Definitions of Managed Objects for Bridges

Status of This Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in TCP/IP-based internets.
   In particular, it defines objects for managing MAC bridges based on
   the IEEE 802.1D-1998 standard between Local Area Network (LAN)
   segments. Provisions are made for the support of transparent
   bridging. Provisions are also made so that these objects apply to
   bridges connected by subnetworks other than LAN segments.

   The MIB module presented in this memo is a translation of the
   BRIDGE-MIB defined in RFC 1493 to the SMIv2 syntax.

   This memo obsoletes RFC 1493.

Table of Contents

1. The Internet-Standard Management Framework

   For a detailed overview of the documents that describe the current
   Internet-Standard Management Framework, please refer to section 7 of
   RFC 3410 [RFC3410].

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. MIB objects are generally
   accessed through the Simple Network Management Protocol (SNMP).
   Objects in the MIB are defined using the mechanisms defined in the
   Structure of Management Information (SMI). This memo specifies a MIB
   module that is compliant to the SMIv2, which is described in STD 58,
   RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580
   [RFC2580].

2. Conventions

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
   "OPTIONAL", when they appear in this document, are to be interpreted
   as described in BCP 14, RFC 2119 [RFC2119].

3. Overview

   A common device present in many networks is the Bridge. This device
   is used to connect Local Area Network segments below the network
   layer.

   There are two major modes defined for this bridging: transparent and
   source route. The transparent method of bridging is defined in the
   IEEE 802.1D specification [IEEE8021D]. This memo defines those
   objects needed for the management of a bridging entity that operates
   in the transparent mode, as well as some objects that apply to all
   types of bridges.

   To be consistent with IAB directives and good engineering practices,
   an explicit attempt was made to keep this MIB module as simple as
   possible. This was accomplished by applying the following criteria
   to objects proposed for inclusion:

   1. Start with a small set of essential objects and add only as
      further objects are needed.

   2. Require that objects be essential for either fault or
      configuration management.

   3. Consider evidence of current use and/or utility.

   4. Limit the total number of objects.

   5. Exclude objects that are simply derivable from others in this or
      other MIB modules.

   6. Avoid causing critical sections to be heavily instrumented. The
      guideline that was followed is one counter per critical section
      per layer.

3.1 Structure of the MIB Module

   Objects in this MIB module are arranged into subtrees. Each subtree
   is organized as a set of related objects. The overall structure and
   assignment of objects to their subtrees is shown below. Where
   appropriate, the corresponding IEEE 802.1D [IEEE8021D] management
   object name is also included.

```
   Bridge MIB Name                    IEEE 802.1D Name

   dot1dBridge
     dot1dBase
       BridgeAddress                  Bridge.BridgeAddress
       NumPorts                       Bridge.NumberOfPorts
       Type
       PortTable
         Port                         BridgePort.PortNumber
         IfIndex
         Circuit
         DelayExceededDiscards          .DiscardTransitDelay
         MtuExceededDiscards            .DiscardOnError
     dot1dStp
       ProtocolSpecification
       Priority                       SpanningTreeProtocol
                                        .BridgePriority
       TimeSinceTopologyChange          .TimeSinceTopologyChange
       TopChanges                       .TopologyChangeCount
       DesignatedRoot                   .DesignatedRoot
       RootCost                         .RootCost
       RootPort                         .RootPort
       MaxAge                           .MaxAge
       HelloTime                        .HelloTime
       HoldTime                         .HoldTime
       ForwardDelay                     .ForwardDelay
       BridgeMaxAge                     .BridgeMaxAge
       BridgeHelloTime                  .BridgeHelloTime
       BridgeForwardDelay               .BridgeForwardDelay
       PortTable
         Port                         SpanningTreeProtocolPort
                                        .PortNumber
         Priority                       .PortPriority
         State                          .SpanningTreeState
         Enable
         PathCost                       .PortPathCost
         DesignatedRoot                 .DesignatedRoot
         DesignatedCost                 .DesignatedCost
         DesignatedBridge               .DesignatedBridge
         DesignatedPort                 .DesignatedPort
         ForwardTransitions
```

```
   dot1dTp
      LearnedEntryDiscards              BridgeFilter.DatabaseSize
                                          .NumDynamic,NumStatic
      AgingTime                        BridgeFilter.AgingTime
      FdbTable
         Address
         Port
         Status
      PortTable
         Port
         MaxInfo
         InFrames                      BridgePort.FramesReceived
         OutFrames                        .ForwardOutbound
         InDiscards                       .DiscardInbound
   dot1dStatic
      StaticTable
         Address
         ReceivePort
         AllowedToGoTo
         Status
```

The following IEEE 802.1D management objects have not been included
in the BRIDGE-MIB module for the indicated reasons.

```
IEEE 802.1D Object                Disposition

Bridge.BridgeName                 Same as sysDescr (SNMPv2-MIB)
Bridge.BridgeUpTime               Same as sysUpTime (SNMPv2-MIB)
Bridge.PortAddresses              Same as ifPhysAddress (IF-MIB)
BridgePort.PortName               Same as ifDescr (IF-MIB)
BridgePort.PortType               Same as ifType (IF-MIB)
BridgePort.RoutingType            Derivable from the implemented
                                  subtrees

SpanningTreeProtocol
    .BridgeIdentifier             Combination of dot1dStpPriority
                                  and dot1dBaseBridgeAddress
    .TopologyChange               Since this is transitory, it
                                  is not considered useful.

SpanningTreeProtocolPort
    .Uptime                       Same as ifLastChange (IF-MIB)
    .PortIdentifier               Combination of dot1dStpPort
                                  and dot1dStpPortPriority
    .TopologyChangeAcknowledged   Since this is transitory, it
                                  is not considered useful.
    .DiscardLackOfBuffers         Redundant
```

       Transmission Priority   These objects are not required
                                          as per the Pics Proforma and
                                          are not considered useful.
          .TransmissionPriorityName
          .OutboundUserPriority
          .OutboundAccessPriority

3.1.1 The dot1dBase Subtree

   This subtree contains the objects that are applicable to all types of
   bridges.

3.1.2 The dot1dStp Subtree

   This subtree contains the objects that denote the bridge's state with
   respect to the Spanning Tree Protocol. If a node does not implement
   the Spanning Tree Protocol, this subtree will not be implemented.

3.1.3 The dot1dSr Subtree

   This subtree contains the objects that describe the entity's state
   with respect to source route bridging. This subtree described in RFC
   1525 [RFC1525] is applicable only to source route bridging.

3.1.4 The dot1dTp Subtree

   This subtree contains objects that describe the entity's state with
   respect to transparent bridging. If transparent bridging is not
   supported, this subtree will not be implemented. This subtree is
   applicable to transparent-only and SRT bridges.

3.1.5 The dot1dStatic Subtree

   This subtree contains objects that describe the entity's state with
   respect to destination-address filtering. If destination-address
   filtering is not supported, this subtree will not be implemented.
   This subtree is applicable to any type of bridge that performs
   destination-address filtering.

3.2 Relationship to Other MIB Modules

   As described above, some IEEE 802.1D management objects have not been
   included in this MIB module because they overlap with objects in
   other MIB modules that are applicable to a bridge implementing this
   MIB module.

3.2.1 Relationship to the SNMPv2-MIB

The SNMPv2-MIB [RFC3418] defines objects that are generally
applicable to managed devices. These objects apply to the device as
a whole, irrespective of whether the device's sole functionality is
bridging, or whether bridging is only a subset of the device's
functionality.

