Definitions of Managed Objects for IEEE 802.1q
Virtual LAN Bridges

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1. Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular it describes objects used for managing bridges based on the IEEE 802.1q draft standard between Local Area Network (LAN) segments.

This memo uses SNMPv2 as the basis for defining VLAN MIB, and refers to other MIBs whose published definitions use SNMPv2 convention.
2. The SNMPv2 Network Management Framework

The SNMPv2 Network Management Framework presently consists of four major components. They are:

- **RFC 1902** [1] which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management.
- **RFC 1213** [2] defines MIB-II, the core set of managed objects for the Internet suite of protocols.
- **RFC 1157** [3] and **RFC 1905** [4] which defines two versions of the protocol used network access to managed objects.

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

3. 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) defined in the SMI. In particular, each object object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to also refer to the object type.

4. Overview

Virtual LAN (VLAN) is now an integral feature of switched LAN networks. VLAN can be viewed as a group of end-stations on multiple LAN segments and can communicate as if they were on a single LAN. The VLAN Bridge which implements Virtual LAN provides the following benefits.

(i) Broadcast containment
(ii) Security
(iii) Easy administration
There are various styles in which Virtual LANs can be defined.

(i) Port based VLAN
(ii) MAC address based VLAN
(iii) Protocol based VLAN
(iv) IP Subnet based VLAN
(v) IP Multicast based VLAN
(vi) ELAN based VLAN
(vii) Policy based VLAN

IEEE 802.1q is currently working on port based Virtual LAN. This memo defines those objects needed for the management of a Port based VLAN. The definitions presented here are based on Section 7, "VLAN Bridge management" of IEEE Draft 802.1q-1997 [7].

4.1. Structure of MIB

The Managed objects in this MIB are arranged into a single group. The overall structure and assignment of objects to the group is shown below. The mapping of IEEE 802.1q management objects is also included.

<table>
<thead>
<tr>
<th>VLAN Bridge MIB Name</th>
<th>IEEE 802.1q Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>dot1qVlan</td>
<td>BridgeVlanConfiguration</td>
</tr>
<tr>
<td>Version</td>
<td>.VersionNumber</td>
</tr>
<tr>
<td>NumVlans</td>
<td></td>
</tr>
<tr>
<td>VlanTypesSupported</td>
<td></td>
</tr>
<tr>
<td>TriggerPortSet</td>
<td>.TriggerPortSet</td>
</tr>
<tr>
<td>PortTable</td>
<td></td>
</tr>
<tr>
<td>Port</td>
<td>.PortNumber</td>
</tr>
<tr>
<td>PVID</td>
<td>.PVID</td>
</tr>
<tr>
<td>ConfigTable</td>
<td>VlanConfiguration</td>
</tr>
<tr>
<td>Identifier</td>
<td>.VlanIdentifier</td>
</tr>
<tr>
<td>VlanTypeInIngress</td>
<td></td>
</tr>
<tr>
<td>UntaggedPortList</td>
<td>.ListOfUntaggedPorts</td>
</tr>
<tr>
<td>EgressPortList</td>
<td>.ListOfEgressPorts</td>
</tr>
<tr>
<td>Enable</td>
<td></td>
</tr>
</tbody>
</table>

5. Application of MIB II to VLAN

5.1. The ‘interfaces’ Group

The Interfaces Group of MIB II defines generic managed objects for managing interfaces. This memo contains the media-specific extensions to the Interfaces Group for managing VLAN interfaces.
This memo assumes the interpretation of the Interfaces Group to be in accordance with [5] which states that the interfaces table (ifTable) contains information on the managed resource’s interfaces and that each sub-layer below the internetwork layer of a network interface is considered an interface. Thus the VLAN interface is represented as an entry in the ifTable. The inter-relation of entries in the ifTable is defined by Interfaces Stack Group defined in [5].

5.1.1. Interpretations of ifTable for VLAN

Some specific interpretations of ifTable for the VLAN layer follow.

