# First Hop Redundancy Protocols Configuration Guide, Cisco IOS XE Release 3E

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**C H A P T E R 1**

# 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.

**[other]**

**A note on link local addresses**
The HSRP protocol uses a link local address as part of the protocol and this is not changed by the global address feature. Consider the global address feature as exchanging global addresses within the protocol for use, but the protocol itself still uses link locals for its protocol operation. If you only configure a global address, then there is a link-local address that is automatically allocated using the Extended Unique Identifier (EUI-64) method. You can use the **show standby** command to see the allocated link local address. You can still configure an IPv6 link local address by manual configuration if you require it. Manual configuration takes the group out of the 'implicit link-local' mode and replaces the automatic link local address with the configured one. If the configured one is later removed, but there is still a global address, then another implicit link local address is recalculated and applied.

# 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.

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# Information About HSRP Global IPv6 Address

## HSRP: Global IPv6 Address

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.

The figure below depicts a deployment scenario that uses an HSRP IPv6 global virtual interface:
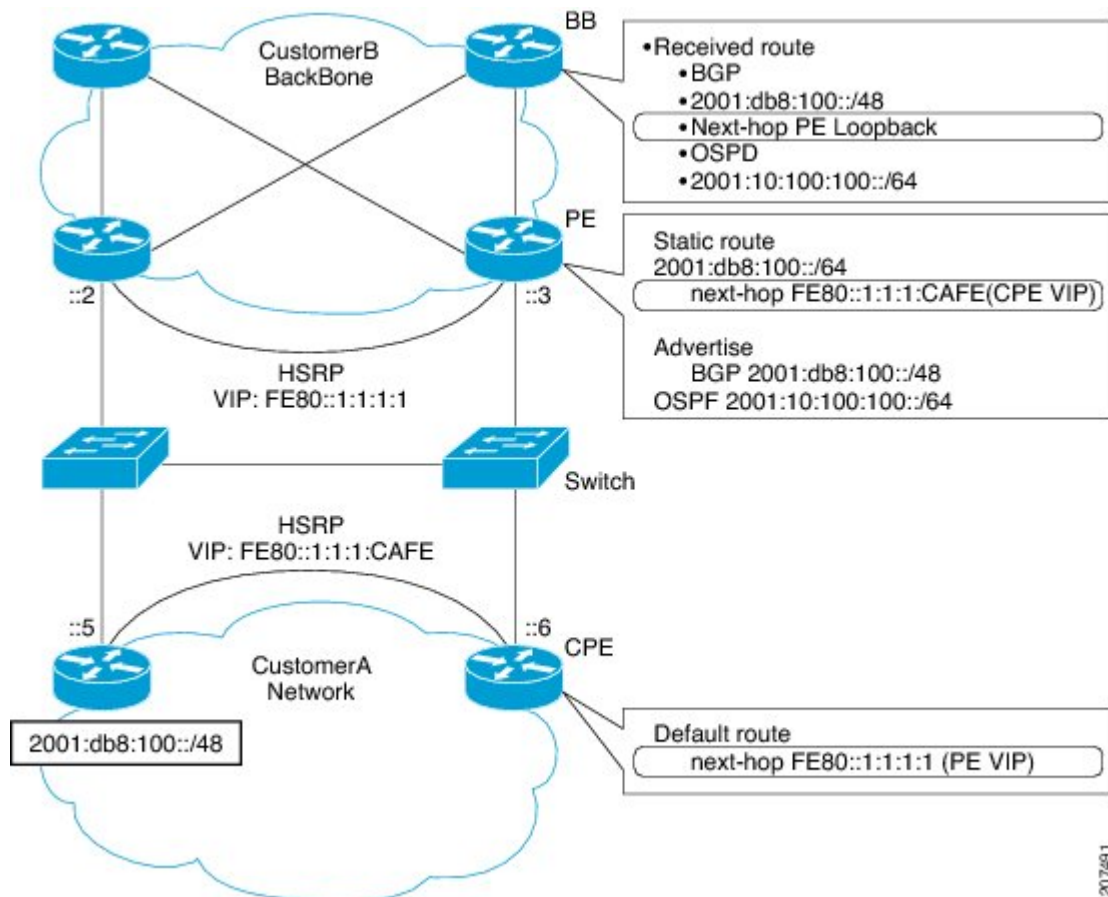


