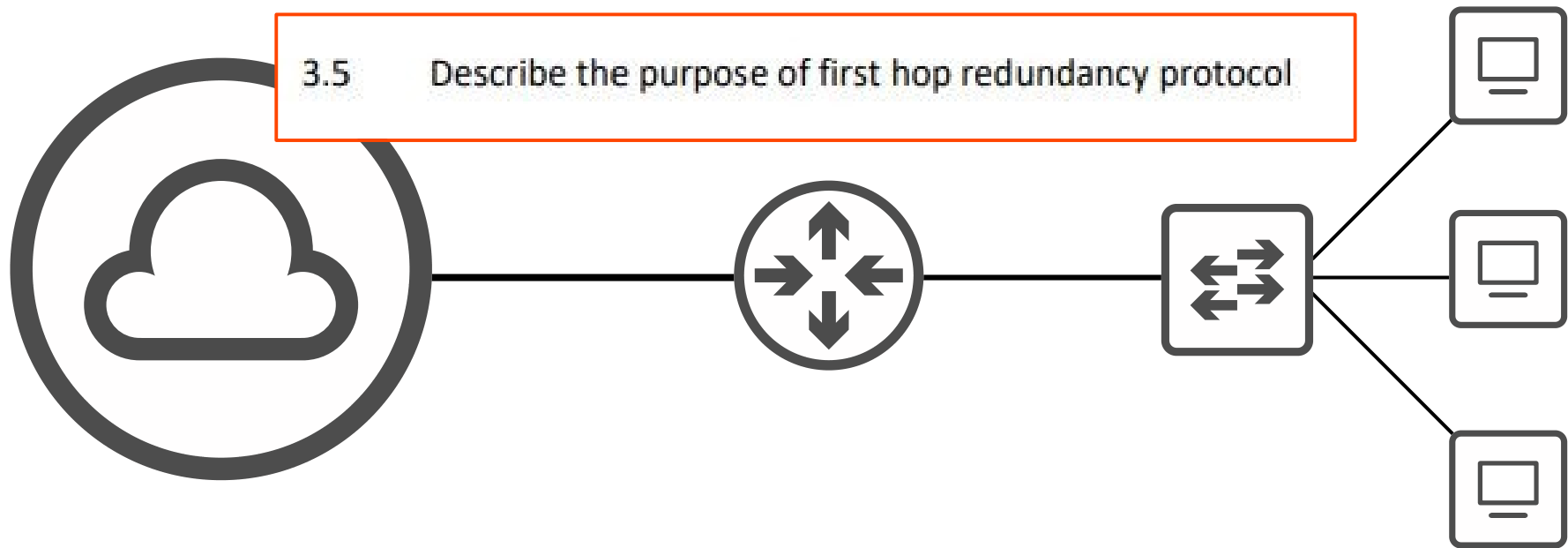


CCNA 200-301 Day 29

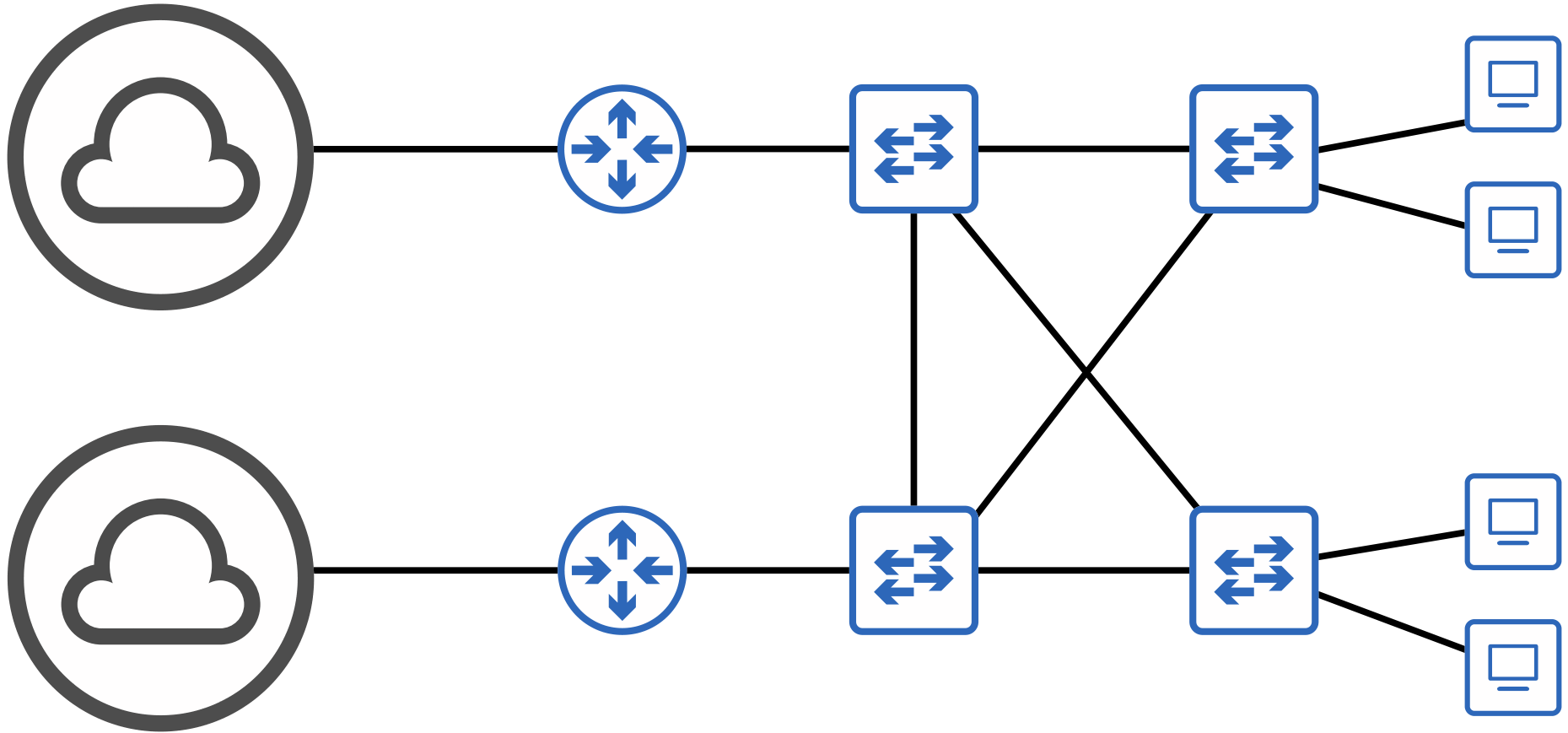
First Hop Redundancy Protocols



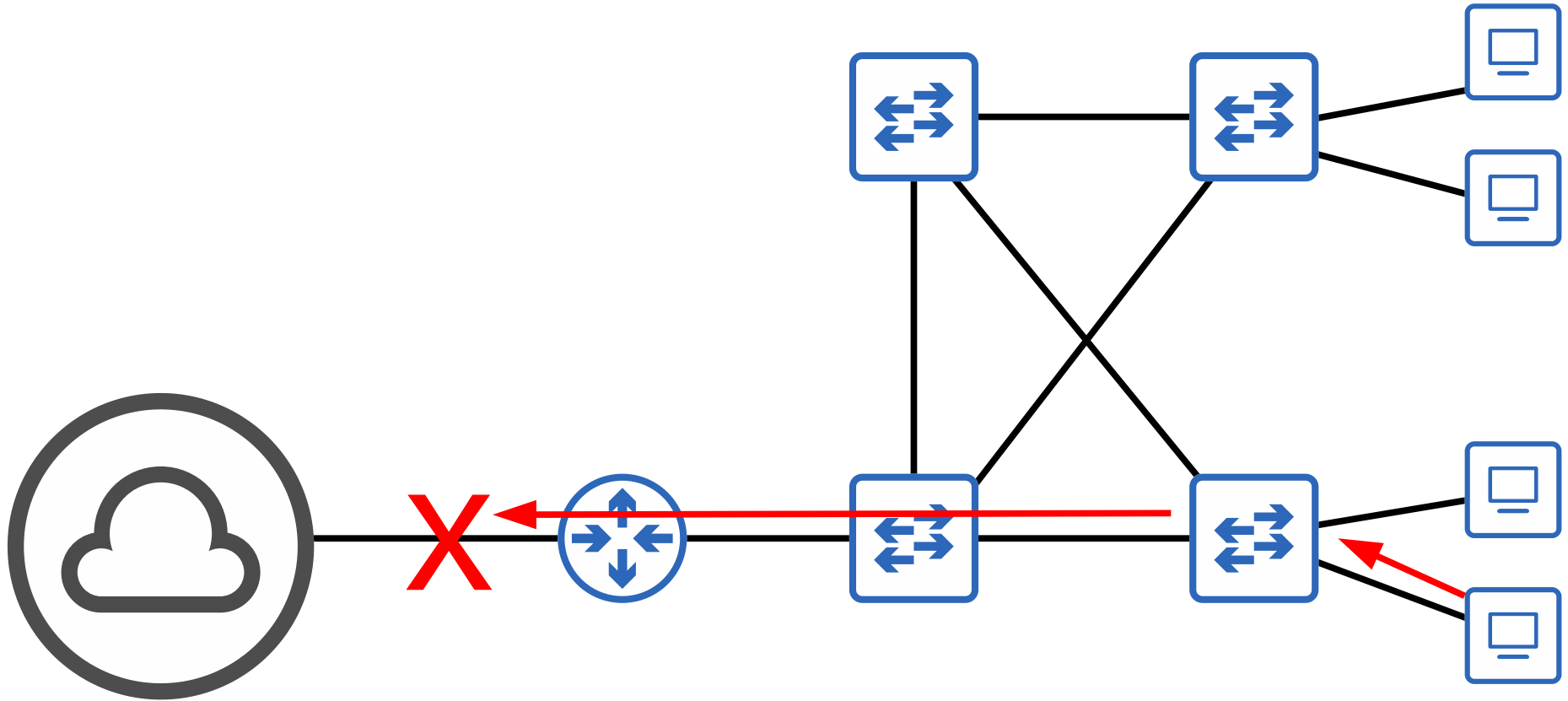
Things we'll cover

- The purpose of FHRPs
- HSRP (Hot Standby Router Protocol)
- VRRP (Virtual Router Redundancy Protocol)
- GLBP (Gateway Load Balancing Protocol)
- Basic HSRP Configuration

