

Network Working Group
Request for Comments: 4188
Obsoletes: 1493
Category: Standards Track

K. Norseth, Ed.
L-3 Communications
E. Bell, Ed.
3Com Europe Limited
September 2005

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.

Copyright Notice

Copyright (C) The Internet Society (2005).

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 | 2 |
| 2. Conventions | 2 |
| 3. Overview | 3 |
| 3.1. Structure of the MIB Module | 3 |
| 3.1.1. The dotldBase Subtree | 6 |
| 3.1.2. The dotldStp Subtree | 6 |
| 3.1.3. The dotldSr Subtree | 6 |
| 3.1.4. The dotldTp Subtree | 6 |
| 3.1.5. The dotldStatic Subtree | 6 |
| 3.2. Relationship to Other MIB Modules | 6 |
| 3.2.1. Relationship to the SNMPv2-MIB | 7 |
| 3.2.2. Relationship to the IF-MIB | 7 |
| 4. Definitions | 8 |
| 5. IANA Considerations | 39 |
| 6. Security Considerations | 39 |
| 7. Acknowledgements | 40 |
| 8. Contact Information | 41 |
| 9. Changes from RFC 1493 | 42 |
| 10. References | 42 |
| 10.1. Normative References | 42 |
| 10.2. Informative References | 43 |

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  
        Tel: +1 801-594-2809  
        Email: kenyon.c.norseth@L-3com.com  
        Postal: 640 N. 2200 West.  
        Salt Lake City, Utah 84116-0850
```


Les Bell (Editor)
3Com Europe Limited
Phone: +44 1442 438025
Email: elbell@ntlworld.com
Postal: 3Com Centre, Boundary Way
Hemel Hempstead
Herts. HP2 7YU
UK

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:

$$b = \text{floor}((n * 256) / 100)$$

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:

$$n = \text{ceiling}((b * 100) / 256)$$

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
 -- -----

dotldNotifications OBJECT IDENTIFIER ::= { dotldBridge 0 }

dotldBase OBJECT IDENTIFIER ::= { dotldBridge 1 }

dotldStp OBJECT IDENTIFIER ::= { dotldBridge 2 }

dotldSr OBJECT IDENTIFIER ::= { dotldBridge 3 }

-- documented in RFC 1525

dotldTp OBJECT IDENTIFIER ::= { dotldBridge 4 }

dotldStatic OBJECT IDENTIFIER ::= { dotldBridge 5 }

-- Subtrees used by Bridge MIB Extensions:

-- pBridgeMIB MODULE-IDENTITY ::= { dotldBridge 6 }

-- qBridgeMIB MODULE-IDENTITY ::= { dotldBridge 7 }

-- Note that the practice of registering related MIB modules below dotldBridge has been discouraged since there is no robust mechanism to track such registrations.

dotldConformance OBJECT IDENTIFIER ::= { dotldBridge 8 }

-- -----
 -- the dotldBase subtree
 -- -----

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

dotldBaseBridgeAddress 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 dotldStpPriority, 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"

::= { dotldBase 1 }

dotldBaseNumPorts 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"

::= { dotldBase 2 }

dotldBaseType 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."

::= { dotldBase 3 }

-- -----
-- The Generic Bridge Port Table
-- -----

dotldBasePortTable OBJECT-TYPE

SYNTAX SEQUENCE OF DotldBasePortEntry

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."

::= { dotldBase 4 }

```

dotldBasePortEntry OBJECT-TYPE
    SYNTAX      DotldBasePortEntry
    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       { dotldBasePort }
    ::= { dotldBasePortTable 1 }

