

# Applying First-Hop Redundancy Protocols

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# Overview



**First-hop redundancy protocols provide redundancy for high availability and load balancing**

## **Examine FHRP**

- HSRP
- VRRP
- FHRP on IPv6

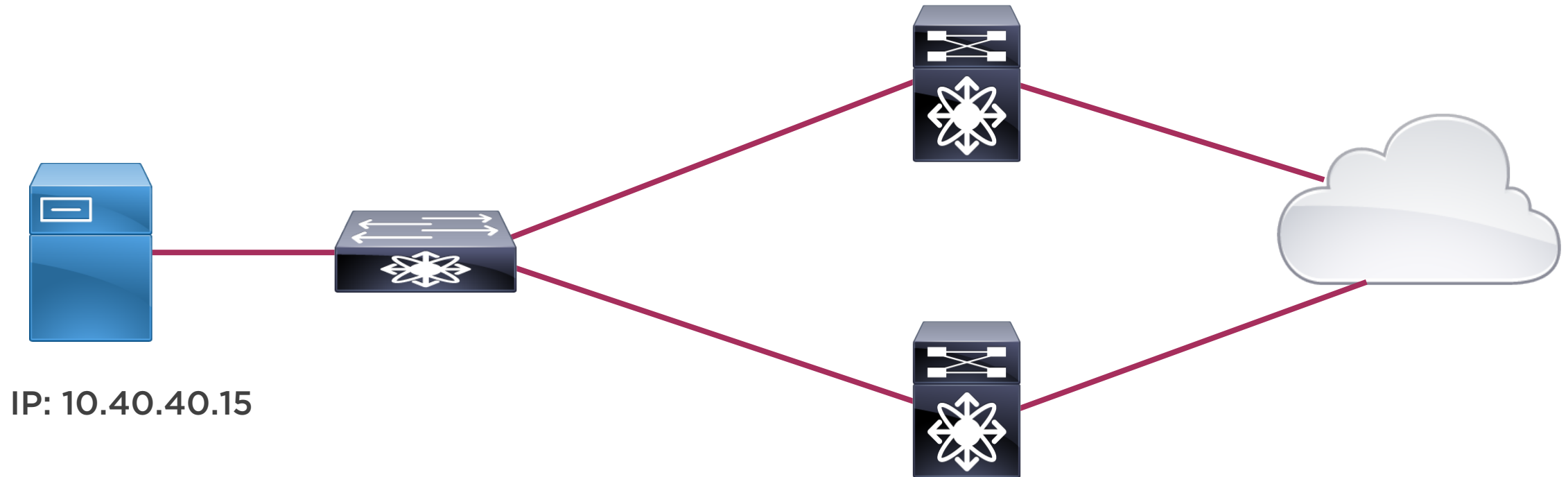


FHRP

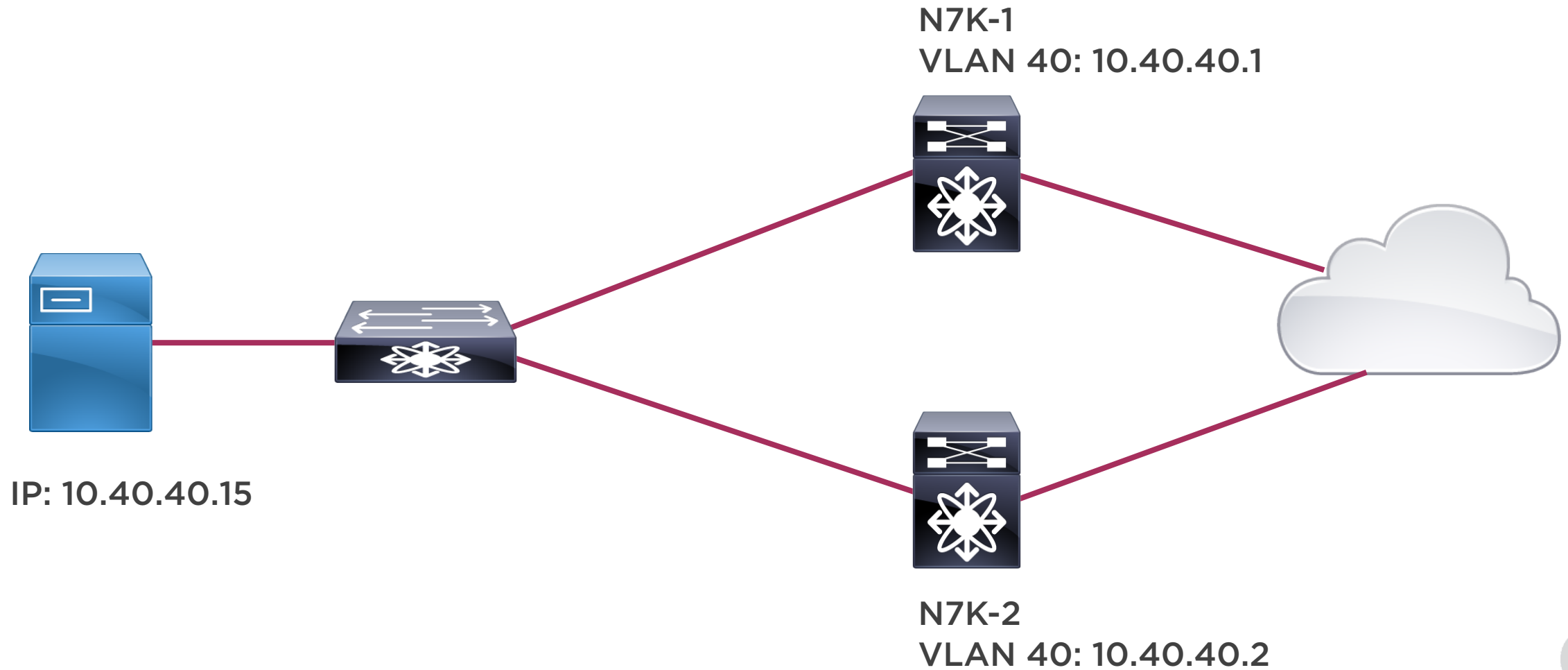
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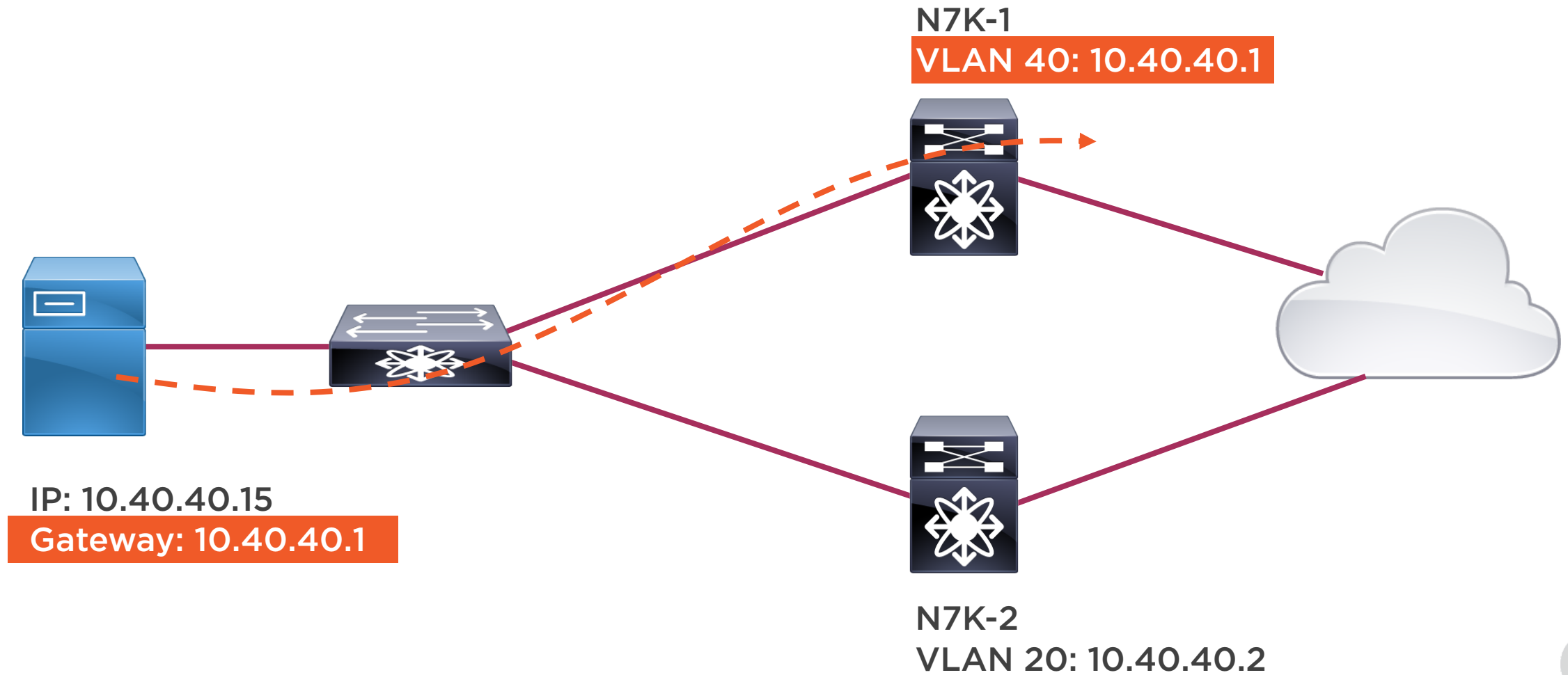
# Network Topology



