

Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—Specific requirements—

Amendment to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications—

Aggregation of Multiple Link Segments

Sponsor
**LAN MAN Standards Committee
of the
IEEE Computer Society**

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Abstract: An optional Link Aggregation sublayer for use with CSMA/CD MACs is defined. Link Aggregation allows one or more links to be aggregated together to form a Link Aggregation Group, such that a MAC Client can treat the Link Aggregation Group as if it were a single link. To this end, it specifies the establishment of DTE to DTE logical links, consisting of N parallel instances of full duplex point-to-point links operating at the same data rate.

Keywords: Aggregated Link, Aggregator, Link Aggregation Group, Physical Layer

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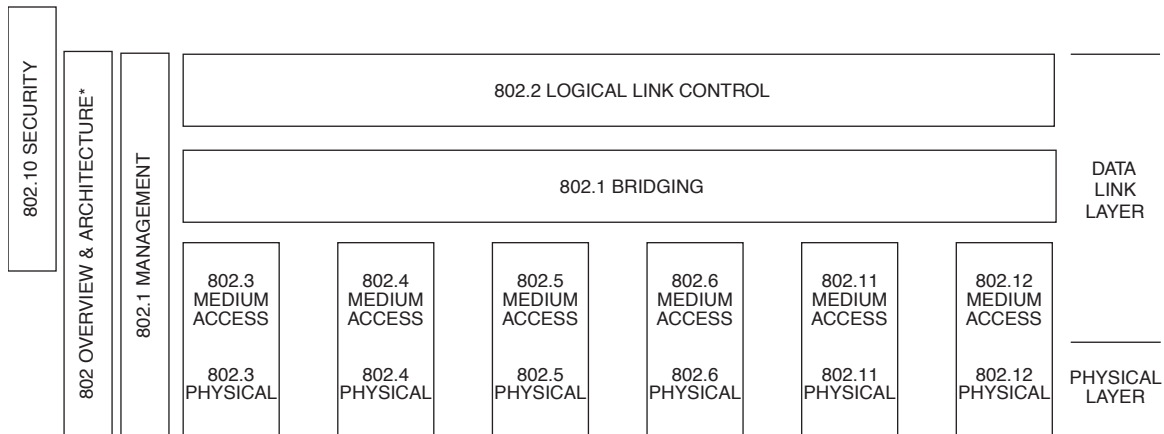
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Introduction to IEEE Std 802.3ad-2000

This standard is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1: 1994). The access standards define seven types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The standards defining the technologies noted above are as follows:

- IEEE Std 802 *Overview and Architecture.* This standard provides an overview to the family of IEEE 802 Standards.
- ANSI/IEEE Std 802.1B and 802.1k [ISO/IEC 15802-2] *LAN/MAN Management.* Defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ANSI/IEEE Std 802.1D *Media Access Control (MAC) Bridges.* Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- ANSI/IEEE Std 802.1E [ISO/IEC 15802-4] *System Load Protocol.* Specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.
- ANSI/IEEE Std 802.1F *Common Definitions and Procedures for IEEE 802 Management Information.*
- ANSI/IEEE Std 802.1G [ISO/IEC 15802-5] *Remote Media Access Control (MAC) Bridging.* Specifies extensions for the interconnection, using non-LAN communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.
- IEEE Std 802.1H [ISO/IEC TR 11802-5] *Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks.*
- ANSI/IEEE Std 802.2 [ISO/IEC 8802-2] *Logical Link Control.*
- ANSI/IEEE Std 802.3 *CSMA/CD Access Method and Physical Layer Specifications.*

- ANSI/IEEE Std 802.4 [ISO/IEC 8802-4] *Token Passing Bus Access Method and Physical Layer Specifications.*
- ANSI/IEEE Std 802.5 [ISO/IEC 8802-5] *Token Ring Access Method and Physical Layer Specifications.*
- ANSI/IEEE Std 802.6 [ISO/IEC 8802-6] *Distributed Queue Dual Bus Access Method and Physical Layer Specifications.*
- ANSI/IEEE Std 802.10 *Interoperable LAN/MAN Security.*
- ANSI/IEEE Std 802.11 [ISO/IEC DIS 8802-11] *Wireless LAN Medium Access Control (MAC) and Physical Layer Specifications.*
- ANSI/IEEE Std 802.12 [ISO/IEC 8802-12] *Demand Priority Access Method, Physical Layer and Repeater Specifications.*

In addition to the family of standards, the following is a recommended practice for a common Physical Layer technology:

- IEEE Std 802.7 *IEEE Recommended Practice for Broadband Local Area Networks.*

Conformance test methodology

An additional standard, 1802.3 provides conformance test information for 10BASE-T.

IEEE Std 802.3ad-2000

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated to this standard within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Details on the contents of this standard are provided on the following pages.

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and IEEE Std 802.3ab-1999

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Information technology—

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Changes to IEEE Std 802.3, 1998 Edition as amended by IEEE Std 802.3ac-1998 and IEEE Std 802.3ab-1999

[These changes are part of IEEE 802.3, 1998 Edition]

EDITORIAL NOTE—This amendment is based on the current edition of IEEE Std 802.3, 1998 Edition, and approved amendments 802.3ac and 802.3ab. The editing instructions define how to merge the material contained here into this base document set to form the new comprehensive standard as created by the addition of IEEE Std 802.3ad-2000.

Editing instructions are shown in ***bold italic***. Three editing instructions are used: change, delete, and insert. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed either by using strikethrough (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. Editorial notes will not be carried over into future editions. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

1.1 Overview

Insert the following sentence at the end of the first paragraph of 1.1:

In addition, it specifies a method for linearly incrementing a system's data rate by aggregating multiple physical links of the same speed into one logical link.

1.3 Normative references

Insert the following references in alphanumeric order into the reference list in 1.3.

IETF RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets*, Rose, M., and K. McCloghrie, May 1990.¹

IETF RFC 1157, *A Simple Network Management Protocol (SNMP)*, Case, J., Fedor, M., Schoffstall, M., and J. Davin, May 1990.

IETF RFC 1212, *Concise MIB Definitions*, Rose, M., and K. McCloghrie, March 1991.

IETF STD 17, RFC 1213, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II*, McCloghrie K., and M. Rose, Editors, March 1991.

IETF RFC 1215, *A Convention for Defining Traps for use with the SNMP*, M. Rose, March 1991.

IETF RFC 1901, *Introduction to Community-based SNMPv2*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 1902, *Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 1903, *Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMPv2)*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 1904, *Conformance Statements for Version 2 of the Simple Network Management Protocol (SNMPv2)*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 1905, *Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 1906, *Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)*, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, January 1996.

IETF RFC 2233, *The Interfaces Group MIB using SMIv2*, McCloghrie, K., and F. Kastenholz, November 1997.

IETF RFC 2271, *An Architecture for Describing SNMP Management Frameworks*, Harrington, D., Presuhn, R., and B. Wijnen, January 1998.

IETF RFC 2272, *Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)*, Case, J., Harrington D., Presuhn R., and B. Wijnen, January 1998.

IETF RFC 2273, *SNMPv3 Applications*, Levi, D., Meyer, P., and B. Stewart, January 1998.

IETF RFC 2274, *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*, Blumenthal, U., and B. Wijnen, January 1998.

IETF RFC 2275, *View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)*, Wijnen, B., Presuhn, R., and K. McCloghrie, January 1998.

ISO/IEC 15802-1: 1995, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Common specifications—Part 1: Medium Access Control (MAC) service definition.²

¹IETF RFCs are available from the Internet Engineering Task Force website at <http://www.ietf.org/rfc.html>.

²ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

1.4 Definitions

Insert the following definitions at the end of 1.4. These definitions will be renumbered in alphabetic order in a future edition and placed in the proper sequence with other definitions:

1.4.xxx Actor: The local entity in a Link Aggregation Control Protocol exchange. (See IEEE 802.3 Clause 43.)

