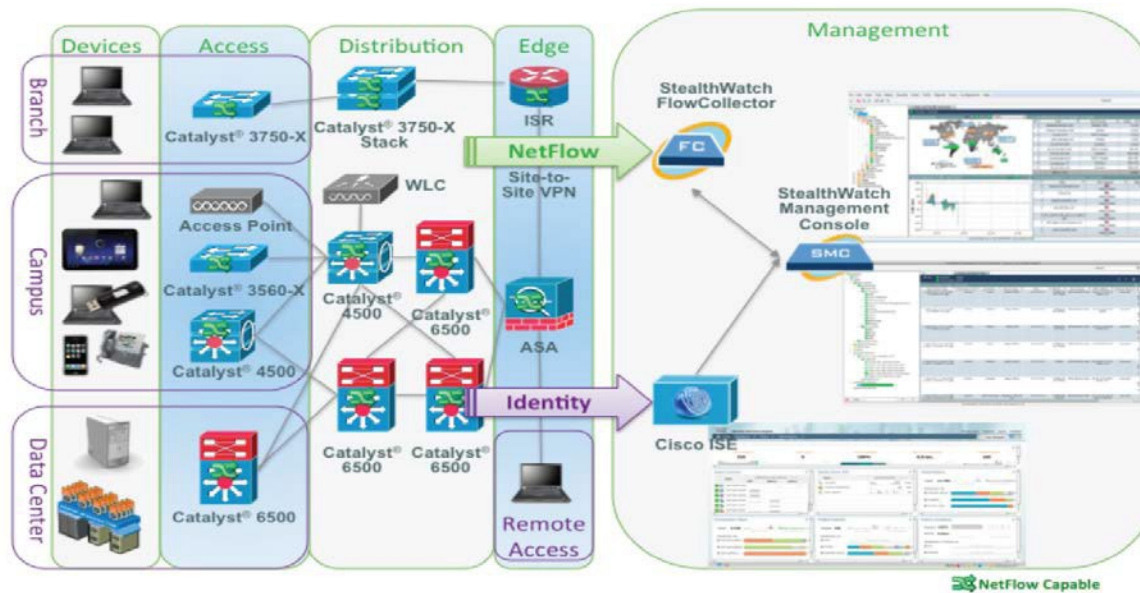


CIS 3250

Redundant First Hop Routers

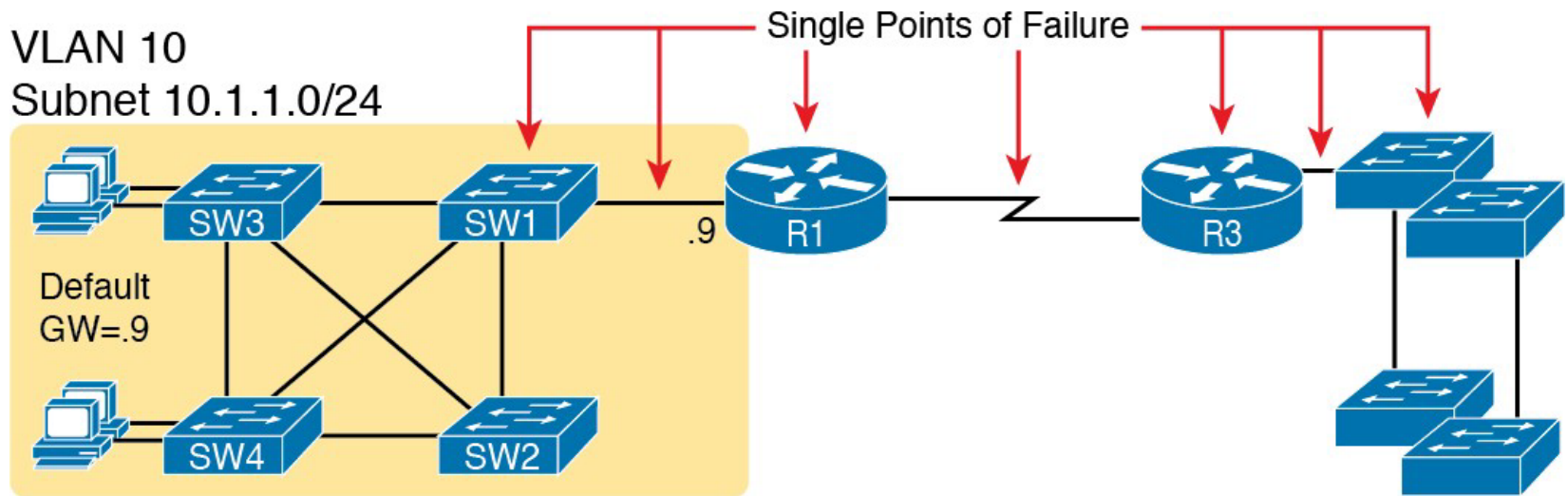


FHRP Concepts

- When two or more routers connect to the same LAN subnet, all those routers could be used as the default router for the hosts in the subnet.
