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Definitions of Managed Objects for IEEE 802.12 Interfaces

Status of this Memo

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing network interfaces based on IEEE 802.12.

2. Object Definitions

Management information is viewed as a collection of managed objects, residing in a virtual information store, termed the Management Information Base (MIB). Collections of related objects are defined in MIB modules. MIB modules are written using a subset of Abstract Syntax Notation One (ASN.1) [1] termed the Structure of Management Information (SMI) [2]. In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to refer to the object type.

3. Overview

Instances of these object types represent attributes of an interface to an IEEE 802.12 communications medium. At present, IEEE 802.12 media are identified by one value of the ifType object in the Internet-standard MIB:

```
ieee80212(55)
```

For this interface, the value of the ifSpecific variable in the MIB-II [5] has the OBJECT IDENTIFIER value:

```
dot12MIB    OBJECT IDENTIFIER ::= { transmission 45 }
```

The values for the ifType object are defined by the IANAifType textual convention. The Internet Assigned Numbers Authority (IANA) is responsible for the assignment of all Internet numbers, including new ifType values. Therefore, IANA is responsible for maintaining the definition of this textual convention. The current definition of the IANAifType textual convention is available from IANA's World Wide Web server at:

```
http://www.iana.org/iana/
```

The definitions presented here are based on the IEEE Standard 802.12-1995, [6] Clause 13 "Layer management functions and services", and Annex C "GDMO Specifications for Demand Priority Managed Objects". Implementors of these MIB objects should note that the IEEE document 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 [6] are represented by previously defined objects in the Internet-standard MIB [5] or in the Evolution of the Interfaces Group of MIB-II [7], 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 MAC address of an interface, and multicast information associated with an interface.

3.1. MAC Addresses

All representations of MAC addresses in this MIB module, and in other related MIB modules (like RFC 1573), are in "canonical" order defined by 802.1a, i.e., as if it were transmitted least significant bit first. This is true even if the interface is operating in token ring framing mode, which requires MAC addresses to be transmitted most significant bit first.

3.2. Relation to RFC 1213

This section applies only when this MIB is used in conjunction with the "old" (i.e., pre-RFC 1573) interface group.

The relationship between an IEEE 802.12 interface and an interface in the context of the Internet-standard MIB 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.

3.3. Relation to RFC 1573

RFC 1573, the Interface MIB Evolution, requires that any MIB which is an adjunct of the Interface MIB, clarify specific areas within the Interface MIB. These areas are intentionally left vague in RFC 1573 to avoid over constraining the MIB, thereby precluding management of certain media-types.

An agent which implements this MIB module must support the ifGeneralGroup, ifStackGroup, ifHCPacketGroup, and ifRcvAddressGroup of RFC 1573.

Section 3.3 of RFC 1573 enumerates several areas which a media-specific MIB must clarify. In addition, there are some objects in RFC 1573 for which additional clarification of how to apply them to an IEEE 802.12 interface would be helpful. Each of these areas is addressed in a following subsection. The implementor is referred to RFC 1573 in order to understand the general intent of these areas.

3.3.1. Layering Model

For the typical usage of this MIB module, there will be no sub-layers "above" or "below" the 802.12 Interface. However, this MIB module does not preclude such layering.

3.3.2. Virtual Circuits

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

3.3.3. ifTestTable

This MIB does not define any tests for media instrumented by this MIB. Implementation of the ifTestTable is not required. An implementation may optionally implement the ifTestTable to execute vendor specific tests.

3.3.4. ifRcvAddressTable

This table contains all IEEE addresses, unicast, multicast, and broadcast, for which this interface will receive packets and forward them up to a higher layer entity for consumption. In addition, when the interface is using 802.5 framing mode, the ifRcvAddressTable will contain the functional address mask.

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.

3.3.5. ifPhysAddress

This object contains the IEEE 802.12 address which is placed in the source-address field of any 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 choose, 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. This is true even when the interface is using token ring framing mode, which transmits addresses high-order bit first.

3.3.6. Specific Interface MIB Objects

The following table provides specific implementation guidelines for the interface group objects in the conformance groups listed above.

Object	Use for an 802.12 Interface
ifIndex	Each 802.12 interface is represented by an ifEntry. Interface tables in this MIB module are indexed by ifIndex.
ifDescr	Refer to [7].
ifType	The IANA reserved value for 802.12 - 55.
ifMtu	The value of ifMtu on an 802.12 interface will depend on the type of framing that is in use on that interface. Changing the dot12DesiredFramingType may have the effect of changing ifMtu after the next time that the interface trains. When dot12CurrentFramingType is equal to frameType88023, ifMtu will be equal to 1500. When dot12CurrentFramingType is equal to frameType88025, ifMtu will be 4464.
ifSpeed	The speed of the interface in bits per second. For current 802.12 implementations, this will be equal to 100,000,000 (100 million).
ifPhysAddress	See Section 3.3.5.

