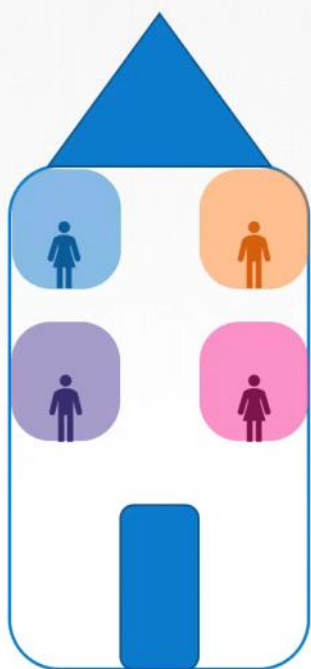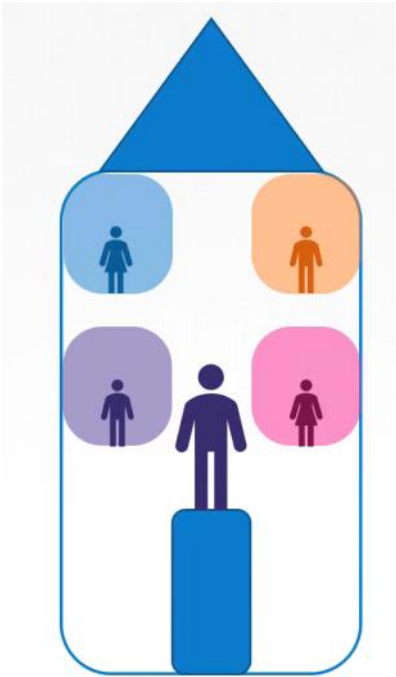# PRE-REQUISITE
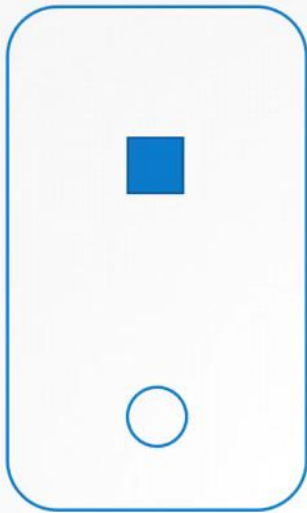# NETWORK
NAMESPACES
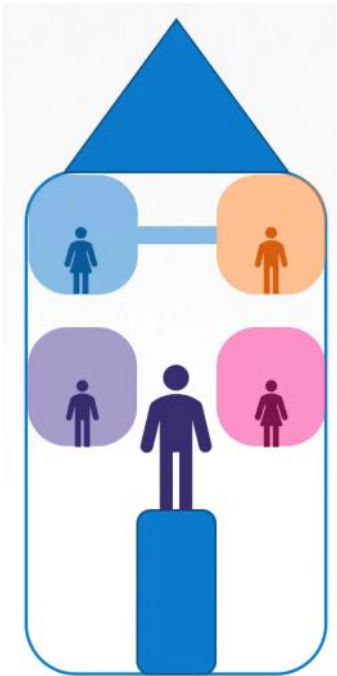
PROCESS NAMESPACE

PROCESS NAMESPACE


```
▶ ps aux                                              (On the container)
USER        PID %CPU %MEM      VSZ   RSS TTY      STAT START    TIME COMMAND
root          1  0.0  0.0     4528   828 ?        Ss   03:06    0:00 nginx
```

PROCESS NAMESPACE

```
  ps aux                                                      (On the container)
USER          PID %CPU %MEM    VSZ    RSS TTY      STAT START   TIME COMMAND
root            1  0.0  0.0   4528    828 ?        Ss   03:06   0:00 nginx
```
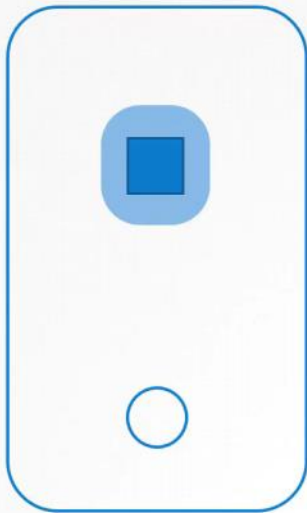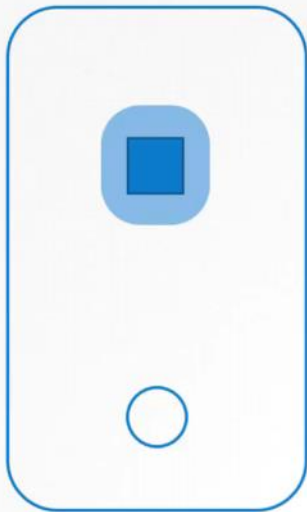
```
  ps aux                                                      (On the host)
USER          PID %CPU %MEM    VSZ    RSS TTY      STAT START   TIME COMMAND
project      3720  0.1  0.1  95500   4916 ?        R    06:06   0:00 sshd: project@pts/0
project      3725  0.0  0.1  95196   4132 ?        S    06:06   0:00 sshd: project@notty
project      3727  0.2  0.1  21352   5340 pts/0    Ss   06:06   0:00 -bash
root         3802  0.0  0.0   8924   3616 ?        Sl   06:06   0:00 docker-containerd-
shim -namespace m
root         3816  1.0  0.0   4528    828 ?        Ss   06:06   0:00 nginx
```
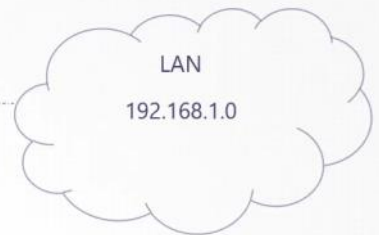
NETWORK NAMESPACE

