



First Hop Redundancy Protocols Configuration Guide, Cisco IOS XE Release 3SE (Catalyst 3850 Switches)

Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <http://www.cisco.com/go/trademarks>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)

© 2015 Cisco Systems, Inc. All rights reserved.



CONTENTS

CHAPTER 1

Configuring VRRP 1

| | |
|---|----|
| Finding Feature Information | 1 |
| Restrictions for VRRP | 2 |
| Information About VRRP | 2 |
| VRRP Operation | 2 |
| VRRP Benefits | 4 |
| Multiple Virtual Router Support | 5 |
| VRRP Router Priority and Preemption | 5 |
| VRRP Advertisements | 6 |
| VRRP Object Tracking | 6 |
| How VRRP Object Tracking Affects the Priority of a Device | 6 |
| In Service Software Upgrade--VRRP | 7 |
| VRRP Support for Stateful Switchover | 7 |
| How to Configure VRRP | 7 |
| Customizing VRRP | 7 |
| Enabling VRRP | 9 |
| Configuring VRRP Object Tracking | 11 |
| Configuring VRRP Text Authentication | 13 |
| Configuration Examples for VRRP | 14 |
| Example: Configuring VRRP | 14 |
| Example: VRRP Object Tracking | 15 |
| Example: VRRP Object Tracking Verification | 16 |
| Example: VRRP Text Authentication | 16 |
| Example: VRRP MIB Trap | 16 |
| Additional References | 16 |
| Feature Information for VRRP | 18 |
| Glossary | 22 |

CHAPTER 2**HSRP: Global IPv6 Address 23**

Finding Feature Information 23

Information About HSRP Global IPv6 Address 24

HSRP: Global IPv6 Address 24

How to Enable HSRP Global IPv6 Address 24

Enabling and Verifying an HSRP Group for IPv6 Operation 24

Configuration Example for HSRP Global IPv6 Address 26

Example: Configuring HSRP Global IPv6 Addresses 26

Additional References 27

Feature Information for HSRP: Global IPv6 Address 28

Glossary 28



CHAPTER

1

Configuring VRRP

The Virtual Router Redundancy Protocol (VRRP) is an election protocol that dynamically assigns responsibility for one or more virtual routers to the VRRP routers on a LAN, allowing several routers on a multiaccess link to utilize the same virtual IP address. A VRRP router is configured to run the VRRP protocol in conjunction with one or more other routers attached to a LAN. In a VRRP configuration, one router is elected as the virtual router master, with the other routers acting as backups in case the virtual router master fails.

This module explains the concepts related to VRRP and describes how to configure VRRP in a network.

- [Finding Feature Information, page 1](#)
- [Restrictions for VRRP, page 2](#)
- [Information About VRRP, page 2](#)
- [How to Configure VRRP, page 7](#)
- [Configuration Examples for VRRP, page 14](#)
- [Additional References, page 16](#)
- [Feature Information for VRRP, page 18](#)
- [Glossary, page 22](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for VRRP

- VRRP is designed for use over multiaccess, multicast, or broadcast capable Ethernet LANs. VRRP is not intended as a replacement for existing dynamic protocols.
- VRRP is supported on Ethernet, Fast Ethernet, Bridge Group Virtual Interface (BVI), and Gigabit Ethernet interfaces, and on Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs), VRF-aware MPLS VPNs, and VLANs.
- Because of the forwarding delay that is associated with the initialization of a BVI interface, you must configure the VRRP advertise timer to a value equal to or greater than the forwarding delay on the BVI interface. This setting prevents a VRRP router on a recently initialized BVI interface from unconditionally taking over the master role. Use the **bridge forward-time** command to set the forwarding delay on the BVI interface. Use the **vrrp timers advertise** command to set the VRRP advertisement timer.

Information About VRRP

VRRP Operation

There are several ways a LAN client can determine which router should be the first hop to a particular remote destination. The client can use a dynamic process or static configuration. Examples of dynamic router discovery are as follows:

- Proxy ARP—The client uses Address Resolution Protocol (ARP) to get the destination it wants to reach, and a router will respond to the ARP request with its own MAC address.
- Routing protocol—The client listens to dynamic routing protocol updates (for example, from Routing Information Protocol [RIP]) and forms its own routing table.
- ICMP Router Discovery Protocol (IRDP) client—The client runs an Internet Control Message Protocol (ICMP) router discovery client.

The drawback to dynamic discovery protocols is that they incur some configuration and processing overhead on the LAN client. Also, in the event of a router failure, the process of switching to another router can be slow.

