

5 **Draft Standard for**
6 **Local and metropolitan area networks—**

7 **Link Aggregation**

8 **Amendment 1:**
9 **YANG for Link Aggregation**

10 Prepared by the
11 **Time-Sensitive Networking (TSN) Task Group of IEEE 802.1**

12 Sponsor

13 **LAN/MAN** Standards Committee
14 **of** the
15 **IEEE Computer Society**

16 **This and the following cover pages are not part of the draft.** They provide revision and other information
17 for IEEE 802.1 Working Group members and will be updated as convenient. **New participants: Please read**
18 **these cover pages**, they contain information that should help you contribute effectively to this standards
19 development project. The [Introduction to the current draft](#) should be useful to all readers.

20 The text proper of this draft begins with the [Title page](#).

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5 presented at the beginning of each of our Working Group and Task Group meeting.

6 The IEEE SA [PAR \(Project Authorization Request\)](#) and [CSD](#) (Criteria for Standards Development established
7 by IEEE 802) are summarized in these cover pages and links are provided to the full text of both PAR and
8 CSD. As part of the IEEE 802® process, the text of the PAR and CSD of each project is reviewed regularly to
9 ensure their continued validity. A vote of "Approve" on this draft is also an affirmation that the PAR and CSD
10 for this project are still valid.

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12 formatting, spelling, etc. are routinely handled between the 802.1 Editor and the IEEE Staff Editors prior to
13 publication, after balloting and the process of achieving agreement on the technical content of the standard is
14 complete. Readers are urged to devote their valuable time and energy only to comments that materially affect
15 either the technical content of the document or the clarity of that technical content. Comments should not
16 simply state what is wrong, but also what might be done to fix the problem.

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18 activities, working papers, and email distribution lists etc. can be found on the 802.1 Website:

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21 policy of considering comments from all who are interested and willing to contribute to the development of the
22 draft. Individuals not attending meetings have helped to identify sources of misunderstanding and ambiguity
23 in past projects. The email lists exist primarily to allow the members of the working group to develop
24 standards, and are not a general forum. All contributors to the work of 802.1 should familiarize themselves
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28 Working Group and Time-Sensitive Networking (TSN) Task Group.

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40 <http://standards.ieee.org/about/sasb/patcom/materials.html>

41 As part of our IEEE 802 process, the text of the PAR and CSD (Criteria for Standards Development, formerly
42 referred to as the 5 Criteria or 5C's) is reviewed on a regular basis in order to ensure their continued validity.
43 A vote of "Approve" on this draft is also an affirmation by the balloter that the PAR is still valid.

1 **PAR (Project Authorization Request) and CSD**

2 This page is a draft, based on the proposed PAR and CSD as of the close of the May 2023 802.1 Interim
3 Meeting.

4 Extracts from the PAR, as approved by IEEE NesCom <date>:

5 <https://www.ieee802.org/1/files/public/docs2023/dy-draft-PAR-0523-v01.pdf>

6 and the CSD (Criteria for Standards Development):

7 <https://www.ieee802.org/1/files/public/docs2023/dy-draft-CSD-0523-v01.pdf>

8 follow.

9 **Scope of the project:**

10 This amendment specifies YANG that allows configuration and status reporting for bridges and bridge
11 components for the Multiple Spanning Tree Protocol (MSTP). This amendment addresses MSTP
12 requirements arising from industrial automation networks, updating existing managed objects and updating
13 the existing Management Information Base (MIB) to match the YANG capabilities. Additionally, this
14 amendment addresses errors or omissions in existing functionality.

15 **PAR Need for the Project:**

16 YANG (RFC 7950) is a formalized data modeling language that is widely accepted and can be used to
17 simplify network configuration. The ability to manage the Multiple Spanning Tree Protocol via YANG
18 modules is needed for compatibility with modern network management systems. Industrial automation
19 networks require parameter value ranges that can differ from those currently supported.

20 **CSD broad market potential [extract]:**

21 The proposed amendment will support the use of YANG, which has broad industry support in networks that
22 use IEEE Std 802.1Q. Both IEEE Std 802.1Q and YANG are already supported and used by multiple
23 vendors, network providers, and network users. There is a wide interest in the industry to manage MSTP via
24 YANG. Furthermore, industrial automation networks require parameter value ranges that can differ from
25 those currently supported.

26 **Economic feasibility [extract]:**

- 27 a) Management using YANG utilizes a balance between end station and infrastructure capabilities; the
28 balance will be similar to that for existing management methods.
- 29 b) The cost factors will be similar to those of existing management methods.
- 30 c) This project extends the YANG capabilities of IEEE Std 802.1Q to MSTP as a step towards a
31 complete YANG management solution. This helps to eliminate multiple management platforms,
32 thus reduces installation cost.
- 33 d) This project extends the YANG capabilities of IEEE Std 802.1Q to manage MSTP as a step towards
34 a complete YANG management solution. This helps to eliminate multiple management platforms,
35 thus reduces operational cost.

1 Draft development

2 During the early stages of draft development, 802.1 editors have a responsibility to attempt to craft technically
3 coherent drafts from the resolutions of ballot comments and from the other discussions that take place in the
4 working group meetings. Preparation of drafts often exposes inconsistencies in editor's instructions or
5 exposes the need to make choices between approaches that were not fully apparent in the meeting. Choices
6 and requests by the editors' for contributions on specific issues will be found in the editors' [Introduction to the](#)
7 [current draft](#) and at appropriate points in the draft.

8 Any text with a Cyan background (as in this sentence) is temporary, with conditional tag 'Editor comment',
9 inserted by the Editors to solicit comment, suggest a future change, or act simply as an aide memoire. Text
10 can also **highlighted** to be draw it to the readers' attention, using conditional tag 'Editor highlight'. In both
11 these case conditional tagging helps location, and eventual removal, of text or highlighting and can control
12 whether or not it is displayed.

13 The ballot comments received on each draft, and the editors' proposed and final disposition of comments on
14 working group drafts, are part of the audit trail of the development of the standard and are available, along
15 with all the revisions of the draft on the 802.1 website (for address see above).

16 During the early stages of draft development the proposed text can be moved around a great deal, and even
17 minor rearrangement can lead to a lot of 'change', not all of which is noteworthy from the point of the reviewer,
18 so the use of automatic change bars is not very effective. In early drafts change bars may be omitted or
19 applied manually, with a view to drawing the readers attention to the most significant areas of change.
20 Readers interested in viewing every change are encouraged to use Adobe Acrobat to compare the document
21 with their selected prior draft. Note that the FrameMaker change bar feature is useless when it comes to
22 indicating changes to Figures.

23 This draft has been prepared from a set of Framemaker files with conditional text that supports the production
24 of the present amendment draft and a preliminary roll up of that amendment draft into the text of the base
25 standard, i.e. IEEE Std 802.1AX as of the last Revision as amended by prior amendments (usually as of the
26 close of their successful SA ballots) as noted on the Title Page and the first Cover Page. The editor may
27 make preliminary roll ups available to check consistency with the base standard and cross-references to text
28 that does not appear in this amendment. Roll ups may also be recorded as part of the approved P802.1AX
29 Revision project.

30 For a description of the use of conditional text and other FrameMaker and IEEE Std 802.1Q Style
31 considerations applicable to this draft see the EDITOR-PLEASE-READ-ME file in the FrameMaker books
32 used to generate these drafts.

33 There are generally multiple amendments under development at any time, and while they will add or amend
34 different clauses in the base standard, there are some clauses (notably Clauses 12, 48, and the PICS
35 Annexes that all are likely to change). They will need to be fully integrated before or during SA Ballot, and
36 complete that ballot in serial order to avoid future problems.

37 Records of participants in the development of the standard are added after SA Ballot, as part of
38 pre-publication editing by IEEE Staff.

39 MIB and YANG modules

40 The MIB and YANG modules that are modified or added by this amendment are attached to the draft pdf as
41 plain text (UTF-8) .mib and .yang files. When a roll up of the current base standard plus this amendment is
42 made available, all the MIB and YANG modules for the roll up are attached.

43 —

1 Introduction to the current draft¹

2 This introduction is not part of the draft, and should not be the subject of ballot comments.

3 D0.1

4 This is an initial draft and comments are requested on all aspects of the draft. It includes a number of notes
5 that may be of help to the Editors as well as informing the initial review process.

6 Mick Seaman, 802.1Q Editor

7 The 802-1Qdy.book, i.e. the FrameMaker set of individual .fm documents that are included in this
8 amendment draft, includes all the .fm documents that appear to be required (an initial assessment). Clauses
9 not required are not in the book. Even if marked as Excluded in the book, they would be updated by applying
10 Show/Hide Conditional Text to the book, which can take time and result in more unresolved cross-reference
11 reports on book update than necessary. These other files are in the same 802-1Qdy directory so can be added
12 to the book if necessary, however before adding check with the 802.1Q Editor to make sure that the latest
13 version is being added, to reduce the work that will be needed when merging the amendment changes into
14 the most recent set of sources for final SA Ballot.

15 The following files are included:

- 16 — Q01 (Clause 1. Overview). This is currently included just to provide the amendment editorial
17 instructions, and the copy of title page information that always precedes these. It would be a waste
18 of time to transfer this material to the first clause file with text to be amended, and that file could
19 change through the course of the project in any case.
- 20 — Q13 (Clause 13). Change the upper bound of the Max Hops range, and added draft text to the
21 following Note, following the style of prior amendments in explaining when and why a detailed
22 item has been changed. Note also that the remaining text of this clause has been checked for out of
23 date references to 802.1D and STP. These have been removed where they might appear to be
24 normative language, but retained where they explain backwards compatibility aspects of the current
25 standard (which might still be relevant to some users, even this long after RSTP standardization).
26 These changes are changed barred so that they can be reviewed as part of the now approved
27 P802.1Q-2022 Revision Project. Change bars for this Clause's .fm file should not be removed en
28 masse.
- 29 — Q17-7-6-MSTP-MIB (17.7.6 Definitions for the IEEE8021-MSTP-MIB module). This has been
30 included with a preliminary update, changing the upper bound of the range for
31 ieee8021MstpCistMaxHops from 40 to 100 (which may not be the eventual value determined by this
32 project). References to IEEE Std 802.1D (2004) have been removed, as that standard was obsoleted
33 a long while ago.

34 Other files in the 802-1Q.book that is used to generate the entire 802.1Q roll up (the last Revision, plus
35 recent amendments, plus this amendment) are not part of the 802-1Qdy book. The present omission of the
36 following may be noteworthy:

- 37 — Q02 (Clause 2. Normative references). No additional references are envisaged at present.
- 38 — Q03 (Clause 3. Definitions). No additional definitions are expected.
- 39 — Q04 (Clause 4. Abbreviations). No additional definitions are expected.
- 40 — Q05 (Clause 5. Conformance). There is no absolute need for additions to the Conformance clause,
41 even with the addition of the new YANG module. This would appear to be covered by the existing
42 5.4.1 VLAN Bridge component options item w) (as of P802.1Qcj/D2.5):

¹ The whole or parts of the introduction, possibly updated, to past drafts may be retained at the Editor's discretion, with the most recent introduction first. The introduction to each draft may solicit input on specific subjects.

