

IP Interfaces: Part 2

Instructions

For the second lab, you will select IP addresses from 10.10.11.0/24 to configure R2, R3, and R4 in Area 1 as shown in the network diagram. Since R2, R3, and R4 are connected by different hubs, they are not in the same broadcast and collision domain, and therefore do not have direct access to each other via Ethernet.

You will configure four different subnets so that each pair of directly connected routers can communicate with each other. But you also must make sure that your subnets do not overlap.

Before configuring your VMs, fill in the table and verify that you have assigned appropriate subnets for all three VMs. Each subnet should be large enough to accommodate its routers, but no larger than necessary.

Note that you will assign a /28 on R4 (eth2) to be used later for a subsequent DHCP assignment.

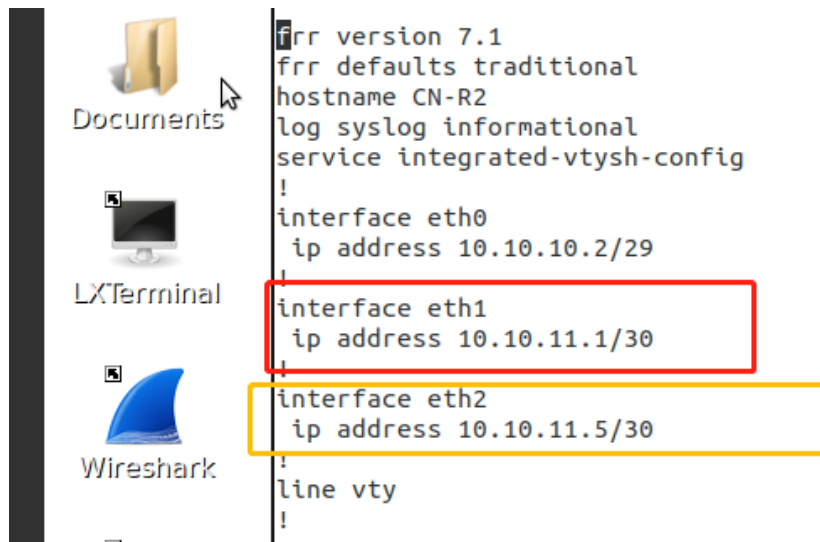
| VM (interface) | IP Address | Network Address | Broadcast Address | Range (usable addresses) |
|----------------|-------------|-----------------|-------------------|---------------------------|
| R2 (eth1) | 10.10.11.1 | 10.10.11.0/30 | 10.10.11.3 | 10.10.11.1 - 10.10.11.2 |
| R3 (eth0) | 10.10.11.2 | | | |
| R2 (eth2) | 10.10.11.5 | 10.10.11.4/30 | 10.10.11.7 | 10.10.11.5 - 10.10.11.6 |
| R4 (eth1) | 10.10.11.6 | | | |
| R3 (eth1) | 10.10.11.9 | 10.10.11.8/30 | 10.10.11.11 | 10.10.11.9 - 10.10.11.10 |
| R4 (eth0) | 10.10.11.10 | | | |
| R4 (eth2) | 10.10.11.17 | 10.10.11.16/28 | 10.10.11.31 | 10.10.11.17 - 10.10.11.31 |

Part 1: Configuring Network Interfaces

Use `vtysh` to do the configurations (See Interface Commands under Zebra in the `frouting` manual). Don't forget to write to memory or your changes will be lost.

You may use Linux's `ifconfig` command in order to verify that you have saved your network configuration (see `man ifconfig`).

R2 frr.conf and ifconfig confirmation of ip address



```
frr version 7.1
frr defaults traditional
hostname CN-R2
log syslog informational
service integrated-vtysh-config
!
interface eth0
 ip address 10.10.10.2/29
!
interface eth1
 ip address 10.10.11.1/30
!
interface eth2
 ip address 10.10.11.5/30
!
line vty
!
```

```
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.1 netmask 255.255.255.252 broadcast 10.10.11.3
    inet6 fe80::200:ff:fe00:5 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:05 txqueuelen 1000 (Ethernet)
    RX packets 12 bytes 822 (822.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 41 bytes 5410 (5.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.5 netmask 255.255.255.252 broadcast 10.10.11.7
    inet6 fe80::200:ff:fe00:9 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:09 txqueuelen 1000 (Ethernet)
    RX packets 10 bytes 656 (656.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 43 bytes 5582 (5.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
```

