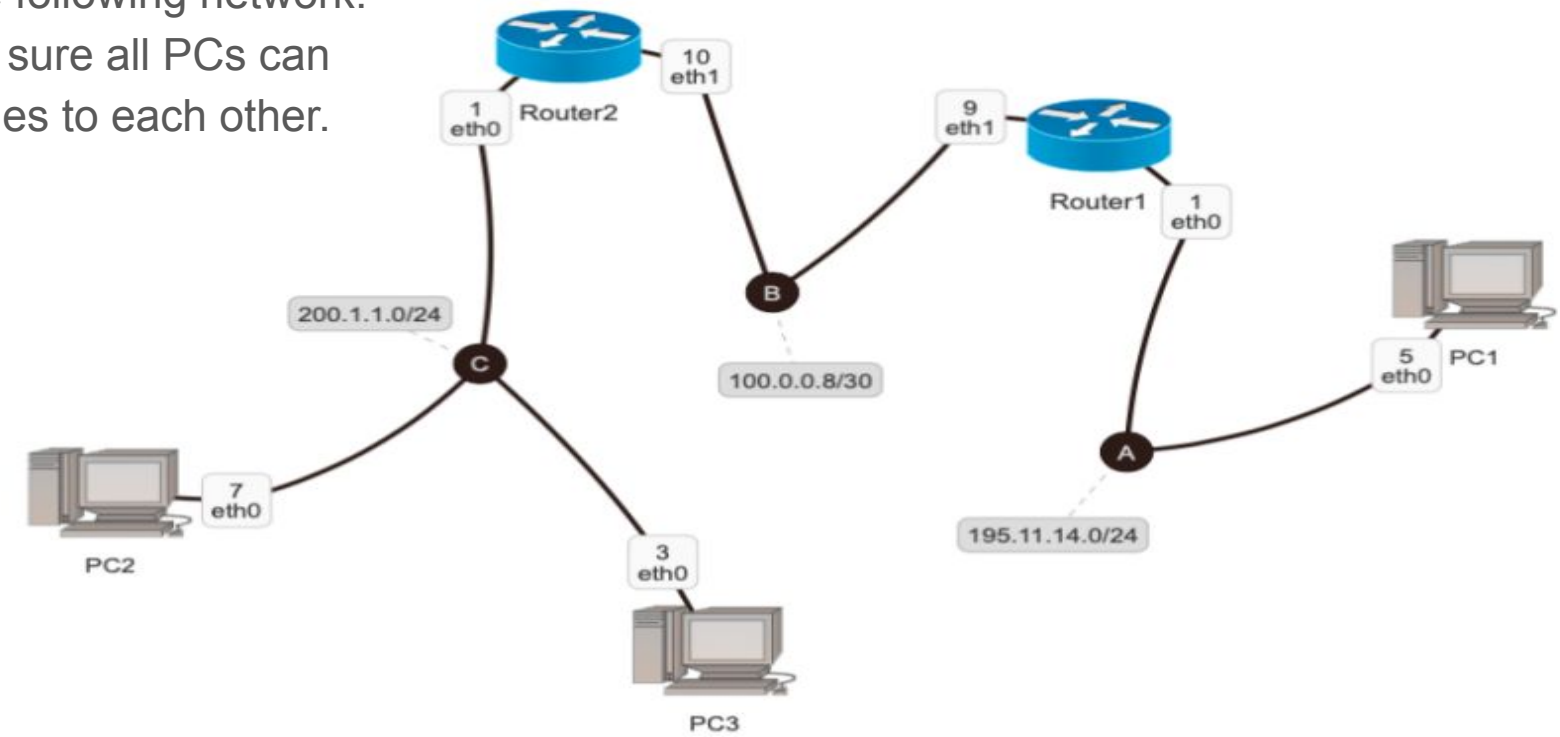
Lab 02

CT106H - Computer network

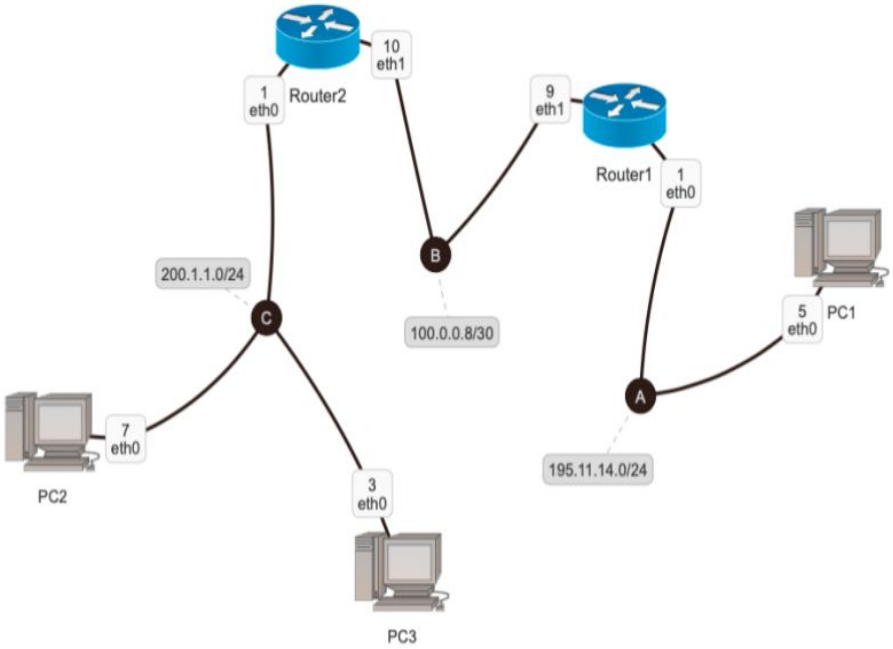
Exercise 6

Construct the following network. Please make sure all PCs can send messages to each other.



