Network Working Group
Request for Comments: 4878
Category: Standards Track

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June 2007

Definitions and Managed Objects for Operations, Administration, and Maintenance (OAM) Functions on Ethernet-Like Interfaces

Status of This Memo

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Abstract

This document defines objects for managing Operations, Administration, and Maintenance (OAM) capabilities on Ethernet-like interfaces conformant to the Ethernet OAM functionality defined in the Ethernet in the First Mile (EFM) clauses of the Ethernet standards. The Ethernet OAM functionality is complementary to the Simple Network Management Protocol (SNMP) in that it is focused on a small set of link-specific functions for directly connected Ethernet interfaces. This document defines objects for controlling those link OAM functions and for providing results and status of the OAM functions to management entities.

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1. Introduction

The IEEE 802.3ah Ethernet in the First Mile (EFM) taskforce added new management capabilities to Ethernet-like interfaces. These management capabilities were introduced to provide some basic Ordered Aggregate (OA) function on Ethernet media. The defined functionality includes discovery, error signaling, loopback, and link monitoring. This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community to manage these new Ethernet interface capabilities.

Conventions Used in This Document

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 RFC 2119 [RFC2119].

2. 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].

3. Overview

Ethernet networks have evolved over the past 30 years from simple LANs to a variety of other applications, including wide-area networks. To address some of these emerging markets, the IEEE 802.3ah taskforce defined additional clauses in [802.3ah] for the IEEE 802.3 standard [802.3-2002] to better address Ethernet deployments in the public-access network. Although Ethernet-access deployments were the primary motivation for the taskforce activity, the results of the taskforce are not strictly limited to that application. Ethernet OAM can be implemented on Ethernet links that are not EFM.

The Ethernet in the First Mile (EFM) taskforce was focused on four somewhat independent objectives to better address Ethernet access deployments: optics, copper, Ethernet passive optical networks (Ethernet PON, or EPON), and operations, administration, and maintenance (OAM). The optics sub-taskforce developed new optical physical layers that better served the long-reach outside plant networks typically found in the access network, including developing physical layers that operate up to 20 Km and supporting the environmental conditions of access deployments. The copper sub-taskforce developed two new physical layers that run Ethernet natively over existing twisted pair wires that have been supporting voice services for decades. The EPON sub-taskforce developed a new point-to-multipoint Ethernet physical layer, utilizing Ethernet framing natively over a time-division multiple-access (TDMA) infrastructure. The OAM sub-taskforce introduced some basic management functionality into an Ethernet link to better monitor and maintain Ethernet networks in geographically disparate networks.

This document defines the management objects necessary to integrate Ethernet OAM functionality into the SNMP management framework.

Ethernet OAM is composed of a core set of functions and a set of optional functional groups. The mandatory functions include discovery operations (determining if the other end of the link is OA capable and what OAM functions it supports), state machine implementation, and some critical event flows. The optional functional groups are for (a) link events, (b) remote loopback, and (c) variable retrieval and response. Each optional functional group is controlled by a separate MIB table(s).

Ethernet OAM is complementary with SNMP management in that it provides some basic management functions at layer two, rather than using layer three and above as required by SNMP over an IP infrastructure. Ethernet OAM provides single-hop functionality in that it works only between two directly connected Ethernet stations. SNMP can be used to manage the Ethernet OAM interactions of one Ethernet station with another.

Ethernet OAM has three functional objectives, which are detailed in the next three sections. The definition of a basic Ethernet OA protocol data unit is given in Section 3.4.

3.1. Remote Fault Indication

Remote fault indication provides a mechanism for one end of an Ethernet link to signal the other end that the receive path is non-operational. Some Ethernet physical layers offer mechanisms to signal this condition at the physical layer. Ethernet OAM added a mechanism so that some Ethernet physical layers can operate in unidirectional mode, allowing frames to be transmitted in one direction even when the other direction is non-operational. Traditionally, Ethernet PHYs do not allow frame transmission in one direction if the other direction is not operational. Using this mode, Ethernet OAM allows frame-based signaling of remote fault conditions while still not allowing higher-layer applications to be aware of the unidirectional capability. This document includes mechanisms for capturing that fault information and reflecting such information in objects and notifications within the SNMP management framework.

3.2. Link Monitoring

Ethernet OAM includes event signaling capability so that one end of an Ethernet link can indicate the occurrence of certain important events to the other end of the link. This happens via layer two protocols. This document defines methods for incorporating the occurrence of these layer two events, both at the local end and far end of the link, into the SNMP management framework.

Ethernet OAM also includes mechanisms for one Ethernet station to query another directly connected Ethernet station about the status of its Ethernet interface variables and status. This document does not include mechanisms for controlling how one Ethernet endpoint may use this functionality to query the status or statistics of a peer Ethernet entity.

3.3. Remote Loopback

Remote loopback is a link state where the peer Ethernet entity echoes every received packet (without modifications) back onto the link. Remote loopback is intrusive in that the other end of the link is not forwarding traffic from higher layers out over the link. This document defines objects controlling loopback operation and reading the status of the loopback state.

3.4. Ethernet OAM Protocol Data Units

An Ethernet OAM protocol data unit is a valid Ethernet frame with a destination Media Access Control (MAC) address equal to the reserved MAC address for Slow Protocols (See 43B of [802.3ah]), a lengthOrType field equal to the reserved type for Slow Protocols, and a Slow Protocols subtype equal to that of the subtype reserved for Ethernet OAM.

OAMPDU is used throughout this document as an abbreviation for Ethernet OAM protocol data unit. OAMPDUs are the mechanism by which two directly connected Ethernet interfaces exchange OA information.

4. Relation to the Other MIB Modules

The definitions presented here are based on Clauses 30 and 57 of [802.3ah]. Note that these clauses describe many of these variables and their effects on the MAC layer. In some cases, there is a one-to-one relationship between an object in this document and an object in the Clause 30 MIB of [802.3ah]. In other cases, the objects of this document reflect a more complex entity and are reflected by more than one object in the Clause 30 MIB of [802.3ah].

4.1. Relation to Other MIB Modules

The objects defined in this document manage OAM functionality introduced in [802.3ah] These objects do not overlap with the interfaces MIB [RFC2863], the Ethernet-like interfaces MIB [RFC3635], or any other MIB currently used to manage various aspects of an Ethernet interface. The objects defined here are defined for Ethernet-like interfaces only and use the same ifIndex as the associated Ethernet interface. Ethernet OAM can be implemented on any Ethernet-like interface.

4.2. Relation to Other EFM MIB Modules

The Ethernet OAM functionality and MIB Module is independent of the other functionality and MIB Modules derived from [802.3ah] for copper [802.3ah-copper] and EPON [802.3ah-epon]. Ethernet OAM may be implemented (or not) on the new EFM interface types, just as it can on any other Ethernet interface.

4.3. Mapping of IEEE 802.3ah Managed Objects

This section contains the mapping between managed objects defined in [802.3ah] Clause 30, and managed objects defined in this document.

IEEE 802.3 Managed Object	Corresponding SNMP object
oOA	
.aOAMID	IF-MIB ifIndex
.aOAMAdminState	dot3OamAdminState
.aOAMMode	dot3OamMode
.aOAMDiscoveryState	dot3OamOperStatus
.aOAMRemoteMACAddress	dot3OamPeerMacAddress
.aOAMLocalConfiguration	dot3OamFunctionsSupported
.aOAMRemoteConfiguration	dot3OamPeerFunctionsSupported, dot3OamPeerMode
.aOAMLocalPDUConfiguration	dot3OamMaxOamPduSize
.aOAMRemotePDUConfiguration	dot3OamPeerMaxOamPduSize
.aOAMLocalFlagsField	dot3OamOperStatus, dot3OamEventLogEntry
.aOAMRemoteFlagsField	dot3OamOperStatus, dot3OamEventLogEntry
.aOAMLocalRevision	dot3OamConfigRevision
.aOAMRemoteRevision	dot3OamPeerConfigRevision
.aOAMLocalState	dot3OamLoopbackStatus
.aOAMRemoteState	dot3OamLoopbackStatus
.aOAMRemoteVendorOUI	dot3OamPeerVendorOui
.aOAMRemoteVendorSpecificInfo	dot3OamPeerVendorInfo
.aOAMUnsupportedCodesTx	dot3OamUnsupportedCodesTx
.aOAMUnsupportedCodesRx	dot3OamUnsupportedCodesRx
.aOAMInformationTx	dot3OamInformationTx
.aOAMInformationRx	dot3OamInformationRx
.aOAMUniqueEventNotificationTx	dot3OamUniqueEventNotificationTx
.aOAMUniqueEventNotificationRx	dot3OamUniqueEventNotificationRx
.aOAMDuplicateEventNotificationTx	dot3OamDuplicateEventNotificationTx
.aOAMDuplicateEventNotificationRx	dot3OamDuplicateEventNotificationRx
.aOAMLoopbackControlTx	dot3OamLoopbackControlTx

```
    .aOAMLoopbackControlRx          dot3OamLoopbackControlRx
    .aOAMVariableRequestTx          dot3OamVariableRequestTx
    .aOAMVariableRequestRx          dot3OamVariableRequestRx
    .aOAMVariableResponseTx         dot3OamVariableResponseTx
    .aOAMVariableResponseRx         dot3OamVariableResponseRx
    .aOAMOrganizationSpecificTx     dot3OamOrgSpecificTx
    .aOAMOrganizationSpecificRx     dot3OamOrgSpecificTx

    .aOAMLocalErrSymPeriodConfig    dot3OamErrSymPeriodWindow,
                                    dot3OamErrSymPeriodThreshold
    .aOAMLocalErrSymPeriodEvent     dot3OamEventLogEntry
    .aOAMLocalErrFrameConfig        dot3OamErrFrameWindow,
                                    dot3OamErrFrameThreshold
    .aOAMLocalErrFrameEvent         dot3OamEventLogEntry
    .aOAMLocalErrFramePeriodConfig  dot3OamErrFramePeriodWindow,
                                    dot3OamErrFramePeriodThreshold
    .aOAMLocalErrFramePeriodEvent   dot3OamEventLogEntry
    .aOAMLocalErrFrameSecsSummaryConfig
                                    dot3OamErrFrameSecsSummaryWindow,
                                    dot3OamErrFrameSecssummaryThreshold
    .aOAMLocalErrFrameSecsSummaryEvent
                                    dot3OamEventLogEntry
    .aOAMRemoteErrSymPeriodEvent    dot3OamEventLogEntry
    .aOAMRemoteErrFrameEvent        dot3OamEventLogEntry
    .aOAMRemoteErrFramePeriodEvent  dot3OamEventLogEntry
    .aOAMRemoteErrFrameSecsSummaryEvent
                                    dot3OamEventLogEntry
    .aFramesLostDueToOAmError       dot3OamFramesLostDueToOam
    .acOAMAdminControl              dot3OamAdminState
```

There are no IEEE 802.3ah managed objects that are not reflected in this MIB Module in some manner.

