

IEEE Std 802.3ah™-2004

(Amendment to IEEE Std 802.3™-2002

as amended by

IEEE Stds 802.3ae™-2002, 802.3af™-2002,

802.3aj™-2003 and 802.3ak™-2004)

802.3ah™

**IEEE Standard for Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements**

**Part 3: Carrier Sense Multiple Access with
Collision Detection (CSMA/CD) Access Method
and Physical Layer Specifications**

**Amendment: Media Access Control
Parameters, Physical Layers, and Management
Parameters for Subscriber Access Networks**

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee



3 Park Avenue, New York, NY 10016-5997, USA

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Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks

Sponsor

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

Approved 24 June 2004

IEEE-SA Standards Board

Abstract: This amendment to IEEE Std 802.3-2002 as amended by IEEE Std 802.3ae-2002, IEEE Std 802.3af-2003, IEEE Std 802.3aj-2003, and IEEE Std 802.3ak-2004 combines a minimal set of extensions to the IEEE 802.3 Media Access Control (MAC) and MAC Control sublayers with a family of Physical (PHY) Layers. These Physical Layers include optical fiber and voice grade copper cable Physical Medium Dependent sublayers (PMDs) for point-to-point connections in subscriber access networks. This amendment also introduces the concept of Ethernet Passive Optical Networks (EPONs), in which a point to multi-point (P2MP) network topology is implemented with passive optical splitters, along with optical fiber PMDs that support this topology. In addition, a mechanism for network Operations, Administration and Maintenance (OAM) is included to facilitate network operation and troubleshooting. To support these innovations, options for unidirectional transmission of frames are provided for 100BASE-X, 1000BASE-X, 10GBASE-R, 10GBASE-W, and 10GBASE-X.

Keywords: Ethernet in the First Mile, EFM, Ethernet Passive Optical Network, EPON, Ethernet over DSL, Multi-point MAC Control, MPMC, Operations, Administration, Maintenance, OAM, full duplex MAC, P2MP, P2P, 100BASE-LX10, 100BASE-BX10, 1000BASE-LX10, 1000BASE-BX10, 1000BASE-PX10, 1000BASE-PX20, 10PASS-TS, 2BASE-TL, last mile

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Introduction

(This introduction is not part of IEEE Std 802.3ah-2004, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements— CSMA/CD Access Method and Physical Layer Specifications Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks).

IEEE Std 802.3™ was first published in 1985. Since the initial publication, many projects have added functionality or provided maintenance updates to the specifications and text included in the standard. Each IEEE 802.3 project/amendment is identified with a suffix (e.g., IEEE 802.3ae). A historical listing of all projects that have added to or modified IEEE Std 802.3 follows as a part of this introductory material. The listing is in chronological order of project initiation and for each project describes: subject, clauses added (if any), approval dates, and committee officers.

The media access control (MAC) protocol specified in IEEE Std 802.3 is Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This MAC protocol was included in the experimental Ethernet developed at Xerox Palo Alto Research Center. While the experimental Ethernet had a 2.94 Mb/s data rate, IEEE Std 802.3-1985 specified operation at 10 Mb/s. Since 1985 new media options, new speeds of operation, and new protocol capabilities have been added to IEEE Std 802.3.

Some of the major additions to IEEE Std 802.3 are identified in the marketplace with their project number. This is most common for projects adding higher speeds of operation or new protocols. For example, IEEE Std 802.3u™ added 100 Mb/s operation (also called Fast Ethernet), IEEE Std 802.3x™ specified full duplex operation and a flow control protocol, IEEE Std 802.3z™ added 1000 Mb/s operation (also called Gigabit Ethernet) and IEEE Std 802.3ad™ specified link aggregation. These major additions are all now included in IEEE Std 802.3-2002 and are not available as separate documents.

Recent additions such as IEEE Std 802.3ae (also called 10 Gigabit Ethernet) and IEEE Std 802.3af (also called Power over Ethernet) are currently published as separate documents. These recent amendments are part of IEEE Std 802.3 and they are dependent on and reference information published in IEEE Std 802.3-2002.

At the date of IEEE Std 802.3ah publication, IEEE Std 802.3 is comprised of the following documents:

IEEE Std 802.3-2002

Section One—Includes Clause 1 through Clause 20 and Annexes A through H. Section One includes the specifications for 10 Mb/s operation and the MAC, frame formats and service interfaces used for all speeds of operation.

Section Two—Includes Clause 21 through Clause 32 and Annexes 22A through 32A. Section Two includes the specifications for 100 Mb/s operation and management attributes for multiple protocols and operational speeds.

Section Three—Includes Clause 34 through Clause 43 and Annexes 36A through 43C. Section Three includes the specifications for 1000 Mb/s operation.

IEEE Std 802.3ae-2002

Includes changes to IEEE Std 802.3-2002, and adds Clause 44 through Clause 53 and Annexes 44A through 50A. This amendment includes specifications for 10 Gb/s operation.

IEEE Std 802.3af-2003

Includes changes to IEEE Std 802.3-2002, and adds Clause 33 and Annexes 33A through 33E. This amendment includes specifications for the provision of power over 10BASE-T, 100BASE-TX, and 1000BASE-T cabling.

IEEE Std 802.3aj-2003

Includes changes to IEEE Std 802.3-2002 and IEEE Std 802.3ae-2002.

IEEE Std 802.3ak-2004

Includes changes to IEEE Std 802.3-2002, and IEEE Std 802.3ae-2002, and adds Clause 54. This amendment adds 10GBASE-CX4 specifications for 10 Gb/s operation over balanced shielded cabling.

IEEE Std 802.3ah-2004

Includes changes to IEEE Std 802.3-2002, IEEE Std 802.3ae-2002, and IEEE Std 802.3af-2003, and adds Clause 56 through Clause 67 and Annex 58A through Annex 67A. This amendment defines services and protocol elements that permit the exchange of IEEE Std 802.3 format frames between stations in a subscriber access network.

IEEE Std 802.3 will continue to evolve. Revisions are anticipated to the above standards within the next few years to integrate approved changes into IEEE Std 802.3, to clarify existing material, to correct possible errors, and to incorporate new related material.

Conformance test methodology

An additional standard, IEEE Std 1802.3™-2001, provides conformance test information for 10BASE-T.

IEEE Std 802.3ah-2004

IEEE Std 802.3ah-2004, Ethernet in the First Mile is an amendment to IEEE Std 802.3. The standard includes changes to IEEE Std 802.3, and these changes are marked in comparison to the last published standard. In some cases, text included in IEEE Std 802.3-2002 has been modified by IEEE Std 802.3ae-2002, IEEE Std 802.3af-2003, then IEEE Std 802.3aj-2003 and again by IEEE Std 802.3ah-2004.

This document defines services and protocol elements that permit the exchange IEEE Std 802.3 format frames between stations in a subscriber access network.

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List of special symbols

For the benefit of those who have received this document by electronic means, what follows is a list of special symbols and operators. If any of these symbols or operators fail to print out correctly, the editors hope that this table will at least help you to sort out the meaning of the resulting funny-shaped blobs and strokes appearing in the body of the document.

Special symbols and operators

Printed Character	Meaning	Frame V character code	Font
*	Boolean AND	ALT-042	Symbol
+	Boolean OR, arithmetic addition	ALT-043	Symbol
^	Boolean XOR	^	Times
!	Boolean NOT	ALT-033	Symbol
<	Less than	ALT-060	Symbol
≤	Less than or equal to	ALT-0163	Symbol
=	Equal to	ALT-061	Symbol
≠	Not equal to	ALT-0185	Symbol
≥	Greater than or equal to	ALT-0179	Symbol
>	Greater than	ALT-062	Symbol
←	Assignment operator	ALT-0220	Symbol
∈	Indicates membership	ALT-0206	Symbol
∉	Indicates nonmembership	ALT-0207	Symbol
±	Plus or minus (a tolerance)	ALT-0177	Symbol
°	Degrees (as in degrees Celsius)	ALT-0176	Symbol
Σ	Summation	ALT-0229	Symbol
—	Big dash (em dash)	Ctrl-q Shft-q	Times
–	Little dash (en dash)	Ctrl-q Shft-p	Times
†	Dagger	ALT-0134	Times
‡	Double dagger	ALT-0135	Times
α	Lower case alpha	a	Symbol
β	Lower case beta	b	Symbol
ε	Lower case epsilon	e	Symbol
γ	Lower case gamma	g	Symbol
√	Square root	ALT-0214	Times

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

Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks

[These changes are part of IEEE Std 802.3™-2002.]

EDITORIAL NOTE—This amendment is based on the current edition of IEEE Std 802.3-2002 as amended by IEEE Std 802.3ae™-2002, IEEE Std 802.3af™-2003, IEEE Std 802.3aj™-2003, and IEEE Std 802.3ak™-2004. 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 802.3ah™-2004.

Editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***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 ~~striketrough~~ (to remove old material) or underline (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. Introduction

1.2 Notation

Insert the following to the end of 1.2.5, Hexadecimal notation:

Numerical values designated with a 16 subscript indicate a hexadecimal interpretation of the corresponding number. For example: 0F₁₆ represents an 8-bit hexadecimal value of the decimal number 15.

