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Definitions of Managed Objects for IEEE 802.3 Repeater Devices

Status of this Memo

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines objects for managing IEEE 802.3 10 Mb/second baseband repeaters, sometimes referred to as "hubs."

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1. The Network Management Framework

The Internet-standard Network Management Framework consists of three components. They are:

- o STD 16, RFC 1155 which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. STD 16, RFC 1212 defines a more concise description mechanism, which is wholly consistent with the SMI.

- o STD 17, RFC 1213 defines MIB-II, the core set of managed objects for the Internet suite of protocols.

- o STD 15, RFC 1157 which defines the SNMP, the protocol used for network access to managed objects.

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 or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) defined in the SMI. In particular, each object 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 the object types defined in this memo represent attributes of an IEEE 802.3 (Ethernet-like) repeater, as defined by Section 9, "Repeater Unit for 10 Mb/s Baseband Networks" in the IEEE 802.3/ISO 8802-3 CSMA/CD standard [7].

These Repeater MIB objects may be used to manage non-standard repeater-like devices, but defining objects to describe

implementation-specific properties of non-standard repeater-like devices is outside the scope of this memo.

The definitions presented here are based on the IEEE draft standard P802.3K, "Layer Management for 10 Mb/s Baseband Repeaters" [8]. Implementors of these MIB objects should note that [8] explicitly describes 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 the IEEE 802.3 Repeater Management draft, with the intention that the same instrumentation can be used to implement both the IEEE and IETF management standards.

2.1. Terminology

2.1.1. Repeaters, Hubs and Concentrators

In late 1988, the IEEE 802.3 Hub Management task force was chartered to define managed objects for both 802.3 repeaters and the proposed 10BASE-FA synchronous active stars. The term "hub" was used to cover both repeaters and active stars.

In March, 1991, the active star proposal was dropped from the 10BASE-F draft. Subsequently the 802.3 group changed the name of the task force to be the IEEE 802.3 Repeater Management Task Force, and likewise renamed their draft.

The use of the term "hub" has led to some confusion, as the terms "hub," "intelligent hub," and "concentrator" are often used to indicate a modular chassis with plug-in modules that provide generalized LAN/WAN connectivity, often with a mix of 802.3 repeater, token ring, and FDDI connectivity, internetworked by bridges, routers, and terminal servers.

To be clear that this work covers the management of IEEE 802.3 repeaters only, the editors of this MIB definitions document chose to call this a "Repeater MIB" instead of a "Hub MIB."

2.1.2. Repeaters, Ports, and MAUs

The following text roughly defines the terms "repeater," "port," and "MAU" as used in the context of this memo. This text is imprecise and omits many technical details. For a more complete and precise definition of these terms, refer to Section 9 of [7].

An IEEE 802.3 repeater connects "Ethernet-like" media segments together to extend the network length and topology beyond what can be achieved with a single coax segment. It can be pictured as a star structure with two or more input/output ports. The diagram below illustrates a 6-port repeater:

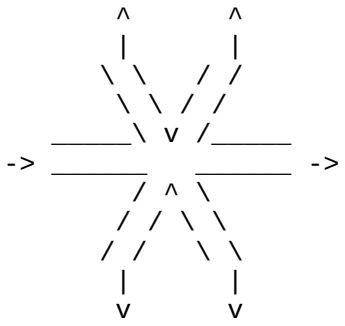

Figure 1. Repeater Unit

All the stations on the media segments connected to a given repeater's ports participate in a single collision domain. A packet transmitted by any of these stations is seen by all of these stations.

Data coming in on any port in the repeater is transmitted out through each of the remaining n-1 ports. If data comes in to the repeater on two or more ports simultaneously or the repeater detects a collision on the incoming port, the repeater transmits a jamming signal out on all ports for the duration of the collision.

A repeater is a bit-wise store-and-forward device. It is differentiated from a bridge (a frame store-and-forward device) in that it is primarily concerned with carrier sense and data bits, and does not make data-handling decisions based on the legality or contents of a packet. A repeater retransmits data bits as they are received. Its data FIFO holds only enough bits to make sure that the FIFO does not underflow when the data rate of incoming bits is slightly slower than the repeater's transmission rate.

A repeater is not an end-station on the network, and does not count toward the overall limit of 1024 stations. A repeater has no MAC address associated with it, and therefore packets may not be addressed to the repeater or to its ports. (Packets may be addressed to the MAC address of a management entity that is monitoring a repeater. This management entity may or may not be connected to the network through one of the repeater's ports. How the management entity obtains information about the activity on the repeater is an

implementation issue, and is not discussed in this memo.)

A repeater is connected to the network with Medium Attachment Units (MAUs), and sometimes through Attachment Unit Interfaces (AUIs) as well. ("MAUs" are also known as transceivers, and an "AUI" is the same as a 15-pin Ethernet or DIX connector.)

The 802.3 standard defines a "repeater set" as the "repeater unit" plus its associated MAUs (and AUIs if present). The "repeater unit" is defined as the portion of the repeater set that is inboard of the physical media interfaces. The MAUs may be physically separate from the repeater unit, or they may be integrated into the same physical package.

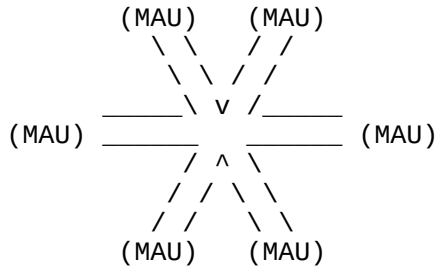

Figure 2. Repeater Set

The most commonly-used MAUs are the 10BASE-5 (AUI to thick "yellow" coax), 10BASE-2 (BNC to thin coax), 10BASE-T (unshielded twisted-pair), and FOIRL (asynchronous fiber optic inter-repeater link, which is being combined into the 10BASE-F standard as 10BASE-FL). The draft 10BASE-F standard also includes the definition for a new synchronous fiber optic attachment, known as 10BASE-FB.

It should be stressed that the repeater MIB being defined by the IEEE covers only the repeater unit management - it does not include management of the MAUs that form the repeater set. The IEEE recognizes that MAU management should be the same for MAUs connected to end-stations (DTEs) as it is for MAUs connected to repeaters. This memo follows the same strategy; the definition of management information for MAUs is being addressed in a separate memo.

2.1.3. Ports and Groups

Repeaters are often implemented in modular "concentrators," where a card cage holds several field-replaceable cards. Several cards may form a single repeater unit, with each card containing one or more of the repeater's ports. Because of this modular architecture, users typically identify these repeater ports with a card number plus the

port number relative to the card, e.g., Card 3, Port 11.

