# LINUX NETWORKING BASICS

## Networking Pre-Requisites

- Switching and Routing
  - Switching
  - Routing
  - Default Gateway
- DNS
  - DNS Configurations on Linux
  - CoreDNS Introduction
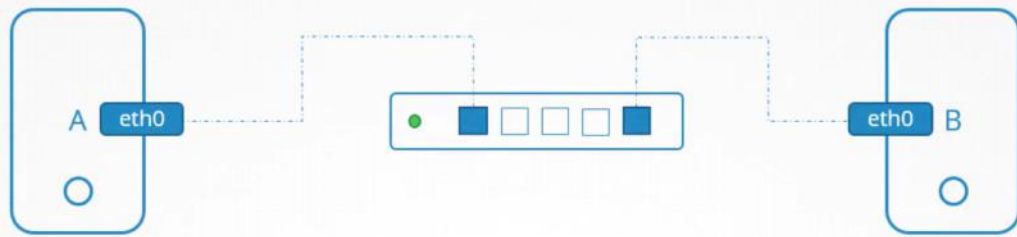- Network Namespaces
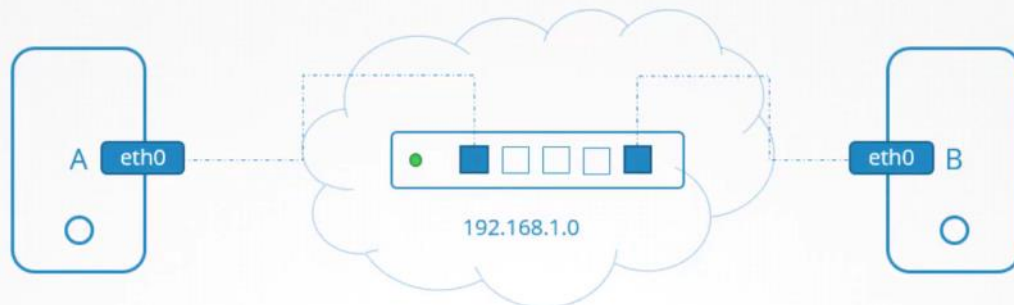- Docker Networking

## Switching



## Switching

# Switching



```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP mode DEFAULT group default qlen 1000
```

```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdis
fq_codel state UP mode DEFAULT group default qlen 100
```

# Switching



192.168.1.0

```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP mode DEFAULT group default qlen 1000
```

```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdis
fq_codel state UP mode DEFAULT group default qlen 100
```
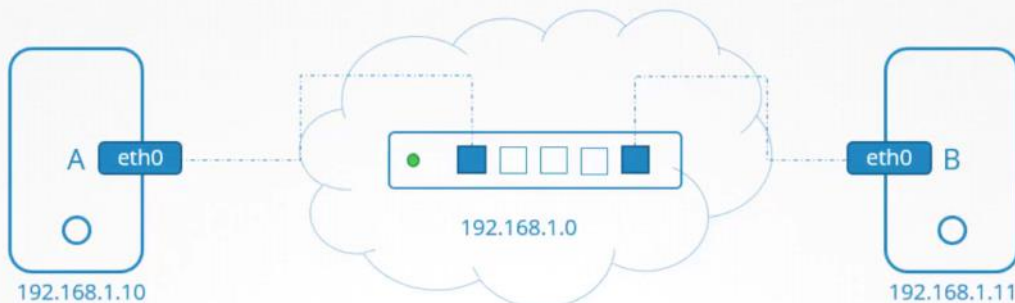
# Switching



