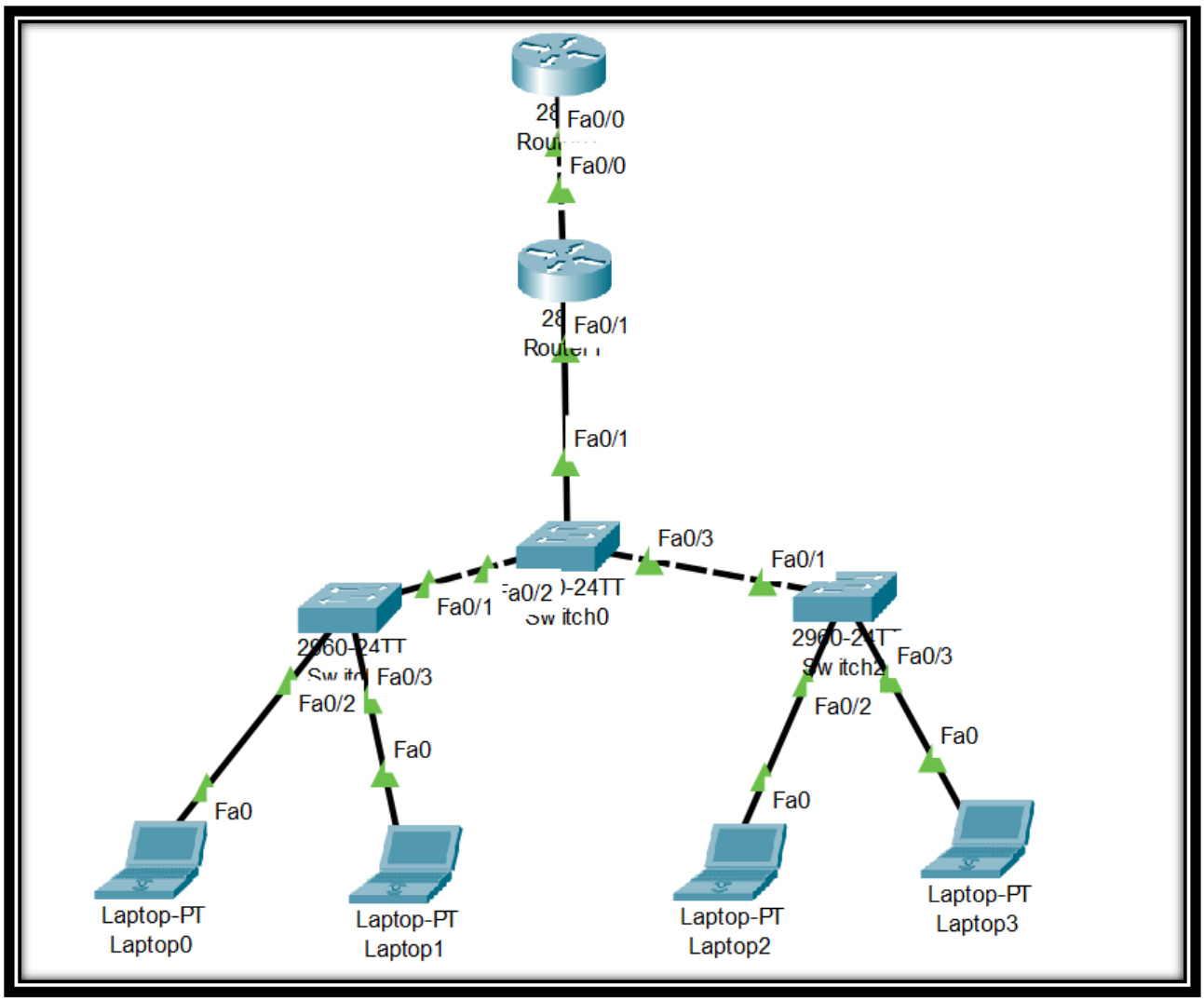
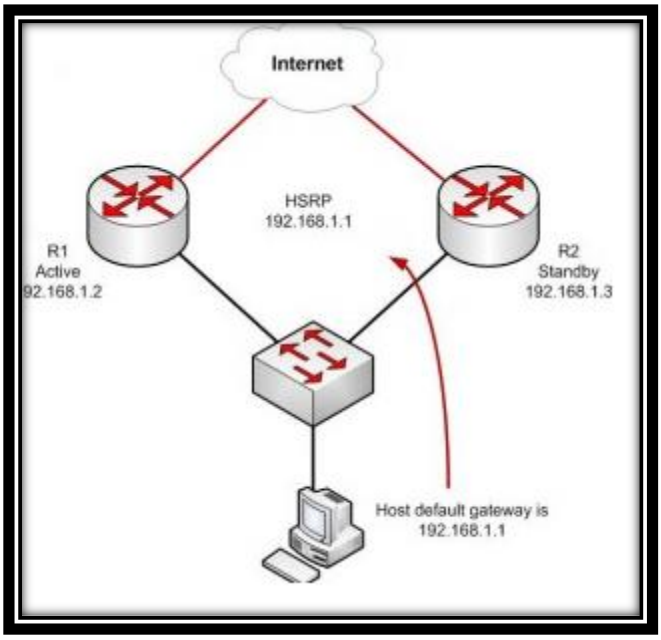

Networkforyou
Welcome
To
Network for you
FHRP
Networkforyou

Redundancy:

- In Today world Redundancy is very important for anything.
- Let see the below Network Infrastructure devices are a single point of failure.
- If any switch or router goes down, the Pcs will lose their net access.