<table>
<thead>
<tr>
<th>ifTable Object</th>
<th>Use for VLAN Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ifIndex</td>
<td>Each VLAN is represented by an entry in the ifTable.</td>
</tr>
<tr>
<td>ifDescr</td>
<td>Description of the VLAN.</td>
</tr>
<tr>
<td>ifType</td>
<td>Type of the VLAN.</td>
</tr>
<tr>
<td>ifSpeed</td>
<td>The bandwidth in bits per second for use by the VLAN layer.</td>
</tr>
<tr>
<td>ifPhysAddress</td>
<td>see interfaces MIB [5].</td>
</tr>
<tr>
<td>ifAdminStatus</td>
<td>see interfaces MIB [5].</td>
</tr>
<tr>
<td>ifOperStatus</td>
<td>see interfaces MIB [5].</td>
</tr>
<tr>
<td>ifLastChange</td>
<td>see interfaces MIB [5].</td>
</tr>
<tr>
<td>ifName</td>
<td>Textual name (unique on this system) of the VLAN or an octet string of zero length.</td>
</tr>
<tr>
<td>ifLinkUpDownTrapenable</td>
<td>Default is disabled (2).</td>
</tr>
<tr>
<td>ifConnectorPresent</td>
<td>Set to false (2).</td>
</tr>
<tr>
<td>ifPromiscuousMode</td>
<td>Set to false (2).</td>
</tr>
<tr>
<td>ifHighSpeed</td>
<td>Set to false (2).</td>
</tr>
<tr>
<td>ifHCInOctets</td>
<td>The 64-bit version of ifInOctets; supported if required by the compliance statements in [5].</td>
</tr>
</tbody>
</table>
ifHCOutOctets  The 64-bit version of ifOutOctets; supported if required by the compliance statements in [5].

5.1.2. Interpretations of ifStackTable for VLAN

This section describes by example how to use ifStackTable to represent the relationship of VLAN with router interfaces. Implementors of the stack table for VLAN interface should look at the appropriate RFC for the service being stacked on VLAN. Examples given below are for illustration purposes only.

Example:

A router over VLAN interfaces.

```
+---------------------------------------------+                   
|                   Router                    |                   
+---------------------------------------------+                   
|                   |                   |                   
| +-------------------+ +------------+ +--------+ 
| | VLAN 1       | | VLAN 2     | | VLAN 3  | 
| +-------------------+ +------------+ +--------+ 
| |              | |            | |        | 
| +-------------------+ +------------+ +--------+ 
| | Ethernet     | | Token Ring | |  LANE  | 
| |     1        | |      1     | |    1   | 
| +-------------------+ +------------+ +--------+ 
```

The assignment of the index values could for example be:

<table>
<thead>
<tr>
<th>ifIndex</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP Router</td>
</tr>
<tr>
<td>2</td>
<td>VLAN #1</td>
</tr>
<tr>
<td>3</td>
<td>VLAN #2</td>
</tr>
<tr>
<td>4</td>
<td>VLAN #3</td>
</tr>
<tr>
<td>5</td>
<td>Ethernet #1</td>
</tr>
<tr>
<td>6</td>
<td>Ethernet #2</td>
</tr>
<tr>
<td>7</td>
<td>Token Ring #1</td>
</tr>
<tr>
<td>8</td>
<td>LANE #1</td>
</tr>
</tbody>
</table>

The ifStackTable is then used to show the relationships between the various interfaces.
6. Definitions

VLAN-MIB DEFINITIONS ::= BEGIN

IMPORTS
  MODULE-IDENTITY, OBJECT-TYPE, FROM SNMPv2-SMI
  MODULE-COMPLIANCE, OBJECT-GROUP FROM SNMPv2-CONF
  ifIndex FROM IF-MIB;

dot1qVlan MODULE-IDENTITY
  LAST-UPDATED "9706121330Z"
  ORGANIZATION "IETF"
  CONTACT-INFO
    " Jeyasubramanian"
    Postal: Future Software Private Limited
    481, Mount Road, Nandanam,
    Madras-600 035. INDIA
    Tel: +91 44 4340323
    Fax: +91 44 4344157
    E-mail: jeyai@future.futsoft.com"
  DESCRIPTION
    "The MIB module for managing VLAN switches."

