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Definitions of Managed Objects for IEEE 802.3 Repeater Devices using SMIv2

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 and 100 Mb/second baseband repeaters based on IEEE Std 802.3 Section 30, "10 & 100 Mb/s Management," October 26, 1995.

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1. The SNMP Network Management Framework

The SNMP Network Management Framework presently consists of three major components. They are:

- the SMI, described in RFC 1902 [6] - the mechanisms used for describing and naming objects for the purpose of management.
- the MIB-II, STD 17, RFC 1213 [5] - the core set of managed objects for the Internet suite of protocols.
- the protocol, STD 15, RFC 1157 [10] and/or RFC 1905 [9] - the protocol used for accessing managed information.

Textual conventions are defined in RFC 1903 [7], and conformance statements are defined in RFC 1904 [8].

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 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

2.1. Relationship to RFC 1516

This MIB is intended as a superset of that defined by RFC 1516 [11], which will go to historic status. This MIB includes all of the objects contained in that MIB, plus several new ones which provide

for significant additional capabilities. Implementors are encouraged to support all applicable conformance groups in order to make the best use of the new functionality provided by this MIB. The new objects provide support for:

- o multiple repeaters
- o 100BASE-T management
- o port TopN capability
- o address search and topology mapping

Certain objects have been deprecated; in particular, those scalar objects used for managing a single repeater are now of minimal use since they are duplicated in the new multiple- repeater definitions. Additional objects have been deprecated based on implementation experience with RFC 1516.

2.2. Repeater Management

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 [1], and Section 27, "Repeater for 100 Mb/s Baseband Networks" in the IEEE Standard 802.3u-1995 [2].

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 Section 30.4, "Layer Management for 10 and 100 Mb/s Baseband Repeaters" and Annex 30A, "GDMO Specificataions for 802.3 managed objects" of [3].

Implementors of these MIB objects should note that [3] 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 [3], with the intention that the same instrumentation can be used to implement both the IEEE and IETF management standards.

2.3. Structure of the MIB

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

2.3.1. Basic Definitions

The basic definitions include objects which are applicable to all repeaters: status, parameter and control objects for each repeater within the managed system, for the port groups within the system, and for the individual ports themselves.

2.3.2. Monitor Definitions

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

2.3.3. Address Tracking Definitions

This collection includes objects for tracking the MAC addresses of the DTEs attached to the ports within the system and for mapping the topology of a network.

Note: These definitions are based on a technology which has been patented by Hewlett-Packard Company. HP has granted rights to this technology to implementors of this MIB. See [12] and [13] for details.

2.3.4. Top N Definitions

These objects may be used for tracking the ports with the most activity within the system or within particular repeaters.

2.4. Relationship to Other MIBs

2.4.1. 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].

2.4.1.1. 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.

2.4.1.2. 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. 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 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.)

3. Definitions

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

   IMPORTS
       Counter32, Counter64, Integer32, Gauge32, TimeTicks,
       OBJECT-TYPE, MODULE-IDENTITY, NOTIFICATION-TYPE, mib-2
           FROM SNMPv2-SMI
       TimeStamp, DisplayString, MacAddress, TEXTUAL-CONVENTION,
       RowStatus, TestAndIncr
           FROM SNMPv2-TC
       OBJECT-GROUP, MODULE-COMPLIANCE
           FROM SNMPv2-CONF
       OwnerString
           FROM IF-MIB;


   snmpRptrMod MODULE-IDENTITY
       LAST-UPDATED    "9609140000Z"
       ORGANIZATION    "IETF HUB MIB Working Group"
       CONTACT-INFO
           "WG E-mail: hubmib@hprnd.rose.hp.com

                Chair: Dan Romascanu
              Postal: Madge Networks (Israel) Ltd.
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                      118 Turnpike Rd.
                      Southborough, MA 01772 USA
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              E-mail: kdegraaf@isd.3com.com"
       DESCRIPTION
           "Management information for 802.3 repeaters.

           The following references are used throughout
           this MIB module:

           [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 (1993).

[IEEE 802.3 Mgt]
refers to IEEE 802.3u-1995, '10 Mb/s &
100 Mb/s Management, Section 30,'
Supplement to ANSI/IEEE 802.3.

The following terms are used throughout this MIB module. For complete formal definitions, the IEEE 802.3 standards should be consulted wherever possible:

System - A managed entity compliant with this MIB, and incorporating at least one managed 802.3 repeater.

Chassis - An enclosure for one managed repeater, part of a managed repeater, or several managed repeaters. It typically contains an integral power supply and a variable number of available module slots.

Repeater-unit - The portion of the repeater set that is inboard of the physical media interfaces. The physical media interfaces (MAUs, AUIs) may be physically separated from the repeater-unit, or they may be integrated into the same physical package.

Trivial repeater-unit - An isolated port that can gather statistics.

Group - A recommended, but optional, entity defined by the IEEE 802.3 management standard, in order to support a modular numbering scheme. The classical example allows an implementor to represent field-replaceable units as groups of ports, with the port numbering matching the modular hardware implementation.