To support this modular numbering scheme, this document follows the example of the IEEE Repeater Management draft [8], allowing an implementor to separate the ports in a repeater into "groups", if desired. For example, an implementor might choose to represent field-replaceable units as groups of ports so that the port numbering would match the modular hardware implementation.

This group mapping is recommended but optional. An implementor may choose to put all of a modular repeater's ports into a single group, or to divide the ports into groups that do not match physical divisions.

The object rptrGroupCapacity, which has a maximum value of 1024, indicates the maximum number of groups that a given repeater may contain. The value of rptrGroupCapacity must remain constant from one management restart to the next.

Each group within the repeater is uniquely identified by a group number in the range 1..rptrGroupCapacity. Groups may come and go without causing a management reset, and may be sparsely numbered within the repeater. For example, in a 12- card cage, cards 3, 5, 6, and 7 may together form a single repeater, and the implementor may choose to number them as groups 3, 5, 6, and 7, respectively.

The object rptrGroupPortCapacity, which also has a maximum value of 1024, indicates the maximum number of ports that a given group may contain. The value of rptrGroupPortCapacity must not change for a given group. However, a group may be deleted from the repeater and replaced with a group containing a different number of ports. The value of rptrGroupLastOperStatusChange will indicate that a change took place.

Each port within the repeater is uniquely identified by a combination of group number and port number, where port number is an integer in the range 1..rptrGroupPortCapacity. As with groups within a repeater, ports within a group may be sparsely numbered. Likewise, ports may come and go within a group without causing a management reset.

2.1.4. Internal Ports and MAUs

Repeater ports may be thought of as sources of traffic into the repeater. In addition to the externally visible ports mentioned above, such as those with 10BASE-T MAUs, or AUI ports with external transceivers, some implementations may have internal ports that are not obvious to the end-user but are nevertheless sources of traffic

into the repeater. Examples include internal management ports, through which an agent communicates, and ports connecting to a backplane internal to the implementation.

Some implementations may not manage all of a repeater's ports. For managed ports, there must be entries in the port table; unmanaged ports will not show up in the table.

It is the decision of the implementor to select the appropriate group(s) in which to place internal ports. GroupCapacity for a given group always reflects the number of MANAGED ports in that group.

If some ports are unmanaged such that not all packet sources are represented by managed ports, then the sum of the input counters for the repeater will not equal the actual output of the repeater.

2.2. Supporting Functions

The IEEE 802.3 Hub Management draft [8] defines the following seven functions and seven signals used to describe precisely when port counters are incremented. The relationship between the functions and signals is shown in Figure 3.

The CollisionEvent, ActivityDuration, CarrierEvent, FramingError, OctetCount, FCSError, and SourceAddress output signals defined here are not retrievable MIB objects, but rather are concepts used in defining the MIB objects. The inputs are defined in Section 9 of the IEEE 802.3 standard [7].

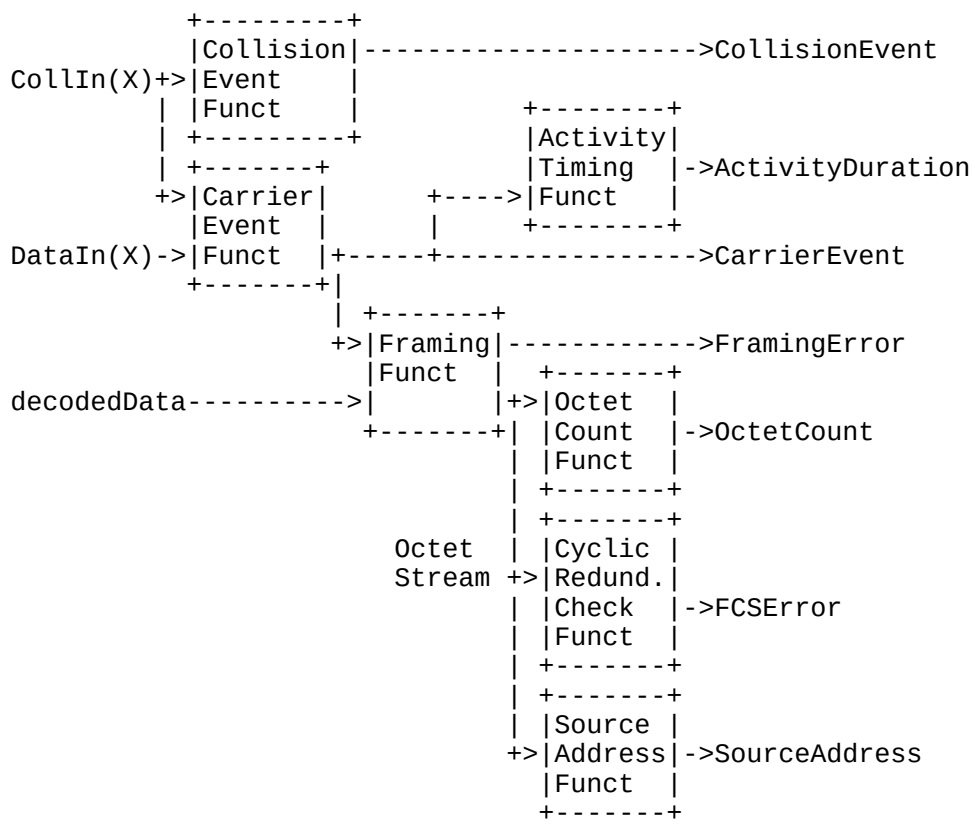

Figure 3. Port Functions Relationship

Collision Event Function: The collision event function asserts the CollisionEvent signal when the CollIn(X) variable has the value SQE. The CollisionEvent signal remains asserted until the assertion of any CarrierEvent signal due to the reception of the following event.

Carrier Event Function: The carrier event function asserts the CarrierEvent signal when the repeater exits the IDLE state, Fig 9-2 [7], and the port has been determined to be port N. It deasserts the CarrierEvent signal when, for a duration of at least Carrier Recovery Time (Ref: 9.5.6.5 [7]), both the DataIn(N) variable has the value II and the CollIn(N) variable has the value -SQE. The value N is the port assigned at the time of transition from the IDLE state.

Framing Function: The framing function recognizes the boundaries of an incoming frame by monitoring the CarrierEvent signal and the

decoded data stream. Data bits are accepted while the CarrierEvent signal is asserted. The framing function strips preamble and start of frame delimiter from the received data stream. The remaining bits are aligned along octet boundaries. If there is not an integral number of octets, then FramingError shall be asserted. The FramingError signal is cleared upon the assertion of the CarrierEvent signal due to the reception of the following event.