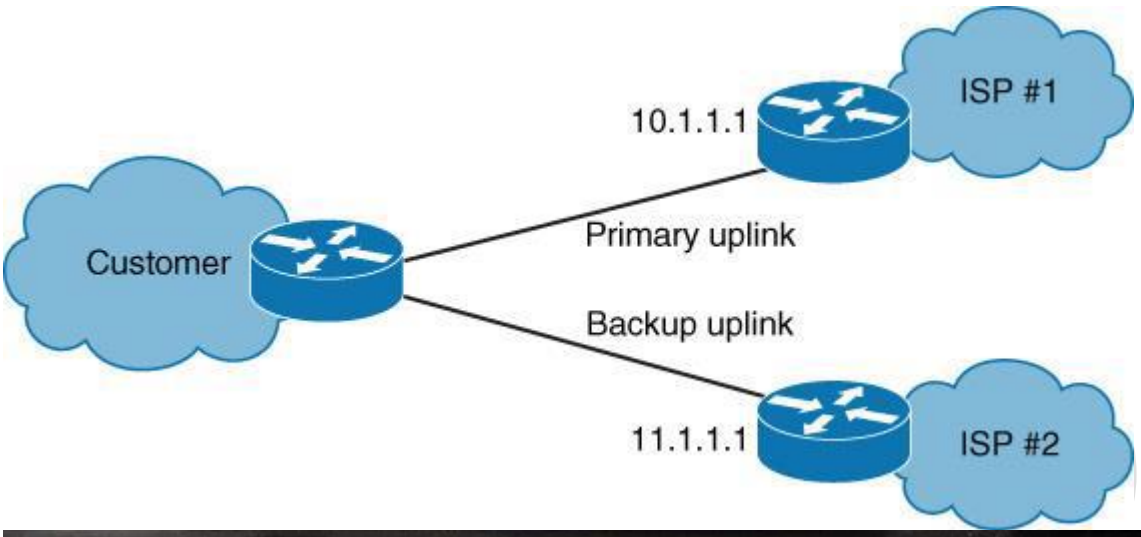




Redundancy:

- Redundancy, Failover, High Availability, Clustering, RAID and Fault-tolerance.
- A good network design provides the redundancy in devices and network links.
- Redundancy is basically extra hardware or software that can be used as backup.
- If the main hardware or software fails or link fail or unavailable in case of emergency.
- It is method for ensuring network availability in case of network device or path failure.
- It is method for ensuring network availability in case of network device unavailability.
- Network redundancy is process through which additional or alternate instances of network
- High availability is a feature which provides redundancy and fault tolerance automatically.
- High Availability is a number of connected devices processing and providing a services.
- The goal is to ensure this service is always available even in the event of a failure or down.
- Set up to allow company to connect their device to more than one Internet connection.
- If one connection goes down, all traffic would failover to the other Internet connection.
- This would eliminate single point of failure and would re-assure availability and reliability.
- RAID is a fault tolerance solution for hard drives usually implemented in the servers.
- Redundant Array of Independent Disks providing redundancy and fault tolerance.
- When a device fails another device takes over this process which is referred to as a failover.
- Redundancy, Fault-tolerance, & High-availability, all refer to some sort of failover of backup.


Redundant power supplies


ISP #1
10.1.1.1
Customer
Primary uplink
Backup uplink
11.1.1.1
ISP #2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SAS
200GB SSD
300GB15k

- First Hop Redundancy Protocols (FHRPs), Which Provides redundancy for the function of the default router in any subnet.
- Or In simple words we can say first hop redundancy protocols gives you the element of redundancy to support a failure and allow your hosts on that LAN to continue to communicate.
- It allows default gateway redundancy. That is having more than one default gateway enabled. If one gateway fail other gateway start running.
- Organizations use various protocols to prevent a single point failure in their networks.
- One of these protocols is the **First Hop Redundancy Protocol (FHRP)** which presents a virtual default gateway to the organization's network to provide a near 100 percent network uptime.
- **FHRP is used to prevent network failure at a default gateway.**
- This is achieved by **configuring multiple routers with the same IP address and Mac address, thus presenting an illusion of a single virtual router to the hosts in a Local Area Network (LAN).**
- **The IP address of the virtual router is configured on all hosts in that network or subnet as their default gateway.**

There are Three First hop redundancy protocols (FHRP):

1. HSRP (Hot Standby Router Protocol) --- Cisco proprietary
2. VRRP (Virtual Router Redundancy Protocol) ------ Open Standard ------- It is very similar to HSRP
3. GLBP (Gateway Load Balancing Protocol) --- Cisco proprietary ----- Supports load balancing

FHRP Working:

- Creating group of physical gateway using Layer 3 device router or Switches.
- Agree to assign one Virtual IP address, which same to all first hop devices.
- Virtual IP going to use as gateway address to all LAN devices.
- The FHRP creating Virtual MAC address.
- One First hop is respond address resolution protocol request.
- It is using the Keep lives message in order to get Virtual gateway status.
- LAN devices use Virtual IP and MAC address as default gateway.