- 1 “w) Support YANG modules for the management of VLAN Bridge capabilities (Clause 48).”
2
3 Note that P802.1Qcw, which added several YANG modules, did not make any additions for these to
4 the conformance clause. It did add PICS entries for the new YANG modules (to A.47 and to Tables
5 in Annex B, numbering since corrected).
6
7 On the other hand, 802.1Qcz Congestion Isolation did add a specific YANG line item (5.32 item g),
8 as did P802.1Qcj (5.9.2 item h, 5.12.3 item j), and 802.1Q-2022 5.4.1.1 Multiple Spanning Tree
9 (MST) operation (optional) does call out MIB support in item p), though it does not specify which
10 MIB(s).
11
12 — Q12 (Clause 12. Bridge management). This clause defers to 13.25 and Table 13-5 for the limit on
13 Max Hops, so does not need to be changed to increase that limit. It is to be hoped that development
14 of the YANG model does not introduce changes that need to be reflected into this clause, or Clause
15 13.
16 — Q17 (Clause 17. Management Information Base (MIB) — 17.1 Internet Standard Management
17 Framework & 17.2 Structure of the MIB. No changes should be necessary, unless the work on the
18 YANG adds objects that are to be reflected into the MIB.
19 — Q17-3 (17.3 MIB module relationships, 17.4 Security considerations, 17.5 Dynamic component and
20 Port creation, 17.6 MIB operations for service interface configuration). No changes to any of these
21 should be necessary.
22 — Q17-7-3-SPANNING-TREE-MIB. Not currently included, but may be required if the YANG work
23 identifies improvements that need to be made to the MIB(s). I believe such changes are within the
24 scope of the project.
25 — Q48 (Clause 48. YANG Data Models — Introductory text & 48.1 YANG Framework. This includes
26 Figure 48-2—YANG root hierarchy with IEEE 802.1Q YANG models, but has not been updated by
27 any of the recent amendments.
28 — Q-X (Annex X Bibliography). No additional references are expected at present. If any are suggested,
29 take care that they are not items already in the 2. Normative References. Both these Clause 2 and the
30 Bibliography will be updated by Annexes in publication, and the Bibliography is more of a nuisance
because of the IEEE Style Guide rule placing it as the last Annexes, which means that it can move
around. That movement is hard to handle as successive amendments shift its position.

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6 **Draft Standard for**
7 **Local and metropolitan area networks—**
8 **Link Aggregation**
9 **Amendment 1:**
10 **YANG for Link Aggregation**

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12 **Time-Sensitive Networking (TSN) Task Group of IEEE 802.1**

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14 **LAN/MAN** Standards Committee
15 **of** the
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1

2 **Abstract:** This amendment to IEEE Std 802.1AX-2020 specifies a Unified Modeling Language
3 (UML)-based model and YANG modules for Link Aggregation configuration and status reporting.

4 **Keywords:** Aggregated Link, Aggregator, Distributed Resilient Network Interconnect, DRNI,
5 interconnect, Link Aggregation, Link Aggregation Group, local area network, management,
6 Network-Network Interface, NNI, YANG.

7

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2 <<The following lists will be updated in the usual way prior to publication>>

3 At the time this standard was submitted to the IEEE-SA Standards Board for approval, the IEEE 802.1
4 Working Group had the following membership:

5 **Glenn Parsons, *Chair***
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10

<<TBA>>

¹ The following members of the individual balloting committee voted on this standard. Balloters may have
² voted for approval, disapproval, or abstention.

<<TBA>>

³ When the IEEE-SA Standards Board approved this standard on XX Month 20xx, it had the following
⁴ membership:

⁵ <<TBA>>

<<TBA>>

⁶
⁷ *Member Emeritus

⁸
⁹
¹⁰

1 **Introduction**

This introduction is not part of IEEE Std 802.1AXdz™-20XX, IEEE Standard for Local and metropolitan area networks— Link Aggregation—Amendment 1: YANG for Link Aggregation.

2 IEEE Std 802.1AXdz™-202X: YANG for Link Aggregation specifies a Unified Modeling Language
3 (UML)-based model and YANG modules for Link Aggregation configuration and status reporting

4 This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution.
5 Revisions are anticipated within the next few years to clarify existing material, to correct possible errors, and
6 to incorporate new related material. Information on the current revision state of this and other IEEE 802
7 standards may be obtained from

8	Secretary,	IEEE-SA	Standards	Board
9	445	Hoes		Lane
10	Piscataway,	NJ		08854-4141
11	USA			

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2. Normative references

Insert the following references into Clause 2 in alphanumeric order:

IETF RFC 6241, Network Configuration Protocol (NETCONF), June 2011.

IETF RFC 6991, Common YANG Data Types, July 2013

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

IETF RFC 8343, A YANG Data Model for Interface Management, March 2018

IETF RFC 8349, A YANG Data Model for Routing Management (NMDA Version), March 2018

3. Definitions

Insert new definitions at the end of 3.1 as follows:

YANG: IETF defined data modeling language, published as IETF RFC 7950.

YANG model: One or more YANG modules used to configure and monitor the managed element or system.

YANG module: The description of the data model used to configure and monitor the managed element or system. A YANG module defines a hierarchy of nodes that can be used for NETCONF-based (see IETF RFC 7803) and RESTCONF-based (see IETF RFC 8040) operations.

5. Conformance

Insert the following text (item j) after item i) in the lettered list of 5.3.2

- j) Support YANG modules for the management of Link Aggregation capabilities (Clause 10).

Insert Clause 10 after Clause 9 as follows:

10. Link Aggregation YANG definitions

This clause specifies YANG modules that provide control and status monitoring of systems and system components that implement functionality specified in this standard.

This clause:

- a) Introduces the YANG framework that governs the naming and hierarchy of configuration and operational data structures in the data models, and the modeling of network interfaces (10.1).
- b) Describes the information data model and its relationship to the operational processes and managed objects specified in the other clauses of this standard, and provides a UML representation of each data model (10.2).
- c) Describes the structure of the data models, each of which comprises or makes use of one or more YANG modules (10.3).
- d) Includes a relationship description of other modules imported in YANG modules (10.4)
- e) Reviews security considerations applicable to each of the modules, with specific reference to data nodes in the YANG modules that compose the model (10.5).
- f) Includes each of the YANG modules and its data schema (10.6).

10.1 Internet Standard Management Framework

This YANG module uses the YANG 1.1 Data Modeling Language as specified in IETF RFC 7950.

The YANG framework applies hierarchy in the following areas:

- a) The uniform resource name (URN), as specified in 802d. The structure of the URN is such that *ieee* is the root (i.e., name-space identifier), followed by the standard, then the working group developing the standard.
- b) The YANG objects form a hierarchy of configuration and operational data structures that define the YANG model.

10.2 Information Model for Link Aggregation Management

The YANG objects are based on the managed objects in Clause 7. A UML-like representation of the management model is provided in the following subclauses.

The purpose of an UML-like² diagram is to express the model design on a single piece of paper. The structure of the UML-like representation shows the name of the object followed by a list of properties for the object. The properties indicate its type and accessibility. It should be noted that the UML-like representation is meant to express simplified semantics for the properties. It is not meant to provide the specific datatype as used to encode the object in either MIB or YANG. In the UML-like representation, a box with a white background represents information that comes from sources outside of the IEEE. A box with a gray background represents objects that are defined by this IEEE Standard.

²A description of the UML-like diagrams used in this clause is provided at <https://1.ieee802.org/uml-like-diagrams>

The YANG hierarchical structure that incorporates the Link Aggregation YANG modules supported by this standard is represented by Figure 10-1. In the figures in this clause, items that are shaded gray are described in this document, items with no background shading are defined elsewhere. The YANG data model is realized in three YANG modules. One module *ieee802-dot1ax-types* provides data types that are needed by the Link Aggregation configuration and monitoring objects. The *ieee802-dot1ax* module provides the Link Aggregation, Aggregation Port, and Aggregator configuration and monitoring objects. The *ieee802-dot1ax-drni* module provides the Distribute Resilient Network Interface (DRNI) configuration and monitoring objects. The ability to augment the port container to support extension TLVs is also shown. The Link Aggregation and DRNI capabilities are not only applicable to IEEE Std 802.1Q bridges, but also (for example) end stations, and routers.

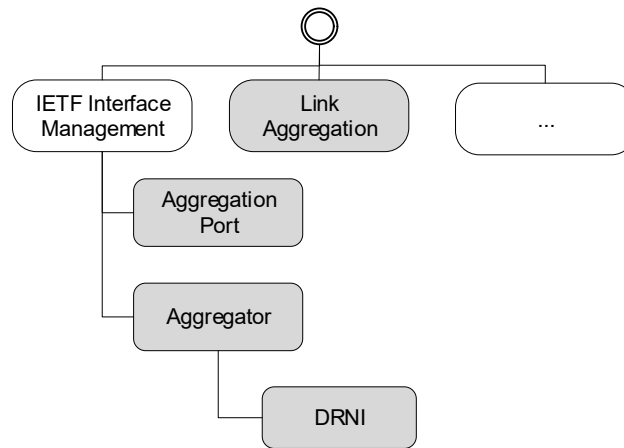


Figure 10-1—YANG root hierarchy with Link Aggregation YANG modules

10.2.1 Link Aggregation UML

The Link Aggregation Configuration and Monitoring Objects in 10-2 show the objects that are applicable on a system supporting link aggregation. This consists of a list of key-groups. Each key group has a unique combination of actor-system-id and actor-admin-key, and includes parameters that must have the same value for any aggregator and/or aggregation port that have the same actor-system-id and actor-admin-key.

