Managed Objects of Ethernet Passive Optical Networks (EPON)

Status of This Memo

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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.

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1. 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].

2. 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.

2.1. Terminology and Abbreviations

   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].

   ACK - Acknowledge

   BER - Bit Error Rate

   BW - Bandwidth

   CO - Central Office

   CPE - Customer Premises Equipment

   CRC - Cyclic Redundancy Check

   EFM - Ethernet First Mile

   EPON - Ethernet Passive Optical Network

   FCS - Frame Check Sequence

FEC - Forward Error Correction

GMII - Gigabit Media Independent Interface

LAN - Local Area Network

LLID - Logical Link Identifier

MAC - Media Access Control

Mbps - Megabit 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)

P2MP - Point-to-Multipoint

P2PE - Point-to-Point Emulation

PCS - Physical Coding Sublayer

PHY - Physical Layer

PMA - Physical Medium Attachment

PMD - Physical Medium Dependent

PON - Passive Optical Network

RS - Reconciliation Sublayer

RTT - Round Trip Time

SLA - Service Level Agreement

   SLD - Start of LLID Delimiter

   TDM - Time Division Multiplexing

   TQ - Time Quanta

2.2. EPON Architecture Highlights

2.2.1. Introduction

   The EPON standard, as defined in [802.3ah], defines 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:

```
             Device with
             one or more P2MP
             interfaces such as OLT
             for EPON                         An EPON         IP host
             ------- OLT          ONU        "modem"         --------
  Other IEEE |     | interface |  interface ------ Other IEEE|      |
  interface  |     |-------\----------------|    | interface |      |
  ==========|      |        \                |    |==========|      |
            |      |         \                ------          --------
            |      |          \               ------          --------
            .      .           \-----------|    |            |      |
            |      |------\                  |    |==========|      |
            |      |       \                 ------          --------
            -------         \ etc
```

   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 (Multi-Point Control Protocol) - defines the Multi-
   Point architecture, and control protocol for the media access of
   EPON.

   clause 65 -

   a) Virtual links definition for the EPON
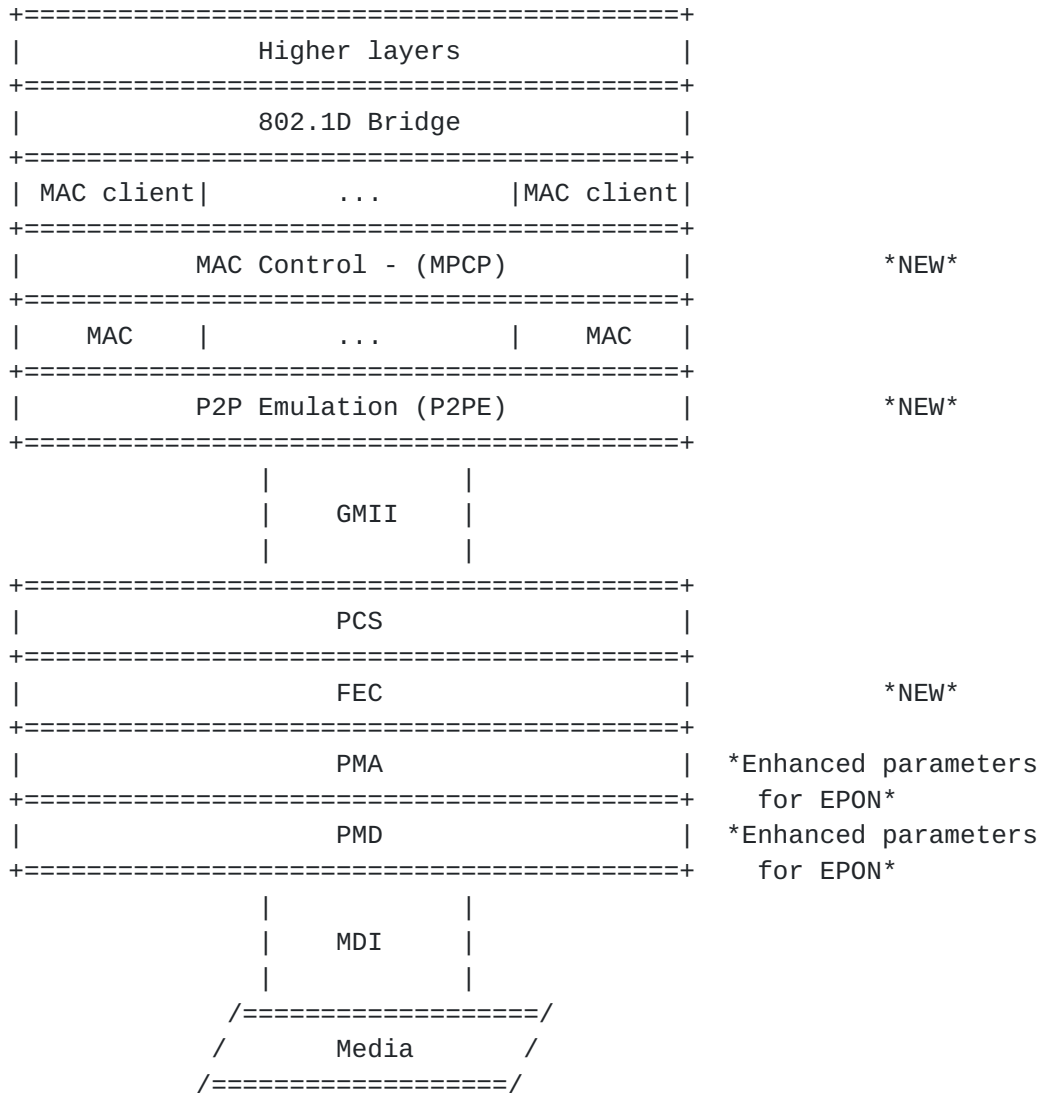
   b) FEC