Exercise 6 (solution)

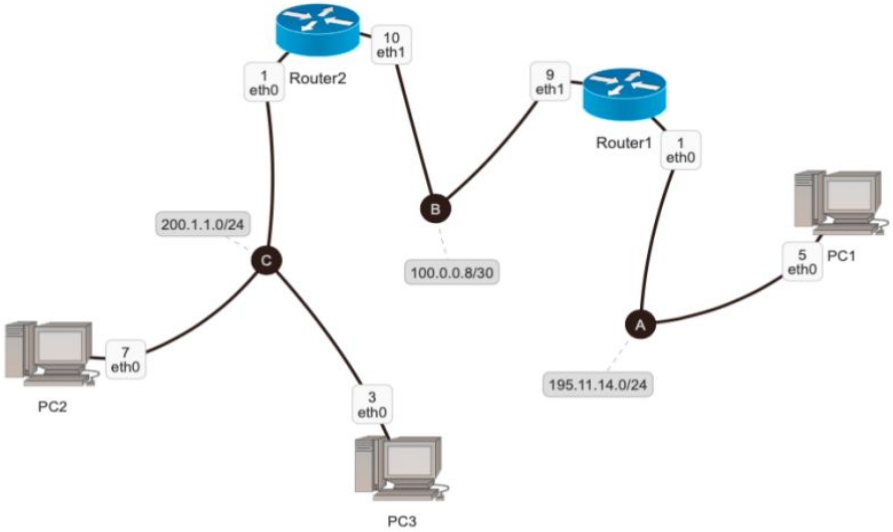
```
lnk@NhutKhang: ~/CT106H/exercise06
lnk@NhutKhang:~/CT106H/exercise06$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
├── r1.startup
├── r2
└── r2.startup

5 directories, 6 files
lnk@NhutKhang:~/CT106H/exercise06$ cat lab.conf
pc1[0]=A
pc2[0]=C
pc3[0]=C
r1[0]=A
r1[1]=B
r2[0]=C
r2[1]=B
```



Exercise 6 (solution)

lnk@NhutKhang: ~/CT106H/exercise06

```
lnk@NhutKhang:~/CT106H/exercise06$ cat pc1.startup
ifconfig eth0 195.11.14.5/24 up
route add default gw 195.11.14.1
lnk@NhutKhang:~/CT106H/exercise06$ cat pc2.startup
ifconfig eth0 200.1.1.7/24 up
route add default gw 200.1.1.1
lnk@NhutKhang:~/CT106H/exercise06$ cat pc3.startup
ifconfig eth0 200.1.1.3/24 up
route add default gw 200.1.1.1
lnk@NhutKhang:~/CT106H/exercise06$ cat r1.startup
ifconfig eth0 195.11.14.1/24 up
ifconfig eth1 100.0.0.9/24 up
route add -net 200.1.1.0/24 gw 100.0.0.10
lnk@NhutKhang:~/CT106H/exercise06$ cat r2.startup
ifconfig eth0 200.1.1.1/24 up
ifconfig eth1 100.0.0.10/24 up
route add -net 195.11.14.0/24 gw 100.0.0.9
lnk@NhutKhang:~/CT106H/exercise06$
```



Exercise 6 (solution)

root@pc1: /

```
--- Startup Commands Log

++ ifconfig eth0 195.11.14.5/24 up
++ route add default gw 195.11.14.1

--- End Startup Commands Log

root@pc1:/# ping 200.1.1.7
PING 200.1.1.7 (200.1.1.7) 56(84) bytes of data.
64 bytes from 200.1.1.7: icmp_seq=1 ttl=62 time=0.222 ms
64 bytes from 200.1.1.7: icmp_seq=2 ttl=62 time=0.368 ms
64 bytes from 200.1.1.7: icmp_seq=3 ttl=62 time=0.387 ms
^C
--- 200.1.1.7 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 53ms
rtt min/avg/max/mdev = 0.222/0.325/0.387/0.076 ms
root@pc1:/# ping 200.1.1.3
PING 200.1.1.3 (200.1.1.3) 56(84) bytes of data.
64 bytes from 200.1.1.3: icmp_seq=1 ttl=62 time=0.284 ms
64 bytes from 200.1.1.3: icmp_seq=2 ttl=62 time=0.137 ms
^C
--- 200.1.1.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 2ms
rtt min/avg/max/mdev = 0.137/0.210/0.284/0.074 ms
root@pc1:/#
```

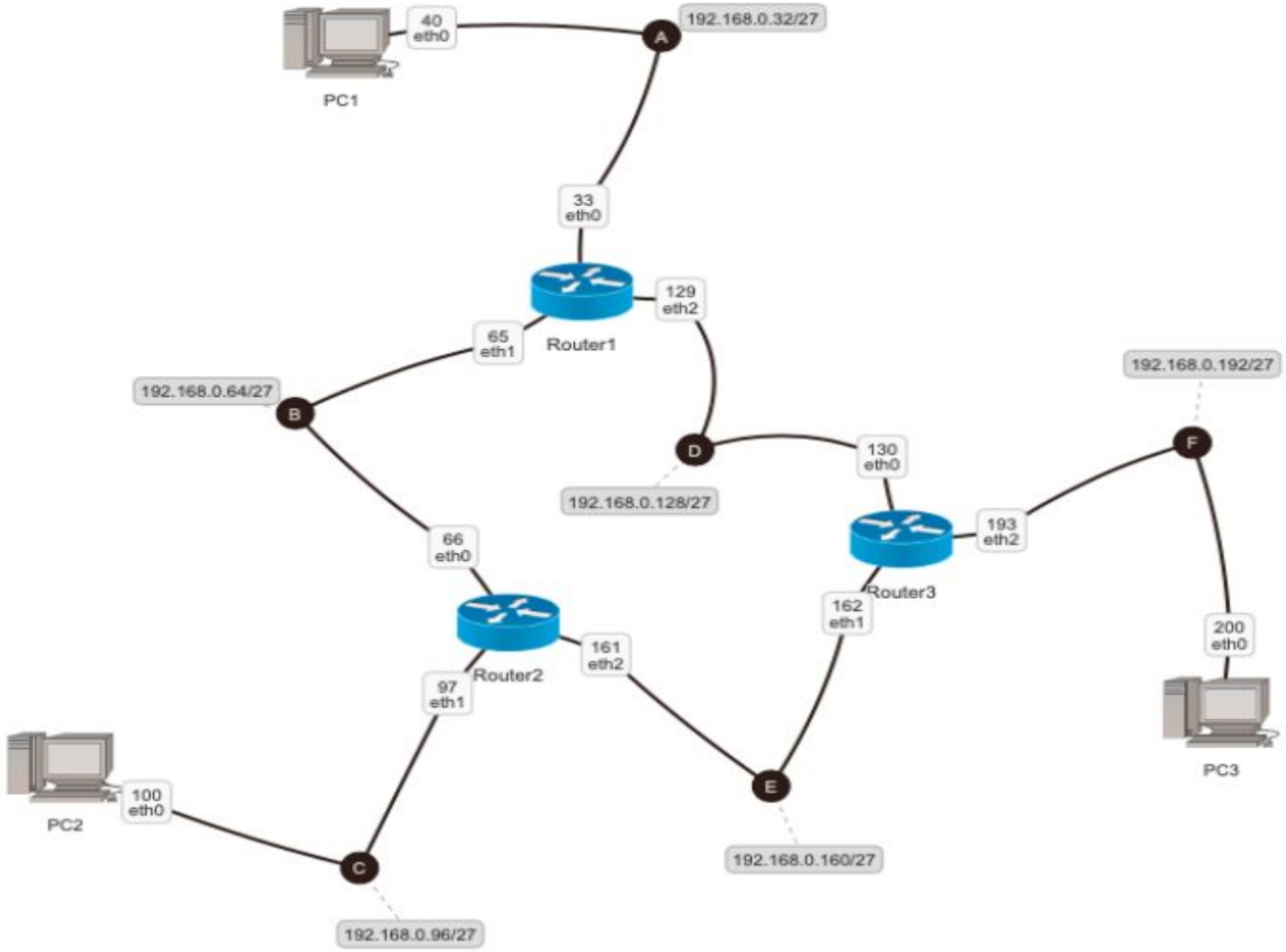
root@r1: /

```
--- Startup Commands Log

++ ifconfig eth0 195.11.14.1/24 up
++ ifconfig eth1 100.0.0.9/24 up
++ route add -net 200.1.1.0/24 gw 100.0.0.10

--- End Startup Commands Log

root@r1:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
100.0.0.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
195.11.14.0     0.0.0.0         255.255.255.0   U     0      0        0 eth0
200.1.1.0       100.0.0.10      255.255.255.0   UG    0      0        0 eth1
root@r1:/#
```

