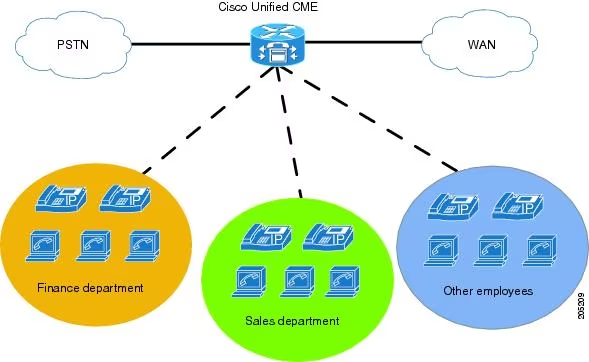
Cisco Lab 6: VRF-Lite



The purpose of this lab is to teach us how to use VRFs. This allows routers to have multiple routing tables exist simultaneously. Understanding how VRFs work will allow me to build multiple routing tables in the future, which would allow me to route different groups of devices to different locations without needing different routers. Compared to the previous lab, this one was quite easy to complete.

First, some background information. **V**irtual **R**outing and **F**orwarding is layer 3 technology that allows multiple of the same network to co-exist on the same network. That means you can have multiple networks with the address of say 192.168.1.0/24 on the same router. This is because VRFs isolate networks virtually and allow them to communicate within themselves, but not between each other. This also means that typing “show ip route” will show nothing. You have to specify which VRF’s routing table to show off.

The major advantage of VRFs is that they can separate networks. This means that multiple netwoks can have the same network address and subnet mask without separating them from other routers. For example, network A has the IP address of 172.16.3.0/24, but network B also has 172.16.3.0/24. Keep in mind that they are both on the same router. In a way, VRFs are the layer 3 equivalent of VLANs, where multiple LANs can be made and used on a single switch. This allows you to basically create an arbitrary number of full-size networks without the need to confuse yourself with subnetting.

The kind of VRFs that we implemented here was VRF-lite. VRF-lite is basically a simpler version of VRFs, but it works pretty similarly. The big difference between VRF and VRF-lite is that VRF-lite doesn’t use MPLS (multiprotocol label switching) or MP BGP (multiprotocol BGP). I don’t want to go into detail on how these protocols work, but all that needs to be known for now is that these make VRF much more scalable than VRF-lite. However, if you don’t plan on scaling anything significantly or at all, then VRF-lite is all you need.

In summary, I set up 3 routers with VRF to allow PCs to ping each other withing their respective VRFs, and to prevent them from pinging each other across VRFs.

Here are all the new commands needed for this lab to work.

vrf definition [name] | Creates the VRF and names it

address-family [ipv4/ipv6] | Activates the IPv4 and v6 address families so they can be used later

interface [interface] | Opens interface

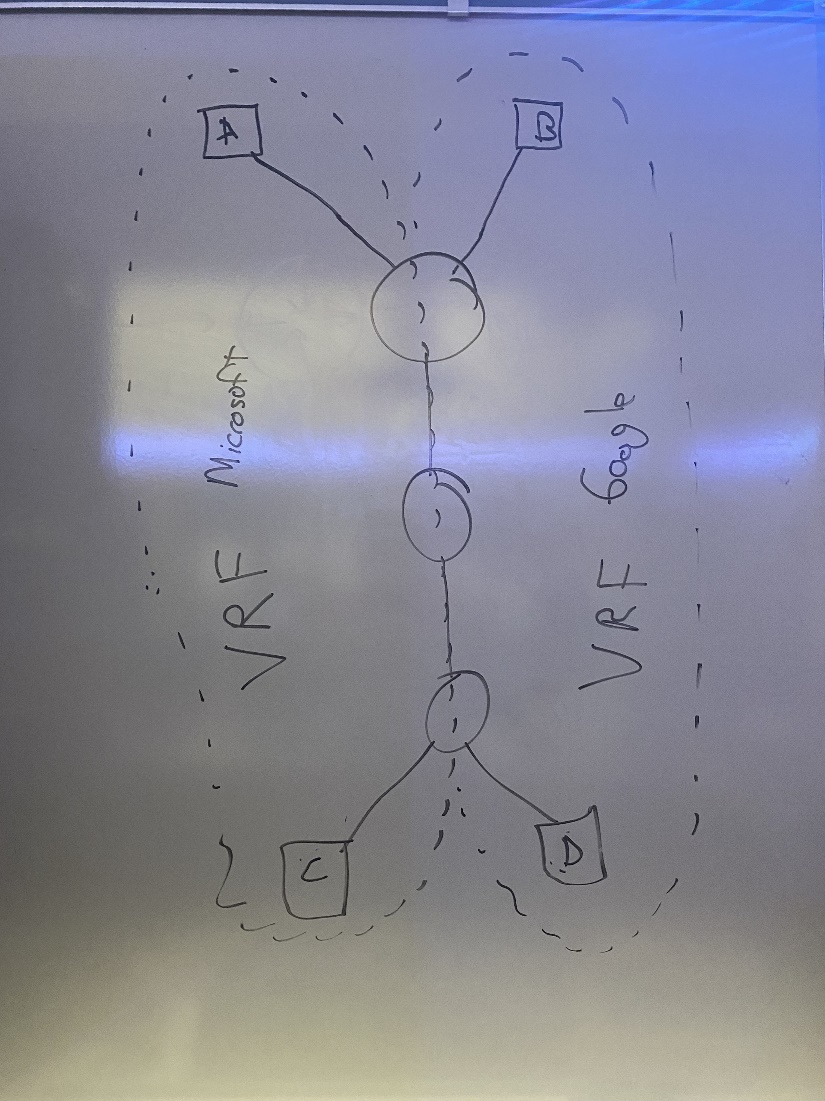
vrf forwarding [name] | Binds interface to specified VRF

