Cisco AP Lab

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**Purpose**

VRF is an important component in network security and management. Instead of the traditional routing table, VRF allows routers to have virtual routing tables that are independent of each other. This provides the key advantage of being able to route traffic from various sources under different rules. Furthermore, it allows two devices with the same ip address or overlapping networks to use the same router. This is especially useful when configuring private IP addresses as without VRF, some private IP address networks could overlap and cause trouble.

**Background**

VRF provides virtual routing tables, that is it allows a router to make routing decisions dependent on which source the packet comes from. Let’s imagine two houses that live on the same street. Now lets say that one of these houses contains the president of the US (trust me, the analogy holds) while the other contains an average Samaritan. In a traditional network, both the president of the US and the average Samaritan have to use the same road to get out of neighborhood. That works fine, but now let’s pretend like our average Samaritan wasn’t so nice. What if they were a malicious actor. In our traditional network design, they’d have free reign to know what the president of the US is up to, and how to contact them.

That’s where VRF comes in. VRF or virtual router forwarding allows us to create separate “roads”. One for the president, and one for our not-so-nice Samaritan. How VRF works is it divides up the road. Depending on where you come from, your section of road will differ. There’s no way to get between the two roads. As such, our president has a sectioned off piece of road that only they can access while the average Samaritan has their own section of the road. Neither of the two of them know each other exist, let alone have access to each other’s houses.

Through this lab, we learned how to set up those two houses (In our topology, they were two computers) and how to section off those roads. Without VRF, the two computers would be able to see and ping each other but with VRF it’s like the other doesn’t exist.

**Lab Summary**

First, we created a general topology for the entire setup including 2 end devices connected to a chain of 4 routers and 2 other end devices on the other end. We configured each end device as needed with the appropriate IP address and set up VRF on the routers.

1. Set up basic device configuration including hostname and other basic device security information.
2. Enabled 2 different VRFs on each device.
3. Put the appropriate interfaces into each VRF.
4. Set IP addresses on interfaces based on our topology.
5. Set up default routes to distribute the appropriate IP addresses around our network.
6. Set up end device IP addresses and tested end to end connectivity.

**Lab Commands**

**Hostname RX**: Sets a unique hostname to identify the various routers

**Interface g0/0/X**: Access the interfaces

**No shut**: Turns on the interfaces

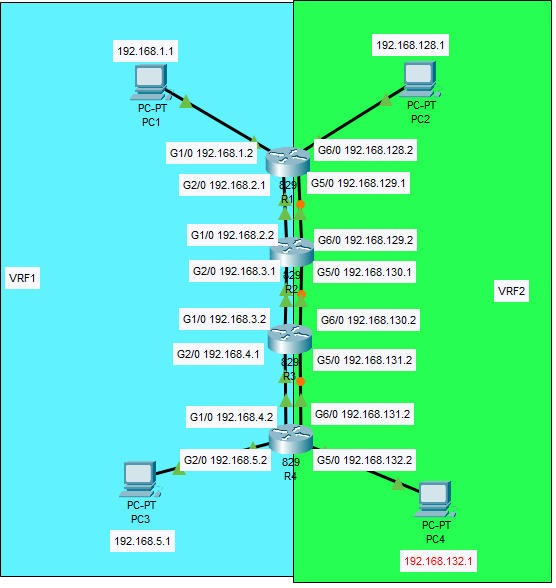
**Ip add 192.168.x.x 255.255.255.0**: sets an ipv4 address on an interface

**Ip vrf vrf1:** Creates the specific VRF named “vrf1”

**Ip vrf forwarding vrf1:** Associates a certain interface with the vrf named “vrf1”. This takes the interface out of the normal routing table

**Ip route vrf vrf1 192.168.x.x 255.255.255.0 192.168.x.x:** Creates an Ipv4 route for vrf1 that will route traffic from the first network toward the second ip address.

**Network Diagram**



**Configuration:**

**R1:**

en

config t

hostname R1

ip vrf vrf1

exit

ip vrf vrf2

exit

int G1/0

ip vrf forwarding vrf1

int G2/0

ip vrf forwarding vrf1

int G5/0

ip vrf forwarding vrf2

int g6/0

ip vrf forwarding vrf2

exit

int G1/0

no shut

ip add 192.168.1.2 255.255.255.0

int G2/0

no shut

ip add 192.168.2.1 255.255.255.0

int G6/0

no shut

ip add 192.168.128.2 255.255.255.0

int G5/0

no shut

ip add 192.168.129.1 255.255.255.0

!