- The term First Hop Redundancy Protocol (FHRP) refers to a category of protocols that can be used so that the hosts can take advantage of redundant routers in a subnet.

Need for Redundancy

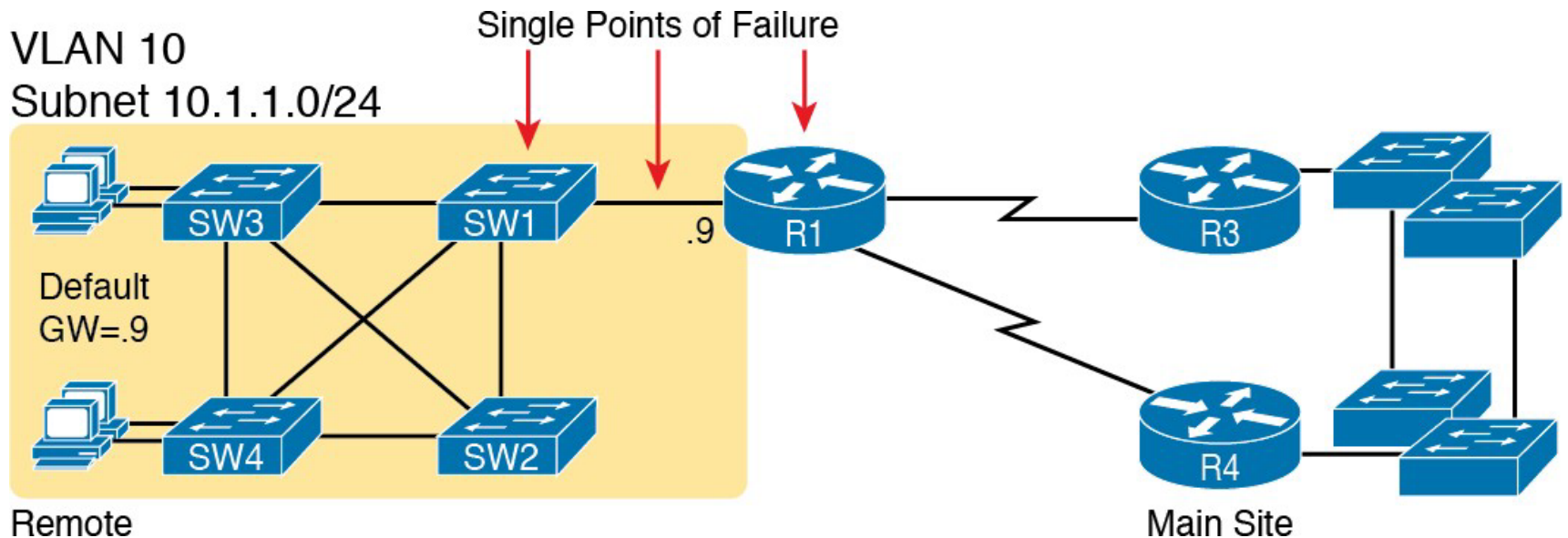
- Networks need redundant links to improve the availability of the network.



