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# Definitions of Managed Objects for Bridges

## Status of this Memo

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

## 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-1990 standard between Local Area Network (LAN) segments. Provisions are made for support of transparent bridging. Provisions are also made so that these objects apply to bridges connected by subnetworks other than LAN segments.

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## 1. The Network Management Framework

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

STD16/RFC 1155 which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. STD16/RFC 1212 defines a more concise description mechanism, which is wholly consistent with the SMI.

RFC 1156 which defines MIB-I, the core set of managed objects for the Internet suite of protocols. STD17/RFC 1213, defines MIB-II, an evolution of MIB-I based on implementation experience and new operational requirements.

STD15/RFC 1157 which defines the SNMP, the protocol used for network access to managed objects.

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

## 2. Objects

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) [7] defined in the SMI. In particular, each object is named by an OBJECT IDENTIFIER, an administratively assigned name, which specifies an object type. 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 also refer to the object type.

### 2.1. Format of Definitions

Section 5 contains the specification of all object types contained in this MIB module. The object types are defined using the conventions defined in the SMI, as amended by the extensions specified in [9,10].

## 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 draft IEEE 802.1d specification [11]. This memo defines those objects needed for the management of a bridging entity operating in the transparent mode, as well as some objects applicable to all types of bridges.

To be consistent with IAB directives and good engineering practice, an explicit attempt was made to keep this MIB 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 objects be essential for either fault or configuration management.

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

(4) Limit the total of objects.

(5) Exclude objects which are simply derivable from others in this or other MIBs.

(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 MIB

Objects in this MIB are arranged into groups. Each group is organized as a set of related objects. The overall structure and assignment of objects to their groups is shown below. Where appropriate the corresponding IEEE 802.1d [11] 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 for the indicated reasons.

| IEEE 802.1d Object | Disposition |
|---|---|
| Bridge.BridgeName | Same as sysDescr (MIB II) |
| Bridge.BridgeUpTime | Same as sysUpTime (MIB II) |
| Bridge.PortAddresses | Same as ifPhysAddress (MIB II) |
| BridgePort.PortName | Same as ifDescr (MIB II) |
| BridgePort.PortType | Same as ifType (MIB II) |
| BridgePort.RoutingType | Derivable from the implemented groups |
| SpanningTreeProtocol | |
| .BridgeIdentifier | Combination of dot1dStpPriority and dot1dBaseBridgeAddress |
| .TopologyChange | Since this is transitory, it is not considered useful. |
| SpanningTreeProtocolPort | |
| .Uptime | Same as ifLastChange (MIB II) |
| .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 not considered useful. |
| .TransmissionPriorityName | |
| .OutboundUserPriority | |
| .OutboundAccessPriority | |

#### 3.1.1. The dot1dBase Group

This mandatory group contains the objects which are applicable to all types of bridges.

#### 3.1.2. The dot1dStp Group

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

#### 3.1.3. The dot1dSr Group

This group contains the objects that describe the entity's state with respect to source route bridging. If source routing is not supported this group will not be implemented. This group is applicable to source route only, and SRT bridges. This group will be described in a separate document applicable only to source route bridging.

#### 3.1.4. The dot1dTp Group

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

#### 3.1.5. The dot1dStatic Group

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

### 3.2. Relationship to Other MIBs

As described above, some IEEE 802.1d management objects have not been included in this MIB because they overlap with objects in other MIBs applicable to a bridge implementing this MIB. In particular, it is assumed that a bridge implementing this MIB will also implement (at least) the 'system' group and the 'interfaces' group defined in MIB-II [6].

#### 3.2.1. 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 as a whole irrespective of whether the entity's sole functionality is bridging, or whether bridging is only a subset of the entity's functionality.

### 3.2.2. 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.) 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.

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' group, 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 but 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 functionality 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 which exclusively performed bridging, all protocols would be considered as being bridged, whereas in an entity which performed IP routing on IP datagrams and only bridged other protocols, only the non-IP data would be considered as being bridged.