DotldBasePortEntry ::=
    SEQUENCE {
        dotldBasePort
            Integer32,
        dotldBasePortIfIndex
            InterfaceIndex,
        dotldBasePortCircuit
            OBJECT IDENTIFIER,
        dotldBasePortDelayExceededDiscards
            Counter32,
        dotldBasePortMtuExceededDiscards
            Counter32
    }

dotldBasePort 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."
    ::= { dotldBasePortEntry 1 }

dotldBasePortIfIndex 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."
    ::= { dotldBasePortEntry 2 }

dotldBasePortCircuit 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 }
```

```

dotldTpFdbStatus 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
                dotldTpFdbPort, nor an entry in the
                dotldStaticTable) is being used to determine if
                and how frames addressed to the value of the
                corresponding instance of dotldTpFdbAddress 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 dotldTpFdbPort was learned, and is being
                used.
            self(4) - the value of the corresponding instance of
                dotldTpFdbAddress represents one of the bridge's
                addresses.  The corresponding instance of
                dotldTpFdbPort indicates which of the bridge's
                ports has this address.
            mgmt(5) - the value of the corresponding instance of
                dotldTpFdbAddress is also the value of an
                existing instance of dotldStaticAddress."
    ::= { dotldTpFdbEntry 3 }

```

```

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

```

```

dotldTpPortTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF DotldTpPortEntry
    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.
-- -----
```

dotldStaticTable OBJECT-TYPE

```
SYNTAX      SEQUENCE OF DotldStaticEntry
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"
 ::= { dotldStatic 1 }
```

dotldStaticEntry OBJECT-TYPE

```
SYNTAX      DotldStaticEntry
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       { dotldStaticAddress, dotldStaticReceivePort }
 ::= { dotldStaticTable 1 }
```

DotldStaticEntry ::=

```
SEQUENCE {
    dotldStaticAddress      MacAddress,
    dotldStaticReceivePort  Integer32,
    dotldStaticAllowedToGoTo OCTET STRING,
    dotldStaticStatus       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 authors of the SMIV1 module were E. Decker, P. Langille, A. Rijssinghani, and K. McCloghrrie. Further acknowledgement is given to the members of the original Bridge Working Group in [RFC1493].

This document was produced on behalf of the Bridge MIB Working Group in the Operations and Management area of the Internet Engineering Task Force. The editors wish to thank the members of the Bridge MIB Working Group, especially Mike MacFadden, John Flick, and Bert Visscher for their many comments and suggestions that improved this

effort. Juergen Schoenwaelder helped in finalizing the document for publication.

8. Contact Information

The original version of this document was the result of significant work by four major contributors:

E. Decker

P. Langille

A. Rijssinghan
Accton Technology Corporation
5 Mount Royal Ave
Marlboro, MA 01752
USA

K. McCloghrie
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

The conversion to the SMIV2 format is based on work done by the following two contributors:

Kenyon C. Norseth
L-3 Communications
640 N. 2200 West
Salt Lake City, Utah 84116-0850
USA

E. Bell
3Com Europe Limited
3Com Centre, Boundary Way
Hemel Hempstead Herts. HP2 7YU
UK

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

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIV2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIV2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIV2", STD 58, RFC 2580, April 1999.

- [RFC3418] Presuhn, R., "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)", STD 62, RFC 3418, December 2002.
- [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.
- [IEEE8021D] IEEE Project 802 Local and Metropolitan Area Networks, "ANSI/IEEE Standard 802.1D-1998 MAC Bridges", March 1998.

10.2 Informative References

- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.
- [RFC1493] Decker, E., Langille, P., Rijssinghani, A., and K. McCloghrie, "Definitions of Managed Objects for Bridges", RFC 1493, July 1993.
- [RFC1525] Decker, E., McCloghrie, K., Langille, P., and A. Rijssinghani, "Definitions of Managed Objects for Source Routing Bridges", RFC 1525, September 1993.

Authors' Addresses

Kenyon C. Norseth (editor)
L-3 Communications
640 N. 2200 West
Salt Lake City, Utah 84116-0850
USA

Phone: +1 801-594-2809
EMail: kenyon.c.norseth@L-3com.com

E. Bell (editor)
3Com Europe Limited
3Com Centre, Boundary Way
Hemel Hempstead Herts. HP2 7YU
UK

Phone: +44 1442 438025
EMail: elbell@ntlworld.com

Full Copyright Statement

Copyright (C) The Internet Society (2005).

This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