Activity Timing Function: The activity timing function measures the duration of the assertion of the CarrierEvent signal. This duration value must be adjusted by removing the value of Carrier Recovery Time (Ref: 9.5.6.5 [7]) to obtain the true duration of activity on the network. The output of the Activity Timing function is the ActivityDuration value, which represents the duration of the CarrierEvent signal as expressed in units of bit times.

Octet Counting Function: The octet counting function counts the number of complete octets received from the output of the framing function. The output of the octet counting function is the OctetCount value. The OctetCount value is reset to zero upon the assertion of the CarrierEvent signal due to the reception of the following event.

Cyclic Redundancy Check Function: The cyclic redundancy check function verifies that the sequence of octets output by the framing function contains a valid frame check sequence field. The frame check sequence field is the last four octets received from the output of the framing function. The algorithm for generating an FCS from the octet stream is specified in 3.2.8 [7]. If the FCS generated according to this algorithm is not the same as the last four octets received from the framing function then the FCSError signal is asserted. The FCSError signal is cleared upon the assertion of the CarrierEvent signal due to the reception of the following event.

Source Address Function: The source address function extracts octets from the stream output by the framing function. The seventh through twelfth octets shall be extracted from the octet stream and output as the SourceAddress variable. The SourceAddress variable is set to an invalid state upon the assertion of the CarrierEvent signal due to the reception of the following event.

2.3. Structure of MIB

Objects in this MIB are arranged into MIB groups. Each MIB group is organized as a set of related objects.

2.3.1. The Basic Group Definitions

This mandatory group contains the objects which are applicable to all repeaters. It contains status, parameter and control objects for the repeater as a whole, the port groups within the repeater, as well as for the individual ports themselves.

2.3.2. The Monitor Group Definitions

This optional group contains monitoring statistics for the repeater as a whole and for individual ports.

2.3.3. The Address Tracking Group Definitions

This optional group contains objects for tracking the MAC addresses of the DTEs attached to the ports of the repeater.

2.4. Relationship to Other MIBs

It is assumed that a repeater implementing this MIB will also implement (at least) the 'system' group defined in MIB-II [3].

2.4.1. 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 a repeater.

2.4.2. 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 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. A repeater is a bitwise store-and-forward device. It recognizes activity and bits, but does not process incoming data based on any packet-related information (such as checksum or addresses). A

repeater has no MAC address, no MAC implementation, and does not pass packets up to higher-level protocol entities for processing.

(When a network management entity is observing the 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.)

2.5. Textual Conventions

The datatype MacAddress is used as a textual convention in this document. This textual convention has NO effect on either the syntax nor the semantics of any managed object. Objects defined using this convention are always encoded by means of the rules that define their primitive type. Hence, no changes to the SMI or the SNMP are necessary to accommodate this textual convention which is adopted merely for the convenience of readers.