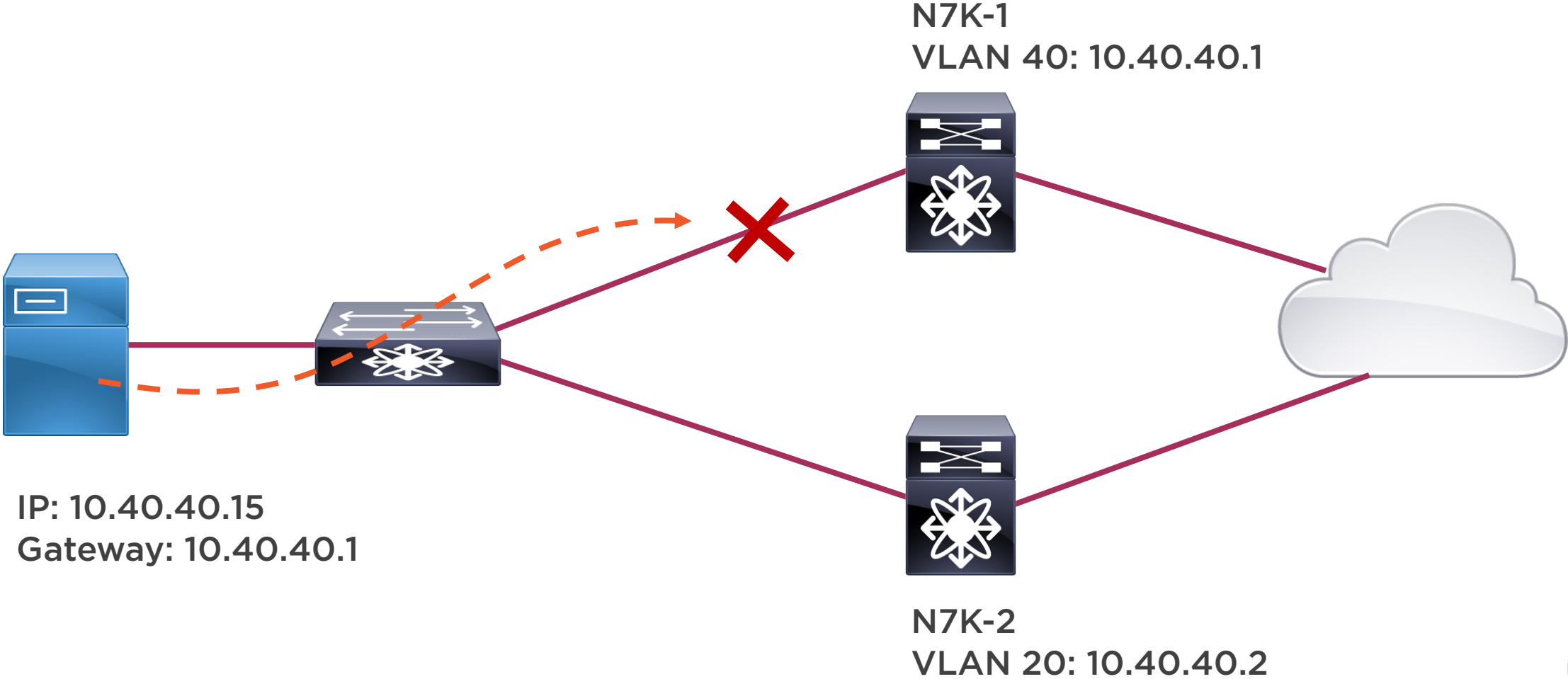
# Network Redundancy



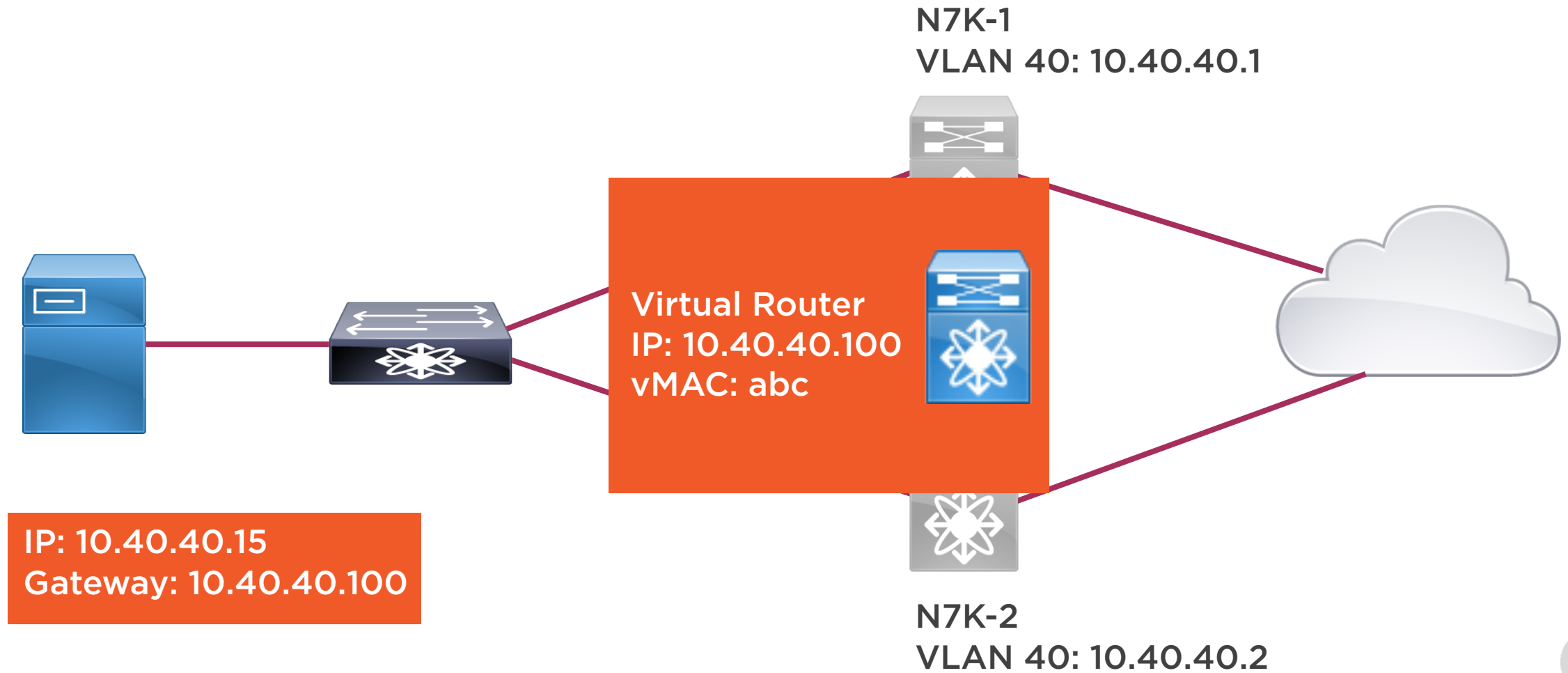
# Default Gateway



# Route Failure



# Solution - Virtual Router





# FHRP Available



## HSRP

Cisco proprietary  
Active and Standby  
routers



## VRRP

IEEE variation,  
behaves like HSRP



## GLBP

Uses AVF routers  
Multiple AVFs can  
exist in a GLBP group

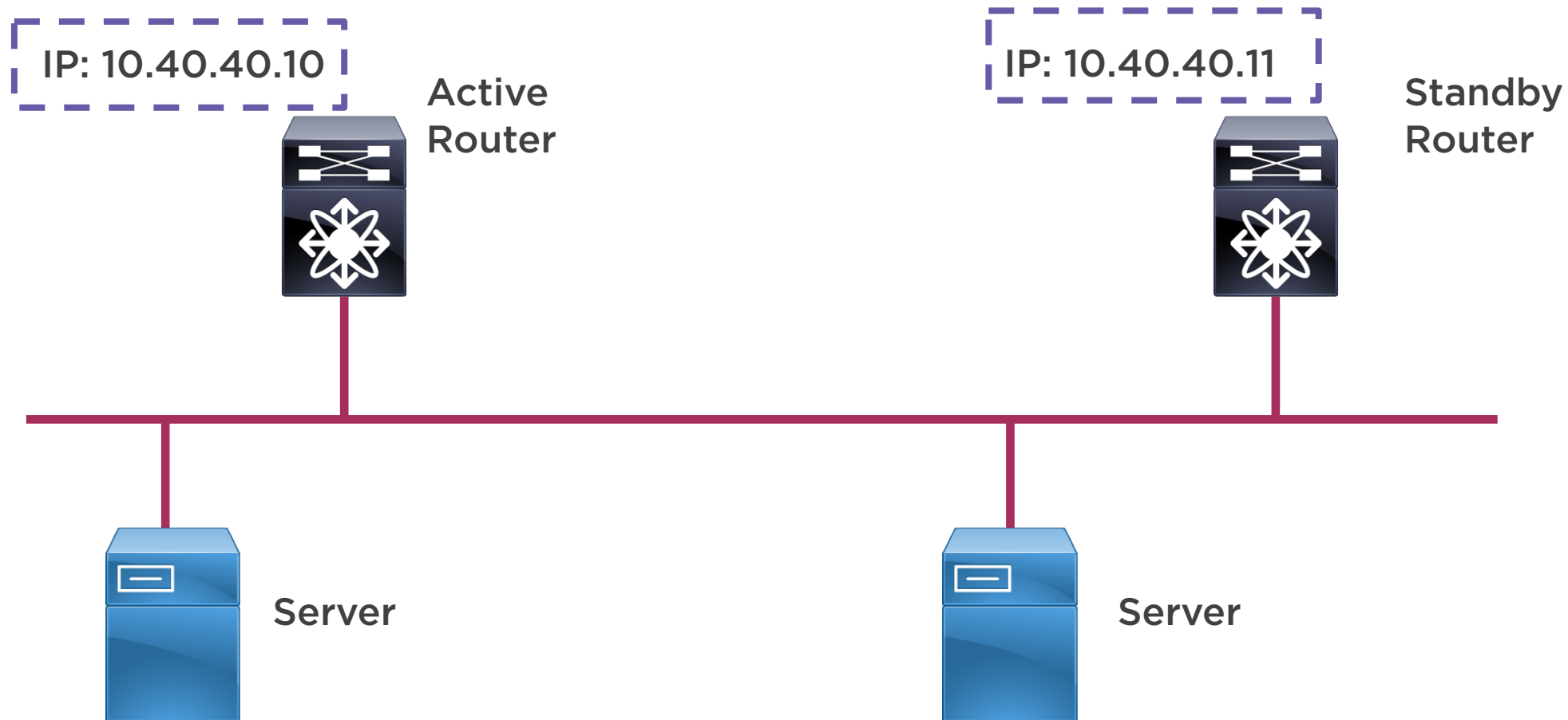


# HSRP

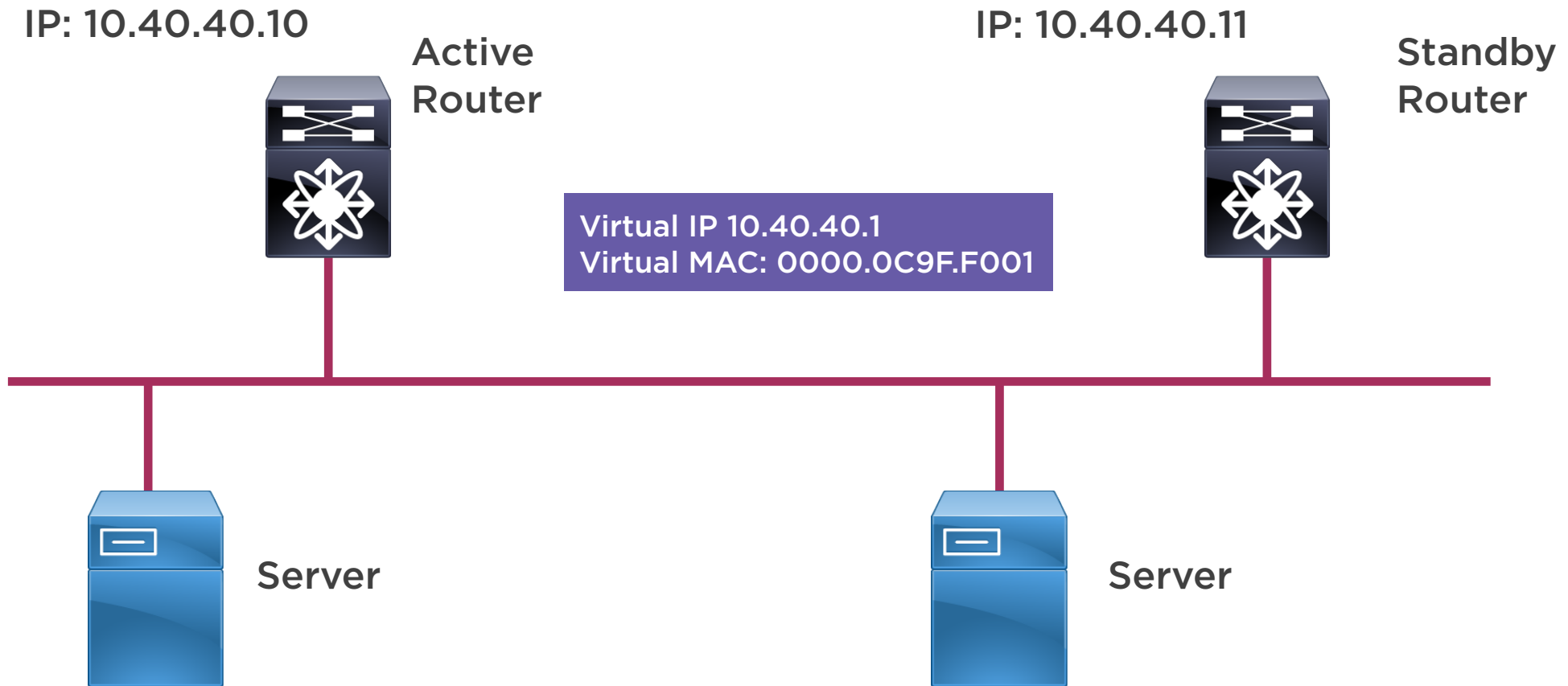
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# HSRP Overview