5. MIB Structure

The Ethernet OAM MIB objects of this memo focus on the OA capabilities introduced in [802.3ah]. The MIB objects are partitioned into six different MIB groups.

The dot3OamTable group manages the primary OAM objects of the Ethernet interface. This group controls the state and status of OA as well as the mode in which it operates.

The dot3OamPeerTable maintains the current information on the status and configuration of the peer OAM entity on the Ethernet interface. Managed information includes the capabilities and function available on the peer OAM entity.

The dot3OamLoopbackTable manages the loopback function introduced in [802.3ah]. This table controls enabling and disabling loopback, as well as indicating the loopback status of Ethernet OAM on this interface.

The dot3OamStatsTable maintains statistics on the number and type of Ethernet OAM frames being transmitted and received on the Ethernet interface.

The dot3OamEventConfigTable defines the objects for managing the event notification capability available in Ethernet OAM. With Ethernet OAM, one device may send notifications to its peer devices whenever an important event happens on the local device. This table provides management of which events result in notifications via Ethernet OAM notifications and/or via SNMP notifications.

The dot3OamEventLogTable manages the current status of local and remote events detected via Ethernet OAM. This table is updated whenever local events are detected by Ethernet OAM or whenever Ethernet OAM Event Notifications are received from the peer OA entity.

There are two notifications defined to report Ethernet OAM events (one for threshold crossing events, one for non-threshold crossing events). Both notifications are contained within the same conformance group.

6. MIB Definition

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

 IMPORTS
   MODULE-IDENTITY, mib-2, OBJECT-TYPE, Counter32, Unsigned32,
     Integer32, NOTIFICATION-TYPE
     FROM SNMPv2-SMI
     -- from [RFC2578]
   TEXTUAL-CONVENTION, MacAddress, TimeStamp, TruthValue

     FROM SNMPv2-TC
     -- from [RFC2579]
   CounterBasedGauge64
     FROM HCNUM-TC
     -- from [RFC2856]
   ifIndex
     FROM IF-MIB
     -- from [RFC2863]
   MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
     FROM SNMPv2-CONF;
```

```
        -- from [RFC2580]

      dot3OamMIB MODULE-IDENTITY
        LAST-UPDATED "200706140000Z"  -- June 14,2007"
        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-requests@ietf.org
            In Body: subscribe your_email_address
          Chair: Bert Wijnen
            Alcatel-Lucent
            Email: bwijnen at alcatel-lucent dot com
          Editor: Matt Squire
            Hatteras Networks
            E-mail: msquire at hatterasnetworks dot com
          "
        DESCRIPTION
          "The MIB module for managing the new Ethernet OAM features
          introduced by the Ethernet in the First Mile taskforce (IEEE
          802.3ah).  The functionality presented here is based on IEEE
          802.3ah [802.3ah], released in October, 2004.  [802.3ah] was
          prepared as an addendum to the standing version of IEEE 802.3
          [802.3-2002].  Since then, [802.3ah] has been
          merged into the base IEEE 802.3 specification in [802.3-2005].

          In particular, this MIB focuses on the new OAM functions
          introduced in Clause 57 of [802.3ah].  The OAM functionality
          of Clause 57 is controlled by new management attributes
          introduced in Clause 30 of [802.3ah].  The OAM functions are
          not specific to any particular Ethernet physical layer, and
          can be generically applied to any Ethernet interface of
          [802.3-2002].

          An Ethernet OAM protocol data unit is a valid Ethernet frame
          with a destination MAC address equal to the reserved MAC
          address for Slow Protocols (See 43B of [802.3ah]), a
          lengthOrType field equal to the reserved type for Slow
          Protocols, and a Slow Protocols subtype equal to that of the
          subtype reserved for Ethernet OAM.  OAMPDU is used throughout
          this document as an abbreviation for Ethernet OAM protocol
          data unit.

          The following reference is used throughout this MIB module:
```

```
            [802.3ah] refers to:
              IEEE Std 802.3ah-2004: 'Draft amendment 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',
              October 2004.

            [802.3-2002] refers to:
              IEEE Std 802.3-2002:
              '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',
              March 2002.

            [802.3-2005] refers to:
              IEEE Std 802.3-2005:
              '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',
              December 2005.

            [802-2001] refers to:
              'IEEE Standard for LAN/MAN (Local Area
              Network/Metropolitan Area Network): Overview and
              Architecture', IEEE 802, June 2001.

           Copyright (c) The IETF Trust (2007).  This version of
           this MIB module is part of RFC 4878; See the RFC itself for
           full legal notices. "

         REVISION    "200706140000Z"  -- June 14, 2007"
         DESCRIPTION "Initial version, published as RFC 4878."
          ::= { mib-2 158 }

       --
       -- Sections of the Ethernet OAM MIB
```

```
--
   dot3OamNotifications OBJECT IDENTIFIER ::= { dot3OamMIB 0 }
   dot3OamObjects       OBJECT IDENTIFIER ::= { dot3OamMIB 1 }
   dot3OamConformance   OBJECT IDENTIFIER ::= { dot3OamMIB 2 }

--
-- Textual conventions for the OAM MIB
--
EightOTwoOui ::= TEXTUAL-CONVENTION
  STATUS       current
  DESCRIPTION
    "24-bit Organizationally Unique Identifier.  Information on
    OUIs can be found in IEEE 802-2001 [802-2001], Clause 9."
  SYNTAX       OCTET STRING(SIZE(3))

-- ****************************************************************
--
-- Ethernet OAM Control group
--

dot3OamTable OBJECT-TYPE
  SYNTAX      SEQUENCE OF Dot3OamEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "This table contains the primary controls and status for the
    OAM capabilities of an Ethernet-like interface.  There will be
    one row in this table for each Ethernet-like interface in the
    system that supports the OAM functions defined in [802.3ah].
    "
  ::= { dot3OamObjects 1 }

dot3OamEntry OBJECT-TYPE
  SYNTAX     Dot3OamEntry
  MAX-ACCESS not-accessible
  STATUS     current
  DESCRIPTION
    "An entry in the table that contains information on the
    Ethernet OAM function for a single Ethernet like interface.
    Entries in the table are created automatically for each
    interface supporting Ethernet OAM.  The status of the row
    entry can be determined from dot3OamOperStatus.

    A dot3OamEntry is indexed in the dot3OamTable by the ifIndex
    object of the Interfaces MIB.
    "
  INDEX       { ifIndex }
  ::= { dot3OamTable 1 }
```

```
      Dot3OamEntry ::=
        SEQUENCE {
          dot3OamAdminState                   INTEGER,
          dot3OamOperStatus                   INTEGER,
          dot3OamMode                         INTEGER,
          dot3OamMaxOamPduSize                Unsigned32,
          dot3OamConfigRevision               Unsigned32,
          dot3OamFunctionsSupported           BITS
        }

      dot3OamAdminState OBJECT-TYPE
        SYNTAX      INTEGER {
                      enabled(1),
                      disabled(2)
                    }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "This object is used to provision the default administrative
          OAM mode for this interface.  This object represents the
          desired state of OAM for this interface.

          The dot3OamAdminState always starts in the disabled(2) state
          until an explicit management action or configuration
          information retained by the system causes a transition to the
          enabled(1) state.  When enabled(1), Ethernet OAM will attempt
          to operate over this interface.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.2"
        ::= { dot3OamEntry 1 }

      dot3OamOperStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                      disabled(1),
                      linkFault(2),
                      passiveWait(3),
                      activeSendLocal(4),
                      sendLocalAndRemote(5),
                      sendLocalAndRemoteOk(6),
                      oamPeeringLocallyRejected(7),
                      oamPeeringRemotelyRejected(8),
                      operational(9),
                      nonOperHalfDuplex(10)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "At initialization and failure conditions, two OAM entities on
```

the same full-duplex Ethernet link begin a discovery phase to determine what OAM capabilities may be used on that link. The progress of this initialization is controlled by the OA sublayer.

This value is always disabled(1) if OAM is disabled on this interface via the dot3OamAdminState.

If the link has detected a fault and is transmitting OAMPDUs with a link fault indication, the value is linkFault(2). Also, if the interface is not operational (ifOperStatus is not up(1)), linkFault(2) is returned. Note that the object ifOperStatus may not be up(1) as a result of link failure or administrative action (ifAdminState being down(2) or testing(3)).

The passiveWait(3) state is returned only by OAM entities in passive mode (dot3OamMode) and reflects the state in which the OAM entity is waiting to see if the peer device is OA capable. The activeSendLocal(4) value is used by active mode devices (dot3OamMode) and reflects the OAM entity actively trying to discover whether the peer has OAM capability but has not yet made that determination.

The state sendLocalAndRemote(5) reflects that the local OA entity has discovered the peer but has not yet accepted or rejected the configuration of the peer. The local device can, for whatever reason, decide that the peer device is unacceptable and decline OAM peering. If the local OAM entity rejects the peer OAM entity, the state becomes oamPeeringLocallyRejected(7). If the OAM peering is allowed by the local device, the state moves to sendLocalAndRemoteOk(6). Note that both the sendLocalAndRemote(5) and oamPeeringLocallyRejected(7) states fall within the state SEND_LOCAL_REMOTE of the Discovery state diagram [802.3ah, Figure 57-5], with the difference being whether the local OAM client has actively rejected the peering or has just not indicated any decision yet. Whether a peering decision has been made is indicated via the local flags field in the OAMPDU (reflected in the aOAMLocalFlagsField of 30.3.6.1.10).

If the remote OAM entity rejects the peering, the state becomes oamPeeringRemotelyRejected(8). Note that both the sendLocalAndRemoteOk(6) and oamPeeringRemotelyRejected(8) states fall within the state SEND_LOCAL_REMOTE_OK of the Discovery state diagram [802.3ah, Figure 57-5], with the difference being whether the remote OAM client has rejected

```
          the peering or has just not yet decided.  This is indicated
          via the remote flags field in the OAMPDU (reflected in the
          aOAMRemoteFlagsField of 30.3.6.1.11).

