Definitions of Managed Objects for
the Virtual Router Redundancy Protocol Version 3 (VRRPv3)

Abstract

This specification defines a portion of the Management Information
Base (MIB) for use with network management based on the Simple
Network Management Protocol (SNMP). In particular, it defines
objects for configuring, monitoring, and controlling routers that
employ the Virtual Router Redundancy Protocol Version 3 (VRRPv3) for
both IPv4 and IPv6 as defined in RFC 5798. This memo obsoletes RFC
2787.

Status of This Memo

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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. Introduction

This specification defines a portion of the MIB for use with SNMP-based network management. In particular, it defines objects for configuring, monitoring, and controlling routers that employ the Virtual Router Redundancy Protocol Version 3 (VRRPv3) for both IPv4 and IPv6 as defined in RFC 5798 [RFC5798].

3. Terminology

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

4. Relationship to RFC 2787

This document obsoletes RFC 2787 [RFC2787]. The major changes in this document reflect changes in the VRRP protocol between RFC 2338 [RFC2338] and RFC 5798 [RFC5798]. This document is also updated to conform to current MIB conventions.

5. Relation to Interface Group (IF-MIB)

Since a router can be participating in VRRP on one or more interfaces, "ifIndex" is used as an index into the tables defined in the VRRP MIB. This MIB module imports ifIndex from the IF-MIB. At this time, the latest version of the IF-MIB is from RFC 2863 [RFC2863].

6. Multi-Stack Implementations

This MIB module is designed to support multi-stack implementations that run VRRP over IPv4 and IPv6. The IP version, Virtual Router Identifier (VRID), and ifIndex are used to uniquely identify rows in a multi-stack implementation.

7. Interpretation of RFC 5798

During the review of this document, it emerged that there are different possible interpretations of [RFC5798]. The authors of that document and the VRRP working group were unable to reach consensus as to which interpretation is correct. This document makes the following assumption:
IPv4 and IPv6 virtual routers are treated as two separate logical entities and represented as two separate entries in the vrrpv3OperationsTable. This is required due to the undefined behavior of the protocol in [RFC5798] in a multi-stack scenario.

8. VRRP MIB Structure and Design

This MIB module contains three tables:

1. The vrrpv3OperationsTable contains objects that define the operational characteristics of a VRRP router. Rows in this table correspond to instances of virtual routers.

2. The vrrpv3StatisticsTable contains the operating statistics for a VRRP router.

3. The vrrpv3AssociatedIpAddrTable contains the addresses of the virtual router(s) that a given VRRP router is backing up.

Tables are indexed on ifIndex, VRID, and the IP version to uniquely identify a VRRP router.

Notifications in this MIB module are controlled using the mechanisms defined in [RFC3413].

9. VRRP Multi-Stack Scenario

The following section provides examples of how some of the objects in this MIB are instantiated.

KEY:
----
The labels in the following tables and diagrams correspond to the actual MIB objects as follows:

if      = IfIndex
AddrType= vrrpv3OperationsInetAddrType
VrId    = vrrpv3OperationsVrId
State   = vrrpv3OperationsStatus
Prior   = vrrpv3OperationsPriority
IpAddr  = vrrpv3OperationsMasterIpAddr

The following figure shows a hypothetical network with two VRRP routers, VR1 & VR2, configured with two virtual routers. Addresses in ‘( )’ indicate the address of the default gateway for a given host; H1 to H4 are IPv4 hosts, and H5 to H8 are IPv6 hosts. A, B, and C are IPv4 addresses, and X, Y, and Z are IPv6 addresses. In the diagram, "Interface" is used in the context defined in IF-MIB.
### VRRP Unified MIB

**VR1**
- **Intf** = I1
- **IP A**
- **IP C**
- **VRID** = 1

**VR2**
- **Intf** = I2
- **IP X**
- **IP B**
- **IP Z**
- **VRID** = 2

<table>
<thead>
<tr>
<th>Intf</th>
<th>VRID</th>
<th>AddrType</th>
<th>State</th>
<th>Prior</th>
<th>IpAddr</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>01</td>
<td>1</td>
<td>M</td>
<td>255</td>
<td>A</td>
</tr>
<tr>
<td>I1</td>
<td>01</td>
<td>2</td>
<td>B</td>
<td>1-254</td>
<td>Y</td>
</tr>
<tr>
<td>I1</td>
<td>02</td>
<td>1</td>
<td>B</td>
<td>1-254</td>
<td>B</td>
</tr>
<tr>
<td>I1</td>
<td>02</td>
<td>2</td>
<td>M</td>
<td>255</td>
<td>X</td>
</tr>
</tbody>
</table>
### vrrpv3AssociatedIpAddrTable