1.3 Normative References

Change existing reference to read as follows:

~~ITU-T Recommendation G.652, 2000—Characteristics of a single-mode optical fibre cable.~~
ITU-T Recommendation G.652, 2003—Characteristics of a single-mode optical fibre and cable.

~~ANSI X3.230-1994 (FC-PH), Information Technology—Fibre Channel—Physical and Signaling Interface.~~
~~ANSI INCITS 230-1994 (R1999), Information Technology—Fibre Channel—Physical and Signaling Interface (FC-PH) (formerly ANSI X3.230-1994).~~

Insert the following references in alphabetic order into the reference list in 1.3:

ANSI/EIA-455-95A-2000, Absolute Optical Power Test for Optical Fibers and Cables.

ANSI/EIA/TIA-455-127-1991, FOTP-127 — Spectral Characterization of Multimode Laser Diodes.

ANSI T1.417-2001, Spectrum management for loop transmission systems.

ANSI T1.424-2004, Interface between networks and customer installations - Very-high Speed Digital Subscriber Lines (VDSL) Metallic Interface (Trial-Use Standard).

ETSI TS1 101 270-1 (1999), Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 1: Functional requirements.

ETSI TS 270-2 (2001), Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 2: Transceiver specification.

IEC 61280-2-2 (1998), Fiber optic communication sub-system basic test procedures – Part 2-2: Test procedures for digital systems – Optical eye pattern, waveform, and extinction ratio.

IEC 61754-1:1996, Fibre optic interfaces —Part 1: General and guidance.

ITU-T Recommendation G.991.2 (2001), Amendment 1.

ITU-T Recommendation G.991.2 (2001), Single-Pair High-Speed Digital Subscriber Line (SHDSL) transceivers.

ITU-T Recommendation G.993.1 (2003), Amendment 1.

ITU-T Recommendation G.993.1 (2001), Very high speed digital subscriber line foundation.

ITU-T Recommendation G.994.1 (2004), Handshake procedures for digital subscriber line (DSL) transceivers.

ITU-T Recommendation G.975 (2000), Optical fibre submarine cable systems Forward error correction for submarine systems.

1.4 Definitions

Change 1.4.10 to the following:

1.4.10 100BASE-FX: IEEE 802.3 Physical Layer specification for a 100 Mb/s CSMA/CD local area network over two optical fibers. (See IEEE 802.3 Clauses 24 and 26.) IEEE 802.3 Physical Layer specification for a 100 Mb/s CSMA/CD local area network over two multimode optical fibers. (See IEEE 802.3 Clauses 24 and 26.)

Insert the following definitions alphabetically into 1.4. Renumber the definitions as required. These definitions will be renumbered in alphabetic order in a future edition of this standard:

1.4.xxx 100BASE-BX10: IEEE 802.3 Physical Layer specification for a 100 Mb/s point to point link over one single mode fiber. The link includes two different specifications for 100BASE-BX10-D and 100BASE-BX10-U. (See IEEE 802.3 Clauses 58 and 66.)

1.4.xxx 100BASE-LX10: IEEE 802.3 Physical Layer specification for a 100 Mb/s point to point link over two single mode optical fibers. (See IEEE 802.3 Clauses 58 and 66.)

1.4.xxx 1000BASE-BX10: IEEE 802.3 Physical Layer specification for a 1000 Mb/s point to point link over one single mode optical fiber. (See IEEE 802.3 Clauses 59 and 66.)

1.4.xxx 1000BASE-LX10: IEEE 802.3 Physical Layer specification for a 1000 Mb/s point to point link over two single-mode or multimode optical fibers. (See IEEE 802.3 Clauses 59 and 66.)

1.4.xxx 1000BASE-PX10: IEEE 802.3 Physical Layer specification for a 1000 Mb/s point to multi-point link over one single mode optical fiber, with a reach of up to 10 km. (See IEEE 802.3 Clauses 60, 65, and 66.)

1.4.xxx 1000BASE-PX20: IEEE 802.3 Physical Layer specification for a 1000 Mb/s point to multi-point link over one single mode optical fiber, with a reach of up to 20 km. (See IEEE 802.3 Clauses 60, 65, and 66.)

1.4.xxx 10PASS-TS: IEEE 802.3 Physical Layer specification up to 100 Mb/s point to point link over single copper wire pair. (See IEEE 802.3 Clauses 61 and 62.)

1.4.xxx 2BASE-TL: IEEE 802.3 Physical Layer specification up to 5.696 Mb/s point to point link over single copper wire pair. (See IEEE 802.3 Clauses 61 and 63.)

1.4.xxx Aggregation group: A collection of PME's that may be aggregated according to a particular implementation of the PME aggregation function. (See IEEE 802.3 subclause 61.2.2.)

1.4.xxx Bandplan: The set of parameters that control the lowest and highest frequencies and power at which 10PASS-TS and 2BASE-TL may operate.

1.4.xxx Coupled Power Ratio (CPR): The ratio (in dB) of the total power coupled into a multimode fiber to the optical power that can be coupled into a single-mode fiber.

1.4.xxx Downstream: In an access network, where there is a clear indication in each deployment as to which end of a link is closer to a subscriber, transmission toward the subscriber end of the link.

1.4.xxx Grant: Within P2MP protocols, a permission to transmit at a specific time, for a specific duration. Grants are issued by the OLT (master) to ONUs (slaves) by means of GATE messages.

1.4.xxx Logical Link Identifier (LLID): A numeric identifier assigned to a P2MP association between an OLT and ONU established through the Point-to-Point Emulation sublayer. Each P2MP association is assigned a unique LLID. The P2MP association is bound to an ONU DTE, where a MAC would observe a private association.

1.4.xxx OAM Discovery: Process that detects the presence and configuration of the OAM sublayer in the remote DTE.

1.4.xxx Operations, Administration, and Maintenance (OAM): A group of network support functions that monitor and sustain segment operation, activities that are concerned with, but not limited to, failure detection, notification, location, and repairs that are intended to eliminate faults and keep a segment in an operational state and support activities required to provide the services of a subscriber access network to users/subscribers.

1.4.xxx Optical Line Terminal (OLT): The network-end DTE for an optical access network. The OLT is the master entity in a P2MP network with regard to the MPCP protocol.

1.4.xxx Optical Network Unit (ONU): The subscriber-end DTE to an optical access network. An ONU is a slave entity in a P2MP network with regard to the MPCP protocol.

1.4.xxx P2MP Discovery: Process by which the OLT finds a newly attached and active ONU in the P2MP network, and by which the OLT and ONU exchange registration information. The OLT sends a GATE flagged for discovery.

1.4.xxx P2MP Discovery window: A time period in a given wavelength band reserved by the OLT exclusively for the discovery process.

1.4.xxx P2MP Timestamp: The timestamp used to synchronize slaves (e.g., ONUs) with the master (OLT) and for the ranging process.

1.4.xxx Point to Multi-Point Network (P2MP): A passive optical network providing transport of Ethernet frames (See Clauses 64 and 65).

1.4.xxx Point-to-point emulation (P2PE): Emulation of private communication between two end-stations (e.g., ONU) in a P2MP. Emulation creates the equivalent of a star topology with the OLT in the nexus, and is required for compliance with IEEE 802.1D bridging.

1.4.xxx Ranging: A procedure by which the propagation delay between a master (e.g., OLT) and slave (e.g., ONU) is measured. The round trip delay computation is performed by the OLT, using the timestamp in MPCP messages from the ONU.

1.4.xxx Reflectance: Ratio of reflected to incident power. This is the inverse of return loss.

1.4.xxx Upstream: In an access network, transmission away from the subscriber end of the link. Applicable to networks where there is a clear indication in each deployment as to which end of a link is closer to a subscriber.

1.5 Abbreviations

Insert the following abbreviations in alphabetic order into the abbreviations list in 1.5:

10P	label to indicate “pertains to 10PASS-TS port-type”
10P/2B	label to indicate “pertains to 10PASS-TS and 2BASE-TL port-types”
2B	label to indicate “pertains to 2BASE-TL port-type”
2-PAM	two level pulse amplitude modulation
CO	central office
CPE	customer premises equipment
CPR	coupled power ratio
DA	destination address
DMT	discrete multi-tone
DSL	digital subscriber line
EFM	Ethernet in the first mile
FEC	forward error correction
FSW	frame synchronization word
IB	indicator bits
LLID	logical link identifier
LT	line termination
MDIO	management data input/output
MPCP	multi-point control protocol
NT	network termination
OAM	operations, administration, and maintenance
OAMPDU	operations, administration, and maintenance protocol data unit
ODN	optical distribution network
OH	overhead
OLT	optical line terminal
ONU	optical network unit
ORLT	optical return loss tolerance
P2MP	point to multi-point
P2P	point to point
P2PE	point-to-point emulation
PAF	PME aggregation function
PAM	pulse amplitude modulation
PME	physical medium entity
PMS-TC	physical media specific - transmission convergence
PSD	power spectral density
SA	source address
SHDSL	single-pair high-speed digital subscriber line
TC	transmission convergence
TCM	trellis coded modulation
TPS-TC	transport protocol specific transmission convergence sublayer
UPBO	upstream power back-off
VDSL	very high speed digital subscriber line
VTU	VDSL transceiver unit
VTU-O	VTU at the central office end
VTU-R	VTU at the remote end
xDSL	generic term covering the family of all DSL technologies

22. Reconciliation Sublayer (RS) and Media Independent Interface (MII)

22.2.4 Management functions

Change the third paragraph of this subclause (IEEE Std 802.3af-2003) as follows:

The MII basic register set consists of two registers referred to as the Control register (Register 0) and the Status register (Register 1). All PHYs that provide an MII shall incorporate the basic register set. All PHYs that provide a GMII shall incorporate an extended basic register set consisting of the Control register (Register 0), Status register (Register 1), and Extended Status register (Register 15). The status and control functions defined here are considered basic and fundamental to 100 Mb/s and 1000 Mb/s PHYs. Registers 2 through ~~12~~14 are part of the extended register set. The format of Registers 4 through 10 are defined for the specific Auto-Negotiation protocol used (Clause 28 or Clause 37). The format of these registers is selected by the bit settings of Registers 1 and 15.