          When the local OAM entity learns that both it and the remote
          OAM entity have accepted the peering, the state moves to
          operational(9) corresponding to the SEND_ANY state of the
          Discovery state diagram [802.3ah, Figure 57-5].

          Since Ethernet OAM functions are not designed to work
          completely over half-duplex interfaces, the value
          nonOperHalfDuplex(10) is returned whenever Ethernet OAM is
          enabled (dot3OamAdminState is enabled(1)), but the interface
          is in half-duplex operation.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.4, 30.3.6.1.10, 30.3.6.1.11"
        ::= { dot3OamEntry 2 }

      dot3OamMode OBJECT-TYPE
        SYNTAX      INTEGER {
                      passive(1),
                      active(2)
                    }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "This object configures the mode of OAM operation for this
          Ethernet-like interface.  OAM on Ethernet interfaces may be in
          'active' mode or 'passive' mode.  These two modes differ in
          that active mode provides additional capabilities to initiate
          monitoring activities with the remote OAM peer entity, while
          passive mode generally waits for the peer to initiate OA
          actions with it.  As an example, an active OAM entity can put
          the remote OAM entity in a loopback state, where a passive OA
          entity cannot.

          The default value of dot3OamMode is dependent on the type of
          system on which this Ethernet-like interface resides.  The
          default value should be 'active(2)' unless it is known that
          this system should take on a subservient role to the other
          device connected over this interface.

          Changing this value results in incrementing the configuration
          revision field of locally generated OAMPDUs (30.3.6.1.12) and
          potentially re-doing the OAM discovery process if the
          dot3OamOperStatus was already operational(9).
          "
        REFERENCE   "[802.3ah], 30.3.6.1.3"
```

```
        ::= { dot3OamEntry 3 }

      dot3OamMaxOamPduSize OBJECT-TYPE
        SYNTAX      Unsigned32 (64..1518)
        UNITS       "octets"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The largest OAMPDU that the OAM entity supports.  OA
          entities exchange maximum OAMPDU sizes and negotiate to use
          the smaller of the two maximum OAMPDU sizes between the peers.
          This value is determined by the local implementation.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.8"
        ::= { dot3OamEntry 4 }

      dot3OamConfigRevision OBJECT-TYPE
        SYNTAX      Unsigned32(0..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The configuration revision of the OAM entity as reflected in
          the latest OAMPDU sent by the OAM entity.  The config revision
          is used by OAM entities to indicate that configuration changes
          have occurred, which might require the peer OAM entity to
          re-evaluate whether OAM peering is allowed.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.12"
        ::= { dot3OamEntry 5 }

      dot3OamFunctionsSupported OBJECT-TYPE
        SYNTAX      BITS {
                      unidirectionalSupport (0),
                      loopbackSupport(1),
                      eventSupport(2),
                      variableSupport(3)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The OAM functions supported on this Ethernet-like interface.
          OAM consists of separate functional sets beyond the basic
          discovery process that is always required.  These functional
          groups can be supported independently by any implementation.
          These values are communicated to the peer via the local
          configuration field of Information OAMPDUs.

          Setting 'unidirectionalSupport(0)' indicates that the OA
```

```
          entity supports the transmission of OAMPDUs on links that are
          operating in unidirectional mode (traffic flowing in one
          direction only).  Setting 'loopbackSupport(1)' indicates that
          the OAM entity can initiate and respond to loopback commands.
          Setting 'eventSupport(2)' indicates that the OAM entity can
          send and receive Event Notification OAMPDUs.  Setting
          'variableSupport(3)' indicates that the OAM entity can send
          and receive Variable Request and Response OAMPDUs.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.6"
        ::= { dot3OamEntry 6 }

      -- ****************************************************************
      --
      -- Ethernet OAM Peer group
      --

      dot3OamPeerTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF Dot3OamPeerEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
          "This table contains information about the OAM peer for a
          particular Ethernet-like interface.  OAM entities communicate
          with a single OAM peer entity on Ethernet links on which OA
          is enabled and operating properly.  There is one entry in this
          table for each entry in the dot3OamTable for which information
          on the peer OAM entity is available.
          "
        ::= { dot3OamObjects 2 }

      dot3OamPeerEntry OBJECT-TYPE
        SYNTAX      Dot3OamPeerEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
          "An entry in the table containing information on the peer OA
          entity for a single Ethernet-like interface.

          Note that there is at most one OAM peer for each Ethernet-like
          interface.  Entries are automatically created when information
          about the OAM peer entity becomes available, and automatically
          deleted when the OAM peer entity is no longer in
          communication.  Peer information is not available when
          dot3OamOperStatus is disabled(1), linkFault(2),
          passiveWait(3), activeSendLocal(4), or nonOperHalfDuplex(10).
          "
        INDEX       { ifIndex }
```

```
    ::= { dot3OamPeerTable 1 }

  Dot3OamPeerEntry ::=
    SEQUENCE {
      dot3OamPeerMacAddress              MacAddress,
      dot3OamPeerVendorOui               EightOTwoOui,
      dot3OamPeerVendorInfo              Unsigned32,
      dot3OamPeerMode                    INTEGER,
      dot3OamPeerMaxOamPduSize           Unsigned32,
      dot3OamPeerConfigRevision          Unsigned32,
      dot3OamPeerFunctionsSupported      BITS
    }

  dot3OamPeerMacAddress OBJECT-TYPE
    SYNTAX      MacAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The MAC address of the peer OAM entity.  The MAC address is
      derived from the most recently received OAMPDU.
      "
    REFERENCE   "[802.3ah], 30.3.6.1.5."
    ::= { dot3OamPeerEntry 1 }

  dot3OamPeerVendorOui OBJECT-TYPE
    SYNTAX      EightOTwoOui
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The OUI of the OAM peer as reflected in the latest
      Information OAMPDU received with a Local Information TLV.  The
      OUI can be used to identify the vendor of the remote OA
      entity.  This value is initialized to three octets of zero
      before any Local Information TLV is received.
      "
    REFERENCE   "[802.3ah], 30.3.6.1.16."
    ::= { dot3OamPeerEntry 2 }

  dot3OamPeerVendorInfo OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The Vendor Info of the OAM peer as reflected in the latest
      Information OAMPDU received with a Local Information TLV.
      The semantics of the Vendor Information field is proprietary
      and specific to the vendor (identified by the
      dot3OamPeerVendorOui).  This information could, for example,
```

```
          be used to identify a specific product or product family.
          This value is initialized to zero before any Local
          Information TLV is received.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.17."
        ::= { dot3OamPeerEntry 3 }

      dot3OamPeerMode OBJECT-TYPE
        SYNTAX      INTEGER {
                      passive(1),
                      active(2),
                      unknown(3)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The mode of the OAM peer as reflected in the latest
          Information OAMPDU received with a Local Information TLV.  The
          mode of the peer can be determined from the Configuration
          field in the Local Information TLV of the last Information
          OAMPDU received from the peer.  The value is unknown(3)
          whenever no Local Information TLV has been received.  The
          values of active(2) and passive(1) are returned when a Local
          Information TLV has been received indicating that the peer is
          in active or passive mode, respectively.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.7."
        ::= { dot3OamPeerEntry 4 }

      dot3OamPeerMaxOamPduSize OBJECT-TYPE
        SYNTAX      Unsigned32 (0 | 64..1518)
        UNITS       "octets"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The maximum size of OAMPDU supported by the peer as reflected
          in the latest Information OAMPDU received with a Local
          Information TLV.  Ethernet OAM on this interface must not use
          OAMPDUs that exceed this size.  The maximum OAMPDU size can be
          determined from the PDU Configuration field of the Local
          Information TLV of the last Information OAMPDU received from
          the peer.  A value of zero is returned if no Local Information
          TLV has been received.  Otherwise, the value of the OAM peer's
          maximum OAMPDU size is returned in this value.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.9."
        ::= { dot3OamPeerEntry 5 }
```

```
    dot3OamPeerConfigRevision OBJECT-TYPE
      SYNTAX      Unsigned32(0..65535)
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The configuration revision of the OAM peer as reflected in
        the latest OAMPDU.  This attribute is changed by the peer
        whenever it has a local configuration change for Ethernet OA
        on this interface.  The configuration revision can be
        determined from the Revision field of the Local Information
        TLV of the most recently received Information OAMPDU with
        a Local Information TLV.  A value of zero is returned if
        no Local Information TLV has been received.
      "
      REFERENCE   "[802.3ah], 30.3.6.1.13."
      ::= { dot3OamPeerEntry 6 }

    dot3OamPeerFunctionsSupported OBJECT-TYPE
      SYNTAX      BITS {
                    unidirectionalSupport (0),
                    loopbackSupport(1),
                    eventSupport(2),
                    variableSupport(3)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The OAM functions supported on this Ethernet-like interface.
        OAM consists of separate functionality sets above the basic
        discovery process.  This value indicates the capabilities of
        the peer OAM entity with respect to these functions.  This
        value is initialized so all bits are clear.

        If unidirectionalSupport(0) is set, then the peer OAM entity
        supports sending OAM frames on Ethernet interfaces when the
        receive path is known to be inoperable.  If
        loopbackSupport(1) is set, then the peer OAM entity can send
        and receive OAM loopback commands.  If eventSupport(2) is set,
        then the peer OAM entity can send and receive event OAMPDUs to
        signal various error conditions.  If variableSupport(3) is
        set, then the peer OAM entity can send and receive variable
        requests to monitor the attribute value as described in Clause
        57 of [802.3ah].

        The capabilities of the OAM peer can be determined from the
        configuration field of the Local Information TLV of the most
        recently received Information OAMPDU with a Local Information
        TLV.  All zeros are returned if no Local Information TLV has
```

```
          yet been received.
          "
        REFERENCE   "[802.3ah], REFERENCE 30.3.6.1.7."
        ::= { dot3OamPeerEntry 7 }

      -- ****************************************************************
      --
      -- Ethernet OAM Loopback group
      --

      dot3OamLoopbackTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF Dot3OamLoopbackEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
          "This table contains controls for the loopback state of the
          local link as well as indicates the status of the loopback
          function.  There is one entry in this table for each entry in
          dot3OamTable that supports loopback functionality (where
          dot3OamFunctionsSupported includes the loopbackSupport bit
          set).

