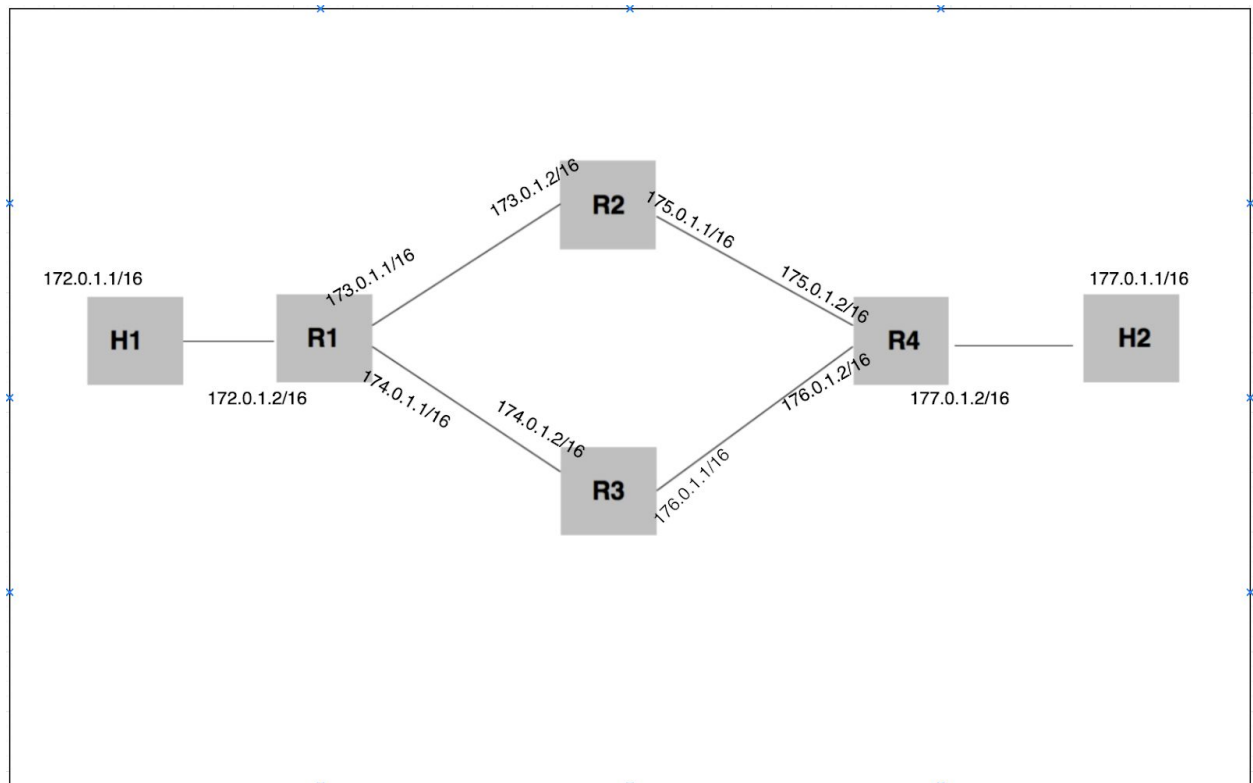


Part A

A1)

- a) topo.py is attached.
- b) Network Topology with IP/Subnet



A2)

a) Configuration for H1 to be able to ping H2:

a.1) Enable IP forwarding for all nodes: `/proc/sys/net/ipv4/ip_forward` file is used for enabling ip forwarding. It is set to 1. By default ip forwarding is disabled at nodes.

```
H1 echo 1 > /proc/sys/net/ipv4/ip_forward
R1 echo 1 > /proc/sys/net/ipv4/ip_forward
R2 echo 1 > /proc/sys/net/ipv4/ip_forward
R3 echo 1 > /proc/sys/net/ipv4/ip_forward
R4 echo 1 > /proc/sys/net/ipv4/ip_forward
H2 echo 1 > /proc/sys/net/ipv4/ip_forward
```

Assign IP for all interfaces:

I use ip addr add command to assign ip address for the interface.

```
R1 ip addr add 173.0.1.1/16 dev R1-eth1
R1 ip addr add 174.0.1.1/16 dev R1-eth2
R2 ip addr add 175.0.1.1/16 dev R2-eth1
R3 ip addr add 176.0.1.1/16 dev R3-eth1
R4 ip addr add 175.0.1.2/16 dev R4-eth1
R4 ip addr add 176.0.1.2/16 dev R4-eth2
```

c) Set static routing paths for each nodes:

I use ip route add command to add the destination subnet and the next-hop/gateway and the Interface through which packet goes out.

```
H1 ip route add default via 172.0.1.2 dev H1-eth0
H2 ip route add default via 177.0.1.2 dev H2-eth0

R1 ip route add 176.0.0.0/16 via 174.0.1.2 dev R1-eth2
R1 ip route add default via 173.0.1.2 dev R1-eth1

R2 ip route add 172.0.0.0/16 via 173.0.1.1 dev R2-eth0
R2 ip route add 174.0.0.0/16 via 173.0.1.1 dev R2-eth0
R2 ip route add default via 175.0.1.2 dev R2-eth1

R3 ip route add 172.0.0.0/16 via 174.0.1.1 dev R3-eth0
R3 ip route add 173.0.0.0/16 via 174.0.1.1 dev R3-eth0
R3 ip route add default via 176.0.1.2 dev R3-eth1

R4 ip route add 174.0.0.0/16 via 176.0.1.1 dev R4-eth2
R4 ip route add default via 175.0.1.1 dev R4-eth1
```

Routing table at all nodes:

```
mininext> H1 ip route
default via 172.0.1.2 dev H1-eth0
172.0.0.0/16 dev H1-eth0 proto kernel scope link src 172.0.1.1
mininext>
mininext> R1 ip route
default via 173.0.1.2 dev R1-eth1
172.0.0.0/16 dev R1-eth0 proto kernel scope link src 172.0.1.2
173.0.0.0/16 dev R1-eth1 proto kernel scope link src 173.0.1.1
174.0.0.0/16 dev R1-eth2 proto kernel scope link src 174.0.1.1
176.0.0.0/16 via 174.0.1.2 dev R1-eth2
mininext>
mininext> R2 ip route
default via 175.0.1.2 dev R2-eth1
172.0.0.0/16 via 173.0.1.1 dev R2-eth0
173.0.0.0/16 dev R2-eth0 proto kernel scope link src 173.0.1.2
174.0.0.0/16 via 173.0.1.1 dev R2-eth0
175.0.0.0/16 dev R2-eth1 proto kernel scope link src 175.0.1.1
mininext>
mininext> R3 ip route
default via 176.0.1.2 dev R3-eth1
172.0.0.0/16 via 174.0.1.1 dev R3-eth0
173.0.0.0/16 via 174.0.1.1 dev R3-eth0
174.0.0.0/16 dev R3-eth0 proto kernel scope link src 174.0.1.2
176.0.0.0/16 dev R3-eth1 proto kernel scope link src 176.0.1.1
mininext>
mininext> R4 ip route
default via 175.0.1.1 dev R4-eth1
174.0.0.0/16 via 176.0.1.1 dev R4-eth2
175.0.0.0/16 dev R4-eth1 proto kernel scope link src 175.0.1.2
176.0.0.0/16 dev R4-eth2 proto kernel scope link src 176.0.1.2
177.0.0.0/16 dev R4-eth0 proto kernel scope link src 177.0.1.2
mininext>
mininext> H2 ip route
default via 177.0.1.2 dev H2-eth0
177.0.0.0/16 dev H2-eth0 proto kernel scope link src 177.0.1.1
```

b) TraceRoute between H1 and H2:

```
mininext> H1 traceroute H2
traceroute to 177.0.1.1 (177.0.1.1), 30 hops max, 60 byte packets
 1  172.0.1.2 (172.0.1.2)  0.022 ms  0.006 ms  0.013 ms
 2  173.0.1.2 (173.0.1.2)  0.011 ms  0.004 ms  0.004 ms
 3  175.0.1.2 (175.0.1.2)  0.013 ms  0.006 ms  0.006 ms
 4  177.0.1.1 (177.0.1.1)  0.010 ms  0.006 ms  0.006 ms
mininext> █
```