        local system. A value of zero shall be used if the system
        either does not know the protocol VLAN ID (PPVID) or does
        not support port and protocol VLAN operation."
    REFERENCE
        "D.2.2.2"
    ::= { lldpV2Xdot1LocProtoVlanEntry 1 }

lldpV2Xdot1LocProtoVlanSupported OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The truth value used to indicate whether the given port
        (associated with the local system) supports port and
        protocol VLANs."
```

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REFERENCE

"D.2.2.1"
::= { lldpV2Xdot1LocProtoVlanEntry 2 }

lldpV2Xdot1LocProtoVlanEnabled OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The truth value used to indicate whether the port and protocol VLANs are enabled on the given port associated with the local system."

REFERENCE

"D.2.2.1"
::= { lldpV2Xdot1LocProtoVlanEntry 3 }

--

-- lldpV2Xdot1LocVlanNameTable : VLAN name information about the local
-- system indexed by ifIndex.
--

lldpV2Xdot1LocVlanNameTable OBJECT-TYPE

SYNTAX SEQUENCE OF LldpV2Xdot1LocVlanNameEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains one or more rows per IEEE 802.1Q VLAN name information on the local system known to this agent."

::= { lldpV2Xdot1LocalData 3 }

lldpV2Xdot1LocVlanNameEntry OBJECT-TYPE

SYNTAX LldpV2Xdot1LocVlanNameEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"VLAN name Information about a particular port component. There may be multiple VLANs, identified by a particular lldpV2Xdot1LocVlanId, configured on the given port."

INDEX { lldpV2LocPortIfIndex,
lldpV2Xdot1LocVlanId }
::= { lldpV2Xdot1LocVlanNameTable 1 }

LldpV2Xdot1LocVlanNameEntry ::= SEQUENCE {

lldpV2Xdot1LocVlanId VlanId,

lldpV2Xdot1LocVlanName SnmpAdminString

}

lldpV2Xdot1LocVlanId OBJECT-TYPE

SYNTAX VlanId

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The integer value used to identify the IEEE 802.1Q VLAN IDs with which the given port is compatible."

REFERENCE

"D.2.3.2"
::= { lldpV2Xdot1LocVlanNameEntry 1 }

lldpV2Xdot1LocVlanName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(1..32))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The string value used to identify VLAN name identified by the Vlan Id associated with the given port on the local system."

This object should contain the value of the dot1QVLANStaticName object (defined in IETF RFC 4363) identified with the given lldpV2Xdot1LocVlanId."

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REFERENCE

"D.2.3.4"
::= { lldpV2Xdot1LocVlanNameEntry 2 }

--

-- lldpV2Xdot1LocProtocolTable : Protocol Identity information
-- re-indexed by ifIndex and destination address
--

lldpV2Xdot1LocProtocolTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1LocProtocolEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one or more rows per protocol identity
information on the local system known to this agent."
REFERENCE
"D.2.4"
::= { lldpV2Xdot1LocalData 4 }

lldpV2Xdot1LocProtocolEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1LocProtocolEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about particular protocols that are accessible
through the given port component.

There may be multiple protocols, identified by particular
lldpV2Xdot1ProtocolIndex, lldpV2LocPortIfIndex"
REFERENCE
"D.2.4"
INDEX { lldpV2LocPortIfIndex,
lldpV2Xdot1LocProtocolIndex }
::= { lldpV2Xdot1LocProtocolTable 1 }

LldpV2Xdot1LocProtocolEntry ::= SEQUENCE {
lldpV2Xdot1LocProtocolIndex Unsigned32,
lldpV2Xdot1LocProtocolId OCTET STRING
}

lldpV2Xdot1LocProtocolIndex OBJECT-TYPE
SYNTAX Unsigned32(1..2147483647)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This object represents an arbitrary local integer value
used by this agent to identify a particular protocol
identity."
::= { lldpV2Xdot1LocProtocolEntry 1 }

lldpV2Xdot1LocProtocolId OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The octet string value used to identify the protocols
associated with the given port of the local system."
REFERENCE
"D.2.4.3"
::= { lldpV2Xdot1LocProtocolEntry 2 }

--

-- lldpV2Xdot1LocVidUsageDigestTable: Table of hash values of
-- system VID Usage Table transmitted
-- via VID Usage Digest TLV.
--

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```
lldpV2Xdot1LocVidUsageDigestTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1LocVidUsageDigestEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per ifIndex/
        destination MAC address pair for usage digest
        information on the local system known to this agent."
    REFERENCE
        "D.2.5"
    ::= { lldpV2Xdot1LocalData 5 }

lldpV2Xdot1LocVidUsageDigestEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1LocVidUsageDigestEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Usage digest information to be transmitted
        through the given port."
    REFERENCE
        "D.2.5"
    INDEX      { lldpV2LocPortIfIndex }
    ::= { lldpV2Xdot1LocVidUsageDigestTable 1 }

lldpV2Xdot1LocVidUsageDigestEntry ::= SEQUENCE {
    lldpV2Xdot1LocVidUsageDigest Unsigned32
}

lldpV2Xdot1LocVidUsageDigest OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The integer value obtained by applying the CRC32 function
        to the 128-octet VID Usage Table. A bit of the VID Usage
        Table contains the value PBB-TE-USAGE (binary 1) if the
        corresponding element of the MST Configuration Table
        (IEEE Std 802.1Q 8.9.1) contains the value PBB-TE MSTID
        (hex FFE) and otherwise contains the value NON-PBB-TE-USAGE
        (binary 0)."
    REFERENCE
        "D.2.5.1"
    ::= { lldpV2Xdot1LocVidUsageDigestEntry 1 }

--
-- lldpV2Xdot1LocManVidTable: Table of values configured on the Local
-- system for the Management VID, or the value 0 if a Management VID
-- has not been provisioned.
--

lldpV2Xdot1LocManVidTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1LocManVidEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per ifIndex/
        destination MAC address pair for usage digest
        information on the local system known to this agent."
    REFERENCE
        "D.2.6"
    ::= { lldpV2Xdot1LocalData 6 }

lldpV2Xdot1LocManVidEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1LocManVidEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Usage digest information to be transmitted
        through the given port."
    REFERENCE
        "D.2.6"
```

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```
INDEX { lldpV2LocPortIfIndex }
::= { lldpV2Xdot1LocManVidTable 1 }

lldpV2Xdot1LocManVidEntry ::= SEQUENCE {
    lldpV2Xdot1LocManVid Unsigned32
}

lldpV2Xdot1LocManVid OBJECT-TYPE
    SYNTAX Unsigned32 (0|1..4094)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The integer value configured on the Local system for
        the Management VID, or
        the value 0 if a Management VID has not been provisioned."
    REFERENCE
        "D.2.6.1"
    ::= { lldpV2Xdot1LocManVidEntry 1 }

-----
-- IEEE 802.1 - Local System Information - Link Aggregation
-----

---
---
--- lldpV2Xdot1LocLinkAggTable: Link Aggregation Information Table
---
---
lldpV2Xdot1LocLinkAggTable OBJECT-TYPE
    SYNTAX SEQUENCE OF LldpV2Xdot1LocLinkAggEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "This table contains one row per port of link aggregation
        information (as a part of the LLDP 802.1 organizational
        extension) on the local system known to this agent."
    ::= { lldpV2Xdot1LocalData 7 }

lldpV2Xdot1LocLinkAggEntry OBJECT-TYPE
    SYNTAX LldpV2Xdot1LocLinkAggEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Link Aggregation information about a particular port
        component."
    INDEX { lldpV2LocPortIfIndex }
    ::= { lldpV2Xdot1LocLinkAggTable 1 }

lldpV2Xdot1LocLinkAggEntry ::= SEQUENCE {
    lldpV2Xdot1LocLinkAggStatus LldpV2XLinkAggStatusMap,
    lldpV2Xdot1LocLinkAggPortId Unsigned32
}

lldpV2Xdot1LocLinkAggStatus OBJECT-TYPE
    SYNTAX LldpV2XLinkAggStatusMap
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The bitmap value contains the link aggregation
        capabilities and the current aggregation status of the
        link."
    REFERENCE
        "IEEE Std 802.1AX"
    ::= { lldpV2Xdot1LocLinkAggEntry 1 }

lldpV2Xdot1LocLinkAggPortId OBJECT-TYPE
    SYNTAX Unsigned32 (0|1..2147483647)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This object contains the IEEE 802.1 aggregated port
```

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identifier, aAggPortID (IEEE Std 802.1AX, 6.3.2.1.1), derived from the ifNumber of the ifIndex for the port component in link aggregation.

If the port is not in link aggregation state and/or it does not support link aggregation, this value should be set to zero."

REFERENCE

"IEEE Std 802.1AX"
::= { lldpV2Xdot1LocLinkAggEntry 2 }

-- IEEE 802.1 - Remote System Information

--
-- lldpV2Xdot1RemTable - re-indexed for ifIndex and destination MAC
-- address

lldpV2Xdot1RemTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1RemEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one or more rows per physical network connection known to this agent. The agent may wish to ensure that only one lldpV2Xdot1RemEntry is present for each local port, or it may choose to maintain multiple lldpV2Xdot1RemEntries for the same local port."
::= { lldpV2Xdot1RemTableData 1 }

lldpV2Xdot1RemEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1RemEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about a particular port component."
INDEX { lldpV2RemTimeMark,
lldpV2RemLocalIfIndex,
lldpV2RemLocalDestMACAddress,
lldpV2RemIndex }
::= { lldpV2Xdot1RemTable 1 }

LldpV2Xdot1RemEntry ::= SEQUENCE {
lldpV2Xdot1RemPortVlanId Unsigned32
}

lldpV2Xdot1RemPortVlanId OBJECT-TYPE
SYNTAX Unsigned32 (0|1..4094)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The integer value used to identify the port's VLAN identifier-Identifier associated with the remote system. if the remote system either does not know the PVID or does not support Port-based VLAN operation, the value of lldpV2Xdot1RemPortVlanId should be zero."
REFERENCE
"D.2.1.1"
::= { lldpV2Xdot1RemEntry 1 }

--
-- lldpV2Xdot1RemProtoVlanTable - re-indexed by ifIndex and
-- destination MAC address
--

lldpV2Xdot1RemProtoVlanTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1RemProtoVlanEntry

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MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one or more rows per Port and Protocol
VLAN information about the remote system, received on the
given port."
::= { lldpV2Xdot1RemoteData 2 }

lldpV2Xdot1RemProtoVlanEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1RemProtoVlanEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Port and protocol VLAN name Information about a particular
port component. There may be multiple protocol VLANs,
identified by a particular lldpV2Xdot1RemProtoVlanId,
configured on the remote system."
INDEX { lldpV2RemTimeMark,
lldpV2RemLocalIfIndex,
lldpV2RemLocalDestMACAddress,
lldpV2RemIndex,
lldpV2Xdot1RemProtoVlanId }
::= { lldpV2Xdot1RemProtoVlanTable 1 }

LldpV2Xdot1RemProtoVlanEntry ::= SEQUENCE {
lldpV2Xdot1RemProtoVlanId Unsigned32,
lldpV2Xdot1RemProtoVlanSupported TruthValue,
lldpV2Xdot1RemProtoVlanEnabled TruthValue
}

lldpV2Xdot1RemProtoVlanId OBJECT-TYPE
SYNTAX Unsigned32(0|1..4094)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The integer value used to identify the port and protocol
VLANs associated with the given port associated with the
remote system.

If port and protocol VLANs are not supported on the given
port associated with the remote system, or if the port is
not enabled with any port and protocol VLAN, the value of
lldpV2Xdot1RemProtoVlanId should be zero."
REFERENCE
"D.2.2.2"
::= { lldpV2Xdot1RemProtoVlanEntry 1 }

lldpV2Xdot1RemProtoVlanSupported OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The truth value used to indicate whether the given port
(associated with the remote system) is capable of
supporting port and protocol VLANs."
REFERENCE
"D.2.2.1"
::= { lldpV2Xdot1RemProtoVlanEntry 2 }

lldpV2Xdot1RemProtoVlanEnabled OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The truth value used to indicate whether the port and
protocol VLANs are enabled on the given port associated
with
the remote system."
REFERENCE
"D.2.2.1"
::= { lldpV2Xdot1RemProtoVlanEntry 3 }

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```
--
-- lldpV2Xdot1RemVlanNameTable : VLAN name information of the remote
--                               systems
-- Re-indexed by ifIndex and destination MAC address
--

lldpV2Xdot1RemVlanNameTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1RemVlanNameEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one or more rows per IEEE 802.1Q VLAN
        name information about the remote system, received on the
        given port."
    REFERENCE
        "D.2.3"
    ::= { lldpV2Xdot1RemoteData 3 }

lldpV2Xdot1RemVlanNameEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1RemVlanNameEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "VLAN name Information about a particular port component.
        There may be multiple VLANs, identified by a particular
        lldpV2Xdot1RemVlanId, received on the given port."
    INDEX       { lldpV2RemTimeMark,
                  lldpV2RemLocalIfIndex,
                  lldpV2RemLocalDestMACAddress,
                  lldpV2RemIndex,
                  lldpV2Xdot1RemVlanId }
    ::= { lldpV2Xdot1RemVlanNameTable 1 }

LldpV2Xdot1RemVlanNameEntry ::= SEQUENCE {
    lldpV2Xdot1RemVlanId      VlanId,
    lldpV2Xdot1RemVlanName    SnmpAdminString
}

lldpV2Xdot1RemVlanId OBJECT-TYPE
    SYNTAX      VlanId
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The integer value used to identify the IEEE 802.1Q
        VLAN IDs with which the given port of the remote system
        is compatible."
    REFERENCE
        "D.2.3.2"
    ::= { lldpV2Xdot1RemVlanNameEntry 1 }

lldpV2Xdot1RemVlanName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(1..32))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The string value used to identify VLAN name identified
        by the VLAN Id associated with the remote system."
    REFERENCE
        "D.2.3.4"
    ::= { lldpV2Xdot1RemVlanNameEntry 2 }
```

```
--
-- lldpV2Xdot1RemProtocolTable : Protocol information of the remote
--                               systems Re-indexed by ifIndex and destination MAC address
--
```

```
lldpV2Xdot1RemProtocolTable OBJECT-TYPE
```

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```
SYNTAX      SEQUENCE OF LldpV2Xdot1RemProtocolEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "This table contains one or more rows per protocol
    information about the remote system, received on
    the given port."
 ::= { lldpV2Xdot1RemoteData 4 }

lldpV2Xdot1RemProtocolEntry OBJECT-TYPE
SYNTAX      LldpV2Xdot1RemProtocolEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "Protocol information about a particular port component.
    There may be multiple protocols, identified by a particular
    lldpV2Xdot1ProtocolIndex, received on the given port."
INDEX      { lldpV2RemTimeMark,
              lldpV2RemLocalIfIndex,
              lldpV2RemLocalDestMACAddress,
              lldpV2RemIndex,
              lldpV2Xdot1RemProtocolIndex }
 ::= { lldpV2Xdot1RemProtocolTable 1 }

LldpV2Xdot1RemProtocolEntry ::= SEQUENCE {
    lldpV2Xdot1RemProtocolIndex  Unsigned32,
    lldpV2Xdot1RemProtocolId     OCTET STRING
}

lldpV2Xdot1RemProtocolIndex OBJECT-TYPE
SYNTAX      Unsigned32(1..2147483647)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "This object represents an arbitrary local integer value
    used by this agent to identify a particular protocol
    identity."
 ::= { lldpV2Xdot1RemProtocolEntry 1 }

lldpV2Xdot1RemProtocolId OBJECT-TYPE
SYNTAX      OCTET STRING (SIZE (1..255))
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The octet string value used to identify the protocols
    associated with the given port of remote system."
REFERENCE
    "D.2.4.3"
 ::= { lldpV2Xdot1RemProtocolEntry 2 }