router eigrp [name] | Instead of AS, you give it a virtual instance name. Name does not have to be the same as the VRF that it will be linked to

address-family [ipv4/ipv6] vrf [vrf] autonomous-system [#] | Opens the address family and binds the VRF to that family.

The remaining commands are pretty much the same as other labs.

Here is the network diagram that was conveniently laid out for me to use:



In this lab, I only had 2 PCs, so I used PC A and PC B in this diagram and used loopback interfaces for C and D.

Here are all the routers’ running configurations and IP and IPv6 routes, as well as the pings from PC A to “PC C.”

R1#show run

Building configuration...

Current configuration : 2896 bytes

Last configuration change at 21:46:41 UTC Mon Jan 23 2023

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R1

boot-start-marker

boot-end-marker

vrf definition Google

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Microsoft

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

ipv6 unicast-routing

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21442B21

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

vlan 10

name Microsoft

vlan 20

name Google

interface GigabitEthernet0/0/0

vrf forwarding Microsoft

ip address 10.0.0.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001::1/64

interface GigabitEthernet0/0/1

vrf forwarding Google

ip address 10.0.0.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001::1/64

interface Serial0/1/0

no ip address

interface Serial0/1/1

no ip address

interface GigabitEthernet0/2/0

no ip address

negotiation auto

interface GigabitEthernet0/2/0.10

encapsulation dot1Q 10

vrf forwarding Microsoft

ip address 10.0.1.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:1::1/64

interface GigabitEthernet0/2/0.20

encapsulation dot1Q 20

vrf forwarding Google

ip address 10.0.1.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:1::1/64

interface GigabitEthernet0/2/1

no ip address

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

negotiation auto

interface Vlan1

no ip address

router eigrp Microsoft

address-family ipv4 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

address-family ipv6 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

eigrp router-id 1.1.1.1

exit-address-family

router eigrp Google

address-family ipv6 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

eigrp router-id 1.1.1.1

exit-address-family

address-family ipv4 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R1#show ip route

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

R1#show ip route vrf Google

Routing Table: Google

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

C 10.0.0.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.0.1/32 is directly connected, GigabitEthernet0/0/1

C 10.0.1.0/24 is directly connected, GigabitEthernet0/2/0.20

L 10.0.1.1/32 is directly connected, GigabitEthernet0/2/0.20

D 10.0.2.0/24

[90/15360] via 10.0.1.2, 00:38:40, GigabitEthernet0/2/0.20

D 10.0.3.0/24

[90/16000] via 10.0.1.2, 00:38:25, GigabitEthernet0/2/0.20

R1#show ip route vrf Microsoft

Routing Table: Microsoft

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

C 10.0.0.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.0.1/32 is directly connected, GigabitEthernet0/0/0

C 10.0.1.0/24 is directly connected, GigabitEthernet0/2/0.10

L 10.0.1.1/32 is directly connected, GigabitEthernet0/2/0.10

D 10.0.2.0/24

[90/15360] via 10.0.1.2, 00:38:49, GigabitEthernet0/2/0.10

D 10.0.3.0/24

[90/16000] via 10.0.1.2, 00:38:31, GigabitEthernet0/2/0.10

R1#

Router 2:

R2#show run

Building configuration...