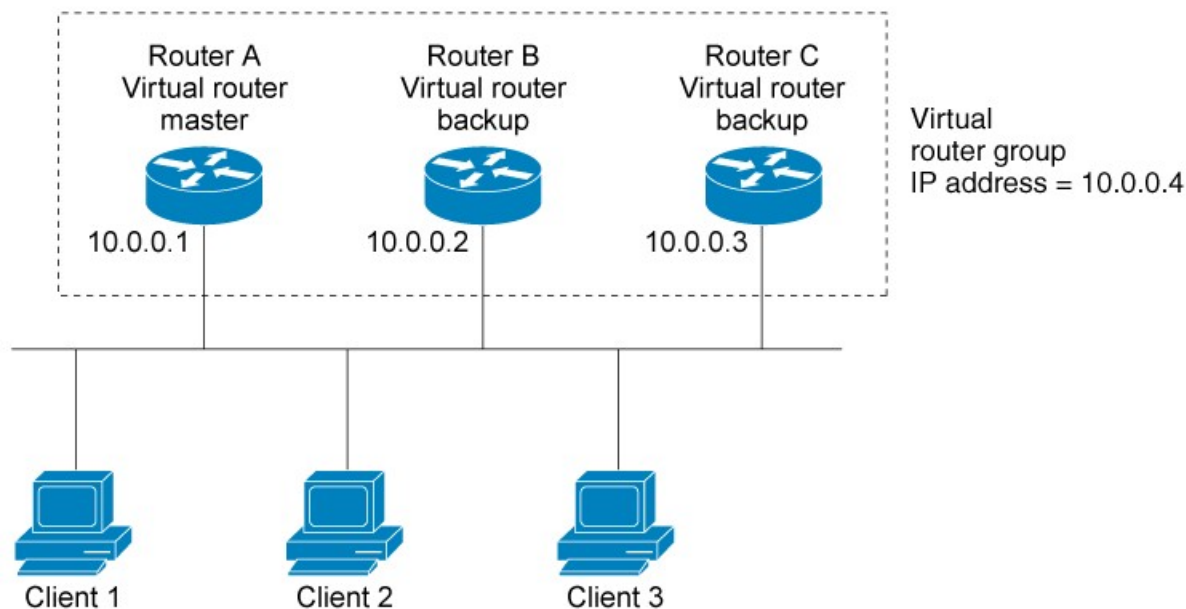
An alternative to dynamic discovery protocols is to statically configure a default router on the client. This approach simplifies client configuration and processing, but creates a single point of failure. If the default gateway fails, the LAN client is limited to communicating only on the local IP network segment and is cut off from the rest of the network.

VRRP can solve the static configuration problem. VRRP enables a group of routers to form a single *virtual router*. The LAN clients can then be configured with the virtual router as their default gateway. The virtual router, representing a group of routers, is also known as a VRRP group.

VRRP is supported on Ethernet, Fast Ethernet, BVI, and Gigabit Ethernet interfaces, and on MPLS VPNs, VRF-aware MPLS VPNs, and VLANs.

The figure below shows a LAN topology in which VRRP is configured. In this example, Routers A, B, and C are VRRP routers (routers running VRRP) that comprise a virtual router. The IP address of the virtual router is the same as that configured for the Ethernet interface of Router A (10.0.0.1).

Figure 1: Basic VRRP Topology

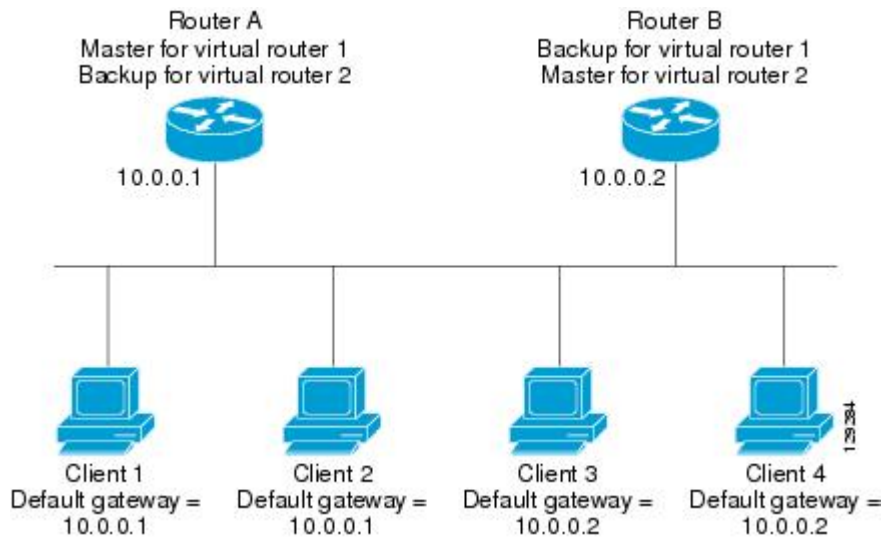


Because the virtual router uses the IP address of the physical Ethernet interface of Router A, Router A assumes the role of the virtual router master and is also known as the IP address owner. As the virtual router master, Router A controls the IP address of the virtual router and is responsible for forwarding packets sent to this IP address. Clients 1 through 3 are configured with the default gateway IP address of 10.0.0.1.

Routers B and C function as virtual router backups. If the virtual router master fails, the router configured with the higher priority will become the virtual router master and provide uninterrupted service for the LAN hosts. When Router A recovers, it becomes the virtual router master again. For more detail on the roles that VRRP routers play and what happens if the virtual router master fails, see the [VRRP Router Priority and Preemption](#) section.

The figure below shows a LAN topology in which VRRP is configured so that Routers A and B share the traffic to and from clients 1 through 4 and that Routers A and B act as virtual router backups to each other if either router fails.

Figure 2: Load Sharing and Redundancy VRRP Topology



In this topology, two virtual routers are configured. (For more information, see the [Multiple Virtual Router Support](#) section.) For virtual router 1, Router A is the owner of IP address 10.0.0.1 and virtual router master, and Router B is the virtual router backup to Router A. Clients 1 and 2 are configured with the default gateway IP address of 10.0.0.1.

For virtual router 2, Router B is the owner of IP address 10.0.0.2 and virtual router master, and Router A is the virtual router backup to Router B. Clients 3 and 4 are configured with the default gateway IP address of 10.0.0.2.

VRRP Benefits

Redundancy

VRRP enables you to configure multiple routers as the default gateway router, which reduces the possibility of a single point of failure in a network.

