

TP2 : Réseaux, sous réseaux et routage

**CAUMES Clément (PC1) - LAMMAMRA Aicha (PC2) -
MTALSI MERIMI Mehdi (PC3) - RAMAROSON Andritsalama
(PC4)**

Exercice 1

On va faire la configuration suivante :

- Le sous réseau 192.168.1.0 sera composé du PC de Clément (PC1) et celui d'Aicha (PC2) qui seront connectés à l'aide d'un commutateur 1.
- Le sous réseau 192.168.2.0 sera composé du PC de Mehdi (PC3) et celui de Andritsalama (PC4) qui seront connectés avec un commutateur 2.
- Les deux commutateurs seront connectés par un routeur.



Exercice 2

Clément configure l'adresse IP et le mask du PC1 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.1.1 netmask 255.255.255.192
```

Aicha configure l'adresse IP et le mask du PC2 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.1.2 netmask 255.255.255.192
[sudo] Mot de passe pour irs :
```

Mehdi configure l'adresse IP et le mask du PC3 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.2.3 netmask 255.255.255.192
```

Andritsalama configure l'adresse IP et le mask du PC4 :

```
root@serveur:/home/irs# ifconfig enp3s0 inet 192.168.2.4 netmask 255.255.255.192
root@serveur:/home/irs#
```

Exercice 3

Pour vérifier la bonne connexion des deux sous réseaux, on envoie des pings :

Du PC1 au PC2 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.1.2
PING 192.168.1.2 (192.168.1.2) 56(84) bytes of data.
From 192.168.1.1 icmp_seq=1 Destination Host Unreachable
From 192.168.1.1 icmp_seq=2 Destination Host Unreachable
From 192.168.1.1 icmp_seq=3 Destination Host Unreachable
From 192.168.1.1 icmp_seq=4 Destination Host Unreachable
From 192.168.1.1 icmp_seq=5 Destination Host Unreachable
From 192.168.1.1 icmp_seq=6 Destination Host Unreachable
From 192.168.1.1 icmp_seq=7 Destination Host Unreachable
From 192.168.1.1 icmp_seq=8 Destination Host Unreachable
From 192.168.1.1 icmp_seq=9 Destination Host Unreachable
From 192.168.1.1 icmp_seq=10 Destination Host Unreachable
From 192.168.1.1 icmp_seq=11 Destination Host Unreachable
From 192.168.1.1 icmp_seq=12 Destination Host Unreachable
64 bytes from 192.168.1.2: icmp_seq=13 ttl=64 time=1024 ms
64 bytes from 192.168.1.2: icmp_seq=14 ttl=64 time=0.651 ms
64 bytes from 192.168.1.2: icmp_seq=15 ttl=64 time=0.413 ms
64 bytes from 192.168.1.2: icmp_seq=16 ttl=64 time=0.428 ms
64 bytes from 192.168.1.2: icmp_seq=17 ttl=64 time=0.482 ms
64 bytes from 192.168.1.2: icmp_seq=18 ttl=64 time=0.497 ms
64 bytes from 192.168.1.2: icmp_seq=19 ttl=64 time=0.514 ms
64 bytes from 192.168.1.2: icmp_seq=20 ttl=64 time=0.486 ms
64 bytes from 192.168.1.2: icmp_seq=21 ttl=64 time=0.495 ms
64 bytes from 192.168.1.2: icmp_seq=22 ttl=64 time=0.483 ms
64 bytes from 192.168.1.2: icmp_seq=23 ttl=64 time=0.359 ms
64 bytes from 192.168.1.2: icmp_seq=24 ttl=64 time=0.463 ms
64 bytes from 192.168.1.2: icmp_seq=25 ttl=64 time=0.504 ms
64 bytes from 192.168.1.2: icmp_seq=26 ttl=64 time=0.404 ms
64 bytes from 192.168.1.2: icmp_seq=27 ttl=64 time=0.524 ms
64 bytes from 192.168.1.2: icmp_seq=28 ttl=64 time=0.484 ms
64 bytes from 192.168.1.2: icmp_seq=29 ttl=64 time=0.487 ms
^C
--- 192.168.1.2 ping statistics ---
29 packets transmitted, 17 received, +12 errors, 41% packet loss, time 28638ms
rtt min/avg/max/mdev = 0.359/60.716/1024.514/240.949 ms, pipe 4
irs@irs-OptiPlex-3040:~$
```

