Implementing VRRP

The Virtual Router Redundancy Protocol (VRRP) feature allows for transparent failover at the first-hop IP router, enabling a group of routers to form a single virtual router.

Note For a complete description of the VRRP commands listed in this module, refer to the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Command Reference* publication. To locate documentation of other commands that appear in this chapter, use the command reference master index, or search online.

Feature History for Implementing VRRP

Release	Modification
Release 3.7.2	This feature was introduced.
Release 3.9.0	• BFD for VRRP feature was added. • MIB support for VRRP feature was added.
Release 4.1.0	VRRP over IPv6 feature was added.

Prerequisites for Implementing VRRP on Cisco IOS XR Software

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Restrictions for Implementing VRRP on Cisco IOS XR Software

VRRP is supported on Ethernet interfaces, Ethernet sub-interfaces and Ethernet link bundles.

The following are restrictions for implementing VRRP:

- ICMP redirects are not supported.
- Upto 4000 sessions are permitted on Ethernet sub-interfaces.
- On bundle interfaces, the number of sessions per member vary depending on the number of bundle members and their location on network processor (NP) as listed here:
  - One member on one NP: 3999 VRRP sessions
  - Two members on same NP: 1999 VRRP sessions
  - Four members on same NP: 999 VRRP sessions
  - Two members, one on each NP: 3999 VRRP sessions
  - Four members, two on each NP: 1999 VRRP sessions

Information About Implementing VRRP

To implement VRRP , you need to understand the following concepts:

VRRP Overview

A LAN client can use a dynamic process or static configuration to determine which router should be the first hop to a particular remote destination. The client 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 responds 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.
- IRDP (ICMP Router Discovery Protocol) client—The client runs an Internet Control Message Protocol (ICMP) router discovery client.

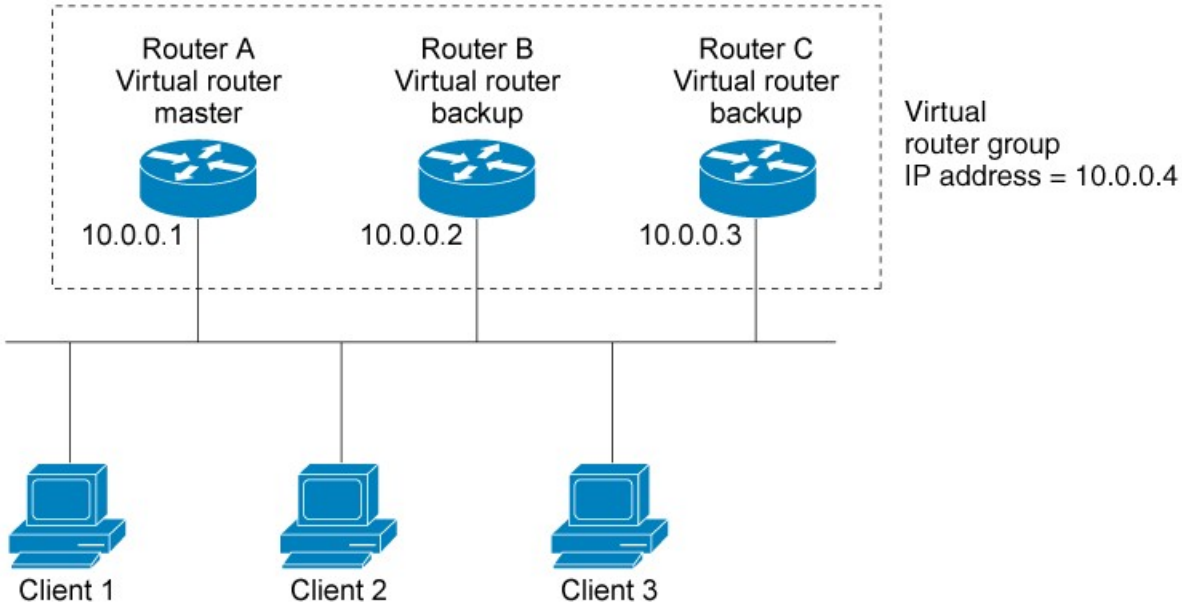
The drawback to dynamic discovery protocols is that they incur some configuration and processing overhead on the LAN client. Also, in the event of a router failure, the process of switching to another router can be slow.