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.2.2

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.129.2

**R2:**

en

config t

hostname R2

ip vrf vrf1

exit

ip vrf vrf2

exit

int G1/0

ip vrf forwarding vrf1

int G2/0

ip vrf forwarding vrf1

int G5/0

ip vrf forwarding vrf2

int g6/0

ip vrf forwarding vrf2

exit

int G1/0

no shut

ip add 192.168.2.2 255.255.255.0

int G2/0

no shut

ip add 192.168.3.1 255.255.255.0

int G6/0

no shut

ip add 192.168.129.2 255.255.255.0

int G5/0

no shut

ip add 192.168.130.1 255.255.255.0

!

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.3.2

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.2.1

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.130.2

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.129.1

**R3:**

en

config t

hostname R3

ip vrf vrf1

exit

ip vrf vrf2

exit

int G1/0

ip vrf forwarding vrf1

int G2/0

ip vrf forwarding vrf1

int G5/0

ip vrf forwarding vrf2

int g6/0

ip vrf forwarding vrf2

exit

int G1/0

no shut

ip add 192.168.3.2 255.255.255.0

int G2/0

no shut

ip add 192.168.4.1 255.255.255.0

int G6/0

no shut

ip add 192.168.130.2 255.255.255.0

int G5/0

no shut

ip add 192.168.131.1 255.255.255.0

!

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.4.2

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.3.1

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.131.2

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.130.1

**R4:**

en

config t

hostname R4

ip vrf vrf1

exit

ip vrf vrf2

exit

int G1/0

ip vrf forwarding vrf1

int G2/0

ip vrf forwarding vrf1

int G5/0

ip vrf forwarding vrf2

int g6/0

ip vrf forwarding vrf2

exit

int G1/0

no shut

ip add 192.168.4.2 255.255.255.0

int G2/0

no shut

ip add 192.168.5.2 255.255.255.0

int G6/0

no shut

ip add 192.168.131.2 255.255.255.0

int G5/0

no shut

ip add 192.168.132.2 255.255.255.0

!

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.4.1

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.131.1

**PCs:**

PC1:

ip 192.168.1.1/24 192.168.1.2

PC2:

ip 192.168.128.1/24 192.168.128.2

PC3:

ip 192.168.5.1/24 192.168.5.2

PC4:

ip 192.168.132.1/24 192.168.132.2

**Show Run:**

**R1**

Building configuration...

Current configuration : 1610 bytes

!

upgrade fpd auto

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R1

!

boot-start-marker

boot-end-marker

!

no aaa new-model

no ip icmp rate-limit unreachable

ip vrf vrf1

!

ip vrf vrf2

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

!

interface GigabitEthernet1/0

ip vrf forwarding vrf1

ip address 192.168.1.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet2/0

ip vrf forwarding vrf1

ip address 192.168.2.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet3/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet4/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet5/0

ip vrf forwarding vrf2

ip address 192.168.129.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet6/0

ip vrf forwarding vrf2

ip address 192.168.128.2 255.255.255.0

negotiation auto

!

ip forward-protocol nd

no ip http server

no ip http secure-server

!

!

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.2.2

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.129.2

!

no cdp log mismatch duplex

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

End

**R2**

Current configuration : 1726 bytes

!

upgrade fpd auto

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

hostname R2

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

!

ip vrf vrf1

!

ip vrf vrf2

!

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

!

redundancy

!

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

!

interface GigabitEthernet1/0

ip vrf forwarding vrf1

ip address 192.168.2.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet2/0

ip vrf forwarding vrf1

ip address 192.168.3.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet3/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet4/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet5/0

ip vrf forwarding vrf2

ip address 192.168.130.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet6/0

ip vrf forwarding vrf2

ip address 192.168.129.2 255.255.255.0

negotiation auto

!

ip forward-protocol nd

no ip http server

no ip http secure-server

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.2.1

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.3.2

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.129.1

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.130.2

!

no cdp log mismatch duplex

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

!

!

end

**R3**

Current configuration : 1726 bytes

!

upgrade fpd auto

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R3

!

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

ip vrf vrf1

!

ip vrf vrf2

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

redundancy

!

ip tcp synwait-time 5

!

interface FastEthernet0/0

no ip address

shutdown

duplex half

!

interface GigabitEthernet1/0

ip vrf forwarding vrf1

ip address 192.168.3.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet2/0

ip vrf forwarding vrf1

ip address 192.168.4.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet3/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet4/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet5/0

ip vrf forwarding vrf2

ip address 192.168.131.1 255.255.255.0

negotiation auto

!

interface GigabitEthernet6/0

ip vrf forwarding vrf2

ip address 192.168.130.2 255.255.255.0

negotiation auto

!

ip forward-protocol nd

no ip http server

no ip http secure-server

!