eth0

192.168.1.2

LAN

192.168.1.0

NETWORK NAMESPACE

veth0

Routing Table	ARP Table

eth0

192.168.1.2

LAN

192.168.1.0

Routing Table	ARP Table
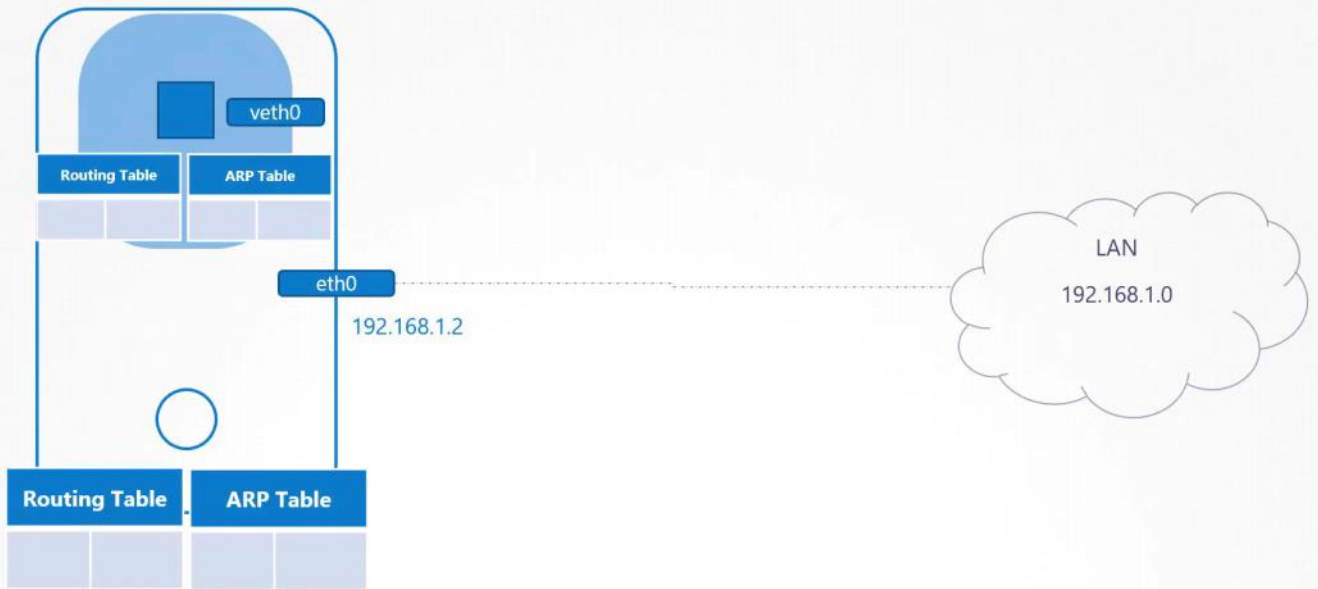
CREATE NETWORK NS

```
ip netns add red
```

```
ip netns add blue
```

```
ip netns
red
blue
```
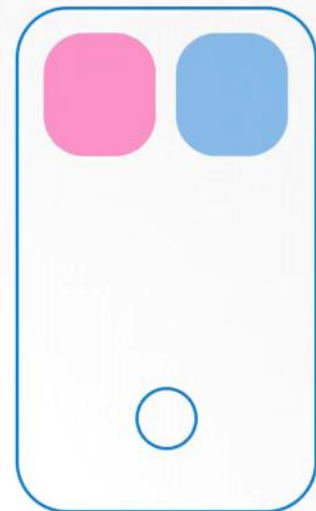
EXEC IN NETWORK NS

```
▶ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc state UNKNOWN mode DEFAULT group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc state UP mode DEFAULT qlen 1000
   link/ether 02:42:ac:11:00:08 brd ff:ff:ff:ff:ff:ff
```
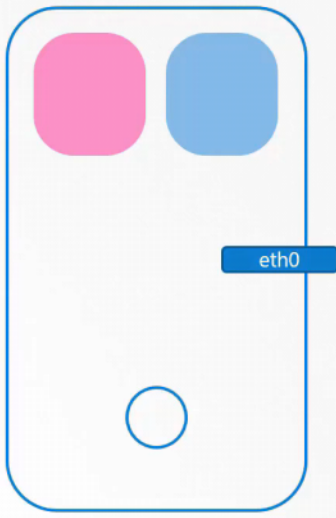
```
▶ ip netns exec red  ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc state UNKNOWN mode DEFAULT group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
```

```
▶ ip -n red  link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc state UNKNOWN mode DEFAULT group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
```

```
ip netns exec red ip link
              =
ip    -n red          link
```
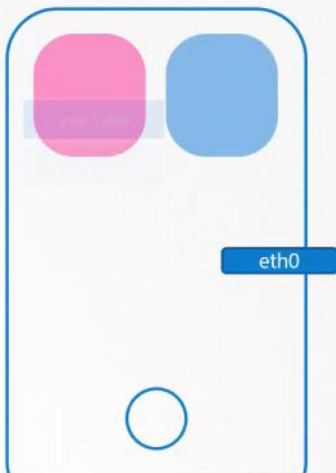
EXEC IN NETWORK NS

```
▶ arp
Address              HWtype  HWaddress          Flags Mask        Iface
172.17.0.21          ether   02:42:ac:11:00:15  C                eth0
172.16.0.8           ether   06:fe:d3:b5:59:65  C                eth0
_gateway             ether   02:42:d5:7a:84:8e  C                eth0
host01               ether   02:42:ac:11:00:1c  C                eth0
```

```
▶ ip netns exec red arp
Address              HWtype  HWaddress          Flags Mask        Iface
```

ARP Table	
172.17.0.21	02:42:ac:11:00:15
172.16.0.8	06:fe:d3:b5:59:65

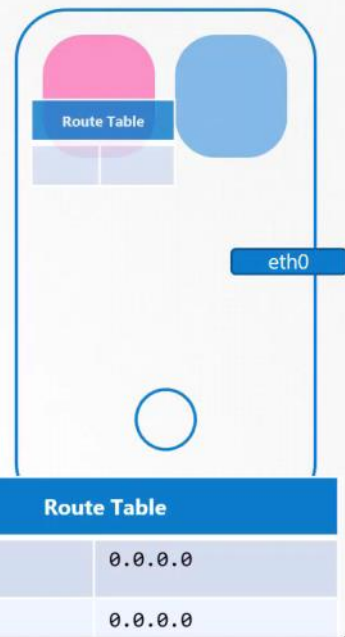# EXEC IN NETWORK NS

```
route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    202    0        0 eth0
172.17.0.0      0.0.0.0         255.255.0.0     U     202    0        0 eth0
172.17.0.0      0.0.0.0         255.255.255.0   U     0      0        0 docker0
```
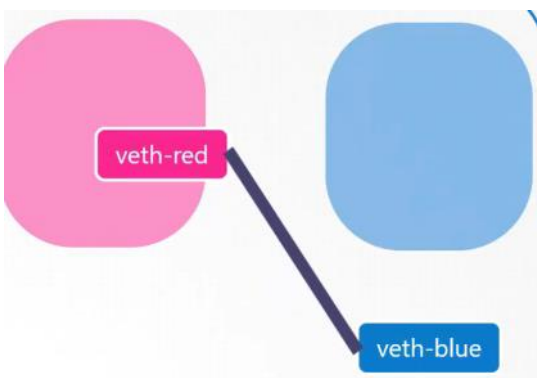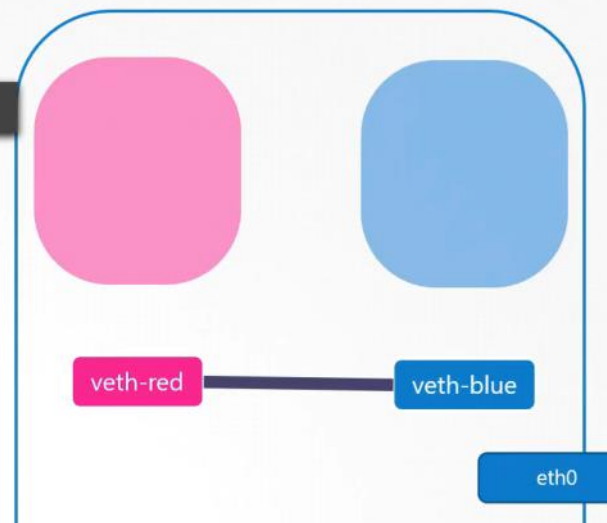
```
ip netns exec red route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
```

Route Table	
172.17.0.0	0.0.0.0
17.18.0.0	0.0.0.0

```
ip link add veth-red type veth peer name veth-blue
```