--
-- lldpV2Xdot1RemVidUsageDigestTable: Table of hash values of
-- system VID Usage Table received
-- via VID Usage Digest TLV.
-- This version replaced by a reindexed version (V2).
--
lldpV2Xdot1RemVidUsageDigestTable OBJECT-TYPE
SYNTAX      SEQUENCE OF LldpV2Xdot1RemVidUsageDigestEntry
MAX-ACCESS  not-accessible
STATUS      deprecated
DESCRIPTION
    "This table contains one row per ifIndex/
    destination MAC address pair for usage digest
    information received by the local system."
REFERENCE
    "D.2.5"
 ::= { lldpV2Xdot1RemoteData 5 }
```

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```
lldpV2Xdot1RemVidUsageDigestEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1RemVidUsageDigestEntry
    MAX-ACCESS  not-accessible
    STATUS      deprecated
    DESCRIPTION
        "Usage digest information received on
         the given port/destination address pair."
    REFERENCE
        "D.2.5"
    INDEX      { lldpV2RemTimeMark,
                  lldpV2RemLocalIfIndex,
                  lldpV2RemLocalDestMACAddress }
    ::= { lldpV2Xdot1RemVidUsageDigestTable 1 }

lldpV2Xdot1RemVidUsageDigestEntry ::= SEQUENCE {
    lldpV2Xdot1RemVidUsageDigest  Unsigned32
}

lldpV2Xdot1RemVidUsageDigest OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "The integer value obtained by applying the CRC32 function
         to the 128-octet VID Usage Table. A bit of the VID Usage
         Table contains the value PBB-TE-USAGE (binary 1) if the
         corresponding element of the MST Configuration Table
         (IEEE Std 802.1Q 8.9.1) contains the value PBB-TE MSTID
         (hex FFE) and otherwise contains the value NON-PBB-TE-USAGE
         (binary 0)."
    REFERENCE
        "D.2.5.1"
    ::= { lldpV2Xdot1RemVidUsageDigestEntry 1 }

--
-- lldpV2Xdot1RemManVidTable: Table of values configured on remote
-- systems for the Management VID, or the value 0 if a Management
-- VID has not been provisioned.
-- This version replaced by a reindexed version (V2).
--

lldpV2Xdot1RemManVidTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1RemManVidEntry
    MAX-ACCESS  not-accessible
    STATUS      deprecated
    DESCRIPTION
        "This table contains one row per ifIndex/
         destination MAC address pair for management VID
         information received from remote systems."
    REFERENCE
        "D.2.6"
    ::= { lldpV2Xdot1RemoteData 6 }

lldpV2Xdot1RemManVidEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1RemManVidEntry
    MAX-ACCESS  not-accessible
    STATUS      deprecated
    DESCRIPTION
        "Management VID information received
         through the given port/destination address pair."
    REFERENCE
        "D.2.6"
    INDEX      { lldpV2RemTimeMark,
                  lldpV2RemLocalIfIndex,
                  lldpV2RemLocalDestMACAddress }
    ::= { lldpV2Xdot1RemManVidTable 1 }

lldpV2Xdot1RemManVidEntry ::= SEQUENCE {
    lldpV2Xdot1RemManVid  Unsigned32
}
```

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```
lldpV2Xdot1RemManVid OBJECT-TYPE
    SYNTAX Unsigned32 (0|1..4094)
    MAX-ACCESS read-only
    STATUS deprecated
    DESCRIPTION
        "The integer value configured on a system for
        the Management VID, or
        the value 0 if a Management VID has not been provisioned."
    REFERENCE
        "D.2.6.1"
 ::= { lldpV2Xdot1RemManVidEntry 1 }

--
-- lldpV2Xdot1RemVidUsageDigestV2Table: Table of hash values of
-- system VID Usage Table received
-- via VID Usage Digest TLV.
--

lldpV2Xdot1RemVidUsageDigestV2Table OBJECT-TYPE
    SYNTAX SEQUENCE OF lldpV2Xdot1RemVidUsageDigestV2Entry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "This table contains one row per ifIndex/
        destination MAC address pair for usage digest
        information received by the local system."
    REFERENCE
        "D.2.5"
 ::= { lldpV2Xdot1RemoteData 8 }

lldpV2Xdot1RemVidUsageDigestV2Entry OBJECT-TYPE
    SYNTAX LldpV2Xdot1RemVidUsageDigestV2Entry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Usage digest information received on
        the given port/destination address pair."
    REFERENCE
        "D.2.5"
    INDEX { lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex }
 ::= { lldpV2Xdot1RemVidUsageDigestV2Table 1 }

lldpV2Xdot1RemVidUsageDigestV2Entry ::= SEQUENCE {
    lldpV2Xdot1RemVidUsageDigestV2 Unsigned32
}

lldpV2Xdot1RemVidUsageDigestV2 OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The integer value obtained by applying the CRC32 function
        to the 128-octet VID Usage Table. A bit of the VID Usage
        Table contains the value PBB-TE-USAGE (binary 1) if the
        corresponding element of the MST Configuration Table
        (IEEE Std 802.1Q 8.9.1) contains the value PBB-TE MSTID
        (hex FFE) and otherwise contains the value NON-PBB-TE-USAGE
        (binary 0)."
```

REFERENCE

"D.2.5.1"

::= { lldpV2Xdot1RemVidUsageDigestV2Entry 1 }

--

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-- lldpV2Xdot1RemManVidV2Table: Table of values configured on remote
-- systems for the Management VID, or the value 0 if a Management
-- VID has not been provisioned.
--

lldpV2Xdot1RemManVidV2Table OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1RemManVidV2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per ifIndex/
destination MAC address pair for management VID
information received from remote systems."
REFERENCE
"D.2.6"
::= { lldpV2Xdot1RemoteData 9 }

lldpV2Xdot1RemManVidV2Entry OBJECT-TYPE
SYNTAX LldpV2Xdot1RemManVidV2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Management VID information received
through the given port/destination address pair."
REFERENCE
"D.2.6"
INDEX { lldpV2RemTimeMark,
lldpV2RemLocalIfIndex,
lldpV2RemLocalDestMACAddress,
lldpV2RemIndex }
::= { lldpV2Xdot1RemManVidV2Table 1 }

lldpV2Xdot1RemManVidV2Entry ::= SEQUENCE {
lldpV2Xdot1RemManVidV2 Unsigned32
}

lldpV2Xdot1RemManVidV2 OBJECT-TYPE
SYNTAX Unsigned32 (0|1..4094)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The integer value configured on a system for
the Management VID, or
the value 0 if a Management VID has not been provisioned."
REFERENCE
"D.2.6.1"
::= { lldpV2Xdot1RemManVidV2Entry 1 }

-- Remote System Information - Link Aggregation

--- lldpV2Xdot1RemLinkAggTable: Link Aggregation Information Table

lldpV2Xdot1RemLinkAggTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1RemLinkAggEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains port link aggregation information
(as a part of the LLDP IEEE 802.1 organizational extension)
of the remote system."
::= { lldpV2Xdot1RemoteData 7 }

lldpV2Xdot1RemLinkAggEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1RemLinkAggEntry
MAX-ACCESS not-accessible

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```
STATUS      current
DESCRIPTION
    "Link Aggregation information about remote system's port
    component."
INDEX      { lldpV2RemTimeMark,
             lldpV2RemLocalIfIndex,
             lldpV2RemLocalDestMACAddress,
             lldpV2RemIndex }
 ::= { lldpV2Xdot1RemLinkAggTable 1 }

LldpV2Xdot1RemLinkAggEntry ::= SEQUENCE {
    lldpV2Xdot1RemLinkAggStatus      LldpV2XLinkAggStatusMap,
    lldpV2Xdot1RemLinkAggPortId      Unsigned32
}

lldpV2Xdot1RemLinkAggStatus OBJECT-TYPE
SYNTAX      LldpV2XLinkAggStatusMap
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The bitmap value contains the link aggregation capabilities
    and the current aggregation status of the link."
REFERENCE
    "IEEE Std 802.1AX"
 ::= { lldpV2Xdot1RemLinkAggEntry 1 }

lldpV2Xdot1RemLinkAggPortId OBJECT-TYPE
SYNTAX      Unsigned32(0|1..2147483647)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "This object contains the IEEE 802.1 aggregated port
    identifier, aAggPortID (IEEE Std 802.1AX, 7.3.2.1.1 6.3.2.1.1),
    derived from the ifNumber of the ifIndex for the port
    component associated with the remote system.

    If the remote port is not in link aggregation state and/or
    it does not support link aggregation, this value should be
    zero."
REFERENCE
    "IEEE Std 802.1AX"
 ::= { lldpV2Xdot1RemLinkAggEntry 2 }

-----
-- Conformance Information for the basicSet TLV set
-----

lldpV2Xdot1Conformance
    OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 2 }
lldpV2Xdot1Compliances
    OBJECT IDENTIFIER ::= { lldpV2Xdot1Conformance 1 }
lldpV2Xdot1Groups
    OBJECT IDENTIFIER ::= { lldpV2Xdot1Conformance 2 }

-- compliance statements

lldpV2Xdot1TxRxCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
    "A compliance statement for SNMP entities that implement
    the IEEE 802.1 organizationally defined LLDP extension MIB.

    This group is mandatory for all agents that implement the
    LLDP 802.1 organizational extension in TX and/or RX mode
    for the basicSet TLV set.

    This version defines compliance requirements for
    V2 of the LLDP MIB."
MODULE      -- this module
    MANDATORY-GROUPS { lldpV2Xdot1ConfigGroup,
```

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```

        ifGeneralInformationGroup
    }
    ::= { lldpV2Xdot1Compliances 1 }

lldpV2Xdot1TxCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "A compliance statement for SNMP entities that implement
        the IEEE 802.1 organizationally defined LLDP extension MIB.

        This group is mandatory for agents that implement the
        LLDP 802.1 organizational extension in the RX mode
        for the basicSet TLV set.

        This version defines compliance requirements for
        V2 of the LLDP MIB."
    MODULE -- this module
        MANDATORY-GROUPS { lldpV2Xdot1LocSysGroup }

    ::= { lldpV2Xdot1Compliances 2 }

lldpV2Xdot1RxCompliance MODULE-COMPLIANCE
    STATUS deprecated
    DESCRIPTION
        "A compliance statement for SNMP entities that implement
        the IEEE 802.1 organizationally defined LLDP extension MIB.

        This group is mandatory for agents that implement the
        LLDP 802.1 organizational extension in the RX mode
        for the basicSet TLV set.

        This version defines compliance requirements for
        V2 of the LLDP MIB."
    MODULE -- this module
        MANDATORY-GROUPS { lldpV2Xdot1RemSysGroup }

    ::= { lldpV2Xdot1Compliances 3 }

lldpV2Xdot1RxComplianceV2 MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "A compliance statement for SNMP entities that implement
        the IEEE 802.1 organizationally defined LLDP extension MIB.

        This group is mandatory for agents that implement the
        LLDP 802.1 organizational extension in the RX mode
        for the basicSet TLV set.

        This version defines compliance requirements for
        V2 of the LLDP MIB."
    MODULE -- this module
        MANDATORY-GROUPS { lldpV2Xdot1RemSysV2Group }

    ::= { lldpV2Xdot1Compliances 4 }

-- MIB groupings for the basicSet TLV set
lldpV2Xdot1ConfigGroup OBJECT-GROUP
    OBJECTS {
        lldpV2Xdot1ConfigPortVlanTxEnable,
        lldpV2Xdot1ConfigVlanNameTxEnable,
        lldpV2Xdot1ConfigProtoVlanTxEnable,
        lldpV2Xdot1ConfigProtocolTxEnable,
        lldpV2Xdot1ConfigVidUsageDigestTxEnable,
        lldpV2Xdot1ConfigManVidTxEnable
    }
    STATUS current
    DESCRIPTION
        "The collection of objects that are used to configure the
        IEEE 802.1 organizationally defined LLDP extension

```

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```
implementation behavior for the basicSet TLV set."
::= { lldpV2Xdot1Groups 1 }

lldpV2Xdot1LocSysGroup OBJECT-GROUP
OBJECTS {
    lldpV2Xdot1LocPortVlanId,
    lldpV2Xdot1LocProtoVlanSupported,
    lldpV2Xdot1LocProtoVlanEnabled,
    lldpV2Xdot1LocVlanName,
    lldpV2Xdot1LocProtocolId,
    lldpV2Xdot1LocVidUsageDigest,
    lldpV2Xdot1LocManVid,
    lldpV2Xdot1LocLinkAggStatus,
    lldpV2Xdot1LocLinkAggPortId
}
STATUS current
DESCRIPTION
    "The collection of objects that are used to represent
    IEEE 802.1 organizationally defined LLDP extension
    associated with the Local Device Information for the
    basicSet TLV set."
::= { lldpV2Xdot1Groups 2 }

lldpV2Xdot1RemSysGroup OBJECT-GROUP
OBJECTS {
    lldpV2Xdot1RemPortVlanId,
    lldpV2Xdot1RemProtoVlanSupported,
    lldpV2Xdot1RemProtoVlanEnabled,
    lldpV2Xdot1RemVlanName,
    lldpV2Xdot1RemProtocolId,
    lldpV2Xdot1RemVidUsageDigest,
    lldpV2Xdot1RemManVid,
    lldpV2Xdot1RemLinkAggStatus,
    lldpV2Xdot1RemLinkAggPortId
}
STATUS deprecated
DESCRIPTION
    "The collection of objects that are used to represent LLDP
    802.1 organizational extension Remote Device Information
    for the basicSet TLV set."
::= { lldpV2Xdot1Groups 3 }

lldpV2Xdot1RemSysV2Group OBJECT-GROUP
OBJECTS {
    lldpV2Xdot1RemPortVlanId,
    lldpV2Xdot1RemProtoVlanSupported,
    lldpV2Xdot1RemProtoVlanEnabled,
    lldpV2Xdot1RemVlanName,
    lldpV2Xdot1RemProtocolId,
    lldpV2Xdot1RemVidUsageDigestV2,
    lldpV2Xdot1RemManVidV2,
    lldpV2Xdot1RemLinkAggStatus,
    lldpV2Xdot1RemLinkAggPortId
}
STATUS current
DESCRIPTION
    "The collection of objects that are used to represent LLDP
    802.1 organizational extension Remote Device Information
    for the basicSet TLV set."
::= { lldpV2Xdot1Groups 4 }

-----
--
-- Organizationally Defined Information Extension - IEEE 802.1
-- Definitions to support the cnSet TLV set (Table D-1)
-- for Congestion Notification
--
-----

lldpXdot1CnMIB OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 3 }
```

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```
lldpXdot1CnObjects OBJECT IDENTIFIER ::= { lldpXdot1CnMIB 1 }

-- CN 802.1 MIB Extension groups

lldpXdot1CnConfig OBJECT IDENTIFIER ::= { lldpXdot1CnObjects 1 }
lldpXdot1CnLocalData OBJECT IDENTIFIER ::= { lldpXdot1CnObjects 2 }
lldpXdot1CnRemoteData OBJECT IDENTIFIER ::= { lldpXdot1CnObjects 3 }

-----
-- Textual conventions for Congestion Notification
-----

LldpV2CnBitVector ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "This TC describes a bit vector used in the Congestion
        Notification objects. Each bit represents a Boolean status
        associated with a priority code point. A bit value of 0
        represents FALSE, 1 represents TRUE.

        The bit 'pri0status(0)' indicates the status for priority 0
        The bit 'pri1status(1)' indicates the status for priority 1
        The bit 'pri2status(2)' indicates the status for priority 2
        The bit 'pri3status(3)' indicates the status for priority 3
        The bit 'pri4status(4)' indicates the status for priority 4
        The bit 'pri5status(5)' indicates the status for priority 5
        The bit 'pri6status(6)' indicates the status for priority 6
        The bit 'pri7status(7)' indicates the status for priority 7"

    SYNTAX      BITS {
        pri0status(0),
        pri1status(1),
        pri2status(2),
        pri3status(3),
        pri4status(4),
        pri5status(5),
        pri6status(6),
        pri7status(7)
    }

-----
-- IEEE 802.1 - Congestion Notification Configuration
-----

--
-- lldpXdot1CnConfigCnTable : configure the
-- transmission of the Congestion Notification TLV on a set of ports
--

lldpXdot1CnConfigCnTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1CnConfigCnEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "A table that controls selection of Congestion Notification
        TLVs to be transmitted on individual ports."
    ::= { lldpXdot1CnConfig 1 }

lldpXdot1CnConfigCnEntry OBJECT-TYPE
    SYNTAX      LldpXdot1CnConfigCnEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "LLDP configuration information that controls the
        transmission of IEEE 802.1 organizationally defined
        Congestion Notification TLV on LLDP transmission-capable ports.