Du PC2 au PC1 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=0.337 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=64 time=0.403 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=64 time=0.486 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=64 time=0.280 ms
64 bytes from 192.168.1.1: icmp_seq=5 ttl=64 time=0.258 ms
64 bytes from 192.168.1.1: icmp_seq=6 ttl=64 time=0.257 ms
64 bytes from 192.168.1.1: icmp_seq=7 ttl=64 time=0.282 ms
64 bytes from 192.168.1.1: icmp_seq=8 ttl=64 time=0.484 ms
64 bytes from 192.168.1.1: icmp_seq=9 ttl=64 time=0.262 ms
```

Du PC3 au PC4 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.2.4
PING 192.168.2.4 (192.168.2.4) 56(84) bytes of data.
64 bytes from 192.168.2.4: icmp_seq=1 ttl=64 time=0.342 ms
64 bytes from 192.168.2.4: icmp_seq=2 ttl=64 time=0.518 ms
64 bytes from 192.168.2.4: icmp_seq=3 ttl=64 time=0.470 ms
64 bytes from 192.168.2.4: icmp_seq=4 ttl=64 time=0.483 ms
64 bytes from 192.168.2.4: icmp_seq=5 ttl=64 time=0.475 ms
64 bytes from 192.168.2.4: icmp_seq=6 ttl=64 time=0.404 ms
64 bytes from 192.168.2.4: icmp_seq=7 ttl=64 time=0.376 ms
64 bytes from 192.168.2.4: icmp_seq=8 ttl=64 time=0.487 ms
64 bytes from 192.168.2.4: icmp_seq=9 ttl=64 time=0.490 ms
64 bytes from 192.168.2.4: icmp_seq=10 ttl=64 time=0.491 ms
64 bytes from 192.168.2.4: icmp_seq=11 ttl=64 time=0.454 ms
64 bytes from 192.168.2.4: icmp_seq=12 ttl=64 time=0.493 ms
64 bytes from 192.168.2.4: icmp_seq=13 ttl=64 time=0.475 ms
64 bytes from 192.168.2.4: icmp_seq=14 ttl=64 time=0.301 ms
64 bytes from 192.168.2.4: icmp_seq=15 ttl=64 time=0.404 ms
64 bytes from 192.168.2.4: icmp_seq=16 ttl=64 time=0.376 ms
64 bytes from 192.168.2.4: icmp_seq=17 ttl=64 time=0.487 ms
64 bytes from 192.168.2.4: icmp_seq=18 ttl=64 time=0.472 ms
64 bytes from 192.168.2.4: icmp_seq=19 ttl=64 time=0.306 ms
64 bytes from 192.168.2.4: icmp_seq=20 ttl=64 time=0.489 ms
^C
--- 192.168.2.4 ping statistics ---
20 packets transmitted, 20 received, 0% packet loss, time 19417ms
rtt min/avg/max/mdev = 0.301/0.439/0.518/0.069 ms
```

Du PC4 au PC3 :

```
^C
--- 192.168.2.3 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8186ms
rtt min/avg/max/mdev = 0.395/0.472/0.522/0.045 ms
root@serveur:/home/irs#
```

La connexion a été correctement réalisée, on utilise netstat pour voir la table de routage :

Sur le PC1 et le PC2 :

```
irs@irs-OptiPlex-3040:~$ netstat -rn
Table de routage IP du noyau
Destination      Passerelle      Genmask          Indic   MSS Fenêtre irtt Iface
192.168.1.0      0.0.0.0        255.255.255.192 U        0 0        0 enp3s0
192.168.1.0      0.0.0.0        255.255.255.192 U        0 0        0 enp2s0
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.1.1 netmask 255.255.255.192
```

Sur le PC3 et le PC4 :

```
irs@irs-OptiPlex-3040:~$ netstat -rn
Table de routage IP du noyau
Destination      Passerelle      Genmask          Indic   MSS Fenêtre irtt Iface
192.168.2.0      0.0.0.0        255.255.255.192 U        0 0        0 enp3s0
```

On remarque que le chemin pris par un paquet pour atteindre une machine appartenant au même sous réseau est un routage direct (0.0.0.0). Cela signifie qu'il n'y a pas d'interfaces qui entrent en jeu (d'où le 0.0.0.0).

Exercice 4

Tout d'abord, on configure les passerelles par défaut sur chaque hôte qui permettra d'envoyer des paquets provenant d'une adresse IP d'un réseau différent :

Pour le PC1 avec 192.168.1.62 comme adresse de la passerelle :

```
irs@irs-OptiPlex-3040:~$ sudo route add default gw 192.168.1.62
[sudo] Mot de passe de irs :
irs@irs-OptiPlex-3040:~$ netstat -rn
Table de routage IP du noyau
Destination      Passerelle      Genmask          Indic   MSS Fenêtre irtt Iface
0.0.0.0          192.168.1.62  0.0.0.0          UG     0 0        0 enp3s0
192.168.1.0      0.0.0.0        255.255.255.192 U        0 0        0 enp3s0
192.168.1.0      0.0.0.0        255.255.255.192 U        0 0        0 enp2s0
irs@irs-OptiPlex-3040:~$
```

Pour le PC2 avec 192.168.1.62 comme adresse de la passerelle :

```
irs@irs-OptiPlex-3040:~$ sudo route add default gw 192.168.1.62
[sudo] Mot de passe de irs :
irs@irs-OptiPlex-3040:~$ netstat -rn
Table de routage IP du noyau
Destination      Passerelle      Genmask          Indic   MSS Fenêtre irtt Iface
0.0.0.0          192.168.1.62  0.0.0.0          UG     0 0        0 enp3s0
192.168.1.0      0.0.0.0        255.255.255.192 U        0 0        0 enp3s0
```