          Loopback can be used to place the remote OAM entity in a state
          where every received frame (except OAMPDUs) is echoed back
          over the same interface on which they were received.  In this
          state, at the remote entity, 'normal' traffic is disabled as
          only the looped back frames are transmitted on the interface.
          Loopback is thus an intrusive operation that prohibits normal
          data flow and should be used accordingly.
          "
        ::= { dot3OamObjects 3 }

      dot3OamLoopbackEntry OBJECT-TYPE
        SYNTAX      Dot3OamLoopbackEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
          "An entry in the table, containing information on the loopback
          status for a single Ethernet-like interface.  Entries in the
          table are automatically created whenever the local OAM entity
          supports loopback capabilities.  The loopback status on the
          interface can be determined from the dot3OamLoopbackStatus
          object.
          "
        INDEX       { ifIndex }
        ::= { dot3OamLoopbackTable 1 }

      Dot3OamLoopbackEntry ::=
```

```
    SEQUENCE {
      dot3OamLoopbackStatus             INTEGER,
      dot3OamLoopbackIgnoreRx           INTEGER
    }

  dot3OamLoopbackStatus OBJECT-TYPE
    SYNTAX      INTEGER {
                  -- all values, except where noted, can be read
                  -- but cannot be written
                  noLoopback (1),

                  -- initiatingLoopback can be read or written
                  initiatingLoopback (2),
                  remoteLoopback (3),

                  -- terminatingLoopback can be read or written
                  terminatingLoopback (4),
                  localLoopback (5),
                  unknown (6)
                }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
      "The loopback status of the OAM entity.  This status is
      determined by a combination of the local parser and
      multiplexer states, the remote parser and multiplexer states,
      as well as by the actions of the local OAM client.  When
      operating in normal mode with no loopback in progress, the
      status reads noLoopback(1).

      The values initiatingLoopback(2) and terminatingLoopback(4)
      can be read or written.  The other values can only be read -
      they can never be written.  Writing initiatingLoopback causes
      the local OAM entity to start the loopback process with its
      peer.  This value can only be written when the status is
      noLoopback(1).  Writing the value initiatingLoopback(2) in any
      other state has no effect.  When in remoteLoopback(3), writing
      terminatingLoopback(4) causes the local OAM entity to initiate
      the termination of the loopback state.  Writing
      terminatingLoopack(4) in any other state has no effect.

      If the OAM client initiates a loopback and has sent a
      Loopback OAMPDU and is waiting for a response, where the local
      parser and multiplexer states are DISCARD (see [802.3ah,
      57.2.11.1]), the status is 'initiatingLoopback'.  In this
      case, the local OAM entity has yet to receive any
      acknowledgment that the remote OAM entity has received its
      loopback command request.
```

```
        If the local OAM client knows that the remote OAM entity is in
        loopback mode (via the remote state information as described
        in [802.3ah, 57.2.11.1, 30.3.6.1.15]), the status is
        remoteLoopback(3).  If the local OAM client is in the process
        of terminating the remote loopback [802.3ah, 57.2.11.3,
        30.3.6.1.14] with its local multiplexer and parser states in
        DISCARD, the status is terminatingLoopback(4).  If the remote
        OAM client has put the local OAM entity in loopback mode as
        indicated by its local parser state, the status is
        localLoopback(5).

        The unknown(6) status indicates that the parser and
        multiplexer combination is unexpected.  This status may be
        returned if the OAM loopback is in a transition state but
        should not persist.

        The values of this attribute correspond to the following
        values of the local and remote parser and multiplexer states.

          value            LclPrsr   LclMux    RmtPrsr   RmtMux
          noLoopback         FWD       FWD       FWD       FWD
          initLoopback     DISCARD   DISCARD     FWD       FWD
          rmtLoopback      DISCARD     FWD      LPBK    DISCARD
          tmtngLoopback    DISCARD   DISCARD    LPBK    DISCARD
          lclLoopback        LPBK    DISCARD   DISCARD     FWD
          unknown            ***   any other combination   ***
        "
      REFERENCE   "[802.3ah], REFERENCE 57.2.11, 30.3.61.14,
        30.3.6.1.15"
      ::= { dot3OamLoopbackEntry 1 }

    dot3OamLoopbackIgnoreRx OBJECT-TYPE
      SYNTAX      INTEGER { ignore(1), process(2) }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "Since OAM loopback is a disruptive operation (user traffic
        does not pass), this attribute provides a mechanism to provide
        controls over whether received OAM loopback commands are
        processed or ignored.  When the value is ignore(1), received
        loopback commands are ignored.  When the value is process(2),
        OAM loopback commands are processed.  The default value is to
        ignore loopback commands (ignore(1)).
        "
      REFERENCE   "[802.3ah], REFERENCE 57.2.11, 30.3.61.14,
        30.3.6.1.15"
      ::= { dot3OamLoopbackEntry 2 }
```

```
-- ************************************************************
--
-- Ethernet OAM Statistics group
--

dot3OamStatsTable OBJECT-TYPE
  SYNTAX      SEQUENCE OF Dot3OamStatsEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "This table contains statistics for the OAM function on a
    particular Ethernet-like interface.  There is an entry in the
    table for every entry in the dot3OamTable.

    The counters in this table are defined as 32-bit entries to
    match the counter size as defined in [802.3ah].  Given that
    the OA protocol is a slow protocol, the counters increment at
    a slow rate.
    "
  ::= { dot3OamObjects 4 }

dot3OamStatsEntry OBJECT-TYPE
  SYNTAX      Dot3OamStatsEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "An entry in the table containing statistics information on
    the Ethernet OAM function for a single Ethernet-like
    interface.  Entries are automatically created for every entry
    in the dot3OamTable.  Counters are maintained across
    transitions in dot3OamOperStatus.
    "
  INDEX       { ifIndex }
  ::= { dot3OamStatsTable 1 }

Dot3OamStatsEntry ::=
  SEQUENCE {
            dot3OamInformationTx                Counter32,
            dot3OamInformationRx                Counter32,
            dot3OamUniqueEventNotificationTx    Counter32,
            dot3OamUniqueEventNotificationRx    Counter32,
            dot3OamDuplicateEventNotificationTx Counter32,
            dot3OamDuplicateEventNotificationRx Counter32,
            dot3OamLoopbackControlTx            Counter32,
            dot3OamLoopbackControlRx            Counter32,
            dot3OamVariableRequestTx            Counter32,
            dot3OamVariableRequestRx            Counter32,
            dot3OamVariableResponseTx           Counter32,
```

```
                dot3OamVariableResponseRx          Counter32,
                dot3OamOrgSpecificTx               Counter32,
                dot3OamOrgSpecificRx               Counter32,
                dot3OamUnsupportedCodesTx          Counter32,
                dot3OamUnsupportedCodesRx          Counter32,
                dot3OamFramesLostDueToOam          Counter32
              }

    dot3OamInformationTx OBJECT-TYPE
      SYNTAX      Counter32
      UNITS       "frames"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "A count of the number of Information OAMPDUs transmitted on
        this 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.  "
      REFERENCE   "[802.3ah], 30.3.6.1.20."
      ::= { dot3OamStatsEntry 1 }

    dot3OamInformationRx OBJECT-TYPE
      SYNTAX      Counter32
      UNITS       "frames"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "A count of the number of Information OAMPDUs received on this
        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.
        "
      REFERENCE   "[802.3ah], 30.3.6.1.21."
      ::= { dot3OamStatsEntry 2 }

    dot3OamUniqueEventNotificationTx OBJECT-TYPE
      SYNTAX      Counter32
      UNITS       "frames"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "A count of the number of unique Event OAMPDUs transmitted on
        this interface.  Event Notifications may be sent in duplicate
        to increase the probability of successfully being received,
```

```
          given the possibility that a frame may be lost in transit.
          Duplicate Event Notification transmissions are counted by
          dot3OamDuplicateEventNotificationTx.

          A unique Event Notification OAMPDU is indicated as an Event
          Notification OAMPDU with a Sequence Number field that is
          distinct from the previously transmitted Event Notification
          OAMPDU Sequence Number.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.22."
        ::= { dot3OamStatsEntry 3 }

      dot3OamUniqueEventNotificationRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of unique Event OAMPDUs received on
          this interface.  Event Notification OAMPDUs may be sent in
          duplicate to increase the probability of successfully being
          received, given the possibility that a frame may be lost in
          transit.  Duplicate Event Notification receptions are counted
          by dot3OamDuplicateEventNotificationRx.

          A unique Event Notification OAMPDU is indicated as an Event
          Notification OAMPDU with a Sequence Number field that is
          distinct from the previously received Event Notification
          OAMPDU Sequence Number.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.24."
        ::= { dot3OamStatsEntry 4 }

      dot3OamDuplicateEventNotificationTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of duplicate Event OAMPDUs transmitted
```

```
          on this interface.  Event Notification OAMPDUs may be sent in
          duplicate to increase the probability of successfully being
          received, given the possibility that a frame may be lost in
          transit.

          A duplicate Event Notification OAMPDU is indicated as an Event
          Notification OAMPDU with a Sequence Number field that is
          identical to the previously transmitted Event Notification
          OAMPDU Sequence Number.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.23."
        ::= { dot3OamStatsEntry 5 }

      dot3OamDuplicateEventNotificationRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of duplicate Event OAMPDUs received on
          this interface.  Event Notification OAMPDUs may be sent in
          duplicate to increase the probability of successfully being
          received, given the possibility that a frame may be lost in
          transit.

