

# Day 29: First Hop Redundancy Protocols

## CCNA Study Guide: First Hop Redundancy Protocols (FHRP)

### 1.0 Introduction: The Default Gateway as a Single Point of Failure

In a standard network, end-user devices rely on a single Default Gateway to reach the outside world. If the physical router providing that gateway fails, the entire subnet loses connectivity.

First Hop Redundancy Protocols (FHRP) mitigate this risk by grouping multiple physical routers into a single logical, redundant gateway.

The Metaphor: The Shared Doorway

Imagine an office with only one exit. If that door jams, everyone is trapped. FHRP is like having two doors side-by-side that appear as one "virtual door" to the employees. If one door sticks, people automatically walk through the other without even realizing the first one failed.

# 2.0 Core FHRP Concepts and Mechanisms

## 2.1 The Building Blocks of Redundancy

- Virtual IP (VIP): The single IP address shared by the group. This is what hosts use as their Default Gateway.
- Virtual MAC (VMAC): A shared Layer 2 address associated with the VIP.
- Active/Master Router: The router currently responsible for forwarding traffic sent to the VIP.
- Standby/Backup Router: The router(s) listening for "Hello" messages from the Active router, ready to take over.

## 2.2 The Automatic Failover Process

1. Health Monitoring: Routers exchange Hello messages via multicast.
2. Failure Detection: If the Standby router stops hearing Hellos for a specific duration (the Hold Time), it assumes the Active router has failed.
3. Role Transition: The Standby router promotes itself to Active.
4. Gratuitous ARP (GARP): The new Active router sends a GARP to the switch. This forces the switch to update its MAC address table so that frames destined for the VMAC are now sent to the new router's physical port.

# 3.0 Comparative Analysis of Major FHRPs

Feature	HSRP	VRRP	GLBP
Full Name	Hot Standby Router Protocol	Virtual Router Redundancy Protocol	Gateway Load Balancing Protocol
Owner	Cisco Proprietary	Open Standard	Cisco Proprietary
Primary Roles	Active / Standby	Master / Backup	AVG / AVF
Load Balancing	No (Active/Passive)	No (Active/Passive)	Yes (Active/Active)
Preemption	Disabled by Default	Enabled by Default	Enabled by Default

Multicast IP	224.0.0.102 (v2)	224.0.0.18	224.0.0.102
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# Virtual MAC Address Formats

- HSRP v1: 0000.0C07.ACXX (XX = Group ID)
- HSRP v2: 0000.0C9F.FXXX (XXX = Group ID)
- VRRP: 0000.5E00.01XX (XX = Group ID)
- GLBP: 0007.B400.XXYY (XX = Group ID, YY = Forwarder ID)

## 4.0 Deep Dive: Hot Standby Router Protocol (HSRP)

HSRP is the most common FHRP encountered in Cisco environments.

### 4.1 Election and Preemption

- Highest Priority: The router with the highest priority wins (Default: 100, Range: 0-255).
- Highest IP: If priorities are tied, the router with the highest IP address on the interface wins.
- Preemption: If a primary router reboots, it will not take back the Active role by default, even if it has a higher priority. Preemption must be manually enabled to allow the "better" router to seize control back.

### 4.2 HSRP Versions

Feature	HSRP v1	HSRP v2
Group Range	0 - 255	0 - 4095
IPv6 Support	No	Yes
Multicast Addr	224.0.0.2	224.0.0.102
Timer Support	Seconds	Milliseconds

# 5.0 HSRP Configuration and Verification

## 5.1 Configuration Example

```
Router(config)# interface g0/0
```

```
Router(config-if)# standby version 2
```

```
Router(config-if)# standby 1 ip 10.0.0.1      # Set Virtual IP
```

```
Router(config-if)# standby 1 priority 150     # Make this the preferred Active
```

```
Router(config-if)# standby 1 preempt        # Allow it to take back control
```

## 5.2 Verification Commands

Command	Purpose
show standby	Detailed view of roles, VIP, VMAC, and timers.
show standby brief	Concise summary of all HSRP groups and their states.

# 6.0 CCNA Exam Essentials (Key "Gotchas")

1. Traceroute Behavior: When tracing a path from a host, the first hop will show the Physical IP of the active router, not the Virtual IP.
2. GLBP Roles: \* AVG (Active Virtual Gateway): Answers ARP requests and assigns different VMACs to routers.
  - AVF (Active Virtual Forwarder): The routers that actually forward the data.
3. GARP Importance: Failover relies on the switch updating its MAC table via the Gratuitous ARP. Without it, the switch would continue sending frames to the dead router's port.

# TL;DR Summary

- FHRP provides a Virtual IP (Gateway) that stays active even if a physical router fails.
- HSRP is Cisco's standard; VRRP is the open-standard equivalent.
- GLBP is the only one that does true active-active load balancing.
- Election: Highest Priority wins; use Preemption to ensure the primary router regains control after a reboot.
- Verification: Use show standby brief to quickly check which router is currently Active.

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Revision #1

Created 2026-03-14 19:31:42 UTC by Tony Utter

Updated 2026-03-14 19:31:58 UTC by Tony Utter