3. Definitions

```
SNMP-REPEATER-MIB DEFINITIONS ::= BEGIN

IMPORTS
    Counter, TimeTicks, Gauge
                                        FROM RFC1155-SMI
    DisplayString                       FROM RFC1213-MIB
    TRAP-TYPE                           FROM RFC-1215
    OBJECT-TYPE                         FROM RFC-1212;


snmpDot3RptrMgt OBJECT IDENTIFIER ::= { mib-2 22 }


-- All representations of MAC addresses in this MIB Module use,
-- as a textual convention (i.e., this convention does not affect
-- their encoding), the data type:

MacAddress ::= OCTET STRING (SIZE (6))    -- a 6 octet address in
                                          -- the "canonical" order
-- defined by IEEE 802.1a, i.e., as if it were transmitted least
-- significant bit first.


--                      References
--
-- The following references are used throughout this MIB:
--
```

```
   -- [IEEE 802.3 Std]
   --    refers to IEEE 802.3/ISO 8802-3 Information processing
   --    systems - Local area networks - Part 3: Carrier sense
   --    multiple access with collision detection (CSMA/CD)
   --    access method and physical layer specifications
   --    (2nd edition, September 21, 1990).
   --
   -- [IEEE 802.3 Rptr Mgt]
   --    refers to IEEE P802.3K, 'Layer Management for 10 Mb/s
   --    Baseband Repeaters, Section 19,' Draft Supplement to
   --    ANSI/IEEE 802.3, (Draft 8, April 9, 1992)


   --                      MIB Groups
   --
   -- The rptrBasicPackage group is mandatory.
   -- The rptrMonitorPackage and rptrAddrTrackPackage
   -- groups are optional.


   rptrBasicPackage
       OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 1 }

   rptrMonitorPackage
       OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 2 }

   rptrAddrTrackPackage
       OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 3 }


   -- object identifiers for organizing the information
   -- in the groups by repeater, port-group, and port

   rptrRptrInfo
       OBJECT IDENTIFIER ::= { rptrBasicPackage 1 }
   rptrGroupInfo
       OBJECT IDENTIFIER ::= { rptrBasicPackage 2 }
   rptrPortInfo
       OBJECT IDENTIFIER ::= { rptrBasicPackage 3 }

   rptrMonitorRptrInfo
       OBJECT IDENTIFIER ::= { rptrMonitorPackage 1 }
   rptrMonitorGroupInfo
       OBJECT IDENTIFIER ::= { rptrMonitorPackage 2 }
   rptrMonitorPortInfo
       OBJECT IDENTIFIER ::= { rptrMonitorPackage 3 }

   rptrAddrTrackRptrInfo     -- this subtree is currently unused
```

```
        OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 1 }
    rptrAddrTrackGroupInfo    -- this subtree is currently unused
        OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 2 }
    rptrAddrTrackPortInfo
        OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 3 }


    --
    --                    The BASIC GROUP
    --
    -- Implementation of the Basic Group is mandatory for all
    -- managed repeaters.

    --
    -- Basic Repeater Information
    --
    -- Configuration, status, and control objects for the overall
    -- repeater
    --

    rptrGroupCapacity OBJECT-TYPE
        SYNTAX    INTEGER (1..1024)
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The rptrGroupCapacity is the number of groups
                that can be contained within the repeater.  Within
                each managed repeater, the groups are uniquely
                numbered in the range from 1 to rptrGroupCapacity.

                Some groups may not be present in the repeater, in
                which case the actual number of groups present
                will be less than rptrGroupCapacity.  The number
                of groups present will never be greater than
                rptrGroupCapacity.

                Note:  In practice, this will generally be the
                number of field-replaceable units (i.e., modules,
                cards, or boards) that can fit in the physical
                repeater enclosure, and the group numbers will
                correspond to numbers marked on the physical
                enclosure."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.2,
                aRepeaterGroupCapacity."
        ::= { rptrRptrInfo 1 }

    rptrOperStatus OBJECT-TYPE
```

```
        SYNTAX  INTEGER {
                    other(1),           -- undefined or unknown status
                    ok(2),              -- no known failures
                    rptrFailure(3),     -- repeater-related failure
                    groupFailure(4),    -- group-related failure
                    portFailure(5),     -- port-related failure
                    generalFailure(6)   -- failure, unspecified type
                }
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The rptrOperStatus object indicates the
                operational state of the repeater.  The
                rptrHealthText object may be consulted for more
                specific information about the state of the
                repeater's health.

                In the case of multiple kinds of failures (e.g.,
                repeater failure and port failure), the value of
                this attribute shall reflect the highest priority
                failure in the following order, listed highest
                priority first:

                    rptrFailure(3)
                    groupFailure(4)
                    portFailure(5)
                    generalFailure(6)."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.2,
                aRepeaterHealthState."
        ::= { rptrRptrInfo 2 }

    rptrHealthText OBJECT-TYPE
        SYNTAX    DisplayString (SIZE (0..255))
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The health text object is a text string that
                provides information relevant to the operational
                state of the repeater.  Agents may use this string
                to provide detailed information on current
                failures, including how they were detected, and/or
                instructions for problem resolution.  The contents
                are agent-specific."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.2,
                aRepeaterHealthText."
        ::= { rptrRptrInfo 3 }
```

```
   rptrReset OBJECT-TYPE
       SYNTAX    INTEGER {
                     noReset(1),
                     reset(2)
                 }
       ACCESS    read-write
       STATUS    mandatory
       DESCRIPTION
               "Setting this object to reset(2) causes a
               transition to the START state of Fig 9-2 in
               section 9 [IEEE 802.3 Std].

               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
               portAdminStatus parameters.  Included in this
               action is the execution of a disruptive Self-Test
               with the following characteristics:  a) The nature
               of the tests is not specified.  b) The test resets
               the repeater but without affecting management
               information about the repeater.  c) The test does
               not inject packets onto any segment.  d) Packets
               received during the test may or may not be
               transferred.  e) The test does not interfere with
               management functions.

               After performing this self-test, the agent will
               update the repeater health information (including
               rptrOperStatus and rptrHealthText), and send a
               rptrHealth trap."
       REFERENCE
               "Reference IEEE 802.3 Rptr Mgt, 19.2.3.3,
               acResetRepeater."
       ::= { rptrRptrInfo 4 }

   rptrNonDisruptTest OBJECT-TYPE
       SYNTAX    INTEGER {
                     noSelfTest(1),
```

```
                    selfTest(2)
                }
        ACCESS    read-write
        STATUS    mandatory
        DESCRIPTION
                "Setting this object to selfTest(2) causes the
                repeater to perform a agent-specific, non-
                disruptive self-test that has the following
                characteristics:  a) The nature of the tests is
                not specified.  b) The test does not change the
                state of the repeater or management information
                about the repeater.  c) The test does not inject
                packets onto any segment.  d) The test does not
                prevent the relay of any packets.  e) The test
                does not interfere with management functions.

                After performing this test, the agent will update
                the repeater health information (including
                rptrOperStatus and rptrHealthText) and send a
                rptrHealth trap.

                Note that this definition allows returning an
                'okay' result after doing a trivial test.

                Setting this object to noSelfTest(1) has no
                effect.  The agent will always return the value
                noSelfTest(1) when this object is read."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.3,
                acExecuteNonDisruptiveSelfTest."
        ::= { rptrRptrInfo 5 }

    rptrTotalPartitionedPorts OBJECT-TYPE
        SYNTAX    Gauge
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object returns the total number of ports in
                the repeater whose current state meets all three
                of the following criteria:  rptrPortOperStatus
                does not have the value notPresent(3),
                rptrPortAdminStatus is enabled(1), and
                rptrPortAutoPartitionState is autoPartitioned(2)."
        ::= { rptrRptrInfo 6 }
```

```
   --
   -- The Basic Port Group Table
   --

   rptrGroupTable OBJECT-TYPE
       SYNTAX    SEQUENCE OF RptrGroupEntry
       ACCESS    not-accessible
       STATUS    mandatory
       DESCRIPTION
               "Table of descriptive and status information about
               the groups of ports."
       ::= { rptrGroupInfo 1 }

   rptrGroupEntry OBJECT-TYPE
       SYNTAX    RptrGroupEntry
       ACCESS    not-accessible
       STATUS    mandatory
       DESCRIPTION
               "An entry in the table, containing information
               about a single group of ports."
       INDEX    { rptrGroupIndex }
       ::= { rptrGroupTable 1 }

   RptrGroupEntry ::=
       SEQUENCE {
           rptrGroupIndex
               INTEGER,
           rptrGroupDescr
               DisplayString,
           rptrGroupObjectID
               OBJECT IDENTIFIER,
           rptrGroupOperStatus
               INTEGER,
           rptrGroupLastOperStatusChange
               TimeTicks,
           rptrGroupPortCapacity
               INTEGER
       }

   rptrGroupIndex OBJECT-TYPE
       SYNTAX    INTEGER (1..1024)
       ACCESS    read-only
       STATUS    mandatory
       DESCRIPTION
               "This object identifies the group within the
               repeater for which this entry contains
               information.  This value is never greater than
               rptrGroupCapacity."
```

```
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.5.2,
                aGroupID."
        ::= { rptrGroupEntry 1 }