veth-red — veth-blue

eth0

veth-red

veth-blue

```
ip link set veth-red netns red
```

```
ip link set veth-blue netns blue
```

```
ip link add veth-red type veth peer name veth-blue
```

```
ip link set veth-red netns red
```

```
ip link set veth-blue netns blue
```

```
ip -n red  addr add 192.168.15.1 dev veth-red
```
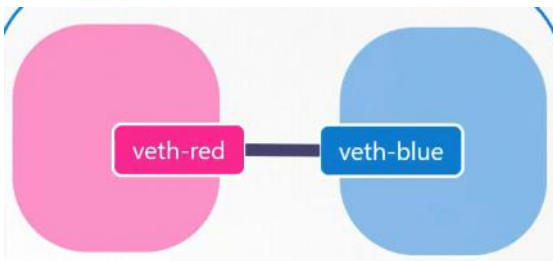
```
ip -n blue addr add 192.168.15.2 dev veth-blue
```
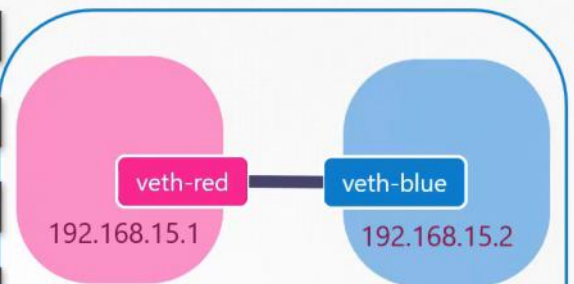


```
ip link add veth-red type veth peer name veth-blue
```

```
ip link set veth-red netns red
```

```
ip link set veth-blue netns blue
```

```
ip -n red  addr add 192.168.15.1 dev veth-red
```
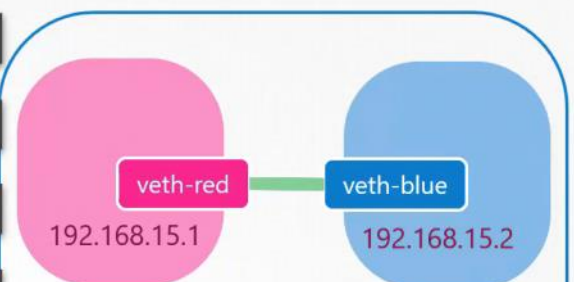
```
ip -n blue addr add 192.168.15.2 dev veth-blue
```

```
ip -n red  link set veth-red up
```

```
ip -n blue link set veth-blue up
```

```
ip netns exec red ping 192.168.15.2
PING 192.168.15.2 (192.168.15.2) 56(84) bytes of data.
64 bytes from 192.168.15.2: icmp_seq=1 ttl=64 time=0.026 ms
```

```
ip -n red  link set veth-red up
```

```
ip -n blue link set veth-blue up
```

```
ip netns exec red ping 192.168.15.2
PING 192.168.15.2 (192.168.15.2) 56(84) bytes of data.
64 bytes from 192.168.15.2: icmp_seq=1 ttl=64 time=0.026 ms
```
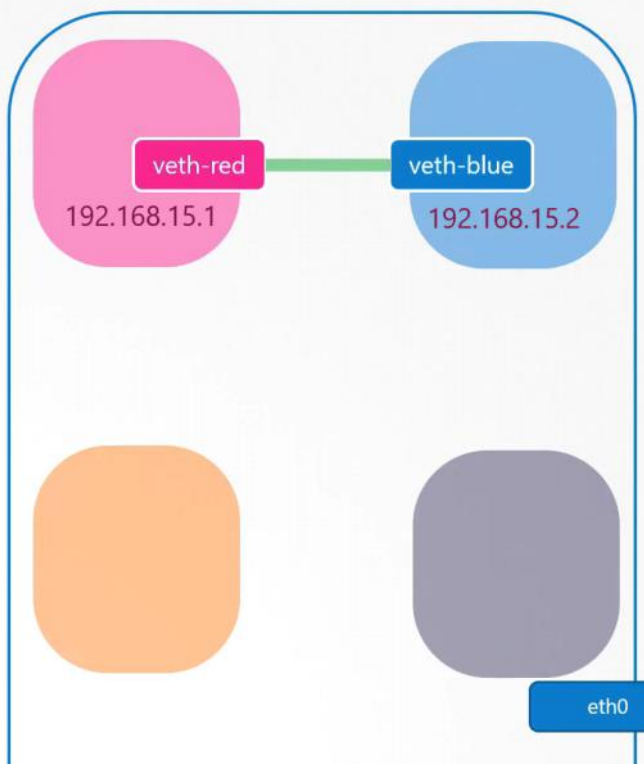
```
ip netns exec red arp
Address          HWtype  HWaddress           Flags Mask      Iface
192.168.15.2     ether   ba:b0:6d:68:09:e9   C               veth-red
```

```
ip netns exec blue arp
Address          HWtype  HWaddress           Flags Mask      Iface
192.168.15.1     ether   7a:9d:9b:c8:3b:7f   C               veth-blue
```

```
arp
Address          HWtype  HWaddress             Flags Mask      Iface
192.168.1.3      ether   52:54:00:12:35:03     C               eth0
192.168.1.4      ether   52:54:00:12:35:04     C               eth0
```

ARP Table	
192.168.15.2	ba:b0:6d:68:09:e9

ARP Table	
192.168.15.1	7a:9d:9b:c8:3b:7f

eth0

ARP Table	
192.168.1.3	52:54:00:12:35:03
192.168.1.4	52:54:00:12:35:04

veth-red 192.168.15.1 — veth-blue 192.168.15.2

eth0

LINUX
BRIDGE

OvS
Open vSwitch

veth-red — veth-blue
192.168.15.1   192.168.15.2

Network
192.168.15.0

eth0

LINUX BRIDGE

```
ip link add v-net-0 type bridge
```

veth-red — veth-blue
192.168.15.1   192.168.15.2

Network
192.168.15.0
v-net-0

eth0

```
ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state
UNKNOWN mode DEFAULT group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 02:0d:31:14:c7:a7 brd ff:ff:ff:ff:ff:ff
6: v-net-0: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN
mode DEFAULT group default qlen 1000
    link/ether 06:9d:69:52:6f:61 brd ff:ff:ff:ff:ff:ff
```
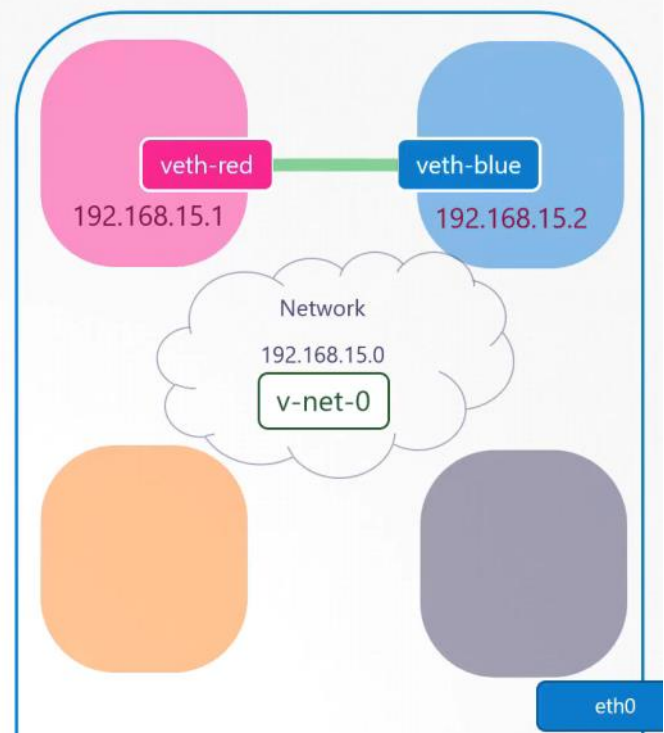
LINUX BRIDGE

```
▶ ip link add v-net-0 type bridge
```

```
▶ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state
UNKNOWN mode DEFAULT group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 02:0d:31:14:c7:a7 brd ff:ff:ff:ff:ff:ff
6: v-net-0: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN
mode DEFAULT group default qlen 1000
    link/ether 06:9d:69:52:6f:61 brd ff:ff:ff:ff:ff:ff
```

```
▶ ip link set dev v-net-0 up
```

veth-red 192.168.15.1 — veth-blue 192.168.15.2

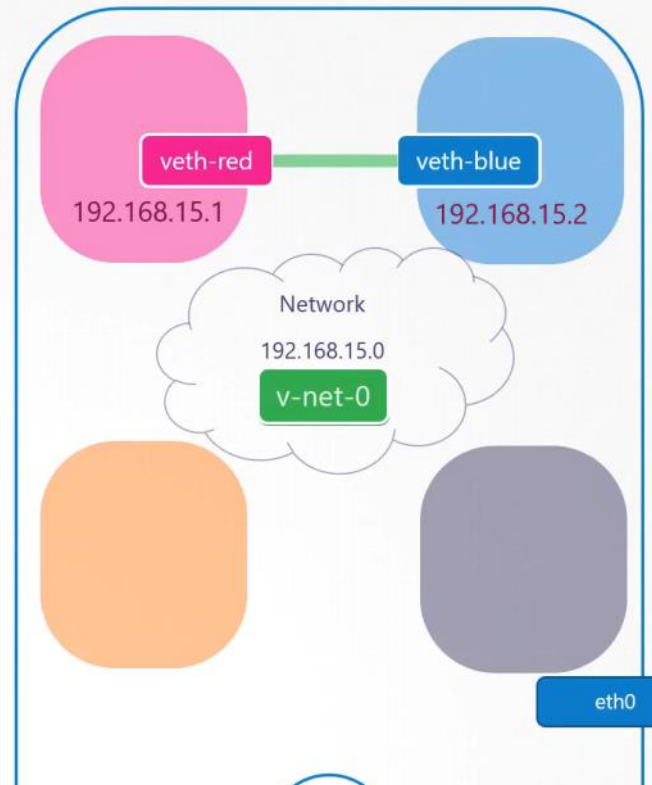Network 192.168.15.0 — v-net-0

eth0

```
▶ ip -n red link del veth-red
```

```
▶ ip link add veth-red type veth peer name veth-red-br
```