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

### 3.3. Textual Conventions

The datatypes, MacAddress, BridgeId and Timeout, are used as textual conventions in this document. These textual conventions have NO effect on either the syntax nor the semantics of any managed object. Objects defined using these conventions are always encoded by means of the rules that define their primitive type. Hence, no changes to the SMI or the SNMP are necessary to accommodate these textual conventions which are adopted merely for the convenience of readers.

## 4. Changes from RFC 1286

(1) Updated all text to remove references to source route bridging where not applicable. SR MIB will be a separate document.

(2) Removed dot1dSrPortTable. Retained OID definition of dot1dSr.

(3) Updated all references of "draft P802.1d/D9" to "IEEE 802.1D-1990".

(4) Updated bibliography.

(5) Added clarification to description of dot1dPortPathCost.

(6) Put recommended default in description of dot1dStaticAllowedToGoTo.

(7) Put recommended default in description of dot1dStaticStatus.

(8) Put recommended default in description of dot1dTpAgingTime. Specified range of (10..1000000).

(9) Updated all port number syntaxes, when used as index, to use the range (1..65535).

(10) Updated definition of dot1dTpPortInFrames and dot1dTpPortOutFrames.

(11) Added text to the traps indicating that they are optional.

(12) Clarified definition of dot1dStpForwardDelay.

