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**Managed Objects of Ethernet Passive Optical Networks (EPON)**  
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## Abstract

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP based Internets. In particular, it defines objects for managing interfaces that conform to the Ethernet Passive Optical Networks (EPON) standard as defined in the IEEE Std 802.3ah-2004, which are extended capabilities to the Ethernet like interfaces.

## The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to [section 7 of RFC 3410](#) [[RFC3410](#)]. Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, [RFC 2578](#) [[RFC2578](#)], STD 58, [RFC 2579](#) [[RFC2579](#)] and STD 58, [RFC 2580](#) [[RFC2580](#)].



## Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

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## **1. Overview**

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP based Internets. In particular, it defines objects for managing interfaces that conform to the Ethernet Passive Optical Networks (EPON) standard as defined in [[802.3ah](#)], which are extended capabilities to the Ethernet like interfaces. The document contains a list of management objects based on the attributes defined in the relevant parts of [[802.3ah](#)] Annex 30A, referring to EPON.

### **1.1. Terminology and abbreviations**

ACK - Acknowledge

BER - Bit Error Rate

BW - Bandwidth

CO - Central Office

CPE - Customer Premises Equipment

CRC - Cyclic Redundancy Check

FCS - Frame Check Sequence

FEC - Forward Error Correction

EFM - Ethernet First Mile

EPON - Ethernet Passive Optical Network

GMII - Gigabit Media Independent Interface

LAN - Local Area Network

LLID - Logical Link Identifier

MAC - Media Access Control

Mbps - Mega-bit per second

MDI - Medium Dependent Interface

MDIO - Management Data Input/Output

MPCP - Multi-Point Control Protocol





MP2PE - Multi-Point to Point Emulation

OAM - Operation Administration Maintenance

OLT - Optical Line Terminal (Server unit of the EPON)

OMP - Optical Multi-Point

ONU - Optical Network Unit (Client unit of the EPON)

P2PE - Point to Point Emulation

P2MP - Point to Multi-Point

PCS - Physical Coding Sublayer

PHY - Physical Layer

PMD - Physical Medium Dependent

PMA - Physical Medium Attachment

PON - Passive Optical Network

RTT - Round Trip Time

RS - Reconciliation Sublayer

SLA - Service Level Agreement

SLD - Start of LLID Delimiter

TDM - Time Division Multiplexing

TQ - Time Quanta

## **1.2. EPON architecture highlights**

### **1.2.1. Introduction**

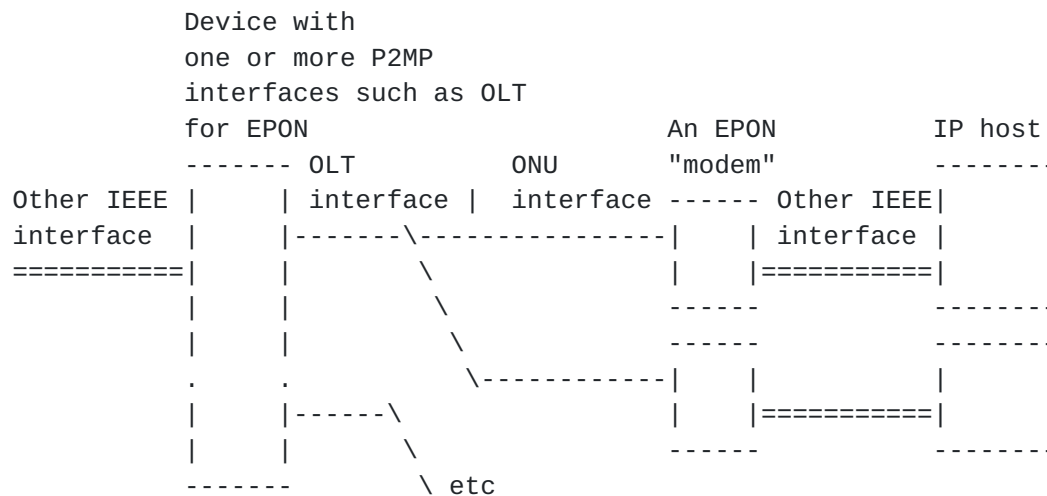
The EPON standard, as defined in [[802.3ah](#)], is defining the physical media (Layer 1) and media access (layer 2) of the EPON interface. The EPON is a variant of the Gigabit Ethernet protocol for the Optical Access. The Optical Access topology is based on passive optical splitting topology. The link of a Passive Optical Network (PON) is based on a single, shared optical fiber with passive optical splitters dividing the single fiber into separate subscribers.



The Optical Line Terminal (OLT) is the server unit of the network, located at the Central Office (CO).

The Optical Network Unit (ONU) is the client unit of the network, located at the Customer Premises Equipment (CPE).

The following diagram describes the PON topology:



The IEEE layering architecture of an EPON interface is defined in the diagram of figure 56.2 [802.3ah]. The following clauses in the [802.3ah] define the corresponding layers of an EPON interface:

Clause 30 - management

Clause 60 - PMD for EPON media (Burst PMD)

Clause 64 - MPCP (Multipoint control protocol) - defines the multipoint architecture, and control protocol for the media access of EPON.

Clause 65 -

a) Virtual links definition for the EPON

b) FEC

c) PMA for the EPON.



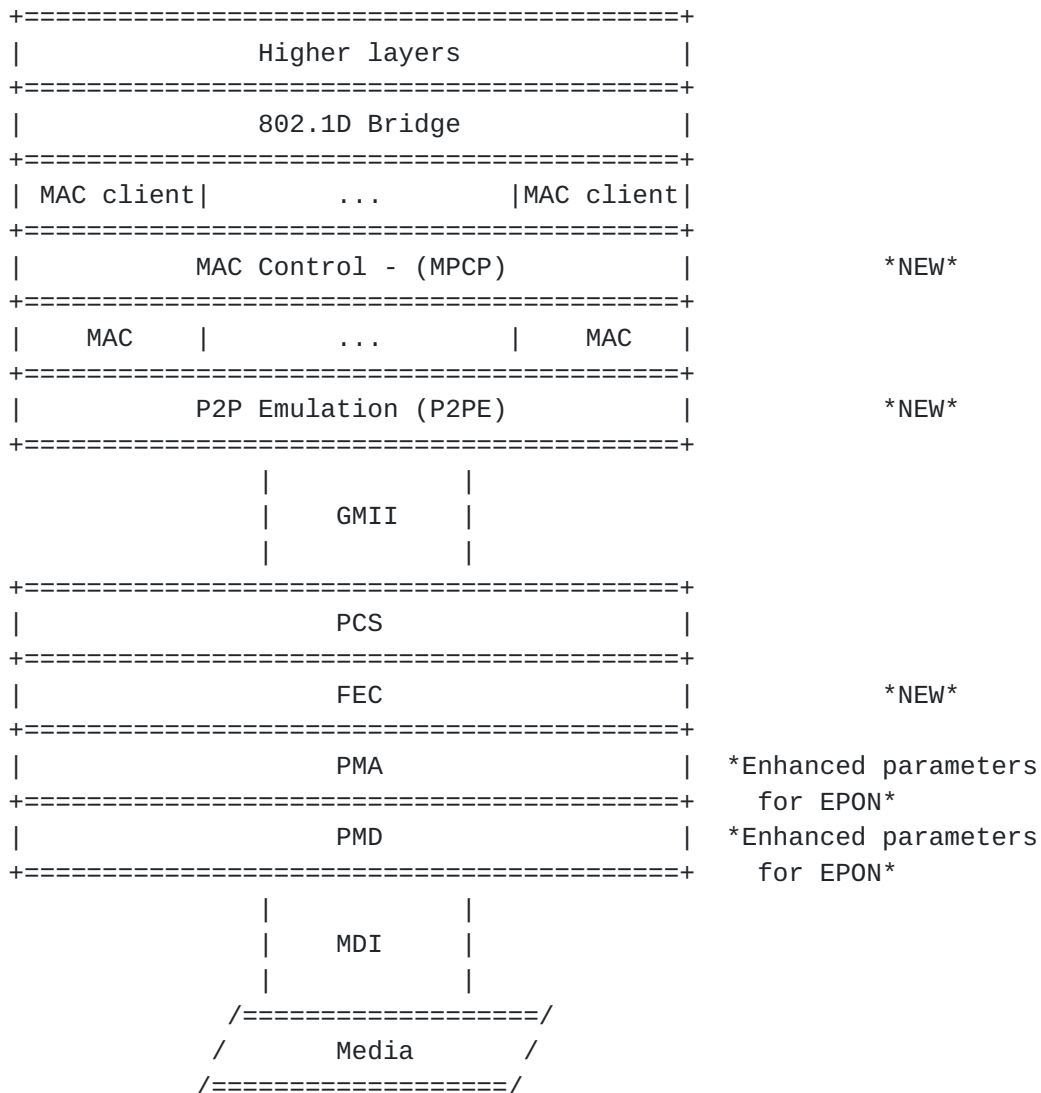
### **1.2.2. Principles of operation**

The specification of the EPON interface is based on the specification of the gigabit Ethernet interface as described in [[802.3](#)] clause 35 and 36. The Ethernet MAC is working in gigabit rate. The media interface to the MAC is through the GMII interface as described in clause 35 and the PCS layer is based on the gigabit Ethernet PCS as described in clause 36. The special EPON layers are added to the Ethernet layering in the following places:

The MPCP is placed in the MAC control layer, providing the EPON control protocol. The Emulation layer, located at the RS (Reconciliation Sublayer), creates virtual private path to each ONU. The FEC layer is located between the PCS and PMA layers, enhancing reach and split performance of the optical link.



The following diagram describes the layering model of an EPON interface:



### [1.2.3.](#) The physical media

The physical link is a fiber optical link. The OLT and ONUs are connected through passive optical splitters. Downlink denotes the transmission from the OLT to the ONUs. Uplink denotes the transmission from the ONUs to the OLT. Uplink and downlink are multiplexed using separated wavelengths on the same fiber. The downlink is a broadcast medium where the OLT transmits the data to all ONUs. The uplink is a shared transmission medium for all of the ONUs. The uplink access is based on time division multiplexing (TDM)





and the management of the TDM media access is defined by the Multi-Point control protocol (MPCP). The MPCP is a control protocol based on an inband packet messaging. The OLT sends control messages (GATE messages) allowing ONUs to transmit, defining when the transmission occurs and what is its duration. These messages define the transmission order and the amount of BW for each ONU. A scheduling algorithm at the OLT, which is not defined in the [802.3ah], is responsible of allocating the BW and controlling the delay of each ONU according to its SLA.

#### **1.2.4. PMD specifications**

The same optical wavelength plan as the [ITU-T G.983] is selected. The transceivers are derivatives of existing Ethernet optical transceivers, with dual wavelength on a single fiber and extended burst capabilities for the uplink. The uplink burst capability is the burst transmission functionality for the ONUs and burst reception functionality for the OLT. The [802.3ah] selected very relaxed burst parameters to reduce the device cost of EPON products.

#### **1.2.5. Point to point emulation**

The downstream is a broadcast link meaning the OLT transmission is shared for all ONUs. The sharing of the transmission of the OLT has some negative privacy aspects, and should be limited to broadcast traffic in nature only. The traffic dedicated to each ONU should not be shared. The solution provided by the [802.3ah] is to partition the EPON link, in a virtual manner, between the ONUs. Each ONU has a dedicated virtual link to the OLT. The [802.3ah] also defines an additional link for broadcast transmission. The medium becomes an aggregation of point-to-point tunnels. The OLT can not preserve its EPON interface as a single interface connected to N devices (following the properties of the physical interface). The EPON interface of the OLT is partitioned into separate virtual interfaces, an interface for each virtual link. Hence the OLT behaves like a device with N virtual ports (and an additional port for the broadcast transmission). The additional single-copy-broadcast channel (tagged as all ones LLID) is added to allow the broadcast transmission within a single copy to all ONUs, preserving the inherent advantage of BW efficiency of the PON shared media. The ONUs filter the downlink traffic which is not intended for their reception, according to the virtual link marking. An LLID tag is attached at the preamble of the Ethernet packet denoting the virtual link. The LLID marks the destination port in the downstream and source port in the upstream.

The virtual links concept is also used to avoid a violation of the [802.1d] bridging rules for peer to peer traffic in the PON. Peer to peer traffic is traffic between ONUs in the same PON. The OLT can



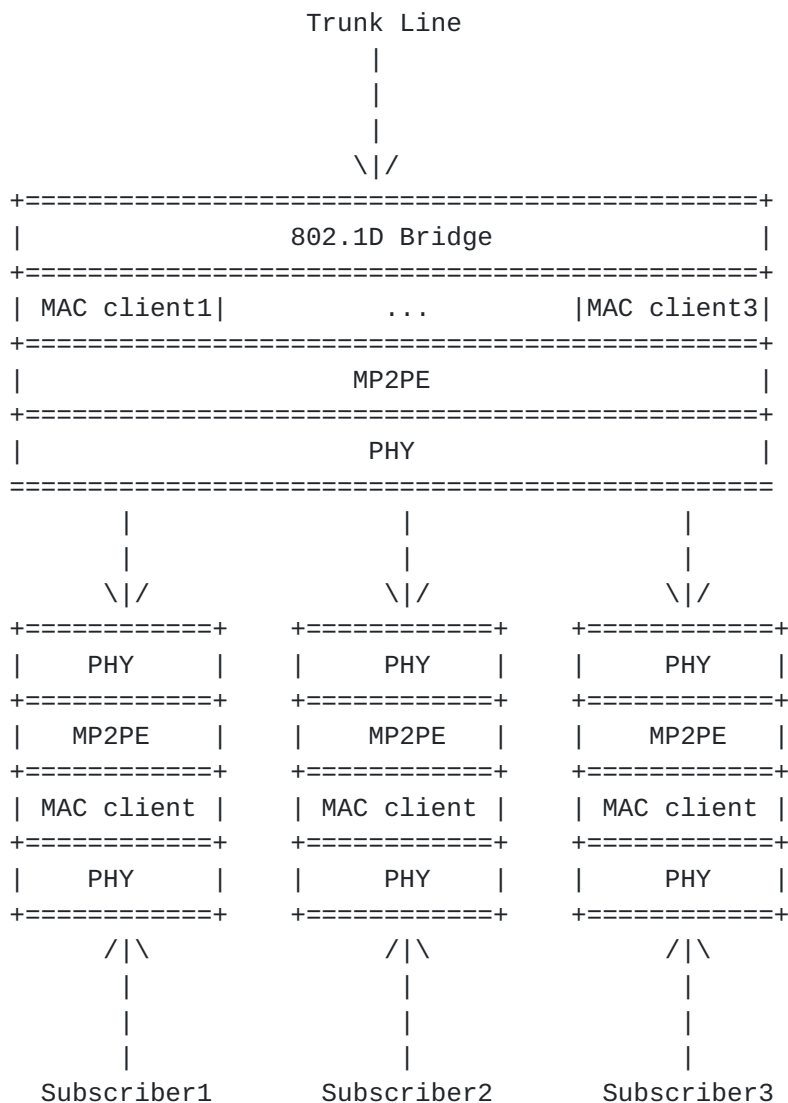
not preserve the EPON interface as a single interface connected to N devices and allow traffic between these devices without violating the bridging rules. The source address and destination address of the peer to peer traffic are behind the same port and therefore the traffic should be discarded. The separation of the ONUs into virtual links solves this issue. The OLT has N virtual ports for the single physical EPON port. A bridge sees a single MAC Client for every link pair.

The private paths concept solves the networking problems and it provides subscriber isolation.