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.

The Virtual Router Redundancy Protocol (VRRP) feature can solve the static configuration problem. VRRP is an IP routing redundancy protocol designed to allow for transparent failover at the first-hop IP router. 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*.

For example, Figure 1: Basic VRRP Topology, on page 3 shows a LAN topology in which VRRP is configured. In this example, Routers A, B, and C are *VRRP routers* (routers running VRRP) that compose a virtual router. The IP address of the virtual router is the same as that configured for the interface of Router A (10.0.0.1).

Figure 1: Basic VRRP Topology



Because the virtual router uses the IP address of the physical interface of Router A, Router A assumes the role of the *master virtual router* and is also known as the *IP address owner.* As the master virtual router, 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 *backup virtual routers*. If the master virtual router fails, the router configured with the higher priority becomes the master virtual router and provides uninterrupted service for the LAN hosts. When Router A recovers, it becomes the master virtual router again.

Note We recommend that you disable Spanning Tree Protocol (STP) on switch ports to which the virtual routers are connected. Enable RSTP or rapid-PVST on the switch interfaces if the switch supports these protocols.

Multiple Virtual Router Support

You can configure up to 100 virtual routers on a router interface. On Cisco ASR 9000 Enhanced Ethernet line cards, you can configure up to 256 virtual routers on a router interface. The actual number of virtual routers that a router interface can support depends on the following factors:

- 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 or more virtual routers and as a backup for one or more virtual routers.

VRRP Router Priority

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 master virtual router fails.

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

If no VRRP router owns the IP address, the priority of a VRRP router, combined with the reempt settings, determines if a VRRP router functions as a master or a backup virtual router. By default, the highest priority VRRP router functions as master, and all the others function as backups. Priority also determines the order of ascendancy to becoming a master virtual router if the master virtual router fails. You can configure the priority of each backup virtual router with a value of 1 through 254, using the **vrrp priority** command.

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

By default, a preemptive scheme is enabled whereby a higher-priority backup virtual router that becomes available takes over from the current master virtual router. You can disable this preemptive scheme using the **vrrp preempt disable** command. If preemption is disabled, the backup virtual router that is elected to become master upon the failure of the original higher priority master, remains the master even if the original master virtual router recovers and becomes available again.

VRRP Advertisements

The master virtual router sends VRRP advertisements to other VRRP routers in the same group. The advertisements communicate the priority and state of the master virtual router. 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.

Benefits of VRRP

The benefits of VRRP are as follows:

- 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—VRRP supports up to 100 virtual routers (VRRP groups) on a router interface, subject to the platform supporting multiple MAC addresses. On Cisco ASR 9000 Enhanced Ethernet line cards, you can configure up to 256 virtual routers on a router interface. Cisco ASR 9000 Series Routers support up to a limit of 100 per system with default timers and on Cisco ASR 9000 Enhanced Ethernet line cards, up to a limit of 256 per system with default timers. Multiple virtual router support enables you to implement redundancy and load sharing in your LAN topology.
- 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 backup virtual router that has taken over for a failing master virtual router with a higher-priority backup virtual router that has become available.
- Text Authentication—You can ensure that VRRP messages received from VRRP routers that comprise a virtual router are authenticated by configuring a simple text password.
- 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 assigns VRRP the IP protocol number 112.

How to Implement VRRP on Cisco IOS XR Software

This section contains instructions for the following tasks:

Note The VRRP virtual router id (vrid) has to be different for different sub-interfaces, for a given physical interface.