veth-red — veth-red-br

```
▶ ip link add veth-blue type veth peer name veth-blue-br
```
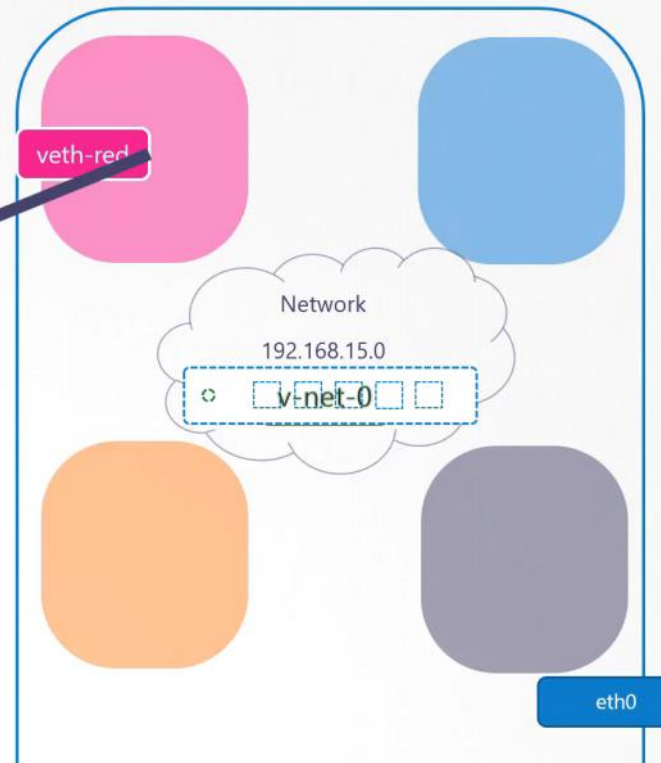
veth-blue — veth-blue-br

LINUX BRIDGE

```
ip link set veth-red netns red
```

```
ip link set veth-red-br master v-net-0
```

veth-red

veth-red-br

veth-blue — veth-blue-br

Network

192.168.15.0

v-net-0

eth0

LINUX BRIDGE

```
ip link set veth-red netns red
```

```
ip link set veth-red-br master v-net-0
```

```
ip link set veth-blue netns blue
```

```
ip link set veth-blue-br master v-net-0
```

veth-blue

veth-red

veth-red-br

Network

veth-blue-br

192.168.15.0

v-net-0
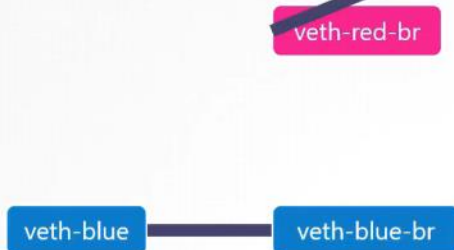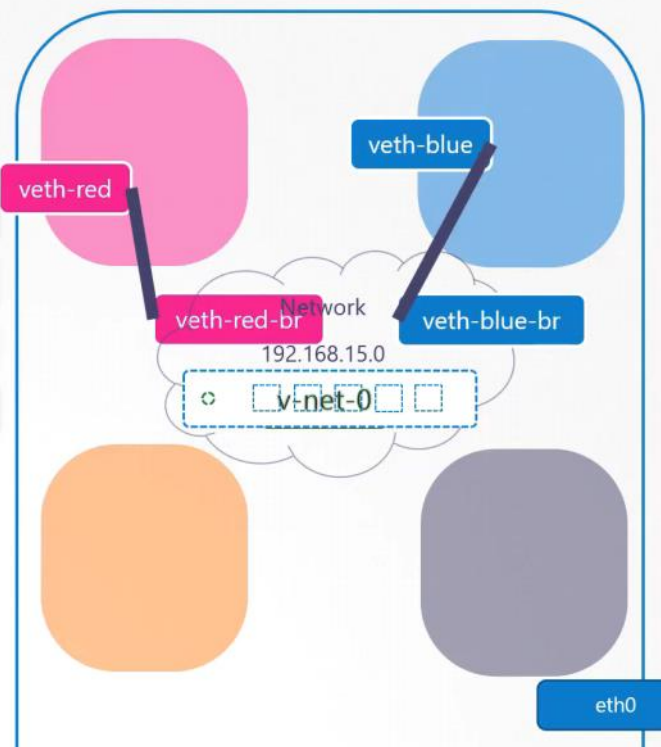
eth0

LINUX BRIDGE


```
ip link set veth-red netns red
```

```
ip link set veth-red-br master v-net-0
```

```
ip link set veth-blue netns blue
```
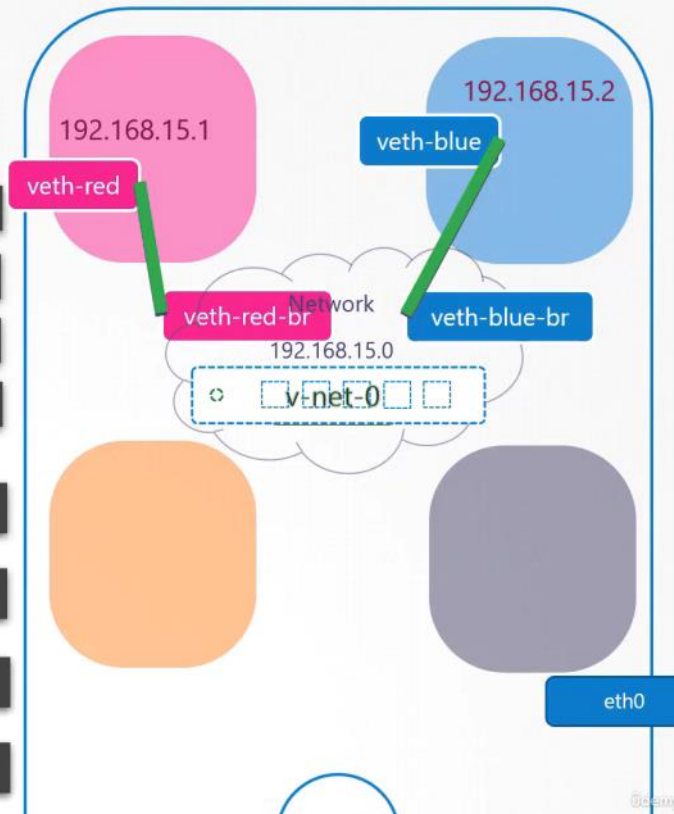
```
ip link set veth-blue-br master v-net-0
```

```
ip -n red addr add 192.168.15.1 dev veth-red
```

```
ip -n blue addr add 192.168.15.2 dev veth-blue
```

```
ip -n red link set veth-red up
```

```
ip -n blue link set veth-blue up
```

