                     Definitions of Managed Objects for
                     the Ethernet-like Interface Types

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Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in the Internet community.
   This memo obsoletes RFC 2358 ''Definitions of Managed Objects for the
   Ethernet-like Interface Types''. This memo extends that
   specification by including management information useful for the
   management of 1000 Mb/s and full-duplex Ethernet interfaces.

   Ethernet technology, as defined by the 802.3 Working Group of the
   IEEE, continues to evolve, with scalable increases in speed, new
   types of cabling and interfaces, and new features. This evolution
   may require changes in the managed objects in order to reflect this
   new functionality. This document, as with other documents issued by
   this working group, reflects a certain stage in the evolution of
   Ethernet technology. In the future, this document might be revised,
   or new documents might be issued by the Ethernet Interfaces and Hub

MIB Working Group, in order to reflect the evolution of Ethernet
technology.

Distribution of this memo is unlimited. Please forward comments to
hubmib@hprnd.rose.hp.com.

Table of Contents

1. Introduction

This memo defines a portion of the Management Information Base (MIB)
for use with network management protocols in the Internet community.
In particular, it defines objects for managing Ethernet-like
interfaces.

This memo also includes a MIB module. This MIB module extends the
list of managed objects specified in the earlier version of this MIB:
RFC 2358 [23].

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 [26].

2. The SNMP Management Framework

The SNMP Management Framework presently consists of five major
components:

o   An overall architecture, described in RFC 2271 [1].

o   Mechanisms for describing and naming objects and events for the
     purpose of management. The first version of this Structure of
     Management Information (SMI) is called SMIv1 and described in
     RFC 1155 [2], RFC 1212 [3] and RFC 1215 [4]. The second version,
     called SMIv2, is described in RFC 1902 [5], RFC 1903 [6] and RFC
     1904 [7].

o   Message protocols for transferring management information. The
     first version of the SNMP message protocol is called SNMPv1 and
     described in RFC 1157 [8]. A second version of the SNMP message
     protocol, which is not an Internet standards track protocol, is
     called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10].
     The third version of the message protocol is called SNMPv3 and
     described in RFC 1906 [10], RFC 2272 [11] and RFC 2274 [12].

o   Protocol operations for accessing management information. The
     first set of protocol operations and associated PDU formats is
     described in RFC 1157 [8]. A second set of protocol operations
     and associated PDU formats is described in RFC 1905 [13].

o   A set of fundamental applications described in RFC 2273 [14] and
     the view-based access control mechanism described in RFC 2275
     [15].

Managed objects are accessed via a virtual information store, termed
the Management Information Base or MIB. Objects in the MIB are
defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A
MIB conforming to the SMIv1 can be produced through the appropriate
translations. The resulting translated MIB must be semantically
equivalent, except where objects or events are omitted because no
translation is possible (use of Counter64). Some machine readable
information in SMIv2 will be converted into textual descriptions in
SMIv1 during the translation process. However, this loss of machine
readable information is not considered to change the semantics of the
MIB.

3. Overview

Instances of these object types represent attributes of an interface
to an ethernet-like communications medium. At present, ethernet-like
media are identified by the following values of the ifType object in
the Interfaces MIB [25]:

        ethernetCsmacd(6)
        iso88023Csmacd(7)
        starLan(11)

The definitions presented here are based on Section 30, "10 Mb/s, 100
Mb/s and 1000 Mb/s Management", and Annex 30A, "GDMO Specification
for 802.3 managed object classes" of IEEE Std. 802.3, 1998 Edition
[16], as originally interpreted by Frank Kastenholz then of Interlan
in [17]. Implementors of these MIB objects should note that IEEE
Std. 802.3 [16] explicitly describes (in the form of Pascal
pseudocode) when, where, and how various MAC attributes are measured.
The IEEE document also describes the effects of MAC actions that may
be invoked by manipulating instances of the MIB objects defined here.

To the extent that some of the attributes defined in [16] are
represented by previously defined objects in MIB-2 [24] or in the
Interfaces MIB [25], such attributes are not redundantly represented
by objects defined in this memo. Among the attributes represented by
objects defined in other memos are the number of octets transmitted
or received on a particular interface, the number of frames
transmitted or received on a particular interface, the promiscuous
status of an interface, the MAC address of an interface, and
multicast information associated with an interface.

3.1. Relation to MIB-2

This section applies only when this MIB is used in conjunction with
the "old" (RFC 1213) [24] interface group.

The relationship between an ethernet-like interface and an interface
in the context of MIB-2 is one-to-one. As such, the value of an
ifIndex object instance can be directly used to identify
corresponding instances of the objects defined herein.

For agents which implement the (now deprecated) ifSpecific object, an
instance of that object that is associated with an ethernet-like
interface has the OBJECT IDENTIFIER value:

        dot3   OBJECT IDENTIFER ::= { transmission 7 }

3.2. Relation to the Interfaces MIB

The Interface MIB [25] requires that any MIB which is an adjunct of
the Interface MIB clarify specific areas within the Interface MIB.
These areas were intentionally left vague in the Interface MIB to
avoid over constraining the MIB, thereby precluding management of
certain media-types.

Section 3.3 of [25] enumerates several areas which a media-specific
MIB must clarify. Each of these areas is addressed in a following
subsection. The implementor is referred to [25] in order to
understand the general intent of these areas.

3.2.1. Layering Model

This MIB does not provide for layering. There are no sublayers.

EDITOR'S NOTE:

One could foresee the development of an 802.2 and enet-transceiver
MIB. They could be higher and lower sublayers, respectively. All
that THIS document should do is allude to the possibilities and urge
the implementor to be aware of the possibility and that they may have
requirements which supersede the requirements in this document.

3.2.2. Virtual Circuits

This medium does not support virtual circuits and this area is not
applicable to this MIB.

3.2.3. ifTestTable

This MIB defines two tests for media which are instrumented with this
MIB; TDR and Loopback. Implementation of these tests is not
required. Many common interface chips do not support one or both of
these tests.

These two tests are provided as a convenience, allowing a common
method to invoke the test.

Standard MIBs do not include objects in which to return the results
of the TDR test. Any needed objects MUST be provided in the vendor
specific MIB.

Note that the ifTestTable is now deprecated. Work is underway to

define a replacement MIB for system and interface testing. It is
expected that the tests defined in this document will be usable in
this replacement MIB.

[3.2.4](). **ifRcvAddressTable**

This table contains all IEEE 802.3 addresses, unicast, multicast, and
broadcast, for which this interface will receive packets and forward
them up to a higher layer entity for local consumption. The format
of the address, contained in ifRcvAddressAddress, is the same as for
ifPhysAddress.

In the event that the interface is part of a MAC bridge, this table
does not include unicast addresses which are accepted for possible
forwarding out some other port. This table is explicitly not
intended to provide a bridge address filtering mechanism.

[3.2.5](). **ifPhysAddress**

This object contains the IEEE 802.3 address which is placed in the
source-address field of any Ethernet, Starlan, or IEEE 802.3 frames
that originate at this interface. Usually this will be kept in ROM
on the interface hardware. Some systems may set this address via
software.

In a system where there are several such addresses the designer has a
tougher choice. The address chosen should be the one most likely to
be of use to network management (e.g. the address placed in ARP
responses for systems which are primarily IP systems).

If the designer truly can not chose, use of the factory- provided ROM
address is suggested.

If the address can not be determined, an octet string of zero length
should be returned.

The address is stored in binary in this object. The address is
stored in "canonical" bit order, that is, the Group Bit is positioned
as the low-order bit of the first octet. Thus, the first byte of a
multicast address would have the bit 0x01 set.

[3.2.6](). **ifType**

This MIB applies to interfaces which have any of the following ifType
values:

```
        ethernetCsmacd(6)
        iso88023Csmacd(7)
        starLan(11)
```

It is RECOMMENDED that all Ethernet-like interfaces use an ifType of
ethernetCsmacd(6) regardless of the speed that the interface is
running or the link-layer encapsulation in use. iso88023Csmacd(7)
and starLan(11) are supported for backwards compatability.