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 master virtual router 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.

The sections that follow describe how to customize your VRRP configuration.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family** {**ipv4** | **ipv6**}
5. **vrrp** *vrid* **version** { *2* | *3* }
6. **text-authentication**
7. **accept-mode**{**disable**}
8. **priority** *priority*
9. **preempt** [**delay** *seconds*] [**disable**]
10. **timer** [**msec**] *interval* [**force**]
11. **track interface** *type instance interface-path-id* [*priority-decrement*]
12. **delay** [**minimum** *seconds*] [**reload** *seconds*]
13. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables VRRP interface configuration mode on a specific interface.
Step 4	**address-family** {**ipv4**	**ipv6**} **Example:** `RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv6`	Enters the IPv4 or IPv6 address family submode.
Step 5	**vrrp** *vrid* **version** { *2* | *3* }	Enters the virtual router configuration submode.

	Command or Action	Purpose

	Example:
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# vrrp 3 version 3`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Note The **version** keyword is available only for the ipv4 address family.

Step 6	**text-authentication** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# text-authentication`	(Optional) Configures the simple text authentication used for Virtual Router Redundancy Protocol (VRRP) packets received from other routers running VRRP. • When a VRRP packet arrives from another router in the VRRP group, its authentication string is compared to the string configured on the local system. If the strings match, the message is accepted. If they do not match, the packet is discarded. • All routers within the group must be configured with the same authentication string. • To disable VRRP authentication, use the **no text-authentication** command. **Note** Plain text authentication is not meant to be used for security. It simply provides a way to prevent a misconfigured router from participating in VRRP.
Step 7	**accept-mode**{**disable**} **Example:** `RP/0/RSP0/CPU0:router# (config-vrrp-virtual-router)# accept-mode disable`	Enters the IPv4 or IPv6 address family submode.
Step 8	**priority** *priority* **Example:** `RP/0/RSP0/CPU0:router# (config-vrrp-virtual-router)# priority 254`	(Optional) Sets the priority of the virtual router. • Use the **priority** command to control which router becomes the master router. • The **priority** command is ignored while the router is the virtual IP address owner. • To remove the priority of the virtual router, use the **no priority** command.
Step 9	**preempt** [**delay** *seconds*] [**disable**] **Example:** `RP/0/RSP0/CPU0:router#`	(Optional) Sets the master virtual router and optionally, the time in seconds before the router advertises virtual IP address ownership to be the master router. • Use the **preempt** command to control which router becomes the master router.

	Command or Action	Purpose
	`(config-vrrp-virtual-router)# preempt delay 15`	• The **preempt** command is ignored while the router is the virtual IP address owner. • (Optional) Use the **disable** keyword to disable preemption. To reestablish the default (enabled), use the **no preempt** command.
Step 10	**timer** [**msec**] *interval* [**force**] **Example:** `RP/0/RSP0/CPU0:router# (config-vrrp-virtual-router)# timer 4`	(Optional) Configures the interval between successive advertisements by the master router in a VRRP virtual router. • To restore the default value, use the **no timer** command. **Note** We recommend configuring the same VRRPv3 timers on all VRRP routers when interoperating with other vendors.
Step 11	**track interface** *type instance interface-path-id* [*priority-decrement*] **Example:** `RP/0/RSP0/CPU0:router# (config-vrrp-virtual-router)# track interface TenGigE 0/0/CPU0/1 30`	(Optional) Configures the VRRP to track an interface. • Enter the **no track interface** *type instance interface-path-id* [*priority-decrement*] command to disable tracking. • Only IP interfaces are tracked. • A tracked interface is up if IP on that interface is up. Otherwise, the tracked interface is down. • You can configure VRRP to track an interface that can alter the priority level of a virtual router for a VRRP virtual router. When the IP protocol state of an interface goes down or the interface has been removed from the router, the priority of the backup virtual router is decremented by the value specified in the priority-decrement argument. When the IP protocol state on the interface returns to the up state, the priority is restored.
Step 12	**delay** [**minimum** *seconds*] [**reload** *seconds*] **Example:** `RP/0/RSP0/CPU0:router# (config-vrrp-virtual-router) # delay minimum 2 reload 10`	(Optional) Delays the startup of the state machine when an interface comes up, so that the network has time to settle and there are no unnecessary state changes early after the link comes up. The reload delay is the delay applied after the first interface up event. The minimum delay is the delay that is applied after any subsequent interface up event (if the interface flaps).
Step 13	**commit**	