<table>
<thead>
<tr>
<th>if</th>
<th>VrId</th>
<th>AddrType</th>
<th>IP</th>
<th>RowStat</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>01</td>
<td>1</td>
<td>A</td>
<td>active</td>
</tr>
<tr>
<td>I1</td>
<td>01</td>
<td>1</td>
<td>C</td>
<td>active</td>
</tr>
<tr>
<td>I1</td>
<td>01</td>
<td>2</td>
<td>Y</td>
<td>active</td>
</tr>
<tr>
<td>I1</td>
<td>01</td>
<td>2</td>
<td>Z</td>
<td>active</td>
</tr>
<tr>
<td>I1</td>
<td>02</td>
<td>1</td>
<td>B</td>
<td>active</td>
</tr>
<tr>
<td>I1</td>
<td>02</td>
<td>2</td>
<td>X</td>
<td>active</td>
</tr>
</tbody>
</table>

----- MIB Tables For VRRP Router "VR2": -----  

### vrrpv3OperationsTable

<table>
<thead>
<tr>
<th>if</th>
<th>VrId</th>
<th>AddrType</th>
<th>State</th>
<th>Prior</th>
<th>IpAddr</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2</td>
<td>01</td>
<td>1</td>
<td>B</td>
<td>1-254</td>
<td>A</td>
</tr>
<tr>
<td>I2</td>
<td>01</td>
<td>2</td>
<td>M</td>
<td>255</td>
<td>Y</td>
</tr>
<tr>
<td>I2</td>
<td>02</td>
<td>1</td>
<td>M</td>
<td>255</td>
<td>B</td>
</tr>
<tr>
<td>I2</td>
<td>02</td>
<td>2</td>
<td>B</td>
<td>1-254</td>
<td>X</td>
</tr>
</tbody>
</table>
## vrrpv3AssociatedIpAddrTable

<table>
<thead>
<tr>
<th>if</th>
<th>VrId</th>
<th>AddrType</th>
<th>IP</th>
<th>RowStat</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2</td>
<td>01</td>
<td>1</td>
<td>A</td>
<td>active</td>
</tr>
<tr>
<td>I2</td>
<td>01</td>
<td>1</td>
<td>C</td>
<td>active</td>
</tr>
<tr>
<td>I2</td>
<td>01</td>
<td>2</td>
<td>Y</td>
<td>active</td>
</tr>
<tr>
<td>I2</td>
<td>01</td>
<td>2</td>
<td>Z</td>
<td>active</td>
</tr>
<tr>
<td>I2</td>
<td>02</td>
<td>1</td>
<td>B</td>
<td>active</td>
</tr>
<tr>
<td>I2</td>
<td>02</td>
<td>2</td>
<td>X</td>
<td>active</td>
</tr>
</tbody>
</table>

### NOTES:

1) For "State": M = Master;   B = Backup.
   In the vrrpv3OperationsTable, a "priority" of 255 indicates that the respective router owns the IP address, e.g., this IP address is native to the router (i.e., "the IP Address Owner").

### 10. Definitions

This MIB module makes reference to the following documents [RFC2578], [RFC2579], [RFC2580], [RFC2863], and [RFC4001].

VRRPV3-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE,
   NOTIFICATION-TYPE, Counter32,
   Integer32, mib-2, Unsigned32,
   Counter64, TimeTicks
   FROM SNMPv2-SMI             -- RFC2578

   TEXTUAL-CONVENTION, RowStatus,
   MacAddress, TruthValue, TimeStamp,
   TimeInterval
   FROM SNMPv2-TC              -- RFC2579

   MODULE-COMPLIANCE, OBJECT-GROUP,
   NOTIFICATION-GROUP
   FROM SNMPv2-CONF            -- RFC2580

---

Tata Standards Track [Page 7]
This MIB describes objects used for managing Virtual Router Redundancy Protocol version 3 (VRRPv3).
"The value of the Virtual Router Identifier noted as (VRID) in RFC 5798. This, along with interface index (ifIndex) and IP version, serves to uniquely identify a virtual router on a given VRRP router."