System interconnect segment - An internal segment allowing interconnection of ports belonging to different physical entities into the same logical manageable repeater. Examples of implementation might be backplane busses in modular hubs, or chaining cables in stacks of hubs.

```
            Stack - A scalable system that may include
            managed repeaters, in which modularity is
            achieved by interconnecting a number of
            different chassis.

            Module - A building block in a modular
            chassis.  It typically maps into one 'slot';
            however, the range of configurations may be
            very large, with several modules entering
            one slot, or one module covering several
            slots.
            "
        REVISION "9309010000Z"
        DESCRIPTION
            "Published as RFC 1516"
        REVISION "9210010000Z"
        DESCRIPTION
            "Published as RFC 1368"
        ::= { snmpDot3RptrMgt 5 }



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


    OptMacAddr ::= TEXTUAL-CONVENTION
        DISPLAY-HINT    "1x:"
        STATUS          current
        DESCRIPTION
            "Either a 6 octet address in the 'canonical'
            order defined by IEEE 802.1a, i.e., as if it
            were transmitted least significant bit first
            if a value is available or a zero length string."
        REFERENCE
            "See MacAddress in SNMPv2-TC. The only difference
            is that a zero length string is allowed as a value
            for OptMacAddr and not for MacAddress."
        SYNTAX OCTET STRING (SIZE (0 | 6))



    -- Basic information at the repeater, group, and port level.

    rptrBasicPackage
        OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 1 }
      rptrRptrInfo
            OBJECT IDENTIFIER ::= { rptrBasicPackage 1 }
      rptrGroupInfo
```

```
            OBJECT IDENTIFIER ::= { rptrBasicPackage 2 }
      rptrPortInfo
            OBJECT IDENTIFIER ::= { rptrBasicPackage 3 }
      rptrAllRptrInfo
            OBJECT IDENTIFIER ::= { rptrBasicPackage 4 }

   -- Monitoring information at the repeater, group, and port level.
   rptrMonitorPackage
       OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 2 }
      rptrMonitorRptrInfo
            OBJECT IDENTIFIER ::= { rptrMonitorPackage 1 }
      rptrMonitorGroupInfo
            OBJECT IDENTIFIER ::= { rptrMonitorPackage 2 }
      rptrMonitorPortInfo
            OBJECT IDENTIFIER ::= { rptrMonitorPackage 3 }
      rptrMonitorAllRptrInfo
            OBJECT IDENTIFIER ::= { rptrMonitorPackage 4 }

   -- Address tracking information at the repeater, group,
   -- and port level.
   rptrAddrTrackPackage
       OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 3 }
      rptrAddrTrackRptrInfo
            OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 1 }
      rptrAddrTrackGroupInfo
            -- this subtree is currently unused
            OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 2 }
      rptrAddrTrackPortInfo
            OBJECT IDENTIFIER ::= { rptrAddrTrackPackage 3 }

   -- TopN information.
   rptrTopNPackage
            OBJECT IDENTIFIER ::= { snmpDot3RptrMgt 4 }
      rptrTopNRptrInfo
            -- this subtree is currently unused
            OBJECT IDENTIFIER ::= { rptrTopNPackage 1 }
      rptrTopNGroupInfo
            -- this subtree is currently unused
            OBJECT IDENTIFIER ::= { rptrTopNPackage 2 }
      rptrTopNPortInfo
            OBJECT IDENTIFIER ::= { rptrTopNPackage 3 }


   -- Old version of basic information at the repeater level.
   --
   -- In a system containing a single managed repeater,
   -- configuration, status, and control objects for the overall
   -- repeater.
```

```
   --
   -- The objects contained under the rptrRptrInfo subtree are
   -- intended for backwards compatibility with implementations of
   -- RFC 1516 [11].  In newer implementations (both single- and
   -- multiple-repeater implementations) the rptrInfoTable should
   -- be implemented.  It is the preferred source of this information,
   -- as it contains the values for all repeaters managed by the
   -- agent.  In all cases, the objects in the rptrRptrInfo subtree
   -- are duplicates of the corresponding objects in the first entry
   -- of the rptrInfoTable.

   rptrGroupCapacity OBJECT-TYPE
       SYNTAX      Integer32 (1..2147483647)
       MAX-ACCESS  read-only
       STATUS      deprecated
       DESCRIPTION
               "********** THIS OBJECT IS DEPRECATED **********

               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
               "[IEEE 802.3 Mgt], 30.4.1.1.3,
               aRepeaterGroupCapacity."
       ::= { rptrRptrInfo 1 }

   rptrOperStatus OBJECT-TYPE
       SYNTAX      INTEGER {
                     other(1),            -- undefined or unknown
                     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
```

```
                }
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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
                "[IEEE 802.3 Mgt], 30.4.1.1.5, aRepeaterHealthState."
        ::= { rptrRptrInfo 2 }

    rptrHealthText OBJECT-TYPE
        SYNTAX      DisplayString (SIZE (0..255))
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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
                "[IEEE 802.3 Mgt], 30.4.1.1.6, aRepeaterHealthText."
        ::= { rptrRptrInfo 3 }

    rptrReset OBJECT-TYPE
        SYNTAX      INTEGER {
                      noReset(1),
                      reset(2)
```

```
                }
        MAX-ACCESS  read-write
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                Setting this object to reset(2) causes a
                transition to the START state of Fig 9-2 in
                section 9 [IEEE 802.3 Std] for a 10Mb/s repeater,
                and the START state of Fig 27-2 in section 27
                of that standard for a 100Mb/s repeater.

                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
                "[IEEE 802.3 Mgt], 30.4.1.2.1, acResetRepeater."
        ::= { rptrRptrInfo 4 }

    rptrNonDisruptTest OBJECT-TYPE
        SYNTAX      INTEGER {
                      noSelfTest(1),
                      selfTest(2)
```

```
                }
        MAX-ACCESS  read-write
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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
                "[IEEE 802.3 Mgt], 30.4.1.2.2,
                acExecuteNonDisruptiveSelfTest."
        ::= { rptrRptrInfo 5 }

    rptrTotalPartitionedPorts OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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 }
```

```
   -- Basic information at the group level.
   --
   -- Configuration and status objects for each
   -- managed group in the system, independent
   -- of whether there is one or more managed
   -- repeater-units in the system.

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

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

   RptrGroupEntry ::=
       SEQUENCE {
           rptrGroupIndex
               Integer32,
           rptrGroupDescr
               DisplayString,
           rptrGroupObjectID
               OBJECT IDENTIFIER,
           rptrGroupOperStatus
               INTEGER,
           rptrGroupLastOperStatusChange
               TimeTicks,
           rptrGroupPortCapacity
               Integer32
       }

   rptrGroupIndex OBJECT-TYPE
       SYNTAX      Integer32 (1..2147483647)
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
               "This object identifies the group within the
```

```
                system for which this entry contains
                information."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.2.1.1, aGroupID."
        ::= { rptrGroupEntry 1 }

    rptrGroupDescr OBJECT-TYPE
        SYNTAX      DisplayString (SIZE (0..255))
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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
        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 FOIRL Plug-in Module.'"
        ::= { rptrGroupEntry 3 }

    rptrGroupOperStatus 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 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
      MAX-ACCESS  read-only
      STATUS      deprecated
      DESCRIPTION
              "********** THIS OBJECT IS DEPRECATED **********

              An object that contains the value of sysUpTime at
              the time when the last of the following occurred:
                1) the agent cold- or warm-started;
                2) the row for the group was created (such
                   as when the group was added to the system); or
                3) the value of rptrGroupOperStatus for the
                   group 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      Integer32 (1..2147483647)
      MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
                "The rptrGroupPortCapacity 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
                rptrGroupPortCapacity.

                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 rptrGroupPortCapacity.
                The number of ports present in the group will never
                be greater than the value of 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
                "IEEE 802.3 Mgt, 30.4.2.1.2, aGroupPortCapacity."
        ::= { rptrGroupEntry 6 }


    -- Basic information at the port level.
    --
    -- Configuration and status objects for
    -- each managed repeater port in the system,
    -- independent of whether there is one or more
    -- managed repeater-units in the system.

    rptrPortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "Table of descriptive and status information about
                the repeater ports in the system.  The number of
                entries is independent of the number of repeaters
                in the managed system."
        ::= { rptrPortInfo 1 }

    rptrPortEntry OBJECT-TYPE
        SYNTAX      RptrPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the table, containing information
                about a single port."
```

```
        INDEX    { rptrPortGroupIndex, rptrPortIndex }
        ::= { rptrPortTable 1 }

    RptrPortEntry ::=
        SEQUENCE {
            rptrPortGroupIndex
                Integer32,
            rptrPortIndex
                Integer32,
            rptrPortAdminStatus
                INTEGER,
            rptrPortAutoPartitionState
                INTEGER,
            rptrPortOperStatus
                INTEGER,
            rptrPortRptrId
                Integer32
        }

    rptrPortGroupIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifies the group containing the
                port for which this entry contains information."
        ::= { rptrPortEntry 1 }

    rptrPortIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        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
                rptrGroupPortCapacity for the associated group."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.1, aPortID."
        ::= { rptrPortEntry 2 }

    rptrPortAdminStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                      enabled(1),
                      disabled(2)
```

```
                }
        MAX-ACCESS  read-write
        STATUS      current
        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
                "[IEEE 802.3 Mgt], 30.4.3.1.2, aPortAdminState
                and 30.4.3.2.1, acPortAdminControl."
        ::= { rptrPortEntry 3 }

    rptrPortAutoPartitionState OBJECT-TYPE
        SYNTAX      INTEGER {
                      notAutoPartitioned(1),
                      autoPartitioned(2)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        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 Sections
                9 and 27 of [IEEE 802.3 Std].  They are not
                differentiated here."
        REFERENCE
```

```
                "[IEEE 802.3 Mgt], 30.4.3.1.3, aAutoPartitionState."
        ::= { rptrPortEntry 4 }

    rptrPortOperStatus  OBJECT-TYPE
        SYNTAX      INTEGER {
                      operational(1),
                      notOperational(2),
                      notPresent(3)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        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 }

    rptrPortRptrId OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifies the repeater to
                which this port belongs.  The repeater
                identified by a particular value of this object
                is the same as that identified by the same
                value of rptrInfoId.  A value of zero
                indicates that this port currently is not
                a member of any repeater."
        ::= { rptrPortEntry 6 }


    -- New version of basic information at the repeater level.
    --
    -- Configuration, status, and control objects for
    -- each managed repeater in the system.

    rptrInfoTable OBJECT-TYPE
```

```
        SYNTAX      SEQUENCE OF RptrInfoEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table of information about each
                non-trivial repeater. The number of entries
                depends on the physical configuration of the
                managed system."
        ::= { rptrAllRptrInfo 1 }

    rptrInfoEntry OBJECT-TYPE
        SYNTAX      RptrInfoEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the table, containing information
                about a single non-trivial repeater."
        INDEX    { rptrInfoId }
        ::= { rptrInfoTable 1 }

    RptrInfoEntry ::=
        SEQUENCE {
            rptrInfoId
                Integer32,
            rptrInfoRptrType
                INTEGER,
            rptrInfoOperStatus
                INTEGER,
            rptrInfoReset
                INTEGER,
            rptrInfoPartitionedPorts
                Gauge32,
            rptrInfoLastChange
                TimeStamp
        }

    rptrInfoId OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifies the repeater for which
                this entry contains information."
        ::= { rptrInfoEntry 1 }

    rptrInfoRptrType OBJECT-TYPE
        SYNTAX      INTEGER {
                      other(1),               -- undefined or unknown
```

```
                    tenMb(2),
                    onehundredMbClassI(3),
                    onehundredMbClassII(4)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
              "The rptrInfoRptrType returns a value that identifies
              the CSMA/CD repeater type."
      REFERENCE
              "[IEEE 802.3 Mgt], 30.4.1.1.2, aRepeaterType."
      ::= { rptrInfoEntry 2 }

   rptrInfoOperStatus OBJECT-TYPE
      SYNTAX      INTEGER {
                    other(1),
                    ok(2),
                    failure(3)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
              "The rptrInfoOperStatus object indicates the
              operational state of the repeater."
      REFERENCE
              "[IEEE 802.3 Mgt], 30.4.1.1.5, aRepeaterHealthState."
      ::= { rptrInfoEntry 3 }

   rptrInfoReset OBJECT-TYPE
      SYNTAX      INTEGER {
                    noReset(1),
                    reset(2)
                  }
      MAX-ACCESS  read-write
      STATUS      current
      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] for a 10Mb/s repeater,
              and to the START state of Fig 27-2 in section 27
              of that standard for a 100Mb/s repeater.

              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
                rptrInfoOperStatus), and send a rptrInfoResetEvent
                notification."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.1.2.1, acResetRepeater."
        ::= { rptrInfoEntry 4 }

    rptrInfoPartitionedPorts OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        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)."
        ::= { rptrInfoEntry 5 }

    rptrInfoLastChange 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 rptrInfoOperStatus;
                4) ports were added or removed as members of
                   the repeater; or
                5) any of the counters associated with this
                   repeater had a discontinuity."
        ::= { rptrInfoEntry 6 }




   --
   -- Old version of statistics at the repeater level.
   --
   -- Performance monitoring statistics for the repeater
   --
   -- In a system containing a single managed repeater-unit,
   -- the statistics object for the repeater-unit.

   -- The objects contained under the rptrMonitorRptrInfo subtree are
   -- intended for backwards compatibility with implementations of
   -- RFC 1516 [11].  In newer implementations (both single- and
   -- multiple-repeater implementations), the rptrMonitorTable will
   -- be implemented.  It is the preferred source of this information,
   -- as it contains the values for all repeaters managed by the
   -- agent.  In all cases, the objects in the rptrMonitorRptrInfo
   -- subtree are duplicates of the corresponding objects in the
   -- first entry of the rptrMonitorTable.


   rptrMonitorTransmitCollisions OBJECT-TYPE
       SYNTAX      Counter32
       MAX-ACCESS  read-only
       STATUS      deprecated
       DESCRIPTION
               "********** THIS OBJECT IS DEPRECATED **********

               For a clause 9 (10Mb/s) repeater, 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]).

               For a clause 27 repeater, this counter is
               incremented every time the repeater core state
               diagram enters the Jam state as a result of
               Activity(ALL) > 1 (fig 27-2 [IEEE 802.3 Std]).
```

```
                The approximate minimum time for rollover of this
                counter is 16 hours in a 10Mb/s repeater and 1.6
                hours in a 100Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.1.1.8, aTransmitCollisions."
        ::= { rptrMonitorRptrInfo 1 }


    -- Statistics at the group level.
    --
    -- In a system containing a single managed repeater-unit,
    -- the statistics objects for each group.

    rptrMonitorGroupTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrMonitorGroupEntry
        MAX-ACCESS  not-accessible
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                Table of performance and error statistics for the
                groups within the repeater.  The number of entries
                is the same as that in the rptrGroupTable."
        ::= { rptrMonitorGroupInfo 1 }

    rptrMonitorGroupEntry OBJECT-TYPE
        SYNTAX    RptrMonitorGroupEntry
        MAX-ACCESS  not-accessible
        STATUS    deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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.

                Note:  Group-level counters are
```

```
                deprecated in this MIB.  It is recommended
                that management applications instead use
                the repeater-level counters contained in
                the rptrMonTable."
        INDEX    { rptrMonitorGroupIndex }
        ::= { rptrMonitorGroupTable 1 }

    RptrMonitorGroupEntry ::=
        SEQUENCE {
            rptrMonitorGroupIndex
                Integer32,
            rptrMonitorGroupTotalFrames
                Counter32,
            rptrMonitorGroupTotalOctets
                Counter32,
            rptrMonitorGroupTotalErrors
                Counter32
        }

    rptrMonitorGroupIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                This object identifies the group within the
                repeater for which this entry contains
                information."
        ::= { rptrMonitorGroupEntry 1 }

    rptrMonitorGroupTotalFrames OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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 in a 10Mb/s repeater."
        ::= { rptrMonitorGroupEntry 2 }

    rptrMonitorGroupTotalOctets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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 in a
                10Mb/s repeater."
        ::= { rptrMonitorGroupEntry 3 }

    rptrMonitorGroupTotalErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                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 }


    -- Statistics at the port level.
    --

    rptrMonitorPortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrMonitorPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "Table of performance and error statistics for the
                ports.  The number of entries is the same as that
```

```
                in the rptrPortTable.

                The columnar object rptrMonitorPortLastChange
                is used to indicate possible discontinuities
                of counter type columnar objects in the table."
        ::= { rptrMonitorPortInfo 1 }

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

    RptrMonitorPortEntry ::=
        SEQUENCE {
            rptrMonitorPortGroupIndex
                Integer32,
            rptrMonitorPortIndex
                Integer32,
            rptrMonitorPortReadableFrames
                Counter32,
            rptrMonitorPortReadableOctets
                Counter32,
            rptrMonitorPortFCSErrors
                Counter32,
            rptrMonitorPortAlignmentErrors
                Counter32,
            rptrMonitorPortFrameTooLongs
                Counter32,
            rptrMonitorPortShortEvents
                Counter32,
            rptrMonitorPortRunts
                Counter32,
            rptrMonitorPortCollisions
                Counter32,
            rptrMonitorPortLateEvents
                Counter32,
            rptrMonitorPortVeryLongEvents
                Counter32,
            rptrMonitorPortDataRateMismatches
                Counter32,
            rptrMonitorPortAutoPartitions
                Counter32,
            rptrMonitorPortTotalErrors
```

```
            Counter32,
        rptrMonitorPortLastChange
            TimeStamp
    }

rptrMonitorPortGroupIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "This object identifies the group containing the
            port for which this entry contains information."
    ::= { rptrMonitorPortEntry 1 }

rptrMonitorPortIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "This object identifies the port within the group
            for which this entry contains information."
    REFERENCE
            "[IEEE 802.3 Mgt], 30.4.3.1.1, aPortID."
    ::= { rptrMonitorPortEntry 2 }

rptrMonitorPortReadableFrames OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    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.

            A discontinuity may occur in the value
            when the value of object
            rptrMonitorPortLastChange changes.

            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 at 10Mb/s."
    REFERENCE
```

```
                "[IEEE 802.3 Mgt], 30.4.3.1.4, aReadableFrames."
        ::= { rptrMonitorPortEntry 3 }

    rptrMonitorPortReadableOctets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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).

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                This statistic provides an indicator of the total
                data transferred.  The approximate minimum time
                for rollover of this counter in a 10Mb/s repeater
                is 58 minutes.

                For ports receiving traffic at a maximum rate in
                a 100Mb/s repeater, this counter can roll over
                in less than 6 minutes.  Since that amount of time
                could be less than a management station's poll cycle
                time, in order to avoid a loss of information a
                management station is advised to also poll the
                rptrMonitorPortUpper32Octets object, or to use the
                64-bit counter defined by
                rptrMonitorPortHCReadableOctets instead of the
                two 32-bit counters."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.5, aReadableOctets."
        ::= { rptrMonitorPortEntry 4 }

    rptrMonitorPortFCSErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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).

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 80 hours at 10Mb/s."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.6,
                aFrameCheckSequenceErrors."
        ::= { rptrMonitorPortEntry 5 }

    rptrMonitorPortAlignmentErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 80 hours at 10Mb/s."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.7, aAlignmentErrors."
        ::= { rptrMonitorPortEntry 6 }

    rptrMonitorPortFrameTooLongs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 61 days in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.8, aFramesTooLong."
        ::= { rptrMonitorPortEntry 7 }

    rptrMonitorPortShortEvents OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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.

                Notes:

                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 significance of this attribute is different
                in 10 and 100 Mb/s collision domains.  Clause 9
                repeaters perform fragment extension of short
```

```
                events which would be counted as runts on the
                interconnect ports of other repeaters.  Clause
                27 repeaters do not perform fragment extension.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 16 hours in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.9, aShortEvents."
        ::= { rptrMonitorPortEntry 8 }

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