LINUX BRIDGE


```
ping 192.168.15.1
Not Reachable!
```
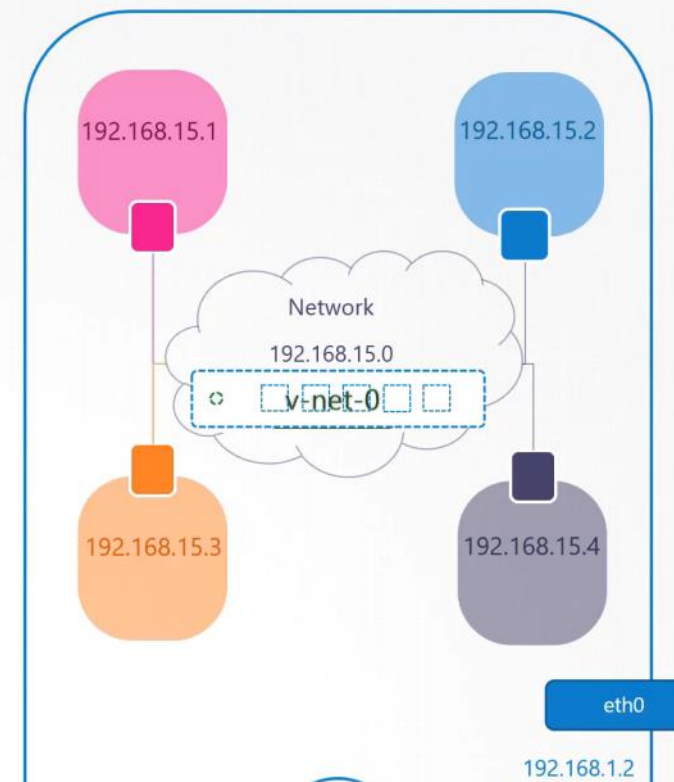
LINUX BRIDGE

```
ping 192.168.15.1
Not Reachable!
```

```
ip addr add 192.168.15.5/24 dev v-net-0
```

```
ping 192.168.15.1
PING 192.168.15.1 (192.168.15.1) 56(84) bytes of data.
64 bytes from 192.168.15.1: icmp_seq=1 ttl=64 time=0.026 ms
```