        This configuration object augments the lldpV2PortConfigEntry of
        the LLDP-MIB, therefore it is only present along with the port
        configuration defined by the associated lldpV2PortConfigEntry
        entry."
```

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Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2PortConfigEntry }

::= { lldpXdot1CnConfigCnTable 1 }

lldpXdot1CnConfigCnEntry ::= SEQUENCE {
 lldpXdot1CnConfigCnTxEnable TruthValue
}

lldpXdot1CnConfigCnTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The lldpXdot1CnConfigCnTxEnable, which is defined as a truth value and configured by the network management, determines whether the IEEE 802.1 organizationally defined Congestion Notification TLV transmission is allowed on a given LLDP transmission-capable port.

 The value of this object is restored from non-volatile storage after a re-initialization of the management system."
REFERENCE
 "D.2.7"
DEFVAL { false }
::= { lldpXdot1CnConfigCnEntry 1 }

-- IEEE 802.1 - Congestion Notification Local System Information

--- lldpV2Xdot1LocCnTable: Port Extension Information Table

lldpV2Xdot1LocCnTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpV2Xdot1LocCnEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "This table contains one row per port of Congestion Notification information (as a part of the LLDP 802.1 organizational extension) on the local system known to this agent."
::= { lldpXdot1CnLocalData 1 }

lldpV2Xdot1LocCnEntry OBJECT-TYPE
SYNTAX LldpV2Xdot1LocCnEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "Congestion Notification information about a particular port component."
INDEX { lldpV2LocPortIfIndex }
::= { lldpV2Xdot1LocCnTable 1 }

LldpV2Xdot1LocCnEntry ::= SEQUENCE {
 lldpV2Xdot1LocCNPVIndicators LldpV2CnBitVector,
 lldpV2Xdot1LocReadyIndicators LldpV2CnBitVector
}

lldpV2Xdot1LocCNPVIndicators OBJECT-TYPE
SYNTAX LldpV2CnBitVector
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "This object contains the CNPV indicators for the Port."
REFERENCE
 "D.2.7.3"

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```
::= { lldpV2Xdot1LocCnEntry 1 }

lldpV2Xdot1LocReadyIndicators OBJECT-TYPE
    SYNTAX      LldpV2CnBitVector
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the Ready indicators
        for the Port."
    REFERENCE
        "D.2.7.4"
    ::= { lldpV2Xdot1LocCnEntry 2 }

-----
-- IEEE 802.1 - Congestion Notification Remote System Information
-----

---
---
--- lldpV2Xdot1RemCnTable: Port Extension Information Table
---
---
lldpV2Xdot1RemCnTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpV2Xdot1RemCnEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains Congestion Notification information
        (as a part of the LLDP IEEE 802.1 organizational extension)
        of the remote system."
    ::= { lldpXdot1CnRemoteData 1 }

lldpV2Xdot1RemCnEntry OBJECT-TYPE
    SYNTAX      LldpV2Xdot1RemCnEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Port Extension information about remote systems port
        component."
    INDEX      { lldpV2RemTimeMark,
                  lldpV2RemLocalIfIndex,
                  lldpV2RemLocalDestMACAddress,
                  lldpV2RemIndex }
    ::= { lldpV2Xdot1RemCnTable 1 }

lldpV2Xdot1RemCnEntry ::= SEQUENCE {
    lldpV2Xdot1RemCNPVIndicators  LldpV2CnBitVector,
    lldpV2Xdot1RemReadyIndicators LldpV2CnBitVector
}

lldpV2Xdot1RemCNPVIndicators OBJECT-TYPE
    SYNTAX      LldpV2CnBitVector
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the CNPV indicators
        for the Port."
    REFERENCE
        "D.2.7.3"
    ::= { lldpV2Xdot1RemCnEntry 1 }

lldpV2Xdot1RemReadyIndicators OBJECT-TYPE
    SYNTAX      LldpV2CnBitVector
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the Ready indicators
        for the Port."
    REFERENCE
        "D.2.7.4"
    ::= { lldpV2Xdot1RemCnEntry 2 }
```

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```
-----
-- IEEE 802.1 - Congestion Notification Conformance Information
-----

lldpXdot1CnConformance OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 4 }

lldpXdot1CnCompliances
  OBJECT IDENTIFIER ::= { lldpXdot1CnConformance 1 }
lldpXdot1CnGroups OBJECT IDENTIFIER ::= { lldpXdot1CnConformance 2 }

--
-- Congestion Notification - Compliance Statements
--

lldpXdot1CnCompliance MODULE-COMPLIANCE
  STATUS          current
  DESCRIPTION
    "A compliance statement for SNMP entities that implement
    the IEEE 802.1 organizationally defined Congestion
    Notification group in the LLDP extension MIB.

    This group is mandatory for agents that implement the
    Congestion Notification cnSet TLV set."
  MODULE          -- this module
    MANDATORY-GROUPS { lldpXdot1CnGroup,
                        ifGeneralInformationGroup }
  ::= { lldpXdot1CnCompliances 1 }

--
-- Congestion Notification - MIB groupings
--

lldpXdot1CnGroup OBJECT-GROUP
  OBJECTS {
    lldpXdot1CnConfigCnTxEnable,
    lldpV2Xdot1LocCNPVIndicators,
    lldpV2Xdot1LocReadyIndicators,
    lldpV2Xdot1RemCNPVIndicators,
    lldpV2Xdot1RemReadyIndicators
  }
  STATUS current
  DESCRIPTION
    "The collection of objects that support the
    Congestion Notification cnSet TLV set."
  ::= { lldpXdot1CnGroups 1 }

-----
--
-- Organizationally Defined Information Extension - IEEE 802.1
-- Definitions to support the Data Center eXchange Protocol
-- (DCBX) TLV Set (Table D-1)
--
-----

lldpXdot1dcbxMIB OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 5 }
lldpXdot1dcbxObjects OBJECT IDENTIFIER ::= { lldpXdot1dcbxMIB 1 }

-- DCBX 802.1 MIB Extension groups

lldpXdot1dcbxConfig OBJECT IDENTIFIER ::= { lldpXdot1dcbxObjects 1 }
lldpXdot1dcbxLocalData OBJECT IDENTIFIER ::= { lldpXdot1dcbxObjects 2 }
lldpXdot1dcbxRemoteData OBJECT IDENTIFIER ::= { lldpXdot1dcbxObjects 3 }
lldpXdot1dcbxAdminData OBJECT IDENTIFIER ::= { lldpXdot1dcbxObjects 4 }

--
-- IEEE 802.1 - DCBX Textual Conventions
--
-----

lldpXdot1dcbxTrafficClassValue ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "d"
```

```

STATUS      current
DESCRIPTION
    "Indicates a traffic class. Values 0-7 correspond to
    traffic classes."
SYNTAX      Unsigned32 (0..7)

LldpXdot1dcbxTrafficClassBandwidthValue ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS      current
    DESCRIPTION
        "Indicates the bandwidth in percent assigned to a
        traffic class."
    SYNTAX      Unsigned32 (0..100)

LldpXdot1dcbxAppSelector ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "Indicates the contents of a protocol object
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
           6 bit DSCP value is stored in the low order 6 bits of the
           protocol object. The higher order bits are set to zero.
           (See IETF RFC 2474 for the definition of the DSCP value.)"
    SYNTAX      INTEGER {
        asEtherType(1),
        asTCPPortNumber(2),
        asUDPPortNumber(3),
        asTCPUDPPortNumber(4),
        asDSCPValue(5)
    }

LldpXdot1dcbxAppProtocol ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS      current
    DESCRIPTION
        "Contains the application protocol indicator the
        type of which is specified by an object with
        the syntax of
        LldpXdot1dcbxAppSelector"
    SYNTAX      Unsigned32 (0..65535)

LldpXdot1dcbxSupportedCapacity ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS      current
    DESCRIPTION
        "Indicates the supported capacity of a given feature,
        for example, the number of traffic classes supported.
        This TC is used for features that have a maximum
        capacity of eight and a minimum of one."
    SYNTAX      Unsigned32 (1..8)

LldpXdot1dcbxTrafficSelectionAlgorithm ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "Indicates the Traffic Selection Algorithm
        0: Strict Priority
        1: Credit-based shaper
        2: Enhanced transmission selection
        3-254: Reserved for future standardization
        255: Vendor specific"
    SYNTAX      INTEGER {
        tsaStrictPriority(0),
        tsaCreditBasedShaper(1),
        tsaEnhancedTransmission(2),
        tsaVendorSpecific(255)
    }

```

-- IEEE 802.1 - DCBX Configuration

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```
-----  
--  
-- lldpXdot1dcbxConfigETSConfigurationTable : configure the  
-- transmission of the ETS Configuration TLV on a set of ports  
--  
  
lldpXdot1dcbxConfigETSConfigurationTable OBJECT-TYPE  
    SYNTAX      SEQUENCE OF LldpXdot1dcbxConfigETSConfigurationEntry  
    MAX-ACCESS   not-accessible  
    STATUS       current  
    DESCRIPTION  
        "A table that controls selection of ETS Configuration  
        TLVs to be transmitted on individual ports."  
    ::= { lldpXdot1dcbxConfig 1 }  
  
lldpXdot1dcbxConfigETSConfigurationEntry OBJECT-TYPE  
    SYNTAX      LldpXdot1dcbxConfigETSConfigurationEntry  
    MAX-ACCESS   not-accessible  
    STATUS       current  
    DESCRIPTION  
        "LLDP configuration information that controls the  
        transmission of IEEE 802.1 organizationally defined  
        ETS Configuration TLV on LLDP transmission-capable ports.  
  
        This configuration object augments the lldpV2PortConfigEntry of  
        the LLDP-MIB, therefore it is only present along with the port  
        configuration defined by the associated lldpV2PortConfigEntry  
        entry.  
  
        Each active lldpConfigEntry is restored from non-volatile  
        storage (along with the corresponding lldpV2PortConfigEntry)  
        after a re-initialization of the management system."  
    AUGMENTS     { lldpV2PortConfigEntry }  
    ::= { lldpXdot1dcbxConfigETSConfigurationTable 1 }  
  
lldpXdot1dcbxConfigETSConfigurationEntry ::= SEQUENCE {  
    lldpXdot1dcbxConfigETSConfigurationTxEnable TruthValue  
}  
  
lldpXdot1dcbxConfigETSConfigurationTxEnable OBJECT-TYPE  
    SYNTAX      TruthValue  
    MAX-ACCESS   read-write  
    STATUS       current  
    DESCRIPTION  
        "The lldpXdot1dcbxConfigETSConfigurationTxEnable, which is  
        defined as a truth value and configured by the network  
        management, determines whether the IEEE 802.1 organizationally  
        defined ETS Configuration TLV transmission is allowed on a  
        given LLDP transmission-capable port.  
  
        The value of this object is restored from non-volatile  
        storage after a re-initialization of the management system."  
    REFERENCE  
        "D.2.8"  
    DEFVAL      { false }  
    ::= { lldpXdot1dcbxConfigETSConfigurationEntry 1 }  
  
--  
-- lldpXdot1dcbxConfigETSRecommendationTable : configure the  
-- transmission of the ETS Recommendation TLV on a set of ports  
--  
  
lldpXdot1dcbxConfigETSRecommendationTable OBJECT-TYPE  
    SYNTAX      SEQUENCE OF LldpXdot1dcbxConfigETSRecommendationEntry  
    MAX-ACCESS   not-accessible  
    STATUS       current  
    DESCRIPTION  
        "A table that controls selection of ETS Recommendation  
        TLVs to be transmitted on individual ports."  
    ::= { lldpXdot1dcbxConfig 2 }
```

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lldpXdot1dcbxConfigETSRecommendationEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxConfigETSRecommendationEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"LLDP configuration information that controls the transmission of IEEE 802.1 organizationally defined ETS Recommendation TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of the LLDP-MIB, therefore it is only present along with the port configuration defined by the associated lldpV2PortConfigEntry entry.

Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry) after a re-initialization of the management system."
AUGMENTS { lldpV2PortConfigEntry }
::= { lldpXdot1dcbxConfigETSRecommendationTable 1 }

LldpXdot1dcbxConfigETSRecommendationEntry ::= SEQUENCE {
 lldpXdot1dcbxConfigETSRecommendationTxEnable TruthValue
}

lldpXdot1dcbxConfigETSRecommendationTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The lldpXdot1dcbxConfigETSRecommendationTxEnable, which is defined as a truth value and configured by the network management, determines whether the IEEE 802.1 organizationally defined ETS Recommendation TLV transmission is allowed on a given LLDP transmission-capable port.

The value of this object is restored from non-volatile storage after a re-initialization of the management system."
REFERENCE
"D.2.9"
DEFVAL { false }
::= { lldpXdot1dcbxConfigETSRecommendationEntry 1 }

--
-- lldpXdot1dcbxConfigPFCTable : configure the transmission of the
-- Priority-based Flow Control Configuration TLV on a set of ports
--

lldpXdot1dcbxConfigPFCTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpXdot1dcbxConfigPFCEntree
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A table that controls selection of Priority-based Flow Control Configuration TLVs to be transmitted on individual ports."
::= { lldpXdot1dcbxConfig 3 }

lldpXdot1dcbxConfigPFCEntree OBJECT-TYPE
SYNTAX LldpXdot1dcbxConfigPFCEntree
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"LLDP configuration information that controls the transmission of IEEE 802.1 organizationally defined Priority-based Flow Control Configuration TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of the LLDP-MIB, therefore it is only present along with the port configuration defined by the associated lldpV2PortConfigEntry entry.

Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry)

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after a re-initialization of the management system."

AUGMENTS { lldpV2PortConfigEntry }

::= { lldpXdotldcbxConfigPFCTable 1 }

lldpXdotldcbxConfigPFCTable ::= SEQUENCE {
 lldpXdotldcbxConfigPFCTxEnable TruthValue
}

lldpXdotldcbxConfigPFCTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The lldpXdotldcbxConfigPFCTxEnable, which is defined
 as a truth value and configured by the network management,
 determines whether the IEEE 802.1 organizationally defined
 Priority-based Flow Control Configuration TLV transmission is allowed on
 a given LLDP transmission-capable port.

 The value of this object is restored from non-volatile
 storage after a re-initialization of the management system."
REFERENCE
 "D.2.10"
DEFVAL { false }
 ::= { lldpXdotldcbxConfigPFCTable 1 }

--
-- lldpXdotldcbxConfigApplicationPriorityTable : configure the
-- transmission of the Application Priority TLV on a set of ports
--

lldpXdotldcbxConfigApplicationPriorityTable OBJECT-TYPE
SYNTAX SEQUENCE OF
 lldpXdotldcbxConfigApplicationPriorityEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "A table that controls selection of Priority-based
 Flow Control Configuration TLVs to be transmitted on individual ports."
 ::= { lldpXdotldcbxConfig 4 }

lldpXdotldcbxConfigApplicationPriorityEntry OBJECT-TYPE
SYNTAX lldpXdotldcbxConfigApplicationPriorityEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "LLDP configuration information that controls the
 transmission of IEEE 802.1 organizationally defined
 Application Priority TLV on LLDP transmission-capable ports.

 This configuration object augments the lldpV2PortConfigEntry of
 the LLDP-MIB, therefore it is only present along with the port
 configuration defined by the associated lldpV2PortConfigEntry
 entry.

 Each active lldpConfigEntry is restored from non-volatile
 storage (along with the corresponding lldpV2PortConfigEntry)
 after a re-initialization of the management system."
AUGMENTS { lldpV2PortConfigEntry }

::= { lldpXdotldcbxConfigApplicationPriorityTable 1 }

lldpXdotldcbxConfigApplicationPriorityEntry ::= SEQUENCE {
 lldpXdotldcbxConfigApplicationPriorityTxEnable TruthValue
}

lldpXdotldcbxConfigApplicationPriorityTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The lldpXdotldcbxConfigApplicationPriorityTxEnable, which
 is defined as a truth value and configured by the network

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management, determines whether the IEEE 802.1 organizationally defined Application Priority TLV transmission is allowed on a given LLDP transmission-capable port.

The value of this object is restored from non-volatile storage after a re-initialization of the management system."

REFERENCE

"D.2.11"

DEFVAL { false }

::= { lldpXdotldcbxConfigApplicationPriorityEntry 1 }

--

-- lldpXdotldcbxConfigApplicationVlanTable : configure the
-- transmission of the Application VLAN TLV on a set of ports
--

lldpXdotldcbxConfigApplicationVlanTable OBJECT-TYPE

SYNTAX SEQUENCE OF

LldpXdotldcbxConfigApplicationVlanEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table that controls selection of Application VLAN TLVs to be transmitted on individual ports."