In the figure above, the provider equipment (PE) devices need to inject a route to reach the customer premises equipment (CPE) from the backbone devices. Because there are two CPEs, HSRP is convenient to use. The static route will be set with a link-local next hop (FE80::1:1:1:CAFE). If this address is injected in the backbone, this route is useless with a link-local next hop, as link-local addresses only have scope within the Layer 2 local LAN space. To address this issue, the next hop of the static route toward the virtual address must be set to a non link-local address, so backbone devices can route packets to the PE devices. At the next-hop address

resolution, the active HSRP group member will reply to neighbor solicitation (NS) messages sent to the non link-local address.

### Jitter timers

Jitter timers are used in HSRP. They are recommended for timers running on services that work realtime and scale. Jitter timers are intended to significantly improve the reliability of HSRP, and other FHRP protocols, by reducing the chance of bunching of HSRP groups operations, and thus help reduce CPU and network traffic spikes. In the case of HSRP, a given device may have up to 4000 operational groups configured. In order to distribute the load on the device and network, the HSRP timers use a jitter. A given timer instance may take up to 20% more than the configured value. For example, for a hold time set to 15 seconds, the actual hold time may take 18 seconds.

In HSRP, the Hello timer (which sends the Hello Packet) has a negative Jitter, while the Holddown timer (which checks for failure of a peer) has a positive jitter.

# 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 modified EUI-64 format interface identifier is generated in which the EUI-64 interface identifier is created from the relevant HSRP virtual MAC address

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 device 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 detec tion 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. Device solicitation messages, which have a value of 133 in the Type field of the ICMPv6 packet header, are sent by hosts at system startup so that the host can immediately auto-configure 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** {*ipv6-global-address* | *ipv6-address/prefix-length* | *ipv6-prefix/prefix-length* | *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**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 unicast-routing**<br><br>**Example:**<br><br>`Device(config)# ipv6 unicast-routing` | Enables the forwarding of IPv6 unicast datagrams.<br><br>• The **ipv6 unicast-routing** command must be enabled for HSRP for IPv6 to work. |
| **Step 4** | **interface** *type number*<br><br>**Example:**<br><br>`Device(config)# interface ethernet 0/0` | Specifies an interface type and number, and places the device in interface configuration mode. |
| **Step 5** | **standby** [*group-number*] **ipv6** {*ipv6-global-address* \| *ipv6-address/prefix-length* \| *ipv6-prefix/prefix-length* \| *link-local-address* \| **autoconfig**}<br><br>**Example:**<br><br>`Device(config-if)# standby 1 ipv6 autoconfig` | Activates the HSRP in IPv6.<br><br>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. |
| **Step 6** | **standby** [*group-number*] **preempt** [**delay minimum** *seconds* \| **reload** *seconds* \| **sync** *seconds*]<br><br>**Example:**<br><br>`Device(config-if)# standby 1 preempt` | Configures HSRP preemption and preemption delay. |
| **Step 7** | **standby** [*group-number*] **priority** *priority*<br><br>**Example:**<br><br>`Device(config-if)# standby 1 priority 110` | Configures HSRP priority. |
| **Step 8** | **exit**<br><br>**Example:**<br><br>`Device(config-if)# exit` | Returns to privileged EXEC mode. |

| | Command or Action | Purpose |
|---|---|---|
| Step 9 | **show standby** [*type number* [*group*]] [**all** \| **brief**]<br><br>**Example:**<br>`Device# show standby` | Displays HSRP information. |
| Step 10 | **show ipv6 interface** [**brief**] [*interface-type interface-number*] [**prefix**]<br><br>**Example:**<br>`Device# show ipv6 interface ethernet 0/0` | Displays the usability status of interfaces configured for IPv6. |