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.3.1

ip route vrf vrf1 192.168.5.0 255.255.255.0 192.168.4.2

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.130.1

ip route vrf vrf2 192.168.132.0 255.255.255.0 192.168.131.2

!

no cdp log mismatch duplex

!

control-plane

!

mgcp profile default

gatekeeper

shutdown

!

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

!

end

**R4**

Current configuration : 1610 bytes

!

upgrade fpd auto

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R4

!

boot-start-marker

boot-end-marker

!

no aaa new-model

no ip icmp rate-limit unreachable

!

ip vrf vrf1

!

ip vrf vrf2

!

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

!

redundancy

!

ip tcp synwait-time 5

!

interface FastEthernet0/0

no ip address

shutdown

duplex half

!

interface GigabitEthernet1/0

ip vrf forwarding vrf1

ip address 192.168.4.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet2/0

ip vrf forwarding vrf1

ip address 192.168.5.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet3/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet4/0

no ip address

shutdown

negotiation auto

!

interface GigabitEthernet5/0

ip vrf forwarding vrf2

ip address 192.168.132.2 255.255.255.0

negotiation auto

!

interface GigabitEthernet6/0

ip vrf forwarding vrf2

ip address 192.168.131.2 255.255.255.0

negotiation auto

!

ip forward-protocol nd

no ip http server

no ip http secure-server

!

ip route vrf vrf1 192.168.1.0 255.255.255.0 192.168.4.1

ip route vrf vrf2 192.168.128.0 255.255.255.0 192.168.131.1

!

no cdp log mismatch duplex

control-plane

mgcp profile default

!

gatekeeper

shutdown

!

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

**Show IP Route vrf vrf1/vrf2**

**R1**

**R1#show ip route vrf vrf1**

Routing Table: vrf1

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet1/0

L 192.168.1.2/32 is directly connected, GigabitEthernet1/0

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet2/0

L 192.168.2.1/32 is directly connected, GigabitEthernet2/0

S 192.168.5.0/24 [1/0] via 192.168.2.2

**R1#show ip route vrf vrf2**

Routing Table: vrf2

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

192.168.128.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.128.0/24 is directly connected, GigabitEthernet6/0

L 192.168.128.2/32 is directly connected, GigabitEthernet6/0

192.168.129.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.129.0/24 is directly connected, GigabitEthernet5/0

L 192.168.129.1/32 is directly connected, GigabitEthernet5/0

S 192.168.132.0/24 [1/0] via 192.168.129.2

R1#

**R2**

**R2#show ip route vrf vrf1**

Routing Table: vrf1

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.1.0/24 [1/0] via 192.168.2.1

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet1/0

L 192.168.2.2/32 is directly connected, GigabitEthernet1/0

192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.3.0/24 is directly connected, GigabitEthernet2/0

L 192.168.3.1/32 is directly connected, GigabitEthernet2/0

S 192.168.5.0/24 [1/0] via 192.168.3.2

**R2#show ip route vrf vrf2**

Routing Table: vrf2

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.128.0/24 [1/0] via 192.168.129.1

192.168.129.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.129.0/24 is directly connected, GigabitEthernet6/0

L 192.168.129.2/32 is directly connected, GigabitEthernet6/0

192.168.130.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.130.0/24 is directly connected, GigabitEthernet5/0

L 192.168.130.1/32 is directly connected, GigabitEthernet5/0

S 192.168.132.0/24 [1/0] via 192.168.130.2

R2#

**R3**

**R3#show ip route vrf vrf1**

Routing Table: vrf1

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.1.0/24 [1/0] via 192.168.3.1

192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.3.0/24 is directly connected, GigabitEthernet1/0

L 192.168.3.2/32 is directly connected, GigabitEthernet1/0

192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.4.0/24 is directly connected, GigabitEthernet2/0

L 192.168.4.1/32 is directly connected, GigabitEthernet2/0

S 192.168.5.0/24 [1/0] via 192.168.4.2

**R3#show ip route vrf vrf2**

Routing Table: vrf2

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.128.0/24 [1/0] via 192.168.130.1

192.168.130.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.130.0/24 is directly connected, GigabitEthernet6/0