As explained in Section 3.1, full support for the 802.1D management
objects requires that the SNMPv2-MIB objects sysDescr and sysUpTime
be implemented. Note that compliance with the current SNMPv2-MIB
module requires additional objects and notifications to be
implemented, as specified in RFC 3418 [RFC3418].

3.2.2 Relationship to the IF-MIB

The IF-MIB [RFC2863] defines managed objects for managing network
interfaces. A network 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. The term 'segment' is used in this
memo to refer to such a subnetwork, whether it be an Ethernet
segment, a 'ring', a WAN link, or even an X.25 virtual circuit.

As explained in Section 3.1, full support for the 802.1D management
objects requires that the IF-MIB objects ifIndex, ifType, ifDescr,
ifPhysAddress, and ifLastChange are implemented. Note that
compliance to the current IF-MIB module requires additional objects
and notifications to be implemented as specified in RFC 2863
[RFC2863].

Implicit in this BRIDGE-MIB is the notion of ports on a bridge. Each
of these ports is associated with one interface of the 'interfaces'
subtree, and in most situations, each port is associated with a
different interface. However, there are situations in which multiple
ports are associated with the same interface. An example of such a
situation would be several ports, each corresponding, one-to-one,
with several X.25 virtual circuits that are all on the same
interface.

Each port is uniquely identified by a port number. A port number has
no mandatory relationship to an interface number, but in the simple
case, a port number will have the same value as the corresponding
interface's interface number. Port numbers are in the range
(1..dot1dBaseNumPorts).

Some entities perform other functionalities as well as bridging
through the sending and receiving of data on their interfaces. In
such situations, only a subset of the data sent/received on an
interface is within the domain of the entity's bridging
functionality. This subset is considered to be delineated according
to a set of protocols, with some protocols being bridged, and other
protocols not being bridged. For example, in an entity that
exclusively performs bridging, all protocols would be considered as
bridged, whereas in an entity that performs IP routing on IP
datagrams and only bridges other protocols, only the non-IP data
would be considered as having been bridged.

Thus, this BRIDGE-MIB (and in particular, its counters) are
applicable only to that subset of the data on an entity's interfaces
that is sent/received for a protocol being bridged. All such data is
sent/received via the ports of the bridge.

4. Definitions

```
   BRIDGE-MIB DEFINITIONS ::= BEGIN

   -- ---------------------------------------------------------------- --
   -- MIB for IEEE 802.1D devices
   -- ---------------------------------------------------------------- --
   IMPORTS
       MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
       Counter32, Integer32, TimeTicks, mib-2
           FROM SNMPv2-SMI
       TEXTUAL-CONVENTION, MacAddress
           FROM SNMPv2-TC
       MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
           FROM SNMPv2-CONF
       InterfaceIndex FROM IF-MIB
       ;

   dot1dBridge MODULE-IDENTITY
       LAST-UPDATED "200509190000Z"
       ORGANIZATION "IETF Bridge MIB Working Group"
       CONTACT-INFO
           "Email: bridge-mib@ietf.org

                   K.C. Norseth (Editor)
                   L-3 Communications
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            Send comments to <bridge-mib@ietf.org>"
        DESCRIPTION
            "The Bridge MIB module for managing devices that support
            IEEE 802.1D.

            Copyright (C) The Internet Society (2005). This version of
            this MIB module is part of RFC 4188; see the RFC itself for
            full legal notices."
        REVISION   "200509190000Z"
        DESCRIPTION
            "Third revision, published as part of RFC 4188.

            The MIB module has been converted to SMIv2 format.
            Conformance statements have been added and some
            description and reference clauses have been updated.

            The object dot1dStpPortPathCost32 was added to
            support IEEE 802.1t and the permissible values of
            dot1dStpPriority and dot1dStpPortPriority have been
            clarified for bridges supporting IEEE 802.1t or
            IEEE 802.1w.

            The interpretation of dot1dStpTimeSinceTopologyChange
            has been clarified for bridges supporting the Rapid
            Spanning Tree Protocol (RSTP)."
        REVISION   "199307310000Z"
        DESCRIPTION
            "Second revision, published as part of RFC 1493."
        REVISION   "199112310000Z"
        DESCRIPTION
            "Initial revision, published as part of RFC 1286."
        ::= { mib-2 17 }

    -- -- --
    -- Textual Conventions
    -- -- --

    BridgeId ::= TEXTUAL-CONVENTION

              STATUS   current
              DESCRIPTION
                  "The Bridge-Identifier, as used in the Spanning Tree
                  Protocol, to uniquely identify a bridge. Its first two
                  octets (in network byte order) contain a priority value,
                  and its last 6 octets contain the MAC address used to
                  refer to a bridge in a unique fashion (typically, the
                  numerically smallest MAC address of all ports on the
                  bridge)."
              SYNTAX   OCTET STRING (SIZE (8))

      Timeout ::= TEXTUAL-CONVENTION
              DISPLAY-HINT "d"
              STATUS   current
              DESCRIPTION
                  "A Spanning Tree Protocol (STP) timer in units of 1/100
                  seconds. Several objects in this MIB module represent
                  values of timers used by the Spanning Tree Protocol.
                  In this MIB, these timers have values in units of
                  hundredths of a second (i.e., 1/100 secs).

                  These timers, when stored in a Spanning Tree Protocol's
                  BPDU, are in units of 1/256 seconds. Note, however, that
                  802.1D-1998 specifies a settable granularity of no more
                  than one second for these timers. To avoid ambiguity,
                  a conversion algorithm is defined below for converting
                  between the different units, which ensures a timer's
                  value is not distorted by multiple conversions.

                  To convert a Timeout value into a value in units of
                  1/256 seconds, the following algorithm should be used:

                      b = floor((n * 256) / 100)

                  where:
                      floor   =   quotient [ignore remainder]
                      n is the value in 1/100 second units
                      b is the value in 1/256 second units

                  To convert the value from 1/256 second units back to
                  1/100 seconds, the following algorithm should be used:

                      n = ceiling((b * 100) / 256)

                  where:
                      ceiling = quotient [if remainder is 0], or
                                quotient + 1 [if remainder is nonzero]
                      n is the value in 1/100 second units

              b is the value in 1/256 second units

          Note: it is important that the arithmetic operations are
          done in the order specified (i.e., multiply first,
          divide second)."
        SYNTAX   Integer32

    -- -- --
    -- subtrees in the Bridge MIB
    -- -- --

    dot1dNotifications OBJECT IDENTIFIER ::= { dot1dBridge 0 }

    dot1dBase   OBJECT IDENTIFIER ::= { dot1dBridge 1 }
    dot1dStp   OBJECT IDENTIFIER ::= { dot1dBridge 2 }

    dot1dSr   OBJECT IDENTIFIER ::= { dot1dBridge 3 }
    -- documented in RFC 1525

    dot1dTp   OBJECT IDENTIFIER ::= { dot1dBridge 4 }
    dot1dStatic   OBJECT IDENTIFIER ::= { dot1dBridge 5 }

    -- Subtrees used by Bridge MIB Extensions:
    --   pBridgeMIB MODULE-IDENTITY   ::= { dot1dBridge 6 }
    --   qBridgeMIB MODULE-IDENTITY   ::= { dot1dBridge 7 }
    -- Note that the practice of registering related MIB modules
    -- below dot1dBridge has been discouraged since there is no
    -- robust mechanism to track such registrations.

    dot1dConformance   OBJECT IDENTIFIER ::= { dot1dBridge 8 }

    -- -- --
    -- the dot1dBase subtree
    -- -- --
    -- Implementation of the dot1dBase subtree is mandatory for all
    -- bridges.
    -- -- --

    dot1dBaseBridgeAddress OBJECT-TYPE

        SYNTAX   MacAddress
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The MAC address used by this bridge when it must be
             referred to in a unique fashion. It is recommended
             that this be the numerically smallest MAC address of
             all ports that belong to this bridge. However, it is only