          A duplicate Event Notification OAMPDU is indicated as an Event
          Notification OAMPDU with a Sequence Number field that is
          identical to the previously received Event Notification OAMPDU
          Sequence Number.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.25."
        ::= { dot3OamStatsEntry 6 }

      dot3OamLoopbackControlTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Loopback Control OAMPDUs transmitted
```

```
          on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.26."
        ::= { dot3OamStatsEntry 7 }

      dot3OamLoopbackControlRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Loopback Control OAMPDUs received
          on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.27."
        ::= { dot3OamStatsEntry 8 }

      dot3OamVariableRequestTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Variable Request OAMPDUs transmitted
          on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.28."
        ::= { dot3OamStatsEntry 9 }

      dot3OamVariableRequestRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Variable Request OAMPDUs received on
```

```
          this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.29."
        ::= { dot3OamStatsEntry 10 }

      dot3OamVariableResponseTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Variable Response OAMPDUs
          transmitted on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.30."
        ::= { dot3OamStatsEntry 11 }

      dot3OamVariableResponseRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Variable Response OAMPDUs received
          on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.31."
        ::= { dot3OamStatsEntry 12 }

       dot3OamOrgSpecificTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Organization Specific OAMPDUs
```

```
          transmitted on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.32."
        ::= { dot3OamStatsEntry 13 }

      dot3OamOrgSpecificRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of Organization Specific OAMPDUs
          received on this 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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.33."
        ::= { dot3OamStatsEntry 14 }

      dot3OamUnsupportedCodesTx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of OAMPDUs transmitted on this
          interface with an unsupported op-code.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.18."
        ::= { dot3OamStatsEntry 15 }

      dot3OamUnsupportedCodesRx OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of OAMPDUs received on this interface
```

```
          with an unsupported op-code.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.19."
        ::= { dot3OamStatsEntry 16 }

      dot3OamFramesLostDueToOam OBJECT-TYPE
        SYNTAX      Counter32
        UNITS       "frames"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "A count of the number of frames that were dropped by the OA
          multiplexer.  Since the OAM multiplexer has multiple inputs
          and a single output, there may be cases where frames are
          dropped due to transmit resource contention.  This counter is
          incremented whenever a frame is dropped by the OAM layer.
          Note that any Ethernet frame, not just OAMPDUs, may be dropped
          by the OAM layer.  This can occur when an OAMPDU takes
          precedence over a 'normal' frame resulting in the 'normal'
          frame being dropped.

          When this counter is incremented, no other counters in this
          MIB are incremented.

          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.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.46."
        ::= { dot3OamStatsEntry 17 }

      -- ****************************************************************
      --
      -- Ethernet OAM Event Configuration group
      --

      dot3OamEventConfigTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF Dot3OamEventConfigEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
          "Ethernet OAM includes the ability to generate and receive
          Event Notification OAMPDUs to indicate various link problems.
          This table contains the mechanisms to enable Event
```

```
        Notifications and configure the thresholds to generate the
        standard Ethernet OAM events.  There is one entry in the table
        for every entry in dot3OamTable that supports OAM events
        (where dot3OamFunctionsSupported includes the eventSupport
        bit set).  The values in the table are maintained across
        changes to dot3OamOperStatus.

        The standard threshold crossing events are:
          - Errored Symbol Period Event.  Generated when the number of
            symbol errors exceeds a threshold within a given window
            defined by a number of symbols (for example, 1,000 symbols
            out of 1,000,000 had errors).
          - Errored Frame Period Event.  Generated when the number of
            frame errors exceeds a threshold within a given window
            defined by a number of frames (for example, 10 frames out
            of 1000 had errors).
          - Errored Frame Event.  Generated when the number of frame
            errors exceeds a threshold within a given window defined
            by a period of time (for example, 10 frames in 1 second
            had errors).
          - Errored Frame Seconds Summary Event.  Generated when the
            number of errored frame seconds exceeds a threshold within
            a given time period (for example, 10 errored frame seconds
            within the last 100 seconds).  An errored frame second is
            defined as a 1 second interval which had >0 frame errors.
        There are other events (dying gasp, critical events) that are
        not threshold crossing events but which can be
        enabled/disabled via this table.
        "
      ::= { dot3OamObjects 5 }

    dot3OamEventConfigEntry OBJECT-TYPE
      SYNTAX      Dot3OamEventConfigEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "Entries are automatically created and deleted from this
        table, and exist whenever the OAM entity supports Ethernet OA
        events (as indicated by the eventSupport bit in
        dot3OamFunctionsSuppported).  Values in the table are
        maintained across changes to the value of dot3OamOperStatus.

        Event configuration controls when the local management entity
        sends Event Notification OAMPDUs to its OAM peer, and when
        certain event flags are set or cleared in OAMPDUs.
        "
      INDEX       { ifIndex }
      ::= { dot3OamEventConfigTable 1 }
```

```
      Dot3OamEventConfigEntry ::=
        SEQUENCE {
                  dot3OamErrSymPeriodWindowHi        Unsigned32,
                  dot3OamErrSymPeriodWindowLo        Unsigned32,
                  dot3OamErrSymPeriodThresholdHi     Unsigned32,
                  dot3OamErrSymPeriodThresholdLo     Unsigned32,
                  dot3OamErrSymPeriodEvNotifEnable   TruthValue,
                  dot3OamErrFramePeriodWindow        Unsigned32,
                  dot3OamErrFramePeriodThreshold     Unsigned32,
                  dot3OamErrFramePeriodEvNotifEnable TruthValue,
                  dot3OamErrFrameWindow              Unsigned32,
                  dot3OamErrFrameThreshold           Unsigned32,
                  dot3OamErrFrameEvNotifEnable       TruthValue,
                  dot3OamErrFrameSecsSummaryWindow   Integer32,
                  dot3OamErrFrameSecsSummaryThreshold Integer32,
                  dot3OamErrFrameSecsEvNotifEnable   TruthValue,
                  dot3OamDyingGaspEnable             TruthValue,
                  dot3OamCriticalEventEnable         TruthValue
                }

      dot3OamErrSymPeriodWindowHi OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "2^32 symbols"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The two objects dot3OamErrSymPeriodWindowHi and
          dot3OamErrSymPeriodLo together form an unsigned 64-bit
          integer representing the number of symbols over which this
          threshold event is defined.  This is defined as
        dot3OamErrSymPeriodWindow = ((2^32)*dot3OamErrSymPeriodWindowHi)
                                          + dot3OamErrSymPeriodWindowLo

          If dot3OamErrSymPeriodThreshold symbol errors occur within a
          window of dot3OamErrSymPeriodWindow symbols, an Event
          Notification OAMPDU should be generated with an Errored Symbol
          Period Event TLV indicating that the threshold has been
          crossed in this window.

          The default value for dot3OamErrSymPeriodWindow is the number
          of symbols in one second for the underlying physical layer.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.34"
        ::= { dot3OamEventConfigEntry 1 }

      dot3OamErrSymPeriodWindowLo OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "symbols"
```

```
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The two objects dot3OamErrSymPeriodWindowHi and
          dot3OamErrSymPeriodWindowLo together form an unsigned 64-bit
          integer representing the number of symbols over which this
          threshold event is defined.  This is defined as

        dot3OamErrSymPeriodWindow = ((2^32)*dot3OamErrSymPeriodWindowHi)
                                        + dot3OamErrSymPeriodWindowLo

          If dot3OamErrSymPeriodThreshold symbol errors occur within a
          window of dot3OamErrSymPeriodWindow symbols, an Event
          Notification OAMPDU should be generated with an Errored Symbol
          Period Event TLV indicating that the threshold has been
          crossed in this window.

          The default value for dot3OamErrSymPeriodWindow is the number
          of symbols in one second for the underlying physical layer.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.34"
        ::= { dot3OamEventConfigEntry 2 }

      dot3OamErrSymPeriodThresholdHi OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "2^32 symbols"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The two objects dot3OamErrSymPeriodThresholdHi and
          dot3OamErrSymPeriodThresholdLo together form an unsigned
          64-bit integer representing the number of symbol errors that
          must occur within a given window to cause this event.

          This is defined as

            dot3OamErrSymPeriodThreshold =
                              ((2^32) * dot3OamErrSymPeriodThresholdHi)
                                      + dot3OamErrSymPeriodThresholdLo

          If dot3OamErrSymPeriodThreshold symbol errors occur within a
          window of dot3OamErrSymPeriodWindow symbols, an Event
          Notification OAMPDU should be generated with an Errored Symbol
          Period Event TLV indicating that the threshold has been
          crossed in this window.

          The default value for dot3OamErrSymPeriodThreshold is one
          symbol errors.  If the threshold value is zero, then an Event
```

```
          Notification OAMPDU is sent periodically (at the end of every
          window).  This can be used as an asynchronous notification to
          the peer OAM entity of the statistics related to this
          threshold crossing alarm.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.34"
        ::= { dot3OamEventConfigEntry 3 }

      dot3OamErrSymPeriodThresholdLo OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "symbols"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The two objects dot3OamErrSymPeriodThresholdHi and
          dot3OamErrSymPeriodThresholdLo together form an unsigned
          64-bit integer representing the number of symbol errors that
          must occur within a given window to cause this event.

          This is defined as

            dot3OamErrSymPeriodThreshold =
                              ((2^32) * dot3OamErrSymPeriodThresholdHi)
                                      + dot3OamErrSymPeriodThresholdLo

          If dot3OamErrSymPeriodThreshold symbol errors occur within a
          window of dot3OamErrSymPeriodWindow symbols, an Event
          Notification OAMPDU should be generated with an Errored Symbol
          Period Event TLV indicating that the threshold has been
          crossed in this window.

          The default value for dot3OamErrSymPeriodThreshold is one
          symbol error.  If the threshold value is zero, then an Event
          Notification OAMPDU is sent periodically (at the end of every
          window).  This can be used as an asynchronous notification to
          the peer OAM entity of the statistics related to this
          threshold crossing alarm.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.34"
        ::= { dot3OamEventConfigEntry 4 }

      dot3OamErrSymPeriodEvNotifEnable OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "If true, the OAM entity should send an Event Notification
          OAMPDU when an Errored Symbol Period Event occurs.
```

```
          By default, this object should have the value true for
          Ethernet-like interfaces that support OAM.  If the OAM layer
          does not support Event Notifications (as indicated via the
          dot3OamFunctionsSupported attribute), this value is ignored.
          "
        ::= { dot3OamEventConfigEntry 5 }

      dot3OamErrFramePeriodWindow OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "frames"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The number of frames over which the threshold is defined.
          The default value of the window is the number of minimum size
          Ethernet frames that can be received over the physical layer
          in one second.

          If dot3OamErrFramePeriodThreshold frame errors occur within a
          window of dot3OamErrFramePeriodWindow frames, an Event
          Notification OAMPDU should be generated with an Errored Frame
          Period Event TLV indicating that the threshold has been
          crossed in this window.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.38"
        ::= { dot3OamEventConfigEntry 6 }

      dot3OamErrFramePeriodThreshold OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "frames"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The number of frame errors that must occur for this event to
          be triggered.  The default value is one frame error.  If the
          threshold value is zero, then an Event Notification OAMPDU is
          sent periodically (at the end of every window).  This can be
          used as an asynchronous notification to the peer OAM entity of
          the statistics related to this threshold crossing alarm.