REFERENCE "RFC 5798 (Sections 3 and 5.2.3)"

SYNTAX Integer32 (1..255)

-- VRRPv3 MIB Groups

vrrpv3Notifications OBJECT IDENTIFIER ::= { vrrpv3MIB 0 }
vrrpv3Objects OBJECT IDENTIFIER ::= { vrrpv3MIB 1 }
vrrpv3Conformance OBJECT IDENTIFIER ::= { vrrpv3MIB 2 }

-- VRRPv3 MIB Objects

vrrpv3Operations OBJECT IDENTIFIER ::= { vrrpv3Objects 1 }
vrrpv3Statistics OBJECT IDENTIFIER ::= { vrrpv3Objects 2 }

-- VRRPv3 Operations Table

vrrpv3OperationsTable OBJECT-TYPE
SYNTAX SEQUENCE OF Vrrpv3OperationsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Unified Operations table for a VRRP router that consists of a sequence (i.e., one or more conceptual rows) of ‘vrrpv3OperationsEntry’ items each of which describe the operational characteristics of a virtual router."

::= { vrrpv3Operations 1 }

vrrpv3OperationsEntry OBJECT-TYPE
SYNTAX Vrrpv3OperationsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in the vrrpv3OperationsTable containing the operational characteristics of a virtual router. On a VRRP router, a given virtual router is identified by a combination of ifIndex, VRID, and the IP version. ifIndex represents an interface of the router.

A row must be created with vrrpv3OperationsStatus set to initialize(1) and cannot transition to backup(2) or master(3) until"
vrrpv3OperationsRowStatus is transitioned to active(1).

The information in this table is persistent and when written the entity SHOULD save the change to non-volatile storage."

INDEX   { ifIndex, vrrpv3OperationsVrId, vrrpv3OperationsInetAddrType }
 ::= { vrrpv3OperationsTable 1 }

Vrrpv3OperationsEntry ::= SEQUENCE {
  vrrpv3OperationsVrId  Vrrpv3VrIdTC,
  vrrpv3OperationsInetAddrType  InetAddressType,
  vrrpv3OperationsMasterIpAddr  InetAddress,
  vrrpv3OperationsPrimaryIpAddr  InetAddress,
  vrrpv3OperationsVirtualMacAddr  MacAddress,
  vrrpv3OperationsStatus  INTEGER,
  vrrpv3OperationsPriority  Unsigned32,
  vrrpv3OperationsAddrCount  Integer32,
  vrrpv3OperationsAdvInterval  TimeInterval,
  vrrpv3OperationsPreemptMode  TruthValue,
  vrrpv3OperationsAcceptMode  TruthValue,
  vrrpv3OperationsUpTime  TimeTicks,
  vrrpv3OperationsRowStatus  RowStatus
}

vrrpv3OperationsVrId OBJECT-TYPE
SYNTAX       Vrrpv3VrIdTC
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This object contains the Virtual Router Identifier (VRID)."
REFERENCE "RFC 4001"
::= { vrrpv3OperationsEntry 1 }

vrrpv3OperationsInetAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The IP address type of Vrrpv3OperationsEntry and Vrrpv3AssociatedIpAddrEntry. This value determines the type for vrrpv3OperationsMasterIpAddr, vrrpv3OperationsPrimaryIpAddr, and vrrpv3AssociatedIpAddrAddress. ipv4(1) and ipv6(2) are the only two values supported in this MIB module."
REFERENCE "RFC 4001"
::= { vrrpv3OperationsEntry 2 }

vrrpv3OperationsMasterIpAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The master router’s real IP address. The master router would set this address to vrrpv3OperationsPrimaryIpAddr while transitioning to master state. For backup routers, this is the IP address listed as the source in the VRRP advertisement last received by this virtual router."
REFERENCE "RFC 5798"
::= { vrrpv3OperationsEntry 3 }

