



Implementing HSRP

The Hot Standby Router Protocol (HSRP) is an IP routing redundancy protocol designed to allow for transparent failover at the first-hop IP router. HSRP provides high network availability, because it routes IP traffic from hosts on networks without relying on the availability of any single router. HSRP is used in a group of routers for selecting an active router and a standby router. (An active router is the router of choice for routing packets; a standby router is a router that takes over the routing duties when an active router fails, or when preset conditions are met.)

Feature History for Implementing HSRP

Release	Modification
Release 2.0	This feature was introduced.
Release 3.4.0	This feature was updated to support the minimum and reload delay options.
Release 3.5.0	HSRP supports Ethernet link bundles.
Release 3.9.0	<ul style="list-style-type: none">• BFD for HSRP feature was added.• Hot restartability for HSRP feature was added.
Release 4.2.0	Multiple Group Optimization (MGO) for HSRP feature was added.
Release 4.2.1	Enhanced object tracking for HSRP and IP Static feature was added.



Note GLBP is not supported on ASR9k.

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Prerequisites for Implementing HSRP

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 HSRP

HSRP is supported on Ethernet interfaces, Ethernet sub-interfaces, Ethernet link bundles, and Bridge Virtual Interfaces (BVI).

Information About Implementing HSRP

To implement HSRP on Cisco IOS XR software, you need to understand the following concepts:

HSRP Overview

HSRP is useful for hosts that do not support a router discovery protocol (such as Internet Control Message Protocol [ICMP] Router Discovery Protocol [IRDP]) and cannot switch to a new router when their selected router reloads or loses power. Because existing TCP sessions can survive the failover, this protocol also provides a more transparent recovery for hosts that dynamically choose a next hop for routing IP traffic.

When HSRP is configured on a network segment, it provides a virtual MAC address and an IP address that is shared among a group of routers running HSRP. The address of this HSRP group is referred to as the *virtual IP address*. One of these devices is selected by the protocol to be the *active router*. The active router receives and routes packets destined for the MAC address of the group. For n routers running HSRP, $n + 1$ IP and MAC addresses are assigned.

HSRP detects when the designated active router fails, at which point a selected standby router assumes control of the MAC and IP addresses of the HSRP group. A new *standby router* is also selected at that time.

Devices that are running HSRP send and receive multicast User Datagram Protocol (UDP) based hello packets to detect router failure and to designate active and standby routers.

