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Definitions of Managed Objects for IEEE 802.12 Repeater Devices

Status of this Memo

Copyright Notice

Abstract

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 repeaters based on IEEE 802.12.

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1. The SNMP Network Management Framework

The SNMP Network Management Framework consists of several components. For the purpose of this specification, the applicable components of the Framework are the SMI and related documents [2, 3, 4], which define the mechanisms used for describing and naming objects for the purpose of management.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

1.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base (MIB). Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [1] defined in the 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.

2. Overview

Instances of these object types represent attributes of an IEEE 802.12 repeater, as defined by Section 12, "RMAC Protocol" in IEEE Standard 802.12-1995 [6].

The definitions presented here are based on Section 13, "Layer management functions and services", and Annex C, "GDMO Specifications for Demand Priority Managed Objects" of IEEE Standard 802.12-1995 [6].

Implementors of these MIB objects should note that the IEEE document explicitly describes (in the form of Pascal pseudocode) when, where, and how various repeater attributes are measured. The IEEE document also describes the effects of repeater actions that may be invoked by manipulating instances of the MIB objects defined here.

The counters in this document are defined to be the same as those counters in IEEE Standard 802.12-1995, with the intention that the same instrumentation can be used to implement both the IEEE and IETF management standards.

2.1. Repeater Management Model

The model used in the design of this MIB allows for a managed system to contain one or more managed 802.12 repeaters, and one or more managed 802.12 repeater ports.

A repeater port may be thought of as a source of traffic into a repeater in the system. The vgRptrBasicPortTable contains entries for each physical repeater port in the managed system. An implementor may choose to separate these ports into "groups". For example, a group may be used to represent a field-replaceable unit, so that the port numbering may match the numbering in the hardware implementation. Note that this group mapping is recommended but optional. An implementor may choose to put all of the system's ports into a single group, or to divide the ports into groups that do not match physical divisions. Each group within the system is uniquely identified by a group number. Each port within a system is uniquely identified by a combination of group number and port number. The method of numbering groups and ports is implementation-specific. Both groups and ports may be sparsely numbered.

In addition to the externally visible ports, some implementations may have internal ports that are not obvious to the end-user but are nevertheless sources of traffic into the repeater system. Examples include internal management ports, through which an agent communicates, and ports connecting to a backplane internal to the implementation. It is the decision of the implementor to select the appropriate group(s) in which to place internal ports.

Managed repeaters in the system are represented by entries in the vgRptrInfoTable. There may be multiple repeaters in the managed system. They are uniquely identified by a repeater number. The method of numbering repeaters is implementation-specific. Each port will either be associated with one of the repeaters, or isolated (a so-called "trivial" repeater). The set of ports associated with a single repeater will be in the same contention domain, and will be participating in the same instance of the Demand Priority Access Method protocol. The mapping of ports to repeaters may be static or dynamic. A column in the vgRptrBasicPortTable, vgRptrPortRptrInfoIndex, indicates the repeater that the port is currently associated with. The method for assigning a port to a repeater is implementation-specific.

2.2. MAC Addresses

All representations of MAC addresses in this MIB module 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 repeater is operating in token ring framing mode, which requires MAC addresses to be transmitted most significant bit first.

2.3. Master Mode and Slave Mode

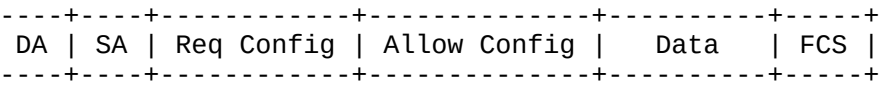
In an IEEE 802.12 network, "master" devices act as network controllers to decide when to grant requesting end-nodes permission to transmit. These master devices may be repeaters, or other active controller devices such as switches.

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

An 802.12 repeater always acts in "master" mode on its local ports, which may connect to end nodes, switch or other device ports acting in "slave" mode, or lower-level repeaters in a cascade. It acts in "slave" mode on cascade ports, which may connect to an upper-level repeater in a cascade, or to switch or other device ports operating in "master" mode.

2.4. 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:

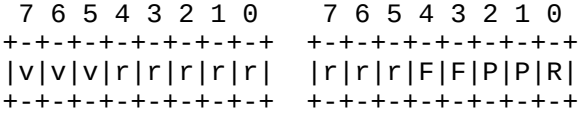


DA = destination address (six octets)
SA = source address (six octets)
Req Config = requested configuration (2 octets)
Allow Config = allowed configuration (2 octets)
Data = data (594 to 675 octets)
FCS = frame check sequence (4 octets)

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.

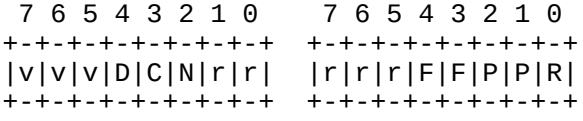
First Octet: Second Octet:



vvv: The version of the 802.12 training protocol with which the training initiator is compliant. The current version is 100. Note that because of the different bit ordering used in IEEE and IETF documents, this value corresponds to version 1.
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. Note that because of the different bit ordering used in IEEE and IETF documents, this value corresponds to version 1.
D: 0 = No duplicate address has been detected.
1 = Duplicate address has been detected.
C: 0 = The requested configuration is compatible with the network and the attached port.
1 = The requested configuration is not compatible with the network and/or the attached port. In this case, the FF, PP, and R bits indicate a 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 exchanged without error to complete training ensures that marginal links will not complete training.

2.5. Structure of the MIB

Objects in this MIB are arranged into OID subtrees, each of which contains a set of related objects within a broad functional category. These subtrees are intended for organizational convenience ONLY, and have no relation to the conformance groups defined later in the document.

2.5.1. Basic Definitions

The basic definitions include objects for managing the basic status and control parameters for each repeater within the managed system, for the port groups within the managed system, and for the individual ports themselves.

2.5.2. Monitor Definitions

The monitor definitions include monitoring statistics for each repeater within the system and for individual ports.

2.5.3. Address Tracking Definitions

This collection includes objects for tracking the MAC addresses of the DTEs attached to the ports within the system.

Note that this MIB also includes by reference a collection of objects from the 802.3 Repeater MIB which may be used for mapping the topology of a network. These definitions are based on a technology which has been patented by Hewlett-Packard Company (HP). HP has granted rights to this technology to implementors of this MIB. See [8] and [9] for details.

2.6. Relationship to other MIBs

2.6.1. Relationship to MIB-II

It is assumed that a repeater implementing this MIB will also implement (at least) the 'system' group defined in MIB-II [5].

2.6.1.1. Relationship to the 'system' group

In MIB-II, the 'system' group is defined as being mandatory for all systems such that each managed entity contains one instance of each object in the 'system' group. Thus, those objects apply to the entity even if the entity's sole functionality is management of repeaters.

Note that all of the managed repeaters (i.e. entries in the vgRptrInfoTable) will normally exist within a single naming scope. Therefore, there will normally only be a single instance of each of the objects in the system group for the entire managed repeater system regardless of how many managed repeaters there are in the system.

2.6.1.2. Relationship to the 'interfaces' group

In MIB-II, the 'interfaces' group is defined as being mandatory for all systems and contains information on an entity's interfaces, where each interface is thought of as being attached to a 'subnetwork'. (Note that this term is not to be confused with 'subnet' which refers to an addressing partitioning scheme used in the Internet suite of protocols.)

This Repeater MIB uses the notion of ports on a repeater. The concept of a MIB-II interface has NO specific relationship to a repeater's port. Therefore, the 'interfaces' group applies only to the one (or more) network interfaces on which the entity managing the repeater sends and receives management protocol operations, and does not apply to the repeater's ports.

This is consistent with the physical-layer nature of a repeater. An 802.12 repeater has an RMAC implementation, which acts as the repeater end of the Demand Priority Access Method, but does not contain a DTE MAC implementation, and does not pass packets up to higher-level protocol entities for processing.

(When a network management entity is observing a repeater, it may appear as though the repeater is passing packets to a higher-level protocol entity. However, this is only a means of implementing management, and this passing of management information is not part of the repeater functionality.)

2.6.2. Relationship to the 802.3 Repeater MIB

An IEEE 802.12 repeater can be configured to operate in either ethernet or token ring framing mode. This only affects the frame format and address bit order of the frames on the wire. An 802.12 network does not use the media access protocol for either ethernet or token ring. Instead, IEEE 802.12 defines its own media access protocol, the Demand Priority Access Method (DPAM).

There is an existing standards-track MIB module for instrumenting IEEE 802.3 repeaters [7]. That MIB module is designed to instrument the operation of the repeater in a network implementing the 802.3 media access protocol. Therefore, much of that MIB does not apply to 802.12 repeaters.