# HSRP Virtual IP



# HSRP ARP

IP: 10.40.40.10

Active  
Router



IP: 10.40.40.11

Standby  
Router



Virtual IP 10.40.40.1  
Virtual MAC: 0000.0C9F.F001



Server



ARP



Server



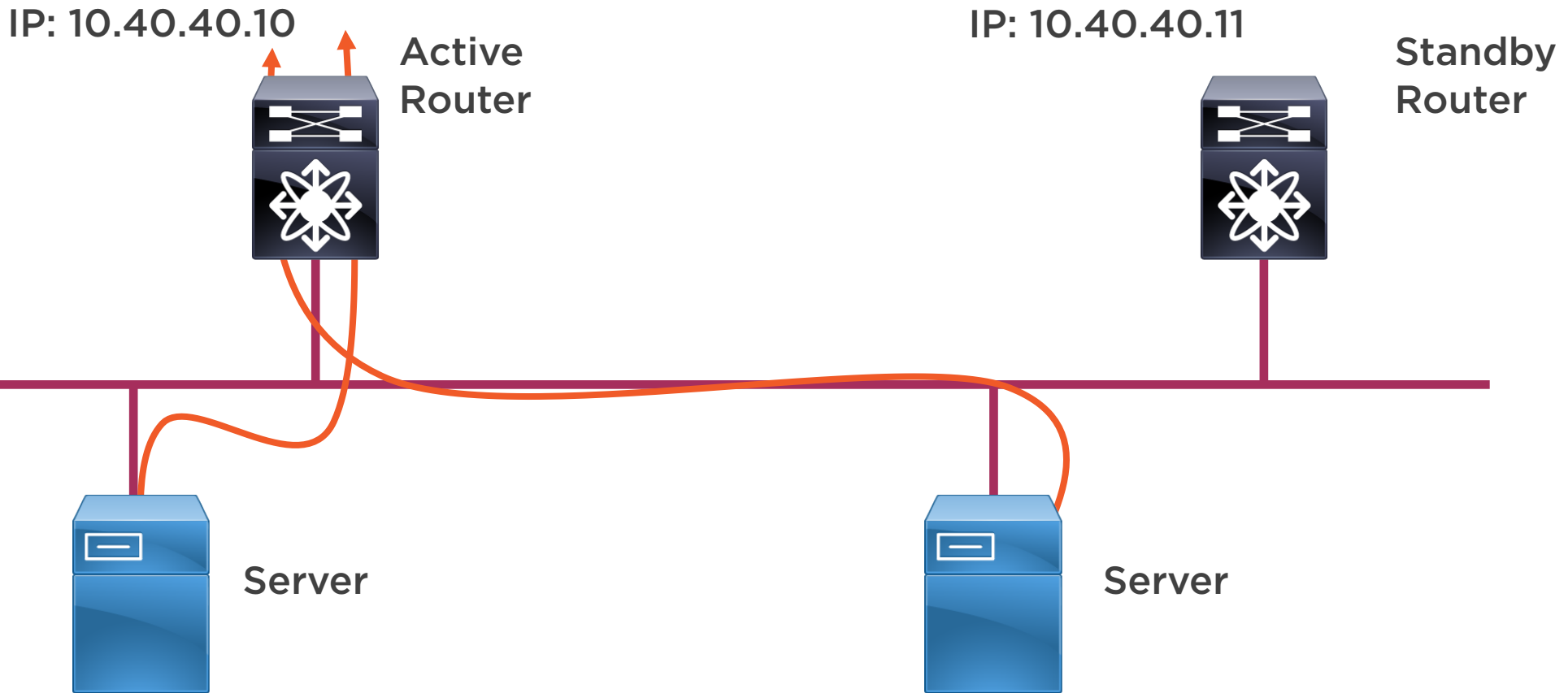
ARP

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001



# HSRP Traffic Flow



Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001



# HSRP Redundancy

IP: 10.40.40.10

Active  
Router



IP: 10.40.40.11

Standby  
Router



Virtual IP 10.40.40.1  
Virtual MAC: 0000.0C9F.F001



Server



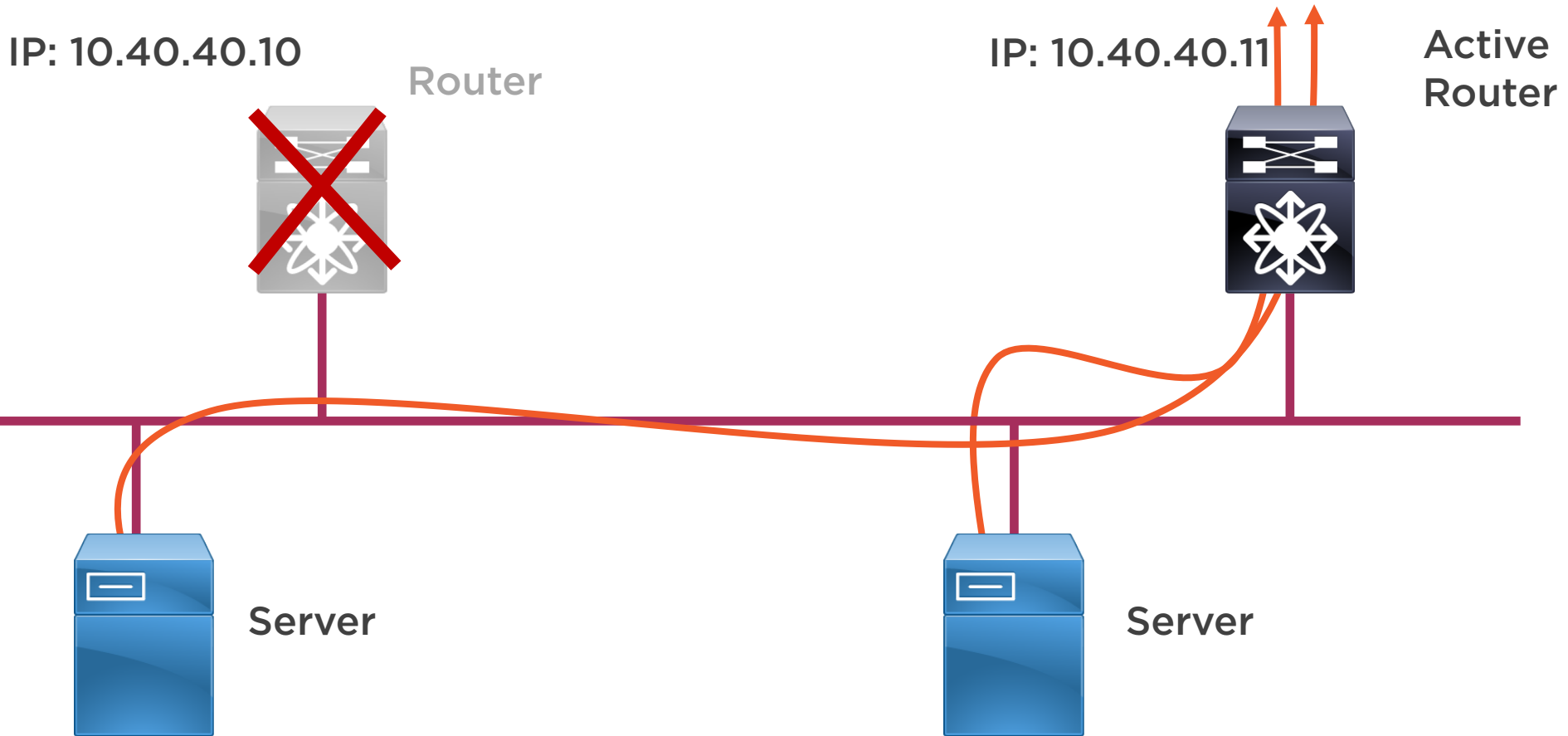
Server

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001



# HSRP Redundancy



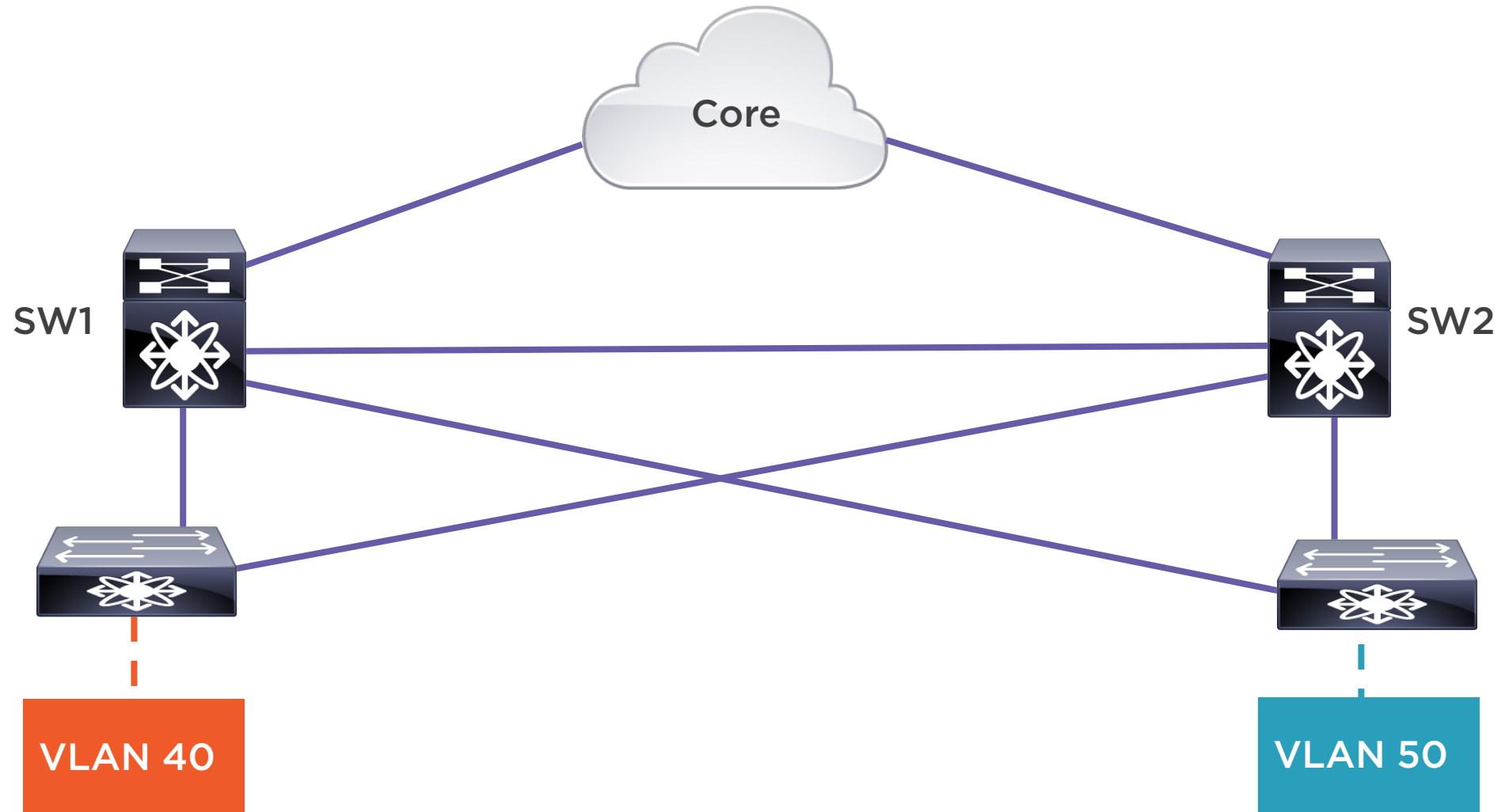
Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001