root@r2: /

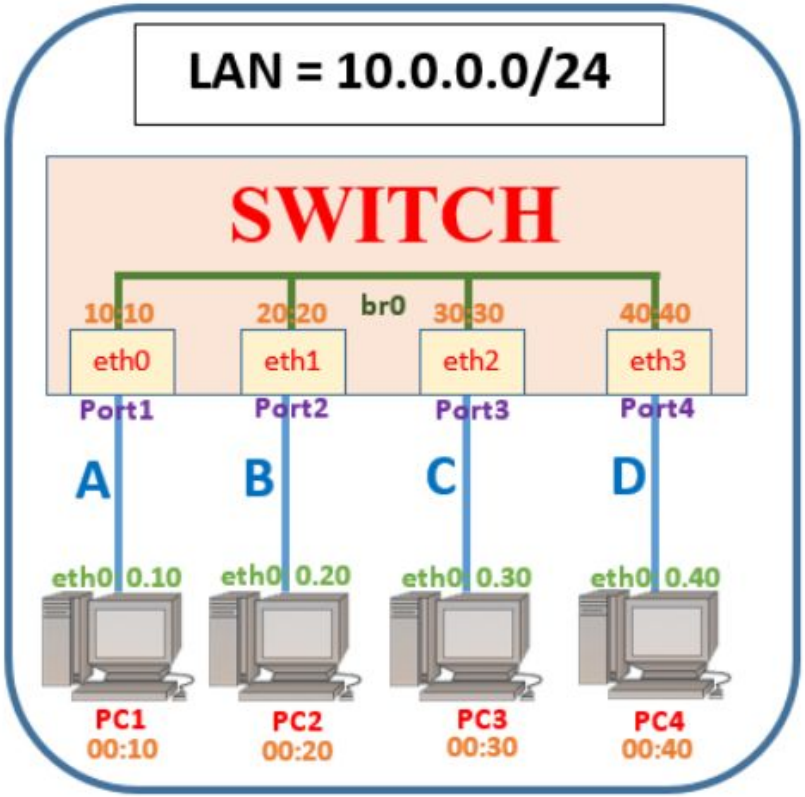
```
--- Startup Commands Log

++ ifconfig eth0 200.1.1.1/24 up
++ ifconfig eth1 100.0.0.10/24 up
++ route add -net 195.11.14.0/24 gw 100.0.0.9

--- End Startup Commands Log

root@r2:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
100.0.0.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
195.11.14.0     100.0.0.9       255.255.255.0   UG    0      0        0 eth1
200.1.1.0       0.0.0.0         255.255.255.0   U     0      0        0 eth0
root@r2:/#
```

Exercise 7


PC1
40
eth0
A
192.168.0.32/27
33
eth0
Router1
129
eth2
65
eth1
192.168.0.64/27
B
D
192.168.0.128/27
130
eth0
192.168.0.192/27
F
Router3
193
eth2
162
eth1
66
eth0
Router2
161
eth2
97
eth1
200
eth0
PC3
PC2
100
eth0
C
192.168.0.96/27
E
192.168.0.160/27