There are three other interface types defined in the IANAifType-MIB
for Ethernet. They are fastEther(62), fastEtherFX(69), and
gigabitEthernet(117). This document takes the position that an
Ethernet is an Ethernet, and Ethernet interfaces SHOULD always have
the same value of ifType. Information on the particular flavor of
Ethernet that an interface is running is available from ifSpeed in
the Interfaces MIB, and ifMauType in the 802.3 MAU MIB. An
Ethernet-like interface SHOULD NOT use the fastEther(62),
fastEtherFX(69), or gigabitEthernet(117) ifTypes.

Interfaces with any of the supported ifType values map to the
EtherLike-MIB in the same manner. There are no implementation
differences.

3.2.7. Specific Interface MIB Objects

The following table provides specific implementation guidelines for
applying the interface group objects to ethernet-like media.

   Object

   ifIndex   Each ethernet-like interface is
                          represented by an ifEntry. The
                          dot3StatsTable in this MIB module is
                          indexed by dot3StatsIndex. The interface
                          identified by a particular value of
                          dot3StatsIndex is the same interface as
                          identified by the same value of ifIndex.

   ifDescr   Refer to [25].

   ifType   Refer to section 3.2.6.

   ifMtu   1500 octets. NOTE: This is the MTU as
                          seen by the MAC client. When a higher
                          layer protocol, like IP, is running over
                          Ethernet, this is the MTU that will be
                          seen by that higher layer protocol.

                                However, when using the IEEE 802.2 LLC
                                protocol, higher layer protocols will
                                see a different MTU. In particular, an
                                LLC type 1 client protocol will see
                                an MTU of 1497 octets, and a protocol
                                running over SNAP will see an MTU of
                                1492 octets.

     ifSpeed   The current operational speed of the
                                interface in bits per second. For
                                current ethernet-like interfaces, this
                                will be equal to 1,000,000 (1 million),
                                10,000,000 (10 million), 100,000,000
                                (100 million), or 1,000,000,000 (1
                                billion). If the interface implements
                                auto-negotiation, auto-negotiation is
                                enabled for this interface, and the
                                interface has not yet negotiated to an
                                operational speed, this object SHOULD
                                reflect the maximum speed supported by
                                the interface. Note that this object
                                MUST NOT indicate a doubled value when
                                operating in full-duplex mode. It MUST
                                indicate the correct line speed
                                regardless of the current duplex mode.
                                The duplex mode of the interface may
                                be determined by examining either the
                                dot3StatsDuplexStatus object in this
                                MIBmodule, or the ifMauType object in
                                the 802.3 MAU MIB.

     ifPhysAddress   Refer to section 3.2.5.

     ifAdminStatus   Write access is not required. Support
                                for 'testing' is not required.

     ifOperStatus   The operational state of the interface.
                                Support for 'testing' is not required.
                                The value 'dormant' has no meaning for
                                an ethernet-like interface.

     ifLastChange   Refer to [25].

     ifInOctets   The number of octets in valid MAC frames
                                received on this interface, including
                                the MAC header and FCS.

     ifInUcastPkts   Refer to [25].

ifInDiscards   Refer to [25].

ifInErrors   The sum for this interface of
                        dot3StatsAlignmentErrors,
                        dot3StatsFCSErrors,
                        dot3StatsFrameTooLongs,
                        dot3StatsInternalMacReceiveErrors and
                        dot3StatsSymbolErrors.

ifInUnknownProtos   Refer to [25].

ifOutOctets   The number of octets transmitted in
                        valid MAC frames on this interface,
                        including the MAC header and FCS.

ifOutUcastPkts   Refer to [25].

ifOutDiscards   Refer to [25].

ifOutErrors   The sum for this interface of:
                        dot3StatsSQETestErrors,
                        dot3StatsLateCollisions,
                        dot3StatsExcessiveCollisions,
                        dot3StatsInternalMacTransmitErrors and
                        dot3StatsCarrierSenseErrors.

ifName   Locally-significant textual name for the
                        interface (e.g. lan0).

ifInMulticastPkts   Refer to [25].

ifInBroadcastPkts   Refer to [25].

ifOutMulticastPkts   Refer to [25].

ifOutBroadcastPkts   Refer to [25].

ifHCInOctets   64-bit versions of counters. Required
ifHCOutOctets   for ethernet-like interfaces that are
                        capable of operating at 20Mbit/sec or
                        faster, even if the interface is
                        currently operating at less than
                        20Mbit/sec.

ifHCInUcastPkts   64-bit versions of packet counters.
ifHCInMulticastPkts   Required for ethernet-like interfaces
ifHCInBroadcastPkts   that are capable of operating at
ifHCOutUcastPkts   640Mbit/sec or faster, even if the

```
   ifHCOutMulticastPkts       interface is currently operating at
   ifHCOutBroadcastPkts       less than 640Mbit/sec.

   ifLinkUpDownTrapEnable     Refer to [25].  Default is 'enabled'

   ifHighSpeed                The current operational speed of the
                              interface in millions of bits per
                              second. For current ethernet-like
                              interfaces, this will be equal to 1, 10,
                              100, or 1,000.  If the interface
                              implements auto-negotiation,
                              auto-negotiation is enabled for this
                              interface, and the interface has not yet
                              negotiated to an operational speed, this
                              object SHOULD reflect the maximum speed
                              supported by the interface. Note that
                              this object MUST NOT indicate a doubled
                              value when operating in full-duplex
                              mode.  It MUST indicate the correct line
                              speed regardless of the current duplex
                              mode. The duplex mode of the interface
                              may be determined by examining either
                              the dot3StatsDuplexStatus object in this
                              MIB module, or the ifMauType object in
                              the 802.3 MAU MIB.

 ifPromiscuousMode          Refer to [25].

 ifConnectorPresent         This will normally be 'true'.

 ifAlias                    Refer to [25].

 ifCounterDiscontinuityTime Refer to [25].

 ifStackHigherLayer         Refer to section 3.2.1.
 ifStackLowerLayer
 ifStackStatus

 ifRcvAddressAddress        Refer to section 3.2.4.
 ifRcvAddressStatus
 ifRcvAddressType
```

3.3. Relation to the 802.3 MAU MIB

   Support for the mauModIfCompl2 compliance statement of the MAU-MIB
   [27] is REQUIRED for Ethernet-like interfaces. This MIB is needed in
   order to allow applications to determine the current MAU type in use

by the interface, and to control autonegotiation and duplex mode for
the interface. Implementing this MIB module without implementing the
MAU-MIB would leave applications with no standard way to determine
the media type in use, and no standard way to control the duplex mode
of the interface.

3.4. dot3StatsEtherChipSet

This document defines an object called dot3StatsEtherChipSet, which
is used to identify the MAC hardware used to communicate on an
interface. Previous versions of this document contained a number of
OID assignments for some existing Ethernet chipsets. Maintaining
that list as part of this document has proven to be problematic, so
the OID assignments contained in prevous versions of this document
have now been moved to a separate document [28].

The dot3StatsEtherChipSet object has now been deprecated.
Implementation feedback indicates that this object is much more
useful in theory than in practice. The object's utility in debugging
network problems in the field appears to be limited. In those cases
where it may be useful, it is not sufficient, since it identifies
only the MAC chip, and not the PHY, PMD, or driver. The
administrative overhead involved in maintaining a central registry of
chipset OIDs cannot be justified for an object whose usefulness is
questionable at best.

Implementations which continue to support this object for the purpose
of backwards compatability may continue to use the values defined in
[28]. For chipsets not listed in [28], implementors should assign
OBJECT IDENTIFIERS within that part of the registration tree
delegated to individual enterprises.