However, the 802.3 Repeater MIB also contains a collection of objects that may be used to map the topology of a network. These objects are contained in a separable OBJECT-GROUP, are not 802.3-specific, and are considered useful for 802.12 repeaters. In addition, the layer

management clause of the IEEE 802.12 specification includes similar functionality. Therefore, vendors of agents for 802.12 repeaters are encouraged to implement the snmpRptrGrpRptrAddrSearch OBJECT-GROUP defined in the 802.3 Repeater MIB.

2.7. Mapping of IEEE 802.12 Managed Objects

IEEE 802.12 Managed Object	Corresponding SNMP Object
oRepeater	
.aCurrentFramingType	vgRptrInfoCurrentFramingType
.aDesiredFramingType	vgRptrInfoDesiredFramingType
.aFramingCapability	vgRptrInfoFramingCapability
.aMACAddress	vgRptrInfoMACAddress
.aRepeaterHealthState	vgRptrInfoOperStatus
.aRepeaterID	vgRptrInfoIndex
.aRepeaterSearchAddress	SNMP-REPEATER-MIB - rptrAddrSearchAddress
.aRepeaterSearchGroup	SNMP-REPEATER-MIB - rptrAddrSearchGroup
.aRepeaterSearchPort	SNMP-REPEATER-MIB - rptrAddrSearchPort
.aRepeaterSearchState	SNMP-REPEATER-MIB - rptrAddrSearchState
.aRMACVersion	vgRptrInfoTrainingVersion
.acRepeaterSearchAddress	SNMP-REPEATER-MIB - rptrAddrSearchAddress
.acResetRepeater	vgRptrInfoReset
.nRepeaterHealth	vgRptrHealth
.nRepeaterReset	vgRptrResetEvent
oGroup	
.aGroupCablesBundled	vgRptrGroupCablesBundled
.aGroupID	vgRptrGroupIndex
.aGroupPortCapacity	vgRptrGroupPortCapacity
oPort	
.aAllowableTrainingType	vgRptrPortAllowedTrainType
.aBroadcastFramesReceived	vgRptrPortBroadcastFrames
.aCentralMgmtDetectedDupAddr	vgRptrMgrDetectedDupAddress
.aDataErrorFramesReceived	vgRptrPortDataErrorFrames
.aHighPriorityFramesReceived	vgRptrPortHighPriorityFrames
.aHighPriorityOctetsReceived	vgRptrPortHCHighPriorityOctets, or vgRptrPortHighPriorityOctets and vgRptrPortHighPriOctetRollovers
.aIPMFramesReceived	vgRptrPortIPMFrames
.aLastTrainedAddress	vgRptrAddrLastTrainedAddress
.aLastTrainingConfig	vgRptrPortLastTrainConfig

.aLocalRptrDetectedDupAddr	vgRptrRptrDetectedDupAddress
.aMulticastFramesReceived	vgRptrPortMulticastFrames
.aNormalPriorityFramesReceived	vgRptrPortNormPriorityFrames
.aNormalPriorityOctetsReceived	vgRptrPortHCNormPriorityOctets, or vgRptrPortNormPriorityOctets and vgRptrPortNormPriOctetRollovers
.aNullAddressedFramesReceived	vgRptrPortNullAddressedFrames
.aOctetsInUnreadableFramesRcvd	vgRptrPortHCUnreadableOctets, or vgRptrPortUnreadableOctets and vgRptrPortUnreadOctetRollovers
.aOversizeFramesReceived	vgRptrPortOversizeFrames
.aPortAdministrativeState	vgRptrPortAdminStatus
.aPortID	vgRptrPortIndex
.aPortStatus	vgRptrPortOperStatus
.aPortType	vgRptrPortType
.aPriorityEnable	vgRptrPortPriorityEnable
.aPriorityPromotions	vgRptrPortPriorityPromotions
.aReadableFramesReceived	vgRptrPortReadableFrames
.aReadableOctetsReceived	vgRptrPortHCReadableOctets, or vgRptrPortReadableOctets and vgRptrPortReadOctetRollovers
.aSupportedCascadeMode	vgRptrPortSupportedCascadeMode
.aSupportedPromiscMode	vgRptrPortSupportedPromiscMode
.aTrainedAddressChanges	vgRptrAddrTrainedAddressChanges
.aTrainingResult	vgRptrPortTrainingResult
.aTransitionsIntoTraining	vgRptrPortTransitionToTrainings
.acPortAdministrativeControl	vgRptrPortAdminStatus

The following IEEE 802.12 managed objects have not been included in the 802.12 Repeater MIB for the indicated reasons.

IEEE 802.12 Managed Object	Disposition
oRepeater	
.aGroupMap	Can be determined by GetNext sweep of vgRptrBasicGroupTable
.aRepeaterGroupCapacity	Meaning is unclear in many repeater implementations. For example, some cards may have daughter cards which make group capacity change depending on the cards installed. Meaning is also unclear in a stackable implementation. Also, since groups are not required to be numbered from 1..capacity, but may be computed algorithmically or

	related to Entity MIB indices, this object was not considered useful.
.aRepeaterHealthData	Since the data is implementation specific and non-interoperable, it was not considered useful.
.aRepeaterHealthText	Implementation experience with similar object in 802.3 Rptr MIB indicated it was not useful.
.acExecuteNonDisruptiveSelfTest	Implementation experience with similar object in 802.3 Rptr MIB indicated it was not useful.
.nGroupMapChange	Since aGroupMap was not included, a notification of a change in that object was not needed.
oGroup	
.aPortMap	Can be determined by GetNext sweep of vgRptrBasicPortTable
.nPortMapChange	Since aPortMap was not included, a notification of a change in that object was not needed.
oPort	
.aMediaType	This object is a function of the Physical Media Dependent (PMD) layer, which is defined differently for each type of network. For an 802.3 network, .aMediaType corresponds to the PMD definitions in the 802.3 MAU MIB. For management of an 802.12 network, mapping of this object is deferred to future work on an 802.12 PMD MIB which will include both repeater and interface PMD information and redundant link support.

3. Definitions

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

          IMPORTS
              mib-2, Integer32, Counter32, Counter64,
              OBJECT-TYPE, MODULE-IDENTITY, NOTIFICATION-TYPE
                  FROM SNMPv2-SMI
              MacAddress, TruthValue, TimeStamp
                  FROM SNMPv2-TC
              MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
                  FROM SNMPv2-CONF;

          vgRptrMIB MODULE-IDENTITY
               LAST-UPDATED "9705192256Z"  -- May 19, 1997
               ORGANIZATION "IETF 100VG-AnyLAN Working Group"
               CONTACT-INFO
                       "WG E-mail: vgmib@hprnd.rose.hp.com

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                          E-mail: johnf@hprnd.rose.hp.com"
               DESCRIPTION
                       "This MIB module describes objects for managing
                       IEEE 802.12 repeaters."
               ::= { mib-2 53 }

          vgRptrObjects      OBJECT IDENTIFIER ::= { vgRptrMIB 1 }
          vgRptrBasic        OBJECT IDENTIFIER ::= { vgRptrObjects 1 }
          vgRptrBasicRptr    OBJECT IDENTIFIER ::= { vgRptrBasic 1 }

          vgRptrInfoTable OBJECT-TYPE
              SYNTAX     SEQUENCE OF VgRptrInfoEntry
              MAX-ACCESS not-accessible
              STATUS     current
              DESCRIPTION
```

```
                "A table of information about each 802.12 repeater
                in the managed system."
        ::= { vgRptrBasicRptr 1 }

    vgRptrInfoEntry OBJECT-TYPE
        SYNTAX     VgRptrInfoEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "An entry in the table, containing information
                about a single repeater."
        INDEX      { vgRptrInfoIndex }
        ::= { vgRptrInfoTable 1 }

    VgRptrInfoEntry ::=
        SEQUENCE {
            vgRptrInfoIndex                 Integer32,
            vgRptrInfoMACAddress            MacAddress,
            vgRptrInfoCurrentFramingType    INTEGER,
            vgRptrInfoDesiredFramingType    INTEGER,
            vgRptrInfoFramingCapability     INTEGER,
            vgRptrInfoTrainingVersion       INTEGER,
            vgRptrInfoOperStatus            INTEGER,
            vgRptrInfoReset                 INTEGER,
            vgRptrInfoLastChange            TimeStamp
        }

    vgRptrInfoIndex OBJECT-TYPE
        SYNTAX     Integer32 (1..2147483647)
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "A unique identifier for the repeater for which
                this entry contains information.  The numbering
                scheme for repeaters is implementation specific."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aRepeaterID."
        ::= { vgRptrInfoEntry 1 }

    vgRptrInfoMACAddress OBJECT-TYPE
        SYNTAX     MacAddress
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The MAC address used by the repeater when it
                initiates training on the uplink port.  Repeaters
                are allowed to train with an assigned MAC address
```

```
                or a null (all zeroes) MAC address."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aMACAddress."
        ::= { vgRptrInfoEntry 2 }

    vgRptrInfoCurrentFramingType OBJECT-TYPE
        SYNTAX     INTEGER {
                       frameType88023(1),
                       frameType88025(2)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The type of framing (802.3 or 802.5) currently
                in use by the repeater."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aCurrentFramingType."
        ::= { vgRptrInfoEntry 3 }

    vgRptrInfoDesiredFramingType OBJECT-TYPE
        SYNTAX     INTEGER {
                       frameType88023(1),
                       frameType88025(2)
                   }
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The type of framing which will be used by the
                repeater after the next time it is reset.