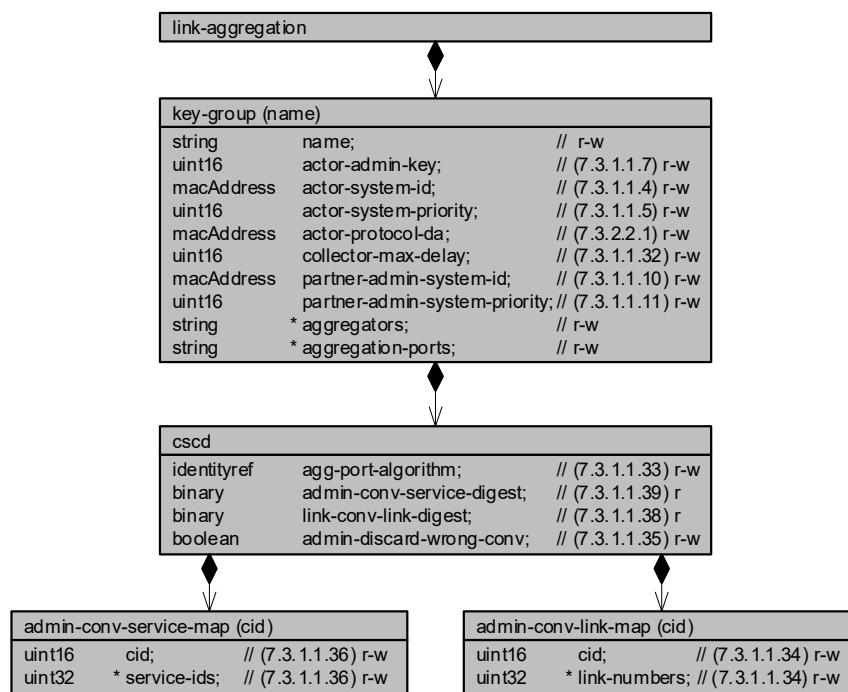


Figure 10-2—Key Group Configuration and Monitoring Objects

10-3 shows

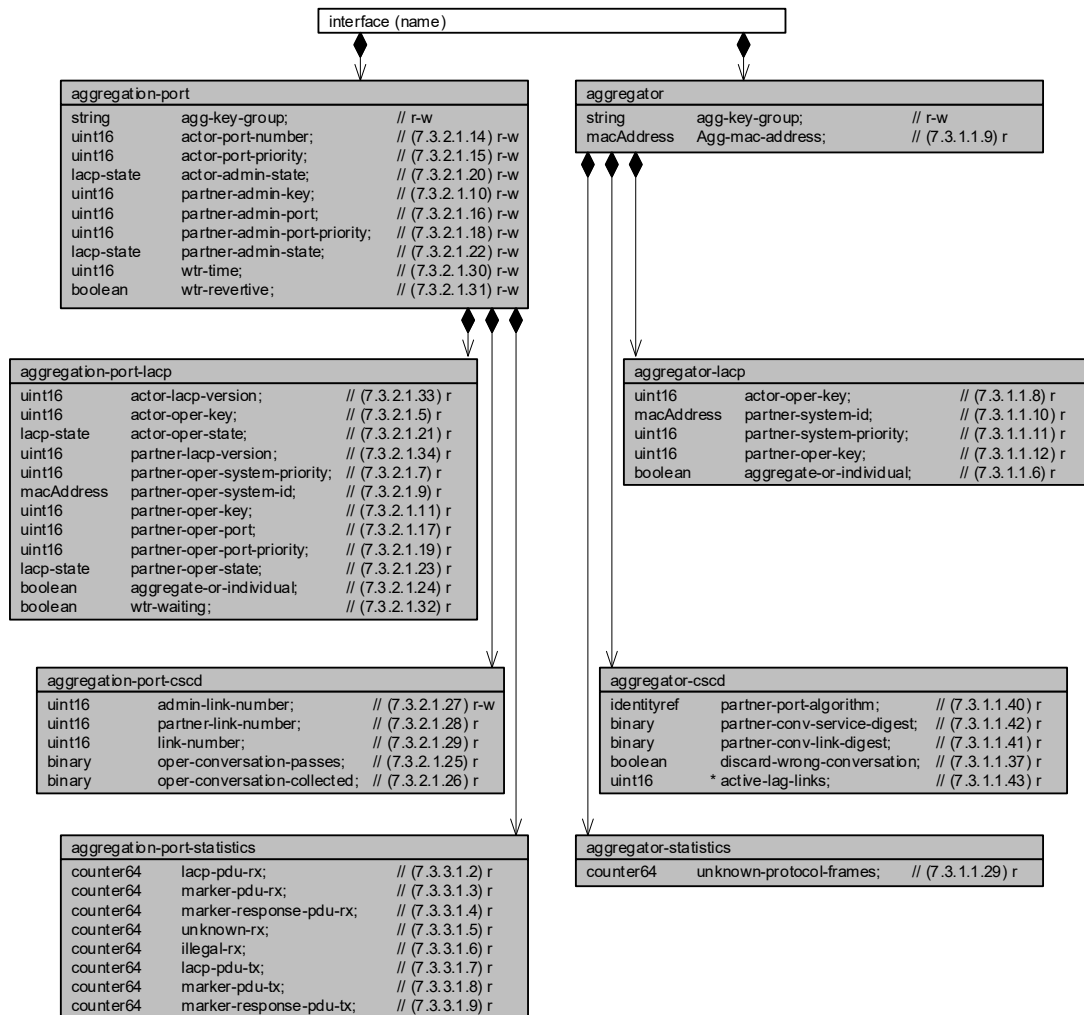


Figure 10-3—Aggregator and Aggregation Port Configuration and Monitoring Objects

10.2.2 DRNI UML

The DRNI Configuration and Monitoring Objects in 10-4 show the objects that are applicable to an Aggregator augmented with DRNI.

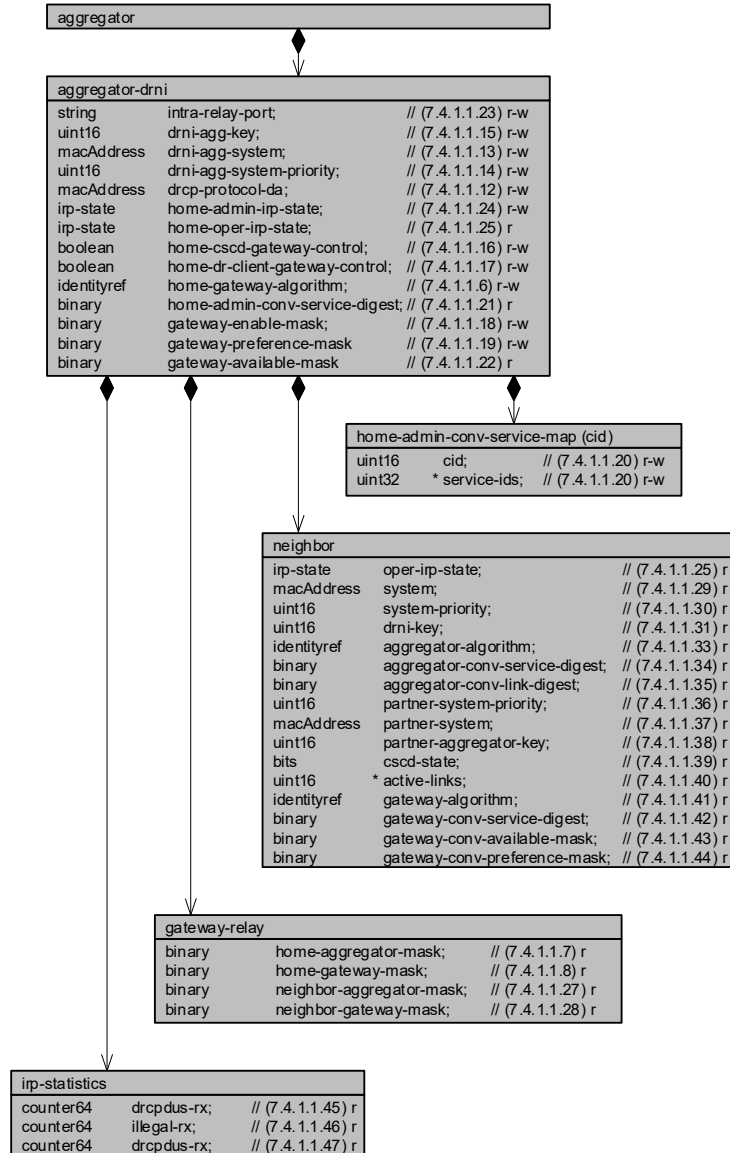


Figure 10-4—DRNI Configuration and Monitoring Objects

10.3 Structure of the Link Aggregation YANG Model

The IEEE YANG model specified in this standard is divided into three YANG modules. A summary of the modules contained in this clause is represented in Table 10-1.

Table 10-1—Structure of the YANG modules

Module	Subclause	Notes
ieee802-dot1ax-types	10.6.2.1	Type definitions used for Link Aggregation YANG.
ieee802-dot1ax	10.6.2.2	Link Aggregation Management
ieee802-dot1z-drni	10.6.2.3	DRNI Management

In the YANG module definitions below, if any discrepancy between the DESCRIPTION text and the corresponding definition in any other part of this standard occurs, the definitions outside this subclause take precedence.

10.4 Relationship to other YANG modules

This clause describes how the *ieee802-dot1ax* and *ieee802-dot1ax-drni* YANG modules are related to the YANG modules that are imported.

10.4.1 IEEE 802.1AX Types Module

The *ieee802-dot1ax-types* module provides reusable types that are used by the *ieee802-dot1ax* and *ieee802-dot1ax-drni* modules.

10.4.2 IETF YANG Types Module

The *ietf-yang-types* YANG module (IETF RFC 6991) contains a set of derived YANG types. This document leverages counter64.

10.4.3 IETF Interfaces YANG Module

The *ietf-interfaces* YANG module (IETF RFC 8343) contains a set of YANG definitions for managing network interfaces. This document augments an *ietf-interfaces:interface* with aggregation-port or aggregator data nodes..

10.4.4 IEEE 802 Types Module

The *ieee802-types* module provides reusable types that are used in IEEE 802 standards.

The type for mac-addresses defined in *ieee802-types* has a pattern that allows upper and lower case letters. To avoid issues with string comparison, it is suggested to only use upper case for the letters in the hexadecimal numbers. Implementers using code comparing MAC addresses should note that there is still an issue with a difference between the IETF mac-address definition and the IEEE mac-address definition.

10.5 Security Considerations

The YANG modules defined in this clause are designed to be accessed via a network configuration protocol (e.g., NETCONF protocol). In the case of NETCONF, the lowest NETCONF layer is the secure transport layer and the mandatory to implement secure transport is SSH. The NETCONF access control model provides the means to restrict access for particular NETCONF users to a pre-configured subset of all available NETCONF protocol operations and content.

It is the responsibility of a system's implementor and administrator to ensure that the protocol entities in the system that support NETCONF, and any other remote configuration protocols that make use of these YANG modules, are properly configured to allow access only to those users who have legitimate rights to read or write data nodes. This standard does not specify how the credentials of those users are to be stored or validated.

10.5.1 Security considerations of the *ieee802-dot1ax* YANG modules

There are several management objects defined in the *ieee802-dot1ax* and *ieee802-dot1ax-drni* YANG modules 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), 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 is possible.

The following containers, and the objects in these containers, of the *ieee802-dot1ax* and *ieee802-dot1ax-drni* YANG modules can be manipulated to interfere with the operation of the Link Aggregation Control Protocol (LACP) or the Distributed Relay Control Protocol (DRCP). This could, for example, cause network instability and result in the loss of service for a large number of end users.

```
dot1ax/link-aggregation/key-group
dot1ax/link-aggregation/cscd
dot1ax/link-aggregation/cscd/admin-conv-service-map
dot1ax/link-aggregation/cscd/admin-conv-link-map
dot1ax/aggregation-port
dot1ax/aggregation-port/cscd/admin-link-number
dot1ax/aggregator
dot1ax-drni/aggregator/drni
dot1ax-drni/aggregator/drni/home-admin-conv-service-map
```

Some of the readable data in this YANG module may be considered sensitive or vulnerable in some network environments. It is important to control all types of access (e.g., including NETCONF get, get-config operations) to these objects and possibly to even encrypt the values of these objects when sending them over the network. For example the system name and other information about the remote systems could provide information about the configuration and topology of the network and could be considered a privacy threat.

10.6 Definition of the YANG modules^{3,4}

10.6.1 YANG schema definitions

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams is as follows:

- Brackets "[" and "]" enclose list keys.
- Abbreviations before data node names: "rw" means configuration (read-write), and "ro" means state data (read-only).
- Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.
- Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- Ellipsis ("...") stand for contents of subtrees that are not shown.