```
                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 16 hours in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.10, aRunts."
        ::= { rptrMonitorPortEntry 9 }

    rptrMonitorPortCollisions OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "For a clause 9 repeater, this counter is
                incremented by one for any CarrierEvent signal
                on any port for which the CollisionEvent signal
                on this port is asserted.  For a clause 27
                repeater port the counter increments on entering
                the Collision Count Increment state of the
                partition state diagram (fig 27-8 of
                [IEEE 802.3 Std]).

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 16 hours in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.11, aCollisions."
        ::= { rptrMonitorPortEntry 10 }

    rptrMonitorPortLateEvents OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "For a clause 9 repeater port, 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.  For a clause 27 repeater
                port, this counter is incremented by one on
                entering the Collision Count Increment state
```

```
                of the  partition state diagram (fig 27-8)
                while the  ActivityDuration is greater than
                the LateEvent- Threshold.  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.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 81 hours in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.12, aLateEvents."
        ::= { rptrMonitorPortEntry 11 }

    rptrMonitorPortVeryLongEvents OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "For a clause 9 repeater port, this counter
                is incremented by one for each CarrierEvent
                whose ActivityDuration is greater than the
                MAU Jabber Lockup Protection timer TW3
                (Ref: 9.6.1 & 9.6.5, IEEE 802.3 Std).

                For a clause 27 repeater port, this counter
                is incremented by one on entry to the
                Rx Jabber state of the receiver timer state
                diagram (fig 27-7).  Other counters may
                be incremented as appropriate.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.13, aVeryLongEvents."
        ::= { rptrMonitorPortEntry 12 }

    rptrMonitorPortDataRateMismatches OBJECT-TYPE
```

```
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This counter is incremented by one for each
                frame received by this port that meets all
                of the conditions required by only one of the
                following two measurement methods:

                Measurement method A:  1) The CollisionEvent
                signal is not asserted (10Mb/s operation) or
                the Collision Count Increment state of the
                partition state diagram (fig 27-8 of
                [IEEE 802.3 Std]) has not been entered
                (100Mb/s operation).  2) The ActivityDuration
                is greater than ValidPacketMinTime.  3) The
                frequency (data rate) is detectably mismatched
                from the local transmit frequency.

                Measurement method B:  1) The CollisionEvent
                signal is not asserted (10Mb/s operation)
                or the Collision Count Increment state of the
                partition state diagram (fig 27-8 of
                [IEEE 802.3 Std]) has not been entered
                (100Mb/s operation).  2) The OctetCount is
                greater than 63.  3) 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.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.14, aDataRateMismatches."
        ::= { rptrMonitorPortEntry 13 }