1.4.xxx Aggregation Key: A parameter associated with each port and with each aggregator of an Aggregation System identifying those ports that can be aggregated together. Ports in an Aggregation System that share the same Aggregation Key value are potentially able to aggregate together. (See IEEE 802.3 Clause 43.)

1.4.xxx Aggregation Link: An instance of a MAC-Physical Layer-Medium Physical Layer-MAC entity between a pair of Aggregation Systems. (See IEEE 802.3 Clause 43.)

1.4.xxx Aggregation Port: An instance of a MAC-Physical Layer entity within an Aggregation System. (See IEEE 802.3 Clause 43.)

1.4.xxx Aggregation System: A uniquely identifiable entity comprising (among other things) an arbitrary grouping of one or more ports for the purpose of aggregation. An instance of an aggregated link always occurs between exactly two Aggregation Systems. A physical device may comprise a single Aggregation System or more than one Aggregation System. (See IEEE 802.3 Clause 43.)

1.4.xxx Conversation: A set of MAC frames transmitted from one end station to another, where all of the MAC frames form an ordered sequence, and where the communicating end stations require the ordering to be maintained among the set of MAC frames exchanged. (See IEEE 802.3 Clause 43.)

1.4.xxx end station: A system attached to a LAN that is an initial source or a final destination of MAC frames transmitted across that LAN. A Network layer router is, from the perspective of the LAN, an end station; a MAC Bridge, in its role of forwarding MAC frames from one LAN to another, is not an end station. (See IEEE 802.3 Clause 43.)

1.4.xxx Link Aggregation Group: A group of links that appear to a MAC Client as if they were a single link. All links in a Link Aggregation Group connect between the same pair of Aggregation Systems. One or more conversations may be associated with each link that is part of a Link Aggregation Group. (See IEEE 802.3 Clause 43.)

1.4.xxx Partner: The remote entity in a Link Aggregation Control Protocol exchange. (See IEEE 802.3 Clause 43.)

1.5 Abbreviations

Insert the following abbreviations alphabetically in the list in 1.5:

LACP	Link Aggregation Control Protocol
LACPDU	Link Aggregation Control Protocol Data Unit
LAG	Link Aggregation Group
LAG ID	Link Aggregation Group Identifier
Mux	Multiplexer
NTT	Need To Transmit
PDU	Protocol Data Unit
TLV	Type/Length/Value

2.3 Detailed service specification

Change the subclauses as indicated:

2.3.1 MA_DATA.request

2.3.1.2 Semantics of the service primitive

The semantics of the primitive are as follows:

```
MA_DATA.request      (
                      destination_address,
                      source_address,
                      m_sdu,
                      service_class
                      )
```

The destination_address parameter may specify either an individual or a group MAC entity address. It must contain sufficient information to create the DA field that is prepended to the frame by the local MAC sublayer entity and any physical information. The source_address parameter, if present, must specify an individual MAC address. If the source_address parameter is omitted, the local MAC sublayer entity will insert a value associated with that entity. The m_sdu parameter specifies the MAC service data unit to be transmitted by the MAC sublayer entity. There is sufficient information associated with m_sdu for the MAC sublayer entity to determine the length of the data unit. The service_class parameter indicates a quality of service requested by the MAC client (see 2.3.1.5).

EDITORIAL NOTE—New insert text is “source_address” in the three instances above.

30. 10 Mb/s, 100 Mb/s, and 1000 Mb/s Management

Change the title of this clause as follows:

30. 10 Mb/s, 100 Mb/s, and 1000 Mb/s, MAC Control, and Link Aggregation Management

Change the first paragraph of this clause as follows:

This clause provides the Layer Management specification for DTEs, repeaters, and MAUs based on the CSMA/CD access method. The clause is produced from the ISO framework additions to Clause 5, Layer Management; Clause 19, Repeater Management; and Clause 20, MAU Management. It incorporates additions to the objects, attributes, and behaviors to support 100 Mb/s and 1000 Mb/s CSMA/CD, full duplex operation, MAC Control, and Link Aggregation.

30.2 Managed objects

30.2.2.1 Text description of managed objects

Change the first paragraph of 30.2.2.1 as shown:

In case of conflict, the formal behavior definitions in 30.3, 30.4, 30.5, ~~and 30.6,~~ and 30.7 take precedence over the text descriptions in this subclause.

Insert the following text immediately before the description of oMACControlEntity:

oAggregator

If implemented, oAggregator is the top-most managed object class of the DTE portion of the containment tree shown in Figure 30-3. Note that this managed object class may be contained within another superior managed object class. Such containment is expected, but is outside the scope of this International Standard. The oAggregator managed object class provides the management controls necessary to allow an instance of an Aggregator to be managed.

oAggregationPort

If oAggregator is implemented, oAggregationPort is contained within oAggregator. An instance of this managed object class is present for each Aggregation Port that is part of the aggregation represented by the oAggregator instance. This managed object class provides the basic management controls necessary to allow an instance of an Aggregation Port to be managed, for the purposes of Link Aggregation.

oAggPortStats

If oAggregator is implemented, a single instance of oAggPortStats may be contained within oAggregationPort. This managed object class provides optional additional statistics related to LACP and Marker protocol activity on an instance of an Aggregation Port that is involved in Link Aggregation.

oAggPortDebugInformation If oAggregator is implemented, a single instance of oAggPortDebugInformation may be contained within oAggregationPort. This managed object class provides optional additional information that can assist with debugging and fault finding in Systems that support Link Aggregation.

Change the descriptions of oMACControlEntity and oMACEntity as shown:

oMACControlEntity If implemented, and if oAggregator is implemented, oMACControlEntity is contained within oAggregator. Otherwise, if implemented, oMACControlEntity becomes the top-most managed object class of the DTE portion of the containment tree shown in Figure 30-3. Note that this managed object class may be contained within another superior managed object class. Such containment is expected, but is outside the scope of this International Standard.

oMACEntity If oMACControlEntity is implemented, oMACEntity is contained within oMACControlEntity. Otherwise, if oAggregator is implemented, oMACEntity is contained within oAggregator. Otherwise, oMACEntity becomes the top-most managed object class of the DTE portion of the containment tree shown in Figure 30-3. Note that this managed object class may be contained within another superior managed object class. Such containment is expected, but is outside the scope of this International Standard.

30.2.3 Containment

Change the first paragraph of 30.2.3 as shown:

A containment relationship is a structuring relationship for managed objects in which the existence of a contained managed object is dependent on the existence of a containing managed object. The contained managed object is said to be the subordinate managed object, and the containing managed object is said to be the superior managed object. The containment relationship is used for naming managed objects. The local containment relationships among object classes are depicted in the entity relationship diagram, Figure 30-3. This figure also shows the names, naming attributes, and data attributes of the object classes as well as and whether a particular containment relationship is one-to-one or one-to-many. For further requirements on this topic, see IEEE Std 802.1F-1993.