Change Table 22-6 (IEEE Std 802.3af-2003) as follows:

Table 22–6—MII management register set

Register address	Register name	Basic/Extended	
		MII	GMII
0	Control	B	B
1	Status	B	B
2,3	PHY Identifier	E	E
4	Auto-Negotiation Advertisement	E	E
5	Auto-Negotiation Link Partner Base Page Ability	E	E
6	Auto-Negotiation Expansion	E	E
7	Auto-Negotiation Next Page Transmit	E	E
8	Auto-Negotiation Link Partner Received Next Page	E	E
9	MASTER-SLAVE Control Register	E	E
10	MASTER-SLAVE Status Register	E	E
11	PSE Control Register	E	E
12	PSE Status Register	E	E
~~13,14~~	~~Reserved~~	~~E~~	~~E~~
<u>13</u>	<u>MMD Access Control Register</u>	<u>E</u>	<u>E</u>
<u>14</u>	<u>MMD Access Address Data Register</u>	<u>E</u>	<u>E</u>
15	Extended Status	Reserved	B
16 through 31	Vendor Specific	E	E

22.2.4.1 Control register (Register 0)

Change Table 22-7 as follows:

Table 22–7—Control register bit definitions

Bit(s)	Name	Description	R/W ^a
0.15	Reset	1 = PHY reset 0 = normal operation	R/W SC
0.14	Loopback	1 = enable loopback mode 0 = disable loopback mode	R/W
0.13	Speed Selection (LSB)	0.6 0.13 1 1 = Reserved 1 0 = 1000 Mb/s 0 1 = 100 Mb/s 0 0 = 10 Mb/s	R/W
0.12	Auto-Negotiation Enable	1 = ~~E~~ nable Auto-Negotiation Pprocess 0 = ~~D~~ isable Auto-Negotiation Pprocess	R/W
0.11	Power Down	1 = power down 0 = normal operation ^b	R/W
0.10	Isolate	1 = electrically Isolate PHY from MII or GMII 0 = normal operation ^b	R/W
0.9	Restart Auto-Negotiation	1 = ~~R~~ estart Auto-Negotiation Pprocess 0 = normal operation	R/W SC
0.8	Duplex Mode	1 = ~~F~~ ull Dduplex 0 = ~~H~~ alf Dduplex	R/W
0.7	Collision Test	1 = enable COL signal test 0 = disable COL signal test	R/W
0.6	Speed Selection (MSB)	0.6 0.13 1 1 = Reserved 1 0 = 1000 Mb/s 0 1 = 100 Mb/s 0 0 = 10 Mb/s	R/W
<u>0.5</u>	<u>Unidirectional enable</u>	<u>When bit 0.12 is one or bit 0.8 is zero, this bit is ignored.</u> <u>When bit 0.12 is zero and bit 0.8 is one:</u> <u>1 = Enable transmit from media independent interface</u> <u>regardless of whether the PHY has determined that a valid</u> <u>link has been established</u> <u>0 = Enable transmit from media independent interface</u> <u>only when the PHY has determined that a valid link has</u> <u>been established</u>	<u>R/W</u>
~~0.5:0~~ 0.4:0	Reserved	Write as 0, ignore on Rread	R/W

^aR/W = Read/Write, SC = Self-Clearing.

^bFor normal operation, both 0.10 and 0.11 must be cleared to zero; see 22.2.4.1.5.

Change 22.2.4.1.11 to read

22.2.4.1.11 Reserved bits

Bits ~~0.5-0.4:0~~ are reserved for future standardization. They shall be written as zero and shall be ignored when read; however, a PHY shall return the value zero in these bits.

Insert subclause:

22.2.4.1.12 Unidirectional enable

If a PHY reports via bit 1.7 that it lacks the ability to encode and transmit data from the media independent interface regardless of whether the PHY has determined that a valid link has been established, the PHY shall return a value of zero in bit 0.5, and any attempt to write a one to bit 0.5 shall be ignored.

The ability to encode and transmit data from the media independent interface regardless of whether the PHY has determined that a valid link has been established is controlled by bit 0.5 as well as the status of Auto-Negotiation Enable bit 0.12 and the Duplex Mode bit 0.8 as this ability can only be supported if Auto-Negotiation is disabled and the PHY is operating in full-duplex mode. If bit 0.5 is set to a logic one, bit 0.12 to logic zero and bit 0.8 to logic one, encoding and transmitting data from the media independent interface shall be enabled regardless of whether the PHY has determined that a valid link has been established. If bit 0.5 is set to a logic zero, bit 0.12 to logic one or bit 0.8 to logic zero, encoding and transmitting data from the media independent interface shall be dependent on whether the PHY has determined that a valid link has been established. When bit 0.12 is one or bit 0.8 is zero, bit 0.5 shall be ignored.

A management entity shall set bit 0.5 to a logic one only after it has enabled an associated OAM sublayer (see Clause 57) or if this device is a 1000BASE-PX-D PHY. A management entity shall clear bit 0.5 to a logic zero prior to it disabling an associated OAM sublayer when this device is not a 1000BASE-PX-D PHY. To avoid collisions, a management entity should not set bit 0.5 of a 1000BASE-PX-U PHY to a logic one.

The default value of bit 0.5 is zero, except for 1000BASE-PX-D, where it is one.

22.2.4.2 Status register (Register 1)

Change the ninth row of Table 22-8:

Table 22-8—Status register bit definitions

Bit(s)	Name	Description	R/W ^a
1.15	100BASE-T4	1 = PHY able to perform 100BASE-T4 0 = PHY not able to perform 100BASE-T4	RO
1.14	100BASE-X Full Duplex	1 = PHY able to perform full duplex 100BASE-X 0 = PHY not able to perform full duplex 100BASE-X	RO
1.13	100BASE-X Half Duplex	1 = PHY able to perform half duplex 100BASE-X 0 = PHY not able to perform half duplex 100BASE-X	RO
1.12	10 Mb/s Full Duplex	1 = PHY able to operate at 10 Mb/s in full duplex mode 0 = PHY not able to operate at 10 Mb/s in full duplex mode	RO
1.11	10 Mb/s Half Duplex	1 = PHY able to operate at 10 Mb/s in half duplex mode 0 = PHY not able to operate at 10 Mb/s in half duplex mode	RO
1.10	100BASE-T2 Full Duplex	1 = PHY able to perform full duplex 100BASE-T2 0 = PHY not able to perform full duplex 100BASE-T2	RO
1.9	100BASE-T2 Half Duplex	1 = PHY able to perform half duplex 100BASE-T2 0 = PHY not able to perform half duplex 100BASE-T2	RO
1.8	Extended Status	1 = Extended status information in Register 15 0 = No extended status information in Register 15	RO
1.7	~~Reserved~~ <u>Unidirectional ability</u>	~~ignore when read~~ <u>1 = PHY able to transmit from media independent interface regardless of whether the PHY has determined that a valid link has been established</u> <u>0 = PHY able to transmit from media independent interface only when the PHY has determined that a valid link has been established</u>	RO
1.6	MF Preamble Suppression	1 = PHY will accept management frames with preamble suppressed. 0 = PHY will not accept management frames with preamble suppressed.	RO
1.5	Auto-Negotiation Complete	1 = Auto-Negotiation process completed 0 = Auto-Negotiation process not completed	RO
1.4	Remote Fault	1 = remote fault condition detected 0 = no remote fault condition detected	RO/ LH
1.3	Auto-Negotiation Ability	1 = PHY is able to perform Auto-Negotiation 0 = PHY is not able to perform Auto-Negotiation	RO
1.2	Link Status	1 = link is up 0 = link is down	RO/LL
1.1	Jabber Detect	1 = jabber condition detected 0 = no jabber condition detected	RO/LH
1.0	Extended Capability	1 = extended register capabilities 0 = basic register set capabilities only	RO

^aRO = Read Only, LL = Latching Low, LH = Latching High

Replace 22.2.4.2.8 with the following

22.2.4.2.8 Unidirectional ability

When read as a logic one, bit 1.7 indicates that the PHY has the ability to encode and transmit data from the media independent interface regardless of whether the PHY has determined that a valid link has been established. When read as a logic zero, bit 1.7 indicates the PHY is able to transmit data from the media independent interface only when the PHY has determined that a valid link has been established.