# Configuration Example for HSRP Global IPv6 Address

## Example: Configuring HSRP Global IPv6 Addresses

This example shows three HSRP global IPv6 addresses with an explicitly configured link-local address:

```
Device(config)# interface ethernet 0/0
Device(config-if)# no ip address
Device(config-if)# ipv6 address 2001::DB8:1/64
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)# exit
```

# Additional References for HSRP Global IPv6 Address

**Related Documents**

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Cisco IOS Master Command List, All Releases |
| HSRP commands | *Cisco IOS First Hop Redundancy Protocols Command Reference* |
| Troubleshooting HSRP | *Hot Standby Router Protocol: Frequently Asked Questions* |
| IPv6 addressing and connectivity | *IPv6 Configuration Guide* |

| Related Topic | Document Title |
|---|---|
| IPv6 commands | *Cisco IOS IPv6 Command Reference* |
| Cisco IOS IPv6 features | Cisco IOS IPv6 Feature Mapping |

**RFCs**

| RFCs | Title |
|---|---|
| RFCs for IPv6 | *IPv6 RFCs* |

**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

*Table 1: Feature Information for HSRP: Global IPv6 Address*

| Feature Name | Releases | Feature Information |
|---|---|---|
| HSRP: Global IPv6 Address | Cisco IOS XE 3.6E | The HSRP global IPv6 address feature allows users to configure multiple non-link local addresses as virtual addresses.<br><br>In Cisco IOS Release Cisco IOS XE Release 3.6E, this feature is supported on the following platforms:<br><br>• Cisco Catalyst 3850 Series Switches<br><br>• Cisco Catalyst 3650 Series Switches<br><br>• Cisco Catalyst 4500E Supervisor Engine 7L-E<br><br>• Cisco Catalyst 4500-X Series Switches<br><br>• Cisco Catalyst 4500E Supervisor Engine 8-E<br><br>The following commands were introduced or modified: **standby ipv6**. |

# VRRPv3 Protocol Support

Virtual Router Redundancy Protocol (VRRP) enables a group of devices to form a single virtual device to provide redundancy. The LAN clients can then be configured with the virtual device as their default gateway. The virtual device, representing a group of devices, is also known as a VRRP group. The VRRP version 3 (v3) Protocol Support feature provides the capability to support IPv4 and IPv6 addresses while VRRP version 2 (v2) only supports IPv4 addresses. This module explains concepts related to VRRPv3 and describes how to create and customize a VRRP group in a network. Benefits of using VRRPv3 Protocol Support include the following:

- Interoperability in multi-vendor environments.

- VRRPv3 supports usage of IPv4 and IPv6 addresses while VRRPv2 only supports IPv4 addresses

- Improved scalability through the use of VRRS Pathways.

**Note**   In this module, VRRP and VRRPv3 are used interchangeably.

# Finding Feature Information

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# Restrictions for VRRPv3 Protocol Support

- VRRPv3 is not intended as a replacement for existing dynamic protocols. VRRPv3 is designed for use over multi-access, multicast, or broadcast capable Ethernet LANs.

- VRRPv3 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 not configure the VRRPv3 advertise timer to a value lesser than the forwarding delay on the BVI interface. If you configure the VRRPv3 advertise timer to a value equal to or greater than the forwarding delay on the BVI interface, the setting prevents a VRRP device 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.

- VRRPv3 does not support Stateful Switchover (SSO).

- VRRPv3 protocol does not support authentication.

- Full network redundancy can only be achieved if VRRP operates over the same network path as the VRRS Pathway redundant interfaces. For full redundancy, the following restrictions apply:

  - VRRS pathways should not share a different physical interface as the parent VRRP group or be configured on a sub-interface having a different physical interface as the parent VRRP group.

  - VRRS pathways should not be configured on Switch Virtual Interface (SVI) interfaces as long as the associated VLAN does not share the same trunk as the VLAN on which the parent VRRP group is configured.