::= { lldpXdotldcbxConfig 5 }

lldpXdotldcbxConfigApplicationVlanEntry OBJECT-TYPE

SYNTAX LldpXdotldcbxConfigApplicationVlanEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"LLDP configuration information that controls the transmission of IEEE 802.1 organizationally defined Application VLAN TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of the LLDP-MIB, therefore it is only present along with the port configuration defined by the associated lldpV2PortConfigEntry entry.

Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2PortConfigEntry }

::= { lldpXdotldcbxConfigApplicationVlanTable 1 }

lldpXdotldcbxConfigApplicationVlanEntry ::= SEQUENCE {
lldpXdotldcbxConfigApplicationVlanTxEnable TruthValue
}

lldpXdotldcbxConfigApplicationVlanTxEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The lldpXdotldcbxConfigApplicationVlanTxEnable, which is defined as a truth value and configured by the network management, determines whether the IEEE 802.1 organizationally defined Application VLAN TLV transmission is allowed on a given LLDP transmission-capable port.

The value of this object is restored from non-volatile storage after a re-initialization of the management system."

REFERENCE

"D.2.14"

DEFVAL { false }

::= { lldpXdotldcbxConfigApplicationVlanEntry 1 }

-- IEEE 802.1 - DCBX Local System Information

```
--
-- lldpXdot1dcbxLocETSConfigurationTable - Contains the information
-- for the ETS Configuration TLV.
--
lldpXdot1dcbxLocETSConfiguration OBJECT IDENTIFIER
    ::= { lldpXdot1dcbxLocalData 1 }

lldpXdot1dcbxLocETSBasicConfigurationTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxLocETSBasicConfigurationEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per port for the IEEE 802.1
        organizationally defined LLDP ETS Configuration TLV on
        the local system known to this agent agent."
    ::= { lldpXdot1dcbxLocETSConfiguration 1 }

lldpXdot1dcbxLocETSBasicConfigurationEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocETSBasicConfigurationEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about the IEEE 802.1 organizational defined
        ETS Configuration TLV LLDP extension."
    INDEX       { lldpV2LocPortIfIndex }
    ::= { lldpXdot1dcbxLocETSBasicConfigurationTable 1 }

LldpXdot1dcbxLocETSBasicConfigurationEntry ::= SEQUENCE {
    lldpXdot1dcbxLocETSConCreditBasedShaperSupport TruthValue,
    lldpXdot1dcbxLocETSConTrafficClassesSupported
        LldpXdot1dcbxSupportedCapacity,
    lldpXdot1dcbxLocETSConWilling TruthValue
}

lldpXdot1dcbxLocETSConCreditBasedShaperSupport OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates if the credit-based shaper Traffic Selection
        Algorithm is supported on the local system."
    REFERENCE
        "D.2.8.4"
    ::= { lldpXdot1dcbxLocETSBasicConfigurationEntry 1 }

lldpXdot1dcbxLocETSConTrafficClassesSupported OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates the number of traffic classes supported."
    REFERENCE
        "D.2.8.5"
    ::= { lldpXdot1dcbxLocETSBasicConfigurationEntry 2 }

lldpXdot1dcbxLocETSConWilling OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates if the local system is willing to accept the
        ETS configuration recommended by the remote system."
    REFERENCE
        "D.2.8.3"
    ::= { lldpXdot1dcbxLocETSBasicConfigurationEntry 3 }

lldpXdot1dcbxLocETSConPriorityAssignmentTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxLocETSConPriorityAssignmentEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
```

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"This table contains one row per priority. The entry in each row indicates the traffic class to which the priority is assigned."

```

 ::= { lldpXdot1dcbxLocETSTConfiguration 2 }

lldpXdot1dcbxLocETSTConPriorityAssignmentEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocETSTConPriorityAssignmentEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates a priority to traffic class assignment."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxLocETSTConPriority
        }
    ::= { lldpXdot1dcbxLocETSTConPriorityAssignmentTable 1 }

lldpXdot1dcbxLocETSTConPriorityAssignmentEntry ::= SEQUENCE {
    lldpXdot1dcbxLocETSTConPriority      IEEE8021PriorityValue,
    lldpXdot1dcbxLocETSTConPriTrafficClass
        LldpXdot1dcbxTrafficClassValue
}

lldpXdot1dcbxLocETSTConPriority OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates the priority that is assigned to a traffic
        class."
    REFERENCE
        "D.2.8.6"
    ::= { lldpXdot1dcbxLocETSTConPriorityAssignmentEntry 1 }

lldpXdot1dcbxLocETSTConPriTrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the traffic class to which this priority is
        to be assigned."
    REFERENCE
        "D.2.8.6"
    ::= { lldpXdot1dcbxLocETSTConPriorityAssignmentEntry 2 }

lldpXdot1dcbxLocETSTConTrafficClassBandwidthTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxLocETSTConTrafficClassBandwidthEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per traffic class. The
        entry in each row indicates the traffic class to
        which the bandwidth is assigned."
    ::= { lldpXdot1dcbxLocETSTConfiguration 3 }

lldpXdot1dcbxLocETSTConTrafficClassBandwidthEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocETSTConTrafficClassBandwidthEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates a traffic class to Bandwidth assignment."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxLocETSTConTrafficClass
        }
    ::= { lldpXdot1dcbxLocETSTConTrafficClassBandwidthTable 1 }

lldpXdot1dcbxLocETSTConTrafficClassBandwidthEntry ::= SEQUENCE {
    lldpXdot1dcbxLocETSTConTrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxLocETSTConTrafficClassBandwidth

```

```

        LldpXdot1dcbxTrafficClassBandwidthValue
    }

lldpXdot1dcbxLocETSTrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates the traffic class to
        which this bandwidth applies applies."
    REFERENCE
        "D.2.8.7"
    ::= { lldpXdot1dcbxLocETSTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxLocETSTrafficClassBandwidth OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassBandwidthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the bandwidth assigned to this traffic class."
    REFERENCE
        "D.2.8.7"
    ::= { lldpXdot1dcbxLocETSTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxLocETSTrafficSelectionAlgorithmTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxLocETSTrafficSelectionAlgorithmEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per traffic class. The entry
        in each row indicates the traffic selection algorithm to be
        used by the traffic class."
    ::= { lldpXdot1dcbxLocETSConfiguration 4 }

lldpXdot1dcbxLocETSTrafficSelectionAlgorithmEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocETSTrafficSelectionAlgorithmEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates a traffic class to traffic selection algorithm
        assignment."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxLocETSConTSATrafficClass
        }
    ::= { lldpXdot1dcbxLocETSTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxLocETSTrafficSelectionAlgorithmEntry ::= SEQUENCE {
    lldpXdot1dcbxLocETSConTSATrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxLocETSTrafficSelectionAlgorithm
        LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxLocETSConTSATrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates the traffic class that is assigned to a traffic
        selection algorithm."
    REFERENCE
        "D.2.8.8"
    ::= { lldpXdot1dcbxLocETSTrafficSelectionAlgorithmEntry 1 }

lldpXdot1dcbxLocETSTrafficSelectionAlgorithm OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficSelectionAlgorithm
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION

```

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"Indicates the Traffic Selection Algorithm to which this traffic class is to be assigned."

REFERENCE
"D.2.8.8"
::= { lldpXdot1dcbxLocETSConTrafficSelectionAlgorithmEntry 2 }

--
-- lldpXdot1dcbxLocETSRecommendationTable - Contains the information for
-- the ETS Recommendation TLV.
--

lldpXdot1dcbxLocETSReco OBJECT IDENTIFIER ::= { lldpXdot1dcbxLocalData 2 }

lldpXdot1dcbxLocETSRecoTrafficClassBandwidthTable OBJECT-TYPE
SYNTAX SEQUENCE OF
LldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per traffic class. The entry in each row indicates the traffic class to which the bandwidth is assigned."
::= { lldpXdot1dcbxLocETSReco 1 }

lldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates a traffic class to Bandwidth assignment."
INDEX
{
lldpV2LocPortIfIndex,
lldpXdot1dcbxLocETSRecoTrafficClass
}
::= { lldpXdot1dcbxLocETSRecoTrafficClassBandwidthTable 1 }

lldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry ::= SEQUENCE {
lldpXdot1dcbxLocETSRecoTrafficClass
LldpXdot1dcbxTrafficClassValue,
lldpXdot1dcbxLocETSRecoTrafficClassBandwidth
LldpXdot1dcbxTrafficClassBandwidthValue
}

lldpXdot1dcbxLocETSRecoTrafficClass OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassValue
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the traffic class to which this bandwidth ~~applies~~ applies."
REFERENCE
"D.2.9.3"
::= { lldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxLocETSRecoTrafficClassBandwidth OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassBandwidthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the bandwidth assigned to this traffic class."
REFERENCE
"D.2.9.4"
::= { lldpXdot1dcbxLocETSRecoTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmTable OBJECT-TYPE
SYNTAX SEQUENCE OF
LldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per priority. The entry in each row indicates the traffic selection algorithm to be used"

```

    by the traffic class."
    ::= { lldpXdot1dcbxLocETSReco 2 }

lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates a priority to traffic selection algorithm
        assignment."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxLocETSRecoTSATrafficClass
        }
    ::= { lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry ::= SEQUENCE {
    lldpXdot1dcbxLocETSRecoTSATrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithm
        LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxLocETSRecoTSATrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates the traffic class that is assigned to a traffic
        selection algorithm."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry 1 }

lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithm OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficSelectionAlgorithm
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the Traffic Selection Algorithm to which this
        traffic class is to be assigned."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithmEntry 2 }

--
-- lldpXdot1dcbxLocPFCBTable - Contains the information for the PFC
-- Configuration TLV.
--
lldpXdot1dcbxLocPFC OBJECT IDENTIFIER ::= { lldpXdot1dcbxLocalData 3 }

lldpXdot1dcbxLocPFCBTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxLocPFCBBasicEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per port for the IEEE 802.1
        organizationally defined LLDP PFC TLV on the local
        system known to this agent agent."
    ::= { lldpXdot1dcbxLocPFC 1 }

lldpXdot1dcbxLocPFCBBasicEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocPFCBBasicEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about the IEEE 802.1 organizational defined
        PFC TLV LLDP extension."
    INDEX
        { lldpV2LocPortIfIndex }
    ::= { lldpXdot1dcbxLocPFCBTable 1 }

lldpXdot1dcbxLocPFCBBasicEntry ::= SEQUENCE {

```

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```
lldpXdot1dcbxLocPFCWilling      TruthValue,
lldpXdot1dcbxLocPFCMBC          TruthValue,
lldpXdot1dcbxLocPFCCap          LldpXdot1dcbxSupportedCapacity
}

lldpXdot1dcbxLocPFCWilling OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates if the local system is willing to accept the
        PFC configuration of the remote system."
    REFERENCE
        "D.2.10.3"
    ::= { lldpXdot1dcbxLocPFCBasicEntry 1 }

lldpXdot1dcbxLocPFCMBC OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates if the local system is capable of bypassing
        MACsec processing when MACsec is disabled."
    REFERENCE
        "D.2.10.4"
    ::= { lldpXdot1dcbxLocPFCBasicEntry 2 }

lldpXdot1dcbxLocPFCCap OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the number of traffic classes on the local device
        that may simultaneously have PFC enabled."
    REFERENCE
        "D.2.10.5"
    ::= { lldpXdot1dcbxLocPFCBasicEntry 3 }

lldpXdot1dcbxLocPFCEnableTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxLocPFCEnableEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains eight entries, one entry per priority,
        indicating if PFC is enabled on the corresponding priority."
    ::= { lldpXdot1dcbxLocPFC 2 }

lldpXdot1dcbxLocPFCEnableEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocPFCEnableEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Each entry indicates if PFC is enabled on the
        corresponding corresponding priority"
    INDEX
        lldpV2LocPortIfIndex,
        lldpXdot1dcbxLocPFCEnablePriority
    ::= { lldpXdot1dcbxLocPFCEnableTable 1 }

lldpXdot1dcbxLocPFCEnableEntry ::= SEQUENCE {
    lldpXdot1dcbxLocPFCEnablePriority IEEE8021PriorityValue,
    lldpXdot1dcbxLocPFCEnableEnabled TruthValue
}

lldpXdot1dcbxLocPFCEnablePriority OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Priority Priority for which PFC is enabled / disabled"
    ::= { lldpXdot1dcbxLocPFCEnableEntry 1 }
```

```

lldpXdot1dcbxLocPFCEnableEnabled OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates if PFC is enabled on the corresponding priority priority."
    REFERENCE
        "D.2.10.6"
    ::= { lldpXdot1dcbxLocPFCEnableEntry 2 }

--
-- lldpXdot1dcbxLocApplicationPriorityTable - Contains the information
-- for the Application Priority TLV.
--

lldpXdot1dcbxLocApplicationPriorityAppTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxLocApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Table containing entries indicating the priority to be used
        for a given application application."
    ::= { lldpXdot1dcbxLocalData 4 }

lldpXdot1dcbxLocApplicationPriorityAppEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxLocApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Entry that indicates the priority to be used for a
        given application."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxLocApplicationPriorityAESelector,
            lldpXdot1dcbxLocApplicationPriorityAEProtocol
        }
    ::= { lldpXdot1dcbxLocApplicationPriorityAppTable 1 }

LldpXdot1dcbxLocApplicationPriorityAppEntry ::= SEQUENCE {
    lldpXdot1dcbxLocApplicationPriorityAESelector
        LldpXdot1dcbxAppSelector,
    lldpXdot1dcbxLocApplicationPriorityAEProtocol
        LldpXdot1dcbxAppProtocol,
    lldpXdot1dcbxLocApplicationPriorityAEPriority
        IEEE8021PriorityValue
}

lldpXdot1dcbxLocApplicationPriorityAESelector OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppSelector
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the contents of the protocol object
        (lldpXdot1dcbxLocApplicationPriorityAEProtocol)
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
           6 bit DSCP value is stored in the low order 6 bits of the
           protocol object. The higher order bits are set to zero.
           (See IETF RFC 2474 for the definition of the DSCP value.)"
    REFERENCE
        "D.2.11.3"
    ::= { lldpXdot1dcbxLocApplicationPriorityAppEntry 1 }