Change Figure 30-3 as shown:

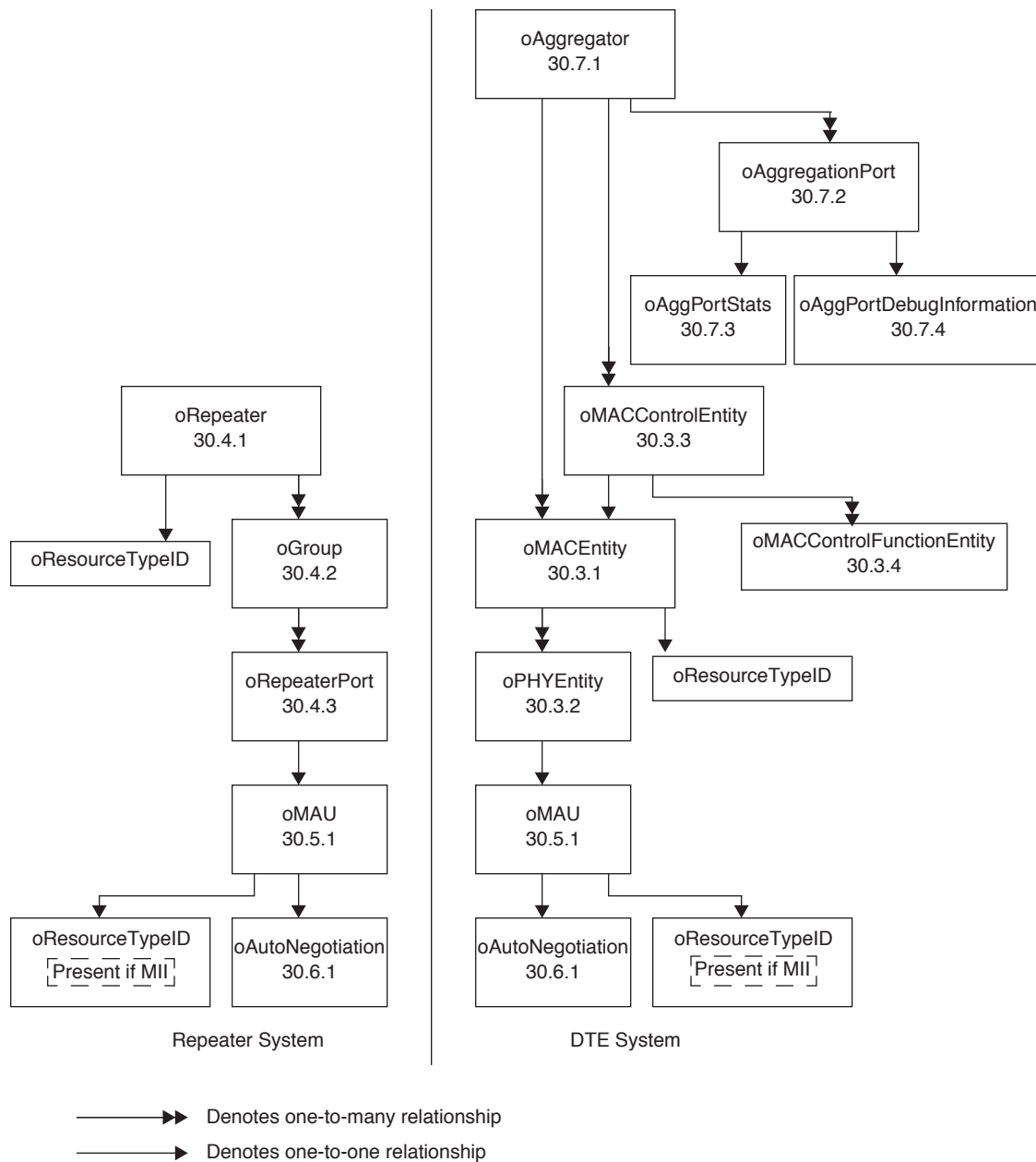


Figure 30-3—10/100/1000 Mb/s MAC, Control, and Link Aggregation entity relationship diagram

30.2.5 Capabilities

Change the first two paragraphs of 30.2.5 as shown:

This standard makes use of the concept of *packages*, as defined in ISO/IEC 10165-4: 1992, as a means of grouping behavior, attributes, actions, and notifications within a managed object class definition. Packages may be either mandatory or conditional, that is to say, present if a given condition is true. Within this standard *capabilities* are defined, each of which corresponds to a set of packages that are components of a number of managed object class definitions and that share the same condition for presence. Implementation of the appropriate basic and mandatory packages is the minimum requirement for claiming conformance to IEEE 802.3 10 Mb/s, 100 Mb/s, and 1000 Mb/s, MAC Control, and Link Aggregation Management. Implementation of an entire optional capability is required in order to claim conformance to that capability. The capabilities and packages for 10 Mb/s, 100 Mb/s, and 1000 Mb/s Management are specified in Table 30-1a, Table 30-1b, Table 30-1c, Table 30-1d, and Table 30-1e. The capabilities and packages for Link Aggregation Management are specified in Table 30-2.

DTE Management has two packages that are required for management at the minimum conformance configuration—the Basic Package and the Mandatory Package. Systems that implement the optional MAC Control sublayer shall also implement the Basic and Mandatory Packages for the MAC Control Entity managed object class to claim DTE minimum conformance. For systems that include multiple PHY entities per MAC entity and implement the Multiple PHY Package to manage the selection of the active PHY, the optional Recommended Package shall be implemented. Systems that implement the optional Link Aggregation sublayer shall also implement the Basic and Mandatory Packages for the Aggregator and Aggregation Port managed object class to claim minimum DTE conformance.

Insert new Table 30-2, as shown:

Table 30-2—Link Aggregation Capabilities

				DTE					
	Object Name	Object Type	Operations Supported	Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Aggregation Port Statistics (Optional)	Aggregation Port Debug Information (Optional)
oAggregator (30.7.1)									
	aAggID	ATTRIBUTE	GET	X					
	aAggDescription	ATTRIBUTE	GET		X				
	aAggName	ATTRIBUTE	GET-SET		X				
	aAggActorSystemID	ATTRIBUTE	GET-SET		X				

Table 30-2—Link Aggregation Capabilities (continued)

Object Name	Object Type	Operations Supported	DTE					
			Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Aggregation Port Statistics (Optional)	Aggregation Port Debug Information (Optional)
aAggActorSystemPriority	ATTRIBUTE	GET-SET		X				
aAggAggregateOrIndividual	ATTRIBUTE	GET		X				
aAggActorAdminKey	ATTRIBUTE	GET-SET		X				
aAggActorOperKey	ATTRIBUTE	GET		X				
aAggMACAddress	ATTRIBUTE	GET		X				
aAggPartnerSystemID	ATTRIBUTE	GET		X				
aAggPartnerSystemPriority	ATTRIBUTE	GET		X				
aAggPartnerOperKey	ATTRIBUTE	GET		X				
aAggAdminState	ATTRIBUTE	GET-SET		X				
aAggOperState	ATTRIBUTE	GET		X				
aAggTimeOfLastOperChange	ATTRIBUTE	GET		X				
aAggDataRate	ATTRIBUTE	GET		X				
aAggOctetsTxOK	ATTRIBUTE	GET			X			
aAggOctetsRxOK	ATTRIBUTE	GET			X			
aAggFramesTxOK	ATTRIBUTE	GET		X				
aAggFramesRxOK	ATTRIBUTE	GET		X				
aAggMulticastFramesTxOK	ATTRIBUTE	GET				X		
aAggMulticastFramesRxOK	ATTRIBUTE	GET				X		
aAggBroadcastFramesTxOK	ATTRIBUTE	GET				X		
aAggBroadcastFramesRxOK	ATTRIBUTE	GET				X		
aAggFramesDiscardedOnTx	ATTRIBUTE	GET			X			
aAggFramesDiscardedOnRx	ATTRIBUTE	GET			X			
aAggFramesWithTxErrors	ATTRIBUTE	GET			X			
aAggFramesWithRxErrors	ATTRIBUTE	GET			X			
aAggUnknownProtocolFrames	ATTRIBUTE	GET			X			
aAggLinkUpDownNotificationEnable	ATTRIBUTE	GET-SET		X				

Table 30-2—Link Aggregation Capabilities (continued)