# Information About VRRPv3 Protocol Support

## VRRPv3 Benefits

### Support for IPv4 and IPv6

VRRPv3 supports IPv4 and IPv6 address families while VRRPv2 only supports IPv4 addresses.

**Note** When VRRPv3 is in use, VRRPv2 is unavailable. For VRRPv3 to be configurable, the **fhrp version vrrp v3** command must be used in global configuration mode

### Redundancy

VRRP enables you to configure multiple devices as the default gateway device, 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 devices, thereby sharing the traffic load more equitably between available devices.

### Multiple Virtual Devices

VRRP supports up to 255 virtual devices (VRRP groups) on a device physical interface, subject to restrictions in scaling. Multiple virtual device support enables you to implement redundancy and load sharing in your LAN topology. In scaled environments, VRRS Pathways should be used in combination with VRRP control groups.

### Multiple IP Addresses

The virtual device 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.

**Note** To utilize secondary IP addresses in a VRRP group, a primary address must be configured on the same group.

### Preemption

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

**Note** Preemption of a lower priority master device is enabled with an optional delay.

### Advertisement Protocol

VRRP uses a dedicated Internet Assigned Numbers Authority (IANA) standard multicast address for VRRP advertisements. For IPv4, the multicast address is 224.0.0.18. For IPv6, the multicast address is FF02:0:0:0:0:0:0:12. This addressing scheme minimizes the number of devices that must service the multicasts and allows test equipment to accurately identify VRRP packets on a segment. The IANA has assigned VRRP the IP protocol number 112.

# VRRP Device Priority and Preemption

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

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

Priority also determines if a VRRP device functions as a virtual device backup and the order of ascendancy to becoming a virtual device master if the virtual device master fails. You can configure the priority of each virtual device backup with a value of 1 through 254 using the **priority** command (use the **vrrp address-family** command to enter the VRRP configuration mode and access the **priority** option).

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

By default, a preemptive scheme is enabled whereby a higher priority virtual device backup that becomes available takes over from the virtual device backup that was elected to become virtual device master. You can disable this preemptive scheme using the **no preempt** command (use the **vrrp address-family** command to enter the VRRP configuration mode, and enter the **no preempt** command). If preemption is disabled, the virtual device backup that is elected to become virtual device master remains the master until the original virtual device master recovers and becomes master again.

> **Note** Preemption of a lower priority master device is enabled with an optional delay.

# VRRP Advertisements

The virtual device master sends VRRP advertisements to other VRRP devices in the same group. The advertisements communicate the priority and state of the virtual device master. The VRRP advertisements are encapsulated into either IPv4 or IPv6 packets (based on the VRRP group configuration) and sent to the appropriate multicast address assigned to the VRRP group. For IPv4, the multicast address is 224.0.0.18. For IPv6, the multicast address is FF02:0:0:0:0:0:0:12. The advertisements are sent every second by default and the interval is configurable.

Cisco devices allow you to configure millisecond timers, which is a change from VRRPv2. You need to manually configure the millisecond timer values on both the primary and the backup devices. The master advertisement value displayed in the **show vrrp** command output on the backup devices is always 1 second because the packets on the backup devices 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. The use of the millisecond timer values is compatible with third party vendors, as long as they also support VRRPv3. You can specify a timer value between 100 milliseconds and 40000 milliseconds.

# How to Configure VRRPv3 Protocol Support

## Enabling VRRPv3 on a Device

To enable VRRPv3 on a device, perform the following task:

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **fhrp version vrrp v3**
4. **end**

**DETAILED STEPS**

|  | Command or Action | Purpose |
|---|---|---|
| Step 1 | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| Step 2 | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| Step 3 | **fhrp version vrrp v3**<br><br>**Example:**<br>`Device(config)# fhrp version vrrp v3` | Enables the ability to configure VRRPv3 and VRRS.<br><br>**Note**   When VRRPv3 is in use, VRRPv2 is unavailable. |
| Step 4 | **end**<br><br>**Example:**<br>`Device(config)# end` | Returns to privileged EXEC mode. |