3.5. Mapping of IEEE 802.3 Managed Objects

```
IEEE 802.3 Managed Object          Corresponding SNMP Object

oMacEntity
 .aMACID                           dot3StatsIndex or
                                   IF-MIB - ifIndex
 .aFramesTransmittedOK             IF-MIB - ifOutUCastPkts +
                                             ifOutMulticastPkts +
                                             ifOutBroadcastPkts
 .aSingleCollisionFrames           dot3StatsSingleCollisionFrames
 .aMultipleCollisionFrames         dot3StatsMultipleCollisionFrames
 .aFramesReceivedOK                IF-MIB - ifInUcastPkts +
                                             ifInMulticastPkts +
```

```
                                          ifInBroadcastPkts
     .aFrameCheckSequenceErrors        dot3StatsFCSErrors
     .aAlignmentErrors                 dot3StatsAlignmentErrors
     .aOctetsTransmittedOK             IF-MIB - ifOutOctets*
     .aFramesWithDeferredXmissions     dot3StatsDeferredTransmissions
     .aLateCollisions                  dot3StatsLateCollisions
     .aFramesAbortedDueToXSColls       dot3StatsExcessiveCollisions
     .aFramesLostDueToIntMACXmitError dot3StatsInternalMacTransmitErrors
     .aCarrierSenseErrors              dot3StatsCarrierSenseErrors
     .aOctetsReceivedOK                IF-MIB - ifInOctets*
     .aFramesLostDueToIntMACRcvError   dot3StatsInternalMacReceiveErrors
     .aPromiscuousStatus               IF-MIB - ifPromiscuousMode
     .aReadMulticastAddressList        IF-MIB - ifRcvAddressTable
     .aMulticastFramesXmittedOK        IF-MIB - ifOutMulticastPkts
     .aBroadcastFramesXmittedOK        IF-MIB - ifOutBroadcastPkts
     .aMulticastFramesReceivedOK       IF-MIB - ifInMulticastPkts
     .aBroadcastFramesReceivedOK       IF-MIB - ifInBroadcastPkts
     .aFrameTooLongErrors              dot3StatsFrameTooLongs
     .aReadWriteMACAddress             IF-MIB - ifPhysAddress
     .aCollisionFrames                 dot3CollFrequencies
     .aDuplexStatus                    dot3StatsDuplexStatus
     .acAddGroupAddress                IF-MIB - ifRcvAddressTable
     .acDeleteGroupAddress             IF-MIB - ifRcvAddressTable
     .acExecuteSelfTest                dot3TestLoopBack

  oPHYEntity
   .aPHYID                            dot3StatsIndex or
                                      IF-MIB - ifIndex
   .aSQETestErrors                    dot3StatsSQETestErrors
   .aSymbolErrorDuringCarrier         dot3StatsSymbolErrors

  oMACControlEntity
   .aMACControlID                     dot3StatsIndex or
                                      IF-MIB - ifIndex
   .aMACControlFunctionsSupported     dot3ControlFunctionsSupported and
                                      dot3ControlFunctionsEnabled
   .aUnsupportedOpcodesReceived       dot3ControlInUnknownOpcodes

  oPAUSEEntity
   .aPAUSELinkDelayAllowance          dot3PauseLinkDelayAllowance
   .aPAUSEMACCtrlFramesTransmitted  dot3OutPauseFrames
   .aPAUSEMACCtrlFramesReceived       dot3InPauseFrames
```

   * Note that the octet counters in IF-MIB do not exactly match the
   definition of the octet counters in IEEE 802.3. aOctetsTransmittedOK
   and aOctetsReceivedOK count only the octets in the clientData and Pad
   fields, whereas ifInOctets and ifOutOctets include the entire MAC

   frame, including MAC header and FCS. However, the IF-MIB counters
   can be derived from the IEEE 802.3 counters as follows:

     ifInOctets = aOctetsReceivedOK + (18 * aFramesReceivedOK)
     ifOutOctets = aOctetsTransmittedOK + (18 * aFramesTransmittedOK)

   The following IEEE 802.3 managed objects have been removed from this
   MIB module as a result of implementation feedback:

   oMacEntity
     .aFramesWithExcessiveDeferral
     .aInRangeLengthErrors
     .aOutOfRangeLengthField
     .aMACEnableStatus
     .aTransmitEnableStatus
     .aMulticastReceiveStatus
     .acInitializeMAC

   Please see [19] for the detailed reasoning on why these objects were
   removed.

   In addition, the following IEEE 802.3 managed objects have not been
   included in this MIB for the following reasons.

   IEEE 802.3 Managed Object   Disposition

   oMACEntity
     .aMACCapabilities   Can be derived from
                                    MAU-MIB - ifMauTypeListBits

   oPHYEntity
     .aPhyType   Can be derived from
                                    MAU-MIB - ifMauType

     .aPhyTypeList   Can be derived from
                                    MAU-MIB - ifMauTypeListBits

     .aMIIDetect   Not considered useful.

     .aPhyAdminState   Can already obtain interface
                                    state from IF-MIB - ifOperStatus
                                    and MAU state from MAU-MIB -
                                    ifMauStatus. Providing an
                                    additional state for the PHY
                                    was not considered useful.

     .acPhyAdminControl   Can already control interface
                                    state from IF-MIB - ifAdminStatus

                                      and MAU state from MAU-MIB -
                                      ifMauStatus. Providing separate
                                      admin control of the PHY was not
                                      considered useful.

   oMACControlEntity
    .aMACControlFramesTransmitted   Can be determined by summing the
                                     OutFrames counters for the
                                     individual control functions

    .aMACControlFramesReceived   Can be determined by summing the
                                     InFrames counters for the
                                     individual control functions

[4]. **Definitions**

    EtherLike-MIB DEFINITIONS ::= BEGIN

        IMPORTS
            MODULE-IDENTITY, OBJECT-TYPE, OBJECT-IDENTITY,
            Counter32, Unsigned32, mib-2, transmission
                FROM SNMPv2-SMI
            MODULE-COMPLIANCE, OBJECT-GROUP
                FROM SNMPv2-CONF
            ifIndex, InterfaceIndex
                FROM IF-MIB;

        etherMIB MODULE-IDENTITY
            LAST-UPDATED "9901280031Z" -- January 28, 1999
            ORGANIZATION "IETF Ethernet Interfaces and Hub MIB
                        Working Group"
            CONTACT-INFO
                "WG E-mail: hubmib@hprnd.rose.hp.com
              To subscribe: hubmib-request@hprnd.rose.hp.com

                    Chair: Dan Romascanu
                   Postal: Lucent Technologies
                           Atidum Technology Park, Bldg. 3
                           Tel Aviv 61131
                           Israel
                      Tel: +972 3 645 8414
                   E-mail: dromasca@lucent.com

                   Editor: John Flick
                   Postal: Hewlett-Packard Company
                           8000 Foothills Blvd. M/S 5557
                           Roseville, CA 95747-5557
                           USA

                        Tel: +1 916 785 4018
                        Fax: +1 916 785 1199
                     E-mail: johnf@rose.hp.com

                     Editor: Jeffrey Johnson
                     Postal: RedBack Networks
                             2570 North First Street, Suite 410
                             San Jose, CA, 95131
                             USA
                        Tel: +1 408 571 2699
                        Fax: +1 408 571 2698
                     E-Mail: jeff@redbacknetworks.com"

          DESCRIPTION "The MIB module to describe generic objects for
                     Ethernet-like network interfaces.

                     The following reference is used throughout this
                     MIB module:

                     [IEEE 802.3 Std] refers to:
                        IEEE Std 802.3, 1998 Edition: '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',
                        September 1998.

                     Of particular interest is Clause 30, '10Mb/s,
                     100Mb/s and 1000Mb/s Management'."

          REVISION   "9901280031Z" -- January 28, 1999
          DESCRIPTION "Updated to include support for 1000 Mb/sec
                     interfaces and full-duplex interfaces."