Object Name	Object Type	Operations Supported	DTE					
			Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Aggregation Port Statistics (Optional)	Aggregation Port Debug Information (Optional)
nAggLinkUpNotification	NOTIFICATION			X				
nAggLinkDownNotification	NOTIFICATION			X				
aAggPortList	ATTRIBUTE	GET			X			
aAggCollectorMaxDelay	ATTRIBUTE	GET-SET		X				
oAggregationPort (30.7.2)								
aAggPortID	ATTRIBUTE	GET	X					
aAggPortActorSystemPriority	ATTRIBUTE	GET-SET		X				
aAggPortActorSystemID	ATTRIBUTE	GET		X				
aAggPortActorAdminKey	ATTRIBUTE	GET-SET		X				
aAggPortActorOperKey	ATTRIBUTE	GET		X				
aAggPortPartnerAdminSystemPriority	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperSystemPriority	ATTRIBUTE	GET		X				
aAggPortPartnerAdminSystemID	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperSystemID	ATTRIBUTE	GET		X				
aAggPortPartnerAdminKey	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperKey	ATTRIBUTE	GET		X				
aAggPortSelectedAggID	ATTRIBUTE	GET		X				
aAggPortAttachedAggID	ATTRIBUTE	GET		X				
aAggPortActorPort	ATTRIBUTE	GET		X				
aAggPortActorPortPriority	ATTRIBUTE	GET-SET		X				
aAggPortPartnerAdminPort	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperPort	ATTRIBUTE	GET		X				
aAggPortPartnerAdminPortPriority	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperPortPriority	ATTRIBUTE	GET		X				
aAggPortActorAdminState	ATTRIBUTE	GET-SET		X				
aAggPortActorOperState	ATTRIBUTE	GET		X				

Table 30-2—Link Aggregation Capabilities (continued)

Object Name	Object Type	Operations Supported	DTE					
			Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Aggregation Port Statistics (Optional)	Aggregation Port Debug Information (Optional)
aAggPortPartnerAdminState	ATTRIBUTE	GET-SET		X				
aAggPortPartnerOperState	ATTRIBUTE	GET		X				
aAggPortAggregateOrIndividual	ATTRIBUTE	GET		X				
oAggPortStats (30.7.3)								
aAggPortStatsID	ATTRIBUTE	GET					X	
aAggPortStatsLACPDUsRx	ATTRIBUTE	GET					X	
aAggPortStatsMarkerPDUsRx	ATTRIBUTE	GET					X	
aAggPortStatsMarkerResponsePDUsRx	ATTRIBUTE	GET					X	
aAggPortStatsUnknownRx	ATTRIBUTE	GET					X	
aAggPortStatsIllegalRx	ATTRIBUTE	GET					X	
aAggPortStatsLACPDUsTx	ATTRIBUTE	GET					X	
aAggPortStatsMarkerPDUsTx	ATTRIBUTE	GET					X	
aAggPortStatsMarkerResponsePDUsTx	ATTRIBUTE	GET					X	
oAggPortDebugInformation (30.7.4)								
aAggPortDebugInformationID	ATTRIBUTE	GET						X
aAggPortDebugRxState	ATTRIBUTE	GET						X
aAggPortDebugLastRxTime	ATTRIBUTE	GET						X
aAggPortDebugMuxState	ATTRIBUTE	GET						X
aAggPortDebugMuxReason	ATTRIBUTE	GET						X
aAggPortDebugActorChurnState	ATTRIBUTE	GET						X
aAggPortDebugPartnerChurnState	ATTRIBUTE	GET						X
aAggPortDebugActorChurnCount	ATTRIBUTE	GET						X
aAggPortDebugPartnerChurnCount	ATTRIBUTE	GET						X
aAggPortDebugActorSyncTransitionCount	ATTRIBUTE	GET						X
aAggPortDebugPartnerSyncTransitionCount	ATTRIBUTE	GET						X
aAggPortDebugActorChangeCount	ATTRIBUTE	GET						X

Table 30-2—Link Aggregation Capabilities (continued)

	Object Name	Object Type	Operations Supported	DTE					
				Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Aggregation Port Statistics (Optional)	Aggregation Port Debug Information (Optional)
	aAggPortDebugPartnerChangeCount	ATTRIBUTE	GET						X
Common Attributes Template									
	aCMCounter	ATTRIBUTE	GET		X	X	X	X	X

Insert new subclause 30.7 and its subordinate subclauses at the end of Clause 30, as shown:

30.7 Management for Link Aggregation

30.7.1 Aggregator managed object class

This subclause formally defines the behaviors for the oAggregator managed object class, attributes, and notifications.

Some of the attributes that are part of the definition of the oAggregator managed object class are derived by summing counter values from attributes of other objects; e.g., to generate a count of received frames for the Aggregator, the individual value for each Aggregation Port contributes to the sum. Where calculations of this form are used, the values that contribute to the Aggregator's attributes are *increments* in the values of the component attributes, not their absolute values. As any individual Aggregation Port is potentially only temporarily attached to its current Aggregator, the count values it contributes to the Aggregator's counters are the increments in its values that it has experienced during the period of time that it has been attached to that Aggregator.

The counter values defined for the Aggregator have been formulated as far as possible to make the Aggregator behave like an individual IEEE 802.3 MAC. The counts of frames received and transmitted are formulated to reflect the counts that would be expected by the MAC Client; they do not include frames transmitted and received as part of the operation of LACP or the Marker protocol, only frames that pass through the interface between the MAC Client and the Aggregator. However, as LACP and the Marker protocol are, as far as the individual MACs are concerned, part of their MAC Client, the RX/TX counters for the individual MACs will reflect both control and data traffic. As counts of errors at the port level cannot always be cleanly delineated between those that occurred as a result of aggregation activity and those that did not, no attempt has been made to separate these aspects of the port error counts. Therefore, there is not necessarily a

direct correspondence between the individual MAC counters and the corresponding derived counters at the Aggregator level.

It should also be noted that the counters defined for the Aggregator include values that can only apply to half duplex links. This is consistent with the approach taken in Link Aggregation that a link that can only operate as an individual link is nonetheless considered as being attached to an Aggregator. This simplifies the modelling of managed objects for links that can operate in either half or full duplex, and ensures a consistent presentation of the attributes regardless of the type of links attached to the Aggregator.

NOTE—The operation of autonegotiation may mean that a given link can operate in full duplex or half duplex, depending upon the capabilities of the device(s) connected to it. Keeping the management view the same regardless of a link's current mode of operation allows a consistent management approach to be taken across all types of links.

30.7.1.1 Aggregator attributes

30.7.1.1.1 aAggID

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The unique identifier allocated to this Aggregator by the local System. This attribute identifies an Aggregator instance among the subordinate managed objects of the containing object. This value is read-only.

NOTE—The aAggID is represented in the SNMP MIB as an ifIndex—see 30C.4.2.;

30.7.1.1.2 aAggDescription

ATTRIBUTE

APPROPRIATE SYNTAX:

A PrintableString, 255 characters max.

BEHAVIOUR DEFINED AS:

A human-readable text string containing information about the Aggregator. This string could include information about the distribution algorithm in use on this Aggregator; for example, “Aggregator 1, Dist Alg=Dest MAC address.” This string is read-only. The contents are vendor specific.;

30.7.1.1.3 aAggName

ATTRIBUTE

APPROPRIATE SYNTAX:

A PrintableString, 255 characters max.

BEHAVIOUR DEFINED AS:

A human-readable text string containing a locally significant name for the Aggregator. This string is read-write.;

30.7.1.1.4 aAggActorSystemID

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-write MAC address value used as a unique identifier for the System that contains this Aggregator.