As the tunneling is only a virtual tunneling, there is a single physical interface and a single physical layer for the device so that some attributes are shared. For example, the interface has a single local MAC address.

The virtual tunneling for an OLT with 3 ONUs, is illustrated in the following diagram.





#### 1.2.6. Principles of the MPCP

The EPON standard defines a media access control of an optical Access network. The Access network has some substantial differences from the legacy LAN which the Ethernet was designed for. The differences mainly lie in the provisioning of the network. An Access network is an administrated environment, with an operator providing the service and subscribers consuming it. The operator is controlling the network and managing its traffic. For instance BW is controlled and subscribers are billed for services. The MPCP protocol divides the Ethernet interfaces into two unequal types of network units. The first interface is an OLT interface, which is a server unit, controlling the network. The second interface is an ONU interface, which is a client unit, participating in the network.



The OLT, which is the server unit, manages the network. The MPCP controls the TDM transmission of the uplink. The MPCP is implemented at the MAC control layer and the MPCP messages are MAC control messages using the 0x8808 Ethertype. These messages are not forwarded out of the MAC.

A concept of time must exist in the protocol in order to schedule the uplink transmission. A timestamp which is set by the OLT and synchronized between the network units is passed through the MPCP messages. The timestamp is also used to measure the RTT of each ONU. RTT is compensated by the OLT, in the generation of the grants for the uplink transmission. The difference of incoming timestamp to local time allows the OLT to calculate the RTT. RTT compensation is needed as the RTT in an Access network can have a significant value. The standard allows the network to reach a 20km distance which is equivalent to a 200usec RTT (25Kbytes of data).

The TDM control is done using the GATE messages. These messages define, for each ONU, the time for transmission and the length of transmission. The RTT is reduced from the transmission time in the GATE message to shift the transmission time of the ONU in the opposite direction.

A scheduling algorithm at the OLT, which is not defined in the [\[802.3ah\]](#), is responsible for dividing the BW and controlling the transmission delay of each ONU according to its SLA. The MPCP defines a closed loop operation, in order for this algorithm to be efficient. The MPCP allows the ONUs to report on the amount of BW they require for transmission using a special REPORT message. This allows allocating BW to an ONU only when requested, relying on the statistical burst property of the traffic, allowing different peak BW for different ONUs at different times, hence allowing oversubscription of the BW. The REPORT message reports the amount of data waiting in the ONU queues.

In addition to that the MPCP defines a protocol of auto-discovery and registration of ONUs.





The registration process is defined in the diagram below:



A new ONU requests to register (sends a REG\_REQUEST message) in a special discovery grant, allocated for that by the OLT. During that time more than one ONU might try to register. A collision in transmission might occur as the RTT of the new ONUs is not yet known. A random backoff mechanism of the transmission is used to schedule the following registration requests to avoid these collisions. When the OLT receives REG\_REQUEST message of an ONU and approves this ONU then it sends a REGISTER message to this ONU defining its LLID. From that point the ONU transmission is scheduled by its LLID, knowing the RTT, and no collision can occur. The ONU replies with a REGISTER\_ACK message and the registration process of the MPCP ends. Higher layer protocols may yet be needed to authenticate the ONU and allow it to participate in the network.



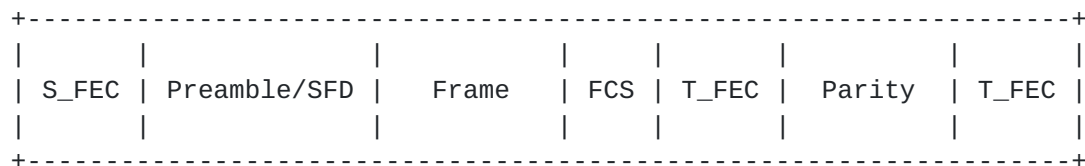
### **1.2.7. Forward Error correction (FEC)**

The FEC is defined to enhance the link budget of the PON. As each splitter attenuates the optical signal, the number of the splits and the distance are limited by the link budget. Hence an FEC which improves the link budget, has a benefit. The FEC code used is the RS(239,255,8), similar to the FEC code in [ITU-T G.975], improving the BER from  $1E-4$  to  $1E-12$ .

The FEC parity encapsulation is based on the framing of the Ethernet packet. The Ethernet packets are spaced by MAC rate adaptation, and the parity bytes are inserted after the packet, in the provided space.

As the start and end of packet codewords define also the FEC boundaries, and they are outside the FEC protection, they are replaced by a series of symbols to reduce their vulnerability to errors.

The following diagram presents an FEC protected frame:



The FEC is added in a separate layer between the PCS and PMA layers of the [802.3].

The FEC layer introduces a fixed delay in receive path and transmit path.

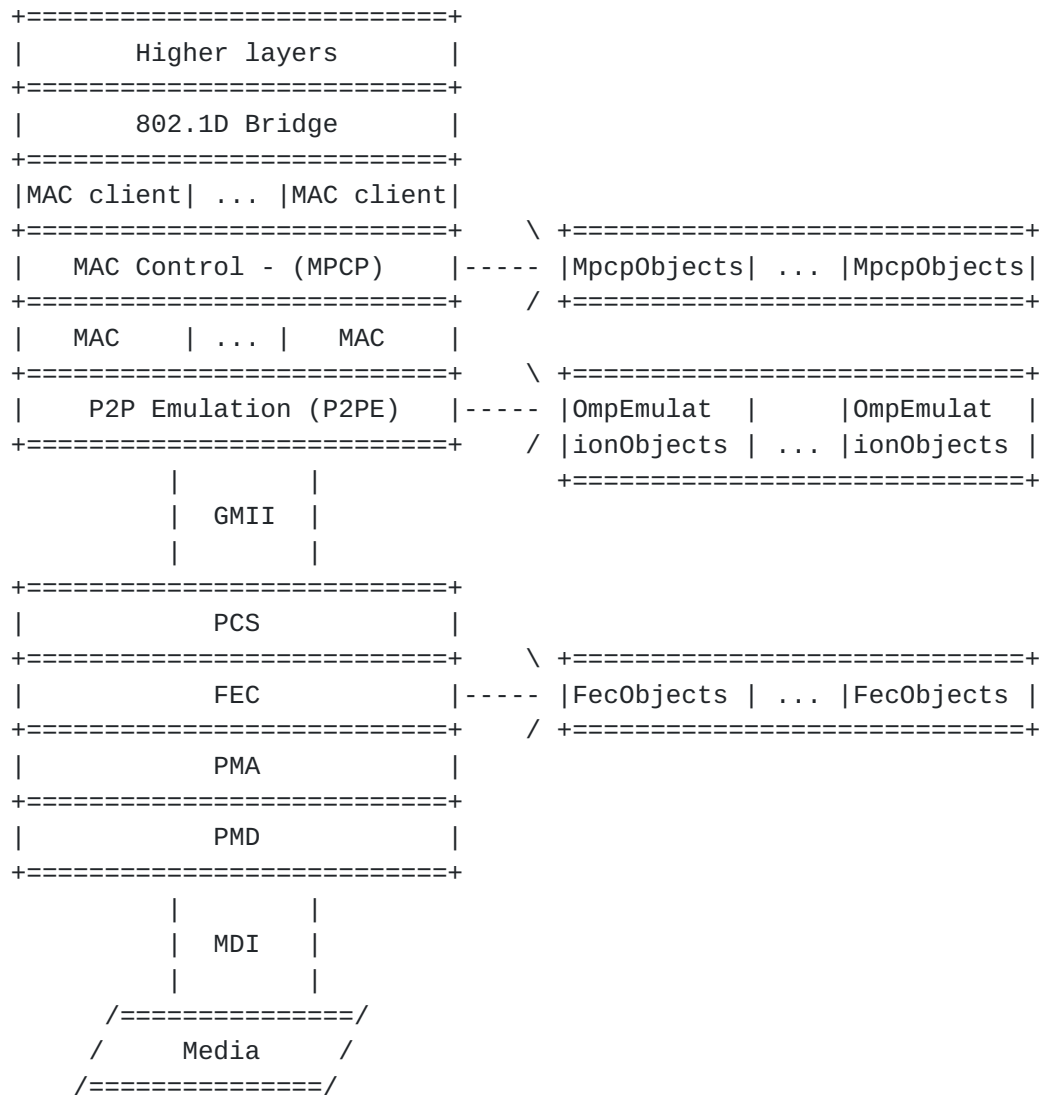
The FEC layer is optional.

### **1.3. Management architecture**

Each one of the EPON layers is accompanied with a management interface, which is controlled through clause 30 of the [802.3ah]. As the [802.3ah] spec may be used for different applications and some of the clauses may be used separately, the IEEE management clause allocates for each one of them a separate package. The MIB document follows this partition.



The following diagram presents the relation of the MIB groups to the [802.3ah] layers:



The association is strait forward for the ONU interface. There is one logical and one physical interface and a single copy exists for each layer, that can be remotely queried by the OLT.

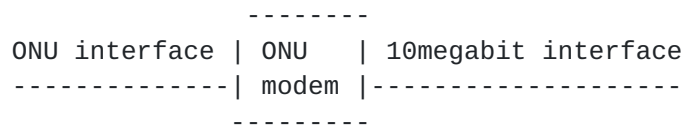
At the OLT there is a single physical interface and N virtual interfaces for the virtual links of the ONUs (and another virtual interface for the broadcast virtual link). As can be seen from the layering diagram above, the MAC layer is virtually duplicated.



Therefore in this document it was selected that the management of a virtual interface is like a physical interface and an interface index is allocated for each one of the virtual links and an additional interface index is allocated for the OLT.

To illustrate the interface modeling, consider two devices. The first device has two physical interfaces, is typically located at a consumer's site, and called an "ONU modem".

An "ONU modem" is shown in the figure below:



This device would have 3 entries in the IF table, and one IF stack entry, for example:

ifIndex=1 - interface for 10megabit interface

ifIndex=2 - interface for the optical interface

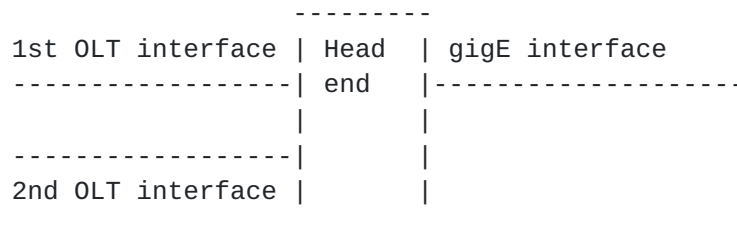
ifIndex=200 - interface for the ONU interface

And then in IF stack table:

ifStackHigherLayer=200, ifStackLowerLayer=2 - map between the physical and the ONU

The second device has three physical interfaces, is typically located at the provider's site, and may be called a "headend".

A "headend" is shown in the figure below:







This device would have 5 entries (when no attached ONUs) in the IF table, for example:

ifIndex=1 - interface for gigE interface

ifIndex=2 - interface for 1st optical interface

ifIndex=3 - interface for 2nd optical interface

ifIndex=265535 - interface for the 1st OLT broadcast interface

ifIndex=365535 - interface for the 2nd OLT broadcast interface

And then in IF stack table:

ifStackHigherLayer=265535, ifStackLowerLayer=2 - map between the 1st physical and its broadcast interface

ifStackHigherLayer=365535, ifStackLowerLayer=3 - map between the 2nd physical and its broadcast interface

If two ONUs connected to the first OLT interface, then for example, the following entries would be added to the IF table:

ifIndex=200001 - interface for the 1st ONU of 1st OLT

ifIndex=200002 - interface for the 2nd ONU of 1st OLT

And in the IF stack table:

ifStackHigherLayer=200001, ifStackLowerLayer=2 - map between the 1st physical and 1st ONU

ifStackHigherLayer=200002, ifStackLowerLayer=2 - map between the 1st physical and 2nd ONU

For each physical interface, there would be an entry (ifIndex) in the tables of the interface MIB module [[RFC2863](#)], MAU MIB module [[RFC3636](#)] and Etherlike MIB module [[RFC3635](#)]. Additionally, there would be entries (ifIndexes) for the virtual interfaces of the OLT interface. The justification for the additional allocation of indexes is that the virtual interfaces are quite well distinguished as they connect different physical ONUs, from the OLT side. For instance there is a meaning for separate bad frames counter or bad octets counter for each virtual link, as the ONUs can be differently distanced. This is quite similar to a case of separate physical interfaces.



The same partition concept exists for the MIB module of this document. Each row in the tables is indexed according to the ifIndex and specifically there is a row for each virtual link. There are some control objects which are shared and are the same for the virtual interfaces (and they should have the same value for each ifIndex) but most of the objects have different values for N+1 logical interfaces at the OLT. This is done for each MIB group. It is a bit different from the [\[802.3ah\]](#) layering diagram which presents the P2MP layer as a single layer while duplicating the MAC and MAC client layers (Please see the diagram above). However from management perspective it is more convenient and neat to partition the management of the layers for the virtual links, as the atomic managed entity is the virtual link. It is also convenient to use the interface index of the virtual link for that purpose, as it is already used to index the rows of the virtual links at the Interface, MAU and etherLike interfaces MIBs.



## 2. MIB structure

This document defines the DOT3 EPON MIB module. The DOT3 EPON MIB module defines the objects used for management of the [\[802.3ah\]](#) Point to Multipoint (P2MP) interfaces. These MIB objects are included in four groups.

i) The Multi-Point Control Protocol (MPCP) MIB objects - MIB objects related to [\[802.3ah\]](#) clause 64 Multi Point Control Protocol attributes. The following tables are presented in this group:

The dot3MpcpControlTable defines the objects used for the configuration and status indication, which are per logical link, of MPCP compliant interfaces.

The dot3MpcpStatTable defines the statistics objects, which are per logical link, of MPCP compliant interfaces.

The operational mode of an OLT/ONU for the tables is defined by the dot3MpcpMode object in the dot3MpcpControlTable.

ii) The OMPEmulation MIB objects - MIB objects related to [\[802.3ah\]](#) clause 65 point to point emulation attributes. The following tables are presented in this group:

The dot3OmpEmulationTable defines the objects used for the configuration and status indication, which are per logical link, of OMPEmulation compliant interfaces.

The dot3OmpEmulationStatTable defines the statistics objects which are per logical link, of OMPEmulation compliant interfaces.

The operational mode of an OLT/ONU for the tables is defined by the dot3OmpEmulationType object in the dot3OmpEmulationTable.

iii) The FEC MIB objects - MIB objects related to [\[802.3ah\]](#) clause 60 and clause 65 EPON FEC attributes. The following table is presented in this group:

The dot3EponFecTable defines the objects used for the configuration and status indication, which are per logical link, of FEC EPON compliant interfaces.

iv) The EPON extended package MIB objects - MIB objects used for configuration and status indication with extended capabilities of the



EPON interfaces. The following tables are presented in this group:

The dot3ExtPkgControlTable defines the objects which are per logical link, used for the configuration and status indication of EPON compliant interfaces.

The dot3ExtPkgQueueTable defines the objects which are per logical link, and per queue, used for the configuration and status indication of the ONU queues reported in the MPCP REPORT message, of EPON compliant interfaces.

The dot3ExtPkgQueueSetsTable defines the objects which are per logical link, per queue, and per queue\_set, used for the configuration and status indication of the ONU queue\_sets reported in the MPCP REPORT message, of EPON compliant interfaces.

The dot3ExtPkgOptIfTable defines the objects which are per logical link, used for the control and status indication of the optical interface of EPON compliant interfaces.