   c) PMA for the EPON.

2.2.2. Principles of Operation

   The specification of the EPON interface is based on the specification
   of the gigabit Ethernet interface as described in [802.3], clauses 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:

```
    +==========================================+
    |                Higher layers             |
    +==========================================+
    |                802.1D Bridge             |
    +==========================================+
    | MAC client|        ...        |MAC client|
    +==========================================+
    |            MAC Control - (MPCP)          |                *NEW*
    +==========================================+
    |    MAC    |        ...        |    MAC    |
    +==========================================+
    |            P2P Emulation (P2PE)          |                *NEW*
    +==========================================+
                    |           |
                    |    GMII   |
                    |           |
    +==========================================+
    |                    PCS                   |
    +==========================================+
    |                    FEC                   |                *NEW*
    +==========================================+
    |                    PMA                   |   *Enhanced parameters
    +==========================================+      for EPON*
    |                    PMD                   |   *Enhanced parameters
    +==========================================+      for EPON*
                    |           |
                    |    MDI    |
                    |           |
                 /==================/
                /     Media       /
               /==================/
```

2.2.3. 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 for allocating the BW and controlling the delay of each
ONU according to its SLA.

2.2.4. PMD Specifications

PMD specifications select the same optical wavelength plan as the
[ITU-T.G.983]. 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
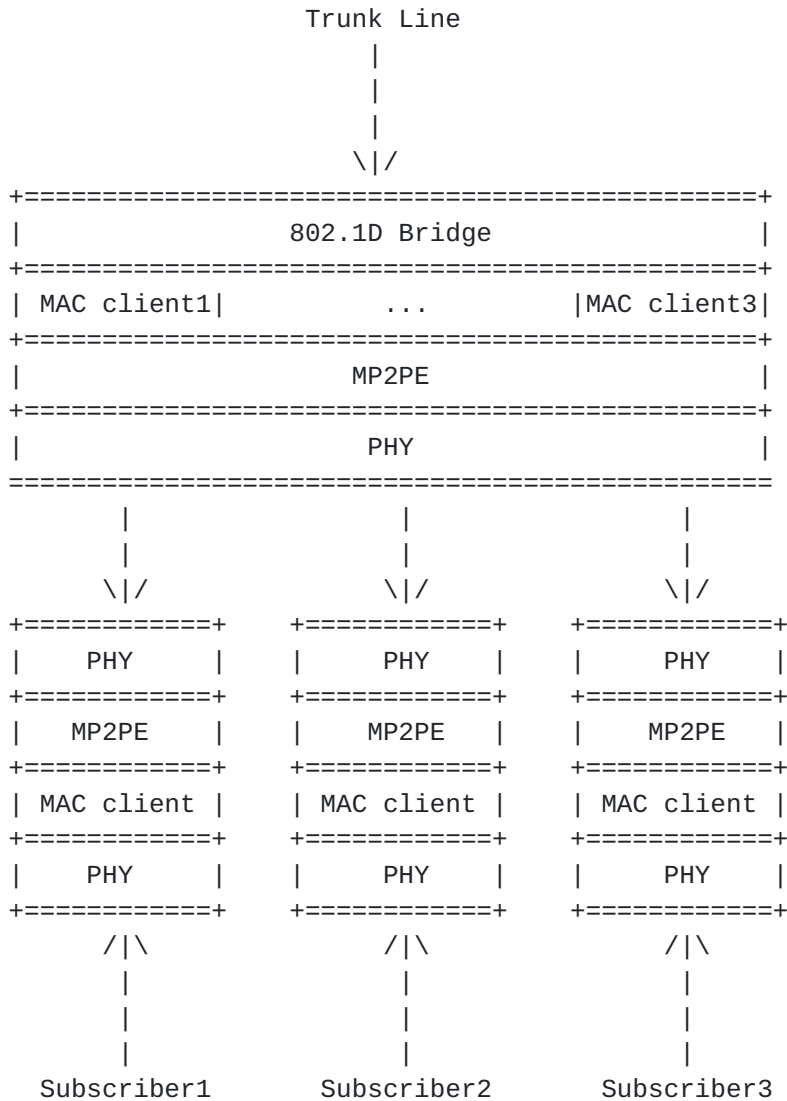products.

2.2.5. Point-to-Point Emulation

The downstream is a broadcast link, which means that 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 [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 cannot
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 one 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 that 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
cannot 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 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.

```
                        Trunk Line
                            |
                            |
                            |
                          \ | /
       +=============================================+
       |               802.1D Bridge                 |
       +=============================================+
       | MAC client1|          ...          |MAC client3|
       +=============================================+
       |                    MP2PE                     |
       +=============================================+