NOTE—From the perspective of the Link Aggregation mechanisms described in Clause 43, only a single combination of Actor's System ID and System Priority are considered, and no distinction is made between the values of these parameters for an Aggregator and the port(s) that are associated with it (i.e., the protocol is described in terms of the operation of aggregation within a single System). However, the managed objects provided for the Aggregator and the port both allow management of these parameters. The result of this is to permit a single piece of equipment to be configured by management to contain more than one System from the point of view of the operation of Link Aggregation. This may be of particular use in the configuration of equipment that has limited aggregation capability (see 43.6).;

30.7.1.1.5 aAggActorSystemPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A 2-octet read-write value indicating the priority value associated with the Actor's System ID.;

30.7.1.1.6 aAggAggregateOrIndividual

ATTRIBUTE

APPROPRIATE SYNTAX:

BOOLEAN

BEHAVIOUR DEFINED AS:

A read-only Boolean value indicating whether the Aggregator represents an Aggregate ("TRUE") or an Individual link ("FALSE").;

30.7.1.1.7 aAggActorAdminKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

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 43.6.2. This is a 16-bit read-write value. The meaning of particular Key values is of local significance.;

30.7.1.1.8 aAggActorOperKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

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 43.6.2. This is a 16-bit read-only value. The meaning of particular Key values is of local significance.;

30.7.1.1.9 aAggMACAddress

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-only value carrying the individual MAC address assigned to the Aggregator.;

30.7.1.1.10 aAggPartnerSystemID

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-only MAC address value 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.;

30.7.1.1.11 aAggPartnerSystemPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A 2-octet read-only value that indicates the priority value associated with the Partner's System ID. If the aggregation is manually configured, this System Priority value will be a value assigned by the local System.;

30.7.1.1.12 aAggPartnerOperKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current operational value of the Key for the Aggregator's current protocol Partner. This is a 16-bit read-only value. If the aggregation is manually configured, this Key value will be a value assigned by the local System.;

30.7.1.1.13 aAggAdminState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

up
down

BEHAVIOUR DEFINED AS:

This read-write value defines the administrative state of the Aggregator. A value of "up" indicates that the operational state of the Aggregator (aAggOperState) is permitted to be either up or down. A value of "down" forces the operational state of the Aggregator to be down. Changes to the administrative state affect the operational state of the Aggregator only, not the operational state of the Aggregation Ports that are attached to the Aggregator. A GET operation returns the current administrative state. A SET operation changes the administrative state to a new value.;

30.7.1.1.14 aAggOperState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

up
down

BEHAVIOUR DEFINED AS:

This read-only value defines the operational state of the Aggregator. The operational state is “up” if one or more of the Aggregation Ports that are attached to the Aggregator are collecting, or both collecting and distributing, and if the value of aAggAdminState for the Aggregator is also “up.” If none of the Aggregation Ports that are attached to the Aggregator are collecting and/or distributing, or if there are no Aggregation Ports attached to this Aggregator, then the operational state is “down.” An operational state of “up” indicates that the Aggregator is available for use by the MAC Client; a value of “down” indicates that the Aggregator is not available for use by the MAC Client.;

30.7.1.1.15 aAggTimeOfLastOperChange

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The value of aTimeSinceSystemReset (Annex F.2.1) at the time the interface entered its current operational state. If the current state was entered prior to the last re-initialization of the local network management subsystem, then this object contains a value of zero. This value is read-only.;

30.7.1.1.16 aAggDataRate

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current data rate, in bits per second, of the aggregate link. The value is calculated as N times the data rate of a single link in the aggregation, where N is the number of active links. This attribute is read-only.;

30.7.1.1.17 aAggOctetsTxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 1 230 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data and padding octets transmitted by this Aggregator on all Aggregation Ports that are (or have been) members of the aggregation. The count does not include octets transmitted by the Aggregator in frames that carry LACPDUs or Marker PDUs (30.7.3.1.7,

30.7.3.1.8, 30.7.3.1.9). However, it includes frames discarded by the Distribution function of the Aggregator (30.7.1.1.25). This value is read-only.;

30.7.1.1.18 aAggOctetsRxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 1 230 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data and padding octets received by this Aggregator, from the Aggregation Ports that are (or have been) members of the aggregation. The count does not include octets received in frames that carry LACP or Marker PDUs (30.7.3.1.2, 30.7.3.1.3, 30.7.3.1.4), or frames discarded by the Collection function of the Aggregator (30.7.1.1.26). This value is read-only.;

30.7.1.1.19 aAggFramesTxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data frames transmitted by this Aggregator on all Aggregation Ports that are (or have been) members of the aggregation. The count does not include frames transmitted by the Aggregator that carry LACP or Marker PDUs (30.7.3.1.7, 30.7.3.1.8, 30.7.3.1.9). However, it includes frames discarded by the Distribution function of the Aggregator (30.7.1.1.25). This value is read-only.;

30.7.1.1.20 aAggFramesRxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data frames received by this Aggregator, from the Aggregation Ports that are (or have been) members of the aggregation. The count does not include frames that carry LACP or Marker PDUs (30.7.3.1.2, 30.7.3.1.3, 30.7.3.1.4), or frames discarded by the Collection function of the Aggregator (30.7.1.1.26). This value is read-only.;

30.7.1.1.21 aAggMulticastFramesTxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data frames transmitted by this Aggregator on all Aggregation Ports that are (or have been) members of the aggregation, to a group destination address other than the broadcast address. The count does not include frames transmitted by the Aggregator that carry LACP or Marker PDUs (30.7.3.1.7, 30.7.3.1.8, 30.7.3.1.9). However, it includes frames discarded by the Distribution function of the Aggregator (30.7.1.1.25). This value is read-only.;

30.7.1.1.22 aAggMulticastFramesRxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the data frames received by this Aggregator, from the Aggregation Ports that are (or have been) members of the aggregation, that were addressed to an active group address other than the broadcast address. The count does not include frames that carry LACP or Marker PDUs (30.7.3.1.2, 30.7.3.1.3, 30.7.3.1.4), or frames discarded by the Collection function of the Aggregator (30.7.1.1.26). This value is read-only.;

30.7.1.1.23 aAggBroadcastFramesTxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the broadcast data frames transmitted by this Aggregator on all Aggregation Ports that are (or have been) members of the aggregation. The count does not include frames transmitted by the Aggregator that carry LACP or Marker PDUs (30.7.3.1.7, 30.7.3.1.8, 30.7.3.1.9). However, it includes frames discarded by the Distribution function of the Aggregator (30.7.1.1.25). This value is read-only.;

30.7.1.1.24 aAggBroadcastFramesRxOK

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of the broadcast data frames received by this Aggregator, from the Aggregation Ports that are (or have been) members of the aggregation. The count does not include frames that carry LACP or Marker PDUs (30.7.3.1.2, 30.7.3.1.3, 30.7.3.1.4), illegal or unknown protocol frames (30.7.3.1.5, 30.7.3.1.6), or frames discarded by the Collection function of the Aggregator (30.7.1.1.26). This value is read-only.;

30.7.1.1.25 aAggFramesDiscardedOnTx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of data frames requested to be transmitted by this Aggregator that were discarded by the Distribution function of the Aggregator when conversations are re-allocated to different ports, due to the requirement to ensure that the conversations are flushed on the old ports in order to maintain proper frame ordering (43A.3), or discarded as a result of excessive collisions by ports that are (or have been) members of the aggregation. This value is read-only.;

30.7.1.1.26 aAggFramesDiscardedOnRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of data frames, received on all ports that are (or have been) members of the aggregation, that were discarded by the Collection function of the Aggregator as they were received on ports whose Collection function was disabled. This value is read-only.;

30.7.1.1.27 aAggFramesWithTxErrors

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of data frames requested to be transmitted by this Aggregator that experienced transmission errors on ports that are (or have been) members of the aggregation. This count does not include frames discarded due to excess collisions. This value is read-only.;

30.7.1.1.28 aAggFramesWithRxErrors

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

A count of data frames discarded on reception by all ports that are (or have been) members of the aggregation, or that were discarded by the Collection function of the Aggregator, or that were discarded by the Aggregator due to the detection of an illegal Slow Protocols PDU (30.7.3.1.6). This value is read-only.;

30.7.1.1.29 aAggUnknownProtocolFrames

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 16 000 counts per second for a single 10 Mb/s aggregation.