## Creating and Customizing a VRRP Group

To create a VRRP group, perform the following task. Steps 6 to 14 denote customizing options for the group, and they are optional:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **fhrp version vrrp v3**
4. **interface** *type number*
5. **vrrp** *group-id* **address-family** {**ipv4** | **ipv6**}
6. **address** *ip-address* [**primary** | **secondary**]
7. **description** *group-description*
8. **match-address**
9. **preempt delay minimum** *seconds*
10. **priority** *priority-level*
11. **timers advertise** *interval*
12. **vrrpv2**
13. **vrrs leader** *vrrs-leader-name*
14. **shutdown**
15. **end**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>Device> enable | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>Device# configure terminal | Enters global configuration mode. |
| **Step 3** | **fhrp version vrrp v3**<br><br>**Example:**<br><br>Device(config)# fhrp version vrrp v3 | Enables the ability to configure VRRPv3 and VRRS.<br><br>**Note**    When VRRPv3 is in use, VRRPv2 is unavailable. |
| **Step 4** | **interface** *type number*<br><br>**Example:**<br><br>Device(config)# interface GigabitEthernet 0/0/0 | Enters interface configuration mode. |

| | | **Command or Action** | **Purpose** |
|---|---|---|---|
| **Step 5** | | **vrrp** *group-id* **address-family** {**ipv4** | **ipv6**} **Example:** `Device(config-if)# vrrp 3 address-family ipv4` | Creates a VRRP group and enters VRRP configuration mode. |
| **Step 6** | | **address** *ip-address* [**primary** | **secondary**] **Example:** `Device(config-if-vrrp)# address 100.0.1.10 primary` | Specifies a primary or secondary address for the VRRP group. **Note** VRRPv3 for IPv6 requires that a primary virtual link-local IPv6 address is configured to allow the group to operate. After the primary link-local IPv6 address is established on the group, you can add the secondary global addresses. |
| **Step 7** | | **description** *group-description* **Example:** `Device(config-if-vrrp)# description group 3` | (Optional) Specifies a description for the VRRP group. |
| **Step 8** | | **match-address** **Example:** `Device(config-if-vrrp)# match-address` | (Optional) Matches secondary address in the advertisement packet against the configured address. • Secondary address matching is enabled by default. |
| **Step 9** | | **preempt delay minimum** *seconds* **Example:** `Device(config-if-vrrp)# preempt delay minimum 30` | (Optional) Enables preemption of lower priority master device with an optional delay. • Preemption is enabled by default. |
| **Step 10** | | **priority** *priority-level* **Example:** `Device(config-if-vrrp)# priority 3` | (Optional) Specifies the priority value of the VRRP group. • The priority of a VRRP group is 100 by default. |
| **Step 11** | | **timers advertise** *interval* **Example:** `Device(config-if-vrrp)# timers advertise 1000` | (Optional) Sets the advertisement timer in milliseconds. • The advertisement timer is set to 1000 milliseconds by default. |
| **Step 12** | | **vrrpv2** **Example:** `Device(config-if-vrrp)# vrrpv2` | (Optional) Enables support for VRRPv2 simultaneously, so as to interoperate with devices which only support VRRP v2. • VRRPv2 is disabled by default. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 13** | **vrrs leader** *vrrs-leader-name*<br><br>**Example:**<br><br>Device(config-if-vrrp)# vrrs leader leader-1 | (Optional) Specifies a leader's name to be registered with VRRS and to be used by followers.<br><br>    • A registered VRRS name is unavailable by default. |
| **Step 14** | **shutdown**<br><br>**Example:**<br><br>Device(config-if-vrrp)# shutdown | (Optional) Disables VRRP configuration for the VRRP group.<br><br>    • VRRP configuration is enabled for a VRRP group by default. |
| **Step 15** | **end**<br><br>**Example:**<br><br>Device(config)# end | Returns to privileged EXEC mode. |

# Configuring the Delay Period Before FHRP Client Initialization

To configure the delay period before the initialization of all FHRP clients on an interface, perform the following task:

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **fhrp version vrrp v3**
4. **interface** *type number*
5. **fhrp delay** {[**minimum**] [**reload**] *seconds*}
6. **end**

**DETAILED STEPS**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>Device> enable | Enables privileged EXEC mode.<br><br>    • Enter your password if prompted. |

| | **Command or Action** | **Purpose** |
|---|---|---|
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>Device# configure terminal | Enters global configuration mode. |
| **Step 3** | **fhrp version vrrp v3**<br><br>**Example:**<br><br>Device(config)# fhrp version vrrp v3 | Enables the ability to configure VRRPv3 and VRRS.<br><br>**Note**    When VRRPv3 is in use, VRRPv2 is unavailable. |
| **Step 4** | **interface** *type number*<br><br>**Example:**<br><br>Device(config)# interface GigabitEthernet 0/0/0 | Enters interface configuration mode. |
| **Step 5** | **fhrp delay** {[**minimum**] [**reload**] *seconds*}<br><br>**Example:**<br><br>Device(config-if)# fhrp delay minimum 5 | Specifies the delay period for the initialization of FHRP clients after an interface comes up.<br><br>• The range is 0-3600 seconds. |
| **Step 6** | **end**<br><br>**Example:**<br><br>Device(config)# end | Returns to privileged EXEC mode. |

# Configuration Examples for VRRPv3 Protocol Support

## Example: Enabling VRRPv3 on a Device

The following example shows how to enable VRRPv3 on a device:

```
Device> enable
Device# configure terminal
Device(config)# fhrp version vrrp v3
Device(config-if-vrrp)# end
```

# Example: Creating and Customizing a VRRP Group

The following example shows how to create and customize a VRRP group:

```
Device> enable
Device# configure terminal
Device(config)# fhrp version vrrp v3
Device(config)# interface gigabitethernet0/0
Device(config-if)# vrrp 3 address-family ipv4
Device(config-if-vrrp)# address 100.0.1.10 primary
Device(config-if-vrrp)# description group 3
Device(config-if-vrrp)# match-address
Device(config-if-vrrp)# preempt delay minimum 30
Device(config-if-vrrp)# end
```

**Note**   In the above example, the **fhrp version vrrp v3** command is used in the global configuration mode.

# Example: Configuring the Delay Period Before FHRP Client Initialization

The following example shows how to configure the delay period before FHRP client initialization :

```
Device> enable
Device# configure terminal
Device(config)# fhrp version vrrp v3
Device(config)# interface gigabitethernet0/0
Device(config-if)# fhrp delay minimum 5
Device(config-if-vrrp)# end
```

**Note**   In the above example, a five-second delay period is specified for the initialization of FHRP clients after the interface comes up. You can specify a delay period between 0 and 3600 seconds.

