VRF(Virtual routing and forwarding)

Basic VRF

Step 1. Create VRF instance

```
admin@sonic:~$ sudo config vrf add Vrf_01
```

Caution: When you create VRF instance, it has naming rule. The head of the naming string must be "Vrf".

Step 2. Binding the Ethernet0/VLAN10 to VRF instance.

```
admin@sonic:~$ sudo config interface vrf bind Ethernet0 Vrf_01
admin@sonic:~$ sudo config interface vrf bind Vlan10 Vrf_01
```

Caution: If there's an IP address on Ethernet0 after binding the VRF, the IP address will be removed.

Step 3: Adding IP address on Ethernet0 (refer to this article)

Step 4. Checking the VRF

```
admin@sonic:~$ show vrf
VRF     Interfaces
------  ------------
Vrf_01  Ethernet0
        Vlan10
```

```
admin@sonic:~$ show ip interfaces
Interface    Master    IPv4 address/mask    Admin/Oper    BGP Neighbor
Neighbor IP
-----------  --------  -------------------  ------------  --------------
-------------
Ethernet0    Vrf_01    192.168.1.1/24       up/up         N/A             N/A
Vlan10       Vrf_01    192.168.10.1/24      up/up       N/A             N/A
docker0                240.127.1.1/24       up/down       N/A             N/A
eth0                   188.188.97.31/16     up/up         N/A             N/A
lo                     127.0.0.1/8          up/up         N/A             N/A
```

Step 5: Checking the routing table.

You may check the routing table for the VRF instance or check all of the routing tables.

```
admin@sonic:~$ show ip route vrf Vrf_01
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

C>*192.168.1.0/24 is directly connected, Ethernet0, 00:04:25
K>*192.168.1.1/32 [0/0] is directly connected, Ethernet0, 00:04:25
C>*192.168.10.0/24 is directly connected, Vlan10, 00:04:11
K>*192.168.10.1/32 [0/0] is directly connected, Vlan10, 00:04:11
```

```
admin@sonic:~$ show ip route vrf all
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 Vrf_01:
C>*192.168.1.0/24 is directly connected, Ethernet0, 00:05:26
K>*192.168.1.1/32 [0/0] is directly connected, Ethernet0, 00:05:26
```

```
C>*192.168.10.0/24 is directly connected, Vlan10, 00:05:12
K>*192.168.10.1/32 [0/0] is directly connected, Vlan10, 00:05:12

VRF default:
C>*188.188.0.0/16 is directly connected, eth0, 17:43:26
```

Management VRF

Step 1. Create Management VRF

```
admin@sonic:~$ sudo config vrf add mgmt
```

Step 2. Checking the Management VRF

```
admin@sonic:~$ show mgmt-vrf

ManagementVRF : Enabled

Management VRF interfaces in Linux:
128: mgmt: <NOARP,MASTER,UP,LOWER_UP> mtu 65536 qdisc noqueue state UP mode
DEFAULT group default qlen 1000
    link/ether 52:2f:cc:b8:28:b5 brd ff:ff:ff:ff:ff:ff promiscuity 0 minmtu 68
maxmtu 1500
    vrf table 5000 addrgenmode eui64 numtxqueues 1 numrxqueues 1 gso_max_size
65536 gso_max_segs 65535
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq master mgmt state
UP mode DEFAULT group default qlen 1000
    link/ether 80:a2:35:4f:4f:40 brd ff:ff:ff:ff:ff:ff
129: lo-m: <BROADCAST,NOARP,UP,LOWER_UP> mtu 1500 qdisc noqueue master mgmt
state UNKNOWN mode DEFAULT group default qlen 1000
    link/ether 0a:25:2e:1f:32:90 brd ff:ff:ff:ff:ff:ff

admin@sonic:~$ show ip interfaces
Interface    Master    IPv4 address/mask    Admin/Oper    BGP Neighbor
Neighbor IP
-----------  --------  -------------------  ------------  --------------
-------------
Ethernet0    Vrf_01    192.168.1.1/24       up/up         N/A             N/A
Loopback0              10.1.0.1/32          up/up         N/A             N/A
docker0                240.127.1.1/24       up/down       N/A             N/A
eth0         mgmt      188.188.97.31/16     up/up         N/A             N/A
lo                     127.0.0.1/8          up/up         N/A             N/A
lo-m         mgmt      127.0.0.1/8          up/up         N/A             N/A
```