BEHAVIOUR DEFINED AS:

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 (30.7.3.1.5). This value is read-only.;

30.7.1.1.30 aAggLinkUpDownNotificationEnable

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

enabled
disabled

BEHAVIOUR DEFINED AS:

When set to “enabled,” Link Up and Link Down notifications are enabled for this Aggregator. When set to “disabled,” Link Up and Link Down notifications are disabled for this Aggregator. This value is read-write.;

30.7.1.1.31 aAggPortList

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE OF INTEGERS that match the syntax of aAggPortID.

BEHAVIOUR DEFINED AS:

The value of this read-only attribute contains the list of Aggregation Ports that are currently attached to the Aggregator. An empty list indicates that there are no Aggregation Ports attached. Each integer value in the list carries an aAggPortID attribute value (30.7.2.1.1).;

30.7.1.1.32 aAggCollectorMaxDelay

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The value of this 16-bit read-write attribute 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 43.2.3.1.1).;

30.7.1.2 Aggregator Notifications

30.7.1.2.1 nAggLinkUpNotification

NOTIFICATION

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

When aAggLinkUpDownNotificationEnable is set to “enabled,” a Link Up notification is generated when the Operational State of the aggregator changes from “down” to “up.” When aAggLinkUpDownNotificationEnable is set to “disabled,” no Link Up notifications are generated. The notification carries the identifier of the Aggregator whose state has changed.;

30.7.1.2.2 nAggLinkDownNotification

NOTIFICATION

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

When `aAggLinkUpDownNotificationEnable` is set to “enabled,” a Link Down notification is generated when the Operational State of the aggregator changes from “up” to “down.” When `aAggLinkUpDownNotificationEnable` is set to “disabled,” no Link Down notifications are generated. The notification carries the identifier of the Aggregator whose state has changed.;

30.7.2 Aggregation Port managed object class

This subclause formally defines the behaviors for the `oAggregationPort` managed object class attributes.

30.7.2.1 Aggregation Port Attributes**30.7.2.1.1 aAggPortID**

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The unique identifier allocated to this Aggregation Port by the local System. This attribute identifies an Aggregation Port instance among the subordinate managed objects of the containing object. This value is read-only.

NOTE—The `aAggPortID` is represented in the SNMP MIB as an `ifIndex`—see 30C.4.4.;

30.7.2.1.2 aAggPortActorSystemPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A 2-octet read-write value used to define the priority value associated with the Actor’s System ID.;

30.7.2.1.3 aAggPortActorSystemID

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-only MAC address value that defines the value of the System ID for the System that contains this Aggregation Port.;

30.7.2.1.4 aAggPortActorAdminKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current administrative value of the Key for the Aggregation Port. This is a 16-bit read-write value. The meaning of particular Key values is of local significance.;

30.7.2.1.5 aAggPortActorOperKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current operational value of the Key for the Aggregation Port. This is a 16-bit read-only value. The meaning of particular Key values is of local significance.;

30.7.2.1.6 aAggPortPartnerAdminSystemPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A 2-octet read-write value used to define the administrative value of priority associated with the Partner's System ID. The assigned value is used, along with the value of aAggPortPartnerAdminSystemID, aAggPortPartnerAdminKey, aAggPortPartnerAdminPort, and aAggPortPartnerAdminPortPriority, in order to achieve manually configured aggregation.;

30.7.2.1.7 aAggPortPartnerOperSystemPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A 2-octet read-only value indicating the operational value of priority associated with the Partner's System ID. The value of this attribute may contain the manually configured value carried in aAggPortPartnerAdminSystemPriority if there is no protocol Partner.;

30.7.2.1.8 aAggPortPartnerAdminSystemID

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-write MACAddress value representing the administrative value of the Aggregation Port's protocol Partner's System ID. The assigned value is used, along with the value of aAggPortPartnerAdminSystemPriority, aAggPortPartnerAdminKey, aAggPortPartnerAdminPort, and aAggPortPartnerAdminPortPriority, in order to achieve manually configured aggregation.;

30.7.2.1.9 aAggPortPartnerOperSystemID

ATTRIBUTE

APPROPRIATE SYNTAX:

MACAddress

BEHAVIOUR DEFINED AS:

A 6-octet read-only MACAddress value representing the current value of the Aggregation Port's protocol Partner's 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 aAggPortPartnerAdminSystemID if there is no protocol Partner.;

30.7.2.1.10 aAggPortPartnerAdminKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current administrative value of the Key for the protocol Partner. This is a 16-bit read-write value. The assigned value is used, along with the value of aAggPortPartnerAdminSystemPriority, aAggPortPartnerAdminSystemID, aAggPortPartnerAdminPort, and aAggPortPartnerAdminPortPriority, in order to achieve manually configured aggregation.;

30.7.2.1.11 aAggPortPartnerOperKey

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current operational value of the Key for the protocol Partner. The value of this attribute may contain the manually configured value carried in aAggPortPartnerAdminKey if there is no protocol Partner. This is a 16-bit read-only value.;

30.7.2.1.12 aAggPortSelectedAggID

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The identifier value of the Aggregator that this Aggregation Port has currently selected. Zero indicates that the Aggregation Port has not selected an Aggregator, either because it is in the process of detaching from an Aggregator or because there is no suitable Aggregator available for it to select. This value is read-only.;

30.7.2.1.13 aAggPortAttachedAggID

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The identifier value of the Aggregator that this Aggregation Port is currently attached to. Zero indicates that the Aggregation Port is not currently attached to an Aggregator. This value is read-only.;

30.7.2.1.14 aAggPortActorPort

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The port number locally assigned to the Aggregation Port. The port number is communicated in LACPDUs as the Actor_Port. This value is read-only.;

30.7.2.1.15 aAggPortActorPortPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The priority value assigned to this Aggregation Port. This 16-bit value is read-write.;

30.7.2.1.16 aAggPortPartnerAdminPort

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current administrative value of the port number for the protocol Partner. This is a 16-bit read-write value. The assigned value is used, along with the value of aAggPortPartnerAdminSystemPriority, aAggPortPartnerAdminSystemID, aAggPortPartnerAdminKey, and aAggPortPartnerAdminPortPriority, in order to achieve manually configured aggregation.;

30.7.2.1.17 aAggPortPartnerOperPort

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The operational port number assigned to this Aggregation Port by the Aggregation Port's protocol Partner. The value of this attribute may contain the manually configured value carried in aAggPortPartnerAdminPort if there is no protocol Partner. This 16-bit value is read-only.;

30.7.2.1.18 aAggPortPartnerAdminPortPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The current administrative value of the port priority for the protocol Partner. This is a 16-bit read-write value. The assigned value is used, along with the value of aAggPortPartnerAdminSystemPriority, aAggPortPartnerAdminSystemID, aAggPortPartnerAdminKey, and aAggPortPartnerAdminPort, in order to achieve manually configured aggregation.;

30.7.2.1.19 aAggPortPartnerOperPortPriority

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The priority value assigned to this Aggregation Port by the Partner. The value of this attribute may contain the manually configured value carried in aAggPortPartnerAdminPortPriority if there is no protocol Partner. This 16-bit value is read-only.;

30.7.2.1.20 aAggPortActorAdminState

ATTRIBUTE

APPROPRIATE SYNTAX:

BIT STRING [SIZE (1..8)]

BEHAVIOUR DEFINED AS:

A string of 8 bits, corresponding to the administrative values of Actor_State (43.4.2) as transmitted by the Actor in LACPDU's. The first bit corresponds to bit 0 of Actor_State (LACP_Activity), the second bit corresponds to bit 1 (LACP_Timeout), the third bit corresponds to bit 2 (Aggregation), the fourth bit corresponds to bit 3 (Synchronization), the fifth bit corresponds to bit 4 (Collecting), the sixth bit corresponds to bit 5 (Distributing), the seventh bit corresponds to bit 6 (Defaulted), and the eighth bit corresponds to bit 7 (Expired). These values allow administrative control over the values of LACP_Activity, LACP_Timeout, and Aggregation. This attribute value is read-write.;