## 5. Definitions

```
        BRIDGE-MIB DEFINITIONS ::= BEGIN

        IMPORTS
                    Counter, TimeTicks
                            FROM RFC1155-SMI
                    mib-2
                            FROM RFC1213-MIB
                    OBJECT-TYPE
                            FROM RFC-1212
                    TRAP-TYPE
                            FROM RFC-1215;

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

        MacAddress ::= OCTET STRING (SIZE (6))    -- a 6 octet address
                                                  -- in the
                                                  -- "canonical"
                                                  -- order
        -- defined by IEEE 802.1a, i.e., as if it were transmitted
        -- least significant bit first, even though 802.5 (in
        -- contrast to other n802.x protocols) requires MAC
        -- addresses to be transmitted most significant bit first.
        --
        -- 16-bit addresses, if needed, are represented by setting
        -- their upper 4 octets to all 0's, i.e., AAFF would be
        -- represented as 00000000AAFF.


        -- Similarly, all representations of Bridge-Id in this MIB
        -- Module use, as a textual convention (i.e. this
        -- convention does not affect their encoding), the data
        -- type:

        BridgeId ::= OCTET STRING (SIZE (8))   -- 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).
```

```
-- 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 hundreths 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-1990 specifies a settable granularity of
-- no more than 1 second for these timers.  To avoid
-- ambiguity, a data type is defined here as a textual
-- convention and all representation of these timers
-- in this MIB module are defined using this data type.  An
-- algorithm is also defined for converting between the
-- different units, to ensure a timer's value is not
-- distorted by multiple conversions.
-- The data type is:

Timeout ::= INTEGER -- a STP timer in units of 1/100 seconds

-- 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 non-zero]
--      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).


   dot1dBridge   OBJECT IDENTIFIER ::= { mib-2 17 }
```

```
        -- groups in the Bridge MIB

        dot1dBase     OBJECT IDENTIFIER ::= { dot1dBridge 1 }

        dot1dStp      OBJECT IDENTIFIER ::= { dot1dBridge 2 }

        dot1dSr       OBJECT IDENTIFIER ::= { dot1dBridge 3 }
        -- separately documented

        dot1dTp       OBJECT IDENTIFIER ::= { dot1dBridge 4 }

        dot1dStatic   OBJECT IDENTIFIER ::= { dot1dBridge 5 }


        -- the dot1dBase group

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

        dot1dBaseBridgeAddress OBJECT-TYPE
            SYNTAX  MacAddress
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Sections 6.4.1.1.3 and 3.12.5"
            ::= { dot1dBase 1 }

        dot1dBaseNumPorts OBJECT-TYPE
            SYNTAX  INTEGER
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The number of ports controlled by this bridging
                    entity."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.4.1.1.3"
            ::= { dot1dBase 2 }

        dot1dBaseType OBJECT-TYPE
```

```
            SYNTAX  INTEGER {
                        unknown(1),
                        transparent-only(2),
                        sourceroute-only(3),
                        srt(4)
                    }
            ACCESS  read-only
            STATUS  mandatory
            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
            ACCESS  not-accessible
            STATUS  mandatory
            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
            ACCESS  not-accessible
            STATUS  mandatory
            DESCRIPTION
                    "A list of information for each port of the
                    bridge."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.4.2, 6.6.1"
            INDEX  { dot1dBasePort }
            ::= { dot1dBasePortTable 1 }


        Dot1dBasePortEntry ::=
            SEQUENCE {
                dot1dBasePort
                    INTEGER,
                dot1dBasePortIfIndex
                    INTEGER,
                dot1dBasePortCircuit
```

```
                    OBJECT IDENTIFIER,
                dot1dBasePortDelayExceededDiscards
                    Counter,
                dot1dBasePortMtuExceededDiscards
                    Counter
            }

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

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

        dot1dBasePortCircuit OBJECT-TYPE
            SYNTAX  OBJECT IDENTIFIER
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "For a port which (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  Counter
```

```
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 6.6.1.1.3"
            ::= { dot1dBasePortEntry 4 }

        dot1dBasePortMtuExceededDiscards OBJECT-TYPE
            SYNTAX  Counter
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 6.6.1.1.3"
            ::= { dot1dBasePortEntry 5 }


        -- the dot1dStp group

        -- Implementation of the dot1dStp group 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)
                    }
            ACCESS  read-only
            STATUS  mandatory
            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
                    are released that are incompatible with the