L 192.168.130.2/32 is directly connected, GigabitEthernet6/0

192.168.131.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.131.0/24 is directly connected, GigabitEthernet5/0

L 192.168.131.1/32 is directly connected, GigabitEthernet5/0

S 192.168.132.0/24 [1/0] via 192.168.131.2

**R4**

R4#show ip route vrf vrf1

Routing Table: vrf1

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.1.0/24 [1/0] via 192.168.4.1

192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.4.0/24 is directly connected, GigabitEthernet1/0

L 192.168.4.2/32 is directly connected, GigabitEthernet1/0

192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.5.0/24 is directly connected, GigabitEthernet2/0

L 192.168.5.2/32 is directly connected, GigabitEthernet2/0

R4#show ip route vrf vrf2

Routing Table: vrf2

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

S 192.168.128.0/24 [1/0] via 192.168.131.1

192.168.131.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.131.0/24 is directly connected, GigabitEthernet6/0

L 192.168.131.2/32 is directly connected, GigabitEthernet6/0

192.168.132.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.132.0/24 is directly connected, GigabitEthernet5/0

L 192.168.132.2/32 is directly connected, GigabitEthernet5/0

R4#

**Pings**

**PC1**

PC1> ping 192.168.5.1

84 bytes from 192.168.5.1 icmp\_seq=1 ttl=60 time=134.738 ms

84 bytes from 192.168.5.1 icmp\_seq=2 ttl=60 time=121.111 ms

84 bytes from 192.168.5.1 icmp\_seq=3 ttl=60 time=119.953 ms

84 bytes from 192.168.5.1 icmp\_seq=4 ttl=60 time=121.153 ms

84 bytes from 192.168.5.1 icmp\_seq=5 ttl=60 time=121.456 ms

PC1> ping 192.168.128.1

\*192.168.1.2 icmp\_seq=1 ttl=255 time=15.163 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=2 ttl=255 time=14.862 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=3 ttl=255 time=15.180 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=4 ttl=255 time=15.042 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=5 ttl=255 time=15.482 ms (ICMP type:3, code:1, Destination host unreachable)

PC1> ping 192.168.132.1

\*192.168.1.2 icmp\_seq=1 ttl=255 time=15.165 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=2 ttl=255 time=15.101 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=3 ttl=255 time=15.131 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=4 ttl=255 time=15.289 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.1.2 icmp\_seq=5 ttl=255 time=15.034 ms (ICMP type:3, code:1, Destination host unreachable)

**PC2**

PC2> ping 192.168.132.1

84 bytes from 192.168.132.1 icmp\_seq=1 ttl=60 time=136.130 ms

84 bytes from 192.168.132.1 icmp\_seq=2 ttl=60 time=121.589 ms

84 bytes from 192.168.132.1 icmp\_seq=3 ttl=60 time=121.214 ms

84 bytes from 192.168.132.1 icmp\_seq=4 ttl=60 time=121.633 ms

84 bytes from 192.168.132.1 icmp\_seq=5 ttl=60 time=121.045 ms

PC2> ping 192.168.5.1

\*192.168.128.2 icmp\_seq=1 ttl=255 time=15.018 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=2 ttl=255 time=15.110 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=3 ttl=255 time=15.171 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=4 ttl=255 time=14.933 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=5 ttl=255 time=15.290 ms (ICMP type:3, code:1, Destination host unreachable)

PC2> ping 192.168.1.1

\*192.168.128.2 icmp\_seq=1 ttl=255 time=14.962 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=2 ttl=255 time=15.313 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=3 ttl=255 time=15.400 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=4 ttl=255 time=15.022 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.128.2 icmp\_seq=5 ttl=255 time=15.142 ms (ICMP type:3, code:1, Destination host unreachable)

**PC3**

PC3> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp\_seq=1 ttl=60 time=120.178 ms

84 bytes from 192.168.1.1 icmp\_seq=2 ttl=60 time=120.831 ms

84 bytes from 192.168.1.1 icmp\_seq=3 ttl=60 time=121.203 ms

84 bytes from 192.168.1.1 icmp\_seq=4 ttl=60 time=121.202 ms

84 bytes from 192.168.1.1 icmp\_seq=5 ttl=60 time=121.464 ms

PC3> ping 192.168.132.1

\*192.168.5.2 icmp\_seq=1 ttl=255 time=15.113 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=2 ttl=255 time=15.177 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=3 ttl=255 time=15.022 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=4 ttl=255 time=14.970 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=5 ttl=255 time=15.473 ms (ICMP type:3, code:1, Destination host unreachable)