HSRP (Hot Standby Router Protocol):

- HSRP Stands for Hot Standby Router Protocol and it is CISCO Proprietary protocol.
- There are two version of HSRP (that is HSRP v1 and HSRP V2).
- Two or more CISCO Router or Switches on LAN segment form an HSRP group.
- In HSRP, One CISCO Router or Switch assumes the function of **Active** device and other will be **Standby**.
- In HSRP, the **highest priority gateway** is elected as active gateway of group.
- And Active gateway is the owner of Virtual MAC and Virtual IP address.
- In HSRP, the default priority is set to 100 but it can be tune from (0-255).
- Highest interface IP as the tiebreaker and **preempt option is disabled by default**.
- In HSRP Version 1 use Multicast Address 224.0.0.2 for sending the Hello traffic.
- In HSRP Version 2 use Multicast Address 224.0.0.102 for sending the Hello traffic.
- In HSRP, the message can be **authenticated** using the clear **text or the MD5**.
- In HSRP Version 1 allows for group numbers ranging from **0-255.**
- In HSRP Version 2 allows for group numbers ranging from **0-4095.**
- HSRP Version 1 Virtual MAC 0000.0c07.acXX (XX is group no (0-225)).
- HSRP Version 2 Virtual MAC 0000.0c9f.fXXX (XXX is group no (0-4095)).
- HSRP Version 2 support IPV6 address where as HSRP Version 1 doesn't support IPV6
- HSRP Version 1 and HSRP Version 2 are not compatible with each other.
- In HSRP Version 1 and 2 Default Hello time is 3 seconds, Hold time is 10 seconds.
- On CISCO Router or Switches by default have priority 100.

HSRP State:

Initial:

- The beginning state.
- The initial state indicates that HSRP does not run.
- This state is entered via a configuration change or when an interface first comes up.

Listen:

- The Router knows the Virtual IP address.
- But the router is neither the active router nor the standby router.
- It listens for hello message from those routes.

Speak:

- The Router sends periodic Hello messages and actively participates in the election of the **active or standby router.**

- A Router cannot enter speak state unless the router has the Virtual IP address.

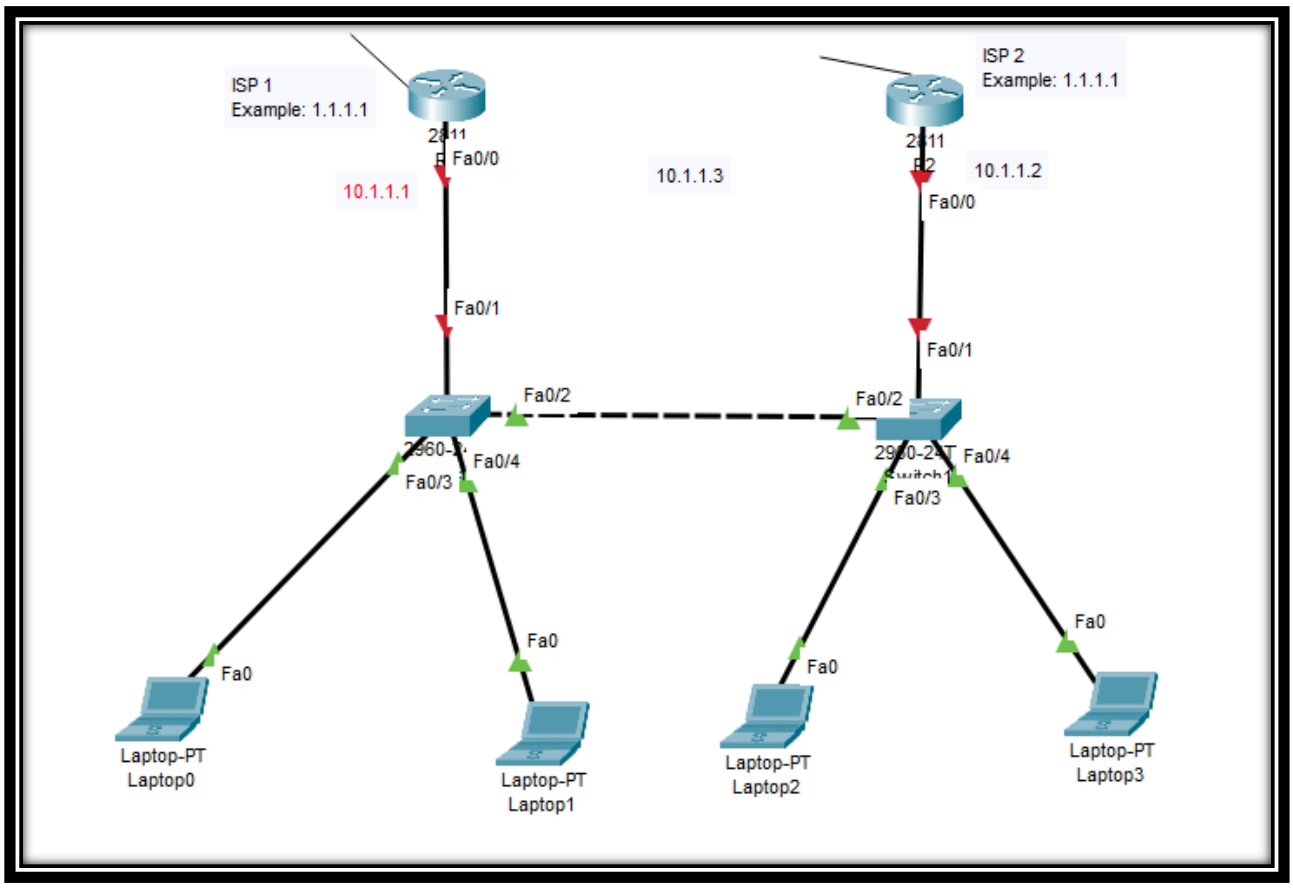
Standby:

- The Router did not become the active router but will keep sending Hello message.
- If the active router fails it will take over.