A PHY shall return a value of zero in bit 1.7 if it is not a 100BASE-X PHY using the PCS and PMA specified in 66.1 or a 1000BASE-X PHY using the PCS and PMA specified in 66.2.

22.2.4.3 Extended capability registers

Change the first paragraph of this subclause (IEEE Std 802.3af-2003) as follows:

In addition to the basic register set defined in 22.2.4.1 and 22.2.4.2, PHYs may provide an extended set of capabilities that may be accessed and controlled via the MII management interface. ~~Thirteen~~^{Eleven} registers have been defined within the extended address space for the purpose of providing a PHY-specific identifier to layer management, to provide control and monitoring for the Auto-Negotiation process, ~~and to provide control and monitoring of power sourcing equipment, and to provide MDIO Manageable Device (MMD) register access.~~

Insert the following new subclauses after subclause 22.2.4.3.10, renumber current subclause 22.2.4.3.11 to 22.2.4.3.13. Renumber current tables after the newly inserted tables.

22.2.4.3.11 MMD access control register (Register 13)

The assignment of bits in the MMD access control register is shown in Table 22–9. The MMD access control register is used in conjunction with the MMD access address data register (Register 14) to provide access to the MMD address space using the interface and mechanisms defined in 22.2.4.

Table 22–9—MMD access control register bit definitions

Bit(s)	Name	Description	R/W ^a															
13.15:14	Function	<table><tr><td>13.15</td><td>13.14</td><td></td></tr><tr><td>0</td><td>0</td><td>= address</td></tr><tr><td>0</td><td>1</td><td>= data, no post increment</td></tr><tr><td>1</td><td>0</td><td>= data, post increment on reads and writes</td></tr><tr><td>1</td><td>1</td><td>= data, post increment on writes only</td></tr></table>	13.15	13.14		0	0	= address	0	1	= data, no post increment	1	0	= data, post increment on reads and writes	1	1	= data, post increment on writes only	R/W
13.15	13.14																	
0	0	= address																
0	1	= data, no post increment																
1	0	= data, post increment on reads and writes																
1	1	= data, post increment on writes only																
13.13:5	Reserved	Write as 0, ignore on read	R/W															
13.4:0	DEVAD	Device address	R/W															

^aR/W = Read/Write

Each MMD maintains its own individual address register as described in 45.2.7. The DEVAD field directs any accesses of Register 14 to the appropriate MMD as described in 45.2. If the access of Register 14 is an address access (bits 13.15:14 = 00) then it is directed to the address register within the MMD associated with the value in the DEVAD field (bits 13.4:0). Otherwise, both the DEVAD field and that MMD's address register direct the Register 14 data accesses to the appropriate registers within that MMD.

The Function field can be set to any of four values:

- a) When set to 00, accesses to Register 14 access the MMD's individual address register. This address register should always be initialized before attempting any accesses to other MMD registers.
- b) When set to 01, accesses to Register 14 access the register within the MMD selected by the value in the MMD's address register.
- c) When set to 10, accesses to Register 14 access the register within the MMD selected by the value in the MMD's address register. After that access is complete, for both read and write accesses, the value in the MMD's address field is incremented.
- d) When set to 11, accesses to Register 14 access the register within the MMD selected by the value in the MMD's address register. After that access is complete, for write accesses only, the value in the MMD's address field is incremented. For read accesses, the value in the MMD's address field is not modified.

For additional insight into the operation and usage of this register, see Annex 22D.

22.2.4.3.12 MMD access address data register (Register 14)

The assignment of bits in the MMD access address data register is shown in Table 22–10. The MMD access address data register is used in conjunction with the MMD access control register (Register 13) to provide access to the MMD address space using the interface and mechanisms defined in 22.2.4. Accesses to this register are controlled by the value of the fields in Register 13 and the contents of the MMD's individual address field as described in 22.2.4.3.11.

Table 22–10—MMD access address data register bit definitions

Bit(s)	Name	Description	R/W ^a
14.15:0	Address Data	If 13.15:14 = 00, MMD DEVAD's address register. Otherwise, MMD DEVAD's data register as indicated by the contents of its address register	R/W

^aR/W = Read/Write

For additional insight into the operation and usage of this register, see Annex 22D.

22.7.2.3 Major capabilities/options

*Insert the following major capability/option into 22.7.2.3 after *GM:*

Item	Feature	Subclause	Status	Support	Value/Comment
*MUNI	Implementation of unidirectional PCS	22.2.4	O	Yes [] No []	

22.7.3.4 Management functions

Insert the following PICS items into 22.7.3.4 after MF37, and renumber the following PICS items:

Item	Feature	Subclause	Status	Support	Value/Comment
MF38	PHY without unidirectional ability	22.2.4.1.12	M	Yes [] NA []	PHY returns a value of 0 in 0.5 if 1.7=0
MF39	PHY without unidirectional ability	22.2.4.1.12	M	Yes [] NA []	PHY always maintains a value of 0 in 0.5 if 1.7=0
MF40	Unidirectional enable	22.2.4.1.12	MUNI:M	Yes [] NA []	By setting 0.12 = 0, 0.8 = 1 and 0.5 = 1
MF41	Unidirectional disable	22.2.4.1.12	MUNI:M	Yes [] NA []	By setting 0.12 = 1, 0.8 = 0 or 0.5 = 0
MF42	Ignore bit 0.5	22.2.4.1.12	MUNI:M	Yes [] NA []	Ignore 0.5 when 0.12 = 1 or 0.8 = 0
MF43	Enable unidirectional mode	22.2.4.1.12	MUNI:M	Yes [] NA []	Enable only when OAM sublayer is enabled or when part of 1000BASE-PX-D PHY
MF44	Disable unidirectional mode	22.2.4.1.12	MUNI:M	Yes [] NA []	Unidirectional mode is disabled before disabling OAM sublayer when not part of 1000BASE-PX-D PHY
MF45	Unidirectional ability	22.2.4.2.8	M	Yes [] NA []	Bit 1.7 = 0 for all PHYs except those using 66.1 and 66.2

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

Change the title of this clause as follows:

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

30.1 Overview

Change the first paragraph of this subclause as follows (as modified by IEEE Std 802.3ae-2002 and IEEE Std 802.3af-2003):

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 behaviours to support 100 Mb/s, 1000 Mb/s and 10 Gb/s, full duplex operation, MAC Control, Link Aggregation, ~~and DTE Power via MDI, and subscriber access networks.~~

30.1.1 Scope

Change the first paragraph of this subclause as follows (as modified by IEEE Std 802.3ae-2002 and IEEE Std 802.3af-2003):

This clause includes selections from Clauses 5, 19, and 20. It is intended to be an entirely equivalent specification for the management of 10 Mb/s DTEs, 10 Mb/s baseband repeater units, and 10 Mb/s integrated MAUs. It incorporates additions to the objects, attributes, and behaviours to support subsequent additions to this standard. ~~It also includes the additions for management of MAC Control, DTEs and repeaters at speeds greater than 10 Mb/s, embedded MAUs, PHYs and DTE Power via MDI.~~ Implementations of management for DTEs, repeater units, and embedded MAUs should follow the requirements of this clause (e.g., a 10 Mb/s implementation should incorporate the attributes to indicate that it is not capable of 100 Mb/s or 1000 Mb/s operation; half duplex DTE should incorporate the attributes to indicate that it is not capable of full duplex operation, etc.).

30.1.2 Relationship to objects in IEEE 802.1F

Change the second paragraph of this subclause as follows (as modified by IEEE Std 802.3af-2003):

oResourceTypeID

This object class is mandatory and shall be implemented as defined in IEEE 802.1F. This object is bound to oMAC-Entity, oRepeater, oMidSpan and oMAU as defined by the NAME BINDINGS in 30A.10.1. Note that the binding to oMAU is mandatory only when MII is present. The Entity Relationship Diagrams, Figures 30-3, ~~30-4~~, and ~~30-45~~, shows these bindings pictorially.

30.1.4 Management model

Change the second last paragraph of this subclause as follows (as modified by IEEE Std 802.3ae-2002 and IEEE Std 802.3af-2003):

The above items are defined in 30.3 through ~~30.10~~ 30.3.7 of this clause in terms of the template requirements of ISO/IEC 10165-4: 1991.

30.2.2.1 Text description of managed objects

Change the following paragraphs of this subclause as follows (as modified by IEEE Std 802.3ae-2002 and IEEE Std 802.3af-2003):

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

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.

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.

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.