ifAdminStatus	Write access is not required. Support for 'testing' is not required. Setting this object to 'up' will cause dot12Commands to be set to 'open'. Setting this object to 'down' will cause dot12Commands to be set to 'close'. Setting dot12Commands to 'open' will set this object to 'up'. Setting dot12Commands to 'close' will set this object to 'down'. Setting dot12Commands to 'reset' will have no effect on this object.
ifOperStatus	When dot12Status is equal to 'opened', this object will be equal to 'up'. When dot12Status is equal to 'closed', 'opening', 'openFailure' or 'linkFailure', this object will be equal to 'down'. Support for 'testing' is not required, but may be used to indicate that a vendor specific test is in progress. The value 'dormant' has no meaning for an IEEE 802.12 interface.
ifLastChange	Refer to [7].
ifInOctets	The number of octets in valid MAC frames received on this interface, including the MAC header and FCS.
ifInUcastPkts	Refer to [7].
ifInDiscards	Refer to [7].
ifInErrors	The sum for this interface of dot12InIPMErrors, dot12InOversizeFrameErrors, dot12InDataErrors, and any additional internal errors that may occur in an implementation.
ifInUnknownProtos	Refer to [7].
ifOutOctets	The number of octets transmitted in MAC frames on this interface, including the MAC header and FCS.
ifOutUcastPkts	Refer to [7].
ifOutDiscards	Refer to [7].

ifOutErrors	The number of implementation-specific internal transmit errors on this interface.
ifName	Locally-significant textual name for the interface (e.g. vg0).
ifInMulticastPkts	Refer to [7]. When dot12CurrentFramingType is frameType88025, this count includes packets addressed to functional addresses.
ifInBroadcastPkts	Refer to [7].
ifOutMulticastPkts	Refer to [7]. When dot12CurrentFramingType is frameType88025, this count includes packets addressed to functional addresses.
ifOutBroadcastPkts	Refer to [7].
ifHCInOctets	64-bit version of ifInOctets.
ifHCOutOctets	64-bit version of ifOutOctets
ifHC*Pkts	Not required for 100 MBit interfaces. Future IEEE 802.12 interfaces which operate at higher speeds may require implementation of these counters, but such interfaces are beyond the scope of this memo.
ifLinkUpDownTrapEnable	Refer to [7]. Default is 'enabled'.
ifHighSpeed	The speed of the interface in millions of bits per second. For current 802.12 implementations, this will be equal to 100.
ifPromiscuousMode	Reflects whether the interface has successfully trained and is currently operating in promiscuous mode. dot12DesiredPromiscStatus is used to select the promiscuous mode to be requested in the next training attempt. Setting ifPromiscuousMode will update dot12DesiredPromiscStatus and cause the interface to attempt to retrain using the new promiscuous mode. After the interface has retrained, ifPromiscuousMode will reflect the mode that is in use, not the mode that was requested.

ifConnectorPresent	This will normally be 'true'.
ifStackHigherLayer ifStackLowerLayer ifStackStatus	Refer to section 3.3.1
ifRcvAddressAddress ifRcvAddressStatus ifRcvAddressType	Refer to section 3.3.4.

3.4. Relation to RFC 1643, RFC 1650, and RFC 1748

An IEEE 802.12 interface can be configured to operate in either ethernet or token ring framing mode. An IEEE 802.12 interface uses the frame format for the configured framing mode, but does not use the media access protocol for ethernet or token ring. Instead, IEEE 802.12 defines its own media access protocol, the Demand Priority Access Method (DPAM).

There are existing standards-track MIB modules for instrumenting ethernet-like interfaces and token ring interfaces. At the time of this writing, they are: STD 50, RFC 1643, "Definitions of Managed Objects for Ethernet-like Interface Types" [8]; RFC 1650, "Definitions of Managed Objects for Ethernet-like Interface Types using SMIv2" [9]; and RFC 1748, "IEEE 802.5 MIB using SMIv2" [10]. These MIB modules are designed to instrument the media access protocol for these respective technologies. Since IEEE 802.12 interfaces do not implement either of these media access protocols, an agent should not implement RFC 1643, RFC 1650, or RFC 1748 for IEEE 802.12 interfaces.

3.5. Relation to RFC 1749

When an IEEE 802.12 interface is operating in token ring framing mode, and the end node supports token ring source routing, the agent should implement RFC 1749, the IEEE 802.5 Station Source Routing MIB [11] for those interfaces.

3.6. Master Mode Operation

In an IEEE 802.12 network, "master" devices act as network controllers to decide when to grant requesting end-nodes permission to transmit. These master devices may be repeaters, or other active controller devices such as switches.

Devices which do not act as network controllers, such as end-nodes or passive switches, are considered to be operating in "slave" mode.

The dot12ControlMode object indicates if the interface is operating in master mode or slave mode.