                The value of this object should be preserved
                across repeater resets and power failures."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aDesiredFramingType."
        ::= { vgRptrInfoEntry 4 }

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

```
                "The type of framing this repeater is capable of
                supporting."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aFramingCapability."
        ::= { vgRptrInfoEntry 5 }

    vgRptrInfoTrainingVersion OBJECT-TYPE
        SYNTAX     INTEGER (0..7)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The highest version bits (vvv bits) supported by
                the repeater during training."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aRMACVersion."
        ::= { vgRptrInfoEntry 6 }

    vgRptrInfoOperStatus OBJECT-TYPE
        SYNTAX     INTEGER {
                       other(1),
                       ok(2),
                       generalFailure(3)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The vgRptrInfoOperStatus object indicates the
                operational state of the repeater."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.1,
                aRepeaterHealthState."
        ::= { vgRptrInfoEntry 7 }

    vgRptrInfoReset OBJECT-TYPE
        SYNTAX     INTEGER {
                       noReset(1),
                       reset(2)
                   }

        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "Setting this object to reset(2) causes the
                repeater to transition to its initial state as
                specified in clause 12 [IEEE Std 802.12].
```

```
                Setting this object to noReset(1) has no effect.
                The agent will always return the value noReset(1)
                when this object is read.

                After receiving a request to set this variable to
                reset(2), the agent is allowed to delay the reset
                for a short period.  For example, the implementor
                may choose to delay the reset long enough to
                allow the SNMP response to be transmitted.  In
                any event, the SNMP response must be transmitted.

                This action does not reset the management
                counters defined in this document nor does it
                affect the vgRptrPortAdminStatus parameters.
                Included in this action is the execution of a
                disruptive Self-Test with the following
                characteristics:

                    1) The nature of the tests is not specified.
                    2) The test resets the repeater but without
                       affecting configurable management
                       information about the repeater.
                    3) Packets received during the test may or
                       may not be transferred.
                    4) The test does not interfere with
                       management functions.

                After performing this self-test, the agent will
                update the repeater health information (including
                vgRptrInfoOperStatus), and send a
                vgRptrResetEvent."
            REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.2.2,
                acResetRepeater."
            ::= { vgRptrInfoEntry 8 }

        vgRptrInfoLastChange OBJECT-TYPE
            SYNTAX     TimeStamp
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                "The value of sysUpTime when any of the following
                conditions occurred:

                    1) agent cold- or warm-started;
                    2) this instance of repeater was created
                       (such as when a device or module was
                       added to the system);
```

```
                    3) a change in the value of
                       vgRptrInfoOperStatus;
                    4) ports were added or removed as members of
                       the repeater; or
                    5) any of the counters associated with this
                       repeater had a discontinuity."
        ::= { vgRptrInfoEntry 9 }

    vgRptrBasicGroup  OBJECT IDENTIFIER ::= { vgRptrBasic 2 }

    vgRptrBasicGroupTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF VgRptrBasicGroupEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "A table containing information about groups of
                ports."
        ::= { vgRptrBasicGroup 1 }

    vgRptrBasicGroupEntry OBJECT-TYPE
        SYNTAX     VgRptrBasicGroupEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "An entry in the vgRptrBasicGroupTable, containing
                information about a single group of ports."
        INDEX      { vgRptrGroupIndex }
        ::= { vgRptrBasicGroupTable 1 }

    VgRptrBasicGroupEntry ::=
        SEQUENCE {
            vgRptrGroupIndex                Integer32,
            vgRptrGroupObjectID             OBJECT IDENTIFIER,
            vgRptrGroupOperStatus           INTEGER,
            vgRptrGroupPortCapacity         Integer32,
            vgRptrGroupCablesBundled        INTEGER
        }

    vgRptrGroupIndex OBJECT-TYPE
        SYNTAX     Integer32 (1..2146483647)
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "This object identifies the group within the
                system for which this entry contains information.
                The numbering scheme for groups is implementation
                specific."
        REFERENCE
```

```
                "IEEE Standard 802.12-1995, 13.2.4.4.1,
                aGroupID."
        ::= { vgRptrBasicGroupEntry 1 }

    vgRptrGroupObjectID OBJECT-TYPE
        SYNTAX     OBJECT IDENTIFIER
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The vendor's authoritative identification of the
                group.  This value may be allocated within the
                SMI enterprises subtree (1.3.6.1.4.1) and
                provides a straight-forward and unambiguous means
                for determining what kind of group is being
                managed.

                For example, this object could take the value
                1.3.6.1.4.1.4242.1.2.14 if vendor 'Flintstones,
                Inc.' was assigned the subtree 1.3.6.1.4.1.4242,
                and had assigned the identifier
                1.3.6.1.4.1.4242.1.2.14 to its 'Wilma Flintstone
                6-Port Plug-in Module.'"
        ::= { vgRptrBasicGroupEntry 2 }

    vgRptrGroupOperStatus OBJECT-TYPE
        SYNTAX     INTEGER {
                       other(1),
                       operational(2),
                       malfunctioning(3),
                       notPresent(4),
                       underTest(5),
                       resetInProgress(6)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "An object that indicates the operational status
                of the group.

                A status of notPresent(4) indicates that the
                group is temporarily or permanently physically
                and/or logically not a part of the system.  It
                is an implementation-specific matter as to
                whether the agent effectively removes notPresent
                entries from the table.

                A status of operational(2) indicates that the
                group is functioning, and a status of
```

```
                malfunctioning(3) indicates that the group is
                malfunctioning in some way."
        ::= { vgRptrBasicGroupEntry 3 }

    vgRptrGroupPortCapacity OBJECT-TYPE
        SYNTAX     Integer32 (1..2146483647)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The vgRptrGroupPortCapacity is the number of
                ports that can be contained within the group.
                Valid range is 1-2147483647.  Within each group,
                the ports are uniquely numbered in the range from
                1 to vgRptrGroupPortCapacity.

                Some ports may not be present in the system, in
                which case the actual number of ports present will
                be less than the value of vgRptrGroupPortCapacity.
                The number of ports present is never greater than
                the value of vgRptrGroupPortCapacity.

                Note:  In practice, this will generally be the
                number of ports on a module, card, or board, and
                the port numbers will correspond to numbers marked
                on the physical embodiment."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.4.1,
                aGroupPortCapacity."
        ::= { vgRptrBasicGroupEntry 4 }

    vgRptrGroupCablesBundled OBJECT-TYPE
        SYNTAX     INTEGER {
                       someCablesBundled(1),
                       noCablesBundled(2)
                   }
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "This object is used to indicate whether there are
                any four-pair UTP links connected to this group
                that are contained in a cable bundle with multiple
                four-pair groups (e.g. a 25-pair bundle).  Bundled
                cable may only be used for repeater-to-end node
                links where the end node is not in promiscuous
                mode.

                When a broadcast or multicast packet is received
                from a port on this group that is not a
```

```
                promiscuous or cascaded port, the packet will be
                buffered completely before being repeated if
                this object is set to 'someCablesBundled(1)'.
                When this object is equal to 'noCablesBundled(2)',
                all packets received from ports on this group will
                be repeated as the frame is being received.

                Note that the value 'someCablesBundled(1)' will
                work in the vast majority of all installations,
                regardless of whether or not any cables are