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

```
        STATUS      current
        DESCRIPTION
                "This counter is incremented by one for
                each time the repeater has automatically
                partitioned this port.

                The conditions that cause a clause 9
                repeater port to partition are specified in
                the partition state diagram in clause 9 of
                [IEEE 802.3 Std].  They are not differentiated
                here.  A clause 27 repeater port partitions
                on entry to the Partition Wait state of the
                partition state diagram (fig 27-8 in
                [IEEE 802.3 Std]).

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.15, aAutoPartitions."
        ::= { rptrMonitorPortEntry 14 }

    rptrMonitorPortTotalErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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,
                    rptrMonitorPortDataRateMismatches, and
                    rptrMonitorPortSymbolErrors.

                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.

                Note that rptrMonitorPortRunts is not included
                in this total; this is because runts usually
                indicate collision fragments, a normal network
                event.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        ::= { rptrMonitorPortEntry 15 }

    rptrMonitorPortLastChange 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."
        ::= { rptrMonitorPortEntry 16 }

    rptrMonitor100PortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrMonitor100PortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "Table of additional performance and error
                statistics for 100Mb/s ports, above and
                beyond those parameters that apply to both
                10 and 100Mbps ports.  Entries exist only for
                ports attached to 100Mbps repeaters.

                The columnar object rptrMonitorPortLastChange
                is used to indicate possible discontinuities
                of counter type columnar objects in this table."
        ::= { rptrMonitorPortInfo 2 }

    rptrMonitor100PortEntry OBJECT-TYPE
        SYNTAX      RptrMonitor100PortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
```

```
        DESCRIPTION
                "An entry in the table, containing performance
                and error statistics for a single 100Mb/s port."
        INDEX    { rptrMonitorPortGroupIndex, rptrMonitorPortIndex }
        ::= { rptrMonitor100PortTable 1 }

    RptrMonitor100PortEntry ::=
        SEQUENCE {
            rptrMonitorPortIsolates
                Counter32,
            rptrMonitorPortSymbolErrors
                Counter32,
            rptrMonitorPortUpper32Octets
                Counter32,
            rptrMonitorPortHCReadableOctets
                Counter64
        }

    rptrMonitorPortIsolates OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This counter is incremented by one each time that
                the repeater port automatically isolates as a
                consequence of false carrier events.  The conditions
                which cause a port to automatically isolate are
                defined by the transition from the False Carrier
                state to the Link Unstable state of the carrier
                integrity state diagram (figure 27-9)
                [IEEE 802.3 Standard].

                Note:  Isolates do not affect the value of
                the PortOperStatus object.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.16, aIsolates."
        ::= { rptrMonitor100PortEntry 1 }

    rptrMonitorPortSymbolErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This counter is incremented by one each time when
```

```
                valid length packet was received at the port and
                there was at least one occurrence of an invalid
                data symbol. This can increment only once per valid
                carrier event. A collision presence at any port of
                the repeater containing port N, will not cause this
                attribute to increment.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 7.4 hours at 100Mb/s."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.17,
                aSymbolErrorDuringPacket."
        ::= { rptrMonitor100PortEntry 2 }

    rptrMonitorPortUpper32Octets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object is the number of octets contained in
                valid frames that have been received on this port,
                modulo 2**32.  That is, it contains the upper 32
                bits of a 64-bit octets counter, of which the
                lower 32 bits are contained in the
                rptrMonitorPortReadableOctets object.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMP V1) and are used to
                manage a repeater type of 100Mb/s.

                Conformance clauses for this MIB are defined such
                that implementation of this object is not required
                in a system which does not support 100Mb/s.
                However, systems with mixed 10 and 100Mb/s ports
                may implement this object across all ports,
                including 10Mb/s.  If this object is implemented,
                it must be according to the definition in the first
                paragraph of this description; that is, the value
                of this object MUST be a valid count.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
```

```
        ::= { rptrMonitor100PortEntry 3 }

    rptrMonitorPortHCReadableOctets OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        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.

                This counter is a 64-bit version of rptrMonitor-
                PortReadableOctets. It should be used by network
                management protocols which suppport 64-bit counters
                (e.g. SNMPv2).

                Conformance clauses for this MIB are defined such
                that implementation of this object is not required
                in a system which does not support 100Mb/s.
                However, systems with mixed 10 and 100Mb/s ports
                may implement this object across all ports,
                including 10Mb/s.  If this object is implemented,
                it must be according to the definition in the first
                paragraph of this description; that is, the value
                of this object MUST be a valid count.

                A discontinuity may occur in the value
                when the value of object
                rptrMonitorPortLastChange changes."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.5, aReadableOoctets."
        ::= { rptrMonitor100PortEntry 4 }


    -- New version of statistics at the repeater level.
    --
    -- Statistics objects for each managed repeater
    -- in the system.

    rptrMonTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrMonEntry
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table of information about each
                non-trivial repeater.  The number of entries
                in this table is the same as the number of
                entries in the rptrInfoTable.

                The columnar object rptrInfoLastChange is
                used to indicate possible discontinuities of
                counter type columnar objects in this table."
        ::= { rptrMonitorAllRptrInfo 1 }

    rptrMonEntry OBJECT-TYPE
        SYNTAX      RptrMonEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the table, containing information
                about a single non-trivial repeater."
        INDEX    { rptrInfoId }
        ::= { rptrMonTable 1 }

    RptrMonEntry ::=
        SEQUENCE {
            rptrMonTxCollisions
                Counter32,
            rptrMonTotalFrames
                Counter32,
            rptrMonTotalErrors
                Counter32,
            rptrMonTotalOctets
                Counter32
        }

    rptrMonTxCollisions OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "For a clause 9 (10Mb/s) repeater, 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]).

                For a clause 27 repeater, this counter is
                incremented every time the repeater core state
```

```
                diagram enters the Jam state as a result of
                Activity(ALL) > 1 (fig 27-2 [IEEE 802.3 Std]).

                The approximate minimum time for rollover of this
                counter is 16 hours in a 10Mb/s repeater and 1.6
                hours in a 100Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.1.1.8, aTransmitCollisions"
        ::= { rptrMonEntry 1 }

    rptrMonTotalFrames OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The number of frames of valid frame length
                that have been received on the ports in this repeater
                and for which the FCSError and CollisionEvent
                signals were not asserted.  If an implementation
                can not obtain a count of frames as seen by
                the repeater itself, this counter may be
                implemented as the summation of the values of the
                rptrMonitorPortReadableFrames counters for all of
                the ports in the repeater.

                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 in a 10Mb/s repeater."
        ::= { rptrMonEntry 3 }

    rptrMonTotalErrors 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.  The errors
                included in this count are the same as those listed
                for the rptrMonitorPortTotalErrors counter.  If an
                implementation can not 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 rptrMonitorPortTotalErrors counters for all of
                the ports in the repeater."
        ::= { rptrMonEntry 4 }

    rptrMonTotalOctets OBJECT-TYPE
```

```
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of octets contained in the valid
                frames that have been received on the ports in
                this group.  If an implementation can not obtain
                a count of octets as seen by the repeater itself,
                this counter may be 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 in a 10Mb/s repeater
                is 58 minutes divided by the number of ports in
                the repeater.

                For 100Mb/s repeaters processing traffic at a
                maximum rate, this counter can roll over in less
                than 6 minutes divided by the number of ports in
                the repeater.  Since that amount of time could
                be less than a management station's poll cycle
                time, in order to avoid a loss of information a
                management station is advised to also poll the
                rptrMonUpper32TotalOctets object, or to use the
                64-bit counter defined by rptrMonHCTotalOctets
                instead of the two 32-bit counters."
        ::= { rptrMonEntry 5 }

    rptrMon100Table OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrMon100Entry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table of additional information about each
                100Mb/s repeater, augmenting the entries in
                the rptrMonTable.  Entries exist in this table
                only for 100Mb/s repeaters.

                The columnar object rptrInfoLastChange is
                used to indicate possible discontinuities of
                counter type columnar objects in this table."
        ::= { rptrMonitorAllRptrInfo 2 }

    rptrMon100Entry OBJECT-TYPE
        SYNTAX      RptrMon100Entry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
                "An entry in the table, containing information
                about a single 100Mbps repeater."
        INDEX    { rptrInfoId }
        ::= { rptrMon100Table 1 }

    RptrMon100Entry ::=
        SEQUENCE {
            rptrMonUpper32TotalOctets
                Counter32,
            rptrMonHCTotalOctets
                Counter64
        }

    rptrMonUpper32TotalOctets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of octets contained in the valid
                frames that have been received on the ports in
                this repeater, modulo 2**32.  That is, it contains
                the upper 32 bits of a 64-bit counter, of which
                the lower 32 bits are contained in the
                rptrMonTotalOctets object.  If an implementation
                can not obtain a count of octets as seen
                by the repeater itself, the 64-bit value
                may be the summation of the values of the
                rptrMonitorPortReadableOctets counters combined
                with the corresponding rptrMonitorPortUpper32Octets
                counters for all of the ports in the repeater.

                This statistic provides an indicator of the total
                data transferred within the repeater.

                This two-counter mechanism is provided for those
                network management protocols that do not support
                64-bit counters (e.g. SNMP V1) and are used to
                manage a repeater type of 100Mb/s.

                Conformance clauses for this MIB are defined such
                that implementation of this object is not required
                in a system which does not support 100Mb/s.
                However, systems with mixed 10 and 100Mb/s ports
                may implement this object across all ports,
                including 10Mb/s.  If this object is implemented,
                it must be according to the definition in the first
```

```
                paragraph of this description; that is, the value
                of this object MUST be a valid count."
        ::= { rptrMon100Entry 1 }

    rptrMonHCTotalOctets OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of octets contained in the valid
                frames that have been received on the ports in
                this group.  If a implementation can not obtain
                a count of octets as seen by the repeater itself,
                this counter may be 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.

                This counter is a 64-bit (high-capacity) version
                of rptrMonUpper32TotalOctets and rptrMonTotalOctets.
                It should be used by network management protocols
                which support 64-bit counters (e.g. SNMPv2).

                Conformance clauses for this MIB are defined such
                that implementation of this object is not required
                in a system which does not support 100Mb/s.
                However, systems with mixed 10 and 100Mb/s ports
                may implement this object across all ports,
                including 10Mb/s.  If this object is implemented,
                it must be according to the definition in the first
                paragraph of this description; that is, the value
                of this object MUST be a valid count."
        ::= { rptrMon100Entry 2 }


    --
    -- The Repeater Address Search Table
    --
    -- This table provides an active address tracking
    -- capability which can be also used to collect the
    -- necessary information for mapping the topology
    -- of a network.  Note that an NMS is required to have
    -- read-write access to the table in order to access
    -- this function.  Section 4, "Topology Mapping",
    -- contains a description of an algorithm which can
    -- make use of this table, in combination with the
```

```
   -- forwarding databases of managed bridges/switches
   -- in the network, to map network topology.
   --

   rptrAddrSearchTable OBJECT-TYPE
       SYNTAX     SEQUENCE OF RptrAddrSearchEntry
       MAX-ACCESS not-accessible
       STATUS     current
       DESCRIPTION
               "This table contains one entry per repeater in the
               system.  It defines objects which allow a network
               management application to instruct an agent to watch
               for a given MAC address and report which port it
               was seen on.  Only one address search can be in
               progress on each repeater at any one time.  Before
               starting an address search, a management application
               should obtain 'ownership' of the entry in
               rptrAddrSearchTable for the repeater that is to
               perform the search.  This is accomplished with the
               rptrAddrSearchLock and rptrAddrSearchStatus as
               follows:

               try_again:
                   get(rptrAddrSearchLock, rptrAddrSearchStatus)
                   while (rptrAddrSearchStatus != notInUse)
                   {
                       /* Loop waiting for objects to be available*/
                       short delay
                       get(rptrAddrSearchLock, rptrAddrSearchStatus)
                   }

                   /* Try to claim map objects */
                   lock_value = rptrAddrSearchLock
                   if ( set(rptrAddrSearchLock = lock_value,
                            rptrAddrSearchStatus = inUse,
                            rptrAddrSearchOwner = 'my-IP-address)
                     == FAILURE)
                       /* Another manager got the lock */
                       goto try_again

                   /* I have the lock */
                   set (rptrAddrSearchAddress = <search target>)

                   wait for rptrAddrSearchState to change from none

                   if (rptrAddrSearchState == single)
                       get (rptrAddrSearchGroup, rptrAddrSearchPort)
```

```
                    /* release the lock, making sure not to overwrite
                       anyone else's lock */
                    set (rptrAddrSearchLock = lock_value+1,
                         rptrAddrSearchStatus = notInUse,
                         rptrAddrSearchOwner = '')
```

A management station first retrieves the values of the appropriate instances of the rptrAddrSearchLock and rptrAddrSearchStatus objects, periodically repeating the retrieval if necessary, until the value of rptrAddrSearchStatus is 'notInUse'. The management station then tries to set the same instance of the rptrAddrSearchLock object to the value it just retrieved, the same instance of the rptrAddrSearchStatus object to 'inUse', and the corresponding instance of rptrAddrSearchOwner to a value indicating itself. If the set operation succeeds, then the management station has obtained ownership of the rptrAddrSearchEntry, and the value of rptrAddrSearchLock is incremented by the agent (as per the semantics of TestAndIncr). Failure of the set operation indicates that some other manager has obtained ownership of the rptrAddrSearchEntry.

Once ownership is obtained, the management station can proceed with the search operation. Note that the agent will reset rptrAddrSearchStatus to 'notInUse' if it has been in the 'inUse' state for an abnormally long period of time, to prevent a misbehaving manager from permanently locking the entry. It is suggested that this timeout period be between one and five minutes.