R3 frr.conf and ifconfig confirmation of ip address

```
GNU nano 2.9.8 /etc/frr/frr.conf

frr version 7.1
frr defaults traditional
hostname CN-R3
log syslog informational
service integrated-vtysh-config
!
interface eth0
ip address 10.10.11.2/30
!
interface eth1
ip address 10.10.11.9/30
!
line vty
!
```

```
student@CN-R3:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.2 netmask 255.255.255.252 broadcast 10.10.11.3
    inet6 fe80::200:ff:fe00:6 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:06 txqueuelen 1000 (Ethernet)
    RX packets 12 bytes 822 (822.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 43 bytes 5582 (5.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.9 netmask 255.255.255.252 broadcast 10.10.11.11
    inet6 fe80::200:ff:fe00:7 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:07 txqueuelen 1000 (Ethernet)
    RX packets 12 bytes 822 (822.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 42 bytes 5517 (5.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

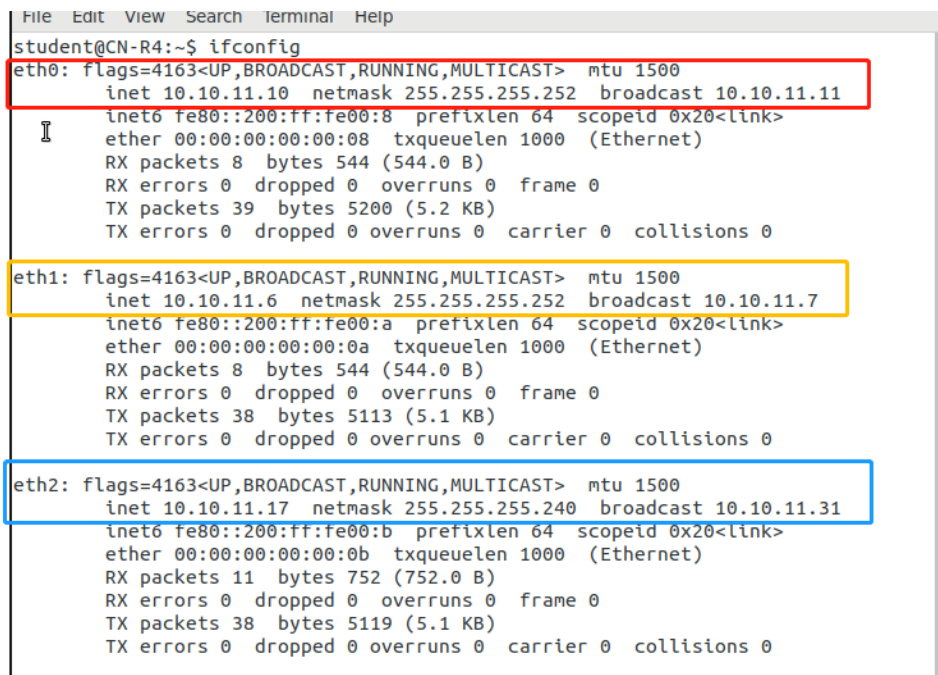
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 375 bytes 26589 (26.5 KB)
```

R4 frr.conf and ifconfig confirmation of ip address



```
root@CN-R4: /home/student
File Edit View Search Terminal Help
GNU nano 2.9.8 /etc/frr/frr.conf

frr version 7.1
frr defaults traditional
hostname CN-R4
log syslog informational
service integrated-vtysh-config
!
interface eth0
ip address 10.10.11.10/30
!
interface eth1
ip address 10.10.11.6/30
!
interface eth2
ip address 10.10.11.17/28
!
line vty
!
```



```
File Edit View Search Terminal Help
student@CN-R4:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.10 netmask 255.255.255.252 broadcast 10.10.11.11
    inet6 fe80::200:ff:fe00:8 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:08 txqueuelen 1000 (Ethernet)
    RX packets 8 bytes 544 (544.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 39 bytes 5200 (5.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.6 netmask 255.255.255.252 broadcast 10.10.11.7
    inet6 fe80::200:ff:fe00:a prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:0a txqueuelen 1000 (Ethernet)
    RX packets 8 bytes 544 (544.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 38 bytes 5113 (5.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.11.17 netmask 255.255.255.240 broadcast 10.10.11.31
    inet6 fe80::200:ff:fe00:b prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:00:00:0b txqueuelen 1000 (Ethernet)
    RX packets 11 bytes 752 (752.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 38 bytes 5119 (5.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Ping from R2, and Updated ARP table