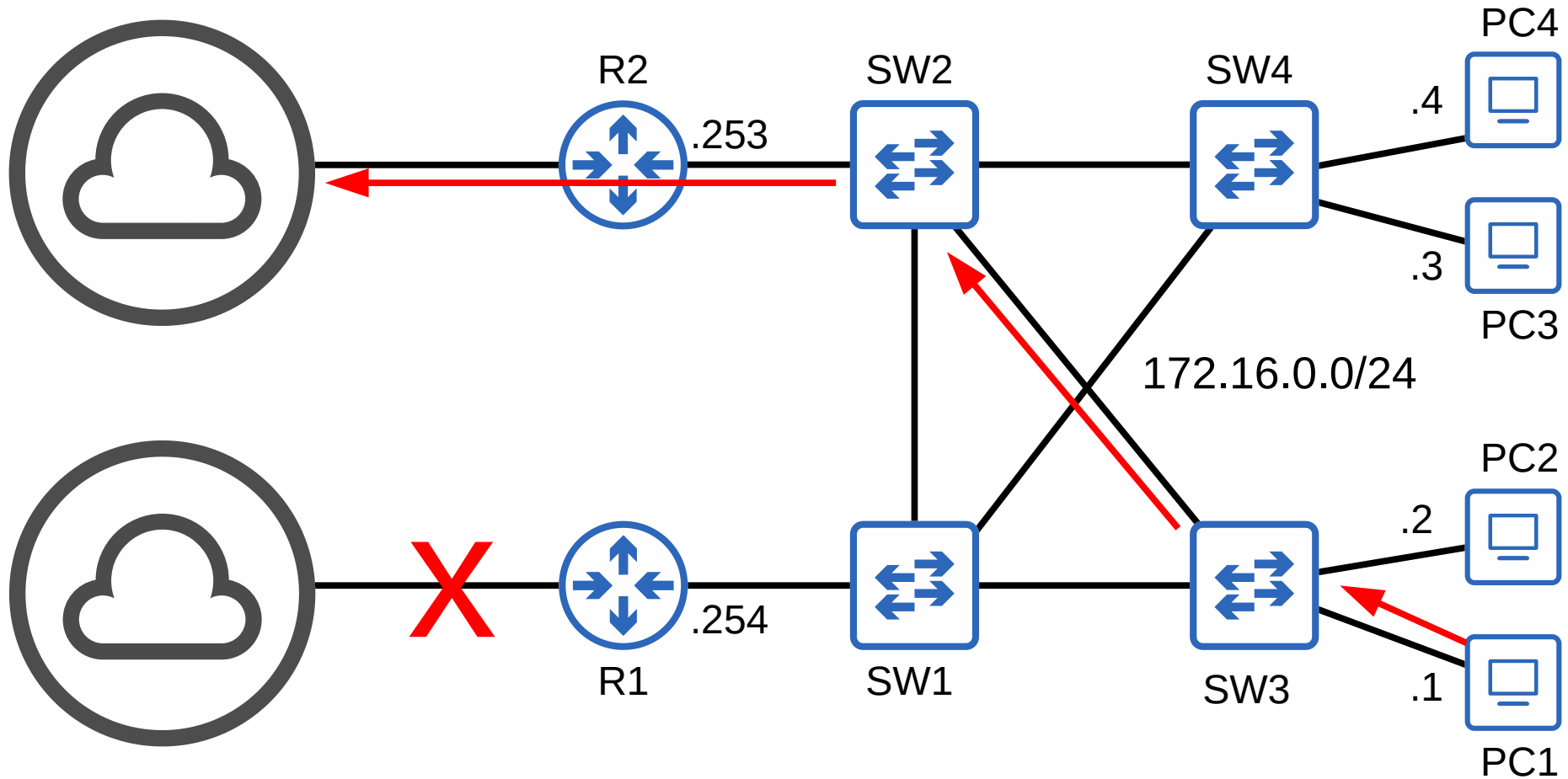
First Hop Redundancy Protocols



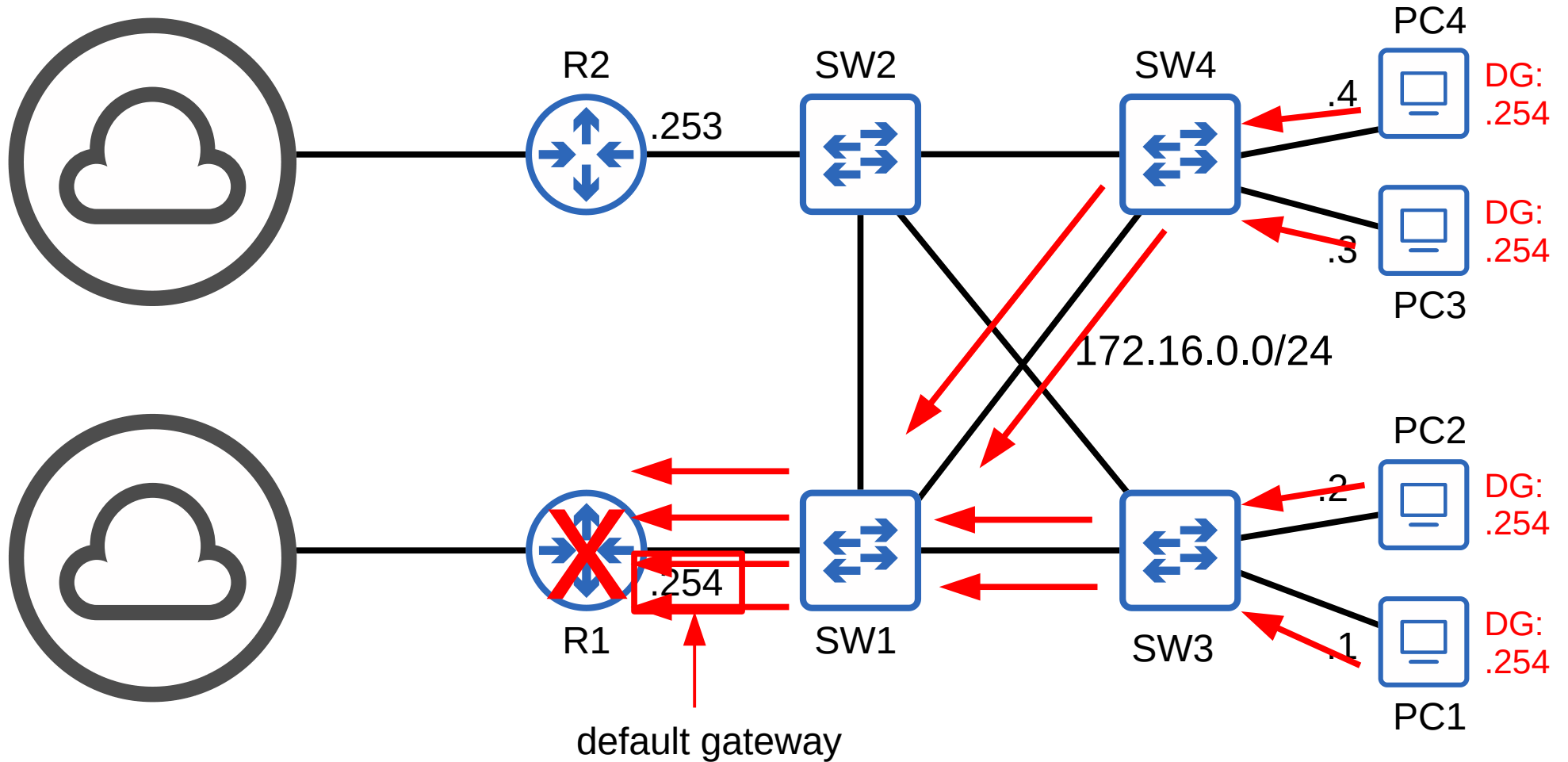
First Hop Redundancy Protocols



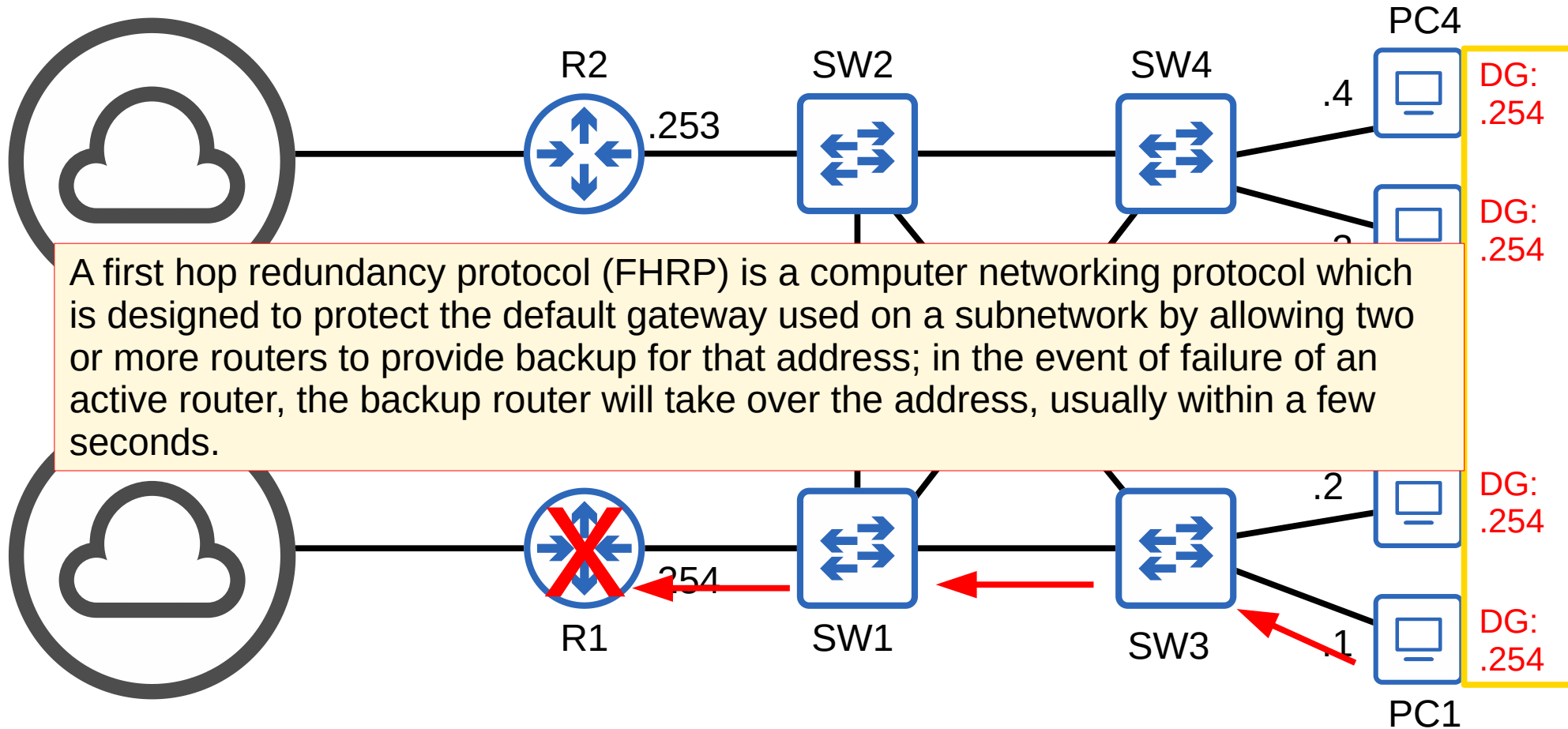
First Hop Redundancy Protocols



First Hop Redundancy Protocols

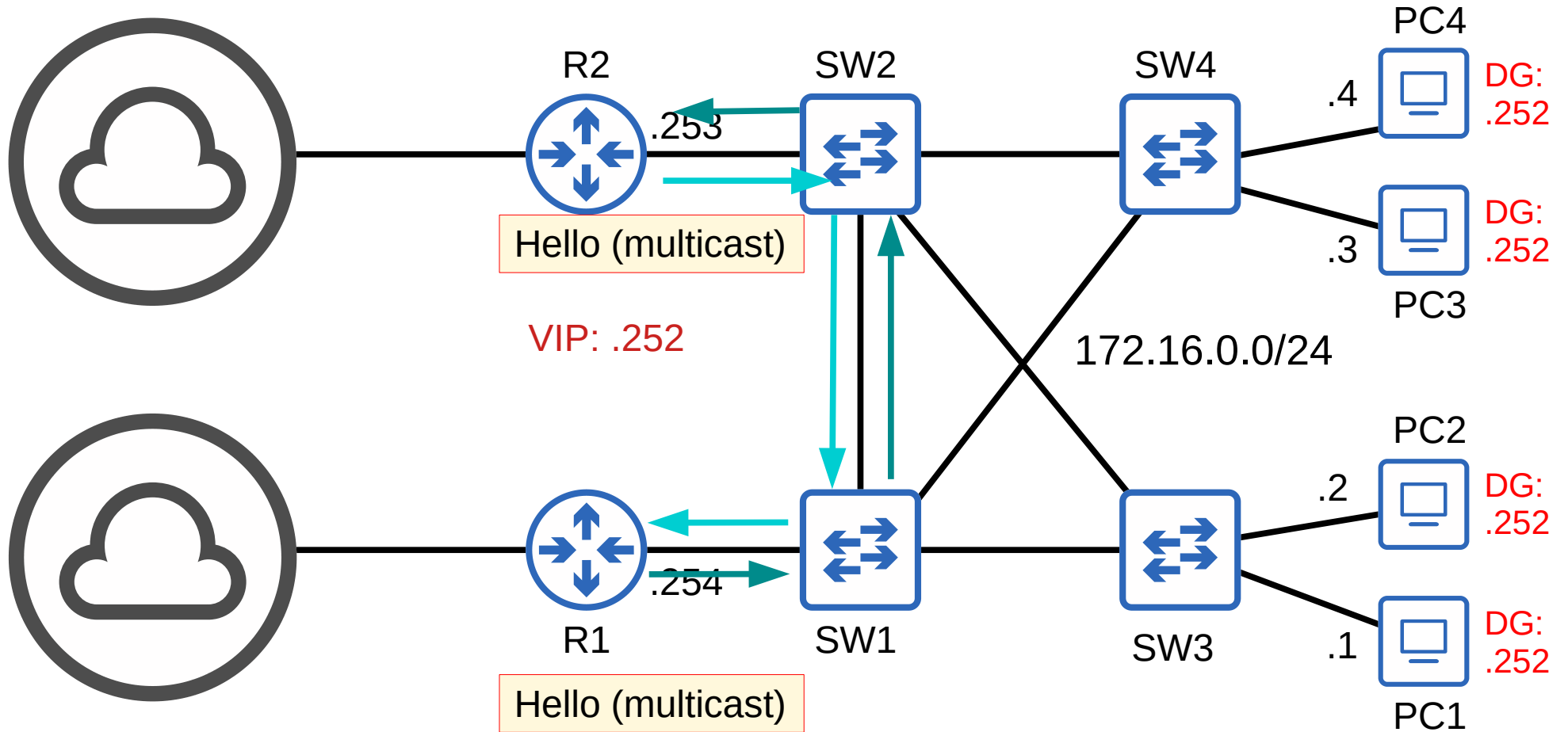


First Hop Redundancy Protocols

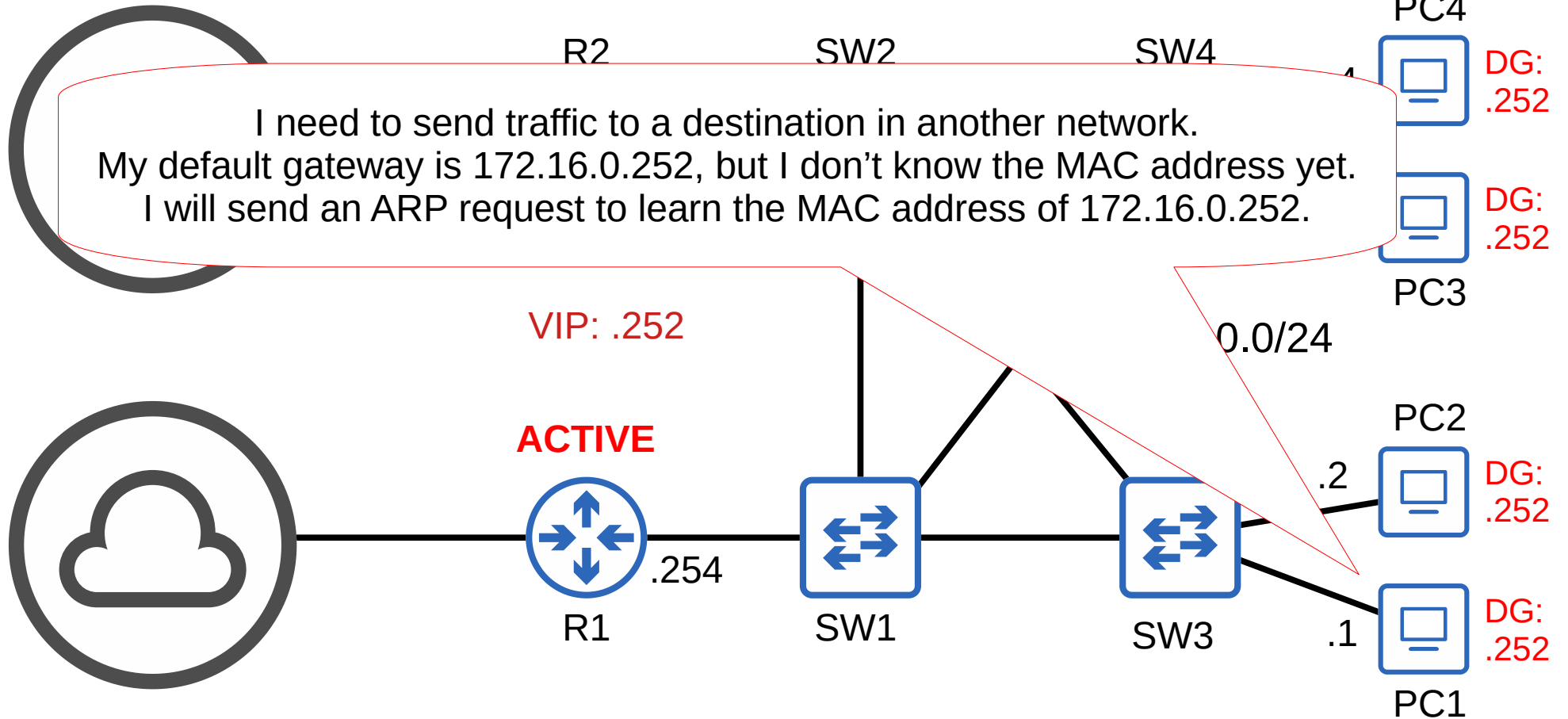


A first hop redundancy protocol (FHRP) is a computer networking protocol which is designed to protect the default gateway used on a subnetwork by allowing two or more routers to provide backup for that address; in the event of failure of an active router, the backup router will take over the address, usually within a few seconds.