Pour le PC3 avec 192.168.2.62 comme adresse de la passerelle :

```
irs@irs-OptiPlex-3040:~$ netstat -rn
Table de routage IP du noyau
Destination      Passerelle      Genmask          Indic   MSS Fenêtre irtt Iface
0.0.0.0          192.168.2.62  0.0.0.0          UG     0 0        0 enp3s0
192.168.2.0      0.0.0.0        255.255.255.192 U        0 0        0 enp3s0
```

Pour le PC4 avec 192.168.2.62 comme adresse de la passerelle :

```
root@serveur:/home/irs# route add default gw 192.168.2.62
root@serveur:/home/irs# netstat -rn
Table de routage IP du noyau
Destination     Passerelle      Genmask        Indic   MSS Fenêtre irtt Iface
0.0.0.0         192.168.2.62  0.0.0.0        UG      0 0          0 enp3s0
192.168.2.0     0.0.0.0       255.255.255.192 U        0 0          0 enp3s0
192.168.42.0    0.0.0.0       255.255.255.0  U        0 0          0 enp2s0
```

Ensuite, on connecte le commutateur 1 sur l'interface Fa0/0 (192.168.1.62) et le commutateur sur Fa0/1 (192.168.2.62). Puis, on configure le routeur les adresses IP des interfaces :

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#interface fa0/0
R3(config-if)#ip address 192.168.1.62 255.255.255.192
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface fa0/1
R3(config-if)#ip address 192.168.2.62 255.255.255.192
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#exit
R3#co
*Mar 29 09:44:20.431: %SYS-5-CONFIG_I: Configured from console by consolepy
% Incomplete command.

R3#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R3#
```

Puis, on réalise le routage statique entre les deux sous réseaux avec le routeur :

```
R3(config)#ip route 192.168.2.0 255.255.255.192 fa0/1
R3(config)#ip route 192.168.1.0 255.255.255.192 fa0/0
R3(config)#exit
R3#co
*Mar 29 09:46:56.315: %SYS-5-CONFIG_I: Configured from console by consolepy
% Incomplete command.

R3#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R3#
```

On peut maintenant réaliser les pings correctement entre les deux sous réseaux :

Sur le PC1 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.2.3
PING 192.168.2.3 (192.168.2.3) 56(84) bytes of data.
64 bytes from 192.168.2.3: icmp_seq=1 ttl=63 time=0.536 ms
64 bytes from 192.168.2.3: icmp_seq=2 ttl=63 time=0.536 ms
64 bytes from 192.168.2.3: icmp_seq=3 ttl=63 time=0.490 ms
^C
--- 192.168.2.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 0.490/0.520/0.536/0.034 ms
irs@irs-OptiPlex-3040:~$ ping 192.168.2.4
PING 192.168.2.4 (192.168.2.4) 56(84) bytes of data.
64 bytes from 192.168.2.4: icmp_seq=1 ttl=63 time=0.524 ms
64 bytes from 192.168.2.4: icmp_seq=2 ttl=63 time=0.599 ms
64 bytes from 192.168.2.4: icmp_seq=3 ttl=63 time=0.577 ms
^C
--- 192.168.2.4 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2025ms
rtt min/avg/max/mdev = 0.524/0.566/0.599/0.041 ms
irs@irs-OptiPlex-3040:~$
```

Sur le PC2 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.2.3
PING 192.168.2.3 (192.168.2.3) 56(84) bytes of data.
64 bytes from 192.168.2.3: icmp_seq=2 ttl=63 time=0.615 ms
64 bytes from 192.168.2.3: icmp_seq=3 ttl=63 time=0.628 ms
64 bytes from 192.168.2.3: icmp_seq=4 ttl=63 time=0.621 ms
^C
--- 192.168.2.3 ping statistics ---
4 packets transmitted, 3 received, 25% packet loss, time 3051ms
rtt min/avg/max/mdev = 0.615/0.621/0.628/0.021 ms
irs@irs-OptiPlex-3040:~$ ping 192.168.2.4
PING 192.168.2.4 (192.168.2.4) 56(84) bytes of data.
64 bytes from 192.168.2.4: icmp_seq=1 ttl=63 time=0.546 ms
64 bytes from 192.168.2.4: icmp_seq=2 ttl=63 time=0.598 ms
64 bytes from 192.168.2.4: icmp_seq=3 ttl=63 time=0.588 ms
64 bytes from 192.168.2.4: icmp_seq=4 ttl=63 time=0.587 ms
^C
--- 192.168.2.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3058ms
rtt min/avg/max/mdev = 0.546/0.579/0.598/0.035 ms
```

Sur le PC3 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=1 ttl=63 time=5.43 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=63 time=0.580 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=63 time=0.579 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=63 time=0.611 ms
64 bytes from 192.168.1.1: icmp_seq=5 ttl=63 time=0.624 ms
64 bytes from 192.168.1.1: icmp_seq=6 ttl=63 time=0.624 ms
64 bytes from 192.168.1.1: icmp_seq=7 ttl=63 time=0.356 ms
64 bytes from 192.168.1.1: icmp_seq=8 ttl=63 time=0.572 ms
64 bytes from 192.168.1.1: icmp_seq=9 ttl=63 time=0.593 ms
64 bytes from 192.168.1.1: icmp_seq=10 ttl=63 time=0.500 ms
64 bytes from 192.168.1.1: icmp_seq=11 ttl=63 time=0.592 ms
64 bytes from 192.168.1.1: icmp_seq=12 ttl=63 time=0.589 ms
64 bytes from 192.168.1.1: icmp_seq=13 ttl=63 time=0.633 ms
64 bytes from 192.168.1.1: icmp_seq=14 ttl=63 time=0.425 ms
64 bytes from 192.168.1.1: icmp_seq=15 ttl=63 time=0.576 ms
64 bytes from 192.168.1.1: icmp_seq=16 ttl=63 time=0.569 ms
64 bytes from 192.168.1.1: icmp_seq=17 ttl=63 time=0.556 ms
64 bytes from 192.168.1.1: icmp_seq=18 ttl=63 time=0.575 ms
64 bytes from 192.168.1.1: icmp_seq=19 ttl=63 time=0.569 ms
64 bytes from 192.168.1.1: icmp_seq=20 ttl=63 time=0.627 ms
^C
--- 192.168.1.1 ping statistics ---
20 packets transmitted, 20 received, 0% packet loss, time 19406ms
rtt min/avg/max/mdev = 0.356/0.809/5.431/1.062 ms
```