Default Gateway: 10.40.40.1  
Default Gateway MAC: 0000.0C9F.F001

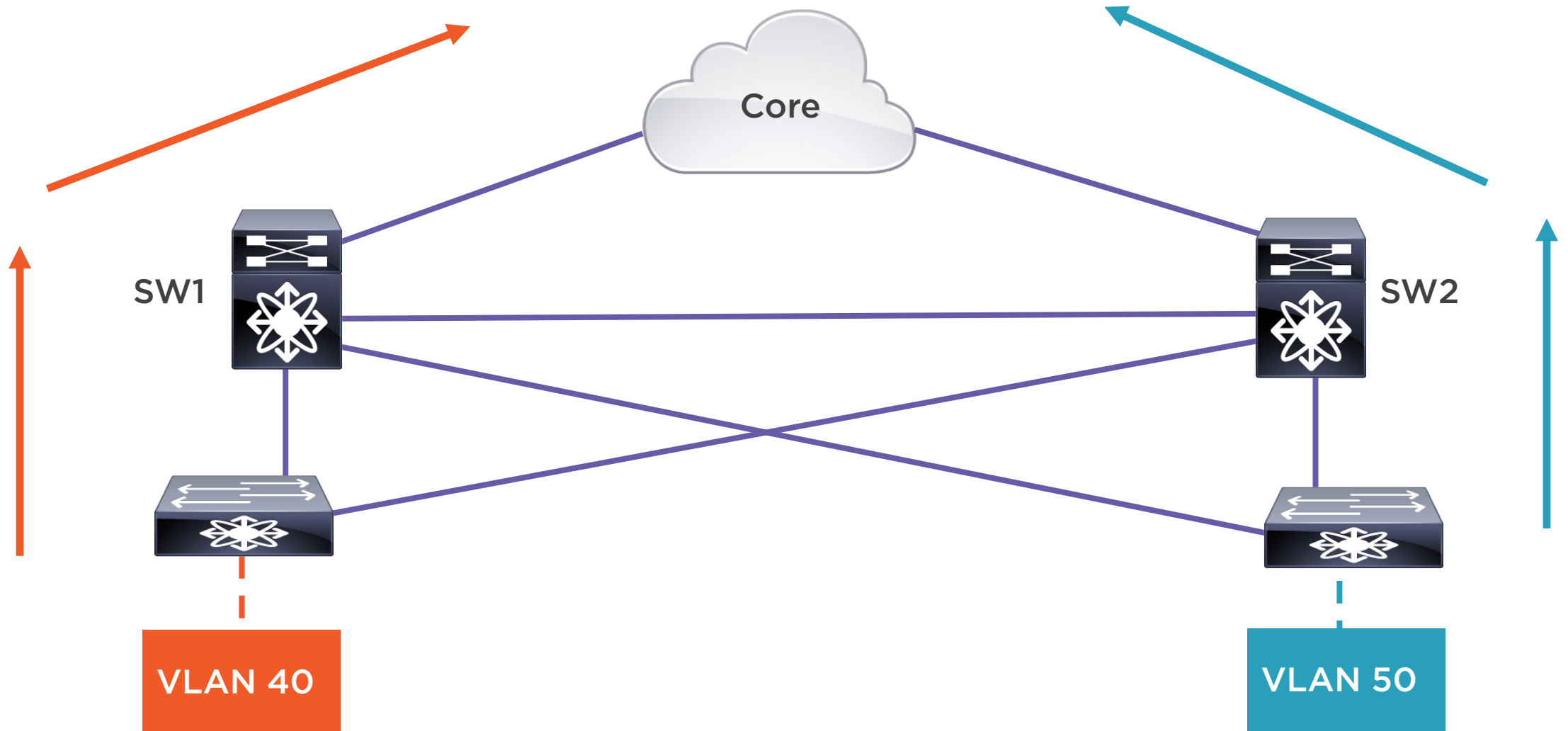




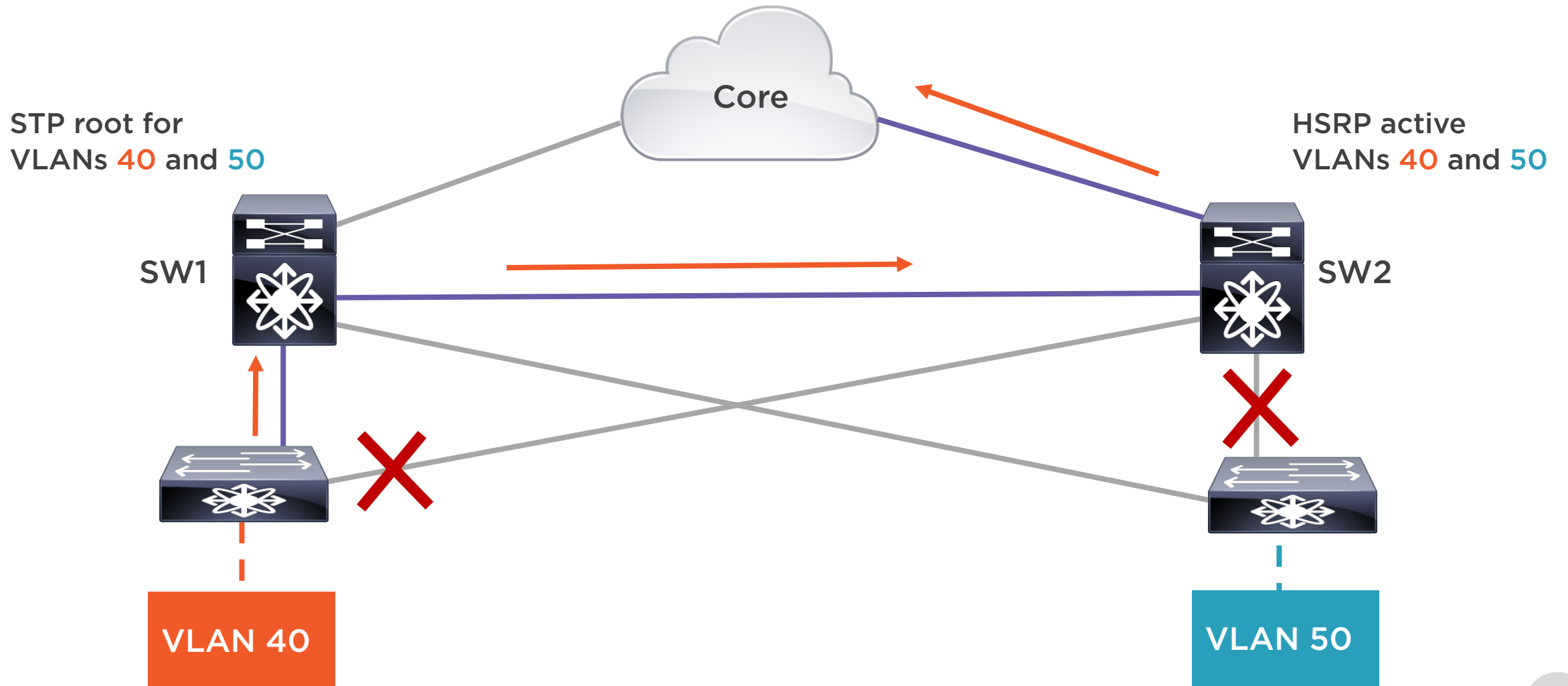
# HSRP with STP



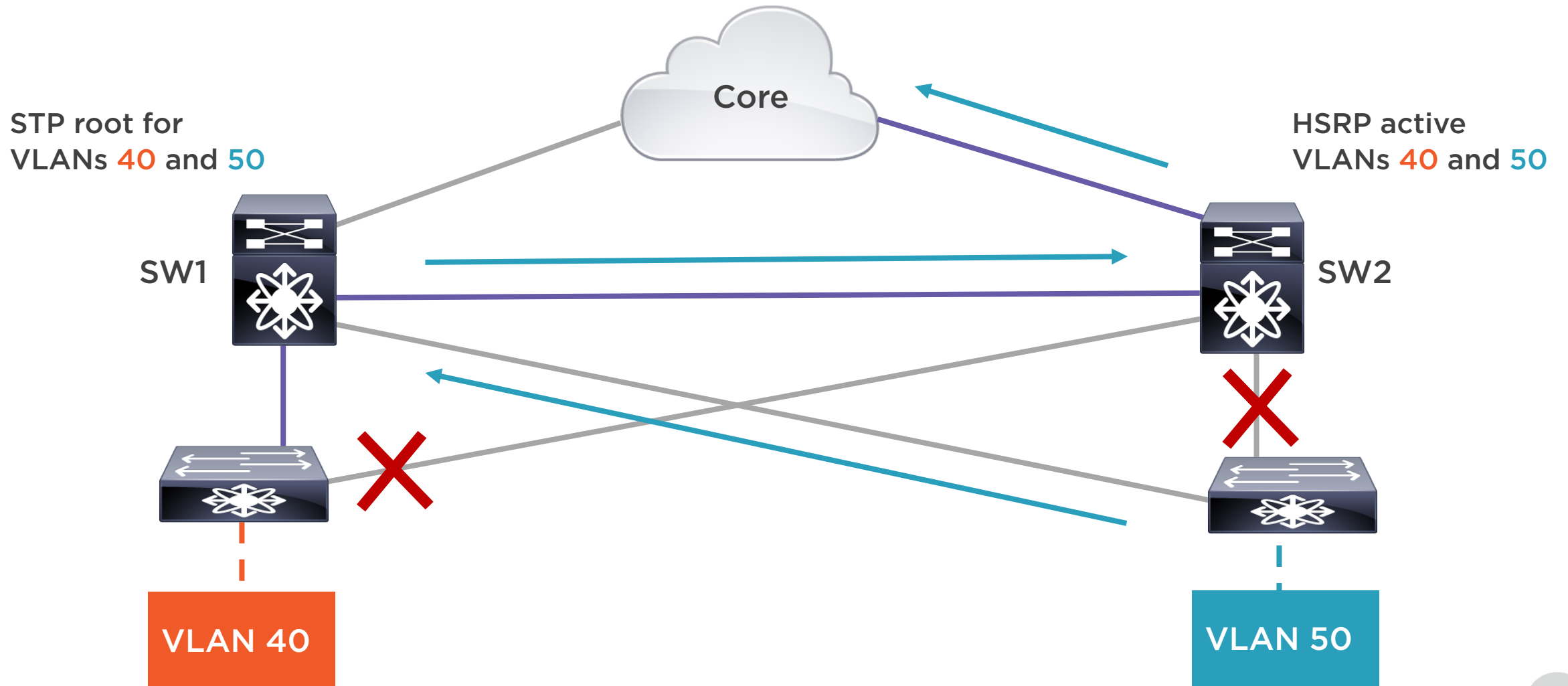
# HSRP with STP



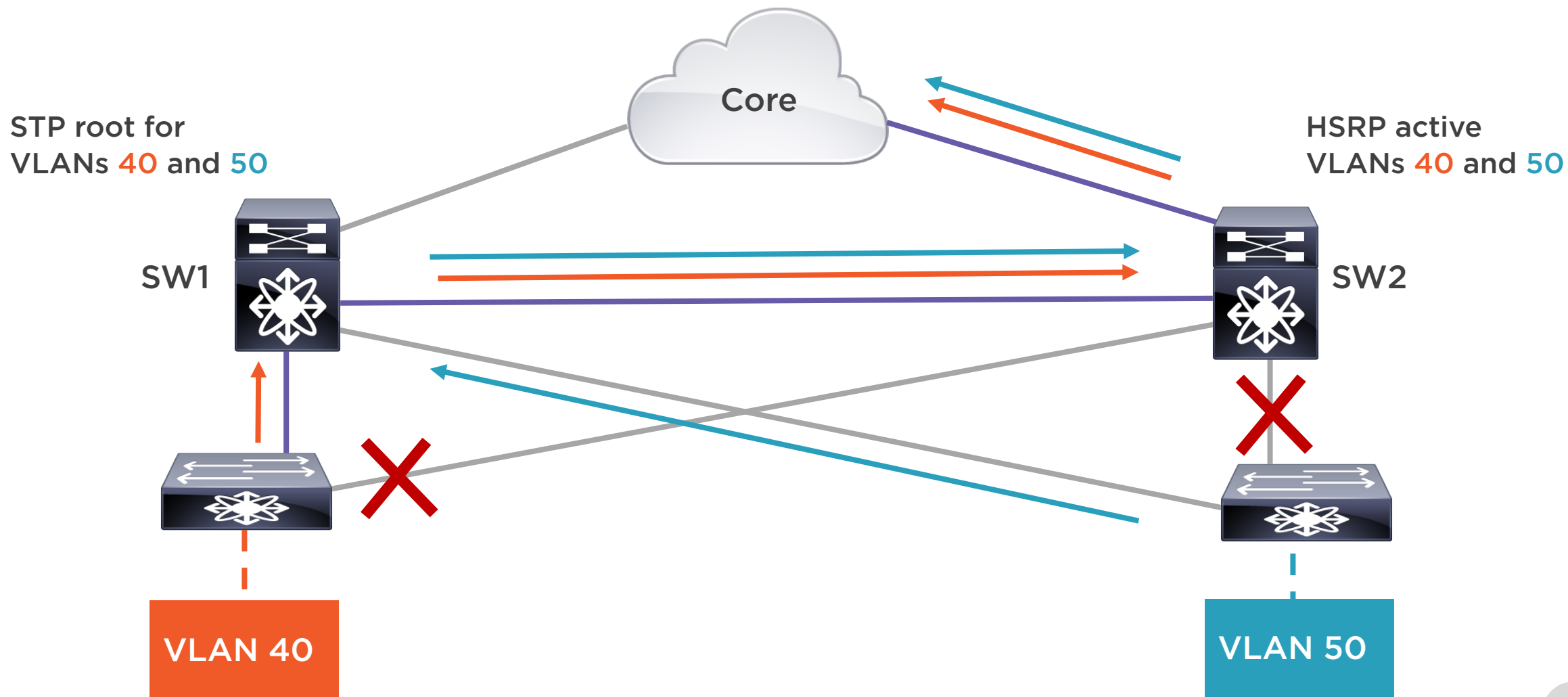
# HSRP with STP



# HSRP with STP



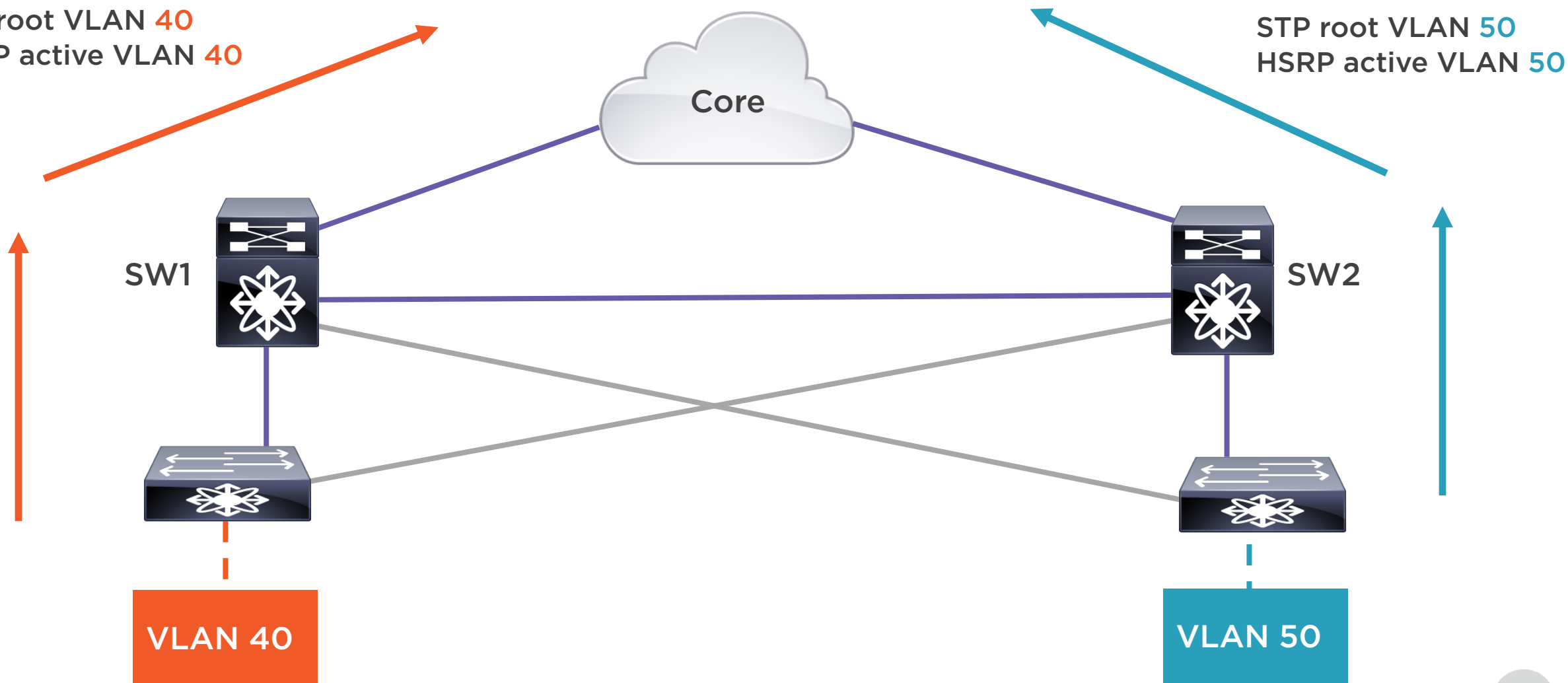
# HSRP with STP



# HSRP with STP

STP root VLAN 40  
HSRP active VLAN 40

STP root VLAN 50  
HSRP active VLAN 50



# HSRP and vPC



Whenever a virtual port-channel (vPC) peer switch needs to forward traffic for a vPC, it will forward it to a local vPC port if possible



Normally, only the active HSRP router forwards traffic that is received for the virtual default gateway MAC address



For vPCs, Cisco enhanced the forwarding rules to allow the standby router to forward frames destined for the virtual MAC address



The result is that the vPC peer link between the active and standby routers does not carry vPC traffic unless there is a failure