lldpXdot1dcbxLocApplicationPriorityAEProtocol OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppProtocol
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION

```

"The protocol indicator of the type indicated by
lldpXdot1dcbxLocApplicationPriorityASelector."

REFERENCE
"D.2.11.3"
::= { lldpXdot1dcbxLocApplicationPriorityAppEntry 2 }

lldpXdot1dcbxLocApplicationPriorityAEPriority OBJECT-TYPE
SYNTAX IEEE8021PriorityValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The priority code point that should be used in
frames transporting the protocol indicated by
lldpXdot1dcbxLocApplicationPriorityASelector and
lldpXdot1dcbxLocApplicationPriorityAProtocol."
REFERENCE
"D.2.11.3"
::= { lldpXdot1dcbxLocApplicationPriorityAppEntry 3 }

--
-- lldpXdot1dcbxLocApplicationVlanAppTable - Contains the information
-- for the Application VLAN TLV.
--

lldpXdot1dcbxLocApplicationVlanAppTable OBJECT-TYPE
SYNTAX SEQUENCE OF
LldpXdot1dcbxLocApplicationVlanAppEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Table containing entries indicating the VLAN to be used
for a given ~~application~~ application."
::= { lldpXdot1dcbxLocalData 5 }

lldpXdot1dcbxLocApplicationVlanAppEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxLocApplicationVlanAppEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Entry that indicates the VLAN to be used for a
given application."
INDEX
{
lldpV2LocPortIfIndex,
lldpXdot1dcbxLocApplicationVlanASelector,
lldpXdot1dcbxLocApplicationVlanAProtocol
}
::= { lldpXdot1dcbxLocApplicationVlanAppTable 1 }

LldpXdot1dcbxLocApplicationVlanAppEntry ::= SEQUENCE {
lldpXdot1dcbxLocApplicationVlanASelector
LldpXdot1dcbxAppSelector,
lldpXdot1dcbxLocApplicationVlanAProtocol
LldpXdot1dcbxAppProtocol,
lldpXdot1dcbxLocApplicationVlanAEVlanId
VlanId
}
}

lldpXdot1dcbxLocApplicationVlanASelector OBJECT-TYPE
SYNTAX LldpXdot1dcbxAppSelector
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the contents of the protocol object
(lldpXdot1dcbxLocApplicationVlanAProtocol)
1: EtherType
2: Well Known Port number over TCP, or SCTP
3: Well Known Port number over UDP, or DCCP
4: Well Known Port number over TCP, SCTP, UDP, and DCCP
5: Differentiated Services Code Point (DSCP) value. The
6 bit DSCP value is stored in the low order 6 bits of the
protocol object. The higher order bits are set to zero.
(See IETF RFC 2474 for the definition of the DSCP value.)"

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REFERENCE

"D.2.11.3"

::= { lldpXdot1dcbxLocApplicationVlanAppEntry 1 }

lldpXdot1dcbxLocApplicationVlanAEProtocol OBJECT-TYPE

SYNTAX LldpXdot1dcbxAppProtocol

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The protocol indicator of the type indicated by
lldpXdot1dcbxLocApplicationVlanAESelector."

REFERENCE

"D.2.11.3"

::= { lldpXdot1dcbxLocApplicationVlanAppEntry 2 }

lldpXdot1dcbxLocApplicationVlanAEVlanId OBJECT-TYPE

SYNTAX VlanId

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The VLAN Identifier that should be used in
frames transporting the protocol indicated by
lldpXdot1dcbxLocApplicationVlanAESelector and
lldpXdot1dcbxLocApplicationVlanAEProtocol."

REFERENCE

"D.2.14.3"

::= { lldpXdot1dcbxLocApplicationVlanAppEntry 3 }

-- IEEE 802.1 - DCBX Remote System Information

--

-- lldpXdot1dcbxRemETSConfigurationTable - Contains the information
-- for the remote system ETS Configuration TLV.

--

lldpXdot1dcbxRemETSConfiguration OBJECT IDENTIFIER

::= { lldpXdot1dcbxRemoteData 1 }

lldpXdot1dcbxRemETSBasicConfigurationTable OBJECT-TYPE

SYNTAX SEQUENCE OF LldpXdot1dcbxRemETSBasicConfigurationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains one row per port for the IEEE 802.1
organizationally defined LLDP ETS Configuration TLV on
the local system known to this ~~agent~~ agent."

::= { lldpXdot1dcbxRemETSConfiguration 1 }

lldpXdot1dcbxRemETSBasicConfigurationEntry OBJECT-TYPE

SYNTAX LldpXdot1dcbxRemETSBasicConfigurationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Information about the IEEE 802.1 organizational defined
ETS Configuration TLV LLDP extension."

INDEX {
 lldpV2RemTimeMark,
 lldpV2RemLocalIfIndex,
 lldpV2RemLocalDestMACAddress,
 lldpV2RemIndex
}

::= { lldpXdot1dcbxRemETSBasicConfigurationTable 1 }

lldpXdot1dcbxRemETSBasicConfigurationEntry ::= SEQUENCE {

 lldpXdot1dcbxRemETSConCreditBasedShaperSupport TruthValue,

 lldpXdot1dcbxRemETSConTrafficClassesSupported

 LldpXdot1dcbxSupportedCapacity,

 lldpXdot1dcbxRemETSConWilling TruthValue

}

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lldpXdot1dcbxRemETSConCreditBasedShaperSupport OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates if the credit-based shaper Traffic Selection algorithm is supported on the remote system."
REFERENCE
"D.2.8.4"
::= { lldpXdot1dcbxRemETSBasicConfigurationEntry 1 }

lldpXdot1dcbxRemETSConTrafficClassesSupported OBJECT-TYPE
SYNTAX LldpXdot1dcbxSupportedCapacity
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the number of traffic classes supported."
REFERENCE
"D.2.8.5"
::= { lldpXdot1dcbxRemETSBasicConfigurationEntry 2 }

lldpXdot1dcbxRemETSConWilling OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates if the remote system is willing to accept the ETS configuration recommended by the remote system."
REFERENCE
"D.2.8.3"
::= { lldpXdot1dcbxRemETSBasicConfigurationEntry 3 }

lldpXdot1dcbxRemETSConPriorityAssignmentTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpXdot1dcbxRemETSConPriorityAssignmentEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per priority. The entry in each row indicates the traffic class to which the priority is assigned."
::= { lldpXdot1dcbxRemETSConfiguration 2 }

lldpXdot1dcbxRemETSConPriorityAssignmentEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxRemETSConPriorityAssignmentEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates a priority to traffic class assignment."
INDEX
{
lldpV2RemTimeMark,
lldpV2RemLocalIfIndex,
lldpV2RemLocalDestMACAddress,
lldpV2RemIndex,
lldpXdot1dcbxRemETSConPriority
}
::= { lldpXdot1dcbxRemETSConPriorityAssignmentTable 1 }

LldpXdot1dcbxRemETSConPriorityAssignmentEntry ::= SEQUENCE {
lldpXdot1dcbxRemETSConPriority IEEE8021PriorityValue,
lldpXdot1dcbxRemETSConPriTrafficClass
LldpXdot1dcbxTrafficClassValue
}
}

lldpXdot1dcbxRemETSConPriority OBJECT-TYPE
SYNTAX IEEE8021PriorityValue
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the priority that is assigned to a traffic class."
REFERENCE

```

"D.2.8.6"
::= { lldpXdot1dcbxRemETSConPriorityAssignmentEntry 1 }

lldpXdot1dcbxRemETSConPriTrafficClass OBJECT-TYPE
SYNTAX      LldpXdot1dcbxTrafficClassValue
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "Indicates the traffic class to which this priority is
    to be assigned."
REFERENCE
    "D.2.8.6"
::= { lldpXdot1dcbxRemETSConPriorityAssignmentEntry 2 }

lldpXdot1dcbxRemETSConTrafficClassBandwidthTable OBJECT-TYPE
SYNTAX      SEQUENCE OF
            LldpXdot1dcbxRemETSConTrafficClassBandwidthEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "This table contains one row per traffic class. The
    entry in each row indicates the traffic class to
    which the bandwidth is assigned."
::= { lldpXdot1dcbxRemETSConConfiguration 3 }

lldpXdot1dcbxRemETSConTrafficClassBandwidthEntry OBJECT-TYPE
SYNTAX      LldpXdot1dcbxRemETSConTrafficClassBandwidthEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "Indicates a traffic class to Bandwidth assignment."
INDEX       {
            lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex,
            lldpXdot1dcbxRemETSConTrafficClass
        }
::= { lldpXdot1dcbxRemETSConTrafficClassBandwidthTable 1 }

LldpXdot1dcbxRemETSConTrafficClassBandwidthEntry ::= SEQUENCE {
    lldpXdot1dcbxRemETSConTrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxRemETSConTrafficClassBandwidth
        LldpXdot1dcbxTrafficClassBandwidthValue
}

lldpXdot1dcbxRemETSConTrafficClass OBJECT-TYPE
SYNTAX      LldpXdot1dcbxTrafficClassValue
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "Indicates the traffic class to
    which this bandwidth applies applies."
REFERENCE
    "D.2.8.7"
::= { lldpXdot1dcbxRemETSConTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxRemETSConTrafficClassBandwidth OBJECT-TYPE
SYNTAX      LldpXdot1dcbxTrafficClassBandwidthValue
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "Indicates the bandwidth assigned to this traffic class."
REFERENCE
    "D.2.8.7"
::= { lldpXdot1dcbxRemETSConTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmTable OBJECT-TYPE
SYNTAX      SEQUENCE OF
            LldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry

```

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```

MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "This table contains one row per traffic class. The
    entry in each row indicates the traffic selection
    algorithm to be used by the traffic class."
 ::= { lldpXdot1dcbxRemETSConfiguration 4 }

lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry OBJECT-TYPE
SYNTAX          LldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "Indicates a traffic class to traffic selection
    algorithm assignment."
INDEX
    {
        lldpV2RemTimeMark,
        lldpV2RemLocalIfIndex,
        lldpV2RemLocalDestMACAddress,
        lldpV2RemIndex,
        lldpXdot1dcbxRemETSConTSATrafficClass
    }
 ::= { lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry ::= SEQUENCE
    lldpXdot1dcbxRemETSConTSATrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxRemETSConTrafficSelectionAlgorithm
        LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxRemETSConTSATrafficClass OBJECT-TYPE
SYNTAX          LldpXdot1dcbxTrafficClassValue
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "Indicates the traffic class that is assigned to a traffic
    selection algorithm."
REFERENCE
    "D.2.8.8"
 ::= { lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry 1 }

lldpXdot1dcbxRemETSConTrafficSelectionAlgorithm OBJECT-TYPE
SYNTAX          LldpXdot1dcbxTrafficSelectionAlgorithm
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "Indicates the Traffic Selection Algorithm to which this
    traffic class is to be assigned."
REFERENCE
    "D.2.8.8"
 ::= { lldpXdot1dcbxRemETSConTrafficSelectionAlgorithmEntry 2 }

--
-- lldpXdot1dcbxRemETSRecommendationTable - Contains the information for
-- the remote system ETS Recommendation TLV.
--
lldpXdot1dcbxRemETSReco OBJECT IDENTIFIER ::=
    { lldpXdot1dcbxRemoteData 2 }

lldpXdot1dcbxRemETSRecoTrafficClassBandwidthTable OBJECT-TYPE
SYNTAX          SEQUENCE OF
                LldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "This table contains one row per traffic class. The
    entry in each row indicates the traffic class to
    which the bandwidth is assigned."
 ::= { lldpXdot1dcbxRemETSReco 1 }

lldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry OBJECT-TYPE

```

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SYNTAX LldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates a traffic class to Bandwidth assignment."
INDEX
{
 lldpV2RemTimeMark,
 lldpV2RemLocalIfIndex,
 lldpV2RemLocalDestMACAddress,
 lldpV2RemIndex,
 lldpXdot1dcbxRemETSRecoTrafficClass
}
::= { lldpXdot1dcbxRemETSRecoTrafficClassBandwidthTable 1 }

LldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry ::= SEQUENCE {
 lldpXdot1dcbxRemETSRecoTrafficClass
 LldpXdot1dcbxTrafficClassValue,
 lldpXdot1dcbxRemETSRecoTrafficClassBandwidth
 LldpXdot1dcbxTrafficClassBandwidthValue
}

lldpXdot1dcbxRemETSRecoTrafficClass OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassValue
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the traffic class to
which this bandwidth ~~applies~~ applies."
REFERENCE
"D.2.9.4"
::= { lldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxRemETSRecoTrafficClassBandwidth OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassBandwidthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the bandwidth assigned to this traffic class."
REFERENCE
"D.2.9.4"
::= { lldpXdot1dcbxRemETSRecoTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmTable OBJECT-TYPE
SYNTAX SEQUENCE OF
 LldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per traffic class. The
entry in each row indicates the traffic selection
algorithm to be used by the priority."
::= { lldpXdot1dcbxRemETSReco 2 }

lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates a priority to traffic selection algorithm
assignment."
INDEX
{
 lldpV2RemTimeMark,
 lldpV2RemLocalIfIndex,
 lldpV2RemLocalDestMACAddress,
 lldpV2RemIndex,
 lldpXdot1dcbxRemETSRecoTSATrafficClass
}
::= { lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmTable 1 }

LldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry ::= SEQUENCE {
 lldpXdot1dcbxRemETSRecoTSATrafficClass
 LldpXdot1dcbxTrafficClassValue,
}

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```
lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithm
    LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxRemETSRecoTSATrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the traffic class that is assigned to a traffic
        selection algorithm."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry 1 }

lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithm OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficSelectionAlgorithm
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates the Traffic Selection Algorithm to which this
        traffic class is to be assigned."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithmEntry 2 }

--
-- lldpXdot1dcbxRemPFCTable - Contains the information for the remote
-- system PFC TLV.
--
lldpXdot1dcbxRemPFC OBJECT IDENTIFIER ::= { lldpXdot1dcbxRemoteData 3 }

lldpXdot1dcbxRemPFCBasicTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxRemPFCBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per port for the IEEE 802.1
        organizationally defined LLDP PFC TLV on the local
        system known to this agent agent."
    ::= { lldpXdot1dcbxRemPFC 1 }

lldpXdot1dcbxRemPFCBasicEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxRemPFCBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about the IEEE 802.1 organizational defined
        PFC TLV LLDP extension."
    INDEX
        {
            lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex
        }
    ::= { lldpXdot1dcbxRemPFCBasicTable 1 }

LldpXdot1dcbxRemPFCBasicEntry ::= SEQUENCE {
    lldpXdot1dcbxRemPFCWilling      TruthValue,
    lldpXdot1dcbxRemPFCMBC          TruthValue,
    lldpXdot1dcbxRemPFCFCap         LldpXdot1dcbxSupportedCapacity
}

lldpXdot1dcbxRemPFCWilling OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates if the remote system is willing to accept the
        PFC configuration of the local system."
    REFERENCE
        "D.2.10.3"
```

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```
::= { lldpXdot1dcbxRemPFCBasicEntry 1 }

lldpXdot1dcbxRemPFCMBC OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates if the remote system is capable of bypassing
        MACsec processing when MACsec is disabled."
    REFERENCE
        "D.2.10.4"
    ::= { lldpXdot1dcbxRemPFCBasicEntry 2 }

lldpXdot1dcbxRemPFCCap OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the number of traffic classes on the remote device
        that may simultaneously have PFC enabled."
    REFERENCE
        "D.2.10.5"
    ::= { lldpXdot1dcbxRemPFCBasicEntry 3 }

lldpXdot1dcbxRemPFCEnableTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxRemPFCEnableEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains eight entries, one entry per priority,
        indicating if PFC is enabled on the corresponding priority."
    ::= { lldpXdot1dcbxRemPFC 2 }

lldpXdot1dcbxRemPFCEnableEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxRemPFCEnableEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Each entry indicates if PFC is enabled on the
        corresponding priority priority."
    INDEX
        {
            lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex,
            lldpXdot1dcbxRemPFCEnablePriority
        }
    ::= { lldpXdot1dcbxRemPFCEnableTable 1 }

lldpXdot1dcbxRemPFCEnableEntry ::= SEQUENCE {
    lldpXdot1dcbxRemPFCEnablePriority IEEE8021PriorityValue,
    lldpXdot1dcbxRemPFCEnableEnabled TruthValue
}

lldpXdot1dcbxRemPFCEnablePriority OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Prioity Priority for which PFC is enabled / disabled"
    ::= { lldpXdot1dcbxRemPFCEnableEntry 1 }

lldpXdot1dcbxRemPFCEnableEnabled OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates if PFC is enabled on the corresponding priority priority."
    REFERENCE
        "D.2.10.6"
    ::= { lldpXdot1dcbxRemPFCEnableEntry 2 }
```