Active:

- The router will actively forward packet from clients and send Hello messages.

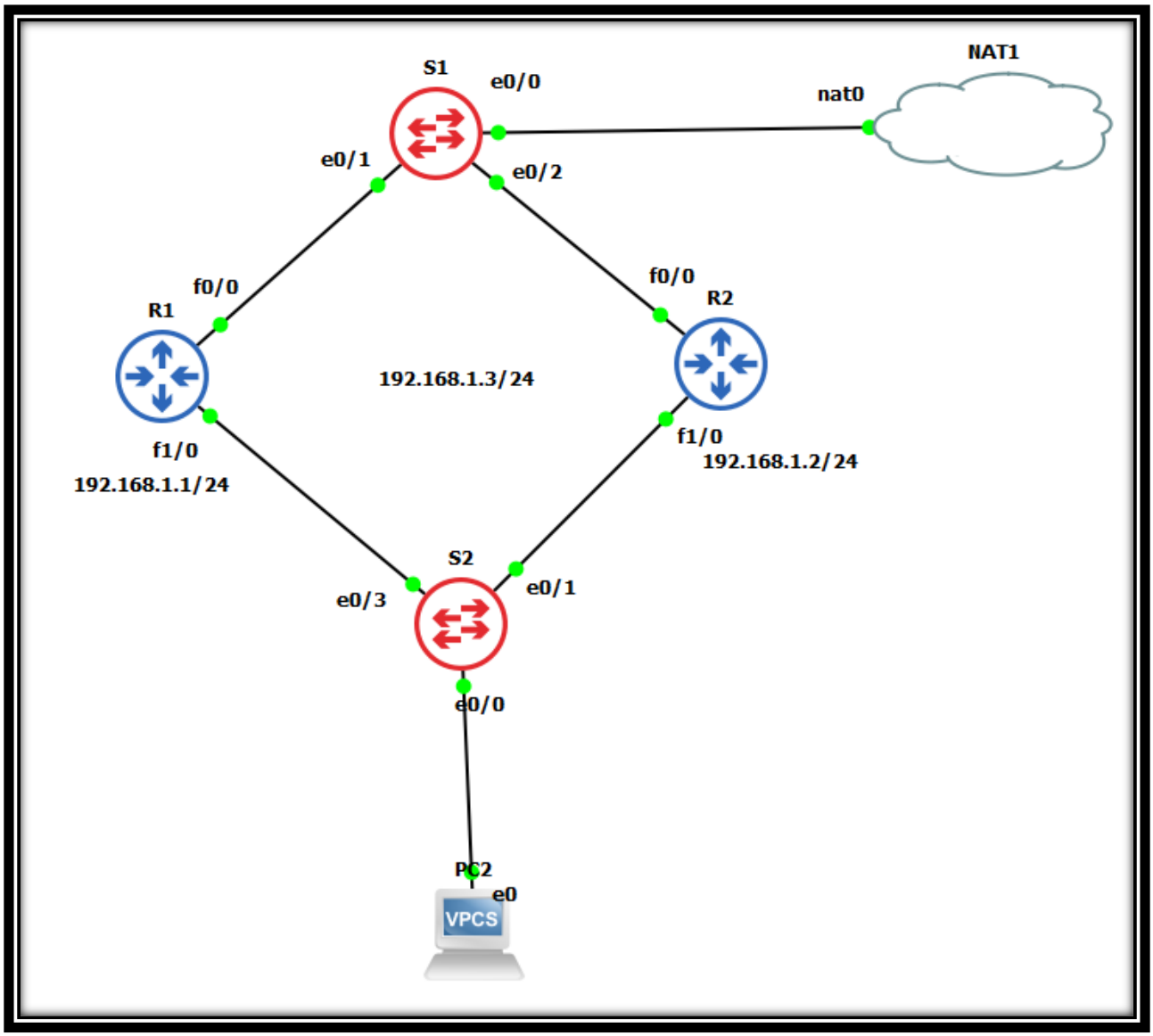
Lab time: HSRP



R1 Configuration	R2 Configuration
config t hostname GW1 int f0/0 ip add 10.1.1.1 255.0.0.0 no sh int lo 0 ip add 1.1.1.1 255.0.0.0 int f0/0 standby 1 ip 10.1.1.3	config t hostname GW2 int f0/0 ip add 10.1.1.2 255.0.0.0 no sh int lo 0 ip add 1.1.1.1 255.0.0.0 int f0/0 standby 1 ip 10.1.1.3 standby 1 priority 110 standby 1 preempt
R1#show standby R1#show standby brief R1#debug standby packets R1#debug standby events	This command is use to Check HSRP.


```
GW2#sh standby
FastEthernet0/0 - Group 1
  State is Active
    6 state changes, last state change 00:00:38
  Virtual IP address is 10.1.1.3
  Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.799 secs
  Preemption disabled
  Active router is local
  Standby router is 10.1.1.1
  Priority 100 (default 100)
  Group name is hsrp-Fa0/0-1 (default)
GW2#sh standby
GW2#sh standby br
GW2#sh standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Fa0/0       1    100   Active  local           10.1.1.1        10.1.1.3
GW2#
```

Lab Time with Authentication and WAN Link:



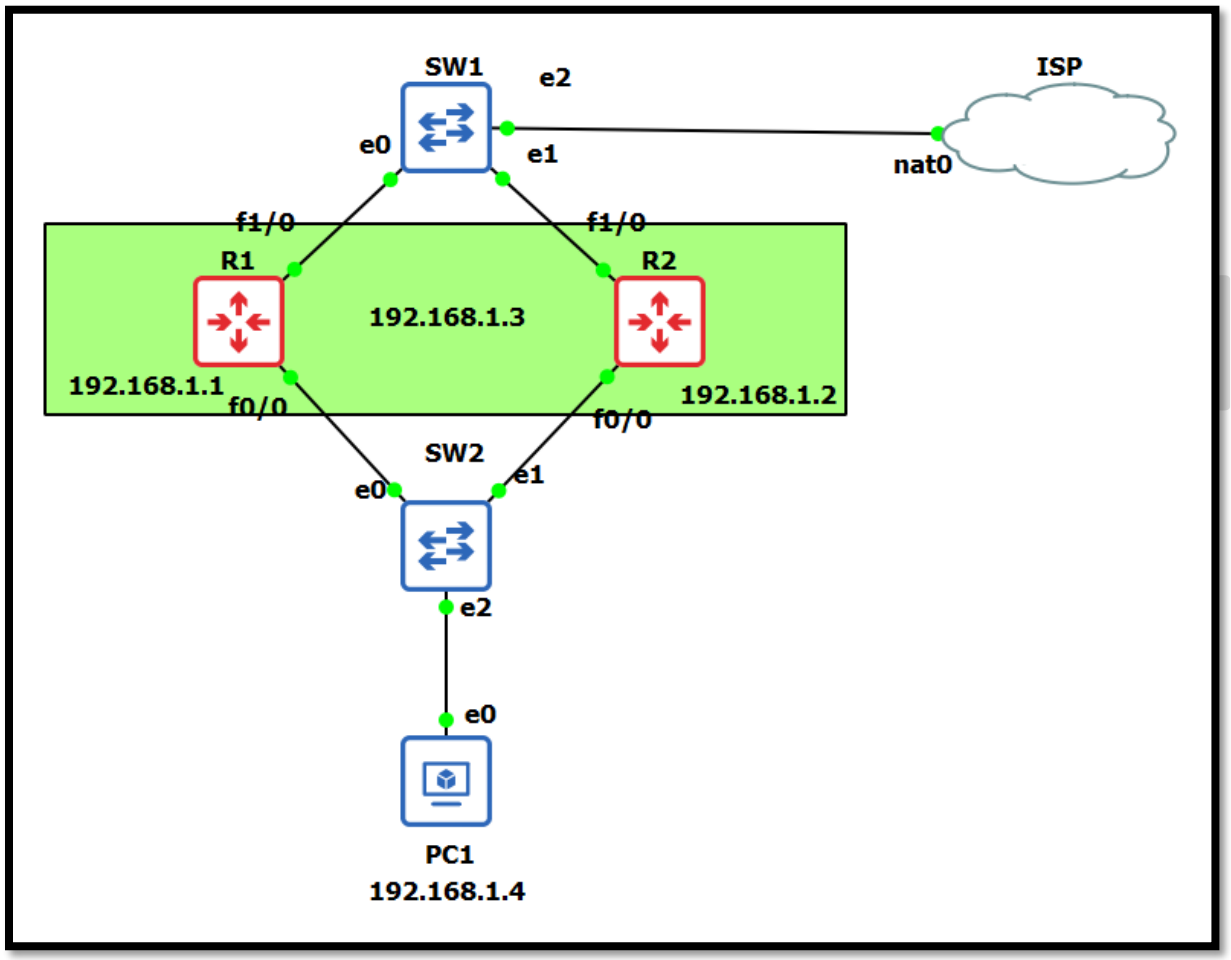
R1 Configuration	R2 Configuration
en config t hostname R1 int f0/0 ip add dhcp no sh int f1/0 ip add 192.168.1.1 255.255.255.0 no sh ip domain-lookup ip name-server 8.8.8.8 int f1/0 standby 1 ip 192.168.1.3 standby 1 name Group1 standby 1 authentication md5 key-string abc standby 1 preempt standby 1 priority 110 standby 1 track fastEthernet 0/0 20	en config t hostname R2 int f0/0 ip add dhcp no sh int f1/0 ip add 192.168.1.2 255.255.255.0 no sh ip domain-lookup ip name-server 8.8.8.8 int f1/0 standby 1 ip 192.168.1.3 standby 1 name Group1 standby 1 authentication md5 key-string abc standby 1 preempt

VRRP (Virtual Router Redundancy Protocol):

- VRRP stand for Virtual Router Redundancy Protocol.
- VRRP is open Standard.
- VRRP is very similar to HSRP (Host Standby Router Protocol) and can be used to create a virtual gateway.
- In VRRP Hello timer 1 second and hold time 3 seconds where as in HSRP Hello timer 3 seconds and hold timer 10 second.
- VRRP uses terms master/backup same as active/standby in HSRP.
- In VRRP, one Router or Switch assumes the function of “Master” device and other “Backup”.
- Master sends VRRP advertisements to other routers in the same group.
- VRRP uses multicast IP 244.0.0.18 for Hello mechanism and elections. – IPV4
- VRRP use the Virtual MAC address which is 0000.5E00.01XX. (XX is group no.).

- VRRP uses own transport protocol 112.
- In VRRP the preemption is enabled by default where as in HSRP it is disabled by default.
- Preemption can be disabled using the no vrrp preempt command under interface.
- Virtual IP Address can be the same as the real IP address on the interface.
- In VRRP, the gateway becomes master using highest priority 255.
- There are 3 Versions of VRRP and Version 3 support IPV6 and IPV4. Whereas Version 2 support only IPV4.