3.7. Normal and High Priority Counters

The IEEE 802.12 interface MIB does not provide normal priority transmit counters. Standardization of normal priority transmit counters could not be justified -- ifOutUcastPkts, ifOutMulticastPkts, ifOutBroadcastPkts, ifOutOctets, dot12OutHighPriorityFrames, and dot12OutHighPriorityOctets should suffice. More precisely, the number of normal priority frames transmitted can be calculated as:

```
outNormPriorityFrames = ifOutUcastPkts             +
                        ifOutMulticastPkts         +
                        ifOutBroadcastPkts         -
                        dot12OutHighPriorityFrames
```

The number of normal priority octets transmitted can be calculated as:

```
outNormPriorityOctets = ifOutOctets                -
                        dot12OutHighPriorityOctets
```

On the other hand, normal priority receive counters are provided. The main reason for this is that the normal priority and high priority counters include errored frames, whereas the ifIn*Pkts and ifInOctets do not include errored frames. dot12InNormPriorityFrames could be calculated, but the calculation is tedious:

```
inNormPriorityFrames = ifInUcastPkts               +
                       ifInMulticastPkts           +
                       ifInBroadcastPkts           +
                       dot12InNullAddressedFrames  +
                       ifInErrors                  +
                       ifInDiscards                +
                       ifInUnknownProtos           -
                       dot12InHighPriorityFrames
```

dot12InNormPriorityOctets includes octets in unreadable frames, which is not available elsewhere. The number of octets in unreadable frames can be calculated as:

```
octetsInUnreadableFrames = dot12InNormPriorityOctets +
                           dot12InHighPriorityOctets -
                           ifInOctets
```

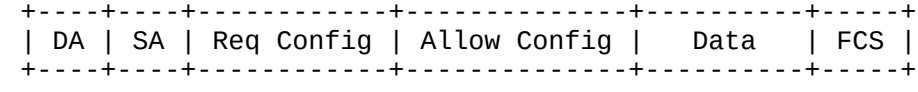
Also, the total traffic at this interface can be calculated as:

```
traffic = dot12InNormPriorityOctets +
          dot12InHighPriorityOctets +
          ifOutOctets
```

In other words, the normal priority receive counters were deemed useful, whereas the normal priority transmit counters can be easily calculated from other available counters.

3.8. IEEE 802.12 Training Frames

Training frames are special MAC frames that are used only during link initialization. Training frames are initially constructed by the device at the lower end of a link, which is the slave mode device for the link. The training frame format is as follows:

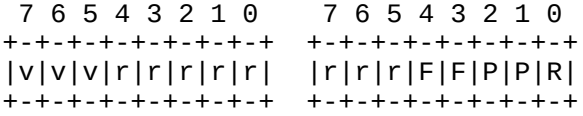


DA = destination address (six octets)
SA = source address (six octets)
Req Config = requested configuration (2 octets)
Allow Config = allowed configuration (2 octets)
Data = data (594 to 675 octets)
FCS = frame check sequence (4 octets)

Training frames are always sent with a null destination address. To pass training, an end node must use its source address in the source address field of the training frame. A repeater may use a non-null source address if it has one, or it may use a null source address.

The requested configuration field allows the slave mode device to inform the master mode device about itself and to request configuration options. The training response frame from the master mode device contains the slave mode device's requested configuration from the training request frame. The currently defined format of the requested configuration field as defined in the IEEE Standard 802.12-1995 standard is shown below. Please refer to the most current version of the IEEE document for a more up to date description of this field. In particular, the reserved bits may be used in later versions of the standard.

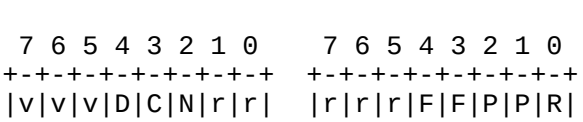
First Octet: Second Octet:



vvv: The version of the 802.12 training protocol with which the training initiator is compliant. The current version is 100.
r: Reserved bits (set to zero)
FF: 00 = frameType88023
01 = frameType88025
10 = reserved
11 = frameTypeEither
PP: 00 = singleAddressMode
01 = promiscuousMode
10 = reserved
11 = reserved
R: 0 = the training initiator is an end node
1 = the training initiator is a repeater

The allowed configuration field allows the master mode device to respond with the allowed configuration. The slave mode device sets the contents of this field to all zero bits. The master mode device sets the allowed configuration field as follows:

First Octet: Second Octet:



vvv: The version of the 802.12 training protocol with which the training responder is compliant. The current version is 100.

```
D:   0  = No duplicate address has been detected.
     1  = Duplicate address has been detected
C:   0  = The requested configuration is compatible with the
          network.
     1  = The requested configuration is not compatible with
          the network.  In this case, the FF, PP, and R bits
          indicate the configuration that would be allowed.
N:   0  = Access will be allowed, providing the configuration
          is compatible (C = 0).
     1  = Access is not granted because of security
          restrictions
r:   Reserved bits (set to zero)
FF:  00 = frameType88023 will be used
     01 = frameType88025 will be used
     10 = reserved
     11 = reserved
PP:  00 = singleAddressMode
     01 = promiscuousMode
     10 = reserved
     11 = reserved
R:   0  = Requested access as an end node is allowed
     1  = Requested access as a repeater is allowed
```

Again, note that the most recent version of the IEEE 802.12 standard should be consulted for the most up to date definition of the requested configuration and allowed configuration fields.

The data field contains between 594 and 675 octets and is filled in by the training initiator. The first 55 octets may be used for vendor specific protocol information. The remaining octets are all zeros. The length of the training frame combined with the requirement that 24 consecutive training frames be received without error to complete training ensures that marginal links will not complete training.