Enabling VRRP

Use the **address** command to enable VRRP on an interface, as described in the sections that follow.

SUMMARY STEPS

1. **configure**
2. router vrrp
3. **interface** type interface-path-id
4. **address-family ipv4**
5. **vrrp** *vrid* **version** { *2* | *3* }
6. **address** *address*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	router vrrp **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables VRRP configuration mode.

Step 3	**interface** type interface-path-id
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`
	`RP/0/RSP0/CPU0:router(config-vrrp-if)#`
		Enables VRRP interface configuration mode on a specific interface.

Step 4	**address-family ipv4** **Example:** `RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv4`	Enters the IPv4 or IPv6 address family submode.

Step 5	**vrrp** *vrid* **version** { *2* | *3* }
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# vrrp 3 version 3`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Enters the virtual router configuration submode.
		
		Note The **version** keyword is available only for the ipv4 address family.

	Command or Action	Purpose
Step 6	**address** *address* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# address 2001:db8::/32`	Enables the Virtual Router Redundancy Protocol (VRRP) on an interface and specifies the IP address of the virtual router. • We recommend that you do not remove the VRRP configuration from the IP address owner and leave the IP address of the interface active, because duplicate IP addresses on the LAN will result. • To disable VRRP on the interface and remove the IP address of the virtual router, use the **no address** *address* command.
Step 7	**commit**	

Verifying VRRP

Use the **show vrrp** command to display a brief or detailed status of one or all VRRP virtual routers.

SUMMARY STEPS

1. **show vrrp** [**ipv4** | **ipv6**] [**interface** *type instance interface-path-id* [*vrid*]] [**brief** | **detail** | **statistics** [**all**]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show vrrp** [**ipv4** | **ipv6**] [**interface** *type instance interface-path-id* [*vrid*]] [**brief** | **detail** | **statistics** [**all**]] **Example:** `RP/0/RSP0/CPU0:router # show vrrp`	Displays a brief or detailed status of one or all Virtual Router Redundancy Protocol (VRRP) virtual routers. • If no interface is specified, all virtual routers are displayed.

Clearing VRRP Statistics

Use the **clear vrrp statistics** command to clear all the software counters for the specified virtual router.

SUMMARY STEPS

1. **clear vrrp statistics** [**ipv4** | **ipv6**] [**interface***type interface-path-id* [*vrid*]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**clear vrrp statistics** [**ipv4** | **ipv6**] [**interface***type interface-path-id* [*vrid*]] **Example:** `RP/0/RSP0/CPU0:router# clear vrrp statistics`	Clears all software counters for the specified virtual router. • If no interface is specified, statistics of all virtual routers are removed.

Configuration Examples for VRRP Implementation on Cisco IOS XR Software

This section provides the following VRRP configuration examples:

Configuring accept-mode

Perform this task to disable the installation of routes for the VRRP virtual addresses.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family** {**ipv4** | **ipv6**}
5. **vrrp** *vrid* **version** { *2* | *3* }
6. **accept-mode disable**
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	

	Command or Action	Purpose
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.

Step 3	**interface** *type interface-path-id*
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`
	`RP/0/RSP0/CPU0:router`
		Enables the VRRP interface configuration mode on a specific interface.

Step 4	**address-family** {**ipv4** | **ipv6**}
	
	Example:
	
	`RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv6`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Enters the IPv4 or IPv6 address family submode.