          REVISION   "9806032150Z" -- June 3, 1998
          DESCRIPTION "Updated to include support for 100 Mb/sec
                     interfaces. Published as RFC 2358."

          REVISION   "9402030400Z" -- February 3, 1994
          DESCRIPTION "Version published as RFC 1650."
          ::= { mib-2 35 }

       etherMIBObjects OBJECT IDENTIFIER ::= { etherMIB 1 }

       dot3   OBJECT IDENTIFIER ::= { transmission 7 }

```
        -- the Ethernet-like Statistics group

        dot3StatsTable OBJECT-TYPE
            SYNTAX     SEQUENCE OF Dot3StatsEntry
            MAX-ACCESS not-accessible
            STATUS     current
            DESCRIPTION "Statistics for a collection of ethernet-like
                        interfaces attached to a particular system."
            ::= { dot3 2 }

        dot3StatsEntry OBJECT-TYPE
            SYNTAX     Dot3StatsEntry
            MAX-ACCESS not-accessible
            STATUS     current
            DESCRIPTION "Statistics for a particular interface to an
                        ethernet-like medium."
            INDEX      { dot3StatsIndex }
            ::= { dot3StatsTable 1 }

        Dot3StatsEntry ::=
            SEQUENCE {
                dot3StatsIndex                    InterfaceIndex,
                dot3StatsAlignmentErrors          Counter32,
                dot3StatsFCSErrors                Counter32,
                dot3StatsSingleCollisionFrames    Counter32,
                dot3StatsMultipleCollisionFrames  Counter32,
                dot3StatsSQETestErrors            Counter32,
                dot3StatsDeferredTransmissions    Counter32,
                dot3StatsLateCollisions           Counter32,
                dot3StatsExcessiveCollisions      Counter32,
                dot3StatsInternalMacTransmitErrors Counter32,
                dot3StatsCarrierSenseErrors       Counter32,
                dot3StatsFrameTooLongs            Counter32,
                dot3StatsInternalMacReceiveErrors Counter32,
                dot3StatsEtherChipSet             OBJECT IDENTIFIER,
                dot3StatsSymbolErrors             Counter32,
                dot3StatsDuplexStatus             INTEGER
            }

        dot3StatsIndex OBJECT-TYPE
            SYNTAX     InterfaceIndex
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION "An index value that uniquely identifies an
                        interface to an ethernet-like medium.  The
                        interface identified by a particular value of
                        this index is the same interface as identified
                        by the same value of ifIndex."
```

                 REFERENCE   "RFC 2233, ifIndex"
                 ::= { dot3StatsEntry 1 }

            dot3StatsAlignmentErrors OBJECT-TYPE
                 SYNTAX   Counter32
                 MAX-ACCESS   read-only
                 STATUS   current
                 DESCRIPTION "A count of frames received on a particular
                              interface that are not an integral number of
                              octets in length and do not pass the FCS check.

                              The count represented by an instance of this
                              object is incremented when the alignmentError
                              status is returned by the MAC service to the
                              LLC (or other MAC user). Received frames for
                              which multiple error conditions obtain are,
                              according to the conventions of IEEE 802.3
                              Layer Management, counted exclusively according
                              to the error status presented to the LLC.

                              This counter does not increment for 8-bit wide
                              group encoding schemes."
                 REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.7,
                              aAlignmentErrors"
                 ::= { dot3StatsEntry 2 }

            dot3StatsFCSErrors OBJECT-TYPE
                 SYNTAX   Counter32
                 MAX-ACCESS   read-only
                 STATUS   current
                 DESCRIPTION "A count of frames received on a particular
                              interface that are an integral number of octets
                              in length but do not pass the FCS check. This
                              count does not include frames received with
                              frame-too-long or frame-too-short error.

                              The count represented by an instance of this
                              object is incremented when the frameCheckError
                              status is returned by the MAC service to the
                              LLC (or other MAC user). Received frames for
                              which multiple error conditions obtain are,
                              according to the conventions of IEEE 802.3
                              Layer Management, counted exclusively according
                              to the error status presented to the LLC.

                              Note: Coding errors detected by the physical
                              layer for speeds above 10 Mb/s will cause the
                              frame to fail the FCS check."

```
        REFERENCE    "[IEEE 802.3 Std.], 30.3.1.1.6,
                     aFrameCheckSequenceErrors."
        ::= { dot3StatsEntry 3 }

dot3StatsSingleCollisionFrames OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION "A count of successfully transmitted frames on
                 a particular interface for which transmission
                 is inhibited by exactly one collision.

                 A frame that is counted by an instance of this
                 object is also counted by the corresponding
                 instance of either the ifOutUcastPkts,
                 ifOutMulticastPkts, or ifOutBroadcastPkts,
                 and is not counted by the corresponding
                 instance of the dot3StatsMultipleCollisionFrames
                 object.

                 This counter does not increment when the
                 interface is operating in full-duplex mode."
    REFERENCE    "[IEEE 802.3 Std.], 30.3.1.1.3,
                 aSingleCollisionFrames."
    ::= { dot3StatsEntry 4 }


dot3StatsMultipleCollisionFrames OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION "A count of successfully transmitted frames on
                 a particular interface for which transmission
                 is inhibited by more than one collision.

                 A frame that is counted by an instance of this
                 object is also counted by the corresponding
                 instance of either the ifOutUcastPkts,
                 ifOutMulticastPkts, or ifOutBroadcastPkts,
                 and is not counted by the corresponding
                 instance of the dot3StatsSingleCollisionFrames
                 object.

                 This counter does not increment when the
                 interface is operating in full-duplex mode."
    REFERENCE    "[IEEE 802.3 Std.], 30.3.1.1.4,
                 aMultipleCollisionFrames."
    ::= { dot3StatsEntry 5 }
```

```
     dot3StatsSQETestErrors OBJECT-TYPE
         SYNTAX       Counter32
         MAX-ACCESS   read-only
         STATUS       current
         DESCRIPTION "A count of times that the SQE TEST ERROR
                     message is generated by the PLS sublayer for a
                     particular interface. The SQE TEST ERROR
                     is set in accordance with the rules for
                     verification of the SQE detection mechanism in
                     the PLS Carrier Sense Function as described in
                     IEEE Std. 802.3, 1998 Edition, section 7.2.4.6.

                     This counter does not increment on interfaces
                     operating at speeds greater than 10 Mb/s, or on
                     interfaces operating in full-duplex mode."
         REFERENCE    "[IEEE 802.3 Std.], 7.2.4.6, also 30.3.2.1.4,
                     aSQETestErrors."
         ::= { dot3StatsEntry 6 }

     dot3StatsDeferredTransmissions OBJECT-TYPE
         SYNTAX       Counter32
         MAX-ACCESS   read-only
         STATUS       current
         DESCRIPTION "A count of frames for which the first
                     transmission attempt on a particular interface
                     is delayed because the medium is busy.

                     The count represented by an instance of this
                     object does not include frames involved in
                     collisions.

                     This counter does not increment when the
                     interface is operating in full-duplex mode."
         REFERENCE    "[IEEE 802.3 Std.], 30.3.1.1.9,
                     aFramesWithDeferredXmissions."
         ::= { dot3StatsEntry 7 }

     dot3StatsLateCollisions OBJECT-TYPE
         SYNTAX       Counter32
         MAX-ACCESS   read-only
         STATUS       current
         DESCRIPTION "The number of times that a collision is
                     detected on a particular interface later than
                     one slotTime into the transmission of a packet.

                     A (late) collision included in a count
                     represented by an instance of this object is
                     also considered as a (generic) collision for
```

                        purposes of other collision-related
                        statistics.

                        This counter does not increment when the
                        interface is operating in full-duplex mode."
            REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.10,
                        aLateCollisions."
            ::= { dot3StatsEntry 8 }

        dot3StatsExcessiveCollisions OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION "A count of frames for which transmission on a
                        particular interface fails due to excessive
                        collisions.