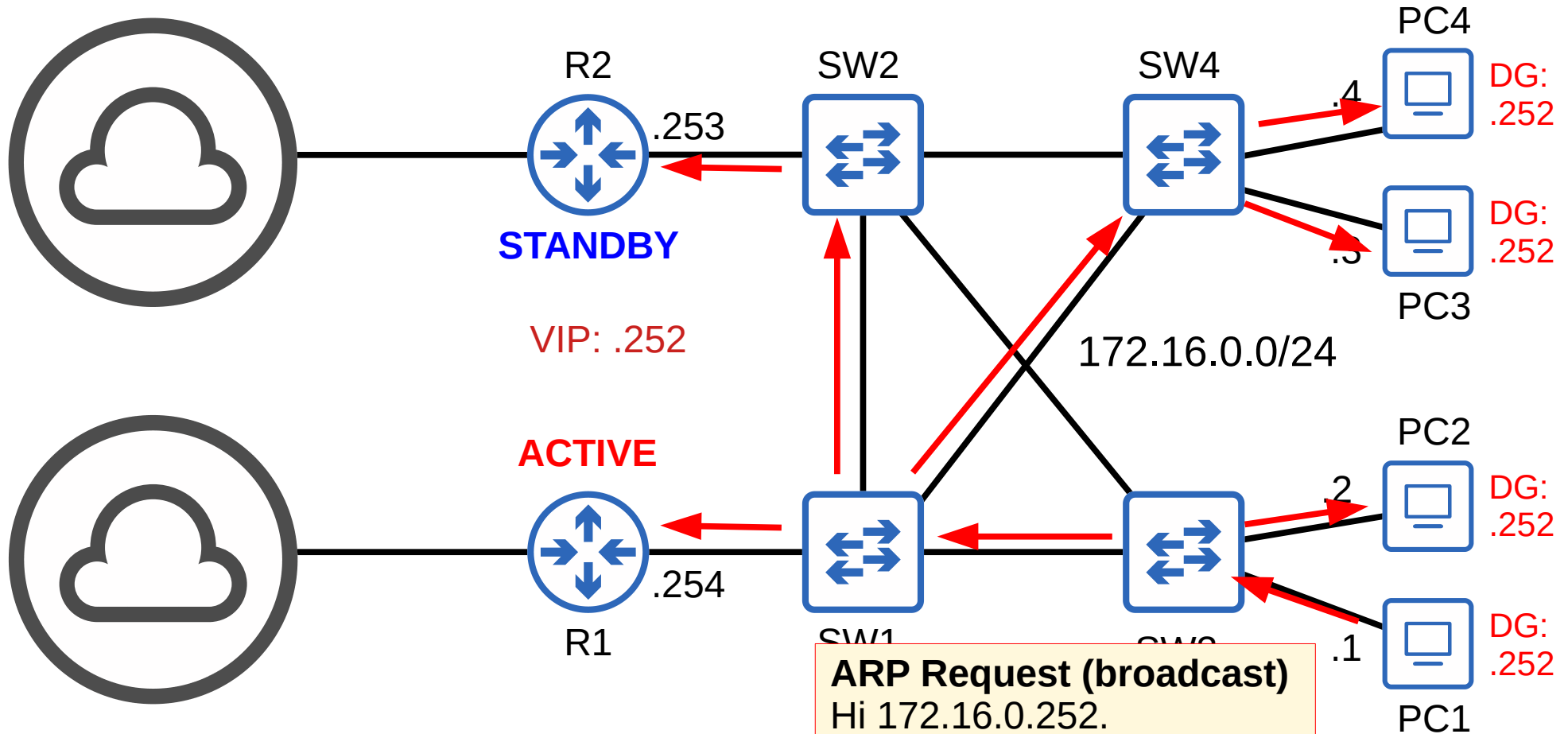
First Hop Redundancy Protocols



First Hop Redundancy Protocols

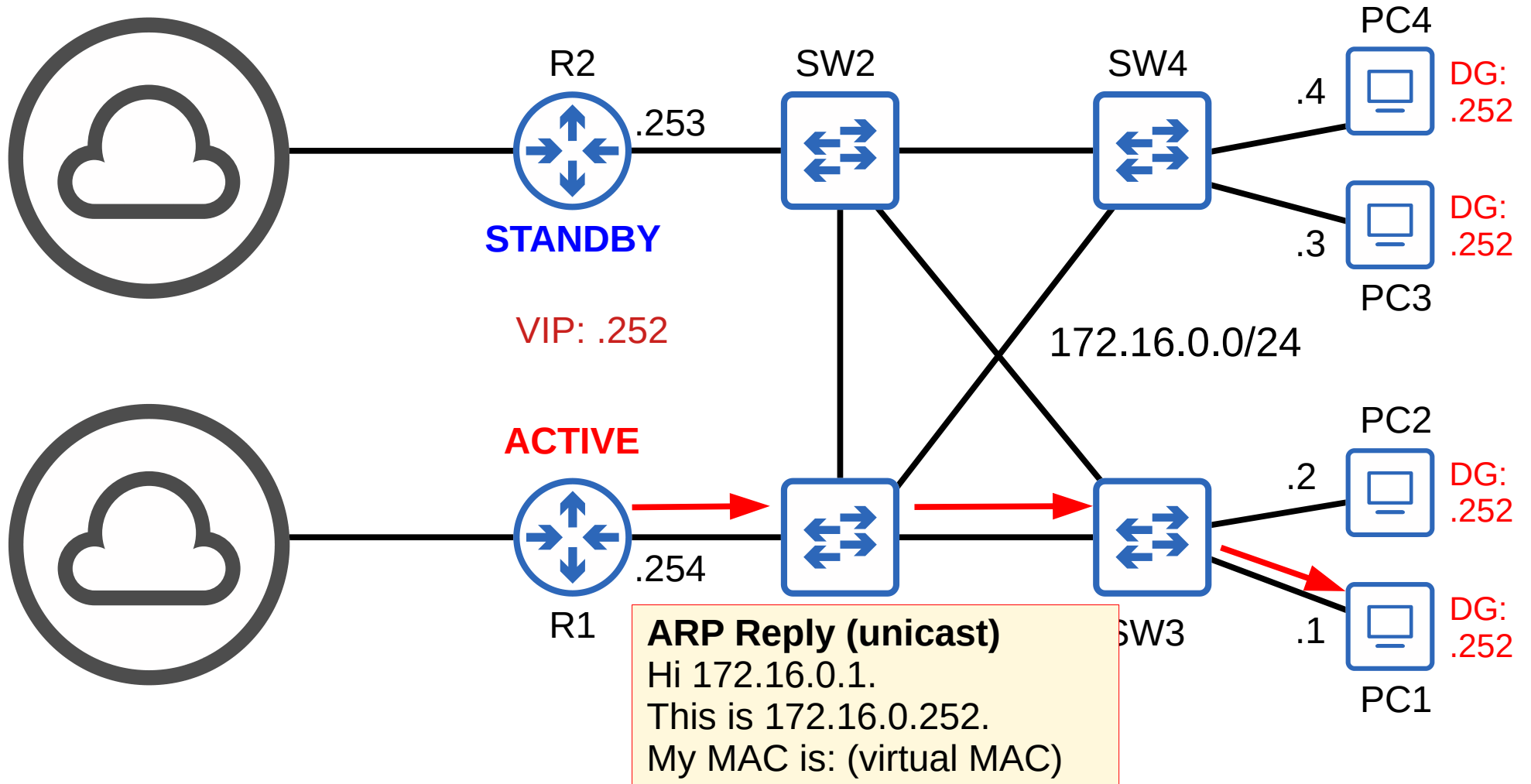


First Hop Redundancy Protocols

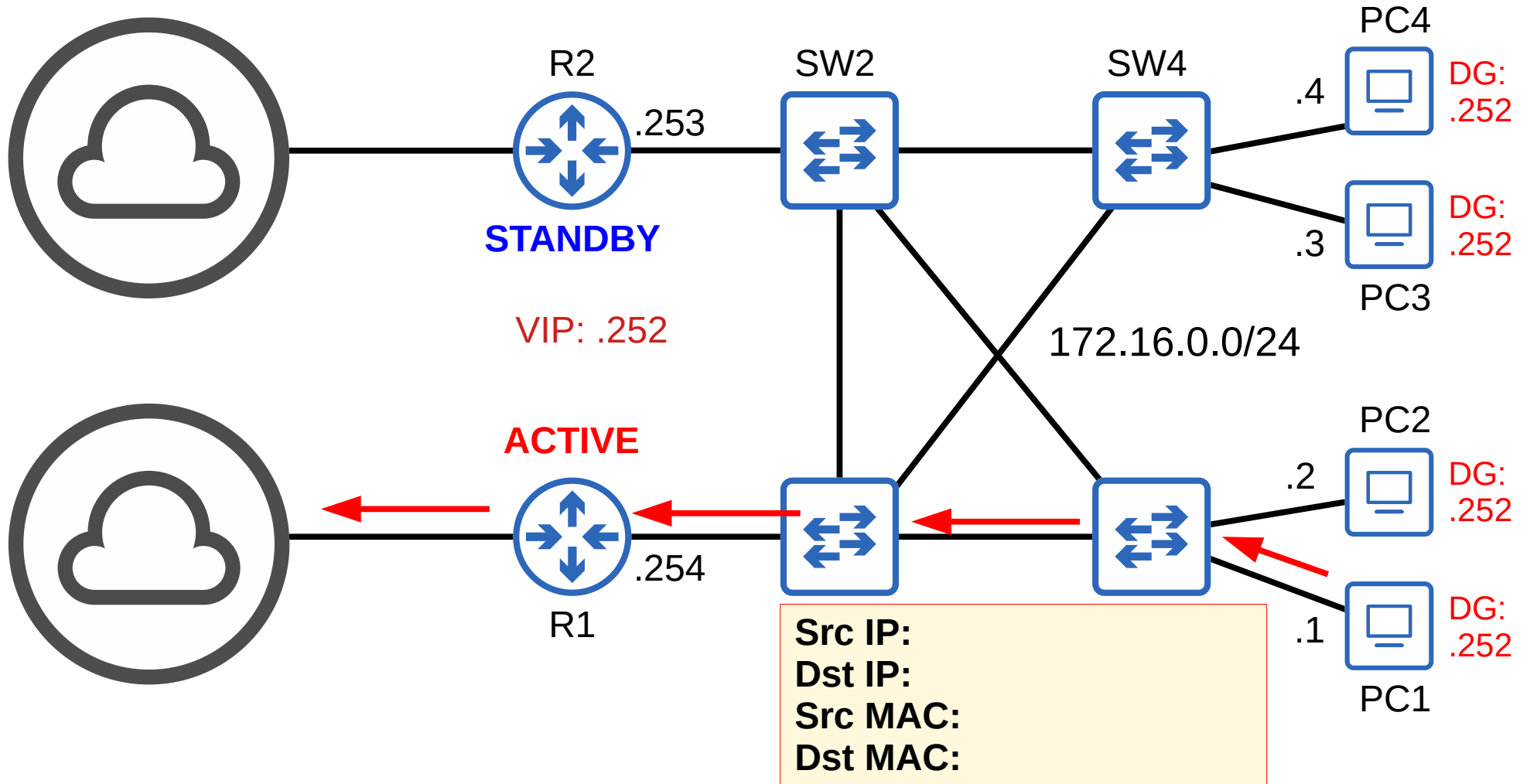


ARP Request (broadcast)
 Hi 172.16.0.252.
 This is 172.16.0.1.
 What's your MAC address?