vrrpv3OperationsPrimaryIpAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"In the case where there is more than one IP Address (associated IP addresses) for a given 'ifIndex', this object is used to specify the IP address that will become the vrrpv3OperationsMasterIpAddress’, should the virtual router transition from backup state to master."
::= { vrrpv3OperationsEntry 4 }
vrrpv3OperationsVirtualMacAddr OBJECT-TYPE
SYNTAX       MacAddress
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
  "The virtual MAC address of the virtual router. Although this object can be
derived from the 'vrrpv3OperationsVrId' object, it is defined so that it
is easily obtainable by a management application and can be included in
VRRP-related SNMP notifications."
::= { vrrpv3OperationsEntry 5 }

vrrpv3OperationsStatus OBJECT-TYPE
SYNTAX       INTEGER {
               initialize(1),
               backup(2),
               master(3)
             }
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
  "The current state of the virtual router.  This object has three
defined values:

- 'initialize', which indicates that the virtual router is waiting for a
  startup event.

- 'backup', which indicates that the virtual router is monitoring the
  availability of the master router.

- 'master', which indicates that the virtual router is forwarding
  packets for IP addresses that are associated with this router."
REFERENCE "RFC 5798"
::= { vrrpv3OperationsEntry 6 }

vrrpv3OperationsPriority OBJECT-TYPE
SYNTAX       Unsigned32 (0..255)
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION
  "This object specifies the priority to be used for the virtual router master
  election process; higher values imply higher priority.

  A priority of '0', although not settable, is sent by the master router to
  indicate that this router has
ceased to participate in VRRP, and a backup virtual router should transition to become a new master.

A priority of 255 is used for the router that owns the associated IP address(es) for VRRP over IPv4 and hence is not settable.

Setting the values of this object to 0 or 255 should be rejected by the agents implementing this MIB module. For example, an SNMP agent would return 'badValue(3)' when a user tries to set the values 0 or 255 for this object."

REFERENCE "RFC 5798, Section 6.1"
DEFVAL { 100 } ::= { vrrpv3OperationsEntry 7 }

vrrpv3OperationsAddrCount OBJECT-TYPE
SYNTAX Integer32 (0..255)
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IP addresses that are associated with this virtual router. This number is equal to the number of rows in the vrrpv3AssociatedAddrTable that correspond to a given ifIndex/VRID/IP version."
REFERENCE "RFC 5798, Section 6.1"
 ::= { vrrpv3OperationsEntry 8 }

vrrpv3OperationsAdvInterval OBJECT-TYPE
SYNTAX TimeInterval (1..4095)
UNITS "centiseconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The time interval, in centiseconds, between sending advertisement messages. Only the master router sends VRRP advertisements."
REFERENCE "RFC 5798, Section 6.1"
DEFVAL { 100}
 ::= { vrrpv3OperationsEntry 9 }

vrrpv3OperationsPreemptMode OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Controls whether a higher priority virtual router will preempt a lower priority master."

REFERENCE "RFC 5798, Section 6.1"

DEFVAL { true }

::= { vrrpv3OperationsEntry 10 }

vrrpv3OperationsAcceptMode OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Controls whether a virtual router in master state will accept packets addressed to the address owner’s IPv6 address as its own if it is not the IPv6 address owner. Default is false(2). This object is not relevant for rows representing VRRP over IPv4 and should be set to false(2)."

DEFVAL { false }

::= { vrrpv3OperationsEntry 11 }

vrrpv3OperationsUpTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This value represents the amount of time, in TimeTicks (hundredth of a second), since this virtual router (i.e., the ‘vrrpv3OperationsStatus’) transitioned out of ’initialize’." 

REFERENCE "RFC 5798, Section 6.1"

::= { vrrpv3OperationsEntry 12 }

vrrpv3OperationsRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The RowStatus variable should be used in accordance to installation and removal conventions for conceptual rows. To create a row in this table, a manager sets this object to either createAndGo(4) or createAndWait(5). Until instances of all corresponding columns are appropriately configured, the value of the corresponding instance of the ‘vrrpv3OperationsRowStatus’ column will be read as notReady(3)."
In particular, a newly created row cannot be made active(1) until (minimally) the corresponding instance of vrrpv3OperationsInetAddrType, vrrpv3OperationsVrId, and vrrpv3OperationsPrimaryIpAddr has been set, and there is at least one active row in the 'vrrpv3AssociatedIpAddrTable' defining an associated IP address.

notInService(2) should be used to administratively bring the row down.