```
student@CN-R2:~$ ping 10.10.11.2
PING 10.10.11.2 (10.10.11.2) 56(84) bytes of data.
64 bytes from 10.10.11.2: icmp_seq=1 ttl=64 time=0.636 ms
64 bytes from 10.10.11.2: icmp_seq=2 ttl=64 time=0.374 ms
^C
--- 10.10.11.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 29ms
rtt min/avg/max/mdev = 0.374/0.505/0.636/0.131 ms
student@CN-R2:~$ ping 10.10.11.6
PING 10.10.11.6 (10.10.11.6) 56(84) bytes of data.
64 bytes from 10.10.11.6: icmp_seq=1 ttl=64 time=0.781 ms
64 bytes from 10.10.11.6: icmp_seq=2 ttl=64 time=0.382 ms
^C
--- 10.10.11.6 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 3ms
rtt min/avg/max/mdev = 0.382/0.581/0.781/0.200 ms
student@CN-R2:~$ arp
```

to R3(eth0)

to R4(eth1)

| Address | Hwtype | Hwaddress | Flags | Mask | Iface |
|------------|--------|-------------------|-------|------|-------|
| 10.10.11.6 | ether | 00:00:00:00:00:0a | C | | eth2 |
| 10.10.11.2 | ether | 00:00:00:00:00:06 | C | | eth1 |

```
student@CN-R2:~$
```

Ping from R3, and Updated ARP table

```
File Edit View Search Terminal Help
student@CN-R3:~$ ping 10.10.11.1 ping to R2(eth1)
PING 10.10.11.1 (10.10.11.1) 56(84) bytes of data.
64 bytes from 10.10.11.1: icmp_seq=1 ttl=64 time=0.336 ms
64 bytes from 10.10.11.1: icmp_seq=2 ttl=64 time=0.275 ms
64 bytes from 10.10.11.1: icmp_seq=3 ttl=64 time=0.347 ms
^C
--- 10.10.11.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 39ms
rtt min/avg/max/mdev = 0.275/0.319/0.347/0.034 ms
student@CN-R3:~$ ping 10.10.11.10 ping to R4(eth0)
PING 10.10.11.10 (10.10.11.10) 56(84) bytes of data.
64 bytes from 10.10.11.10: icmp_seq=1 ttl=64 time=0.513 ms
64 bytes from 10.10.11.10: icmp_seq=2 ttl=64 time=0.220 ms
64 bytes from 10.10.11.10: icmp_seq=3 ttl=64 time=0.197 ms
64 bytes from 10.10.11.10: icmp_seq=4 ttl=64 time=0.309 ms
^C
--- 10.10.11.10 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 62ms
rtt min/avg/max/mdev = 0.197/0.309/0.513/0.126 ms
student@CN-R3:~$ arp
Address                  HWtype  HWaddress           Flags Mask            Iface
10.10.11.10              ether    00:00:00:00:00:08    C                     eth1
10.10.11.1               ether    00:00:00:00:00:05    C                     eth0
student@CN-R3:~$
```

Ping from R4, and Updated ARP table