Current configuration : 5174 bytes

Last configuration change at 21:28:26 UTC Mon Jan 23 2023

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R2

boot-start-marker

boot-end-marker

vrf definition Google

rd 1:20

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Microsoft

rd 1:10

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-2270144787

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2270144787

revocation-check none

rsakeypair TP-self-signed-2270144787

crypto pki certificate chain TP-self-signed-2270144787

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 32323730 31343437 3837301E 170D3233 30313233 32313238

32365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 32373031

34343738 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100C5B4 6CA2315D 6B2B8B37 55ABAEAA 182858C3 A7C8EEC0 7B9352D7

CBF8B577 B42197A7 056AD956 D11E1B7E 8BF9399E B784026E A25B21D4 4FC16DDB

B8FE746B AFC06E05 87939D5E E47A74A1 CD2EB6AD 8DFB8EA0 79EE9B37 66CC9A12

1C22F7C8 88E41B94 8489FD59 AD8FFF63 4B38CEBE 84E64EE7 29FC873E F17CDA9E

606BFB19 D1C9A81D 80615D02 5D498D64 6FDA0108 C3535F56 C9AB78BF AD9AD176

6E91904D 5FFF8126 2CDA02B6 04850B42 6860FBCB AA29DE4C 07400E6C 349C0E10

B9B26062 B568BC42 DFB2486F 8D04EBC8 FE5098E3 F530548B BBCB1E16 0AB8090E

615DFE28 6A65423E 923210A1 AA7BE6E7 A7EDB444 16DB9CE7 00F1BB32 2E5B0B90

9D73E747 844F0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 1439EE02 071E3F9E D220F860 E2D51CA1 3EC84530