Sur le PC4 :

```
root@serveur:/home/irs# ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=2 ttl=63 time=0.591 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=63 time=0.617 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=63 time=0.609 ms
64 bytes from 192.168.1.1: icmp_seq=5 ttl=63 time=0.582 ms
64 bytes from 192.168.1.1: icmp_seq=6 ttl=63 time=0.574 ms
64 bytes from 192.168.1.1: icmp_seq=7 ttl=63 time=0.609 ms
64 bytes from 192.168.1.1: icmp_seq=8 ttl=63 time=0.628 ms
64 bytes from 192.168.1.1: icmp_seq=9 ttl=63 time=0.576 ms
64 bytes from 192.168.1.1: icmp_seq=10 ttl=63 time=0.599 ms
64 bytes from 192.168.1.1: icmp_seq=11 ttl=63 time=0.607 ms
64 bytes from 192.168.1.1: icmp_seq=12 ttl=63 time=0.584 ms
64 bytes from 192.168.1.1: icmp_seq=13 ttl=63 time=0.585 ms
64 bytes from 192.168.1.1: icmp_seq=14 ttl=63 time=0.611 ms
64 bytes from 192.168.1.1: icmp_seq=15 ttl=63 time=0.586 ms
64 bytes from 192.168.1.1: icmp_seq=16 ttl=63 time=0.579 ms
64 bytes from 192.168.1.1: icmp_seq=17 ttl=63 time=0.592 ms
64 bytes from 192.168.1.1: icmp_seq=18 ttl=63 time=0.597 ms
64 bytes from 192.168.1.1: icmp_seq=19 ttl=63 time=0.575 ms
64 bytes from 192.168.1.1: icmp_seq=20 ttl=63 time=0.577 ms
64 bytes from 192.168.1.1: icmp_seq=21 ttl=63 time=0.581 ms
^C
--- 192.168.1.1 ping statistics ---
21 packets transmitted, 20 received, 4% packet loss, time 20447ms
rtt min/avg/max/mdev = 0.574/0.592/0.628/0.036 ms
root@serveur:/home/irs#
```

Sachant que la commande n'était pas installé et que Internet ne fonctionnait pas, nous n'avons pas pu utiliser la commande traceroute.

On peut quand même afficher qu'un paquet envoyé du PC1 au PC3 par exemple va suivre la route suivante :

- 192.168.1.1 (émetteur)
- 192.168.1.62 (interface Fa0/0 du routeur)
- 192.168.2.62 (interface Fa0/1 du routeur)
- 192.168.2.3 (destinataire)

Exercice 5

Pour le PC1 et le PC2, l'adresse de broadcast est 192.168.1.63 (screen de PC1) :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:9d
            inet adr:192.168.1.1 Bcast:192.168.1.63 Masque:255.255.255.192
              adr inet6: fe80::e6be:edff:fe8c:1d9d/64 Scope:Lien
                UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
                Packets reçus:3060 erreurs:0 :364 overruns:0 frame:0
                TX packets:602 errors:0 dropped:0 overruns:0 carrier:0
                collisions:0 lg file transmission:1000
                Octets reçus:741639 (741.6 KB) Octets transmis:60366 (60.3 KB)
```

Le ping sur l'adresse broadcast sur le réseau 1 donne :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.1.63 -b
WARNING: pinging broadcast address
PING 192.168.1.63 (192.168.1.63) 56(84) bytes of data.
64 bytes from 192.168.1.62: icmp_seq=1 ttl=255 time=0.754 ms
64 bytes from 192.168.1.62: icmp_seq=2 ttl=255 time=0.821 ms
64 bytes from 192.168.1.62: icmp_seq=3 ttl=255 time=0.856 ms
64 bytes from 192.168.1.62: icmp_seq=4 ttl=255 time=0.834 ms
64 bytes from 192.168.1.62: icmp_seq=5 ttl=255 time=0.842 ms
^C
--- 192.168.1.63 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4103ms
rtt min/avg/max/mdev = 0.754/0.821/0.856/0.043 ms
```