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```
--
-- lldpXdot1dcbxRemApplicationPriorityTable - Contains the information
-- for the remote system Application Priority TLV.
--

lldpXdot1dcbxRemApplicationPriorityAppTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxRemApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Table containing entries indicating the priority to be used
        for a given application application."
        ::= { lldpXdot1dcbxRemoteData 4 }

lldpXdot1dcbxRemApplicationPriorityAppEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxRemApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Entry that indicates the priority to be used for a
        given application."
    INDEX
        {
            lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex,
            lldpXdot1dcbxRemApplicationPriorityASelector,
            lldpXdot1dcbxRemApplicationPriorityAEProtocol
        }
        ::= { lldpXdot1dcbxRemApplicationPriorityAppTable 1 }

lldpXdot1dcbxRemApplicationPriorityAppEntry ::= SEQUENCE {
    lldpXdot1dcbxRemApplicationPriorityASelector
        LldpXdot1dcbxAppSelector,
    lldpXdot1dcbxRemApplicationPriorityAEProtocol
        LldpXdot1dcbxAppProtocol,
    lldpXdot1dcbxRemApplicationPriorityAEPriority
        IEEE8021PriorityValue
}

lldpXdot1dcbxRemApplicationPriorityASelector OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppSelector
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the contents of the protocol object
        (lldpXdot1dcbxRemApplicationPriorityAEProtocol)
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
           6 bit DSCP value is stored in the low order 6 bits of the
           protocol object. The higher order bits are set to zero.
           (See IETF RFC 2474 for the definition of the DSCP value.)"
    REFERENCE
        "D.2.11.3"
        ::= { lldpXdot1dcbxRemApplicationPriorityAppEntry 1 }

lldpXdot1dcbxRemApplicationPriorityAEProtocol OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppProtocol
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The protocol indicator of the type indicated by
        lldpXdot1dcbxRemApplicationPriorityASelector."
    REFERENCE
        "D.2.11.3"
        ::= { lldpXdot1dcbxRemApplicationPriorityAppEntry 2 }

lldpXdot1dcbxRemApplicationPriorityAEPriority OBJECT-TYPE
```

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```
SYNTAX      IEEE8021PriorityValue
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The priority code point that should be used in
    frames transporting the protocol indicated by
    lldpXdot1dcbxRemApplicationPriorityAESelector and
    lldpXdot1dcbxRemApplicationPriorityAEProtocol."
REFERENCE
    "D.2.11.3"
    ::= { lldpXdot1dcbxRemApplicationPriorityAppEntry 3 }

--
-- lldpXdot1dcbxRemApplicationVlanAppTable - Contains the information
-- for the remote system Application VLAN TLV.
--

lldpXdot1dcbxRemApplicationVlanAppTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxRemApplicationVlanAppEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Table containing entries indicating the VLAN to be used
        for a given application application."
    ::= { lldpXdot1dcbxRemoteData 5 }

lldpXdot1dcbxRemApplicationVlanAppEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxRemApplicationVlanAppEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Entry that indicates the VLAN to be used for a
        given application."
    INDEX
        {
            lldpV2RemTimeMark,
            lldpV2RemLocalIfIndex,
            lldpV2RemLocalDestMACAddress,
            lldpV2RemIndex,
            lldpXdot1dcbxRemApplicationVlanAESelector,
            lldpXdot1dcbxRemApplicationVlanAEProtocol
        }
    ::= { lldpXdot1dcbxRemApplicationVlanAppTable 1 }

LldpXdot1dcbxRemApplicationVlanAppEntry ::= SEQUENCE {
    lldpXdot1dcbxRemApplicationVlanAESelector
        LldpXdot1dcbxAppSelector,
    lldpXdot1dcbxRemApplicationVlanAEProtocol
        LldpXdot1dcbxAppProtocol,
    lldpXdot1dcbxRemApplicationVlanAEVlanId
        VlanId
}

lldpXdot1dcbxRemApplicationVlanAESelector OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppSelector
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Indicates the contents of the protocol object
        (lldpXdot1dcbxRemApplicationVlanAEProtocol)
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
        6 bit DSCP value is stored in the low order 6 bits of the
        protocol object. The higher order bits are set to zero.
        (See IETF RFC 2474 for the definition of the DSCP value.)"
    REFERENCE
        "D.2.11.3"
    ::= { lldpXdot1dcbxRemApplicationVlanAppEntry 1 }
```

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```
lldpXdot1dcbxRemApplicationVlanAEProtocol OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppProtocol
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The protocol indicator of the type indicated by
        lldpXdot1dcbxRemApplicationVlanAESelector."
    REFERENCE
        "D.2.11.3"
    ::= { lldpXdot1dcbxRemApplicationVlanAppEntry 2 }

lldpXdot1dcbxRemApplicationVlanAEVlanId OBJECT-TYPE
    SYNTAX      VlanId
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The VLAN Identifier that should be used in
        frames transporting the protocol indicated by
        lldpXdot1dcbxRemApplicationVlanAESelector and
        lldpXdot1dcbxRemApplicationVlanAEProtocol."
    REFERENCE
        "D.2.14.3"
    ::= { lldpXdot1dcbxRemApplicationVlanAppEntry 3 }

-----
-- IEEE 802.1 - DCBX Administrative Information
-----

--
-- lldpXdot1dcbxAdminETSConfigurationTable - Contains the information
-- for the ETS Configuration TLV.
--
lldpXdot1dcbxAdminETSConfiguration OBJECT IDENTIFIER
    ::= { lldpXdot1dcbxAdminData 1 }

lldpXdot1dcbxAdminETSConfigurationTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxAdminETSConfigurationEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per port for the IEEE 802.1
        organizationally defined LLDP ETS Configuration TLV
        on the local system known to this-agent agent."
    ::= { lldpXdot1dcbxAdminETSConfiguration 1 }

lldpXdot1dcbxAdminETSConfigurationEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAdminETSConfigurationEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about the IEEE 802.1 organizational defined
        ETS Configuration TLV LLDP extension."
    INDEX       { lldpV2LocPortIfIndex }
    ::= { lldpXdot1dcbxAdminETSConfigurationTable 1 }

LldpXdot1dcbxAdminETSConfigurationEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminETSConCreditBasedShaperSupport      TruthValue,
    lldpXdot1dcbxAdminETSConTrafficClassesSupported
        LldpXdot1dcbxSupportedCapacity,
    lldpXdot1dcbxAdminETSConWilling      TruthValue
}

lldpXdot1dcbxAdminETSConCreditBasedShaperSupport OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates support for the credit-based shaper Traffic
        Selection Algorithm."
    REFERENCE
```

```

"D.2.8.4"
::= { lldpXdot1dcbxAdminETSTrafficClassesSupported OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates the number of traffic classes supported."
    REFERENCE
        "D.2.8.5"
    ::= { lldpXdot1dcbxAdminETSTrafficClassesSupported 1 }

lldpXdot1dcbxAdminETSTrafficClassesSupported OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates the number of traffic classes supported."
    REFERENCE
        "D.2.8.5"
    ::= { lldpXdot1dcbxAdminETSTrafficClassesSupported 1 }

lldpXdot1dcbxAdminETSTrafficClassesSupported OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates if the local system is willing to accept the
        ETS configuration recommended by the remote system."
    REFERENCE
        "D.2.8.3"
    DEFVAL      { false }
    ::= { lldpXdot1dcbxAdminETSTrafficClassesSupported 3 }

lldpXdot1dcbxAdminETSPriorityAssignmentTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxAdminETSPriorityAssignmentEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per priority. The entry in each
        row indicates the traffic class to which the priority is
        assigned."
    ::= { lldpXdot1dcbxAdminETSPriorityAssignmentTable 2 }

lldpXdot1dcbxAdminETSPriorityAssignmentEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAdminETSPriorityAssignmentEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates a priority to traffic class assignment."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxAdminETSPriorityAssignmentEntry
        }
    ::= { lldpXdot1dcbxAdminETSPriorityAssignmentTable 1 }

lldpXdot1dcbxAdminETSPriorityAssignmentEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminETSPriorityAssignmentEntry IEEE8021PriorityValue,
    lldpXdot1dcbxAdminETSPriorityAssignmentEntryTrafficClass
        LldpXdot1dcbxTrafficClassValue
}

lldpXdot1dcbxAdminETSPriorityAssignmentEntry OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the priority that is assigned to a traffic
        class."
    REFERENCE
        "D.2.8.6"
    ::= { lldpXdot1dcbxAdminETSPriorityAssignmentTable 1 }

lldpXdot1dcbxAdminETSPriorityAssignmentEntryTrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates the traffic class to which this priority is
        to be assigned."

```

REFERENCE

"D.2.8.6"

DEFVAL { 0 }

::= { lldpXdot1dcbxAdminETSTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxAdminETSTrafficClassBandwidthTable OBJECT-TYPE

SYNTAX SEQUENCE OF

LldpXdot1dcbxAdminETSTrafficClassBandwidthEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains one row per traffic class. The entry in each row indicates the traffic class to which the bandwidth is assigned."

::= { lldpXdot1dcbxAdminETSTrafficClassBandwidthTable 3 }

lldpXdot1dcbxAdminETSTrafficClassBandwidthEntry OBJECT-TYPE

SYNTAX LldpXdot1dcbxAdminETSTrafficClassBandwidthEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Indicates a traffic class to Bandwidth assignment."

INDEX

{
lldpV2LocPortIfIndex,
lldpXdot1dcbxAdminETSTrafficClass

}
::= { lldpXdot1dcbxAdminETSTrafficClassBandwidthTable 1 }

LldpXdot1dcbxAdminETSTrafficClassBandwidthEntry ::= SEQUENCE {

lldpXdot1dcbxAdminETSTrafficClass

LldpXdot1dcbxTrafficClassValue,

lldpXdot1dcbxAdminETSTrafficClassBandwidth

LldpXdot1dcbxTrafficClassBandwidthValue

}

lldpXdot1dcbxAdminETSTrafficClass OBJECT-TYPE

SYNTAX LldpXdot1dcbxTrafficClassValue

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Indicates the traffic class to which this bandwidth ~~applies~~ applies."

REFERENCE

"D.2.8.7"

::= { lldpXdot1dcbxAdminETSTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxAdminETSTrafficClassBandwidth OBJECT-TYPE

SYNTAX LldpXdot1dcbxTrafficClassBandwidthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates the bandwidth assigned to this traffic class. The sum of the bandwidths assigned to a given port is required at all times to equal 100. An operation that attempts to change this table such that the bandwidth entries do not total 100 shall be rejected. An implication of this is that modification of this table requires that multiple set operations be included in a single SNMP PDU, commonly referred to as an MSET operation, to perform simultaneous set operations to keep the sum at 100. Any attempt to change a single entry in this table will result in the operation being rejected since entries in the table referring to the given port will no longer sum to 100."

REFERENCE

"D.2.8.7"

::= { lldpXdot1dcbxAdminETSTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable OBJECT-TYPE

SYNTAX SEQUENCE OF

LldpXdot1dcbxAdminETSTrafficSelectionAlgorithmEntry

MAX-ACCESS not-accessible

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```

STATUS          current
DESCRIPTION
    "This table contains one row per traffic class. The entry
    in each row indicates the traffic selection algorithm to
    be used by the priority."
 ::= { lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable 4 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmEntry OBJECT-TYPE
SYNTAX          LldpXdot1dcbxAdminETSTrafficSelectionAlgorithmEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "Indicates a traffic class to traffic selection
    algorithm assignment."
INDEX
    {
        lldpV2LocPortIfIndex,
        lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable
    }
 ::= { lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxAdminETSTrafficSelectionAlgorithm
        LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable OBJECT-TYPE
SYNTAX          LldpXdot1dcbxTrafficClassValue
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "Indicates the traffic class that is assigned
    to a traffic selection algorithm."
REFERENCE
    "D.2.8.8"
 ::= { lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithm OBJECT-TYPE
SYNTAX          LldpXdot1dcbxTrafficSelectionAlgorithm
MAX-ACCESS      read-write
STATUS          current
DESCRIPTION
    "Indicates the Traffic Selection Algorithm to which this
    traffic class is to be assigned."
REFERENCE
    "D.2.8.8"
 ::= { lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable 2 }

--
-- lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable - Contains the information
-- for the ETSTrafficSelectionAlgorithm TLV.
--
lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable OBJECT IDENTIFIER ::=
{ lldpXdot1dcbxAdminData 2 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTableEntry OBJECT-TYPE
SYNTAX          SEQUENCE OF
                LldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTableEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "This table contains one row per traffic class. The
    entry in each row indicates the traffic class to
    which the bandwidth is assigned."
 ::= { lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTable 1 }

lldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTableEntry OBJECT-TYPE
SYNTAX          LldpXdot1dcbxAdminETSTrafficSelectionAlgorithmTableEntry
MAX-ACCESS      not-accessible
STATUS          current

```

DESCRIPTION
"Indicates a traffic class to Bandwidth assignment."

INDEX
{
 lldpV2LocPortIfIndex,
 lldpXdot1dcbxAdminETSRecoTrafficClass
}
::= { lldpXdot1dcbxAdminETSRecoTrafficClassBandwidthTable 1 }

LldpXdot1dcbxAdminETSRecoTrafficClassBandwidthEntry ::= SEQUENCE {
 lldpXdot1dcbxAdminETSRecoTrafficClass
 LldpXdot1dcbxTrafficClassValue,
 lldpXdot1dcbxAdminETSRecoTrafficClassBandwidth
 LldpXdot1dcbxTrafficClassBandwidthValue
}

lldpXdot1dcbxAdminETSRecoTrafficClass OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassValue
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the traffic class to
which this bandwidth ~~applies~~ applies."

REFERENCE
"D.2.9.4"
::= { lldpXdot1dcbxAdminETSRecoTrafficClassBandwidthEntry 1 }

lldpXdot1dcbxAdminETSRecoTrafficClassBandwidth OBJECT-TYPE
SYNTAX LldpXdot1dcbxTrafficClassBandwidthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"Indicates the bandwidth assigned to this traffic class.
The sum of the bandwidths assigned to a given port is
required at all times to equal 100. An operation that
attempts to change this table such that the bandwidth
entires do not total 100 shall be rejected. An implication
of this is that modification of this table requires that
multiple set operations be included in a single SNMP PDU,
commonly referred to as an MSET operation, to perform
simultaneous set operations to keep the sum at 100. Any
attempt to change a single entry in this table will result
in the operation being rejected since entries in the
table referring to the given port will no longer
sum to 100."

REFERENCE
"D.2.9.4"
::= { lldpXdot1dcbxAdminETSRecoTrafficClassBandwidthEntry 2 }

lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmTable OBJECT-TYPE
SYNTAX SEQUENCE OF
 LldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per traffic class. The entry
in each row indicates the traffic selection algorithm to
be used by the traffic class."
::= { lldpXdot1dcbxAdminETSReco 2 }

lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry OBJECT-TYPE
SYNTAX LldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates a traffic class to traffic selection
algorithm assignment."

INDEX
{
 lldpV2LocPortIfIndex,
 lldpXdot1dcbxAdminETSRecoTSATrafficClass
}
::= { lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmTable 1 }

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```
LldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminETSRecoTSATrafficClass
        LldpXdot1dcbxTrafficClassValue,
    lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithm
        LldpXdot1dcbxTrafficSelectionAlgorithm
}

lldpXdot1dcbxAdminETSRecoTSATrafficClass OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficClassValue
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the traffic class that is assigned to a traffic
        selection algorithm."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry 1 }

lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithm OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxTrafficSelectionAlgorithm
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates the Traffic Selection Algorithm to which this
        traffic class is to be assigned."
    REFERENCE
        "D.2.9.5"
    ::= { lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithmEntry 2 }

--
-- lldpXdot1dcbxAdminPFCBTable - Contains the information for the PFC
-- Configuration TLV.
--
lldpXdot1dcbxAdminPFC OBJECT IDENTIFIER ::= { lldpXdot1dcbxAdminData 3 }

lldpXdot1dcbxAdminPFCBasicTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxAdminPFCBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per port for the IEEE 802.1
        organizationally defined LLDP PFC TLV on the local
        system known to this agent agent."
    ::= { lldpXdot1dcbxAdminPFC 1 }

lldpXdot1dcbxAdminPFCBasicEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAdminPFCBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about the IEEE 802.1 organizational defined
        PFC TLV LLDP extension."
    INDEX       { lldpV2LocPortIfIndex }
    ::= { lldpXdot1dcbxAdminPFCBasicTable 1 }

lldpXdot1dcbxAdminPFCBasicEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminPFCWilling      TruthValue,
    lldpXdot1dcbxAdminPFCMBC          TruthValue,
    lldpXdot1dcbxAdminPFCCap          LldpXdot1dcbxSupportedCapacity
}

lldpXdot1dcbxAdminPFCWilling OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates if the local system is willing to accept the
        PFC configuration of the remote system."
    REFERENCE
        "D.2.10.3"
    DEFVAL      { false }
```

```

::= { lldpXdot1dcbxAdminPFCBasicEntry 1 }

lldpXdot1dcbxAdminPFCMBC OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates if the local system is capable of bypassing
        MACsec processing when MACsec is disabled."
    REFERENCE
        "D.2.10.4"
    ::= { lldpXdot1dcbxAdminPFCBasicEntry 2 }

lldpXdot1dcbxAdminPFCCap OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxSupportedCapacity
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "Indicates the number of traffic classes on the local device
        that may simultaneously have PFC enabled.