When the management station has completed its search operation, it should free the entry by setting the instance of the rptrAddrSearchLock object to the previous value + 1, the instance of the rptrAddrSearchStatus to 'notInUse', and the instance of rptrAddrSearchOwner to a zero length string. This is done to prevent overwriting another station's lock."

```
    ::= { rptrAddrTrackRptrInfo 1 }

rptrAddrSearchEntry OBJECT-TYPE
    SYNTAX     RptrAddrSearchEntry
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
```

```
                "An entry containing objects for invoking an address
                search on a repeater."
        INDEX       { rptrInfoId }
        ::= { rptrAddrSearchTable 1 }

    RptrAddrSearchEntry ::=
        SEQUENCE {
            rptrAddrSearchLock     TestAndIncr,
            rptrAddrSearchStatus   INTEGER,
            rptrAddrSearchAddress  MacAddress,
            rptrAddrSearchState    INTEGER,
            rptrAddrSearchGroup    Integer32,
            rptrAddrSearchPort     Integer32,
            rptrAddrSearchOwner    OwnerString
        }


    rptrAddrSearchLock OBJECT-TYPE
        SYNTAX     TestAndIncr
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "This object is used by a management station as an
                advisory lock for this rptrAddrSearchEntry."
        ::= { rptrAddrSearchEntry 1 }

    rptrAddrSearchStatus  OBJECT-TYPE
        SYNTAX     INTEGER {
                       notInUse(1),
                       inUse(2)
                   }
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "This object is used to indicate that some management
                station is currently using this rptrAddrSearchEntry.
                Cooperating managers should set this object to
                'notInUse' when they are finished using this entry.
                The agent will automatically set the value of this
                object to 'notInUse' if it has been set to 'inUse'
                for an unusually long period of time."
        ::= { rptrAddrSearchEntry 2 }

    rptrAddrSearchAddress OBJECT-TYPE
        SYNTAX     MacAddress
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
```

```
                "This object is used to search for a specified MAC
                address.  When this object is set, an address search
                begins.  This automatically sets the corresponding
                instance of the rptrAddrSearchState object  to 'none'
                and the corresponding instances of the
                rptrAddrSearchGroup and rptrAddrSearchPort objects to
                0.

                When a valid frame is received by this repeater with
                a source MAC address which matches the current value
                of rptrAddrSearchAddress, the agent will update the
                corresponding instances of rptrAddrSearchState,
                rptrAddrSearchGroup and rptrAddrSearchPort to reflect
                the current status of the search, and the group and
                port on which the frame was seen."
        ::= { rptrAddrSearchEntry 3 }

    rptrAddrSearchState OBJECT-TYPE
        SYNTAX     INTEGER {
                        none(1),
                        single(2),
                        multiple(3)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The current state of the MAC address search on this
                repeater.  This object is initialized to 'none' when
                the corresponding instance of rptrAddrSearchAddress
                is set.  If the agent detects the address on exactly
                one port, it will set this object to 'single', and
                set the corresponding instances of
                rptrAddrSearchGroup and rptrAddrSearchPort to reflect
                the group and port on which the address was heard.
                If the agent detects the address on more than one
                port, it will set this object to 'multiple'."
        ::= { rptrAddrSearchEntry 4 }

    rptrAddrSearchGroup OBJECT-TYPE
        SYNTAX     Integer32 (0..2147483647)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The group from which an error-free frame whose
                source address is equal to the corresponding instance
                of rptrAddrSearchAddress has been received.  The
                value of this object is undefined when the
                corresponding instance of rptrAddrSearchState is
```

```
                equal to 'none' or 'multiple'."
        ::= { rptrAddrSearchEntry 5 }

    rptrAddrSearchPort OBJECT-TYPE
        SYNTAX     Integer32 (0..2147483647)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The port rom which an error-free frame whose
                source address is equal to the corresponding instance
                of rptrAddrSearchAddress has been received.  The
                value of this object is undefined when the
                corresponding instance of rptrAddrSearchState is
                equal to 'none' or 'multiple'."
        ::= { rptrAddrSearchEntry 6 }

    rptrAddrSearchOwner OBJECT-TYPE
        SYNTAX     OwnerString
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The entity which currently has 'ownership' of this
                rptrAddrSearchEntry."
        ::= { rptrAddrSearchEntry 7 }


    --
    -- The Port Address Tracking Table
    --
    -- This table provides a way for a network management
    -- application to passively gather information (using
    -- read-only privileges) about which network addresses
    -- are connected to which ports of a repeater.
    --

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

    rptrAddrTrackEntry OBJECT-TYPE
        SYNTAX      RptrAddrTrackEntry
        MAX-ACCESS  not-accessible
        STATUS      current
```

```
        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
                Counter32,
            rptrAddrTrackNewLastSrcAddress
                OptMacAddr,
            rptrAddrTrackCapacity
                Integer32
        }

    rptrAddrTrackGroupIndex OBJECT-TYPE
        SYNTAX      INTEGER (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifies the group containing the
                port for which this entry contains information."
        ::= { rptrAddrTrackEntry 1 }

    rptrAddrTrackPortIndex OBJECT-TYPE
        SYNTAX      INTEGER (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifies the port within the group
                for which this entry contains information."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.1, aPortID."
        ::= { rptrAddrTrackEntry 2 }

    rptrAddrTrackLastSourceAddress OBJECT-TYPE
        SYNTAX      MacAddress
        MAX-ACCESS  read-only
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********
```

```
                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
                "[IEEE 802.3 Mgt], 30.4.3.1.18, aLastSourceAddress."
        ::= { rptrAddrTrackEntry 3 }

    rptrAddrTrackSourceAddrChanges OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        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.

                A discontinuity may occur in the value when the
                value of object rptrMonitorPortLastChange changes.

                The approximate minimum time for rollover of this
                counter is 81 hours in a 10Mb/s repeater."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.19, aSourceAddressChanges."
        ::= { rptrAddrTrackEntry 4 }

    rptrAddrTrackNewLastSrcAddress OBJECT-TYPE
        SYNTAX      OptMacAddr
        MAX-ACCESS  read-only
        STATUS      current
        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
                "[IEEE 802.3 Mgt], 30.4.3.1.18, aLastSourceAddress."
```

```
        ::= { rptrAddrTrackEntry 5 }

    rptrAddrTrackCapacity OBJECT-TYPE
        SYNTAX      Integer32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The maximum number of addresses that can be
                detected on this port. This value indicates
                to the maximum  number of entries in the
                rptrExtAddrTrackTable relative to this port.

                If this object has the value of 1, the agent
                implements only the LastSourceAddress mechanism
                described by RFC 1368 or RFC 1516."
        ::= { rptrAddrTrackEntry 6 }


    -- Table for multiple addresses per port

    rptrExtAddrTrackTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrExtAddrTrackEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table to extend the address tracking table (i.e.,
                rptrAddrTrackTable) with a list of source MAC
                addresses that were recently received on each port.
                The number of ports is the same as the number
                of entries in table rptrPortTable. The number of
                entries in this table depends on the agent/repeater
                implementation and the number of different
                addresses received on each port.

                The first entry for each port contains
                the same MAC address that is given by the
                rptrAddrTrackNewLastSrcAddress for that port.

                Entries in this table for a particular port are
                retained when that port is switched from one
                repeater to another.

                The ordering of MAC addresses listed for a
                particular port is implementation dependent."
        ::= { rptrAddrTrackPortInfo 2 }

    rptrExtAddrTrackEntry OBJECT-TYPE
        SYNTAX      RptrExtAddrTrackEntry
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A row in the table of extended address tracking
                information for ports. Entries can not be directly
                created or deleted via SNMP operations."
        INDEX       { rptrAddrTrackGroupIndex,
                      rptrAddrTrackPortIndex,
                      rptrExtAddrTrackMacIndex }
        ::= { rptrExtAddrTrackTable 1 }

    RptrExtAddrTrackEntry ::= SEQUENCE {
        rptrExtAddrTrackMacIndex Integer32,
        rptrExtAddrTrackSourceAddress MacAddress
        }

    rptrExtAddrTrackMacIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The index of a source MAC address seen on
                the port.

                The ordering of MAC addresses listed for a
                particular port is implementation dependent.

                There is no implied relationship between a
                particular index and a particular MAC
                address.  The index for a particular MAC
                address may change without notice."
        ::= { rptrExtAddrTrackEntry 1 }

    rptrExtAddrTrackSourceAddress OBJECT-TYPE
        SYNTAX      MacAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The source MAC address from a readable frame
                (i.e., counted by rptrMonitorPortReadableFrames)
                recently received by the port."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.3.1.18, aLastSourceAddress."
        ::= { rptrExtAddrTrackEntry 2 }


    -- The Repeater Top "N" Port Group
```

```
   -- The Repeater Top N Port group is used to prepare reports that
   -- describe a list of ports ordered by one of the statistics in the
   -- Repeater Monitor Port Table.  The statistic chosen by the
   -- management station is sampled over a management
   -- station-specified time interval, making the report rate based.
   -- The management station also specifies the number of ports that
   -- are reported.
   --
   -- The rptrTopNPortControlTable is used to initiate the generation
   -- of a report.  The management station may select the parameters
   -- of such a report, such as which repeater, which statistic, how
   -- many ports, and the start & stop times of the sampling.  When
   -- the report is prepared, entries are created in the
   -- rptrTopNPortTable associated with the relevent
   -- rptrTopNControlEntry.  These entries are static for
   -- each report after it has been prepared.

   -- Note that counter discontinuities may appear in some
   -- implementations if ports' assignment to repeaters changes
   -- during the collection of data for a Top "N" report.
   -- A management application could read the corresponding
   -- rptrMonitorPortLastChange timestamp in order to check
   -- whether a discontinuity occurred.


   rptrTopNPortControlTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF RptrTopNPortControlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "A table of control records for reports on the top 'N'
           ports for the rate of a selected counter. The number
           of entries depends on the configuration of the agent.
           The maximum number of entries is implementation
           dependent."
       ::= { rptrTopNPortInfo 1 }

   rptrTopNPortControlEntry OBJECT-TYPE
       SYNTAX      RptrTopNPortControlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
               "A set of parameters that control the creation of a
               report of the top N ports according to several metrics."
       INDEX    { rptrTopNPortControlIndex }
       ::= { rptrTopNPortControlTable 1 }

   RptrTopNPortControlEntry ::= SEQUENCE {
```

```
        rptrTopNPortControlIndex
            Integer32,
        rptrTopNPortRepeaterId
            Integer32,
        rptrTopNPortRateBase
            INTEGER,
        rptrTopNPortTimeRemaining
            Integer32,
        rptrTopNPortDuration
            Integer32,
        rptrTopNPortRequestedSize
            Integer32,
        rptrTopNPortGrantedSize
            Integer32,
        rptrTopNPortStartTime
            TimeStamp,
        rptrTopNPortOwner
            OwnerString,
        rptrTopNPortRowStatus
            RowStatus
    }

    rptrTopNPortControlIndex OBJECT-TYPE
        SYNTAX      Integer32 (1 .. 65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "An index that uniquely identifies an entry in the