Pour le PC3 et le PC4, l'adresse de broadcast est 192.168.2.63 :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:9a
            inet adr:192.168.2.3 Bcast:192.168.2.63 Masque:255.255.255.192
              adr inet6: fe80::e6be:edff:fe8c:1d9a/64 Scope:Lien
                UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
                Packets reçus:1106 erreurs:0 :319 overruns:0 frame:0
                TX packets:315 errors:0 dropped:0 overruns:0 carrier:0
                collisions:0 lg file transmission:1000
                Octets reçus:142613 (142.6 KB) Octets transmis:35284 (35.2 KB)
```

Le ping sur l'adresse broadcast du sous réseau 2 donne :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.2.63 -b
WARNING: pinging broadcast address
PING 192.168.2.63 (192.168.2.63) 56(84) bytes of data.
64 bytes from 192.168.2.62: icmp_seq=1 ttl=255 time=0.751 ms
64 bytes from 192.168.2.62: icmp_seq=2 ttl=255 time=0.832 ms
64 bytes from 192.168.2.62: icmp_seq=3 ttl=255 time=0.861 ms
64 bytes from 192.168.2.62: icmp_seq=4 ttl=255 time=0.846 ms
64 bytes from 192.168.2.62: icmp_seq=5 ttl=255 time=0.846 ms
64 bytes from 192.168.2.62: icmp_seq=6 ttl=255 time=0.863 ms
64 bytes from 192.168.2.62: icmp_seq=7 ttl=255 time=0.700 ms
64 bytes from 192.168.2.62: icmp_seq=8 ttl=255 time=0.843 ms
^C
--- 192.168.2.63 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7167ms
rtt min/avg/max/mdev = 0.700/0.817/0.863/0.065 ms
```

Exercice 6

1) Le réseau est 192.168.42.0 et est de classe C et on a besoin de séparer en 2 sous réseaux.
Donc on rajoute 1 bits au mask et on obtient 255.255.255.128.

Le premier sous-réseau 192.168.42.0 a une plage d'adresse 192.168.42.1 → 192.168.42.126 avec un mask à 255.255.255.128 et une adresse de broadcast égale à 192.168.42.127.

Le deuxième sous-réseau 192.168.42.128 a une plage d'adresse 192.168.42.129 → 192.168.42.254 avec un mask à 255.255.255.128 et une adresse de broadcast égale à 192.168.42.255.

- Pour la configuration, on met l'adresse IP et le mask suivant sur le PC1 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.42.1 netmask 255.255.255.128
```

Et on obtient avec ifconfig :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:9d
            inet adr:192.168.42.1 Bcast:192.168.42.127 Masque:255.255.255.128
              adr inet6: fe80::e6be:edff:fe8c:1d9d/64 Scope:Lien
                        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
                        Packets reçus:80 erreurs:0 :24 overrunns:0 frame:0
                        TX packets:48 errors:0 dropped:0 overrunns:0 carrier:0
                        collisions:0 lg file transmission:1000
                        Octets reçus:34614 (34.6 KB) Octets transmis:8007 (8.0 KB)
```

- Pour la configuration, on met l'adresse IP et le mask suivant sur le PC2 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.42.2 netmask 255.255.255.128
```

Et on obtient avec ifconfig :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:83
            inet adr:192.168.42.2 Bcast:192.168.42.127 Masque:255.255.255.128
              adr inet6: fe80::e6be:edff:fe8c:1d83/64 Scope:Lien
                        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
                        Packets reçus:327 erreurs:0 :27 overrunns:0 frame:0
                        TX packets:98 errors:0 dropped:0 overrunns:0 carrier:0
                        collisions:0 lg file transmission:1000
                        Octets reçus:76825 (76.8 KB) Octets transmis:13808 (13.8 KB)
```

On vérifie la connectivité dans le sous réseau 192.168.42.0 avec des pings :

Un ping entre PC1 et PC2 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.2
PING 192.168.42.2 (192.168.42.2) 56(84) bytes of data.
64 bytes from 192.168.42.2: icmp_seq=1 ttl=64 time=0.493 ms
64 bytes from 192.168.42.2: icmp_seq=2 ttl=64 time=0.487 ms
64 bytes from 192.168.42.2: icmp_seq=3 ttl=64 time=0.480 ms
^C
--- 192.168.42.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2013ms
rtt min/avg/max/mdev = 0.480/0.486/0.493/0.026 ms
```

Un ping entre PC2 et PC1 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.1
PING 192.168.42.1 (192.168.42.1) 56(84) bytes of data.
64 bytes from 192.168.42.1: icmp_seq=1 ttl=64 time=0.405 ms
64 bytes from 192.168.42.1: icmp_seq=2 ttl=64 time=0.385 ms
64 bytes from 192.168.42.1: icmp_seq=3 ttl=64 time=0.489 ms
^C
--- 192.168.42.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2050ms
rtt min/avg/max/mdev = 0.385/0.426/0.489/0.048 ms
irs@irs-OptiPlex-3040:~$
```