    rptrGroupDescr OBJECT-TYPE
        SYNTAX    DisplayString (SIZE (0..255))
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "A textual description of the group.  This value
                should include the full name and version
                identification of the group's hardware type and
                indicate how the group is differentiated from
                other types of groups in the repeater.  Plug-in
                Module, Rev A' or 'Barney Rubble 10BASE-T 4-port
                SIMM socket Version 2.1' are examples of valid
                group descriptions.

                It is mandatory that this only contain printable
                ASCII characters."
        ::= { rptrGroupEntry 2 }

    rptrGroupObjectID OBJECT-TYPE
        SYNTAX    OBJECT IDENTIFIER
        ACCESS    read-only
        STATUS    mandatory
        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 FOIRL Plug-in Module.'"
        ::= { rptrGroupEntry 3 }

    rptrGroupOperStatus OBJECT-TYPE
        SYNTAX    INTEGER {
                      other(1),
                      operational(2),
                      malfunctioning(3),
                      notPresent(4),
```

```
                    underTest(5),
                    resetInProgress(6)
                }
        ACCESS    read-only
        STATUS    mandatory
        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 repeater.  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."
        ::= { rptrGroupEntry 4 }

    rptrGroupLastOperStatusChange OBJECT-TYPE
        SYNTAX    TimeTicks
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "An object that contains the value of sysUpTime at
                the time that the value of the rptrGroupOperStatus
                object for this group last changed.

                A value of zero indicates that the group's
                operational status has not changed since the agent
                last restarted."
        ::= { rptrGroupEntry 5 }

    rptrGroupPortCapacity OBJECT-TYPE
        SYNTAX    INTEGER (1..1024)
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The rptrGroupPortCapacity is the number of ports
                that can be contained within the group.  Valid
                range is 1-1024.  Within each group, the ports are
                uniquely numbered in the range from 1 to
                rptrGroupPortCapacity.

                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
                "Reference IEEE 802.3 Rptr Mgt, 19.2.5.2,
                aGroupPortCapacity."
        ::= { rptrGroupEntry 6 }


    --
    -- The Basic Port Table
    --

    rptrPortTable OBJECT-TYPE
        SYNTAX    SEQUENCE OF RptrPortEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "Table of descriptive and status information about
                the ports."
        ::= { rptrPortInfo 1 }

    rptrPortEntry OBJECT-TYPE
        SYNTAX    RptrPortEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "An entry in the table, containing information
                about a single port."
        INDEX    { rptrPortGroupIndex, rptrPortIndex }
        ::= { rptrPortTable 1 }

    RptrPortEntry ::=
        SEQUENCE {
            rptrPortGroupIndex
                INTEGER,
            rptrPortIndex
                INTEGER,
            rptrPortAdminStatus
                INTEGER,
            rptrPortAutoPartitionState
                INTEGER,
            rptrPortOperStatus
                INTEGER
        }

    rptrPortGroupIndex OBJECT-TYPE
        SYNTAX    INTEGER (1..1024)
```

```
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object identifies the group containing the
                port for which this entry contains information."
        ::= { rptrPortEntry 1 }

    rptrPortIndex OBJECT-TYPE
        SYNTAX    INTEGER (1..1024)
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object identifies the port within the group
                for which this entry contains information.  This
                value can never be greater than
                rptrGroupPortCapacity for the associated group."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aPortID."
        ::= { rptrPortEntry 2 }

    rptrPortAdminStatus OBJECT-TYPE
        SYNTAX    INTEGER {
                      enabled(1),
                      disabled(2)
                  }
        ACCESS    read-write
        STATUS    mandatory
        DESCRIPTION
                "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 admin status takes precedence over auto-
                partition and functionally operates between the
                auto-partition mechanism and the AUI/PMA.

                Setting this object to enabled(1) enables the port
                and exerts a BEGIN on the port's auto-partition
                state machine.

                (In effect, when a port is disabled, the value of
                rptrPortAutoPartitionState for that port is frozen
                until the port is next enabled.  When the port
```

```
                becomes enabled, the rptrPortAutoPartitionState
                becomes notAutoPartitioned(1), regardless of its
                pre-disabling state.)"
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aPortAdminState and 19.2.6.3, acPortAdminControl."
        ::= { rptrPortEntry 3 }

    rptrPortAutoPartitionState OBJECT-TYPE
        SYNTAX    INTEGER {
                      notAutoPartitioned(1),
                      autoPartitioned(2)
                  }
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The autoPartitionState flag indicates whether the
                port is currently partitioned by the repeater's
                auto-partition protection.

                The conditions that cause port partitioning are
                specified in partition state machine in Section 9
                [IEEE 802.3 Std].  They are not differentiated
                here."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aAutoPartitionState."
        ::= { rptrPortEntry 4 }

    rptrPortOperStatus  OBJECT-TYPE
        SYNTAX    INTEGER {
                      operational(1),
                      notOperational(2),
                      notPresent(3)
                  }
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object indicates the port's operational
                status.  The notPresent(3) status indicates the
                port is physically removed (note this may or may
                not be possible depending on the type of port.)
                The operational(1) status indicates that the port
                is enabled (see rptrPortAdminStatus) and working,
                even though it might be auto-partitioned (see
                rptrPortAutoPartitionState).

                If this object has the value operational(1) and
```

```
                rptrPortAdminStatus is set to disabled(2), it is
                expected that this object's value will soon change
                to notOperational(2)."
        ::= { rptrPortEntry 5 }


    --
    --                    The MONITOR GROUP
    --
    -- Implementation of this group is optional, but within the
    -- group all elements are mandatory.  If a managed repeater
    -- implements any part of this group, the entire group shall
    -- be implemented.

    --
    -- Repeater Monitor Information
    --
    -- Performance monitoring statistics for the repeater
    --

    rptrMonitorTransmitCollisions OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented every time the
                repeater state machine enters the TRANSMIT
                COLLISION state from any state other than ONE PORT
                LEFT (Ref: Fig 9-2, IEEE 802.3 Std).

                The approximate minimum time for rollover of this
                counter is 16 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.2,
                aTransmitCollisions."
        ::= { rptrMonitorRptrInfo 1 }


    --
    -- The Group Monitor Table
    --

    rptrMonitorGroupTable OBJECT-TYPE
        SYNTAX    SEQUENCE OF RptrMonitorGroupEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "Table of performance and error statistics for the
```

```
                groups."
        ::= { rptrMonitorGroupInfo 1 }

    rptrMonitorGroupEntry OBJECT-TYPE
        SYNTAX    RptrMonitorGroupEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "An entry in the table, containing total
                performance and error statistics for a single
                group.  Regular retrieval of the information in
                this table provides a means of tracking the
                performance and health of the networked devices
                attached to this group's ports.

                The counters in this table are redundant in the
                sense that they are the summations of information
                already available through other objects.  However,
                these sums provide a considerable optimization of
                network management traffic over the otherwise
                necessary retrieval of the individual counters
                included in each sum."
        INDEX    { rptrMonitorGroupIndex }
        ::= { rptrMonitorGroupTable 1 }

    RptrMonitorGroupEntry ::=
        SEQUENCE {
            rptrMonitorGroupIndex
                INTEGER,
            rptrMonitorGroupTotalFrames
                Counter,
            rptrMonitorGroupTotalOctets
                Counter,
            rptrMonitorGroupTotalErrors
                Counter
        }

    rptrMonitorGroupIndex OBJECT-TYPE
        SYNTAX    INTEGER (1..1024)
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object identifies the group within the
                repeater for which this entry contains
                information."
        ::= { rptrMonitorGroupEntry 1 }

    rptrMonitorGroupTotalFrames OBJECT-TYPE
```

```
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The total number of frames of valid frame length
                that have been received on the ports in this group
                and for which the FCSError and CollisionEvent
                signals were not asserted.  This counter is the
                summation of the values of the
                rptrMonitorPortReadableFrames counters for all of
                the ports in the group.

                This statistic provides one of the parameters
                necessary for obtaining the packet error rate.
                The approximate minimum time for rollover of this
                counter is 80 hours."
        ::= { rptrMonitorGroupEntry 2 }

    rptrMonitorGroupTotalOctets OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The total number of octets contained in the valid
                frames that have been received on the ports in
                this group.  This counter is the summation of the
                values of the rptrMonitorPortReadableOctets
                counters for all of the ports in the group.

                This statistic provides an indicator of the total
                data transferred.  The approximate minimum time