        Note that this typically indicates a physical limitation of the
        device. However, some devices may allow this parameter to be
        administratively configured, in which case the MAX-ACCESS
        should be changed to read-write with and an appropriate
        DEFVAL added."
    REFERENCE
        "D.2.10.5"
    ::= { lldpXdot1dcbxAdminPFCBasicEntry 3 }

lldpXdot1dcbxAdminPFCEnableTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1dcbxAdminPFCEnableEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains eight entries, one entry per priority,
        indicating if PFC is enabled on the corresponding priority."
    ::= { lldpXdot1dcbxAdminPFC 2 }

lldpXdot1dcbxAdminPFCEnableEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAdminPFCEnableEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Each entry indicates if PFC is enabled on the
        corresponding priority priority."
    INDEX {
        lldpV2LocPortIfIndex,
        lldpXdot1dcbxAdminPFCEnablePriority
    }
    ::= { lldpXdot1dcbxAdminPFCEnableTable 1 }

lldpXdot1dcbxAdminPFCEnableEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminPFCEnablePriority IEEE8021PriorityValue,
    lldpXdot1dcbxAdminPFCEnableEnabled TruthValue
}

lldpXdot1dcbxAdminPFCEnablePriority OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Priority Priority for which PFC is enabled / disabled"
    ::= { lldpXdot1dcbxAdminPFCEnableEntry 1 }

lldpXdot1dcbxAdminPFCEnableEnabled OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates if PFC is enabled on the corresponding priority priority."
    REFERENCE

```

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```
"D.2.10.6"
DEFVAL      { false }
::= { lldpXdotldcbxAdminPFCEnableEntry 2 }

--
-- lldpXdotldcbxAdminApplicationPriorityTable - Contains the
-- information for the Application Priority TLV.
--

lldpXdotldcbxAdminApplicationPriorityAppTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdotldcbxAdminApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Table containing entries indicating the priority priority to be used
        for a given application application."
    ::= { lldpXdotldcbxAdminData 4 }

lldpXdotldcbxAdminApplicationPriorityAppEntry OBJECT-TYPE
    SYNTAX      LldpXdotldcbxAdminApplicationPriorityAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Entry that indicates the priority to be used for a
        given application."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdotldcbxAdminApplicationPriorityAESelector,
            lldpXdotldcbxAdminApplicationPriorityAEProtocol
        }
    ::= { lldpXdotldcbxAdminApplicationPriorityAppTable 1 }

LldpXdotldcbxAdminApplicationPriorityAppEntry ::= SEQUENCE {
    lldpXdotldcbxAdminApplicationPriorityAESelector
        LldpXdotldcbxAppSelector,
    lldpXdotldcbxAdminApplicationPriorityAEProtocol
        LldpXdotldcbxAppProtocol,
    lldpXdotldcbxAdminApplicationPriorityAEPriority
        IEEE8021PriorityValue
}

lldpXdotldcbxAdminApplicationPriorityAESelector OBJECT-TYPE
    SYNTAX      LldpXdotldcbxAppSelector
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the contents of the protocol object
        (lldpXdotldcbxAdminApplicationPriorityAEProtocol)
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
        6 bit DSCP value is stored in the low order 6 bits of the
        protocol object. The higher order bits are set to zero.
        (See IETF RFC 2474 for the definition of the DSCP value.)"
    REFERENCE
        "D.2.10.6"
    ::= { lldpXdotldcbxAdminApplicationPriorityAppEntry 1 }

lldpXdotldcbxAdminApplicationPriorityAEProtocol OBJECT-TYPE
    SYNTAX      LldpXdotldcbxAppProtocol
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The protocol indicator of the type indicated by
        lldpXdotldcbxAdminApplicationPriorityAESelector."
    REFERENCE
        "D.2.10.6"
    ::= { lldpXdotldcbxAdminApplicationPriorityAppEntry 2 }
```

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```
lldpXdot1dcbxAdminApplicationPriorityAEPriority OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The priority code point that should be used in
        frames transporting the protocol indicated by
        lldpXdot1dcbxAdminApplicationPriorityAESelector and
        lldpXdot1dcbxAdminApplicationPriorityAEProtocol."
    REFERENCE
        "D.2.10.6"
    ::= { lldpXdot1dcbxAdminApplicationPriorityAppEntry 3 }

--
-- lldpXdot1dcbxAdminApplicationVlanAppTable - Contains the
-- information for the Application VLAN TLV.
--

lldpXdot1dcbxAdminApplicationVlanAppTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF
        LldpXdot1dcbxAdminApplicationVlanAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Table containing entries indicating the VLAN to be used
        for a given application application."
    ::= { lldpXdot1dcbxAdminData 5 }

lldpXdot1dcbxAdminApplicationVlanAppEntry OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAdminApplicationVlanAppEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Entry that indicates the VLAN to be used for a
        given application."
    INDEX
        {
            lldpV2LocPortIfIndex,
            lldpXdot1dcbxAdminApplicationVlanAESelector,
            lldpXdot1dcbxAdminApplicationVlanAEProtocol
        }
    ::= { lldpXdot1dcbxAdminApplicationVlanAppTable 1 }

LldpXdot1dcbxAdminApplicationVlanAppEntry ::= SEQUENCE {
    lldpXdot1dcbxAdminApplicationVlanAESelector
        LldpXdot1dcbxAppSelector,
    lldpXdot1dcbxAdminApplicationVlanAEProtocol
        LldpXdot1dcbxAppProtocol,
    lldpXdot1dcbxAdminApplicationVlanAEVlanId
        VlanId
}

lldpXdot1dcbxAdminApplicationVlanAESelector OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppSelector
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Indicates the contents of the protocol object
        (lldpXdot1dcbxAdminApplicationVlanAEProtocol)
        1: EtherType
        2: Well Known Port number over TCP, or SCTP
        3: Well Known Port number over UDP, or DCCP
        4: Well Known Port number over TCP, SCTP, UDP, and DCCP
        5: Differentiated Services Code Point (DSCP) value. The
           6 bit DSCP value is stored in the low order 6 bits of the
           protocol object. The higher order bits are set to zero.
           (See IETF RFC 2474 for the definition of the DSCP value)."
    REFERENCE
        "D.2.12.3"
    ::= { lldpXdot1dcbxAdminApplicationVlanAppEntry 1 }

lldpXdot1dcbxAdminApplicationVlanAEProtocol OBJECT-TYPE
    SYNTAX      LldpXdot1dcbxAppProtocol
```

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```
MAX-ACCESS      not-accessible
STATUS           current
DESCRIPTION
    "The protocol indicator of the type indicated by
    lldpXdot1dcbxAdminApplicationVlanAESelector."
REFERENCE
    "D.2.14.3"
::= { lldpXdot1dcbxAdminApplicationVlanAppEntry 2 }

lldpXdot1dcbxAdminApplicationVlanAEVlanId OBJECT-TYPE
SYNTAX           VlanId
MAX-ACCESS      read-create
STATUS           current
DESCRIPTION
    "The VLAN Identifier that should be used in
    frames transporting the protocol indicated by
    lldpXdot1dcbxAdminApplicationVlanAESelector and
    lldpXdot1dcbxAdminApplicationVlanAEProtocol."
REFERENCE
    "D.2.14.3"
::= { lldpXdot1dcbxAdminApplicationVlanAppEntry 3 }

-----
-- IEEE 802.1 - DCBX Conformance Information
-----
lldpXdot1dcbxConformance OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 6 }
lldpXdot1dcbxCompliances
    OBJECT IDENTIFIER ::= { lldpXdot1dcbxConformance 1 }
lldpXdot1dcbxGroups
    OBJECT IDENTIFIER ::= { lldpXdot1dcbxConformance 2 }

--
-- Compliance Statements
--

lldpXdot1dcbxCompliance MODULE-COMPLIANCE
STATUS           current
DESCRIPTION
    "A compliance statement for SNMP entities that implement
    the IEEE 802.1 organizationally defined DCBX group in the
    LLDP extension MIB.

    This group is mandatory for agents that implement Enhanced
    Transmission Selection."
MODULE          -- this module
MANDATORY-GROUPS { lldpXdot1dcbxETSGroup,
                    lldpXdot1dcbxPFCGroup,
                    lldpXdot1dcbxApplicationPriorityGroup,
                    lldpXdot1dcbxApplicationVlanGroup,
                    ifGeneralInformationGroup
                  }
::= { lldpXdot1dcbxCompliances 1 }

--
-- MIB Groupings
--

lldpXdot1dcbxETSGroup OBJECT-GROUP
OBJECTS {
    lldpXdot1dcbxConfigETSConfigurationTxEnable,
    lldpXdot1dcbxConfigETSRecommendationTxEnable,
    lldpXdot1dcbxLocETSConCreditBasedShaperSupport,
    lldpXdot1dcbxLocETSConTrafficClassesSupported,
    lldpXdot1dcbxLocETSConWilling,
    lldpXdot1dcbxLocETSConPriTrafficClass,
    lldpXdot1dcbxLocETSConTrafficClassBandwidth,
    lldpXdot1dcbxLocETSConTrafficSelectionAlgorithm,
    lldpXdot1dcbxLocETSRecoTrafficClassBandwidth,
    lldpXdot1dcbxLocETSRecoTrafficSelectionAlgorithm,
    lldpXdot1dcbxRemETSConCreditBasedShaperSupport,
    lldpXdot1dcbxRemETSConTrafficClassesSupported,
    lldpXdot1dcbxRemETSConWilling,
```

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```
lldpXdot1dcbxRemETSTrafficClass,
lldpXdot1dcbxRemETSTrafficClassBandwidth,
lldpXdot1dcbxRemETSTrafficSelectionAlgorithm,
lldpXdot1dcbxRemETSRecoTrafficClassBandwidth,
lldpXdot1dcbxRemETSRecoTrafficSelectionAlgorithm,
lldpXdot1dcbxAdminETSTrafficClass,
lldpXdot1dcbxAdminETSTrafficClassBandwidth,
lldpXdot1dcbxAdminETSTrafficSelectionAlgorithm,
lldpXdot1dcbxAdminETSRecoTrafficClassBandwidth,
lldpXdot1dcbxAdminETSRecoTrafficSelectionAlgorithm
}
STATUS current
DESCRIPTION
    "The collection of objects used for Enhanced
    Transmission Selection."
::= { lldpXdot1dcbxGroups 1 }

lldpXdot1dcbxPFCGroup OBJECT-GROUP
OBJECTS {
    lldpXdot1dcbxConfigPFCEnable,
    lldpXdot1dcbxLocPFCWilling,
    lldpXdot1dcbxLocPFCMBC,
    lldpXdot1dcbxLocPFCCap,
    lldpXdot1dcbxLocPFCEnableEnabled,
    lldpXdot1dcbxRemPFCWilling,
    lldpXdot1dcbxRemPFCMBC,
    lldpXdot1dcbxRemPFCCap,
    lldpXdot1dcbxRemPFCEnableEnabled,
    lldpXdot1dcbxAdminPFCWilling,
    lldpXdot1dcbxAdminPFCMBC,
    lldpXdot1dcbxAdminPFCCap,
    lldpXdot1dcbxAdminPFCEnableEnabled
}
STATUS current
DESCRIPTION
    "The collection of objects used for Priority-
    base Flow Control."
::= { lldpXdot1dcbxGroups 2 }

lldpXdot1dcbxApplicationPriorityGroup OBJECT-GROUP
OBJECTS {
    lldpXdot1dcbxConfigApplicationPriorityTxEnable,
    lldpXdot1dcbxLocApplicationPriorityAEPriority,
    lldpXdot1dcbxRemApplicationPriorityAEPriority,
    lldpXdot1dcbxAdminApplicationPriorityAEPriority
}
STATUS current
DESCRIPTION
    "The collection of objects used for Application
    priority."
::= { lldpXdot1dcbxGroups 3 }

lldpXdot1dcbxApplicationVlanGroup OBJECT-GROUP
OBJECTS {
    lldpXdot1dcbxConfigApplicationVlanTxEnable,
    lldpXdot1dcbxLocApplicationVlanAEVlanId,
    lldpXdot1dcbxRemApplicationVlanAEVlanId,
    lldpXdot1dcbxAdminApplicationVlanAEVlanId
}
STATUS current
DESCRIPTION
    "The collection of objects used for Application
    VLAN."
::= { lldpXdot1dcbxGroups 4 }
```

=====

-- Organizationally Defined Information Extension - IEEE 802.1
-- Definitions to support the ciSet TLV set (Table D-1)
-- for Congestion Isolation
--

lldpXdot1CiMIB OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 8 }
lldpXdot1CiObjects OBJECT IDENTIFIER ::= { lldpXdot1CiMIB 1 }

-- CI 802.1 MIB Extension groups

lldpXdot1CiConfig OBJECT IDENTIFIER ::= { lldpXdot1CiObjects 1 }
lldpXdot1CiLocalData OBJECT IDENTIFIER ::= { lldpXdot1CiObjects 2 }
lldpXdot1CiRemoteData OBJECT IDENTIFIER ::= { lldpXdot1CiObjects 3 }

-- Textual conventions for Congestion Isolation

CiQueueType ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"Indicates whether a queue is a monitored queue, a congesting queue or not participating in Congestion Isolation. The queue type is used when building the queue map field of the Congestion Isolation TLV.

0: The queue is not participating in Congestion Isolation

1: The queue is a monitored queue

2: The queue is a congesting queue"

SYNTAX INTEGER {

ciQNone(0),

ciQMonitor(1),

ciQCongesting(2)

}

-- IEEE 802.1 - Congestion Isolation Configuration

--
-- lldpXdot1CiConfigCiTable : configure the
-- transmission of the Congestion Isolation TLV on a set of ports
--

lldpXdot1CiConfigCiTable OBJECT-TYPE

SYNTAX SEQUENCE OF LldpXdot1CiConfigCiEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table that controls selection of Congestion Isolation TLVs to be transmitted on individual ports."

::= { lldpXdot1CiConfig 1 }

lldpXdot1CiConfigCiEntry OBJECT-TYPE

SYNTAX LldpXdot1CiConfigCiEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"LLDP configuration information that controls the transmission of IEEE 802.1 organizationally defined Congestion Isolation TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of the LLDP-MIB, therefore it is only present along with the port configuration defined by the associated lldpV2PortConfigEntry entry.

Each active lldpConfigEntry is restored from non-volatile storage (along with the corresponding lldpV2PortConfigEntry) after a re-initialization of the management system."

AUGMENTS { lldpV2PortConfigEntry }

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```
 ::= { lldpXdot1CiConfigCiTable 1 }

lldpXdot1CiConfigCiEntry ::= SEQUENCE {
    lldpXdot1CiConfigCiTxEnable TruthValue
}

lldpXdot1CiConfigCiTxEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The lldpXdot1CiConfigCiTxEnable, which is
        defined as a truth value and configured by the network
        management, determines whether the IEEE 802.1 organizationally
        defined Congestion Isolation TLV transmission is allowed
        on a given LLDP transmission-capable port.

        The value of this object is restored from non-volatile
        storage after a re-initialization of the management system."
    REFERENCE
        "D.2.15"
    DEFVAL       { false }
    ::= { lldpXdot1CiConfigCiEntry 1 }

-----
-- IEEE 802.1 - Congestion Isolation Local System Information
-----

---
---
--- lldpXdot1CiLocalData: Contains the information for the CI TLV
---
---
lldpXdot1LocCiBasicTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1LocCiBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains one row per port of basic Congestion Isolation
        information (as a part of the IEEE 802.1 organizational extension)
        on the local system known to this agent."
    ::= { lldpXdot1CiLocalData 1 }

lldpXdot1LocCiBasicEntry OBJECT-TYPE
    SYNTAX      LldpXdot1LocCiBasicEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Basic Congestion Isolation information about a particular port
        component."
    INDEX       { lldpXdot1LocPortIfIndex }
    ::= { lldpXdot1LocCiBasicTable 1 }

lldpXdot1LocCiBasicEntry ::= SEQUENCE {
    lldpXdot1LocCiCIMEncapLen      Unsigned32,
    lldpXdot1LocCiMacAddress       MacAddress,
    lldpXdot1LocCiNetAddressType   AddressFamilyNumbers,
    lldpXdot1LocCiNetAddress       OCTET STRING,
    lldpXdot1LocCiUDPPort          InetPortNumber
}

lldpXdot1LocCiCIMEncapLen OBJECT-TYPE
    SYNTAX      Unsigned32 (60..512)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The requested length in octets of the data encapsulated into
        a CIM by a peer. The default and minimum required value is 60.
        The maximum value is 512."
    REFERENCE
        "D.2.15.4"
    ::= { lldpXdot1LocCiBasicEntry 1 }
```

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```
lldpXdot1LocCiMacAddress OBJECT-TYPE
    SYNTAX      MacAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The MAC address that is to be used as the destination MAC address
        for a CIM to the Bridge or end station."
    REFERENCE
        "D.2.15.5"
    ::= { lldpXdot1LocCiBasicEntry 2 }

lldpXdot1LocCiNetAddressType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of network address identifier encoding used in the
        associated 'lldpXdot1LocCiNetAddress' object. Only the IPv4
        and IPv6 address type encodings enumerated in AddressFamilyNumbers
        are used in the Congestion Isolation TLV."
    REFERENCE
        "D.2.15.7"
    ::= { lldpXdot1LocCiBasicEntry 3 }

lldpXdot1LocCiNetAddress OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(1..31))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The string value used to identify the network address component
        associated with the local system. This address is to be used as
        the destination network address of a layer-3 CIM."
    REFERENCE
        "D.2.15.8"
    ::= { lldpXdot1LocCiBasicEntry 4 }

lldpXdot1LocCiUDPPort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The UDP port number to be used in layer 3 CIMs sent by the peer."
    REFERENCE
        "D.2.15.6"
    ::= { lldpXdot1LocCiBasicEntry 5 }