192.168.15.1

192.168.15.2

Network
192.168.15.0
v-net-0
192.168.15.5

192.168.15.3

192.168.15.4

eth0

192.168.1.2

LINUX BRIDGE

192.168.15.1

192.168.15.2

Network
192.168.15.0
v-net-0
192.168.15.5

192.168.15.3

192.168.15.4

LAN
192.168.1.0

eth0

```
ip netns exec blue ping 192.168.1.3
```
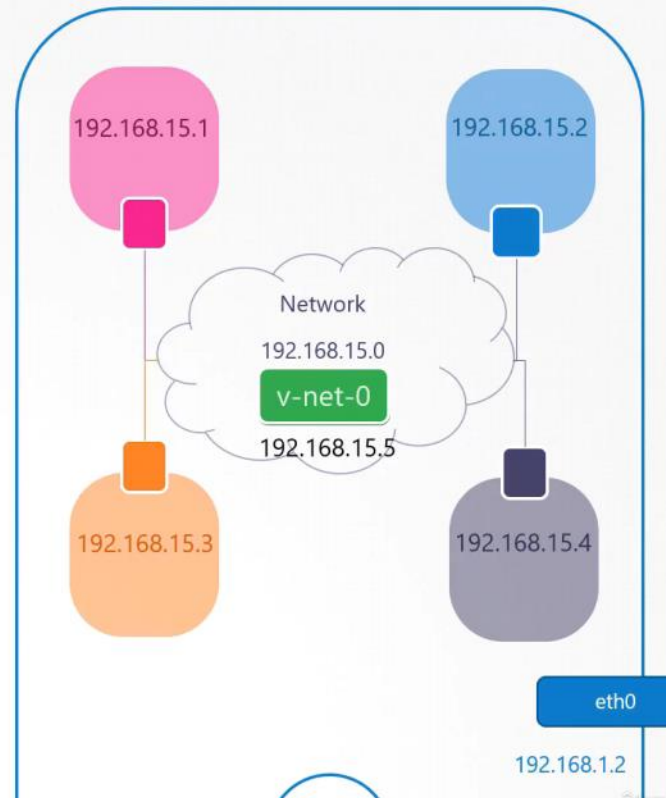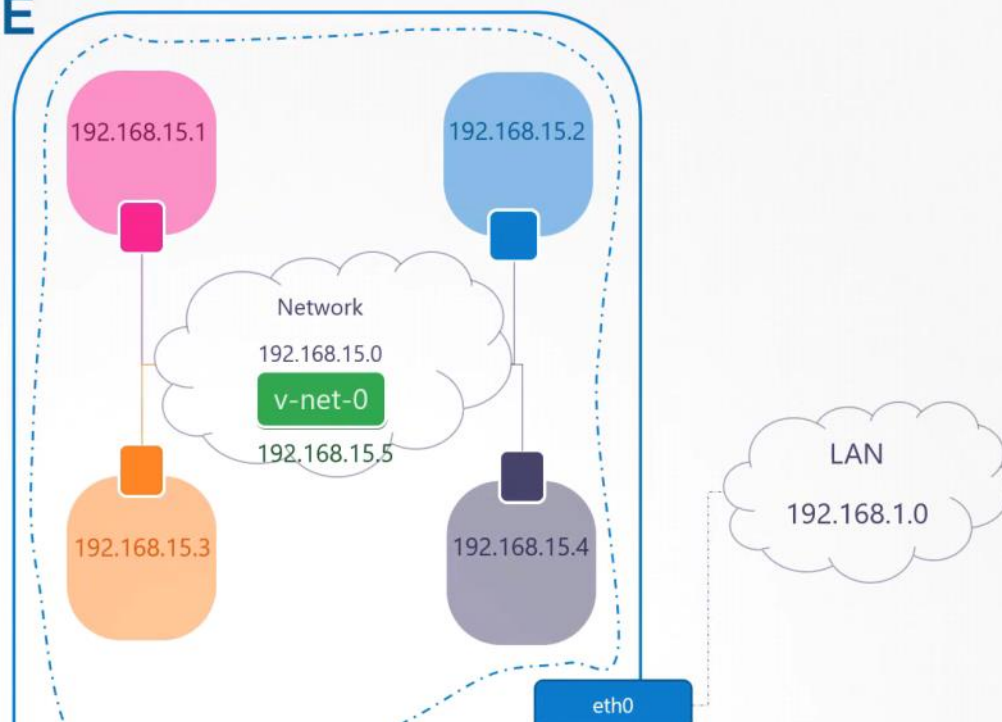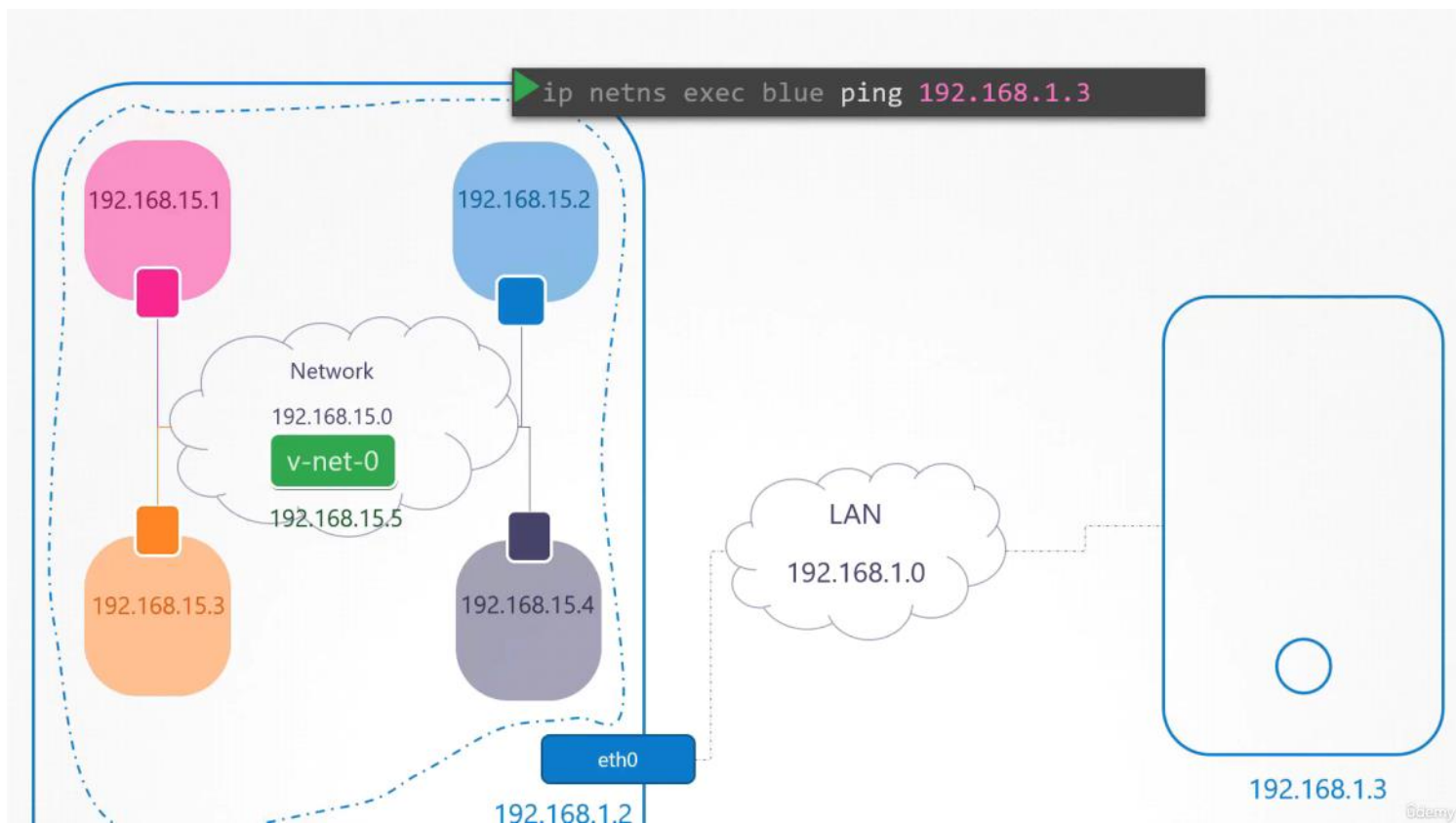
```
ip netns exec blue ping 192.168.1.3
Connect: Network is unreachable
```

```
ip netns exec blue route
Destination      Gateway        Genmask         Flags Metric Ref    Use Iface
192.168.15.0     0.0.0.0        255.255.255.0   U     0      0        0 veth-blue
```

```
ip netns exec blue ip route add 192.168.1.0/24 via 192.168.15.5
Destination      Gateway        Genmask         Flags Metric Ref    Use Iface
192.168.15.0     0.0.0.0        255.255.255.0   U     0      0        0 veth-blue
192.168.1.0      192.168.15.5   255.255.255.0   UG    0      0        0 veth-blue
```

```
▶ ip netns exec blue ping 192.168.1.3
PING 192.168.1.3 (192.168.1.3) 56(84) bytes of data.
```

```
▶ iptables -t nat -A POSTROUTING -s 192.168.15.0/24 -j MASQUERADE
