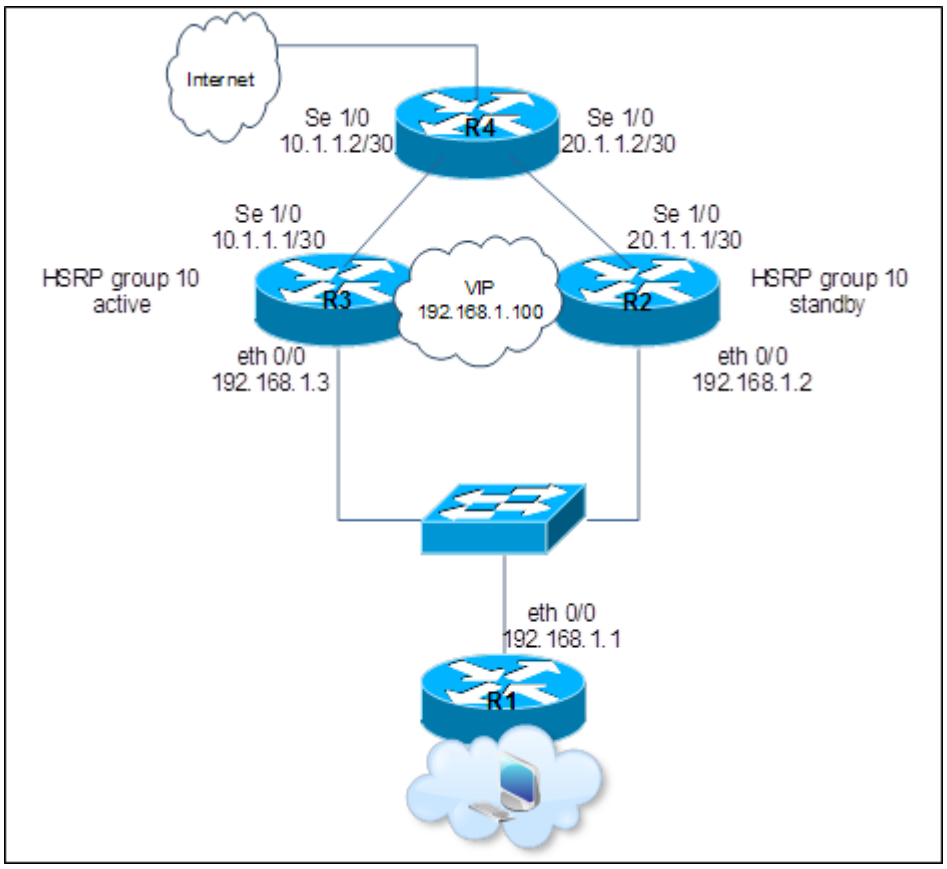
Design and deployment of HSRP in a LAN environment

Folks, welcome back! In this session we would take a look at HSRP. HSRP or Hot Standby Routing Protocol was primarily designed for providing layer two redundancy for default gateways (DG) failures on LAN segments. Understandably, for most networks out there if the default gateway is lost (may be by a router crash or by a interface disconnect or …) LAN looses the ability to communicate with the external networks, HSRP offers some layer 2/3 redundancy for such failures by providing a virtual IP and a virtual MAC address and binding interfaces on two or more routers to the same virtual IP address (VIP).Any one router can be active at a time. A router that is chosen to be active would attend to the requests that come in for the VIP, should the active router go inaccessible the standby router/s assumes the role of servicing the requests for the VIP. Note that to benefit from HSRP, default gateways on the PC's should be configured with the VIP instead of interface addresses of the routers.

With that in mind let's actually design a network that does this for us. Our goal here is to create a HSRP group with R3 as an active router and R2 as a standby router. We would further set the VIP to 192.168.1.100 and R3 to preempt (give it the capability to assume the active role should it go inaccessible and come back up). Further we would like to set a tracking on the interface between R3 and R4, so that if the serial interface goes down, R3 loses its active status to R2 (note that if the serial interface goes down its useless to keep R3 active as it has no way to route the packets to the core) . Also should R3 regain the serial interface it should switch back to active, we would use preempt statement to do that. Refer to the diagram mentioned below for further details.



