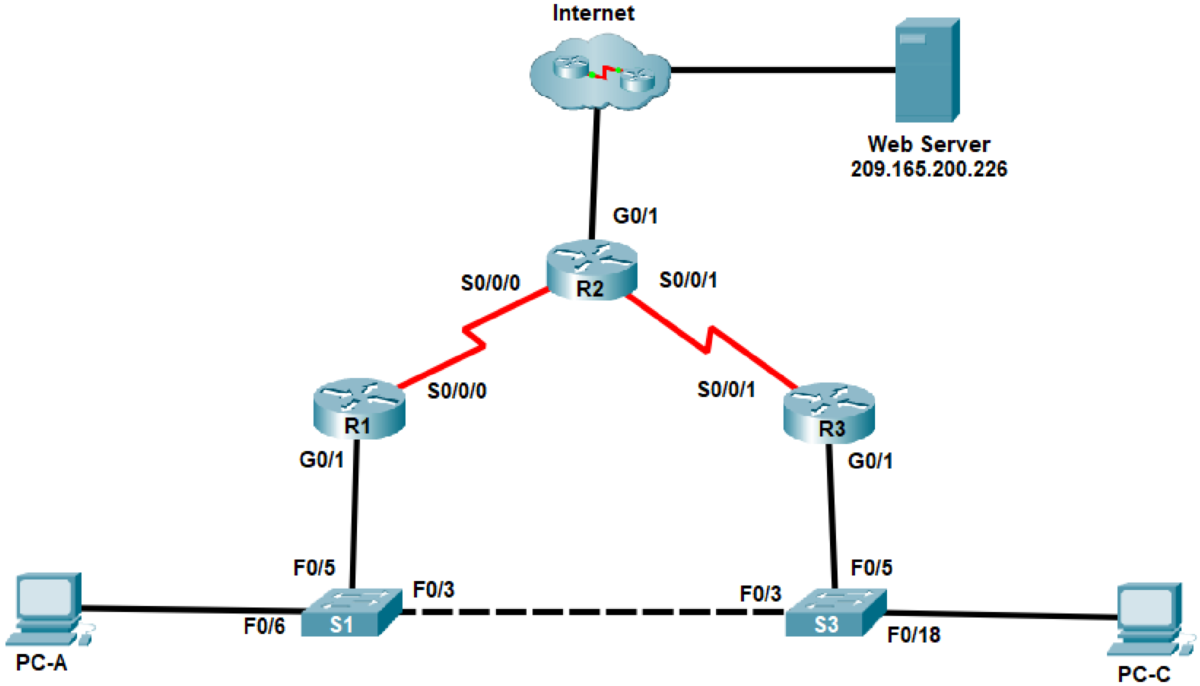
Shaun Lim

Lab 4.1 – Configuring Hot Standby Router Protocol (Packet Tracer)

Note: This activity has an accompanying Packet Tracer file with a preconfigured topology. Make sure to download the PT file when doing this activity.



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	10.1.1.1	255.255.255.252	N/A
R2	S0/0/0	10.1.1.2	255.255.255.252	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A
	G0/1	10.100.100.1	255.255.255.252	N/A
R3	G0/1	192.168.1.3	255.255.255.0	N/A
	S0/0/1	10.2.2.1	255.255.255.252	N/A
I-Net (hidden in Internet)	G0/1	10.100.100.2	255.255.255.252	N/A
	G0/0	209.165.200.225	255.255.255.224	N/A
PC-A	NIC	192.168.1.31	255.255.255.0	192.168.1.1
PC-C	NIC	192.168.1.33	255.255.255.0	192.168.1.3
Web Server	NIC	209.165.200.226	255.255.255.224	209.165.200.225

Objectives

Part 1: Build the Network and Verify Connectivity

Part 2: Configure First Hop Redundancy using HSRP

Part 3: Observe HSRP Operation

Part 4: Configure HSRP Interface Tracking

Background / Scenario

Spanning tree provides loop-free redundancy between switches within a LAN. However, it does not provide redundant default gateways for end-user devices within the network if one of the routers fails. First Hop Redundancy Protocols (FHRPs) provide redundant default gateways for end devices with no end-user configuration necessary. In this lab, you will configure Cisco's Hot Standby Routing Protocol (HSRP), a First Hop Redundancy Protocol (FHRP).

You will configure HSRP on routers R1 and R3, which serve as the default gateways for the hosts on LAN 1 and LAN 2. When you configure HSRP, you will create a virtual gateway that uses the same default gateway address for hosts in both LANs. If one gateway router becomes unavailable, the second router will take over using the same default gateway address that was used by the first router. Because the hosts on the LANs are configured with the IP address of the virtual gateway as the default gateway, the hosts will regain connectivity to remote networks after HSRP activates the remaining router

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will test the network topology for connectivity and determine traffic path in preparation for doing the lab activity procedures.

Step 1: Trace the path to the Web Server from PC-A.

a. Go to the desktop of PC-A and open a command prompt.

b. Trace the path from PC-A to the webserver by executing the tracert 209.165.200.226 command.