192.168.1.0

192.168.1.10

192.168.1.11

```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP mode DEFAULT group default qlen 1000
```

```
ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdis
fq_codel state UP mode DEFAULT group default qlen 100
```
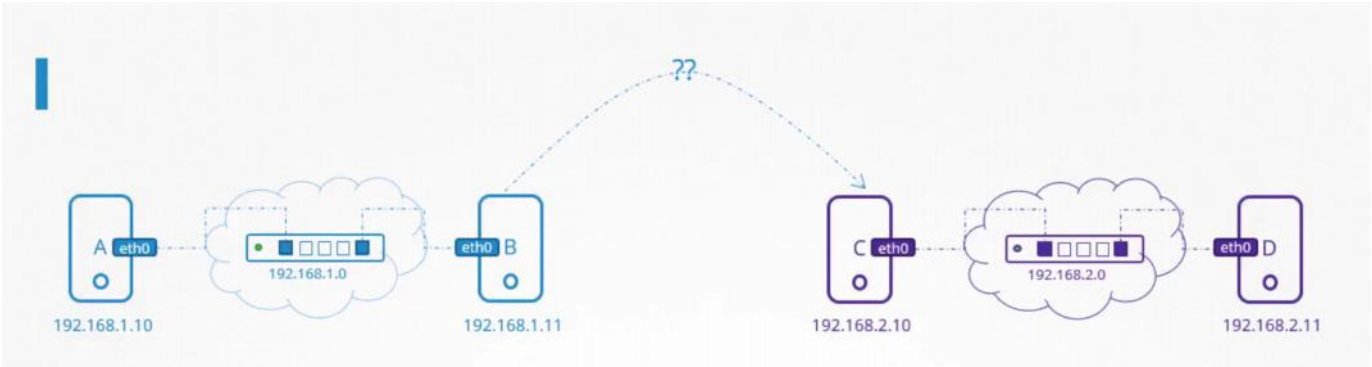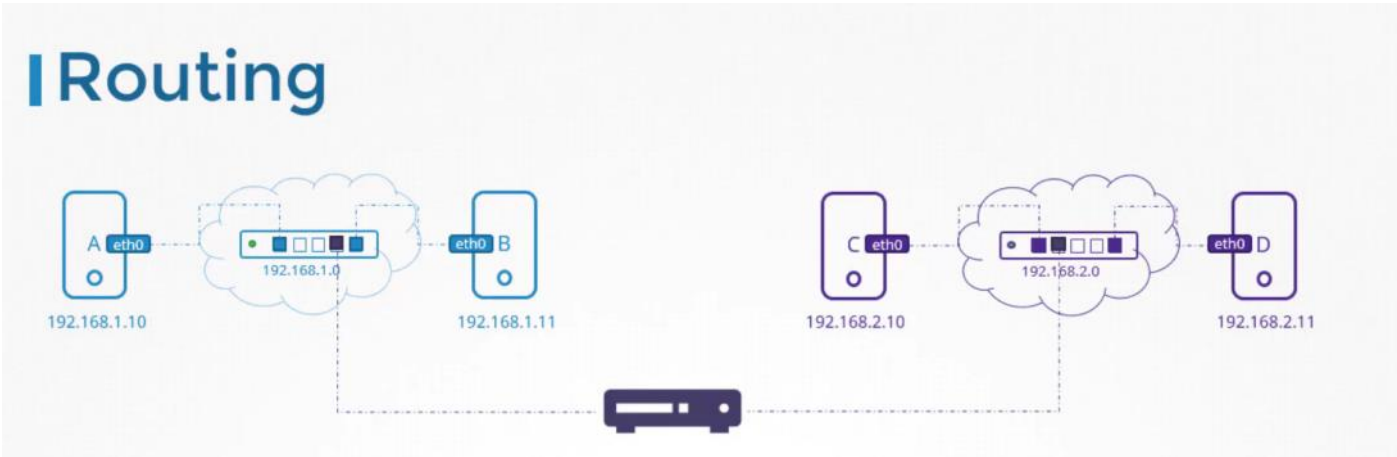
```
ip addr add 192.168.1.10/24 dev eth0
```

```
ip addr add 192.168.1.11/24 dev eth0
```
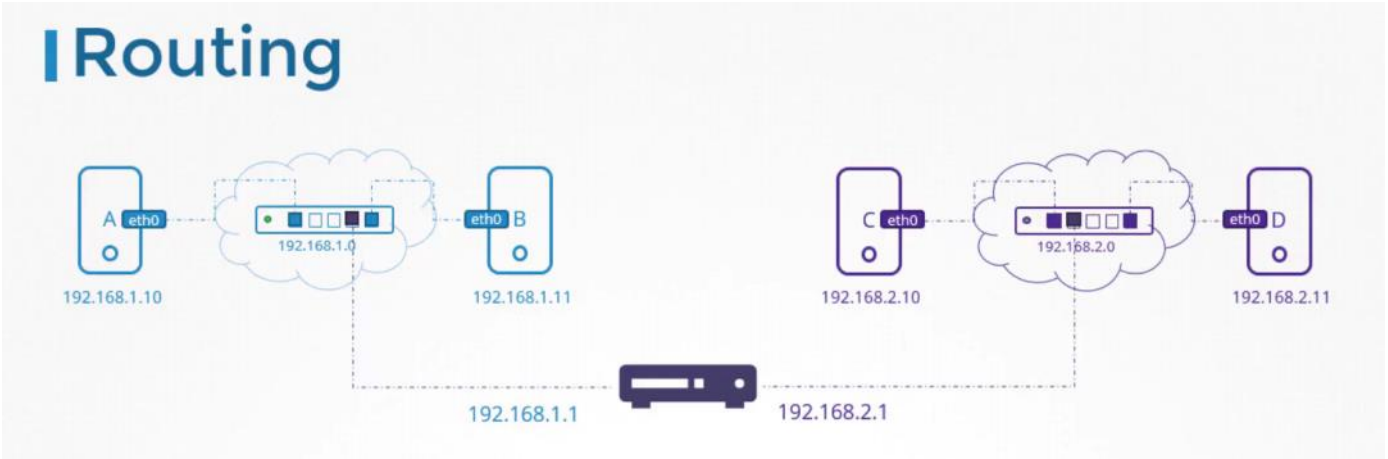
```
▶ ping 192.168.1.11
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
```



# Routing



# Routing



If the network was a room,

the gateway is a door to the outside world

to the other networks or to the internet.

The systems need to know where that door is

to go through that.