```
        required to be unique.  When concatenated with
        dot1dStpPriority, a unique BridgeIdentifier is formed,
        which is used in the Spanning Tree Protocol."
    REFERENCE
        "IEEE 802.1D-1998: clauses 14.4.1.1.3 and 7.12.5"
    ::= { dot1dBase 1 }

dot1dBaseNumPorts OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "ports"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of ports controlled by this bridging
        entity."
    REFERENCE
        "IEEE 802.1D-1998: clause 14.4.1.1.3"
    ::= { dot1dBase 2 }

dot1dBaseType OBJECT-TYPE
    SYNTAX      INTEGER {
                    unknown(1),
                    transparent-only(2),
                    sourceroute-only(3),
                    srt(4)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates what type of bridging this bridge can
        perform.  If a bridge is actually performing a
        certain type of bridging, this will be indicated by
        entries in the port table for the given type."
    ::= { dot1dBase 3 }

-- ---------------------------------------------------------------- --
-- The Generic Bridge Port Table
-- ---------------------------------------------------------------- --
dot1dBasePortTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF Dot1dBasePortEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table that contains generic information about every
        port that is associated with this bridge.  Transparent,
        source-route, and srt ports are included."
    ::= { dot1dBase 4 }
```

```
    dot1dBasePortEntry OBJECT-TYPE
        SYNTAX        Dot1dBasePortEntry
        MAX-ACCESS    not-accessible
        STATUS        current

        DESCRIPTION
            "A list of information for each port of the bridge."
        REFERENCE
            "IEEE 802.1D-1998: clause 14.4.2, 14.6.1"
        INDEX  { dot1dBasePort }
        ::= { dot1dBasePortTable 1 }

    Dot1dBasePortEntry ::=
        SEQUENCE {
            dot1dBasePort
                Integer32,
            dot1dBasePortIfIndex
                InterfaceIndex,
            dot1dBasePortCircuit
                OBJECT IDENTIFIER,
            dot1dBasePortDelayExceededDiscards
                Counter32,
            dot1dBasePortMtuExceededDiscards
                Counter32
        }

    dot1dBasePort OBJECT-TYPE
        SYNTAX        Integer32 (1..65535)
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The port number of the port for which this entry
            contains bridge management information."
        ::= { dot1dBasePortEntry 1 }

    dot1dBasePortIfIndex OBJECT-TYPE
        SYNTAX        InterfaceIndex
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The value of the instance of the ifIndex object,
            defined in IF-MIB, for the interface corresponding
            to this port."
        ::= { dot1dBasePortEntry 2 }

    dot1dBasePortCircuit OBJECT-TYPE
        SYNTAX        OBJECT IDENTIFIER
        MAX-ACCESS    read-only
```

```
            STATUS        current
            DESCRIPTION
                "For a port that (potentially) has the same value of
                dot1dBasePortIfIndex as another port on the same bridge.
                This object contains the name of an object instance
                unique to this port.  For example, in the case where
                multiple ports correspond one-to-one with multiple X.25
                virtual circuits, this value might identify an (e.g.,
                the first) object instance associated with the X.25
                virtual circuit corresponding to this port.

                For a port which has a unique value of
                dot1dBasePortIfIndex, this object can have the value
                { 0 0 }."
            ::= { dot1dBasePortEntry 3 }

        dot1dBasePortDelayExceededDiscards OBJECT-TYPE
            SYNTAX        Counter32
            MAX-ACCESS  read-only
            STATUS        current
            DESCRIPTION
                "The number of frames discarded by this port due
                to excessive transit delay through the bridge.  It
                is incremented by both transparent and source
                route bridges."
            REFERENCE
                "IEEE 802.1D-1998: clause 14.6.1.1.3"
            ::= { dot1dBasePortEntry 4 }

        dot1dBasePortMtuExceededDiscards OBJECT-TYPE
            SYNTAX        Counter32
            MAX-ACCESS  read-only
            STATUS        current
            DESCRIPTION
                "The number of frames discarded by this port due
                to an excessive size.  It is incremented by both
                transparent and source route bridges."
            REFERENCE
                "IEEE 802.1D-1998: clause 14.6.1.1.3"
            ::= { dot1dBasePortEntry 5 }

    -- ---------------------------------------------------------------- --
    -- the dot1dStp subtree
    -- ---------------------------------------------------------------- --
    -- Implementation of the dot1dStp subtree is optional.  It is
    -- implemented by those bridges that support the Spanning Tree
    -- Protocol.
    -- ---------------------------------------------------------------- --
```

```
dot1dStpProtocolSpecification OBJECT-TYPE
    SYNTAX        INTEGER {
                      unknown(1),
                      decLb100(2),
                      ieee8021d(3)
                  }
    MAX-ACCESS  read-only
    STATUS        current
    DESCRIPTION
        "An indication of what version of the Spanning Tree
        Protocol is being run.  The value 'decLb100(2)'
        indicates the DEC LANbridge 100 Spanning Tree protocol.
        IEEE 802.1D implementations will return 'ieee8021d(3)'.
        If future versions of the IEEE Spanning Tree Protocol
        that are incompatible with the current version
        are released a new value will be defined."
    ::= { dot1dStp 1 }

dot1dStpPriority OBJECT-TYPE
    SYNTAX        Integer32 (0..65535)
    MAX-ACCESS  read-write
    STATUS        current
    DESCRIPTION
        "The value of the write-able portion of the Bridge ID
        (i.e., the first two octets of the (8 octet long) Bridge
        ID).  The other (last) 6 octets of the Bridge ID are
        given by the value of dot1dBaseBridgeAddress.
        On bridges supporting IEEE 802.1t or IEEE 802.1w,
        permissible values are 0-61440, in steps of 4096."
    REFERENCE
        "IEEE 802.1D-1998 clause 8.10.2, Table 8-4,
        IEEE 802.1t clause 8.10.2, Table 8-4, clause 14.3."
    ::= { dot1dStp 2 }

dot1dStpTimeSinceTopologyChange OBJECT-TYPE
    SYNTAX        TimeTicks
    UNITS         "centi-seconds"
    MAX-ACCESS  read-only
    STATUS        current
    DESCRIPTION
        "The time (in hundredths of a second) since the
        last time a topology change was detected by the
        bridge entity.
        For RSTP, this reports the time since the tcWhile
        timer for any port on this Bridge was nonzero."
    REFERENCE
        "IEEE 802.1D-1998 clause 14.8.1.1.,
        IEEE 802.1w clause 14.8.1.1."
```

```
        ::= { dot1dStp 3 }

    dot1dStpTopChanges OBJECT-TYPE
        SYNTAX         Counter32
        MAX-ACCESS  read-only
        STATUS         current
        DESCRIPTION
            "The total number of topology changes detected by
            this bridge since the management entity was last
            reset or initialized."
        REFERENCE
            "IEEE 802.1D-1998 clause 14.8.1.1."
        ::= { dot1dStp 4 }

    dot1dStpDesignatedRoot OBJECT-TYPE
        SYNTAX         BridgeId
        MAX-ACCESS  read-only
        STATUS         current
        DESCRIPTION
            "The bridge identifier of the root of the spanning
            tree, as determined by the Spanning Tree Protocol,
            as executed by this node.  This value is used as
            the Root Identifier parameter in all Configuration
            Bridge PDUs originated by this node."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.1"
        ::= { dot1dStp 5 }

    dot1dStpRootCost OBJECT-TYPE
        SYNTAX         Integer32
        MAX-ACCESS  read-only
        STATUS         current
        DESCRIPTION
            "The cost of the path to the root as seen from
            this bridge."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.2"
        ::= { dot1dStp 6 }

    dot1dStpRootPort OBJECT-TYPE
        SYNTAX         Integer32
        MAX-ACCESS  read-only
        STATUS         current
        DESCRIPTION
            "The port number of the port that offers the lowest
            cost path from this bridge to the root bridge."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.3"
```