10.6.1.1 YANG schema definition for *ieee802-dot1ax* YANG module

```
module: ieee802-dot1ax
  +--rw link-aggregation
    +--rw key-group* [name]
      +--rw name string
      +--rw actor-admin-key uint16
      +--rw actor-system-id ieee:mac-address
      +--rw actor-system-priority? uint16
      +--rw actor-protocol-da? ieee:mac-address
      +--rw collector-max-delay? uint16
      +--rw partner-admin-system-id? ieee:mac-address
      +--rw partner-admin-system-priority? uint16
      +--ro aggregators* if:interface-ref
      +--ro aggregation-ports* if:interface-ref
      +--rw cscd {ax:cscd}?
        +--rw agg-port-algorithm? identityref
        +--rw admin-conv-service-map* [cid]
          | +--rw cid uint16
          | +--rw service-ids* uint32
        +--ro admin-conv-service-digest? binary
        +--rw admin-conv-link-map* [cid]
          | +--rw cid uint16
          | +--rw link-numbers* uint16
        +--ro admin-conv-link-digest? binary
        +--rw admin-discard-wrong-conv? enumeration {ax:dwc}?

  augment /if:interfaces/if:interface:
    +--rw aggregator
      +--rw agg-key-group key-group-ref
      +--ro agg-mac-address? ieee:mac-address
      +--ro aggregator-lacp
        | +--ro actor-oper-key? uint16
        | +--ro partner-system-id? ieee:mac-address
        | +--ro partner-system-priority? uint16
        | +--ro partner-oper-key? uint16
        | +--ro aggregate-or-individual? boolean
      +--ro aggregator-cscd {ax:cscd}?
        | +--ro partner-port-algorithm? identityref
        | +--ro partner-conv-service-digest? binary
```

³Copyright release for YANG modules: Users of this standard may freely reproduce the YANG modules contained in this subclause so that they can be used for their intended purpose.

⁴An ASCII version of the YANG module(s) can be obtained by Web browser from the IEEE 802.1 Website at <https://1.ieee802.org/yang-modules/>.


```

|   +--ro partner-conv-link-digest?      binary
|   +--ro discard-wrong-conversation?    boolean
|   +--ro active-lag-links*              uint16
+--ro statistics
|   +--ro unknown-protocol-frames?      yang:counter64
augment /if:interfaces/if:interface:
+--rw aggregation-port!
|   +--rw agg-key-group                  key-group-ref
|   +--rw actor-port-number?            uint16
|   +--rw actor-port-priority?          uint16
|   +--rw actor-admin-state?            ax:lacp-state
|   +--rw partner-admin-key?            uint16
|   +--rw partner-admin-port?           uint16
|   +--rw partner-admin-port-priority?  uint16
|   +--rw partner-admin-state?          ax:lacp-state
|   +--rw wtr-time?                     uint16
|   +--rw wtr-revertive?                boolean
+--ro aggregation-port-lacp
|   +--ro actor-lacp-version?            uint16
|   +--ro actor-oper-key?                uint16
|   +--ro actor-oper-state?              ax:lacp-state
|   +--ro partner-lacp-version?          uint16
|   +--ro partner-oper-system-priority?  uint16
|   +--ro partner-oper-system-id?        ieee:mac-address
|   +--ro partner-oper-key?              uint16
|   +--ro partner-oper-port?             uint16
|   +--ro partner-oper-port-priority?    uint16
|   +--ro partner-oper-state?            ax:lacp-state
|   +--ro aggregate-or-individual?       boolean
|   +--ro wtr-waiting?                   boolean
+--rw aggregation-port-cscd {ax:cscd}?
|   +--rw admin-link-number?             uint16
|   +--ro partner-link-number?           uint16
|   +--ro link-number?                   uint16
|   +--ro oper-conversation-passes?       binary
|   +--ro oper-conversation-collected?   binary
+--ro aggregation-port-statisticss
|   +--ro lacp-pdu-rx?                    yang:counter64
|   +--ro marker-pdu-rx?                  yang:counter64
|   +--ro marker-response-pdu-rx?        yang:counter64
|   +--ro unknown-rx?                    yang:counter64
|   +--ro illegal-rx?                    yang:counter64
|   +--ro lacp-pdu-tx?                    yang:counter64
|   +--ro marker-pdu-tx?                  yang:counter64
|   +--ro marker-response-pdu-tx?        yang:counter64

```

10.6.1.2 YANG schema definition for *ieee802-dot1ax-drni* YANG module

```

module: ieee802-dot1ax-drni

augment /if:interfaces/if:interface/dot1ax:aggregator:
+--rw aggregator-drni!
|   +--rw intra-relay-port                if:interface-ref
|   +--rw drni-agg-key?                   uint16
|   +--rw drni-agg-system?                 ieee:mac-address
|   +--rw drni-agg-system-priority?        uint16
|   +--rw drcp-protocol-da?                ieee:mac-address
|   +--rw home-admin-irp-state?            ax:irp-state
|   +--ro home-oper-irp-state?              ax:irp-state
|   +--rw home-cscd-gateway-control?       boolean
|   +--rw home-dr-client-gateway-control?  boolean
|   +--rw home-gateway-algorithm?          identityref
|   +--rw home-admin-conv-service-map* [cid]

```

```

|   +--rw cid                uint16
|   +--rw service-ids*       uint32
+--ro home-admin-conv-service-digest?  binary
+--rw gateway-enable-mask?            binary
+--rw gateway-preference-mask?        binary
+--ro gateway-available-mask?         binary
+--ro neighbor
|   +--ro oper-irp-state?              ax:irp-state
|   +--ro system?                     ieee:mac-address
|   +--ro system-priority?            uint16
|   +--ro drni-key?                   uint16
|   +--ro aggregator-algorithm?       identityref
|   +--ro aggregator-conv-service-digest?  binary
|   +--ro aggregator-conv-link-digest?  binary
|   +--ro partner-system-priority?     uint16
|   +--ro partner-system?             ieee:mac-address
|   +--ro partner-aggregator-key?     uint16
|   +--ro cscd-state?                 bits
|   +--ro active-links*               uint16
|   +--ro gateway-algorithm?          identityref
|   +--ro gateway-conv-service-digest?  binary
|   +--ro gateway-available-mask?     binary
|   +--ro gateway-preference-mask?    binary
+--ro gateway-relay
|   +--ro home-aggregator-mask?       binary
|   +--ro home-gateway-mask?         binary
|   +--ro neighbor-aggregator-mask?  binary
|   +--ro neighbor-gateway-mask?     binary
augment /if:interfaces/if:interface/if:statistics:
+--ro drni-stats
|   +--ro drcpdus-rx?  yang:counter64
|   +--ro illegal-rx?  yang:counter64
|   +--ro drcpdus-tx?  yang:counter64

```

10.6.2 YANG data model definitions

10.6.2.1 Definition for the *ieee802-dot1ax-types* YANG module

```

module ieee802-dot1ax-types {
  yang-version 1.1;
  namespace "urn:ieee:params:xml:ns:yang:ieee802-dot1ax-types";
  prefix "dot1ax-types";

  import iana-if-type {
    prefix "ianaif";
  }

  organization
    "Institute of Electrical and Electronics Engineers";

  contact
    "Web URL: http://www.ieee802.org/1/

    Working Group Chair:
      Glenn Parsons
      glenn.parsons@ericsson.com

    Editor:
      Stephen Haddock
      shaddock@stanfordalumni.org";

```

```
description
  "Common types used within 802.1AX Link Aggregation modules.

  Copyright (C) IEEE (2024).

  This version of this YANG module is part of IEEE Std 802.1AX;
  see the standard itself for full legal notices."

revision "2024-05-04" {
  description
    "Initial Version.";
  reference
    "IEEE 802.1AX-2020, Link Aggregation.";
}

feature cscd {
  description
    "Conversation Sensitive Collection and Distribution (CSCD)
    is supported.";
  reference
    "IEEE 802.1AX-2020, Clause 5.3.2, Clause 6.6";
}

feature dwc {
  description
    "The Discard Wrong Conversation option in CSCD is
    supported.";
  reference
    "IEEE 802.1AX-2020, Clause 5.3.2, Clause 6.6";
}

typedef lacp-state {
  type bits {
    bit lacp-activity {
      position 0;
      description
        "Provides administrative control over when LACPDUs are
        transmitted. A value of '1' indicates Active mode where
        LACPDUs are sent regardless of partner's lacp-activity
        value. A value of '0' indicates Passive mode where
        LACPDUs are sent only when the partner's lacp-activity
        value is '1' (partner is in Active mode).";
    }
    bit lacp-timeout {
      position 1;
      description
        "Provides administrative control over the frequency of
        received LACPDUs. A value of '1' indicates Short Timeout
        (so partner uses frequent transmission). A value of '0'
        indicates Long Timeout (so partner can use infrequent
        transmission).";
    }
    bit aggregation {
      position 2;
      description
```

```
    "Provides administrative control over whether this
    Aggregation Port can be in a LAG with more than one
    member. A value of '1' indicates the port can be
    aggregated with other ports. A value of '0' indicates
    the port can only be a solitary link.";
}
bit synchronization {
    position 3;
    description
        "The Synchronization state of the MUX state machine.";
}
bit collecting {
    position 4;
    description
        "The Collecting state of the MUX state machine.";
}
bit distributing {
    position 5;
    description
        "The Distributing state of the MUX state machine.";
}
bit defaulted {
    position 6;
    description
        "Indicates the port is using the partner-admin values
        to select an Aggregator.";
}
bit expired {
    position 7;
    description
        "The Expired state of the Receive state machine.";
}
}
description
    "LACP state values as transmitted in LACPDUs.";
reference
    "IEEE 802.1AX-2020, Clause 6.4.1, Clause 6.4.2.3";
}

typedef irp-state {
    type bits {
        bit reserved-1 {
            position 0;
            description
                "Reserved for future use. It is set to 0 on
                transmit and ignored on receipt.";
        }
        bit reserved-2 {
            position 1;
            description
                "Reserved for future use. It is set to 0 on
                transmit and ignored on receipt.";
        }
        bit short-timeout {
            position 2;
            description
                "The Short_Timeout flag indicates the Timeout control value
                in use by the DRCP Receive machine on this IRP. Short Timeout
                is encoded as a 1; Long Timeout is encoded as a 0.";
        }
    }
}
```

```
}
bit synchronization {
  position 3;
  description
    "When the Sync flag is TRUE (1), the DRCP Receive machine has
    determined the Neighbor DRNI System has a compatible
    configuration for forming a DRNI.";
}
bit irc-data {
  position 4;
  description
    "When the IRC_Data flag is TRUE (1), the transfer of Up
    and Down frames is permitted on the IRC.";
}
bit drni {
  position 5;
  description
    "The DRNI flag is TRUE (1) when this DRNI System is paired
    with another DRNI System (i.e., when DR_Solo is FALSE)
    and FALSE (0) otherwise.";
}
bit defaulted {
  position 6;
  description
    "When the Defaulted flag is TRUE (1), the DRCP Receive machine
    is using default operational Neighbor information.
    When FALSE (0), the operational Neighbor information
    in use has been received in a DRCPDU.";
}
bit expired {
  position 7;
  description
    "When the Expired flag is TRUE (1), the DRCP Receive machine
    is in the EXPIRED state.";
}
}
description
  "A string of 8 bits, corresponding to the administrative
  values of IRP_State (9.6.2.3 and Figure 9-13).
  These values allow administrative control over the
  values of Short_Timeout and IRC_Data.

  Implementers are recommended to review Figure 9-13 for
  a diagram of the bit-values. Take note of the 0-7
  aligned YANG bits compared to the 1-8 aligned bits from
  the IEEE specification. Also note that while some of
  these elements are operational by design / by default,
  having an admin value allows for manual override config.";
reference
  "IEEE 802.1AX-2020, Clause 7.4.1.1.24, 9.6.2.3, Figure 9-13";
}

identity distribution-algorithm {
  description
    "Each distribution algorithm is identified by a sequence of
    4octets, structured as shown in Figure 8-1. Distribution
    algorithm identifiers are used by network administrators to
    select between algorithms and, in Conversation-sensitive
```

LACP and Distributed Resilient Network Interconnect (DRNI) operation, to check whether partners and neighbors are using the same algorithm.