Exercise 8

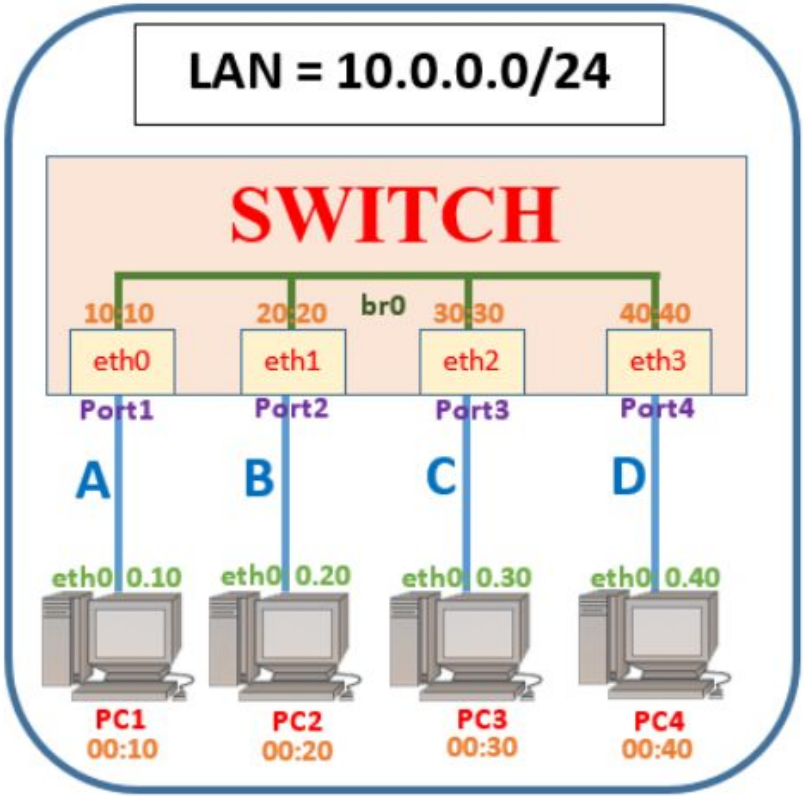
1. Self-study “SWITCH”
2. Construct a LAN using a switch



Exercise 8 (solution)

lnk@NhutKhang: ~/CT106H/exercise08

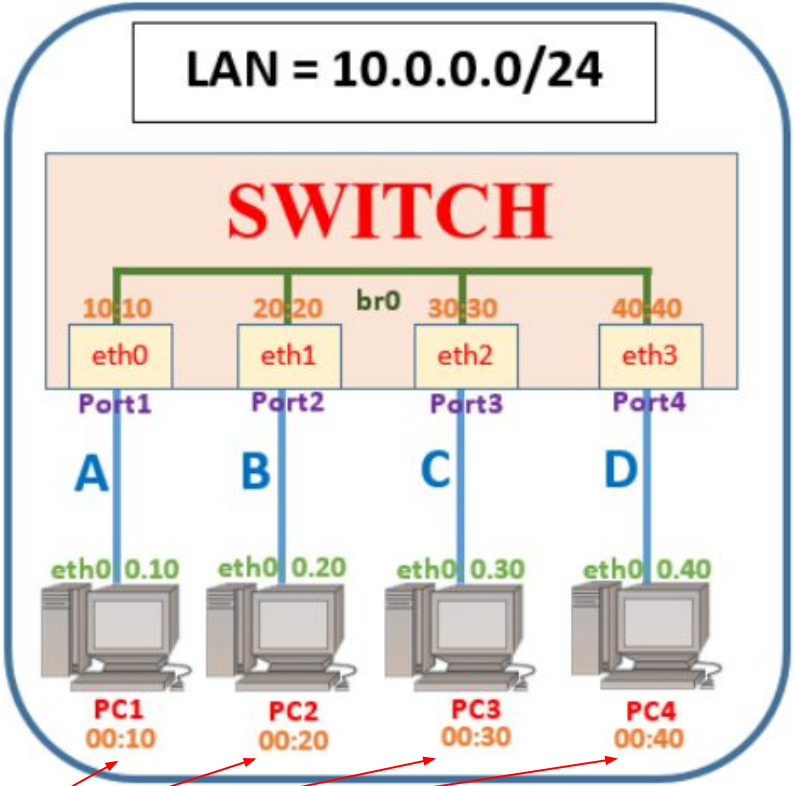
```
lnk@NhutKhang:~/CT106H/exercise08$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── sw
└── sw.startup

5 directories, 6 files
lnk@NhutKhang:~/CT106H/exercise08$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D
sw[0]=A
sw[1]=B
sw[2]=C
sw[3]=D
lnk@NhutKhang:~/CT106H/exercise08$
```



Exercise 8 (solution)

lnk@NhutKhang: ~/CT106H/exercise08

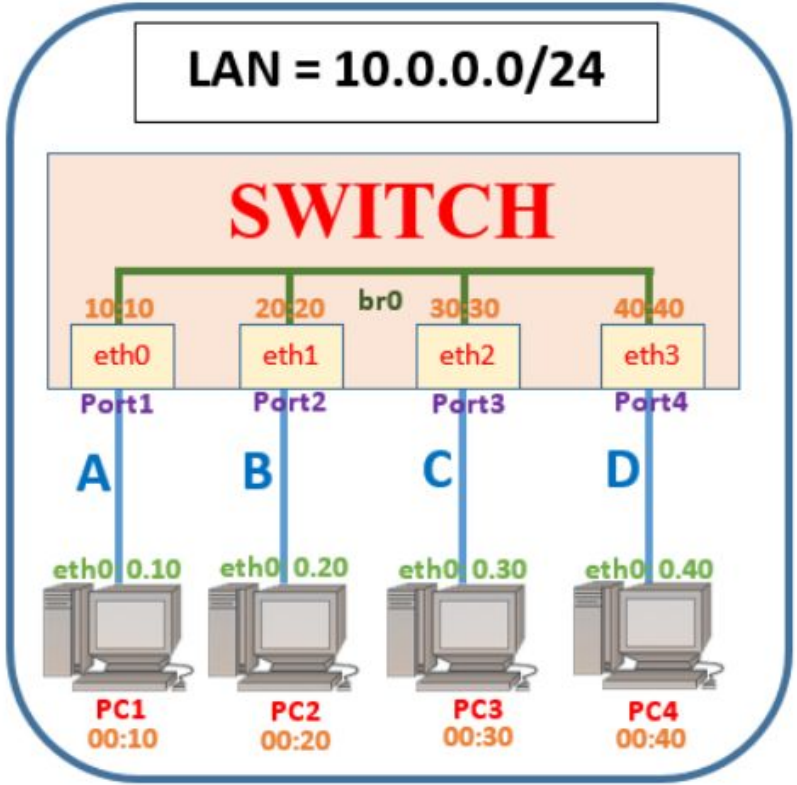
```
lnk@NhutKhang:~/CT106H/exercise08$ cat pc1.startup
ifconfig eth0 10.0.0.10/24 up
ifconfig eth0 hw ether 00:00:00:00:00:10
lnk@NhutKhang:~/CT106H/exercise08$ cat pc2.startup
ifconfig eth0 10.0.0.20/24 up
ifconfig eth0 hw ether 00:00:00:00:00:20
lnk@NhutKhang:~/CT106H/exercise08$ cat pc3.startup
ifconfig eth0 10.0.0.30/24 up
ifconfig eth0 hw ether 00:00:00:00:00:30
lnk@NhutKhang:~/CT106H/exercise08$ cat pc4.startup
ifconfig eth0 10.0.0.40/24 up
ifconfig eth0 hw ether 00:00:00:00:00:40
```