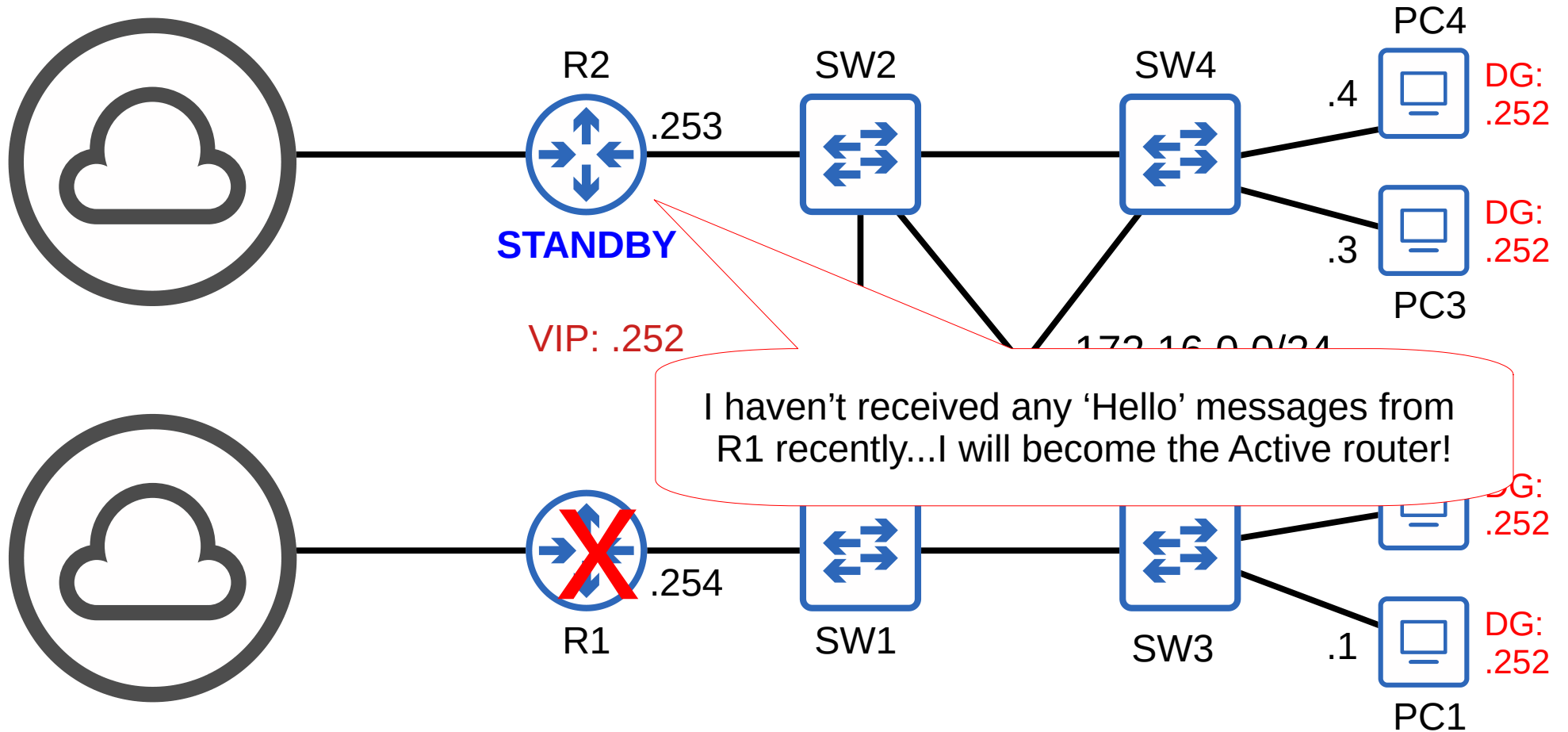
First Hop Redundancy Protocols



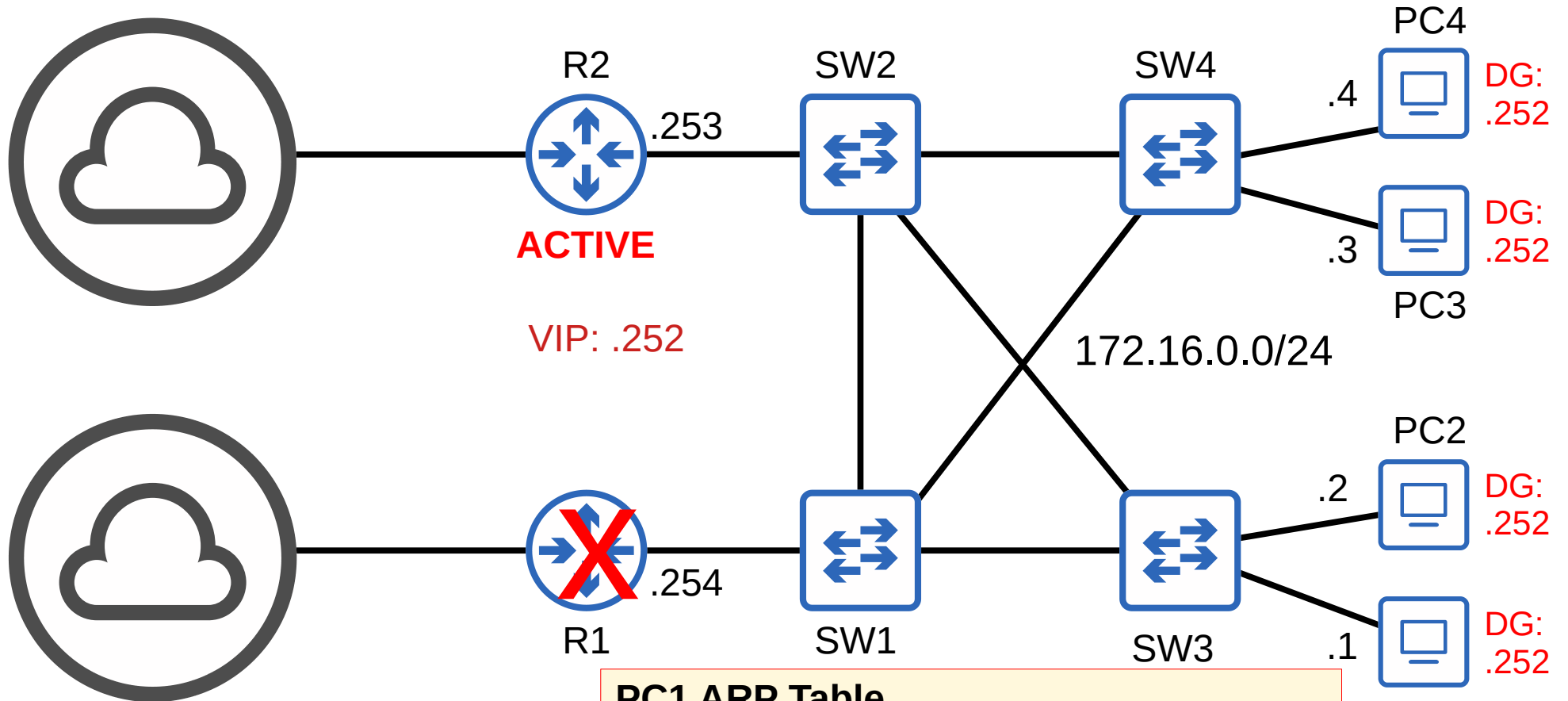
First Hop Redundancy Protocols



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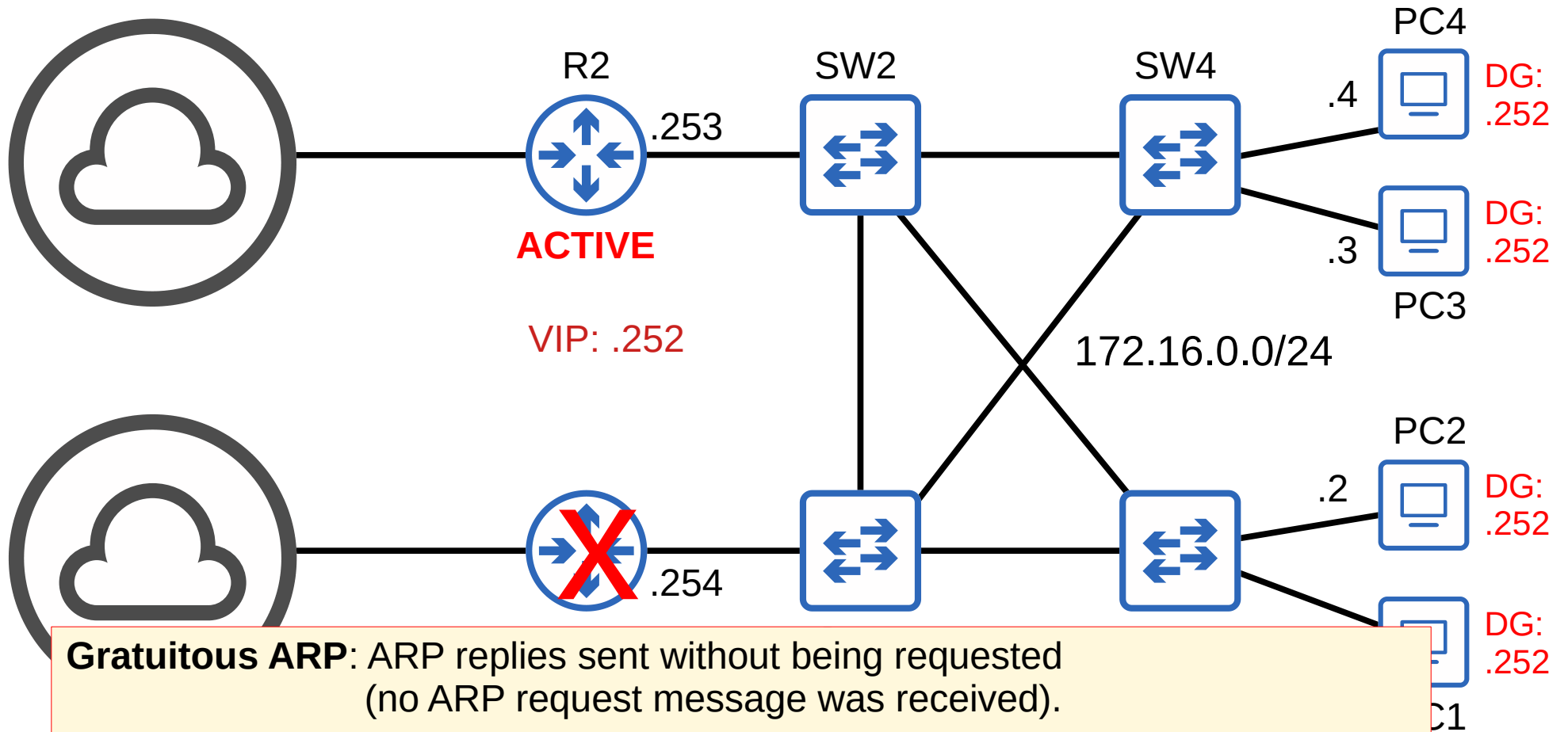


PC1 ARP Table

IP: 172.16.0.252 MAC: Virtual MAC

...