As described in the architecture section, each row in the tables is indexed according to the ifIndex, and specifically there is a row for each virtual link. There are a few control objects which are shared and have the same value for the virtual interfaces (and they should have the same value for each ifIndex) but most of the objects have different values for N+1 logical interfaces at the OLT. This is done for each MIB group. It is a bit different from the [\[802.3ah\]](#) layering diagram which presents the P2MP layer as a single layer while duplicating the MAC and MAC client layers. However from management perspective it is more convenient and neat to partition the management of the layers for the virtual links, as the atomic managed entity is the virtual link. It is also convenient to use the interface index of the virtual link for that purpose, as it is already used to index the rows of the virtual links at the Interface, MAU and etherLike interfaces MIBs.

For example provided below the values of the MPCP control table of an OLT with 3 registered ONUs:





The table below presents the MPCP control table of ONU1 in working mode. A single row exists in the table.

MPCP control MIB object	Value
ifIndex	100
dot3MpcpOperStatus	true
dot3MpcpAdminState	true
dot3MpcpMode	onu
dot3MpcpSyncTime	25
dot3MpcpLinkID	1
dot3MpcpRemoteMACAddress	OLT_MAC_Address
dot3MpcpRegistrationState	registered
dot3MpcpTransmitElapsed	10
dot3MpcpReceiveElapsed	10
dot3MpcpRoundTripTime	100

Table 1

OLT\_MAC\_Address is the MAC address of the OLT EPON interface.

The creation of the rows of the ONU interface is done at initialization.

For example, provided below are the values for the MPCP control table of the ONU, after initialization, before registration.



The table below presents the MPCP control table of ONU1 after initialization. A single row exists in the table.

MPCP control MIB object	Value
ifIndex	100
dot3MpcpOperStatus	true
dot3MpcpAdminState	true
dot3MpcpMode	onu
dot3MpcpSyncTime	0
dot3MpcpLinkID	0
dot3MpcpRemoteMACAddress	00:00:00:00:00:00
dot3MpcpRegistrationState	unregistered
dot3MpcpTransmitElapsed	0
dot3MpcpReceiveElapsed	0
dot3MpcpRoundTripTime	0

Table 2



The table below presents the MPCP control table of the OLT in working mode. Four rows exist in the table associated with the virtual links.

MPCP control MIB object	Value	Value	Value	Value
ifIndex	100001	100002	100003	165535
dot3MpcpOperStatus	true	true	true	true
dot3MpcpAdminState	true	true	true	true
dot3MpcpMode	olt	olt	olt	olt
dot3MpcpSyncTime	25	25	25	25
dot3MpcpLinkID	1	2	3	65535
dot3MpcpRemoteMACAddress	ONU1_MAC_Address	ONU2_MAC_Address	ONU3_MAC_Address	BRCT_MAC_Address
dot3MpcpRegistrationState	registered	registered	registered	registered
dot3MpcpTransmitElapsed	10	10	10	10
dot3MpcpReceiveElapsed	10	10	10	10
dot3MpcpRoundTripTime	100	60	20	0

Table 3

ONU1\_MAC\_Address is the MAC address of ONU1 EPON interface.

ONU2\_MAC\_Address is the MAC address of ONU2 EPON interface.

ONU3\_MAC\_Address is the MAC address of ONU3 EPON interface.

BRCT\_MAC\_Address is the MAC address of the broadcast EPON interface,



which is the OLT MAC address.

The creation of the rows of the OLT interface and the broadcast virtual interface is done at initialization.

The creation of rows of the virtual interfaces at the OLT is done when the link is established (ONU registers) and the deletion is done when the link is deleted (ONU deregisters).

For example, provided below are the values of the MPCP control table of the OLT after initialization, before the ONUs register.

The table below presents the MPCP control table of the OLT after initialization. A single row exists in this table associated with the virtual broadcast link.

+-----+-----+	
MPCP control MIB object	Value
+-----+-----+	
ifIndex	165535
dot3MpcpOperStatus	true
dot3MpcpAdminState	true
dot3MpcpMode	olt
dot3MpcpSyncTime	25
dot3MpcpLinkID	65535
dot3MpcpRemoteMACAddress	BRCT_MAC_Address
dot3MpcpRegistrationState	registered
dot3MpcpTransmitElapsed	10
dot3MpcpReceiveElapsed	100000
dot3MpcpRoundTripTime	0
+-----+-----+	

Table 4

BRCT\_MAC\_Address is the MAC address of the broadcast EPON interface, which is the OLT MAC address.





### **3. Relation to other MIB Modules**

#### **3.1. Relation to the Interfaces MIB and Ethernet-like Interfaces MIB**

EPON interface is a kind of Ether-like interface. This MIB module extends the objects of the Interface MIB and the Ether-like interfaces MIB for an EPON type interface.

Implementing this module therefore MUST require implementation of the Interfaces MIB module [[RFC2863](#)] and the Ethernet-like Interfaces MIB module [[RFC3635](#)].

Thus, each managed EPON interface would have a corresponding entry in the mandatory tables of the Ether-like MIB module found in [[RFC3635](#)], and likewise in the tables of the Interface MIB module found in [[RFC2863](#)]. Also each managed virtual EPON interface would have a corresponding entry in the mandatory tables of the Ether-like MIB module found in [[RFC3635](#)], and likewise in the tables of the Interface MIB module found in [[RFC2863](#)] with a dedicated ifIndex for this interface.

In this document there is no replication of the objects from these MIBs, so for instance the document is defining dot3MpcpRemoteMACAddress only while assuming the local MAC address object is already defined in [[RFC3635](#)].

The interface MIB module [[RFC2863](#)] defines the interface index (ifIndex). Interface Index, as specified in [[RFC2863](#)] is used in this MIB Module as an index to the EPON MIB tables. The ifIndex is used to denote the physical interface and the virtual link interfaces at the OLT. The OLT interface and the virtual link interfaces are stacked using the ifStack table defined in [[RFC2863](#)], and the ifInvStack defined in [[RFC2864](#)]. The OLT interface is the lower layer of all other interfaces associated with the virtual links.

This document defines the specific EPON objects of an ONU interface and an OLT interface. Information in the tables is per LLID. The rows in the EPON MIB tables, referring to the LLIDs are denoted with the corresponding ifIndexes of the virtual link interfaces.

Please note that each virtual interface does not have a different physical MAC address at the OLT as the physical interface is the same. It is specified in the [[802.3ah](#)] [section 64.1.2](#). The corresponding object of the Ether-like interface MIB is duplicated for all the virtual interfaces.

For example the values of the Interface MIB objects are presented in



the following tables, for an OLT with 3 registered ONUs:

The table below presents the objects of the Interface MIB of an ONU in working mode.

Interface MIB object	Value
ifIndex	1
ifDescr	"interface description"
ifType	ethernetCsmacd (6) 1000base-Px
ifMtu	MTU size (1522)
ifSpeed	10000000000
ifPhysAddress	ONU_MAC_Address
ifAdminStatus	up
ifOperStatus	Up
ifLastChange	ONUUp_time
ifInOctets	ONU_octets_number
ifInUcastPkts	ONU_unicast_frame_number
ifInNUcastPkts	ONU_non_unicast_frame_number
ifInDiscards	ONU_discard_frame_number
ifInErrors	ONU_error_frame_number
ifInUnknownProtos	ONU_unknown_frame_number
ifOutOctets	ONU_octets_number
ifOutUcastPkts	ONU_unicast_frame_number
ifOutNUcastPkts	ONU_non_unicast_frame_number
ifOutDiscards	ONU_discard_frame_number
ifOutErrors	ONU_error_frame_number



ifOutQLen	ONU_queue_frame_number	
+-----+	+-----+	+-----+

Table 5

ONU\_MAC\_Address is the MAC address of the ONU EPON interface.

The table below presents the objects of the Interface MIB of the ONU interface.

Interface MIB object	Value	
+-----+	+-----+	+-----+
ifIndex	100	
ifDescr	"interface description"	
ifType	ethernetCsmacd (6) 1000base-Px	
ifMtu	MTU size (1522)	
ifSpeed	1000000000	
ifPhysAddress	ONU_MAC_Address	
ifAdminStatus	up	
ifOperStatus	Up	
ifLastChange	up_time	
ifInOctets	ONU1_octets_number	
ifInUcastPkts	ONU1_unicast_frame_number	
ifInNUcastPkts	ONU1_non_unicast_frame_number	
ifInDiscards	ONU1_discard_frame_number	
ifInErrors	ONU1_error_frame_number	
ifInUnknownProtos	ONU1_unknown_frame_number	
ifOutOctets	ONU1_octets_number	
ifOutUcastPkts	ONU1_unicast_frame_number	
ifOutNUcastPkts	ONU1_non_unicast_frame_number	



ifOutDiscards	ONU1_discard_frame_number	
ifOutErrors	ONU1_error_frame_number	
ifOutQLen	ONU1_queue_frame_number	
+-----+	+-----+	+-----+

Table 6

ONU\_MAC\_Address is the MAC address of the ONU EPON interface.

The following values will be set in the ifStack and ifInvStack tables related to this example.

ifStackTable:

ifStackHigherLayer=100, ifStackLowerLayer=1 - map between the physical interface and the ONU

ifInvStackTable:

ifStackLowerLayer=1, ifStackHigherLayer=100,- map between the ONU and the physical interface

The table below presents the Interface MIB objects of an OLT interface.

+-----+	+-----+	+-----+
Interface MIB object	Value	
+-----+	+-----+	+-----+
ifIndex	2	
ifDescr	"interface description"	
ifType	ethernetCsmacd (6) 1000base-Px	
ifMtu	MTU size (1522)	
ifSpeed	10000000000	
ifPhysAddress	OLT_MAC_Address	
ifAdminStatus	up	
ifOperStatus	Up	
ifLastChange	OLTup_time	





ifInOctets	OLT_octets_number	
ifInUcastPkts	OLT_unicast_frame_number	
ifInNUcastPkts	OLT_non_unicast_frame_number	
ifInDiscards	OLT_discard_frame_number	
ifInErrors	OLT_error_frame_number	
ifInUnknownProtos	OLT_unknown_frame_number	
ifOutOctets	OLT_octets_number	
ifOutUcastPkts	OLT_unicast_frame_number	
ifOutNUcastPkts	OLT_non_unicast_frame_number	
ifOutDiscards	OLT_discard_frame_number	
ifOutErrors	OLT_error_frame_number	
ifOutQLen	OLT_queue_frame_number	
+-----+	+-----+	+-----+

Table 7

OLT\_MAC\_Address is the MAC address of the OLT EPON interface.

The table below presents the Interface MIB objects of an OLT interface, associated with the virtual link interfaces.

+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
Interfac	Value	Value	Value	Value	
eMIB					
object					
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
ifIndex	200001	200002	200003	265535	
ifDescr	"interface	"interface	"interface	"interface	
	description	description	description	description"	
	"	"	"		
ifType	ethernetCsm	ethernetCsm	ethernetCsm	ethernetCsm	
	acd (6)	acd (6)	acd (6)	cd (6)	
ifMtu	MTUsize(152	MTUsize(152	MTUsize(152	MTUsize(1522	
	2)	2)	2)	)	



ifSpeed	10000000000	10000000000	10000000000	10000000000
ifPhysAddress	OLT_MAC_Address	OLT_MAC_Address	OLT_MAC_Address	OLT_MAC_Address
ifAdminStatus	up	up	up	up
ifOperStatus	Up	Up	Up	Up
ifLastChange	ONU1_up_time	ONU2_up_time	ONU3_up_time	up_time
ifInOctets	ONU1_octets_number	ONU2_octets_number	ONU3_octets_number	BRCT_octets_number
ifInUcastPkts	ONU1_unic_frame_num	ONU2_unic_frame_num	ONU3_unic_frame_num	BRCT_unic_frame_num
ifInNUcastPkts	ONU1_non_unic_frame_num	ONU2_non_unic_frame_num	ONU3_non_unic_frame_num	BRCT_non_unic_frame_num
ifInDiscards	ONU1_disc_frame_num	ONU2_disc_frame_num	ONU3_disc_frame_num	BRCT_disc_frame_num
ifInErrors	ONU1_err_frame_num	ONU2_err_frame_num	ONU3_err_frame_num	BRCT_err_frame_num
ifInUnknownProtos	ONU1_unknw_frame_num	ONU2_unknw_frame_num	ONU3_unknw_frame_num	BRCT_unknw_frame_num
ifOutOctets	ONU1_octets_number	ONU2_octets_number	ONU3_octets_number	BRCT_octets_number
ifOutUcastPkts	ONU1_unic_frame_num	ONU2_unic_frame_num	ONU3_unic_frame_num	BRCT_unic_frame_num
ifOutNUcastPkts	ONU1_non_unic_frame_num	ONU2_non_unic_frame_num	ONU3_non_unic_frame_num	BRCT_non_unic_frame_num
ifOutDiscards	ONU1_disc_frame_num	ONU2_disc_frame_num	ONU3_disc_frame_num	BRCT_disc_frame_num



ifOutErr	ONU1_err_fr	ONU2_err_fr	ONU3_err_fr	BRCT_err_fra	
ors	ame_num	ame_num	ame_num	me_num	
ifOutQLe	ONU1_queue_	ONU2_queue_	ONU3_queue_	BRCT_queue_f	
n	frame_num	frame_num	frame_num	rame_num	
+-----+	+-----+	+-----+	+-----+	+-----+	+

Table 8

OLT\_MAC\_Address is the MAC address of the OLT EPON interface.

The following values will be set in the ifStack and ifInvStack tables related to this example:

ifStackTable:

ifStackHigherLayer=265535, ifStackLowerLayer=2 - map between the OLT physical interface and its broadcast virtual interface

ifStackHigherLayer=200001, ifStackLowerLayer=2 - map between the OLT physical interface and its virtual interface of the 1st ONU

ifStackHigherLayer=200002, ifStackLowerLayer=2 - map between the OLT physical interface and its virtual interface of the 2nd ONU

ifStackHigherLayer=200003, ifStackLowerLayer=2 - map between the OLT physical interface and its virtual interface of the 3rd ONU

ifInvStackTable:

ifStackLowerLayer=2, ifStackHigherLayer=265535, - map between the broadcast interface of the OLT and the OLT physical interface

ifStackLowerLayer=2, ifStackHigherLayer=200001 - map between the OLT virtual interface of the 1st ONU and the OLT physical interface

ifStackLowerLayer=2, ifStackHigherLayer=200002 - map between the OLT virtual interface of the 2nd ONU and the OLT physical interface

ifStackLowerLayer=2, ifStackHigherLayer=200003 - map between the OLT virtual interface of the 3rd ONU and the OLT physical interface

The rows for the ONU interface, for the OLT interface and for the OLT broadcast interface are created in initialization.

The creation of a row for a virtual link is done when the virtual link is established (ONU registers) and deletion is done when the



virtual link is deleted (ONU deregisters).

The EPON MIB module also extends the Interface MIB module with a set of counters, which are specific for the EPON interface. The EPON MIB module implements the same handling of the counters when the operation of the interface starts or stops. The interface MIB document describes the possible behavior of counters when an interface is re-initialized using the `ifCounterDiscontinuityTime` indicator, indicating the discontinuity of the counters. Please see [\[RFC2863\] section 3.1.5](#) p.11 for more information. The counters of the EPON MIB should be handled in a similar manner.

### **3.2. Relation to the IEEE 802.3 MAU MIBs**

The MAU types of the EPON Interface are defined in the amended MAU MIB document. This document assumes the implementation of the MAU MIB for this purpose and does not repeat the EPON MAU types. Therefore implementing this module MUST require implementation of the MAU-MIB module [\[RFC3636bis-03\]](#).