This identity is intended to serve as base identity, not to be directly referenced.

Vendor specific, combination (ex: multi-layer), and other customized distribution algorithms should be created as their own identities in their own YANG files, derived from this imported base type.";

```
reference
  "IEEE 802.1AX-2020, Clause 8.1, Clause 8.2";
}
identity unspecified {
  base distribution-algorithm;
  description
    "The 'Unspecified distribution algorithm' identifier has been
    reserved for use when the algorithm is unknown (or is not
    advertised).";
  reference
    "IEEE 802.1AX-2020, Table 8-1";
}
identity c-vids-nomap {
  base distribution-algorithm;
  description
    "Distribution based on C-VIDs (8.2.1). No Service ID mapping
    table is used.";
  reference
    "IEEE 802.1AX-2020, Table 8-1";
}
identity c-vids-map {
  base distribution-algorithm;
  description
    "Distribution based on C-VIDs (8.2.1). A Service ID mapping table
    is used.";
  reference
    "IEEE 802.1AX-2020, Table 8-1";
}
identity s-vids-nomap {
  base distribution-algorithm;
  description
    "Distribution based on S-VIDs (8.2.2). No Service ID mapping
    table is used.";
  reference
    "IEEE 802.1AX-2020, Table 8-1";
}
identity s-vids-map {
  base distribution-algorithm;
  description
    "Distribution based on S-VIDs (8.2.2). A Service ID mapping table
    is used.";
  reference
    "IEEE 802.1AX-2020, Table 8-1";
}
identity i-sids-nomap {
  base distribution-algorithm;
  description
    "Distribution based on I-SIDs (8.2.3). No Service ID mapping
```

```
        table is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}
identity i-sids-map {
    base distribution-algorithm;
    description
        "Distribution based on I-SIDs (8.2.3). A Service ID mapping table
        is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}
identity te-sids-nomap {
    base distribution-algorithm;
    description
        "Distribution based on TE-SIDs (8.2.4). No Service ID mapping
        table is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}
identity te-sids-map {
    base distribution-algorithm;
    description
        "Distribution based on TE-SIDs (8.2.4). A Service ID mapping table
        is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}
identity flow-hash-nomap {
    base distribution-algorithm;
    description
        "Distribution based on Flow Hash (8.2.5). No Service ID mapping
        table is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}
identity flow-hash-map {
    base distribution-algorithm;
    description
        "Distribution based on Flow Hash (8.2.5). A Service ID mapping table
        is used.";
    reference
        "IEEE 802.1AX-2020, Table 8-1";
}

identity ieee8021axIrp {
    base ianaif:iana-interface-type;
    description
        "IEEE 802.1ax Intra-Relay Port.";
}
}
```

10.6.2.2 Definition for the *ieee802-dot1ax* YANG module

```
module ieee802-dot1ax {
```

```
yang-version 1.1;
namespace "urn:ieee:params:xml:ns:yang:ieee802-dotlax";
prefix "dotlax";

import ieee802-dotlax-types {
    prefix "ax";
}
import ieee802-types {
    prefix "ieee";
}
import ietf-yang-types {
    prefix "yang";
}
import ietf-interfaces {
    prefix "if";
}
import iana-if-type {
    prefix "ianaif";
}

organization
    "Institute of Electrical and Electronics Engineers";

contact
    "Web URL: http://www.ieee802.org/1/

    Working Group Chair:
        Glenn Parsons
        glenn.parsons@ericsson.com

    Editor:
        Stephen Haddock
        shaddock@stanfordalumni.org";

description
    "This YANG module describes the configuration model for Link
    Aggregation, as specified in IEEE Std 802.1AX, including Link
    Aggregation Control Protocol (LACP) and Conversation Sensitive
    Collection and Distribution.

    Copyright (C) IEEE (2024).

    This version of this YANG module is part of IEEE Std 802.1AX;
    see the standard itself for full legal notices.";

revision "2024-05-04" {
    description
        "Initial Version.";
    reference
        "IEEE 802.1AX-2020, Link Aggregation.";
}

typedef key-group-ref {
    type leafref {
        path "/dotlax:link-aggregation/dotlax:key-group/dotlax:name";
    }
    description
        "This type is used by aggregators and aggregation ports to
        reference an entry in the key-group list.";
}

// -----
```



```
// Configuration objects used by 802.1AX YANG module
// -----

container link-aggregation {
  description
    "LAG System specific configuration nodes.";
  list key-group {
    key name;
    unique "actor-system-id actor-admin-key";
    description
      "List of key groups. A key group is the set of aggregators
      and aggregation ports that share the same system priority,
      system identifier, and aggregation key, and therefore can
      potentially form a Link Aggregation Group. Each entry in
      the key group list contains the parameters common to all
      aggregation ports and/or aggregators in the key group.";
    leaf name {
      type string;
      description
        "Name for the key group.";
    }
    leaf actor-admin-key {
      type uint16;
      mandatory true;
      description
        "The current administrative value of the Key for the
        Aggregator. The administrative Key value may differ
        from the operational Key value for the reasons
        discussed in 5.6.2. The meaning of particular Key
        values is of local significance.";
      reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.7
        IEEE 802.1AX-2020, Clause 7.3.2.1.4";
    }
    leaf actor-system-id {
      type ieee:mac-address;
      mandatory true;
      description
        "The unique identifier for the aggregating system.";
      reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.4
        IEEE 802.1AX-2020, Clause 7.3.2.1.3";
    }
    leaf actor-system-priority {
      type uint16;
      default 1;
      description
        "The priority of the aggregating system.";
      reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.5
        IEEE 802.1AX-2020, Clause 7.3.2.1.2";
    }
    leaf actor-protocol-da {
      type ieee:mac-address;
      must
        '. = "01-80-c2-00-00-00" or . = "01-80-C2-00-00-00" or
        . = "01-80-c2-00-00-02" or . = "01-80-C2-00-00-02" or
        . = "01-80-c2-00-00-03" or . = "01-80-C2-00-00-03"' {
          error-message "Invalid protocol address";
        }
      default "01-80-c2-00-00-02";
      description
        "A 6-octet read-write MAC Address value specifying the DA
        to be used when sending Link Aggregation Control and
```

```
Marker PDUs. Valid addresses are the Nearest Customer
Bridge, Slow_Protocols_Multicast, and Nearest non-TPMR
Bridge group addresses. The default value
shall be the Slow_Protocols_Multicast address.";
reference
  "IEEE 802.1AX-2020, Clause 7.3.2.2.1, Clause 6.2.10.2";
}
leaf collector-max-delay {
  type uint16;
  description
    "Defines the maximum delay, in tens of microseconds,
    that may be imposed by the Frame Collector between
    receiving a frame from an Aggregator Parser, and
    either delivering the frame to its MAC Client or
    discarding the frame (see 5.2.3.1.1).
    Used to determine the maximum delay for the Marker
    Protocol to wait for a Marker Response.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.1.1.32, Clause 6.2.3.1.1,
    Clause B.3";
}
leaf partner-admin-system-id {
  type ieee:mac-address;
  default "00-00-00-00-00-00";
  description
    "The administrative value of the Partners System ID.
    The assigned value is used, along with the value of
    port-partner-admin-system-id, partner-admin-key,
    partner-admin-port, and partner-admin-port-priority,
    to achieve administratively configured Link
    Aggregation Groups with a partner that does not run
    LACP.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.1.1.10
    IEEE 802.1AX-2020, Clause 7.3.2.1.8";
}
leaf partner-admin-system-priority {
  type uint16;
  default 0;
  description
    "The administrative value of priority associated
    with the Partners System ID. The assigned
    value is used, along with the value of
    port-partner-admin-system-id, partner-admin-key,
    partner-admin-port, and partner-admin-port-priority,
    to achieve administratively configured Link
    Aggregation Groups with a partner that does not run
    LACP.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.1.1.11
    IEEE 802.1AX-2020, Clause 7.3.2.1.6";
}
leaf-list aggregators {
  type if:interface-ref;
  config false;
  description
    "A list of the if:name of aggregators assigned to this
    key group.";
  reference
    "link-aggregation:key-groups";
}
leaf-list aggregation-ports {
  type if:interface-ref;
  config false;
```

```
description
  "A list of the if:name of aggregation ports assigned to
  this key group.";
reference
  "link-aggregation:key-groups";
}

container cscd {
  if-feature "ax:cscd";
  description
    "Contains CSCD parameters that need to be consistent for all aggrega-
tion ports
    and/or aggregators in the key group.";
  leaf agg-port-algorithm {
    type identityref {
      base ax:distribution-algorithm;
    }
    default ax:unspecified;
    description
      "Identifies the algorithm used by the Aggregator to assign
      frames to a Port Conversation ID.
      Default is the value for an unspecified distribution algorithm.";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.1.1.33";
  }

  list admin-conv-service-map {
    key cid;
    description
      "Data structure to map service identifiers to conversation identi-
fiers.
      Each entry consists of a Conversation ID (CID) and a list of zero
or more
      Service Identifiers (SIDs) that map to it.";
    leaf cid {
      type uint16 {
        range 0..4095;
      }
      description
        "Port Conversation Identifier";
    }
    leaf-list service-ids {
      type uint32;
      description
        "List of SIDs that are associated with the CID.";
    }
    reference
      "IEEE 802.1AX-2020, Clause 7.3.1.1.36, Clause 6.6.3.1";
  }

  leaf admin-conv-service-digest {
    type binary;
    config false;
    description
      "The MD5 Digest of the admin-conv-service-map. The value is NULL
      when the distribution algorithm specified by agg-port-algorithm
      does not use the admin-conv-service-map.";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.1.1.39, Clause 6.6.3.1";
  }

  list admin-conv-link-map {
    key cid;
    description
      "Data structure to map Conversation Identifiers to a Link Number
      Each entry consists of a Conversation ID (CID) and a list of link
```

```
numbers that
    can potentially be selected for that CID. The value selected will
be the first link number
    in the list that is currently operational.";
leaf cid {
    type uint16 {
        range 0..4095;
    }
    description
        "Port Conversation Identifier";
}
leaf-list link-numbers {
    type uint16;
    description
        "Ordered list of Link Numbers to carry packets with this CID.";
}
reference
    "IEEE 802.1AX-2020, Clause 7.3.1.1.34, Clause 6.6.3.1";
}
leaf admin-conv-link-digest {
    type binary;
    config false;
    description
        "The MD5 Digest of the admin-conv-link-map. The value is NULL
        when the distribution algorithm specified by agg-port-algorithm
        does not use the admin-conv-link-map.";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.38, Clause 6.6.3.1";
}

leaf admin-discard-wrong-conv {
    if-feature "ax:dwc";
    type enumeration {
        enum force-true {
            value 1;
            description
                "Indicates that an Aggregator should discard a frame that
                is collected from an Aggregation Port that is different from
                the Aggregation Port to which the Aggregator would distribute
                a frame with the same Port Conversation ID.";
        }
        enum force-false {
            value 2;
            description
                "Indicates that an Aggregator should not discard a frame that
                is collected from an Aggregation Port that is different from
                the Aggregation Port to which the Aggregator would distribute
                a frame with the same Port Conversation ID.
                This is the behavior of the Aggregator when DWC is not sup-
ported";
        }
        enum auto {
            value 3;
            description
                "Indicates that the Aggregator should behave as if
                the value was force-true only when the actor and partner agree
on
                the algorithms (other than unspecified) and mapping tables used
was
                to map frames to Aggregation Ports, and behave as if the value
                force-false otherwise.";
        }
    }
    default force-false;
}
```

```
        description
            "Indicates whether an Aggregator should discard a frame that
            is collected from an Aggregation Port that is different from
            the Aggregation Port to which the Aggregator would distribute
            a frame with the same Port Conversion ID.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.35, Clause 6.6";
    }
}

//
// Aggregator Nodes
//
augment "/if:interfaces/if:interface" {
    when
        "derived-from-or-self(if:type, 'ianaif:ieee8023adLag') or "+
        "if:type = 'ax:ieee8021axIrp'" {
        description
            "Applies to interfaces representing a LAG or
            DRNI Inter-Relay Port.";
    }
    description
        "Augment Interface with Aggregator parameters.";
    container aggregator {
        description
            "Contains the Aggregator configuration information which
            provides the management controls necessary to allow an
            instance of an Aggregator to be managed.";
        leaf agg-key-group {
            type key-group-ref;
            mandatory true;
            description
                "Specifies the entry in the link-aggregation key-groups
                list to which this aggregator is assigned.";
        }
        leaf agg-mac-address {
            type ieee:mac-address;
            config false;
            description
                "The MAC address assigned to the Aggregator.";
            reference
                "IEEE 802.1AX-2020, Clause 7.3.1.1.9";
        }
        container aggregator-lacp {
            config false;
            description
                "Contains aggregator LACP operational data.";
            leaf actor-oper-key {
                type uint16;
                description
                    "The current operational value of the Key for the
                    Aggregator. The administrative Key value may differ
                    from the operational Key value for the reasons
                    discussed in 5.6.2. The meaning of particular Key
                    values is of local significance.";
                reference
                    "IEEE 802.1AX-2020, Clause 7.3.1.1.8";
            }
        }
        leaf partner-system-id {
            type ieee:mac-address;
            description

