Hands-on Advanced Networking Topics: BGP, BGP Hijacking, MPLS, MPLS-based VPNs, Segment Routing, and others

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Lab 6: Virtual Routing and Forwarding (VRF)

Introduction to VRF

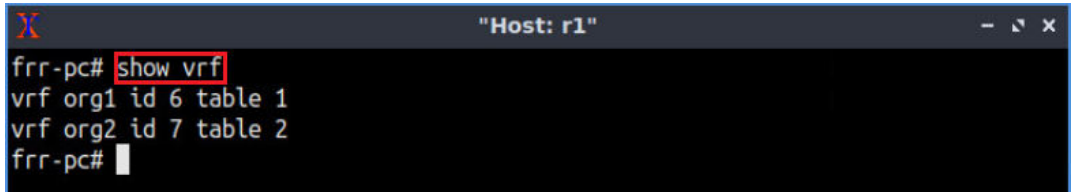
- VRF is a technology that allows multiple instances of a routing table to co-exist within the same router at the same time
- An interface cannot belong to more than one VRF at a time
- It is commonly used by Internet Service Providers (ISPs) to create separate Virtual Private Networks (VPNs) for customers

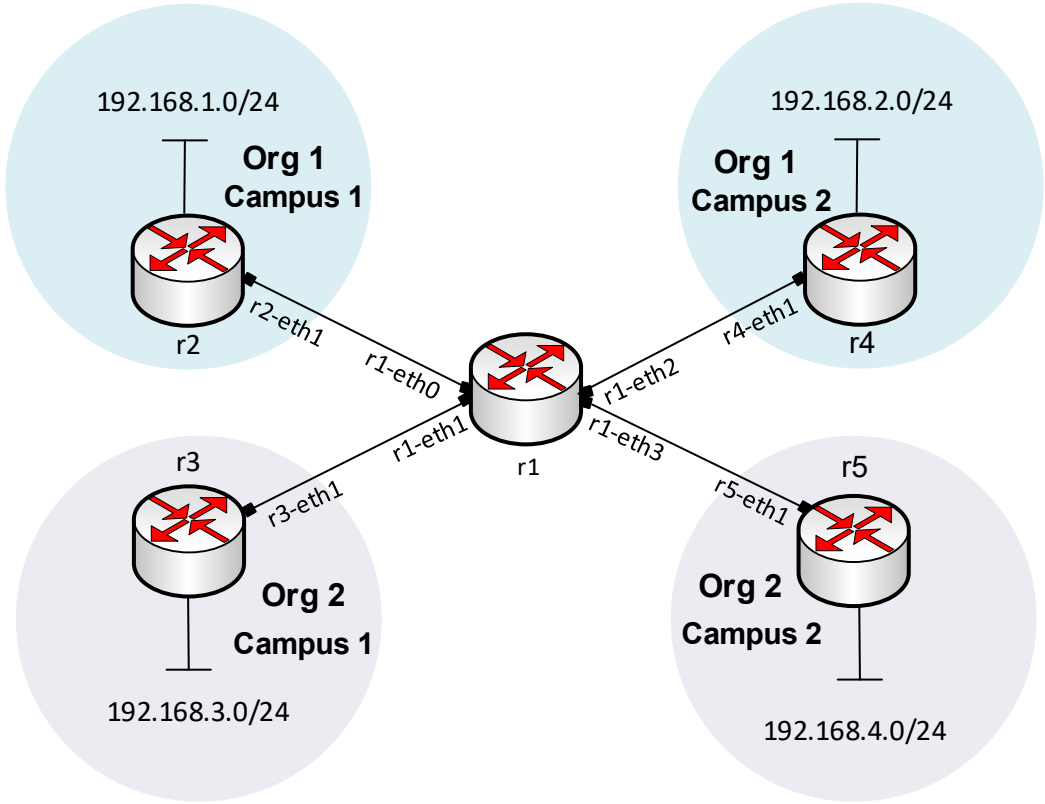
VRF Advantages

- VRF saves resources by eliminating the need for extra physical routers
- It allows overlapping Ip addresses since the routing instances are separated for each VRF
- It is useful when there is a requirement to segregate different application (i.e., voice, video, data)
- VRF increases network functionality because network paths can be segmented without requiring multiple routers