# Example: VRRP Status, Configuration, and Statistics Details

The following is a sample output of the status, configuration and statistics details for a VRRP group:

```
Device> enable
Device# show vrrp detail

 Ethernet0/0 - Group 1 - Address-Family IPv4

 State is MASTER
 State duration 3.707 secs
 Virtual IP address is 1.0.0.10
 Virtual MAC address is 0000.5E00.0101
 Advertisement interval is 1000 msec
 Preemption enabled
 Priority is 100
 Master Router is 1.0.0.1 (local), priority is 100
 Master Advertisement interval is 1000 msec (expires in 686 msec)
 Master Down interval is unknown
 State is MASTER
 State duration 3.707 secs
 VRRPv3 Advertisements: sent 5 (errors 0) - rcvd 0
 VRRPv2 Advertisements: sent 0 (errors 0) - rcvd 0
```

```
 Group Discarded Packets: 0
   VRRPv2 incompatibility: 0
   IP Address Owner conflicts: 0
   Invalid address count: 0
   IP address configuration mismatch : 0
   Invalid Advert Interval: 0
   Adverts received in Init state: 0
   Invalid group other reason: 0
 Group State transition:
   Init to master: 0
   Init to backup: 1 (Last change Mon Jul 30 16:42:01.856)
   Backup to master: 1 (Last change Mon Jul 30 16:42:05.469)
   Master to backup: 0
   Master to init: 0
   Backup to init: 0

Device# exit
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Master Commands List, All Releases |
| FHRP commands | First Hop Redundancy Protocols Command Reference |
| Configuring VRRPv2 | *Configuring VRRP* |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| RFC5798 | *Virtual Router Redundancy Protocol* |

### 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 VRRPv3 Protocol Support

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 VRRPv3 Protocol Support*

| Feature Name | Releases | Feature Information |
| --- | --- | --- |
| VRRPv3 Protocol Support | Cisco IOS XE 3.6E | VRRP enables a group of devices to form a single virtual device to provide redundancy. The LAN clients can then be configured with the virtual device as their default gateway. The virtual device, representing a group of devices, is also known as a VRRP group. The VRRPv3 Protocol Support feature provides the capability to support IPv4 and IPv6 addresses. <br><br> In Cisco IOS Release Cisco IOS XE Release 3.6E, this feature is supported on the following platforms: <br><br> • Cisco Catalyst 4500E Supervisor Engine 6-E <br><br> • Cisco Catalyst 4500E Supervisor Engine 7L-E <br><br> • Cisco Catalyst 4500-X Series Switches <br><br> • Cisco Catalyst 4500E Supervisor Engine 8-E <br><br> The following commands were introduced or modified: **fhrp delay**, **show vrrp**, **vrrp address-family**. |

# 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.

**C H A P T E R 3**

# VRRPv3: Object Tracking Integration

Virtual Router Redundancy Protocol (VRRP) enables a group of devices to form a single virtual device to provide redundancy. The LAN clients then can be configured with the virtual device as the default gateway. The virtual device, representing a group of devices, is also known as a VRRP group. The VRRPv3: Object Tracking Integration feature allows you to track the behavior of an object and receive notifications of changes. This module explains how object tracking, in particular the tracking of IPv6 objects, is integrated into VRRP version 3 (VRRPv3) and describes how to track an IPv6 object using a VRRPv3 group. See the "VRRP Object Tracking" section for more information on object tracking.

# 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 VRRPv3: Object Tracking Integration

## 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 a 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.

# How to Configure VRRPv3: Object Tracking Integration

## Tracking an IPv6 Object using VRRPv3

### SUMMARY STEPS

1. **fhrp version vrrp v3**
2. **interface** *type number*
3. **vrrp** *group-id* **address-family ipv6**
4. **track** *object-number* **decrement** *number*
5. **end**

### DETAILED STEPS

|  | Command or Action | Purpose |
|---|---|---|
| Step 1 | **fhrp version vrrp v3**<br><br>**Example:**<br><br>`Device(config)# fhrp version vrrp v3` | Enables you to configure Virtual Router Redundancy Protocol version 3 (VRRPv3) and Virtual Router Redundancy Service (VRRS) on a device.<br><br>**Note**    When VRRPv3 is in use, VRRPv2 is unavailable. |
| Step 2 | **interface** *type number*<br><br>**Example:**<br><br>`Device(config)# interface GigabitEthernet 0/0/0` | Specifies an interface and enters interface configuration mode. |
| Step 3 | **vrrp** *group-id* **address-family ipv6**<br><br>**Example:**<br><br>`Device(config-if)# vrrp 1 address-family ipv6` | Creates a VRRP group for IPv6 and enters VRRP configuration mode. |
| Step 4 | **track** *object-number* **decrement** *number*<br><br>**Example:**<br><br>`Device(config-if-vrrp)# track 1 decrement 20` | Configures the tracking process to track the state of the IPv6 object using the VRRPv3 group. VRRP on Ethernet interface 0/0 then registers with the tracking process to be informed of any changes to the IPv6 object on the VRRPv3 group. If the IPv6 object state on serial interface VRRPv3 goes down, then the priority of the VRRP group is reduced by 20. |
| Step 5 | **end**<br><br>**Example:**<br><br>`Device(config-if-vrrp)# end` | Returns to privileged EXEC mode. |

# Configuration Examples for VRRPv3: Object Tracking Integration

## Example: Tracking an IPv6 Object using VRRPv3

In the following example, the tracking process is configured to track the state of the IPv6 object using the VRRPv3 group. VRRP on GigabitEthernet interface 0/0/0 then registers with the tracking process to be informed of any changes to the IPv6 object on the VRRPv3 group. If the IPv6 object state on serial interface VRRPv3 goes down, then the priority of the VRRP group is reduced by 20:

```
Device(config)# fhrp version vrrp v3
Device(config)# interface GigabitEthernet 0/0/0
Device(config-if)# vrrp 1 address-family ipv6
Device(config-if-vrrp)# track 1 decrement 20
```

## Example: Verifying VRRP IPv6 Object Tracking

```
Device# show vrrp

Ethernet0/0 - Group 1 - Address-Family IPv4
  State is BACKUP
  State duration 1 mins 41.856 secs
  Virtual IP address is 172.24.1.253
  Virtual MAC address is 0000.5E00.0101
  Advertisement interval is 1000 msec
  Preemption enabled
  Priority is 80 (configured 100)
    Track object 1 state Down decrement 20
  Master Router is 172.24.1.2, priority is 100
  Master Advertisement interval is 1000 msec (learned)
  Master Down interval is 3609 msec (expires in 3297 msec)

Device# show track ipv6 route brief

Track Type         Instance                  Parameter        State Last Change
601   ipv6 route   3172::1/32                metric threshold Down  00:08:55
602   ipv6 route   3192:ABCD::1/64           metric threshold Down  00:08:55
603   ipv6 route   3108:ABCD::CDEF:1/96      metric threshold Down  00:08:55
604   ipv6 route   3162::EF01/16             metric threshold Down  00:08:55
605   ipv6 route   3289::2/64                metric threshold Down  00:08:55
606   ipv6 route   3888::1200/64             metric threshold Down  00:08:55
607   ipv6 route   7001::AAAA/64             metric threshold Down  00:08:55
608   ipv6 route   9999::BBBB/64             metric threshold Down  00:08:55
611   ipv6 route   1111::1111/64             reachability     Down  00:08:55
612   ipv6 route   2222:3333::4444/64        reachability     Down  00:08:55
613   ipv6 route   5555::5555/64             reachability     Down  00:08:55
614   ipv6 route   3192::1/128               reachability     Down  00:08:55
```

# Additional References for VRRPv3: Object Tracking Integration

**Related Documents**

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Cisco IOS Master Command List, All Releases |
| HSRP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples | *Cisco IOS First Hop Redundancy Protocols Command Reference* |
| Troubleshooting HSRP | *Hot Standby Router Protocol: Frequently Asked Questions* |

**RFCs**

| RFCs | Title |
|---|---|
| RFC 792 | *Internet Control Message Protocol* |
| RFC 1828 | *IP Authentication Using Keyed MD5* |
| RFC 5798 | *Virtual Router Redundancy Protocol* |

**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 VRRPv3: Object Tracking Integration

*Table 3: Feature Information for VRRPv3: Object Tracking Integration*

| Feature Name | Releases | Feature Information |
|---|---|---|
| VRRPv3: Object Tracking Integration | Cisco IOS XE 3.6E | The VRRPv3: Object Tracking Integration feature allows you to use a VRRPv3 group to track an object. In Cisco IOS Release Cisco IOS XE Release 3.6E, this feature is supported on the following platforms: <br><br>• Cisco Catalyst 4500E Supervisor Engine 7L-E <br>• Cisco Catalyst 4500-X Series Switches <br>• Cisco Catalyst 4500E Supervisor Engine 8-E <br>• Cisco Catalyst 2960-X Series Switches <br><br>The following commands were introduced or modified: **fhrp version vrrp v3**, **show vrrp**, **track (VRRP)**. |