3.9. Mapping of IEEE 802.12 Managed Objects

The following table lists all the managed objects defined for oEndNode in the IEEE 802.12 Standard, and the corresponding SNMP objects.

IEEE 802.12 Managed Object	Corresponding SNMP Object
oEndNode	
.aBroadcastFramesReceived	IF-MIB - ifInBroadcastPkts
.aBroadcastFramesTransmitted	IF-MIB - ifOutBroadcastPkts
.aDataErrorFramesReceived	dot12InDataErrors
.aDesiredFramingType	dot12DesiredFramingType

.aDesiredPromiscuousStatus	dot12DesiredPromiscStatus
.aFramesTransmitted	IF-MIB - ifOutUCastPkts + ifOutMulticastPkts + ifOutBroadcastPkts
.aFramingCapability	dot12FramingCapability
.aFunctionalAddresses	IF-MIB - ifRcvAddressTable
.aHighPriorityFramesReceived	dot12InHighPriorityFrames
.aHighPriorityFramesTransmitted	dot12OutHighPriorityFrames
.aHighPriorityOctetsReceived	dot12InHighPriorityOctets or dot12InHCHighPriorityOctets
.aHighPriorityOctetsTransmitted	dot12OutHighPriorityOctets or dot12OutHCHighPriorityOctets
.aIPMFramesReceived	dot12InIPMErrors
.aLastTrainingConfig	dot12LastTrainingConfig
.aMACID	IF-MIB - ifIndex
.aMACStatus	dot12Status
.aMACVersion	dot12TrainingVersion
.aMediaType	<not yet mapped> Tranceiver MIB issue
.aMulticastFramesReceived	IF-MIB - ifInMulticastPkts
.aMulticastFramesTransmitted	IF-MIB - ifOutMulticastPkts
.aMulticastReceiveStatus	IF-MIB - ifRcvAddressTable
.aNormalPriorityFramesReceived	dot12InNormPriorityFrames
.aNormalPriorityOctetsReceived	dot12InNormPriorityOctets or dot12InHCNormPriorityOctets
.aNullAddressedFramesReceived	dot12InNullAddressedFrames
.aOctetsTransmitted	IF-MIB - ifOutOctets or ifHCOutOctets
.aOversizeFramesReceived	dot12InOversizeFrameErrors
.aReadableFramesReceived	IF-MIB - ifInUcastPkts + ifInMulticastPkts + ifInBroadcastPkts
.aReadableOctetsReceived	IF-MIB - ifInOctets or ifHCInOctets
.aReadMulticastList	IF-MIB - ifRcvAddressTable
.aReadWriteMACAddress	IF-MIB - ifPhysAddress
.aTransitionsIntoTraining	dot12TransitionIntoTrainings
.acAddGroupAddress	IF-MIB - ifRcvAddressTable
.acClose	dot12Commands: ’close’
.acDeleteGroupAddress	IF-MIB - ifRcvAddressTable
.acExecuteSelftest	IF-MIB - ifAdminStatus
.acInitializeMAC	dot12Commands: ’reset’
.acOpen	dot12Commands: ’open’

