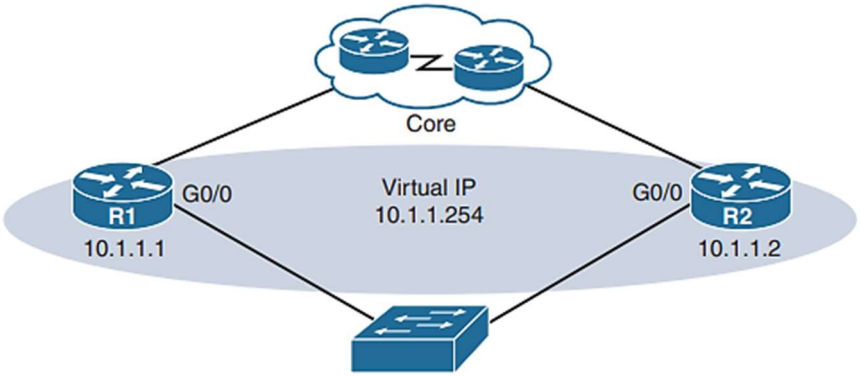
3.5 FHRP: Describe the purpose, function, and concepts of first hop redundancy protocols

Figure 24-3 Redundant Default Gateway Example



A first hop redundancy protocol (FHRP) is a networking protocol designed to protect the default gateway used on a network by allowing two or more routers to provide backup for that address. If an active router fails, the backup router will quickly take over the address.

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

To set up FHRP, a virtual IP is configured on the two routers, and a virtual MAC address is generated on the virtual IP. Then, and active and a standby routers are elected.

The active routers reply to ARP request using virtual MAC address. When the standby router takes over the active one, a **gratuitous ARP** (ARP that does not need reply) is broadcasted to inform the new router location in the network.

There are 3 main FHRPs:

- Hot Standby Router Protocol (HSRP).
- Virtual Router Redundancy Protocol (VRRP).
- Gateway Load Balancing Protocol (GLBP), using Active Virtual Gateway/Forwarders instead of active/standby routers.

Those 3 FHRPs are as follow:

FHRP	TERMINOLOGY	MULTICAST IP	VIRTUAL MAC	CISCO PROPRIETARY	ACTIVE/ACTIVE LOAD BALANCING
HSRPv1	Active/Standby	224.0.0.2	0000.0c07.acXX	Yes	No
HSRPv2	Active/Standby	224.0.0.102	0000.0c9f.fXXX	Yes	No
VRRP	Master/Backup	224.0.0.18	0000.5e00.01XX	No	No
GLBP	AVG/AVF	224.0.0.102	0007.b400.XXYY	Yes	Yes

The following statements are true regarding Hot Standby Router Protocol (HSRP):

- One router is elected as the active router, and another router is elected as the standby router.
- In an HSRP group, only one virtual IP address and one virtual MAC address is used.

Only the active router will use the Hot Standby Router Protocol (HSRP) virtual Internet Protocol (IP) address and will respond to Address Resolution Protocol (ARP) requests with the HSRP virtual Media Access Control (MAC) address. HSRP is a Cisco-proprietary protocol that enables two or more routers to act as a single virtual router. Multiple routers are assigned to an HSRP group, and the routers function as a single gateway. The HSRP virtual IP address can then be configured as the default gateway address for client devices.

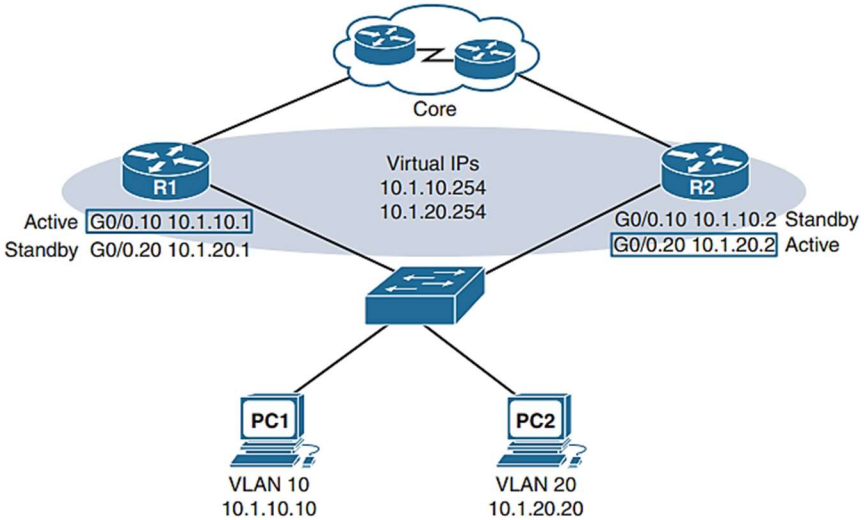
HSRP is a Cisco-proprietary First-Hop Redundancy Protocol (FHRP). Based on priority value, HSRP elects a single active router and a standby router. The active router is the router with the highest priority; it forwards packets, responds to ARP requests with a virtual MAC address, and can be the only router that is explicitly configured with the virtual IP address.

The standby router is the router with the second-highest priority. If multiple HSRP routers have the same priority, the router with the highest IP address will be elected as the active router. The router with the second-highest IP address will be elected as the standby router, which will assume the role of the active router if the active router fails. To participate in the active and standby router election process, each HSRP router must be a member of the same group. An HSRP group is identified by a group number from 0 through 255. The default HSRP group value is 0.

The election of a master router and the placement of all other routers in the group into the backup state are characteristics of Virtual Router Redundancy Protocol (VRRP). Like HSRP, VRRP provides router redundancy and only one router is active at any time. If the master router becomes unavailable, one of the backup routers will become the master router.

Routers in a single HSRP group cannot forward a portion of the traffic in a load-balancing fashion. You can provide load balancing by configuring multiple HSRP groups or by configuring Gateway Load Balancing Protocol (GLBP). GLBP elects an active virtual gateway (AVG) and up to four primary active virtual forwarders (AVFs). The AVG in a GLBP group assigns a virtual MAC address to the AVFs. When the AVG receives Address Resolution Protocol (ARP) requests that are sent to the virtual IP address for the GLBP group, the AVG responds with different virtual MAC addresses. This provides load balancing, because each of the primary AVFs will participate by forwarding a portion of the traffic sent to the virtual IP address.

Figure 24-4 HSRP Load Balancing Example



To implement HSRP load balancing for different VLANs, configure R1 as the active router for half the VLANs and R2 as the active router for the other half of the VLANs (see Example 24-7).

Hot Standby Routing Protocol (HSRP) does not do load balancing.
Therefore, only one router is forwarding per VLAN per group in HSRP. You must implement the above.