       |                     PHY                      |
       ===============================================
              |                 |                 |
              |                 |                 |
            \ | /             \ | /             \ | /
       +============+     +============+     +============+
       |    PHY     |     |    PHY     |     |    PHY     |
       +============+     +============+     +============+
       |    MP2PE   |     |    MP2PE    |     |    MP2PE   |
       +============+     +============+     +============+
       | MAC client |     | MAC client |     | MAC client |
       +============+     +============+     +============+
       |    PHY     |     |    PHY     |     |    PHY     |
       +============+     +============+     +============+
           / | \             / | \             / | \
             |                 |                 |
             |                 |                 |
             |                 |                 |
        Subscriber1       Subscriber2       Subscriber3
```

2.2.6. 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 for which the Ethernet was designed. The differences
lie mainly 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 20 km distance, which is
equivalent to a 200 usec RTT (25 Kbytes of data).

The TDM control is done using 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, and 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, the MPCP defines a protocol of auto-discovery and
registration of ONUs.

The registration process is defined in the diagram below:

```
     OLT                                              ONU
      |                                                |
      |          Discovery Gate message              \|
      |----------------------------------------------|
      |                                              /|
      |                                               |
      |/        Register Request message              |
      |----------------------------------------------|
      |\                                              |
      |                                               |
      |            Register message                   |
      |             (assigning LLID)                 \|
      |----------------------------------------------|
      |                                              /|
      |                                               |
      |              Gate message                    \|
      |----------------------------------------------|
      |                                              /|
      |                                               |
      |/          Register ACK message                |
      |----------------------------------------------|
      |\                                              |
      |                                               |
      |                                               |
```

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 a 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 be needed to
authenticate the ONU and allow it to participate in the network.