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.

oAutoNegotiation

The managed object of that portion of the containment trees shown in Figure 30–3 and Figure 30–4. The attributes, notifications, and actions defined in this subclause are contained within the MAU managed object.

oGroup

The group managed object class is a view of a collection of repeater ports.

oMACControlEntity

If implemented, and if oOAM is implemented, a single instance of oMACControlEntity is contained within oOAM. Otherwise, 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.

oMACControlFunctionEntity

If implemented, oMACControlFunctionEntity is contained within oMACControlEntity. The oMACControlFunctionEntity managed object class provides the management controls necessary to allow an instance of the MAC Control PAUSE function to be managed. Contained within oMACControlEntity. Each function defined and implemented within the MAC Control sublayer has an associated oMACControlFunctionEntity for the purpose of managing that function.

oMACEntity

If oMACControlEntity is implemented, oMACEntity is contained within oMACControlEntity. Otherwise, if oOAM is implemented, oMACEntity is contained within oOAM. 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.

oMAU

The managed object of that portion of the containment trees shown in Figure 30–3 and Figure 30–4. The attributes, notifications, and actions defined in this subclause are contained within the MAU managed object. Neither counter values nor the value of MAUAdminState is required to be preserved across events involving the loss of power.

oMidSpan

The top-most managed object class of the Midspan containment tree shown in Figure 30–54. 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 standard.

oMPCP

If implemented, oMPCP is contained within oMACControlEntity. The oMPCP managed object class provides the management controls necessary to allow an instance of the Multi-Point MAC Control function to be managed.

oOAM

If implemented, and if oAggregator is implemented, oOAM 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. Otherwise, if implemented, oOAM becomes the top-most managed object class of the DTE 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.

oOMPEmulation

If implemented, oOMPEmulation is contained within oMACEntity. The oOMPEmulation managed object class provides the management controls necessary to allow an instance of an OMPEmulation sublayer to be managed.

oPHYEntity

If oOMPEmulation is implemented, oPHYEntity is contained within oOMPEmulation. Otherwise oPHYEntity is contained within oMACEntity. Many instances of oPHYEntity may coexist within one instance of oMACEntity; however, only one PHY may be active for data transfer to and from the MAC at any one time. oPHYEntity is the managed object that contains the MAU, PAF and PSE managed objects in a DTE.

<u>oPAF</u>	<u>The oPAF managed object class provides the management controls necessary to allow an instance of a PME aggregation function (PAF) to be managed. The PAF managed object class also provides a view of a collection of PMEs.</u>
<u>oPME</u>	<u>The oPME managed object class provides the management controls necessary to allow an instance of a PME to be managed. The oPAF managed object contains the PME managed object in a DTE.</u>
oPSE	The managed object of that portion of the containment trees shown in Figure 30–3, Figure 30–4, and Figure 30–54. The attributes and actions defined in this subclause are contained within the oPSE managed object.
oPSEGroup	The PSE Group managed object class is a view of a collection of PSEs.
oRepeater	The top-most managed object class of the repeater ~~portion of the~~ containment tree shown in ~~Figure 30–4~~ 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 standard.
oRepeaterMonitor	A managed object class called out by IEEE Std 802.1F-1993. See 30.1.2, oEWMAMetricMonitor.
oRepeaterPort	The repeater port managed object class provides a view of the functional link between the data transfer service and a single PMA. The attributes associated with repeater port deal with the monitoring of traffic being handled by the repeater from the port and control of the operation of the port. The Port Enable/Disable function as reported by portAdminState is preserved across events involving loss of power. The oRepeaterPort managed object contains the MAU managed object in a repeater set. NOTE—Attachment to nonstandard PMAs is outside the scope of this standard.
oResourceTypeID	A managed object class called out by IEEE Std 802.1F-1993. It is used within this clause to identify manufacturer, product, and revision of managed components that implement functions and interfaces defined within IEEE 802.3. The Clause 22 MII or Clause 35 GMII specifies two registers to carry PHY Identifier (22.2.4.3.1), which provides succinct information sufficient to support oResourceTypeID.
oWIS	The managed object of that portion of the containment tree shown in Figure 30–3. The attributes defined in this subclause are contained within the oMAU managed object.

30.2.3 Containment

Change the first paragraph of this subclause as follows (as modified by IEEE Std 802.3af-2003):

A containment relationship is a structuring relationship for managed objects in which the existence of a 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 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 diagrams, Figure 30–3, through Figure 30–5 and Figure 30–4. These figures show the names of the object classes and whether a particular containment relationship is one-to-one, ~~or~~ one-to-many, or many-to-one. For further requirements on this topic, see IEEE Std 802.1F-1993. PSE management is only valid in a system that provides management at the next higher containment level, that is, either a DTE, repeater or Midspan with management.

Replace Figure 30–3 with the following:

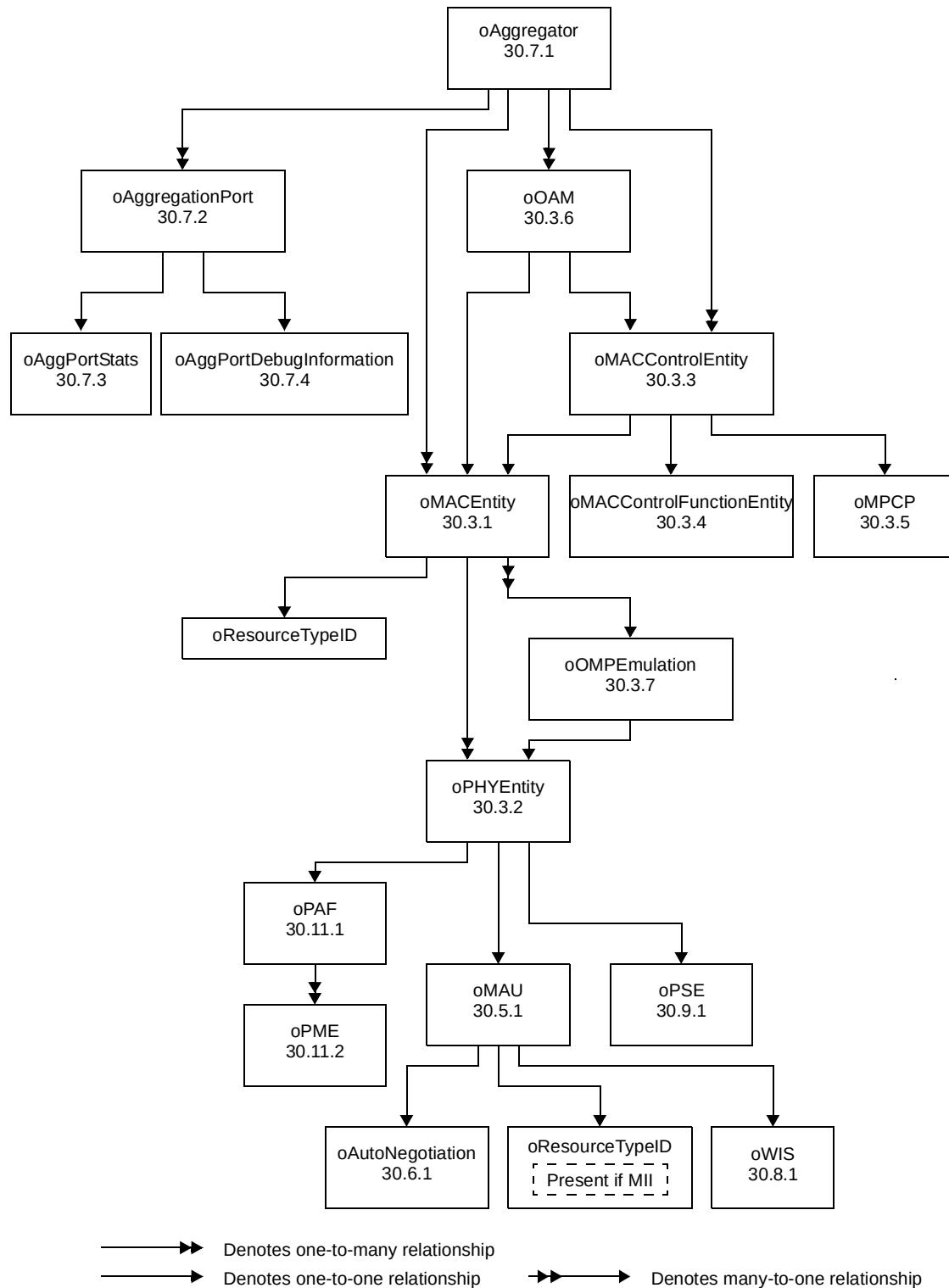


Figure 30–3—DTE System entity relationship diagram

Insert new Figure 30–4 as follows. Renumber existing figures as required.