                physically in a bundle, since packets received
                from promiscuous and cascaded ports automatically
                avoid the store and forward.  The main situation
                in which 'noCablesBundled(2)' is beneficial is
                when there is a large amount of multicast traffic
                and the cables are not in a bundle.

                The value of this object should be preserved
                across repeater resets and power failures."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.4.1,
                aGroupCablesBundled."
        ::= { vgRptrBasicGroupEntry 5 }

    vgRptrBasicPort   OBJECT IDENTIFIER ::= { vgRptrBasic 3 }

    vgRptrBasicPortTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF VgRptrBasicPortEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "A table containing configuration and status
                information about 802.12 repeater ports in the
                system.  The number of entries is independent of
                the number of repeaters in the managed system."
        ::= { vgRptrBasicPort 1 }

    vgRptrBasicPortEntry OBJECT-TYPE
        SYNTAX     VgRptrBasicPortEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "An entry in the vgRptrBasicPortTable, containing
                information about a single port."
        INDEX      { vgRptrGroupIndex, vgRptrPortIndex }
        ::= { vgRptrBasicPortTable 1 }

    VgRptrBasicPortEntry ::=
```

```
        SEQUENCE {
            vgRptrPortIndex                 Integer32,
            vgRptrPortType                  INTEGER,
            vgRptrPortAdminStatus           INTEGER,
            vgRptrPortOperStatus            INTEGER,
            vgRptrPortSupportedPromiscMode  INTEGER,
            vgRptrPortSupportedCascadeMode  INTEGER,
            vgRptrPortAllowedTrainType      INTEGER,
            vgRptrPortLastTrainConfig       OCTET STRING,
            vgRptrPortTrainingResult        OCTET STRING,
            vgRptrPortPriorityEnable        TruthValue,
            vgRptrPortRptrInfoIndex         Integer32
        }

    vgRptrPortIndex OBJECT-TYPE
        SYNTAX     Integer32 (1..2147483647)
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "This object identifies the port within the group
                for which this entry contains information.  This
                identifies the port independently from the
                repeater it may be attached to.  The numbering
                scheme for ports is implementation specific;
                however, this value can never be greater than
                vgRptrGroupPortCapacity for the associated group."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aPortID."
        ::= { vgRptrBasicPortEntry 1 }

    vgRptrPortType OBJECT-TYPE
        SYNTAX     INTEGER {
                       cascadeExternal(1),
                       cascadeInternal(2),
                       localExternal(3),
                       localInternal(4)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "Describes the type of port.  One of the
                following:

                    cascadeExternal - Port is an uplink with
                                      physical connections which
                                      are externally visible
                    cascadeInternal - Port is an uplink with
```

```
                                        physical connections which
                                        are not externally visible,
                                        such as a connection to an
                                        internal backplane in a
                                        chassis
                        localExternal   - Port is a downlink or local
                                        port with externally
                                        visible connections
                        localInternal   - Port is a downlink or local
                                        port with connections which
                                        are not externally visible,
                                        such as a connection to an
                                        internal agent

                ’internal’ is used to identify ports which place
                traffic into the repeater, but do not have any
                external connections.  Note that both DTE and
                cascaded repeater downlinks are considered
                ’local’ ports."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aPortType."
        ::= { vgRptrBasicPortEntry 2 }

    vgRptrPortAdminStatus OBJECT-TYPE
        SYNTAX     INTEGER {
                       enabled(1),
                       disabled(2)
                   }
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "Port enable/disable function.  Enabling a
                disabled port will cause training to be
                initiated by the training initiator (the slave
                mode device) on the link.  Setting this object to
                disabled(2) disables the port.

                A disabled port neither transmits nor receives.
                Once disabled, a port must be explicitly enabled
                to restore operation.  A port which is disabled
                when power is lost or when a reset is exerted
                shall remain disabled when normal operation
                resumes.

                The value of this object should be preserved
                across repeater resets and power failures."
        REFERENCE
```

```
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aPortAdministrativeState."
            ::= { vgRptrBasicPortEntry 3 }

        vgRptrPortOperStatus OBJECT-TYPE
            SYNTAX     INTEGER {
                           active(1),
                           inactive(2),
                           training(3)
                       }
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                "Current status for the port as specified by the
                PORT_META_STATE in the port process module of
                clause 12 [IEEE Std 802.12].

                During initialization or any link warning
                conditions, vgRptrPortStatus will be
                'inactive(2)'.

                When Training_Up is received by the repeater on a
                local port (or when Training_Down is received on
                a cascade port), vgRptrPortStatus will change to
                'training(3)' and vgRptrTrainingResult can be
                monitored to see the detailed status regarding
                training.

                When 24 consecutive good FCS packets are exchanged
                and the configuration bits are OK,
                vgRptrPortStatus will change to 'active(1)'.

                A disabled port shall have a port status of
                'inactive(2)'."
            REFERENCE
                "IEEE Standard 802.12, 13.2.4.5.1,
                aPortStatus."
            ::= { vgRptrBasicPortEntry 4 }

        vgRptrPortSupportedPromiscMode OBJECT-TYPE
            SYNTAX     INTEGER {
                           singleModeOnly(1),
                           singleOrPromiscMode(2),
                           promiscModeOnly(3)
                       }
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
```

```
                "This object describes whether the port hardware
                is capable of supporting promiscuous mode, single
                address mode (i.e., repeater filters unicasts not
                addressed to the end station attached to this
                port), or both.  A port for which vgRptrPortType
                is equal to 'cascadeInternal' or 'cascadeExternal'
                will always have a value of 'promiscModeOnly' for
                this object."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aSupportedPromiscMode."
        ::= { vgRptrBasicPortEntry 5 }

    vgRptrPortSupportedCascadeMode OBJECT-TYPE
        SYNTAX      INTEGER {
                        endNodesOnly(1),
                        endNodesOrRepeaters(2),
                        cascadePort(3)
                    }
        MAX-ACCESS read-only
        STATUS      current
        DESCRIPTION
                "This object describes whether the port hardware
                is capable of supporting cascaded repeaters, end
                nodes, or both.  A port for which vgRptrPortType
                is equal to 'cascadeInternal' or
                'cascadeExternal' will always have a value of
                'cascadePort' for this object."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aSupportedCascadeMode."
        ::= { vgRptrBasicPortEntry 6 }

    vgRptrPortAllowedTrainType OBJECT-TYPE
        SYNTAX      INTEGER {
                        allowEndNodesOnly(1),
                        allowPromiscuousEndNodes(2),
                        allowEndNodesOrRepeaters(3),
                        allowAnything(4)
                    }
        MAX-ACCESS read-write
        STATUS      current
        DESCRIPTION
                "This security object is set by the network
                manager to configure what type of device is
                permitted to connect to the port.  One of the
                following values:
```

```
    allowEndNodesOnly        - only non-
                               promiscuous end
                               nodes permitted.
    allowPromiscuousEndNodes - promiscuous or
                               non-promiscuous
                               end nodes
                               permitted
    allowEndNodesOrRepeaters - repeaters or non-
                               promiscuous end
                               nodes permitted
    allowAnything            - repeaters,
                               promiscuous or
                               non-promiscuous
                               end nodes
                               permitted
```