Load Sharing

You can configure VRRP in such a way that traffic to and from LAN clients can be shared by multiple routers, thereby sharing the traffic load more equitably among available routers.

Multiple Virtual Routers

Multiple IP Addresses

The virtual router can manage multiple IP addresses, including secondary IP addresses. Therefore, if you have multiple subnets configured on an Ethernet interface, you can configure VRRP on each subnet.

Preemption

The redundancy scheme of VRRP enables you to preempt a virtual router backup that has taken over for a failing virtual router master with a higher priority virtual router backup that has become available.

Authentication

VRRP message digest 5 (MD5) algorithm authentication protects against VRRP-spoofing software and uses the industry-standard MD5 algorithm for improved reliability and security.

Advertisement Protocol

VRRP uses a dedicated Internet Assigned Numbers Authority (IANA) standard multicast address (224.0.0.18) for VRRP advertisements. This addressing scheme minimizes the number of routers that must service the multicasts and allows test equipment to accurately identify VRRP packets on a segment. The IANA assigned VRRP the IP protocol number 112.

VRRP Object Tracking

VRRP object tracking provides a way to ensure the best VRRP router is the virtual router master for the group by altering VRRP priorities to the status of tracked objects such as the interface or IP route states.

Multiple Virtual Router Support

- Router processing capability
- Router memory capability
- Router interface support of multiple MAC addresses

In a topology where multiple virtual routers are configured on a router interface, the interface can act as a master for one virtual router and as a backup for one or more virtual routers.

VRRP Router Priority and Preemption

An important aspect of the VRRP redundancy scheme is VRRP router priority. Priority determines the role that each VRRP router plays and what happens if the virtual router master fails.

If a VRRP router owns the IP address of the virtual router and the IP address of the physical interface, this router will function as a virtual router master.

Priority also determines if a VRRP router functions as a virtual router backup and the order of ascendancy to becoming a virtual router master if the virtual router master fails. You can configure the priority of each virtual router backup with a value of 1 through 254 using the **vrrp priority** command.

For example, if Router A, the virtual router master in a LAN topology, fails, an election process takes place to determine if virtual router backups B or C should take over. If Routers B and C are configured with the priorities of 101 and 100, respectively, Router B is elected to become virtual router master because it has the higher priority. If Routers B and C are both configured with the priority of 100, the virtual router backup with the higher IP address is elected to become the virtual router master.

By default, a preemptive scheme is enabled whereby a higher priority virtual router backup that becomes available takes over for the virtual router backup that was elected to become virtual router master. You can disable this preemptive scheme using the **no vrrp preempt** command. If preemption is disabled, the virtual

router backup that is elected to become virtual router master remains the master until the original virtual router master recovers and becomes master again.

VRRP Advertisements

The virtual router master sends VRRP advertisements to other VRRP routers in the same group. The advertisements communicate the priority and state of the virtual router master. The VRRP advertisements are encapsulated in IP packets and sent to the IP Version 4 multicast address assigned to the VRRP group. The advertisements are sent every second by default; the interval is configurable.

Although the VRRP protocol as per RFC 3768 does not support millisecond timers, Cisco routers allow you to configure millisecond timers. You need to manually configure the millisecond timer values on both the primary and the backup routers. The master advertisement value displayed in the **show vrrp** command output on the backup routers is always 1 second because the packets on the backup routers do not accept millisecond values.

You must use millisecond timers where absolutely necessary and with careful consideration and testing. Millisecond values work only under favorable circumstances, and you must be aware that the use of the millisecond timer values restricts VRRP operation to Cisco devices only.

VRRP Object Tracking

Object tracking is an independent process that manages creating, monitoring, and removing tracked objects such as the state of the line protocol of an interface. Clients such as the Hot Standby Router Protocol (HSRP), Gateway Load Balancing Protocol (GLBP), and VRRP register their interest with specific tracked objects and act when the state of an object changes.

Each tracked object is identified by a unique number that is specified on the tracking CLI. Client processes such as VRRP use this number to track a specific object.

The tracking process periodically polls the tracked objects and notes any change of value. The changes in the tracked object are communicated to interested client processes, either immediately or after a specified delay. The object values are reported as either up or down.

VRRP object tracking gives VRRP access to all the objects available through the tracking process. The tracking process allows you to track individual objects such as the state of an interface line protocol, state of an IP route, or the reachability of a route.

VRRP provides an interface to the tracking process. Each VRRP group can track multiple objects that may affect the priority of the VRRP device. You specify the object number to be tracked and VRRP is notified of any change to the object. VRRP increments (or decrements) the priority of the virtual device based on the state of the object being tracked.

How VRRP Object Tracking Affects the Priority of a Device

The priority of a device can change dynamically if it has been configured for object tracking and the object that is being tracked goes down. The tracking process periodically polls the tracked objects and notes any change of value. The changes in the tracked object are communicated to VRRP, either immediately or after a specified delay. The object values are reported as either up or down. Examples of objects that can be tracked are the line protocol state of an interface or the reachability of an IP route. If the specified object goes down, the VRRP priority is reduced. The VRRP device with the higher priority can now become the virtual device

master if it has the **vrrp preempt** command configured. See the “VRRP Object Tracking” section for more information on object tracking.

In Service Software Upgrade--VRRP

VRRP supports In Service Software Upgrade (ISSU). In Service Software Upgrade (ISSU) allows a high-availability (HA) system to run in stateful switchover (SSO) mode even when different versions of software are running on the active and standby Route Processors (RPs) or line cards.