30.7.2.1.21 aAggPortActorOperState

ATTRIBUTE

APPROPRIATE SYNTAX:

BIT STRING [SIZE (1..8)]

BEHAVIOUR DEFINED AS:

A string of 8 bits, corresponding to the current operational values of Actor_State (43.4.2) as transmitted by the Actor in LACPDU's. The bit allocations are as defined in 30.7.2.1.20. This attribute value is read-only.;

30.7.2.1.22 aAggPortPartnerAdminState

ATTRIBUTE

APPROPRIATE SYNTAX:

BIT STRING [SIZE (1..8)]

BEHAVIOUR DEFINED AS:

A string of 8 bits, corresponding to the current administrative value of Actor_State for the protocol Partner. The bit allocations are as defined in 30.7.2.1.20. This attribute value is read-write. The assigned value is used in order to achieve manually configured aggregation.;

30.7.2.1.23 aAggPortPartnerOperState**ATTRIBUTE****APPROPRIATE SYNTAX:**

BIT STRING [SIZE (1..8)]

BEHAVIOUR DEFINED AS:

A string of 8 bits, corresponding to the current values of Actor_State in the most recently received LACPDU transmitted by the protocol Partner. The bit allocations are as defined in 30.7.2.1.20. In the absence of an active protocol Partner, this value may reflect the manually configured value aAggPortPartnerAdminState. This attribute value is read-only.;

30.7.2.1.24 aAggPortAggregateOrIndividual**ATTRIBUTE****APPROPRIATE SYNTAX:**

BOOLEAN

BEHAVIOUR DEFINED AS:

A read-only Boolean value indicating whether the Aggregation Port is able to Aggregate ("TRUE") or is only able to operate as an Individual link ("FALSE").;

30.7.3 Aggregation Port Statistics managed object class

This subclause formally defines the behaviors for the oAggPortStats managed object class attributes.

30.7.3.1 Aggregation Port Statistics attributes**30.7.3.1.1 aAggPortStatsID****ATTRIBUTE****APPROPRIATE SYNTAX:**

INTEGER

BEHAVIOUR DEFINED AS:

This read-only attribute identifies an Aggregation Port Statistics object instance among the subordinate managed objects of the containing object. The value allocated to this attribute shall be the same as the containing oAggregationPort managed object.;

30.7.3.1.2 aAggPortStatsLACPDUsRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of valid LACPDUs received on this Aggregation Port. This value is read-only.;

30.7.3.1.3 aAggPortStatsMarkerPDUsRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of valid Marker PDUs received on this Aggregation Port. This value is read-only.;

30.7.3.1.4 aAggPortStatsMarkerResponsePDUsRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of valid Marker Response PDUs received on this Aggregation Port. This value is read-only.;

30.7.3.1.5 aAggPortStatsUnknownRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 50 counts per second.

BEHAVIOUR DEFINED AS:

The number of frames received that either
— Carry the Slow Protocols Ethernet Type value (43B.4), but contain an unknown PDU, or

— Are addressed to the Slow Protocols group MAC Address (43B.3), but do not carry the Slow Protocols Ethernet Type. This value is read-only.;

30.7.3.1.6 aAggPortStatsIllegalRx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 50 counts per second.

BEHAVIOUR DEFINED AS:

The number of frames received that carry the Slow Protocols Ethernet Type value (43B.4), but contain a badly formed PDU or an illegal value of Protocol Subtype (43B.4). This value is read-only.;

30.7.3.1.7 aAggPortStatsLACPDUsTx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of LACPDUs transmitted on this Aggregation Port. This value is read-only.;

30.7.3.1.8 aAggPortStatsMarkerPDUsTx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of Marker PDUs transmitted on this Aggregation Port. This value is read-only.;

30.7.3.1.9 aAggPortStatsMarkerResponsePDUsTx

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

The number of Marker Response PDUs transmitted on this Aggregation Port. This value is read-only.;

30.7.4 Aggregation Port Debug Information managed object class

This subclause formally defines the behaviors for the oAggPortDebugInformation managed object class attributes.

30.7.4.1 Aggregation Port Debug Information attributes

30.7.4.1.1 aAggPortDebugInformationID

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

This read-only attribute identifies an LACP Debug Information object instance among the subordinate managed objects of the containing object. The value allocated to this attribute shall be the same as the containing oAggregationPort managed object.;

30.7.4.1.2 aAggPortDebugRxState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

current
expired
defaulted
initialize
lACPDisabled
portDisabled

BEHAVIOUR DEFINED AS:

This attribute holds the value “current” if the Receive state machine for the Aggregation Port is in the CURRENT state, “expired” if the Receive state machine is in the EXPIRED state, “defaulted” if the Receive state machine is in the DEFAULTED state, “initialize” if the Receive state machine is in the INITIALIZE state, “lACPDisabled” if the Receive state machine is in the LACP_DISABLED state, or “portDisabled” if the Receive state machine is in the PORT_DISABLED state. This value is read-only.;

30.7.4.1.3 aAggPortDebugLastRxTime

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The value of aTimeSinceSystemReset (F.2.1) when the last LACPDU was received by this Aggregation Port. This value is read-only.;

30.7.4.1.4 aAggPortDebugMuxState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

detached
waiting
attached
collecting
distributing
collecting_distributing

BEHAVIOUR DEFINED AS:

This attribute holds the value “detached” if the Mux state machine (43.4.15) for the Aggregation Port is in the DETACHED state, “waiting” if the Mux state machine for the Aggregation Port is in the WAITING state, “attached” if the Mux state machine for the Aggregation Port is in the ATTACHED state, “collecting” if the Mux state machine for the Aggregation Port is in the COLLECTING state, “distributing” if the Mux state machine for the Aggregation Port is in the DISTRIBUTING state, and “collecting_distributing” if the Mux state machine for the Aggregation Port is in the COLLECTING_DISTRIBUTING state. This value is read-only.;

30.7.4.1.5 aAggPortDebugMuxReason

ATTRIBUTE

APPROPRIATE SYNTAX:

A PrintableString, 255 characters max.

BEHAVIOUR DEFINED AS:

A human-readable text string indicating the reason for the most recent change of Mux machine state. This value is read-only.;

30.7.4.1.6 aAggPortDebugActorChurnState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

noChurn
churn

BEHAVIOUR DEFINED AS:

The state of the Actor Churn Detection machine (43.4.17) for the Aggregation Port. A value of “noChurn” indicates that the state machine is in either the NO_ACTOR_CHURN or the ACTOR_CHURN_MONITOR state, and “churn” indicates that the state machine is in the ACTOR_CHURN state. This value is read-only.;

30.7.4.1.7 aAggPortDebugPartnerChurnState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

noChurn
churn

BEHAVIOUR DEFINED AS:

The state of the Partner Churn Detection machine (43.4.17) for the Aggregation Port. A value of “noChurn” indicates that the state machine is in either the NO_PARTNER_CHURN or the PARTNER_CHURN_MONITOR state, and “churn” indicates that the state machine is in the PARTNER_CHURN state. This value is read-only.;

30.7.4.1.8 aAggPortDebugActorChurnCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Actor Churn state machine has entered the ACTOR_CHURN state. This value is read-only.;

30.7.4.1.9 aAggPortDebugPartnerChurnCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Partner Churn state machine has entered the PARTNER_CHURN state. This value is read-only.;

30.7.4.1.10 aAggPortDebugActorSyncTransitionCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Actor's Mux state machine (43.4.15) has entered the IN_SYNC state. This value is read-only.;

30.7.4.1.11 aAggPortDebugPartnerSyncTransitionCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Partner's Mux state machine (43.4.15) has entered the IN_SYNC state. This value is read-only.;

30.7.4.1.12 aAggPortDebugActorChangeCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Actor's perception of the LAG ID for this Aggregation Port has changed. This value is read-only.;

30.7.4.1.13 aAggPortDebugPartnerChangeCount

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 5 counts per second.