                        This counter does not increment when the
                        interface is operating in full-duplex mode."
            REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.11,
                        aFramesAbortedDueToXSColls."
            ::= { dot3StatsEntry 9 }

        dot3StatsInternalMacTransmitErrors OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION "A count of frames for which transmission on a
                        particular interface fails due to an internal
                        MAC sublayer transmit error. A frame is only
                        counted by an instance of this object if it is
                        not counted by the corresponding instance of
                        either the dot3StatsLateCollisions object, the
                        dot3StatsExcessiveCollisions object, or the
                        dot3StatsCarrierSenseErrors object.

                        The precise meaning of the count represented by
                        an instance of this object is implementation-
                        specific. In particular, an instance of this
                        object may represent a count of transmission
                        errors on a particular interface that are not
                        otherwise counted."
            REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.12,
                        aFramesLostDueToIntMACXmitError."
            ::= { dot3StatsEntry 10 }

        dot3StatsCarrierSenseErrors OBJECT-TYPE
            SYNTAX   Counter32

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The number of times that the carrier sense
                    condition was lost or never asserted when
                    attempting to transmit a frame on a particular
                    interface.

                    The count represented by an instance of this
                    object is incremented at most once per
                    transmission attempt, even if the carrier sense
                    condition fluctuates during a transmission
                    attempt.

                    This counter does not increment when the
                    interface is operating in full-duplex mode."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.13,
                    aCarrierSenseErrors."
        ::= { dot3StatsEntry 11 }

    -- { dot3StatsEntry 12 } is not assigned

    dot3StatsFrameTooLongs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "A count of frames received on a particular
                    interface that exceed the maximum permitted
                    frame size.

                    The count represented by an instance of this
                    object is incremented when the frameTooLong
                    status is returned by the MAC service to the
                    LLC (or other MAC user). Received frames for
                    which multiple error conditions obtain are,
                    according to the conventions of IEEE 802.3
                    Layer Management, counted exclusively according
                    to the error status presented to the LLC."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.25,
                    aFrameTooLongErrors."
        ::= { dot3StatsEntry 13 }

    -- { dot3StatsEntry 14 } is not assigned

    -- { dot3StatsEntry 15 } is not assigned

    dot3StatsInternalMacReceiveErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
```

```
            STATUS      current
            DESCRIPTION "A count of frames for which reception on a
                        particular interface fails due to an internal
                        MAC sublayer receive error. A frame is only
                        counted by an instance of this object if it is
                        not counted by the corresponding instance of
                        either the dot3StatsFrameTooLongs object, the
                        dot3StatsAlignmentErrors object, or the
                        dot3StatsFCSErrors object.

                        The precise meaning of the count represented by
                        an instance of this object is implementation-
                        specific.  In particular, an instance of this
                        object may represent a count of receive errors
                        on a particular interface that are not
                        otherwise counted."
            REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.15,
                        aFramesLostDueToIntMACRcvError."
            ::= { dot3StatsEntry 16 }

       dot3StatsEtherChipSet OBJECT-TYPE
            SYNTAX      OBJECT IDENTIFIER
            MAX-ACCESS  read-only
            STATUS      deprecated
            DESCRIPTION "******** THIS OBJECT IS DEPRECATED ********

                        This object contains an OBJECT IDENTIFIER
                        which identifies the chipset used to
                        realize the interface. Ethernet-like
                        interfaces are typically built out of
                        several different chips. The MIB implementor
                        is presented with a decision of which chip
                        to identify via this object. The implementor
                        should identify the chip which is usually
                        called the Medium Access Control chip.
                        If no such chip is easily identifiable,
                        the implementor should identify the chip
                        which actually gathers the transmit
                        and receive statistics and error
                        indications. This would allow a
                        manager station to correlate the
                        statistics and the chip generating
                        them, giving it the ability to take
                        into account any known anomalies
                        in the chip."
            ::= { dot3StatsEntry 17 }

       dot3StatsSymbolErrors OBJECT-TYPE
```

```
             SYNTAX       Counter32
             MAX-ACCESS   read-only
             STATUS       current
             DESCRIPTION "For an interface operating at 100 Mb/s, the
                          number of times there was an invalid data symbol
                          when a valid carrier was present.

                          For an interface operating in half-duplex mode
                          at 1000 Mb/s, the number of times the receiving
                          media is non-idle (a carrier event) for a period
                          of time equal to or greater than slotTime, and
                          during which there was at least one occurrence
                          of an event that causes the PHY to indicate
                          'Data reception error' or 'carrier extend error'
                          on the GMII.

                          For an interface operating in full-duplex mode
                          at 1000 Mb/s, the number of times the receiving
                          media is non-idle a carrier event) for a period
                          of time equal to or greater than minFrameSize,
                          and during which there was at least one
                          occurrence of an event that causes the PHY to
                          indicate 'Data reception error' on the GMII.

                          The count represented by an instance of this
                          object is incremented at most once per carrier
                          event, even if multiple symbol errors occur
                          during the carrier event.  This count does
                          not increment if a collision is present."
             REFERENCE   "[IEEE 802.3 Std.], 30.3.2.1.5,
                          aSymbolErrorDuringCarrier."
             ::= { dot3StatsEntry 18 }

        dot3StatsDuplexStatus OBJECT-TYPE
             SYNTAX       INTEGER {
                              unknown(1),
                              halfDuplex(2),
                              fullDuplex(3)
                          }
             MAX-ACCESS   read-only
             STATUS       current
             DESCRIPTION "The current mode of operation of the MAC
                          entity.  'unknown' indicates that the current
                          duplex mode could not be determined.

                          Management control of the duplex mode is
                          accomplished through the MAU MIB.  When
                          an interface does not support autonegotiation,
```

```
                        or when autonegotiation is not enabled, the
                        duplex mode is controlled using
                        ifMauDefaultType.  When autonegotiation is
                        supported and enabled, duplex mode is controlled
                        using ifMauAutoNegAdvertisedBits.  In either
                        case, the currently operating duplex mode is
                        reflected both in this object and in ifMauType."
            REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.32,
                        aDuplexStatus."
            ::= { dot3StatsEntry 19 }


     -- the Ethernet-like Collision Statistics group

     -- Implementation of this group is optional; it is appropriate
     -- for all systems which have the necessary metering

     dot3CollTable OBJECT-TYPE
         SYNTAX       SEQUENCE OF Dot3CollEntry
         MAX-ACCESS   not-accessible
         STATUS       current
         DESCRIPTION "A collection of collision histograms for a
                      particular set of interfaces."
         REFERENCE   "[IEEE 802.3 Std.], 30.3.1.1.30,
                      aCollisionFrames."
         ::= { dot3 5 }


     dot3CollEntry OBJECT-TYPE
         SYNTAX       Dot3CollEntry
         MAX-ACCESS   not-accessible
         STATUS       current
         DESCRIPTION "A cell in the histogram of per-frame
                      collisions for a particular interface.  An
                      instance of this object represents the
                      frequency of individual MAC frames for which
                      the transmission (successful or otherwise) on a
                      particular interface is accompanied by a
                      particular number of media collisions."
         INDEX        { ifIndex, dot3CollCount }
         ::= { dot3CollTable 1 }