# Gateway



```
▶ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
```

```
▶ ip route add 192.168.2.0/24 via 192.168.1.1
▶ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.2.0     192.168.1.1     255.255.255.0   UG    0      0        0 eth0
```

```
▶ ip route add 192.168.1.0/24 via 192.168.2.1
▶ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.2.1     255.255.255.0   UG    0      0        0 eth0
```
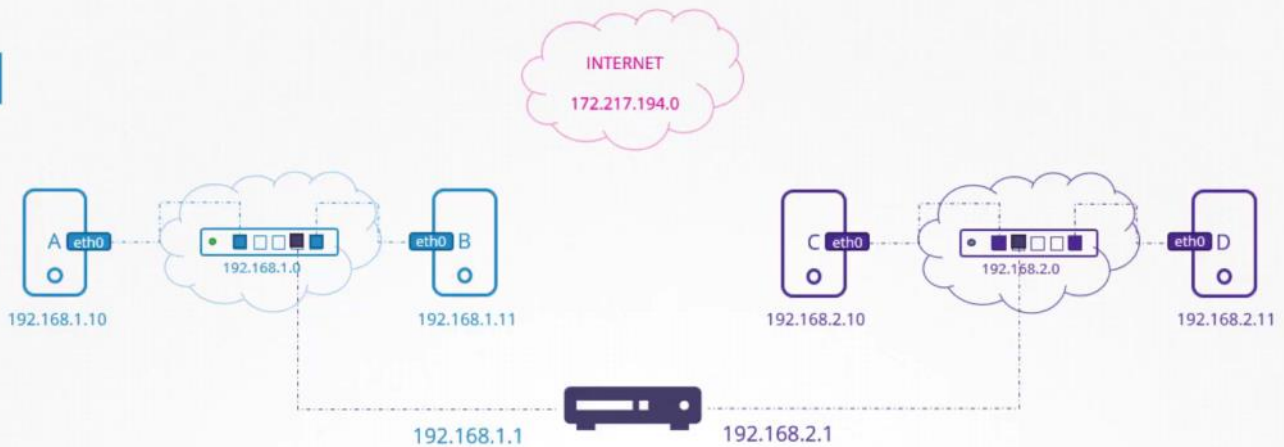
```
 ▶ ip route add 192.168.1.0/24 via 192.168.2.1
```
```
 ▶ ip route add 172.217.194.0/24 via 192.168.2.1
```
```
 ▶  route
```
```
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
192.168.1.0      192.168.2.1      255.255.255.0    UG    0      0        0 eth0
172.217.194.0    192.168.2.1      255.255.255.0    UG    0      0        0 eth0
```



```
 ▶ ip route add 192.168.1.0/24 via 192.168.2.1
```
```
 ▶ ip route add 172.217.194.0/24 via 192.168.2.1
```
```
 ▶  route
```
```
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
192.168.1.0      192.168.2.1      255.255.255.0    UG    0      0        0 eth0
172.217.194.0    192.168.2.1      255.255.255.0    UG    0      0        0 eth0
```
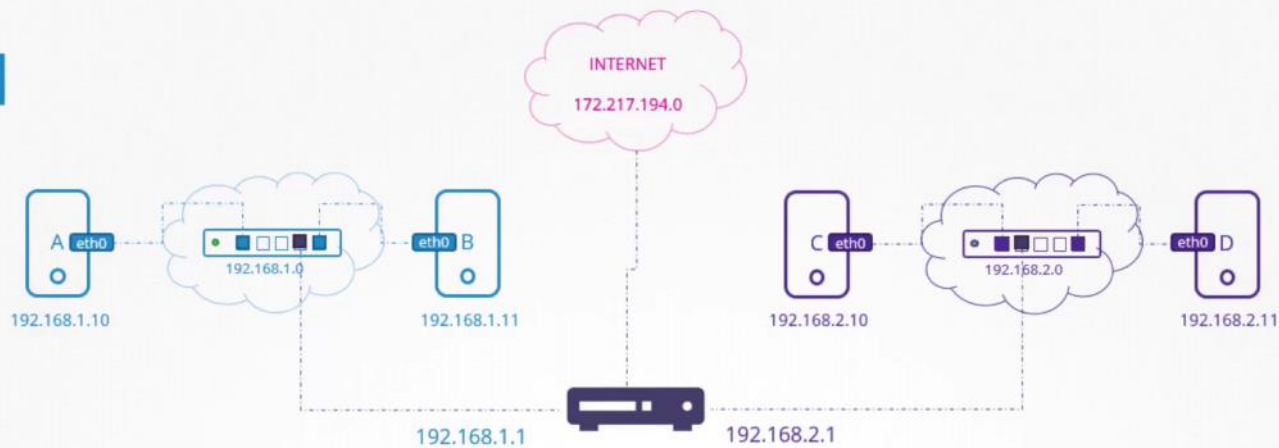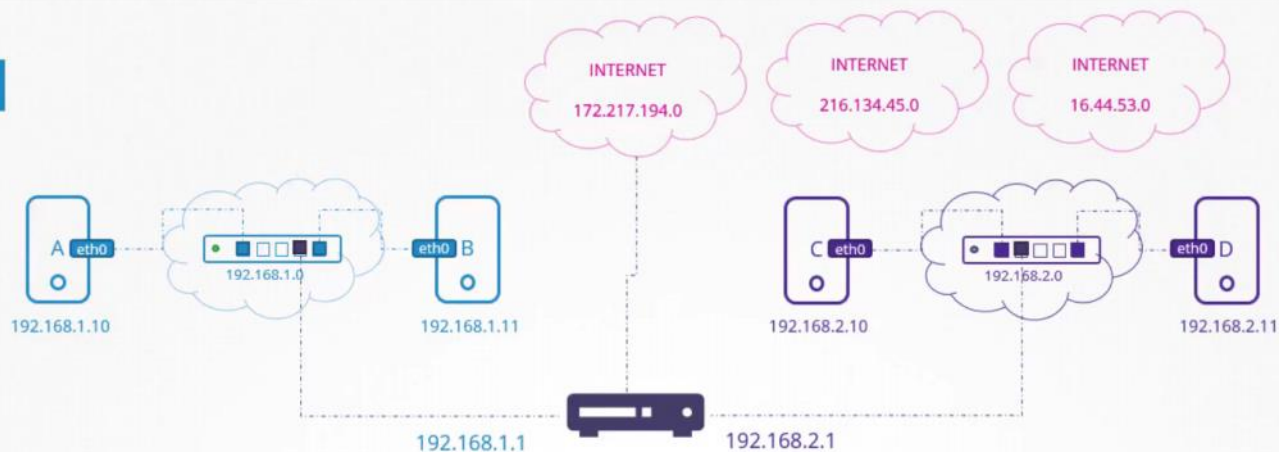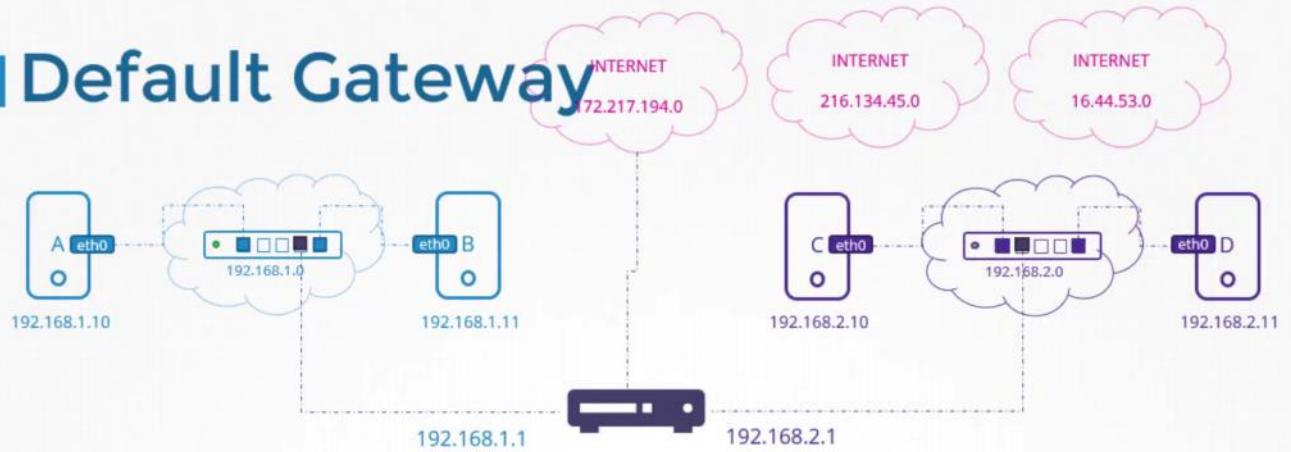
# Default Gateway