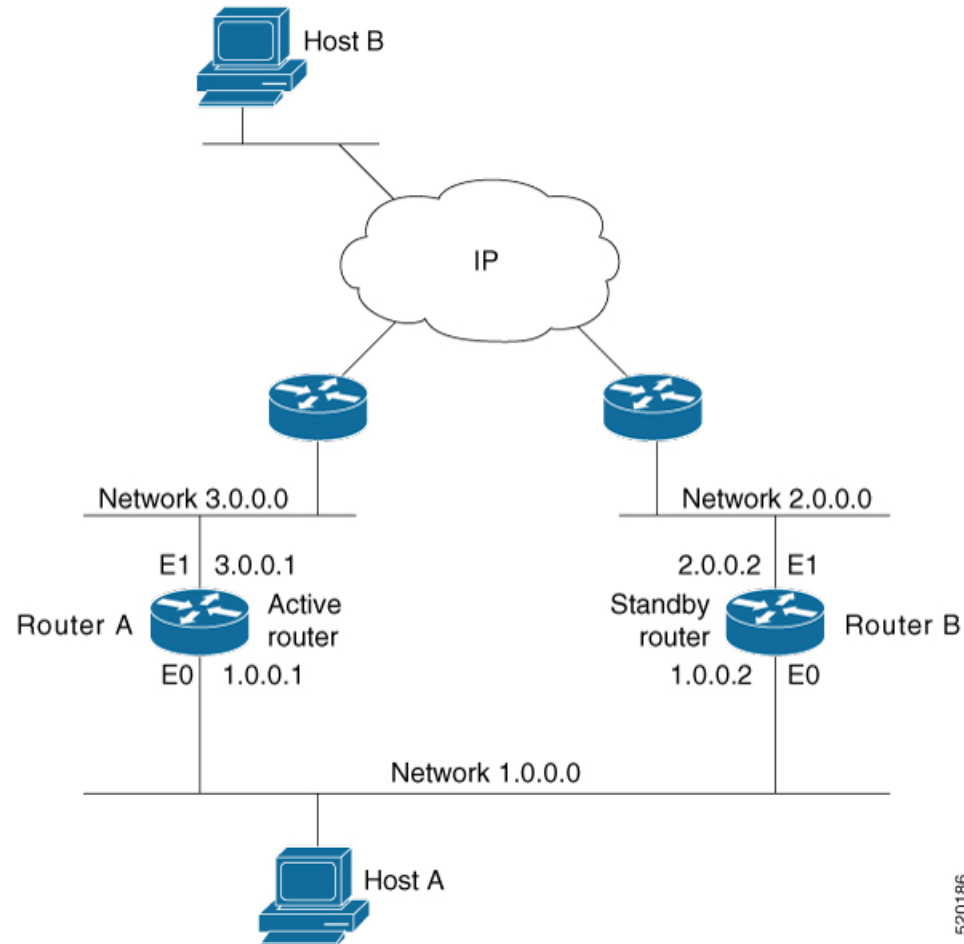
HSRP Groups

An HSRP group consists of two or more routers running HSRP that are configured to provide hot standby services for one another. HSRP uses a priority scheme to determine which HSRP-configured router is to be the default active router. To configure a router as the active router, you assign it a priority that is higher than the priority of all the other HSRP-configured routers. The default priority is 100, so if you configure just one router to have a higher priority, that router will be the default active router.

HSRP works by the exchange of multicast messages that advertise priority among the HSRP group. When the active router fails to send a hello message within a configurable period of time, the standby router with the highest priority becomes the active router. The transition of packet-forwarding functions between routers is completely transparent to all hosts on the network.

Figure 1: Routers Configured as an HSRP Group, on page 3 shows routers configured as members of a single HSRP group.

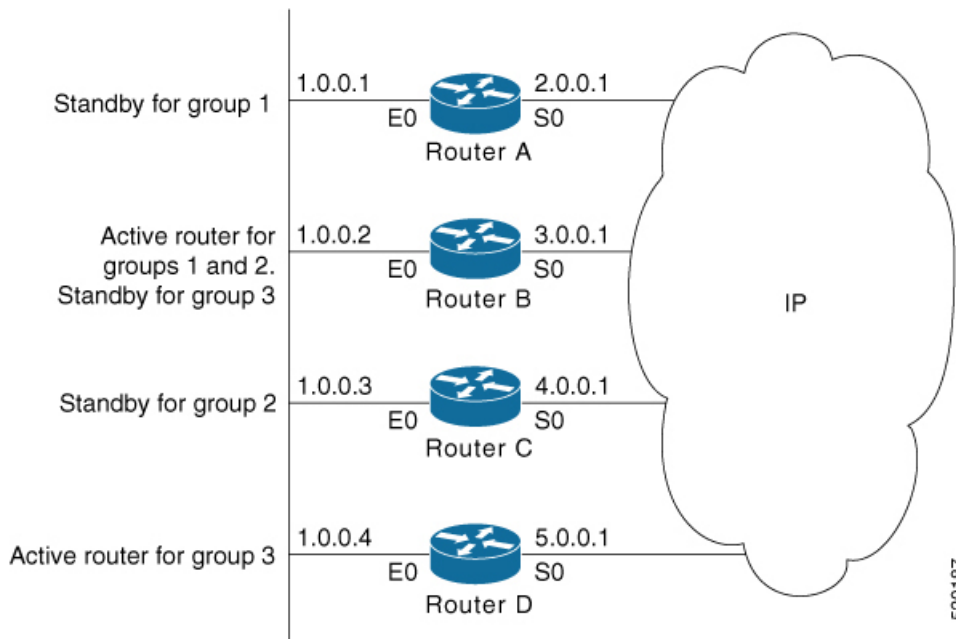
Figure 1: Routers Configured as an HSRP Group



All hosts on the network are configured to use the IP address of the virtual router (in this case, 1.0.0.3) as the default gateway.

A single router interface can also be configured to belong to more than one HSRP group. Figure 2: Routers Configured as Members of Multiple HSRP Groups, on page 4 shows routers configured as members of multiple HSRP groups.

Figure 2: Routers Configured as Members of Multiple HSRP Groups



In Figure 2: Routers Configured as Members of Multiple HSRP Groups, on page 4, the Ethernet interface 0 of Router A belongs to group 1. Ethernet interface 0 of Router B belongs to groups 1, 2, and 3. The Ethernet interface 0 of Router C belongs to group 2, and the Ethernet interface 0 of Router D belongs to group 3. When you establish groups, you might want to align them along departmental organizations. In this case, group 1 might support the Engineering Department, group 2 might support the Manufacturing Department, and group 3 might support the Finance Department.

Router B is configured as the active router for groups 1 and 2 and as the standby router for group 3. Router D is configured as the active router for group 3. If Router D fails for any reason, Router B assumes the packet-transfer functions of Router D and maintains the ability of users in the Finance Department to access data on other subnets.



Note A different virtual MAC address (VMAC) is required for each sub interface. VMAC is determined from the group ID. Therefore, a unique group ID is required for each sub interface configured, unless the VMAC is configured explicitly.



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.