1D301D06 03551D0E 04160414 39EE0207 1E3F9ED2 20F860E2 D51CA13E C845301D

300D0609 2A864886 F70D0101 05050003 82010100 74F18476 94D716C6 A6ED8B9A

0C99CD78 ECF54673 18A313E7 0A73A3EE A1A99CCC DA621F5C BA9255EE E3A17096

E96823AC 3D3ABE87 9EC0511E 79275F6F 932CF7F6 864D12C8 6A76564F 84AB9690

DD19A244 842ABB33 0C12F3D5 F0F7B0E8 DC85015D 26017B70 FA439A6B 3193FD19

F878C0EC C3581461 4957B1B5 FF43A9B2 B8B01C61 67C9317C 1F7E4E63 CF0698B6

03ACAA3D 657FA139 FC20ED71 63494FCA DAA11257 8276BA02 F3F34D8E CAFFA9C9

C2434D74 31BEB866 728D912A B9C27613 E6B3924B 418ED4BB 54235FC2 7B11D4AE

CA91A6C8 FB08B033 1E58B996 C778B75C CF0E8473 EBDAB785 99CEF3AE 6BEFDE74

10FB7DEE 2CF70DEB 3252B959 08915BC9 78460CCB

quit

license udi pid ISR4321/K9 sn FLM24060912

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

no ip address

negotiation auto

interface GigabitEthernet0/0/1

no ip address

negotiation auto

interface GigabitEthernet0/2/0

no ip address

negotiation auto

interface GigabitEthernet0/2/0.10

encapsulation dot1Q 10

vrf forwarding Microsoft

ip address 10.0.1.2 255.255.255.0

ipv6 address FE80::2 link-local

ipv6 address 2001:1::2/64

interface GigabitEthernet0/2/0.20

encapsulation dot1Q 20

vrf forwarding Google

ip address 10.0.1.2 255.255.255.0

ipv6 address FE80::2 link-local

ipv6 address 2001:1::2/64

interface GigabitEthernet0/2/1

no ip address

negotiation auto

interface GigabitEthernet0/2/1.10

encapsulation dot1Q 10

vrf forwarding Microsoft

ip address 10.0.2.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:2::1/64

interface GigabitEthernet0/2/1.20

encapsulation dot1Q 20

vrf forwarding Google

ip address 10.0.2.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:2::1/64

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

negotiation auto

router eigrp Microsoft

address-family ipv4 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

address-family ipv6 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

eigrp router-id 2.2.2.2

exit-address-family

router eigrp Google

address-family ipv6 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

eigrp router-id 2.2.2.2

exit-address-family

address-family ipv4 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

ip forward-protocol nd

no ip http server

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R2#show ip route

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

R2#show ip route vrf Google

Routing Table: Google

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

D 10.0.0.0/24

[90/15360] via 10.0.1.1, 00:32:21, GigabitEthernet0/2/0.20

C 10.0.1.0/24 is directly connected, GigabitEthernet0/2/0.20

L 10.0.1.2/32 is directly connected, GigabitEthernet0/2/0.20

C 10.0.2.0/24 is directly connected, GigabitEthernet0/2/1.20

L 10.0.2.1/32 is directly connected, GigabitEthernet0/2/1.20

D 10.0.3.0/24

[90/10880] via 10.0.2.2, 00:39:46, GigabitEthernet0/2/1.20

R2#show ip route vrf Microsoft

Routing Table: Microsoft

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

D 10.0.0.0/24

[90/15360] via 10.0.1.1, 00:36:49, GigabitEthernet0/2/0.10

C 10.0.1.0/24 is directly connected, GigabitEthernet0/2/0.10

L 10.0.1.2/32 is directly connected, GigabitEthernet0/2/0.10

C 10.0.2.0/24 is directly connected, GigabitEthernet0/2/1.10

L 10.0.2.1/32 is directly connected, GigabitEthernet0/2/1.10

D 10.0.3.0/24

[90/10880] via 10.0.2.2, 00:39:49, GigabitEthernet0/2/1.10

R2#

Router 3:

R3#show run

Building configuration...

Current configuration : 5150 bytes

Last configuration change at 21:34:58 UTC Mon Jan 23 2023

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R3

boot-start-marker

boot-end-marker

vrf definition Google

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

vrf definition Microsoft

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-4144679456

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-4144679456

revocation-check none

rsakeypair TP-self-signed-4144679456

crypto pki certificate chain TP-self-signed-4144679456

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 34313434 36373934 3536301E 170D3233 30313139 32323131

30385A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 31343436

37393435 36308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100A09D 93BDA389 091A78BD C390A97E 589DBF2B E71E9C2B 01DB093C

4E40F274 5606A9B9 DCA90B6C 40E406B8 AD6AB092 557ED760 F7A78FFA D5999F83

70BBA1B0 D444FC25 0CA0CF24 00CDCBE6 B5257D6F 747CF06E 9769A83A 662945D8

8C3E53A4 58321E8A D7F422F0 E5E91A91 DF1B1CB7 F905EF6D DAA6301F CDAC13AB

8514C09C 67BD5764 581B2560 3009E1AD D889911F 3323537E 967EE814 3D6EDBBD

45A659A3 2E9CCD57 8BC6D979 606D787C 5551FA3A 1AC363FD D7E81A4D 1FBFAFDF

C7B48645 B5D456FF E3C013B9 7521C8D5 0F474924 51B87B22 7FC47F3D 46C52ADE

12155994 2EE00488 DBD56EC2 8898D4C3 4E6F5F8E A36D7C92 61E60DA1 E548C01A

E1DB54E8 09C70203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 142167BA 234342FB 5E8E3641 3F4D18CF 573470C8

B2301D06 03551D0E 04160414 2167BA23 4342FB5E 8E36413F 4D18CF57 3470C8B2

300D0609 2A864886 F70D0101 05050003 82010100 4EB8A070 16BDC486 813FE81C

948527B3 AF0114D2 32787C11 C5CEB9B9 F759BD53 9FFCE7F0 E308E8FF 5E8858E9

3B259E55 B4CA85A6 2962F890 7BCC9928 1B0F05C0 AA312232 484812B3 E35D373D

F82CF390 9294BA32 B23974D9 58401BF6 8DB4A255 02871E76 D5EB0657 FD4EC43F

2A13DE09 FFCF099B EB2ECF43 9810A1A7 67502434 0ACC7AB2 724A25BB A9D53C7E

1AD07881 1FE8E4D0 966B5C02 29D01E44 EF401274 4728C487 DD3F798A 73A57A81

87DB116F 1089B2C7 1B35E96D 18B32B04 8D8F726D 96F867A4 A2E042B8 DEC66D99

E419E1D2 CFD599DF B54D4CAD DA031BC0 19B7BF18 968B6B46 11381C74 9E15599E

3F1FE2EB D73045D0 529764BD 0FCF22F5 20813C82

quit

license udi pid ISR4321/K9 sn FLM2408005M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

vrf forwarding Microsoft

ip address 10.0.3.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:3::1/64

interface Loopback1

vrf forwarding Google

ip address 10.0.3.1 255.255.255.0

ipv6 address FE80::1 link-local

ipv6 address 2001:3::1/64

interface GigabitEthernet0/0/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/0/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/1