The handling of the `ifMAU` tables for the EPON case is similar to the handling described in the former section for the Interface and Ether-like interface MIBs. A single row exists for the ONU in the `ifMauTable`. A row for each virtual link (N+1 rows) exists at the OLT, with a separate value of `ifMauIfIndex` for each virtual link.

As specified above the rows for the ONU interface, for the OLT interface and for the OLT broadcast interface are created in initialization.

The creation of a row for a virtual link is done when the virtual link is established (ONU registers) and deletion is done when the virtual link is deleted (ONU deregisters).

### **3.3. Relation to the EFM OAM MIB**

The EPON interfaces are aimed to the optical access networks and most probably will be accompanied with the implementation of the OAM section of the [\[802.3ah\]](#). Therefore the EFM OAM MIB module [\[I-D.ietf-hubmib-efm-mib\]](#) MAY be implemented, when this MIB module is implemented, defining managed objects for the OAM layer that are complementary to the EFM EPON MIB module. As the OAM is defined for a point to point link it is implemented in this case, using the virtual links which are defined for the P2MP network, so that an instance is held for each Logical link (LLID) of the EPON. The corresponding `ifIndex` of the virtual link is used as the `ifIndex` of the tables of the OAM MIB module, for this purpose.





### **3.4. Relation to the bridge MIB**

It is very probable that an EPON OLT will implement a bridging functionality above the EPON interface layer, bridging between the EPON users and the network. Bridge functionality is specified at [\[802.1d\]](#). In this scenario the virtual ports of the EPON are corresponding to the virtual bridge ports. There is a direct mapping between the bridge ports and the LLIDs, which are virtual EPON channels.

Therefore the bridge MIB modules [\[RFC4188\]](#), [\[RFC1525\]](#) MAY be implemented when the EFM EPON MIB module is implemented for an EPON OLT, defining managed objects for the bridge layer.

The values of dot1dBasePortIfIndex would correspond to the ifIndex of the virtual port (1 for LLID1, 2 for LLID2,...)

The broadcast virtual EPON interface of the OLT has no direct mapping to a virtual bridge port as it is not port specific but used for broadcast traffic.



#### 4. Mapping of IEEE 802.3ah Managed Objects

This section contains the mapping between the managed objects defined in this document and the attributes defined in [802.3ah] Clause 30. The tables are divided to the relevant groups.

oMPCP managed object class (30.3.5)

dot3EPON MIB module object	IEEE802.3ah attribute	Reference
ifIndex	aMPCPID	30.3.5.1.1
dot3MpcpOperStatus	aMPCPAdminState	30.3.5.1.2
dot3MpcpMode	aMPCPMode	30.3.5.1.3
dot3MpcpLinkID	aMPCPLinkID	30.3.5.1.4
dot3MpcpRemoteMACAddress	aMPCPRemoteMACAddress	30.3.5.1.5
dot3MpcpRegistrationState	aMPCPRegistrationState	30.3.5.1.6
dot3MpcpMACCtrlFramesTransmitted	aMPCPMACCtrlFramesTransmitted	30.3.5.1.7
dot3MpcpMACCtrlFramesReceived	aMPCPMACCtrlFramesReceived	30.3.5.1.8
dot3MpcpTxGate	aMPCPTxGate	30.3.5.1.9
dot3MpcpTxRegAck	aMPCPTxRegAck	30.3.5.1.10
dot3MpcpTxRegister	aMPCPTxRegister	30.3.5.1.11
dot3MpcpTxRegRequest	aMPCPTxRegRequest	30.3.5.1.12
dot3MpcpTxReport	aMPCPTxReport	30.3.5.1.13
dot3MpcpRxGate	aMPCPRxGate	30.3.5.1.14
dot3MpcpRxRegAck	aMPCPRxRegAck	30.3.5.1.15



dot3MpcpRxRegister	aMPCPRxRegister	30.3.5.1.1
		6
dot3MpcpRxRegRequest	aMPCPRxRegRequest	30.3.5.1.1
		7
dot3MpcpRxReport	aMPCPRxReport	30.3.5.1.1
		8
dot3MpcpTransmitElapsed	aMPCPTransmitElapsed	30.3.5.1.1
		9
dot3MpcpReceiveElapsed	aMPCPReceiveElapsed	30.3.5.1.2
		0
dot3MpcpRoundTripTime	aMPCPRoundTripTime	30.3.5.1.2
		1
dot3MpcpDiscoveryWindowsSent	aMPCPDiscoveryWindowsSent	30.3.5.1.2
		2
dot3MpcpDiscoveryTimeout	aMPCPDiscoveryTimeout	30.3.5.1.2
		3
dot3MpcpMaximumPendingGranularity	aMPCPMaximumPendingGranularity	30.3.5.1.2
		4
dot3MpcpAdminState	aMPCPAdminControl	30.3.5.2.1
dot3MpcpSyncTime	SyncTime	64.3.3.2

Table 9



## oOMPEmulation managed object class (30.3.7)

dot3EPON MIB module object	IEEE802.3ah attribute	Reference
ifIndex	aOMPEmulationID	30.3.7.1.1
dot30mpEmulationType	aOMPEmulationType	30.3.7.1.2
dot30mpEmulationSLDErrors	aSLDErrors	30.3.7.1.3
dot30mpEmulationCRC8Errors	aCRC8Errors	30.3.7.1.4
dot30mpEmulationGoodLLID	aGoodLLID	30.3.7.1.5
dot30mpEmulationOnuPonCastLLID	aONUPONcastLLID	30.3.7.1.6
dot30mpEmulationOltPonCastLLID	aOLTPONcastLLID	30.3.7.1.7
dot30mpEmulationBadLLID	aBadLLID	30.3.7.1.8
dot30mpEmulationBroadcastBitNotOnuLLid		
dot30mpEmulationOnuLLIDNotBroadcast		
dot30mpEmulationBroadcastBitPlusOnuLLid		
dot30mpEmulationNotBroadcastBitNotOnuLLid		

Table 10





## oMAU managed object class (30.5.1)

dot3EPON MIB module object	IEEE802.3ah attribute	Reference
dot3EponFecPCSCodingViolation	aPCSCodingViolation	30.5.1.1.1 2
dot3EponFecAbility	aFECAbility	30.5.1.1.1 3
dot3EponFecMode	aFECmode	30.5.1.1.1 4
dot3EponFecCorrectedBlocks	aFECCorrectedBlocks	30.5.1.1.1 5
dot3EponFecUncorrectableBlocks	aFECUncorrectableBl ocks	30.5.1.1.1 6
dot3EponFecBufferHeadCodingVio lation		

Table 11



## 5. Definitions - The DOT3 EPON MIB module

```
DOT3-EPON-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, mib-2, OBJECT-TYPE, Counter32,  
    Integer32, Unsigned32, Counter64
```

```
    FROM SNMPv2-SMI
```

```
    TruthValue, MacAddress
```

```
    FROM SNMPv2-TC
```

```
    ifIndex
```

```
    FROM IF-MIB
```

```
    MODULE-COMPLIANCE, OBJECT-GROUP
```

```
    FROM SNMPv2-CONF
```

```
;
```

```
dot3EponMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200611070000Z" -- November 7, 2006
```

```
    ORGANIZATION "IETF Ethernet Interfaces and Hub MIB Working  
    Group"
```

```
    CONTACT-INFO
```

```
        "WG charter:
```

```
        http://www.ietf.org/html.charters/hubmib-charter.html
```

```
        Mailing Lists:
```

```
        General Discussion: hubmib@ietf.org
```

```
        To Subscribe: hubmib-request@ietf.org
```

```
        In Body: subscribe your_email_address
```

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        Chair: Bert Wijnen
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        Tel: +972-9-9628000 Ext: 302
```

```
        E-mail: lior_khermosh@pmc-sierra.com"
```

```
DESCRIPTION
```



"The objects in this MIB module are used to manage the Ethernet in the First Mile(EFM) Ethernet Passive Optical Network(EPON) Interfaces as defined in IEEE P802.3ah clause 60,64,65.

The following reference is used throughout this MIB module:  
[[802.3ah](#)] refers to:

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 - Media Access Control Parameters, Physical Layers and Management Parameters for subscriber access networks. IEEE Std 802.3ah-2004, October 2004.

Of particular interest are Clause 64(Multi-Point Control Protocol - MPCP), Clause 65(Point to Multipoint Reconciliation Sublayer - P2MP RS), Clause 60 (Ethernet Passive Optical Network Physical Medium Dependent - EPON PMDs), Clause 30, 'Management', and Clause 45, 'Management Data Input/Output (MDIO) Interface'.

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Key abbreviations:

BER - Bit Error Rate  
BW - bandwidth  
CRC - Cyclic Redundancy Check  
EFM - Ethernet First Mile  
EPON - Ethernet Passive Optical Network  
FEC - Forward Error Correction  
LLID - Logical Link Identifier  
MAC - Media Access Control  
Mbps - Mega-bit per second  
MDIO - Management Data Input/Output  
MPCP - Multi-Point Control Protocol  
OLT - Optical Line Terminal (Server unit of the EPON)  
OMP - Optical Multi-Point  
ONU - Optical Network Unit (Client unit of the EPON)  
P2MP - Point to Multi-Point  
PHY - Physical Layer  
PMD - Physical Medium Dependent  
PON - Passive Optical Network  
RTT - Round Trip Time  
SLD - Start of LLID Delimiter  
TQ - Time Quanta



```
"

-- Editor's Note: Replace XXXX with the actual RFC number
-- assigned by RFC Editor and remove this note

REVISION      "200611070000Z" -- November 7, 2006
DESCRIPTION    "Initial version, published as RFC XXXX."

::= { mib-2 XXX }

-- Editor's Note (to be removed prior to publication): the
-- IANA is requested to assign a value for "XXX" under the
-- 'mib-2' subtree and to record the assignment in the SMI
-- Numbers registry. When the assignment has been made, the
-- RFC Editor is asked to replace "XXX" (here and in the MIB
-- module) with the assigned value and to remove this note.

dot3EponObjects OBJECT IDENTIFIER ::= { dot3EponMIB 1}

dot3EponConformance OBJECT IDENTIFIER ::= { dot3EponMIB 2}

-- MPCP MIB modules definitions ([802.3ah] clause 30.3.5)

dot3EponMpcpObjects
    OBJECT IDENTIFIER ::= { dot3EponObjects 1 }

dot3MpcpControlTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF Dot3MpcpControlEntry
    MAX-ACCESS not-accessible
    STATUS  current
    DESCRIPTION
        "A Table of dot3 Multi-Point Control Protocol (MPCP)
        MIB objects. The entries in the table are control and
        status objects of the MPCP.
        Each object has a row for every virtual link denoted by
        the corresponding ifIndex.
        The LLID field, as defined in the [802.3ah] is a 2bytes
        register (15bits field and a broadcast bit) limiting the
        number of virtual links to 32768. Typically the number
        of expected virtual links in a PON is like the number of
        ONUs, which is 32-64, plus an additional entry for
        broadcast LLID (with a value of 0xffff)."
```

```
 ::= { dot3EponMpcpObjects 1 }

dot3MpcpControlEntry OBJECT-TYPE
```





SYNTAX Dot3MpcpControlEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the dot3 MPCP Control table.

Rows exist for an OLT interface and an ONU interface.

A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created.

The rows in the table for an ONU interface are created at system initialization.

The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization.

A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

::= { dot3MpcpControlTable 1}

Dot3MpcpControlEntry ::=

SEQUENCE {

dot3MpcpOperStatus	TruthValue,
dot3MpcpAdminState	TruthValue,
dot3MpcpMode	INTEGER,
dot3MpcpSyncTime	Unsigned32,
dot3MpcpLinkID	Unsigned32,
dot3MpcpRemoteMACAddress	MacAddress,
dot3MpcpRegistrationState	INTEGER,
dot3MpcpTransmitElapsed	Unsigned32,
dot3MpcpReceiveElapsed	Unsigned32,
dot3MpcpRoundTripTime	Unsigned32,
dot3MpcpMaximumPendingGrants	Unsigned32

}

dot3MpcpOperStatus OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object reflects the operational state of the Multi-Point MAC Control sublayer, as defined in [\[802.3ah\]](#) clause 64. When the value is true(1) the interface will act as if Multi-Point control protocol is enabled. When the value is false(2) the interface will act as if the Multi-Point control protocol is disabled. The operational state can be changed using the dot3MpcpAdminState object.



This object is applicable for an OLT, with the same value for all virtual interfaces, and for an ONU."

REFERENCE "[[802.3ah](#)], 30.3.5.1.2."

::= { dot3MpcpControlEntry 1 }

#### dot3MpcpAdminState OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

##### DESCRIPTION

"This object is used to define the admin state of the Multi-Point MAC Control sublayer, as defined in [[802.3ah](#)] clause 64, and to reflect its state. When selecting the value as true(1) the Multi-Point control protocol of the interface is enabled. When selecting the value as false(2) the Multi-Point Control protocol of the interface is disabled. This object reflects the administrative state of the Multi-Point control protocol of the interface. The write operation is not restricted in this document and can be done at any time. Changing dot3MpcpAdminState state can lead to disabling the Multi-point control protocol on the respective interface leading to the interruption of service of the users connected to the respective EPON interface. This object is applicable for an OLT, with the same value for all virtual interfaces, and for an ONU."

REFERENCE "[[802.3ah](#)], 30.3.5.2.1."

DEFVAL { false }

::= { dot3MpcpControlEntry 2 }

#### dot3MpcpMode OBJECT-TYPE

SYNTAX INTEGER {

olt(1),

onu(2)

}

MAX-ACCESS read-only

STATUS current

##### DESCRIPTION

"This object is used to identify the operational state of the Multi-Point MAC Control sublayer, as defined in [[802.3ah](#)] clause 64. Reading olt(1) for an OLT (server) mode and onu(2) for an ONU (client) mode. This object is used to identify the operational mode for the MPCP tables. This object is applicable for an OLT, with the same value for all virtual interfaces, and for an ONU."