Which devices are on the path from PC-A to the Web Server? Use the addressing table to determine the device names.

PC-A -> R1 (G0/0 Interface) -> R2 (S0/0/0 Interface) -> I-Net -> Web Server

Step 2: Trace the path to the Web Server from PC-C.

Repeat the process in Step 1 from PC-C.

Which devices are on the path from PC-C to the Web Server?

PC-C -> R3 (G0/1 interface) -> R2 (S0/0/1 interface) -> I-Net -> Web Server

Step 3: Observe the network behavior when R3 becomes unavailable.

a. Disconnect the link between R3 and S3. You may use the delete tool of Packet Tracer for this.

b. Execute the tracert command again on PC-C with the Web Server as the destination then compare the current output with the output of the command from Step 2.

What are the results this time?

The request timed out.

c. Reconnect the link between R3 G0/1 and S3 F0/5 then wait for the link lights to turn green

d. Retest the connection by pinging the Web Server for PC-C. The ping should be successful. Otherwise, recheck the connection.

Part 2: Configure First Hop Redundancy Using HSRP

Even though the topology has been designed with some redundancy (two routers and two switches on the same LAN network), both PC-A and PC-C are configured with only one gateway address. PC-A is using R1 and PC-C is using R3. If either of these routers or the interfaces on the routers went down, the PC could lose its connection to the Internet.

In Part 2, you will test how the network behaves both before and after configuring HSRP. To do this, you will determine the path that packets take to the loopback address on R2.

Step 1: Configure HSRP on R1

a. Configure HSRP on the G0/1 LAN interface of R1.

```
R1(config)# interface g0/1
```

b. Specify the HSRP protocol version number. The most recent version is version **2**.

Note: Standby version 1 only supports IPv4 addressing.

```
R1(config-if)# standby version 2
```

c. Configure the IP address of the virtual default gateway. This address must be configured on any hosts that require the services of the default gateway. It replaces the physical interface address of the router that has been previously configured on the hosts.

Multiple instances of HSRP can be configured on a router. You must specify the HSRP group number to identify the virtual interface between routers in a HSRP group. This number must be consistent between the routers in the group. The group number for this configuration is 1.

```
R1(config-if)# standby 1 ip 192.168.1.254
```

d. Designate the active router for the HSRP group. It is the router that will be used as the gateway device unless it fails or the path to it becomes inactive or unusable. Specify the priority for the router interface. The default value is 100. A higher value will determine which router is the active router. If the priorities of the routers in the HSRP group are the same, then the router with the highest configured IP address will become the active router.

```
R1(config-if)# standby 1 priority 105
```

R1 will operate as the active router and traffic from the two LANs will use it as the default gateway.

e. If it is desirable that the active router resume that role when it becomes available again, configure it to preempt the service of the standby router. The active router will take over the gateway role when it becomes operable again.

```
R1(config-if)# standby 1 preempt
```

Step 2: Configure HSRP on R3.

Configure the R3 interface that is connected to LAN 2 to be part of the HSRP group as the standby router.

Repeat only steps 1b and 1c above.

```
R3(config)# interface g0/1
R3(config-if)# standby version 2
R3(config-if)# standby 1 ip 192.168.1.254
```


What will the HSRP priority of R3 be when it is added to HSRP group 1?	100

Step 3: Verify HSRP Configuration

a. Verify HSRP by issuing the **show standby** command on R1 and R3. Verify the values for HSRP role, group, virtual IP address of the gateway, preemption, and priority. Note that HSRP also identifies the active and standby router IP addresses for the group.

```
R1# show standby
GigabitEthernet0/1 - Group 1 (version 2)
  State is Active
    4 state changes, last state change 00:00:30
  Virtual IP address is 192.168.1.254
  Active virtual MAC address is 0000.0C9F.F001
    Local virtual MAC address is 0000.0C9F.F001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.696 secs
  Preemption enabled
  Active router is local
  Standby router is 192.168.1.3
  Priority 150 (configured 150)
  Group name is "hsrp-Gi0/1-1" (default)

R3# show standby
GigabitEthernet0/0 - Group 1 (version 2)
  State is Standby
    4 state changes, last state change 00:02:29
  Virtual IP address is 192.168.1.254
  Active virtual MAC address is 0000.0C9F.F001
    Local virtual MAC address is 0000.0C9F.F001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.720 secs
  Preemption disabled
  Active router is 192.168.1.1
    MAC address is d48c.b5ce.a0c1
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-Gi0/0-1" (default)
```

Using the output shown above, answer the following questions:

Which router is the active router?	R1
Which router is the standby router?	R3
What is the MAC address for the virtual IP address?	0000.0C9F.F001

b. Use the **show standby brief** command on R1 and R3 to view an HSRP status summary. Sample output is shown below.

```
R1# show standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gi0/1       1    150 P Active  local           192.168.1.3     192.168.1.254

R3# show standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gi0/0     1    100   Standby 192.168.1.1     local           192.168.1.254
```

c. Change the default gateway address for PC-A and PC-C to the virtual gateway address of the HSRP group.

Which address should you use?	192.168.1.254

d. Verify the new settings. Issue a ping from both PC-A and PC-C to the Web Server.

Are the pings successful?	Yes

Part 3: Observe HSRP Operation

In part 3, you will observe the effect of HSRP in terms of allowing a network to recover from a gateway failure.

Step 1: Make the active router unavailable.

a. Trace the path from PC-A to the webserver by executing the tracert 209.165.200.226 command.

Which devices are on the path from PC-A to the Web Server after configuring HSRP? Use the addressing table to determine the device names.

PC-A -> R1 (G0/1 Interface) -> R2 (S0/0/0 Interface) -> I-Net -> Web Server

b. Open the command prompt on PC-A and issue a continuous ping to the Webserver using the **ping –t** command.

```
C:\>ping -t 209.165.200.226
```

Ensure that you leave the command prompt window open.

c. Break the link to R1 by shutting down the R1 G0/1 interface or by deleting its connection.

d. Observe the ongoing ping test of PC-A.

What do you notice?

The request timed out twice, but eventually the ping was successful.

e. Stop the ping on PC-A by clicking on CRTL-C.

f. Trace the path from PC-A to the webserver by executing the tracert 209.165.200.226 command.

Which devices are on the path from PC-A to the Web Server this time? Use the addressing table to determine the device names.

PC-A -> R3 (G0/1 Interface) -> R2 (S0/0/0 Interface) -> I-Net -> Web Server

Step 2: Verify HSRP settings on R1 and R3.

a. Issue the **show standby brief** command on R1 and R3.

Which router is the active router?	R3

b. Restore the connection between R1 and S1. Wait for a few seconds then issue the **show standby brief command** on R1

Which router is the active router this time?	R1

Why did the active role revert back to R1 after reconnecting the link to the network? Explain.

Because of the preempt command and the fact that R1 had a higher priority than R3. Therefore, after reconnecting the link, R3 went back to standby and R1 became the active router again.

Part 4: Configure HSRP Interface Tracking

The interface tracking capability of HSRP allows routers to automatically adjust priorities based on the status of an interface. This is useful in cases when an interface is considered an important basis for choosing which router should be the active router in a network. The priority of the router is automatically decremented when a tracked interface goes down triggering an active router reelection if used in conjunction with the preemption option.

On real devices, the automatically decremented value can be configured; but due to limitations in Packet Tracer, this decrement is set at 10.

Step 1: Test HSRP behavior without interface tracking

a. Perform a continuous ping from PC-A to the webserver. Do not close the command prompt.

b. Break the connection between R1 and R2 by shutting down the S0/0/0 interface or by deleting the link.

c. Return to the PC-A command prompt and observe the ongoing ping test.

Is PC-A still able to maintain its connectivity to the webserver?	No

d. End the ping on PC-A (CTRL-C)

e. Issue the **show standby brief** command on R1 and R3.

Which router is the active router?	R1

f. Restore the serial connection between R1 and R2. And ensure that PC-A can now reach the webserver again.

Step 2: Enable interface tracking on R1 and R3

Since R1 S0/0/0 is a critical interface connecting to the Internet, R1 is rendered useless as a network gateway should this interface lose connectivity. In such scenarios, interface tracking can be a useful feature so that R1 can automatically lower its HSRP priority and relinquish its active role to another router that may still have a connection to the Internet.

a. Enable interface tracking on R1 and set it to monitor the status of S0/0/0

```
R1(config)# interface g0/1
R1(config-if)# standby 1 track S0/0/0
```

b. Enable the preemption feature on R3.

```
R3(config)# interface g0/1
R3(config-if)# standby 1 preempt
```

Step 3: Observe HSRP behavior with interface tracking.

a. Restart a continuous ping from PC-A to the webserver.

b. Break the connection between R1 and R2 again by shutting down the S0/0/0 interface or by deleting the link.

c. Return to the PC-A command prompt and observe the ongoing ping test.

Is PC-A still able to maintain its connectivity to the webserver this time?	Yes

d. End the ping on PC-A (CTRL-C)

e. Issue the **show standby brief** command on R1 and R3.

Which router is the active router?	R3
What is the current priority of R1?	95
What is the current priority of R3?	100

f. Restore the serial connection between R1 and R2 then wait for a few seconds.

g. Issue the **show standby brief** command again on R1 and R3.

Which router is the active router?	R1
What is the current priority of R1?	105
What is the current priority of R3?	100

Reflection

1. Why is router redundancy an important feature in a network?

Router redundancy is an important feature in a network to provide fault tolerance and minimize downtime.

2. What purpose does HSRP interface tracking serve in the network and why is it necessary to also enable preemption when using this feature?

HSRP interface tracking maintains network reliability and performance. It allows the HSRP process to monitor additional interfaces on a router, and when a tracked interface becomes unavailable, the HSRP priority of the router decreases. This is done to ensure that the network can quickly respond to changes and maintain connectivity throughout. Preemption is needed in order for a router to take over an active role if it becomes available again after it gets disconnected/disabled/failed. Without enabling preemption, the router won't be able to take over the active role even if it becomes online again.