Let's begin by configuring R2 (refer to the snapshot mentioned below). Note that the VIP in this case is 192.168.1.100 and R2 is given a priority of 101, also note that the preempt keyword enables R2 to kick the active router off and assume its role, should the priority of R2 increase to a better value.

```
R2#sh run int eth 0/0
Building configuration...

Current configuration : 154 bytes
!
interface Ethernet0/0
 ip address 192.168.1.2 255.255.255.0
 half-duplex
 standby 10 ip 192.168.1.100
 standby 10 priority 101
 standby 10 preempt
end
```

Let's move on to R3. The configuration is almost the same on R3 except for increasing the priority to 255 (thereby making it an active router in the group) and adding a statement to indicate that serial 1/0 to be a tracking interface, with a priority negation of 155. In essence whenever serial 1/0 goes down; a priority of 155 is subtracted from 255 bringing the priority value to 100, thereby making R2 as the active router (remember R2's priority value is 101). Again note that due to the preempt statement in the config, should the serial 1/0 come back on R3, it again returns to its original active state.

```
R3#sh run int eth 0/0
Building configuration...

Current configuration : 186 bytes
!
interface Ethernet0/0
 ip address 192.168.1.3 255.255.255.0
 half-duplex
 standby 10 ip 192.168.1.100
 standby 10 priority 255
 standby 10 preempt
 standby 10 track Serial1/0 155
end
```

Once that's done, we see that the HSRP groups come up.

```
R3#sh standby br
                     P indicates configured to preempt.
                     |
Interface   Grp Prio P State    Active          Standby         Virtual IP
Et0/0       10  255  P Active   local           192.168.1.2     192.168.1.100
R3#
```

```
R2#sh standby br
                     P indicates configured to preempt.
                     |
Interface   Grp Prio P State    Active          Standby         Virtual IP
Et0/0       10  101  P Standby  192.168.1.3     local           192.168.1.100
R2#
```

Also note that that R2 and R3 exchange the HSRP hello's between each other once every 3 seconds by default. A debug log on R3 below shows hello packets coming into R3 from R2 announcing that it's in standby mode and a hello packet leaving R3 announcing that it's active.

```
R3#
00:17:10: HSRP: Et0/0 Grp 10 Hello  in  192.168.1.2 Standby pri 101 vIP 192.168.1.100
00:17:13: HSRP: Et0/0 Grp 10 Hello  out 192.168.1.3 Active  pri 255 vIP 192.168.1.100
00:17:13: HSRP: Et0/0 Grp 10 Hello  in  192.168.1.2 Standby pri 101 vIP 192.168.1.100
00:17:16: HSRP: Et0/0 Grp 10 Hello  out 192.168.1.3 Active  pri 255 vIP 192.168.1.100
00:17:16: HSRP: Et0/0 Grp 10 Hello  in  192.168.1.2 Standby pri 101 vIP 192.168.1.100
R3#
```

Taking a look at the arp table on router R1 mentioned below, note that the VIP now has a separate MAC address of 0000.0c07.ac0a, which is different from the individual BIA's of the routers R2 and R3. Note that the 0x0a on the last octet corresponds to the decimal 10, the HSRP group number that we created.

```
R1#sh ip arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  192.168.1.100          76   0000.0c07.ac0a  ARPA   Ethernet0/0
Internet  192.168.1.1             -   0050.0f05.6b21  ARPA   Ethernet0/0
Internet  192.168.1.3            85   0007.eb6f.5281  ARPA   Ethernet0/0
Internet  192.168.1.2            85   0007.5000.fb81  ARPA   Ethernet0/0
R1#
```

Now that we are familiar with the inner workings of HSRP, let's see it in action. As a first test, I would unplug the Ethernet cable on R3. As soon as this happens the router

resigns itself of active role and goes into an Init state because it detects the change in the eth interface.