R1 and the One WAN Link as Single Points of Failure

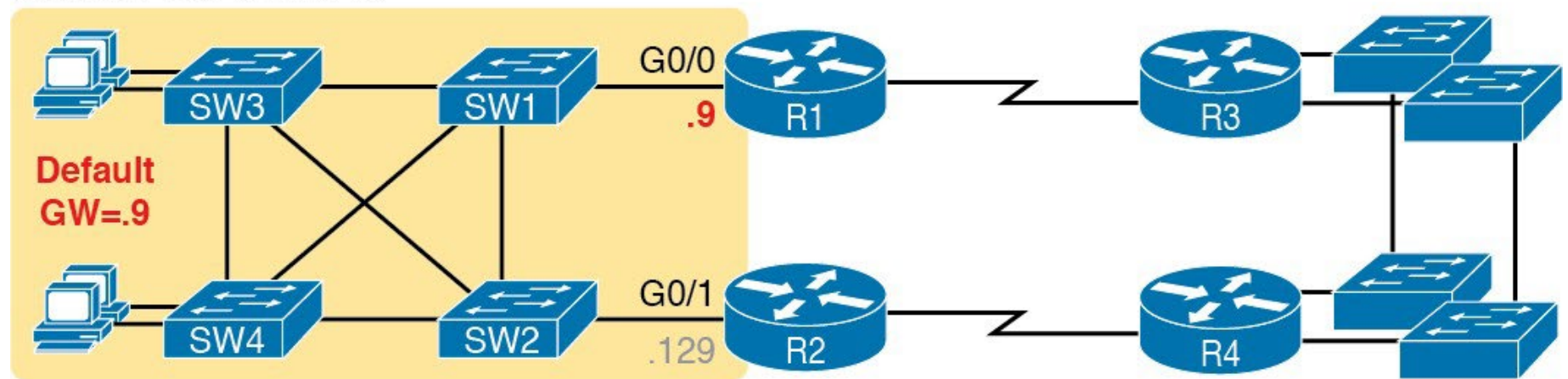
Improving Availability

- To improve availability, the network engineer first looks at a design to identify points where redundant options may be added.



Higher Availability, but with R1 Still as a Single Point of Failure

VLAN 10
Subnet 10.1.1.0/24



Removing All Single Points of Failure from the Network Design

FHRP

Generically, each FHRP makes the following happen:

1. All hosts act like they always have, with one default router setting that never has to change
2. The default routers share a virtual IP address in the subnet, defined by the FHRP
3. Hosts use the FHRP virtual IP address as their default router address
4. The routers exchange FHRP protocol messages, so both agree at any given moment which router does what work.
5. When a router fails or has some other problem, the routers use the FHRP to choose which router takes over responsibilities

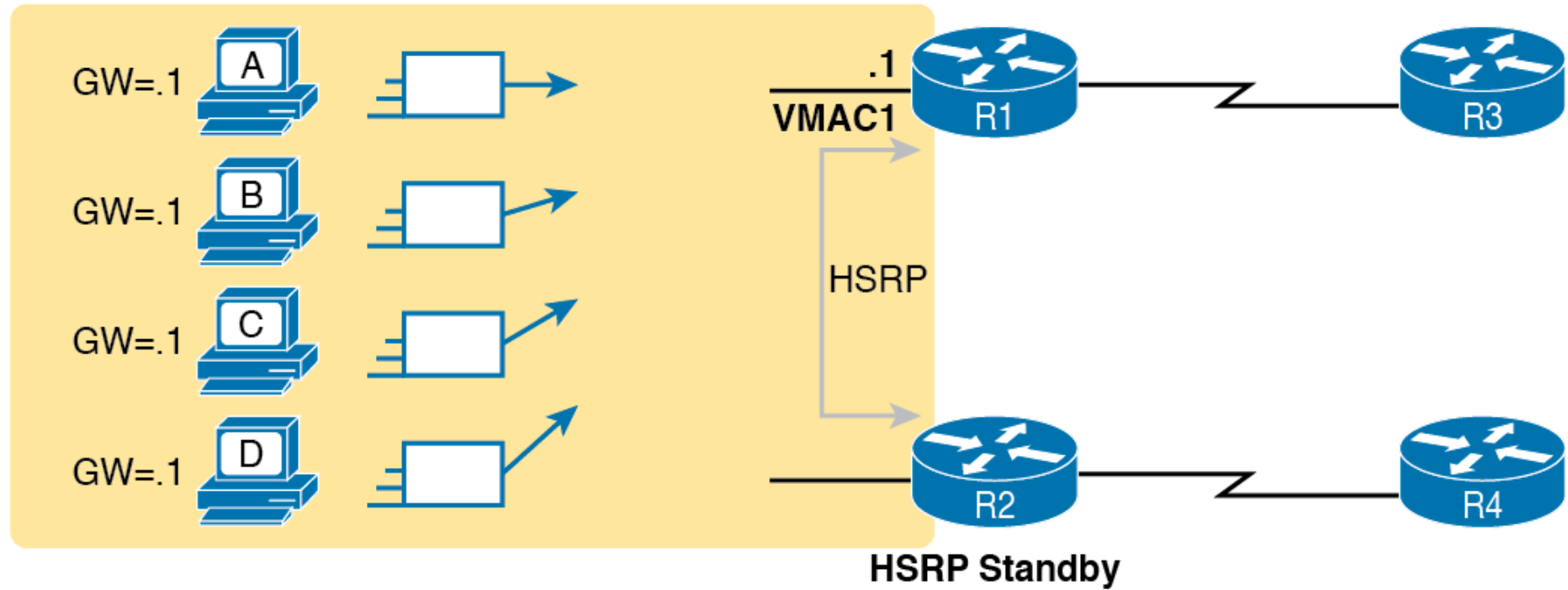
Three Solutions for First-Hop Redundancy