HSRP and ARP

When a router in an HSRP group goes active, it sends a number of ARP responses containing its virtual IP address and the virtual MAC address. These ARP responses help switches and learning bridges update their

port-to-MAC maps. These ARP responses also provide routers configured to use the burned-in address of the interface as its virtual MAC address (instead of the preassigned MAC address or the functional address) with a means to update the ARP entries for the virtual IP address. Unlike the gratuitous ARP responses sent to identify the interface IP address when an interface comes up, the HSRP router ARP response packet carries the virtual MAC address in the packet header. The ARP data fields for IP address and media address contain the virtual IP and virtual MAC addresses.

Preemption

The HSRP preemption feature enables the router with highest priority to immediately become the active router. Priority is determined first by the priority value that you configure, and then by the IP address. In each case, a higher value is of greater priority.

When a higher-priority router preempts a lower-priority router, it sends a coup message. When a lower-priority active router receives a coup message or hello message from a higher-priority active router, it changes to the speak state and sends a resign message.

ICMP Redirect Messages

Internet Control Message Protocol (ICMP) is a network layer Internet protocol that provides message packets to report errors and other information relevant to IP processing. ICMP provides many diagnostic functions and can send and redirect error packets to the host. When running HSRP, it is important to prevent hosts from discovering the interface (or real) MAC addresses of routers in the HSRP group. If a host is redirected by ICMP to the real MAC address of a router, and that router later fails, then packets from the host are lost.

ICMP redirect messages are automatically enabled on interfaces configured with HSRP. This functionality works by filtering outgoing ICMP redirect messages through HSRP, where the next-hop IP address may be changed to an HSRP virtual IP address.

To support ICMP redirects, redirect messages are filtered through HSRP, where the next-hop IP address is changed to an HSRP virtual address. When HSRP redirects are turned on, ICMP interfaces with HSRP do this filtering. HSRP keeps track of all HSRP routers by sending advertisements and maintaining a real IP address to virtual IP address mapping to perform the redirect filtering.

How to Implement HSRP

This section contains instructions for the following tasks:

Enabling HSRP

The **hsrp ipv4** command activates HSRP on the configured interface. If an IP address is specified, that address is used as the designated address for the Hot Standby group. If no IP address is specified, the virtual address is learned from the active router. For HSRP to elect a designated router, at least one router in the Hot Standby group must have been configured with, or learned, the designated address. Configuring the designated address on the active router always overrides a designated address that is currently in use.

SUMMARY STEPS

1. **configure**
2. **router hsrp**

3. **interface** type interface-path-id
4. **address-family ipv4**
5. **hsrp group-number version version-no**
6. **address { learn | address [secondary] }**
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface type interface-path-id Example: RP/0/RP0/CPU0:router(config-hsrp)# interface GigabitEthernet 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp group-number version version-no Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 1	Enables HSRP group submenu. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 6	address { learn address [secondary] } Example: RP/0/RP0/CPU0:router(config-hsrp-gp)# address learn	Activates HSRP on the configured interface. • If an IP address is specified, that address is used as the designated address for the Hot Standby group. If no IP address is specified, the virtual address is learned from the active router. Note If you configure HSRP for IPv6, you must configure a link local IPv6 address or enable it using the autoconfig keyword. If you do not configure a linklocal IPv6 address, the router does not accept the configuration when you commit your changes using the commit keyword.
Step 7	commit	

Enabling HSRP for IPv6

Use the following steps to enable HSRP for IPv6.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **address-family ipv6**
5. **hsrp** *group-number*
6. **address linklocal** {**autoconfig** | *ipv6-address*}
7. **address global** *ipv6-address*
8. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv6 Example: RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv6	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-number</i> Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1	Enables HSRP group submenu. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 6	address linklocal { autoconfig <i>ipv6-address</i> } Example: RP/0/RP0/CPU0:router(config-hsrp-gp)# address linklocal autoconfig	Activates HSRP on the configured interface and assigns a linklocal IPv6 address. • The virtual linklocal address must not match any other virtual linklocal address that is already configured for a different group.

	Command or Action	Purpose
		<p>The virtual linklocal address must not match the interface linklocal IPv6 address.</p> <p>If you use the autoconfig keyword, the linklocal address is calculated using the EUI-64 format.</p> <p>Use the legacy-compatible keyword to be compatible with Cisco IOS and other legacy Cisco devices.</p>
Step 7	<p>address global <i>ipv6-address</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# address global 2001:DB8:A:B::1</pre>	<p>Activates HSRP on the configured interface and assigns a global IPv6 address.</p> <p>Note If you configure HSRP for IPv6, you must configure a link local IPv6 address or enable it using the autoconfig keyword. If you do not configure a linklocal IPv6 address, the router does not accept the configuration when you commit your changes using the commit keyword.</p>
Step 8	commit	

Configuring HSRP Group Attributes

To configure other Hot Standby group attributes that affect how the local router participates in HSRP, use the following procedure in interface configuration mode as needed:

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **hsrp use-bia**
5. **address-family ipv4**
6. **hsrp** *group-number* **version** *version-no*
7. **priority** *priority*
8. **track** *type instance* [*priority-decrement*]
9. **preempt** [*delay seconds*]
10. **authentication** *string*
11. **mac-address** *address*
12. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	

	Command or Action	Purpose
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface type interface-path-id Example: RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	hsrp use-bia Example: RP/0/RP0/CPU0:router(config-hsrp-if)# hsrp use-bia	(Optional) Configures the HSRP to use the burned-in address of the interface as its virtual MAC address, instead of the preassigned MAC address or the functional address. <ul style="list-style-type: none"> • Enter the use-bia command on an interface when there are devices that reject Address Resolution Protocol (ARP) replies with source hardware addresses set to a functional address. • To restore the default virtual MAC address, use the no hsrp use-bia command.
Step 5	address-family ipv4 Example: RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 6	hsrp group-number version version-no Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 1	Enables HSRP group submenu. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 7	priority priority Example: RP/0/RP0/CPU0:router(config-hsrp-gp)# priority 100	(Optional) Configures HSRP priority. <ul style="list-style-type: none"> • The assigned priority is used to help select the active and standby routers. Assuming that preemption is enabled, the router with the highest priority becomes the designated active router. In case of ties, the primary IP addresses are compared, and the higher IP address has priority. • The priority of the device can change dynamically if an interface is configured with the track command and another interface on the device goes down. • If preemption is not enabled using the preempt command, the router may not become active even

	Command or Action	Purpose
		<p>though it might have a higher priority than other HSRP routers.</p> <ul style="list-style-type: none"> To restore the default HSRP priority values, use the no priority command.
Step 8	<p>track <i>type</i> instance [<i>priority-decrement</i>]</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# track TenGigE 0/3/0/1</pre>	<p>(Optional) Configures an interface so that the Hot Standby priority changes on the basis of the availability of other interfaces.</p> <ul style="list-style-type: none"> When a tracked interface goes down, the Hot Standby priority decreases by 10. If an interface is not tracked, its state changes do not affect the Hot Standby priority. For each interface configured for Hot Standby, you can configure a separate list of interfaces to be tracked. The optional <i>priority-decrement</i> argument specifies by how much to decrement the Hot Standby priority when a tracked interface goes down. When the tracked interface comes back up, the priority is incrementally increased by the same amount. When multiple tracked interfaces are down and the <i>priority-decrement</i> argument has been configured, these configured priority decrements are cumulative. If tracked interfaces are down, but none of them were configured with priority decrements, the default decrement is 10 and it is cumulative. The preempt command must be used in conjunction with this command on all routers in the group whenever the best available router should be used to forward packets. If the preempt command is not used, the active router stays active, regardless of the current priorities of the other HSRP routers. To remove the tracking, use the no preempt command.
Step 9	<p>preempt [<i>delay seconds</i>]</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# preempt</pre>	<p>(Optional) Configures HSRP preemption and preemption delay.</p> <ul style="list-style-type: none"> When you configure preemption and preemption delay with the preempt command, the local router attempts to assume control as the active router when the local router has a Hot Standby priority higher than the current active router. If the preempt command is not configured, the local router assumes control as the active router only if it receives information indicating that no router is currently in the active state (acting as the designated router).

	Command or Action	Purpose
		<ul style="list-style-type: none"> • When a router first comes up, it does not have a complete routing table. If it is configured to preempt, it becomes the active router, yet it is unable to provide adequate routing services. This problem can be solved by configuring a delay before the preempting router actually preempts the currently active router. • The preempt <i>delay seconds</i> value does not apply if there is no router currently in the active state. In this case, the local router becomes active after the appropriate timeouts (see the timers command), regardless of the preempt delay seconds value. • To restore the default HSRP preemption and preemption delay values, use the no preempt command.
Step 10	<p>authentication <i>string</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# authentication company1</pre>	<p>(Optional) Configures an authentication string for the Hot Standby Router Protocol (HSRP).</p> <ul style="list-style-type: none"> • The authentication string is sent unencrypted in all HSRP messages. The same authentication string must be configured on all routers and access servers on a LAN to ensure interoperation. • Authentication mismatch prevents a device from learning the designated Hot Standby IP address and the Hot Standby timer values from other routers configured with HSRP. • Authentication mismatch does not prevent protocol events such as one router taking over as the designated router. • To delete an authentication string, use the no authentication command.
Step 11	<p>mac-address <i>address</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-if)# mac-address 4000.1000.1060</pre>	<p>(Optional) Specifies a virtual MAC address for the HSRP.</p> <ul style="list-style-type: none"> • We do not recommend this command, except for IBM networking environments in which first-hop redundancy is based on being able to use a virtual MAC address, and in which you cannot change the first-hop addresses in the PCs that are connected to an Ethernet switch. • HSRP is used to help end stations locate the first-hop gateway for IP routing. The end stations are configured with a default gateway. However, HSRP can provide first-hop redundancy for other protocols. Some protocols, such as Advanced Peer-to-Peer Networking (APPN), use the MAC address to identify

	Command or Action	Purpose
		<p>the first-hop for routing purposes. In this case, it is often necessary to specify the virtual MAC address; the virtual IP address is unimportant for these protocols. Use the mac-address command to specify the virtual MAC address.</p> <ul style="list-style-type: none"> • The MAC address specified is used as the virtual MAC address when the router is active. • The mac-address command is intended for certain APPN configurations. • In an APPN network, an end node is typically configured with the MAC address of the adjacent network node. Use the mac-address command in the routers to set the virtual MAC address to the value used in the end nodes. • Enter the no mac-address command to revert to the standard virtual MAC address (0000.0C07.ACn).
Step 12	commit	

Configuring the HSRP Activation Delay

The activation delay for HSRP is designed to delay the startup of the state machine when an interface comes up. This give the network time to settle and avoids unnecessary state changes early after the link comes up.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **hsrp delay** [**minimum seconds**] [**reload seconds**]
5. **address-family ipv4**
6. **hsrp group-number version version-no**
7. **address** { **learn** | *address* [**secondary**] }
8. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: <pre>RP/0/RP0/CPU0:router(config)# router hsrp</pre>	Enables HSRP configuration mode.

	Command or Action	Purpose
Step 3	interface <i>type interface-path-id</i> Example: <pre>RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1</pre>	Enables HSRP interface configuration mode on a specific interface.
Step 4	hsrp delay [<i>minimum seconds</i>] [<i>reload seconds</i>] Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-if)#hsrp delay minimum 2 reload 10</pre>	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 5	address-family ipv4 Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4</pre>	Enables HSRP address-family configuration mode on a specific interface.
Step 6	hsrp group-number version version-no Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 1</pre>	Enables HSRP group submenu. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 7	address { learn address [secondary] } Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# address learn</pre>	Activates HSRP on the configured interface. <ul style="list-style-type: none"> • If an IP address is specified, that address is used as the designated address for the Hot Standby group. If no IP address is specified, the virtual address is learned from the active router. Note If you configure HSRP for IPv6, you must configure a link local IPv6 address or enable it using the autoconfig keyword. If you do not configure a linklocal IPv6 address, the router does not accept the configuration when you commit your changes using the commit keyword.
Step 8	commit	

Enabling HSRP Support for ICMP Redirect Messages

By default, HSRP filtering of ICMP redirect messages is enabled on routers running HSRP.

To configure the reenabling of this feature on your router if it is disabled, use the **hsrp redirects** command in interface configuration mode.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **hsrp redirects disable**
5. **address-family ipv4**
6. **hsrp group-number version version-no**
7. **address** { **learn** | *address [secondary]* }
8. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	hsrp redirects disable Example: RP/0/RP0/CPU0:router(config-hsrp-if)# hsrp redirects	Configures Internet Control Message Protocol (ICMP) redirect messages to be sent when the Hot Standby Router Protocol (HSRP) is configured on an interface. <ul style="list-style-type: none"> • The hsrp redirects command can be configured on a per-interface basis. When HSRP is first configured on an interface, the setting for that interface inherits the global value. If ICMP redirects have been explicitly disabled on an interface, then the global command cannot reenables the functionality. • With the hsrp redirects command enabled, ICMP redirect messages are filtered by replacing the real IP address in the next-hop address of the redirect packet with a virtual IP address, if it is known to HSRP. • To revert to the default, which is that ICMP messages are enabled, use the no hsrp redirects command.
Step 5	address-family ipv4 Example: RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.

	Command or Action	Purpose
Step 6	hsrp <i>group-number</i> version <i>version-no</i> Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 1</pre>	Enables HSRP group submode. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 7	address { learn <i>address</i> [secondary] } Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-gp)# address learn</pre>	Activates HSRP on the configured interface. <ul style="list-style-type: none"> If an IP address is specified, that address is used as the designated address for the Hot Standby group. If no IP address is specified, the virtual address is learned from the active router. Note If you configure HSRP for IPv6, you must configure a link local IPv6 address or enable it using the autoconfig keyword. If you do not configure a linklocal IPv6 address, the router does not accept the configuration when you commit your changes using the commit keyword.
Step 8	commit	

Multiple Group Optimization (MGO) for HSRP

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

Customizing HSRP

Customizing the behavior of HSRP is optional. Be aware that as soon as you enable a HSRP group, that group is in operation.

SUMMARY STEPS

- configure**
- router hsrp**
- interface** *type interface-path-id*
- address-family ipv4**
- hsrp** *group-no* **version** *version-no*
- name** *name*
- address** { **learn** | *address* }
- address** *address* **secondary**
- authentication** *string*
- bfd fast-detect**
- mac-address** *address*

12. **hsrp** *group-no slave*
13. **follow** *mgo-session-name*
14. **address** *ip-address*
15. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: <pre>Router(config)# router hsrp</pre>	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: <pre>Router(config-hsrp)# interface TenGigE 0/2/0/1</pre>	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: <pre>Router(config-hsrp-if)# address-family ipv4</pre>	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-no version version-no</i> Example: <pre>Router(config-hsrp-ipv4)# hsrp 1 version 2</pre>	Enables HSRP group configuration mode on a specific interface. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 6	name <i>name</i> Example: <pre>Router(config-hsrp-gp)# name s1</pre>	Configures an HSRP session name.
Step 7	address { learn <i>address</i> } Example: <pre>Router(config-hsrp-gp)# address learn</pre>	Enables hot standby protocol for IP. • If an IP address is specified, that address is used as the designated address for the Hot Standby group. If no IP address is specified, the virtual address is learned from the active router.
Step 8	address <i>address secondary</i> Example: <pre>Router(config-hsrp-gp)# address 10.20.30.1</pre>	Configures the secondary virtual IPv4 address for a router.

	Command or Action	Purpose
	<code>secondary</code>	
Step 9	authentication <i>string</i> Example: <pre>Router(config-hsrp-gp)# authentication company1</pre>	Configures an authentication string for the Hot Standby Router Protocol (HSRP).
Step 10	bfd fast-detect Example: <pre>Router(config-hsrp-gp)# bfd fast-detect</pre>	Enables bidirectional forwarding(BFD) fast-detection on a HSRP interface.
Step 11	mac-address <i>address</i> Example: <pre>Router(config-hsrp-gp)# mac-address 4000.1000.1060</pre>	Specifies a virtual MAC address for the Hot Standby Router Protocol (HSRP).
Step 12	hsrp <i>group-no slave</i> Example: <pre>Router(config-hsrp-gp)# hsrp 2 slave</pre>	Enables HSRP slave configuration mode on a specific interface.
Step 13	follow <i>mgo-session-name</i> Example: <pre>Router(config-hsrp-slave)# follow s1</pre>	Instructs the subordinate group to inherit its state from a specified group.
Step 14	address <i>ip-address</i> Example: <pre>Router(config-hsrp-slave)# address 10.3.2.2</pre>	Configures the primary virtual IPv4 address for the subordinate group.
Step 15	commit	

Configuring a Primary Virtual IPv4 Address

To enable hot standby protocol for IP, use the **address (hsrp)** command in the HSRP group submode.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **hsrp** *group-noversion version-no*
6. **address** { *learn* | *address*}
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/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/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-noversion version-no</i> Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 2	Enables HSRP group configuration mode on a specific interface. Note <ul style="list-style-type: none"> • The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families. • HSRP version 2 provides an extended group range of 0-4095.
Step 6	address { <i>learn</i> <i>address</i> } Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# address learn	Enables hot standby protocol for IP.
Step 7	commit	

Configuring a Secondary Virtual IPv4 Address

To configure the secondary virtual IPv4 address for a router, use the **address secondary** command in the Hot Standby Router Protocol (HSRP) virtual router submode.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/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/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-noversion version-no</i> Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 2	Enables HSRP group configuration mode on a specific interface. Note <ul style="list-style-type: none"> • The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families. • HSRP version 2 provides an extended group range of 0-4095.
Step 6	address <i>address</i> secondary Example:	Configures the secondary virtual IPv4 address for a router.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router(config-hsrp-ipv4)# address 10.20.30.1 secondary	
Step 7	commit	

Configuring the Subordinate Group to Inherit its State from a Specified Group

To instruct the subordinate group to inherit its state from a specified group, use the following steps:

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: Router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: Router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: Router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-no slave</i> Example: Router(config-hsrp-ipv4)# hsrp 2 slave	Enables HSRP slave configuration mode on a specific interface.
Step 6	follow <i>mgo-session-name</i> Example:	Instructs the subordinate group to inherit its state from a specified group.

	Command or Action	Purpose
	<code>Router(config-hsrp-slave)# follow m1</code>	
Step 7	commit	

Configuring a Subordinate Primary Virtual IPv4 Address

To configure the primary virtual IPv4 address for the subordinate group, use the **subordinate primary virtual IPv4 address** command in the HSRP slave submode.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: <code>Router(config)# router hsrp</code>	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: <code>Router(config-hsrp)# interface TenGigE 0/2/0/1</code>	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: <code>Router(config-hsrp-if)# address-family ipv4</code>	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp group-no slave Example: <code>Router(config-hsrp-ipv4)# hsrp 2 slave</code>	Enables HSRP slave configuration mode on a specific interface.
Step 6	address ip-address Example:	Configures the primary virtual IPv4 address for the subordinate group.

	Command or Action	Purpose
	Router(config-hsrp-slave)# address 10.2.3.2	
Step 7	commit	

Configuring a Secondary Virtual IPv4 address for the Subordinate Group

Perform this task to configure the secondary virtual IPv4 address for the subordinate 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: Router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: Router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: Router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp group-no slave Example: Router(config-hsrp-address-family)# hsrp 2 slave	Enables HSRP slave configuration mode on a specific interface.
Step 6	address address secondary Example:	Configures the secondary virtual IPv4 address for a router.

	Command or Action	Purpose
	Router(config-hsrp-slave)# address 10.20.30.1 secondary	
Step 7	commit	

Configuring a Subordinate Virtual MAC Address

To configure the virtual MAC address for the subordinate group, use the **subordinate virtual mac address** command in the HSRP slave submode.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: Router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: Router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	address-family ipv4 Example: Router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp group-no slave Example: Router(config-hsrp-ipv4)# hsrp 2 slave	Enables HSRP slave configuration mode on a specific interface.

	Command or Action	Purpose
Step 6	mac-address <i>address</i> Example: Router(config-hsrp-slave)# mac-address 10.20.30	Configures the virtual MAC address for the subordinate group.
Step 7	commit	

Configuring an HSRP Session Name

To configure an HSRP session name, use the **session name** command in the HSRP group submode.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/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/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp <i>group-noversion version-no</i> Example:	Enables HSRP group configuration mode on a specific interface.

	Command or Action	Purpose
	<pre>RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 2</pre>	<p>Note</p> <ul style="list-style-type: none"> • The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families. • HSRP version 2 provides an extended group range of 0-4095.
Step 6	<p>name <i>name</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-hsrp-ipv4)# name s1</pre>	Configures an HSRP session name.
Step 7	commit	

BFD for HSRP

Bidirectional Forwarding Detection (BFD) is a network protocol used to detect faults between two forwarding engines. BFD sessions can operate in one of the two modes, namely, asynchronous mode or demand mode. In asynchronous mode, both endpoints periodically send hello packets to each other. If a number of those packets are not received, the session is considered down. In demand mode, it is not mandatory to exchange hello packets; either of the hosts can send hello messages, if needed. Cisco supports the BFD asynchronous mode.

Advantages of BFD

- BFD provides failure detection in less than one second.
- BFD supports all types of encapsulation.
- BFD is not tied to any particular routing protocol, supports almost all routing protocols.

BFD Process

HSRP uses BFD to detect link failure and facilitate fast failover times without excessive control packet overhead.

The HSRP process creates BFD sessions as required. When a BFD session goes down, each Standby group monitoring the session transitions to Active state.

HSRP does not participate in any state elections for 10 seconds after a transition to Active state triggered by a BFD session going down.

Configuring BFD

For HSRP, configuration is applied under the existing HSRP-interface sub-mode, with BFD fast failure configurable per HSRP group and the timers (minimum-interface and multiplier) configurable per interface. BFD fast failure detection is disabled by default.

Enabling BFD

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **address-family ipv4**
5. **hsrp** [*group number*] **version** *version-no* **bfd fast-detect** [**peer** **ipv4** *ipv4-address* *interface-type* *interface-path-id*]
6. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/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/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp [<i>group number</i>] version <i>version-no</i> bfd fast-detect [peer ipv4 <i>ipv4-address</i> <i>interface-type</i> <i>interface-path-id</i>] Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 2 bfd fast-detect peer ipv4 10.3.5.2 TenGigE 0/3/4/2	Enables fast detection on a specific interface. Note <ul style="list-style-type: none"> • The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families. • HSRP version 2 provides an extended group range of 0-4095.
Step 6	commit	

Modifying BFD timers (minimum interval)

Minimum interval determines the frequency of sending BFD packets to BFD peers (in milliseconds). The default minimum interval is 15ms.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*
4. **hsrp bfd minimum-interval** *interval*
5. **address-family ipv4**
6. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface <i>type interface-path-id</i> Example: RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1	Enables HSRP interface configuration mode on a specific interface.
Step 4	hsrp bfd minimum-interval <i>interval</i> Example: RP/0/RP0/CPU0:router(config-hsrp-if)# hsrp bfd minimum-interval 20	Sets the minimum interval to the specified period. The interval is in milliseconds; range is 15 to 30000 milliseconds.
Step 5	address-family ipv4 Example: RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 6	commit	

Modifying BFD timers (multiplier)

Multiplier is the number of consecutive BFD packets which must be missed from a BFD peer before declaring that peer unavailable. The default multiplier is 3.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** *type interface-path-id*

4. `hsrp bfd multiplier multiplier`
5. `address-family ipv4`
6. `commit`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>configure</code>	
Step 2	<code>router hsrp</code> Example: <pre>RP/0/RP0/CPU0:router(config)# router hsrp</pre>	Enables HSRP configuration mode.
Step 3	<code>interface type interface-path-id</code> Example: <pre>RP/0/RP0/CPU0:router(config-hsrp)# interface TenGigE 0/2/0/1</pre>	Enables HSRP interface configuration mode on a specific interface.
Step 4	<code>hsrp bfd multiplier multiplier</code> Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-if)# hsrp bfd multiplier 30</pre>	Sets the multiplier to the value. Range is 2 to 50.
Step 5	<code>address-family ipv4</code> Example: <pre>RP/0/RP0/CPU0:router(config-hsrp-if)# address-family ipv4</pre>	Enables HSRP address-family configuration mode on a specific interface.
Step 6	<code>commit</code>	

Enhanced Object Tracking for HSRP and IP Static

A failure between the active router and the core network cannot be detected using standard HSRP failure detection mechanisms. Object tracking is used to detect such failures. When such a failure occurs, the active router applies a priority decrement to its HSRP session. If this causes its priority to fall below that of the standby router, it will detect this from the HSRP control traffic, and then use this as a trigger to preempt and take over the active role.

Cisco IOS XR software supports up to 512 tracked objects.

The enhanced object tracking for HSRP and IP Static feature provides first-hop redundancy as well as default gateway selection based on IP Service Level Agreement (IPSLA).

See the *Routing Configuration Guide for Cisco CRS Routers*, for more information about enhanced object tracking for static routes.

Configuring object tracking for HSRP

To enable tracking of the named object with the specified decrement, use the following configuration in the HSRP group sub mode.

SUMMARY STEPS

1. **configure**
2. **router hsrp**
3. **interface** type interface-path-id
4. **address-family ipv4**
5. **hsrp** group-number **version** version-no
6. **track** object name [priority-decrement]
7. **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure	
Step 2	router hsrp Example: RP/0/RP0/CPU0:router(config)# router hsrp	Enables HSRP configuration mode.
Step 3	interface type interface-path-id Example: RP/0/RP0/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/RP0/CPU0:router(config-hsrp-if)# address-family ipv4	Enables HSRP address-family configuration mode on a specific interface.
Step 5	hsrp group-number version version-no Example: RP/0/RP0/CPU0:router(config-hsrp-ipv4)# hsrp 1 version 1	Enables HSRP group submodule. Note The version keyword is available only if IPv4 address-family is selected. By default, version is set to 2 for IPv6 address families.
Step 6	track object name [priority-decrement] Example: RP/0/RP0/CPU0:router(config-hsrp-gp)# track object t1 2	Enable tracking of the named object with the specified decrement.
Step 7	commit	

Hot Restartability for HSRP

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

Configuration Examples for HSRP Implementation on Software

This section provides the following HSRP configuration examples:

Configuring an HSRP Group: Example

The following is an example of enabling HSRP on an interface and configuring HSRP group attributes:

```
configure
router hsrp
interface TenGigE 0/2/0/1
address-family ipv4
hsrp 1
name s1
address 10.0.0.5
timers 100 200
preempt delay 500
priority 20
track TenGigE 0/2/0/2
authentication company0
use-bia
commit
hsrp 2 slave
follow s1
address 10.3.2.2
commit
```

Configuring a Router for Multiple HSRP Groups: Example

The following is an example of configuring a router for multiple HSRP groups:

```
configure
router hsrp
interface TenGigE 0/2/0/3
address family ipv4
hsrp 1
address 1.0.0.5
priority 20
preempt
authentication sclara
hsrp 2
address 1.0.0.6
priority 110
preempt
authentication mtview
hsrp 3
address 1.0.0.7
```

```

preempt
authentication svale
commit

```

Additional References

The following sections provide references related to HSRP

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Quality of Service Commands on Modular QoS Command Reference for Cisco CRS Routers</i>
Class-based traffic shaping, traffic policing, low-latency queuing, and Modified Deficit Round Robin (MDRR)	<i>Configuring Modular Quality of Service Congestion Management on Modular QoS Configuration Guide for Cisco CRS Routers</i>
WRED, RED, and tail drop	<i>Configuring Modular QoS Congestion Avoidance on Modular QoS Configuration Guide for Cisco CRS Routers</i>
HSRP commands	<i>HSRP Commands on IP Addresses and Services Command Reference for Cisco CRS Routers</i>
getting started material	<i>Cisco IOS XR Getting Started Guide for the Cisco CRS Router</i>
Information about user groups and task IDs	<i>Configuring AAA Services on System Security Configuration Guide for Cisco CRS Routers</i>

Standards and RFCs

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

MIBs

MB	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
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/support