                for rollover of this counter is 58 minutes."
        ::= { rptrMonitorGroupEntry 3 }

    rptrMonitorGroupTotalErrors OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The total number of errors which have occurred on
                all of the ports in this group.  This counter is
                the summation of the values of the
                rptrMonitorPortTotalErrors counters for all of the
                ports in the group."
        ::= { rptrMonitorGroupEntry 4 }

    --
    -- The Port Monitor Table
```

```
   --

   rptrMonitorPortTable OBJECT-TYPE
       SYNTAX    SEQUENCE OF RptrMonitorPortEntry
       ACCESS    not-accessible
       STATUS    mandatory
       DESCRIPTION
               "Table of performance and error statistics for the
               ports."
       ::= { rptrMonitorPortInfo 1 }

   rptrMonitorPortEntry OBJECT-TYPE
       SYNTAX    RptrMonitorPortEntry
       ACCESS    not-accessible
       STATUS    mandatory
       DESCRIPTION
               "An entry in the table, containing performance and
               error statistics for a single port."
       INDEX    { rptrMonitorPortGroupIndex, rptrMonitorPortIndex }
       ::= { rptrMonitorPortTable 1 }

   RptrMonitorPortEntry ::=
       SEQUENCE {
           rptrMonitorPortGroupIndex
               INTEGER,
           rptrMonitorPortIndex
               INTEGER,
           rptrMonitorPortReadableFrames
               Counter,
           rptrMonitorPortReadableOctets
               Counter,
           rptrMonitorPortFCSErrors
               Counter,
           rptrMonitorPortAlignmentErrors
               Counter,
           rptrMonitorPortFrameTooLongs
               Counter,
           rptrMonitorPortShortEvents
               Counter,
           rptrMonitorPortRunts
               Counter,
           rptrMonitorPortCollisions
               Counter,
           rptrMonitorPortLateEvents
               Counter,
           rptrMonitorPortVeryLongEvents
               Counter,
           rptrMonitorPortDataRateMismatches
```

```
            Counter,
        rptrMonitorPortAutoPartitions
            Counter,
        rptrMonitorPortTotalErrors
            Counter
    }

rptrMonitorPortGroupIndex OBJECT-TYPE
    SYNTAX    INTEGER (1..1024)
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
            "This object identifies the group containing the
            port for which this entry contains information."
    ::= { rptrMonitorPortEntry 1 }

rptrMonitorPortIndex OBJECT-TYPE
    SYNTAX    INTEGER (1..1024)
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
            "This object identifies the port within the group
            for which this entry contains information."
    REFERENCE
            "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
            aPortID."
    ::= { rptrMonitorPortEntry 2 }

rptrMonitorPortReadableFrames OBJECT-TYPE
    SYNTAX    Counter
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
            "This object is the number of frames of valid
            frame length that have been received on this port.
            This counter is incremented by one for each frame
            received on this port whose OctetCount is greater
            than or equal to minFrameSize and less than or
            equal to maxFrameSize (Ref: IEEE 802.3 Std,
            4.4.2.1) and for which the FCSError and
            CollisionEvent signals are not asserted.

            This statistic provides one of the parameters
            necessary for obtaining the packet error rate.
            The approximate minimum time for rollover of this
            counter is 80 hours."
    REFERENCE
            "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
```

```
                aReadableFrames."
        ::= { rptrMonitorPortEntry 3 }

    rptrMonitorPortReadableOoctets OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object is the number of octets contained in
                valid 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., including
                FCS octets but excluding framing bits and dribble
                bits).

                This statistic provides an indicator of the total
                data transferred.  The approximate minimum time
                for rollover of this counter is 58 minutes."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aReadableOctets."
        ::= { rptrMonitorPortEntry 4 }

    rptrMonitorPortFCSErrors OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each frame
                received on this port with the FCSError signal
                asserted and the FramingError and CollisionEvent
                signals deasserted and whose OctetCount is greater
                than or equal to minFrameSize and less than or
                equal to maxFrameSize (Ref: 4.4.2.1, IEEE 802.3
                Std).

                The approximate minimum time for rollover of this
                counter is 80 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aFrameCheckSequenceErrors."
        ::= { rptrMonitorPortEntry 5 }

    rptrMonitorPortAlignmentErrors OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
```

```
        DESCRIPTION
                "This counter is incremented by one for each frame
                received on this port with the FCSError and
                FramingError signals asserted and CollisionEvent
                signal deasserted and whose OctetCount is greater
                than or equal to minFrameSize and less than or
                equal to maxFrameSize (Ref: IEEE 802.3 Std,
                4.4.2.1).  If rptrMonitorPortAlignmentErrors is
                incremented then the rptrMonitorPortFCSErrors
                Counter shall not be incremented for the same
                frame.

                The approximate minimum time for rollover of this
                counter is 80 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aAlignmentErrors."
        ::= { rptrMonitorPortEntry 6 }

    rptrMonitorPortFrameTooLongs OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each frame
                received on this port whose OctetCount is greater
                than maxFrameSize (Ref: 4.4.2.1, IEEE 802.3 Std).
                If rptrMonitorPortFrameTooLongs is incremented
                then neither the rptrMonitorPortAlignmentErrors
                nor the rptrMonitorPortFCSErrors counter shall be
                incremented for the frame.

                The approximate minimum time for rollover of this
                counter is 61 days."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aFramesTooLong."
        ::= { rptrMonitorPortEntry 7 }

    rptrMonitorPortShortEvents OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each
                CarrierEvent on this port with ActivityDuration
                less than ShortEventMaxTime.  ShortEventMaxTime is
                greater than 74 bit times and less than 82 bit
```

```
                times.  ShortEventMaxTime has tolerances included
                to provide for circuit losses between a
                conformance test point at the AUI and the
                measurement point within the state machine.

                Note:  shortEvents may indicate externally
                generated noise hits which will cause the repeater
                to transmit Runts to its other ports, or propagate
                a collision (which may be late) back to the
                transmitting DTE and damaged frames to the rest of
                the network.

                Implementors may wish to consider selecting the
                ShortEventMaxTime towards the lower end of the
                allowed tolerance range to accommodate bit losses
                suffered through physical channel devices not
                budgeted for within this standard.

                The approximate minimum time for rollover of this
                counter is 16 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aShortEvents."
        ::= { rptrMonitorPortEntry 8 }

    rptrMonitorPortRunts OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each
                CarrierEvent on this port that meets one of the
                following two conditions.  Only one test need be
                made.  a) The ActivityDuration is greater than
                ShortEventMaxTime and less than ValidPacketMinTime
                and the CollisionEvent signal is deasserted.  b)
                The OctetCount is less than 64, the
                ActivityDuration is greater than ShortEventMaxTime
                and the CollisionEvent signal is deasserted.
                ValidPacketMinTime is greater than or equal to 552
                bit times and less than 565 bit times.

                An event whose length is greater than 74 bit times
                but less than 82 bit times shall increment either
                the shortEvents counter or the runts counter but
                not both.  A CarrierEvent greater than or equal to
                552 bit times but less than 565 bit times may or
                may not be counted as a runt.
```

```
                ValidPacketMinTime has tolerances included to
                provide for circuit losses between a conformance
                test point at the AUI and the measurement point
                within the state machine.

                Runts usually indicate collision fragments, a
                normal network event.  In certain situations
                associated with large diameter networks a
                percentage of collision fragments may exceed
                ValidPacketMinTime.

                The approximate minimum time for rollover of this
                counter is 16 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2, aRunts."
        ::= { rptrMonitorPortEntry 9 }

    rptrMonitorPortCollisions OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for any
                CarrierEvent signal on any port for which the
                CollisionEvent signal on this port is also
                asserted.

                The approximate minimum time for rollover of this
                counter is 16 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aCollisions."
        ::= { rptrMonitorPortEntry 10 }

    rptrMonitorPortLateEvents OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each
                CarrierEvent on this port in which the CollIn(X)
                variable transitions to the value SQE (Ref:
                9.6.6.2, IEEE 802.3 Std) while the
                ActivityDuration is greater than the
                LateEventThreshold.  Such a CarrierEvent is
                counted twice, as both a collision and as a
                lateEvent.
```

```
                The LateEventThreshold is greater than 480 bit
                times and less than 565 bit times.
                LateEventThreshold has tolerances included to
                permit an implementation to build a single
                threshold to serve as both the LateEventThreshold
                and ValidPacketMinTime threshold.