```
File Edit View Search Terminal Help
student@CN-R4:~$ ping 10.10.11.5
PING 10.10.11.5 (10.10.11.5) 56(84) bytes of data.
64 bytes from 10.10.11.5: icmp_seq=1 ttl=64 time=0.477 ms
64 bytes from 10.10.11.5: icmp_seq=2 ttl=64 time=0.426 ms
64 bytes from 10.10.11.5: icmp_seq=3 ttl=64 time=0.377 ms
^C
--- 10.10.11.5 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 32ms
rtt min/avg/max/mdev = 0.377/0.426/0.477/0.047 ms
student@CN-R4:~$ ping 10.10.11.9
PING 10.10.11.9 (10.10.11.9) 56(84) bytes of data.
64 bytes from 10.10.11.9: icmp_seq=1 ttl=64 time=0.303 ms
64 bytes from 10.10.11.9: icmp_seq=2 ttl=64 time=0.421 ms
64 bytes from 10.10.11.9: icmp_seq=3 ttl=64 time=0.480 ms
^C
--- 10.10.11.9 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 50ms
rtt min/avg/max/mdev = 0.303/0.401/0.480/0.075 ms
student@CN-R4:~$ arp
Address                  HWtype  HWaddress           Flags Mask            Iface
10.10.11.5                ether    00:00:00:00:00:09    C                      eth1
10.10.11.9                ether    00:00:00:00:00:07    C                      eth0
student@CN-R4:~$
```


Part 2: Questions

- a) Why must we ensure that our subnets do not overlap? Discuss one example of something that could go wrong. (10 points)

Because if there is an overlap between subnets then messages can go to the wrong destination address.

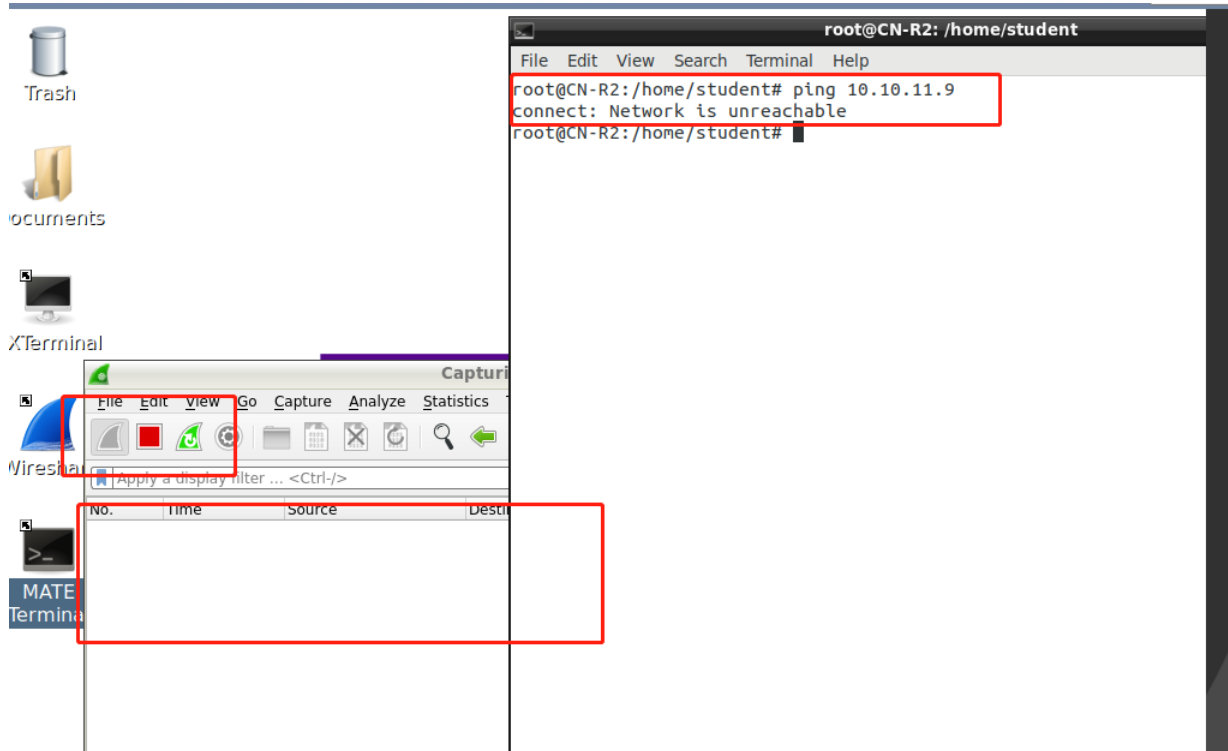
For e.g. assume two routers R1 and R2 have different subnets but the same IP address and their subnets overlap. Then the message intended for R2 might go to R1 instead.