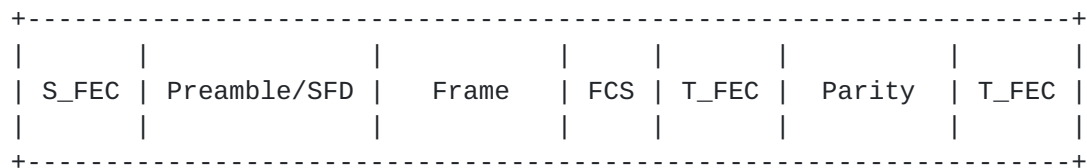## [2.2.7](#). Forward Error Correction (FEC)

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 that

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 also define 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:

```
+-------------------------------------------------------------------+
|       |               |         |     |       |        |       |  |
| S_FEC | Preamble/SFD  |  Frame  | FCS | T_FEC | Parity | T_FEC |
|       |               |         |     |       |        |       |  |
+-------------------------------------------------------------------+
```

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
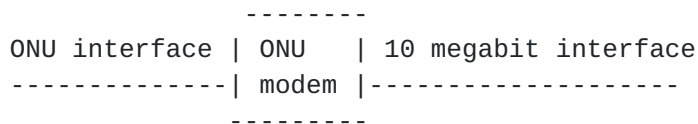path.

The FEC layer is optional.

2.3. Management Architecture

Each one of the EPON layers is accompanied by a management interface
that is controlled through clause 30 of the [802.3ah]. As the
[802.3ah] specification 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:

```
+==========================+
|       Higher layers      |
+==========================+
|        802.1D Bridge     |
+==========================+
|MAC client| ... |MAC client|
+==========================+    \ +============================+
|    MAC Control - (MPCP)   |----- |MpcpObjects| ... |MpcpObjects|
+==========================+    / +============================+
|   MAC     | ... |   MAC    |
+==========================+    \ +============================+
|     P2P Emulation (P2PE)  |----- |OmpEmulat  |     |OmpEmulat  |
+==========================+    / |ionObjects | ... |ionObjects |
            |        |             +============================+
            |  GMII  |
            |        |
+==========================+
|           PCS            |
+==========================+    \ +============================+
|           FEC            |----- |FecObjects | ... |FecObjects |
+==========================+    / +============================+
|           PMA            |
+==========================+
|           PMD            |
+==========================+
            |        |
            |  MDI   |
            |        |
       /==============/
      /     Media     /
     /==============/
```

The association is straightforward 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, 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 is called an "ONU modem".

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

```
                          --------
          ONU interface | ONU    | 10 megabit interface
          --------------| modem  |--------------------
                          ---------
```

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

ifIndex=1 - interface for 10 megabit interface

ifIndex=2 - interface for the optical interface

ifIndex=200 - interface for the ONU interface

And then in the 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:

```
                          ---------
          1st OLT interface | Head  | gigE interface
          ------------------| end   |--------------------
                            |       |
          ------------------|       |
          2nd OLT interface |       |
                          ---------
```
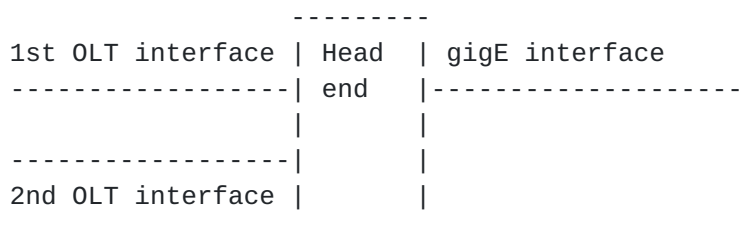
This device would have 5 entries (when there are no attached ONUs) in
the IF table, for example:

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 the 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
[RFC4836], 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 are indexed according to the
ifIndex; specifically, there is a row for each virtual link. There
are some control objects that 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
a 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.

3. 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 that 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 links, of
OMPEmulation compliant interfaces.