Step 5	**vrrp** *vrid* **version** { *2* | *3* }
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# vrrp 3 version 3`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Enters the virtual router configuration submode.
		
		Note The **version** keyword is available only for the ipv4 address family.

Step 6	**accept-mode disable** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# accept-mode disable`	Disables the installation of routes for the VRRP virtual addresses.
Step 7	**commit**	

Configuring a Global Virtual IPv6 Address

Perform this task to configure the global virtual IPv6 address for a virtual router.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv6**
5. **vrrp** *vrid* **version 3**
6. **address global** *address*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables the VRRP interface configuration mode on a specific interface.
Step 4	**address-family ipv6** **Example:** `RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv6`	Enters the IPv4 or IPv6 address family submode.
Step 5	**vrrp** *vrid* **version 3** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 3 version 3`	Enters the virtual router configuration submode. **Note** The **version** keyword is available only for the ipv4 address family.
Step 6	**address global** *address* **Example:**	Configures the global virtual IPv6 address for a virtual router.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:routerconfig-vrrp-virtual-router)# address global 2001:db8::/32`	**Note** VRRP packet sizes are limited by the corresponding interface's Maximum Transmission Unit (MTU). This limits the maximum number of global virtual IPv6 addresses that can be supported in a single VRRP session. For example, the default MTU on gigabitEthernet interfaces would allow for a maximum of 90 VRRP global virtual IPv6 addresses in a single session. In order to have more such addresses, you need to increase the interface's MTU accordingly.
Step 7	**commit**	

Configuring a Primary Virtual IPv4 Address

Perform this task to configure the primary virtual IPv4 address for a virtual router.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **vrrp** *vrid* **version** { *2* | *3* }
6. **address** *address*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:**	Enables the VRRP interface configuration mode on a specific interface.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1` `RP/0/RSP0/CPU0:router`	

Step 4	**address-family ipv4**
	
	Example:
	
	`RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv4`
	`RP/0/RSP0/CPU0:router(config-vrrp-address-family)#`
		Enters the IPv4 address family submode.

Step 5	**vrrp** *vrid* **version** { *2* | *3* }
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 3 version 2`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)`
		Enters the virtual router configuration submode.
		Note The **version** keyword is available only for the ipv4 address family.

Step 6	**address** *address* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# address 10.20.30.1`	Configures the primary virtual IPv4 address for a virtual router.
Step 7	**commit**	

Configuring a Secondary Virtual IPv4 Address

Perform this task to configure the secondary virtual IPv4 address for a virtual router.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **vrrp** *vrid* **version** { *2* | *3* }
6. **address** *address* **secondary**
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.

Step 3	**interface** *type interface-path-id*
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`
	`RP/0/RSP0/CPU0:router`
		Enables the VRRP interface configuration mode on a specific interface.

Step 4	**address-family ipv4**
	
	Example:
	
	`RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv4`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Enters the IPv4 address family submode.

Step 5	**vrrp** *vrid* **version** { *2* | *3* }
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# vrrp 3 version 3`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		Enters the virtual router configuration submode.
		
		Note The **version** keyword is available only for the ipv4 address family.

Step 6	**address** *address* **secondary** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)# address 10.20.30.1 secondary`	Configures the secondary virtual IPv4 address for a virtual router.
Step 7	**commit**	

Configuring a Virtual Link-Local IPv6 Address

Perform this task to either configure the virtual link-local IPv6 address for a virtual router or to specify that the virtual link-local IPv6 address should be enabled and calculated automatically from the virtual router virtual Media Access Control (MAC) address.

The IPv6 address space is structured differently compared to IPv4. Link-local addresses are used to identify each interface on the local network. These addresses may either be configured or determined automatically in a standard way using the link-layer (hardware) address of the interface (MAC address for Ethernet interfaces). Link-local addresses have a standard format and are valid only on the local network (they cannot be routed to, from multiple hops away).