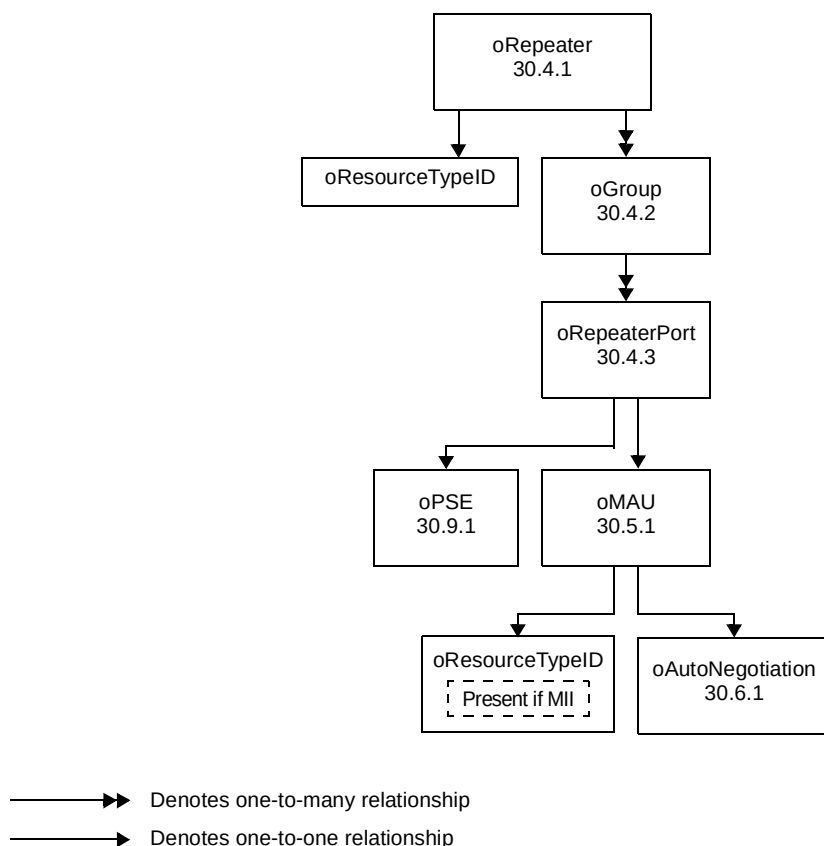


Figure 30–4—Repeater entity relationship diagram

30.2.5 Capabilities

Change the first paragraph of this subclause as follows (as modified by IEEE Std 802.3ae-2002 and IEEE Std 802.3af-2003):

This standard makes use of the concept of *packages* as defined in ISO/IEC 10165-4: 1992 as a means of grouping behaviour, attributes, actions, and notifications within a managed object class definition. Packages may either be mandatory, or be 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, which are components of a number of managed object class definitions and which 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 Management. Implementation of an entire optional capability is required in order to claim conformance to that capability. The capabilities and packages for IEEE 802.3 Management are specified in Tables 30–1 through 30–5.

In Tables 30-1a, 30-1b, 30-1c, 30-1d and 30-1e change the DTE and MAU column heading ‘100/1000 Mb/s Monitor Capability (Optional)’ to read ‘PHY Error Monitor Capability (Optional)’.

Insert the following entries to Table 30–1b after ‘aRateControlStatus’ (as modified by IEEE Std 802.3ae-2002):

				DTE								Repeater				MAU							
				Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Array Package (Optional)	Excessive Deferral Package (Optional)	Multiple PHY Package (Optional)	PHY Error Monitor Capability (Optional)	Basic Control Capability (Mandatory)	Performance Monitor Capability (Optional)	Address Tracking Capability (Optional)	100/1000 Mb/s Monitor Capability (Optional)	1000 Mb/s Burst Monitor Capability (Optional)	Basic Package (Mandatory)	MAU Control Package (Optional)	Media Loss Tracking Package (Conditional)	Broadband DTE MAU Package (Conditional)	MII Capability (Conditional)	PHY Error Monitor Capability (Optional)	Auto-Negotiation Package (Mandatory)
	aDeferControlAbility	ATTRIBUTE	GET	X																			
	aDeferControlStatus	ATTRIBUTE	GET-SET	X																			

Change the following entry in Table 30–1c (as modified by IEEE 802.3ae-2002):

				DTE								Repeater				MAU							
				Basic Package (Mandatory)	Mandatory Package (Mandatory)	Recommended Package (Optional)	Optional Package (Optional)	Array Package (Optional)	Excessive Deferral Package (Optional)	Multiple PHY Package (Optional)	PHY Error Monitor Capability (Optional)	Basic Control Capability (Mandatory)	Performance Monitor Capability (Optional)	Address Tracking Capability (Optional)	100/1000 Mb/s Monitor Capability (Optional)	1000 Mb/s Burst Monitor Capability (Optional)	Basic Package (Mandatory)	MAU Control Package (Optional)	Media Loss Tracking Package (Conditional)	Broadband DTE MAU Package (Conditional)	MII Capability (Conditional)	PHY Error Monitor Capability (Optional)	Auto-Negotiation Package (Mandatory)
oMACControlFunctionPAUSEEntity managed object class (instance of oMACControlFunctionEntity) (30.3.4)																							

Insert the following new table after Table 30–4:

Table 30–5—EFM Capabilities

			DTE			MAU		PME	
			Multi-Point Control Protocol Package (Conditional)	Operation Administration Maintenance Package (Conditional)	Optical Multipoint Emulation Package (Conditional)	Optical Multipoint Emulation Monitor Package (Optional)	PCS Code Error Monitor Package (Optional)	Forward Error Correction Package (Conditional)	Basic Package (Mandatory)
									PME Aggregation Package (Optional)
									10P/2B Package (Mandatory)
oMPCP managed object class (30.3.5)									
aMPCPID	ATTRIBUTE	GET	X						
aMPCPAdminState	ATTRIBUTE	GET	X						
aMPCPMode	ATTRIBUTE	GET	X						
aMPCPLinkID	ATTRIBUTE	GET	X						
aMPCPRemoteMACAddress	ATTRIBUTE	GET	X						
aMPCPRegistrationState	ATTRIBUTE	GET	X						
aMPCPMACCtrlFramesTransmitted	ATTRIBUTE	GET	X						
aMPCPMACCtrlFramesReceived	ATTRIBUTE	GET	X						
aMPCPTxGate	ATTRIBUTE	GET	X						
aMPCPTxRegAck	ATTRIBUTE	GET	X						
aMPCPTxRegister	ATTRIBUTE	GET	X						
aMPCPTxRegRequest	ATTRIBUTE	GET	X						
aMPCPTxReport	ATTRIBUTE	GET	X						
aMPCPRxGate	ATTRIBUTE	GET	X						
aMPCPRxRegAck	ATTRIBUTE	GET	X						
aMPCPRxRegister	ATTRIBUTE	GET	X						
aMPCPRxRegRequest	ATTRIBUTE	GET	X						
aMPCPRxReport	ATTRIBUTE	GET	X						
aMPCPTransmitElapsed	ATTRIBUTE	GET	X						
aMPCPReceiveElapsed	ATTRIBUTE	GET	X						
aMPCPRoundTripTime	ATTRIBUTE	GET	X						
aMPCPDiscoveryWindowsSent	ATTRIBUTE	GET	X						
aMPCPDiscoveryTimeout	ATTRIBUTE	GET	X						
aMPCPMaximumPendingGrants	ATTRIBUTE	GET	X						
acMPCPAdminControl	ACTION		X						
oOAM managed object class (30.3.6)									
aOAMID	ATTRIBUTE	GET	X						

Table 30–5—EFM Capabilities (continued)

			DTE	MAU	PME
			Multi-Point Control Protocol Package (Conditional)		
			Operation Administration Maintenance Package (Conditional)		
			Optical Multipoint Emulation Package (Conditional)		
			Optical Multipoint Emulation Monitor Package (Optional)		
			PCS Code Error Monitor Package (Optional)		
			Forward Error Correction Package (Conditional)		
				Basic Package (Mandatory)	
				PME Aggregation Package (Optional)	
				10P/2B Package (Mandatory)	
aOAMAdminState	ATTRIBUTE	GET	X		
aOAMMode	ATTRIBUTE	GET-SET	X		
aOAMDiscoveryState	ATTRIBUTE	GET	X		
aOAMRemoteMACAddress	ATTRIBUTE	GET	X		
aOAMLocalConfiguration	ATTRIBUTE	GET	X		
aOAMRemoteConfiguration	ATTRIBUTE	GET	X		
aOAMLocalPDUConfiguration	ATTRIBUTE	GET	X		
aOAMRemotePDUConfiguration	ATTRIBUTE	GET	X		
aOAMLocalFlagsField	ATTRIBUTE	GET	X		
aOAMRemoteFlagsField	ATTRIBUTE	GET	X		
aOAMLocalRevision	ATTRIBUTE	GET	X		
aOAMRemoteRevision	ATTRIBUTE	GET	X		
aOAMLocalState	ATTRIBUTE	GET	X		
aOAMRemoteState	ATTRIBUTE	GET	X		
aOAMRemoteVendorOUI	ATTRIBUTE	GET	X		
aOAMRemoteVendorSpecificInfo	ATTRIBUTE	GET	X		
aOAMUnsupportedCodesTx	ATTRIBUTE	GET	X		
aOAMUnsupportedCodesRx	ATTRIBUTE	GET	X		
aOAMInformationTx	ATTRIBUTE	GET	X		
aOAMInformationRx	ATTRIBUTE	GET	X		
aOAMUniqueEventNotificationTx	ATTRIBUTE	GET	X		
aOAMDuplicateEventNotificationTx	ATTRIBUTE	GET	X		
aOAMUniqueEventNotificationRx	ATTRIBUTE	GET	X		
aOAMDuplicateEventNotificationRx	ATTRIBUTE	GET	X		
aOAMLoopbackControlTx	ATTRIBUTE	GET	X		
aOAMLoopbackControlRx	ATTRIBUTE	GET	X		
aOAMVariableRequestTx	ATTRIBUTE	GET	X		
aOAMVariableRequestRx	ATTRIBUTE	GET	X		
aOAMVariableResponseTx	ATTRIBUTE	GET	X		
aOAMVariableResponseRx	ATTRIBUTE	GET	X		
aOAMOrganizationSpecificTx	ATTRIBUTE	GET	X		
aOAMOrganizationSpecificRx	ATTRIBUTE	GET	X		