 ::= { experimental XX }
dot1qVlanVersion OBJECT-TYPE
SYNTAX INTEGER
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The 802.1q VLAN Version number. Reported as '1' by
devices which implement VLAN functionality as per the
draft P802.1q/D5."
REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.2.1.3"
::= { dot1qVlan 1 }

dot1qVlanNumVlans OBJECT-TYPE
SYNTAX INTEGER (0..4095)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of VLANs associated with this VLAN bridge.
The number of VLANs supported by the bridge can not
exceed 4095."
REFERENCE
"P802.1q/D5, February 28, 1997: Section 4.3.2.3"
::= { dot1qVlan 2 }

dot1qVlanTypesSupported OBJECT-TYPE
SYNTAX INTEGER
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The type of VLANs supported by this VLAN bridge. Here
each bit position indicates the type of VLANs supported
by this VLAN bridge.
  0 - Port based VLAN.
  1 - MAC Address based VLAN.
  2 - Protocol based VLAN.
  3 - IP Subnet based VLAN.
  4 - IP Multicast based VLAN.
  5 - ELAN based VLAN.
  6 - Policy based VLAN"
REFERENCE
"P802.1q/D5, February 28, 1997: Section C.2.2"
::= { dot1qVlan 3 }

dot1qVlanTriggerPortSetMembers OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(8))
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The set of ports that are members of the Trigger Port Set. 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 VLAN 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.)"

DEFVAL { 0 }
REFERENCE
"P802.1q/D5, February 28, 1997: Section 6.3"
::= { dot1qVlan 4 }

-- The PVID Group
-- Implementation of this group is mandatory for all
-- VLAN bridges.

-- The PVID Group consists of one table
-- PVID

-- PVID Table
dot1qVlanPvidTable OBJECT-TYPE
SYNTAX  SEQUENCE OF Dot1qVlanPvidEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"A table that contains information about every port that is associated with this VLAN bridge."
REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.3.1"
::= { dot1qVlan 5 }

dot1qVlanPvidEntry OBJECT-TYPE
SYNTAX  Dot1qVlanPvidEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"A list of PVID information for each port of a VLAN bridge."
INDEX  { ifIndex }
REFERENCE  "P802.1q/D5, February 28, 1997: Section 7.3.1"
::= { dot1qVlanPortTable 1 }

Dot1qVlanPvidEntry ::= SEQUENCE {
    dot1qVlanPort  INTEGER,
    dot1qVlanPvid  INTEGER
}

dot1qVlanPort OBJECT-TYPE
SYNTAX  INTEGER (0..63)
MAX-ACCESS read-only
STATUS current
DESCRIPTION  "The port number of the port for which this entry contains VLAN bridging management information."
REFERENCE  "P802.1q/D5, February 28, 1997: Section 7.3.1"
::= { dot1qVlanPortEntry 1 }

dot1qVlanPvid OBJECT-TYPE
SYNTAX  INTEGER (1..4095)
MAX-ACCESS read-only
STATUS current
DESCRIPTION  "A 12 bit Port VLAN Identifier for this Port.
  0 - The Null VLAN ID. It is used when the Tag Header contains only user_priority information; No VLAN identifier is present in the frame. This number is not allowed here.
  1 - The Default PVID value used for tagging frames on ingress through a Bridge Port. The PVID used for Port-based tagging of frames can be changed by management."
REFERENCE  "P802.1q/D5, February 28, 1997: Section 3.4.1.1"
DEFVAL  { 1 }
::= { dot1qVlanPortEntry 2 }

-- The VLAN Config Group
-- Implementation of this group is mandatory for all
-- VLAN bridges.
-- The VLAN Config Group consists of one table
-- VLAN Configuration