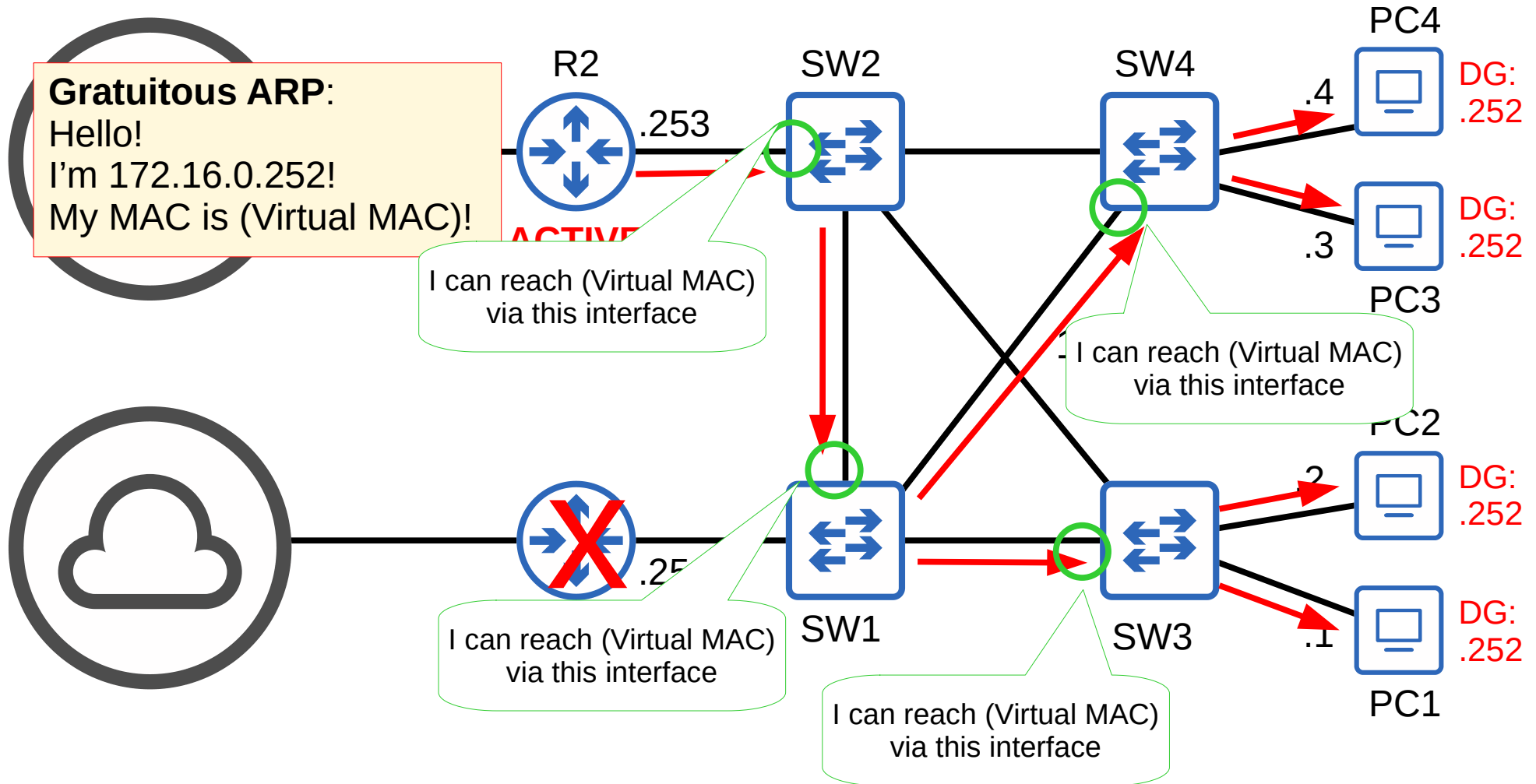
First Hop Redundancy Protocols



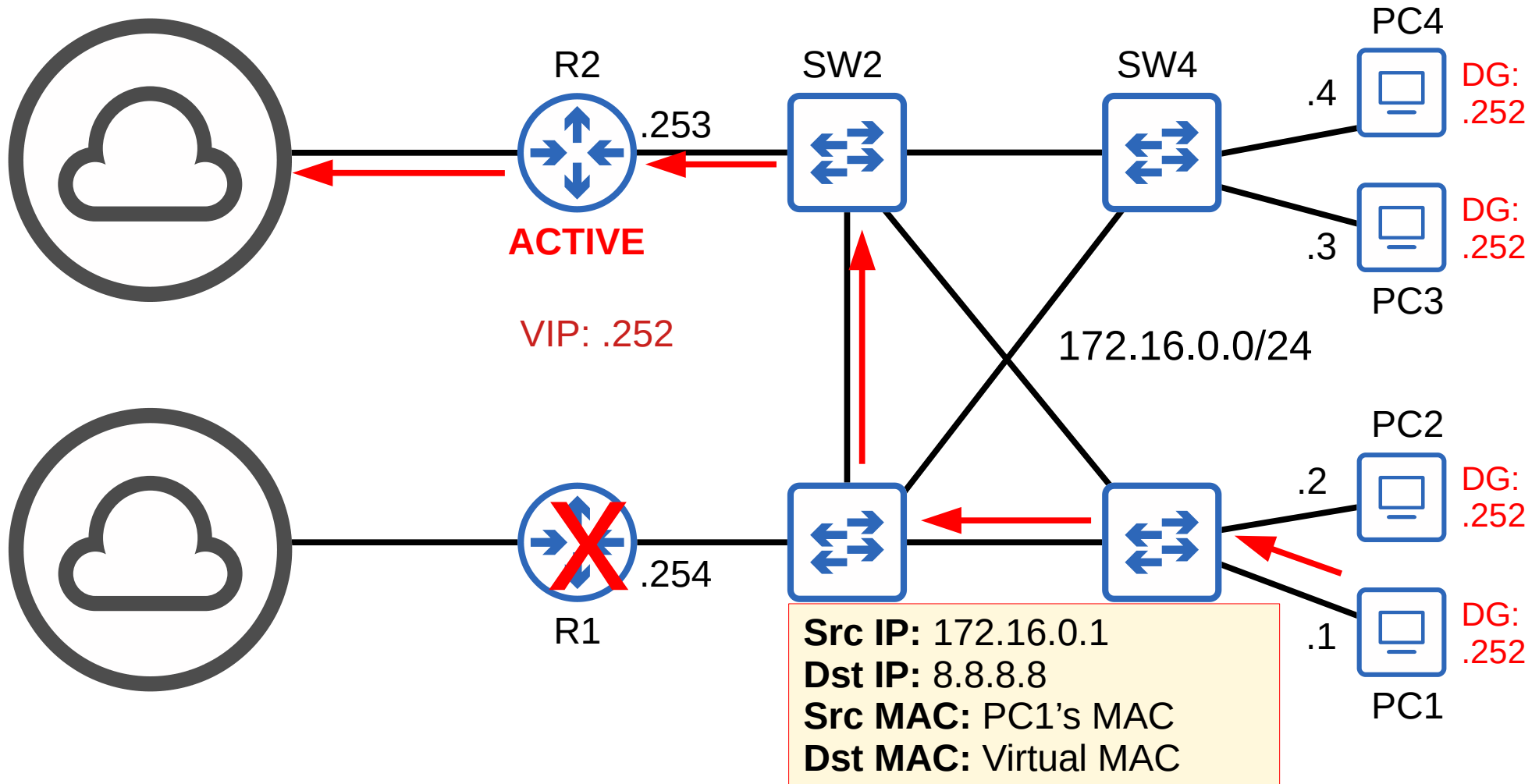
Gratuitous ARP: ARP replies sent without being requested (no ARP request message was received).

*the frames are broadcast to FFFF.FFFF.FFFF (normal ARP replies are unicast)

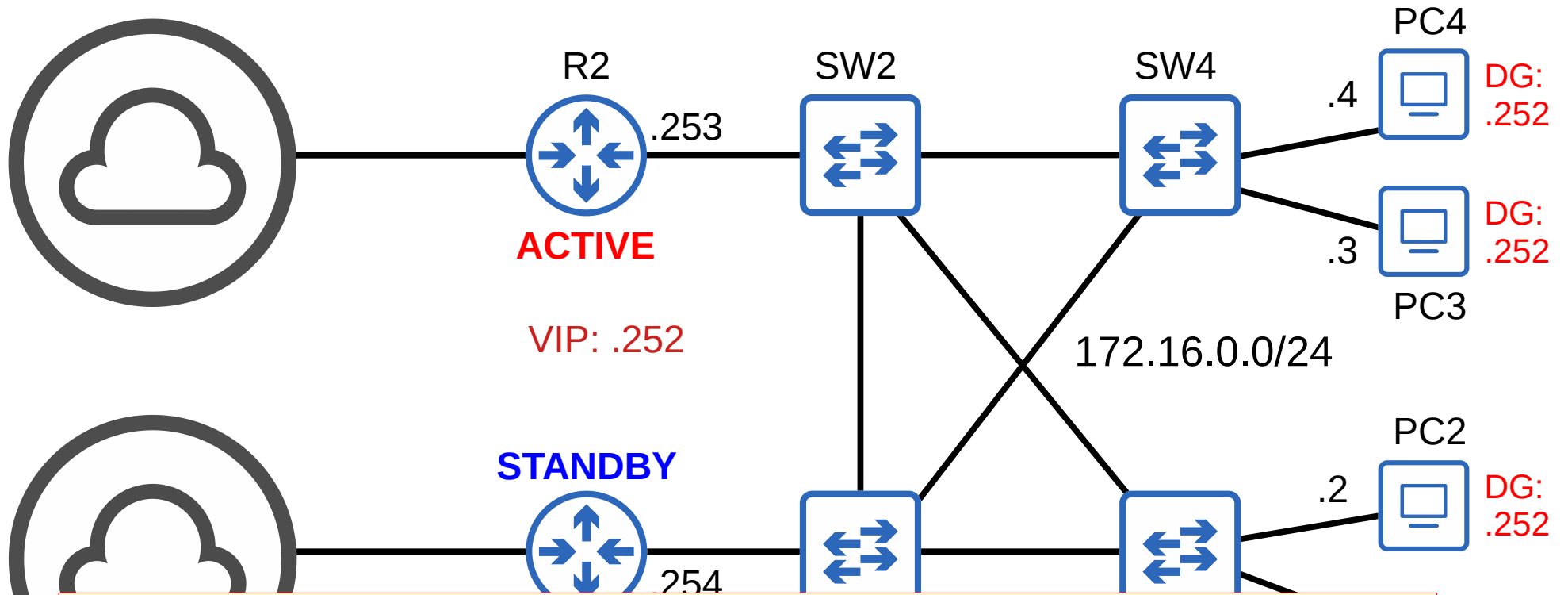
First Hop Redundancy Protocols



First Hop Redundancy Protocols



First Hop Redundancy Protocols



FHRPs are 'non-preemptive'. The current active router will not automatically give up its role, even if the former active router returns.