BEHAVIOUR DEFINED AS:

Count of the number of times the Partner's perception of the LAG ID (43.3.6.1) for this Aggregation Port has changed. This value is read-only.;

Annex 30A

(normative)

GDMO specification for IEEE 802.3 managed object classes

30A.1.1 DTE MAC entity formal definition

Insert the following name binding definitions after the current definition nbMACName in 30.A.1.1:

nbMAC-MACControl

NAME BINDING

SUBORDINATE OBJECT CLASS	oMACEntity;
NAMED BY SUPERIOR OBJECT CLASS	oMACControlEntity;
WITH ATTRIBUTE	aMACID;
REGISTERED AS	{iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) nameBinding(6) nbMAC-MACControl(16)};

nbMAC-Aggregator

NAME BINDING

SUBORDINATE OBJECT CLASS	oMACEntity;
NAMED BY SUPERIOR OBJECT CLASS	oAggregator;
WITH ATTRIBUTE	aMACID;
REGISTERED AS	{iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) nameBinding(6) nbMAC-Aggregator(17)};

30A.3.1 DTE MAC control entity formal definition

Insert the following name binding definitions before the current definition nbMACControlMonitor in 30.A.3.1:

nbMACControl-System

NAME BINDING

SUBORDINATE OBJECT CLASS	oMACControlEntity;
NAMED BY SUPERIOR OBJECT CLASS	"ISO/IEC 10165-2":system;
WITH ATTRIBUTE	aMACControlID;
REGISTERED AS	{iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) nameBinding(6) nbMACControl-System(18)};

nbMACControl-Aggregator

NAME BINDING

SUBORDINATE OBJECT CLASS	oMACControlEntity;
NAMED BY SUPERIOR OBJECT CLASS	oAggregator;
WITH ATTRIBUTE	aMACControlID;
REGISTERED AS	{iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) nameBinding(6) nbMACControl-Aggregator(19)};

Insert the following new subclauses in sequence after 30.A.10:

30A.11 Aggregator managed object class

30A.11.1 Aggregator, formal definition

oAggregator	MANAGED OBJECT CLASS		
DERIVED FROM	“CCITT Rec. X.721 (1992) ISO/IEC 10165-2 : 1992”:top;		
CHARACTERIZED BY			
pAggregatorBasic	PACKAGE		
ATTRIBUTES	aAggID	GET;	
;			
;			
CONDITIONAL PACKAGES			
pAggregatorMandatory	PACKAGE		
ATTRIBUTES	aAggDescription	GET,	
	aAggName	GET-REPLACE,	
	aAggActorSystemID	GET-REPLACE,	
	aAggActorSystemPriority	GET-REPLACE,	
	aAggAggregateOrIndividual	GET,	
	aAggActorAdminKey	GET-REPLACE,	
	aAggActorOperKey	GET,	
	aAggMACAddress	GET,	
	aAggPartnerSystemID	GET,	
	aAggPartnerSystemPriority	GET,	
	aAggPartnerOperKey	GET,	
	aAggAdminState	GET-REPLACE,	
	aAggOperState	GET,	
	aAggTimeOfLastOperChange	GET,	
	aAggDataRate	GET,	
	aAggFramesTxOK	GET,	
	aAggFramesRxOK	GET,	
	aAggLinkUpDownNotificationEnable	GET-REPLACE,	
	aAggCollectorMaxDelay	GET-REPLACE;	
NOTIFICATIONS			
	nAggLinkUpNotification,		
	nAggLinkDownNotification;		
REGISTERED AS			
	{iso(1) member-body(2) us(840) 802dot3(10006) csmacd-		
	mgt(30) package(4) pAggregatorMandatory(19)};		
PRESENT IF	Conformance to Link Aggregation management is desired;		
pAggregatorRecommended	PACKAGE		
ATTRIBUTES	aAggOctetsTxOK	GET,	
	aAggOctetsRxOK	GET,	
	aAggFramesDiscardedOnTx	GET,	
	aAggFramesDiscardedOnRx	GET,	
	aAggFramesWithTxErrors	GET,	
	aAggFramesWithRxErrors	GET,	
	aAggUnknownProtocolFrames	GET,	
	aAggPortList	GET;	
REGISTERED AS			

```

        {iso(1) member-body(2) us(840) 802dot3(10006) csmacd-
mgt(30) package(4) pAggregatorRecommended(20)};
PRESENT IF The recommended package is implemented;
pAggregatorOptional PACKAGE
ATTRIBUTES aAggMulticastFramesTxOK GET,
aAggMulticastFramesRxOK GET,
aAggBroadcastFramesTxOK GET,
aAggBroadcastFramesRxOK GET;
REGISTERED AS
        {iso(1) member-body(2) us(840) 802dot3(10006) csmacd-
mgt(30) package(4) pAggregatorOptional(21)};
PRESENT IF The optional package is implemented;
;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgmt(30) managedOb-
jectClass(3) oAggregator(10)};

```

nbAggregatorName NAME BINDING

```

SUBORDINATE OBJECT CLASS oAggregator;
NAMED BY SUPERIOR OBJECT CLASS "ISO/IEC 10165-2":system;
WITH ATTRIBUTE aAggID
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgmt(30) nameBind-
ing(6) nbAggregatorName(20)};

```

30A.11.2 Aggregator attributes

aAggID ATTRIBUTE

```

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.AggID;
MATCHES FOR EQUALITY;
BEHAVIOUR bAggID;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgmt(30) attribute(7)
aAggID(101)};

```

bAggID BEHAVIOUR

```

DEFINED AS See "BEHAVIOUR DEFINED AS" in 30.7.1.1.1;

```

aAggDescription ATTRIBUTE

```

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.DescriptionString;
MATCHES FOR EQUALITY;
BEHAVIOUR bAggDescription;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgmt(30) attribute(7)
aAggDescription(102)};

```

bAggDescription BEHAVIOUR

```

DEFINED AS See "BEHAVIOUR DEFINED AS" in 30.7.1.1.2;

```

aAggName

ATTRIBUTE

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.DescriptionString;
MATCHES FOR EQUALITY;
BEHAVIOUR bAggName;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) attribute(7)
aAggName(103)};

bAggName

BEHAVIOUR

DEFINED AS See “BEHAVIOUR DEFINED AS” in 30.7.1.1.3;

aAggActorSystemID

ATTRIBUTE

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.MACAddress;
MATCHES FOR EQUALITY, ORDERING;
BEHAVIOUR bAggActorSystemID;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) attribute(7)
aAggActorSystemID(104)};

bAggActorSystemID

BEHAVIOUR

DEFINED AS See “BEHAVIOUR DEFINED AS” in 30.7.1.1.4;

aAggActorSystemPriority

ATTRIBUTE

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.PriorityValue;
MATCHES FOR EQUALITY, ORDERING;
BEHAVIOUR bAggActorSystemPriority;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) attribute(7)
aAggActorSystemPriority(105)};

bAggActorSystemPriority

BEHAVIOUR

DEFINED AS See “BEHAVIOUR DEFINED AS” in 30.7.1.1.5;

aAggAggregateOrIndividual

ATTRIBUTE

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.AggOrInd;
MATCHES FOR EQUALITY;
BEHAVIOUR bAggAggregateOrIndividual;
REGISTERED AS {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgt(30) attribute(7)
aAggAggregateOrIndividual(106)};

bAggAggregateOrIndividual

BEHAVIOUR

DEFINED AS See “BEHAVIOUR DEFINED AS” in 30.7.1.1.6;

aAggActorAdminKey

ATTRIBUTE

WITH ATTRIBUTE SYNTAX IEEE802Dot3-MgmtAttributeModule.KeyValue;
MATCHES FOR EQUALITY;
BEHAVIOUR bAggActorAdminKey;