INTERNET
172.217.194.0

INTERNET
216.134.45.0

INTERNET
16.44.53.0

A eth0 — 192.168.1.0 — eth0 B

192.168.1.10

192.168.1.11

C eth0 — 192.168.2.0 — eth0 D

192.168.2.10

192.168.2.11

192.168.1.1

192.168.2.1

```
ip route add 192.168.1.0/24 via 192.168.2.1
```

```
ip route add default via 192.168.2.1
```

```
route
Kernel IP routing table
```

| Destination | Gateway | Genmask | Flags | Metric | Ref | Use | Iface |
|---|---|---|---|---|---|---|---|
| 192.168.1.0 | 192.168.2.1 | 255.255.255.0 | UG | 0 | 0 | 0 | eth0 |
| 172.217.194.0 | 192.168.2.1 | 255.255.255.0 | UG | 0 | 0 | 0 | eth0 |
| default | 192.168.2.1 | 0.0.0.0 | UG | 0 | 0 | 0 | eth0 |

# Default Gateway

INTERNET
172.217.194.0

INTERNET
216.134.45.0

INTERNET
16.44.53.0

A eth0 — 192.168.1.0 — eth0 B

192.168.1.10

192.168.1.11

C eth0 — 192.168.2.0 — eth0 D

192.168.2.10

192.168.2.11

192.168.1.1

192.168.2.1

```
ip route add default via 192.168.2.1
```

```
route
Kernel IP routing table
```

| Destination | Gateway | Genmask | Flags | Metric | Ref | Use | Iface |
|---|---|---|---|---|---|---|---|
| default | 192.168.2.1 | 0.0.0.0 | UG | 0 | 0 | 0 | eth0 |
| 0.0.0.0 | 192.168.2.1 | 0.0.0.0 | UG | 0 | 0 | 0 | eth0 |