4. Definitions

```
      DOT12-IF-MIB DEFINITIONS ::= BEGIN

          IMPORTS
              transmission, Counter32, Counter64, OBJECT-TYPE,
              MODULE-IDENTITY
                  FROM SNMPv2-SMI
              MODULE-COMPLIANCE, OBJECT-GROUP
                  FROM SNMPv2-CONF
              ifIndex
                  FROM IF-MIB;

          dot12MIB MODULE-IDENTITY
               LAST-UPDATED "9602220452Z"  -- February 22, 1996
               ORGANIZATION "IETF 100VG-AnyLAN MIB Working Group"
               CONTACT-INFO
                       "       John Flick

                       Postal: Hewlett Packard Company
                               8000 Foothills Blvd. M/S 5556
                               Roseville, CA 95747-5556
                       Tel:    +1 916 785 4018
                       Fax:    +1 916 785 3583

                       E-mail: johnf@hprnd.rose.hp.com"
               DESCRIPTION
                       "This MIB module describes objects for
                       managing IEEE 802.12 interfaces."
               ::= { transmission 45 }

          dot12MIBObjects     OBJECT IDENTIFIER ::= { dot12MIB 1 }

          dot12ConfigTable OBJECT-TYPE
              SYNTAX     SEQUENCE OF Dot12ConfigEntry
              MAX-ACCESS not-accessible
              STATUS     current
              DESCRIPTION
                      "Configuration information for a collection of
                      802.12 interfaces attached to a particular
                      system."
              ::= { dot12MIBObjects 1 }

          dot12ConfigEntry OBJECT-TYPE
              SYNTAX     Dot12ConfigEntry
              MAX-ACCESS not-accessible
              STATUS     current
              DESCRIPTION
```

```
                "Configuration for a particular interface to an
                802.12 medium."
        INDEX      { ifIndex }
        ::= { dot12ConfigTable 1 }

    Dot12ConfigEntry ::=
        SEQUENCE {
            dot12CurrentFramingType         INTEGER,
            dot12DesiredFramingType         INTEGER,
            dot12FramingCapability          INTEGER,
            dot12DesiredPromiscStatus       INTEGER,
            dot12TrainingVersion            INTEGER,
            dot12LastTrainingConfig         OCTET STRING,
            dot12Commands                   INTEGER,
            dot12Status                     INTEGER,
            dot12ControlMode                INTEGER
        }

    dot12CurrentFramingType OBJECT-TYPE
        SYNTAX     INTEGER {
                       frameType88023(1),
                       frameType88025(2),
                       frameTypeUnknown(3)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "When dot12DesiredFramingType is one of
                'frameType88023' or 'frameType88025', this is the
                type of framing asserted by the interface.

                When dot12DesiredFramingType is 'frameTypeEither',
                dot12CurrentFramingType shall be one of
                'frameType88023' or 'frameType88025' when the
                dot12Status is 'opened'.   When the dot12Status is
                anything other than 'opened',
                dot12CurrentFramingType shall take the value of
                'frameTypeUnknown'."
        ::= { dot12ConfigEntry 1 }

    dot12DesiredFramingType OBJECT-TYPE
        SYNTAX     INTEGER {
                       frameType88023(1),
                       frameType88025(2),
                       frameTypeEither(3)
                   }
        MAX-ACCESS read-write
        STATUS     current
```

```
            DESCRIPTION
                    "The type of framing which will be requested by
                    the interface during the next interface MAC
                    initialization or open action.

                    In master mode, this is the framing mode which
                    will be granted by the interface.  Note that
                    for a master mode interface, this object must be
                    equal to 'frameType88023' or 'frameType88025',
                    since a master mode interface cannot grant
                    'frameTypeEither'."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aDesiredFramingType."
            ::= { dot12ConfigEntry 2 }

        dot12FramingCapability OBJECT-TYPE
            SYNTAX     INTEGER {
                           frameType88023(1),
                           frameType88025(2),
                           frameTypeEither(3)
                       }
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The type of framing this interface is capable of
                    supporting."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aFramingCapability."
            ::= { dot12ConfigEntry 3 }

        dot12DesiredPromiscStatus OBJECT-TYPE
            SYNTAX     INTEGER {
                           singleAddressMode(1),
                           promiscuousMode(2)
                       }
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                    "This object is used to select the promiscuous
                    mode that this interface will request in the next
                    training packet issued on this interface.
                    Whether the repeater grants the requested mode
                    must be verified by examining the state of the PP
                    bits in the corresponding instance of
                    dot12LastTrainingConfig.
```

```
                    In master mode, this object controls whether or
                    not promiscuous mode will be granted by the
                    interface when requested by the lower level
                    device.

                    Note that this object indicates the desired mode
                    for the next time the interface trains.  The
                    currently active mode will be reflected in
                    dot12LastTrainingConfig and in ifPromiscuousMode."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aDesiredPromiscuousStatus."
            ::= { dot12ConfigEntry 4 }

        dot12TrainingVersion OBJECT-TYPE
            SYNTAX     INTEGER (0..7)
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The value that will be used in the version bits
                    (vvv bits) in training frames on this interface.
                    This is the highest version number supported by
                    this MAC."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aMACVersion."
            ::= { dot12ConfigEntry 5 }

        dot12LastTrainingConfig OBJECT-TYPE
            SYNTAX     OCTET STRING (SIZE(2))
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This 16 bit field contains the configuration
                    bits from the most recent error-free training
                    frame received during training on this interface.
                    Training request frames are received when in
                    master mode, while training response frames are
                    received in slave mode.  On master mode interfaces,
                    this object contains the contents of the
                    requested configuration field of the most recent
                    training request frame.  On slave mode interfaces,
                    this object contains the contents of the allowed
                    configuration field of the most recent training
                    response frame.  The format of the current version
                    of this field is described in section 3.8.  Please
                    refer to the most recent version of the IEEE
                    802.12 standard for the most up-to-date definition
```

```
                of the format of this object."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aLastTrainingConfig."
        ::= { dot12ConfigEntry 6 }

    dot12Commands OBJECT-TYPE
        SYNTAX     INTEGER {
                       noOp(1),
                       open(2),
                       reset(3),
                       close(4)
                   }
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "If the current value of dot12Status is 'closed',
                setting the value of this object to 'open' will
                change the corresponding instance of MIB-II's
                ifAdminStatus to 'up', cause this interface to
                enter the 'opening' state, and will cause training
                to be initiated on this interface.  The progress
                and success of the open is given by the values of
                the dot12Status object.  Setting this object to
                'open' when dot12Status has a value other than
                'closed' has no effect.

                Setting the corresponding instance of ifAdminStatus
                to 'up' when the current value of dot12Status is
                'closed' will have the same effect as setting this
                object to 'open'.  Setting ifAdminStatus to 'up'
                when dot12Status has a value other than 'closed'
                has no effect.

                Setting the value of this object to 'close' will
                move this interface into the 'closed' state and
                cause all transmit and receive actions to stop.
                This object will then have to be set to 'open' in
                order to reinitiate training.

                Setting the corresponding instance of ifAdminStatus
                to 'down' will have the same effect as setting this
                object to 'close'.

                Setting the value of this object to 'reset' when
                the current value of dot12Status has a value other
                than 'closed' will reset the interface.  On a
                reset, all MIB counters should retain their values.
```

```
                This will cause the MAC to initiate an
                acInitializeMAC action as specified in IEEE 802.12.
                This will cause training to be reinitiated on this
                interface.  Setting this object to 'reset' when
                dot12Status has a value of 'closed' has no effect.
                Setting this object to 'reset' has no effect on the
                corresponding instance of ifAdminStatus.

                Setting the value of this object to 'noOp' has no
                effect.

                When read, this object will always have a value
                of 'noOp'."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.2,
                acOpen, acClose, acInitializeMAC.
                Also, RFC1231 IEEE802.5 Token Ring MIB,
                dot5Commands."
        ::= { dot12ConfigEntry 7 }

    dot12Status OBJECT-TYPE
        SYNTAX     INTEGER {
                       opened(1),
                       closed(2),
                       opening(3),
                       openFailure(5),
                       linkFailure(6)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The current interface status with respect to
                training.  One of the following values:

                    opened      - Training has completed
                                  successfully.
                    closed      - MAC has been disabled by
                                  setting dot12Commands to
                                  'close'.
                    opening     - MAC is in training.  Training
                                  signals have been received.
                    openFailure - Passed 24 error-free packets,
                                  but there is a problem, noted
                                  in the training configuration
                                  bits (dot12LastTrainingConfig).
                    linkFailure - Training signals not received,
                                  or could not pass 24 error-free
                                  packets.
```