     Dot3CollEntry ::=
         SEQUENCE {
             dot3CollCount       INTEGER,
             dot3CollFrequencies  Counter32
         }
```

        -- { dot3CollEntry 1 } is no longer in use

        dot3CollCount OBJECT-TYPE
            SYNTAX   INTEGER (1..16)
            MAX-ACCESS not-accessible
            STATUS   current
            DESCRIPTION "The number of per-frame media collisions for
                        which a particular collision histogram cell
                        represents the frequency on a particular
                        interface."
            ::= { dot3CollEntry 2 }

        dot3CollFrequencies OBJECT-TYPE
            SYNTAX   Counter32
            MAX-ACCESS read-only
            STATUS   current
            DESCRIPTION "A count of individual MAC frames for which the
                        transmission (successful or otherwise) on a
                        particular interface occurs after the
                        frame has experienced exactly the number
                        of collisions in the associated
                        dot3CollCount object.

                        For example, a frame which is transmitted
                        on interface 77 after experiencing
                        exactly 4 collisions would be indicated
                        by incrementing only dot3CollFrequencies.77.4.
                        No other instance of dot3CollFrequencies would
                        be incremented in this example.

                        This counter does not increment when the
                        interface is operating in full-duplex mode."
            ::= { dot3CollEntry 3 }

        dot3ControlTable OBJECT-TYPE
            SYNTAX   SEQUENCE OF Dot3ControlEntry
            MAX-ACCESS not-accessible
            STATUS   current
            DESCRIPTION "A table of descriptive and status information
                        about the MAC Control sublayer on the
                        ethernet-like interfaces attached to a
                        particular system."
            ::= { dot3 9 }

        dot3ControlEntry OBJECT-TYPE
            SYNTAX   Dot3ControlEntry

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "An entry in the table, containing information
                    about the MAC Control sublayer on a single
                    ethernet-like interface."
        INDEX       { dot3StatsIndex }
        ::= { dot3ControlTable 1 }

    Dot3ControlEntry ::=
        SEQUENCE {
            dot3ControlFunctionsSupported       BITS,
            dot3ControlInUnknownOpcodes         Counter32
        }

    dot3ControlFunctionsSupported OBJECT-TYPE
        SYNTAX      BITS {
                        pause(0)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "A list of the possible MAC Control functions
                    implemented for this interface."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.3.2,
                    aMACControlFunctionsSupported."
        ::= { dot3ControlEntry 1 }

    dot3ControlInUnknownOpcodes OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "A count of MAC Control frames received on this
                    interface that contain an opcode that is not
                    supported by this device."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.3.5,
                    aUnsupportedOpcodesReceived"
        ::= { dot3ControlEntry 2 }


    dot3PauseTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF Dot3PauseEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A table of descriptive and status information
                    about the MAC Control PAUSE function on the
                    ethernet-like interfaces attached to a
                    particular system."
        ::= { dot3 10 }
```

        dot3PauseEntry OBJECT-TYPE
            SYNTAX   Dot3PauseEntry
            MAX-ACCESS not-accessible
            STATUS   current
            DESCRIPTION "An entry in the table, containing information
                        about the MAC Control PAUSE function on a single
                        ethernet-like interface."
            INDEX   { dot3StatsIndex }
            ::= { dot3PauseTable 1 }

        Dot3PauseEntry ::=
            SEQUENCE {
                dot3PauseAdminMode   INTEGER,
                dot3PauseOperMode   INTEGER,
                dot3PauseLinkDelayAllowance   Unsigned32,
                dot3InPauseFrames   Counter32,
                dot3OutPauseFrames   Counter32
            }

        dot3PauseAdminMode OBJECT-TYPE
            SYNTAX   INTEGER {
                            disabled(1),
                            enabledXmit(2),
                            enabledRcv(3),
                            enabledXmitAndRcv(4)
                        }
            MAX-ACCESS read-write
            STATUS   current
            DESCRIPTION "This object is used to configure the default
                        administrative PAUSE mode for this interface.

                        This object represents the
                        administratively-configured PAUSE mode for this
                        interface. If auto-negotiation is not enabled
                        or is not implemented for the active MAU
                        attached to this interface, the value of this
                        object determines the operational PAUSE mode
                        of the interface whenever it is operating in
                        full-duplex mode. In this case, a set to this
                        object will force the interface into the
                        specified mode.

                        If auto-negotiation is implemented and enabled
                        for the MAU attached to this interface, the
                        PAUSE mode for this interface is determined by
                        auto-negotiation, and the value of this object
                        denotes the mode to which the interface will
                        automatically revert if/when auto-negotiation is

                        later disabled. Note that when auto-negotiation
                        is running, administrative control of the PAUSE
                        mode may be accomplished using the
                        ifMauAutoNegCapAdvertisedBits object in the
                        MAU-MIB.

                        Note that the value of this object is ignored
                        when the interface is not operating in
                        full-duplex mode.

                        An attempt to set this object to
                        'enabledXmit(2)' or 'enabledRcv(3)' will fail
                        on interfaces that do not support operation
                        at greater than 100 Mb/s."
             ::= { dot3PauseEntry 1 }

        dot3PauseOperMode OBJECT-TYPE
            SYNTAX   INTEGER {
                            disabled(1),
                            enabledXmit(2),
                            enabledRcv(3),
                            enabledXmitAndRcv(4)
                          }
            MAX-ACCESS read-only
            STATUS   current
            DESCRIPTION "This object reflects the PAUSE mode currently
                        in use on this interface, as determined by
                        either (1) the result of the auto-negotiation
                        function or (2) if auto-negotiation is not
                        enabled or is not implemented for the active MAU
                        attached to this interface, by the value of
                        dot3PauseAdminMode. Interfaces operating at
                        100 Mb/s or less will never return
                        'enabledXmit(2)' or 'enabledRcv(3)'. Interfaces
                        operating in half-duplex mode will always return
                        'disabled(1)'. Interfaces on which
                        auto-negotiation is enabled but not yet
                        completed should return the value
                        'disabled(1)'."
             ::= { dot3PauseEntry 2 }

        dot3PauseLinkDelayAllowance OBJECT-TYPE
            SYNTAX   Unsigned32 (0..4294967295)
            MAX-ACCESS read-write
            STATUS   current
            DESCRIPTION "The allowance, in bit times, made by the PAUSE
                        MAC Control entity for round-trip propagation
                        delay of the full-duplex link."

```
        REFERENCE   "[IEEE 802.3 Std.], 30.3.4.1,
                    aPAUSELinkDelayAllowance."
        ::= { dot3PauseEntry 3 }

    dot3InPauseFrames OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "A count of MAC Control frames received on this
                    interface with an opcode indicating the PAUSE
                    operation.

                    This counter does not increment when the
                    interface is operating in half-duplex mode."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.4.3,
                    aPAUSEMACCtrlFramesReceived."
        ::= { dot3PauseEntry 4 }

    dot3OutPauseFrames OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "A count of MAC Control frames transmitted on
                    this interface with an opcode indicating the
                    PAUSE operation.

                    This counter does not increment when the
                    interface is operating in half-duplex mode."
        REFERENCE   "[IEEE 802.3 Std.], 30.3.4.2,
                    aPAUSEMACCtrlFramesTransmitted."
        ::= { dot3PauseEntry 5 }


    --   802.3 Tests

    dot3Tests   OBJECT IDENTIFIER ::= { dot3 6 }

    dot3Errors  OBJECT IDENTIFIER ::= { dot3 7 }


    --   TDR Test

    dot3TestTdr OBJECT-IDENTITY
        STATUS      current
        DESCRIPTION "The Time-Domain Reflectometry (TDR) test is
                    specific to ethernet-like interfaces of type
                    10Base5 and 10Base2.  The TDR value may be
                    useful in determining the approximate distance
```

                      to a cable fault. It is advisable to repeat
                      this test to check for a consistent resulting
                      TDR value, to verify that there is a fault.

                      A TDR test returns as its result the time
                      interval, measured in 10 MHz ticks or 100 nsec
                      units, between the start of TDR test
                      transmission and the subsequent detection of a
                      collision or deassertion of carrier. On
                      successful completion of a TDR test, the result
                      is stored as the value of an appropriate
                      instance of an appropriate vendor specific MIB
                      object, and the OBJECT IDENTIFIER of that
                      instance is stored in the appropriate instance
                      of the appropriate test result code object
                      (thereby indicating where the result has been
                      stored)."
          ::= { dot3Tests 1 }

     -- Loopback Test

     dot3TestLoopBack OBJECT-IDENTITY
         STATUS   current
         DESCRIPTION "This test configures the MAC chip and executes
                      an internal loopback test of memory, data paths,
                      and the MAC chip logic. This loopback test can
                      only be executed if the interface is offline.
                      Once the test has completed, the MAC chip should
                      be reinitialized for network operation, but it
                      should remain offline.