Step 3: Checking the routing table.

```
admin@sonic:~$ show ip route vrf mgmt
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 mgmt:
K>* 0.0.0.0/0 [0/0] via 188.188.1.1, eth0, 00:12:12
C>* 188.188.0.0/16 is directly connected, eth0, 00:12:12


admin@sonic:~$ show ip route vrf all
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 Vrf_01:
C>* 192.168.1.0/24 is directly connected, Ethernet0, 00:01:04
```

```
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

C>* 10.1.0.1/32 is directly connected, Loopback0, 00:01:05

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 mgmt:
K>* 0.0.0.0/0 [0/0] via 188.188.1.1, eth0, 00:01:21
C>* 188.188.0.0/16 is directly connected, eth0, 00:01:21
```

Caution: About the Restriction 2, you need to assign MGMT VRF to run the command.

For example:

```
admin@sonic:~$ ping 8.8.8.8
connect: Network is unreachable     ---> If you didn't assign the MGMT VRF to run the command, it will use in-band data plane network (default VRF).
admin@sonic:~$ sudo ip vrf exec mgmt ping 8.8.8.8 -c 5
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=57 time=2.86 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=57 time=2.64 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=57 time=2.70 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=57 time=2.88 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=57 time=2.83 ms

--- 8.8.8.8 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 10ms
rtt min/avg/max/mdev = 2.637/2.782/2.877/0.095 ms
```

Leaking VRF Routes
Restriction:
The directly connected routes that leaked from other VRFs will be forwarded to CPU, instead of ASIC, so it causes low performance.
Topology:

Setting:
Step 1: Enter Vty shell.

```
admin@sonic:~$ vtysh

Hello, this is FRRouting (version 8.1).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

sonic#
```

Step 2: Set the routing leaking.

```
sonic# configure terminal
sonic(config)# vrf Vrf200
sonic(config-vrf)# ip route 192.168.10.0/24 Vlan100 nexthop-vrf Vrf100
sonic(config-vrf)# exit
sonic(config)# vrf Vrf100
sonic(config-vrf)# ip route 192.168.20.0/24 Vlan200 nexthop-vrf Vrf200
```

Step 3: Check the routing table.

```
sonic# show ip route vrf all
```

```
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, F - PBR,
f - OpenFabric,
> - selected route, * - FIB route, q - queued, r - rejected, b - backup
t - trapped, o - offload failure

VRF Vrf100:
C>* 192.168.10.0/24 is directly connected, Vlan100, 00:11:44
K>* 192.168.10.254/32 [0/0] is directly connected, Vlan100, 00:11:44
S>* 192.168.20.0/24 [1/0] is directly connected, Vlan200 (vrf Vrf200), weight 1,
00:00:07

VRF Vrf200:
S>* 192.168.10.0/24 [1/0] is directly connected, Vlan100 (vrf Vrf100), weight 1,
00:00:26
C>* 192.168.20.0/24 is directly connected, Vlan200, 00:11:34
K>* 192.168.20.254/32 [0/0] is directly connected, Vlan200, 00:11:34

VRF default:
C>* 188.188.0.0/16 is directly connected, eth0, 00:19:03
```

Ping from Host1 to Host2

```
root@ts:~# ping 192.168.20.1 -c 5
PING 192.168.20.1 (192.168.20.1) 56(84) bytes of data.
64 bytes from 192.168.20.1: icmp_seq=1 ttl=63 time=1.19 ms
64 bytes from 192.168.20.1: icmp_seq=2 ttl=63 time=1.47 ms
64 bytes from 192.168.20.1: icmp_seq=3 ttl=63 time=1.46 ms
64 bytes from 192.168.20.1: icmp_seq=4 ttl=63 time=1.34 ms
64 bytes from 192.168.20.1: icmp_seq=5 ttl=63 time=1.33 ms

--- 192.168.20.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4008ms
rtt min/avg/max/mdev = 1.186/1.359/1.472/0.104 ms
```