Whenever the dot12Commands object is set to 'close' or ifAdminStatus is set to 'down', the MAC will go silent, dot12Status will be 'closed', and ifOperStatus will be 'down'.

When the value of this object is equal to 'closed' and the dot12Commands object is set to 'open' or the ifAdminStatus object is set to 'up', training will be initiated on this interface. When the value of this object is not equal to 'closed' and the dot12Commands object is set to 'reset', training will be reinitiated on this interface. Note that sets of some other objects (e.g. dot12ControlMode) or external events (e.g. MAC protocol violations) may also cause training to be reinitiated on this interface.

When training is initiated or reinitiated on an interface, the end node will send Training_Up to the master and initially go to the 'linkFailure' state and ifOperStatus will go to 'down'. When the master sends back Training_Down, dot12Status will change to the 'opening' state, and training packets will be transferred.

After all of the training packets have been passed, dot12Status will change to 'linkFailure' if 24 consecutive error-free packets were not passed, 'opened' if 24 consecutive error-free packets were passed and the training configuration bits were OK, or 'openFailure' if there were 24 consecutive error-free packets, but there was a problem with the training configuration bits.

When in the 'openFailure' state, the dot12LastTrainingConfig object will contain the configuration bits from the last training packet which can be examined to determine the exact reason for the training configuration failure.

If training did not succeed (dot12Status is 'linkFailure' or 'openFailure), the entire process will be restarted after MAC_Retraining_Delay_Timer seconds.