Lab time: VRRP:



R1 VRRP Configuration	R2 VRRP Configuration
R1(config)#interface FastEthernet 0/0 R1(config-if)# vrrp 1 ip 192.168.1.3 R1(config-if)# vrrp 1 name Group1 R1(config-if)# vrrp 1 priority 110 R1(config-if)# vrrp 1 preempt	R2(config)#interface FastEthernet 0/0 R2(config-if)# vrrp 1 ip 192.168.1.3 R2(config-if)# vrrp 1 name Group1 R2(config-if)# vrrp 1 priority 110 R2(config-if)# vrrp 1 preempt **R2(config) track 1 int f1/0 line-protocol** **R2(config) int f0/0** **R2(config-if) vrrp 1 track 1 decrement 20**
Show command	Show command
R1#show vrrp R1#show vrrp brief R1# show vrrp brief R1# show vrrp all	R2#show vrrp R2#show vrrp brief R2# show vrrp brief R2# show vrrp all

```
R2#sh vrrp b
Interface          Grp Pri Time  Own Pre State   Master addr     Group addr
Fa1/0              1   110 3570       Y  Master  192.168.1.2     192.168.1.3
R2#
```

```
R1#sh vrrp br
Interface          Grp Pri Time  Own Pre State   Master addr     Group addr
Fa1/0              1   110 3570       Y  Backup  192.168.1.2     192.168.1.3
```

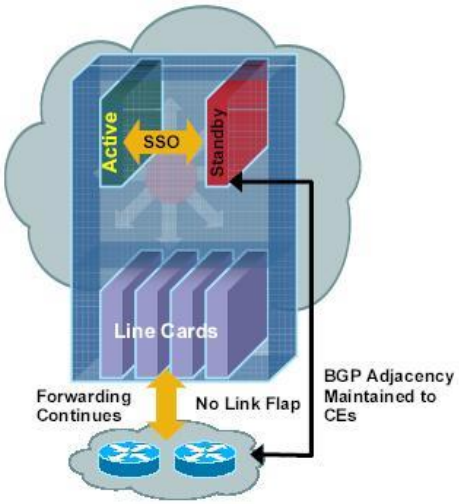
```
R2(config)#int f0/0
R2(config-if)#sh
R2(config-if)#
*Aug 29 21:55:00.471: %TRACKING-5-STATE: 1 interface Fa0/0 line-protocol Up->Down
R2(config-if)#
*Aug 29 21:55:02.419: %LINK-5-CHANGED: Interface FastEthernet0/0, changed state to administratively down
*Aug 29 21:55:03.419: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to down
R2(config-if)#
*Aug 29 21:55:03.699: %VRRP-6-STATECHANGE: Fa1/0 Grp 1 state Master -> Backup
R2(config-if)#
```

```
R1#
*Aug 29 21:55:03.895: %VRRP-6-STATECHANGE: Fa1/0 Grp 1 state Backup -> Master
R1#
```

```
R2(config-if)#do sh vrrp
FastEthernet1/0 - Group 1
  State is Backup
  Virtual IP address is 192.168.1.3
  Virtual MAC address is 0000.5e00.0101
  Advertisement interval is 1.000 sec
  Preemption enabled
  Priority is 90  (cfgd 110)
  VRRS Group name Group1
    Track object 1 state Down decrement 20
  Master Router is 192.168.1.1, priority is 110
  Master Advertisement interval is 1.000 sec
  Master Down interval is 3.570 sec (expires in 2.614 sec)
```

Statefull Switchover (SSO):

Statefull Switchover (SSO) is another seemingly awesome technology that can help you implement high availability when facing a broken non-redundant network design. Here's how it's supposed to work:



A network device runs two copies of the control plane (primary and backup);

Primary control plane continuously synchronizes its state with the backup control plane;

When the primary control plane crashes, the backup control plane already has all the required state and is ready to take over in moments.

GLBP (Gateway Load Balancing Protocol):

- GLBP stands for Gateway Load Balancing Protocol and just like HSRP / VRRP it is used to create a virtual gateway that you can use for hosts.
- One of the key differences of GLBP is that it can do load balancing.
- HSRP can not provide load balancing for single subnet or single group or single vlan but GLBP can provide load balancing for Single VLAN or single subnet or single group.
- All devices running GLBP elect an AVG (Active Virtual Gateway).
- There will be only one AVG for a single group running GLBP but other devices can take over this rule if the AVG fails.
- The role of the AVG is to assign a virtual MAC address to all devices running GLBP.
- All devices become an AVF (Active Virtual Forwarder) including the AVG (Active Virtual Gateway).
- Whenever a computer sends an ARP request the AVG will respond with one of the Virtual MAC addresses of the available AVRFs. Because of this mechanism all devices running GLBP will be used to forward IP Packets.