```
        ::= { dot1dStp 7 }

    dot1dStpMaxAge OBJECT-TYPE
        SYNTAX      Timeout
        UNITS       "centi-seconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The maximum age of Spanning Tree Protocol information
            learned from the network on any port before it is
            discarded, in units of hundredths of a second.  This is
            the actual value that this bridge is currently using."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.4"
        ::= { dot1dStp 8 }

    dot1dStpHelloTime OBJECT-TYPE
        SYNTAX      Timeout
        UNITS       "centi-seconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The amount of time between the transmission of
            Configuration bridge PDUs by this node on any port when
            it is the root of the spanning tree, or trying to become
            so, in units of hundredths of a second.  This is the
            actual value that this bridge is currently using."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.5"
        ::= { dot1dStp 9 }

    dot1dStpHoldTime OBJECT-TYPE
        SYNTAX      Integer32
        UNITS       "centi-seconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This time value determines the interval length
            during which no more than two Configuration bridge
            PDUs shall be transmitted by this node, in units
            of hundredths of a second."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.14"
        ::= { dot1dStp 10 }

    dot1dStpForwardDelay OBJECT-TYPE
        SYNTAX      Timeout
        UNITS       "centi-seconds"
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This time value, measured in units of hundredths of a
            second, controls how fast a port changes its spanning
            state when moving towards the Forwarding state.  The
            value determines how long the port stays in each of the
            Listening and Learning states, which precede the
            Forwarding state.  This value is also used when a
            topology change has been detected and is underway, to
            age all dynamic entries in the Forwarding Database.
            [Note that this value is the one that this bridge is
            currently using, in contrast to
            dot1dStpBridgeForwardDelay, which is the value that this
            bridge and all others would start using if/when this
            bridge were to become the root.]"
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.6"
        ::= { dot1dStp 11 }

    dot1dStpBridgeMaxAge OBJECT-TYPE
        SYNTAX      Timeout (600..4000)
        UNITS       "centi-seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The value that all bridges use for MaxAge when this
            bridge is acting as the root.  Note that 802.1D-1998
            specifies that the range for this parameter is related
            to the value of dot1dStpBridgeHelloTime.  The
            granularity of this timer is specified by 802.1D-1998 to
            be 1 second.  An agent may return a badValue error if a
            set is attempted to a value that is not a whole number
            of seconds."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.8"
        ::= { dot1dStp 12 }

    dot1dStpBridgeHelloTime OBJECT-TYPE
        SYNTAX      Timeout (100..1000)
        UNITS       "centi-seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The value that all bridges use for HelloTime when this
            bridge is acting as the root.  The granularity of this
            timer is specified by 802.1D-1998 to be 1 second.  An
            agent may return a badValue error if a set is attempted
```

```
            to a value that is not a whole number of seconds."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.9"
        ::= { dot1dStp 13 }

    dot1dStpBridgeForwardDelay OBJECT-TYPE
        SYNTAX      Timeout (400..3000)
        UNITS       "centi-seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The value that all bridges use for ForwardDelay when
            this bridge is acting as the root.  Note that
            802.1D-1998 specifies that the range for this parameter
            is related to the value of dot1dStpBridgeMaxAge.  The
            granularity of this timer is specified by 802.1D-1998 to
            be 1 second.  An agent may return a badValue error if a
            set is attempted to a value that is not a whole number
            of seconds."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.3.10"
        ::= { dot1dStp 14 }

    -- ---------------------------------------------------------------- --
    -- The Spanning Tree Port Table
    -- ---------------------------------------------------------------- --

    dot1dStpPortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF Dot1dStpPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A table that contains port-specific information
            for the Spanning Tree Protocol."
        ::= { dot1dStp 15 }

    dot1dStpPortEntry OBJECT-TYPE
        SYNTAX      Dot1dStpPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A list of information maintained by every port about
            the Spanning Tree Protocol state for that port."
        INDEX   { dot1dStpPort }
        ::= { dot1dStpPortTable 1 }

    Dot1dStpPortEntry ::=
        SEQUENCE {
```

```
            dot1dStpPort
                Integer32,
            dot1dStpPortPriority
                Integer32,
            dot1dStpPortState
                INTEGER,
            dot1dStpPortEnable
                INTEGER,
            dot1dStpPortPathCost
                Integer32,
            dot1dStpPortDesignatedRoot
                BridgeId,
            dot1dStpPortDesignatedCost
                Integer32,
            dot1dStpPortDesignatedBridge
                BridgeId,
            dot1dStpPortDesignatedPort
                OCTET STRING,
            dot1dStpPortForwardTransitions
                Counter32,
            dot1dStpPortPathCost32
                Integer32
        }

    dot1dStpPort OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The port number of the port for which this entry
            contains Spanning Tree Protocol management information."
        REFERENCE
            "IEEE 802.1D-1998: clause 14.8.2.1.2"
        ::= { dot1dStpPortEntry 1 }

    dot1dStpPortPriority OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The value of the priority field that is contained in
            the first (in network byte order) octet of the (2 octet
            long) Port ID.  The other octet of the Port ID is given
            by the value of dot1dStpPort.
            On bridges supporting IEEE 802.1t or IEEE 802.1w,
            permissible values are 0-240, in steps of 16."
        REFERENCE
            "IEEE 802.1D-1998 clause 8.10.2, Table 8-4,
```

```
             IEEE 802.1t clause 8.10.2, Table 8-4, clause 14.3."
        ::= { dot1dStpPortEntry 2 }

   dot1dStpPortState OBJECT-TYPE
        SYNTAX        INTEGER {
                         disabled(1),
                         blocking(2),
                         listening(3),
                         learning(4),
                         forwarding(5),
                         broken(6)
                      }
        MAX-ACCESS  read-only
        STATUS        current
        DESCRIPTION
           "The port's current state, as defined by application of
            the Spanning Tree Protocol.  This state controls what
            action a port takes on reception of a frame.  If the
            bridge has detected a port that is malfunctioning, it
            will place that port into the broken(6) state.  For
            ports that are disabled (see dot1dStpPortEnable), this
            object will have a value of disabled(1)."
        REFERENCE
           "IEEE 802.1D-1998: clause 8.5.5.2"
        ::= { dot1dStpPortEntry 3 }

   dot1dStpPortEnable OBJECT-TYPE
        SYNTAX        INTEGER {
                         enabled(1),
                         disabled(2)
                      }
        MAX-ACCESS  read-write
        STATUS        current
        DESCRIPTION
           "The enabled/disabled status of the port."
        REFERENCE
           "IEEE 802.1D-1998: clause 8.5.5.2"
        ::= { dot1dStpPortEntry 4 }