- b) Suppose there is another Router (R5) directly connected to the HUB between R3 and R4. Explain whether or not we would need to reconfigure the IP subnets on R3 and R4 in order to communicate with R5. (10 points)

Yes, we would need to reconfigure the subnets. Because the current subnet /30 only allows for 2 hosts, if R5 is coming in there will be 3 hosts at the same time. So to accommodate another host we will need to reconfigure the subnet to for example, /29.

c) Run Wireshark on R2 (eth1). Now *ping* R3(eth1) from R2. Identify what type of packet is used in *ping*. Why is R2 unable to reach R3 (eth1)? (10 points)

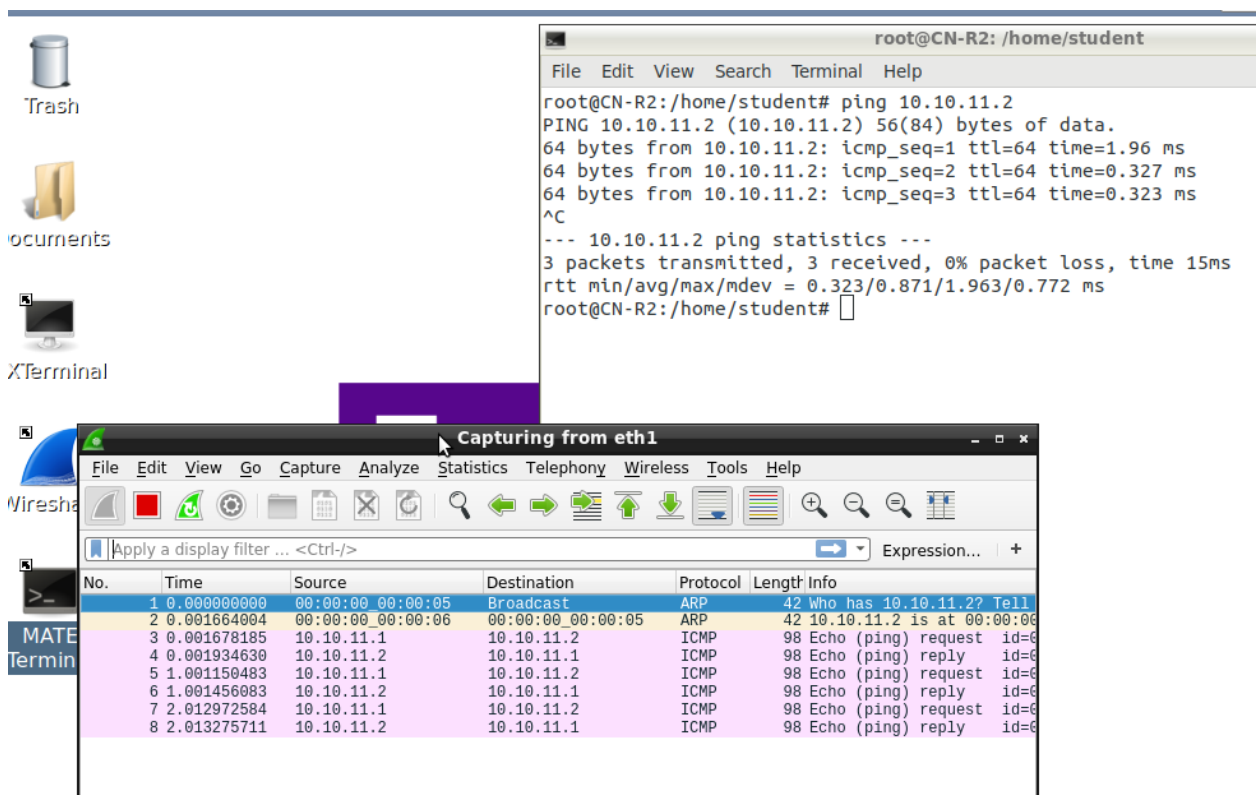
No packets are used in this ping from R2 (eth1) to R3(eth1) . When we try to connect to R3(eth1) we get Network is unreachable. R2(eth1) is unable to reach R3(eth1) because they have different broadcast addresses /subnets.



d) Briefly describe how Wireshark results compare when you *ping* R3 (eth0) from R2 (eth1). (5 points)

When we ping R3(eth0) from R2 unlike R3(eth1) we will get a successful connection as R2(eth1) and R3(eth0) they are in the same broadcast address.

At the Wireshark, R2(eth1) first sends R3(eth0) an ARP request asking who has that IP address of 10.10.11.2(which is R3 eth0). When R3 detects that the request is meant for it, R3 sends R2 it's Mac address back. Then they start communicating using ICMP packets (request and reply)



Submissions

[30 pts] Screenshot of the .conf file under /etc/frr/frr.conf from R2, R3, and R4 [20 pts] Your IP subnet table

[10 pts] Screenshot showing that pinging works between R2, R3, and R4

[5 pts] Screenshot of the ARP tables on R2, R3, and R4

[35 pts] Answers to questions 2a-2d.