                    current version a new value will be defined."
```

```
            ::= { dot1dStp 1 }

        dot1dStpPriority OBJECT-TYPE
            SYNTAX  INTEGER (0..65535)
            ACCESS  read-write
            STATUS  mandatory
            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."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.3.7"
            ::= { dot1dStp 2 }

        dot1dStpTimeSinceTopologyChange OBJECT-TYPE
            SYNTAX  TimeTicks
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The time (in hundredths of a second) since the
                    last time a topology change was detected by the
                    bridge entity."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.8.1.1.3"
            ::= { dot1dStp 3 }

        dot1dStpTopChanges OBJECT-TYPE
            SYNTAX  Counter
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The total number of topology changes detected by
                    this bridge since the management entity was last
                    reset or initialized."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.8.1.1.3"
            ::= { dot1dStp 4 }

        dot1dStpDesignatedRoot OBJECT-TYPE
            SYNTAX  BridgeId
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 4.5.3.1"
        ::= { dot1dStp 5 }

    dot1dStpRootCost OBJECT-TYPE
        SYNTAX  INTEGER
        ACCESS  read-only
        STATUS  mandatory
        DESCRIPTION
                "The cost of the path to the root as seen from
                this bridge."
        REFERENCE
                "IEEE 802.1D-1990: Section 4.5.3.2"
        ::= { dot1dStp 6 }

    dot1dStpRootPort OBJECT-TYPE
        SYNTAX  INTEGER
        ACCESS  read-only
        STATUS  mandatory
        DESCRIPTION
                "The port number of the port which offers the
                lowest cost path from this bridge to the root
                bridge."
        REFERENCE
                "IEEE 802.1D-1990: Section 4.5.3.3"
        ::= { dot1dStp 7 }

    dot1dStpMaxAge OBJECT-TYPE
        SYNTAX  Timeout
        ACCESS  read-only
        STATUS  mandatory
        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-1990: Section 4.5.3.4"
        ::= { dot1dStp 8 }

    dot1dStpHelloTime OBJECT-TYPE
        SYNTAX  Timeout
        ACCESS  read-only
        STATUS  mandatory
        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-1990: Section 4.5.3.5"
            ::= { dot1dStp 9 }

        dot1dStpHoldTime OBJECT-TYPE
            SYNTAX  INTEGER
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 4.5.3.14"
            ::= { dot1dStp 10 }

        dot1dStpForwardDelay OBJECT-TYPE
            SYNTAX  Timeout
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 4.5.3.6"
            ::= { dot1dStp 11 }

        dot1dStpBridgeMaxAge OBJECT-TYPE
            SYNTAX  Timeout (600..4000)
```

```
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The value that all bridges use for MaxAge when
                    this bridge is acting as the root.  Note that
                    802.1D-1990 specifies that the range for this
                    parameter is related to the value of
                    dot1dStpBridgeHelloTime. The granularity of this
                    timer is specified by 802.1D-1990 to be 1 second.
                    An agent may return a badValue error if a set is
                    attempted to a value which is not a whole number
                    of seconds."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.3.8"
            ::= { dot1dStp 12 }

        dot1dStpBridgeHelloTime OBJECT-TYPE
            SYNTAX  Timeout (100..1000)
            ACCESS  read-write
            STATUS  mandatory
            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-
                    1990 to be 1 second.  An agent may return a
                    badValue error if a set is attempted to a value
                    which is not a whole number of seconds."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.3.9"
            ::= { dot1dStp 13 }

        dot1dStpBridgeForwardDelay OBJECT-TYPE
            SYNTAX  Timeout (400..3000)
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The value that all bridges use for ForwardDelay
                    when this bridge is acting as the root.  Note that
                    802.1D-1990 specifies that the range for this
                    parameter is related to the value of
                    dot1dStpBridgeMaxAge.  The granularity of this
                    timer is specified by 802.1D-1990 to be 1 second.
                    An agent may return a badValue error if a set is
                    attempted to a value which is not a whole number
                    of seconds."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.3.10"
            ::= { dot1dStp 14 }
```

```
        -- The Spanning Tree Port Table

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

        dot1dStpPortEntry OBJECT-TYPE
            SYNTAX  Dot1dStpPortEntry
            ACCESS  not-accessible
            STATUS  mandatory
            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
                    INTEGER,
                dot1dStpPortPriority
                    INTEGER,
                dot1dStpPortState
                    INTEGER,
                dot1dStpPortEnable
                    INTEGER,
                dot1dStpPortPathCost