For a port for which vgRptrPortType is equal to 'cascadeInternal' or 'cascadeExternal', the corresponding instance of this object may not be set to 'allowEndNodesOnly' or 'allowPromiscuousEndNodes'.

The agent must reject a SET of this object if the value includes no capabilities that are supported by this port's hardware, as defined by the values of the corresponding instances of vgRptrPortSupportedPromiscMode and vgRptrPortSupportedCascadeMode.

Note that vgRptrPortSupportPromiscMode and vgRptrPortSupportedCascadeMode represent what the port hardware is capable of supporting. vgRptrPortAllowedTrainType is used for setting an administrative policy for a port. The actual set of training configurations that will be allowed to succeed on a port is the intersection of what the hardware will support and what is administratively allowed. The above requirement on what values may be set to this object says that the intersection of what is supported and what is allowed must be non-empty. In other words, it must not result in a situation in which nothing would be allowed to train on that port. However, a value can be set to this object as long as the combination of this object and what is supported by the hardware would still leave at least one configuration that could successfully train on the port.

```
                The value of this object should be preserved
                across repeater resets and power failures."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aAllowableTrainingType."
        ::= { vgRptrBasicPortEntry 7 }

    vgRptrPortLastTrainConfig OBJECT-TYPE
        SYNTAX     OCTET STRING (SIZE(2))
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a 16 bit field.  For local ports,
                this object contains the requested configuration
                field from the most recent error-free training
                request frame sent by the device connected to
                the port.  For cascade ports, this object contains
                the responder's allowed configuration field from
                the most recent error-free training response frame
                received in response to training initiated by this
                repeater.  The format of the current version of
                this field is described in section 3.2.  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, 13.2.4.5.1,
                aLastTrainingConfig."
        ::= { vgRptrBasicPortEntry 8 }

    vgRptrPortTrainingResult OBJECT-TYPE
        SYNTAX     OCTET STRING (SIZE(3))
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This 18 bit field is used to indicate the result
                of training.  It contains two bits which indicate
                if error-free training frames have been received,
                and it also contains the 16 bits of the allowed
                configuration field from the most recent
                error-free training response frame on the port.

                  First Octet:    Second and Third Octets:
                  7 6 5 4 3 2 1 0
                 +-+-+-+-+-+-+-+-+----------------------------+
                 |0|0|0|0|0|0|V|G| allowed configuration field |
                 +-+-+-+-+-+-+-+-+----------------------------+
```

```
                    V:   Valid: set when at least one error-free
                         training frame has been received.
                         Indicates the 16 training configuration
                         bits in vgRptrPortLastTrainConfig and
                         vgRptrPortTrainingResult contain valid
                         information.  This bit is cleared when
                         vgRptrPortStatus transitions to the
                         'inactive' or 'training' state.
                    G:   LinkGood: indicates the link hardware is
                         OK.  Set if 24 consecutive error-free
                         training packets have been exchanged.
                         Cleared when a training packet with
                         errors is received, or when
                         vgRptrPortStatus transitions to the
                         'inactive' or 'training' state.

                The format of the current version of the allowed
                configuration field is described in section 3.2.
                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 field.

                If the port is in training, a management station
                can examine this object to see if any training
                packets have been passed successfully.  If there
                have been any good training packets, the Valid
                bit will be set and the management station can
                examine the allowed configuration field to see if
                there is a duplicate address, configuration, or
                security problem.

                Note that on a repeater local port, this repeater
                generates the training response bits, while on
                a cascade port, the device at the upper end of
                the link originated the training response bits."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aTrainingResult."
        ::= { vgRptrBasicPortEntry 9 }
    vgRptrPortPriorityEnable OBJECT-TYPE
        SYNTAX     TruthValue
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "A configuration flag used to determine whether
                the repeater will service high priority requests
                received on the port as high priority or normal
                priority.  When 'false', high priority requests
```

```
                on this port will be serviced as normal priority.

                The setting of this object has no effect on a
                cascade port.  Also note that the setting of this
                object has no effect on a port connected to a
                cascaded repeater.  In both of these cases, this
                setting is treated as always 'true'.  The value
                'false' only has an effect when the port is a
                localInternal or localExternal port connected to
                an end node.

                The value of this object should be preserved
                across repeater resets and power failures."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aPriorityEnable."
        ::= { vgRptrBasicPortEntry 10 }

    vgRptrPortRptrInfoIndex OBJECT-TYPE
        SYNTAX     Integer32 (0..2147483647)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object identifies the repeater that this
                port is currently mapped to.  The repeater
                identified by a particular value of this object
                is the same as that identified by the same value
                of vgRptrInfoIndex.  A value of zero indicates
                that this port is not currently mapped to any
                repeater."
        ::= { vgRptrBasicPortEntry 11 }


    vgRptrMonitor      OBJECT IDENTIFIER ::= { vgRptrObjects 2 }

    vgRptrMonRepeater  OBJECT IDENTIFIER ::= { vgRptrMonitor 1 }

    vgRptrMonitorTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF VgRptrMonitorEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "A table of performance and error statistics for
                each repeater in the system.  The instance of the
                vgRptrInfoLastChange associated with a repeater
                is used to indicate possible discontinuities of
                the counters in this table that are associated
                with the same repeater."
```

```
            ::= { vgRptrMonRepeater 1 }

        vgRptrMonitorEntry OBJECT-TYPE
            SYNTAX     VgRptrMonitorEntry
            MAX-ACCESS not-accessible
            STATUS     current
            DESCRIPTION
                    "An entry in the table, containing statistics
                    for a single repeater."
            INDEX      { vgRptrInfoIndex }
            ::= { vgRptrMonitorTable 1 }

        VgRptrMonitorEntry ::=
            SEQUENCE {
                vgRptrMonTotalReadableFrames    Counter32,
                vgRptrMonTotalReadableOctets    Counter32,
                vgRptrMonReadableOctetRollovers Counter32,
                vgRptrMonHCTotalReadableOctets  Counter64,
                vgRptrMonTotalErrors            Counter32
            }

        vgRptrMonTotalReadableFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The total number of good frames of valid frame
                    length that have been received on all ports in
                    this repeater.  If an implementation cannot
                    obtain a count of frames as seen by the repeater
                    itself, this counter may be implemented as the
                    summation of the values of the
                    vgRptrPortReadableFrames counters for all of the
                    ports in this repeater.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrInfoLastChange changes."
            ::= { vgRptrMonitorEntry 1 }

        vgRptrMonTotalReadableOctets OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The total number of octets contained in good
                    frames that have been received on all ports in
                    this repeater.  If an implementation cannot
```

```
                obtain a count of octets as seen by the repeater
                itself, this counter may be implemented as the
                summation of the values of the
                vgRptrPortReadableOctets counters for all of the
                ports in this repeater.

                Note that this counter can roll over very
                quickly.  A management station is advised to
                also poll the vgRptrReadableOctetRollovers
                object, or to use the 64-bit counter defined by
                vgRptrMonHCTotalReadableOctets instead of the
                two 32-bit counters.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrInfoLastChange changes."
        ::= { vgRptrMonitorEntry 2 }

    vgRptrMonReadableOctetRollovers OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The total number of times that the associated
                instance of the vgRptrMonTotalReadableOctets
                counter has rolled over.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrInfoLastChange changes."
        ::= { vgRptrMonitorEntry 3 }

    vgRptrMonHCTotalReadableOctets OBJECT-TYPE
        SYNTAX     Counter64
        MAX-ACCESS read-only
        STATUS     current
```

```
            DESCRIPTION
                    "The total number of octets contained in good
                    frames that have been received on all ports in
                    this repeater.  If an implementation cannot
                    obtain a count of octets as seen by the repeater
                    itself, this counter may be implemented as the
                    summation of the values of the
                    vgRptrPortHCReadableOctets counters for all of the
                    ports in this repeater.

                    This counter is a 64 bit version of
                    vgRptrMonTotalReadableOctets.  It should be used
                    by Network Management protocols which support 64
                    bit counters (e.g. SNMPv2).

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrInfoLastChange changes."
            ::= { vgRptrMonitorEntry 4 }

        vgRptrMonTotalErrors OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The total number of errors which have occurred on
                    all of the ports in this repeater.  If an
                    implementation cannot obtain a count of these
                    errors as seen by the repeater itself, this
                    counter may be implemented as the summation of the
                    values of the vgRptrPortIPMFrames,
                    vgRptrPortOversizeFrames, and
                    vgRptrPortDataErrorFrames counters for all of the
                    ports in this repeater.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrInfoLastChange changes."
            ::= { vgRptrMonitorEntry 5 }

        vgRptrMonGroup     OBJECT IDENTIFIER ::= { vgRptrMonitor 2 }
        -- Currently unused

        vgRptrMonPort      OBJECT IDENTIFIER ::= { vgRptrMonitor 3 }

        vgRptrMonPortTable OBJECT-TYPE
            SYNTAX     SEQUENCE OF VgRptrMonPortEntry
            MAX-ACCESS not-accessible
```

```
            STATUS     current
            DESCRIPTION
                    "A table of performance and error statistics for
                    the ports.  The columnar object
                    vgRptrPortLastChange is used to indicate possible
                    discontinuities of counter type columnar objects
                    in this table."
            ::= { vgRptrMonPort 1 }

        vgRptrMonPortEntry OBJECT-TYPE
            SYNTAX     VgRptrMonPortEntry
            MAX-ACCESS not-accessible
            STATUS     current
            DESCRIPTION
                    "An entry in the vgRptrMonPortTable, containing
                    performance and error statistics for a single
                    port."
            INDEX      { vgRptrGroupIndex, vgRptrPortIndex }
            ::= { vgRptrMonPortTable 1 }

        VgRptrMonPortEntry ::=
            SEQUENCE {
                vgRptrPortReadableFrames        Counter32,
                vgRptrPortReadableOctets        Counter32,
                vgRptrPortReadOctetRollovers    Counter32,
                vgRptrPortHCReadableOctets      Counter64,
                vgRptrPortUnreadableOctets      Counter32,
                vgRptrPortUnreadOctetRollovers  Counter32,
                vgRptrPortHCUnreadableOctets    Counter64,
                vgRptrPortHighPriorityFrames    Counter32,
                vgRptrPortHighPriorityOctets    Counter32,
                vgRptrPortHighPriOctetRollovers Counter32,
                vgRptrPortHCHighPriorityOctets  Counter64,
                vgRptrPortNormPriorityFrames    Counter32,
                vgRptrPortNormPriorityOctets    Counter32,
                vgRptrPortNormPriOctetRollovers Counter32,
                vgRptrPortHCNormPriorityOctets  Counter64,
                vgRptrPortBroadcastFrames       Counter32,
                vgRptrPortMulticastFrames       Counter32,
                vgRptrPortNullAddressedFrames   Counter32,
                vgRptrPortIPMFrames             Counter32,
                vgRptrPortOversizeFrames        Counter32,
                vgRptrPortDataErrorFrames       Counter32,
                vgRptrPortPriorityPromotions    Counter32,
                vgRptrPortTransitionToTrainings Counter32,
                vgRptrPortLastChange            TimeStamp
            }
```

```
        vgRptrPortReadableFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is the number of good frames of
                    valid frame length that have been received on
                    this port.  This counter is incremented by one
                    for each frame received on the port which is not
                    counted by any of the following error counters:
                    vgRptrPortIPMFrames, vgRptrPortOversizeFrames,
                    vgRptrPortNullAddressedFrames, or
                    vgRptrPortDataErrorFrames.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aReadableFramesReceived."
            ::= { vgRptrMonPortEntry 1 }

        vgRptrPortReadableOctets OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of the number of octets
                    contained in good frames that have been received
                    on this port.  This counter is incremented by
                    OctetCount for each frame received on this port
                    which has been determined to be a readable frame
                    (i.e. each frame counted by
                    vgRptrPortReadableFrames).

                    Note that this counter can roll over very
                    quickly.  A management station is advised to
                    also poll the vgRptrPortReadOctetRollovers
                    object, or to use the 64-bit counter defined by
                    vgRptrPortHCReadableOctets instead of the two
                    32-bit counters.

                    This two-counter mechanism is provided for those
                    network management protocols that do not support
                    64-bit counters (e.g. SNMPv1).  Note that
                    retrieval of these two counters in the same PDU
                    is NOT guaranteed to be atomic.
```

```
                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aReadableOctetsReceived."
        ::= { vgRptrMonPortEntry 2 }

    vgRptrPortReadOctetRollovers OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of times
                that the associated instance of the
                vgRptrPortReadableOctets counter has rolled over.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aReadableOctetsReceived."
        ::= { vgRptrMonPortEntry 3 }

    vgRptrPortHCReadableOctets OBJECT-TYPE
        SYNTAX     Counter64
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of octets
                contained in good frames that have been received
                on this port.  This counter is incremented by
                OctetCount for each frame received on this port
                which has been determined to be a readable frame
                (i.e. each frame counted by
                vgRptrPortReadableFrames).

                This counter is a 64 bit version of
                vgRptrPortReadableOctets.  It should be used by
                Network Management protocols which support 64 bit
                counters (e.g. SNMPv2).
```

```
                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aReadableOctetsReceived."
        ::= { vgRptrMonPortEntry 4 }

    vgRptrPortUnreadableOctets OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of octets
                contained in invalid frames that have been
                received on this port.  This counter is
                incremented by OctetCount for each frame received
                on this port which is counted by
                vgRptrPortIPMFrames, vgRptrPortOversizeFrames,
                vgRptrPortNullAddressedFrames, or
                vgRptrPortDataErrorFrames.  This counter can be
                combined with vgRptrPortReadableOctets to
                calculate network utilization.

                Note that this counter can roll over very
                quickly.  A management station is advised to
                also poll the vgRptrPortUnreadOctetRollovers
                object, or to use the 64-bit counter defined by
                vgRptrPortHCUnreadableOctets instead of the two
                32-bit counters.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aOctetsInUnreadableFramesRcvd."
        ::= { vgRptrMonPortEntry 5 }

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