MAC address

Exercise 8 (solution)

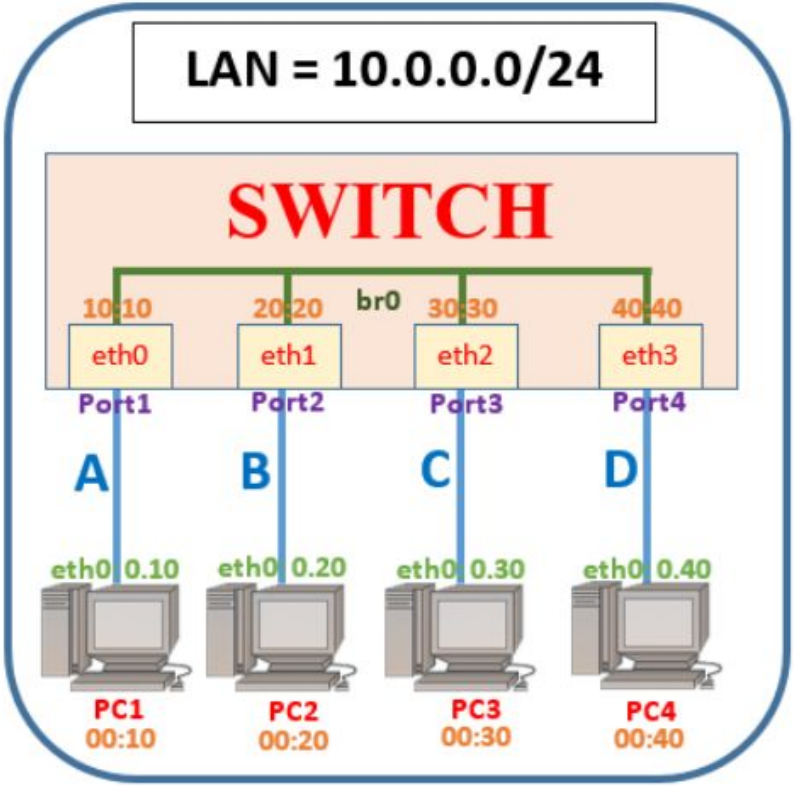
```
lnk@NhutKhang:~/CT106H/exercise08$ cat sw.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:00:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:00:20:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:00:30:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:00:40:40
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl stp br0 on
ifconfig br0 up
```



Exercise 8 (solution)

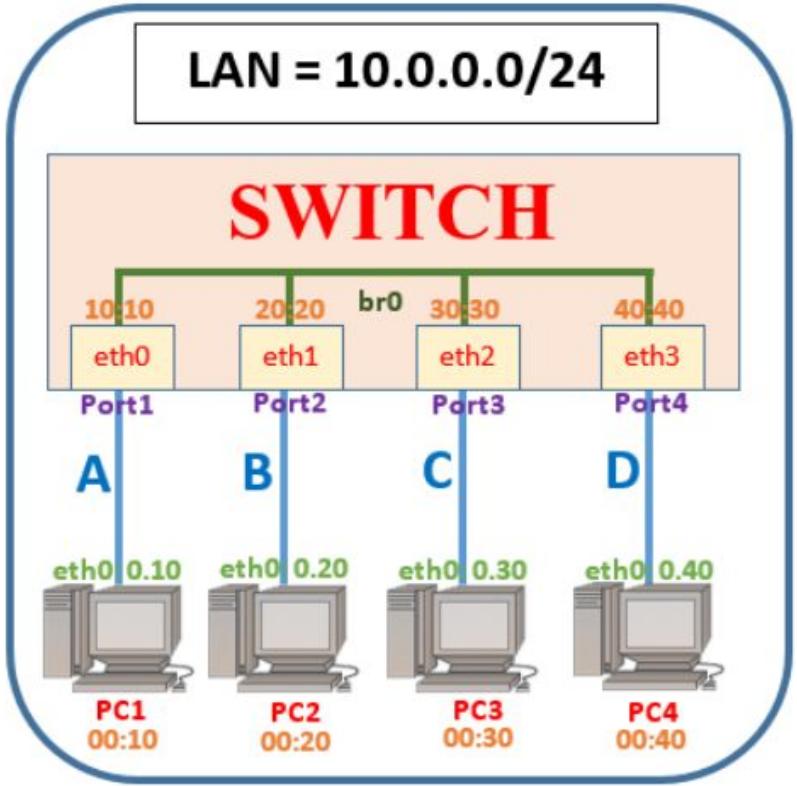
- Start the network
- On the switch type the following command to check the Mac Lookup Table, and explain the information lists in the Table

```
brctl showmacs br0
```



E

```
root@sw: /
--- Startup Commands Log

++ ifconfig eth0 up
++ ifconfig eth0 hw ether 00:00:00:00:10:10
++ ifconfig eth1 up
++ ifconfig eth1 hw ether 00:00:00:00:20:20
++ ifconfig eth2 up
++ ifconfig eth2 hw ether 00:00:00:00:30:30
++ ifconfig eth3 up
++ ifconfig eth3 hw ether 00:00:00:00:40:40
++ brctl addbr br0
++ brctl addif br0 eth0
++ brctl addif br0 eth1
++ brctl addif br0 eth2
++ brctl addif br0 eth3
++ brctl stp br0 on
++ ifconfig br0 up

--- End Startup Commands Log

root@sw:/# brctl showmacs br0
port no mac addr                is local?       ageing timer
  1     00:00:00:00:10:10       yes                0.00
  1     00:00:00:00:10:10       yes                0.00
  2     00:00:00:00:20:20       yes                0.00
  2     00:00:00:00:20:20       yes                0.00
  3     00:00:00:00:30:30       yes                0.00
  3     00:00:00:00:30:30       yes                0.00
  4     00:00:00:00:40:40       yes                0.00
  4     00:00:00:00:40:40       yes                0.00
  3     6e:46:a8:0f:a6:e0       no                61.34
  1     76:4e:24:54:e3:ee       no                64.51
  4     a6:f8:2f:a3:a8:2f       no                60.41
  3     aa:3d:b2:62:e8:10       no                68.88
  2     ae:0e:f1:65:47:e9       no                58.36
  4     c2:65:a3:0c:b6:e0       no                61.53
  2     f2:ad:74:38:f4:c9       no                58.36
  1     fe:13:03:a6:f2:d8       no                62.42
root@sw:/#
```