- Pour la configuration, on met l'adresse IP et le mask suivant sur le PC3 :

```
irs@irs-OptiPlex-3040:~$ sudo ifconfig enp3s0 inet 192.168.42.131 netmask 255.255.255.128
```

Et on obtient avec ifconfig :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:9a
            inet adr:192.168.42.131 Bcast:192.168.42.255 Masque:255.255.255.128
            adr inet6: fe80::e6be:edff:fe8c:1d9a/64 Scope:Lien
            UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
            Packets reçus:27 erreurs:0 :27 overruns:0 frame:0
            TX packets:74 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 lg file transmission:1000
            Octets reçus:4750 (4.7 KB) Octets transmis:10904 (10.9 KB)
```

- Pour la configuration, on met l'adresse IP et le mask suivant sur le PC4 :

```
root@serveur:/home/irs# ifconfig enp3s0 inet 192.168.42.132 netmask 255.255.255.128
```

Et on obtient avec ifconfig :

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:c1
            inet adr:192.168.42.132 Bcast:192.168.42.255 Masque:255.255.255.128
            adr inet6: fe80::e6be:edff:fe8c:1dc1/64 Scope:Lien
            UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
            Packets reçus:15991 erreurs:0 :207 overruns:0 frame:0
            TX packets:295 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 lg file transmission:1000
            Octets reçus:5449726 (5.4 MB) Octets transmis:36321 (36.3 KB)
```

On vérifie la connectivité dans le sous réseau 192.168.42.128 avec des pings :

Un ping entre PC3 et PC4 :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.132
PING 192.168.42.132 (192.168.42.132) 56(84) bytes of data.
64 bytes from 192.168.42.132: icmp_seq=1 ttl=64 time=0.550 ms
64 bytes from 192.168.42.132: icmp_seq=2 ttl=64 time=0.452 ms
64 bytes from 192.168.42.132: icmp_seq=3 ttl=64 time=0.470 ms
64 bytes from 192.168.42.132: icmp_seq=4 ttl=64 time=0.504 ms
64 bytes from 192.168.42.132: icmp_seq=5 ttl=64 time=0.301 ms
64 bytes from 192.168.42.132: icmp_seq=6 ttl=64 time=0.397 ms
64 bytes from 192.168.42.132: icmp_seq=7 ttl=64 time=0.456 ms
64 bytes from 192.168.42.132: icmp_seq=8 ttl=64 time=0.398 ms
^C
--- 192.168.42.132 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7161ms
rtt min/avg/max/mdev = 0.301/0.441/0.550/0.071 ms
```

Un ping entre PC4 et PC3 :

```
root@serveur:/home/irs# ifconfig enp3s0 inet 192.168.42.131 netmask 255.255.255.128
root@serveur:/home/irs# ping 192.168.42.131
PING 192.168.42.131 (192.168.42.131) 56(84) bytes of data.
64 bytes from 192.168.42.131: icmp_seq=1 ttl=64 time=0.314 ms
64 bytes from 192.168.42.131: icmp_seq=2 ttl=64 time=0.365 ms
64 bytes from 192.168.42.131: icmp_seq=3 ttl=64 time=0.362 ms
64 bytes from 192.168.42.131: icmp_seq=4 ttl=64 time=0.405 ms
64 bytes from 192.168.42.131: icmp_seq=5 ttl=64 time=0.506 ms
64 bytes from 192.168.42.131: icmp_seq=6 ttl=64 time=0.473 ms
64 bytes from 192.168.42.131: icmp_seq=7 ttl=64 time=0.474 ms
64 bytes from 192.168.42.131: icmp_seq=8 ttl=64 time=0.494 ms
^C
--- 192.168.42.131 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7130ms
rtt min/avg/max/mdev = 0.314/0.424/0.506/0.068 ms
root@serveur:/home/irs#
```

2) Maintenant, on va configurer les passerelles par défaut et le routeur :

On connecte le réseau 192.168.42.0 à l'interface fa0/0 du routeur. Cette interface aura une adresse IP à 192.168.42.126.

On connecte le réseau 192.168.42.128 à l'interface fa0/1 du routeur. Cette interface aura une adresse IP à 192.168.42.254.

```
R4#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R4(config)#interface fa0/0
R4(config-if)#ip address 192.168.42.126 255.255.255.128
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#interface fa0/1
R4(config-if)#ip address 192.168.42.254 255.255.255.128
R4(config-if)#no shutdown
R4(config-if)#end
R4#
*Apr  5 07:22:49.055: %SYS-5-CONFIG_I: Configured from console by console
R4#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
R4#
```

On configure les routes statiques suivantes :

```
R4(config)#ip route 192.168.42.128 255.255.255.128 fa0/1
R4(config)#ip route 192.168.42.0 255.255.255.128 fa0/0
R4(config)#exit
R4#
*Apr  5 07:34:14.735: %SYS-5-CONFIG_I: Configured from console by consolecop
% Incomplete command.