                      If an error occurs during a test, the
                      appropriate test result object will be set
                      to indicate a failure. The two OBJECT
                      IDENTIFIER values dot3ErrorInitError and
                      dot3ErrorLoopbackError may be used to provided
                      more information as values for an appropriate
                      test result code object."
          ::= { dot3Tests 2 }

     dot3ErrorInitError OBJECT-IDENTITY
         STATUS   current
         DESCRIPTION "Couldn't initialize MAC chip for test."
          ::= { dot3Errors 1 }

     dot3ErrorLoopbackError OBJECT-IDENTITY
         STATUS   current
         DESCRIPTION "Expected data not received (or not received

                              correctly) in loopback test."
                 ::= { dot3Errors 2 }

         -- conformance information

         etherConformance OBJECT IDENTIFIER ::= { etherMIB 2 }

         etherGroups   OBJECT IDENTIFIER ::= { etherConformance 1 }
         etherCompliances OBJECT IDENTIFIER ::= { etherConformance 2 }

         -- compliance statements

         etherCompliance MODULE-COMPLIANCE
             STATUS   deprecated
             DESCRIPTION "******** THIS COMPLIANCE IS DEPRECATED ********

                         The compliance statement for managed network
                         entities which have ethernet-like network
                         interfaces.

                         This compliance is deprecated and replaced by
                         dot3Compliance."

             MODULE   -- this module
                 MANDATORY-GROUPS { etherStatsGroup }

                 GROUP   etherCollisionTableGroup
                 DESCRIPTION "This group is optional. It is appropriate
                             for all systems which have the necessary
                             metering. Implementation in such systems is
                             highly recommended."
             ::= { etherCompliances 1 }

         ether100MbsCompliance MODULE-COMPLIANCE
             STATUS   deprecated
             DESCRIPTION "******** THIS COMPLIANCE IS DEPRECATED ********

                         The compliance statement for managed network
                         entities which have 100 Mb/sec ethernet-like
                         network interfaces.

                         This compliance is deprecated and replaced by
                         dot3Compliance."

             MODULE   -- this module
                 MANDATORY-GROUPS { etherStats100MbsGroup }

```
             GROUP        etherCollisionTableGroup
             DESCRIPTION "This group is optional. It is appropriate
                          for all systems which have the necessary
                          metering. Implementation in such systems is
                          highly recommended."
         ::= { etherCompliances 2 }

     dot3Compliance MODULE-COMPLIANCE
         STATUS      current
         DESCRIPTION "The compliance statement for managed network
                      entities which have ethernet-like network
                      interfaces."

         MODULE  -- this module
             MANDATORY-GROUPS { etherStatsBaseGroup }

             GROUP        etherDuplexGroup
             DESCRIPTION "This group is mandatory for all
                          ethernet-like network interfaces which are
                          capable of operating in full-duplex mode.
                          It is highly recommended for all
                          ethernet-like network interfaces."

             GROUP        etherStatsLowSpeedGroup
             DESCRIPTION "This group is mandatory for all
                          ethernet-like network interfaces which are
                          capable of operating at 10 Mb/s or slower in
                          half-duplex mode."

             GROUP        etherStatsHighSpeedGroup
             DESCRIPTION "This group is mandatory for all
                          ethernet-like network interfaces which are
                          capable of operating at 100 Mb/s or faster."

             GROUP        etherControlGroup
             DESCRIPTION "This group is mandatory for all
                          ethernet-like network interfaces that
                          support the MAC Control sublayer."

             GROUP        etherControlPauseGroup
             DESCRIPTION "This group is mandatory for all
                          ethernet-like network interfaces that
                          support the MAC Control PAUSE function."

             OBJECT       dot3PauseLinkDelayAllowance
             MIN-ACCESS  read-only
             DESCRIPTION "Write access is not required."
```

```
              GROUP        etherCollisionTableGroup
              DESCRIPTION "This group is optional. It is appropriate
                           for all ethernet-like network interfaces
                           which are capable of operating in
                           half-duplex mode and have the necessary
                           metering. Implementation in systems with
                           such interfaces is highly recommended."
          ::= { etherCompliances 3 }

       -- units of conformance

       etherStatsGroup OBJECT-GROUP
           OBJECTS     { dot3StatsIndex,
                         dot3StatsAlignmentErrors,
                         dot3StatsFCSErrors,
                         dot3StatsSingleCollisionFrames,
                         dot3StatsMultipleCollisionFrames,
                         dot3StatsSQETestErrors,
                         dot3StatsDeferredTransmissions,
                         dot3StatsLateCollisions,
                         dot3StatsExcessiveCollisions,
                         dot3StatsInternalMacTransmitErrors,
                         dot3StatsCarrierSenseErrors,
                         dot3StatsFrameTooLongs,
                         dot3StatsInternalMacReceiveErrors,
                         dot3StatsEtherChipSet
                       }
           STATUS      deprecated
           DESCRIPTION "********** THIS GROUP IS DEPRECATED **********

                       A collection of objects providing information
                       applicable to all ethernet-like network
                       interfaces.

                       This object group has been deprecated and
                       replaced by etherStatsBaseGroup and
                       etherStatsLowSpeedGroup."
           ::= { etherGroups 1 }

      etherCollisionTableGroup OBJECT-GROUP
          OBJECTS     { dot3CollFrequencies
                      }
          STATUS      current
          DESCRIPTION "A collection of objects providing a histogram
                      of packets successfully transmitted after
                      experiencing exactly N collisions."
          ::= { etherGroups 2 }
```

```
        etherStats100MbsGroup OBJECT-GROUP
            OBJECTS     { dot3StatsIndex,
                          dot3StatsAlignmentErrors,
                          dot3StatsFCSErrors,
                          dot3StatsSingleCollisionFrames,
                          dot3StatsMultipleCollisionFrames,
                          dot3StatsDeferredTransmissions,
                          dot3StatsLateCollisions,
                          dot3StatsExcessiveCollisions,
                          dot3StatsInternalMacTransmitErrors,
                          dot3StatsCarrierSenseErrors,
                          dot3StatsFrameTooLongs,
                          dot3StatsInternalMacReceiveErrors,
                          dot3StatsEtherChipSet,
                          dot3StatsSymbolErrors
                        }
            STATUS      deprecated
            DESCRIPTION "********** THIS GROUP IS DEPRECATED **********

                        A collection of objects providing information
                        applicable to 100 Mb/sec ethernet-like network
                        interfaces.

                        This object group has been deprecated and
                        replaced by etherStatsBaseGroup and
                        etherStatsHighSpeedGroup."
            ::= { etherGroups 3 }

        etherStatsBaseGroup OBJECT-GROUP
            OBJECTS     { dot3StatsIndex,
                          dot3StatsAlignmentErrors,
                          dot3StatsFCSErrors,
                          dot3StatsSingleCollisionFrames,
                          dot3StatsMultipleCollisionFrames,
                          dot3StatsDeferredTransmissions,
                          dot3StatsLateCollisions,
                          dot3StatsExcessiveCollisions,
                          dot3StatsInternalMacTransmitErrors,
                          dot3StatsCarrierSenseErrors,
                          dot3StatsFrameTooLongs,
                          dot3StatsInternalMacReceiveErrors
                        }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        applicable to all ethernet-like network
                        interfaces."
            ::= { etherGroups 4 }
```

```
        etherStatsLowSpeedGroup OBJECT-GROUP
            OBJECTS     { dot3StatsSQETestErrors }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        applicable to ethernet-like network interfaces
                        capable of operating at 10 Mb/s or slower in
                        half-duplex mode."
            ::= { etherGroups 5 }

        etherStatsHighSpeedGroup OBJECT-GROUP
            OBJECTS     { dot3StatsSymbolErrors }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        applicable to ethernet-like network interfaces
                        capable of operating at 100 Mb/s or faster."
            ::= { etherGroups 6 }

        etherDuplexGroup OBJECT-GROUP
            OBJECTS     { dot3StatsDuplexStatus }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        about the duplex mode of an ethernet-like
                        network interface."
            ::= { etherGroups 7 }

        etherControlGroup OBJECT-GROUP
            OBJECTS     { dot3ControlFunctionsSupported,
                          dot3ControlInUnknownOpcodes
                        }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        about the MAC Control sublayer on ethernet-like
                        network interfaces."
            ::= { etherGroups 8 }

        etherControlPauseGroup OBJECT-GROUP
            OBJECTS     { dot3PauseAdminMode,
                          dot3PauseOperMode,
                          dot3PauseLinkDelayAllowance,
                          dot3InPauseFrames,
                          dot3OutPauseFrames
                        }
            STATUS      current
            DESCRIPTION "A collection of objects providing information
                        about and control of the MAC Control PAUSE
                        function on ethernet-like network interfaces."
            ::= { etherGroups 9 }
```