Create VRF

- Create VRF for each organization

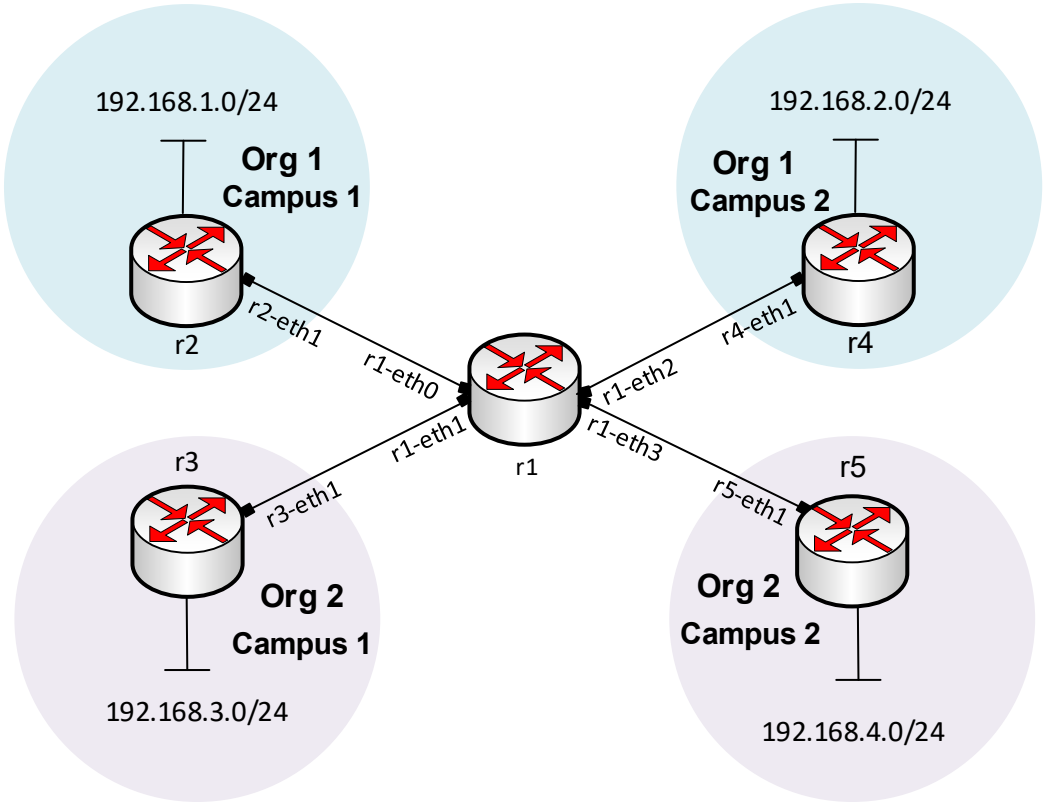




Create VRF

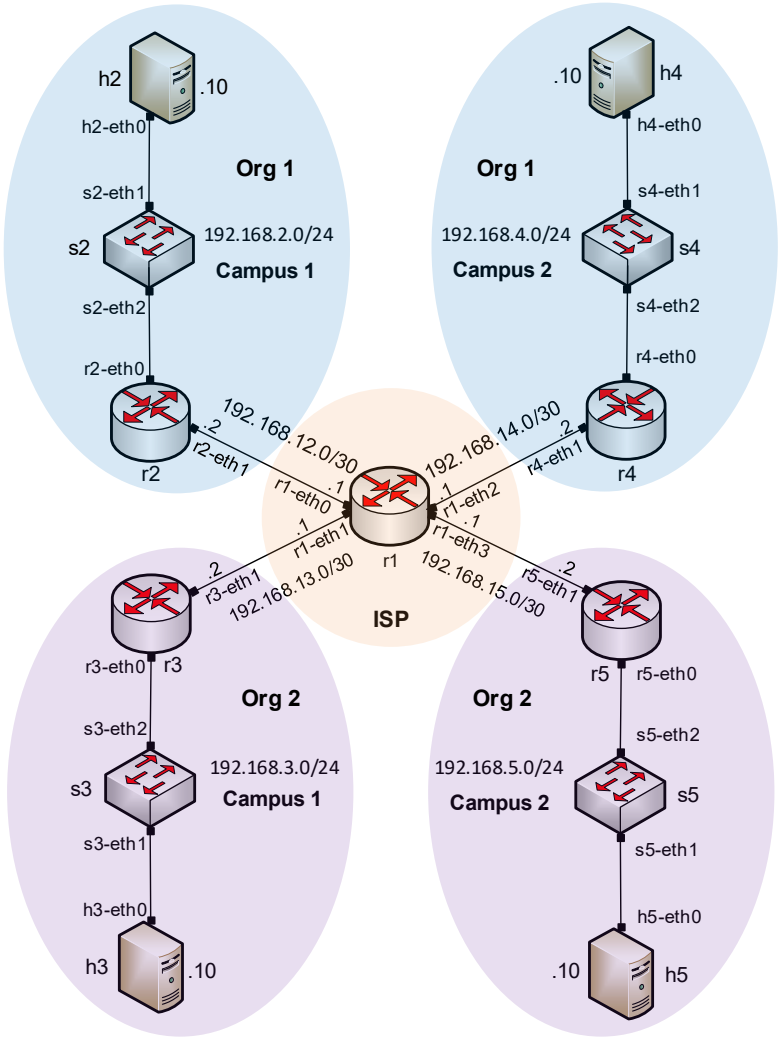
- Assign a VRF for each interface to create separate routing tables

Interface	VRF
r1-eth0	org1
r1-eth2	org1
r1-eth1	org2
r1-eth3	org2



Lab topology

- Two organizations (org1 and org2) are connected to the ISP
- Each organization has two sites (campus 1 and campus 2)
- Initially all the routers/end-hosts can communicate with each other
- After configuring VRF, router r1 creates a separate routing table for each organization



Lab configuration

- Routing table for org1

```
"Host: r1"
frr-pc# show ip route vrf org1
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, D - SHARP,
       F - PBR, f - OpenFabric,
       > - selected route, * - FIB route, q - queued route, r - rejected route

VRF org1:
S>* 192.168.2.0/24 [1/0] via 192.168.12.2, r1-eth0, 02:36:46
S>* 192.168.4.0/24 [1/0] via 192.168.14.2, r1-eth2, 02:32:38
C>* 192.168.12.0/30 is directly connected, r1-eth0, 02:47:20
C>* 192.168.14.0/30 is directly connected, r1-eth2, 02:45:47
frr-pc#
```

- Routing table for org2

```
"Host: r1"
frr-pc# show ip route vrf org2
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, D - SHARP,
       F - PBR, f - OpenFabric,
       > - selected route, * - FIB route, q - queued route, r - rejected route

VRF org2:
S>* 192.168.3.0/24 [1/0] via 192.168.13.2, r1-eth1, 00:06:38
S>* 192.168.5.0/24 [1/0] via 192.168.15.2, r1-eth3, 00:06:27
C>* 192.168.13.0/30 is directly connected, r1-eth1, 02:45:45
C>* 192.168.15.0/30 is directly connected, r1-eth3, 02:44:36
frr-pc#
```