```
REFERENCE    "[802.3ah], 30.3.5.1.3."
DEFVAL { olt }
::= { dot3MpcpControlEntry 3 }
```

dot3MpcpSyncTime OBJECT-TYPE

```
SYNTAX  Unsigned32
UNITS    "TQ (16nsec)"
MAX-ACCESS  read-only
STATUS   current
DESCRIPTION
    "An object that reports the 'sync lock time' of the
    OLT receiver in increments of Time Quanta (TQ)-16ns
    as defined in [802.3ah] 60,64,65. The value returned
    shall be (sync lock time ns)/16. If this value exceeds
    (2^32-1) the value (2^32-1) shall be returned.
    This object is applicable for an OLT, with the same
    value for all virtual interfaces, and for an ONU."
REFERENCE    "[802.3ah], 64.3.3.2."
::= { dot3MpcpControlEntry 4 }
```

dot3MpcpLinkID OBJECT-TYPE

```
SYNTAX  Unsigned32
MAX-ACCESS  read-only
STATUS   current
DESCRIPTION
    "An object that identifies the Logical Link
    identifier (LLID) associated with the MAC of the virtual
    link, as specified in [802.3ah] clause 65.1.3.2.2.
    This object is applicable for an OLT and an ONU. At the
    OLT it has a distinct value for each virtual interface.
    The ONU and the corresponding virtual MAC of the OLT,
    for the same virtual link, have the same value.
    Value is assigned when the ONU registers.
    Value is freed when the ONU deregisters."
REFERENCE    "[802.3ah], 30.3.5.1.4."
::= { dot3MpcpControlEntry 5 }
```

dot3MpcpRemoteMACAddress OBJECT-TYPE

```
SYNTAX  MacAddress
MAX-ACCESS  read-only
STATUS   current
DESCRIPTION
    "An object that identifies the source_address
    parameter of the last MPCPDUs passed to the MAC Control.
    This value is updated on reception of a valid frame with
    (1) a destination Field equal to the reserved multicast
    address for MAC Control specified in [802.3] Annex
```



31A, (2) lengthOrType field value equal to the reserved Type for MAC Control as specified in [802.3] Annex 31A. (3) an MPCP subtype value equal to the subtype reserved for MPCP as specified in [802.3ah] Annex 31A. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. The value reflects the MAC address of the remote entity and therefore the OLT holds a value for each LLID which is the MAC address of the ONU and the ONU has a single value which is the OLT MAC address."

REFERENCE "[802.3ah], 30.3.5.1.5."  
::= { dot3MpcpControlEntry 6 }

dot3MpcpRegistrationState OBJECT-TYPE

SYNTAX INTEGER {  
    unregistered(1),  
    registering(2),  
    registered(3)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that identifies the registration state of the Multi-Point MAC Control sublayer as defined in [802.3ah] clause 64. When this object has the enumeration unregistered(1) the interface is unregistered and may be used for registering a link partner. When this object has the enumeration registering(2) the interface is in the process of registering a link-partner. When this object has the enumeration registered(3) the interface has an established link-partner. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

REFERENCE "[802.3ah], 30.3.5.1.6."  
::= { dot3MpcpControlEntry 7 }

dot3MpcpTransmitElapsed OBJECT-TYPE

SYNTAX Unsigned32

UNITS "TQ (16nsec)"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that reports the interval from last MPCP frame transmission in increments of Time Quanta (TQ)-16ns. The value returned shall be (interval from last MPCP frame transmission in ns)/16. If this value exceeds (2^32-1) the value (2^32-1) shall be returned."





This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

REFERENCE "[[802.3ah](#)], 30.3.5.1.19."

::= { dot3MpcpControlEntry 8 }

dot3MpcpReceiveElapsed OBJECT-TYPE

SYNTAX Unsigned32

UNITS "TQ (16nsec)"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that reports the interval from last MPCP frame reception in increments of Time Quanta (TQ)-16ns. The value returned shall be (interval from last MPCP frame reception in ns)/16. If this value exceeds ( $2^{32}-1$ ) the value ( $2^{32}-1$ ) shall be returned.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

REFERENCE "[[802.3ah](#)], 30.3.5.1.20."

::= { dot3MpcpControlEntry 9 }

dot3MpcpRoundTripTime OBJECT-TYPE

SYNTAX Unsigned32 (0..'ffff'h)

UNITS "TQ (16nsec)"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that reports the MPCP round trip time in increments of Time Quanta (TQ)-16ns. The value returned shall be (round trip time in ns)/16. If this value exceeds ( $2^{16}-1$ ) the value ( $2^{16}-1$ ) shall be returned. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

REFERENCE "[[802.3ah](#)], 30.3.5.1.21."

::= { dot3MpcpControlEntry 10 }

dot3MpcpMaximumPendingGrants OBJECT-TYPE

SYNTAX Unsigned32 (0..255)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that reports the maximum number of grants which an ONU can store for handling. The maximum number of grants which an ONU can store for handling has a range of 0 to 255.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero."



REFERENCE "[[802.3ah](#)], 30.3.5.1.24."  
::= { dot3MpcpControlEntry 11 }

dot3MpcpStatTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot3MpcpStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table defines the list of statistics counters of an interface implementing the [[802.3ah](#)] clause 64 MPCP. Each object has a row for every virtual link denoted by the corresponding ifIndex.  
The LLID field, as defined in the [[802.3ah](#)] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff)."

::= { dot3EponMpcpObjects 2 }

dot3MpcpStatEntry OBJECT-TYPE

SYNTAX Dot3MpcpStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the table of statistics counters of the [[802.3ah](#)] clause 64 MPCP interface.  
Rows exist for an OLT interface and an ONU interface. A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created.  
The rows in the table for an ONU interface are created at system initialization.  
The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization.  
A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

::= { dot3MpcpStatTable 1 }

Dot3MpcpStatEntry ::=

SEQUENCE {

dot3MpcpMACCtrlFramesTransmitted	Counter64,
dot3MpcpMACCtrlFramesReceived	Counter64,
dot3MpcpDiscoveryWindowsSent	Counter32,



dot3MpcpDiscoveryTimeout	Counter32,
dot3MpcpTxRegRequest	Counter64,
dot3MpcpRxRegRequest	Counter64,
dot3MpcpTxRegAck	Counter64,
dot3MpcpRxRegAck	Counter64,
dot3MpcpTxReport	Counter64,
dot3MpcpRxReport	Counter64,
dot3MpcpTxGate	Counter64,
dot3MpcpRxGate	Counter64,
dot3MpcpTxRegister	Counter64,
dot3MpcpRxRegister	Counter64

}

## dot3MpcpMACCtrlFramesTransmitted OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"A count of MPCP frames passed to the MAC sublayer for transmission. This counter is incremented when a MA\_CONTROL.request service primitive is generated within the MAC control sublayer with an opcode indicating an MPCP frame.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.7."

::= { dot3MpcpStatEntry 1 }

## dot3MpcpMACCtrlFramesReceived OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"A count of MPCP frames passed by the MAC sublayer to the MAC Control sublayer. This counter is incremented 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.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface.



Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.8."  
::= { dot3MpcpStatEntry 2}

dot3MpcpDiscoveryWindowsSent OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"A count of discovery windows generated. The counter is incremented by one for each generated discovery window. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the ONU the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.22."  
::= { dot3MpcpStatEntry 3}

dot3MpcpDiscoveryTimeout OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"A count of the number of times a discovery timeout occurs. Increment the counter by one for each discovery processing state-machine reset resulting from timeout waiting for message arrival. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.23."  
::= { dot3MpcpStatEntry 4}

dot3MpcpTxRegRequest OBJECT-TYPE

SYNTAX Counter64





UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "A count of the number of times a REGISTER\_REQ MPCP  
    frame transmission occurs. Increment the counter by one  
    for each REGISTER\_REQ MPCP frame transmitted as defined  
    in [[802.3ah](#)] clause 64.  
    This object is applicable for an OLT and an ONU. At the  
    OLT it has a distinct value for each virtual interface.  
    At the ONU the value should be zero.  
    Discontinuities of this counter can occur at  
    re-initialization of the management system, and at other  
    times as indicated by the value of the  
    ifCounterDiscontinuityTime object of the Interface MIB  
    module."  
REFERENCE "[[802.3ah](#)], 30.3.5.1.12."  
::= { dot3MpcpStatEntry 5}

dot3MpcpRxRegRequest OBJECT-TYPE

SYNTAX Counter64  
UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "A count of the number of times a REGISTER\_REQ MPCP  
    frame reception occurs.  
    Increment the counter by one for each REGISTER\_REQ MPCP  
    frame received as defined in [[802.3ah](#)] clause 64.  
    This object is applicable for an OLT and an ONU. At the  
    OLT it has a distinct value for each virtual interface.  
    At the ONU the value should be zero.  
    Discontinuities of this counter can occur at  
    re-initialization of the management system, and at other  
    times as indicated by the value of the  
    ifCounterDiscontinuityTime object of the Interface MIB  
    module."  
REFERENCE "[[802.3ah](#)], 30.3.5.1.17."  
::= { dot3MpcpStatEntry 6}

dot3MpcpTxRegAck OBJECT-TYPE

SYNTAX Counter64  
UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "A count of the number of times a REGISTER\_ACK MPCP  
    frame transmission occurs. Increment the counter by one



for each REGISTER\_ACK MPCP frame transmitted as defined in [802.3ah] clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface.

At the OLT the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.5.1.10."  
::= { dot3MpcpStatEntry 7}

#### dot3MpcpRxRegAck OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

##### DESCRIPTION

"A count of the number of times a REGISTER\_ACK MPCP frame reception occurs.

Increment the counter by one for each REGISTER\_ACK MPCP frame received, as defined in [802.3ah] clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface.

At the ONU the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.5.1.15."  
::= { dot3MpcpStatEntry 8}

#### dot3MpcpTxReport OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

##### DESCRIPTION

"A count of the number of times a REPORT MPCP frame transmission occurs. Increment the counter by one for each REPORT MPCP frame transmitted as defined in [802.3ah] clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface.

At the OLT the value should be zero.

Discontinuities of this counter can occur at



re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.13."  
::= { dot3MpcpStatEntry 9}

dot3MpcpRxReport OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

Increment the counter by one for each REPORT MPCP frame received, as defined in [[802.3ah](#)] clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the ONU the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.18."  
::= { dot3MpcpStatEntry 10}

dot3MpcpTxGate OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

Increment the counter by one for each GATE MPCP frame transmitted, as defined in [[802.3ah](#)] clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the ONU the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.9."  
::= { dot3MpcpStatEntry 11}



## dot3MpcpRxGate OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

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

Increment the counter by one for each GATE MPCP frame received, as defined in [\[802.3ah\]](#) clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.14."

::= { dot3MpcpStatEntry 12}

## dot3MpcpTxRegister OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

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

Increment the counter by one for each REGISTER MPCP frame transmitted, as defined in [\[802.3ah\]](#) clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the ONU the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.5.1.11."

::= { dot3MpcpStatEntry 13}

## dot3MpcpRxRegister OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION





"A count of the number of times a REGISTER MPCP frame reception occurs.  
Increment the counter by one for each REGISTER MPCP frame received, as defined in [802.3ah] clause 64.  
This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero.  
Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.5.1.16."  
::= { dot3MpcpStatEntry 14 }

-- Optical Multi Point Emulation (OMPEmulation)  
-- managed object definitions

dot30mpEmulationObjects OBJECT IDENTIFIER ::= { dot3EponObjects 2 }

dot30mpEmulationTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot30mpEmulationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of dot3 OmpEmulation MIB objects. The table contain objects for the management of the OMPEmulation sublayer.  
Each object has a row for every virtual link denoted by the corresponding ifIndex.  
The LLID field, as defined in the [802.3ah] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff)."

::= { dot30mpEmulationObjects 1 }

dot30mpEmulationEntry OBJECT-TYPE

SYNTAX Dot30mpEmulationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION



"An entry in the dot3 OmpEmulation table.  
Rows exist for an OLT interface and an ONU interface.  
A Row in the table is denoted by the ifIndex of the link  
and it is created when the ifIndex is created.  
The rows in the table for an ONU interface are created  
at system initialization.  
The row in the table corresponding to the OLT ifIndex  
and the row corresponding to the broadcast virtual link  
are created at system initialization.  
A row in the table corresponding to the ifIndex of a  
virtual links is created when a virtual link is  
established (ONU registers) and deleted when the virtual  
link is deleted (ONU deregisters)."

```
INDEX { ifIndex }  
::= { dot3OmpEmulationTable 1 }
```

```
Dot3OmpEmulationEntry ::=  
SEQUENCE {  
    dot3OmpEmulationType          INTEGER  
}
```

dot3OmpEmulationType OBJECT-TYPE

```
SYNTAX  INTEGER {  
    unknown(1),  
    olt(2),  
    onu(3)  
}
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that indicates the mode of operation  
of the Reconciliation Sublayer for Point to Point  
Emulation (see [[802.3ah](#)] clause 65.1). unknown(1) value  
is assigned in initialization, true state or type not  
yet known. olt(2) value is assigned when the sublayer is  
operating in OLT mode. onu(3) value is assigned when the  
sublayer is operating in ONU mode.

This object is applicable for an OLT, with the same  
value for all virtual interfaces, and for an ONU."

REFERENCE "[[802.3ah](#)], 30.3.7.1.2."

```
::= { dot3OmpEmulationEntry 1}
```

dot3OmpEmulationStatTable OBJECT-TYPE

```
SYNTAX  SEQUENCE OF Dot3OmpEmulationStatEntry
```

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table defines the list of statistics counters of



[802.3ah] clause 65 OMPEmulation sublayer.

Each object has a row for every virtual link denoted by the corresponding ifIndex.

The LLID field, as defined in the [802.3ah] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff)."

```
 ::= { dot3OmpEmulationObjects 2 }
```

dot3OmpEmulationStatEntry OBJECT-TYPE

SYNTAX Dot3OmpEmulationStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the table of statistics counters of [802.3ah] clause 65 OMPEmulation sublayer.

Rows exist for an OLT interface and an ONU interface.

A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created.

The rows in the table for an ONU interface are created at system initialization.

The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization.

A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

```
 ::= { dot3OmpEmulationStatTable 1 }
```

Dot3OmpEmulationStatEntry ::=

SEQUENCE {

dot3OmpEmulationSLDErrors	Counter64,
dot3OmpEmulationCRC8Errors	Counter64,
dot3OmpEmulationBadLLID	Counter64,
dot3OmpEmulationGoodLLID	Counter64,
dot3OmpEmulationOnuPonCastLLID	Counter64,
dot3OmpEmulationOltPonCastLLID	Counter64,
dot3OmpEmulationBroadcastBitNotOnuLlid	Counter64,
dot3OmpEmulationOnuLLIDNotBroadcast	Counter64,
dot3OmpEmulationBroadcastBitPlusOnuLlid	Counter64,
dot3OmpEmulationNotBroadcastBitNotOnuLlid	Counter64

}

dot3OmpEmulationSLDErrors OBJECT-TYPE



SYNTAX Counter64  
UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"A count of frames received that do not contain a valid SLD field as defined in [802.3ah] clause 65.1.3.3.1. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.7.1.3."  
::= { dot30mpEmulationStatEntry 1}

dot30mpEmulationCRC8Errors OBJECT-TYPE

SYNTAX Counter64  
UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, but do not pass the CRC-8 check as defined in [802.3ah] clause 65.1.3.3.3. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.7.1.4."  
::= { dot30mpEmulationStatEntry 2}

dot30mpEmulationBadLLID OBJECT-TYPE

SYNTAX Counter64  
UNITS "frames"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [802.3ah] clause 65.1.3.3.3, but are discarded due to the LLID check as





defined in [802.3ah] clause 65.1.3.3.2.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.7.1.8."

::= { dot30mpEmulationStatEntry 3}

#### dot30mpEmulationGoodLLID OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [802.3ah] clause 65.1.3.3.3.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[802.3ah], 30.3.7.1.5."

::= { dot30mpEmulationStatEntry 4}

#### dot30mpEmulationOnuPonCastLLID OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] 65.1.3.3.1, pass the CRC-8 check, as defined in [802.3ah] 65.1.3.3.3, and the meet the rules of acceptance for an ONU, defined in [802.3ah] 65.1.3.3.2.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other



times as indicated by the value of the  
ifCounterDiscontinuityTime object of the Interface MIB  
module."

REFERENCE "[[802.3ah](#)], 30.3.7.1.6."

::= { dot3OmpEmulationStatEntry 5}

#### dot3OmpEmulationOltPonCastLLID OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [[802.3ah](#)] 65.1.3.3.1, pass the CRC-8 check, as defined in [[802.3ah](#)] 65.1.3.3.3, and the meet the rules of acceptance for an OLT, defined in [[802.3ah](#)] 65.1.3.3.2. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the ONU the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.3.7.1.7."