   dot1dStpPortPathCost OBJECT-TYPE
        SYNTAX        Integer32 (1..65535)
        MAX-ACCESS  read-write
        STATUS        current
        DESCRIPTION
           "The contribution of this port to the path cost of
            paths towards the spanning tree root which include
            this port.  802.1D-1998 recommends that the default
            value of this parameter be in inverse proportion to
```

                 the speed of the attached LAN.

                 New implementations should support dot1dStpPortPathCost32.
                 If the port path costs exceeds the maximum value of this
                 object then this object should report the maximum value,
                 namely 65535. Applications should try to read the
                 dot1dStpPortPathCost32 object if this object reports
                 the maximum value."
            REFERENCE "IEEE 802.1D-1998: clause 8.5.5.3"
                 ::= { dot1dStpPortEntry 5 }

        dot1dStpPortDesignatedRoot OBJECT-TYPE
            SYNTAX   BridgeId
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                 "The unique Bridge Identifier of the Bridge
                 recorded as the Root in the Configuration BPDUs
                 transmitted by the Designated Bridge for the
                 segment to which the port is attached."
            REFERENCE
                 "IEEE 802.1D-1998: clause 8.5.5.4"
            ::= { dot1dStpPortEntry 6 }

        dot1dStpPortDesignatedCost OBJECT-TYPE
            SYNTAX   Integer32
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                 "The path cost of the Designated Port of the segment
                 connected to this port. This value is compared to the
                 Root Path Cost field in received bridge PDUs."
            REFERENCE
                 "IEEE 802.1D-1998: clause 8.5.5.5"
            ::= { dot1dStpPortEntry 7 }

        dot1dStpPortDesignatedBridge OBJECT-TYPE
            SYNTAX   BridgeId
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                 "The Bridge Identifier of the bridge that this
                 port considers to be the Designated Bridge for
                 this port's segment."
            REFERENCE
                 "IEEE 802.1D-1998: clause 8.5.5.6"
            ::= { dot1dStpPortEntry 8 }

```
    dot1dStpPortDesignatedPort OBJECT-TYPE
        SYNTAX        OCTET STRING (SIZE (2))
        MAX-ACCESS  read-only
        STATUS        current
        DESCRIPTION
            "The Port Identifier of the port on the Designated
            Bridge for this port's segment."
        REFERENCE
            "IEEE 802.1D-1998: clause 8.5.5.7"
        ::= { dot1dStpPortEntry 9 }

    dot1dStpPortForwardTransitions OBJECT-TYPE
        SYNTAX        Counter32
        MAX-ACCESS  read-only
        STATUS        current
        DESCRIPTION
            "The number of times this port has transitioned
            from the Learning state to the Forwarding state."
        ::= { dot1dStpPortEntry 10 }

    dot1dStpPortPathCost32 OBJECT-TYPE
        SYNTAX        Integer32 (1..200000000)
        MAX-ACCESS  read-write
        STATUS        current
        DESCRIPTION
            "The contribution of this port to the path cost of
            paths towards the spanning tree root which include
            this port.  802.1D-1998 recommends that the default
            value of this parameter be in inverse proportion to
            the speed of the attached LAN.

            This object replaces dot1dStpPortPathCost to support
            IEEE 802.1t."
        REFERENCE
            "IEEE 802.1t clause 8.10.2, Table 8-5."
        ::= { dot1dStpPortEntry 11 }

    -- ---------------------------------------------------------------- --
    -- the dot1dTp subtree
    -- ---------------------------------------------------------------- --
    -- Implementation of the dot1dTp subtree is optional.  It is
    -- implemented by those bridges that support the transparent
    -- bridging mode.  A transparent or SRT bridge will implement
    -- this subtree.
    -- ---------------------------------------------------------------- --

    dot1dTpLearnedEntryDiscards OBJECT-TYPE
        SYNTAX        Counter32
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of Forwarding Database entries that
        have been or would have been learned, but have been
        discarded due to a lack of storage space in the
        Forwarding Database.  If this counter is increasing, it
        indicates that the Forwarding Database is regularly
        becoming full (a condition that has unpleasant
        performance effects on the subnetwork).  If this counter
        has a significant value but is not presently increasing,
        it indicates that the problem has been occurring but is
        not persistent."
    REFERENCE
        "IEEE 802.1D-1998: clause 14.7.1.1.3"
    ::= { dot1dTp 1 }

dot1dTpAgingTime OBJECT-TYPE
    SYNTAX      Integer32 (10..1000000)
    UNITS       "seconds"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "The timeout period in seconds for aging out
        dynamically-learned forwarding information.
        802.1D-1998 recommends a default of 300 seconds."
    REFERENCE
        "IEEE 802.1D-1998: clause 14.7.1.1.3"
    ::= { dot1dTp 2 }


-- ---------------------------------------------------------------- --
--   The Forwarding Database for Transparent Bridges
-- ---------------------------------------------------------------- --

dot1dTpFdbTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF Dot1dTpFdbEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table that contains information about unicast
        entries for which the bridge has forwarding and/or
        filtering information.  This information is used
        by the transparent bridging function in
        determining how to propagate a received frame."
    ::= { dot1dTp 3 }

dot1dTpFdbEntry OBJECT-TYPE
```

```
    SYNTAX      Dot1dTpFdbEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about a specific unicast MAC address
        for which the bridge has some forwarding and/or
        filtering information."
    INDEX   { dot1dTpFdbAddress }
    ::= { dot1dTpFdbTable 1 }

Dot1dTpFdbEntry ::=
    SEQUENCE {
        dot1dTpFdbAddress
            MacAddress,
        dot1dTpFdbPort
            Integer32,
        dot1dTpFdbStatus
            INTEGER
    }

dot1dTpFdbAddress OBJECT-TYPE
    SYNTAX      MacAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "A unicast MAC address for which the bridge has
        forwarding and/or filtering information."
    REFERENCE
        "IEEE 802.1D-1998: clause 7.9.1, 7.9.2"
    ::= { dot1dTpFdbEntry 1 }

dot1dTpFdbPort OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Either the value '0', or the port number of the port on
        which a frame having a source address equal to the value
        of the corresponding instance of dot1dTpFdbAddress has
        been seen.  A value of '0' indicates that the port
        number has not been learned, but that the bridge does
        have some forwarding/filtering information about this
        address (e.g., in the dot1dStaticTable).  Implementors
        are encouraged to assign the port value to this object
        whenever it is learned, even for addresses for which the
        corresponding value of dot1dTpFdbStatus is not
        learned(3)."
    ::= { dot1dTpFdbEntry 2 }
```

```
dot1dTpFdbStatus OBJECT-TYPE
    SYNTAX        INTEGER {
                    other(1),
                    invalid(2),
                    learned(3),
                    self(4),
                    mgmt(5)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The status of this entry.  The meanings of the
        values are:
            other(1) - none of the following.  This would
                include the case where some other MIB object
                (not the corresponding instance of
                dot1dTpFdbPort, nor an entry in the
                dot1dStaticTable) is being used to determine if
                and how frames addressed to the value of the
                corresponding instance of dot1dTpFdbAddress are
                being forwarded.
            invalid(2) - this entry is no longer valid (e.g.,
                it was learned but has since aged out), but has
                not yet been flushed from the table.
            learned(3) - the value of the corresponding instance
                of dot1dTpFdbPort was learned, and is being
                used.
            self(4) - the value of the corresponding instance of
                dot1dTpFdbAddress represents one of the bridge's
                addresses.  The corresponding instance of
                dot1dTpFdbPort indicates which of the bridge's
                ports has this address.
            mgmt(5) - the value of the corresponding instance of
                dot1dTpFdbAddress is also the value of an
                existing instance of dot1dStaticAddress."
    ::= { dot1dTpFdbEntry 3 }