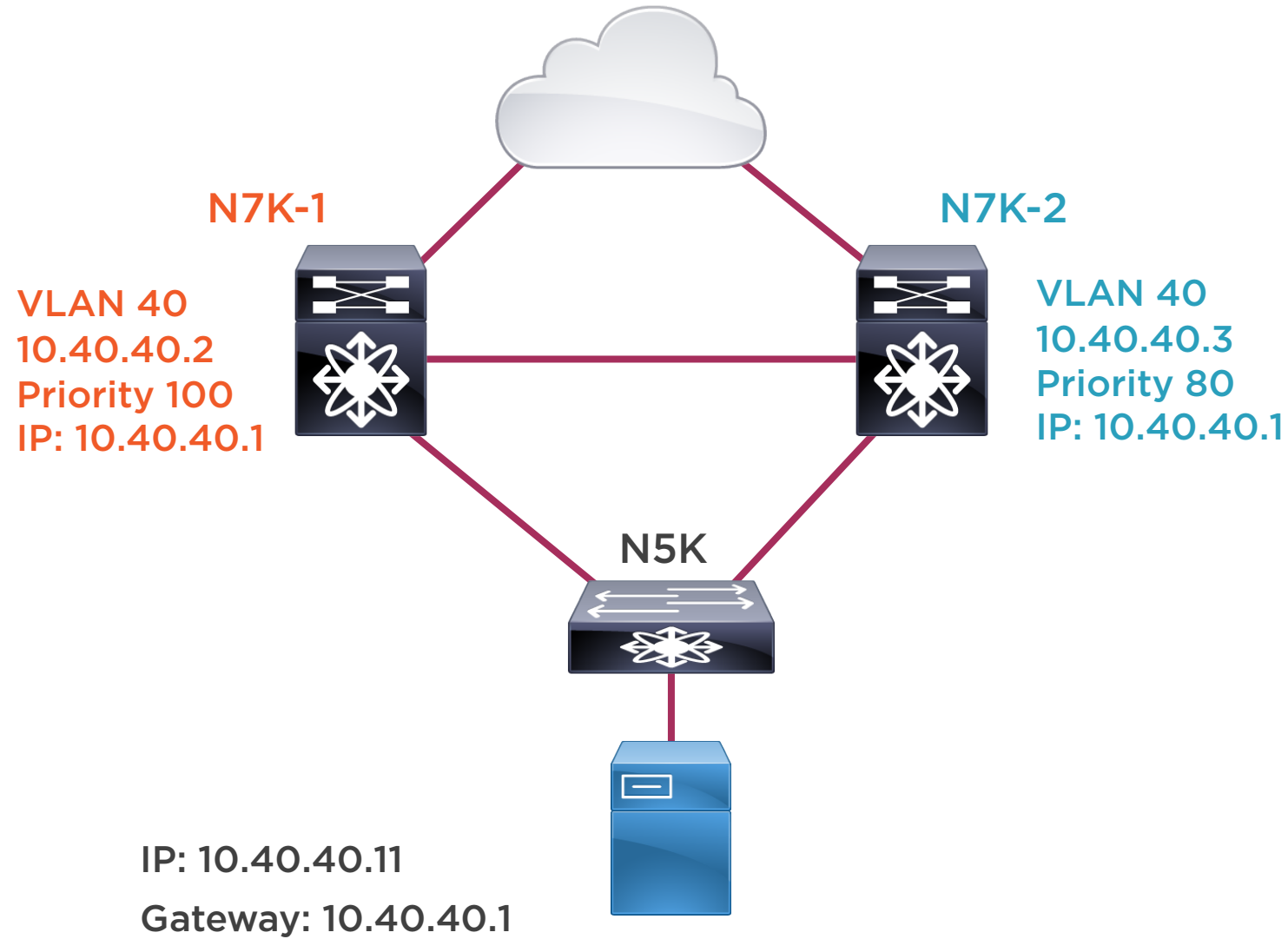
# HSRP Configuration

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# HSRP Configuration



# HSRP Configuration

```
feature hsrp
```

```
!
```

```
interface vlan 40
```

```
ip address 10.40.40.2 255.255.255.0
```

```
hsrp 40
```

```
priority 100
```

```
preempt
```

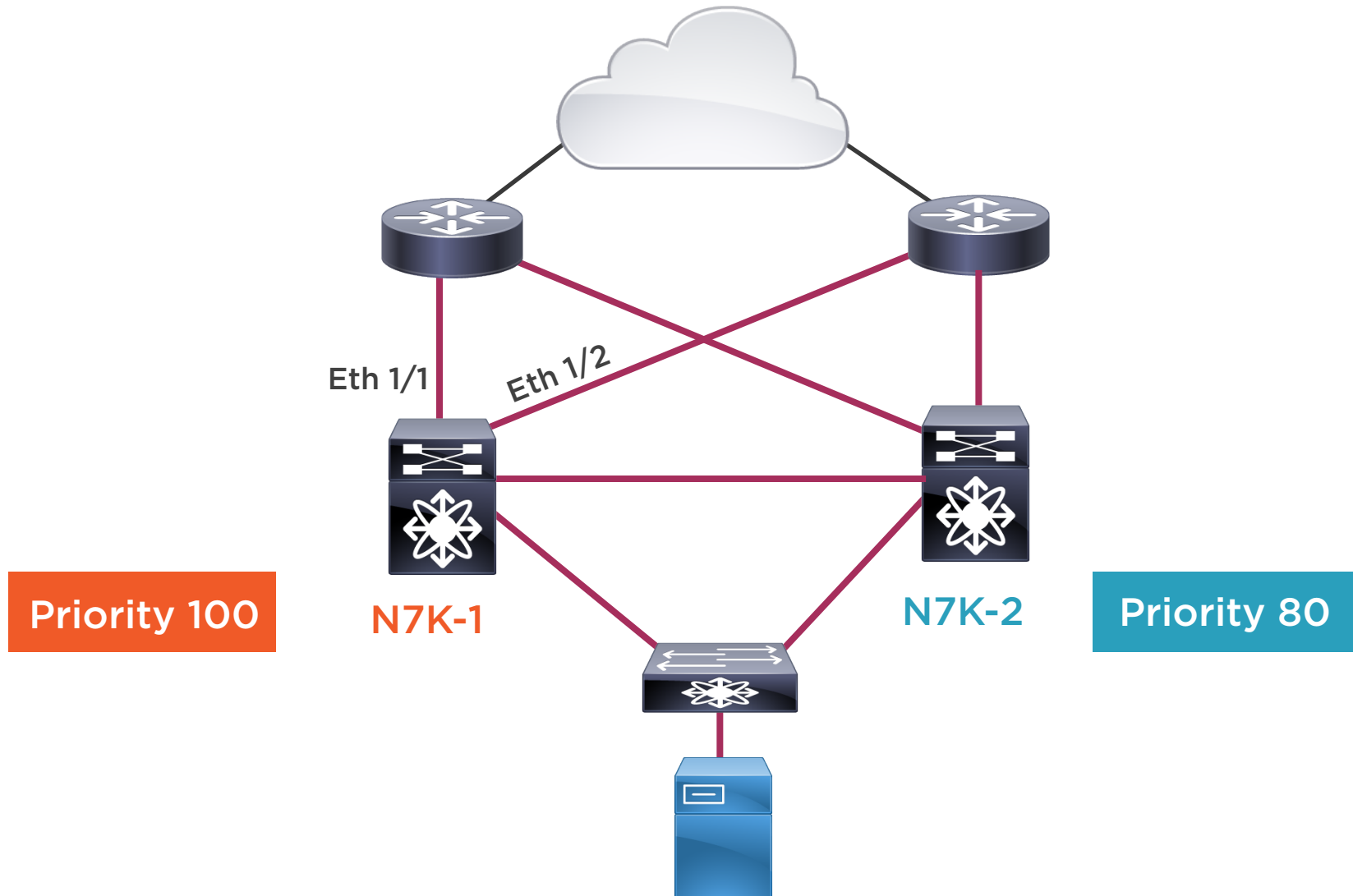
```
preempt delay minimum 60
```

```
ip 10.40.40.1
```

```
no shutdown
```



# HSRP Interface Tracking



# Interface Tracking Configuration

```
track 1 interface eth 1/1 line-protocol
track 2 interface eth 1/2 line protocol
!
interface vlan 40
ip-address 10.40.40.2
hsrp 40
ip 10.40.40.1
priority 100
track 1 decrement 15
track 2 decrement 15
preempt
```



# VRRP

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# VRRP

VRRP is standardized

VRRP is like HSRP in operation and configuration

One master and the others are backup

The virtual VRRP address can be one of the physical IP addresses of the VRRP group member



# VRRP



The device with the used physical address is a VRRP master whenever it is available



The master is the only device that sends advertisements every second to 224.0.0.18 with protocol number 112



Default hold time is 3 seconds, compared to HSRP which sends hellos every 3 seconds, and has a hold time of 10 seconds



Use the millisecond timers only when necessary and with careful consideration and testing and only under favorable circumstances