Table 30–5—EFM Capabilities (continued)

			DTE	MAU	PME
			Multi-Point Control Protocol Package (Conditional)		
			Operation Administration Maintenance Package (Conditional)		
			Optical Multipoint Emulation Package (Conditional)		
			Optical Multipoint Emulation Monitor Package (Optional)		
			PCS Code Error Monitor Package (Optional)		
			Forward Error Correction Package (Conditional)		
			Basic Package (Mandatory)		
			PME Aggregation Package (Optional)		
			10P/2B Package (Mandatory)		
aOAMLocalErrSymPeriodConfig	ATTRIBUTE	GET	X		
aOAMLocalErrSymPeriodEvent	ATTRIBUTE	GET	X		
aOAMLocalErrFrameConfig	ATTRIBUTE	GET	X		
aOAMLocalErrFrameEvent	ATTRIBUTE	GET	X		
aOAMLocalErrFramePeriodConfig	ATTRIBUTE	GET	X		
aOAMLocalErrFramePeriodEvent	ATTRIBUTE	GET	X		
aOAMLocalErrFrameSecsSummaryConfig	ATTRIBUTE	GET	X		
aOAMLocalErrFrameSecsSummaryEvent	ATTRIBUTE	GET	X		
aOAMRemoteErrSymPeriodEvent	ATTRIBUTE	GET	X		
aOAMRemoteErrFrameEvent	ATTRIBUTE	GET	X		
aOAMRemoteErrFramePeriodEvent	ATTRIBUTE	GET	X		
aOAMRemoteErrFrameSecsSummaryEvent	ATTRIBUTE	GET	X		
aFramesLostDueToOAMError	ATTRIBUTE	GET	X		
acOAMAdminControl	ACTION		X		
oOMPEmulation managed object class (30.3.7)					
aOMPEmulationID	ATTRIBUTE	GET		X	
aOMPEmulationType	ATTRIBUTE	GET		X	
aSLDErrors	ATTRIBUTE	GET		X	
aCRC8Errors	ATTRIBUTE	GET		X	
aGoodLLID	ATTRIBUTE	GET			X
aONUPONcastLLID	ATTRIBUTE	GET			X
aOLTPONcastLLID	ATTRIBUTE	GET			X
aBadLLID	ATTRIBUTE	GET			X
oMAU managed object class (30.5.1)					
aPCSCodingViolation	ATTRIBUTE	GET		X	
aFECAbility	ATTRIBUTE	GET			X
aFECCmode	ATTRIBUTE	GET-SET			X
aFECCorrectedBlocks	ATTRIBUTE	GET			X
aFECCUncorrectableBlocks	ATTRIBUTE	GET			X
oPAF managed object class (30.11.1)					
aPAFID	ATTRIBUTE	GET			X

Table 30–5—EFM Capabilities (continued)

			DTE	MAU	PME
			Multi-Point Control Protocol Package (Conditional)		
			Operation Administration Maintenance Package (Conditional)		
			Optical Multipoint Emulation Package (Conditional)		
			Optical Multipoint Emulation Monitor Package (Optional)		
			PCS Code Error Monitor Package (Optional)		
			Forward Error Correction Package (Conditional)		
				Basic Package (Mandatory)	
				PME Aggregation Package (Optional)	
				10P/2B Package (Mandatory)	
aPhyEnd	ATTRIBUTE	GET			X
aPHYCurrentStatus	ATTRIBUTE	GET			X
aPAFSupported	ATTRIBUTE	GET			X
aPAFAdminState	ATTRIBUTE	GET-SET			X
aLocalPAFCapacity	ATTRIBUTE	GET			X
aLocalPMEAvailable	ATTRIBUTE	GET			X
aLocalPMEAggregate	ATTRIBUTE	GET			X
aRemotePAFSupported	ATTRIBUTE	GET			X
aRemotePAFCapacity	ATTRIBUTE	GET			X
aRemotePMEAggregate	ATTRIBUTE	GET			X
oPME managed object class (30.11.2)					
aPMEID	ATTRIBUTE	GET			X
aPMEAdminState	ATTRIBUTE	GET-SET			X
aPMEStatus	ATTRIBUTE	GET			X
aPMESNRMgn	ATTRIBUTE	GET			X
aTCCodingViolations	ATTRIBUTE	GET			X
aProfileSelect	ATTRIBUTE	GET-SET			X
aOperatingProfile	ATTRIBUTE	GET			X
aPMEFECCorrectedBlocks	ATTRIBUTE	GET			X
aPMEFECUncorrectableBlocks	ATTRIBUTE	GET			X
Common Attributes Template					
aCMCounter	ATTRIBUTE	GET	X	X	X

30.3.1.1.20 aFramesWithExcessiveDeferral

Change this subclause as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 412 counts per second at 10 Mb/s

behaviour DEFINED AS:

A count of frames that deferred for an excessive period of time. This counter may only be incremented once per LLC transmission. This counter is incremented when the excessDefer flag is set. The actual update occurs in the LayerMgmtTransmitCounters procedure (5.2.4.2). The contents of this attribute are undefined for MAC entities operating in full duplex mode and also when connected to a PHY utilizing the MAC-PHY Rate Matching defined in 61.2.1.1.;

Insert the following after subclause 30.3.1.1.34 aRateControlStatus:

30.3.1.1.35 aDeferControlAbility

ATTRIBUTE

APPROPRIATE SYNTAX:

BOOLEAN

BEHAVIOUR DEFINED AS:

The enumeration “true” is returned when the interframe spacing is accomplished within the MAC sublayer (see 4A.2.3.2.3), the enumeration “false” is returned otherwise.;

30.3.1.1.36 aDeferControlStatus

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

unknown	defer control mode unknown
defer control off	defer control mode disabled
defer control on	defer control mode enabled

BEHAVIOUR DEFINED AS:

A GET operation returns the current Defer Control mode of operation of the MAC. A SET operation changes the mode of operation of the MAC sublayer to the indicated value. A SET operation shall have no effect on a device whose mode cannot be changed through management or that can only operate in a single mode.

This attribute maps to the variable deferenceMode (see 4A.2.7.2).;

30.3.2.1.2 aPhyType

Change this subclause as follows (as modified by IEEE Std 802.3ae-2002):

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has one of the following entries:

other	Undefined
unknown	Initializing, true state or type not yet known
none	MII present and nothing connected
<u>2BASE-TL</u>	<u>Clause 61 0.5 Mb/s to 5.5 Mb/s 64/65-octet</u>
10 Mb/s	Clause 7 10 Mb/s Manchester
<u>10PASS-TS</u>	<u>Clause 61 2.5 Mb/s to 100 Mb/s 64/65-octet</u>
100BASE-T4	Clause 23 100 Mb/s 8B/6T
100BASE-X	Clause 24 <u>or subclause 66.1</u> 100 Mb/s 4B/5B
100BASE-T2	Clause 32 100 Mb/s PAM5X5
1000BASE-X	Clause 36 <u>or subclause 66.2</u> 1000 Mb/s 8B/10B
1000BASE-T	Clause 40 1000 Mb/s 4D-PAM5

10GBASE-X	Clause 48 10 Gb/s 4 lane 8B/10B
10GBASE-R	Clause 49 10 Gb/s 64B/66B
10GBASE-W	Clause 49 10 Gb/s 64B/66B and Clause 50 WIS

BEHAVIOUR DEFINED AS:

A read-only value that identifies the PHY type. The enumeration of the type is such that the value matches the clause number of this International Standard that specifies the particular PHY. The value of this attribute maps to the value of aMAUType. The enumeration “none” can only occur in a standard implementation where an MII exists and there is nothing connected. However, the attribute aMIIDetect should be used to determine whether an MII exists or not.;

30.3.2.1.3 aPhyTypeList

Change this subclause as follows (as modified by IEEE Std 802.3ae-2002):

ATTRIBUTE**APPROPRIATE SYNTAX:**

A SEQUENCE that meets the requirements of the description below:

other	Undefined
unknown	Initializing, true state or type not yet known
none	MII present and nothing connected
<u>2BASE-TL</u>	<u>Clause 61 0.5 Mb/s to 5.5 Mb/s 64/65-octet</u>
10 Mb/s	Clause 7 10 Mb/s Manchester
<u>10PASS-TS</u>	<u>Clause 61 2.5 Mb/s to 100 Mb/s 64/65-octet</u>
100BASE-T4	Clause 23 100 Mb/s 8B/6T
100BASE-X	Clause 24 <u>or subclause 66.1</u> 100 Mb/s 4B/5B
100BASE-T2	Clause 32 100 Mb/s PAM5X5
1000BASE-X	Clause 36 <u>or subclause 66.2</u> 1000 Mb/s 8B/10B
1000BASE-T	Clause 40 1000 Mb/s 4D-PAM5
10GBASE-X	Clause 48 10 Gb/s 4 lane 8B/10B
10GBASE-R	Clause 49 10 Gb/s 64B/66B
10GBASE-W	Clause 49 10 Gb/s 64B/66B and Clause 50 WIS

BEHAVIOUR DEFINED AS:

A read-only list of the possible types that the PHY could be, identifying the ability of the PHY. If Clause 28 or Clause 37, Auto-Negotiation, is present, then this attribute will map to the local technology ability or advertised ability of the local device.