-- ---------------------------------------------------------------- --
-- Port Table for Transparent Bridges
-- ---------------------------------------------------------------- --

dot1dTpPortTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF Dot1dTpPortEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table that contains information about every port that
        is associated with this transparent bridge."
```

```
       ::= { dot1dTp 4 }

   dot1dTpPortEntry OBJECT-TYPE
       SYNTAX      Dot1dTpPortEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "A list of information for each port of a transparent
           bridge."
       INDEX   { dot1dTpPort }
       ::= { dot1dTpPortTable 1 }

   Dot1dTpPortEntry ::=
       SEQUENCE {
           dot1dTpPort
               Integer32,
           dot1dTpPortMaxInfo
               Integer32,
           dot1dTpPortInFrames
               Counter32,
           dot1dTpPortOutFrames
               Counter32,
           dot1dTpPortInDiscards
               Counter32
       }

   dot1dTpPort OBJECT-TYPE
       SYNTAX      Integer32 (1..65535)
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The port number of the port for which this entry
           contains Transparent bridging management information."
       ::= { dot1dTpPortEntry 1 }

   -- It would be nice if we could use ifMtu as the size of the
   -- largest INFO field, but we can't because ifMtu is defined
   -- to be the size that the (inter-)network layer can use, which
   -- can differ from the MAC layer (especially if several layers
   -- of encapsulation are used).

   dot1dTpPortMaxInfo OBJECT-TYPE
       SYNTAX      Integer32
       UNITS       "bytes"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The maximum size of the INFO (non-MAC) field that
```

                    this port will receive or transmit."
            ::= { dot1dTpPortEntry 2 }

        dot1dTpPortInFrames OBJECT-TYPE
            SYNTAX   Counter32
            UNITS   "frames"
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                "The number of frames that have been received by this
                port from its segment. Note that a frame received on the
                interface corresponding to this port is only counted by
                this object if and only if it is for a protocol being
                processed by the local bridging function, including
                bridge management frames."
            REFERENCE
                "IEEE 802.1D-1998: clause 14.6.1.1.3"
            ::= { dot1dTpPortEntry 3 }

        dot1dTpPortOutFrames OBJECT-TYPE
            SYNTAX   Counter32
            UNITS   "frames"
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                "The number of frames that have been transmitted by this
                port to its segment. Note that a frame transmitted on
                the interface corresponding to this port is only counted
                by this object if and only if it is for a protocol being
                processed by the local bridging function, including
                bridge management frames."
            REFERENCE
                "IEEE 802.1D-1998: clause 14.6.1.1.3"
            ::= { dot1dTpPortEntry 4 }

        dot1dTpPortInDiscards OBJECT-TYPE
            SYNTAX   Counter32
            UNITS   "frames"
            MAX-ACCESS   read-only
            STATUS   current
            DESCRIPTION
                "Count of received valid frames that were discarded
                (i.e., filtered) by the Forwarding Process."
            REFERENCE
                "IEEE 802.1D-1998: clause 14.6.1.1.3"
            ::= { dot1dTpPortEntry 5 }

        -- --- --

```
   -- The Static (Destination-Address Filtering) Database
   -- ------------------------------------------------------------- --
   -- Implementation of this subtree is optional.
   -- ------------------------------------------------------------- --

   dot1dStaticTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF Dot1dStaticEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "A table containing filtering information configured
           into the bridge by (local or network) management
           specifying the set of ports to which frames received
           from specific ports and containing specific destination
           addresses are allowed to be forwarded.  The value of
           zero in this table, as the port number from which frames
           with a specific destination address are received, is
           used to specify all ports for which there is no specific
           entry in this table for that particular destination
           address.  Entries are valid for unicast and for
           group/broadcast addresses."
       REFERENCE
           "IEEE 802.1D-1998: clause 14.7.2"
       ::= { dot1dStatic 1 }

   dot1dStaticEntry OBJECT-TYPE
       SYNTAX      Dot1dStaticEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Filtering information configured into the bridge by
           (local or network) management specifying the set of
           ports to which frames received from a specific port and
           containing a specific destination address are allowed to
           be forwarded."
       REFERENCE
           "IEEE 802.1D-1998: clause 14.7.2"
       INDEX   { dot1dStaticAddress, dot1dStaticReceivePort }
       ::= { dot1dStaticTable 1 }

   Dot1dStaticEntry ::=
       SEQUENCE {
           dot1dStaticAddress       MacAddress,
           dot1dStaticReceivePort   Integer32,
           dot1dStaticAllowedToGoTo OCTET STRING,
           dot1dStaticStatus        INTEGER
       }
```

    dot1dStaticAddress OBJECT-TYPE
        SYNTAX   MacAddress
        MAX-ACCESS read-create
        STATUS   current
        DESCRIPTION
            "The destination MAC address in a frame to which this
            entry's filtering information applies. This object can
            take the value of a unicast address, a group address, or
            the broadcast address."
        REFERENCE
            "IEEE 802.1D-1998: clause 7.9.1, 7.9.2"
        ::= { dot1dStaticEntry 1 }

    dot1dStaticReceivePort OBJECT-TYPE
        SYNTAX   Integer32 (0..65535)
        MAX-ACCESS read-create
        STATUS   current
        DESCRIPTION
            "Either the value '0', or the port number of the port
            from which a frame must be received in order for this
            entry's filtering information to apply. A value of zero
            indicates that this entry applies on all ports of the
            bridge for which there is no other applicable entry."
        ::= { dot1dStaticEntry 2 }

    dot1dStaticAllowedToGoTo OBJECT-TYPE
        SYNTAX   OCTET STRING (SIZE (0..512))
        MAX-ACCESS read-create
        STATUS   current
        DESCRIPTION
            "The set of ports to which frames received from a
            specific port and destined for a specific MAC address,
            are allowed to be forwarded. Each octet within the
            value of this object specifies a set of eight ports,
            with the first octet specifying ports 1 through 8, the
            second octet specifying ports 9 through 16, etc. Within
            each octet, the most significant bit represents the
            lowest numbered port, and the least significant bit
            represents the highest numbered port. Thus, each port
            of the bridge is represented by a single bit within the
            value of this object. If that bit has a value of '1',
            then that port is included in the set of ports; the port
            is not included if its bit has a value of '0'. (Note
            that the setting of the bit corresponding to the port
            from which a frame is received is irrelevant.) The
            default value of this object is a string of ones of
            appropriate length.

```
            The value of this object may exceed the required minimum
            maximum message size of some SNMP transport (484 bytes,
            in the case of SNMP over UDP, see RFC 3417, section 3.2).
            SNMP engines on bridges supporting a large number of
            ports must support appropriate maximum message sizes."
        ::= { dot1dStaticEntry 3 }

    dot1dStaticStatus OBJECT-TYPE
        SYNTAX        INTEGER {
                        other(1),
                        invalid(2),
                        permanent(3),
                        deleteOnReset(4),
                        deleteOnTimeout(5)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This object indicates the status of this entry.
            The default value is permanent(3).
                other(1) - this entry is currently in use but the
                    conditions under which it will remain so are
                    different from each of the following values.
                invalid(2) - writing this value to the object
                    removes the corresponding entry.
                permanent(3) - this entry is currently in use and
                    will remain so after the next reset of the
                    bridge.
                deleteOnReset(4) - this entry is currently in use
                    and will remain so until the next reset of the
                    bridge.
                deleteOnTimeout(5) - this entry is currently in use
                    and will remain so until it is aged out."
        ::= { dot1dStaticEntry 4 }