::= { dot3OmpEmulationStatEntry 6}

#### dot3OmpEmulationBroadcastBitNotOnuLlid OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [[802.3ah](#)] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [[802.3ah](#)] clause 65.1.3.3.3, and contain the broadcast bit in the LLID and not the ONU's LLID (frame accepted) as defined in [[802.3ah](#)] clause 65. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."



```
::= { dot30mpEmulationStatEntry 7}
```

```
dot30mpEmulationOnuLLIDNotBroadcast OBJECT-TYPE
```

```
SYNTAX Counter64
```

```
UNITS "frames"
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [802.3ah] clause 65.1.3.3.3, and contain the ONU's LLID as defined in [802.3ah] clause 65. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

```
::= { dot30mpEmulationStatEntry 8}
```

```
dot30mpEmulationBroadcastBitPlusOnuLlid OBJECT-TYPE
```

```
SYNTAX Counter64
```

```
UNITS "frames"
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [802.3ah] clause 65.1.3.3.3, and contain the broadcast bit in the LLID and match the ONU's LLID (frame reflected) as defined in [802.3ah] clause 65. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

```
::= { dot30mpEmulationStatEntry 9}
```

```
dot30mpEmulationNotBroadcastBitNotOnuLlid OBJECT-TYPE
```

```
SYNTAX Counter64
```

```
UNITS "frames"
```



MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of frames received that contain a valid SLD field, as defined in [802.3ah] clause 65.1.3.3.1, and pass the CRC-8 check, as defined in [802.3ah] clause 65.1.3.3.3, and do not contain the ONU's LLID as defined in [802.3ah] clause 65. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

::= { dot3OmpEmulationStatEntry 10 }

-- FEC managed object definitions (30.5.1)

dot3EponFecObjects OBJECT IDENTIFIER ::= { dot3EponObjects 3 }

dot3EponFecTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot3EponFecEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of dot3 EPON FEC management objects. The entries in the table are control and status objects and statistic counters for the FEC layer. Each object has a row for every virtual link denoted by the corresponding ifIndex. The LLID field, as defined in the [802.3ah] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff)."

::= { dot3EponFecObjects 1 }

dot3EponFecEntry OBJECT-TYPE

SYNTAX Dot3EponFecEntry

MAX-ACCESS not-accessible

STATUS current





## DESCRIPTION

"An entry in the dot3 EPON FEC table.

Rows exist for an OLT interface and an ONU interface.

A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created.

The rows in the table for an ONU interface are created at system initialization.

The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization.

A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

::= { dot3EponFecTable 1 }

Dot3EponFecEntry ::=

SEQUENCE {

dot3EponFecPCSCodingViolation	Counter64,
dot3EponFecAbility	INTEGER,
dot3EponFecMode	INTEGER,
dot3EponFecCorrectedBlocks	Counter64,
dot3EponFecUncorrectableBlocks	Counter64,
dot3EponFecBufferHeadCodingViolation	Counter64

}

dot3EponFecPCSCodingViolation OBJECT-TYPE

SYNTAX Counter64

UNITS "octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"For 100 Mbps operation it is a count of the number of times an invalid code-group is received, other than the /H/ code-group. For 1000 Mbps operation it is a count of the number of times an invalid codegroup is received, other than the /V/ code-group. /H/ denotes a special 4b5b codeword of [802.3] 100 Mbps PCS layer (clause 24), and /V/ denotes a special 8b10b codeword of the [802.3] 1000 Mbps PCS layer (clause 36).

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."



REFERENCE "[[802.3ah](#)], 30.5.1.1.12."  
::= { dot3EponFecEntry 1}

dot3EponFecAbility OBJECT-TYPE

SYNTAX INTEGER {  
    unknown (1),  
    unsupported (2),  
    supported (3)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object that indicates the support of operation of the optional FEC sublayer of the 1000BASE-PX PHY, specified in [[802.3ah](#)] clause 65.2.

unknown(1) value is assigned in initialization, for non FEC support state or type not yet known. unsupported(2) value is assigned when sublayer is not supported.

supported(3) value is assigned when sublayer is supported.

This object is applicable for an OLT, with the same value for all virtual interfaces, and for an ONU.

the FEC counters will have a zero value, when the interface is not supporting FEC.

The counters:

dot3EponFecPCSCodingViolation - not affected by FEC ability.

dot3EponFecCorrectedBlocks - has a zero value when dot3EponFecAbility is unknown (1) and unsupported (2).

dot3EponFecUncorrectableBlocks - has a zero value when dot3EponFecAbility is unknown (1) and unsupported (2).

dot3EponFecBufferHeadCodingViolation - has a zero value when dot3EponFecAbility is unknown (1) and unsupported (2). "

REFERENCE "[[802.3ah](#)], 30.5.1.1.13."  
::= { dot3EponFecEntry 2}

dot3EponFecMode OBJECT-TYPE

SYNTAX INTEGER {  
    unknown (1),  
    disabled (2),  
    enabled (3)  
}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"An object that defines the mode of operation of the optional FEC sublayer of the 1000BASE-PX PHY, specified



in [\[802.3ah\]](#) clause 65.2, and reflects its state.

A GET operation returns the current mode of operation of the PHY. A SET operation changes the mode of operation of the PHY to the indicated value.

unknown(1) value is assigned in initialization, for non FEC support state or type not yet known.

disabled(2) value is assigned when the FEC sublayer is operating in disabled mode.

enabled(3) value is assigned when the FEC sublayer is operating in FEC mode.

The write operation is not restricted in this document and can be done at any time. Changing dot3EponFecMode state can lead to disabling the Forward error correction on the respective interface which can lead to a degradation of the optical link and therefore may lead to an interruption of service of the users connected to the respective EPON interface.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface.

The counting of

the FEC counters will stop when the FEC of the interface is disabled.

The counters:

dot3EponFecPCSCodingViolation - not affected by FEC mode.

dot3EponFecCorrectedBlocks - stops counting when Rx\_FEC is not enabled. (unknown (1) and disabled (2)).

dot3EponFecUncorrectableBlocks - stops counting when Rx\_FEC is not enabled (unknown (1) and disabled (2)).

dot3EponFecBufferHeadCodingViolation - stops counting when Rx\_FEC is not enabled (unknown (1) and disabled (2)).

The object:

dot3EponFecAbility - indicates the FEC ability and it is not affected by the dot3EponFecMode object."

REFERENCE "[[802.3ah](#)], 30.5.1.1.14."

DEFVAL { unknown }

::= { dot3EponFecEntry 3}

dot3EponFecCorrectedBlocks OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"For 10PASS-TS, 2BASE-TL and 1000BASE-PX PHYs it is a count of corrected FEC blocks. This counter will not increment for other PHY Types. Increment the counter by one for each received block that is corrected by the FEC



function in the PHY.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.5.1.1.15."

::= { dot3EponFecEntry 4}

#### dot3EponFecUncorrectableBlocks OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"For 10PASS-TS, 2BASE-TL and 1000BASE-PX PHYs it is a count of uncorrectable FEC blocks. This counter will not increment for other PHY Types. Increment the counter by one for each FEC block that is determined to be uncorrectable by the FEC function in the PHY.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

REFERENCE "[[802.3ah](#)], 30.5.1.1.16."

::= { dot3EponFecEntry 5}

#### dot3EponFecBufferHeadCodingViolation OBJECT-TYPE

SYNTAX Counter64

UNITS "octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"For 1000 Mbps operation it is a count of the number of invalid code-group received directly from the link. The value has a meaning only in 1000 Mbps mode and it is zero otherwise.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."





```
::= { dot3EponFecEntry 6 }
```

```
-- ExtendedPackage managed object definitions
```

```
dot3ExtPkgObjects OBJECT IDENTIFIER ::= { dot3EponObjects 4 }
```

```
dot3ExtPkgControlObjects OBJECT IDENTIFIER ::= { dot3ExtPkgObjects 1 }
```

```
dot3ExtPkgControlTable OBJECT-TYPE
```

```
SYNTAX SEQUENCE OF Dot3ExtPkgControlEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

"A table of Extended package Control management objects. Entries in the table are control and status indication objects of an EPON interface which are gathered in an extended package as an addition to the objects based on the [\[802.3ah\]](#) clause 30 attributes. Each object has a row for every virtual link denoted by the corresponding ifIndex. The LLID field, as defined in the [\[802.3ah\]](#) is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff)."

```
::= { dot3ExtPkgControlObjects 1 }
```

```
dot3ExtPkgControlEntry OBJECT-TYPE
```

```
SYNTAX Dot3ExtPkgControlEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

"An entry in the Extended package Control table. Rows exist for an OLT interface and an ONU interface. A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created. The rows in the table for an ONU interface are created at system initialization. The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization. A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is



established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

::= { dot3ExtPkgControlTable 1 }

Dot3ExtPkgControlEntry ::=

```
SEQUENCE {
    dot3ExtPkgObjectReset                INTEGER,
    dot3ExtPkgObjectPowerDown            TruthValue,
    dot3ExtPkgObjectNumberOfLLIDs        Unsigned32,
    dot3ExtPkgObjectFecEnabled            INTEGER,
    dot3ExtPkgObjectReportMaximumNumQueues Unsigned32,
    dot3ExtPkgObjectRegisterAction        INTEGER
}
```

dot3ExtPkgObjectReset OBJECT-TYPE

```
SYNTAX  INTEGER {
    running(1),
    reset(2)
}
```

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object is used to reset the EPON interface. The interface may be unavailable while the reset occurs and data may be lost.

Setting this object to running(1) will cause the interface to enter into running mode. Setting this object to reset(2) will cause the interface to go into reset mode. When getting running(1) the interface is in running mode. When getting reset(2) the interface is in reset mode.

The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgObjectReset state can lead to a reset of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. A reset for a specific virtual interface resets only this virtual interface and not the physical interface. Thus, a virtual link which is mal-functioning can be reset without affecting the operation of other virtual interfaces.

The reset can cause Discontinuities in the values of the counters of the interface, similar to re-initialization of the management system. Discontinuity should be



indicated by the ifCounterDiscontinuityTime object of the Interface MIB module."

DEFVAL { running }

::= { dot3ExtPkgControlEntry 1 }

#### dot3ExtPkgObjectPowerDown OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

##### DESCRIPTION

"This object is used to power down the EPON interface. The interface may be unavailable while the power down occurs and data may be lost.

Setting this object to true(1) will cause the interface to enter into power down mode. Setting this object to false(2) will cause the interface to go out of power down mode. When getting true(1) the interface is in power down mode. When getting false(2) the interface is not in power down mode.

The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgObjectPowerDown state can lead to a power down of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. A power down/up of a specific virtual interface affects only the virtual interface and not the physical interface. Hence a virtual link which needs a certain handling can be powered down and then powered up without disrupting the operation of other virtual interfaces. The object is relevant when the admin state of the interface is active as set by the dot3MpcpAdminState."

DEFVAL { false }

::= { dot3ExtPkgControlEntry 2 }

#### dot3ExtPkgObjectNumberOfLLIDs OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

##### DESCRIPTION

"A read only object which indicates the number of registered LLIDs. Initialization value is 0.

This object is applicable for an OLT, with the same value for all virtual interfaces, and for an ONU.

The LLID field, as defined in the [\[802.3ah\]](#) is a 2bytes



register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff). At the ONU the number of LLIDs for an interface is one."

::= { dot3ExtPkgControlEntry 3 }

dot3ExtPkgObjectFecEnabled OBJECT-TYPE

SYNTAX INTEGER {  
    noFecEnabled (1),  
    fecTxEnabled (2),  
    fecRxEnabled (3),  
    fecTxRxEnabled (4)  
}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"An object defining the FEC mode of operation of the interface, and indicating its state. The modes defined in this object are extensions to the FEC modes defined in the dot3EponFecMode object.

When noFECEnabled (1) the interface does not enable FEC mode.

When fecTxEnabled (2) the interface enables the FEC transmit mode.

When fecRxEnabled (3) the interface enables the FEC receive mode.

When fecTxRxEnabled (4) the interface enables the FEC transmit and receive mode.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface. The FEC counters are referring to the receive path. The FEC counters will stop when the FEC receive mode of the interface is disabled, as defined by fecRxEnabled (3) and fecTxRxEnabled (4) values.

The counters:

dot3EponFecPCSCodingViolation - not affected by FEC mode.

dot3EponFecCorrectedBlocks - stops counting when Rx\_FEC is not enabled. (noFecEnabled (1) and fecTxEnabled (2)).

dot3EponFecUncorrectableBlocks - stops counting when Rx\_FEC is not enabled (noFecEnabled (1) and fecTxEnabled (2)).

dot3EponFecBufferHeadCodingViolation - stops counting





when Rx\_FEC is not enabled (noFecEnabled (1) and fecTxEnabled (2)).

The objects:

dot3EponFecAbility - indicates the FEC ability and is not affected by the FEC mode.

dot3EponFecMode - indicates the FEC mode for combined RX and TX.

The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgObjectFecEnabled state can lead to disabling the Forward error correction on the respective interface which can lead to a degradation of the optical link and therefore may lead to an interruption of service of the users connected to the respective EPON interface."

DEFVAL { noFecEnabled }

::= { dot3ExtPkgControlEntry 4 }

dot3ExtPkgObjectReportMaximumNumQueues OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object, that defines the maximal number of queues in the REPORT message, as defined in [[802.3ah](#)] 64. For further information please see the description of the queue table.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

DEFVAL { 0 }

::= { dot3ExtPkgControlEntry 5 }

dot3ExtPkgObjectRegisterAction OBJECT-TYPE

SYNTAX INTEGER {  
    none (1),  
    register (2),  
    deregister (3),  
    reregister (4)

}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"An object configuring the registration state of an interface, and indicating its registration state.

Write operation changes the registration state to its new value.

Read operation returns the value of the state.

The registration state is reflected in this object and in



the dot3MpcpRegistrationState object.  
 none(1) indicates an unknown state,  
 register(2) indicates a registered LLID,  
 deregister(3) indicates a deregistered LLID,  
 reregister(4) indicates an LLID which is reregistering.  
 The following list describes the operation of the  
 interface, as specified in the [802.3ah], when a write  
 operation is setting a value.  
 none (1) - not doing any action.  
 register (2) - registering an LLID which request to  
     register (The LLID is in registering mode.  
     dot3MpcpRegistrationState - registering (2) ).  
 deregister (3) - deregisters an LLID which is registered  
     (dot3MpcpRegistrationState - registered (3) ).  
 reregister (4) - reregister an LLID which is registered  
     (dot3MpcpRegistrationState - registered (3) ).  
 The behavior of an ONU and OLT interfaces, at each one  
 of the detailed operation at each state is described in  
 the registration state machine of figure 64-22,  
 [802.3ah].

This object is applicable for an OLT and an ONU. At the  
 OLT it has a distinct value for each virtual interface.  
 The write operation is not restricted in this document  
 and can be done at any time. Changing  
 dot3ExtPkgObjectRegisterAction state can lead to a change  
 in the registration state of the respective interface  
 leading to a deregistration and an interruption of  
 service of the users connected to the respective EPON  
 interface."

```
DEFVAL { none }
::= { dot3ExtPkgControlEntry 6 }
```

#### dot3ExtPkgQueueTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot3ExtPkgQueueEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of the extended package objects for queue  
 management. The [802.3ah] MPCP defines a report message  
 of the occupancy of the transmit queues for the feedback  
 BW request from the ONUs. These queues serve the uplink  
 transmission of the ONU and data is gathered there until  
 the ONU is granted for transmission.  
 The management table of the queues is added here mainly  
 to control the reporting and to gather some statistics  
 of their operation. This table is not duplicating  
 existing management objects of bridging queues,



specified in [802.1d], since the existence of a dedicated transmit queuing mechanism is implied in the [802.3ah] and the ONU may be a device which is not a bridge, with embedded bridging queues.