```



```
▶ iptables -t nat -A POSTROUTING -s 192.168.15.0/24 -j MASQUERADE
```

```
▶ ip netns exec blue ping 192.168.1.3
64 bytes from 192.168.1.3: icmp_seq=1 ttl=63 time=0.587 ms
64 bytes from 192.168.1.3: icmp_seq=2 ttl=63 time=0.466 ms
```
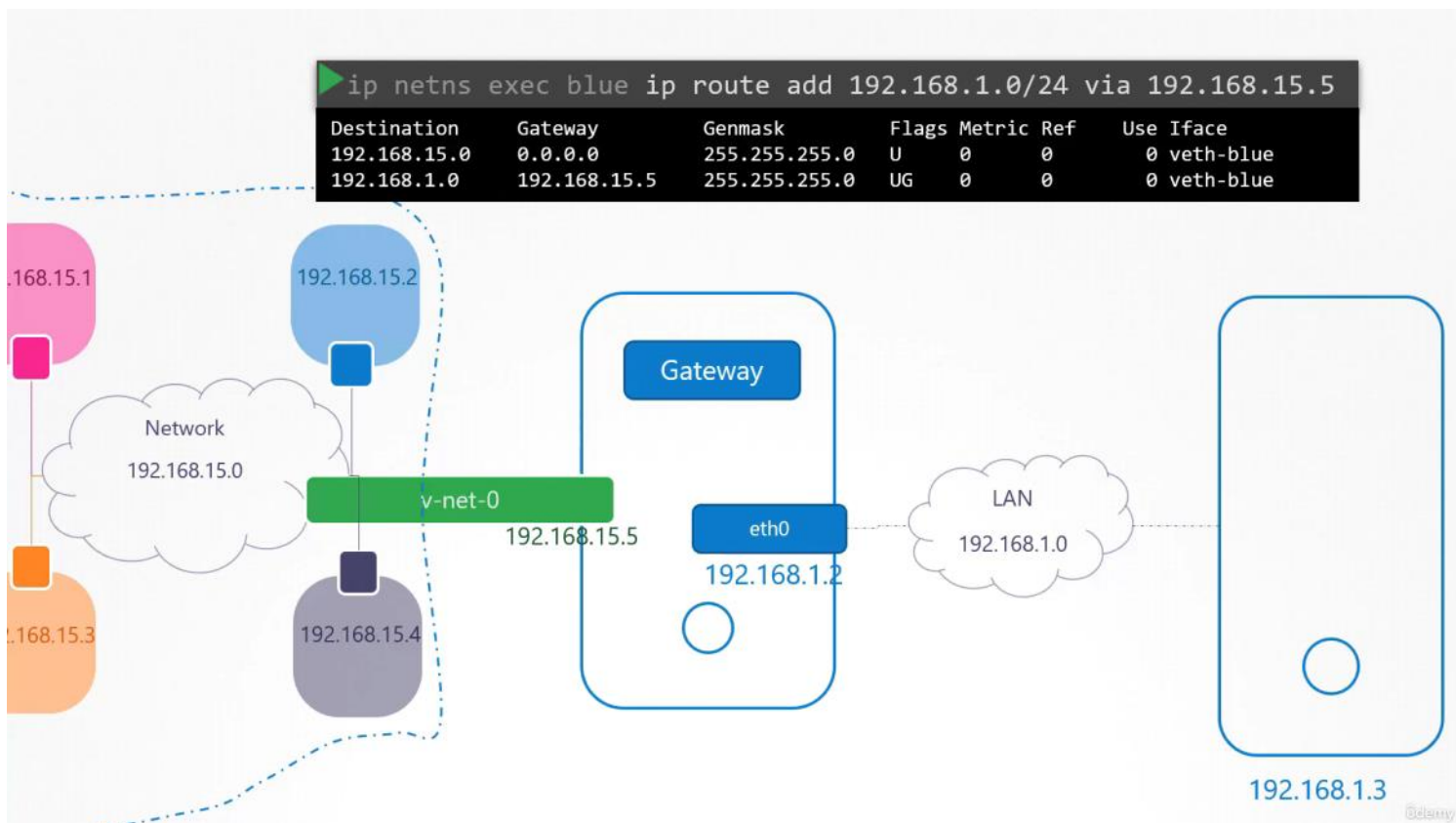
```
▶ip netns exec blue ping 8.8.8.8
Connect: Network is unreachable
```
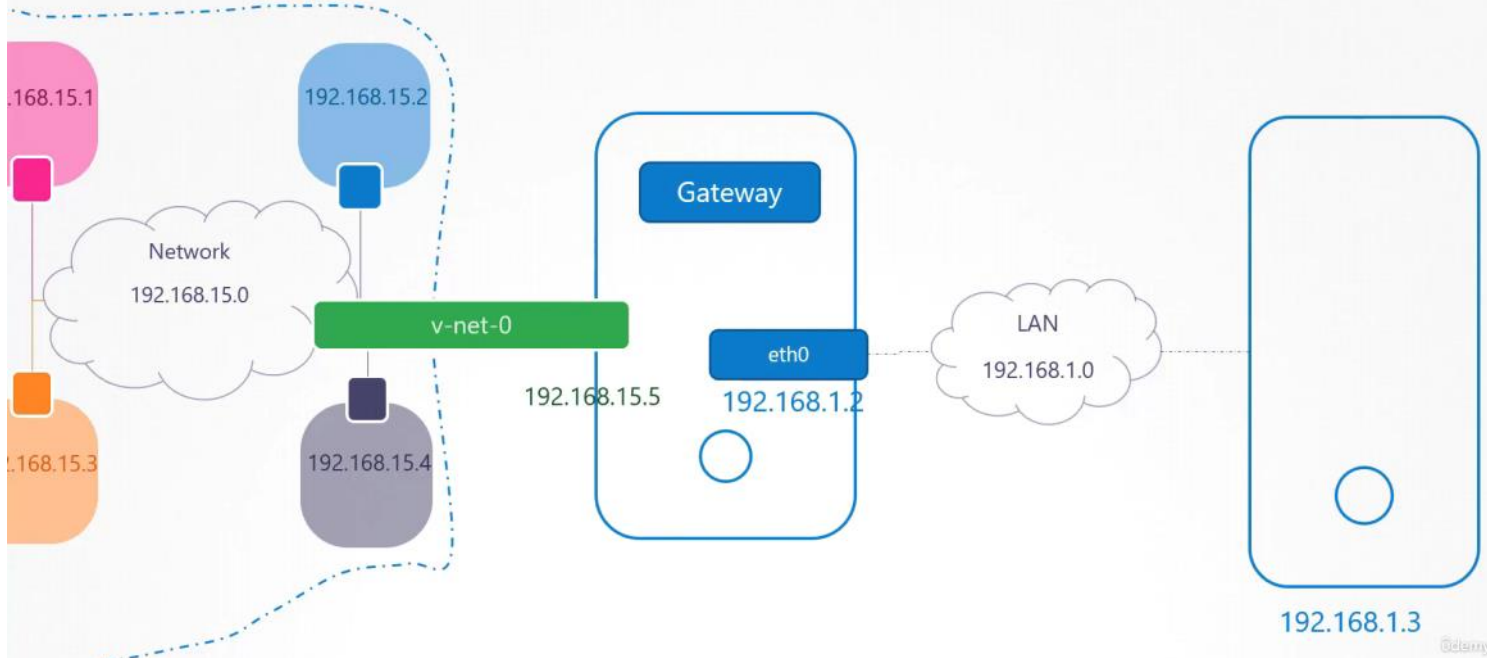


```
▶ip netns exec blue route
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.15.0    0.0.0.0         255.255.255.0   U     0      0        0 veth-blue
192.168.1.0     192.168.15.5    255.255.255.0   UG    0      0        0 veth-blue
68.15.2
```
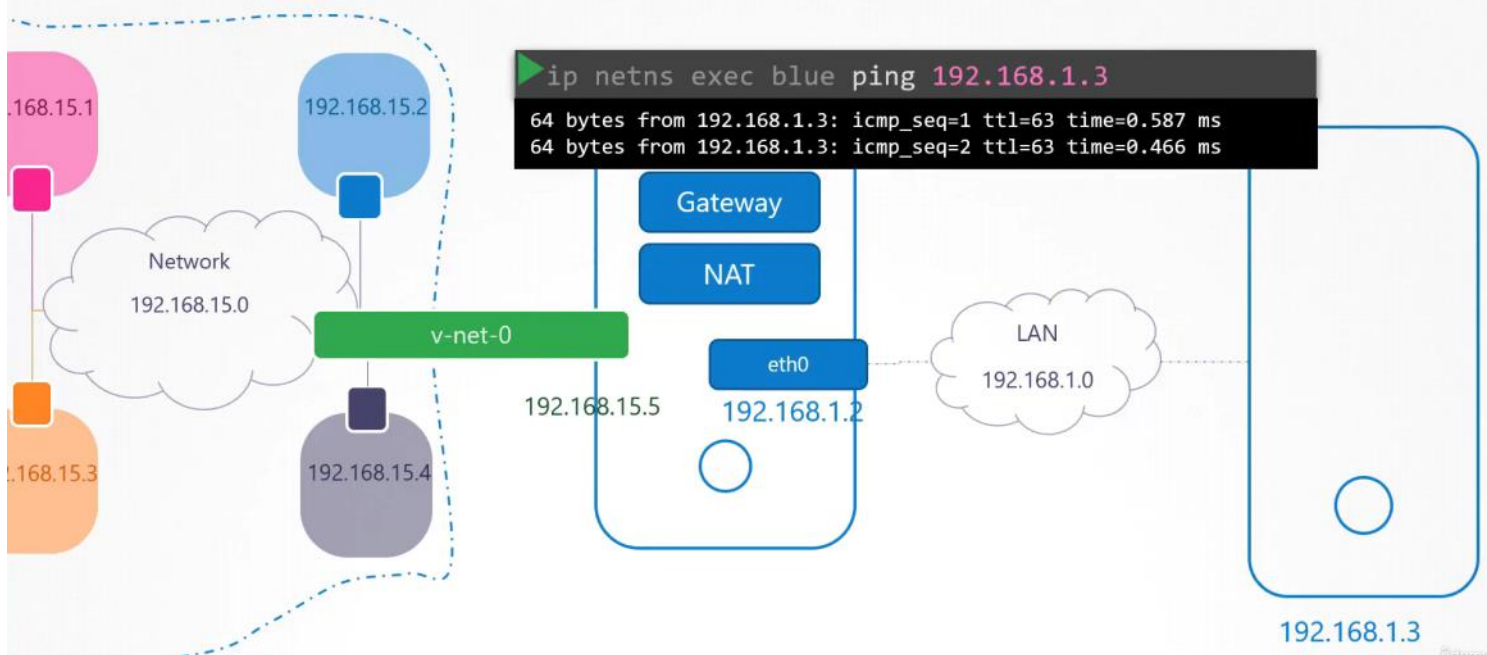
```
.168.15.2
▶ip netns exec blue ip route add default via 192.168.15.5
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.15.0    0.0.0.0         255.255.255.0   U     0      0        0 veth-blue
192.168.1.0     192.168.15.5    255.255.255.0   UG    0      0        0 veth-blue
Default         192.168.15.5    255.255.255.0   UG    0      0        0 veth-blue
```
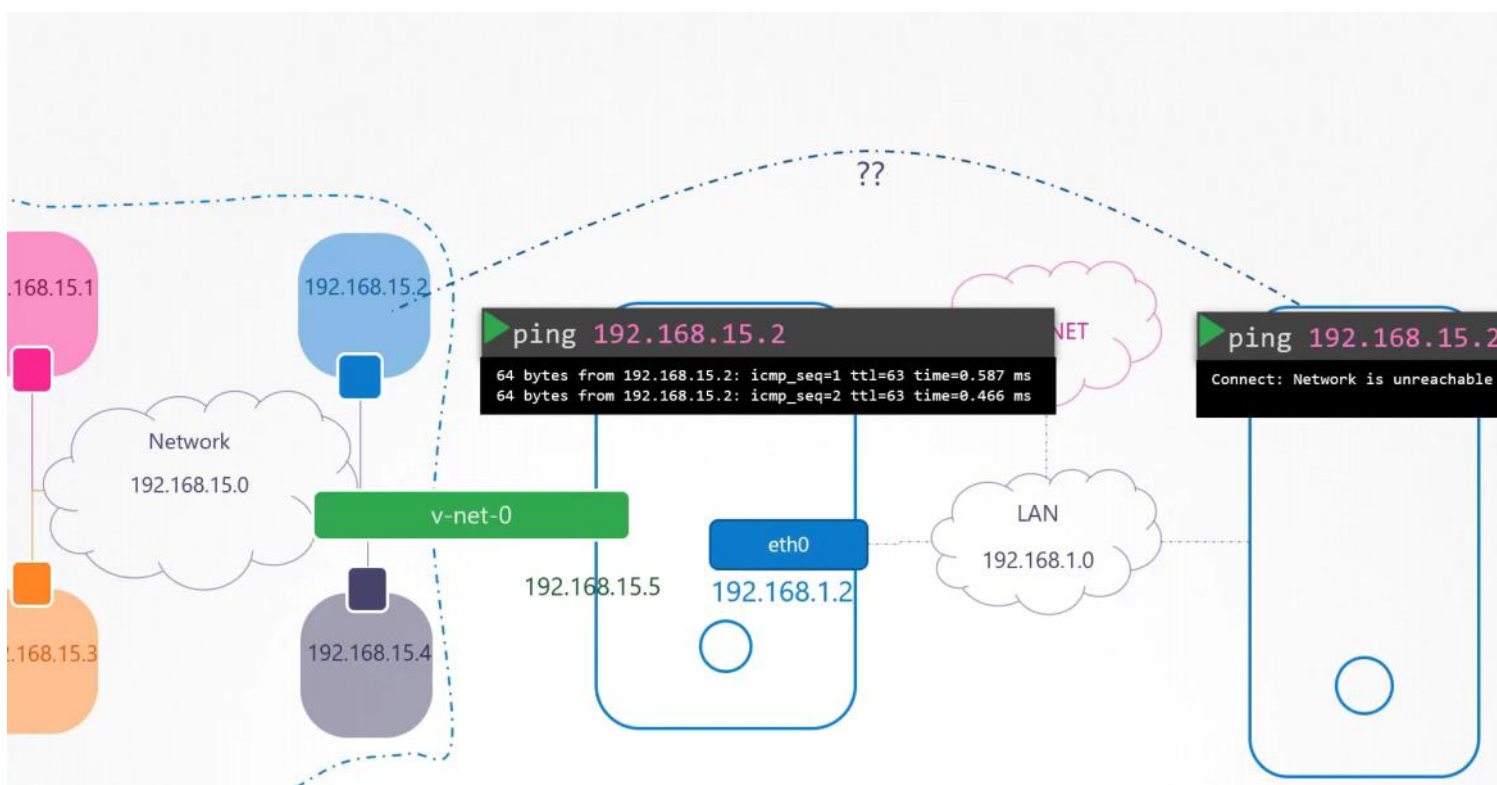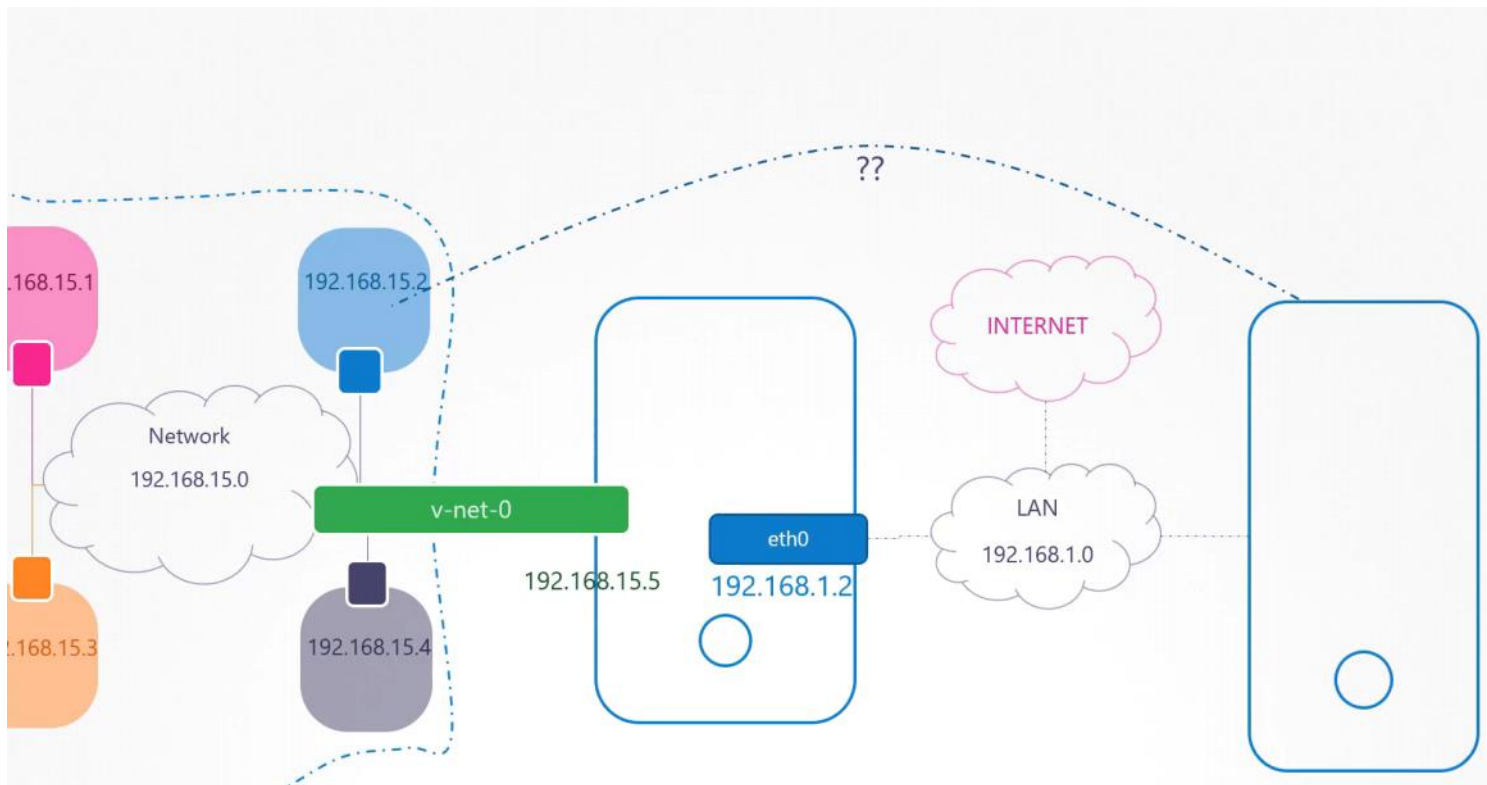
```