    -- ------------------------------------------------------------- --
    -- Notifications for use by Bridges
    -- ------------------------------------------------------------- --
    -- Notifications for the Spanning Tree Protocol
    -- ------------------------------------------------------------- --

    newRoot NOTIFICATION-TYPE
        -- OBJECTS     { }
        STATUS      current
        DESCRIPTION
            "The newRoot trap indicates that the sending agent has
            become the new root of the Spanning Tree; the trap is
            sent by a bridge soon after its election as the new
```

```
                root, e.g., upon expiration of the Topology Change Timer,
                immediately subsequent to its election.  Implementation
                of this trap is optional."
            ::= { dot1dNotifications 1 }

        topologyChange NOTIFICATION-TYPE
            -- OBJECTS     { }
            STATUS        current
            DESCRIPTION
                "A topologyChange trap is sent by a bridge when any of
                its configured ports transitions from the Learning state
                to the Forwarding state, or from the Forwarding state to
                the Blocking state.  The trap is not sent if a newRoot
                trap is sent for the same transition.  Implementation of
                this trap is optional."
            ::= { dot1dNotifications 2 }


        -- ------------------------------------------------------------- --
        -- IEEE 802.1D MIB - Conformance Information
        -- ------------------------------------------------------------- --

        dot1dGroups          OBJECT IDENTIFIER ::= { dot1dConformance 1 }
        dot1dCompliances     OBJECT IDENTIFIER ::= { dot1dConformance 2 }

        -- ------------------------------------------------------------- --
        -- units of conformance
        -- ------------------------------------------------------------- --


        -- ------------------------------------------------------------- --
        -- the dot1dBase group
        -- ------------------------------------------------------------- --

        dot1dBaseBridgeGroup OBJECT-GROUP
            OBJECTS {
                dot1dBaseBridgeAddress,
                dot1dBaseNumPorts,
                dot1dBaseType
            }
            STATUS        current
            DESCRIPTION
                "Bridge level information for this device."
            ::= { dot1dGroups 1 }

        dot1dBasePortGroup OBJECT-GROUP
            OBJECTS {
                dot1dBasePort,
                dot1dBasePortIfIndex,
                dot1dBasePortCircuit,
```

```
        dot1dBasePortDelayExceededDiscards,
        dot1dBasePortMtuExceededDiscards
    }
    STATUS      current
    DESCRIPTION
        "Information for each port on this device."
    ::= { dot1dGroups 2 }

-- ---------------------------------------------------------------- --
-- the dot1dStp group
-- ---------------------------------------------------------------- --

dot1dStpBridgeGroup OBJECT-GROUP
    OBJECTS {
        dot1dStpProtocolSpecification,
        dot1dStpPriority,
        dot1dStpTimeSinceTopologyChange,
        dot1dStpTopChanges,
        dot1dStpDesignatedRoot,
        dot1dStpRootCost,
        dot1dStpRootPort,
        dot1dStpMaxAge,
        dot1dStpHelloTime,
        dot1dStpHoldTime,
        dot1dStpForwardDelay,
        dot1dStpBridgeMaxAge,
        dot1dStpBridgeHelloTime,
        dot1dStpBridgeForwardDelay
    }
    STATUS      current
    DESCRIPTION
        "Bridge level Spanning Tree data for this device."
    ::= { dot1dGroups 3 }

dot1dStpPortGroup OBJECT-GROUP
    OBJECTS {
        dot1dStpPort,
        dot1dStpPortPriority,
        dot1dStpPortState,
        dot1dStpPortEnable,
        dot1dStpPortPathCost,
        dot1dStpPortDesignatedRoot,
        dot1dStpPortDesignatedCost,
        dot1dStpPortDesignatedBridge,
        dot1dStpPortDesignatedPort,
        dot1dStpPortForwardTransitions
    }
    STATUS      current
```

```
        DESCRIPTION
            "Spanning Tree data for each port on this device."
        ::= { dot1dGroups 4 }

    dot1dStpPortGroup2 OBJECT-GROUP
        OBJECTS {
            dot1dStpPort,
            dot1dStpPortPriority,
            dot1dStpPortState,
            dot1dStpPortEnable,
            dot1dStpPortDesignatedRoot,
            dot1dStpPortDesignatedCost,
            dot1dStpPortDesignatedBridge,
            dot1dStpPortDesignatedPort,
            dot1dStpPortForwardTransitions,
            dot1dStpPortPathCost32
        }
        STATUS       current
        DESCRIPTION
            "Spanning Tree data for each port on this device."
        ::= { dot1dGroups 5 }

    dot1dStpPortGroup3 OBJECT-GROUP
        OBJECTS {
            dot1dStpPortPathCost32
        }
        STATUS       current
        DESCRIPTION
            "Spanning Tree data for devices supporting 32-bit
             path costs."
        ::= { dot1dGroups 6 }

    -- ---------------------------------------------------------- --
    -- the dot1dTp group
    -- ---------------------------------------------------------- --

    dot1dTpBridgeGroup OBJECT-GROUP
        OBJECTS {
            dot1dTpLearnedEntryDiscards,
            dot1dTpAgingTime
        }
        STATUS       current
        DESCRIPTION
            "Bridge level Transparent Bridging data."
        ::= { dot1dGroups 7 }

    dot1dTpFdbGroup OBJECT-GROUP
        OBJECTS {
```

```
            dot1dTpFdbAddress,
            dot1dTpFdbPort,
            dot1dTpFdbStatus
        }

        STATUS        current
        DESCRIPTION
            "Filtering Database information for the Bridge."
        ::= { dot1dGroups 8 }

    dot1dTpGroup OBJECT-GROUP
        OBJECTS {
            dot1dTpPort,
            dot1dTpPortMaxInfo,
            dot1dTpPortInFrames,
            dot1dTpPortOutFrames,
            dot1dTpPortInDiscards
        }
        STATUS        current
        DESCRIPTION
            "Dynamic Filtering Database information for each port of
            the Bridge."
        ::= { dot1dGroups 9 }

    -- ---------------------------------------------------------------- --
    -- The Static (Destination-Address Filtering) Database
    -- ---------------------------------------------------------------- --

    dot1dStaticGroup OBJECT-GROUP
        OBJECTS {
            dot1dStaticAddress,
            dot1dStaticReceivePort,
            dot1dStaticAllowedToGoTo,
            dot1dStaticStatus
        }
        STATUS        current
        DESCRIPTION
            "Static Filtering Database information for each port of
            the Bridge."
        ::= { dot1dGroups 10 }

    -- ---------------------------------------------------------------- --
    -- The Trap Notification Group
    -- ---------------------------------------------------------------- --

    dot1dNotificationGroup NOTIFICATION-GROUP
        NOTIFICATIONS {
            newRoot,
```

```
            topologyChange
        }
        STATUS        current
        DESCRIPTION
            "Group of objects describing notifications (traps)."
        ::= { dot1dGroups 11 }

    -- ---------------------------------------------------------------- --
    -- compliance statements
    -- ---------------------------------------------------------------- --

    bridgeCompliance1493 MODULE-COMPLIANCE
        STATUS        current
        DESCRIPTION
            "The compliance statement for device support of bridging
            services, as per RFC1493."

        MODULE
            MANDATORY-GROUPS {
                dot1dBaseBridgeGroup,
                dot1dBasePortGroup
            }

        GROUP    dot1dStpBridgeGroup
        DESCRIPTION
            "Implementation of this group is mandatory for bridges
            that support the Spanning Tree Protocol."

        GROUP    dot1dStpPortGroup
        DESCRIPTION
            "Implementation of this group is mandatory for bridges
            that support the Spanning Tree Protocol."