Global unicast IPv6 addresses occupy a disjoint subset of the IPv6 address space from link-local addresses. They can be routed to, from multiple hops away and have an associated prefix length (between 0 and 128 bits).

Each VRRP virtual router has an associated virtual link-local address. This may be configured or determined automatically from the virtual router's virtual MAC address. The virtual MAC address must be unique on the local network. The virtual link-local address is analogous to an IPv4 virtual router's primary virtual IPv4 address, except that its virtual IP (VIP) state is always considered to be up, since duplicate address detection is not required for addresses whose scope is local.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv6**
5. **vrrp** *vrid* **version 3 address linklocal** {*address* | **autoconfigure**}
6. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables the VRRP interface configuration mode on a specific interface.

	Command or Action	Purpose
Step 4	**address-family ipv6** **Example:** `RP/0/RSP0/CPU0:routerconfig-vrrp-if)# address-family ipv6`	Enters the IPv6 address family submode.

Step 5	**vrrp** *vrid* **version 3 address linklocal** {*address* | **autoconfigure**}
	
	Example:
	
	`RP/0/RSP0/CPU0:routerconfig-vrrp-address-family)# vrrp 1 version 3 address linklocal FE80::260:3EFF:FE11:6770`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
	
	`RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 1 version 3 address linklocal autoconfigure`
	`RP/0/RSP0/CPU0:router(config-vrrp-virtual-router)#`
		• Configures the virtual link-local IPv6 address for the virtual router.
		• Specifies that the virtual link-local IPv6 address should be enabled and calculated automatically from the virtual router virtual MAC address.
		
		Note • You must disable IPv6 Duplicate Address Detection (DAD) on an interface when the VRRP router's virtual link-local address is the same as the interface's link-local address. When DAD is disabled, duplicate packets are not flagged as duplicates.
		• The **version** keyword is available only for the ipv4 address family.

Step 6	**commit**	

Disabling State Change Logging

Perform this task to disable the task of logging the VRRP state change events via syslog.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **message state disable**
4. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	

	Command or Action	Purpose
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables the VRRP configuration mode.

Step 3	**message state disable**
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config-vrrp)# message state disable`
	`RP/0/RSP0/CPU0:router(config-vrrp)#`
		Disables the task of logging the VRRP state change events via syslog.

Step 4	**commit**	

Multiple Group Optimization for Virtual Router Redundancy Protocol

Multiple Group Optimization for Virtual Router Redundancy Protocol (VRRP) provides a solution for reducing control traffic in a deployment consisting of many subinterfaces. By running the VRRP control traffic for just one session, the control traffic is reduced for the subinterfaces with identical redundancy requirements. All other sessions are slaves of this primary session, and inherit their states from it.

Configuring a VRRP Session Name

Perform this task to configure a VRRP session name.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **vrrp** *group-no*
6. **name** *name*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	EnablesVRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables RP interface configuration mode on a specific interface.
Step 4	**address-family ipv4** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-if)# address-family ipv4`	Enables VRRP address-family configuration mode on a specific interface.
Step 5	**vrrp** *group-no* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 1`	Enables VRRP group configuration mode on a specific interface.
Step 6	**name** *name* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-vritual-router)# name s1`	Configures a VRRP session name.
Step 7	**commit**	

Configuring a Slave Follow(VRRP)

Perform this task to instruct the slave group to inherit its state from a specified group.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **vrrp** *group-no* **slave**
6. **follow** *mgo-session-name*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables VRRP interface configuration mode on a specific interface.
Step 4	**address-family ipv4** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-if)# address-family ipv4`	Enables VRRP address-family configuration mode on a specific interface.
Step 5	**vrrp** *group-no* **slave** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 2 slave`	Enables VRRP slave configuration mode on a specific interface.
Step 6	**follow** *mgo-session-name* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-slave)# follow m1`	Instructs the slave group to inherit its state from a specified group.
Step 7	**commit**	

Configuring a Primary Virtual IPv4 Address for a Slave Group(VRRP)

Perform this task to configure the primary virtual IPv4 address for the slave group.