R4#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
```

Maintenant, il faut ajouter les interfaces comme passerelle par défaut :

Pour le réseau 192.168.42.0 :

```
irs@irs-OptiPlex-3040:~$ sudo route add default gw 192.168.42.126
irs@irs-OptiPlex-3040:~$ ping ■
```

Pour le réseau 192.168.42.128 :

```
irs@irs-OptiPlex-3040:~$ sudo route add default gw 192.168.42.254
```

La connectivité est correcte : on peut la vérifier avec des pings : PC2 vers PC3 et PC4 par exemple. On fait de même avec PC3 vers PC1 et PC2 ; et avec PC4 vers PC1 et PC2.

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.131
PING 192.168.42.131 (192.168.42.131) 56(84) bytes of data.
64 bytes from 192.168.42.131: icmp_seq=1 ttl=63 time=0.535 ms
64 bytes from 192.168.42.131: icmp_seq=2 ttl=63 time=0.625 ms
64 bytes from 192.168.42.131: icmp_seq=3 ttl=63 time=0.621 ms
^C
--- 192.168.42.131 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2027ms
rtt min/avg/max/mdev = 0.535/0.593/0.625/0.050 ms
irs@irs-OptiPlex-3040:~$ ping 192.168.42.132
PING 192.168.42.132 (192.168.42.132) 56(84) bytes of data.
64 bytes from 192.168.42.132: icmp_seq=1 ttl=63 time=0.526 ms
64 bytes from 192.168.42.132: icmp_seq=2 ttl=63 time=0.607 ms
64 bytes from 192.168.42.132: icmp_seq=3 ttl=63 time=0.610 ms
^C
--- 192.168.42.132 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2042ms
rtt min/avg/max/mdev = 0.526/0.581/0.610/0.038 ms
```

Exercice 7

- Pour voir l'adresse de broadcast du réseau 192.168.42.0, on fait ifconfig et on obtient 192.168.42.127.

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:83
            inet adr:192.168.42.2 Bcast:192.168.42.127 Masque:255.255.255.128
            adr inet6: fe80::e6be:edff:fe8c:1d83/64 Scope:Lien
            UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
            Packets reçus:327 erreurs:0 :27 overruns:0 frame:0
            TX packets:98 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 lg file transmission:1000
            Octets reçus:76825 (76.8 KB) Octets transmis:13808 (13.8 KB)
```

PC2 fait le ping en broadcast :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.127 -b
WARNING: pinging broadcast address
PING 192.168.42.127 (192.168.42.127) 56(84) bytes of data.
64 bytes from 192.168.42.126: icmp_seq=1 ttl=255 time=0.842 ms
64 bytes from 192.168.42.126: icmp_seq=2 ttl=255 time=0.958 ms
64 bytes from 192.168.42.126: icmp_seq=3 ttl=255 time=0.966 ms
64 bytes from 192.168.42.126: icmp_seq=4 ttl=255 time=0.859 ms
64 bytes from 192.168.42.126: icmp_seq=5 ttl=255 time=0.947 ms
64 bytes from 192.168.42.126: icmp_seq=6 ttl=255 time=1.00 ms
64 bytes from 192.168.42.126: icmp_seq=7 ttl=255 time=0.886 ms
64 bytes from 192.168.42.126: icmp_seq=8 ttl=255 time=0.965 ms
64 bytes from 192.168.42.126: icmp_seq=9 ttl=255 time=0.957 ms
64 bytes from 192.168.42.126: icmp_seq=10 ttl=255 time=0.976 ms
64 bytes from 192.168.42.126: icmp_seq=11 ttl=255 time=0.968 ms
64 bytes from 192.168.42.126: icmp_seq=12 ttl=255 time=0.964 ms
64 bytes from 192.168.42.126: icmp_seq=13 ttl=255 time=0.867 ms
64 bytes from 192.168.42.126: icmp_seq=14 ttl=255 time=0.969 ms
^C
--- 192.168.42.127 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 13064ms
rtt min/avg/max/mdev = 0.842/0.937/1.000/0.056 ms
irs@irs-OptiPlex-3040:~$ █
```

PC1 voit sur Wireshark :

