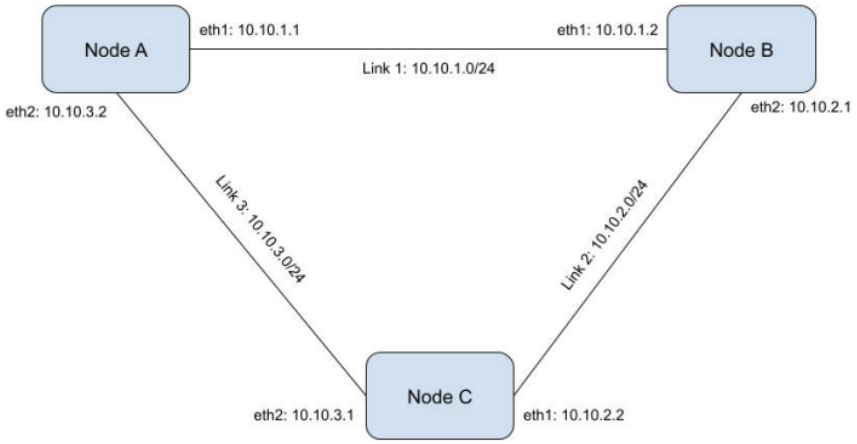
Lab 6

Summary

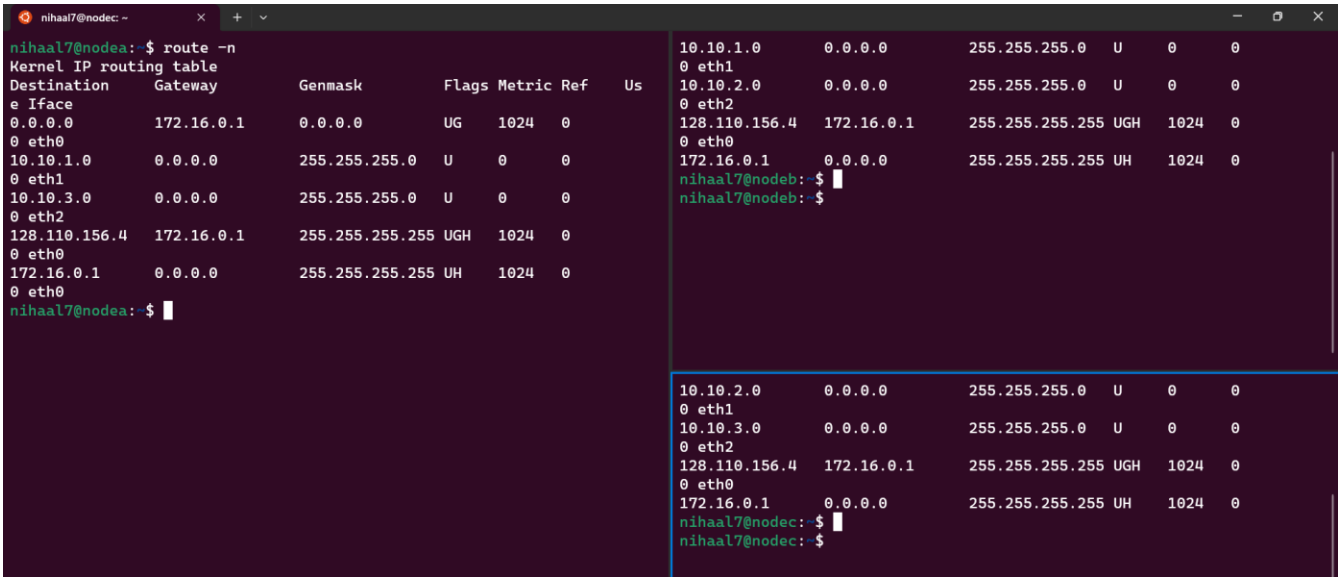
This lab aims to teach us the concept of routing and updating static routing tables to route packages based on our needs.



Initially the above images is the architecture, but we need it so that each IP can be used to access another IP within this architecture. For this we update the routing table manually.