```
            STATUS     current
            DESCRIPTION
                    "This object is a count of the number of times
                    that the associated instance of the
                    vgRptrPortUnreadableOctets counter has rolled
                    over.

                    This two-counter mechanism is provided for those
                    network management protocols that do not support
                    64-bit counters (e.g. SNMPv1).  Note that
                    retrieval of these two counters in the same PDU
                    is NOT guaranteed to be atomic.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aOctetsInUnreadableFramesRcvd."
            ::= { vgRptrMonPortEntry 6 }

        vgRptrPortHCUnreadableOctets OBJECT-TYPE
            SYNTAX     Counter64
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of the number of octets
                    contained in invalid frames that have been
                    received on this port.  This counter is
                    incremented by OctetCount for each frame received
                    on this port which is counted by
                    vgRptrPortIPMFrames, vgRptrPortOversizeFrames,
                    vgRptrPortNullAddressedFrames, or
                    vgRptrPortDataErrorFrames.  This counter can be
                    combined with vgRptrPortHCReadableOctets to
                    calculate network utilization.

                    This counter is a 64 bit version of
                    vgRptrPortUnreadableOctets.  It should be used
                    by Network Management protocols which support 64
                    bit counters (e.g. SNMPv2).

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aOctetsInUnreadableFramesRcvd."
```

```
            ::= { vgRptrMonPortEntry 7 }

        vgRptrPortHighPriorityFrames 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 port.  This
                    counter is incremented by one for each high
                    priority frame received on this port.  This
                    counter includes both good and bad high priority
                    frames, as well as high priority training frames.
                    This counter does not include normal priority
                    frames which were priority promoted.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aHighPriorityFramesReceived."
            ::= { vgRptrMonPortEntry 8 }

        vgRptrPortHighPriorityOctets 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 port.  This counter is
                    incremented by OctetCount for each frame received
                    on this port which is counted by
                    vgRptrPortHighPriorityFrames.

                    Note that this counter can roll over very
                    quickly.  A management station is advised to
                    also poll the vgRptrPortHighPriOctetRollovers
                    object, or to use the 64-bit counter defined by
                    vgRptrPortHCHighPriorityOctets instead of the two
                    32-bit counters.

                    This two-counter mechanism is provided for those
                    network management protocols that do not support
                    64-bit counters (e.g. SNMPv1).  Note that
                    retrieval of these two counters in the same PDU
                    is NOT guaranteed to be atomic.
```

```
                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aHighPriorityOctetsReceived."
        ::= { vgRptrMonPortEntry 9 }

    vgRptrPortHighPriOctetRollovers OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of times
                that the associated instance of the
                vgRptrPortHighPriorityOctets counter has rolled
                over.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aHighPriorityOctetsReceived."
        ::= { vgRptrMonPortEntry 10 }

    vgRptrPortHCHighPriorityOctets 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 port.  This counter is
                incremented by OctetCount for each frame received
                on this port which is counted by
                vgRptrPortHighPriorityFrames.

                This counter is a 64 bit version of
                vgRptrPortHighPriorityOctets.  It should be used
                by Network Management protocols which support
                64 bit counters (e.g. SNMPv2).
```

```
                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aHighPriorityOctetsReceived."
        ::= { vgRptrMonPortEntry 11 }

    vgRptrPortNormPriorityFrames 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 port.  This
                counter is incremented by one for each normal
                priority frame received on this port. This
                counter includes both good and bad normal
                priority frames, as well as normal priority
                training frames and normal priority frames which
                were priority promoted.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aNormalPriorityFramesReceived."
        ::= { vgRptrMonPortEntry 12 }

    vgRptrPortNormPriorityOctets 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 port.  This counter is
                incremented by OctetCount for each frame received
                on this port which is counted by
                vgRptrPortNormPriorityFrames.

                Note that this counter can roll over very
                quickly.  A management station is advised to
                also poll the vgRptrPortNormPriOctetRollovers
                object, or to use the 64-bit counter defined by
                vgRptrPortHCNormPriorityOctets instead of the two
                32-bit counters.
```

```
                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aNormalPriorityOctetsReceived."
        ::= { vgRptrMonPortEntry 13 }

    vgRptrPortNormPriOctetRollovers OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of the number of times
                that the associated instance of the
                vgRptrPortNormPriorityOctets counter has rolled
                over.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMPv1).  Note that
                retrieval of these two counters in the same PDU
                is NOT guaranteed to be atomic.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aNormalPriorityOctetsReceived."

        ::= { vgRptrMonPortEntry 14 }

    vgRptrPortHCNormPriorityOctets 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 port.  This counter is
                incremented by OctetCount for each frame received
```

```
                    on this port which is counted by
                    vgRptrPortNormPriorityFrames.

                    This counter is a 64 bit version of
                    vgRptrPortNormPriorityOctets.  It should be used
                    by Network Management protocols which support
                    64 bit counters (e.g. SNMPv2).