ISSU provides the ability to upgrade or downgrade from one supported release to another while continuing to forward packets and maintain sessions, thereby reducing planned outage time. The ability to upgrade or downgrade is achieved by running different software versions on the active RP and standby RP for a short period of time to maintain state information between RPs. This feature allows the system to switch over to a secondary RP running upgraded (or downgraded) software and continue forwarding packets without session loss and with minimal or no packet loss. This feature is enabled by default.

For detailed information about ISSU, see the In Service Software Upgrade Process document in the *High Availability Configuration Guide*.

VRRP Support for Stateful Switchover

With the introduction of the VRRP Support for Stateful Switchover feature, VRRP is SSO aware. VRRP can detect when a router is failing over to the secondary RP and continue in its current group state.

SSO functions in networking devices (usually edge devices) that support dual Route Processors (RPs). SSO provides RP redundancy by establishing one of the RPs as the active processor and the other RP as the standby processor. SSO also synchronizes critical state information between the RPs so that network state information is dynamically maintained between RPs.

Prior to being SSO aware, if VRRP was deployed on a router with redundant RPs, a switchover of roles between the active RP and the standby RP would result in the router relinquishing its activity as a VRRP group member and then rejoining the group as if it had been reloaded. The SSO--VRRP feature enables VRRP to continue its activities as a group member during a switchover. VRRP state information between redundant RPs is maintained so that the standby RP can continue the router's activities within the VRRP during and after a switchover.

This feature is enabled by default. To disable this feature, use the **no vrrp sso** command in global configuration mode.

For more information, see the Stateful Switchover document.

How to Configure VRRP

Customizing VRRP

Customizing the behavior of VRRP is optional. Be aware that as soon as you enable a VRRP group, that group is operating. It is possible that if you first enable a VRRP group before customizing VRRP, the router could take over control of the group and become the virtual router master before you have finished customizing the feature. Therefore, if you plan to customize VRRP, it is a good idea to do so before enabling VRRP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **vrrp group description** *text*
6. **vrrp group priority** *level*
7. **vrrp group preempt** [**delay minimum** *seconds*]
8. **vrrp group timers learn**
9. **exit**
10. **no vrrp sso**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|---|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | interface <i>type number</i> Example: Router(config)# interface GigabitEthernet 0/0/0 | Enters interface configuration mode. |
| Step 4 | ip address <i>ip-address mask</i> Example: Router(config-if)# ip address 172.16.6.5 255.255.255.0 | Configures an IP address for an interface. |
| Step 5 | vrrp group description <i>text</i> Example: Router(config-if)# vrrp 10 description working-group | Assigns a text description to the VRRP group. |
| Step 6 | vrrp group priority <i>level</i> | Sets the priority level of the router within a VRRP group. |

| | Command or Action | Purpose |
|----------------|---|--|
| | <p>Example:</p> <pre>Router(config-if)# vrrp 10 priority 110</pre> | <ul style="list-style-type: none"> The default priority is 100. |
| Step 7 | <p>vrrp group preempt [delay minimum seconds]</p> <p>Example:</p> <pre>Router(config-if)# vrrp 10 preempt delay minimum 380</pre> | <p>Configures the router to take over as virtual router master for a VRRP group if it has a higher priority than the current virtual router master.</p> <ul style="list-style-type: none"> The default delay period is 0 seconds. The router that is IP address owner will preempt, regardless of the setting of this command. |
| Step 8 | <p>vrrp group timers learn</p> <p>Example:</p> <pre>Router(config-if)# vrrp 10 timers learn</pre> | <p>Configures the router, when it is acting as virtual router backup for a VRRP group, to learn the advertisement interval used by the virtual router master.</p> |
| Step 9 | <p>exit</p> <p>Example:</p> <pre>Router(config-if)# exit</pre> | <p>Exits interface configuration mode.</p> |
| Step 10 | <p>no vrrp sso</p> <p>Example:</p> <pre>Router(config)# no vrrp sso</pre> | <p>(Optional) Disables VRRP support of SSO.</p> <ul style="list-style-type: none"> VRRP support of SSO is enabled by default. |

Enabling VRRP

SUMMARY STEPS

- enable
- configure terminal
- interface *type number*
- ip address *ip-address mask*
- vrrp group ip *ip-address* [secondary]
- end
- show vrrp [brief] | *group*
- show vrrp interface *type number* [brief]

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | interface <i>type number</i> Example: Router(config)# interface GigabitEthernet 0/0/0 | Enters interface configuration mode. |
| Step 4 | ip address <i>ip-address mask</i> Example: Router(config-if)# ip address 172.16.6.5 255.255.255.0 | Configures an IP address for an interface. |
| Step 5 | vrrp group ip <i>ip-address [secondary]</i> Example: Router(config-if)# vrrp 10 ip 172.16.6.1 | Enables VRRP on an interface. <ul style="list-style-type: none"> • After you identify a primary IP address, you can use the vrrp ip command again with the secondary keyword to indicate additional IP addresses supported by this group. <p>Note All routers in the VRRP group must be configured with the same primary address and a matching list of secondary addresses for the virtual router. If different primary or secondary addresses are configured, the routers in the VRRP group will not communicate with each other and any misconfigured router will change its state to master.</p> |
| Step 6 | end Example: Router(config-if)# end | Returns to privileged EXEC mode. |
| Step 7 | show vrrp [brief] <i>group</i> Example: Router# show vrrp 10 | (Optional) Displays a brief or detailed status of one or all VRRP groups on the router. |

| | Command or Action | Purpose |
|---------------|---|--|
| Step 8 | show vrrp interface <i>type number</i> [brief] Example: Router# show vrrp interface GigabitEthernet 0/0/0 | (Optional) Displays the VRRP groups and their status on a specified interface. |