NOTE—At 10 Gb/s the ability of the PMD must be taken into account when reporting the possible types that the PHY could be.;

30.3.3.2 aMACControlFunctionsSupported

Change this subclause as follows:

ATTRIBUTE**APPROPRIATE SYNTAX:**

A SEQUENCE that meets the requirements of the description below:

PAUSE	PAUSE command implemented
<u>MPCP</u>	<u>MPCP implemented</u>

BEHAVIOUR DEFINED AS:

A read-write list of the possible MAC Control functions implemented within the device. Each function implemented will have an associated MAC Control Function Entity object class.

~~Currently, the only function defined is the PAUSE command.;~~

30.3.4 PAUSE entity managed object class

Change this subclause as follows:

This subclause formally defines the behaviours for the oMACControlFunctionEntity ~~oPAUSEEntity~~ managed object class attributes.

Insert the following new subclauses after 30.3.4.3

30.3.5 MPCP managed object class

This subclause formally defines the behaviours for the oMPCP managed object class attributes and actions.

30.3.5.1 MPCP Attributes

30.3.5.1.1 aMPCPID

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

The value of aMPCPID is assigned so as to uniquely identify an MPCP entity among the subordinate managed objects of the containing object.;

30.3.5.1.2 aMPCPAdminState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has the following entries:

enabled
disabled

BEHAVIOUR DEFINED AS:

A read-only value that identifies the operational state of the Multi-Point MAC Control sublayer. An interface which can provide the Multi-Point MAC Control sublayer functions specified in Clause 64 will be enabled to do so when this attribute has the enumeration “enabled”. When this attribute has the enumeration “disabled” the interface will act as it would if it had no Multi-Point MAC Control sublayer. The operational state of the Multi-Point MAC Control sublayer can be changed using the acMPCPAdminControl action.;

30.3.5.1.3 aMPCPMode

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has the following entries:

OLT
ONU

BEHAVIOUR DEFINED AS:

A read-only value that identifies the operational mode of the Multi-Point MAC Control sublayer. An interface which can provide the Multi-Point MAC Control sublayer functions specified in Clause 64 will operate as an OLT when this attribute has the enumeration “OLT”. When this attribute has the enumeration “ONU” the interface will act as an ONU.;

30.3.5.1.4 aMPCPLinkID

ATTRIBUTE

APPROPRIATE SYNTAX:
INTEGER

BEHAVIOUR DEFINED AS:

A read-only value that identifies the Logical Link identity (LLID) associated with the MAC port as specified in 65.1.2.3.2.;

30.3.5.1.5 aMPCPRemoteMACAddress

ATTRIBUTE

APPROPRIATE SYNTAX:
MACAddress

BEHAVIOUR DEFINED AS:

A read-only value that identifies the source_address parameter of the last MPCPDU passed to MAC Control.

This value is updated on reception of a valid frame with (1) a destinationField equal to the reserved multicast address for MAC Control specified in 31A, (2) lengthOrType field value equal to the reserved Type for MAC Control as specified in 31A, (3) an opcode value reserved for one of MPCP messages, as specified in 31A.;

30.3.5.1.6 aMPCPRegistrationState

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that has the following entries:

unregistered	unregistered
registering	registering with link-partner
registered	registered with a link-partner

BEHAVIOUR DEFINED AS:

A read-only value that identifies the operational state of an individual instance of Multi-Point MAC Control. When this attribute has the enumeration “unregistered” the interface is ready for registering a link partner. When this attribute has the enumeration “registering” the interface is in the process of registering a link-partner. When this attribute has the enumeration “registered” the interface has an established and operational link-partner.

NOTE—This attribute may be used by layer management mechanisms or OAM client to obtain the status of logical links in P2MP networks. Specifically, in implementations where the OAM sublayer is interfaced with Multi-Point MAC Control, the OAM_CTRL.request (local_link_status) primitive specified in 57.2.5.3 should be mapped to this attribute as follows:

When the value of this attribute changes from “registering” to “registered”, an OAM_CTRL.request primitive with parameter local_link_status = OK is generated.

When the value of this attribute changes from “registered” to “unregistered”, an OAM_CTRL.request primitive with parameter local_link_status = FAIL is generated.;

30.3.5.1.7 aMPCPMACCtrlFramesTransmitted

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of MPCP frames passed to the MAC sublayer for transmission.

Increment counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating an MPCP frame.;

30.3.5.1.8 aMPCPMACCtrlFramesReceived

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of MPCP frames passed by the MAC sublayer to the MAC Control sublayer.

Increment counter by one when a ReceiveFrame function call returns a valid frame with: (1) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, and (2) an opcode indicating an MPCP frame.;

30.3.5.1.9 aMPCPTxGate

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a GATE MPCP frames transmission occurs.

Increment the counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating a GATE MPCPDU.;

30.3.5.1.10 aMPCPTxRegAck

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER_ACK MPCP frames transmission occurs.

Increment the counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating a REGISTER_ACK MPCPDU.;

30.3.5.1.11 aMPCPTxRegister

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER MPCP frames transmission occurs.

Increment the counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating a REGISTER MPCPDU.;

30.3.5.1.12 aMPCPTxRegRequest

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER_REQ MPCP frames transmission occurs.

Increment the counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating a REGISTER_REQ MPCPDU.;

30.3.5.1.13 aMPCPTxReport

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REPORT MPCP frames transmission occurs.

Increment the counter by one when a MA_CONTROL.request service primitive is generated within the MAC Control sublayer with an opcode indicating a REPORT MPCPDU.;

30.3.5.1.14 aMPCPRxGate

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a GATE MPCP frames reception occurs.

Increment the counter by one when a ReceiveFrame function call returns a valid frame with: (1) a destinationField equal to the reserved multicast address for MAC Control specified in 31A, or unique physical address associated with this station, (2) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, (3) an opcode indicating a GATE MPCPDU.;

30.3.5.1.15 aMPCPRxRegAck

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER_ACK MPCP frames reception occurs.

Increment the counter by one when a ReceiveFrame function call returns a valid frame with: (1) a destinationField equal to the reserved multicast address for MAC Control specified in 31A, (2) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, (3) an opcode indicating a REGISTER_ACK MPCPDU.;

30.3.5.1.16 aMPCPRxRegister

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER MPCP frames reception occurs.

Increment the counter by one when a ReceiveFrame function call returns a valid frame with: (1) a destinationField equal to the unique physical address associated with this station, (2) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, (3) an opcode indicating a REGISTER MPCPDU.;

30.3.5.1.17 aMPCPRxRegRequest

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REGISTER_REQ MPCP frames reception occurs.

Increment the counter by one when a ReceiveFrame function call returns a valid frame with: (1) a destinationField equal to the reserved multicast address for MAC Control specified in 31A, (2) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, (3) an opcode indicating a REGISTER_REQ MPCPDU.;

30.3.5.1.18 aMPCPRxReport

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresetable counter. This counter has a maximum increment rate of 1 600 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of the number of times a REPORT MPCP frames reception occurs.

Increment the counter by one when a ReceiveFrame function call returns a valid frame with: (1) a destinationField equal to the reserved multicast address for MAC Control specified in 31A, (2) a lengthOrType field value equal to the reserved Type for 802.3_MAC_Control as specified in 31.4.1.3, (3) an opcode indicating a REPORT MPCPDU.;

30.3.5.1.19 aMPCPTransmitElapsed

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A read-only value that reports the interval from last MPCP frame transmission in increments of 16 ns. The value returned shall be (interval from last MPCP frame transmission in ns)/16, where this value exceeds ($2^{32}-1$) the value ($2^{32}-1$) shall be returned.;

30.3.5.1.20 aMPCPReceiveElapsed

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A read-only value that reports the interval from last MPCP frame reception in increments of 16 ns. The value returned shall be (interval from last MPCP frame reception in ns)/16, where this value exceeds ($2^{32}-1$) the value ($2^{32}-1$) shall be returned.;

30.3.5.1.21 aMPCPRoundTripTime

ATTRIBUTE

APPROPRIATE SYNTAX:

INTEGER

BEHAVIOUR DEFINED AS:

A read-only value that reports the MPCP round trip time in increments of 16 ns. The value returned shall be (round trip time in ns)/16, where this value exceeds ($2^{16}-1$) the value ($2^{16}-1$) shall be returned. This value is only defined for an OLT. The contents of this attribute are undefined for an ONU.;

30.3.5.1.22 aMPCPDiscoveryWindowsSent

ATTRIBUTE

APPROPRIATE SYNTAX:

Generalized nonresettable counter. This counter has a maximum increment rate of 10 000 counts per second at 1000 Mb/s.

BEHAVIOUR DEFINED AS:

A count of discovery windows generated. The counter is incremented by one for each generated discovery window.;