*you can change this setting to make R1 'preempt' R2 and take back its active role automatically

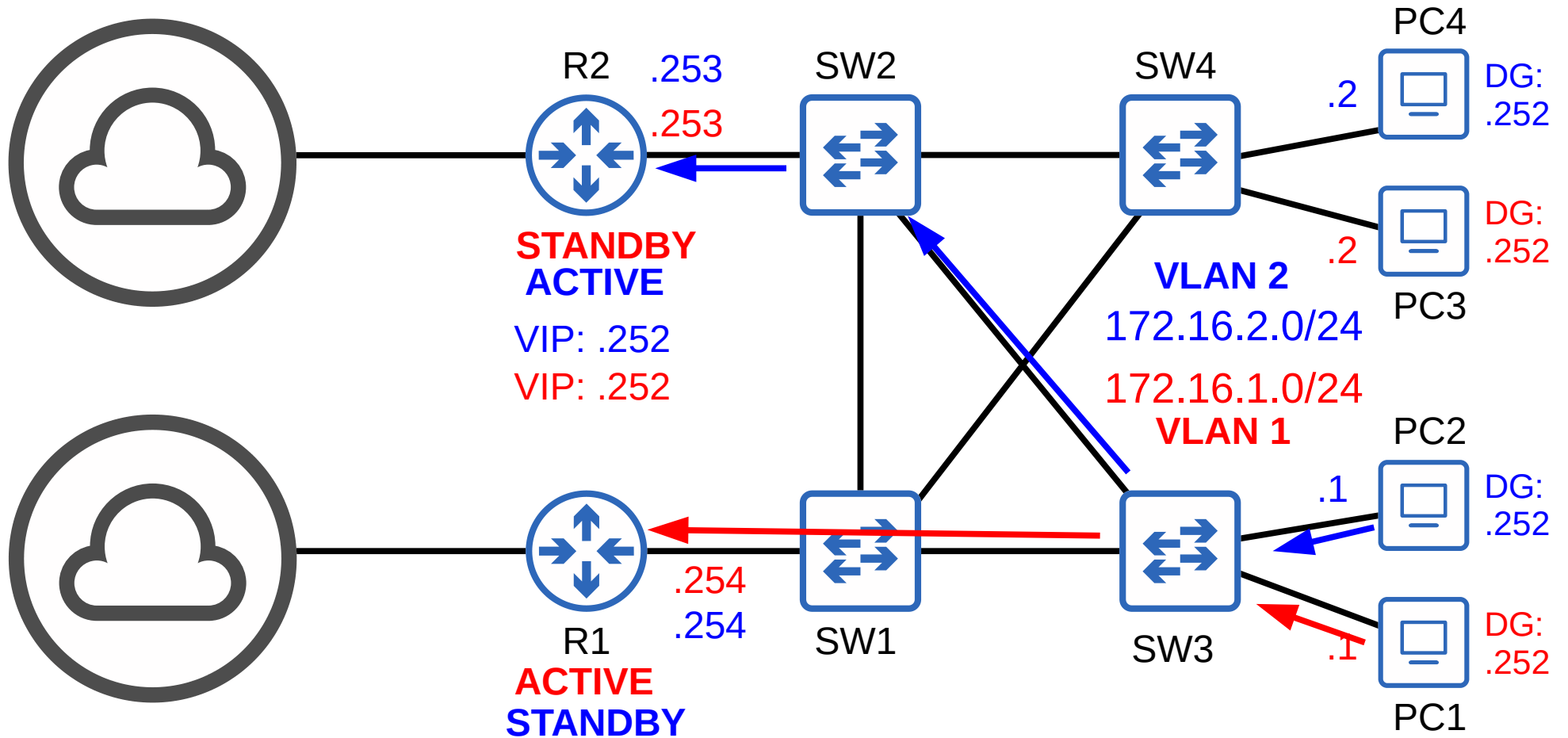
First Hop Redundancy Protocols

- A **virtual IP** is configured on the two routers, and a **virtual MAC** is generated for the virtual IP (each FHRP uses a different format for the virtual MAC)
- An **active** router and a **standby** router are elected. (different FHRPs use different terms)
- End hosts in the network are configured to use the virtual IP as their default gateway.
- The active router replies to ARP requests using the virtual MAC address, so traffic destined for other networks will be sent to it.
- If the active router fails, the standby becomes the next active router. The new active router will send **gratuitous ARP** messages so that switches will update their MAC address tables. It now functions as the default gateway.
- If the old active router comes back online, by default it won't take back its role as the active router. It will become the standby router.
- You can configure 'preemption', so that the old active router does take back its old role.

HSRP (Hot Standby Router Protocol)

- Cisco proprietary.
- An **active** and **standby** router are elected.
- There are two versions: **version 1** and **version 2**.
Version 2 adds IPv6 support and increases the number of *groups* that can be configured.
- Multicast IPv4 address: v1 = 224.0.0.2
v2 = 224.0.0.102
`0000.0c07.ac01`
- Virtual MAC address: v1 = 0000.0c07.acXX (XX = HSRP group number)
v2 = 0000.0c9f.fXXX (XXX = HSRP group number)
`0000.0c9f.f001`
- In a situation with multiple subnets/VLANs, you can configure a different active router in each subnet/VLAN to load balance.

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VRRP (Virtual Router Redundancy Protocol)

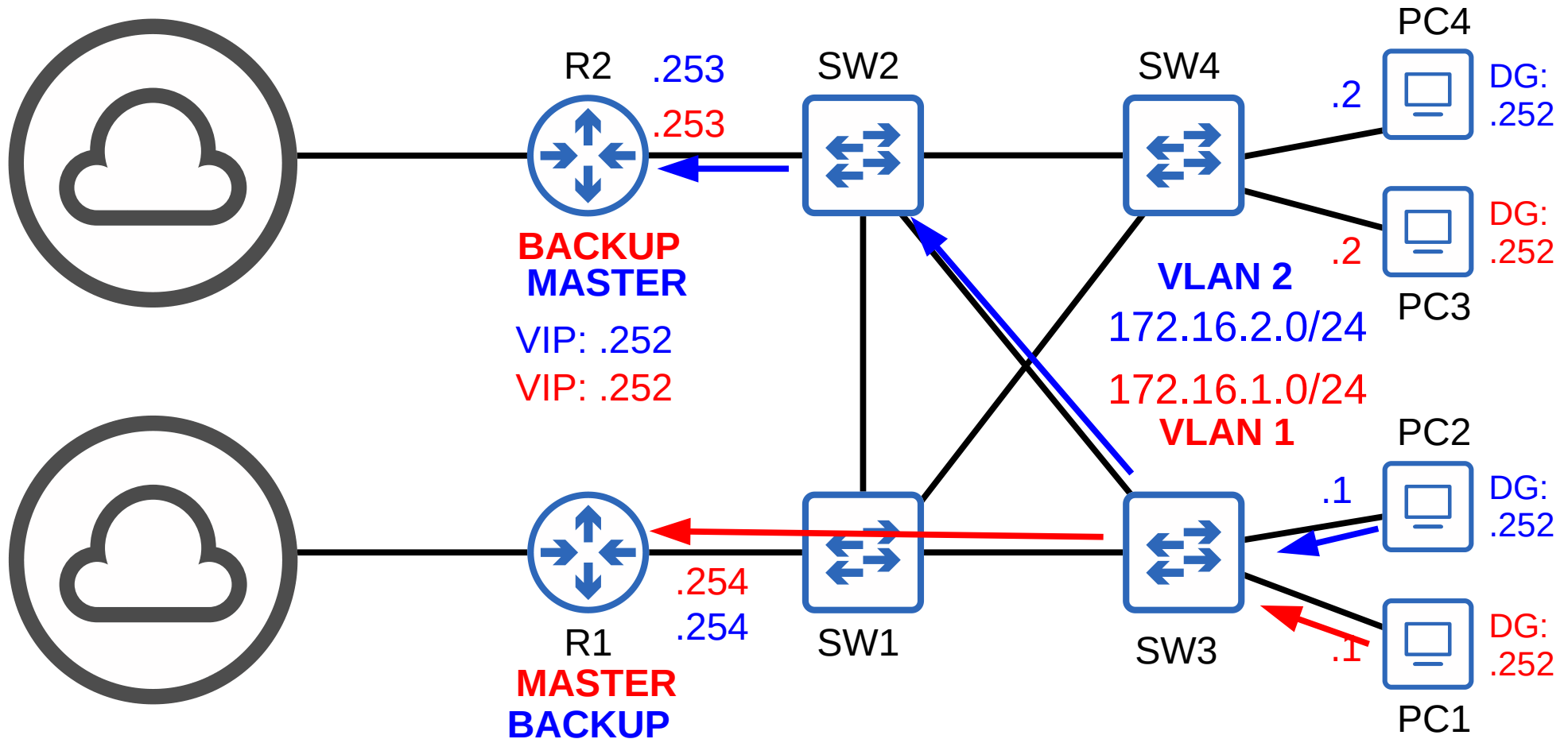
- Open standard
- A **master** and **backup** router are elected.
- Multicast IPv4 address: 224.0.0.18
- Virtual MAC address: 0000.5e00.01XX (XX = VRRP group number)

0000.5e00.01c8

(0xc8 = 200)

- In a situation with multiple subnets/VLANs, you can configure a different master router in each subnet/VLAN to load balance.