Acronym	Full Name	Origin	Redundancy Approach	Load Balancing
HSRP	Hot Standby Router Protocol	Cisco	Active/Standby	Per Subnet
VRRP	Virtual Router Redundancy Protocol	IETF (RFC 5798)	Active/Standby	Per Subnet
GLBP	Gateway Load Balancing Protocol	Cisco	Active/Active	Per Host

HSRP Concepts

- Operates with an active/standby model
- Allows two or more routers to cooperate
- Only one router actively supports the user traffic
- Implements a virtual IP address and matching virtual MAC address
- Virtual IP address must be configured and in the same subnet as the interface
- Hosts refer to the virtual IP address as their default router address

Subnet 10.1.1.0/24



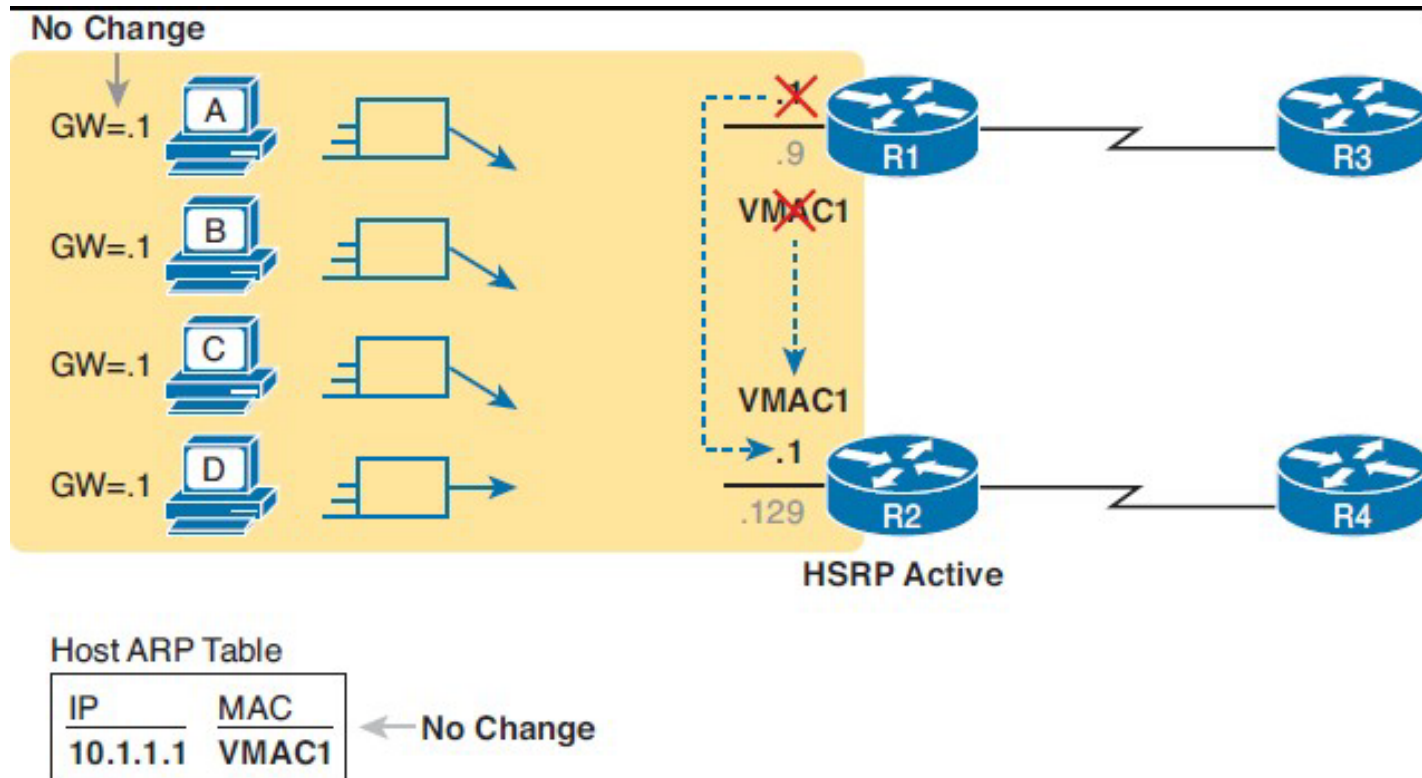
Host ARP Table

IP	MAC
10.1.1.1	VMAC1

All Traffic Goes to .1 (R1, Which is Active); R2 is Standby

HSRP Failover

The routers send HSRP messages to negotiate and decide which router should currently be active, and which should be on standby

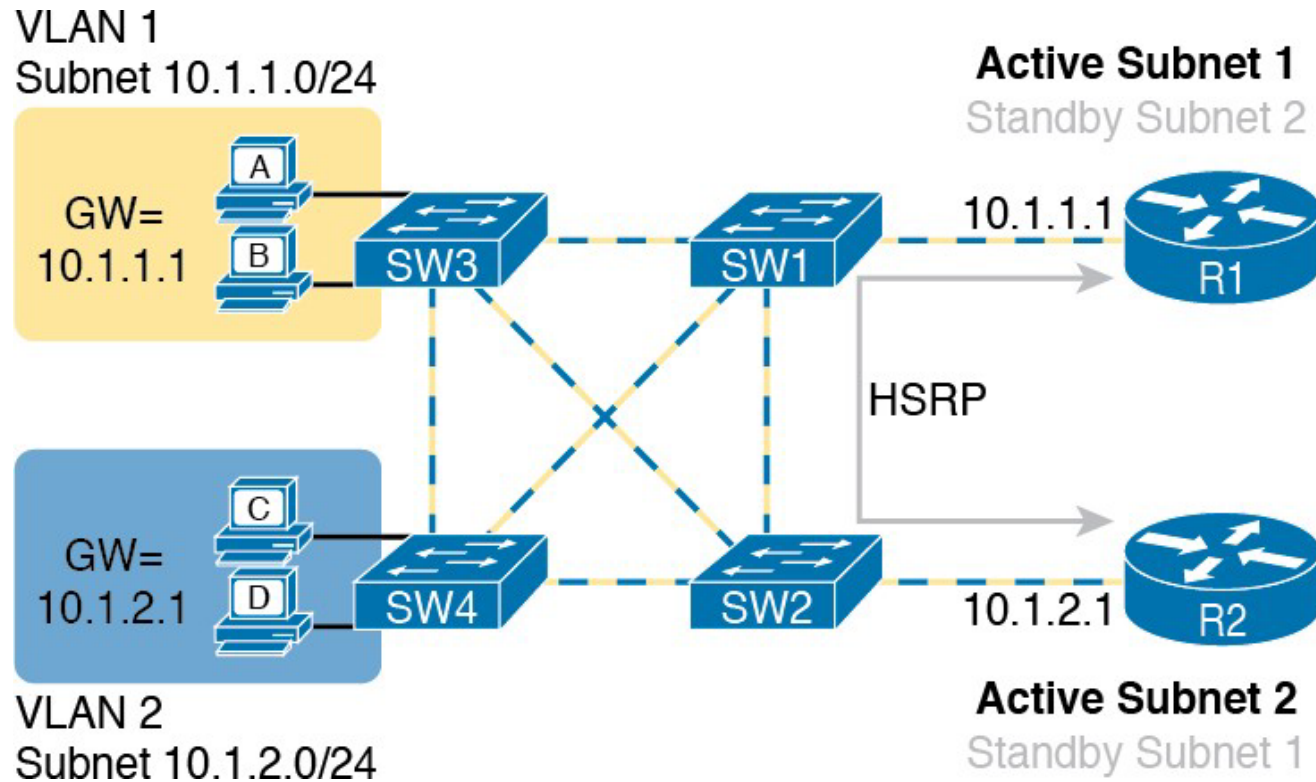


CIS 3250

Packets Sent Through R2 (New Active) Once it Takes Over for Failed R1

HSRP Load Balancing

- HSRP does support load balancing by preferring different routers to be the active router in different subnets.
- HSRP can be configured to prefer one router as active in one VLAN and another router as active in another VLAN, balancing the traffic.