SUMMARY STEPS

1. **configure**
2. **router vrrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **vrrp** *group-no* **slave**
6. **address** *ip-address*
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router vrrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router vrrp`	Enables VRRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp)# interface TenGigE 0/2/0/1`	Enables VRRP interface configuration mode on a specific interface.
Step 4	**address-family ipv4** **Example:** `RP/0/RSP0/CPU0:router(config-hsrp-if)# address-family ipv4`	Enables VRRP address-family configuration mode on a specific interface.
Step 5	**vrrp** *group-no* **slave** **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-address-family)# vrrp 2 slave`	Enables VRRP slave configuration mode on a specific interface.
Step 6	**address** *ip-address* **Example:** `RP/0/RSP0/CPU0:router(config-vrrp-slave)# address 10.2.3.2`	Configures the primary virtual IPv4 address for the slave group.

	Command or Action	Purpose
Step 7	**commit**	

Configuring a Secondary Virtual IPv4 address for the Slave Group

Perform this task to configure the secondary virtual IPv4 address for the slave group.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **hsrp** *group-no* **slave**
6. **address** *address* **secondary**
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**router hsrp** **Example:** `RP/0/RSP0/CPU0:router(config)# router hsrp`	Enables HSRP configuration mode.
Step 3	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1`	Enables HSRP interface configuration mode on a specific interface.
Step 4	**address-family ipv4** **Example:** `RP/0/RSP0/CPU0:router(config-hsrp-if)# address-family ipv4`	Enables HSRP address-family configuration mode on a specific interface.

	Command or Action	Purpose
Step 5	**hsrp** *group-no* **slave** **Example:** `RP/0/RSP0/CPU0:router(config-hsrp-address-family)# hsrp 2 slave`	Enables HSRP slave configuration mode on a specific interface.
Step 6	**address** *address* **secondary** **Example:** `RP/0/RSP0/CPU0:router(config-hsrp-slave)# address 10.20.30.1 secondary`	Configures the secondary virtual IPv4 address for a router.
Step 7	**commit**	

MIB support for VRRP

VRRP enables one or more IP addresses to be assumed by a router when a failure occurs. For example, when IP traffic from a host reaches a failed router because the failed router is the default gateway, the traffic is transparently forwarded by the VRRP router that has assumed control. VRRP does not require configuration of dynamic routing or router discovery protocols on every end host. The VRRP router controlling the IP address(es) associated with a virtual router is called the master, and forwards packets sent to these IP addresses. The election process provides dynamic fail over(standby) in the forwarding responsibility should the master become unavailable. This allows any of the virtual router IP addresses on the LAN to be used as the default first hop router by end-hosts.The advantage gained from using VRRP is a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end-host. SNMP traps provide information of the state changes, when the virtual routers(in standby) are moved to master state or if the standby router is made master.

Configuring SNMP server notifications for VRRP events

The **snmp-server traps vrrp events** command enables the Simple Network Management Protocol (SNMP) server notifications (traps) for VRRP.

SUMMARY STEPS

1. **configure**
2. **snmp-server traps vrrp events**
3. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure**	
Step 2	**snmp-server traps vrrp events** **Example:** `RP/0/RSP0/CPU0:router(config)snmp-server traps vrrp events`	Enables the SNMP server notifications for VRRP.
Step 3	**commit**	

Hot Restartability for VRRP

In the event of failure of a VRRP process in one group, forced failovers in peer VRRP master router groups should be prevented. Hot restartability supports warm RP failover without incurring forced failovers to peer VRRP routers.