                rptrTopNPortControl table.  Each such entry defines
                one top N report prepared for a repeater or system."
        ::= { rptrTopNPortControlEntry 1 }

    rptrTopNPortRepeaterId OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "Identifies the repeater for which a top N report will
                be prepared (see rptrInfoId).  If the value of this
                object is positive, only ports assigned to this repeater
                will be used to form the list in which to order the
                Top N table.  If this value is zero, all ports will be
                eligible for inclusion on the list.

                The value of this object may not be modified if the
                associated rptrTopNPortRowStatus object is equal to
                active(1).
```

```
                If, for a particular row in this table, the repeater
                specified by the value of this object goes away (is
                removed from the rptrInfoTable) while the associated
                rptrTopNPortRowStatus object is equal to active(1),
                the row in this table is preserved by the agent but
                the value of rptrTopNPortRowStatus is changed to
                notInService(2), and the agent may time out the row
                if appropriate.  If the specified repeater comes
                back (reappears in the rptrInfoTable) before the row
                has been timed out, the management station must set
                the value of the rptrTopNPortRowStatus object back
                to active(1) if desired (the agent doesn't do this
                automatically)."
        ::= { rptrTopNPortControlEntry 2 }

    rptrTopNPortRateBase OBJECT-TYPE
        SYNTAX      INTEGER  {
                      readableFrames(1),
                      readableOctets(2),
                      fcsErrors(3),
                      alignmentErrors(4),
                      frameTooLongs(5),
                      shortEvents(6),
                      runts(7),
                      collisions(8),
                      lateEvents(9),
                      veryLongEvents(10),
                      dataRateMismatches(11),
                      autoPartitions(12),
                      totalErrors(13),
                      isolates(14),
                      symbolErrors(15)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The monitored variable, which the rptrTopNPortRate
                variable is based upon.

                The value of this object may not be modified if
                the associated rptrTopNPortRowStatus object has
                a value of active(1)."
        ::= { rptrTopNPortControlEntry 3 }

    rptrTopNPortTimeRemaining OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
                "The number of seconds left in the report
                currently being collected.  When this object
                is modified by the management station, a new
                collection is started, possibly aborting a
                currently running report.  The new value is
                used as the requested duration of this report,
                which is loaded into the associated
                rptrTopNPortDuration object.

                When this object is set to a non-zero value,
                any associated rptrTopNPortEntries shall be
                made inaccessible by the agent.  While the value
                of this object is non-zero, it decrements by one
                per second until it reaches zero.  During this
                time, all associated rptrTopNPortEntries shall
                remain inaccessible.  At the time that this object
                decrements to zero, the report is made accessible
                in the rptrTopNPortTable.  Thus, the rptrTopNPort
                table needs to be created only at the end of the
                collection interval.

                If the value of this object is set to zero
                while the associated report is running, the
                running report is aborted and no associated
                rptrTopNPortEntries are created."
        DEFVAL { 0 }
        ::= { rptrTopNPortControlEntry 4 }

    rptrTopNPortDuration OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The number of seconds that this report has
                collected during the last sampling interval,
                or if this report is currently being collected,
                the number of seconds that this report is being
                collected during this sampling interval.

                When the associated rptrTopNPortTimeRemaining
                object is set, this object shall be set by the
                agent to the same value and shall not be modified
                until the next time the rptrTopNPortTimeRemaining
                is set.

                This value shall be zero if no reports have been
                requested for this rptrTopNPortControlEntry."
```

```
        ::= { rptrTopNPortControlEntry 5 }

   rptrTopNPortRequestedSize OBJECT-TYPE
       SYNTAX      Integer32
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
               "The maximum number of repeater ports requested
               for the Top N Table.

               When this object is created or modified, the
               agent should set rptrTopNPortGrantedSize as close
               to this object as is possible for the particular
               implementation and available resources."
       DEFVAL { 10 }
       ::= { rptrTopNPortControlEntry 6 }

   rptrTopNPortGrantedSize OBJECT-TYPE
       SYNTAX      Integer32 (0..65535)
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
               "The maximum number of repeater ports in the
               top N table.

               When the associated rptrTopNPortRequestedSize object is
               created or modified, the agent should set this object as
               closely to the requested value as is possible for the
               particular implementation and available resources.  The
               agent must not lower this value except as a result of a
               set to the associated rptrTopNPortRequestedSize object."
       ::= { rptrTopNPortControlEntry 7 }

   rptrTopNPortStartTime OBJECT-TYPE
       SYNTAX      TimeStamp
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
               "The value of sysUpTime when this top N report was
               last started.  In other words, this is the time that
               the associated rptrTopNPortTimeRemaining object was
               modified to start the requested report.

               If the report has not yet been started, the value
               of this object is zero."
       ::= { rptrTopNPortControlEntry 8 }

   rptrTopNPortOwner OBJECT-TYPE
```

```
        SYNTAX      OwnerString
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The entity that configured this entry and is
                using the resources assigned to it."
        ::= { rptrTopNPortControlEntry 9 }

    rptrTopNPortRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
               "The status of this row.

               If the value of this object is not equal to
               active(1), all associated entries in the
               rptrTopNPortTable shall be deleted by the
               agent."
        ::= { rptrTopNPortControlEntry 10 }


    -- Top "N" reports

    rptrTopNPortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF RptrTopNPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table of reports for the top 'N' ports based on
                setting of associated control table entries. The
                maximum number of entries depends on the number
                of entries in table rptrTopNPortControlTable and
                the value of object rptrTopNPortGrantedSize for
                each entry.

                For each entry in the rptrTopNPortControlTable,
                repeater ports with the highest value of
                rptrTopNPortRate shall be placed in this table
                in decreasing order of that rate until there is
                no more room or until there are no more ports."
        ::= { rptrTopNPortInfo 2 }

    rptrTopNPortEntry OBJECT-TYPE
        SYNTAX      RptrTopNPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
```

```
                "A set of statistics for a repeater port that is
                part of a top N report."
        INDEX    { rptrTopNPortControlIndex,
                   rptrTopNPortIndex }
        ::= { rptrTopNPortTable 1 }

    RptrTopNPortEntry ::= SEQUENCE {
        rptrTopNPortIndex
            Integer32,
        rptrTopNPortGroupIndex
            Integer32,
        rptrTopNPortPortIndex
            Integer32,
        rptrTopNPortRate
            Gauge32
    }

    rptrTopNPortIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "An index that uniquely identifies an entry in
                the rptrTopNPort table among those in the same
                report.  This index is between 1 and N, where N
                is the number of entries in this report.  Increasing
                values of rptrTopNPortIndex shall be assigned to
                entries with decreasing values of rptrTopNPortRate
                until index N is assigned to the entry with the
                lowest value of rptrTopNPortRate or there are no
                more rptrTopNPortEntries.

                No ports are included in a report where their
                value of rptrTopNPortRate would be zero."
        ::= { rptrTopNPortEntry 1 }

    rptrTopNPortGroupIndex OBJECT-TYPE
        SYNTAX      Integer32  (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "This object identifes the group containing
                the port for this entry. (See also object
                type rptrGroupIndex.)"
        ::= { rptrTopNPortEntry 2 }

    rptrTopNPortPortIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The index of the repeater port.
            (See object type rptrPortIndex.)"
        ::= { rptrTopNPortEntry 3 }

    rptrTopNPortRate OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The amount of change in the selected variable
                during this sampling interval for the identified
                port.  The selected variable is that port's
                instance of the object selected by
                rptrTopNPortRateBase."
        ::= { rptrTopNPortEntry 4 }



    -- Notifications for use by Repeaters

    rptrHealth NOTIFICATION-TYPE
        OBJECTS     { rptrOperStatus }
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                In a system containing a single managed repeater,
                the rptrHealth notification conveys information
                related to the operational status of the repeater.
                It is sent either when the value of
                rptrOperStatus changes, or upon completion of a
                non-disruptive test.

                The rptrHealth notification 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
                "[IEEE 802.3 Mgt], 30.4.1.3.1, nRepeaterHealth
                notification."
        ::= { snmpDot3RptrMgt 0 1 }

    rptrGroupChange NOTIFICATION-TYPE
        OBJECTS     { rptrGroupIndex }
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                In a system containing a single managed repeater,
                this notification is sent when a change occurs in the
                group structure of the 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
                "[IEEE 802.3 Mgt], 30.4.1.3.3, nGroupMapChange
                notification."
        ::= { snmpDot3RptrMgt 0 2 }

    rptrResetEvent NOTIFICATION-TYPE
        OBJECTS     { rptrOperStatus }
        STATUS      deprecated
        DESCRIPTION
                "********** THIS OBJECT IS DEPRECATED **********

                In a system containing a single managed repeater-unit,
                the rptrResetEvent notification 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
                "[IEEE 802.3 Mgt], 30.4.1.3.2, nRepeaterReset
                notification."
        ::= { snmpDot3RptrMgt 0 3 }


    -- Notifications for repeaters in a multiple-repeater implementation.
    -- An implementation may send either the single-repeater OR
    -- multiple-repeater version of these notifications (1 or 4; 2 or 5)
    -- but not both.

    rptrInfoHealth NOTIFICATION-TYPE
        OBJECTS     { rptrInfoOperStatus }
        STATUS      current
        DESCRIPTION
                "In a system containing multiple managed repeaters,
                the rptrInfoHealth notification conveys information
                related to the operational status of a repeater.
                It is sent either when the value of rptrInfoOperStatus
                changes, or upon completion of a non-disruptive test.

                The agent must throttle the generation of
                consecutive rptrInfoHealth notifications for
                the same repeater so that there is at least
                a five-second gap between notifications of this type.
                When notifications are throttled, they are dropped,
                not queued for sending at a future time.  (Note
```

```
                that 'generating' a notification means sending
                to all configured recipients.)"
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.1.3.1, nRepeaterHealth
                notification."
        ::= { snmpDot3RptrMgt 0 4 }

    rptrInfoResetEvent NOTIFICATION-TYPE
        OBJECTS     { rptrInfoOperStatus }
        STATUS      current
        DESCRIPTION
                "In a system containing multiple managed
                repeaters, the rptrInfoResetEvent notification
                conveys information related to the operational
                status of a repeater. This notification is sent
                on completion of a repeater reset action.  A