                    INTEGER,
                dot1dStpPortDesignatedRoot
                    BridgeId,
                dot1dStpPortDesignatedCost
                    INTEGER,
                dot1dStpPortDesignatedBridge
                    BridgeId,
                dot1dStpPortDesignatedPort
                    OCTET STRING,
                dot1dStpPortForwardTransitions
                    Counter
            }

        dot1dStpPort OBJECT-TYPE
            SYNTAX  INTEGER (1..65535)
```

```
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The port number of the port for which this entry
                    contains Spanning Tree Protocol management
                    information."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.8.2.1.2"
            ::= { dot1dStpPortEntry 1 }

        dot1dStpPortPriority OBJECT-TYPE
            SYNTAX  INTEGER (0..255)
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The value of the priority field which 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."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.5.1"
            ::= { dot1dStpPortEntry 2 }

        dot1dStpPortState OBJECT-TYPE
            SYNTAX  INTEGER {
                        disabled(1),
                        blocking(2),
                        listening(3),
                        learning(4),
                        forwarding(5),
                        broken(6)
                    }
            ACCESS  read-only
            STATUS  mandatory
            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 which
                    are disabled (see dot1dStpPortEnable), this object
                    will have a value of disabled(1)."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.5.2"
            ::= { dot1dStpPortEntry 3 }
```

```
        dot1dStpPortEnable OBJECT-TYPE
            SYNTAX  INTEGER {
                        enabled(1),
                        disabled(2)
                    }
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The enabled/disabled status of the port."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.5.2"
            ::= { dot1dStpPortEntry 4 }

        dot1dStpPortPathCost OBJECT-TYPE
            SYNTAX  INTEGER (1..65535)
            ACCESS  read-write
            STATUS  mandatory
            DESCRIPTION
                    "The contribution of this port to the path cost of
                    paths towards the spanning tree root which include
                    this port.  802.1D-1990 recommends that the
                    default value of this parameter be in inverse
                    proportion to the speed of the attached LAN."
            REFERENCE
                    "IEEE 802.1D-1990: Section 4.5.5.3"
            ::= { dot1dStpPortEntry 5 }

        dot1dStpPortDesignatedRoot OBJECT-TYPE
            SYNTAX  BridgeId
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 4.5.5.4"
            ::= { dot1dStpPortEntry 6 }

        dot1dStpPortDesignatedCost OBJECT-TYPE
            SYNTAX  INTEGER
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 4.5.5.5"
        ::= { dot1dStpPortEntry 7 }

    dot1dStpPortDesignatedBridge OBJECT-TYPE
        SYNTAX  BridgeId
        ACCESS  read-only
        STATUS  mandatory
        DESCRIPTION
                "The Bridge Identifier of the bridge which this
                port considers to be the Designated Bridge for
                this port's segment."
        REFERENCE
                "IEEE 802.1D-1990: Section 4.5.5.6"
        ::= { dot1dStpPortEntry 8 }

    dot1dStpPortDesignatedPort OBJECT-TYPE
        SYNTAX  OCTET STRING (SIZE (2))
        ACCESS  read-only
        STATUS  mandatory
        DESCRIPTION
                "The Port Identifier of the port on the Designated
                Bridge for this port's segment."
        REFERENCE
                "IEEE 802.1D-1990: Section 4.5.5.7"
        ::= { dot1dStpPortEntry 9 }

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


    -- the dot1dTp group

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


    dot1dTpLearnedEntryDiscards OBJECT-TYPE
        SYNTAX  Counter
```

```
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The total number of Forwarding Database entries,
                    which have been or would have been learnt, but
                    have been discarded due to a lack of space to
                    store them in the Forwarding Database.  If this
                    counter is increasing, it indicates that the
                    Forwarding Database is regularly becoming full (a
                    condition which 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-1990: Section 6.7.1.1.3"
            ::= { dot1dTp 1 }

        dot1dTpAgingTime OBJECT-TYPE
            SYNTAX   INTEGER (10..1000000)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                    "The timeout period in seconds for aging out
                    dynamically learned forwarding information.
                    802.1D-1990 recommends a default of 300 seconds."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.7.1.1.3"
            ::= { dot1dTp 2 }


        --  The Forwarding Database for Transparent Bridges

        dot1dTpFdbTable OBJECT-TYPE
            SYNTAX  SEQUENCE OF Dot1dTpFdbEntry
            ACCESS  not-accessible
            STATUS  mandatory
            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