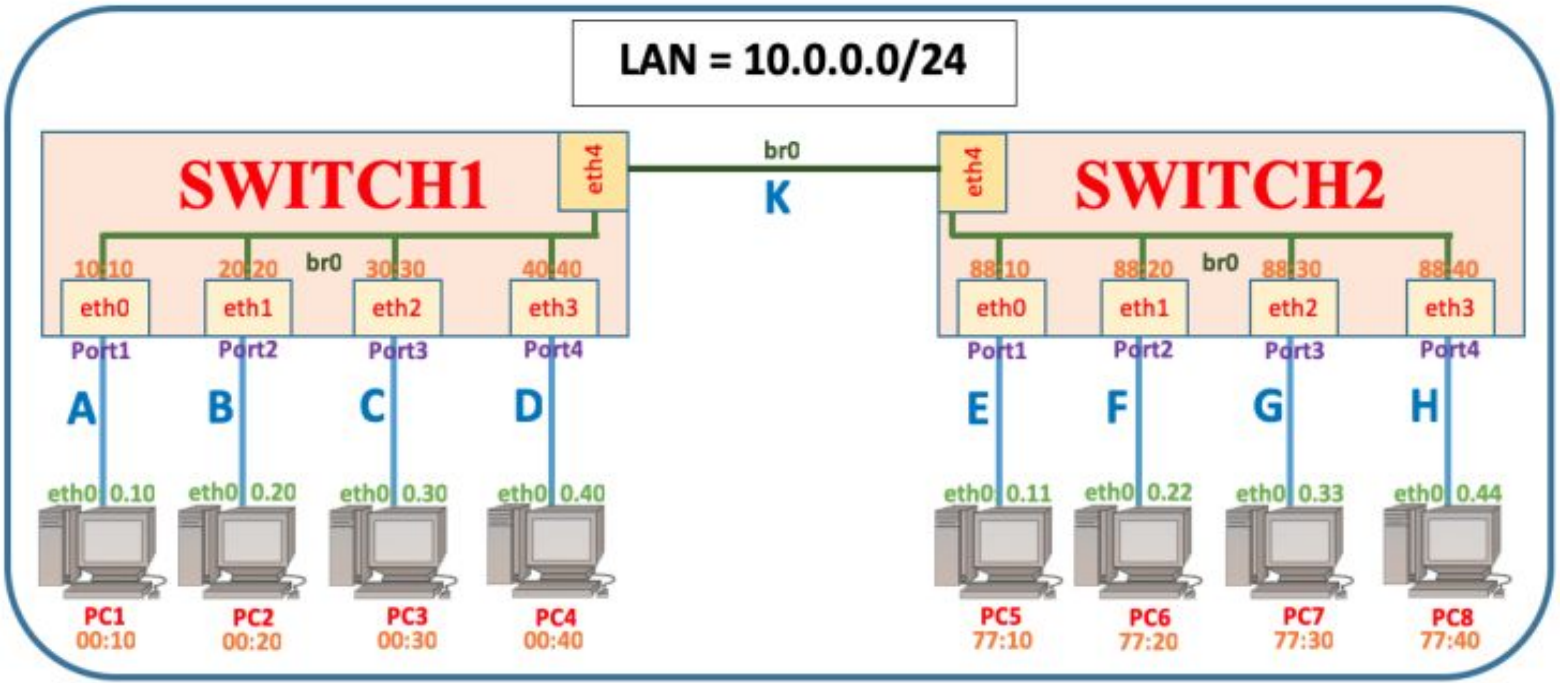


Exercise 8 (cont.)

1. On the switch, pc1 and pc3, run the command:
   - `tcpdump -e -q -w /hostlab/ex8_switch.pcap`
   - `tcpdump -e -q -w /hostlab/ex8_pc1.pcap`
   - `tcpdump -e -q -w /hostlab/ex8_pc3.pcap`
2. On pc2, send the message to pc3 using the command ping 10.0.0.30 , then wait for about 10 seconds, and stop all the the ping command on pc2, and stop tcpdump commands on other devices.
3. On the switch check the contain of the Mac Lookup Table again using the command `brctl showmacs br0`, and explain the information lists in the Table
4. Use Wireshark to open *ex8_switch.pcap*, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:20, explain the contain in the frame
5. Use Wireshark to open *ex8_switch.pcap*, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame
6. Use Wireshark to open *pc1_switch.pcap*, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame
7. Use Wireshark to open *pc3_switch.pcap*, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame

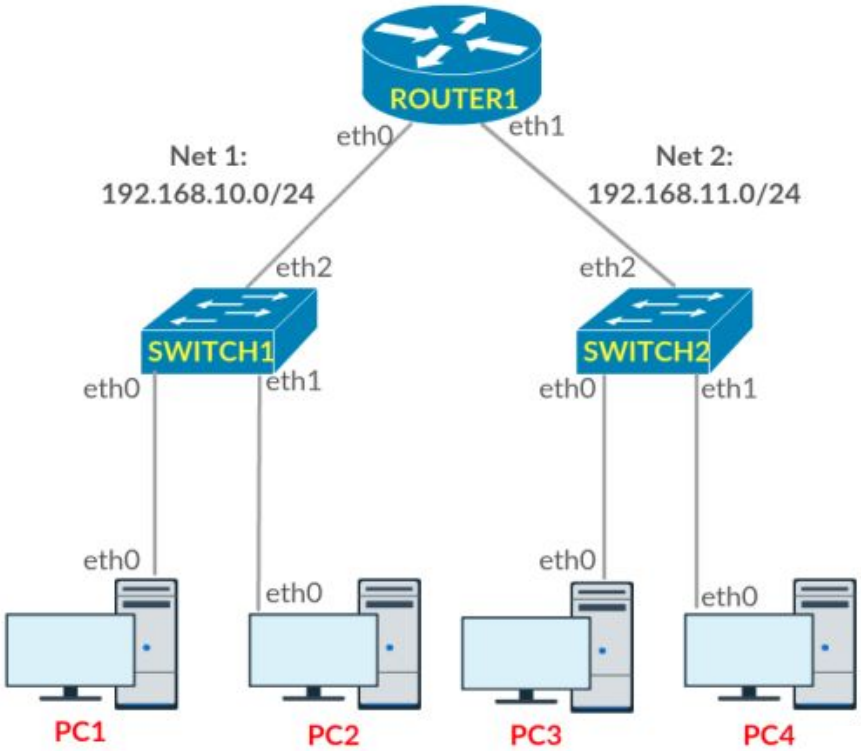
Exercise 9

Construct the following network

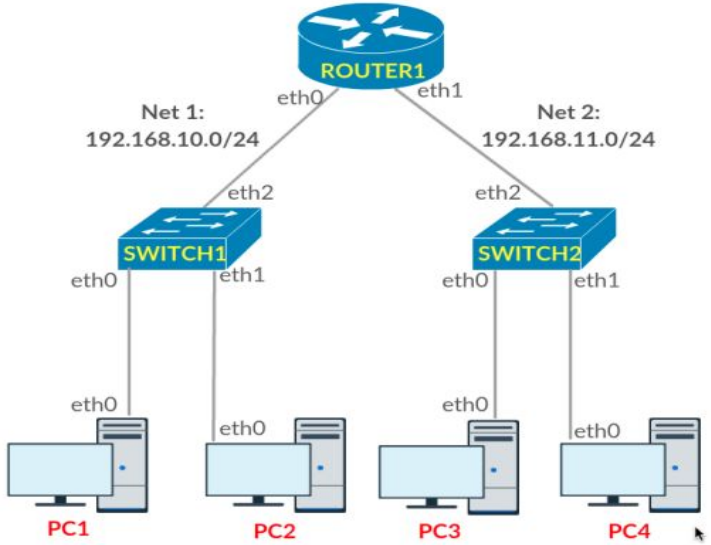


Exercise 10

Construct the following network



Exercise 10 (solution)



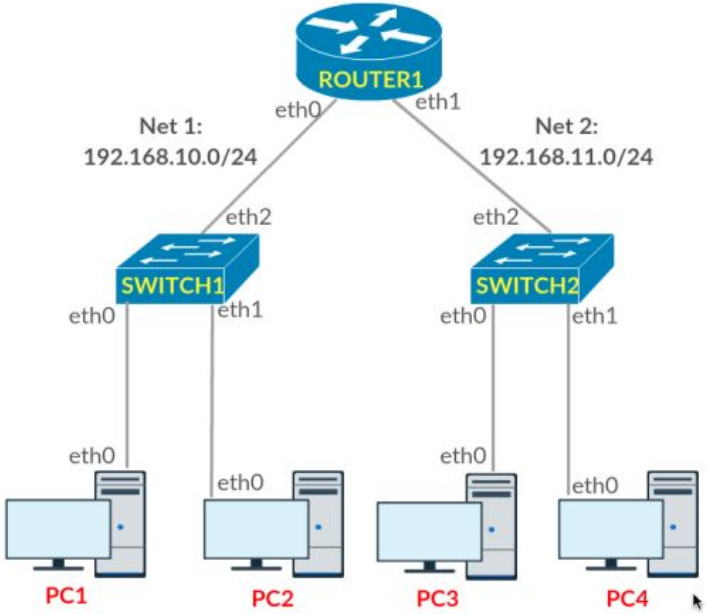

```
lnk@NhutKhang: ~/CT106H/exercise10
lnk@NhutKhang:~/CT106H/exercise10$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── r1
├── r1.startup
├── sw1
├── sw1.startup
├── sw2
└── sw2.startup

7 directories, 8 files
```

```
lnk@NhutKhang:~/CT106H/exercise10$ cat lab.conf
```

DO IT YOURSELF :)

Exercise 10 (solution)

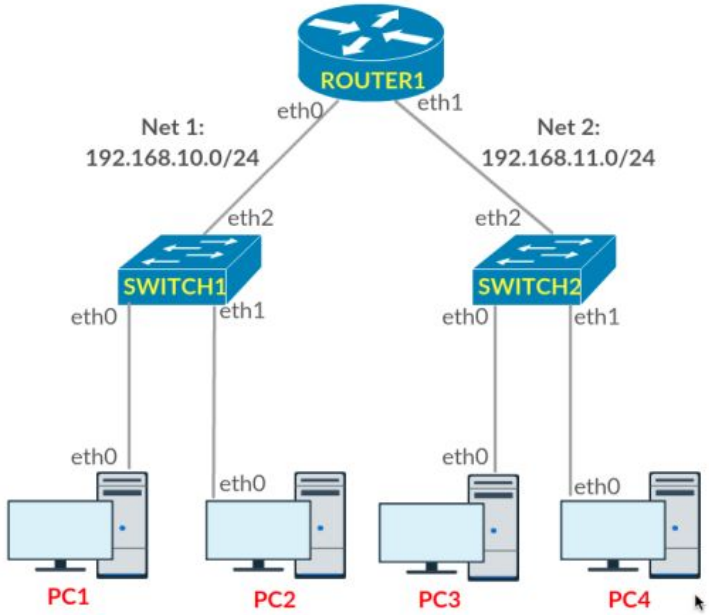
```
lnk@NhutKhang:~/CT106H/exercise10$ cat pc1.startup
ifconfig eth0 192.168.10.10/24
ifconfig eth0 hw ether 00:00:00:00:10:10
route add default gw 192.168.10.1
lnk@NhutKhang:~/CT106H/exercise10$ cat pc2.startup
ifconfig eth0 192.168.10.11/24
ifconfig eth0 hw ether 00:00:00:00:10:11
route add default gw 192.168.10.1
lnk@NhutKhang:~/CT106H/exercise10$ cat pc3.startup
ifconfig eth0 192.168.11.10/24
ifconfig eth0 hw ether 00:00:00:00:11:10
route add default gw 192.168.11.1
lnk@NhutKhang:~/CT106H/exercise10$ cat pc4.startup
ifconfig eth0 192.168.11.11/24
ifconfig eth0 hw ether 00:00:00:00:11:11
route add default gw 192.168.11.1
```