Configuring VRRP Object Tracking



Note If a VRRP group is the IP address owner, its priority is fixed at 255 and cannot be reduced through object tracking.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **track** *object-number* **interface** *type number* {**line-protocol** | **ip routing**}
4. **interface** *type number*
5. **vrrp group ip** *ip-address*
6. **vrrp group priority** *level*
7. **vrrp group track** *object-number* [**decrement** *priority*]
8. **end**
9. **show track** [*object-number*]

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |

| | Command or Action | Purpose |
|---------------|--|--|
| Step 3 | <p>track <i>object-number</i> interface <i>type number</i> {line-protocol ip routing}</p> <p>Example:</p> <pre>Router(config)# track 2 interface serial 6 line-protocol</pre> | <p>Configures an interface to be tracked where changes in the state of the interface affect the priority of a VRRP group.</p> <ul style="list-style-type: none"> • This command configures the interface and corresponding object number to be used with the vrrp track command. • The line-protocol keyword tracks whether the interface is up. The ip routing keyword also checks that IP routing is enabled and active on the interface. • You can also use the track ip route command to track the reachability of an IP route or a metric type object. |
| Step 4 | <p>interface <i>type number</i></p> <p>Example:</p> <pre>Router(config)# interface Ethernet 2</pre> | Enters interface configuration mode. |
| Step 5 | <p>vrrp group ip <i>ip-address</i></p> <p>Example:</p> <pre>Router(config-if)# vrrp 1 ip 10.0.1.20</pre> | Enables VRRP on an interface and identifies the IP address of the virtual router. |
| Step 6 | <p>vrrp group priority <i>level</i></p> <p>Example:</p> <pre>Router(config-if)# vrrp 1 priority 120</pre> | Sets the priority level of the router within a VRRP group. |
| Step 7 | <p>vrrp group track <i>object-number</i> [decrement <i>priority</i>]</p> <p>Example:</p> <pre>Router(config-if)# vrrp 1 track 2 decrement 15</pre> | Configures VRRP to track an object. |
| Step 8 | <p>end</p> <p>Example:</p> <pre>Router(config-if)# end</pre> | Returns to privileged EXEC mode. |
| Step 9 | <p>show track [<i>object-number</i>]</p> <p>Example:</p> <pre>Router# show track 1</pre> | Displays tracking information. |

Configuring VRRP Text Authentication

Before You Begin

Interoperability with vendors that may have implemented the RFC 2338 method is not enabled.

Text authentication cannot be combined with MD5 authentication for a VRRP group at any one time. When MD5 authentication is configured, the text authentication field in VRRP hello messages is set to all zeros on transmit and ignored on receipt, provided the receiving router also has MD5 authentication enabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **terminal interface** *type number*
4. **ip address** *ip-address mask* [**secondary**]
5. **vrrp group authentication text** *text-string*
6. **vrrp group ip** *ip-address*
7. Repeat Steps 1 through 6 on each router that will communicate.
8. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|--|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | terminal interface <i>type number</i> Example: Router(config)# interface Ethernet 0/1 | Configures an interface type and enters interface configuration mode. |
| Step 4 | ip address <i>ip-address mask</i> [secondary] Example: Router(config-if)# ip address 10.0.0.1 255.255.255.0 | Specifies a primary or secondary IP address for an interface. |

| | Command or Action | Purpose |
|---------------|--|--|
| Step 5 | vrrp group authentication text text-string Example: <pre>Router(config-if)# vrrp 1 authentication text textstring1</pre> | Authenticates VRRP packets received from other routers in the group. <ul style="list-style-type: none"> • If you configure authentication, all routers within the VRRP group must use the same authentication string. • The default string is cisco. Note All routers within the VRRP group must be configured with the same authentication string. If the same authentication string is not configured, the routers in the VRRP group will not communicate with each other and any misconfigured router will change its state to master. |
| Step 6 | vrrp group ip ip-address Example: <pre>Router(config-if)# vrrp 1 ip 10.0.1.20</pre> | Enables VRRP on an interface and identifies the IP address of the virtual router. |
| Step 7 | Repeat Steps 1 through 6 on each router that will communicate. | — |
| Step 8 | end Example: <pre>Router(config-if)# end</pre> | Returns to privileged EXEC mode. |

Configuration Examples for VRRP

Example: Configuring VRRP

In the following example, Router A and Router B each belong to three VRRP groups.

In the configuration, each group has the following properties:

- Group 1:
 - Virtual IP address is 10.1.0.10.
 - Router A will become the master for this group with priority 120.
 - Advertising interval is 3 seconds.
 - Preemption is enabled.
- Group 5:

- Router B will become the master for this group with priority 200.
 - Advertising interval is 30 seconds.
 - Preemption is enabled.
- Group 100:
 - Router A will become the master for this group first because it has a higher IP address (10.1.0.2).
 - Advertising interval is the default 1 second.
 - Preemption is disabled.