          If dot3OamErrFramePeriodThreshold frame errors occur within a
          window of dot3OamErrFramePeriodWindow frames, an Event
          Notification OAMPDU should be generated with an Errored Frame
          Period Event TLV indicating that the threshold has been
          crossed in this window.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.38"
```

```
        ::= { dot3OamEventConfigEntry 7 }

      dot3OamErrFramePeriodEvNotifEnable OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "If true, the OAM entity should send an Event Notification
          OAMPDU when an Errored Frame Period Event occurs.

          By default, this object should have the value true for
          Ethernet-like interfaces that support OAM.  If the OAM layer
          does not support Event Notifications (as indicated via the
          dot3OamFunctionsSupported attribute), this value is ignored.
          "
        ::= { dot3OamEventConfigEntry 8 }

      dot3OamErrFrameWindow OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "tenths of a second"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The amount of time (in 100ms increments) over which the
          threshold is defined.  The default value is 10 (1 second).

          If dot3OamErrFrameThreshold frame errors occur within a window
          of dot3OamErrFrameWindow seconds (measured in tenths of
          seconds), an Event Notification OAMPDU should be generated
          with an Errored Frame Event TLV indicating that the threshold
          has been crossed in this window.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.36"
        DEFVAL { 10 }
        ::= { dot3OamEventConfigEntry 9 }

      dot3OamErrFrameThreshold OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "frames"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The number of frame errors that must occur for this event to
          be triggered.  The default value is one frame error.  If the
          threshold value is zero, then an Event Notification OAMPDU is
          sent periodically (at the end of every window).  This can be
          used as an asynchronous notification to the peer OAM entity of
          the statistics related to this threshold crossing alarm.
```

```
        If dot3OamErrFrameThreshold frame errors occur within a window
        of dot3OamErrFrameWindow (in tenths of seconds), an Event
        Notification OAMPDU should be generated with an Errored Frame
        Event TLV indicating the threshold has been crossed in this
        window.
        "
      REFERENCE   "[802.3ah], 30.3.6.1.36"
      DEFVAL { 1 }
      ::= { dot3OamEventConfigEntry 10 }

    dot3OamErrFrameEvNotifEnable OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "If true, the OAM entity should send an Event Notification
        OAMPDU when an Errored Frame Event occurs.

        By default, this object should have the value true for
        Ethernet-like interfaces that support OAM.  If the OAM layer
        does not support Event Notifications (as indicated via the
        dot3OamFunctionsSupported attribute), this value is ignored.
        "
      DEFVAL { true }
      ::= { dot3OamEventConfigEntry 11 }

    dot3OamErrFrameSecsSummaryWindow OBJECT-TYPE
      SYNTAX      Integer32 (100..9000)
      UNITS       "tenths of a second"
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "The amount of time (in 100 ms intervals) over which the
        threshold is defined.  The default value is 100 (10 seconds).

        If dot3OamErrFrameSecsSummaryThreshold frame errors occur
        within a window of dot3OamErrFrameSecsSummaryWindow (in tenths
        of seconds), an Event Notification OAMPDU should be generated
        with an Errored Frame Seconds Summary Event TLV indicating
        that the threshold has been crossed in this window.
        "
      REFERENCE   "[802.3ah], 30.3.6.1.40"
      DEFVAL { 100 }
      ::= { dot3OamEventConfigEntry 12 }

    dot3OamErrFrameSecsSummaryThreshold OBJECT-TYPE
      SYNTAX      Integer32 (1..900)
```

```
        UNITS       "errored frame seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "The number of errored frame seconds that must occur for this
          event to be triggered.  The default value is one errored frame
          second.  If the threshold value is zero, then an Event
          Notification OAMPDU is sent periodically (at the end of every
          window).  This can be used as an asynchronous notification to
          the peer OAM entity of the statistics related to this
          threshold crossing alarm.

          If dot3OamErrFrameSecsSummaryThreshold frame errors occur
          within a window of dot3OamErrFrameSecsSummaryWindow (in tenths
          of seconds), an Event Notification OAMPDU should be generated
          with an Errored Frame Seconds Summary Event TLV indicating
          that the threshold has been crossed in this window.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.40"
        DEFVAL { 1 }
        ::= { dot3OamEventConfigEntry 13 }

      dot3OamErrFrameSecsEvNotifEnable OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "If true, the local OAM entity should send an Event
          Notification OAMPDU when an Errored Frame Seconds Event
          occurs.

          By default, this object should have the value true for
          Ethernet-like interfaces that support OAM.  If the OAM layer
          does not support Event Notifications (as indicated via the
          dot3OamFunctionsSupported attribute), this value is ignored.
          "
        DEFVAL { true }
        ::= { dot3OamEventConfigEntry 14 }

      dot3OamDyingGaspEnable OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "If true, the local OAM entity should attempt to indicate a
          dying gasp via the OAMPDU flags field to its peer OAM entity
          when a dying gasp event occurs.  The exact definition of a
          dying gasp event is implementation dependent.  If the system
```

```
          does not support dying gasp capability, setting this object
          has no effect, and reading the object should always result in
          'false'.

          By default, this object should have the value true for
          Ethernet-like interfaces that support OAM.  If the OAM layer
          does not support Event Notifications (as indicated via the
          dot3OamFunctionsSupported attribute), this value is ignored.
          "
        DEFVAL { true }
        ::= { dot3OamEventConfigEntry 15 }

      dot3OamCriticalEventEnable OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
          "If true, the local OAM entity should attempt to indicate a
          critical event via the OAMPDU flags to its peer OAM entity
          when a critical event occurs.  The exact definition of a
          critical event is implementation dependent.  If the system
          does not support critical event capability, setting this
          object has no effect, and reading the object should always
          result in 'false'.

          By default, this object should have the value true for
          Ethernet-like interfaces that support OAM.  If the OAM layer
          does not support Event Notifications (as indicated via the
          dot3OamFunctionsSupported attribute), this value is ignored.
          "
        DEFVAL { true }
        ::= { dot3OamEventConfigEntry 16 }

      -- ************************************************************
      --
      -- Ethernet OAM Event Log group
      --

      dot3OamEventLogTable OBJECT-TYPE
        SYNTAX       SEQUENCE OF Dot3OamEventLogEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
          "This table records a history of the events that have occurred
          at the Ethernet OAM level.  These events can include locally
          detected events, which may result in locally generated
          OAMPDUs, and remotely detected events, which are detected by
          the OAM peer entity and signaled to the local entity via
```

```
        Ethernet OAM.  Ethernet OAM events can be signaled by Event
        Notification OAMPDUs or by the flags field in any OAMPDU.

        This table contains both threshold crossing events and
        non-threshold crossing events.  The parameters for the
        threshold window, threshold value, and actual value
        (dot3OamEventLogWindowXX, dot3OamEventLogThresholdXX,
        dot3OamEventLogValue) are only applicable to threshold
        crossing events, and are returned as all F's (2^32 - 1) for
        non-threshold crossing events.

        Entries in the table are automatically created when such
        events are detected.  The size of the table is implementation
        dependent.  When the table reaches its maximum size, older
        entries are automatically deleted to make room for newer
        entries.
        "
        ::= { dot3OamObjects 6 }

    dot3OamEventLogEntry OBJECT-TYPE
      SYNTAX      Dot3OamEventLogEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the dot3OamEventLogTable.  Entries are
        automatically created whenever Ethernet OAM events occur at
        the local OAM entity, and when Event Notification OAMPDUs are
        received at the local OAM entity (indicating that events have
        occurred at the peer OAM entity).  The size of the table is
        implementation dependent, but when the table becomes full,
        older events are automatically deleted to make room for newer
        events.  The table index dot3OamEventLogIndex increments for
        each new entry, and when the maximum value is reached, the
        value restarts at zero.
        "
      INDEX       { ifIndex, dot3OamEventLogIndex }
      ::= { dot3OamEventLogTable 1 }

    Dot3OamEventLogEntry ::=
      SEQUENCE {
        dot3OamEventLogIndex               Unsigned32,
        dot3OamEventLogTimestamp           TimeStamp,
        dot3OamEventLogOui                 EightOTwoOui,
        dot3OamEventLogType                Unsigned32,
        dot3OamEventLogLocation            INTEGER,
        dot3OamEventLogWindowHi            Unsigned32,
        dot3OamEventLogWindowLo            Unsigned32,
        dot3OamEventLogThresholdHi         Unsigned32,
```

```
      dot3OamEventLogThresholdLo          Unsigned32,
      dot3OamEventLogValue                CounterBasedGauge64,
      dot3OamEventLogRunningTotal         CounterBasedGauge64,
      dot3OamEventLogEventTotal           Unsigned32
    }

  dot3OamEventLogIndex       OBJECT-TYPE
    SYNTAX      Unsigned32(1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An arbitrary integer for identifying individual events
      within the event log.  "
    ::= { dot3OamEventLogEntry 1 }

  dot3OamEventLogTimestamp  OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The value of sysUpTime at the time of the logged event.  For
      locally generated events, the time of the event can be
      accurately retrieved from sysUpTime.  For remotely generated
      events, the time of the event is indicated by the reception of
      the Event Notification OAMPDU indicating that the event
      occurred on the peer.  A system may attempt to adjust the
      timestamp value to more accurately reflect the time of the
      event at the peer OAM entity by using other information, such
      as that found in the timestamp found of the Event Notification
      TLVs, which provides an indication of the relative time
      between events at the peer entity.  "
    ::= { dot3OamEventLogEntry 2 }

  dot3OamEventLogOui  OBJECT-TYPE
    SYNTAX      EightOTwoOui
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The OUI of the entity defining the object type.  All IEEE
      802.3 defined events (as appearing in [802.3ah] except for the
      Organizationally Unique Event TLVs) use the IEEE 802.3 OUI of
      0x0180C2.  Organizations defining their own Event Notification
      TLVs include their OUI in the Event Notification TLV that
      gets reflected here.  "
    ::= { dot3OamEventLogEntry 3 }

  dot3OamEventLogType      OBJECT-TYPE
    SYNTAX      Unsigned32
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "The type of event that generated this entry in the event log.
          When the OUI is the IEEE 802.3 OUI of 0x0180C2, the following
          event types are defined:
              erroredSymbolEvent(1),
              erroredFramePeriodEvent(2),
              erroredFrameEvent(3),
              erroredFrameSecondsEvent(4),
              linkFault(256),
              dyingGaspEvent(257),
              criticalLinkEvent(258)
          The first four are considered threshold crossing events, as
          they are generated when a metric exceeds a given value within
          a specified window.  The other three are not threshold
          crossing events.