        GROUP    dot1dTpBridgeGroup
        DESCRIPTION
            "Implementation of this group is mandatory for bridges
            that support the transparent bridging mode.  A
            transparent or SRT bridge will implement this group."

        GROUP    dot1dTpFdbGroup
        DESCRIPTION
            "Implementation of this group is mandatory for bridges
            that support the transparent bridging mode.  A
            transparent or SRT bridge will implement this group."

        GROUP    dot1dTpGroup
        DESCRIPTION
            "Implementation of this group is mandatory for bridges
```

            that support the transparent bridging mode. A
            transparent or SRT bridge will implement this group."

        GROUP   dot1dStaticGroup
        DESCRIPTION
            "Implementation of this group is optional."

        GROUP dot1dNotificationGroup
        DESCRIPTION
            "Implementation of this group is optional."
        ::= { dot1dCompliances 1 }

    bridgeCompliance4188 MODULE-COMPLIANCE
        STATUS   current
        DESCRIPTION
            "The compliance statement for device support of bridging
            services. This supports 32-bit Path Cost values and the
            more restricted bridge and port priorities, as per IEEE
            802.1t.

            Full support for the 802.1D management objects requires that
            the SNMPv2-MIB [RFC3418] objects sysDescr, and sysUpTime, as
            well as the IF-MIB [RFC2863] objects ifIndex, ifType,
            ifDescr, ifPhysAddress, and ifLastChange are implemented."

        MODULE
            MANDATORY-GROUPS {
                dot1dBaseBridgeGroup,
                dot1dBasePortGroup
            }

        GROUP   dot1dStpBridgeGroup
        DESCRIPTION
            "Implementation of this group is mandatory for
            bridges that support the Spanning Tree Protocol."

        OBJECT dot1dStpPriority
        SYNTAX Integer32 (0|4096|8192|12288|16384|20480|24576
                        |28672|32768|36864|40960|45056|49152
                        |53248|57344|61440)
        DESCRIPTION
            "The possible values defined by IEEE 802.1t."

        GROUP   dot1dStpPortGroup2
        DESCRIPTION
            "Implementation of this group is mandatory for
            bridges that support the Spanning Tree Protocol."

```
    GROUP    dot1dStpPortGroup3
    DESCRIPTION
        "Implementation of this group is mandatory for bridges
         that support the Spanning Tree Protocol and 32-bit path
         costs.  In particular, this includes devices supporting
         IEEE 802.1t and IEEE 802.1w."

    OBJECT dot1dStpPortPriority
    SYNTAX Integer32 (0|16|32|48|64|80|96|112|128
                     |144|160|176|192|208|224|240)
    DESCRIPTION
        "The possible values defined by IEEE 802.1t."

    GROUP    dot1dTpBridgeGroup
    DESCRIPTION
        "Implementation of this group is mandatory for
         bridges that support the transparent bridging
         mode.  A transparent or SRT bridge will implement
         this group."

    GROUP    dot1dTpFdbGroup
    DESCRIPTION
        "Implementation of this group is mandatory for
         bridges that support the transparent bridging
         mode.  A transparent or SRT bridge will implement
         this group."

    GROUP    dot1dTpGroup
    DESCRIPTION
        "Implementation of this group is mandatory for
         bridges that support the transparent bridging
         mode.  A transparent or SRT bridge will implement
         this group."

    GROUP    dot1dStaticGroup
    DESCRIPTION
        "Implementation of this group is optional."

    GROUP dot1dNotificationGroup
    DESCRIPTION
        "Implementation of this group is optional."

    ::= { dot1dCompliances 2 }

END
```

5. IANA Considerations

   The MIB module in this document uses the following IANA-assigned
   OBJECT IDENTIFIER values that are recorded in the SMI Numbers
   registry:

      Descriptor   OBJECT IDENTIFIER value
      ----------   -----------------------
      dot1dBridge   { mib-2 17 }

6. Security Considerations

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

   Some of the readable objects in this MIB module (i.e., objects with a
   MAX-ACCESS other than not-accessible) may be considered sensitive or
   vulnerable in some network environments. It is thus important to
   control even GET and/or NOTIFY access to these objects and possibly
   to even encrypt the values of these objects when sending them over
   the network via SNMP.

   These are the tables and objects and their sensitivity/vulnerability:

   o The writable objects dot1dStpPriority, dot1dStpBridgeMaxAge,
      dot1dStpBridgeHelloTime, dot1dStpBridgeForwardDelay,
      dot1dStpPortPriority, dot1dStpPortEnable, dot1dStpPortPathCost,
      and dot1dStpPortPathCost32 influence the spanning tree protocol.
      Unauthorized write access to these objects can cause the spanning
      tree protocol to compute other default topologies or it can change
      the speed in which the spanning tree protocol reacts to failures.

   o The writable object dot1dTpAgingTime controls how fast
      dynamically-learned forwarding information is aged out. Setting
      this object to a large value may simplify forwarding table
      overflow attacks.

   o The writable dot1dStaticTable provides a filtering mechanism
      controlling to which ports frames originating from a specific
      source may be forwarded. Write access to this table can be used
      to turn provisioned filtering off or to add filters to prevent
      rightful use of the network.

o The readable objects defined in the BRIDGE-MIB module provide
   information about the topology of a bridged network and the
   attached active stations. The addresses listed in the
   dot1dTpFdbTable usually reveal information about the manufacturer
   of the MAC hardware, which can be useful information for mounting
   other specific attacks.

o The two notifications newRoot and topologyChange are emitted
   during spanning tree computation and may trigger management
   systems to inspect the status of bridges and to recompute internal
   topology information. Hence, forged notifications may cause
   management systems to perform unnecessary computations and to
   generate additional SNMP traffic directed to the bridges in a
   network. Therefore, forged notifications may be part of a denial
   of service attack.

SNMP versions prior to SNMPv3 did not include adequate security.
Even if the network itself is secure (for example by using IPSec),
even then, there is no control as to who on the secure network is
allowed to access and GET/SET (read/change/create/delete) the objects
in this MIB module.

It is RECOMMENDED that implementers consider the security features as
provided by the SNMPv3 framework (see [RFC3410], section 8),
including full support for the SNMPv3 cryptographic mechanisms (for
authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT
RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
enable cryptographic security. It is then a customer/operator
responsibility to ensure that the SNMP entity giving access to an
instance of this MIB module is properly configured to give access to
the objects only to those principals (users) that have legitimate
rights to indeed GET or SET (change/create/delete) them.

7. Acknowledgements

The MIB module presented in this memo is a translation of the
BRIDGE-MIB defined in [RFC1493] to the SMIv2 syntax. The original
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publication.

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9. Changes from RFC 1493

   The following changes have been made from RFC 1493.

   1. Translated the MIB definitions to use SMIv2. This includes the
      introduction of conformance statements. ASN.1 type definitions
      have been converted into textual-conventions and several UNITS
      clauses were added.

   2. The object dot1dStpPortPathCost32 was added to support IEEE
      802.1t.

   3. Permissible values for dot1dStpPriority and dot1dStpPortPriority
      have been clarified for bridges supporting IEEE 802.1t or IEEE
      802.1w.

   4. Interpretation of dot1dStpTimeSinceTopologyChange has been
      clarified for bridges supporting the rapid spanning tree protocol
      (RSTP).

   5. Updated the introductory boilerplate text, the security
      considerations section, and the references to comply with the
      current IETF standards and guidelines.

   6. Updated references to point to newer IEEE 802.1d documents.

   7. Additions and clarifications in various description clauses.

10. References

10.1 Normative References

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10.2 Informative References

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