# Default Gateway

A [eth0]
192.168.1.0
192.168.1.10

eth0 B
192.168.1.11

C [eth0]
192.168.2.0
192.168.2.10

eth0 D
192.168.2.11

INTERNET
172.217.194.0

INTERNET
216.134.45.0

INTERNET
16.44.53.0

192.168.1.1            192.168.2.1
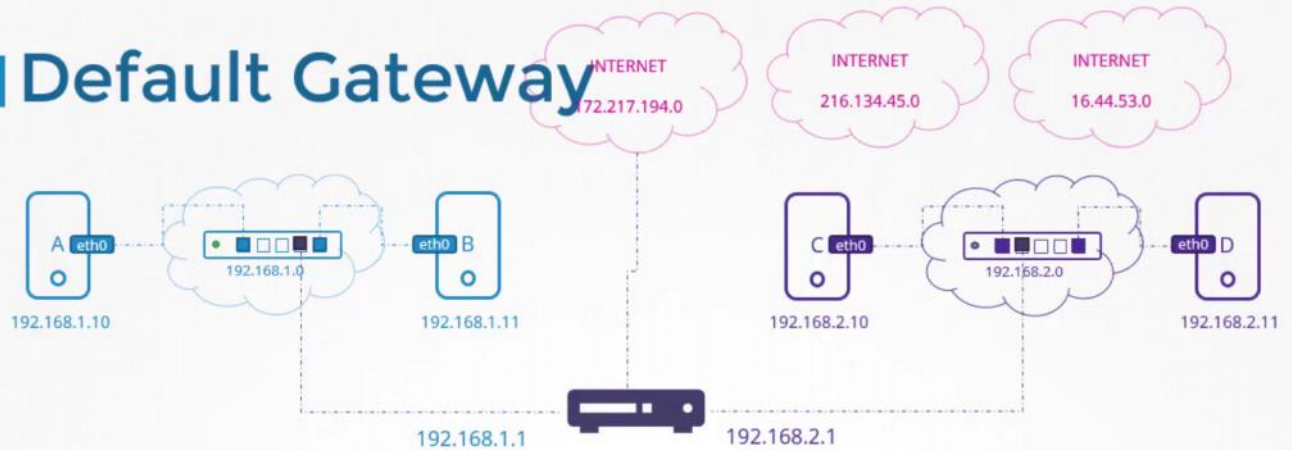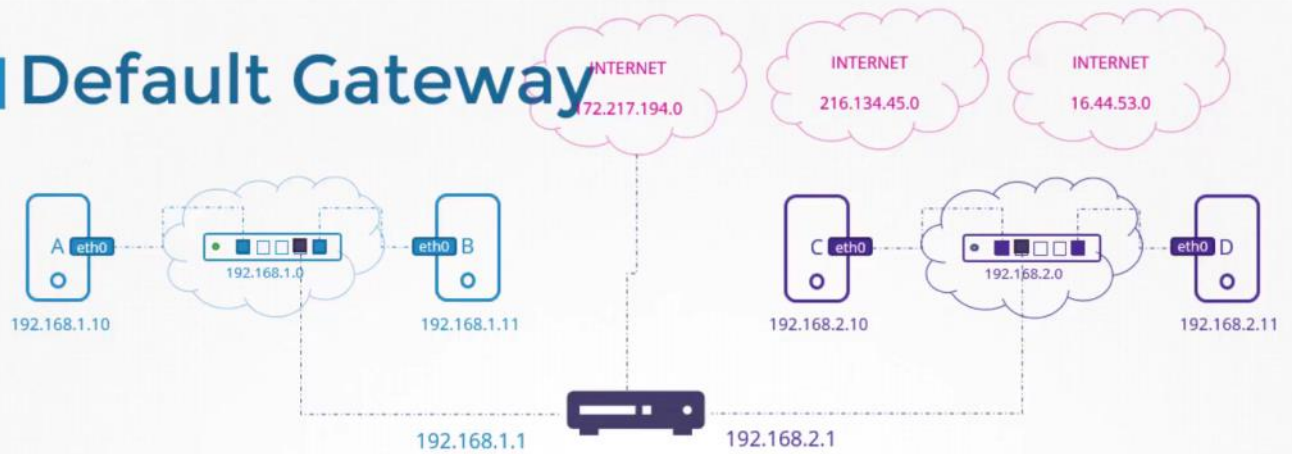
```
ip route add default via 192.168.2.1
```

```
route
```

```
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