Exercise 1

1. Route -n



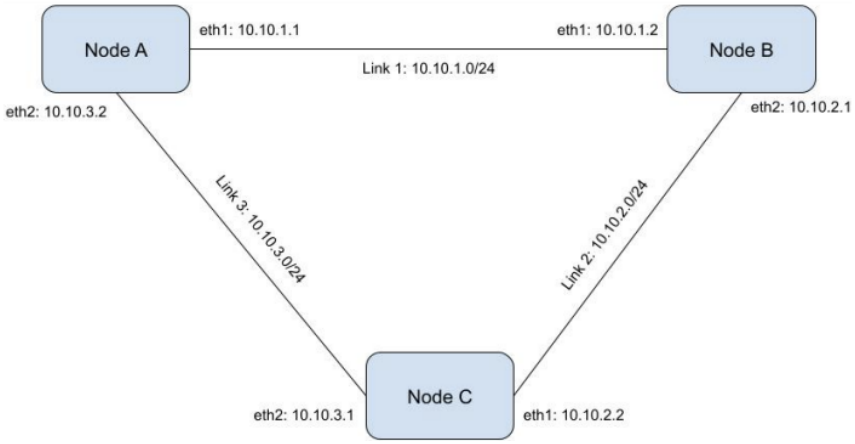
2. eth1 and eth2 of node B and node C

```
nihaal7@nodea:~$ ping 10.10.1.2
PING 10.10.1.2 (10.10.1.2) 56(84) bytes of data.
64 bytes from 10.10.1.2: icmp_seq=1 ttl=64 time=0.690 ms
64 bytes from 10.10.1.2: icmp_seq=2 ttl=64 time=0.300 ms
^C
--- 10.10.1.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1014ms
rtt min/avg/max/mdev = 0.300/0.495/0.690/0.195 ms
nihaal7@nodea:~$ ping 10.10.2.1
PING 10.10.2.1 (10.10.2.1) 56(84) bytes of data.
^C
--- 10.10.2.1 ping statistics ---
7 packets transmitted, 0 received, 100% packet loss, time 6124ms

nihaal7@nodea:~$ ping 10.10.2.2
PING 10.10.2.2 (10.10.2.2) 56(84) bytes of data.
^C
--- 10.10.2.2 ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2035ms

nihaal7@nodea:~$ ping 10.10.3.1
PING 10.10.3.1 (10.10.3.1) 56(84) bytes of data.
64 bytes from 10.10.3.1: icmp_seq=1 ttl=64 time=0.835 ms
64 bytes from 10.10.3.1: icmp_seq=2 ttl=64 time=0.303 ms
^C
--- 10.10.3.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1026ms
rtt min/avg/max/mdev = 0.303/0.569/0.835/0.266 ms
nihaal7@nodea:~$
```

Pinging eth1 of node B and eth2 of node C works, but eth2 of node B and eth1 of node C fail. This is because the current architecture is as shown below.



3. Traceroute 10.10.2.2 from node A

```
nihaal7@nodea:~$ traceroute 10.10.2.2
traceroute to 10.10.2.2 (10.10.2.2), 30 hops max, 60 byte packets
 1  128.110.216.1 (128.110.216.1)  0.493 ms  0.474 ms  0.437 ms
 2  128.110.103.241 (128.110.103.241)  0.412 ms  0.388 ms  0.364 ms
 3  140.197.246.176 (140.197.246.176)  1.158 ms  1.135 ms  1.111 ms
 4  ebc-pep-b-179-int.uen.net (140.197.252.85)  2.016 ms  1.995 ms  1.
974 ms
 5  ddc-pep-b-129-int.uen.net (140.197.252.77)  1.581 ms  1.561 ms  1.
664 ms
 6  140.197.253.103 (140.197.253.103)  1.289 ms  2.108 ms  2.076 ms
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

This happens because the routing table for node A does not know where to send the packets to for the IP 10.10.2.2.

```
        TX packets 2563  bytes 235227 (235.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.1.2  netmask 255.255.255.0  broadcast 10.10.1.255
        inet6 fe80::a3:dfff:febe:47f7  prefixlen 64  scopeid 0x20<link
>
        ether 02:a3:df:be:47:f7  txqueuelen 1000  (Ethernet)
        RX packets 24  bytes 1440 (1.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10  bytes 1125 (1.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.2.1  netmask 255.255.255.0  broadcast 10.10.2.255
        inet6 fe80::f1:b2ff:fee0:806c  prefixlen 64  scopeid 0x20<link
>
```

```
        TX packets 2706  bytes 244846 (244.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.2.2  netmask 255.255.255.0  broadcast 10.10.2.255
        inet6 fe80::20:1cff:fec4:deee  prefixlen 64  scopeid 0x20<link
>
        ether 02:20:1c:c4:de:ee  txqueuelen 1000  (Ethernet)
        RX packets 38  bytes 2749 (2.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10  bytes 1125 (1.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.3.1  netmask 255.255.255.0  broadcast 10.10.3.255
        inet6 fe80::74:4eff:fe89:a9fb  prefixlen 64  scopeid 0x20<link
>
```

Pinging from node A

Exercise 2