A typical order of operation to add a row is:
1. Create a row in vrrpv3OperationsTable with createAndWait(5).
2. Create one or more corresponding rows in vrrpv3AssociatedIpAddrTable.
3. Populate the vrrpv3OperationsEntry.
4. Set vrrpv3OperationsRowStatus to active(1).

A typical order of operation to delete an entry is:
1. Set vrrpv3OperationsRowStatus to notInService(2).
2. Set the corresponding rows in vrrpv3AssociatedIpAddrTable to destroy(6) to delete the entry.
3. Set vrrpv3OperationsRowStatus to destroy(6) to delete the entry.

 ::= { vrrpv3OperationsEntry 13 }

-- VRRP Associated Address Table

vrrpv3AssociatedIpAddrTable OBJECT-TYPE
SYNTAX SEQUENCE OF Vrrpv3AssociatedIpAddrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The table of addresses associated with each virtual router."
 ::= { vrrpv3Operations 2 }

vrrpv3AssociatedIpAddrEntry OBJECT-TYPE
SYNTAX Vrrpv3AssociatedIpAddrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in the table contains an IP address that is associated with a virtual router. The number of rows for a given IP version, VrID, and ifIndex will equal the number of IP addresses associated (e.g., backed up)
by the virtual router (equivalent to 'vrrpv3OperationsIpAddrCount').

Rows in the table cannot be modified unless the value of 'vrrpv3OperationsStatus' for the corresponding entry in the vrrpv3OperationsTable has transitioned to initialize(1).

The information in this table is persistent and when written the entity SHOULD save the change to non-volatile storage."

INDEX    { ifIndex, vrrpv3OperationsVrId, vrrpv3OperationsInetAddrType, vrrpv3AssociatedIpAddrAddress }

::= { vrrpv3AssociatedIpAddrTable 1 }

Vrrpv3AssociatedIpAddrEntry ::= SEQUENCE {
   vrrpv3AssociatedIpAddrAddress InetAddress,
   vrrpv3AssociatedIpAddrRowStatus RowStatus
}

vrrpv3AssociatedIpAddrAddress OBJECT-TYPE
SYNTAX       InetAddress (SIZE (0|4|16))
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION   "The assigned IP addresses that a virtual router is responsible for backing up.

The IP address type is determined by the value of vrrpv3OperationsInetAddrType in the index of this row."
REFERENCE "RFC 5798"
::= { vrrpv3AssociatedIpAddrEntry 1 }

vrrpv3AssociatedIpAddrRowStatus OBJECT-TYPE
SYNTAX       RowStatus
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION   "The row status variable, used according to installation and removal conventions for conceptual
rows. To create a row in this table, a manager sets this object to either createAndGo(4) or createAndWait(5). Setting this object to active(1) results in the addition of an associated address for a virtual router. Setting this object to notInService(2) results in administratively bringing down the row.

Destroying the entry or setting it to destroy(6) removes the associated address from the virtual router. The use of other values is implementation-dependent.

Implementations should not allow deletion of the last row corresponding to an active row in vrrpv3OperationsTable.

Refer to the description of vrrpv3OperationsRowStatus for typical row creation and deletion scenarios.

::= { vrrpv3AssociatedIpAddrEntry 2 }

-- VRRP Router Statistics

vrrpv3RouterChecksumErrors OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of VRRP packets received with an invalid VRRP checksum value.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3GlobalStatisticsDiscontinuityTime."

REFERENCE "RFC 5798, Section 5.2.8"
::= { vrrpv3Statistics 1 }

vrrpv3RouterVersionErrors OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of VRRP packets received with an unknown or unsupported version number.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at
other times as indicated by the value of vrrpv3GlobalStatisticsDiscontinuityTime."

REFERENCE "RFC 5798, Section 5.2.1"
::= { vrrpv3Statistics 2 }

vrrpv3RouterVrIdErrors OBJECT-TYPE
SYNTAX     Counter64
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The total number of VRRP packets received with a
VRID that is not valid for any virtual router on this
router.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
vrrpv3GlobalStatisticsDiscontinuityTime."