The format of the REPORT message, as specified in [802.3], is presented below:

+-----+		
	Destination Address	
+-----+		
	Source Address	
+-----+		
	Length/Type	
+-----+		
	OpCode	
+-----+		
	TimeStamp	
+-----+		
	Number of queue Sets	
+-----+		
	Report bitmap	/ \
+-----+		
	Queue 0 report	
+-----+		
	Queue 1 report	repeated for
+-----+		
	Queue 2 report	every
+-----+		
	Queue 3 report	queue_set
+-----+		
	Queue 4 report	
+-----+		
	Queue 5 report	
+-----+		
	Queue 6 report	
+-----+		
	Queue 7 report	
+-----+		
	Pad/reserved	\  /
+-----+		
	FCS	
+-----+		

The 'Queue report' field reports the occupancy of each uplink transmission queue.

The number of queue sets defines the number of the reported sets, as would be explained in the description of the dot3ExtPkgQueueSetsTable table. For each set the report bitmap defines which queue is present in the



report, meaning that although the MPCP REPORT message can report of up to 8 queues in a REPORT message, the actual number is flexible. The Queue table has a variable size which is limited by the dot3ExtPkgObjectReportMaximumNumQueues object as an ONU can have fewer queues to report.

The entries in the table are control and status indication objects for managing the queues of an EPON interface which are gathered in an extended package as an addition to the objects which are based on the [802.3ah] attributes.

Each object has a row for every virtual link and for every queue in the report.

The LLID field, as defined in the [802.3ah] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff).

The number of queues is between 0 and 7 and limited by dot3ExtPkgObjectReportMaximumNumQueues."

```
::= { dot3ExtPkgControlObjects 2 }
```

dot3ExtPkgQueueEntry OBJECT-TYPE

SYNTAX Dot3ExtPkgQueueEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the Extended package Queue table. At the OLT, the rows exist for each ifIndex and dot3QueueIndex. At the ONU, rows exist for the single ifIndex for each dot3QueueIndex.

Rows in the table are created when the ifIndex of the link is created. A set of rows per queue are added for each ifIndex, denoted by the dot3QueueIndex.

A set of rows per queue in the table, for an ONU interface are created at system initialization.

A set of rows per queue in the table, corresponding to the OLT ifIndex and a set of rows per queue, corresponding to the broadcast virtual link, are created at system initialization.

A set of rows per queue in the table, corresponding to the ifIndex of a virtual link are created when the virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex, dot3QueueIndex }

```
::= { dot3ExtPkgQueueTable 1 }
```





Dot3ExtPkgQueueEntry ::=

```
SEQUENCE {
    dot3QueueIndex                Unsigned32,
    dot3ExtPkgObjectReportNumThreshold    Unsigned32,
    dot3ExtPkgObjectReportMaximumNumThreshold    Unsigned32,
    dot3ExtPkgStatTxFramesQueue    Counter64,
    dot3ExtPkgStatRxFramesQueue    Counter64,
    dot3ExtPkgStatDroppedFramesQueue    Counter64
}
```

dot3QueueIndex OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An object that identifies an index for the queue table reflecting the queue index of the queues which are reported in the MPCP REPORT message, as defined in [\[802.3ah\]](#) clause 64.

The number of queues is between 0 and 7 and limited by dot3ExtPkgObjectReportMaximumNumQueues."

::= { dot3ExtPkgQueueEntry 1 }

dot3ExtPkgObjectReportNumThreshold OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"An object that defines the number of thresholds for each queue in the REPORT message, as defined in [\[802.3ah\]](#) clause 64.

Each queue\_set reporting will provide information on the queue occupancy of frames below the matching Threshold. Read operation reflects the number of thresholds.

Write operation sets the number of thresholds for each queue.

The write operation is not restricted in this document and can be done at any time. Value can not exceed the maximal value defined by the

dot3ExtPkgObjectReportMaximumNumThreshold object.

Changing dot3ExtPkgObjectReportNumThreshold can lead to a change in the reporting of the ONU interface and therefore to a change in the bandwidth allocation of the respective interface. This change may lead a degradation or an interruption of service of the users connected to the respective EPON interface.

This object is applicable for an OLT and an ONU. At the



OLT it has a distinct value for each virtual interface and for each queue. At the ONU it has a distinct value for each queue."

DEFVAL { 0 }

::= { dot3ExtPkgQueueEntry 2 }

#### dot3ExtPkgObjectReportMaximumNumThreshold OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An object, that defines the maximal number of thresholds for each queue in the REPORT message, as defined in [\[802.3ah\]](#) clause 64. Each queue\_set reporting will provide information on the queue occupancy of frames below the matching Threshold.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface and for each queue. At the ONU it has a distinct value for each queue."

DEFVAL { 0 }

::= { dot3ExtPkgQueueEntry 3 }

#### dot3ExtPkgStatTxFramesQueue OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the number of times a frame transmission occurs from the corresponding 'Queue'.

Increment the counter by one for each frame transmitted which is an output of the 'Queue'.

The 'Queue' marking matches the REPORT MPCP message Queue field, as defined in [\[802.3ah\]](#) clause 64.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface and for each queue. At the ONU it has a distinct value for each queue.

At the OLT the value should be zero.

Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

::= { dot3ExtPkgQueueEntry 4 }



## dot3ExtPkgStatRxFramesQueue OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"A count of the number of times a frame reception occurs from the corresponding 'Queue'. Increment the counter by one for each frame received which is an input to the corresponding 'Queue'. The 'Queue' marking matches the REPORT MPCP message Queue field, as defined in [802.3ah] clause 64. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface and for each queue. At the ONU it has a distinct value for each queue. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

::= { dot3ExtPkgQueueEntry 5}

## dot3ExtPkgStatDroppedFramesQueue OBJECT-TYPE

SYNTAX Counter64

UNITS "frames"

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"A count of the number of times a frame drop occurs from the corresponding 'Queue'. Increment the counter by one for each frame dropped from the corresponding 'Queue'. The 'Queue' marking matches the REPORT MPCP message Queue field, as defined in [802.3ah] clause 64. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface and for each queue. At the ONU it has a distinct value for each queue. At the OLT the value should be zero. Discontinuities of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of the ifCounterDiscontinuityTime object of the Interface MIB module."

::= { dot3ExtPkgQueueEntry 6}



## dot3ExtPkgQueueSetsTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot3ExtPkgQueueSetsEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"A table of Extended package objects used for the management of the queue\_sets. Entries are control and status indication objects of an EPON interface which are gathered in an extended package as an addition to the objects based on the [802.3ah] attributes. The objects in this table are specific for the queue\_sets which are reported in the MPCP REPORT message as defined in [802.3ah] clause 64.

The [802.3ah] MPCP defines a report message of the occupancy of the transmit queues for the feedback BW request from the ONUs. These queues serve the uplink transmission of the ONU and data is gathered there until the ONU is granted for transmission.

The management table of the queues\_sets is added here mainly to control the reporting and to gather some statistics of their operation. This table is not duplicating existing management objects of bridging queues, specified in [802.1d], since the existence of a dedicated transmit queuing mechanism is implied in the [802.3ah] and the ONU may be a device which is not a bridge, with embedded bridging queues.

The format of the REPORT message, as specified in [802.3], is presented below:

Destination Address	
Source Address	
Length/Type	
OpCode	
TimeStamp	
Number of queue Sets	
Report bitmap	/ \
Queue 0 report	
Queue 1 report	repeated for
Queue 2 report	every
	queue_set





+-----+		
	Queue 3 report	
+-----+		
	Queue 4 report	
+-----+		
	Queue 5 report	
+-----+		
	Queue 6 report	
+-----+		
	Queue 7 report	
+-----+		\\ /
	Pad/reserved	
+-----+		
	FCS	
+-----+		

As can be seen from the message format, the ONU interface reports of the status of up to 8 queues and it can report in a single MPCP REPORT message of a few sets of queues.

The number of queue\_sets defines the number of the reported sets, and it can reach up to a value of 8. It means that a ONU can hold a variable number of sets between 0 to 7.

The dot3ExtPkgQueueSetsTable table has a variable queue\_set size which is limited by the dot3ExtPkgObjectReportMaximumNumThreshold object as an ONU can have fewer queue\_sets to report.

The 'Queue report' field reports the occupancy of each uplink transmission queue. The queue\_sets can be used to report the occupancy of the queues in a few levels as to allow granting, in an accurate manner, of only part of the data available in the queues. A Threshold is defined for each queue\_set to define the level of the queue which is counted for the report of the occupancy. The threshold is reflected in the queue\_set table by the dot3ExtPkgObjectReportThreshold object.

For each queue set, the report bitmap defines which queues are present in the report, meaning that although the MPCP REPORT message can report of up to 8 queues in a REPORT message, the actual number is flexible.

The dot3ExtPkgQueueSetsTable table has a variable queue size which is limited by the dot3ExtPkgObjectReportMaximumNumQueues object as an ONU can have fewer queues to report.

Each object has a row for every virtual link, for each



queue in the report and for each queue\_set in the queue. The LLID field, as defined in the [802.3ah] is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff).

The number of queues is between 0 and 7 and limited by dot3ExtPkgObjectReportMaximumNumQueues.

The number of queues\_sets is between 0 and 7 and limited by dot3ExtPkgObjectReportMaximumNumThreshold."

```
::= { dot3ExtPkgControlObjects 3 }
```

dot3ExtPkgQueueSetsEntry OBJECT-TYPE

SYNTAX Dot3ExtPkgQueueSetsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the Extended package queue\_set table. At the OLT, the rows exist for each ifIndex, dot3QueueSetQueueIndex and dot3QueueSetIndex. At the ONU, rows exist for the single ifIndex, for each dot3QueueSetQueueIndex and dot3QueueSetIndex. Rows in the table are created when the ifIndex of the link is created. A set of rows per queue and per queue\_set are added for each ifIndex, denoted by dot3QueueSetIndex and dot3QueueSetQueueIndex. A set of rows per queue and per queue\_set in the table, for an ONU interface are created at system initialization. A set of rows per queue and per queue\_Set in the table, corresponding to the OLT ifIndex and a set of rows per queue and per queue\_set, corresponding to the broadcast virtual link, are created at system initialization. A set of rows per queue and per queue\_set in the table, corresponding to the ifIndex of a virtual link are created when the virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex,  
dot3QueueSetQueueIndex,dot3QueueSetIndex}

```
::= { dot3ExtPkgQueueSetsTable 1 }
```

Dot3ExtPkgQueueSetsEntry ::=

SEQUENCE {

dot3QueueSetQueueIndex Unsigned32,

dot3QueueSetIndex Unsigned32,



```
dot3ExtPkgObjectReportThreshold      Unsigned32
}
```

dot3QueueSetQueueIndex OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An object that identifies the queue index for the dot3ExtPkgQueueSetsTable table. The queues are reported in the MPCP REPORT message as defined in [[802.3ah](#)] clause 64.

The number of queues is between 0 and 7 and limited by dot3ExtPkgObjectReportMaximumNumQueues.

Value corresponds to the dot3QueueIndex of the queue table."

::= { dot3ExtPkgQueueSetsEntry 1 }

dot3QueueSetIndex OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An object that identifies the queue\_set index for the dot3ExtPkgQueueSetsTable table. The queues are reported in the MPCP REPORT message as defined in [[802.3ah](#)] clause 64.

The number of queues\_sets is between 0 and 7. and limited by dot3ExtPkgObjectReportMaximumNumThreshold."

::= { dot3ExtPkgQueueSetsEntry 2 }

dot3ExtPkgObjectReportThreshold OBJECT-TYPE

SYNTAX Unsigned32

UNITS "TQ (16nsec)"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"An object that defines the value of threshold report for each queue\_set in the REPORT message, as defined in [[802.3ah](#)] clause 64. The number of sets for each queue is dot3ExtPkgObjectReportNumThreshold.

In the REPORT message, each queue\_set reporting will provide information on the occupancy of the queues for frames below the matching Threshold.

The value returned shall be in Time quanta (TQ) which is 16nsec or 2 octets increments.

Read operation provides the threshold value. Write



operation sets the value of the threshold.

The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgObjectReportThreshold can lead to a change in the reporting of the ONU interface and therefore to a change in the bandwidth allocation of the respective interface. This change may lead a degradation or an interruption of service of the users connected to the respective EPON interface.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface, for each queue and for each queue\_set. At the ONU it has a distinct value for each queue and for each queue\_set."

DEFVAL { 0 }

::= { dot3ExtPkgQueueSetsEntry 3 }

#### --Optical Interface status tables

##### dot3ExtPkgOptIfTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot3ExtPkgOptIfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table defines the control and status indication objects for the optical interface of the EPON interface. Each object has a row for every virtual link denoted by the corresponding ifIndex.

The LLID field, as defined in the [\[802.3ah\]](#) is a 2bytes register (15bits field and a broadcast bit) limiting the number of virtual links to 32768. Typically the number of expected virtual links in a PON is like the number of ONUs, which is 32-64, plus an additional entry for broadcast LLID (with a value of 0xffff).

Although the optical interface is a physical interface, there is a row in the table for each virtual interface. The reason for having a separate row for each virtual link is that the OLT has a separate link for each one of the ONUs. For instance, ONUs could be in different distances with different link budgets and different receive powers, therefore having different power alarms. It is quite similar to a case of different physical interfaces."

::= { dot3ExtPkgControlObjects 5 }

##### dot3ExtPkgOptIfEntry OBJECT-TYPE

SYNTAX Dot3ExtPkgOptIfEntry





MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the optical interface table of the EPON interface.

Rows exist for an OLT interface and an ONU interface.

A Row in the table is denoted by the ifIndex of the link and it is created when the ifIndex is created.

The rows in the table for an ONU interface are created at system initialization.

The row in the table corresponding to the OLT ifIndex and the row corresponding to the broadcast virtual link are created at system initialization.

A row in the table corresponding to the ifIndex of a virtual links is created when a virtual link is established (ONU registers) and deleted when the virtual link is deleted (ONU deregisters)."

INDEX { ifIndex }

::= { dot3ExtPkgOptIfTable 1 }

Dot3ExtPkgOptIfEntry ::=

SEQUENCE {

dot3ExtPkgOptIfSuspectedFlag	TruthValue,
dot3ExtPkgOptIfInputPower	Integer32,
dot3ExtPkgOptIfLowInputPower	Integer32,
dot3ExtPkgOptIfHighInputPower	Integer32,
dot3ExtPkgOptIfLowerInputPowerThreshold	Integer32,
dot3ExtPkgOptIfUpperInputPowerThreshold	Integer32,
dot3ExtPkgOptIfOutputPower	Integer32,
dot3ExtPkgOptIfLowOutputPower	Integer32,
dot3ExtPkgOptIfHighOutputPower	Integer32,
dot3ExtPkgOptIfLowerOutputPowerThreshold	Integer32,
dot3ExtPkgOptIfUpperOutputPowerThreshold	Integer32,
dot3ExtPkgOptIfSignalDetect	TruthValue,
dot3ExtPkgOptIfTransmitAlarm	TruthValue,
dot3ExtPkgOptIfTransmitEnable	TruthValue

}

dot3ExtPkgOptIfSuspectedFlag OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object is a reliability indication.

If true, the data in this entry may be unreliable.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."



```
::= { dot3ExtPkgOptIfEntry 1 }
```

dot3ExtPkgOptIfInputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The optical power monitored at the input.

This object is applicable for an OLT and an ONU. At the

OLT it has a distinct value for each virtual interface."

```
::= { dot3ExtPkgOptIfEntry 2 }
```

dot3ExtPkgOptIfLowInputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The lowest optical power monitored at the input during the  
current 15-minute interval.