The dot3OmpEmulationStatTable defines the statistics objects that 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; specifically, there is a row for
each virtual link. There are a few control objects that 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 a
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 are 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.

4. Relation to Other MIB Modules

4.1. 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. Therefore, for instance, the document is defining
dot3MpcpRemoteMACAddress only while assuming that 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              | 1000000000                    |
| 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              | 1000000000                    |
| 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 eMIB object	Value	Value	Value	Value
ifIndex	200001	200002	200003	265535
ifDescr	"interface description"	"interface description"	"interface description"	"interface description"
ifType	ethernetCsm acd (6)	ethernetCsm acd (6)	ethernetCsm acd (6)	ethernetCsma cd (6)
ifMtu	MTUsize(152 2)	MTUsize(152 2)	MTUsize(152 2)	MTUsize(1522)
ifSpeed	1000000000	1000000000	1000000000	1000000000
ifPhysAd dress	OLT_MAC_Add ress	OLT_MAC_Add ress	OLT_MAC_Add ress	OLT_MAC_Addr ess
ifAdminS tatus	up	up	up	up
ifOperSt atus	Up	Up	Up	Up
ifLastCh ange	ONU1_up_tim e	ONU2_up_tim e	ONU3_up_tim e	up_time
ifInOcte ts	ONU1_octets _number	ONU2_octets _number	ONU3_octets _number	BRCT_octets_ number
ifInUcas tPkts	ONU1_unic_f rame_num	ONU2_unic_f rame_num	ONU3_unic_f rame_num	BRCT_unic_fr ame_num
ifInNUca stPkts	ONU1_non_un ic_frame_nu m	ONU2_non_un ic_frame_nu m	ONU3_non_un ic_frame_nu m	BRCT_non_uni c_frame_num
ifInDisc ards	ONU1_disc_f rame_num	ONU2_disc_f rame_num	ONU3_disc_f rame_num	BRCT_disc_fr ame_numr
ifInErro rs	ONU1_err_fr ame_num	ONU2_err_fr ame_num	ONU3_err_fr ame_num	BRCT_err_fra me_num
ifInUnkn ownProto s	ONU1_unknw_ frame_num	ONU2_unknw_ frame_num	ONU3_unknw_ frame_num	BRCT_unknw_f rame_num
ifOutOct ets	ONU1_octets _number	ONU2_octets _number	ONU3_octets _number	BRCT_octets_ number
ifOutUca stPkts	ONU1_unic_f rame_num	ONU2_unic_f rame_num	ONU3_unic_f rame_num	BRCT_unic_fr ame_num
ifOutNUc astPkts	ONU1_non_un ic_frame_nu m	ONU2_non_un ic_frame_nu m	ONU3_non_un ic_frame_nu m	BRCT_non_uni c_frame_num

```
+----------+------------+------------+------------+--------------+
| Interfac | Value      | Value      | Value      | Value        |
| eMIB     |            |            |            |              |
|  object  |            |            |            |              |
+----------+------------+------------+------------+--------------+
| ifOutDis | ONU1_disc_f | ONU2_disc_f | ONU3_disc_f | BRCT_disc_fr |
| cards    | rame_num   | rame_num   | rame_num   | ame_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, the OLT interface, and 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, page 11 for more information. The counters
of the EPON MIB should be handled in a similar manner.

4.2. 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 [RFC4836].

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, the OLT
interface, and 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).

4.3. 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
[RFC4878] 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 that are

   defined for the P2MP network, so that an instance is held for each
   Logical Link Identifier (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.

4.4. 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] and [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, etc.).

   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.

5. **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 into 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
dot3MpcpMACCtrlFramesTrans	aMPCPMACCtrlFramesTrans	30.3.5.1.7
mitted	mitted	
dot3MpcpMACCtrlFramesRecei	aMPCPMACCtrlFramesRecei	30.3.5.1.8
ved	ved	
dot3MpcpTxGate	aMPCPTxGate	30.3.5.1.9
dot3MpcpTxRegAck	aMPCPTxRegAck	30.3.5.1.1
		0
dot3MpcpTxRegister	aMPCPTxRegister	30.3.5.1.1
		1
dot3MpcpTxRegRequest	aMPCPTxRegRequest	30.3.5.1.1
		2
dot3MpcpTxReport	aMPCPTxReport	30.3.5.1.1
		3
dot3MpcpRxGate	aMPCPRxGate	30.3.5.1.1
		4
dot3MpcpRxRegAck	aMPCPRxRegAck	30.3.5.1.1
		5
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
dot3MpcpDiscoveryWindowsSe	aMPCPDiscoveryWindowsSe	30.3.5.1.2
nt	nt	2

dot3EPON MIB module object	IEEE802.3ah attribute	Reference
dot3MpcpDiscoveryTimeout	aMPCPDiscoveryTimeout	30.3.5.1.2 3
dot3MpcpMaximumPendingGran ts	aMPCPMaximumPendingGran ts	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
dot3OmpEmulationType	aOMPEmulationType	30.3.7.1. 2
dot3OmpEmulationSLDErrors	aSLDErrors	30.3.7.1. 3
dot3OmpEmulationCRC8Errors	aCRC8Errors	30.3.7.1. 4
dot3OmpEmulationGoodLLID	aGoodLLID	30.3.7.1. 5
dot3OmpEmulationOnuPonCastLLID	aONUPONcastLLID	30.3.7.1. 6
dot3OmpEmulationOltPonCastLLID	aOLTPONcastLLID	30.3.7.1. 7
dot3OmpEmulationBadLLID	aBadLLID	30.3.7.1. 8
dot3OmpEmulationBroadcastBitNotOnuL Lid		
dot3OmpEmulationOnuLLIDNotBroadcast		
dot3OmpEmulationBroadcastBitPlusOnu Llid		
dot3OmpEmulationNotBroadcastBitNotO nuLlid		

Table 10

oMAU managed object class (30.5.1)