                The approximate minimum time for rollover of this
                counter is 81 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aLateEvents."
        ::= { rptrMonitorPortEntry 11 }

    rptrMonitorPortVeryLongEvents OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each
                CarrierEvent on this port whose ActivityDuration
                is greater than the MAU Jabber Lockup Protection
                timer TW3 (Ref: 9.6.1 & 9.6.5, IEEE 802.3 Std).
                Other counters may be incremented as appropriate."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aVeryLongEvents."
        ::= { rptrMonitorPortEntry 12 }

    rptrMonitorPortDataRateMismatches OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each frame
                received on this port that meets all of the
                following conditions:  a) The CollisionEvent
                signal is not asserted.  b) The ActivityDuration
                is greater than ValidPacketMinTime.  c) The
                frequency (data rate) is detectably mismatched
                from the local transmit frequency.  The exact
                degree of mismatch is vendor specific and is to be
                defined by the vendor for conformance testing.

                When this event occurs, other counters whose
                increment conditions were satisfied may or may not
                also be incremented, at the implementor's
                discretion.  Whether or not the repeater was able
```

```
                to maintain data integrity is beyond the scope of
                this standard."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aDataRateMismatches."
        ::= { rptrMonitorPortEntry 13 }

    rptrMonitorPortAutoPartitions OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This counter is incremented by one for each time
                the repeater has automatically partitioned this
                port.  The conditions that cause port partitioning
                are specified in the partition state machine in
                Section 9 [IEEE 802.3 Std].  They are not
                differentiated here."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aAutoPartitions."
        ::= { rptrMonitorPortEntry 14 }

    rptrMonitorPortTotalErrors OBJECT-TYPE
        SYNTAX    Counter
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "The total number of errors which have occurred on
                this port.  This counter is the summation of the
                values of other error counters (for the same
                port), namely:

                    rptrMonitorPortFCSErrors,
                    rptrMonitorPortAlignmentErrors,
                    rptrMonitorPortFrameTooLongs,
                    rptrMonitorPortShortEvents,
                    rptrMonitorPortLateEvents,
                    rptrMonitorPortVeryLongEvents, and
                    rptrMonitorPortDataRateMismatches.

                This counter is redundant in the sense that it is
                the summation of information already available
                through other objects.  However, it is included
                specifically because the regular retrieval of this
                object as a means of tracking the health of a port
                provides a considerable optimization of network
                management traffic over the otherwise necessary
```

```
                retrieval of the summed counters."
        ::= { rptrMonitorPortEntry 15 }


    --
    --                    The ADDRESS TRACKING GROUP
    --
    -- Implementation of this group is optional; it is appropriate
    -- for all systems which have the necessary instrumentation.  If a
    -- managed repeater implements any part of this group, the entire
    -- group shall be implemented.

    --
    -- The Port Address Tracking Table
    --

    rptrAddrTrackTable OBJECT-TYPE
        SYNTAX    SEQUENCE OF RptrAddrTrackEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "Table of address mapping information about the
                ports."
        ::= { rptrAddrTrackPortInfo 1 }

    rptrAddrTrackEntry OBJECT-TYPE
        SYNTAX    RptrAddrTrackEntry
        ACCESS    not-accessible
        STATUS    mandatory
        DESCRIPTION
                "An entry in the table, containing address mapping
                information about a single port."
        INDEX    { rptrAddrTrackGroupIndex, rptrAddrTrackPortIndex }
        ::= { rptrAddrTrackTable 1 }

    RptrAddrTrackEntry ::=
        SEQUENCE {
            rptrAddrTrackGroupIndex
                INTEGER,
            rptrAddrTrackPortIndex
                INTEGER,
            rptrAddrTrackLastSourceAddress     -- DEPRECATED OBJECT
                MacAddress,
            rptrAddrTrackSourceAddrChanges
                Counter,
            rptrAddrTrackNewLastSrcAddress
                OCTET STRING
        }
```

```
   rptrAddrTrackGroupIndex OBJECT-TYPE
       SYNTAX    INTEGER (1..1024)
       ACCESS    read-only
       STATUS    mandatory
       DESCRIPTION
               "This object identifies the group containing the
               port for which this entry contains information."
       ::= { rptrAddrTrackEntry 1 }

   rptrAddrTrackPortIndex OBJECT-TYPE
       SYNTAX    INTEGER (1..1024)
       ACCESS    read-only
       STATUS    mandatory
       DESCRIPTION
               "This object identifies the port within the group
               for which this entry contains information."
       REFERENCE
               "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
               aPortID."
       ::= { rptrAddrTrackEntry 2 }

   rptrAddrTrackLastSourceAddress OBJECT-TYPE
       SYNTAX    MacAddress
       ACCESS    read-only
       STATUS    deprecated
       DESCRIPTION
               "This object is the SourceAddress of the last
               readable frame (i.e., counted by
               rptrMonitorPortReadableFrames) received by this
               port.

               This object has been deprecated because its value
               is undefined when no frames have been observed on
               this port.  The replacement object is
               rptrAddrTrackNewLastSrcAddress."
       REFERENCE
               "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
               aLastSourceAddress."
       ::= { rptrAddrTrackEntry 3 }

   rptrAddrTrackSourceAddrChanges OBJECT-TYPE
       SYNTAX    Counter
       ACCESS    read-only
       STATUS    mandatory
       DESCRIPTION
               "This counter is incremented by one for each time
               that the rptrAddrTrackLastSourceAddress attribute
               for this port has changed.
```

```
                This may indicate whether a link is connected to a
                single DTE or another multi-user segment.

                The approximate minimum time for rollover of this
                counter is 81 hours."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aSourceAddressChanges."
        ::= { rptrAddrTrackEntry 4 }

    rptrAddrTrackNewLastSrcAddress OBJECT-TYPE
        SYNTAX    OCTET STRING (SIZE(0 | 6))
        ACCESS    read-only
        STATUS    mandatory
        DESCRIPTION
                "This object is the SourceAddress of the last
                readable frame (i.e., counted by
                rptrMonitorPortReadableFrames) received by this
                port.  If no frames have been received by this
                port since the agent began monitoring the port
                activity, the agent shall return a string of
                length zero."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.6.2,
                aLastSourceAddress."
        ::= { rptrAddrTrackEntry 5 }


    -- Traps for use by Repeaters

    -- Traps are defined using the conventions in RFC 1215 [6].

    rptrHealth TRAP-TYPE
        ENTERPRISE  snmpDot3RptrMgt
        VARIABLES   { rptrOperStatus }
        DESCRIPTION
                "The rptrHealth trap conveys information related
                to the operational status of the repeater.  This
                trap is sent either when the value of
                rptrOperStatus changes, or upon completion of a
                non-disruptive test.

                The rptrHealth trap must contain the
                rptrOperStatus object.  The agent may optionally
                include the rptrHealthText object in the varBind
                list.  See the rptrOperStatus and rptrHealthText
                objects for descriptions of the information that
                is sent.
```

```
                The agent must throttle the generation of
                consecutive rptrHealth 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
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.4,
                hubHealth notification."
        ::= 1

    rptrGroupChange TRAP-TYPE
        ENTERPRISE  snmpDot3RptrMgt
        VARIABLES   { rptrGroupIndex }
        DESCRIPTION
                "This trap is sent when a change occurs in the
                group structure of a repeater.  This occurs only
                when a group is logically or physically removed
                from or added to a repeater.  The varBind list
                contains the identifier of the group that was
                removed or added.

                The agent must throttle the generation of
                consecutive rptrGroupChange traps for the same
                group 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
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.4,
                groupMapChange notification."
        ::= 2

    rptrResetEvent TRAP-TYPE
        ENTERPRISE  snmpDot3RptrMgt
        VARIABLES   { rptrOperStatus }
        DESCRIPTION
                "The rptrResetEvent trap conveys information
                related to the operational status of the repeater.
                This trap is sent on completion of a repeater
                reset action.  A repeater reset action is defined
                as an a transition to the START state of Fig 9-2
                in section 9 [IEEE 802.3 Std], when triggered by a
                management command (e.g., an SNMP Set on the
                rptrReset object).
```

```
                The agent must throttle the generation of
                consecutive rptrResetEvent 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.)

                The rptrResetEvent trap is not sent when the agent
                restarts and sends an SNMP coldStart or warmStart
                trap.  However, it is recommended that a repeater
                agent send the rptrOperStatus object as an
                optional object with its coldStart and warmStart
                trap PDUs.

                The rptrOperStatus object must be included in the
                varbind list sent with this trap.  The agent may
                optionally include the rptrHealthText object as
                well."
        REFERENCE
                "Reference IEEE 802.3 Rptr Mgt, 19.2.3.4, hubReset
                notification."
        ::= 3

    END
```