                repeater reset action is defined as a transition
                to the START state of Fig 9-2 in section 9 of
                [IEEE 802.3 Std], when triggered by a management
                command (e.g., an SNMP Set on the rptrInfoReset
                object).

                The agent must throttle the generation of
                consecutive rptrInfoResetEvent notifications for
                a single repeater so that there is at least
                a five-second gap between notifications of
                this type.  When notifications are throttled,
                they are dropped, not queued for sending at
                a future time.  (Note that 'generating' a
                notification means sending to all configured
                recipients.)

                The rptrInfoResetEvent 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 rptrInfoOperStatus
                object as an optional object with its coldStart
                and warmStart trap PDUs."
        REFERENCE
                "[IEEE 802.3 Mgt], 30.4.1.3.2, nRepeaterReset
                notification."
        ::= { snmpDot3RptrMgt 0 5 }


    -- Conformance information

    snmpRptrModConf
            OBJECT IDENTIFIER ::= { snmpRptrMod 1 }
```

```
     snmpRptrModCompls
           OBJECT IDENTIFIER ::= { snmpRptrModConf 1 }
     snmpRptrModObjGrps
           OBJECT IDENTIFIER ::= { snmpRptrModConf 2 }
     snmpRptrModNotGrps
           OBJECT IDENTIFIER ::= { snmpRptrModConf 3 }


   -- Object groups

   snmpRptrGrpBasic1516 OBJECT-GROUP
       OBJECTS     { rptrGroupCapacity,
                     rptrOperStatus,
                     rptrHealthText,
                     rptrReset,
                     rptrNonDisruptTest,
                     rptrTotalPartitionedPorts,

                     rptrGroupIndex,
                     rptrGroupDescr,
                     rptrGroupObjectID,
                     rptrGroupOperStatus,
                     rptrGroupLastOperStatusChange,
                     rptrGroupPortCapacity,

                     rptrPortGroupIndex,
                     rptrPortIndex,
                     rptrPortAdminStatus,
                     rptrPortAutoPartitionState,
                     rptrPortOperStatus }
       STATUS      deprecated
       DESCRIPTION
           "********** THIS GROUP IS DEPRECATED **********

           Basic group from RFCs 1368 and 1516.

           NOTE: this object group is DEPRECATED and replaced
                 with snmpRptrGrpBasic."
       ::= { snmpRptrModObjGrps 1 }

   snmpRptrGrpMonitor1516 OBJECT-GROUP
       OBJECTS     { rptrMonitorTransmitCollisions,

                     rptrMonitorGroupIndex,
                     rptrMonitorGroupTotalFrames,
                     rptrMonitorGroupTotalOctets,
                     rptrMonitorGroupTotalErrors,
```

```
                    rptrMonitorPortGroupIndex,
                    rptrMonitorPortIndex,
                    rptrMonitorPortReadableFrames,
                    rptrMonitorPortReadableOctets,
                    rptrMonitorPortFCSErrors,
                    rptrMonitorPortAlignmentErrors,
                    rptrMonitorPortFrameTooLongs,
                    rptrMonitorPortShortEvents,
                    rptrMonitorPortRunts,
                    rptrMonitorPortCollisions,
                    rptrMonitorPortLateEvents,
                    rptrMonitorPortVeryLongEvents,
                    rptrMonitorPortDataRateMismatches,
                    rptrMonitorPortAutoPartitions,
                    rptrMonitorPortTotalErrors }
        STATUS      deprecated
        DESCRIPTION
            "********** THIS GROUP IS DEPRECATED **********

            Monitor group from RFCs 1368 and 1516.

            NOTE: this object group is DEPRECATED and replaced
                  with snmpRptrGrpMonitor."
        ::= { snmpRptrModObjGrps 2 }

    snmpRptrGrpAddrTrack1368 OBJECT-GROUP
        OBJECTS     { rptrAddrTrackGroupIndex,
                      rptrAddrTrackPortIndex,
                      rptrAddrTrackLastSourceAddress,
                      rptrAddrTrackSourceAddrChanges }
        STATUS      obsolete
        DESCRIPTION
            "Address tracking group from RFC 1368.

            NOTE: this object group is OBSOLETE and replaced
                  with snmpRptrGrpAddrTrack1516."
        ::= { snmpRptrModObjGrps 3 }

    snmpRptrGrpAddrTrack1516 OBJECT-GROUP
        OBJECTS     { rptrAddrTrackGroupIndex,
                      rptrAddrTrackPortIndex,
                      rptrAddrTrackLastSourceAddress,
                      rptrAddrTrackSourceAddrChanges,
                      rptrAddrTrackNewLastSrcAddress }
        STATUS      deprecated
        DESCRIPTION
            "********** THIS GROUP IS DEPRECATED **********
```

```
            Address tracking group from RFC 1516.

            NOTE: this object group is DEPRECATED and
                  replaced with snmpRptrGrpAddrTrack."
        ::= { snmpRptrModObjGrps 4 }

    snmpRptrGrpBasic OBJECT-GROUP
        OBJECTS     { rptrGroupIndex,
                      rptrGroupObjectID,
                      rptrGroupOperStatus,
                      rptrGroupPortCapacity,

                      rptrPortGroupIndex,
                      rptrPortIndex,
                      rptrPortAdminStatus,
                      rptrPortAutoPartitionState,
                      rptrPortOperStatus,
                      rptrPortRptrId,

                      rptrInfoId,
                      rptrInfoRptrType,
                      rptrInfoOperStatus,
                      rptrInfoReset,
                      rptrInfoPartitionedPorts,
                      rptrInfoLastChange }
        STATUS      current
        DESCRIPTION
            "Basic group for a system with one or more
            repeater-units in multi-segment (post-RFC 1516)
            version of the MIB module."
        ::= { snmpRptrModObjGrps 5 }

    snmpRptrGrpMonitor OBJECT-GROUP
        OBJECTS     { rptrMonitorPortGroupIndex,
                      rptrMonitorPortIndex,
                      rptrMonitorPortReadableFrames,
                      rptrMonitorPortReadableOctets,
                      rptrMonitorPortFCSErrors,
                      rptrMonitorPortAlignmentErrors,
                      rptrMonitorPortFrameTooLongs,
                      rptrMonitorPortShortEvents,
                      rptrMonitorPortRunts,
                      rptrMonitorPortCollisions,
                      rptrMonitorPortLateEvents,
                      rptrMonitorPortVeryLongEvents,
                      rptrMonitorPortDataRateMismatches,
                      rptrMonitorPortAutoPartitions,
                      rptrMonitorPortTotalErrors,
```

```
                    rptrMonitorPortLastChange,

                    rptrMonTxCollisions,
                    rptrMonTotalFrames,
                    rptrMonTotalErrors,
                    rptrMonTotalOctets }
        STATUS      current
        DESCRIPTION
            "Monitor group for a system with one or more
            repeater-units in multi-segment (post-RFC 1516)
            version of the MIB module."
        ::= { snmpRptrModObjGrps 6 }

    snmpRptrGrpMonitor100 OBJECT-GROUP
        OBJECTS     { rptrMonitorPortIsolates,
                      rptrMonitorPortSymbolErrors,
                      rptrMonitorPortUpper32Octets,

                      rptrMonUpper32TotalOctets }
        STATUS      current
        DESCRIPTION
            "Monitor group for 100Mb/s ports and repeaters
            in a system with one or more repeater-units in
            multi-segment (post-RFC 1516) version of the MIB
            module.  Systems which support Counter64 should
            also implement snmpRptrGrpMonitor100w64."
        ::= { snmpRptrModObjGrps 7 }

    snmpRptrGrpMonitor100w64 OBJECT-GROUP
        OBJECTS     { rptrMonitorPortHCReadableOctets,
                      rptrMonHCTotalOctets }
        STATUS      current
        DESCRIPTION
            "Monitor group for 100Mb/s ports and repeaters in a
            system with one or more repeater-units and support
            for Counter64."
        ::= { snmpRptrModObjGrps 8 }

    snmpRptrGrpAddrTrack OBJECT-GROUP
        OBJECTS     { rptrAddrTrackGroupIndex,
                      rptrAddrTrackPortIndex,
                      rptrAddrTrackSourceAddrChanges,
                      rptrAddrTrackNewLastSrcAddress,
                      rptrAddrTrackCapacity }
        STATUS      current
        DESCRIPTION
            "Passive address tracking group for post-RFC 1516
            version of the MIB module."
```

```
        ::= { snmpRptrModObjGrps 9 }

    snmpRptrGrpExtAddrTrack OBJECT-GROUP
        OBJECTS     { rptrExtAddrTrackMacIndex,
                      rptrExtAddrTrackSourceAddress }
        STATUS      current
        DESCRIPTION
            "Extended passive address tracking group for
            a system with one or more repeater-units in
            post-RFC 1516 version of the MIB module."
        ::= { snmpRptrModObjGrps 10 }

    snmpRptrGrpRptrAddrSearch OBJECT-GROUP
        OBJECTS     { rptrAddrSearchLock,
                      rptrAddrSearchStatus,
                      rptrAddrSearchAddress,
                      rptrAddrSearchState,
                      rptrAddrSearchGroup,
                      rptrAddrSearchPort,
                      rptrAddrSearchOwner }
        STATUS      current
        DESCRIPTION
            "Active MAC address search group and topology
            mapping support for repeaters."
        ::= { snmpRptrModObjGrps 11 }

    snmpRptrGrpTopNPort OBJECT-GROUP
        OBJECTS     { rptrTopNPortControlIndex,
                      rptrTopNPortRepeaterId,
                      rptrTopNPortRateBase,
                      rptrTopNPortTimeRemaining,
                      rptrTopNPortDuration,
                      rptrTopNPortRequestedSize,
                      rptrTopNPortGrantedSize,
                      rptrTopNPortStartTime,
                      rptrTopNPortOwner,
                      rptrTopNPortRowStatus,
                      rptrTopNPortIndex,
                      rptrTopNPortGroupIndex,
                      rptrTopNPortPortIndex,
                      rptrTopNPortRate }
        STATUS      current
        DESCRIPTION
            "Top 'N' group for repeater ports."
        ::= { snmpRptrModObjGrps 12 }


    -- Compliances
```

```
   snmpRptrModComplRFC1368 MODULE-COMPLIANCE
       STATUS      obsolete
       DESCRIPTION
           "Compliance for RFC 1368.

           NOTE: this module compliance is OBSOLETE and
                 replaced by snmpRptrModComplRFC1516."

       MODULE -- this module
           MANDATORY-GROUPS { snmpRptrGrpBasic1516 }

           GROUP snmpRptrGrpMonitor1516
           DESCRIPTION
               "Implementation of this optional group is
               recommended for systems which have the
               instrumentation to do performance monitoring."

           GROUP snmpRptrGrpAddrTrack1368
           DESCRIPTION
               "Implementation of this group is
               recommended for systems which have
               the necessary instrumentation."

       ::= { snmpRptrModCompls 1 }

   snmpRptrModComplRFC1516 MODULE-COMPLIANCE
       STATUS      deprecated
       DESCRIPTION
           "********** THIS COMPLIANCE IS DEPRECATED **********

           Compliance for RFC 1516 and for backwards
           compatibility with single-repeater,
           10Mb/s-only implementations."

       MODULE -- this module
           MANDATORY-GROUPS { snmpRptrGrpBasic1516 }

           GROUP snmpRptrGrpMonitor1516
           DESCRIPTION
               "Implementation of this optional group is
               recommended for systems which have the
               instrumentation to do performance monitoring."

           GROUP snmpRptrGrpAddrTrack1516
           DESCRIPTION
               "Implementation of this group is
               recommended for systems which have
               the necessary instrumentation."
```

```
        ::= { snmpRptrModCompls 2 }

    snmpRptrModCompl MODULE-COMPLIANCE
        STATUS      current
        DESCRIPTION
            "Compliance for the multi-segment version of the
            MIB module for a system with one or more
            repeater-units."

        MODULE -- this module
            MANDATORY-GROUPS { snmpRptrGrpBasic,
                               snmpRptrGrpMonitor,
                               snmpRptrGrpAddrTrack }

            GROUP snmpRptrGrpMonitor100
            DESCRIPTION
                "Implementation of this group is
                mandatory for managed systems which
                contain 100Mb/s repeaters."

            GROUP snmpRptrGrpMonitor100w64
            DESCRIPTION
                "Implementation of this group is
                mandatory for managed systems which
                contain 100Mb/s repeaters and which
                can support Counter64."

            GROUP snmpRptrGrpExtAddrTrack
            DESCRIPTION
                "Implementation of this group is
                recommended for systems which have
                the necessary instrumentation to track
                MAC addresses of multiple DTEs attached
                to a single repeater port."

            GROUP snmpRptrGrpRptrAddrSearch
            DESCRIPTION
                "Implementation of this group is
                recommended for systems which allow
                read-write access and which have
                the necessary instrumentation to
                search all incoming data streams
                for a particular MAC address."

            GROUP snmpRptrGrpTopNPort
            DESCRIPTION
                "Implementation of this group is
                recommended for systems which have
```

```
                the necessary resources to support
                TopN statistics reporting."

        ::= { snmpRptrModCompls 3 }


    END
```