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to down
HSRP: Et0/0 Interface down
HSRP: Et0/0 Grp 10 Active: b/HSRP disabled
HSRP: Et0/0 Grp 10 Active router is unknown, was local
HSRP: Et0/0 Grp 10 Standby router is unknown, was 192.168.1.2
HSRP: Et0/0 Grp 10 Resign out 192.168.1.3 Active  pri 255 vIP 192.168.1.100
HSRP: Et0/0 Grp 10 Active -> Init
%HSRP-5-STATECHANGE: Ethernet0/0 Grp 10 state Active -> Init
HSRP: Et0/0 Grp 10 Redundancy "hsrp-Et0/0-10" state Active -> Init
HSRP: Et0/0 Grp 10 Resign out 192.168.1.3 Init    pri 255 vIP 192.168.1.100
R3#
```

R2 does not know what happened until the next few seconds until its hello/dead timers get expired, as soon as that happens it assumes an active role. Debug logs on R2 are mentioned below.

```
HSRP: Et0/0 Grp 10 Standby: c/Active timer expired (192.168.1.3)
HSRP: Et0/0 Grp 10 Active router is local, was 192.168.1.3
HSRP: Et0/0 Grp 10 Standby router is unknown, was local
HSRP: Et0/0 Grp 10 Standby -> Active
%HSRP-5-STATECHANGE: Ethernet0/0 Grp 10 state Standby -> Active
HSRP: Et0/0 Grp 10 Redundancy "hsrp-Et0/0-10" state Standby -> Active
HSRP: Et0/0 Grp 10 Redundancy group hsrp-Et0/0-10 state Active -> Active
HSRP: Et0/0 Grp 10 Redundancy group hsrp-Et0/0-10 state Active -> Active
R2#
```

Note that the virtual MAC address remains unchanged during the switch; hence R1 need not change its arp cache. That's the advantage of using a Virtual mac, rather than router's BIA. A router reboot or any other connectivity loss also results in a similar outcome as above (not shown).As soon as I plug the Ethernet cable back, R3 leaps back to active status (not shown).

As a last section, let's take a look at tracking interface in action. To illustrate this, let's unplug the serial cable from R3, note that as soon the serial 1/0 is unplugged from R3, its priority value changes to 100, which is one less than R2's priority and hence it loses its active status

Mentioned below is a debug log of R3 stepping down.

```
R3#
%TRACKING-5-STATE: 1 interface Se1/0 line-protocol Up->Down
HSRP: Et0/0 Grp 10 Track 1 object changed, state Up -> Down
HSRP: Et0/0 Grp 10 Priority 255 -> 100
HSRP: Et0/0 Grp 10 Active: j/Coup rcvd from higher pri router (101/192.168.1.2)
HSRP: Et0/0 Grp 10 Active router is 192.168.1.2, was local
HSRP: Et0/0 Grp 10 Standby router is unknown, was 192.168.1.2
```

Mentioned here is a debug log of R2 stepping up to be an active router.

```
R2#sh log | in HSRP
HSRP: Et0/0 Grp 10 Standby: h/Hello rcvd from lower pri Active router (100/192.168.1.3)
HSRP: Et0/0 Grp 10 Active router is local, was 192.168.1.3
HSRP: Et0/0 Grp 10 Standby router is unknown, was local
HSRP: Et0/0 Grp 10 Coup   out 192.168.1.2 Standby pri 101 vIP 192.168.1.100
HSRP: Et0/0 Grp 10 Standby -> Active
%HSRP-5-STATECHANGE: Ethernet0/0 Grp 10 state Standby -> Active
```

Note that as soon as the tracking interface is connected back, priority value of R3 surges back to 255 and it becomes active again (not shown).

Source: http://ciscoworks.wordpress.com/2010/07/31/design-and-deployment-of-hsrp-in-a-lan-environment/