            ACCESS  not-accessible
```

```
            STATUS  mandatory
            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
                    INTEGER,
                dot1dTpFdbStatus
                    INTEGER
            }

        dot1dTpFdbAddress OBJECT-TYPE
            SYNTAX  MacAddress
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "A unicast MAC address for which the bridge has
                    forwarding and/or filtering information."
            REFERENCE
                    "IEEE 802.1D-1990: Section 3.9.1, 3.9.2"
            ::= { dot1dTpFdbEntry 1 }

        dot1dTpFdbPort OBJECT-TYPE
            SYNTAX  INTEGER
            ACCESS  read-only
            STATUS  mandatory
            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)
                    }
            ACCESS  read-only
            STATUS  mandatory
            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 not 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
            ACCESS  not-accessible
            STATUS  mandatory
            DESCRIPTION
                    "A table that contains information about every
                    port that is associated with this transparent
                    bridge."
            ::= { dot1dTp 4 }

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

        Dot1dTpPortEntry ::=
            SEQUENCE {
                dot1dTpPort
                    INTEGER,
                dot1dTpPortMaxInfo
                    INTEGER,
                dot1dTpPortInFrames
                    Counter,
                dot1dTpPortOutFrames
                    Counter,
                dot1dTpPortInDiscards
                    Counter
            }

        dot1dTpPort OBJECT-TYPE
            SYNTAX  INTEGER (1..65535)
            ACCESS  read-only
            STATUS  mandatory
            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  INTEGER
            ACCESS  read-only
            STATUS  mandatory
            DESCRIPTION
                    "The maximum size of the INFO (non-MAC) field that
                    this port will receive or transmit."
            ::= { dot1dTpPortEntry 2 }

        dot1dTpPortInFrames OBJECT-TYPE
            SYNTAX  Counter
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 6.6.1.1.3"
            ::= { dot1dTpPortEntry 3 }

        dot1dTpPortOutFrames OBJECT-TYPE
            SYNTAX  Counter
            ACCESS  read-only
            STATUS  mandatory
            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-1990: Section 6.6.1.1.3"
            ::= { dot1dTpPortEntry 4 }

        dot1dTpPortInDiscards OBJECT-TYPE
            SYNTAX   Counter
            ACCESS   read-only
```

```
            STATUS   mandatory
            DESCRIPTION
                    "Count of valid frames received which were
                    discarded (i.e., filtered) by the Forwarding
                    Process."
            REFERENCE
                    "IEEE 802.1D-1990: Section 6.6.1.1.3"
            ::= { dot1dTpPortEntry 5 }


        -- The Static (Destination-Address Filtering) Database

        -- Implementation of this group is optional.


        dot1dStaticTable OBJECT-TYPE
            SYNTAX  SEQUENCE OF Dot1dStaticEntry
            ACCESS  not-accessible
            STATUS  mandatory
            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-1990: Section 6.7.2"
            ::= { dot1dStatic 1 }

        dot1dStaticEntry OBJECT-TYPE
            SYNTAX  Dot1dStaticEntry
            ACCESS  not-accessible
            STATUS  mandatory
            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-1990: Section 6.7.2"
```

```
            INDEX   { dot1dStaticAddress, dot1dStaticReceivePort }
            ::= { dot1dStaticTable 1 }

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

        dot1dStaticAddress OBJECT-TYPE
            SYNTAX  MacAddress
            ACCESS  read-write
            STATUS  mandatory
            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-1990: Section 3.9.1, 3.9.2"
            ::= { dot1dStaticEntry 1 }

        dot1dStaticReceivePort OBJECT-TYPE
            SYNTAX  INTEGER
            ACCESS  read-write
            STATUS  mandatory
            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
            ACCESS  read-write
            STATUS  mandatory
            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."
        ::= { dot1dStaticEntry 3 }

    dot1dStaticStatus OBJECT-TYPE
        SYNTAX  INTEGER {
                    other(1),
                    invalid(2),
                    permanent(3),
                    deleteOnReset(4),
                    deleteOnTimeout(5)
                }
        ACCESS  read-write
        STATUS  mandatory
        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 }


    -- Traps for use by Bridges

    -- Traps for the Spanning Tree Protocol

    newRoot TRAP-TYPE
        ENTERPRISE  dot1dBridge
        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."
        ::= 1

    topologyChange TRAP-TYPE
        ENTERPRISE  dot1dBridge
        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."
        ::= 2

    END
```

## 6. Acknowledgments

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## 8. Security Considerations

Security issues are not discussed in this memo.

## 9. Authors' Addresses

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