If training does succeed (dot12Status changes to

```
                'opened'), ifOperStatus will change to 'up'.  If
                training does not succeed (dot12Status changes to
                'linkFailure' or 'openFailure'), ifOperStatus will
                remain 'down'."
            REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aMACStatus."
            ::= { dot12ConfigEntry 8 }

        dot12ControlMode OBJECT-TYPE
            SYNTAX     INTEGER {
                           masterMode(1),
                           slaveMode(2),
                           learn(3)
                       }
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                "This object is used to configure and report
                whether or not this interface is operating in
                master mode.  In a Demand Priority network, end
                node interfaces typically operate in slave mode,
                while switch interfaces may control the Demand
                Priority protocol and operate in master mode.

                This object may be implemented as a read-only
                object by those agents and interfaces that do not
                implement software control of master mode.  In
                particular, interfaces that cannot operate in
                master mode, and interfaces on which master mode
                is controlled by a pushbutton on the device,
                should implement this object read-only.

                Some interfaces do not require network management
                configuration of this feature and can autosense
                whether to use master mode or slave mode.  The
                value 'learn' is used for that purpose.  While
                autosense is taking place, the value 'learn' is
                returned.

                A network management operation which modifies the
                value of dot12ControlMode causes the interface
                to retrain."
            ::= { dot12ConfigEntry 9 }

        dot12StatTable OBJECT-TYPE
            SYNTAX     SEQUENCE OF Dot12StatEntry
            MAX-ACCESS not-accessible
```

```
            STATUS     current
            DESCRIPTION
                    "Statistics for a collection of 802.12 interfaces
                    attached to a particular system."
            ::= { dot12MIBObjects 2 }

        dot12StatEntry OBJECT-TYPE
            SYNTAX     Dot12StatEntry
            MAX-ACCESS not-accessible
            STATUS     current
            DESCRIPTION
                    "Statistics for a particular interface to an
                    802.12 medium.  The receive statistics in this
                    table apply only to packets received by this
                    station (i.e., packets whose destination address
                    is either the local station address, the
                    broadcast address, or a multicast address that
                    this station is receiving, unless the station is
                    in promiscuous mode)."
            INDEX      { ifIndex }
            ::= { dot12StatTable 1 }

        Dot12StatEntry ::=
            SEQUENCE {
                dot12InHighPriorityFrames       Counter32,
                dot12InHighPriorityOctets       Counter32,
                dot12InNormPriorityFrames       Counter32,
                dot12InNormPriorityOctets       Counter32,
                dot12InIPMErrors                Counter32,
                dot12InOversizeFrameErrors      Counter32,
                dot12InDataErrors               Counter32,
                dot12InNullAddressedFrames      Counter32,
                dot12OutHighPriorityFrames      Counter32,
                dot12OutHighPriorityOctets      Counter32,
                dot12TransitionIntoTrainings    Counter32,
                dot12HCInHighPriorityOctets     Counter64,
                dot12HCInNormPriorityOctets     Counter64,
                dot12HCOutHighPriorityOctets    Counter64
            }

        dot12InHighPriorityFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of high priority frames
                    that have been received on this interface.
                    Includes both good and bad high priority frames,
```

```
                as well as high priority training frames.  Does
                not include normal priority frames which were
                priority promoted."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aHighPriorityFramesReceived."
        ::= { dot12StatEntry 1 }

    dot12InHighPriorityOctets OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of octets
                contained in high priority frames that have been
                received on this interface. This counter is
                incremented by OctetCount for each frame received
                on this interface which is counted by
                dot12InHighPriorityFrames.

                Note that this counter will roll over very
                quickly.  It is provided for backward
                compatibility for Network Management protocols
                that do not support 64 bit counters (e.g. SNMP
                version 1)."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aHighPriorityOctetsReceived."
        ::= { dot12StatEntry 2 }

    dot12InNormPriorityFrames OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of normal priority frames
                that have been received on this interface.
                Includes both good and bad normal priority
                frames, as well as normal priority training
                frames and normal priority frames which were
                priority promoted."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aNormalPriorityFramesReceived."
        ::= { dot12StatEntry 3 }

    dot12InNormPriorityOctets OBJECT-TYPE
        SYNTAX     Counter32
```

```
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of the number of octets
                    contained in normal priority frames that have
                    been received on this interface. This counter is
                    incremented by OctetCount for each frame received
                    on this interface which is counted by
                    dot12InNormPriorityFrames.

                    Note that this counter will roll over very
                    quickly.  It is provided for backward
                    compatibility for Network Management protocols
                    that do not support 64 bit counters (e.g. SNMP
                    version 1)."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aNormalPriorityOctetsReceived."
            ::= { dot12StatEntry 4 }

        dot12InIPMErrors OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of the number of frames
                    that have been received on this interface with an
                    invalid packet marker and no PMI errors.  A
                    repeater will write an invalid packet marker to
                    the end of a frame containing errors as it is
                    forwarded through the repeater to the other
                    ports.  This counter is incremented by one for
                    each frame received on this interface which has
                    had an invalid packet marker added to the end of
                    the frame."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aIPMFramesReceived."
            ::= { dot12StatEntry 5 }

        dot12InOversizeFrameErrors OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of oversize frames
                    received on this interface.  This counter is
                    incremented by one for each frame received on
```

```
                this interface whose OctetCount is larger than
                the maximum legal frame size.  The frame size
                which causes this counter to increment is
                dependent on the current framing type."
            REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aOversizeFramesReceived."
            ::= { dot12StatEntry 6 }

        dot12InDataErrors OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                "This object is a count of errored frames
                received on this interface.  This counter is
                incremented by one for each frame received on
                this interface with any of the following errors:
                bad FCS (with no IPM), PMI errors (excluding
                frames with an IPM as the only PMI error),
                undersize, bad start of frame delimiter, or bad
                end of packet marker.  Does not include frames
                counted by dot12InIPMErrors,
                dot12InNullAddressedFrames, or
                dot12InOversizeFrameErrors.

                This counter indicates problems with the cable
                directly attached to this interface, while
                dot12InIPMErrors indicates problems with remote
                cables."
            REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aDataErrorFramesReceived."
            ::= { dot12StatEntry 7 }

        dot12InNullAddressedFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                "This object is a count of null addressed frames
                received on this interface.  This counter is
                incremented by one for each frame received on
                this interface with a destination MAC address
                consisting of all zero bits.  Both void and
                training frames are included in this counter.

                Note that since this station would normally not
```

```
                receive null addressed frames, this counter is
                only incremented when this station is operating
                in promiscuous mode or in training."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aNullAddressedFramesReceived."
        ::= { dot12StatEntry 8 }

    dot12OutHighPriorityFrames OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This counter is incremented by one for each high
                priority frame successfully transmitted out this
                interface."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aHighPriorityFramesTransmitted."
        ::= { dot12StatEntry 9 }

    dot12OutHighPriorityOctets OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This counter is incremented by OctetCount for
                each frame counted by dot12OutHighPriorityFrames.

                Note that this counter will roll over very
                quickly.  It is provided for backward
                compatibility for Network Management protocols
                that do not support 64 bit counters (e.g. SNMP
                version 1)."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aHighPriorityOctetsTransmitted."
        ::= { dot12StatEntry 10 }

    dot12TransitionIntoTrainings OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of times
                this interface has entered the training state.
                This counter is incremented by one each time
                dot12Status transitions to 'linkFailure' from any
```

```
                state other than 'opening' or 'openFailure'."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aTransitionsIntoTraining."
        ::= { dot12StatEntry 11 }

    dot12HCInHighPriorityOctets OBJECT-TYPE
        SYNTAX     Counter64
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of octets
                contained in high priority frames that have been
                received on this interface. This counter is
                incremented by OctetCount for each frame received
                on this interface which is counted by
                dot12InHighPriorityFrames.

                This counter is a 64 bit version of
                dot12InHighPriorityOctets.  It should be used by
                Network Management protocols which support 64 bit
                counters (e.g. SNMPv2)."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aHighPriorityOctetsReceived."
        ::= { dot12StatEntry 12 }

    dot12HCInNormPriorityOctets OBJECT-TYPE
        SYNTAX     Counter64
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of octets
                contained in normal priority frames that have
                been received on this interface. This counter is
                incremented by OctetCount for each frame received
                on this interface which is counted by
                dot12InNormPriorityFrames.

                This counter is a 64 bit version of
                dot12InNormPriorityOctets.  It should be used by
                Network Management protocols which support 64 bit
                counters (e.g. SNMPv2)."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.5.2.1,
                aNormalPriorityOctetsReceived."
        ::= { dot12StatEntry 13 }
```

```
        dot12HCOutHighPriorityOctets OBJECT-TYPE
            SYNTAX     Counter64
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This counter is incremented by OctetCount for
                    each frame counted by dot12OutHighPriorityFrames.

                    This counter is a 64 bit version of
                    dot12OutHighPriorityOctets.  It should be used by
                    Network Management protocols which support 64 bit
                    counters (e.g. SNMPv2)."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.5.2.1,
                    aHighPriorityOctetsTransmitted."
           ::= { dot12StatEntry 14 }

        -- conformance information

        dot12Conformance  OBJECT IDENTIFIER ::= { dot12MIB 2 }

        dot12Compliances  OBJECT IDENTIFIER ::= { dot12Conformance 1 }
        dot12Groups       OBJECT IDENTIFIER ::= { dot12Conformance 2 }

        -- compliance statements

        dot12Compliance MODULE-COMPLIANCE
            STATUS     current
            DESCRIPTION
                       "The compliance statement for managed network
                       entities that have 802.12 interfaces."

            MODULE  -- this module
                MANDATORY-GROUPS { dot12ConfigGroup, dot12StatsGroup }

                OBJECT       dot12DesiredFramingType
                MIN-ACCESS   read-only
                DESCRIPTION
                       "Write access to this object is not required."

                OBJECT       dot12DesiredPromiscStatus
                MIN-ACCESS   read-only
                DESCRIPTION
                       "Write access to this object is not required."

                OBJECT       dot12Commands
                MIN-ACCESS   read-only
                DESCRIPTION
```

```
                    "Write access to this object is not required."

            OBJECT       dot12ControlMode
            MIN-ACCESS   read-only
            DESCRIPTION
                    "Write access to this object is not required."
        ::= { dot12Compliances 1 }

    -- units of conformance

    dot12ConfigGroup OBJECT-GROUP
        OBJECTS    { dot12DesiredFramingType,
                     dot12FramingCapability,
                     dot12DesiredPromiscStatus,
                     dot12TrainingVersion,
                     dot12LastTrainingConfig,
                     dot12Commands, dot12Status,
                     dot12CurrentFramingType,
                     dot12ControlMode }
        STATUS     current
        DESCRIPTION
                "A collection of objects for managing the status
                and configuration of IEEE 802.12 interfaces."
        ::= { dot12Groups 1 }

    dot12StatsGroup OBJECT-GROUP
        OBJECTS    { dot12InHighPriorityFrames,
                     dot12InHighPriorityOctets,
                     dot12InNormPriorityFrames,
                     dot12InNormPriorityOctets,
                     dot12InIPMErrors,
                     dot12InOversizeFrameErrors,
                     dot12InDataErrors,
                     dot12InNullAddressedFrames,
                     dot12OutHighPriorityFrames,
                     dot12OutHighPriorityOctets,
                     dot12TransitionIntoTrainings,
                     dot12HCInHighPriorityOctets,
                     dot12HCInNormPriorityOctets,
                     dot12HCOutHighPriorityOctets }
        STATUS     current
        DESCRIPTION
                "A collection of objects providing statistics for
                IEEE 802.12 interfaces."
        ::= { dot12Groups 2 }

END
```

5. Acknowledgements

This document was produced by the IETF 100VG-AnyLAN Working Group. It is based on the work of IEEE 802.12.

6. References

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7. Security Considerations

Security issues are not discussed in this memo.

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