VRRP (Virtual Router Redundancy Protocol)



Comparing FHRPs

FHRP	Terminology	Multicast IP	Virtual MAC	Cisco proprietary?
HSRP	Active/Standby	v1: 224.0.0.2 v2: 224.0.0.102	v1: 0000.0c07.acXX v2: 0000.0c9f.fXXX	Yes
VRRP	Master/Backup	224.0.0.18	0000.5e00.01XX	No
GLBP				

GLBP (Gateway Load Balancing Protocol)

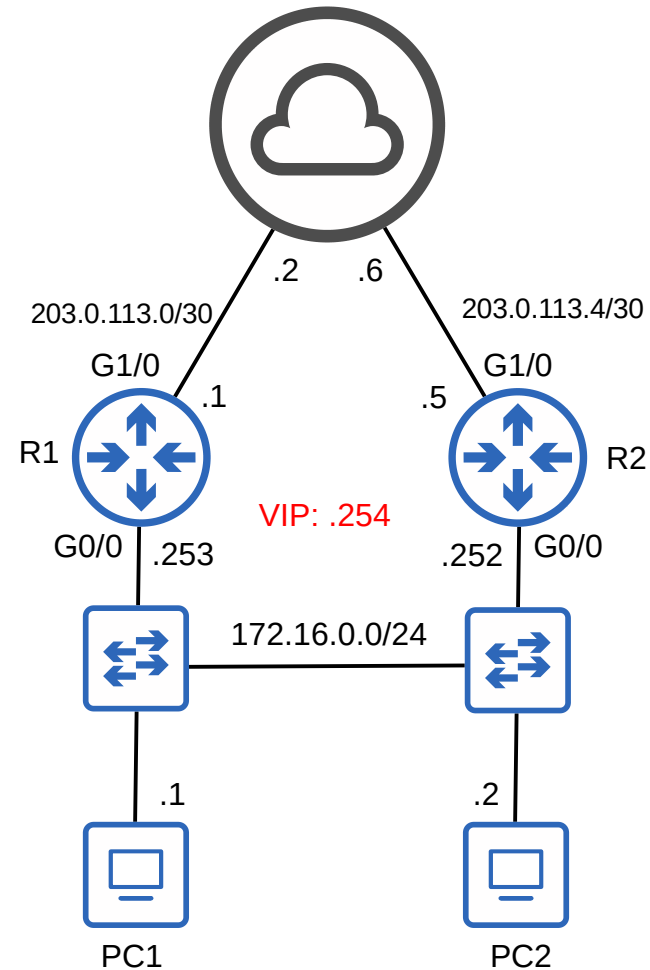
- Cisco proprietary
- Load balances among multiple routers within a single subnet
- An **AVG (Active Virtual Gateway)** is elected.
- Up to four **AVFs (Active Virtual Forwarders)** are assigned by the AVG (the AVG itself can be an AVF, too)
- Each AVF acts as the default gateway for a portion of the hosts in the subnet.
- Multicast IPv4 address: 224.0.0.102
- Virtual MAC address: 0007.b400.XXYY (XX = GLBP group number, YY = AVF number)

0007.b400.0101

Comparing FHRPs

FHRP	Terminology	Multicast IP	Virtual MAC	Cisco proprietary?
HSRP	Active/Standby	v1: 224.0.0.2 v2: 224.0.0.102	v1: 0000.0c07.acXX v2: 0000.0c9f.fXXX	Yes
VRRP	Master/Backup	224.0.0.18	0000.5e00.01XX	No
GLBP	AVG / AVF	224.0.0.102	0007.b400.XXYY	Yes

Configuring HSRP

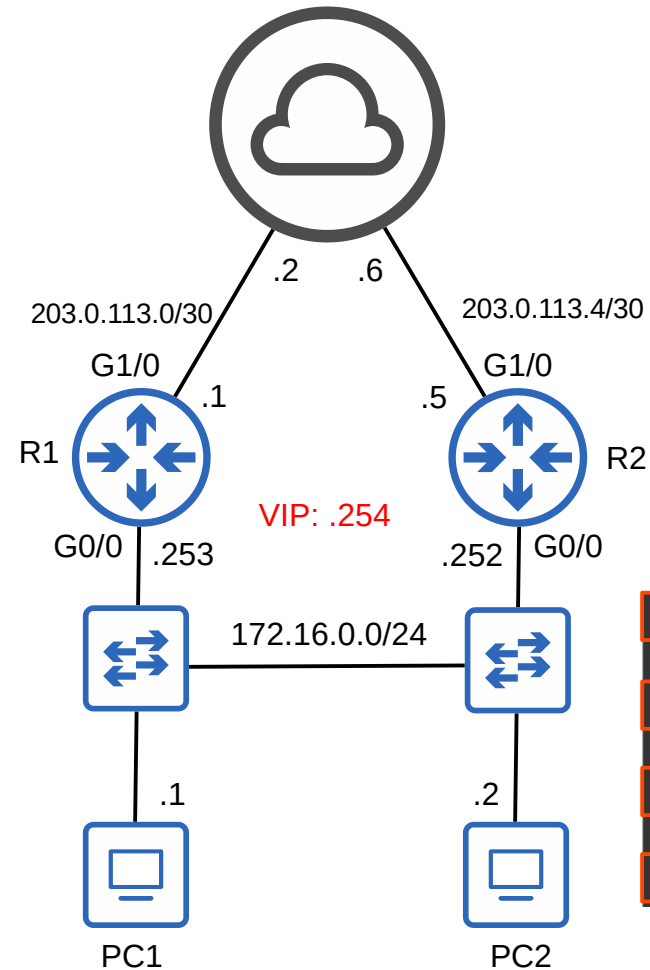


```
R1(config)#interface g0/0
R1(config-if)#standby ?
<0-255>      group number
authentication Authentication
bfd          Enable HSRP BFD
h1          HSRP initial delay t1
```

```
R1(config-if)#standby version 2
R1(config-if)#standby ?
<0-4095>    group number
authentication Authentication
bfd          Enable HSRP BFD
```

```
R1(config-if)#standby 1 ?
authentication Authentication
follow      Name of HSRP group to follow
ip          Enable HSRP IPv4 and set the virtual IP address
ipv6       Enable HSRP IPv6
mac-address Virtual MAC address
name        Redundancy name string
preempt     Overthrow lower priority Active routers
priority    Priority level
timers      Hello and hold timers
track       Priority tracking
```

Configuring HSRP



```
R1(config-if)#standby 1 ip 172.16.0.254
R1(config-if)#
R1(config-if)#standby 1 priority ?
<0-255> Priority value
R1(config-if)#standby 1 priority 200
R1(config-if)#
R1(config-if)#standby 1 preempt
R1(config-if)#
```

Only necessary on the router
you want to become active

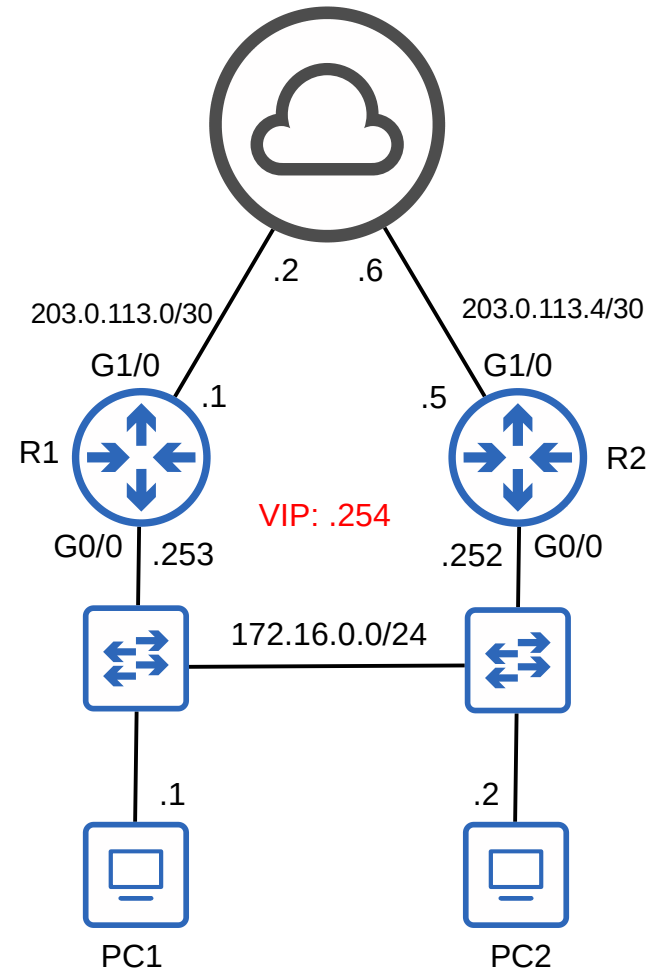
```
R2(config-if)#standby version 2
R2(config-if)#
R2(config-if)#standby 1 ip 172.16.0.254
R2(config-if)#
R2(config-if)#standby 1 priority 50
R2(config-if)#
R2(config-if)#standby 1 preempt
```

The **active router** is determined in this order:
1 – Highest priority
(default 100)
2 – Highest IP address

Preempt causes the router to take the role of active router, even if another router already has the role.

HSRP version 1 and version 2 are not compatible. If R1 uses version 2, R2 must use version 2 also.

Configuring HSRP



```
R1#show standby
GigabitEthernet0/0 - Group 1 (version 2)
  State is Active
    2 state changes, last state change 00:16:30
  Virtual IP address is 172.16.0.254
  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 1.536 secs
  Preemption enabled
  Active router is local
  Standby router is 172.16.0.252, priority 50 (expires in 9.280 sec)
  Priority 200 (configured 200)
  Group name is "hsrp-Gi0/0-1" (default)
R1#
```

```
R2#show standby
GigabitEthernet0/0 - Group 1 (version 2)
  State is Standby
    1 state change, last state change 00:17:05
  Virtual IP address is 172.16.0.254
  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 1.472 secs
  Preemption enabled
  Active router is 172.16.0.253, priority 200 (expires in 10.160 sec)
    MAC address is 0c9f.6041.8800
  Standby router is local
  Priority 50 (configured 50)
  Group name is "hsrp-Gi0/0-1" (default)
R2#
```

- The purpose of FHRPs
- HSRP (Hot Standby Router Protocol)
- VRRP (Virtual Router Redundancy Protocol)
- GLBP (Gateway Load Balancing Protocol)
- Basic HSRP Configuration

```
R1(config-if)# standby version 2
R1(config-if)# standby group-number ip virtual-ip
R1(config-if)# standby group-number priority priority
R1(config-if)# standby group-number preempt
```

Which of the following is an HSRP version 1 virtual MAC address?

a) 0000.0c9f.fa01

b) 0000.0c07.0101

c) 0000.0c9f.f001

d) 0000.0c07.acab $0xAB = 171$

HSRP v1 virtual MAC format: 0000.0c07.ac**XX**

Which of the following is a VRRP virtual MAC address?

a) 0000.5e00.010a $0x0A = 10$

b) 0007.b400.0101

c) 0000.0c9f.ffff

d) 0001.5e00.5e01

VRRP virtual MAC format: 0000.5e00.01**XX**

Which of the following are valid VRRP router roles? (select two)

- a) active
- b) backup
- c) active virtual gateway
- d) master
- e) standby
- f) active virtual forwarder

When the HSRP standby router becomes the new active router, what kind of messages does it send? (select the best answer)

- a) HSRP Hello
- b) Gratuitous ARP
- c) ARP Request
- d) ARP Reply

Which of the following statements accurately describes HSRP? (select the best answer)

- a) It allows you to configure a different default gateway address on each end host.
- b) It allows multiple routers to load-balance traffic for hosts in a subnet.
- c) It provides a redundant default gateway address for hosts in a subnet.
- d) Each router selects a unique virtual IP and MAC address.