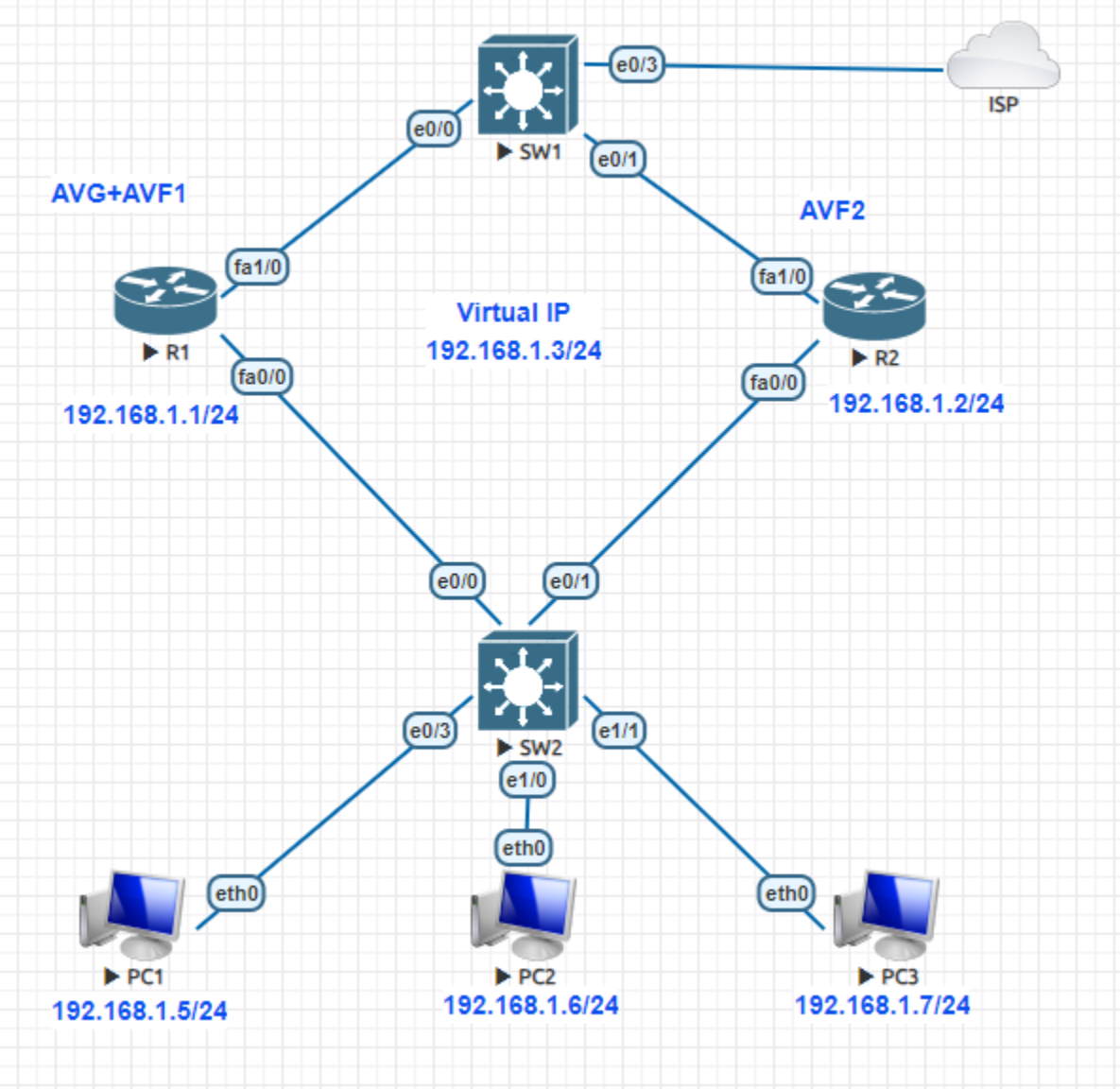
There are multiple methods for load balancing:

1. Round-robin: The AVG will hand out the Virtual MAC address of AVF1, then AVF2, so on after all AVF finish then come back to AVF1etc. **(Maximum AVF we have 4 in each group)**
2. Host-dependent: A host will be able to use the same virtual MAC address of an AVF as long as it is reachable.
3. Weighted: If you want some AVFs to forward more traffic than others you can assign them a different weight.

MAC address:

0007.b4000.XXYY (Where X=GLBP group number and Y = AVF number).

Lab time for GLBP:



R1 Configuration:	R2 Configuration:
en config t hostname R1 int f1/0 ip add dhcp no sh int f0/0 ip add 192.168.1.1 255.255.255.0 no sh int f0/0 glbp 1 ip 192.168.1.3 glbp 1 priority 150 glbp 1 authentication md5 key-string abc glbp 1 preempt exit track 1 interface f1/0 line-protocol int f0/0 glbp 1 weighting track 1 decrement 50 glbp 1 weighting 100 lower 70 upper 80	en config t hostname R2 int f1/0 ip add dhcp no sh int f0/0 ip add 192.168.1.2 255.255.255.0 no sh int f0/0 glbp 1 ip 192.168.1.3 glbp 1 authentication md5 key-string abc glbp 1 preempt exit track 1 interface f1/0 line-protocol int f0/0 glbp 1 weighting track 1 decrement 50 glbp 1 weighting 100 lower 70 upper 80