-- VLAN Configuration Table

dot1qVlanConfigTable OBJECT-TYPE
SYNTAX  SEQUENCE OF Dot1qVlanConfigEntry
MAX-ACCESS not-accessible
STATUS  current
DESCRIPTION
"A table that contains information about every VLAN that is associated with this VLAN bridge."
REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.3"
 ::= { dot1qVlan 6 }

dot1qVlanConfigEntry OBJECT-TYPE
SYNTAX  Dot1qVlanConfigEntry
MAX-ACCESS not-accessible
STATUS  current
DESCRIPTION
"A list of information for each VLAN of a VLAN bridge."
INDEX   { ifIndex }
REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.3"
 ::= { dot1qVlanConfigTable 1 }

Dot1qVlanConfigEntry ::= SEQUENCE {
  dot1qVlanIdentifier INTEGER,
  dot1qVlanTypeInIngress INTEGER,
  dot1qVlanUntaggedPortList OCTET STRING,
  dot1qVlanEgressPortList OCTET STRING,
  dot1qVlanEnable INTEGER
}

dot1qVlanIdentifier OBJECT-TYPE
SYNTAX INTEGER (1..4095)
MAX-ACCESS read-write
STATUS  current
DESCRIPTION
"A 12 bit Identifier for this VLAN."
0 - The Null VLAN ID. It is used when the Tag Header contains only user_priority information; No VLAN identifier is present in the frame. This number is not allowed here.

1 - The Default PVID value used for tagging frames on ingress through a Bridge Port. The PVID used for Port-based tagging of frames can be changed by management.

REFERENCE
"P802.1q/D5, February 28, 1997: Section 3.4.1.1"
 ::= { dot1qVlanConfigEntry 1 }

dot1qVlanTypeInIngress OBJECT-TYPE
SYNTAX INTEGER
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"VLAN type used in ingress ports for VLAN classification of Untagged frames
0 - Port based VLAN.
1 - MAC address based VLAN.
2 - Protocol based VLAN.
3 - IP Subnet based VLAN.
4 - IP Multicast based VLAN.
5 - ELAN based VLAN.
6 - Policy based VLAN."
REFERENCE
"P802.1q/D5, February 28, 1997: Section C.2.2"
 ::= { dot1qVlanConfigEntry 2 }

dot1qVlanUntaggedPortList OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(8))
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The set of ports to which traffic destined for this VLAN should be untagged. 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 VLAN 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.)"

REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.3.1"
::= { dot1qVlanConfigEntry 3 }

dot1qVlanEgressPortList OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(8))
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The set of ports to which traffic destined for this VLAN may be transmitted. 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 VLAN 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.)"

REFERENCE
"P802.1q/D5, February 28, 1997: Section 7.3.1"
::= { dot1qVlanConfigEntry 4 }

dot1qVlanEnable OBJECT-TYPE
SYNTAX INTEGER {
  disable(1),
  enable(2)
}
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"disable - This operation causes the VLAN Identifier to be removed from the Untagged set in the Port Egress Lists of all ports of the Bridge.

enable - This operation causes the VLAN Identifier to be included in the Untagged set of the Port Egress List for each Port, in accordance with the configuration specified."

REFERENCE
"P802.1q/D5, February 28, 1997: Sections 7.3.4 and 7.3.5"
DEFVAL { disable }
::= { dot1qVlanConfigEntry 5 }
7. References


8. Acknowledgments

This draft is based on IEEE Draft P802.1q/D5.

The author wish to thank Sharon Barkai for his many comments and suggestions which improved this effort.
9. Security Considerations

Security issues are not discussed in this memo.

10. Authors’ Address

I. Jeyasubramanian  
Future Software Private Limited.  
Madras - 600 035, INDIA.  
Phone: +91-44-4340323  
Fax: +91-44-4344157  
Email: jeyai@future.futsoft.com

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