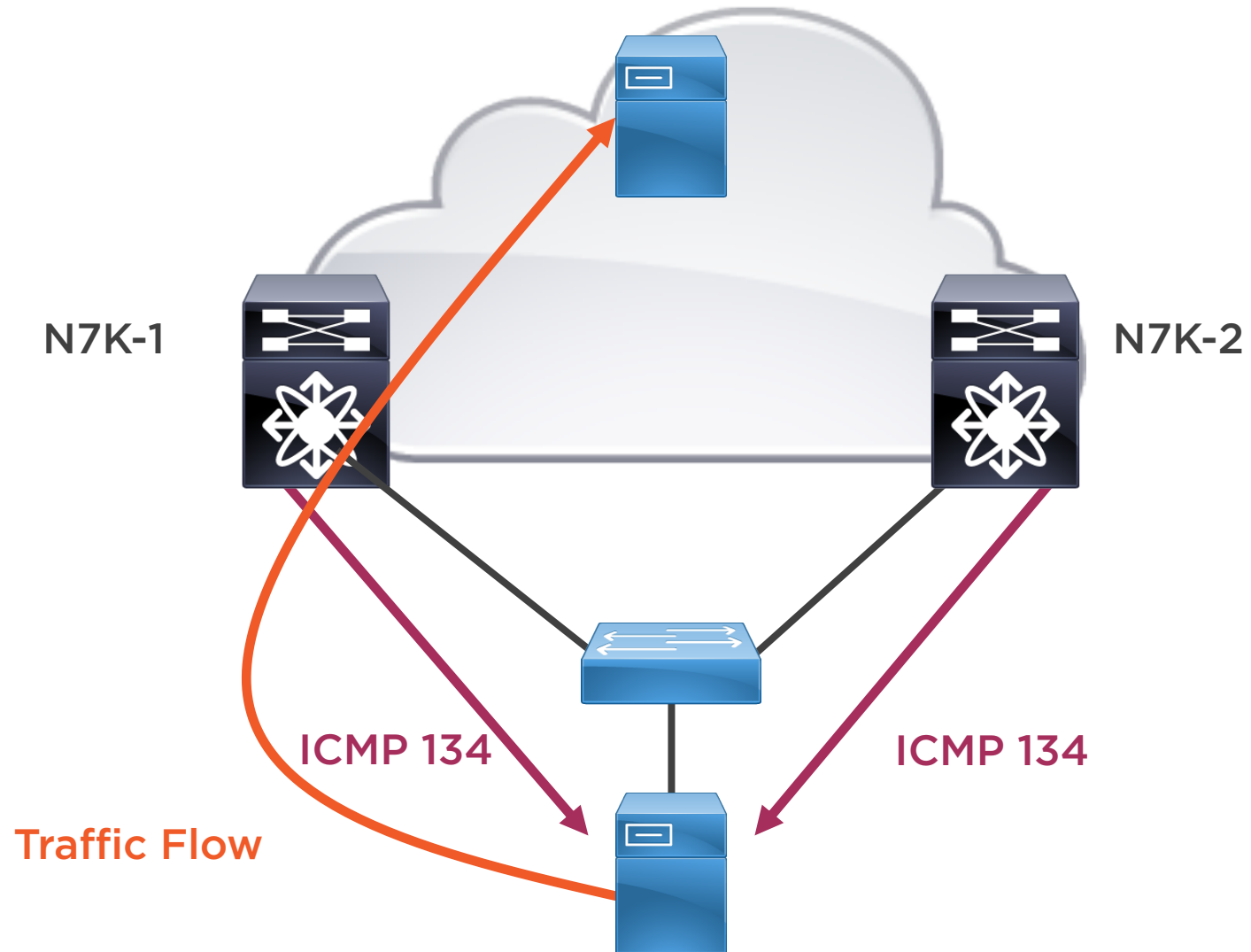
# FHRP on IPv6

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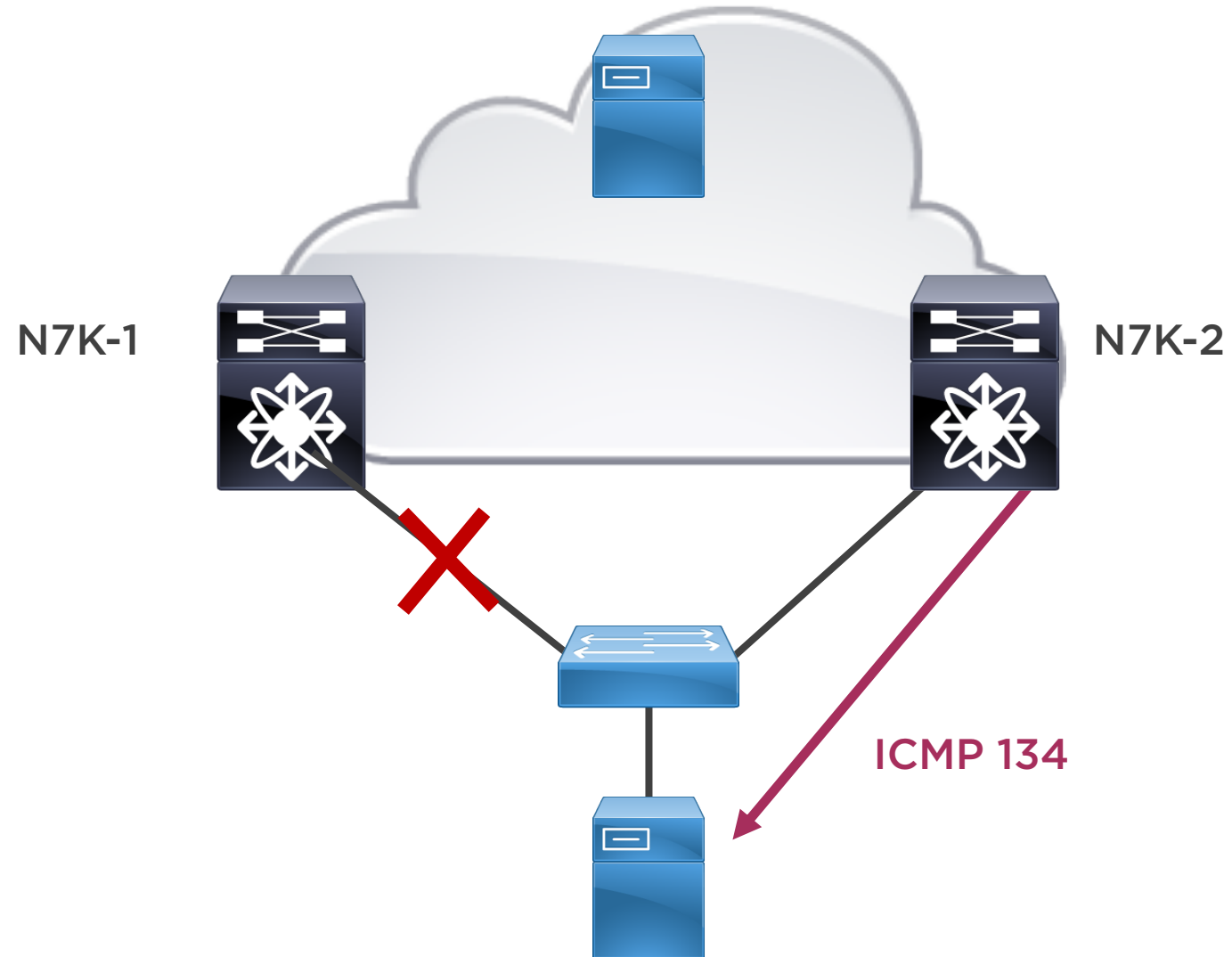




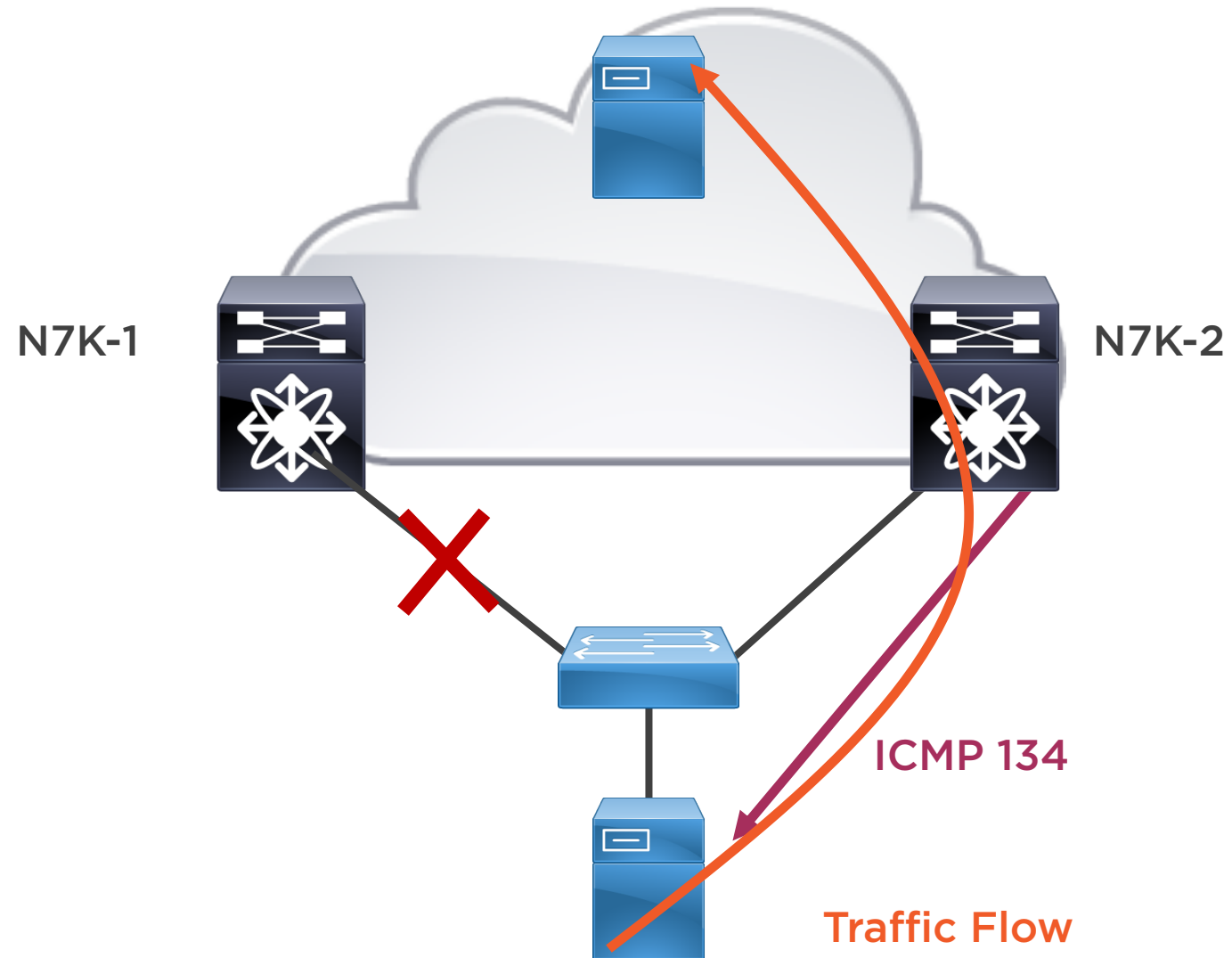
# FHRP on IPv6



# FHRP on IPv6



# FHRP on IPv6



Native IPv6  
redundancy is slow

Failover is not  
possible

Can use technology  
like DHCPv6 instead

