Abstract

This specification defines a portion of the Management Information Base (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 for both IPv4 and IPv6 as defined in RFC 5798. This memo obsoletes RFC 2787.

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Conventions used in this document

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 RFC2119.

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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 Management Information Base (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 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", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

4. Relationship to RFC 2787

This document obsoletes RFC2787 [RFC2787]. The major changes in this document reflect changes in 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 IF-MIB is from RFC2863 [RFC2863].

6. Multi-Stack Implementations

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

7. VRRP MIB Structure and Design

This MIB module contains three tables:

1. The vrrpv3OperationsTable, which contains objects that define the operational characteristics of a VRRP router. Rows in this table correspond to instances of virtual routers.
2. The vrrpv3StatisticsTable which 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].

8. VRRP Multistack 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 = vrrpOpeartionsPriority
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.

```
+------+
| VR1  |
|      |
+------+

| Interface | IP A | IP X | IP B | IP Y | IP Z |
| VRID = 1  | IP C |
| VRID = 2  | VRID = 2 |

---+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+7

----- MIB Tables For VRRP Router "VR1": -----

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>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
--------------------------
| if | VrId | AddrType | IP   | RowStat |

Tata Expires Oct 2011
----- 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").

9. 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
ifIndex
FROM IF-MIB                     -- RFC2863
InetAddressType, InetAddress
FROM INET-ADDRESS-MIB;          -- RFC4001

vrrpv3MIB  MODULE-IDENTITY
LAST-UPDATED "201104220000Z"        -- Apr 22, 2011
ORGANIZATION "IETF VRRP Working Group"
CONTACT-INFO
"WG E-Mail: vrrp@ietf.org

   Editor:   Kalyan Tata
   Check Point Software
   800 Bridge Park Way,
   Redwood City, CA 94065
   Tata_kalyan@yahoo.com"

DESCRIPTION
This MIB describes objects used for managing Virtual Router Redundancy Protocol version 3 (VRRPv3).

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REVISION "201104220000Z" -- Apr 22, 2011
DESCRIPTION "Initial version as published in RFC YYYY."

-- EdNote: Please replace YYYY with actual RFC number for this draft and remove this note.

::= { mib-2 ZZZ }

-- EdNote: Please replace ZZZ with IANA assigned number and remove this note.

-- Textual Conventions

Vrrpv3VrIdTC ::= TEXTUAL-CONVENTION
   DISPLAY-HINT "d"
   STATUS       current
   DESCRIPTION
   "The value of the virtual router identifier noted as (VRID) in RFC5798. 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

Tata Expires Oct 2011
DESCRIPTION
"Unified Operations table for a VRRP router which 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 a 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
}
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. 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 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 vrrpv3OperationsMasterIpAddr', 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 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 not settable.

A 'badValue(3)' should be returned when a user tries to set 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
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 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
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 description of vrrpv3OperationsRowStatus for a 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.

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, this SHOULD be set to 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."
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::= { 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"
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 5.3.4"
 ::= { 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 "milli-seconds"
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 "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 can not 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 }

-- Conformance Groups

vrrpv3OperationsGroup  OBJECT-GROUP
OBJECTS  {
  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,
10. 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:


Specific examples of this include, but are not limited to:

- The vrrpv3OperationsRowStatus object which could be used to disable a virtual router. While there are other columns that, if changed, could disrupt operations, they can not 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), 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.

11. 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 ZZZ }</td>
</tr>
</tbody>
</table>

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12. Normative References


13. Informative References


14. Acknowledgments

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15. Author’s Address

Srinivas Kalyan Tata
Check Point Software
800 Bridge Parkway
Redwood City, CA 94065
Phone: +1-408-505-0542
EMail: tata_kalyan@yahoo.com