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aNormalPriorityOctetsReceived."
            ::= { vgRptrMonPortEntry 15 }

        vgRptrPortBroadcastFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of broadcast packets that
                    have been received on this port.  This counter is
                    incremented by one for each readable frame
                    received on this port whose destination MAC
                    address is the broadcast address.  Frames
                    counted by this counter are also counted by
                    vgRptrPortReadableFrames.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aBroadcastFramesReceived."
            ::= { vgRptrMonPortEntry 16 }

        vgRptrPortMulticastFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of multicast packets that
                    have been received on this port.  This counter is
                    incremented by one for each readable frame
                    received on this port whose destination MAC
                    address has the group address bit set, but is not
                    the broadcast address.  Frames counted by this
```

```
                counter are also counted by
                vgRptrPortReadableFrames, but not by
                vgRptrPortBroadcastFrames.  Note that when the
                value of the instance vgRptrInfoCurrentFramingType
                for the repeater that this port is associated
                with is equal to 'frameType88025', this count
                includes packets addressed to functional
                addresses.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aMulticastFramesReceived."
        ::= { vgRptrMonPortEntry 17 }

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

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aNullAddressedFramesReceived."
        ::= { vgRptrMonPortEntry 18 }

    vgRptrPortIPMFrames 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 port 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 port which has had an
                invalid packet marker added to the end of the
                frame.

                This counter indicates problems occurring in the
                domain of other repeaters, as opposed to problems
                with cables or devices directly attached to this
                repeater.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aIPMFramesReceived."
        ::= { vgRptrMonPortEntry 19 }

    vgRptrPortOversizeFrames OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is a count of oversize frames
                received on this port.  This counter is
                incremented by one for each frame received on
                this port whose OctetCount is larger than the
                maximum legal frame size.

                The frame size which causes this counter to
                increment is dependent on the current value of
                vgRptrInfoCurrentFramingType for the repeater that
                the port is associated with.  When
                vgRptrInfoCurrentFramingType is equal to
                frameType88023 this counter will increment for
                frames that are 1519 octets or larger.  When
                vgRptrInfoCurrentFramingType is equal to
                frameType88025 this counter will increment for
                frames that are 4521 octets or larger.

                This counter may experience a discontinuity when
                the value of the corresponding instance of
                vgRptrPortLastChange changes."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aOversizeFramesReceived."
        ::= { vgRptrMonPortEntry 20 }
```

```
        vgRptrPortDataErrorFrames OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is a count of errored frames
                    received on this port.  This counter is
                    incremented by one for each frame received on
                    this port with any of the following errors: bad
                    FCS (with no IPM), PMI errors (excluding frames
                    with an IPM error as the only PMI error), or
                    undersize (with no IPM).  Does not include
                    packets counted by vgRptrPortIPMFrames,
                    vgRptrPortOversizeFrames, or
                    vgRptrPortNullAddressedFrames.

                    This counter indicates problems with cables or
                    devices directly connected to this repeater, while
                    vgRptrPortIPMFrames indicates problems occurring
                    in the domain of other repeaters.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aDataErrorFramesReceived."
            ::= { vgRptrMonPortEntry 21 }

        vgRptrPortPriorityPromotions OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This counter is incremented by one each time the
                    priority promotion timer has expired on this port
                    and a normal priority frame is priority
                    promoted.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aPriorityPromotions."
            ::= { vgRptrMonPortEntry 22 }

        vgRptrPortTransitionToTrainings OBJECT-TYPE
```

```
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This counter is incremented by one each time the
                    vgRptrPortStatus object for this port transitions
                    into the 'training' state.

                    This counter may experience a discontinuity when
                    the value of the corresponding instance of
                    vgRptrPortLastChange changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aTransitionsIntoTraining."
            ::= { vgRptrMonPortEntry 23 }

        vgRptrPortLastChange OBJECT-TYPE
            SYNTAX     TimeStamp
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The value of sysUpTime when the last of the
                    following occurred:
                      1) the agent cold- or warm-started;
                      2) the row for the port was created
                         (such as when a device or module was
                         added to the system); or
                      3) any condition that would cause one of
                         the counters for the row to experience
                         a discontinuity."
            ::= { vgRptrMonPortEntry 24 }


        vgRptrAddrTrack   OBJECT IDENTIFIER ::= { vgRptrObjects 3 }

        vgRptrAddrTrackRptr
            OBJECT IDENTIFIER ::= { vgRptrAddrTrack 1 }

        -- Currently unused

        vgRptrAddrTrackGroup
            OBJECT IDENTIFIER ::= { vgRptrAddrTrack 2 }
        -- Currently unused

        vgRptrAddrTrackPort
            OBJECT IDENTIFIER ::= { vgRptrAddrTrack 3 }

        vgRptrAddrTrackTable OBJECT-TYPE
```

```
        SYNTAX     SEQUENCE OF VgRptrAddrTrackEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
            "Table of address mapping information about the
            ports."
        ::= { vgRptrAddrTrackPort 1 }

    vgRptrAddrTrackEntry OBJECT-TYPE
        SYNTAX     VgRptrAddrTrackEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
            "An entry in the table, containing address mapping
            information about a single port."
        INDEX      { vgRptrGroupIndex, vgRptrPortIndex }
        ::= { vgRptrAddrTrackTable 1 }

    VgRptrAddrTrackEntry ::=
        SEQUENCE {
            vgRptrAddrLastTrainedAddress   OCTET STRING,
            vgRptrAddrTrainedAddrChanges   Counter32,
            vgRptrRptrDetectedDupAddress   TruthValue,
            vgRptrMgrDetectedDupAddress    TruthValue
        }


    vgRptrAddrLastTrainedAddress OBJECT-TYPE
        SYNTAX     OCTET STRING (SIZE(0 | 6))
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "This object is the MAC address of the last
                station which succeeded in training on this port.
                A cascaded repeater may train using the null
                address.  If no stations have succeeded in
                training on this port since the agent began
                monitoring the port activity, the agent shall
                return a string of length zero."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aLastTrainedAddress."
        ::= { vgRptrAddrTrackEntry 1 }

    vgRptrAddrTrainedAddrChanges OBJECT-TYPE
        SYNTAX     Counter32
        MAX-ACCESS read-only
        STATUS     current
```

```
            DESCRIPTION
                    "This counter is incremented by one for each time
                    that the vgRptrAddrLastTrainedAddress object for
                    this port changes."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aTrainedAddressChanges."
            ::= { vgRptrAddrTrackEntry 2 }

        vgRptrRptrDetectedDupAddress OBJECT-TYPE
            SYNTAX     TruthValue
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "This object is used to indicate that the
                    repeater detected an error-free training frame on
                    this port with a non-null source MAC address which
                    matches the value of vgRptrAddrLastTrainedAddress
                    of another active port in the same repeater.  This
                    is reset to 'false' when an error-free training
                    frame is received with a non-null source MAC
                    address which does not match
                    vgRptrAddrLastTrainedAddress of another port which
                    is active in the same repeater.

                    For the cascade port, this object will be 'true'
                    if the 'D' bit in the most recently received
                    error-free training response frame was set,
                    indicating the device at the other end of the link
                    believes that this repeater's cascade port is
                    using a duplicate address.  This may be because
                    the device at the other end of the link detected a
                    duplicate address itself, or, if the other device
                    is also a repeater, it could be because
                    vgRptrMgrDetectedDupAddress was set to 'true' on
                    the port that this repeater's cascade port is
                    connected to."
            REFERENCE
                    "IEEE Standard 802.12-1995, 13.2.4.5.1,
                    aLocalRptrDetectedDupAddr."
            ::= { vgRptrAddrTrackEntry 3 }

        vgRptrMgrDetectedDupAddress OBJECT-TYPE
            SYNTAX     TruthValue
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                    "This object can be set by a management station
```

```
                when it detects that there is a duplicate MAC
                address.  This object is OR'd with
                vgRptrRptrDetectedDupAddress to form the value of
                the 'D' bit in training response frames on this
                port.

                The purpose of this object is to provide a means
                for network management software to inform an end
                station that it is using a duplicate station
                address.  Setting this object does not affect the
                current state of the link; the end station will
                not be informed of the duplicate address until it
                retrains for some reason.  Note that regardless
                of its station address, the end station will not
                be able to train successfully until the network
                management software has set this object back to
                'false'.  Although this object exists on
                cascade ports, it does not perform any function
                since this repeater is the initiator of training
                on a cascade port."
        REFERENCE
                "IEEE Standard 802.12-1995, 13.2.4.5.1,
                aCentralMgmtDetectedDupAddr."
        ::= { vgRptrAddrTrackEntry 4 }


    vgRptrTraps         OBJECT IDENTIFIER ::= { vgRptrMIB 2 }
    vgRptrTrapPrefix    OBJECT IDENTIFIER ::= { vgRptrTraps 0 }

    vgRptrHealth NOTIFICATION-TYPE
        OBJECTS    { vgRptrInfoOperStatus }
        STATUS     current
        DESCRIPTION
                "A vgRptrHealth trap conveys information related
                to the operational state of a repeater.  This trap
                is sent when the value of an instance of
                vgRptrInfoOperStatus changes.  The vgRptrHealth
                trap is not sent as a result of powering up a
                repeater.