no ip address

negotiation auto

interface GigabitEthernet0/2/1.10

encapsulation dot1Q 10

vrf forwarding Microsoft

ip address 10.0.2.2 255.255.255.0

ipv6 address FE80::2 link-local

ipv6 address 2001:2::2/64

interface GigabitEthernet0/2/1.20

encapsulation dot1Q 20

vrf forwarding Google

ip address 10.0.2.2 255.255.255.0

ipv6 address FE80::2 link-local

ipv6 address 2001:2::2/64

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router eigrp Microsoft

address-family ipv6 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

eigrp router-id 3.3.3.3

exit-address-family

address-family ipv4 unicast vrf Microsoft autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

router eigrp Googlw

address-family ipv4 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

network 10.0.0.0 0.0.3.255

exit-address-family

address-family ipv6 unicast vrf Google autonomous-system 1

topology base

exit-af-topology

eigrp router-id 3.3.3.3

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R3#show ip route

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

R3#show ip route vrf Google

Routing Table: Google

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

D 10.0.0.0/24

[90/20480] via 10.0.2.1, 00:33:58, GigabitEthernet0/2/1.20

D 10.0.1.0/24

[90/15360] via 10.0.2.1, 00:41:24, GigabitEthernet0/2/1.20

C 10.0.2.0/24 is directly connected, GigabitEthernet0/2/1.20

L 10.0.2.2/32 is directly connected, GigabitEthernet0/2/1.20

C 10.0.3.0/24 is directly connected, Loopback1

L 10.0.3.1/32 is directly connected, Loopback1

R3#show ip route vrf Microsoft

Routing Table: Microsoft

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

D 10.0.0.0/24

[90/20480] via 10.0.2.1, 00:38:26, GigabitEthernet0/2/1.10

D 10.0.1.0/24

[90/15360] via 10.0.2.1, 00:41:31, GigabitEthernet0/2/1.10

C 10.0.2.0/24 is directly connected, GigabitEthernet0/2/1.10

L 10.0.2.2/32 is directly connected, GigabitEthernet0/2/1.10

C 10.0.3.0/24 is directly connected, Loopback0

L 10.0.3.1/32 is directly connected, Loopback0

R3#

Pings and traceroutes of the PC:

C:\Users\user>ping 10.0.3.1

Pinging 10.0.3.1 with 32 bytes of data:

Reply from 10.0.3.1: bytes=32 time=1ms TTL=253

Reply from 10.0.3.1: bytes=32 time=1ms TTL=253

Reply from 10.0.3.1: bytes=32 time=1ms TTL=253

Reply from 10.0.3.1: bytes=32 time=1ms TTL=253

Ping statistics for 10.0.3.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\user>tracert 10.0.3.1

Tracing route to 10.0.3.1 over a maximum of 30 hops

1 <1 ms <1 ms <1 ms 10.0.0.1

2 <1 ms <1 ms <1 ms 10.0.1.2

3 1 ms 1 ms 1 ms 10.0.3.1

Trace complete.

C:\Users\user>ping 2001:3::1

Pinging 2001:3::1 with 32 bytes of data:

Reply from 2001:3::1: time=1ms

Reply from 2001:3::1: time=1ms

Reply from 2001:3::1: time=1ms

Reply from 2001:3::1: time=1ms

Ping statistics for 2001:3::1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\user>tracert 2001:3::1

Tracing route to 2001:3::1 over a maximum of 30 hops

1 <1 ms <1 ms <1 ms 2001::1

2 <1 ms <1 ms <1 ms 2001:1::2

3 <1 ms <1 ms <1 ms 2001:3::1

Trace complete.

C:\Users\user>

I had a couple minor issues during this lab. First wasn’t a problem, but something that I noticed after finishing the lab. You could put multiple VRFs into a single group with EIGRP. I used multiple EIGRP groups to separate the VRFs because I assumed that I had to. It doesn’t matter that much, but I just need to keep that in mind. The biggest problem was that when setting up a routing protocol to work with VRFs, OSPF for some reason could not see any of the VRFs that I made. After a little bit of troubleshooting, I gave up and switched to EIGRP. Another problem that I had was trying to get VRFs to work in IPv6. I noticed that using “ip vrf name” didn’t work, so I had to start over with “vrf definition” instead. Otherwise, I didn’t really have any problems otherwise.

In conclusion, I set up VRF-lite on 3 different routers to allow endpoints to get some devices to connect together while blocking other connections. I had a couple problems with it such as using the right routing protocol, but overall, the lab was straightforward. I learned how VRF works and why someone would want to use it rather than buying lots of redundant equipment.