          When the OUI is not 71874 (0x0180C2 in hex), then some other
          organization has defined the event space.  If event subtyping
          is known to the implementation, it may be reflected here.
          Otherwise, this value should return all F's (2^32 - 1).
          "
        REFERENCE   "[802.3ah], 30.3.6.1.10 and 57.5.3."
        ::= { dot3OamEventLogEntry 4 }

      dot3OamEventLogLocation OBJECT-TYPE
        SYNTAX      INTEGER { local(1), remote(2) }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "Whether this event occurred locally (local(1)), or was
          received from the OAM peer via Ethernet OAM (remote(2)).
          "
        ::= { dot3OamEventLogEntry 5 }

      dot3OamEventLogWindowHi      OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "If the event represents a threshold crossing event, the two
          objects dot3OamEventWindowHi and dot3OamEventWindowLo, form
          an unsigned 64-bit integer yielding the window over which the
          value was measured for the threshold crossing event (for
          example, 5, when 11 occurrences happened in 5 seconds while
          the threshold was 10).  The two objects are combined as:
```

```
        dot3OamEventLogWindow = ((2^32) * dot3OamEventLogWindowHi)
                                        + dot3OamEventLogWindowLo

        Otherwise, this value is returned as all F's (2^32 - 1) and
        adds no useful information.
        "
      REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
      ::= { dot3OamEventLogEntry 6 }

    dot3OamEventLogWindowLo      OBJECT-TYPE
      SYNTAX      Unsigned32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "If the event represents a threshold crossing event, the two
        objects dot3OamEventWindowHi and dot3OamEventWindowLo form an
        unsigned 64-bit integer yielding the window over which the
        value was measured for the threshold crossing event (for
        example, 5, when 11 occurrences happened in 5 seconds while
        the threshold was 10).  The two objects are combined as:

        dot3OamEventLogWindow = ((2^32) * dot3OamEventLogWindowHi)
                                        + dot3OamEventLogWindowLo

        Otherwise, this value is returned as all F's (2^32 - 1) and
        adds no useful information.
        "
      REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
      ::= { dot3OamEventLogEntry 7 }

    dot3OamEventLogThresholdHi      OBJECT-TYPE
      SYNTAX      Unsigned32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "If the event represents a threshold crossing event, the two
        objects dot3OamEventThresholdHi and dot3OamEventThresholdLo
        form an unsigned 64-bit integer yielding the value that was
        crossed for the threshold crossing event (for example, 10,
        when 11 occurrences happened in 5 seconds while the threshold
        was 10).  The two objects are combined as:

      dot3OamEventLogThreshold = ((2^32) * dot3OamEventLogThresholdHi)
                                         + dot3OamEventLogThresholdLo

        Otherwise, this value is returned as all F's (2^32 -1) and
        adds no useful information.
        "
```

```
        REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
        ::= { dot3OamEventLogEntry 8 }

      dot3OamEventLogThresholdLo      OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "If the event represents a threshold crossing event, the two
          objects dot3OamEventThresholdHi and dot3OamEventThresholdLo
          form an unsigned 64-bit integer yielding the value that was
          crossed for the threshold crossing event (for example, 10,
          when 11 occurrences happened in 5 seconds while the threshold
          was 10).  The two objects are combined as:

        dot3OamEventLogThreshold = ((2^32) * dot3OamEventLogThresholdHi)
                                           + dot3OamEventLogThresholdLo

          Otherwise, this value is returned as all F's (2^32 - 1) and
          adds no useful information.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
        ::= { dot3OamEventLogEntry 9 }

      dot3OamEventLogValue      OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "If the event represents a threshold crossing event, this
          value indicates the value of the parameter within the given
          window that generated this event (for example, 11, when 11
          occurrences happened in 5 seconds while the threshold was 10).

          Otherwise, this value is returned as all F's
          (2^64 - 1) and adds no useful information.
          "
        REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
        ::= { dot3OamEventLogEntry 10 }

      dot3OamEventLogRunningTotal      OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "Each Event Notification TLV contains a running total of the
          number of times an event has occurred, as well as the number
          of times an Event Notification for the event has been
```

```
          transmitted.  For non-threshold crossing events, the number of
          events (dot3OamLogRunningTotal) and the number of resultant
          Event Notifications (dot3OamLogEventTotal) should be
          identical.

          For threshold crossing events, since multiple occurrences may
          be required to cross the threshold, these values are likely
          different.  This value represents the total number of times
          this event has happened since the last reset (for example,
          3253, when 3253 symbol errors have occurred since the last
          reset, which has resulted in 51 symbol error threshold
          crossing events since the last reset).
          "
        REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
        ::= { dot3OamEventLogEntry 11 }

      dot3OamEventLogEventTotal      OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
          "Each Event Notification TLV contains a running total of the
          number of times an event has occurred, as well as the number
          of times an Event Notification for the event has been
          transmitted.  For non-threshold crossing events, the number of
          events (dot3OamLogRunningTotal) and the number of resultant
          Event Notifications (dot3OamLogEventTotal) should be
          identical.

          For threshold crossing events, since multiple occurrences may
          be required to cross the threshold, these values are likely
          different.  This value represents the total number of times
          one or more of these occurrences have resulted in an Event
          Notification (for example, 51 when 3253 symbol errors have
          occurred since the last reset, which has resulted in 51 symbol
          error threshold crossing events since the last reset).
          "
        REFERENCE   "[802.3ah], 30.3.6.1.37 and 57.5.3.2."
        ::= { dot3OamEventLogEntry 12 }

      -- ****************************************************************
      --
      -- Ethernet OAM Notifications
      --

      dot3OamThresholdEvent NOTIFICATION-TYPE
        OBJECTS { dot3OamEventLogTimestamp,
                  dot3OamEventLogOui,
```

```
                dot3OamEventLogType,
                dot3OamEventLogLocation,
                dot3OamEventLogWindowHi,
                dot3OamEventLogWindowLo,
                dot3OamEventLogThresholdHi,
                dot3OamEventLogThresholdLo,
                dot3OamEventLogValue,
                dot3OamEventLogRunningTotal,
                dot3OamEventLogEventTotal
              }
    STATUS  current
    DESCRIPTION
      "A dot3OamThresholdEvent notification is sent when a local or
      remote threshold crossing event is detected.  A local
      threshold crossing event is detected by the local entity,
      while a remote threshold crossing event is detected by the
      reception of an Ethernet OAM Event Notification OAMPDU
      that indicates a threshold event.

      This notification should not be sent more than once per
      second.

      The OAM entity can be derived from extracting the ifIndex from
      the variable bindings.  The objects in the notification
      correspond to the values in a row instance in the
      dot3OamEventLogTable.

      The management entity should periodically check
      dot3OamEventLogTable to detect any missed events."
   ::= { dot3OamNotifications 1 }

  dot3OamNonThresholdEvent NOTIFICATION-TYPE
    OBJECTS { dot3OamEventLogTimestamp,
              dot3OamEventLogOui,
              dot3OamEventLogType,
              dot3OamEventLogLocation,
              dot3OamEventLogEventTotal
            }
    STATUS  current
    DESCRIPTION
      "A dot3OamNonThresholdEvent notification is sent when a local
      or remote non-threshold crossing event is detected.  A local
      event is detected by the local entity, while a remote event is
      detected by the reception of an Ethernet OAM Event
      Notification OAMPDU that indicates a non-threshold crossing
      event.

      This notification should not be sent more than once per
```

```
          second.

          The OAM entity can be derived from extracting the ifIndex from
          the variable bindings.  The objects in the notification
          correspond to the values in a row instance of the
          dot3OamEventLogTable.

          The management entity should periodically check
          dot3OamEventLogTable to detect any missed events."
       ::= { dot3OamNotifications 2 }

      -- ****************************************************************
      --
      -- Ethernet OAM Compliance group
      --

      dot3OamGroups OBJECT IDENTIFIER ::= { dot3OamConformance 1 }
      dot3OamCompliances OBJECT IDENTIFIER ::= { dot3OamConformance 2 }

      -- Compliance statements

      dot3OamCompliance MODULE-COMPLIANCE
        STATUS          current
        DESCRIPTION "The compliance statement for managed entities
                     supporting OAM on Ethernet-like interfaces.
                     "
      MODULE   -- this module
        MANDATORY-GROUPS { dot3OamControlGroup,
                           dot3OamPeerGroup,
                           dot3OamStatsBaseGroup
                         }

        GROUP       dot3OamLoopbackGroup
        DESCRIPTION
          "This group is mandatory for all IEEE 802.3 OA
          implementations that support loopback functionality. "

        GROUP       dot3OamErrSymbolPeriodEventGroup
        DESCRIPTION
          "This group is mandatory for all IEEE 802.3 OA
          implementations that support event functionality. "

        GROUP       dot3OamErrFramePeriodEventGroup
        DESCRIPTION
          "This group is mandatory for all IEEE 802.3 OA
          implementations that support event functionality. "

        GROUP       dot3OamErrFrameEventGroup
```

```
        DESCRIPTION
          "This group is mandatory for all IEEE 802.3 OA
          implementations that support event functionality. "

        GROUP       dot3OamErrFrameSecsSummaryEventGroup
        DESCRIPTION
          "This group is mandatory for all IEEE 802.3 OA
          implementations that support event functionality. "

        GROUP        dot3OamFlagEventGroup
        DESCRIPTION
          "This group is optional for all IEEE 802.3 OA
          implementations.  The ability to send critical events or dying
          gasp events is not required in any system."