```
+-------------------------------+--------------------+-----------+
| dot3EPON MIB module object    | IEEE802.3ah        | Reference |
|                               | attribute          |           |
+-------------------------------+--------------------+-----------+
| 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 | 30.5.1.1.1 |
|                               | ocks               | 6         |
| dot3EponFecBufferHeadCodingVio |                    |           |
| lation                        |                    |           |
+-------------------------------+--------------------+-----------+
```

Table 11

[6](#).   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 "200703290000Z"  -- March 29, 2007
    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
                    Chair: Bert Wijnen
                    Postal: Lucent Technologies
                            Schagen 33
                            3461 GL Linschoten
                            Netherlands
                    Tel: +31-348-407-775
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                            P.O.Box 2089 Hertzliya Pituach 46120 Israel
                    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
             clauses 60, 64, and 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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         of this MIB module is part of 4837; see the RFC itself for
         full legal notices.

         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 - Megabit 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-Multipoint
            PHY - Physical Layer
            PMD - Physical Medium Dependent
            PON - Passive Optical Network
            RTT - Round Trip Time
            SLD - Start of LLID Delimiter
            TQ - Time Quanta
          "

    REVISION    "200703290000Z"  -- March 29, 2007
    DESCRIPTION "Initial version, published as RFC 4837."

    ::= { mib-2 155 }

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 2-byte
             register (15-bit 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 the 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 for 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], clauses 60, 64, and 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 as specified in [802.3], Annex
                 31A; 2) the 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; the ONU has a single
                 value that 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 the 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
             that an ONU can store for handling. The maximum number

                    of grants that 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 2-byte
                    register (15-bit 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 link 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 clause 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 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], 30.3.5.1.12."
    ::= { 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

dot3OmpEmulationObjects OBJECT IDENTIFIER ::={dot3EponObjects 2}

dot3OmpEmulationTable OBJECT-TYPE
     SYNTAX   SEQUENCE OF Dot3OmpEmulationEntry
     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 2-byte
              register (15-bit 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 1 }

dot3OmpEmulationEntry OBJECT-TYPE
     SYNTAX   Dot3OmpEmulationEntry
     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 is 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 2-byte
                register (15-bit 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."
    ::= { dot3OmpEmulationStatEntry 1}

dot3OmpEmulationCRC8Errors 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."
    ::= { dot3OmpEmulationStatEntry 2}

dot3OmpEmulationBadLLID 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."
        ::= { dot3OmpEmulationStatEntry 3}

dot3OmpEmulationGoodLLID 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."
        ::= { dot3OmpEmulationStatEntry 4}

dot3OmpEmulationOnuPonCastLLID 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,
                 pass the CRC-8 check, as defined in [802.3ah], clause
                 65.1.3.3.3, and meet the rules of acceptance for an
                 ONU 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.
                 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], clause 65.1.3.3.1,
                    pass the CRC-8 check, as defined in [802.3ah], clause
                    65.1.3.3.3, and 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, 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."
         ::= { dot3OmpEmulationStatEntry 7}

dot3OmpEmulationOnuLLIDNotBroadcast 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, 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."
    ::= { dot3OmpEmulationStatEntry 8}

dot3OmpEmulationBroadcastBitPlusOnuLlid 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, 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."
    ::= { dot3OmpEmulationStatEntry 9}

dot3OmpEmulationNotBroadcastBitNotOnuLlid 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, 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 2-byte
               register (15-bit 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 a 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 a 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),
```

```
                 supported(2),
                 unsupported(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 the initialization, for non
              FEC support state or type not yet known.  unsupported(3)
              value is assigned when the sublayer is not supported.
              supported(2) value is assigned when the 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(3).