default         192.168.2.1      0.0.0.0          UG    0      0      0 eth0
0.0.0.0         192.168.2.1      0.0.0.0          UG    0      0      0 eth0
192.168.2.0     0.0.0.0          255.255.255.0    UG    0      0      0 eth0
```
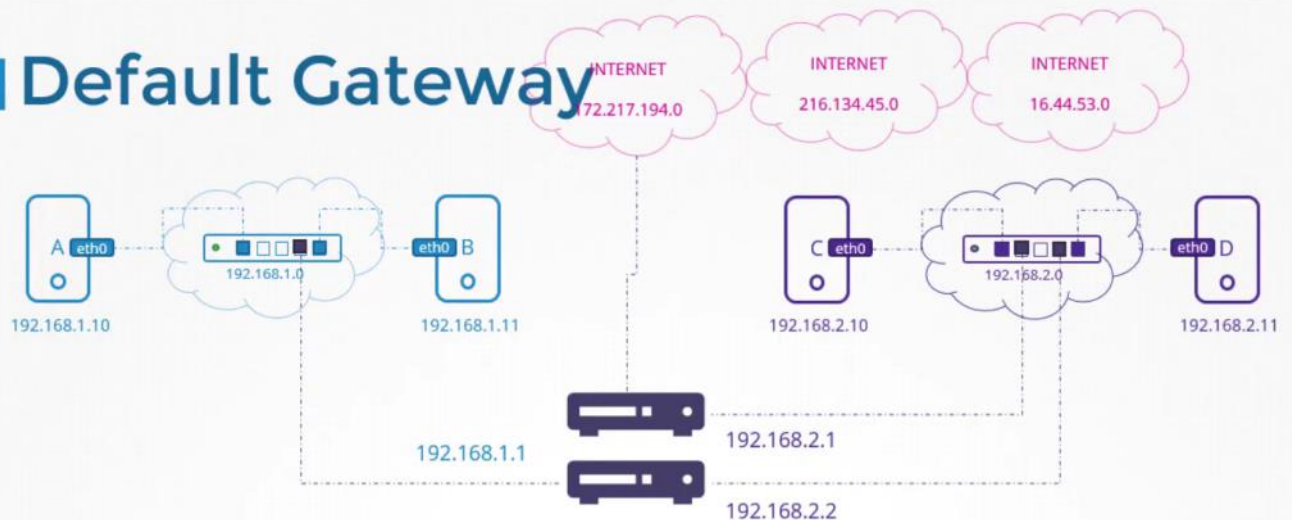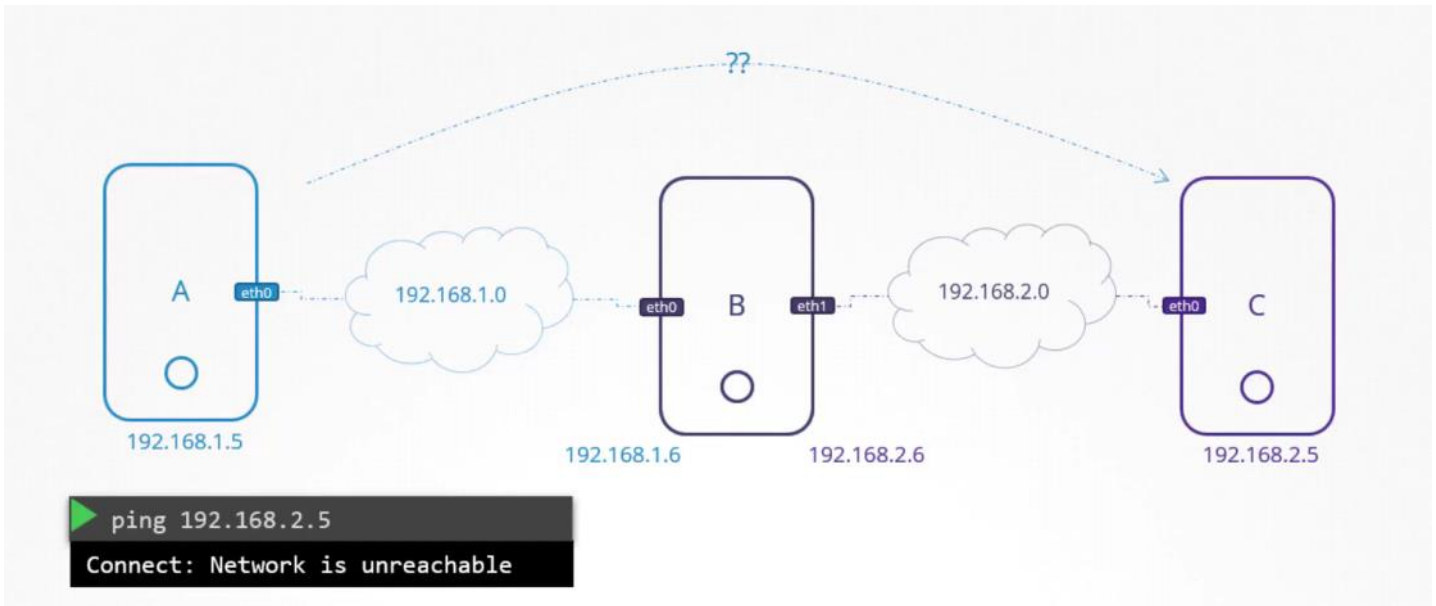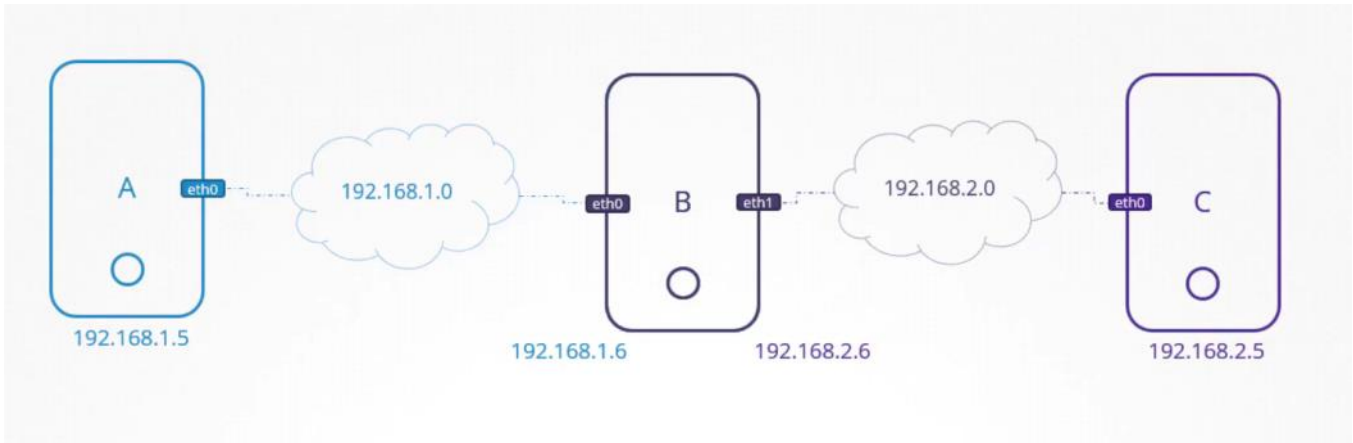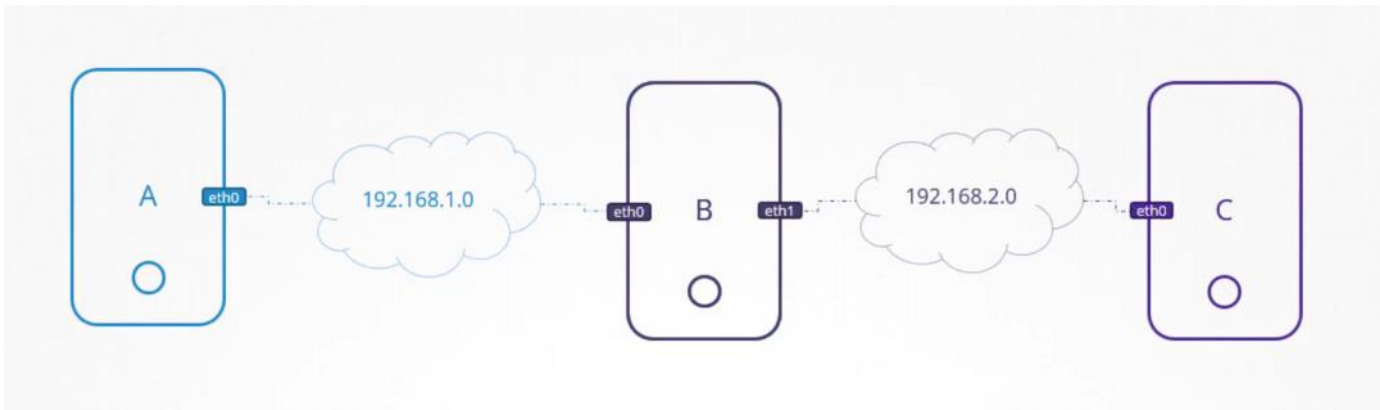
# Default Gateway