--
-- The table specifying the queue map to advertise in the
-- Congestion Isolation TLV.
--

lldpXdot1LocCiQueueMapTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1LocCiQueueMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table specifying whether the queue of a priority is to
        be a monitored queue, congesting queue, or not participating.
        For each participating queue there is a mapped queue. This
        information can be transmitted in the Congestion Isolation TLV."
    REFERENCE
        "D.2.15.3"
    ::= { lldpXdot1CiLocalData 2 }

lldpXdot1LocCiQueueMapEntry OBJECT-TYPE
    SYNTAX      LldpXdot1LocCiQueueMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table specifying whether the queue of a priority is to
```

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be a monitored queue, congesting queue, or not participating.
For each participating queue there is a mapped queue. This
information can be transmitted in the Congestion Isolation TLV.

"

INDEX { lldpV2LocPortIfIndex,
 lldpXdot1LocCiQueueId }

::= { lldpXdot1LocCiQueueMapTable 1 }

lldpXdot1LocCiQueueMapEntry ::= SEQUENCE {
 lldpXdot1LocCiQueueId IEEE8021PriorityValue,
 lldpXdot1LocCiQueueType CiQueueType,
 lldpXdot1LocCiMappedQueue IEEE8021PriorityValue
 }

lldpXdot1LocCiQueueId OBJECT-TYPE
SYNTAX IEEE8021PriorityValue
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The priority for a frame received on this port."
REFERENCE
 "D.2.15.3"
 ::= { lldpXdot1LocCiQueueMapEntry 1 }

lldpXdot1LocCiQueueType OBJECT-TYPE
SYNTAX CiQueueType
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "monitored, congesting, or not used
 The value of this object is restored from non-volatile
 storage after a re-initialization of the management system."
REFERENCE
 "D.2.15.3"
 ::= { lldpXdot1LocCiQueueMapEntry 2 }

lldpXdot1LocCiMappedQueue OBJECT-TYPE
SYNTAX IEEE8021PriorityValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The remapped priority for frames received on this port
 at the received priority.

 The value of this object is restored from non-volatile
 storage after a re-initialization of the management system."
REFERENCE
 "D.2.15.3"
 ::= { lldpXdot1LocCiQueueMapEntry 3 }

-- IEEE 802.1 Congestion Isolation Remote System Information

--- lldpXdot1CiRemoteData: Contains the received information for the CI TLV

lldpXdot1RemCiBasicTable OBJECT-TYPE
SYNTAX SEQUENCE OF LldpXdot1RemCiBasicEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "This table contains one row per port of basic Congestion Isolation
 information (as a part of the LLDP 802.1 organizational extension)
 of the remote system."
 ::= { lldpXdot1CiRemoteData 1 }

lldpXdot1RemCiBasicEntry OBJECT-TYPE

SYNTAX LldpXdot1RemCiBasicEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Basic Congestion Isolation information about a particular port component."
INDEX { lldpV2RemTimeMark,
 lldpV2RemLocalIfIndex,
 lldpV2RemLocalDestMACAddress,
 lldpV2RemIndex }
::= { lldpXdot1RemCiBasicTable 1 }

LldpXdot1RemCiBasicEntry ::= SEQUENCE {
 lldpXdot1RemCiCIMEncapLen Unsigned32,
 lldpXdot1RemCiMacAddress MacAddress,
 lldpXdot1RemCiNetAddressType AddressFamilyNumbers,
 lldpXdot1RemCiNetAddress OCTET STRING,
 lldpXdot1RemCiUDPPort InetPortNumber
}

lldpXdot1RemCiCIMEncapLen OBJECT-TYPE
SYNTAX Unsigned32 (60..512)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The requested length in octets of the data encapsulated into a CIM by a peer. The default and minimum required value is 60. The maximum value is 512."
REFERENCE
"D.2.15.4"
::= { lldpXdot1RemCiBasicEntry 1 }

lldpXdot1RemCiMacAddress OBJECT-TYPE
SYNTAX MacAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The MAC address that is to be used as the destination MAC address for a CIM to the Bridge or end station."
REFERENCE
"D.2.15.5"
::= { lldpXdot1RemCiBasicEntry 2 }

lldpXdot1RemCiNetAddressType OBJECT-TYPE
SYNTAX AddressFamilyNumbers
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The type of network address identifier encoding used in the associated 'lldpXdot1RemCiNetAddress' object. Only the IPv4 and IPv6 address type encodings enumerated in AddressFamilyNumbers are used in the Congestion Isolation TLV."
REFERENCE
"D.2.15.7"
::= { lldpXdot1RemCiBasicEntry 3 }

lldpXdot1RemCiNetAddress OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(1..31))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The string value used to identify the network address component associated with the local system. This address is to be used as the destination network address of a layer-3 CIM."
REFERENCE
"D.2.15.8"
::= { lldpXdot1RemCiBasicEntry 4 }

lldpXdot1RemCiUDPPort OBJECT-TYPE
SYNTAX InetPortNumber
MAX-ACCESS read-only
STATUS current

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```
DESCRIPTION
    "The UDP port number to be used in layer 3 CIMs sent by the peer."
REFERENCE
    "D.2.15.6"
    ::= { lldpXdot1RemCiBasicEntry 5 }

--
-- The table specifying, the queue map to advertise in the
-- Congestion Isolation TLV.
--

lldpXdot1RemCiQueueMapTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1RemCiQueueMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table specifying whether the queue of a priority is to
        be a monitored queue, congesting queue, or not participating.
        For each participating queue there is a mapped queue. This
        information can be transmitted in the Congestion Isolation TLV."
    REFERENCE
        "D.2.15.3"
    ::= { lldpXdot1CiRemoteData 2 }

lldpXdot1RemCiQueueMapEntry OBJECT-TYPE
    SYNTAX      LldpXdot1RemCiQueueMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table specifying whether the queue of a priority is to
        be a monitored queue, congesting queue, or not participating.
        For each participating queue there is a mapped queue. This
        information can be transmitted in the Congestion Isolation TLV."
    INDEX      ( lldpV2RemTimeMark,
                 lldpV2RemLocalIfIndex,
                 lldpV2RemLocalDestMACAddress,
                 lldpV2RemIndex,
                 lldpXdot1RemCiQueueId )
    ::= { lldpXdot1RemCiQueueMapTable 1 }

LldpXdot1RemCiQueueMapEntry ::= SEQUENCE {
    lldpXdot1RemCiQueueId      IEEE8021PriorityValue,
    lldpXdot1RemCiQueueType    CiQueueType,
    lldpXdot1RemCiMappedQueue  IEEE8021PriorityValue
}

lldpXdot1RemCiQueueId OBJECT-TYPE
    SYNTAX      IEEE8021PriorityValue
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The priority for a frame received on this port."
    REFERENCE
        "D.2.15.3"
    ::= { lldpXdot1RemCiQueueMapEntry 1 }

lldpXdot1RemCiQueueType OBJECT-TYPE
    SYNTAX      CiQueueType
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "monitored, congesting, or not used
        The value of this object is restored from non-volatile
        storage after a re-initialization of the management system."
    REFERENCE
        "D.2.15.3"
    ::= { lldpXdot1RemCiQueueMapEntry 2 }

lldpXdot1RemCiMappedQueue OBJECT-TYPE
```

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```
SYNTAX      IEEE8021PriorityValue
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
    "The remapped priority for frames received on this port
    at the received priority.

    The value of this object is restored from non-volatile
    storage after a re-initialization of the management system.
    "
REFERENCE
    "D.2.15.3"
    ::= { lldpXdot1RemCiQueueMapEntry 3 }
```

```
-----
-- IEEE 802.1 - Congestion Isolation Conformance Information
-----
```

```
lldpXdot1CiConformance OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 9 }
```

```
lldpXdot1CiCompliances
```

```
    OBJECT IDENTIFIER ::= { lldpXdot1CiConformance 1 }
```

```
lldpXdot1CiGroups OBJECT IDENTIFIER ::= { lldpXdot1CiConformance 2 }
```

```
--
-- Congestion Isolation - Compliance Statements
--
```

```
lldpXdot1CiCompliance MODULE-COMPLIANCE
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "A compliance statement for SNMP entities that implement
        the IEEE 802.1 organizationally defined Congestion
        Isolation group in the LLDP extension MIB.
```

```
        This group is mandatory for agents that implement the
        Congestion Isolation cnSet TLV set."
```

```
    MODULE      -- this module
```

```
    MANDATORY-GROUPS { lldpXdot1CiGroup,
                        ifGeneralInformationGroup }
```

```
    ::= { lldpXdot1CiCompliances 1 }
```

```
--
-- Congestion Isolation - MIB groupings
--
```

```
lldpXdot1CiGroup OBJECT-GROUP
```

```
    OBJECTS {
```

```
        lldpXdot1CiConfigCiTxEnable,
        lldpXdot1LocCiCIMEncapLen,
        lldpXdot1LocCiMacAddress,
        lldpXdot1LocCiNetAddressType,
        lldpXdot1LocCiNetAddress,
        lldpXdot1LocCiUDPPort,
        lldpXdot1LocCiQueueType,
        lldpXdot1LocCiMappedQueue,
        lldpXdot1RemCiCIMEncapLen,
        lldpXdot1RemCiMacAddress,
        lldpXdot1RemCiNetAddressType,
        lldpXdot1RemCiNetAddress,
        lldpXdot1RemCiUDPPort,
        lldpXdot1RemCiQueueType,
        lldpXdot1RemCiMappedQueue
```

```
    }
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The collection of objects that support the
        Congestion Isolation ciSet TLV set."
```

```
    ::= { lldpXdot1CiGroups 1 }
```

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```
-----
--
-- Organizational Defined Information Extension - IEEE 802.1
-- Definitions to support the trSet TLV set (Table D-1)
-- for Topology Recognition
--
-----

lldpXdot1TrMIB OBJECT IDENTIFIER ::= { lldpV2Xdot1MIB 10 }
lldpXdot1TrObjects OBJECT IDENTIFIER ::= { lldpXdot1TrMIB 1 }

-- TR 802.1 MIB Extension groups

lldpXdot1TrConfig OBJECT IDENTIFIER ::= { lldpXdot1TrObjects 1 }
lldpXdot1TrLocalData OBJECT IDENTIFIER ::= { lldpXdot1TrObjects 2 }
lldpXdot1TrRemoteData OBJECT IDENTIFIER ::= { lldpXdot1TrObjects 3 }

-----
-- Textual conventions for Topology Recognition
-----

LldpXdot1TrDeviceType ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "Indicates the type of device for the Topology Recognition
        algorithm. Used in the Device Type field of the Topology
        Recognition TLV
        0: End-station / Server
        1: Bridge
        2: Router
        255: Unknown"
    SYNTAX      INTEGER {
        trEndStation(0),
        trBridge(1),
        trRouter(2),
        trUnknown(255)
    }

LldpXdot1TrPortOrientation ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "Indicates the orientation of the port in the Topology Recognition
        algorithm. Used in the Port Orientation field of the Topology
        Recognition TLV
        0: uplink
        1: downlink
        2: crosslink
        255: Unknown"
    SYNTAX      INTEGER {
        trPortUplink(0),
        trPortDownlink(1),
        trPortCrosslink(2),
        trPortUnknown(255)
    }

-----
-- IEEE 802.1 - Topology Recognition Configuration
-----

--
-- lldpXdot1TrConfigTrTable : configure the
-- transmission of the Topology Recognition TLV on a set of ports
--

lldpXdot1TrConfigTrTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1TrConfigTrEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "A table that controls selection of Topology Recognition
```

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TLVs to be transmitted on individual ports."
 ::= { lldpXdot1TrConfig 1 }

lldpXdot1TrConfigTrEntry OBJECT-TYPE
SYNTAX LldpXdot1TrConfigTrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"LLDP configuration information that controls the
transmission of IEEE 802.1 organizationally defined
Topology Recognition TLV on LLDP transmission-capable ports.

This configuration object augments the lldpV2PortConfigEntry of
the LLDP-MIB, therefore it is only present along with the port
configuration defined by the associated lldpV2PortConfigEntry
entry.

Each active lldpConfigEntry is restored from non-volatile
storage (along with the corresponding lldpV2PortConfigEntry)
after a re-initialization of the management system."
AUGMENTS { lldpV2PortConfigEntry }
 ::= { lldpXdot1TrConfigTrTable 1 }

lldpXdot1TrConfigTrEntry ::= SEQUENCE {
 lldpXdot1TrConfigTrTxEnable TruthValue
 }

lldpXdot1TrConfigTrTxEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The lldpXdot1TrConfigTrTxEnable, which is
defined as a truth value and configured by the network
management, determines whether the IEEE 802.1 organizationally
defined Topology Recognition TLV transmission is allowed
on a given LLDP transmission-capable port.

The value of this object is restored from non-volatile
storage after a re-initialization of the management system."
REFERENCE
"D.2.16"
DEFVAL { false }
 ::= { lldpXdot1TrConfigTrEntry 1 }

-- IEEE 802.1 - Topology Recognition Local System Information

--- lldpXdot1TrLocalData: Contains the information for the TR TLV

lldpXdot1TrLocalData OBJECT-TYPE
SYNTAX SEQUENCE OF lldpXdot1LocTrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains one row per port of Topology Recognition
information (as a part of the LLDP 802.1 organizational extension)
on the local system known to this agent."
 ::= { lldpXdot1TrLocalData 1 }

lldpXdot1LocTrEntry OBJECT-TYPE
SYNTAX LldpXdot1LocTrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Topology Recognition information about a particular port
component."
INDEX { lldpV2LocPortIfIndex }

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```
 ::= { lldpXdot1LocTrTable 1 }

lldpXdot1LocTrEntry ::= SEQUENCE {
    lldpXdot1LocTrDeviceType      LldpXdot1TrDeviceType,
    lldpXdot1LocTrTopoLevel       Unsigned32,
    lldpXdot1LocTrPortOrientation LldpXdot1TrPortOrientation
}

lldpXdot1LocTrDeviceType OBJECT-TYPE
    SYNTAX      LldpXdot1TrDeviceType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the type of device sending the Topology Recognition TLV.
        End-stations or servers that are non-relay systems at the edge
        of the topology use the value trEndStation(0). A layer-2 relay
        system uses the value trBridge(1) and layer-3 relay systems use
        the value trRouter(2)."
```

REFERENCE
"D.2.16.3"

```
 ::= { lldpXdot1LocTrEntry 1 }

lldpXdot1LocTrTopoLevel OBJECT-TYPE
    SYNTAX      Unsigned32 (0..255)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Indicates the system understanding of its current level in
        the topology. The value of 0 indicates the edge of the topology
        and the value 255 indicates the level is currently unknown. Other
        non-zero values between 1 and 254 indicate the minimum number
        of links between the system and the edge of the topology."

    REFERENCE
        "D.2.16.4"

 ::= { lldpXdot1LocTrEntry 2 }

lldpXdot1LocTrPortOrientation OBJECT-TYPE
    SYNTAX      LldpXdot1TrPortOrientation
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Indicates whether the port is facing a trUplink(0), trDownlink(1),
        trCrosslink(2), or the orientation is TrUnknown(255). An uplink is a
        port that is facing a system that is deeper in the topology (i.e.,
        has a Topology Level greater than the sending system). A downlink
        is a port that is facing a system closer to the edge of the topology
        (i.e., has a Topology Level less than the sending system). A crosslink
        is a port that is facing a system at the same level of the topology.
        Systems that are end-stations initialize this value to trUplink(0).
        Systems that are not end-stations initialize this value to
        TrUnknown(255)."
```

REFERENCE
"D.2.16.5"

```
 ::= { lldpXdot1LocTrEntry 3 }

-----
-- IEEE 802.1 - Topology Recognition Remote System Information
-----

--- lldpXdot1TrRemoteData: Contains the received information for the TR TLV
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---
lldpXdot1RemTrTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LldpXdot1RemTrEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains one row per port of basic Topology Recognition
        information (as a part of the LLDP 802.1 organizational extension)
        of the remote system."
```