        GROUP       dot3OamEventLogGroup
        DESCRIPTION
          "This group is optional for all IEEE 802.3 OA
          implementations.  Entries in this table are dependent on what
          event functionality is supported in the local OA
          implementation.  At least one type of event must be supported
          for entries to appear in this table.  "

        GROUP       dot3OamNotificationGroup
        DESCRIPTION
          "This group is optional for all IEEE 802.3 OA
          implementations.  Since the information in the notifications
          is dependent on the dot3OamEventLogTable, that table must be
          implemented for notifications.  "

        ::= { dot3OamCompliances 1}

     dot3OamControlGroup OBJECT-GROUP
        OBJECTS     {   dot3OamAdminState,
                        dot3OamOperStatus,
                        dot3OamMode,
                        dot3OamMaxOamPduSize,
                        dot3OamConfigRevision,
                        dot3OamFunctionsSupported
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects providing the abilities,
          configuration, and status of an Ethernet OAM entity.  "
        ::= { dot3OamGroups 1 }

     dot3OamPeerGroup OBJECT-GROUP
        OBJECTS     {   dot3OamPeerMacAddress,
```

```
                        dot3OamPeerVendorOui,
                        dot3OamPeerVendorInfo,
                        dot3OamPeerMode,
                        dot3OamPeerFunctionsSupported,
                        dot3OamPeerMaxOamPduSize,
                        dot3OamPeerConfigRevision
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects providing the abilities,
          configuration, and status of a peer Ethernet OAM entity.  "
        ::= { dot3OamGroups 2 }

    dot3OamStatsBaseGroup OBJECT-GROUP
        OBJECTS     {   dot3OamInformationTx,
                        dot3OamInformationRx,
                        dot3OamUniqueEventNotificationTx,
                        dot3OamUniqueEventNotificationRx,
                        dot3OamDuplicateEventNotificationTx,
                        dot3OamDuplicateEventNotificationRx,
                        dot3OamLoopbackControlTx,
                        dot3OamLoopbackControlRx,
                        dot3OamVariableRequestTx,
                        dot3OamVariableRequestRx,
                        dot3OamVariableResponseTx,
                        dot3OamVariableResponseRx,
                        dot3OamOrgSpecificTx,
                        dot3OamOrgSpecificRx,
                        dot3OamUnsupportedCodesTx,
                        dot3OamUnsupportedCodesRx,
                        dot3OamFramesLostDueToOam
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects providing the statistics for the
          number of various transmit and receive events for OAM on an
          Ethernet-like interface.  Note that all of these counters must
          be supported even if the related function (as described in
          dot3OamFunctionsSupported) is not supported.  "
        ::= { dot3OamGroups 3 }

    dot3OamLoopbackGroup OBJECT-GROUP
        OBJECTS     {   dot3OamLoopbackStatus,
                        dot3OamLoopbackIgnoreRx
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects for controlling the OAM remote
```

```
          loopback function.  "
       ::= { dot3OamGroups 4 }

    dot3OamErrSymbolPeriodEventGroup OBJECT-GROUP
       OBJECTS     {   dot3OamErrSymPeriodWindowHi,
                       dot3OamErrSymPeriodWindowLo,
                       dot3OamErrSymPeriodThresholdHi,
                       dot3OamErrSymPeriodThresholdLo,
                       dot3OamErrSymPeriodEvNotifEnable
                   }
       STATUS      current
       DESCRIPTION
         "A collection of objects for configuring the thresholds for an
         Errored Symbol Period Event.

         Each [802.3ah] defined Event Notification TLV has its own
         conformance group because each event can be implemented
         independently of any other.  "
       ::= { dot3OamGroups 5 }

    dot3OamErrFramePeriodEventGroup OBJECT-GROUP
       OBJECTS     {   dot3OamErrFramePeriodWindow,
                       dot3OamErrFramePeriodThreshold,
                       dot3OamErrFramePeriodEvNotifEnable
                   }
       STATUS      current
       DESCRIPTION
         "A collection of objects for configuring the thresholds for an
         Errored Frame Period Event.

         Each [802.3ah] defined Event Notification TLV has its own
         conformance group because each event can be implemented
         independently of any other.  "
       ::= { dot3OamGroups 6 }

    dot3OamErrFrameEventGroup OBJECT-GROUP
       OBJECTS     {   dot3OamErrFrameWindow,
                       dot3OamErrFrameThreshold,
                       dot3OamErrFrameEvNotifEnable
                   }
       STATUS      current
       DESCRIPTION
         "A collection of objects for configuring the thresholds for an
         Errored Frame Event.

         Each [802.3ah] defined Event Notification TLV has its own
         conformance group because each event can be implemented
         independently of any other.  "
```

```
        ::= { dot3OamGroups 7 }

     dot3OamErrFrameSecsSummaryEventGroup OBJECT-GROUP
        OBJECTS     {   dot3OamErrFrameSecsSummaryWindow,
                        dot3OamErrFrameSecsSummaryThreshold,
                        dot3OamErrFrameSecsEvNotifEnable
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects for configuring the thresholds for an
          Errored Frame Seconds Summary Event.

          Each [802.3ah] defined Event Notification TLV has its own
          conformance group because each event can be implemented
          independently of any other.  "
        ::= { dot3OamGroups 8 }

     dot3OamFlagEventGroup OBJECT-GROUP
        OBJECTS     {   dot3OamDyingGaspEnable,
                        dot3OamCriticalEventEnable
                    }
        STATUS      current
        DESCRIPTION
          "A collection of objects for configuring the sending OAMPDUs
          with the critical event flag or dying gasp flag enabled.  "
        ::= { dot3OamGroups 9 }

     dot3OamEventLogGroup OBJECT-GROUP
       OBJECTS {  dot3OamEventLogTimestamp,
                  dot3OamEventLogOui,
                  dot3OamEventLogType,
                  dot3OamEventLogLocation,
                  dot3OamEventLogWindowHi,
                  dot3OamEventLogWindowLo,
                  dot3OamEventLogThresholdHi,
                  dot3OamEventLogThresholdLo,
                  dot3OamEventLogValue,
                  dot3OamEventLogRunningTotal,
                  dot3OamEventLogEventTotal
                }
       STATUS      current
       DESCRIPTION
          "A collection of objects for configuring the thresholds for an
          Errored Frame Seconds Summary Event and maintaining the event
          information.  "
        ::= { dot3OamGroups 10 }

     dot3OamNotificationGroup NOTIFICATION-GROUP
```

```
      NOTIFICATIONS {
                  dot3OamThresholdEvent,
                  dot3OamNonThresholdEvent
                    }
      STATUS      current
      DESCRIPTION
        "A collection of notifications used by Ethernet OAM to signal
        to a management entity that local or remote events have
        occurred on a specified Ethernet link. "
      ::= { dot3OamGroups 11 }

     END
```

7. Security Considerations

The readable objects in this module can provide information about network traffic, and therefore may be considered sensitive. In particular, OAM provides mechanisms for reading the IEEE 802.3 Clause 30 MIB attributes from a link partner via a specialized layer two protocol. Unlike SNMP, IEEE P802.3ah OAM does not include encryption or authentication mechanisms. It should be used in environments where either this interface information is not considered sensitive, or where the facility terminations are protected. By default, OAM is disabled on Ethernet-like interfaces and is therefore not a risk.

IEEE 802.3ah OAM is designed to support deployment in access and enterprise networks. In access networks, one end of a link is the CO-side, and the other is the CPE-side, and the facilities are often protected in wiring cages or closets. In such deployments, it is often the case that the CO-side is protected from access from the CPE-side. Within IEEE P802.3ah OAM, this protection from remote access is accomplished by configuring the CPE-side in passive mode using the dot3OamMode attribute. This prevents the CPE from accessing functions and information at the CO-side of the connection. In enterprise networks, read-only interface information is often considered non-sensitive.

The frequency of OAM PDUs on an Ethernet interface does not adversely affect data traffic, as OAM is a slow protocol with very limited bandwidth potential, and it is not required for normal link operation. And although there are a number of objects in this module with read-write or read-create MAX-ACCESS, they have limited effects on user data.

The loopback capability of OAM can have potentially disruptive effects in that the when enabling remote loopback, the remote station automatically transmits all received traffic back to the local station except for OAM traffic. This completely disrupts all higher

layer protocols such as bridging, IP, and SNMP. Therefore an attribute (dot3OamLoopbackIgnoreRx) was introduced to control whether the local station processes or ignores received loopback commands.

The administrative state and mode are also read-write objects. Disabling OAM can interrupt management activities between peer devices, potentially causing serious problems. Setting the dot3OamMode to an undesired value can allow access to Ethernet monitoring, events, and functions that may not be acceptable in a particular deployment scenario. In addition to loopback functionality, Ethernet interface statistics and events can be accessed via the OAM protocol, which may not be desired in some circumstances.

OAM event configuration also contains read-write objects. These objects control whether events are sent, and at what thresholds. Note that the frequency of event communication is limited by the frequency limits of Slow Protocols on Ethernet interfaces. Also, the information available via OAM events is also available via OA Variable Requests. Access to this information via either OAM events or Variable Requests is controlled by the dot3OamAdminState and dot3OamMode objects. As mentioned previously, inadequate protection of these variables can result in access to link information and functions.

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.

8. IANA Considerations

The Ethernet OAM MIB requires the allocation of a single object identifier for its MODULE-IDENTITY under the MIB-2 tree.

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

Descriptor	OBJECT IDENTIFIER
dot3OamMIB	{ mib-2 158 }

9. References

9.1. Normative References

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[802.3ah-epon] Khermosh, L., "Managed Objects of Ethernet Passive Optical Networks (EPON)", RFC 4837, June 2007.

[RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

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10. Acknowledgments

The author is grateful to all of the participants in the IEEE 802.3ah EFM (Ethernet in the First Mile) taskforce. In particular, the strong leadership and dedication of the following individuals is noted:

Kevin Daines (Editor, IEEE 802.3ah OAM clauses)
Ben Brown (Editor, IEEE 802.3ah Logic clauses)
David Law (Editor, IEEE 802.3ah Management clauses)
Scott Simon (Editor, IEEE 802.3ah Clause 45)
Howard Frazier (Chair, IEEE 802.3ah)
Hugh Barass (Vice-Chair, IEEE 802.3ah)
Wael Diab (Editor, IEEE 802.3ah)

Additionally, certain devoted attendees and contributors to the IEEE 802.3ah OAM sub-taskforce deserve recognition. Although there were many contributors, the following individuals contributed heavily over a long period of time.

Brian Arnold
Brad Booth
Al Braga
Floyd Gerhardt
Bob Grow
Eric Lynskey
David Martin
John Messenger
Dan Romascanu (Ex-Chair, IETF HUBMIB WG)
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Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.