REFERENCE "RFC 5798, Section 5.2.3"
::= { vrrpv3Statistics 3 }

vrrpv3GlobalStatisticsDiscontinuityTime OBJECT-TYPE
SYNTAX     TimeStamp
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime on the most recent occasion at
which one of vrrpv3RouterChecksumErrors, vrrpv3RouterVersionErrors,
and vrrpv3RouterVrIdErrors suffered a discontinuity.

If no such discontinuities have occurred since the last
re-initialization of the local management subsystem,
then this object contains a zero value."

::= { vrrpv3Statistics 4 }

-- VRRP Router Statistics Table

vrrpv3StatisticsTable OBJECT-TYPE
SYNTAX     SEQUENCE OF Vrrpv3StatisticsEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"Table of virtual router statistics."
::= { vrrpv3Statistics 5 }
vrrpv3StatisticsEntry OBJECT-TYPE
SYNTAX       Vrrpv3StatisticsEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  
"An entry in the table containing statistics information about a given virtual router."
AUGMENTS    { vrrpv3OperationsEntry }
 ::= { vrrpv3StatisticsTable 1 }

Vrrpv3StatisticsEntry ::= SEQUENCE {
vrrpv3StatisticsMasterTransitions           Counter32,
vrrpv3StatisticsNewMasterReason            INTEGER,
vrrpv3StatisticsRcvdAdvertisements         Counter64,
vrrpv3StatisticsAdvIntervalErrors          Counter64,
vrrpv3StatisticsIpTtlErrors                Counter64,
vrrpv3StatisticsProtoErrReason             INTEGER,
vrrpv3StatisticsRcvdPriZeroPackets         Counter64,
vrrpv3StatisticsSentPriZeroPackets          Counter64,
vrrpv3StatisticsRcvdInvalidTypePackets      Counter64,
vrrpv3StatisticsAddressListErrors          Counter64,
vrrpv3StatisticsPacketLengthErrors         Counter64,
vrrpv3StatisticsRowDiscontinuityTime       TimeStamp,
vrrpv3StatisticsRefreshRate                Unsigned32
}

vrrpv3StatisticsMasterTransitions OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"The total number of times that this virtual router’s state has transitioned to master state."
Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime.

::= { vrrpv3StatisticsEntry 1 }

vrrpv3StatisticsNewMasterReason OBJECT-TYPE
SYNTAX INTEGER {
  notMaster (0),
  priority (1),
  preempted (2),
  masterNoResponse (3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "This indicates the reason for the virtual router to transition to master state. If the virtual router never transitioned to master state, the value of this object is notMaster(0). Otherwise, this indicates the reason this virtual router transitioned to master state the last time. Used by vrrpv3NewMaster notification."

::= { vrrpv3StatisticsEntry 2 }

vrrpv3StatisticsRcvdAdvertisements OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "The total number of VRRP advertisements received by this virtual router.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."

::= { vrrpv3StatisticsEntry 3 }

vrrpv3StatisticsAdvIntervalErrors OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "The total number of VRRP advertisement packets received for which the advertisement interval is
different from the vrrpv3OperationsAdvInterval configured on this virtual router.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime.

::= { vrrpv3StatisticsEntry 4 }

vrrpv3StatisticsIpTtlErrors OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of VRRP packets received by the virtual router with IPv4 TTL (for VRRP over IPv4) or IPv6 Hop Limit (for VRRP over IPv6) not equal to 255. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."
REFERENCE "RFC 5798, Section 5.1.1.3"

::= { vrrpv3StatisticsEntry 5 }

vrrpv3StatisticsProtoErrReason OBJECT-TYPE
SYNTAX INTEGER {
    noError (0),
    ipTtlError (1),
    versionError (2),
    checksumError (3),
    vrIdError(4)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the reason for the last protocol error. This SHOULD be set to noError(0) when no protocol errors are encountered. Used by vrrpv3ProtoError notification."