FHRP offers more  
features and control

Preemption

Timers / Tracking

## FHRP for IPv6 Considerations



HSRP and VRRP have support for IPv6, but not in all releases. VRRP for IPv6 is less frequently supported, but it is supported on all recent Nexus releases

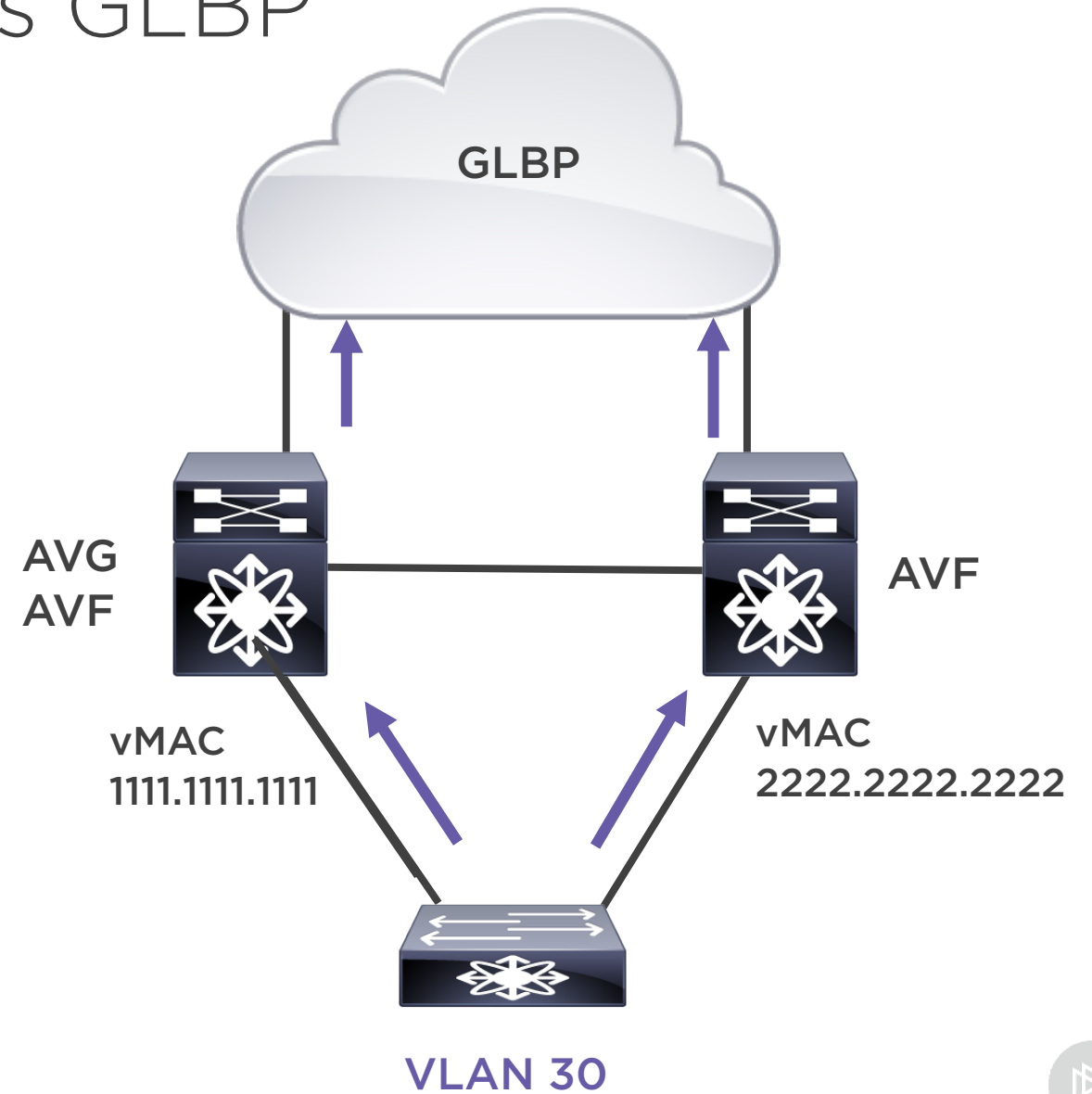
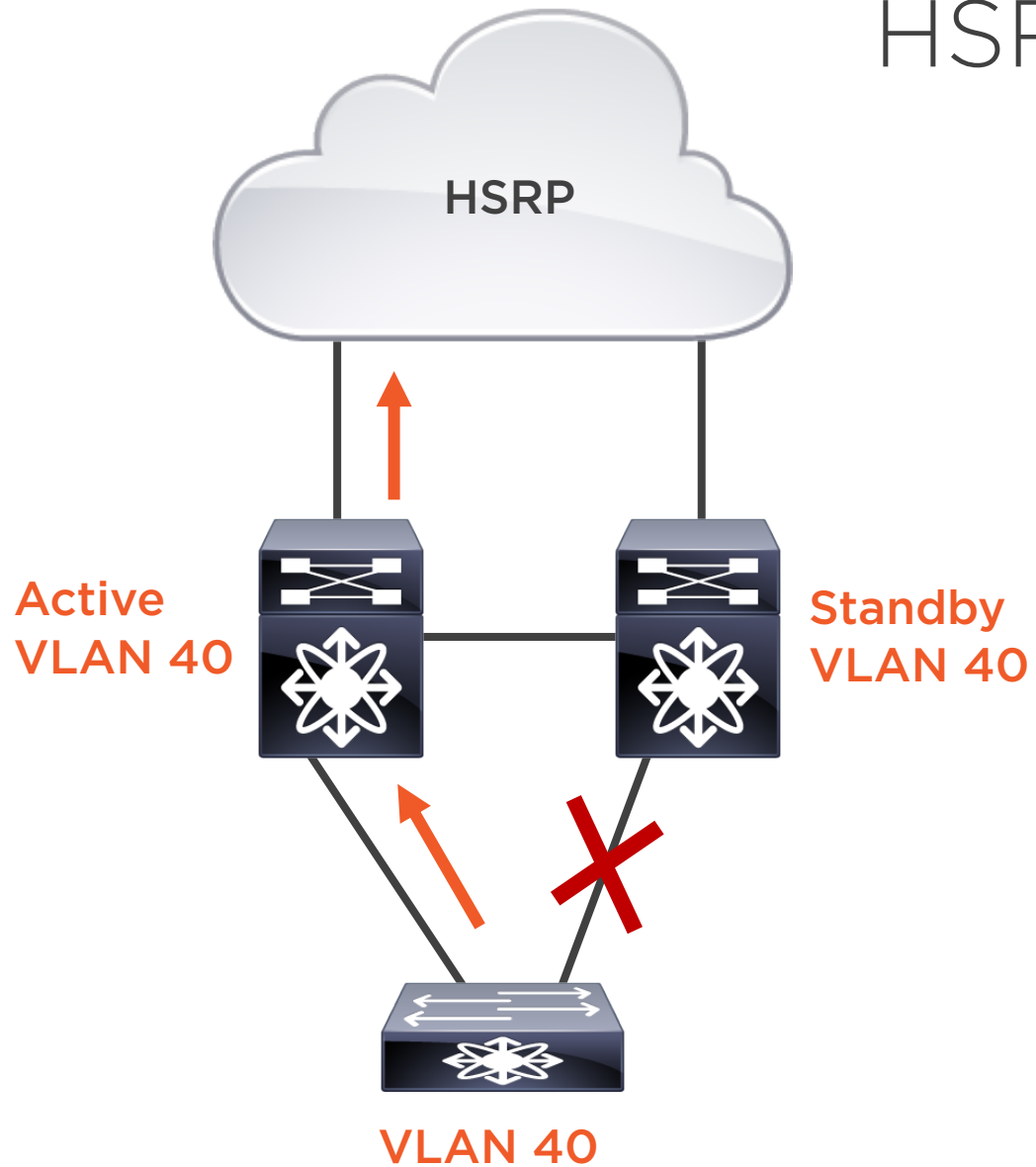