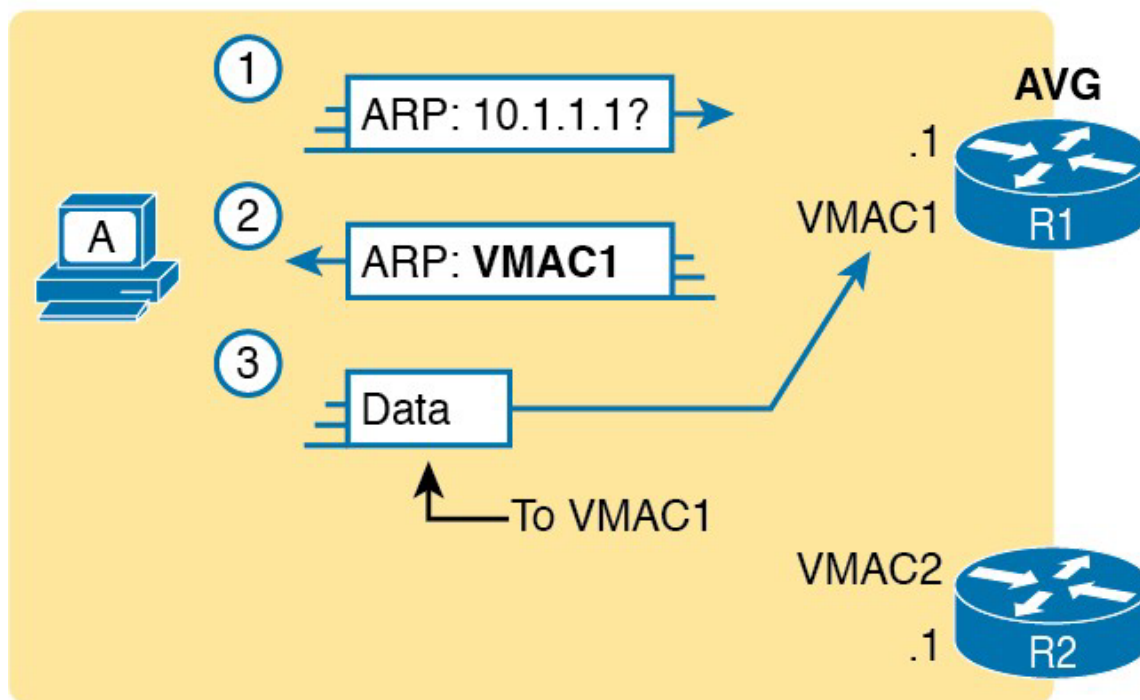


Load Balancing with HSRP by Using Different Active Routers per Subnet

GLBP Concepts

- GLBP balances the packet load per host using an active/active model in each subnet.
- Each GLBP router in a subnet receives off-subnet packets from some of the subnet's hosts.
- Each host still remains unaware of the FHRP, allowing the hosts to configure the same default gateway/router setting, and for the hosts to make no changes when a router fails.
- GLBP uses ARP Reply messages to balance traffic from different hosts through different routers.