Exercise 10 (solution)

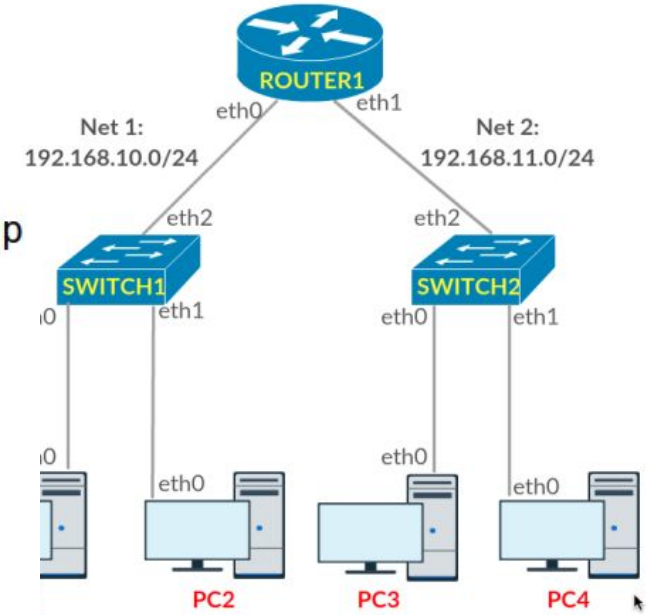
lnk@NhutKhang: ~/CT106H/exercise10

```
lnk@NhutKhang:~/CT106H/exercise10$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:10:10:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:10:10:12
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up
```



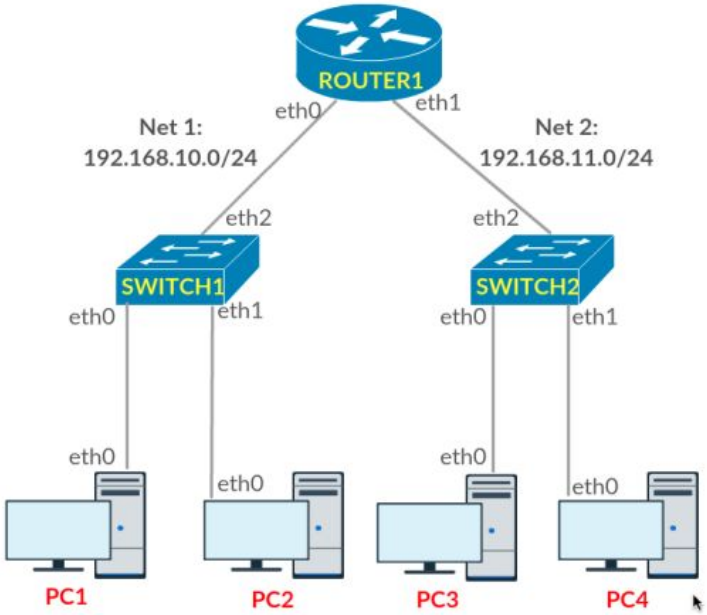
Exercise 10 (solution)

```
lnk@NhutKhang:~/CT106H/exercise10$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:20:11:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:11:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:20:11:12
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
```



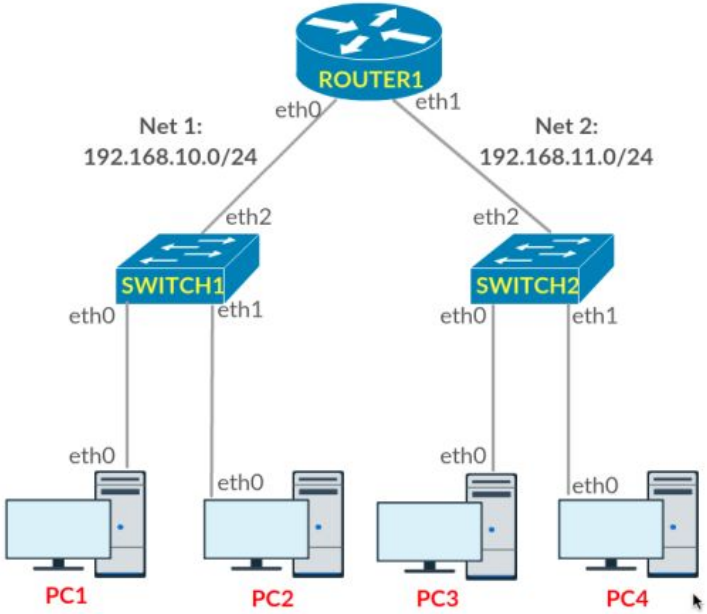
Exercise 10 (solution)

```
root@r1: /
--- Startup Commands Log

++ ifconfig eth0 192.168.10.1/24 up
++ ifconfig eth0 hw ether 00:00:00:50:10:10
++ ifconfig eth1 192.168.11.1/24 up
++ ifconfig eth1 hw ether 00:00:00:50:11:10

--- End Startup Commands Log

root@r1:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.10.0    0.0.0.0         255.255.255.0   U     0      0        0 eth0
192.168.11.0    0.0.0.0         255.255.255.0   U     0      0        0 eth1
root@r1:/#
```



Exercise 10 (solution)

```
root@pc1: /
--- Startup Commands Log

++ ifconfig eth0 192.168.10.10/24
++ ifconfig eth0 hw ether 00:00:00:00:10:10
++ route add default gw 192.168.10.1

--- End Startup Commands Log

root@pc1:/# ping 192.168.11.11
PING 192.168.11.11 (192.168.11.11) 56(84) bytes of data.
64 bytes from 192.168.11.11: icmp_seq=1 ttl=63 time=0.413 ms
64 bytes from 192.168.11.11: icmp_seq=2 ttl=63 time=0.446 ms
64 bytes from 192.168.11.11: icmp_seq=3 ttl=63 time=0.297 ms
^C
--- 192.168.11.11 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 21ms
rtt min/avg/max/mdev = 0.297/0.385/0.446/0.065 ms
root@pc1:/#
```



Exercise 11

Construct the following network