PC3> ping 192.168.128.1

\*192.168.5.2 icmp\_seq=1 ttl=255 time=15.218 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=2 ttl=255 time=15.088 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=3 ttl=255 time=15.212 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=4 ttl=255 time=15.068 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.5.2 icmp\_seq=5 ttl=255 time=15.634 ms (ICMP type:3, code:1, Destination host unreachable)

**PC4**

PC4> ping 192.168.128.1

84 bytes from 192.168.128.1 icmp\_seq=1 ttl=60 time=121.336 ms

84 bytes from 192.168.128.1 icmp\_seq=2 ttl=60 time=121.640 ms

84 bytes from 192.168.128.1 icmp\_seq=3 ttl=60 time=121.079 ms

84 bytes from 192.168.128.1 icmp\_seq=4 ttl=60 time=119.834 ms

84 bytes from 192.168.128.1 icmp\_seq=5 ttl=60 time=121.155 ms

PC4> ping 192.168.1.1

\*192.168.132.2 icmp\_seq=1 ttl=255 time=15.019 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=2 ttl=255 time=15.296 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=3 ttl=255 time=15.236 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=4 ttl=255 time=14.933 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=5 ttl=255 time=15.182 ms (ICMP type:3, code:1, Destination host unreachable)

PC4> ping 192.168.5.1

\*192.168.132.2 icmp\_seq=1 ttl=255 time=15.112 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=2 ttl=255 time=15.359 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=3 ttl=255 time=15.220 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=4 ttl=255 time=14.594 ms (ICMP type:3, code:1, Destination host unreachable)

\*192.168.132.2 icmp\_seq=5 ttl=255 time=15.193 ms (ICMP type:3, code:1, Destination host unreachable)

**Traceroutes**

PC1> trace 192.168.5.1

trace to 192.168.5.1, 8 hops max, press Ctrl+C to stop

1 192.168.1.2 15.187 ms 15.168 ms 15.180 ms

2 192.168.2.2 41.387 ms 45.288 ms 45.215 ms

3 192.168.3.2 76.329 ms 76.181 ms 76.088 ms

4 192.168.4.2 107.140 ms 107.362 ms 105.856 ms

PC2> trace 192.168.132.1

trace to 192.168.132.1, 8 hops max, press Ctrl+C to stop

1 192.168.128.2 15.313 ms 15.155 ms 15.313 ms

2 192.168.129.2 45.207 ms 46.466 ms 45.138 ms

3 192.168.130.2 75.632 ms 75.190 ms 76.774 ms

4 192.168.131.2 105.320 ms 106.484 ms 105.230 ms

PC3> trace 192.168.1.1

trace to 192.168.1.1, 8 hops max, press Ctrl+C to stop

1 192.168.5.2 15.207 ms 14.732 ms 15.117 ms

2 192.168.4.1 46.579 ms 45.400 ms 45.578 ms

3 192.168.3.1 75.663 ms 75.055 ms 76.599 ms

4 192.168.2.1 105.877 ms 106.373 ms 106.260 ms

PC4> trace 192.168.128.1

trace to 192.168.128.1, 8 hops max, press Ctrl+C to stop

1 192.168.132.2 14.877 ms 15.096 ms 15.169 ms

2 192.168.131.1 45.005 ms 45.000 ms 45.307 ms

3 192.168.130.1 76.420 ms 74.831 ms 76.119 ms

4 192.168.129.1 105.539 ms 105.527 ms 105.697 ms

**Problems**

There were pretty few problems with this lab because it was relatively straight forward, but there were still a couple notable ones.

The first was with the router. We needed to make sure to edit the router in GNS3 to have at least 4 ports so we could configure our topology. This involved playing around with the device settings and setting certain device features to PA-GE mode.

The second was with the actual configurations. I made a slight mistake when writing the router config files but a trace route helped me identify and solve the issue. When copying over router configurations, I forgot to change the IP addresses for R4 which led to me being unable to ping across the network.

**Conclusion**

This Lab was relatively straight forward. I think VRF was a pretty neat concept in and of itself. It’s something I wouldn’t think was necessary (I mean who really thinks about making a new virtual routing table), but now that I’ve learned that it exists, it’s apparently clear how useful it could be.

This was also the last lab I did for CCNP during the 2023 – 2024 school year. I thoroughly enjoyed this year and think that this year helped me learn how much depth there is inside networking. There’s always more nuances (and ways to mess up), even in seemingly simple/straightforward concepts.