::= { vrrpv3StatisticsEntry 6 }

vrrpv3StatisticsRcvdPriZeroPackets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of VRRP packets received by the virtual router with a priority of '0'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."
REFERENCE "RFC 5798, Section 5.2.4"
::= { vrrpv3StatisticsEntry 7 }

vrrpv3StatisticsSentPriZeroPackets OBJECT-TYPE
SYNTAX          Counter64
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
"The total number of VRRP packets sent by the virtual router with a priority of '0'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."
REFERENCE "RFC 5798, Section 5.2.4"
::= { vrrpv3StatisticsEntry 8 }

vrrpv3StatisticsRcvdInvalidTypePackets OBJECT-TYPE
SYNTAX          Counter64
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
"The number of VRRP packets received by the virtual router with an invalid value in the 'type' field.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."
::= { vrrpv3StatisticsEntry 9 }

vrrpv3StatisticsAddressListErrors OBJECT-TYPE
SYNTAX          Counter64
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
"The total number of packets received for which the address list does not match the locally configured list for the virtual router."
Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime.

 ::= { vrrpv3StatisticsEntry 10 }

vrrpv3StatisticsPacketLengthErrors OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of packets received with a packet length less than the length of the VRRP header.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of vrrpv3StatisticsRowDiscontinuityTime."

 ::= { vrrpv3StatisticsEntry 11 }

vrrpv3StatisticsRowDiscontinuityTime OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of sysUpTime on the most recent occasion at which any one or more of this entry’s counters suffered a discontinuity.

If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then this object contains a zero value."

 ::= { vrrpv3StatisticsEntry 12 }

vrrpv3StatisticsRefreshRate OBJECT-TYPE
SYNTAX Unsigned32
UNITS "milliseconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The minimum reasonable polling interval for this entry. This object provides an indication of the minimum amount of time required to update the counters in this entry."

 ::= { vrrpv3StatisticsEntry 13 }

-- Notification Definitions
-- Notifications may be controlled using SNMP-NOTIFICATION-MIB
vrrpv3NewMaster NOTIFICATION-TYPE
OBJECTS  
    {  
vrrpv3OperationsMasterIpAddr,  
vrrpv3StatisticsNewMasterReason  
    }
STATUS  current
DESCRIPTION  "The newMaster notification indicates that the sending agent has transitioned to master state."
::= { vrrpv3Notifications 1 }

vrrpv3ProtoError NOTIFICATION-TYPE
OBJECTS  
    {  
vrrpv3StatisticsProtoErrReason  
    }
STATUS  current
DESCRIPTION  "The notification indicates that the sending agent has encountered the protocol error indicated by vrrpv3StatisticsProtoErrReason."
::= { vrrpv3Notifications 2 }

-- Conformance Information

vrrpv3Compliances OBJECT IDENTIFIER ::= { vrrpv3Conformance 1 }
vrrpv3Groups OBJECT IDENTIFIER ::= { vrrpv3Conformance 2 }

-- Compliance Statements

vrrpv3FullCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION  "The compliance statement"
MODULE -- this module
MANDATORY-GROUPS  
    {  
vrrpv3OperationsGroup,  
vrrpv3StatisticsGroup,  
vrrpv3InfoGroup,  
vrrpv3NotificationsGroup  
    }
OBJECT  vrrpv3OperationsPriority
WRITE-SYNTAX  Unsigned32 (1..254)
DESCRIPTION  "Setable values are from 1 to 254."
::= { vrrpv3Compliances 1 }

vrrpv3ReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION  "The compliance statement"
"When this MIB module is implemented without support for read-create (i.e., in read-only mode), then such an implementation can claim read-only compliance. Such a device can then be monitored, but cannot be configured with this MIB."

MODULE -- this module
MANDATORY-GROUPS { 
  vrrpv3OperationsGroup, 
  vrrpv3StatisticsGroup, 
  vrrpv3StatisticsDiscontinuityGroup, 
  vrrpv3InfoGroup, 
  vrrpv3NotificationsGroup
}

OBJECT        vrrpv3OperationsPriority 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3OperationsPrimaryIpAddr 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3OperationsAdvInterval 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3OperationsPreemptMode 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3OperationsAcceptMode 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3OperationsRowStatus 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

OBJECT        vrrpv3AssociatedIpAddrRowStatus 
MIN-ACCESS    read-only 
DESCRIPTION  "Write access is not required."