Router A

```
Router(config)# interface GigabitEthernet 1/0/0
Router(config-if)# ip address 10.1.0.2 255.0.0.0
Router(config-if)# vrrp 1 priority 120
Router(config-if)# vrrp 1 authentication cisco
Router(config-if)# vrrp 1 timers advertise 3
Router(config-if)# vrrp 1 timers learn
Router(config-if)# vrrp 1 ip 10.1.0.10
Router(config-if)# vrrp 5 priority 100
Router(config-if)# vrrp 5 timers advertise 30
Router(config-if)# vrrp 5 timers learn
Router(config-if)# vrrp 5 ip 10.1.0.50
Router(config-if)# vrrp 100 timers learn
Router(config-if)# no vrrp 100 preempt
Router(config-if)# vrrp 100 ip 10.1.0.100
Router(config-if)# no shutdown
```

Router B

```
Router(config)# interface GigabitEthernet 1/0/0
Router(config-if)# ip address 10.1.0.1 255.0.0.0
Router(config-if)# vrrp 1 priority 100
Router(config-if)# vrrp 1 authentication cisco
Router(config-if)# vrrp 1 timers advertise 3
Router(config-if)# vrrp 1 timers learn
Router(config-if)# vrrp 1 ip 10.1.0.10
Router(config-if)# vrrp 5 priority 200
Router(config-if)# vrrp 5 timers advertise 30
Router(config-if)# vrrp 5 timers learn
Router(config-if)# vrrp 5 ip 10.1.0.50
Router(config-if)# vrrp 100 timers learn
Router(config-if)# no vrrp 100 preempt
Router(config-if)# vrrp 100 ip 10.1.0.100
Router(config-if)# no shutdown
```

Example: VRRP Object Tracking

In the following example, the tracking process is configured to track the state of the line protocol on serial interface 0/1. VRRP on Ethernet interface 1/0 then registers with the tracking process to be informed of any changes to the line protocol state of serial interface 0/1. If the line protocol state on serial interface 0/1 goes down, then the priority of the VRRP group is reduced by 15.

```
Router(config)# track 1 interface Serial 0/1 line-protocol
Router(config-track)# exit
```

```

Router(config)# interface Ethernet 1/0
Router(config-if)# ip address 10.0.0.2 255.0.0.0
Router(config-if)# vrrp 1 ip 10.0.0.3
Router(config-if)# vrrp 1 priority 120
Router(config-if)# vrrp 1 track 1 decrement 15

```

Example: VRRP Object Tracking Verification

The following examples verify the configuration shown in the [Example: VRRP Object Tracking](#) section:

```

Router# show vrrp

Ethernet1/0 - Group 1
  State is Master
  Virtual IP address is 10.0.0.3
  Virtual MAC address is 0000.5e00.0101
  Advertisement interval is 1.000 sec
  Preemption is enabled
  min delay is 0.000 sec
  Priority is 105
  Track object 1 state Down decrement 15
  Master Router is 10.0.0.2 (local), priority is 105
  Master Advertisement interval is 1.000 sec
  Master Down interval is 3.531 sec
Router# show track

Track 1
  Interface Serial0/1 line-protocol
  Line protocol is Down (hw down)
  1 change, last change 00:06:53
  Tracked by:
    VRRP Ethernet1/0 1

```

Example: VRRP Text Authentication

The following example shows how to configure VRRP text authentication using a text string:

```

Router(config)# interface GigabitEthernet 0/0/0
Router(config)# ip address 10.21.8.32 255.255.255.0
Router(config-if)# vrrp 10 authentication text stringxyz
Router(config-if)# vrrp 10 ip 10.21.8.10

```

Example: VRRP MIB Trap

```

Router(config)# snmp-server enable traps vrrp
Router(config)# snmp-server host 10.1.1.0 community abc vrrp

```

Additional References

Related Documents

| Related Topic | Document Title |
|--------------------|--|
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |

| Related Topic | Document Title |
|--|---|
| VRRP commands | <i>Cisco IOS IP Application Services Command Reference</i> |
| Object tracking | Configuring Enhanced Object Tracking |
| Hot Standby Routing Protocol (HSRP) | Configuring HSRP |
| In Service Software Upgrade (ISSU) | "In Service Software Upgrade Process" in the <i>High Availability Configuration Guide</i> |
| Gateway Load Balancing Protocol (GLBP) | Configuring GLBP |
| Stateful Switchover | The Stateful Switchover section in the <i>High Availability Configuration Guide</i> |

Standards

| Standards | Title |
|---|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | — |

MIBs

| MIBs | MIBs Link |
|----------|---|
| VRRP MIB | To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs |

RFCs

| RFCs | Title |
|----------|---|
| RFC 2338 | Virtual Router Redundancy Protocol |
| RFC 2787 | Definitions of Managed Objects for the Virtual Router Redundancy Protocol |
| RFC 3768 | Virtual Router Redundancy Protocol (VRRP) |

Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | http://www.cisco.com/cisco/web/support/index.html |