```

```
        "Consisting of the unique identifier for the
        current protocol Partner of this Aggregator. A value
        of zero indicates that there is no known Partner.
        If the aggregation is manually configured, this
        System ID value will be a value assigned by the
        local System.";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.10";
}
leaf partner-system-priority {
    type uint16;
    description
        "Indicates the priority value associated with the
        Partners System ID. If the aggregation is manually
        configured, this System Priority value will be a
        value assigned by the local System.";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.11";
}
leaf partner-oper-key {
    type uint16;
    description
        "The current operational value of the Key for the
        Aggregators current protocol Partner. If the
        aggregation is manually configured, this Key value
        will be a value assigned by the local System.";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.12";
}
leaf aggregate-or-individual {
    type boolean;
    description
        "Indicates whether the Aggregator represents an
        Aggregate (TRUE) or an Individual link (FALSE).";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.1.1.6";
}
}
container aggregator-cscd {
    if-feature "ax:cscd";
    config false;
    description
        "Aggregator parameters obtained by the operation of LACP
        supporting CSCD.";
    leaf partner-port-algorithm {
        type identityref {
            base ax:distribution-algorithm;
        }
        description
            "Operational value of the distribution algorithm in
            use by the LACP Partner.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.40";
    }
    leaf partner-conv-service-digest {
        type binary;
        description
            "The MD5 Digest of the admin-conv-service-map in use
            by the LACP Partner.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.42, Clause 6.6.3.1";
    }
    leaf partner-conv-link-digest {
        type binary;
    }
}
```

```
        description
            "The MD5 Digest of the admin-conv-link-map in use
            by the LACP Partner.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.41, Clause 6.6.3.1";
    }
    leaf discard-wrong-conversation {
        type boolean;
        description
            "The operational value that determines whether an
            Aggregator should discard a frame that is collected
            from an Aggregation Port that is different from the
            Aggregation Port to which the Aggregator would
            distribute a frame with the same Port Conversation
            ID.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.37, Clause 6.6";
    }
    leaf-list active-lag-links {
        type uint16;
        config false;
        description
            "A list, possibly empty, of the operational
            link-number of each Aggregation Port active
            (i.e. Collecting) on this Aggregator.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.43";
    }
}

container statistics {
    config false;
    description
        "Contains the set of stats associated with the
        Aggregator.";
    leaf unknown-protocol-frames {
        type yang:counter64;
        description
            "A count of data frames discarded on reception by all
            ports that are (or have been) members of the
            aggregation, due to the detection of an unknown Slow
            Protocols PDU (7.3.3.1.5)";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.1.1.29";
    }
}

}

//-----
//  Aggregation Port Nodes
//-----
augment "/if:interfaces/if:interface" {
    description
        "Augment interface model with Aggregation port
        configuration nodes.";
    container aggregation-port {
        presence
            "When present, this interface supports Link Aggregation";
        description
            "Contains Aggregation Port configuration related nodes,
            which provides the basic management controls necessary
            to allow an instance of an Aggregation Port to be managed,
```

```
for the purposes of Link Aggregation." ;

leaf agg-key-group {
  type key-group-ref;
  mandatory true;
  description
    "Specifies the entry in the link-aggregation key-groups
    list to which this aggregation-port is assigned." ;
}
leaf actor-port-number {
  type uint16 {
    range 1..65535;
  }
  // %%% Clause 6 says rw ; Clause 7 says ro
  description
    "The port number assigned to the Aggregation Port.
    The port number is communicated in LACPDUs as the
    Actor_Port." ;
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.14, 6.4.6" ;
}
leaf actor-port-priority {
  type uint16;
  default 0;
  description
    "The priority value assigned to this Aggregation Port." ;
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.15, 6.4.6" ;
}
leaf actor-admin-state {
  type ax:lacp-state;
  default "lacp-activity aggregation" ;
  description
    "Corresponding to the administrative values of the
    first three bits (positions 0, 1, and 2) of Actor_State
    as transmitted by the Actor in LACPDUs. Provides
    administrative control over the values of the
    LACP_Activity, LACP_Timeout, and Aggregation state.
    Setting the LACP_Activity state to '0' ensures that the
    transmission of LACPDUs is controlled by the
    partner-oper-state.LACP_Activity.
    Setting the LACP_Timeout to '0' ensures that actor uses
    the Long_Timeout value, allowing the partner to transmit
    LACPDUs at the Slow_Periodic_Time.
    Setting the Aggregation state to '0' ensures that this
    port will not be aggregated with any other ports.
    The remaining five bits (corresponding to
    Synchronization, Collecting, Distributing, Expired,
    and Defaulted) are ignored." ;
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.20, 6.4.1, 6.4.2.2,
    6.4.6" ;
}

leaf partner-admin-key {
  type uint16;
  // %%% Want default equal to actor-port-number.
  // Else mandatory true?
  description
    "The current administrative value of the Key for the
    protocol Partner. The assigned value is used, along with
    the value of port-partner-admin-system-priority,
    partner-admin-system-id, partner-admin-port, and
    partner-admin-port-priority, in order to achieve
```



```
        manually configured aggregation."";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.10";
}
leaf partner-admin-port {
    type uint16;
    // %%% Want default equal to actor-port-number.
    // Else mandatory true?
    description
        "The current administrative value of the port number for
        the protocol Partner. The assigned value is used, along
        with the value of partner-admin-system-priority,
        partner-admin-system-id, port-partner-admin-key, and
        partner-admin-port-priority, in order to achieve
        manually configured aggregation."";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.16";
}
leaf partner-admin-port-priority {
    type uint16;
    default 0;
    description
        "The current administrative value of the port priority
        for the protocol Partner. The assigned value is used,
        along with the value of partner-admin-system-priority,
        partner-admin-system-id, partner-admin-key, and
        partner-admin-port, in order to achieve manually
        configured aggregation."";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.18";
}
leaf partner-admin-state {
    type ax:lacp-state;
    default "synchronization";
    // %%% What should this default be?
    description
        "Corresponding to the administrative values of the first
        four bits (positions 0, 1, 2, and 3) of Partner_State to
        be used when no LACPDUs are received from LACP partner.
        Provides administrative control over the partner's
        LACP_Activity, LACP_Timeout, Aggregation, and
        Synchronization state when the partner's information is
        unknown (i.e. no LACPDUs are received from the partner).
        Setting the LACP_Activity state to '0' ensures that the
        transmission of LACPDUs is controlled by the
        actor-admin-state.LACP_Activity.
        Setting the LACP_Timeout to '0' ensures that LACPDUs
        will be transmitted at the Slow_Periodic_Time.
        Setting the Aggregation state to '0' ensures that this
        port will not be aggregated with any other ports.
        Setting the Synchronization state to '0' prevents this
        port from becoming active.
        The remaining four bits (corresponding to Collecting,
        Distributing, Expired, and Defaulted) are ignored."";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.22, 6.4.1, 6.4.2.2,
        6.4.6";
}

leaf wtr-time {
    type uint16;
    default 1;
    description
        "The wait-to-restore (WTR) period, in seconds, that
```

```
needs to elapse between an Aggregation Port on a LAG
coming up (Port_Operational becoming TRUE) and being
permitted to become active (transmitting and
receiving frames) on the LAG.";
reference
  "IEEE 802.1AX-2020, Clause 7.3.2.1.30";
}
leaf wtr-revertive {
  type boolean;
  default true;
  description
    "Controls revertive or non-revertive mode of operation.
    When TRUE, the Aggregation Port can become active as
    soon as the wait-to-restore timer expires regardless of
    the state of other links in the LAG.
    When FALSE, the Aggregation Port cannot become active
    unless there are no other links that can become active
    in the LAG. The default value is TRUE.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.31";
}

container aggregation-port-lacp {
  config false;
  description
    "Contains Aggregation port LACP operational related
    nodes.";
  leaf actor-lacp-version {
    type uint16;
    description
      "The version number transmitted in LACPDUs on this
      Aggregation Port";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.2.1.33";
  }
  leaf actor-oper-key {
    type uint16;
    description
      "The current operational value of the Key for the
      Aggregation Port. The meaning of particular Key values
      is of local significance.";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.2.1.5";
  }
  leaf actor-oper-state {
    type ax:lacp-state;
    description
      "The operational value of the Actor_State as
      transmitted in LACPDUs.";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.2.1.21, 6.4.1, 6.4.2.2,
      6.4.6";
  }
  leaf partner-lacp-version {
    type uint16;
    description
      "The version number in the LACPDU most recently
      received on this Aggregation Port.";
    reference
      "IEEE 802.1AX-2020, Clause 7.3.2.1.34";
  }
  leaf partner-oper-system-priority {
    type uint16;
    description
```

```
    "Indicates the operational value of priority associated
    with the Partners System ID. The value of this
    attribute may contain the manually configured value
    carried in partner-admin-system-priority if there is
    no protocol Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.7";
}
leaf partner-oper-system-id {
  type ieee:mac-address;
  description
    "Represents the current value of the Aggregation
    Ports protocol Partners System ID. A value of zero
    indicates that there is no known protocol Partner. The
    value of this attribute may contain the manually
    configured value carried in partner-admin-system-id if
    there is no protocol Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.9";
}
leaf partner-oper-key {
  type uint16;
  description
    "The current operational value of the Key for the
    protocol Partner. The value of this attribute may
    contain the manually configured value carried in
    partner-admin-key if there is no protocol Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.11";
}
leaf partner-oper-port {
  type uint16;
  description
    "The operational port number assigned by the
    Aggregation Port's protocol Partner. The value of this
    attribute may contain the administratively configured
    value carried in partner-admin-port if there is no
    protocol Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.17";
}
leaf partner-oper-port-priority {
  type uint16;
  description
    "The operational priority value assigned by the
    Aggregation Port's protocol Partner. The value of this
    attribute may contain the administratively configured
    value carried in partner-admin-port-priority if there
    is no protocol Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.19";
}
leaf partner-oper-state {
  type ax:lacp-state;
  description
    "The operational value of the partner's LACP state
    derived from received LACPDUs or, when Defaulted is
    true, from the partner-admin-state.";
  reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.23, 6.4.1, 6.4.2.2,
    6.4.6";
}
leaf aggregate-or-individual {
  type boolean;
```

```
description
    "When true indicates the Aggregation Port can join a
    LAG consisting of multiple Aggregation Ports.
    When false, indicates that the Aggregation Port can
    only operate as an Solitary link because the
    Aggregation bit is false in either
    actor-oper-port-state or partner-oper-port-state.";
reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.24";
}
leaf wtr-waiting {
    type boolean;
    description
        "Indicates the Aggregation Port is inhibited from
        becoming active for an interval (determined by
        wtr-time) after becoming operational or while
        non-revertive operation is being enforced by the
        Selection Logic.";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.32";
}
}

container aggregation-port-cscd {
    if-feature "ax:cscd";
    description
        "Aggregation port parameters for support of CSCD.";
    leaf admin-link-number {
        type uint16;
        description
            "The Link_Number value for the Aggregation Port,
            configured by the System's administrator, which is
            unique among all Aggregation Ports in the same key
            group, and selected from the set of Link_Numbers in
            the admin-conv-link-map of that key group.

            More than one Aggregation Port in a LAG having the same
            Admin_Link_Number can, if Discard_Wrong_Conversation
            is TRUE, result in significant frame loss. If the
            Admin_Link_Number is not in the set of Link_Numbers
            in the Admin_Conv_Link_Map, then no frames will be
            distributed to this Aggregation Port. A value of 0
            will result in no frames are distributed to this
            Aggregation Port.

            From an implementation standpoint, this can be be
            automatically determined and set by the system.
            This optional leaf allows for administrative
            control over numbering.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.2.1.27";
    }
    leaf partner-link-number {
        type uint16;
        config false;
        description
            "The last received value of the Partner_Link_Number,
            or zero if the Aggregation Port is using default
            values for the Partner or the Partner LACP Version
            is 1.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.2.1.29";
    }
    leaf link-number {
```

```
type uint16;
config false;
description
    "The operational link number for this Aggregation Port.
    The value is either the same as the admin-link-number,
    or the corresponding value fo the LACP partner.";
reference
    "IEEE 802.1AX-2020, Clause 7.3.2.1.28";
}
leaf oper-conversation-passes {
    type binary;
    config false;
    description
        "A vector of Boolean values, with one value for each
        possible Port Conversation ID. A 1 indicates that a
        frame mapping to this Port Conversation ID is
        distributed to this Aggregation Port, and a 0
        indicates that it is not";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.25";
}
leaf oper-conversation-collected {
    type binary;
    config false;
    description
        "A vector of Boolean values, with one value for each
        possible Port Conversation ID. A 1 indicates that a
        frame mapping to this Port Conversation ID can be
        collected from this Aggregation Port, and a 0
        indicates that it cannot";
    reference
        "IEEE 802.1AX-2020, Clause 7.3.2.1.26";
}
}

container aggregation-port-statisticss {
    config false;
    description
        "Contains stats associated with the Aggregation Port.";
    leaf lacp-pdu-rx {
        type yang:counter64;
        description
            "The number of valid LACPDUs received on this
            Aggregation Port.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.3.1.2";
    }
    leaf marker-pdu-rx {
        type yang:counter64;
        description
            "The number of valid Marker PDUs received on this
            Aggregation Port.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.3.1.3";
    }
    leaf marker-response-pdu-rx {
        type yang:counter64;
        description
            "The number of valid Marker Response PDUs received on
            this Aggregation Port.";
        reference
            "IEEE 802.1AX-2020, Clause 7.3.3.1.4";
    }
    leaf unknown-rx {
```