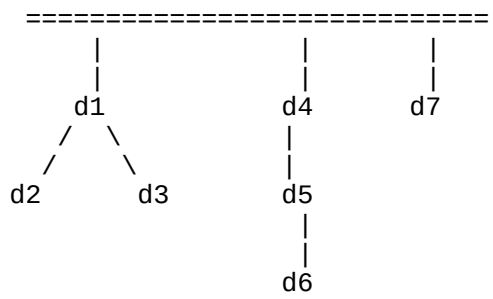
4. Topology Mapping

The network mapping algorithm presented below takes information available from network devices such as repeaters, bridges, and switches, and creates a representation of the physical topology of the network.

Networking devices connect to the network via one or more ports. Through these ports, the device is capable of hearing network packets sent by other devices. By looking the source address in the packet, and identifying which port the packet was heard on, the device can provide information to a Network Management System about the location of an address in the network, relative to that device. For devices such as bridges and switches, the association of address to port can be retrieved via the forwarding data base part of the Bridge MIB. For repeaters, the rptrAddrSearchTable may be used to perform the association.

Given this information, it would be possible for the NMS to create a topology of the network which represents the physical relationships of the devices in the networks. The following is an example of how this might be done:

Assume the network:

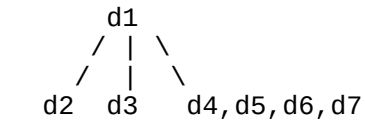


The discovery process would first determine the existence of the network devices and nodes in the network. In the above example, the network devices discovered would be:

d1,d2,d3,d4,d5,d6,d7

From this list of discovered devices, select (arbitrarily or via some heuristic) a device as the starting point. From that device, determine where all other devices are located in the network with respect to the selected device.

For example, if d1 is the selected device, the network in relation to d1 would look like:



So d1 sees d2 on one port, d3 on another port, and d4, d5, and d6 on the third port. In other words, using the rptrAddrSearchTable (if d1 is a repeater) or the Forwarding Database (if it is a bridge or a switch), d1 has located d2 on one port, d1 has located d3 on another port, and finally, d1 has located d4, d5, d6, and d7 on yet another port.

After the first step of the algorithm is accomplished, the next and final step is a recursive one. Go to each of these temporary 'segments' (e.g., the segment connecting d1 and d2, or the segment connecting d1 and d3, or the segment connecting d1, d4, d5, d6, and d7) and determine which of these devices really belongs in that segment.

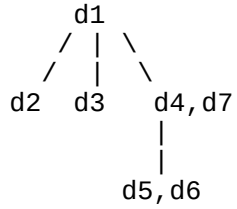
As new segments are created due to this process, the recursive algorithm visits them, and performs the exact same process.

In the example, the segments connecting d1 and d2, and connecting d1 and d3, require no further scrutiny, since there are only two nodes in those segments. However, the segment connecting d1, d4, d5, d6, and d7 may prove to be one or more segments, so we will investigate it.

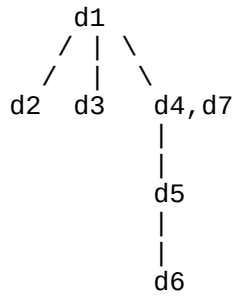
The purpose of this step is to determine which devices are really connected to this segment, and which are actually connected downstream. This is done by giving each of the child devices in the segment (d4, d5, d6, and d7) a chance to eliminate each of the others from the segment.

A device eliminates another device by showing that it hears the parent device (in this case, d1) on one port, and the other device on another port (different from the port on which it heard the parent). If this is true, then it must mean that that device is _between_ the parent device and the device which is being eliminated.

In the example, we can see that device d4 can eliminate both d5 and d6, , but nobody can eliminate d4 and d7, because everybody hears them on the same port that they hear the parent device (d1). So the resulting topology looks like:



Next the algorithm visits the next segment, which is the one connecting d4, d5, and d6. Using the process stated above, d5 can eliminate d6, since it hears d4 on a different port from where it hears d6. Finally, the topology looks like:

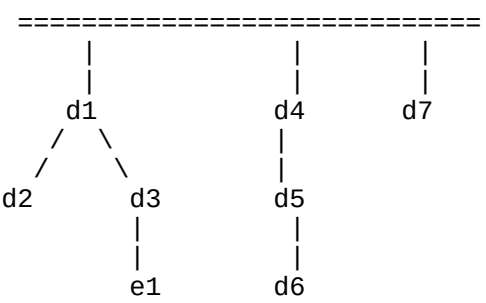


This is actually the topology shown at the beginning of the description.

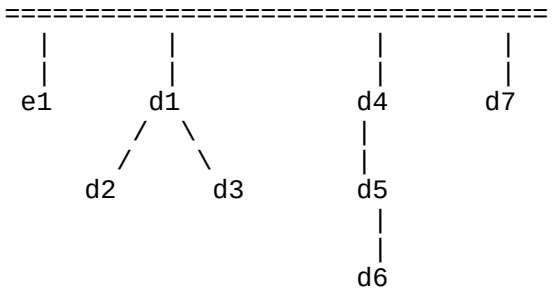
With this information about how the network devices are connected, it is a relatively simple extension to then place nodes such as workstations and PCs in the network. This can be done by placing the node into a segment, then allowing the network devices to show that the node is really not part of that segment.

This elimination can be done because the devices know what port connects them to the segment on which the node is temporarily placed. If they actually hear the node on a different port than that which connects the device to the segment, then the node must be downstream, and so it is moved onto the downstream segment. Then that segment is evaluated, and so forth. Eventually, no device can show that the node is connected downstream, and so it must be attached to that segment.

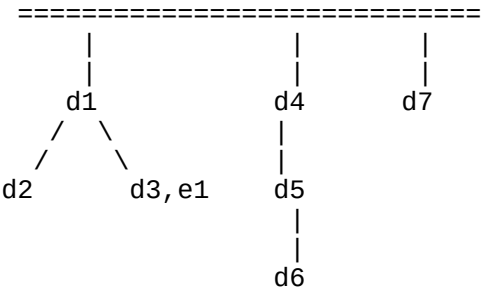
For example, assume the network:



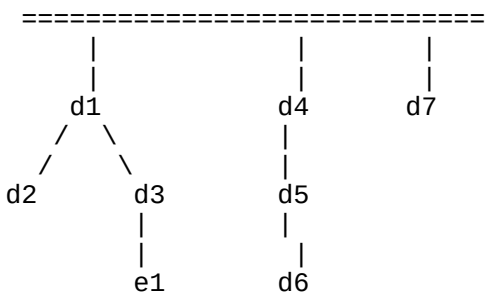
In this network, we are trying to place e1 where it belongs. We begin by placing it arbitrarily into a segment:



In the above case, we would give d1, d4, and d7 a chance to show that e1 is not really on that segment. d4 and d7 hear e1 on the same port which connects them to that segment, so they cannot eliminate e1 from the segment. However, d1 will hear e1 on a different port, so we move e1 down onto the segment which is connected by that port. This yields the following:



Now we give everyone in that segment (besides that parent device, d1) a chance to eliminate e1. Only d3 can try, and it succeeds, so we place e1 on segment which is connected by the port on which d3 heard e1. There is no segment there (yet), so we create one, and end up with the following:



which is the correct position.

5. Acknowledgements

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Chuck Black
John Flick
Jeff Johnson
Leon Leong
Mike Lui
Dave Perkins
Geoff Thompson
Maurice Turcotte
Paul Woodruff

6. References

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7. Security Considerations

Security issues are not discussed in this memo.

8. Authors' Addresses

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