::= { vrrpv3Compliances 2 }
vrrpv3OperationsVirtualMacAddr,
vrrpv3OperationsStatus,
vrrpv3OperationsPriority,
vrrpv3OperationsMasterIpAddr,
vrrpv3OperationsAdvInterval,
vrrpv3OperationsPreemptMode,
vrrpv3OperationsAcceptMode,
vrrpv3OperationsUpTime,
vrrpv3OperationsRowStatus,
vrrpv3OperationsAddrCount,
vrrpv3OperationsPrimaryIpAddr,
vrrpv3AssociatedIpAddrRowStatus
)

STATUS current
DESCRIPTION
"Conformance group for VRRPv3 operations."
 ::= { vrrpv3Groups 1 }

vrrpv3StatisticsGroup OBJECT-GROUP
OBJECTS {
  vrrpv3RouterChecksumErrors,
  vrrpv3RouterVersionErrors,
  vrrpv3RouterVrIdErrors,
  vrrpv3StatisticsMasterTransitions,
  vrrpv3StatisticsNewMasterReason,
  vrrpv3StatisticsRcvdAdvertisements,
  vrrpv3StatisticsAdvIntervalErrors,
  vrrpv3StatisticsRcvdPriZeroPackets,
  vrrpv3StatisticsSentPriZeroPackets,
  vrrpv3StatisticsRcvdInvalidTypePackets,
  vrrpv3StatisticsIpTtlErrors,
  vrrpv3StatisticsProtoErrReason,
  vrrpv3StatisticsAddressListErrors,
  vrrpv3StatisticsPacketLengthErrors,
  vrrpv3StatisticsRowDiscontinuityTime,
  vrrpv3StatisticsRefreshRate
}

STATUS current
DESCRIPTION
"Conformance group for VRRPv3 statistics."
 ::= { vrrpv3Groups 2 }

vrrpv3StatisticsDiscontinuityGroup OBJECT-GROUP
OBJECTS {
  vrrpv3GlobalStatisticsDiscontinuityTime
}

STATUS current
DESCRIPTION
11. Security Considerations

There are a number of management objects defined in this MIB module with 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. These are the tables and objects and their sensitivity/vulnerability:


Examples of how these objects could adversely affect the operation of a virtual router include:
An unauthorized change to vrrpv3OperationsPriority can affect the priority used in master election, resulting in this router either becoming master when it should not, or in some other router being elected by preference. While this will disrupt the operator's plans, it will only replicate the unfortunate failure of multiple routers, and any router that does become master will be capable of filling that role.

Modification of vrrpv3OperationsPrimaryIpAddr would cause the configured router to take on an incorrect IP address if it becomes master, which would be potentially very disruptive to the network operation.

A malicious change to vrrpv3OperationsAdvInterval could either result in the configured router flooding the network with advertisements when it becomes master, or the new master not advertising frequently enough such that some routers do not learn about the new master.

vrrpv3OperationsPreemptMode controls whether this router will preempt another master router. Setting it inappropriately will at worse cause one router to be master against the operator's plans, but that router will still be qualified to operate as a master.

Setting the vrrpv3OperationsAcceptMode could prevent an IPv6-capable VRRP router from accepting packets addressed to the address owner's IPv6 address as its own even if it is not the IPv6 address owner. Although the default for this object is false(2), unauthorized setting of this object to false might restrict the function of some parts of the network.

The vrrpv3OperationsRowStatus object that could be used to disable a virtual router. While there are other columns that, if changed, could disrupt operations, they cannot be changed without first changing the RowStatus object.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), 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.

Implementations MUST provide the security features described by the SNMPv3 framework (see [RFC3410]), including full support for authentication and privacy via the User-based Security Model (USM) [RFC3414] with the AES cipher algorithm [RFC3826]. Implementations MAY also provide support for the Transport Security Model (TSM)
in combination with a secure transport such as SSH 
[RFC5592] or TLS/DTLS [RFC6353].

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.

12. IANA Considerations

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

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vrrpv3MIB</td>
<td>{ mib-2 207 vrrpv3MIB VRRPV3-MIB }</td>
</tr>
</tbody>
</table>

This document obsoletes RFC 2787. Therefore, IANA has deprecated 
value 68 under 'mib-2’, which is assigned to VRRP-MIB.

13. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate 

[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.

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group  

Management Protocol (SNMP) Applications", STD 62, RFC 3413,  
December 2002.
14. Informative References


15. Acknowledgments

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