▶ip netns exec blue ping 8.8.8.8
64 bytes from 8.8.8.8: icmp_seq=1 ttl=63 time=0.587 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=63 time=0.466 ms
```

192.168.15.1
192.168.15.2
Network
192.168.15.0
v-net-0
192.168.15.5
192.168.15.4
192.168.15.3
eth0
192.168.1.2
INTERNET
LAN
192.168.1.0
??

192.168.15.1
192.168.15.2
Network
192.168.15.0
v-net-0
192.168.15.5
192.168.15.4
192.168.15.3
eth0
192.168.1.2
LAN
192.168.1.0
??

```
ping 192.168.15.2
64 bytes from 192.168.15.2: icmp_seq=1 ttl=63 time=0.587 ms
64 bytes from 192.168.15.2: icmp_seq=2 ttl=63 time=0.466 ms
```

```
ping 192.168.15.2
Connect: Network is unreachable
```

```
iptables -t nat -A PREROUTING --dport 80 --to-destination 192.168.15.2:80 -j DNAT
```

FAQ

While testing the Network Namespaces, if you come across
issues where you can't ping one namespace from the other, make
sure you set the NETMASK while setting IP Address.
ie: 192.168.1.10/24

```
ip -n red addr add 192.168.1.10/24 dev veth-red
```

Another thing to check is FirewallD/IP Table rules. Either add
rules to IP Tables to allow traffic from one namespace to another.
Or disable IP Tables all together (Only in a learning environment).