10.6.2.3 Definition for the *ieee802-dot1ax-drni* YANG module

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```
    prefix "dotlax";
  }
  import ieee802-types {
    prefix "ieee";
  }
  import ietf-yang-types {
    prefix "yang";
  }
  import ietf-interfaces {
    prefix "if";
  }
}

organization
  "Institute of Electrical and Electronics Engineers";

contact
  "Web URL: http://www.ieee802.org/1/

  Working Group Chair:
  Glenn Parsons
  glenn.parsons@ericsson.com

  Editor:
  Stephen Haddock
  shaddock@stanfordalumni.org";

description
  "This YANG module describes the configuration model for a
  Distributed Resilient Network Interface (DRNI) as specified
  in 802.1AX.

  Copyright (C) IEEE (2024).

  This version of this YANG module is part of IEEE Std 802.1AX;
  see the standard itself for full legal notices.";

revision "2024-05-04" {
  description
    "Initial Version.";
  reference
    "IEEE 802.1AX-2020, Link Aggregation.";
}

augment "/if:interfaces/if:interface/dotlax:aggregator" {
  description
    "Augmentation parameters only for Aggregators with
    DRNI enabled.";
  container aggregator-drni {
    presence
      "When present, this Aggregator is enabled for DRNI";
    description
      "Aggregator parameters to support a Distributed
      Resilient Network Interface";
    leaf intra-relay-port {
      type if:interface-ref;
      mandatory true;
      description
        "Interface Name (if:name) of the Port supporting the
        Intra Relay Port (IRP) of this DRNI Gateway.";
      reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.23";
    }
    leaf drni-agg-key {
```

```
type uint16;
description
  "The Aggregator Key value to be used by the Aggregator
  supporting this DRNI Gateway (and the Aggregation Ports
  assigned to this DRNI Gateway) when paired with a
  neighbor DRNI System via the IRC. ";
reference
  "IEEE 802.1AX-2020, Clause 7.4.1.1.15";
}
leaf drni-agg-system {
  type ieee:mac-address;
  default "00-00-00-00-00-00";
  description
    "The Aggregator System value to be used by the
    Aggregator supporting this DRNI Gateway (and the
    Aggregation Ports assigned to this DRNI Gateway)
    when paired with a neighborDRNI System via the
    Intra-Relay Connection (IRC).";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.13";
}
leaf drni-agg-system-priority {
  type uint16;
  default 0;
  description
    "The Aggregator System Priority value to be used by the
    Aggregator supporting this DRNI Gateway (and the
    Aggregation Ports assigned to this DRNI Gateway) when
    paired with a neighbor DRNI System via the IRC.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.14";
}
leaf drcp-protocol-da {
  type ieee:mac-address;
  must
    '. = "01-80-c2-00-00-00" or . = "01-80-C2-00-00-00" or
    . = "01-80-c2-00-00-0e" or . = "01-80-C2-00-00-0E" or
    . = "01-80-c2-00-00-03" or . = "01-80-C2-00-00-03"' {
      error-message "Invalid protocol address";
    }
  default "01-80-c2-00-00-03";
  description
    "A 6-octet read-write MAC Address value specifying the
    Destination Address for Distributed Relay Control PDUs
    transmitted on the Intra-Relay Port. Valid addresses are
    the Nearest Customer Bridge, Nearest Bridge, and
    Nearest non-TPMR Bridge group addresses. The default
    value shall be the Nearest Non-TPMR Bridge group
    address.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.12, Clause 9.6.1.1";
}
leaf home-admin-irp-state {
  type ax:irp-state;
  // default      %%% add default value
  description
    "A string of 8 bits, corresponding to the values of
    IRP_State. These values allow administrative control
    over the Short_Timeout and IRC_Data flags.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.24, 9.6.2.3,
    Figure 9-13";
}
leaf home-oper-irp-state {
```



```
type ax:irp-state;
config false;
description
  "A string of 8 bits, corresponding to the current
  operational value of IRP_State as transmitted in
  DRCPDUs.";
reference
  "IEEE 802.1AX-2020, Clause 7.4.1.1.25, 9.6.2.3,
  Figure 9-13";
}
leaf home-cscd-gateway-control {
  type boolean;
  default true;
  description
    "When TRUE, allows the DRNI Gateway Port selection to
    be based on the CSCD parameters that control the
    Aggregator Port selection.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.16";
}
leaf home-dr-client-gateway-control {
  type boolean;
  default true;
  description
    "When TRUE, allows the Distributed Relay Client to
    determine whether to forward frames through the DRNI
    Gateway Port.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.17";
}
leaf home-gateway-algorithm {
  type identityref {
    base ax:distribution-algorithm;
  }
  default ax:unspecified;
  description
    "Identifies the algorithm used by the DRNI Gateway to
    assign frames to a Gateway Conversation ID. 8.2 provides
    the IEEE 802.1 OUI (00-80-C2) Gateway Algorithm
    encodings. Default is the value for an unspecified
    distribution algorithm.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.6";
}
list home-admin-conv-service-map {
  key cid;
  description
    "Data structure to map service identifiers to
    conversation identifiers.Each entry consists of a
    Conversation ID (CID) and a list of zero or more Service
    Identifiers (SIDs) that map to it. Frames with Service
    IDs not contained in the map are not mapped to any
    Gateway Conversation ID and are discarded.";
  leaf cid {
    type uint16 {
      range 0..4095;
    }
    description
      "Port Conversation Identifier";
  }
  leaf-list service-ids {
    type uint32;
    description
```

```
        "List of SIDs that are associated with the CID.";
    }
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.20, Clause 6.6.3.1";
}
leaf home-admin-conv-service-digest {
    type binary;
    config false;
    description
        "The MD5 Digest of the home-admin-conv-service-map. The
        value is NULL when the distribution algorithm specified
        by agg-port-algorithm does not use the
        home-admin-conv-service-map.";
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.21";
}
leaf gateway-enable-mask {
    type binary{
        length 512;
    }
    // %%%% should try to make more user friendly
    description
        "A vector of Boolean values, with one value for each
        possible Gateway Conversation ID. A 1 indicates that
        frames associated with that Gateway Conversation ID
        are allowed to pass through this Gateway Port, and a
        0 indicates that such frames are not allowed to pass.
        Default value is all bits set to 1.";
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.18, 9.5.3.5, 9.6.5";
}
leaf gateway-preference-mask {
    type binary {
        length 512;
    }
    // %%%% should try to make more user friendly
    description
        "A vector of Boolean values, with one value for each
        possible Gateway Conversation ID. A 1 indicates that
        this Gateway Port is the preferred Gateway when both
        DRNI Gateways have the Gateway Conversation ID enabled
        in the gateway-available-mask, and a 0 indicates that
        it is not preferred.
        Default value is all bits set to 1.";
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.19, 9.5.3.5, 9.6.5";
}
leaf gateway-available-mask {
    type binary;
    config false;
    description
        "A vector of Boolean values, with one value for each
        possible Gateway Conversation ID. A 1 indicates that
        this Gateway Port is eligible to be selected to pass
        that Gateway Conversation ID, and a 0 indicates that
        it is not eligible.";
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.22, 9.5.3.5, 9.6.5";
}

container neighbor {
    config false;
    description
```

```
    "Operational values for the DRNI neighbor obtained
    from DRCPDUs.";
  leaf oper-irp-state {
    type ax:irp-state;
    description
      "A string of 8 bits, corresponding to the current
      operational value of IRP_State as transmitted in
      DRCPDUs.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.25, 9.6.2.3,
      Figure 9-13";
  }
  leaf system {
    type ieee:mac-address;
    description
      "The MAC Address portion of the System Identifier of
      the Neighbor DRNI System (connected via the
      Intra-Relay Port). ";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.29";
  }
  leaf system-priority {
    type uint16;
    description
      "The priority portion of the System Identifier of the
      Neighbor DRNI System (connected via the Intra-Relay
      Port).";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.30";
  }
  leaf drni-key {
    type uint16;
    description
      "The DRNI key value received from the Neighbor DRNI
      System (connected via the IntraRelay Port).";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.31";
  }
  leaf aggregator-algorithm {
    type identityref {
      base ax:distribution-algorithm;
    }
    description
      "The Port algorithm used by the Neighbor Aggregator to
      assign frames to Port Conversation IDs.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.33";
  }
  leaf aggregator-conv-service-digest {
    type binary;
    config false;
    description
      "The MD5 Digest of the Neighbor Aggregator's
      Admin_Conv_Service_Map. Obtained from the Home
      Aggregator State TLV last received from the Neighbor
      DRNI System.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.34";
  }
  leaf aggregator-conv-link-digest {
    type binary;
    config false;
    description
      "The MD5 Digest of the Neighbor Aggregator's
```