GLBP

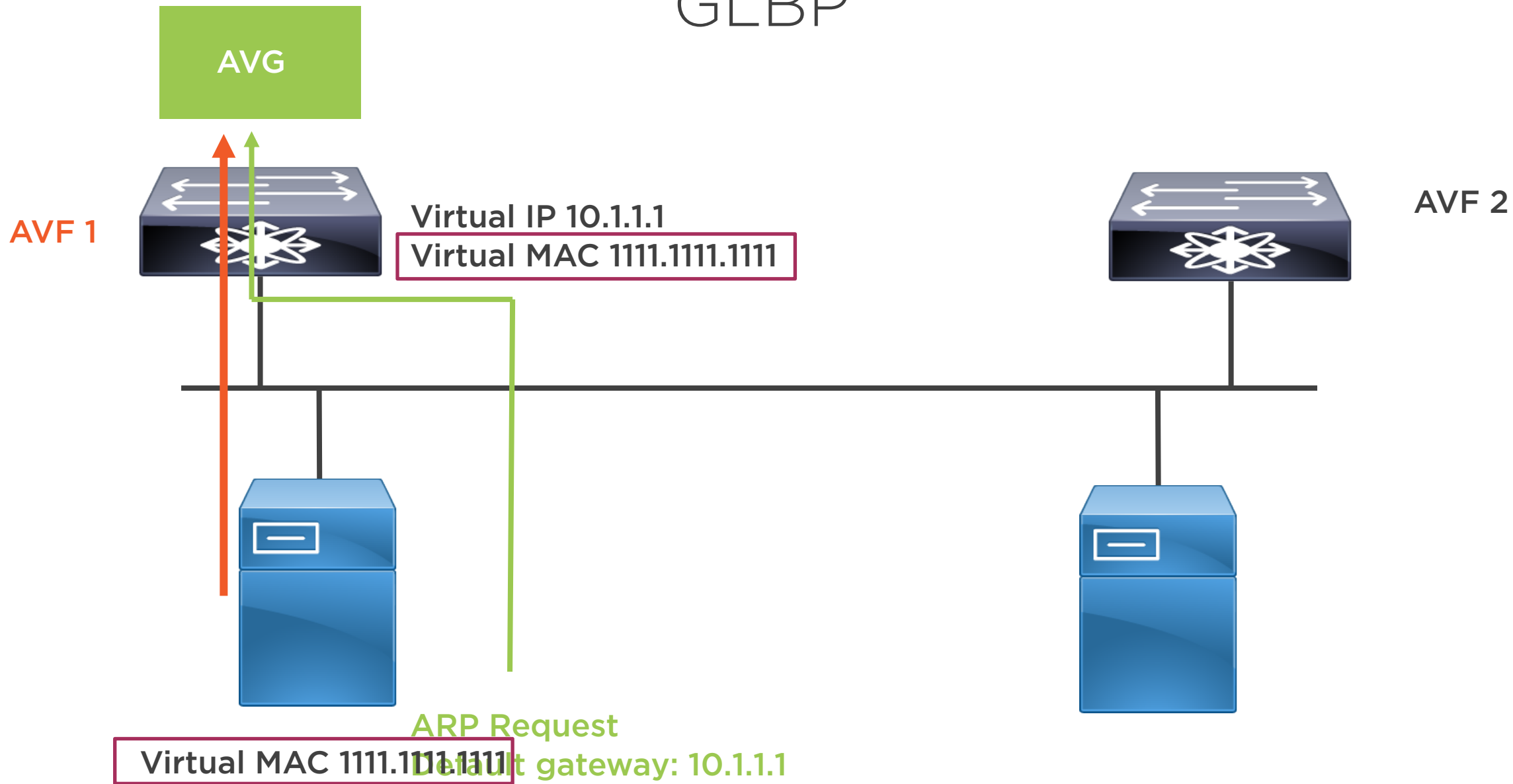
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# HSRP vs GLBP



# GLBP

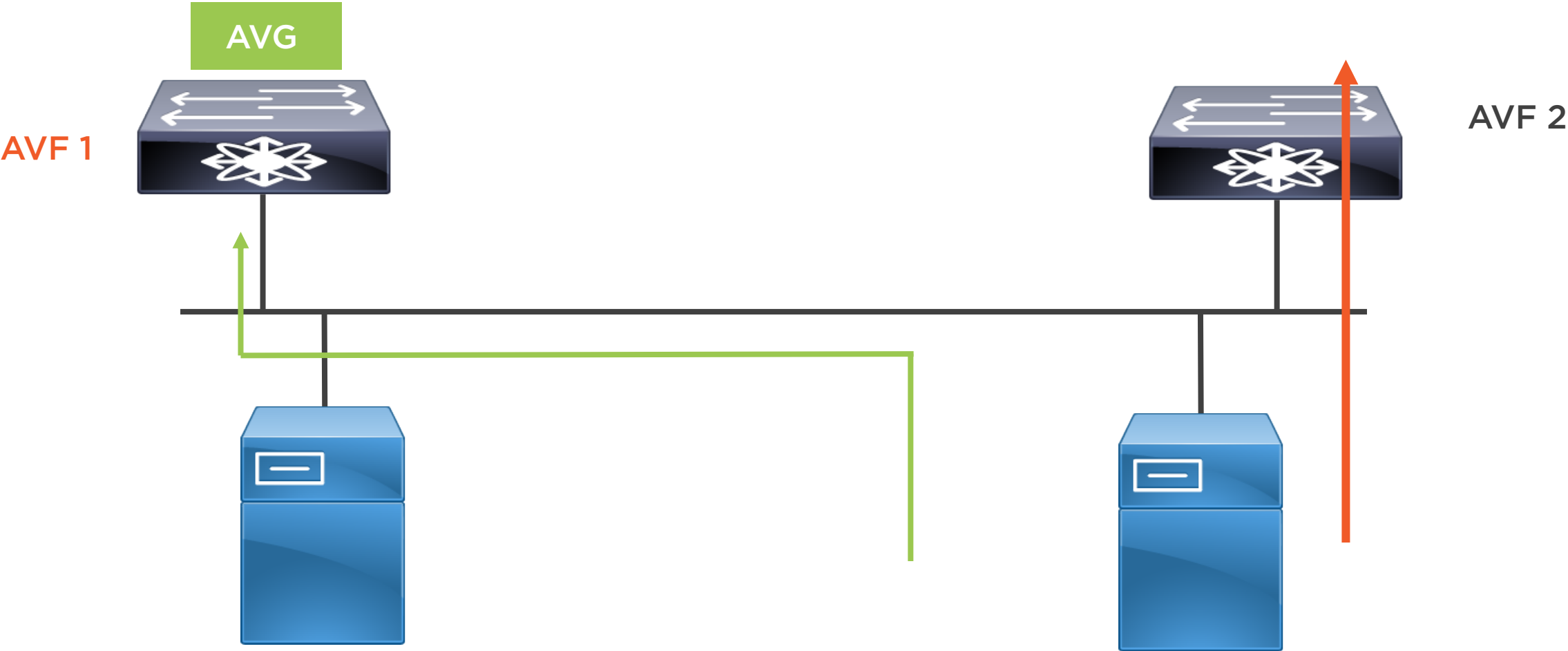




# GLBP

Virtual IP 10.1.1.1  
Virtual MAC 1111.1111.1111

Virtual IP 10.2.2.2  
Virtual MAC 2222.2222.2222



ARP Request  
Default gateway: 10.1.1.1  
Virtual MAC 2222.2222.2222



# Summary



**First-hop redundancy protocols provide redundancy for high availability and load balancing**

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- VRRP
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- GLBP