Configuration Examples for VRRP Implementation on Cisco IOS XR Software

This section provides the following VRRP configuration examples:

Configuring a VRRP Group: Example

This section provides the following configuration example of Router A and Router B, each belonging to three VRRP groups:

Router A:

```
config
interface tenGigE 0/4/0/4
ipv4 address 10.1.0.1/24
exit
router vrrp
interface tenGigE 0/4/0/4
address-family ipv4
vrrp 1 version 2
priority 120
text-authentication cisco
timer 3
address 10.1.0.10
vrrp 5 version 2
timer 30
address 10.1.0.50
```

```
vrrp 100 version 2
preempt disable
address 10.1.0.100
commit
```

Router B:

```
config
interface tenGigE 0/4/0/4
ipv4 address 10.1.0.2/24
exit
router vrrp
interface tenGigE 0/4/0/4
address-family ipv4
vrrp 1 version 2
priority 100
text-authentication cisco
timer 3
address 10.1.0.10
vrrp 5 version 2
priority 200
timer 30
address 10.1.0.50
vrrp 100 version 2
preempt disable
address 10.1.0.100
commit
```

In the configuration example, 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.
  - Advertising interval is 3 seconds .
  - Preemption is enabled.
- Group 5:
  - Router B will become master for this group with priority 200.
  - Advertising interval is 30 seconds .
  - Preemption is enabled .
- Group 100:
  - Router configured first becomes master for this group first, because preempt is disabled.
  - Advertising interval is the default 1 second.
  - Preemption is disabled .
  - Preemption is disabled.

Clearing VRRP Statistics: Example

The **clear vrrp statistics** command produces no output of its own. The command modifies the statistics given by **show vrrp statistics** command so that all the statistics are reset to zero.

The following section provides examples of the output of the **show vrrp statistics** command followed by the **clear vrrp statistics** command:

```
RP/0/RSP0/CPU0:router# show vrrp statistics
show vrrp statistics
Invalid packets:
 Invalid checksum:              0
 Unknown/unsupported versions:  0
 Invalid vrID:                  10
 Too short:                     0
Protocol:
 Transitions to Master          6
Packets:
 Total received:                155
 Bad TTL:                       0
 Failed authentication:         0
 Unknown authentication:        0
 Conflicting authentication:    0
 Unknown Type field:            0
 Conflicting Advertise time:    0
 Conflicting Addresses:         0
 Received with zero priority:   3
 Sent with zero priority:       3
```

```
RP/0/RSP0/CPU0:router# clear vrrp statistics
RP/0/RSP0/CPU0:router# show vrrp statistics
Invalid packets:
 Invalid checksum:              0
 Unknown/unsupported versions:  0
 Invalid vrID:                  0
 Too short:                     0
Protocol:
 Transitions to Master          0
Packets:
 Total received:                0
 Bad TTL:                       0
 Failed authentication:         0
 Unknown authentication:        0
 Conflicting authentication:    0
 Unknown Type field:            0
 Conflicting Advertise time:    0
 Conflicting Addresses:         0
 Received with zero priority:   0
 Sent with zero priority:       0
```

Additional References

The following sections provide references related to VRRP.

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Quality of Service Commands on Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Command Reference*
Class-based traffic shaping, traffic policing, low-latency queuing, and Modified Deficit Round Robin (MDRR)	*Configuring Modular Quality of Service Congestion Management on Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Configuration Guide*
WRED, RED, and tail drop	*Configuring Modular QoS Congestion Avoidance on Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Configuration Guide*
VRRP commands	*VRRP Commands on Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Command Reference*
master command reference	*Cisco ASR 9000 Series Aggregation Services Router Commands Master List*
getting started material	*Cisco ASR 9000 Series Aggregation Services Router Getting Started Guide*
Information about user groups and task IDs	*Configuring AAA Services on Cisco ASR 9000 Series Aggregation Services Router System Security Configuration Guide*

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
—	To locate and download MIBs, use the Cisco MIB Locator found at the following URL and choose a platform under the Cisco Access Products menu: http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

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

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport