**HSRP [Host Standby Router Redundancy Protocol]**

- Cisco Proprietary, Developed in 1993
- Multicast 224.0.0.2, using UDP port 1985 for HSRP v1
- HSRPv2 Multicast 224.0.0.102
- Hello - 3 sec Dead - 10 Sec
- Active / Standby
- Group Number 0 to 255
- Default priority value is 100
- No Load Balancing Only Failover
- HSRP configure in interface,
- Authentication Pain text and MD5

Router progresses a series of states before becoming active
1. Disabled
2. Init
3. Listen
4. Speak
5. Standby
6. Active
HSRP LAB

In this lab, we are configure R1 and R2 are connected in the same LAN. We are going to configure HSRP for that case we will create a virtual router with a virtual-IP. This Virtual IP used as the default-gateway of the all devices of the LAN.

Task 1: Configure R4 and R5 must be work as a host.
Task 2: Configure R3 with routing protocol eigrp1
Task 3: Configure R1 and R2 with routing protocol eigrp 1 & virtual IP 10.1.1.10 with standby group 11
Task 4: Verify using show command and traceroute
Task 5: Shutdown the serial link and resolved the problem with the track command
Task 6: Configure the Authentication
Task 1: Configure R4 and R5 must be work as a host.

Here we will make this router will work as a host

R4#configure terminal
R4(config)#hostname PC40
PC40(config)#no ip routing
PC40(config)#
PC40(config)#ip default-gateway 10.1.1.10 // Virtual IP Address

PC40(config)#interface fastEthernet 0/0
PC40(config-if)#ip address 10.1.1.40 255.255.255.0
PC40(config-if)#no shutdown
PC40(config-if)#exit

PC40(config)#do sh ip int br
Interface    IP-Address  OK? Method Status                Protocol
FastEthernet0/0    10.1.1.40   YES  NVRAM  up                    up
PC40(config)#

---------------------------------
R5 is also our host
---------------------------------
R5#configure terminal
R5(config)#hostname PC50
PC50(config)#
PC50(config)#no ip routing
PC50(config)#
PC50(config)#ip default-gateway 10.1.1.10 // Virtual IP Address

PC50(config)#interface fastEthernet 0/0
PC50(config-if)#ip address 10.1.1.50 255.255.255.0
PC50(config-if)#no shutdown
PC50(config-if)#exit

PC50#show ip int br
Interface    IP-Address  OK? Method Status                Protocol
FastEthernet0/0    10.1.1.50   YES  NVRAM  up                    up
PC50#

---------------------------------------------
Now R4 and R5 works as a PC.
---------------------------------------------
Task 2: Configure R3 with routing protocol eigrp1

R3 configuration
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=

R3#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.

R3(config)#interface loopback 0
R3(config-if)#ip address 3.3.3.3 255.255.255.255
R3(config-if)#no sh
R3(config-if)#exit
R3(config)#
R3(config)#interface loopback 1
R3(config-if)#ip address 4.4.4.4 255.255.255.255
R3(config-if)#no sh
R3(config-if)#exit
R3(config)#
R3(config)#interface Serial0/0
R3(config-if)# description <<<< Connected to the R-1 >>>>
R3(config-if)#ip address 13.1.1.3 255.255.255.0
R3(config-if)#clockrate 128000
R3(config-if)#exit
R3(config)#
R3(config)#interface Serial0/1
R3(config-if)# description <<<< Connected to the R-2 >>>>
R3(config-if)#ip address 23.1.1.3 255.255.255.0
R3(config-if)#clockrate 128000
R3(config-if)#exit
R3(config)#

R3(config)#router eigrp 1
R3(config-router)#passive-interface loopback 1
R3(config-router)#network 3.0.0.0
R3(config-router)#network 4.0.0.0
R3(config-router)#network 13.0.0.0
R3(config-router)#network 23.0.0.0
R3(config-router)#no auto-summary
R3(config-router)#end

R3#copy running-config startup-config
Destination filename [startup-config]? 
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
R3#
R3#show ip interface bri
R3#show ip interface brief

<table>
<thead>
<tr>
<th>Interface</th>
<th>IP-Address</th>
<th>OK? Method</th>
<th>Status</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial0/0</td>
<td>13.1.1.3</td>
<td>YES NVRAM</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>Serial0/1</td>
<td>23.1.1.3</td>
<td>YES NVRAM</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>Serial0/2</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
<td>down</td>
</tr>
<tr>
<td>Serial0/3</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
<td>down</td>
</tr>
<tr>
<td>Loopback0</td>
<td>3.3.3.3</td>
<td>YES NVRAM</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>Loopback1</td>
<td>4.4.4.4</td>
<td>YES manual</td>
<td>up</td>
<td>up</td>
</tr>
</tbody>
</table>

Task 3: Configure R1 and R2 with routing protocol eigrp 1 & virtual IP 10.1.1.10 with standby group 11

R1 Configuration

R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface serial 0/0
R1(config-if)#description <<<Connected to the R-3>>>  // Description
R1(config-if)#ip address 13.1.1.1 255.255.255.0
R1(config-if)#clockrate 128000
R1(config-if)#no shutdown
R1(config-if)# exit

R1(config)#interface FastEthernet1/0
R1(config-if)#ip address 10.1.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#standby 11 ip 10.1.1.10  // Group Number
R1(config-if)#standby 11 priority 150  // Priority Value 150
R1(config-if)#standby 11 preempt  // Enables the HSRP router with the highest priority to immediately becomes the Active Router.
R1(config-if)#exit

R1(config)#router eigrp 1
R1(config-router)#passive-interface FastEthernet1/0
R1(config-router)#network 10.0.0.0
R1(config-router)#network 13.0.0.0
R1(config-router)#no auto-summary
R1(config-router)#end
R1#wr
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]

=====================================================================
R2 Configuration

R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#interface serial 0/0
R2(config-if)#description <<<Connected to the R-3>>> 
R2(config-if)#ip address 23.1.1.2 255.255.255.0
R2(config-if)#clockrate 128000
R2(config-if)#no shutdown
R2(config-if)# exit

R2(config)#interface FastEthernet1/0
R2(config-if)#ip address 10.1.1.2 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#standby 11 ip 10.1.1.10 // Group Number
R2(config-if)#standby 11 priority 130 // Priority Value 150
R2(config-if)#standby 11 preempt // Enables the HSRP wouter with the highest priority to immediately becomes the Active Router.
R2(config-if)#exit

R2(config)#router eigrp 1
R2(config-router)#passive-interface FastEthernet1/0
R2(config-router)#network 10.0.0.0
R2(config-router)# network 23.0.0.0
R2(config-router)# no auto-summary
R2(config-router)#end

R2#wr
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
**Here I am going to describes how the standby preempt and standby track commands work together, and when you must use each one.**

*The standby preempt command enables the Hot Standby Router Protocol (HSRP) router with the highest priority to immediately become the active router. Priority is determined first by the configured priority value, and then by the IP address. In each case, a higher value is of greater priority. When a higher priority router preempt a lower priority router, the router sends a Coup message. When a lower priority active router receives a Coup message or a Hello message from an active, higher priority router, the router changes to the Speak state and sends a resign message.*

*The standby track command allows you to specify another interface on the router for the HSRP process to monitor in order to alter the HSRP priority for a given group. If the line protocol of the specified interface goes down, the HSRP priority is reduced. This means that another HSRP router with higher priority can become the active router if that router has standby preempt enabled.*

Task 4: Verify using show command and traceroute

Verify

```
R1#show standby
FastEthernet1/0 - Group 11
  State is Active
    2 state changes, last state change 00:09:29
  Virtual IP address is 10.1.1.10
  Active virtual MAC address is 0000.0c07.ac0b
    Local virtual MAC address is 0000.0c07.ac0b (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.752 secs
  Preemption enabled
  Active router is local
    Standby router is 10.1.1.2, priority 130 (expires in 8.760 sec)
    Priority 150 (configured 150)
    IP redundancy name is "hsrp-Fa1/0-11" (default)
```

```
R2#show standby
FastEthernet1/0 - Group 11
  State is Standby
    4 state changes, last state change 00:09:01
  Virtual IP address is 10.1.1.10
  Active virtual MAC address is 0000.0c07.ac0b
    Local virtual MAC address is 0000.0c07.ac0b (v1 default)
  Hello time 3 sec, hold time 10 sec
```
Next hello sent in 1.584 secs

Preemption enabled

Active router is 10.1.1.1, priority 150 (expires in 7.592 sec)
Standby router is local
Priority 130 (configured 130)
IP redundancy name is "hsrp-Fa1/0-11" (default)

PC40#traceroute 3.3.3.3

Type escape sequence to abort.
Tracing the route to 3.3.3.3
1 10.1.1.1 64 msec 36 msec 84 msec
2 13.1.1.3 64 msec * 84 msec

PC40#ping 3.3.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/60/84 ms

PC40#

Final verification:
From PC40 to 3.3.3.3 packets is going via fa1/0 of R1 because now this is Active. Now I am going to shut down this link. Packets will forward in this destination via fa1/0 of R2, due to HSRP see there output some packets will lost standby router becomes the Active.

PC40#traceroute 3.3.3.3

Type escape sequence to abort.
Tracing the route to 3.3.3.3
1 10.1.1.1 60 msec 32 msec 24 msec
2 13.1.1.3 128 msec * 20 msec

PC40#ping 3.3.3.3 repeat 555

Type escape sequence to abort.
Sending 555, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 98 percent (496/502), round-trip min/avg/max = 8/42/112 ms

R1#conf t
R1(config)#int fa1/0
R1(config-if)#shutdown
R1(config-if)#
*Mar 1 02:06:11.347: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Active -> Init
R1(config-if)#
*Mar 1 02:06:13.347: %LINK-5-CHANGED: Interface FastEthernet1/0, changed state to administratively down
*Mar 1 02:06:14.347: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to down
R1(config-if)#end

R1#show standby
FastEthernet1/0 - Group 11
  State is Init (interface down)
  3 state changes, last state change 00:06:47
  Virtual IP address is 10.1.1.10
  Active virtual MAC address is unknown
  Local virtual MAC address is 0000.0c07.ac0b (v1 default)
  Hello time 3 sec, hold time 10 sec
  Preemption enabled
  Active router is unknown
  Standby router is unknown
  Priority 150 (configured 150)
  IP redundancy name is "hsrp-Fa1/0-11" (default)
R1#show standby bri
R1#show standby brief
  P indicates configured to preempt.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Grp</th>
<th>Prio</th>
<th>P</th>
<th>State</th>
<th>Active</th>
<th>Standby</th>
<th>Virtual IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fa1/0</td>
<td>11</td>
<td>150</td>
<td>P</td>
<td>Init</td>
<td>unknown</td>
<td>unknown</td>
<td>10.1.1.10</td>
</tr>
</tbody>
</table>
R1#

R2#
*Mar 1 02:06:45.011: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Standby -> Active
R2#
R2# show standby

FastEthernet1/0 - Group 11
State is **Active**
   5 state changes, last state change 00:07:35
Virtual IP address is 10.1.1.10
Active virtual MAC address is 0000.0c07.ac0b
Local virtual MAC address is 0000.0c07.ac0b (v1 default)
Hello time 3 sec, hold time 10 sec
   Next hello sent in 0.808 secs
Preemption enabled
**Active router is local**
**Standby router is unknown**
Priority 130 (configured 130)
IP redundancy name is "hsrp-Fa1/0-11" (default)

R2# show standby brief
   P indicates configured to preempt.
   |
   | Interface  Grp Prio P State    Active          Standby         Virtual IP
   | Fa1/0      11  130  P Active   local           unknown         10.1.1.10

R2#

Verify: Again I am going to shut down the fa1/0 interface of the R-2, What will happen lets see !!

-----------------------------------------------------------------------------------

PC40# traceroute 4.4.4.4

Type escape sequence to abort.
Tracing the route to 4.4.4.4

  1 10.1.1.2 92 msec 36 msec 76 msec
  2 23.1.1.3 92 msec *  80 msec
PC40# ping 4.4.4.4 re 333

Type escape sequence to abort.
Sending 333, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!..........................................................................................!!
!!!..........................................................................................!!
!!!..........................................................................................!!
!!!..........................................................................................!!
!!!..........................................................................................!!
Success rate is 99 percent (332/333), round-trip min/avg/max = 12/42/124 ms
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#int fa1/0
R1(config-if)#no shut
R1(config-if)#no shutdown

*Mar 1 02:35:23.943: %LINK-3-UPDOWN: Interface FastEthernet1/0, changed state to up
R1(config-if)#
*Mar 1 02:35:24.007: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Listen -> Active
R1(config-if)#
*Mar 1 02:35:24.943: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
R1(config-if)#do show standby
FastEthernet1/0 - Group 11
State is Active
  4 state changes, last state change 00:02:31
Virtual IP address is 10.1.1.10
Active virtual MAC address is 0000.0c07.ac0b
  Local virtual MAC address is 0000.0c07.ac0b (v1 default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 1.716 secs

Preemption enabled
Active router is local
Standby router is 10.1.1.2, priority 130 (expires in 9.792 sec)
Priority 150 (configured 150)
IP redundancy name is "hsrp-Fa1/0-11" (default)
R1(config-if)#

R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#
*Mar 1 02:35:48.155: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Active -> Speak
R2(config)#do show standby
R2(config)#do show standby
FastEthernet1/0 - Group 11
State is Standby
  7 state changes, last state change 00:02:55
Virtual IP address is 10.1.1.10
Active virtual MAC address is 0000.0c07.ac0b
  Local virtual MAC address is 0000.0c07.ac0b (v1 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 1.712 secs
Preemption enabled
Active router is 10.1.1.1, priority 150 (expires in 7.680 sec)
Standby router is local
Priority 130 (configured 130)
IP redundancy name is "hsrp-Fa1/0-11" (default)
R2(config)#

Task 5: Shutdown the serial link and resolved the problem with the track command
Verify: If I will shutdown the Serial 0/0, what will happen let see?

R1(config)#interface serial 0/0
R1(config-if)#sh
R1(config-if)#
*Mar  1 02:40:07.831: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor 13.1.1.3 (Serial0/0) is down: interface down
R1(config-if)#
*Mar  1 02:40:09.703: %LINK-5-CHANGED: Interface Serial0/0, changed state to administratively down
*Mar  1 02:40:10.703: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to down
R1(config-if)#

PC40#ping 4.4.4.4 re 444
Type escape sequence to abort.
Sending 444, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 75 percent (243/323), round-trip min/avg/max = 12/43/140 ms
PC40#

Ohh !!! See that output, What is that surprising, For the resolve that problem we will use the track,
if serial links goes down this command works.
*** Without tracking we cannot deploy HSRP

R1(config)#track 40 interface serial 0/0 line-protocol
R1(config-track)#exit
R1(config)#interface fastEthernet 1/0
R1(config-if)#standby 11 track 40 decrement 150
R1(config-if)#
*Mar 1 02:45:36.127: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Active -> Speak

-------------------------------------------
PC40#ping 4.4.4.4 re 333

Type escape sequence to abort.
Sending 333, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 99 percent (276/277), round-trip min/avg/max = 16/44/144 ms
PC40#traceroute 3.3.3.3

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WOW !! Great ! That say Done !!!!

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Task 6: Configure the Authentication
Last one is Authentication
Must be match the key-string

------------------------------------------
R1(config)#interface fastEthernet 1/0
R1(config-if)#standby 11 authentication md5 key-string cisco
R1(config-if)#
*Mar 1 02:52:58.327: %HSRP-4-BADAUTH: Bad authentication from 10.1.1.2, group 11, remote state Standby
R1(config-if)#

R2(config)#
*Mar 1 02:53:31.379: %HSRP-6-STATECHANGE: FastEthernet1/0 Grp 11 state Standby -> Active
R2(config)#
*Mar 1 02:53:57.375: %HSRP-4-BADAUTH: Bad authentication from 10.1.1.1, group 11, remote state Active
R2(config)#
*Mar 1 02:54:30.379: %HSRP-4-BADAUTH: Bad authentication from 10.1.1.1, group 11, remote state Active
R2(config)#

see the message will appears there Bad Authentication because we are configure only R-1 Authentication

------------------------------------------
R2(config)#interface fastEthernet 1/0
R2(config-if)#standby 11 authentication md5 key-string cisco
R2(config-if)#
R2(config-if)#end

R2#copy r s
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
R1#cop r s
Destination filename [startup-config]?
Building configuration...
[OK]
R1#

Enjoy your HSRP configuration cover this document.