A [eth0]
192.168.1.0
192.168.1.10

eth0 B
192.168.1.11

C [eth0]
192.168.2.0
192.168.2.10

eth0 D
192.168.2.11

INTERNET
172.217.194.0

INTERNET
216.134.45.0

INTERNET
16.44.53.0

192.168.2.1

192.168.1.1

192.168.2.2
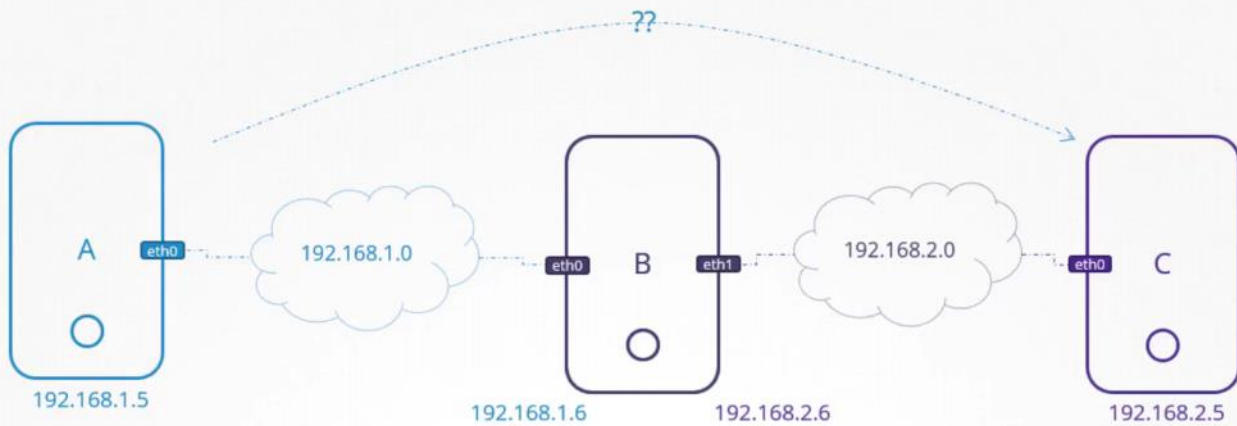
```
ip route add 192.168.1.0/24 via 192.168.2.2
```

```
route
```

```
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
default         192.168.2.1      0.0.0.0          UG    0      0      0 eth0
192.168.1.0     192.168.2.2      255.255.255.0    UG    0      0      0 eth0
```

A — eth0 — 192.168.1.0 — eth0 — B — eth1 — 192.168.2.0 — eth0 — C

A — eth0 — 192.168.1.0 — eth0 — B — eth1 — 192.168.2.0 — eth0 — C
192.168.1.5     192.168.1.6     192.168.2.6     192.168.2.5

??

A — eth0 — 192.168.1.0 — eth0 — B — eth1 — 192.168.2.0 — eth0 — C
192.168.1.5     192.168.1.6     192.168.2.6     192.168.2.5

```
▶ ping 192.168.2.5
Connect: Network is unreachable
```

A — eth0 — 192.168.1.0 — eth0 — B — eth1 — 192.168.2.0 — eth0 — C
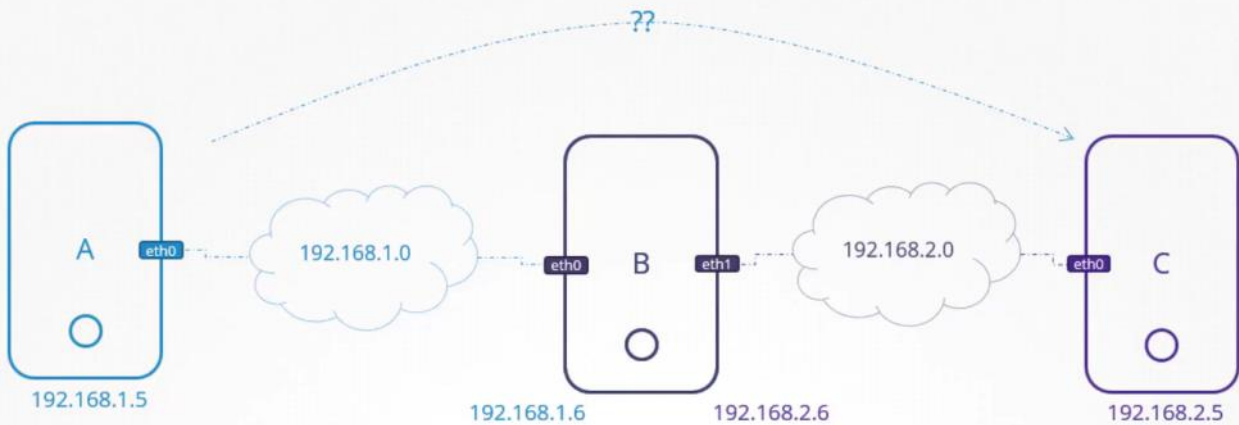
192.168.1.5  192.168.1.6  192.168.2.6  192.168.2.5

```
ping 192.168.2.5
Connect: Network is unreachable
```

```
ip route add 192.168.2.0/24 via 192.168.1.6
```