```
nihaal7@nodea:~$ sudo route add -net 10.10.2.0 netmask 255.255.255.0 gw 10.1
0.1.2 eth1
nihaal7@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Ifac
e
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
10.10.1.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.10.2.0       10.10.1.2       255.255.255.0   UG    0      0        0 eth1
10.10.3.0       0.0.0.0         255.255.255.0   U     0      0        0 eth2
128.110.156.4   172.16.0.1      255.255.255.255 UGH   1024   0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
nihaal7@nodea:~$ sudo route add -net 10.10.3.0 netmask 255.255.255.0 gw 10.1
0.3.1 eth2
nihaal7@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Ifac
e
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
10.10.1.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.10.2.0       10.10.1.2       255.255.255.0   UG    0      0        0 eth1
10.10.3.0       10.10.3.1       255.255.255.0   UG    0      0        0 eth2
10.10.3.0       0.0.0.0         255.255.255.0   U     0      0        0 eth2
128.110.156.4   172.16.0.1      255.255.255.255 UGH   1024   0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
nihaal7@nodea:~$
```

```
nihaal7@nodea:~$ sudo route add -net 10.10.2.0 netmask 255.255.255.0 gw 10.1
0.3.1 eth2
nihaal7@nodea:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Ifac
e
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
10.10.1.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.10.2.0       10.10.3.1       255.255.255.0   UG    0      0        0 eth2
10.10.2.0       10.10.1.2       255.255.255.0   UG    0      0        0 eth1
10.10.3.0       10.10.3.1       255.255.255.0   UG    0      0        0 eth2
10.10.3.0       0.0.0.0         255.255.255.0   U     0      0        0 eth2
128.110.156.4   172.16.0.1      255.255.255.255 UGH   1024   0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
nihaal7@nodea:~$
```

```
nihaal7@nodea:~$ ping 10.10.2.1
PING 10.10.2.1 (10.10.2.1) 56(84) bytes of data.
64 bytes from 10.10.2.1: icmp_seq=1 ttl=64 time=0.480 ms
64 bytes from 10.10.2.1: icmp_seq=2 ttl=64 time=0.303 ms
64 bytes from 10.10.2.1: icmp_seq=3 ttl=64 time=0.282 ms
^C
--- 10.10.2.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2054ms
rtt min/avg/max/mdev = 0.282/0.355/0.480/0.088 ms
nihaal7@nodea:~$ ping 10.10.2.2
PING 10.10.2.2 (10.10.2.2) 56(84) bytes of data.
^C
--- 10.10.2.2 ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2041ms

nihaal7@nodea:~$ ping 10.10.2.2
PING 10.10.2.2 (10.10.2.2) 56(84) bytes of data.
64 bytes from 10.10.2.2: icmp_seq=1 ttl=64 time=0.633 ms
64 bytes from 10.10.2.2: icmp_seq=2 ttl=64 time=0.366 ms
^C
--- 10.10.2.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1005ms
rtt min/avg/max/mdev = 0.366/0.499/0.633/0.133 ms
```

Once we route node A to the other eths of node B and C, after pinging it, we see that the previously unreachable Ips are now reachable.

Below are screenshots of the changed routing tables of node B and node C

Before we change the routing tables, we show inaccessible local IPs from B and C.

For B:

```
nihaal7@nodeb:~$ ping 10.10.3.2
PING 10.10.3.2 (10.10.3.2) 56(84) bytes of data.
^C
--- 10.10.3.2 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1025ms

nihaal7@nodeb:~$ ping 10.10.3.1
PING 10.10.3.1 (10.10.3.1) 56(84) bytes of data.
^C
--- 10.10.3.1 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1017ms

nihaal7@nodeb:~$
```

For C:

```
nihaal7@nodec:~$ ping 10.10.1.1
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data.
^C
--- 10.10.1.1 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1022ms

nihaal7@nodec:~$ ping 10.10.1.2
PING 10.10.1.2 (10.10.1.2) 56(84) bytes of data.
^C
--- 10.10.1.2 ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2033ms
```

Updated routing table of B:

```
nihaal7@nodeb:~$ sudo route add -net 10.10.3.0 netmask 255.255.255.0 gw 10.1
0.1.1 eth1
nihaal7@nodeb:~$ sudo route add -net 10.10.3.0 netmask 255.255.255.0 gw 10.1
0.2.2 eth2
```

```
nihaal7@nodeb:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Ifac
e
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
10.10.1.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.10.2.0       0.0.0.0         255.255.255.0   U     0      0        0 eth2
10.10.3.0       10.10.2.2       255.255.255.0   UG    0      0        0 eth2
10.10.3.0       10.10.1.1       255.255.255.0   UG    0      0        0 eth1
128.110.156.4   172.16.0.1      255.255.255.255 UGH   1024   0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
nihaal7@nodeb:~$
```

Updated routing table of C:

```
nihaal7@nodec:~$ sudo route add -net 10.10.1.0 netmask 255.255.255.0 gw 10.1
0.2.1 eth1
nihaal7@nodec:~$ sudo route add -net 10.10.1.0 netmask 255.255.255.0 gw 10.1
0.3.2 eth2
nihaal7@nodec:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Ifac
e
0.0.0.0         172.16.0.1      0.0.0.0         UG    1024   0        0 eth0
10.10.1.0       10.10.3.2       255.255.255.0   UG    0      0        0 eth2
10.10.1.0       10.10.2.1       255.255.255.0   UG    0      0        0 eth1
10.10.2.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.10.3.0       0.0.0.0         255.255.255.0   U     0      0        0 eth2
128.110.156.4   172.16.0.1      255.255.255.255 UGH   1024   0        0 eth0
172.16.0.1      0.0.0.0         255.255.255.255 UH    1024   0        0 eth0
nihaal7@nodec:~$
```

Proof that node B is updated:

```
nihaal7@nodeb:~$ ping 10.10.3.2
PING 10.10.3.2 (10.10.3.2) 56(84) bytes of data.
64 bytes from 10.10.3.2: icmp_seq=1 ttl=64 time=0.474 ms
64 bytes from 10.10.3.2: icmp_seq=2 ttl=64 time=0.307 ms
^C
--- 10.10.3.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1029ms
rtt min/avg/max/mdev = 0.307/0.390/0.474/0.083 ms
nihaal7@nodeb:~$ ping 10.10.3.1
PING 10.10.3.1 (10.10.3.1) 56(84) bytes of data.
64 bytes from 10.10.3.1: icmp_seq=1 ttl=64 time=0.501 ms
64 bytes from 10.10.3.1: icmp_seq=2 ttl=64 time=0.302 ms
^C
--- 10.10.3.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1013ms
rtt min/avg/max/mdev = 0.302/0.401/0.501/0.099 ms
nihaal7@nodeb:~$
```

Proof that node C is updated:

```
nihaal7@nodec:~$ ping 10.10.1.2
PING 10.10.1.2 (10.10.1.2) 56(84) bytes of data.
64 bytes from 10.10.1.2: icmp_seq=1 ttl=64 time=0.494 ms
64 bytes from 10.10.1.2: icmp_seq=2 ttl=64 time=0.332 ms
^C
--- 10.10.1.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1006ms
rtt min/avg/max/mdev = 0.332/0.413/0.494/0.081 ms
nihaal7@nodec:~$ ping 10.10.1.1
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data.
64 bytes from 10.10.1.1: icmp_seq=1 ttl=64 time=0.427 ms
64 bytes from 10.10.1.1: icmp_seq=2 ttl=64 time=0.282 ms
^C
--- 10.10.1.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1014ms
rtt min/avg/max/mdev = 0.282/0.354/0.427/0.072 ms
nihaal7@nodec:~$
```

Traceroute on node B:

```
user@node-b$ traceroute 10.10.1.1
[OUTPUT]
user@node-b$ traceroute 10.10.3.2
[OUTPUT]
user@node-b$ traceroute 10.10.3.1
[OUTPUT]
user@node-b$ traceroute 10.10.2.2
[OUTPUT]
```

```
nihaal7@nodeb:~$ traceroute 10.10.1.1
traceroute to 10.10.1.1 (10.10.1.1), 30 hops max, 60 byte packets
 1  nodeA-link-0 (10.10.1.1)  0.346 ms  0.295 ms  0.258 ms
nihaal7@nodeb:~$ traceroute 10.10.3.2
traceroute to 10.10.3.2 (10.10.3.2), 30 hops max, 60 byte packets
 1  nodeC-link-1 (10.10.2.2)  0.282 ms  0.259 ms  0.244 ms
 2  nodeA-link-2 (10.10.3.2)  0.608 ms  0.587 ms  0.571 ms
nihaal7@nodeb:~$ traceroute 10.10.3.1
traceroute to 10.10.3.1 (10.10.3.1), 30 hops max, 60 byte packets
 1  nodeC-link-2 (10.10.3.1)  0.477 ms  0.458 ms  0.442 ms
nihaal7@nodeb:~$ traceroute 10.10.2.2
traceroute to 10.10.2.2 (10.10.2.2), 30 hops max, 60 byte packets
 1  nodeC-link-1 (10.10.2.2)  0.246 ms  0.221 ms  0.206 ms
nihaal7@nodeb:~$
```

This confirms that our changes made on the routing table are correct and that all IPs are accessible within each other.

Termination