4. Changes from RFC 1368

(1) Added section 2.1.4, "Internal Ports and MAUs," that defines internal ports and clarifies how they may or may not be managed.

(2) Noted that the failure list for rptrOperStatus is ordered highest priority first.

(3) Clarified rptrReset description to indicate that the agent may briefly delay the reset action.

(4) For rptrReset, clarified the actions that the agent should take after performing the reset and self-test.

(5) For rptrNonDisruptTest, similar change to (3).

(6) Clarified that the rptrNonDisruptTest description allows returning "ok" after doing only a trivial test.

(7) Deprecated rptrAddrTrackLastSourceAddress and defined a

replacement object that has a zero-length value until the first frame is seen on the port.

(8) Clarified that rptrHealth trap is sent after rptrNonDisruptTest even if repeater health information doesn't change as a result of the test.

(9) Clarified text on throttling traps.

5. Acknowledgments

This document is the work of the IETF Hub MIB Working Group. It is based on drafts of the IEEE 802.3 Repeater Management Task Force.

6. References

[1] Rose M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based internets", STD 16, RFC 1155, Performance Systems International, Hughes LAN Systems, May 1990.

[2] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.

[3] McCloghrie K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets", STD 17, RFC 1213, Performance Systems International, March 1991.

[4] Information processing systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), International Organization for Standardization, International Standard 8824, December 1987.

[5] Rose, M., and K. McCloghrie, Editors, "Concise MIB Definitions", STD 16, RFC 1212, Performance Systems International, Hughes LAN Systems, March 1991.

[6] Rose, M., Editor, "A Convention for Defining Traps for use with the SNMP", RFC 1215, Performance Systems International, March 1991.

[7] IEEE 802.3/ISO 8802-3 - Information processing systems - Local area networks - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications, 2nd edition, 21 September 1990.

[8] IEEE P802.3K - Layer Management for 10 Mb/s Baseband Repeaters, Section 19, Draft Supplement to ANSI/IEEE 802.3, Draft 8, 9 April 1992.

7. Security Considerations

Security issues are not discussed in this memo.

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