A — eth0 — 192.168.1.0 — eth0 — B — eth1 — 192.168.2.0 — eth0 — C

192.168.1.5  192.168.1.6  192.168.2.6  192.168.2.5

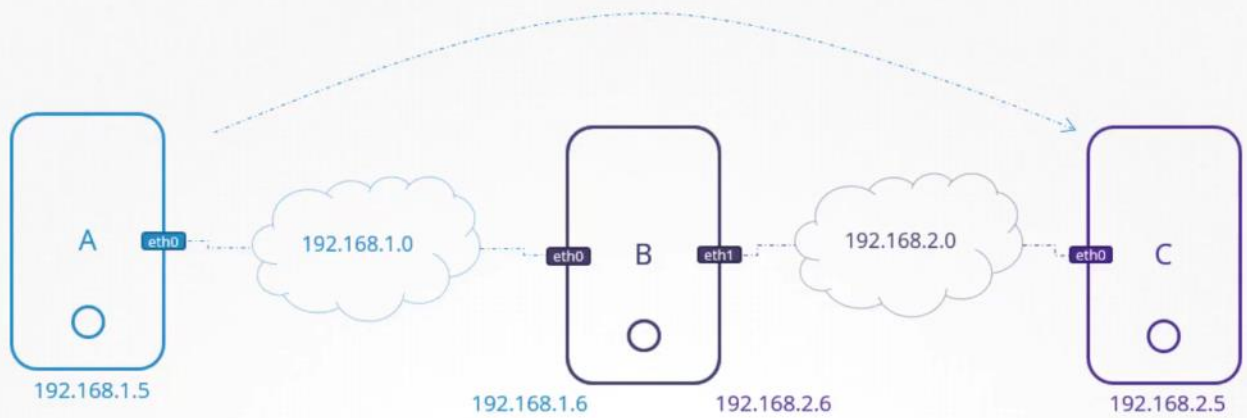```
ping 192.168.2.5
Connect: Network is unreachable
```
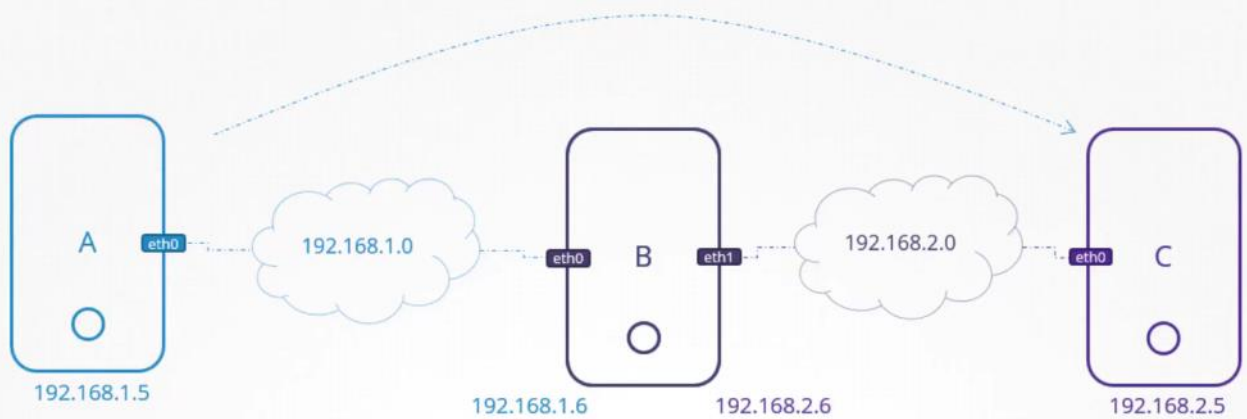
```
ip route add 192.168.2.0/24 via 192.168.1.6
```

```
ip route add 192.168.1.0/24 via 192.168.2.6
```

```
ping 192.168.2.5
```

```
cat /proc/sys/net/ipv4/ip_forward
0
```

```
ping 192.168.2.5
```



```
cat /proc/sys/net/ipv4/ip_forward
0
```
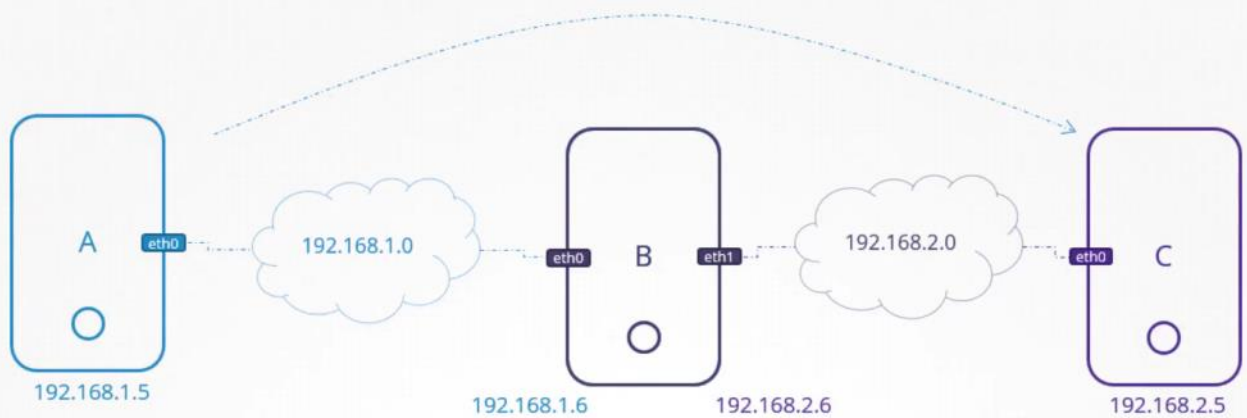
```
echo 1 > /proc/sys/net/ipv4/ip_forward
1
```

```
ping 192.168.2.5
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
```

A  eth0 ···· 192.168.1.0 ···· eth0  B  eth1 ···· 192.168.2.0 ···· eth0  C

192.168.1.5       192.168.1.6    192.168.2.6              192.168.2.5

```
cat /proc/sys/net/ipv4/ip_forward
0
```

/etc/sysctl.conf

```
echo 1 > /proc/sys/net/ipv4/ip_forward
1
```

```
...
net.ipv4.ip_forward = 1
...
```

```
ping 192.168.2.5
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
Reply from 192.168.2.5: bytes=32 time=4ms TTL=117
```

# |Take Aways

```
ip link
```

IP link is to list an modify interfaces on the host.

```
ip addr
```

IP addr command is to see the IP addresses assigned

to those interfaces.

```
ip addr add 192.168.1.10/24 dev eth0
```

to set IP addresses on the interfaces.

If you want to persist these changes,

you must set them in the etc/network/interfaces file.

```
ip route
```                    ```
route
```

is used to view the routing table.

```
ip route add 192.168.1.0/24 via 192.168.2.1
```

is used to add entries into the routing table.

```
cat /proc/sys/net/ipv4/ip_forward
1
```