Feature Information for VRRP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for VRRP

| Feature Name | Releases | Feature Configuration Information |
|--------------|---|---|
| ISSU—VRRP | 15.2(1)S 15.3(1)S Cisco IOS XE Release 3.3 SE | <p>VRRP supports In Service Software Upgrade (ISSU). ISSU allows a high-availability (HA) system to run in Stateful Switchover (SSO) mode even when different versions of Cisco IOS software are running on the active and standby Route Processors (RPs) or line cards.</p> <p>This feature provides customers with the same level of HA functionality for planned outages due to software upgrades as is available with SSO for unplanned outages. That is, the system can switch over to a secondary RP and continue forwarding packets without session loss and with minimal or no packet loss.</p> <p>This feature is enabled by default.</p> <p>There are no new or modified commands for this feature.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |

| Feature Name | Releases | Feature Configuration Information |
|------------------------------------|---|--|
| SSO—VRRP | 15.2(1)S 15.3(1)S Cisco IOS XE Release 3.3 SE | <p>VRRP is now SSO aware. VRRP can detect when a router is failing over to the secondary RP and continue in its current VRRP group state.</p> <p>This feature is enabled by default.</p> <p>The following commands were introduced or modified by this feature: debug vrrp ha,vrrp sso, show vrrp.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |
| Virtual Router Redundancy Protocol | 15.2(1)S 15.3(1)S Cisco IOS XE Release 3.3 SE | <p>VRRP enables a group of routers to form a single virtual router to provide redundancy. The LAN clients can then be configured with the virtual router as their default gateway. The virtual router, representing a group of routers, is also known as a VRRP group.</p> <p>The following commands were introduced by this feature: debug vrrp all, debug vrrp error, debug vrrp events, debug vrrp packets, debug vrrp state, show vrrp, show vrrp interface, vrrp authentication, vrrp description, vrrp ip, vrrp preempt, vrrp priority, vrrp timers advertise, vrrp timers learn.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |

| Feature Name | Releases | Feature Configuration Information |
|----------------------|---|--|
| VRRP Object Tracking | 15.2(1)S 15.3(1)S Cisco IOS XE Release 3.3 SE | <p>The VRRP Object Tracking feature extends the capabilities of the VRRP to allow tracking of specific objects within the router that can alter the priority level of a virtual router for a VRRP group.</p> <p>The following command was introduced by this feature: vrrp track.</p> <p>The following command was modified by this feature: show track.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |
| VRRP MIB—RFC 2787 | Cisco IOS XE Release 3.3 SE | <p>The VRRP MIB--RFC 2787 feature enables an enhancement to the MIB for use with SNMP-based network management. The feature adds support for configuring, monitoring, and controlling routers that use VRRP.</p> <p>The following command was introduced by this feature: vrrp shutdown.</p> <p>The following commands were modified by this feature: snmp-server enable trapsandsnmp-server host.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |

| Feature Name | Releases | Feature Configuration Information |
|---------------------|-----------------------------|---|
| FHRP—VRF Aware VRRP | Cisco IOS XE Release 3.3 SE | <p>The FHRP—VRF Aware VRRP feature enables VRRP support on MPLS VPN.</p> <p>There are no new or modified commands for this feature.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco Catalyst 3850 Series Switches.</p> <p>In Cisco IOS XE Release 3.3SE, this feature is supported on Cisco 5700 Wireless LAN Controllers.</p> |

Glossary

virtual IP address owner —The VRRP router that owns the IP address of the virtual router. The owner is the router that has the virtual router address as its physical interface address.

virtual router —One or more VRRP routers that form a group. The virtual router acts as the default gateway router for LAN clients. Also known as a VRRP group.

virtual router backup —One or more VRRP routers that are available to assume the role of forwarding packets if the virtual router master fails.

virtual router master —The VRRP router that is currently responsible for forwarding packets sent to the IP addresses of the virtual router. Usually the virtual router master also functions as the IP address owner.

VRRP router --A router that is running VRRP.



CHAPTER 2

HSRP: Global IPv6 Address

IPv6 routing protocols ensure device-to-device resilience and failover. However, in situations in which the path between a host and the first-hop device fails, or the first-hop device itself fails, first hop redundancy protocols (FHRPs) ensure host-to-device resilience and failover.

The Hot Standby Router Protocol (HSRP) protects data traffic in case of a gateway failure. The HSRP global IPv6 address feature allows users to configure multiple nonlink local addresses as virtual addresses, and it allows for the storage and management of multiple global IPv6 virtual addresses in addition to the existing primary link-local address. If an IPv6 address is used, it must include an IPv6 prefix length. If a link-local address is used, it must not have a prefix.

- [Finding Feature Information, page 23](#)
- [Information About HSRP Global IPv6 Address, page 24](#)
- [How to Enable HSRP Global IPv6 Address, page 24](#)
- [Configuration Example for HSRP Global IPv6 Address, page 26](#)
- [Additional References, page 27](#)
- [Feature Information for HSRP: Global IPv6 Address, page 28](#)
- [Glossary, page 28](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About HSRP Global IPv6 Address

HSRP: Global IPv6 Address

IPv6 routing protocols ensure device-to-device resilience and failover. However, in situations in which the path between a host and the first-hop device fails, or the first-hop device itself fails, first hop redundancy protocols (FHRPs) ensure host-to-device resilience and failover.

The Hot Standby Router Protocol (HSRP) protects data traffic in case of a gateway failure. The HSRP global IPv6 address feature allows users to configure multiple nonlink local addresses as virtual addresses, and it allows for the storage and management of multiple global IPv6 virtual addresses in addition to the existing primary link-local address. If an IPv6 address is used, it must include an IPv6 prefix length. If a link-local address is used, it must not have a prefix.

How to Enable HSRP Global IPv6 Address

Enabling and Verifying an HSRP Group for IPv6 Operation

In this task, when you enter the **standby ipv6** command, a link-local address is generated from the link-local prefix, and a modified EUI-64 format interface identifier is generated in which the EUI-64 interface identifier is created from the relevant HSRP virtual MAC address.

A link-local address is an IPv6 unicast address that can be automatically configured on any interface using the link-local prefix FE80::/10 (1111 1110 10) and the interface identifier in the modified EUI-64 format. Link-local addresses are used in the stateless autoconfiguration process. Nodes on a local link can use link-local addresses to communicate; the nodes do not need site-local or globally unique addresses to communicate.