          END

5. **Intellectual Property**

   The IETF takes no position regarding the validity or scope of any
   intellectual property or other rights that might be claimed to
   pertain to the implementation or use of the technology described in
   this document or the extent to which any license under such rights
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   copyrights, patents or patent applications, or other proprietary
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   this standard. Please address the information to the IETF Executive
   Director.

6. **Acknowledgements**

   This document was produced by the Ethernet Interfaces and Hub MIB
   Working Group.

   This document is based on the Proposed Standard Ethernet MIB, RFC
   2358 [23], edited by John Flick of Hewlett-Packard and Jeffrey
   Johnson of RedBack Networks and produced by the 802.3 Hub MIB Working
   Group. It extends that document by providing support for full-duplex
   Ethernet interfaces and 1000 Mb/sec Ethernet interfaces as outlined
   in [16].

   RFC 2358, in turn, is almost completely based on both the Standard
   Ethernet MIB, RFC 1643 [21], and the Proposed Standard Ethernet MIB
   using the SNMPv2 SMI, RFC 1650 [22], both of which were edited by
   Frank Kastenholz of FTP Software and produced by the Interfaces MIB
   Working Group. RFC 2358 extends those documents by providing support
   for 100 Mb/sec ethernet interfaces.

   RFC 1643 and RFC 1650, in turn, are based on the Draft Standard
   Ethernet MIB, RFC 1398 [20], also edited by Frank Kastenholz and
   produced by the Ethernet MIB Working Group.

RFC 1398, in turn, is based on the Proposed Standard Ethernet MIB,
RFC 1284 [18], which was edited by John Cook of Chipcom and produced
by the Transmission MIB Working Group. The Ethernet MIB Working
Group gathered implementation experience of the variables specified
in RFC 1284, documented that experience in RFC 1369 [19], and used
that information to develop this revised MIB.

RFC 1284, in turn, is based on a document written by Frank
Kastenholz, then of Interlan, entitled IEEE 802.3 Layer Management
Draft M compatible MIB for TCP/IP Networks [17]. This document was
modestly reworked, initially by the SNMP Working Group, and then by
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for defining objects for MIB interfaces. James Davin, of the MIT
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Kastenholz of Interlan and Louis Steinberg of IBM for their
experimentation.

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8. Security Considerations

There are two management objects defined in this MIB that have a
MAX-ACCESS clause of read-write. Such objects may be considered
sensitive or vulnerable in some network environments. The support
for SET operations in a non-secure environment without proper
protection can have a negative effect on network operations.

There are a number of managed objects in this MIB that may be
considered to contain sensitive information. In particular, the
dot3StatsEtherChipSet object may be considered sensitive in many
environments, since it would allow an intruder to obtain information
about which vendor's equipment is in use on the network. Note that
this object has been deprecated. However, some implementors may
still choose to implement it for backwards compatability.

Therefore, it may be important in some environments to control read
access to these objects and possibly to even encrypt the values of
these objects when sending them over the network via SNMP. Not all
versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is such an insecure environment. 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 (read) the objects in this MIB.

It is recommended that the implementors consider the security
features as provided by the SNMPv3 framework. Specifically, the use
of the User-based Security Model RFC 2274 [12] and the View-based
Access Control Model RFC 2275 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP
entity giving access to an instance of this MIB, is properly
configured to give access to those objects only to those principals
(users) that have legitimate rights to access them.

9. **Author's Addresses**

John Flick
Hewlett-Packard Company
8000 Foothills Blvd. M/S 5557
Roseville, CA 95747-5557

Phone: +1 916 785 4018
Email: johnf@rose.hp.com

Jeffrey Johnson
RedBack Networks
2570 North First Street, Suite 410
San Jose, CA, 95131, USA

Phone: +1 408 571 2699
EMail: jeff@redbacknetworks.com

A. **Change Log**

A.1. **Changes since RFC 2358**

This section enumerates changes made to RFC 2358 to produce this
document.

   (1)   Section 2 has been replaced with the current SNMP
         Management Framework boilerplate.

   (2)   The ifMtu mapping has been clarified.

   (3)   The relationship between the IEEE 802.3 octet counters
         and the IF-MIB octet counters has been clarified.

   (4)   REFERENCE clauses have been updated to reflect the
         actual IEEE 802.3 managed object that each MIB object
         is based on.

   (5)   The following object DESCRIPTION clauses have been
         updated to reflect that they do not increment in

full-duplex mode: dot3StatsSingleCollisionFrames,
dot3StatsMultipleCollisionFrames, dot3StatsSQETestErrors,
dot3StatsDeferredTransmissions, dot3StatsLateCollisions,
dot3StatsExcessiveCollisions, dot3StatsCarrierSenseErrors,
dot3CollFrequencies.

(6)   The following object DESCRIPTION clauses have been
       updated to reflect behaviour on full-duplex and
       1000 Mb/s interfaces: dot3StatsAlignmentErrors,
       dot3StatsFCSErrors, dot3StatsSQETestErrors,
       dot3StatsLateCollisions, dot3StatsSymbolErrors.

(7)   Two new tables, dot3ControlTable and dot3PauseTable,
       have been added.

(8)   A new object, dot3StatsDuplexStatus, has been added.

(9)   The object groups and compliances have been restructured.

(10)   The dot3StatsEtherChipSet object has been deprecated.

(11)   The dot3ChipSets have been moved to a separate document.

A.2. Changes between RFC 1650 and RFC 2358

   This section enumerates changes made to RFC 1650 to produce RFC 2358.

(1)   The MODULE-IDENTITY has been updated to reflect the changes
       in the MIB.

(2)   A new object, dot3StatsSymbolErrors, has been added.

(3)   The definition of the object dot3StatsIndex has been
       converted to use the SMIv2 OBJECT-TYPE macro.

(4)   A new conformance group, etherStats100MbsGroup, has been
       added.

(5)   A new compliance statement, ether100MbsCompliance, has
       been added.

(6)   The Acknowledgements were extended to provide a more
       complete history of the origin of this document.

(7)   The discussion of ifType has been expanded.

(8)   A section on mapping of Interfaces MIB objects has

been added.

(9)   A section defining the relationship of this MIB to
      the MAU MIB has been added.

(10) A section on the mapping of IEEE 802.3 managed objects
      to this MIB and the Interfaces MIB has been added.

(11) Converted the dot3Tests, dot3Errors, and dot3ChipSets
      OIDs to use the OBJECT-IDENTITY macro.

(12) Added to the list of registered dot3ChipSets.

(13) An intellectual property notice and copyright notice
      were added, as required by RFC 2026.