               dot3EponFecUncorrectableBlocks  - has a zero value when
                dot3EponFecAbility is unknown(1) and unsupported(3).
               dot3EponFecBufferHeadCodingViolation - has a zero value
                when dot3EponFecAbility is unknown(1) and
                unsupported(3)."
     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 the 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 for 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
                    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 a 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 2-byte
             register (15-bit 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 for 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 that is malfunctioning 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 that indicates the number of
                     registered LLIDs. The 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 2-byte
                     register (15-bit 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 for 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], clause 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 that 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 that has been requested
                   for registration (The LLID is in registering mode.
                      dot3MpcpRegistrationState - registering(2)).
                      deregister(3) - deregisters an LLID that is registered
                        (dot3MpcpRegistrationState - registered(3)).

                  reregister(4) - reregister an LLID that 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 that 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          |    |
            +-------------------------------------+    | repeated for
            |             Queue 1 report          |    | every
            +-------------------------------------+    | queue_set
            |             Queue 2 report          |    |
            +-------------------------------------+    |
            |             Queue 3 report          |    |
            +-------------------------------------+    |
            |             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 up to 8 queues in a REPORT message, the
actual number is flexible. The Queue table has a
variable size that 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 that are gathered in an extended package as
an addition to the objects that 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 2-byte
register (15-bit 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 the 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 the 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 that 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 cannot 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 that 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         |    |
+----------------------------------+    | repeated for
|           Queue 1 report         |    | every
+----------------------------------+    | queue_set
|           Queue 2 report         |    |
+----------------------------------+    |
|           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 a value of up to 8.
                It means that an ONU can hold a variable number of
                sets between 0 and 7.
                The dot3ExtPkgQueueSetsTable table has a variable
                queue_set size that 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 that 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 that 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 2-byte
                register (15-bit 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 a 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 for 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 2-byte
                 register (15-bit 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 for 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 for 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 for 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 }

```
   dot3OmpeGroupID OBJECT-GROUP
       OBJECTS {
               dot3OmpEmulationType

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

   dot3OmpeGroupStat 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
```

7. IANA Considerations

   IANA has allocated a single object identifier for the MODULE-IDENTITY
   of the DOT3-EPON-MIB module 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-2 155 }
```

8. **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 carefully reviewed
   and commented on the initial versions of this document. Also, some
   special thanks to Bert Wijnen, who is the current WG chair, for his
   review and comments on the final stages of this document.

   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 the IEEE802.3ah Working Group
   people for their contribution and additional reviews of the document.

9. **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 for 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 for 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 for 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 for
   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 for 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 for 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 for 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 for 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
   for 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
   for 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
   for 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
   for 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 for 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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