The default output:

```
R1#sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   150 Active   192.168.1.3     local           192.168.1.2
Fa0/0       1    1   -   Active   0007.b400.0101  local           -
Fa0/0       1    2   -   Listen   0007.b400.0102  192.168.1.2     -
```

```
R2#sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   100 Standby  192.168.1.3     192.168.1.1     local
Fa0/0       1    1   -   Listen   0007.b400.0101  192.168.1.1     -
Fa0/0       1    2   -   Active   0007.b400.0102  local           -
```

```
R1#sh glbp
FastEthernet0/0 - Group 1
  State is Active
    1 state change, last state change 00:24:03
  Virtual IP address is 192.168.1.3
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.984 secs
  Redirect time 600 sec, forwarder timeout 14400 sec
  Authentication MD5, key-string
  Preemption enabled, min delay 0 sec
  Active is local
  Standby is 192.168.1.2, priority 100 (expires in 7.808 sec)
  Priority 150 (configured)
  Weighting 100 (configured 100), thresholds: lower 70, upper 80
    Track object 1 state Up decrement 50
  Load balancing: round-robin
  Group members:
    ca03.1ebd.0000 (192.168.1.1) local
    ca04.202a.0000 (192.168.1.2) authenticated
  There are 2 forwarders (1 active)
  Forwarder 1
    State is Active
      3 state changes, last state change 00:10:25
    MAC address is 0007.b400.0101 (default)
    Owner ID is ca03.1ebd.0000
    Redirection enabled
    Preemption enabled, min delay 30 sec
    Active is local, weighting 100
    Client selection count: 2
  Forwarder 2
    State is Listen
      2 state changes, last state change 00:02:56
    MAC address is 0007.b400.0102 (learnt)
    Owner ID is ca04.202a.0000
    Redirection enabled, 599.840 sec remaining (maximum 600 sec)
    Time to live: 14399.840 sec (maximum 14400 sec)
    Preemption enabled, min delay 30 sec
    Active is 192.168.1.2 (primary), weighting 100 (expires in 9.984 sec)
    Client selection count: 1
```

```
R2#sh glbp
FastEthernet0/0 - Group 1
  State is Standby
    1 state change, last state change 00:25:50
  Virtual IP address is 192.168.1.3
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.592 secs
  Redirect time 600 sec, forwarder timeout 14400 sec
  Authentication MD5, key-string
  Preemption enabled, min delay 0 sec
  Active is 192.168.1.1, priority 150 (expires in 7.520 sec)
  Standby is local
  Priority 100 (default)
  Weighting 100 (configured 100), thresholds: lower 70, upper 80
    Track object 1 state Up decrement 50
  Load balancing: round-robin
  Group members:
    ca03.1ebd.0000 (192.168.1.1) authenticated
    ca04.202a.0000 (192.168.1.2) local
  There are 2 forwarders (1 active)
  Forwarder 1
    State is Listen
      2 state changes, last state change 00:12:33
    MAC address is 0007.b400.0101 (learnt)
    Owner ID is ca03.1ebd.0000
    Time to live: 14399.680 sec (maximum 14400 sec)
    Preemption enabled, min delay 30 sec
    Active is 192.168.1.1 (primary), weighting 100 (expires in 9.344 sec)
  Forwarder 2
    State is Active
      3 state changes, last state change 00:05:05
    MAC address is 0007.b400.0102 (default)
    Owner ID is ca04.202a.0000
    Preemption enabled, min delay 30 sec
    Active is local, weighting 100
R2#
```

If R1 WAN Connectivity go down then R2 will become active for both MAC address as show below.

```
R1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#int f1/0
R1(config-if)#sh
R1(config-if)#
*Sep  2 17:13:58.027: %TRACKING-5-STATE: 1 interface Fa1/0 line-protocol Up->Down
*Sep  2 17:14:00.011: %LINK-5-CHANGED: Interface FastEthernet1/0, changed state to administratively down
*Sep  2 17:14:01.011: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to down
*Sep  2 17:14:33.083: %GLBP-6-FWDSTATECHANGE: FastEthernet0/0 Grp 1 Fwd 1 state Active -> Listen
R1(config-if)#do sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   150 Active   192.168.1.3     local           192.168.1.2
Fa0/0       1    1   -   Listen   0007.b400.0101  192.168.1.2     -
Fa0/0       1    2   -   Listen   0007.b400.0102  192.168.1.2     -
```

```
R2#
*Sep  2 17:14:32.451: %GLBP-6-FWDSTATECHANGE: FastEthernet0/0 Grp 1 Fwd 1 state Listen -> Active
R2#
R2#sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   100 Standby  192.168.1.3     192.168.1.1     local
Fa0/0       1    1   -   Active   0007.b400.0101  local           -
Fa0/0       1    2   -   Active   0007.b400.0102  local           -
R2#
```

If R2 WAN Connectivity go down then R1 will become active for both MAC address as show below.

```
R2(config-if)#int f1/0
R2(config-if)#sh
R2(config-if)#
*Sep  2 17:21:51.143: %TRACKING-5-STATE: 1 interface Fa1/0 line-protocol Up->Down
*Sep  2 17:21:53.127: %LINK-5-CHANGED: Interface FastEthernet1/0, changed state to administratively down
*Sep  2 17:21:54.127: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to down
*Sep  2 17:22:24.543: %GLBP-6-FWDSTATECHANGE: FastEthernet0/0 Grp 1 Fwd 2 state Active -> Listen
R2(config-if)#do sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   100 Standby  192.168.1.3     192.168.1.1     local
Fa0/0       1    1   -   Listen   0007.b400.0101  192.168.1.1     -
Fa0/0       1    2   -   Listen   0007.b400.0102  192.168.1.1     -
```

```
R1#
*Sep  2 17:21:25.239: %SYS-5-CONFIG_I: Configured from console by console
*Sep  2 17:22:25.167: %GLBP-6-FWDSTATECHANGE: FastEthernet0/0 Grp 1 Fwd 2 state Listen -> Active
R1#sh glbp br
Interface   Grp  Fwd Pri State    Address         Active router   Standby router
Fa0/0       1    -   150 Active   192.168.1.3     local           192.168.1.2
Fa0/0       1    1   -   Active   0007.b400.0101  local           -
Fa0/0       1    2   -   Active   0007.b400.0102  local           -
R1#
```

Because we enable track command on both routers.