```
Admin_Conv_Link_Map. Obtained from the Home Aggregator
State TLV (9.6.2.4) last received from the Neighbor
DRNI System.";
reference
  "IEEE 802.1AX-2020, Clause 7.4.1.1.35";
}
leaf partner-system-priority {
  type uint16;
  description
    "The priority portion of the System Identifier of the
    Neighbor Aggregator's Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.36";
}
leaf partner-system {
  type ieee:mac-address;
  description
    "The MAC Address portion of the System Identifier of
    the Neighbor Aggregator's Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.37";
}
leaf partner-aggregator-key {
  type uint16;
  description
    "The operational key value of the Neighbor
    Aggregator's Partner.";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.38";
}
leaf cscd-state {
  type bits {
    bit reserved-1 {
      position 0;
      description
        "Bit 1 is reserved for future use. It is set to 0
        and ignored on receipt.";
    }
    bit reserved-2 {
      position 1;
      description
        "Bit 2 is reserved for future use. It is set to 0
        and ignored on receipt.";
    }
    bit reserved-3 {
      position 2;
      description
        "Bit 3 is reserved for future use. It is set to 0
        and ignored on receipt.";
    }
    bit cscd_gateway_control {
      position 3;
      description
        "CSCD_Gateway_Control is encoded in bit 4. When
        this flag is TRUE, the DRNI Gateway is configured
        to minimize forwarding data frames on the IRC by
        selecting the DRNI Gateway and Aggregator Ports
        for forwarding any given Conversation ID to be in
        the same DRNI System.";
    }
    bit discard_wrong_conversation {
      position 4;
      description
        "Discard_Wrong_Conversation is encoded in bit 5.
```

```
        The Aggregator's Discard_Wrong_Conversation
        value.";
    }
    bit differ_conv_link_digests {
        position 5;
        description
            "Differ_Conv_Link_Digests is encoded in bit 6.
            This flag is TRUE when the Aggregator's
            Actor_Conv_Link_Digest matches the Aggregator's
            Partner_Conv_Link_Digest.";
    }
    bit differ_conv_service_digests {
        position 6;
        description
            "Differ_Conv_Service_Digests is encoded in bit 7.
            This flag is TRUE when the Aggregator's
            Actor_Conv_Service_Digest matches the Aggregator's
            Partner_Conv_Service_Digest.";
    }
    bit differ_port_algorithms {
        position 7;
        description
            "Differ_Port_Algorithms is encoded in bit 8. The
            Aggregator's differPortAlgorithms flag is TRUE
            when the Aggregator's Actor_Port_Algorithm matches
            the Aggregator's Partner_Port_Algorithm.";
    }
}
description
    "8 bits, corresponding to the Aggregator_CSCD_State
    in the Neighbor_Aggregator_State variable. The first
    three bits (the least significant bits of CSCD_State)
    are reserved; the fourth bit corresponds to the
    Neighbor's value for Home_Admin_CSCD_Gateway_Control;
    the fifth bit corresponds to the Neighbor Aggregator's
    operational value for Discard_Wrong_Conversation; and
    the sixth, seventh, and eighth bits correspond to the
    Neighbor Aggregator's operational value for
    differConvLinkDigests, differConvServiceDigests, and
    differPortAlgorithms, respectively, (the most
    significant bits of CSCD_State).";
reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.39";
}
leaf-list active-links {
    type uint16;
    description
        "A list of the operational Link_Numbers of Aggregation
        Ports that are currently active (i.e., collecting) on
        the Neighbor's Aggregator. An empty list indicates that
        there are no Aggregation Ports active. Each integer
        value in the list carries an aAggPortOperLinkNumber
        attribute value.";
    reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.40 ";
}
leaf gateway-algorithm {
    type identityref {
        base ax:distribution-algorithm;
    }
    description
        "The gateway algorithm used by the Neighbor DRNI
        Gateway to assign frames to Gateway Conversation IDs.";
    reference
```

```
        "IEEE 802.1AX-2020, Clause 7.4.1.1.41";
    }
    leaf gateway-conv-service-digest {
        type binary;
        description
            "The MD5 Digest of the Neighbor DRNI Gateway's
            the Home_Admin_Gateway_Conv_Service_Map. Obtained
            from Gateway_Conv_Service_Digest in the
            Neighbor_Gateway_State TLV last received from the
            Neighbor DRNI System.";
        reference
            "IEEE 802.1AX-2020, Clause 7.4.1.1.42";
    }
    leaf gateway-available-mask {
        type binary;
        description
            "A vector of Boolean values, with one value for each
            possible Gateway Conversation ID. A 1 indicates that
            the Neighbor DRNI Gateway Port is eligible to be
            selected to pass that Gateway Conversation ID, and
            a 0 indicates that it is not eligible.";
        reference
            "IEEE 802.1AX-2020, Clause 7.4.1.1.43";
    }
    leaf gateway-preference-mask {
        type binary;
        description
            "A vector of Boolean values, with one value for each
            possible Gateway Conversation ID. A 1 indicates that
            the Neighbor DRNI Gateway Port is the preferred
            Gateway when both DRNI Gateways have the Gateway
            Conversation ID enabled in the gateway-available-mask,
            and a 0 indicates that it is not preferred.";
        reference
            "IEEE 802.1AX-2020, Clause 7.4.1.1.44";
    }
}

container gateway-relay {
    config false;
    description
        "The set of masks, indexed by CID that determine the
        forwarding of frames by the DRNI Gateway Relay.";
    leaf home-aggregator-mask {
        type binary;
        description
            "A vector of Boolean values, with one value for each
            possible Port Conversation ID. A 1 indicates that the
            Port Conversation ID is allowed to be distributed
            through this DRNI Gateway's Aggregator, and a 0
            indicates that it cannot";
        reference
            "IEEE 802.1AX-2020, Clause 7.4.1.1.7, 9.5.2.2";
    }
    leaf home-gateway-mask {
        type binary;
        description
            "A vector of Boolean values, with one value for each
            possible Port Conversation ID. A 1 indicates that the
            Port Conversation ID is allowed to pass through this
            DRNI Gateway Port, and a 0 indicates that it cannot";
        reference
            "IEEE 802.1AX-2020, Clause 7.4.1.1.8, 9.5.2.2";
    }
}
```

```

leaf neighbor-aggregator-mask {
  type binary;
  description
    "A vector of Boolean values, with one value for each
    possible Port Conversation ID. A 1 indicates that the
    Port Conversation ID is allowed to be distributed
    through the IRP to the Neighbor Aggregator, and a 0
    indicates that it is not";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.27, 9.5.2.2";
}
leaf neighbor-gateway-mask {
  type binary;
  description
    "A vector of Boolean values, with one value for each
    possible Port Conversation ID. A 1 indicates that the
    Port Conversation ID is allowed to be passed to the
    Neighbor DRNI Gateway Port via the IRP, and a 0
    indicates that it is not";
  reference
    "IEEE 802.1AX-2020, Clause 7.4.1.1.28, 9.5.2.2";
}
/*
}

container irp-statistics {
  config false;
  description
    "Contains the set of counters associated with the
    Intra-Relay Port (IRP).";
  leaf drcpdus-rx {
    type yang:counter64;
    description
      "The number of valid DRCPDUs received on this
      Intra-Relay Port.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.45";
  }
  leaf illegal-rx {
    type yang:counter64;
    description
      "The number of frames received on this Intra-Relay
      Port that carry the DRCP EtherType value,
      but contain a badly formed PDU.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.46, 9.6.1.4";
  }
  leaf drcpdus-tx {
    type yang:counter64;
    description
      "The number of valid DRCPDUs transmitted on this
      Intra-Relay Port.";
    reference
      "IEEE 802.1AX-2020, Clause 7.4.1.1.47";
  }
}
/**/
}

augment "/if:interfaces/if:interface/if:statistics" {
  when
    "../dotlax:aggregator/drni:aggregator-drni" {
  //
    "/if:interfaces/if:interface[if:name=current()/../if:name]/
dotlax:aggregator/drni:aggregator-drni" {

```

```
    description
      "Applies to aggregators with DRNI present.";
    }
  description
    "Augment interface statistics with DRNI statistics.";
  container drni-stats {
    description
      "Contains DRNI specific statistics.";
    leaf drcpdus-rx {
      type yang:counter64;
      description
        "The number of valid DRCPDUs received on this
        Intra-Relay Port.";
      reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.45";
    }
    leaf illegal-rx {
      type yang:counter64;
      description
        "The number of frames received on this Intra-Relay
        Port that carry the DRCP EtherType value,
        but contain a badly formed PDU.";
      reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.46, 9.6.1.4";
    }
    leaf drcpdus-tx {
      type yang:counter64;
      description
        "The number of valid DRCPDUs transmitted on this
        Intra-Relay Port.";
      reference
        "IEEE 802.1AX-2020, Clause 7.4.1.1.47";
    }
  }
}
```


Annex A

(normative)

Protocol implementation conformance statement (PICS) proforma⁵

Insert the following rows at the end of the table in A.2.1

A.2.1 Major capabilities/options

Item	Feature	Status	References	Support
yang	Does the implementation support management operations using YANG modules?	O	10.6	Yes [] No []
yang modules	Is the ieee802-dot1ax-types module supported?	yang:M	10.6.2.1	Yes [] No []
	Is the ieee802-dot1ax module supported?	yang:M	10.6.2.2	Yes [] No []
	Is the ieee802-dot1ax-drni module supported?	yang:M	10.6.2.3	Yes [] No []

⁵ Copyright release for PICS proformas: Users of this standard may freely reproduce the PICS proforma in this subclause so that it can be used for its intended purpose and may further publish the completed PICS.

Annex G

(informative)

Bibliography

Insert the following two bibliography entries after [B8] in Annex G:

[B9] IETF RFC 7803, Changing the Registration Policy for the NETCONF Capability URNs Registry, February 2016.

[B10] IETF RFC 8040, RESTCONF Protocol, January 2017.