In IPv6, a device on the link advertises in RA messages any site-local and global prefixes, and its willingness to function as a default device for the link. RA messages are sent periodically and in response to router solicitation messages, which are sent by hosts at system startup.

A node on the link can automatically configure site-local and global IPv6 addresses by appending its interface identifier (64 bits) to the prefixes (64 bits) included in the RA messages. The resulting 128-bit IPv6 addresses configured by the node are then subjected to duplicate address detection to ensure their uniqueness on the link. If the prefixes advertised in the RA messages are globally unique, then the IPv6 addresses configured by the node are also guaranteed to be globally unique. Router solicitation messages, which have a value of 133 in the Type field of the ICMP packet header, are sent by hosts at system startup so that the host can immediately autoconfigure without needing to wait for the next scheduled RA message.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 unicast-routing**
4. **interface** *type number*
5. **standby** [*group-number*] **ipv6** {*link-local-address* | **autoconfig**}
6. **standby** [*group-number*] **preempt** [**delay minimum** *seconds* | **reload** *seconds* | **sync** *seconds*]
7. **standby** [*group-number*] **priority** *priority*
8. **exit**
9. **show standby** [*type number* [*group*]] [**all** | **brief**]
10. **show ipv6 interface** [**brief**] [*interface-type interface-number*] [**prefix**]

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | ipv6 unicast-routing Example: Device(config)# ipv6 unicast-routing | Enables the forwarding of IPv6 unicast datagrams. • The ipv6 unicast-routing command must be enabled for HSRP for IPv6 to work. |
| Step 4 | interface <i>type number</i> Example: Device(config)# interface GigabitEthernet 0/0/0 | Specifies an interface type and number, and places the device in interface configuration mode. |
| Step 5 | standby [<i>group-number</i>] ipv6 { <i>link-local-address</i> autoconfig } | Activates the HSRP in IPv6. |
| Step 6 | standby [<i>group-number</i>] preempt [delay minimum <i>seconds</i> reload <i>seconds</i> sync <i>seconds</i>] | Configures HSRP preemption and preemption delay. |

| | Command or Action | Purpose |
|----------------|---|--|
| | <p>Example:</p> <pre>Device(config-if)# standby 1 preempt</pre> | |
| Step 7 | <p>standby <i>[group-number]</i> priority <i>priority</i></p> <p>Example:</p> <pre>Device(config-if)# standby 1 priority 110</pre> | Configures HSRP priority. |
| Step 8 | <p>exit</p> <p>Example:</p> <pre>Device(config-if)# exit</pre> | Returns the device to privileged EXEC mode. |
| Step 9 | <p>show standby <i>[type number [group]]</i> [all brief]</p> <p>Example:</p> <pre>Device# show standby</pre> | Displays HSRP information. |
| Step 10 | <p>show ipv6 interface [brief] <i>[interface-type interface-number]</i> [prefix]</p> <p>Example:</p> <pre>Device# show ipv6 interface GigabitEthernet 0/0/0</pre> | Displays the usability status of interfaces configured for IPv6. |

Configuration Example for HSRP Global IPv6 Address

Example: Configuring HSRP Global IPv6 Addresses

```
Device(config)# interface GigabitEthernet 0/0
Device(config-if)# no ip address
Device(config-if)# ipv6 address 2001::DB8:1/64
Device(config-if)# standby version 2
Device(config-if)# standby 1 ipv6 FE80::1:CAFE
Device(config-if)# standby 1 ipv6 2001::DB8:2/64
Device(config-if)# standby 1 ipv6 2001:DB8::3/64
Device(config-if)# standby 1 ipv6 2001:DB8::4/64
Device(config-if)# end
```

Additional References

Related Documents

| Related Topic | Document Title |
|----------------------------------|--|
| IPv6 addressing and connectivity | <i>IPv6 Configuration Guide</i> |
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| IPv6 commands | <i>Cisco IOS IPv6 Command Reference</i> |
| Cisco IOS IPv6 features | Cisco IOS IPv6 Feature Mapping |
| GLBP | <i>Configuring GLBP</i> |

Standards and RFCs

| Standard/RFC | Title |
|---------------|------------------|
| RFCs for IPv6 | <i>IPv6 RFCs</i> |

MIBs

| MIB | MIBs Link |
|-----|--|
| | To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs |

Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | http://www.cisco.com/cisco/web/support/index.html |

Feature Information for HSRP: Global IPv6 Address

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for HSRP: Global IPv6 Address

| Feature Name | Releases | Feature Information |
|---------------------------|----------|---|
| HSRP: Global IPv6 Address | | <p>The HSRP global IPv6 address feature allows users to configure multiple non-link local addresses as virtual addresses.</p> <p>The following command was introduced: standby ipv6.</p> |

Glossary

Virtual IP address owner—The VRRP device that owns the IP address of the virtual device. The owner is the device that has the virtual device address as its physical interface address.

Virtual device—One or more VRRP devices that form a group. The virtual device acts as the default gateway device for LAN clients. The virtual device is also known as a VRRP group.

Virtual device backup—One or more VRRP devices that are available to assume the role of forwarding packets if the virtual device master fails.

Virtual device master—The VRRP device that is currently responsible for forwarding packets sent to the IP addresses of the virtual device. Usually, the virtual device master also functions as the IP address owner.

VRRP device—A device that is running VRRP.