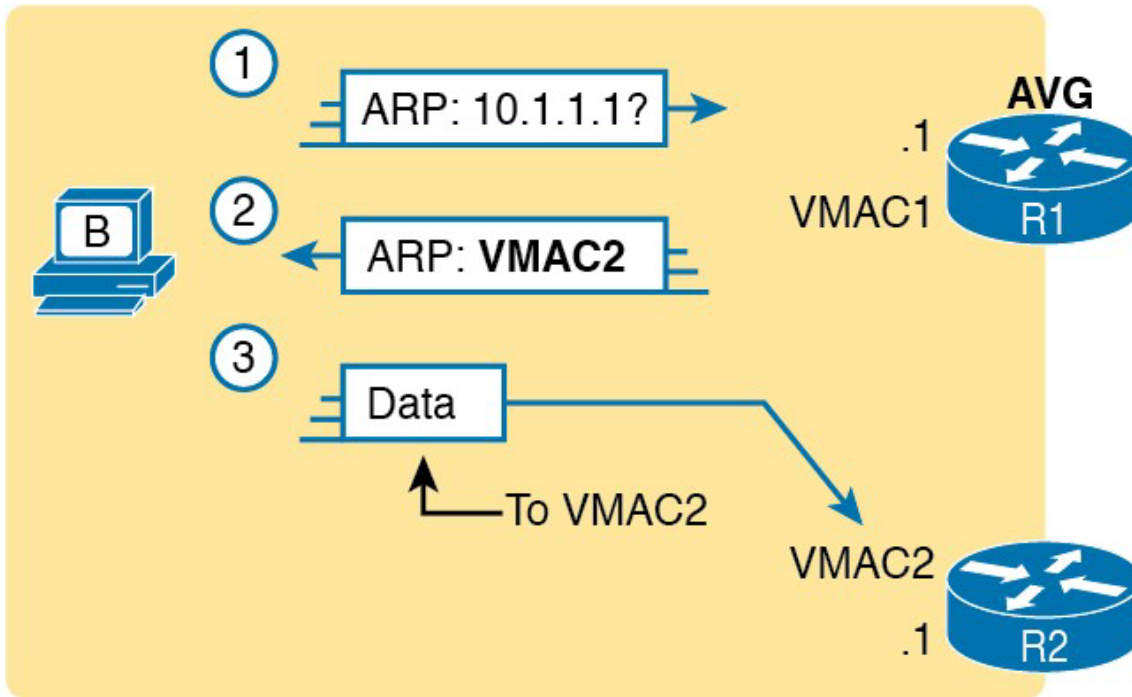
10.1.1.0/24



GLBP Table

<u>Role</u>	<u>Router</u>	<u>Address</u>
AVG	R1	10.1.1.1
Forwarder	R1	VMAC1
Forwarder	R2	VMAC2

GLBP Directs Host A by Sending Back ARP Reply with R1's MAC1



GLBP Table

<u>Role</u>	<u>Router</u>	<u>Address</u>
AVG	R1	10.1.1.1
Forwarder	R1	VMAC1
Forwarder	R2	VMAC2

GLBP Directs Host B by Sending Back ARP Reply with R2's VMAC2

GLBP Process

- The routers must be ready to take over for the other router if it fails.
- GLBP refers to each router as a forwarder.
- Each router acts as a forwarder for its virtual MAC address, but it listens to GLBP messages to ensure the other forwarders are still working.
- If another forwarder fails, the still-working forwarder takes over the failed forwarder's virtual MAC address role and continues to forward traffic.

HSRP Configuration

R1#show running-config

! Lines omitted for brevity

```
interface GigabitEthernet0/0
```

```
ip address 10.1.1.9 255.255.255.0
```

```
standby version 2
```

```
standby 1 ip 10.1.1.1
```

```
standby 1 priority 110
```

```
standby 1 name HSRP-group-for-book
```

! The following configuration, on R2, is identical except for the priority,

! the interface IP address, and the HSRP priority

R2#show running-config

! Lines omitted for brevity

```
interface GigabitEthernet0/0
```

```
ip address 10.1.1.129 255.255.255.0
```

```
standby version 2
```

```
standby 1 ip 10.1.1.1
```

```
standby 1 name HSRP-group-for-book
```

GLBP Configuration

! First, the configuration on R1

R1#show running-config

! Lines omitted for brevity

```
interface GigabitEthernet0/0
ip address 10.1.1.9 255.255.255.0
glbp 1 ip 10.1.1.1
glbp 1 priority 110
glbp 1 name GLBP-group-for-book
```

! The following configuration, on R2, is identical except for
! the interface IP address, and the GLBP priority

R2#show running-config

! Lines omitted for brevity

```
interface GigabitEthernet0/0
ip address 10.1.1.129 255.255.255.0
glbp 1 ip 10.1.1.1
glbp 1 name HSRP-group-for-book
```

Local State

Row is About...	Fwd Column Value	R1 State	R2 State
AVG	-	Active	Standby
Forwarder 1	1	Listen	Active
Forwarder 2	2	Active	Listen