                The vgRptrHealth trap must contain the instance of
                the vgRptrInfoOperStatus object associated with
                the affected repeater.

                The agent must throttle the generation of
                consecutive vgRptrHealth traps so that there is at
                least a five-second gap between traps of this
                type.  When traps are throttled, they are dropped,
```

```
                not queued for sending at a future time.  (Note
                that 'generating' a trap means sending to all
                configured recipients.)"
        REFERENCE
                "IEEE 802.12, Layer Management, 13.2.4.2.3,
                nRepeaterHealth."
        ::= { vgRptrTrapPrefix 1 }

    vgRptrResetEvent NOTIFICATION-TYPE
        OBJECTS    { vgRptrInfoOperStatus }
        STATUS     current
        DESCRIPTION
                "A vgRptrResetEvent trap conveys information
                related to the operational state of a repeater.
                This trap is sent on completion of a repeater
                reset action.  A repeater reset action is defined
                as a transition to its initial state as specified
                in clause 12 [IEEE Std 802.12] when triggered by
                a management command.

                The vgRptrResetEvent trap is not sent when the
                agent restarts and sends an SNMP coldStart or
                warmStart trap.

                The vgRptrResetEvent trap must contain the
                instance of the vgRptrInfoOperStatus object
                associated with the affected repeater.

                The agent must throttle the generation of
                consecutive vgRptrResetEvent traps so that there
                is at least a five-second gap between traps of
                this type.  When traps are throttled, they are
                dropped, not queued for sending at a future time.
                (Note that 'generating' a trap means sending to
                all configured recipients.)"
        REFERENCE
                "IEEE 802.12, Layer Management, 13.2.4.2.3,
                nRepeaterReset."
        ::= { vgRptrTrapPrefix 2 }

    -- conformance information

    vgRptrConformance OBJECT IDENTIFIER ::= { vgRptrMIB 3 }

    vgRptrCompliances
                 OBJECT IDENTIFIER ::= { vgRptrConformance 1 }

    vgRptrGroups OBJECT IDENTIFIER ::= { vgRptrConformance 2 }
```

```
        -- compliance statements

        vgRptrCompliance MODULE-COMPLIANCE
            STATUS     current
            DESCRIPTION
                    "The compliance statement for managed 802.12
                    repeaters."

            MODULE  -- this module
                MANDATORY-GROUPS { vgRptrConfigGroup,
                                   vgRptrStatsGroup,
                                   vgRptrAddrGroup,
                                   vgRptrNotificationsGroup }

                GROUP        vgRptrStats64Group
                DESCRIPTION
                       "Implementation of this group is recommended
                       for systems which can support Counter64."

                OBJECT       vgRptrInfoDesiredFramingType
                MIN-ACCESS   read-only
                DESCRIPTION
                        "Write access to this object is not required
                        in a repeater system that does not support
                        configuration of framing types."

            MODULE     SNMP-REPEATER-MIB
                GROUP        snmpRptrGrpRptrAddrSearch
                DESCRIPTION
                        "Implementation of this group is recommended
                        for systems which have the necessary
                        instrumentation to search all incoming data
                        streams for a particular source MAC address."
            ::= { vgRptrCompliances 1 }

        -- units of conformance

        vgRptrConfigGroup OBJECT-GROUP
            OBJECTS    {
                         vgRptrInfoMACAddress,
                         vgRptrInfoCurrentFramingType,
                         vgRptrInfoDesiredFramingType,
                         vgRptrInfoFramingCapability,
                         vgRptrInfoTrainingVersion,
                         vgRptrInfoOperStatus,
                         vgRptrInfoReset,
                         vgRptrInfoLastChange,
                         vgRptrGroupObjectID,
```

```
                        vgRptrGroupOperStatus,
                        vgRptrGroupPortCapacity,
                        vgRptrGroupCablesBundled,
                        vgRptrPortType,
                        vgRptrPortAdminStatus,
                        vgRptrPortOperStatus,
                        vgRptrPortSupportedPromiscMode,
                        vgRptrPortSupportedCascadeMode,
                        vgRptrPortAllowedTrainType,
                        vgRptrPortLastTrainConfig,
                        vgRptrPortTrainingResult,
                        vgRptrPortPriorityEnable,
                        vgRptrPortRptrInfoIndex
                      }
    STATUS     current
    DESCRIPTION
            "A collection of objects for managing the status
            and configuration of IEEE 802.12 repeaters."
    ::= { vgRptrGroups 1 }

vgRptrStatsGroup OBJECT-GROUP
    OBJECTS    {
                  vgRptrMonTotalReadableFrames,
                  vgRptrMonTotalReadableOctets,
                  vgRptrMonReadableOctetRollovers,
                  vgRptrMonTotalErrors,
                  vgRptrPortReadableFrames,
                  vgRptrPortReadableOctets,
                  vgRptrPortReadOctetRollovers,
                  vgRptrPortUnreadableOctets,
                  vgRptrPortUnreadOctetRollovers,
                  vgRptrPortHighPriorityFrames,
                  vgRptrPortHighPriorityOctets,
                  vgRptrPortHighPriOctetRollovers,
                  vgRptrPortNormPriorityFrames,
                  vgRptrPortNormPriorityOctets,
                  vgRptrPortNormPriOctetRollovers,
                  vgRptrPortBroadcastFrames,
                  vgRptrPortMulticastFrames,
                  vgRptrPortNullAddressedFrames,
                  vgRptrPortIPMFrames,
                  vgRptrPortOversizeFrames,
                  vgRptrPortDataErrorFrames,
                  vgRptrPortPriorityPromotions,
                  vgRptrPortTransitionToTrainings,
                  vgRptrPortLastChange
                }
    STATUS     current
```

```
            DESCRIPTION
                    "A collection of objects for providing statistics
                    for IEEE 802.12 repeaters.  Systems which support
                    Counter64 should also implement
                    vgRptrStats64Group."
            ::= { vgRptrGroups 2 }

        vgRptrStats64Group OBJECT-GROUP
            OBJECTS    {
                         vgRptrMonHCTotalReadableOctets,
                         vgRptrPortHCReadableOctets,
                         vgRptrPortHCUnreadableOctets,
                         vgRptrPortHCHighPriorityOctets,
                         vgRptrPortHCNormPriorityOctets
                       }
            STATUS     current
            DESCRIPTION
                    "A collection of objects for providing statistics
                    for IEEE 802.12 repeaters in a system that
                    supports Counter64."
            ::= { vgRptrGroups 3 }

        vgRptrAddrGroup OBJECT-GROUP
            OBJECTS    {
                         vgRptrAddrLastTrainedAddress,
                         vgRptrAddrTrainedAddrChanges,
                         vgRptrRptrDetectedDupAddress,
                         vgRptrMgrDetectedDupAddress
                       }
            STATUS     current
            DESCRIPTION
                    "A collection of objects for tracking addresses
                    on IEEE 802.12 repeaters."
            ::= { vgRptrGroups 4 }

        vgRptrNotificationsGroup NOTIFICATION-GROUP
            NOTIFICATIONS {
                            vgRptrHealth,
                            vgRptrResetEvent
                          }
            STATUS        current
            DESCRIPTION
                    "A collection of notifications used to indicate
                    802.12 repeater general status changes."
            ::= { vgRptrGroups 5 }

        END
```

4. Acknowledgements

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David Lapp
Jason Spofford
Kaj Tesink

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5. References

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6. Security Considerations

Certain management information defined in this MIB may be considered sensitive in some network environments. Therefore, authentication of received SNMP requests and controlled access to management information should be employed in such environments. The method for this authentication is a function of the SNMP Administrative Framework, and has not been expanded by this MIB.

Several objects in the vgRptrConfigGroup allow write access. Setting these objects can have a serious effect on the operation of the network, including modifying the framing type of the network, resetting the repeater, enabling and disabling individual ports, and modifying the allowed capabilities of end stations attached to each port. It is recommended that implementers seriously consider whether set operations should be allowed without providing, at a minimum, authentication of request origin.

One particular object in this MIB, vgRptrPortAllowedTrainType, is considered significant for providing operational security in an 802.12 network. It is recommended that network administrators configure this object to the 'allowEndNodesOnly' value on all ports except ports which the administrator knows are attached to cascaded repeaters or devices which require promiscuous receive capability (bridges, switches, RMON probes, etc.). This will prevent unauthorized users from extending the network (by attaching cascaded repeaters or bridges) without the administrator's knowledge, and will prevent unauthorized end nodes from listening promiscuously to network traffic.

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