This object is applicable for an OLT and an ONU. At the

OLT it has a distinct value for each virtual interface."

```
::= { dot3ExtPkgOptIfEntry 3 }
```

dot3ExtPkgOptIfHighInputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The highest optical power monitored at the input during the  
current 15-minute interval.

This object is applicable for an OLT and an ONU. At the

OLT it has a distinct value for each virtual interface."

```
::= { dot3ExtPkgOptIfEntry 4 }
```

dot3ExtPkgOptIfLowerInputPowerThreshold OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The lower limit threshold on input power. If

dot3ExtPkgOptIfInputPower drops to this value or below,  
a Threshold Crossing Alert (TCA) should be sent.

Reading will present the threshold value. Writing will  
set the value of the threshold.



The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgOptIfLowerInputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 5 }

#### dot3ExtPkgOptIfUpperInputPowerThreshold OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-write

STATUS current

##### DESCRIPTION

"The upper limit threshold on input power. If dot3ExtPkgOptIfInputPower reaches or exceeds this value, a Threshold Crossing Alert (TCA) should be sent. Reading will present the threshold value. Writing will set the value of the threshold.

The write operation is not restricted in this document and can be done at any time. Changing

dot3ExtPkgOptIfUpperInputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 6 }

#### dot3ExtPkgOptIfOutputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only

STATUS current

##### DESCRIPTION

"The optical power monitored at the output.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 7 }

#### dot3ExtPkgOptIfLowOutputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only



STATUS current

DESCRIPTION

"The lowest optical power monitored at the output during the current 15-minute interval.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 8 }

dot3ExtPkgOptIfHighOutputPower OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The highest optical power monitored at the output during the current 15-minute interval.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 9 }

dot3ExtPkgOptIfLowerOutputPowerThreshold OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The lower limit threshold on output power. If dot3ExtPkgOptIfOutputPower drops to this value or below, a Threshold Crossing Alert (TCA) should be sent. Reading will present the threshold value. Writing will set the value of the threshold.

The write operation is not restricted in this document and can be done at any time. Changing

dot3ExtPkgOptIfLowerOutputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface.

This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

::= { dot3ExtPkgOptIfEntry 10 }

dot3ExtPkgOptIfUpperOutputPowerThreshold OBJECT-TYPE

SYNTAX Integer32

UNITS "0.1 dbm"

MAX-ACCESS read-write

STATUS current

DESCRIPTION





"The upper limit threshold on output power. If dot3ExtPkgOptIfOutputPower reaches or exceeds this value, a Threshold Crossing Alert (TCA) should be sent. Reading will present the threshold value. Writing will set the value of the threshold. The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgOptIfUpperOutputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert. This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

```
::= { dot3ExtPkgOptIfEntry 11 }
```

dot3ExtPkgOptIfSignalDetect OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"When getting true(1) there is a valid optical signal at the receive, that is above the optical power level for signal detection. When getting false(2) the optical signal at the receive is below the optical power level for signal detection.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

DEFVAL { false }

```
::= { dot3ExtPkgOptIfEntry 12 }
```

dot3ExtPkgOptIfTransmitAlarm OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"When getting true(1) there is a non-valid optical signal at the transmit of the interface, either a higher level or lower level than expected. When getting false(2) the optical signal at the transmit is valid and in the required range.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

DEFVAL { false }

```
::= { dot3ExtPkgOptIfEntry 13 }
```

dot3ExtPkgOptIfTransmitEnable OBJECT-TYPE



SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Setting this object to true(1) will cause the optical interface to start transmission (according to the control protocol specified for the logical interface). Setting this object to false(2) will cause the interface to stop the optical transmission.

When getting true(1) the optical interface is in transmitting mode (obeying to the logical control protocol).

When getting false(2) the optical interface is not in transmitting mode.

The write operation is not restricted in this document and can be done at any time. Changing dot3ExtPkgOptIfTransmitEnable state can lead to a halt in the optical transmission of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

The object is relevant when the admin state of the interface is active as set by the dot3MpcpAdminState.

This object is applicable for an OLT and an ONU. At the OLT it has a distinct value for each virtual interface."

DEFVAL { false }

::= { dot3ExtPkgOptIfEntry 14 }

-- Conformance Statements

-- Conformance Groups

dot3EponGroups        OBJECT IDENTIFIER ::= { dot3EponConformance 1 }

dot3MpcpGroupBase OBJECT-GROUP

OBJECTS {

dot3MpcpOperStatus,  
dot3MpcpAdminState,  
dot3MpcpMode,  
dot3MpcpSyncTime,  
dot3MpcpLinkID,  
dot3MpcpRemoteMACAddress,  
dot3MpcpRegistrationState,  
dot3MpcpMaximumPendingGrants,  
dot3MpcpTransmitElapsed,  
dot3MpcpReceiveElapsed,  
dot3MpcpRoundTripTime



```
}
STATUS current
DESCRIPTION
    "A collection of objects of dot3 Mpcp Control entity state
    definition. Objects are per LLID."
::= { dot3EponGroups 1 }

dot3MpcpGroupStat OBJECT-GROUP
OBJECTS {
    dot3MpcpMACCtrlFramesTransmitted,
    dot3MpcpMACCtrlFramesReceived,
    dot3MpcpDiscoveryWindowsSent,
    dot3MpcpDiscoveryTimeout ,
    dot3MpcpTxRegRequest,
    dot3MpcpRxRegRequest,
    dot3MpcpTxRegAck,
    dot3MpcpRxRegAck,
    dot3MpcpTxReport,
    dot3MpcpRxReport,
    dot3MpcpTxGate,
    dot3MpcpRxGate,
    dot3MpcpTxRegister,
    dot3MpcpRxRegister
}
STATUS current
DESCRIPTION
    "A collection of objects of dot3 Mpcp Statistics.
    Objects are per LLID."
::= { dot3EponGroups 2 }

dot3OmpGroupID OBJECT-GROUP
OBJECTS {
    dot3OmpEmulationType
}
STATUS current
DESCRIPTION
    "A collection of objects of dot3 OMP emulation entity
    state definition. Objects are per LLID."
::= { dot3EponGroups 3 }

dot3OmpGroupStat OBJECT-GROUP
OBJECTS {
    dot3OmpEmulationSLDErrors,
    dot3OmpEmulationCRC8Errors,
    dot3OmpEmulationBadLLID,
```



```
        dot3OmpEmulationGoodLLID,  
        dot3OmpEmulationOnuPonCastLLID,  
        dot3OmpEmulationOltPonCastLLID,  
        dot3OmpEmulationBroadcastBitNotOnuLlid,  
        dot3OmpEmulationOnuLLIDNotBroadcast,  
        dot3OmpEmulationBroadcastBitPlusOnuLlid,  
        dot3OmpEmulationNotBroadcastBitNotOnuLlid  
    }  
    STATUS    current  
    DESCRIPTION  
        "A collection of objects of dot3 OMP emulation  
        Statistics. Objects are per LLID."  
    ::= { dot3EponGroups 4 }
```

dot3EponFecGroupAll OBJECT-GROUP

```
    OBJECTS {  
        dot3EponFecPCSCodingViolation,  
        dot3EponFecAbility,  
        dot3EponFecMode,  
        dot3EponFecCorrectedBlocks,  
        dot3EponFecUncorrectableBlocks,  
        dot3EponFecBufferHeadCodingViolation  
    }  
    STATUS    current  
    DESCRIPTION  
        "A collection of objects of dot3 FEC group control and  
        statistics. Objects are per LLID."  
    ::= { dot3EponGroups 5 }
```

dot3ExtPkgGroupControl OBJECT-GROUP

```
    OBJECTS {  
        dot3ExtPkgObjectReset,  
        dot3ExtPkgObjectPowerDown,  
        dot3ExtPkgObjectNumberOfLLIDs,  
        dot3ExtPkgObjectFecEnabled,  
        dot3ExtPkgObjectReportMaximumNumQueues,  
        dot3ExtPkgObjectRegisterAction  
    }  
    STATUS    current  
    DESCRIPTION  
        "A collection of objects of dot3ExtPkg control  
        definition. Objects are per LLID."  
    ::= { dot3EponGroups 6 }
```

dot3ExtPkgGroupQueue OBJECT-GROUP





```
OBJECTS {
    dot3ExtPkgObjectReportNumThreshold,
    dot3ExtPkgObjectReportMaximumNumThreshold,
    dot3ExtPkgStatTxFramesQueue,
    dot3ExtPkgStatRxFramesQueue,
    dot3ExtPkgStatDroppedFramesQueue
}
STATUS current
DESCRIPTION
    "A collection of objects of dot3ExtPkg Queue
    control. Objects are per LLID, per queue."
::= { dot3EponGroups 7 }

dot3ExtPkgGroupQueueSets OBJECT-GROUP
OBJECTS {
    dot3ExtPkgObjectReportThreshold
}
STATUS current
DESCRIPTION
    "A collection of objects of dot3ExtPkg queue_set
    control. Objects are per LLID, per queue, per
    queue_set."
::= { dot3EponGroups 8 }

dot3ExtPkgGroupOptIf OBJECT-GROUP
OBJECTS {
    dot3ExtPkgOptIfSuspectedFlag,
    dot3ExtPkgOptIfInputPower,
    dot3ExtPkgOptIfLowInputPower,
    dot3ExtPkgOptIfHighInputPower,
    dot3ExtPkgOptIfLowerInputPowerThreshold,
    dot3ExtPkgOptIfUpperInputPowerThreshold,
    dot3ExtPkgOptIfOutputPower,
    dot3ExtPkgOptIfLowOutputPower,
    dot3ExtPkgOptIfHighOutputPower,
    dot3ExtPkgOptIfLowerOutputPowerThreshold,
    dot3ExtPkgOptIfUpperOutputPowerThreshold,
    dot3ExtPkgOptIfSignalDetect,
    dot3ExtPkgOptIfTransmitAlarm,
    dot3ExtPkgOptIfTransmitEnable
}
STATUS current
DESCRIPTION
    "A collection of objects of control and status indication
    of the optical interface.
    Objects are per LLID."
```



```
 ::= { dot3EponGroups 9 }

-- Compliance

dot3EponCompliances
  OBJECT IDENTIFIER ::= { dot3EponConformance 2 }

dot3MPCPCompliance MODULE-COMPLIANCE
  STATUS          current
  DESCRIPTION     "The compliance statement for Multi-Point
                  control protocol interfaces."

  MODULE -- this module
  MANDATORY-GROUPS { dot3MpcpGroupBase}

  GROUP          dot3MpcpGroupStat
  DESCRIPTION    "This group is mandatory for all MPCP supporting
                  interfaces for statistics collection."
  ::= { dot3EponCompliances 1}

dot3OMPECompliance MODULE-COMPLIANCE
  STATUS          current
  DESCRIPTION     "The compliance statement for OMPEmulation
                  interfaces."

  MODULE -- this module
  MANDATORY-GROUPS { dot3OmpeGroupID}

  GROUP          dot3OmpeGroupStat
  DESCRIPTION    "This group is mandatory for all OMPemulation
                  supporting interfaces for statistics collection."

  ::= { dot3EponCompliances 2}

dot3EponFecCompliance MODULE-COMPLIANCE
  STATUS          current
  DESCRIPTION     "The compliance statement for FEC EPON interfaces.
                  This group is mandatory for all FEC supporting
                  interfaces for control and statistics collection."

  MODULE -- this module
  MANDATORY-GROUPS { dot3EponFecGroupAll }

  ::= { dot3EponCompliances 3}
```



```
dot3ExtPkgCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION "The compliance statement for EPON Interfaces
                using the extended package."
    MODULE      -- this module
    MANDATORY-GROUPS { dot3ExtPkgGroupControl }

    GROUP       dot3ExtPkgGroupQueue
    DESCRIPTION " This group is mandatory for all EPON interfaces
                supporting REPORT queue management of the extended
                package."

    GROUP       dot3ExtPkgGroupQueueSets
    DESCRIPTION " This group is mandatory for all EPON interfaces
                supporting REPORT queue_sets management of the
                extended package."

    GROUP       dot3ExtPkgGroupOptIf
    DESCRIPTION "This group is mandatory for all EPON interfaces
                supporting optical interfaces management,
                of the extended package."

    ::= { dot3EponCompliances 4}

END
```



## 6. IANA Considerations

The DOT3-EPON-MIB module requires the allocation of a single object identifier for its MODULE-IDENTITY under the MIB-2 tree.

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor -----	OBJECT IDENTIFIER value -----
dot3EponMIB	{ mib-2 XXX }

Editor's Note (to be removed prior to publication): the IANA is requested to assign a value for "XXX" under the 'mib-2' subtree and to record the assignment in the SMI Numbers registry. When the assignment has been made, the RFC Editor is asked to replace "XXX" (here and in the MIB module) with the assigned value and to remove this note.





## **7. Acknowledgements**

This document is the result of the efforts of the HUBMIB Working Group. Some special thanks to Dan Romascanu who was WG chair during most of the development of this document, and who did carefully review and comment on the initial draft documents. Also some special thanks to Bert Wijnen who is the current WG chair for his review and comment on the final stages of this document.

Also special thanks are due to David Perkins for his detailed and helpful MIB Doctor review of this document.

Also some special thanks to some of IEEE802.3ah Working Group people for their contribution and additional reviews of the document.



## **8. Security Considerations**

There are number of managed objects defined in this MIB module that have a MAX-ACCESS clause of read-write or read-create. Writing to these objects can have potentially disruptive effects on network operation: Including:

Changing dot3MpcpAdminState state can lead to disabling the Multi-point control protocol on the respective interface leading to the interruption of service of the users connected to the respective EPON interface.

Changing dot3EponFecMode state can lead to disabling the Forward error correction on the respective interface which can lead to a degradation of the optical link and therefore may lead to an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectReset state can lead to a reset of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectPowerDown state can lead to a power down of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectFecEnabled state can lead to disabling the Forward error correction on the respective interface which can lead to a degradation of the optical link and therefore may lead to an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectRegisterAction state can lead to a change in the registration state of the respective interface leading to a deregistration and an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectReportNumThreshold can lead to a change in the reporting of the ONU interface and therefore to a change in the bandwidth allocation of the respective interface. This change may lead a degradation or an interruption of service of the users connected to the respective EPON interface.

Changing dot3ExtPkgObjectReportThreshold can lead to a change in the reporting of the ONU interface and therefore to a change in the bandwidth allocation of the respective interface. This change may lead a degradation or an interruption of service of the users connected to the respective EPON interface.



Changing dot3ExtPkgOptIfLowerInputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

Changing dot3ExtPkgOptIfUpperInputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

Changing dot3ExtPkgOptIfLowerOutputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

Changing dot3ExtPkgOptIfUpperOutputPowerThreshold can lead to a Threshold Crossing Alert (TCA) being sent for the respective interface. This alert may be leading to an interruption of service of the users connected to the respective EPON interface, depending on the system action on such an alert.

Changing dot3ExtPkgOptIfTransmitEnable state can lead to a halt in the optical transmission of the respective interface leading to an interruption of service of the users connected to the respective EPON interface.

The user of this MIB module must therefore be aware that support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

The readable objects in this MIB module (i.e., those with MAX-ACCESS other than not-accessible) may be considered sensitive in some environments since, collectively, they provide information about the performance of network interfaces and can reveal some aspects of their configuration. In such environments it is important to control even GET and NOTIFY access to these objects and possibly even to encrypt their values when sending them over the network via SNMP.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.



It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [\[RFC3410\], section 8](#)), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.





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