25	30.751128195	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=1/256, ttl=64 (no response found!)
26	31.784127100	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=2/512, ttl=64 (no response found!)
27	31.868335965	0.0.0.0	255.255.255.255	DHCP	618 DHCP Discover - Transaction ID 0x54b
28	32.602797937	CiscoInc_86:f5:01	Spanning-tree-(for...)	STP	60 Conf. Root = 32768/1/00:14:ic:86:f5:00 Cost = 0 Port = 0x8001
29	32.758143709	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=3/768, ttl=64 (no response found!)
30	33.786430814	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=4/1024, ttl=64 (no response found!)
31	34.442834044	CiscoInc_86:f5:01	CiscoInc_86:f5:01	LOOP	60 Reply
32	34.602800051	CiscoInc_86:f5:01	Spanning-tree-(for...)	STP	60 Conf. Root = 32768/1/00:14:ic:86:f5:00 Cost = 0 Port = 0x8001
33	34.792133543	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=5/1280, ttl=64 (no response found!)
34	35.793237325	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=6/1536, ttl=64 (no response found!)
35	36.602951032	CiscoInc_86:f5:01	Spanning-tree-(for...)	STP	60 Conf. Root = 32768/1/00:14:ic:86:f5:00 Cost = 0 Port = 0x8001
36	36.794774444	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=7/1792, ttl=64 (no response found!)
37	37.800158574	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=8/2048, ttl=64 (no response found!)
38	38.602880108	CiscoInc_86:f5:01	Spanning-tree-(for...)	STP	60 Conf. Root = 32768/1/00:14:ic:86:f5:00 Cost = 0 Port = 0x8001
39	38.801473081	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=9/2304, ttl=64 (no response found!)
40	39.802684343	192.168.42.2	192.168.42.127	ICMP	98 Echo (ping) request id=0x0b6c, seq=10/2560, ttl=64 (no response found!)
41	40.327624982	0.0.0.0	255.255.255.255	DHCP	618 DHCP Discover - Transaction ID 0x54f

On peut voir les adresses du réseau 192.168.42.1 et 192.168.42.2.

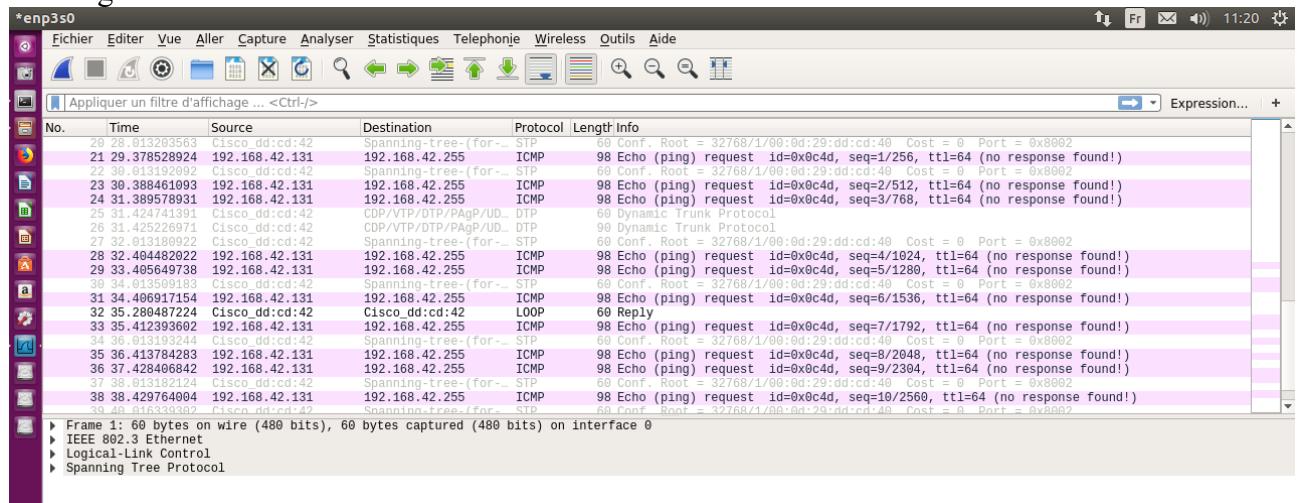
- Pour voir l'adresse de broadcast du réseau 192.168.42.128, on fait ifconfig et on obtient 192.168.42.255.

```
enp3s0      Link encap:Ethernet HWaddr e4:be:ed:8c:1d:9a
            inet adr:192.168.42.131 Bcast:192.168.42.255 Masque:255.255.255.128
            adr inet6: fe80::e6be:edff:fe8c:1d9a/64 Scope:Lien
            UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
            Packets reçus:27 erreurs:0 :27 overruns:0 frame:0
            TX packets:74 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 lg file transmission:1000
            Octets reçus:4750 (4.7 KB) Octets transmis:10904 (10.9 KB)
```

PC3 fait le ping en broadcast :

```
irs@irs-OptiPlex-3040:~$ ping 192.168.42.255 -b
WARNING: pinging broadcast address
PING 192.168.42.255 (192.168.42.255) 56(84) bytes of data.
64 bytes from 192.168.42.254: icmp_seq=1 ttl=255 time=0.808 ms
64 bytes from 192.168.42.254: icmp_seq=2 ttl=255 time=0.976 ms
64 bytes from 192.168.42.254: icmp_seq=3 ttl=255 time=0.865 ms
64 bytes from 192.168.42.254: icmp_seq=4 ttl=255 time=0.960 ms
64 bytes from 192.168.42.254: icmp_seq=5 ttl=255 time=0.931 ms
64 bytes from 192.168.42.254: icmp_seq=6 ttl=255 time=0.868 ms
64 bytes from 192.168.42.254: icmp_seq=7 ttl=255 time=0.973 ms
64 bytes from 192.168.42.254: icmp_seq=8 ttl=255 time=0.873 ms
64 bytes from 192.168.42.254: icmp_seq=9 ttl=255 time=0.968 ms
64 bytes from 192.168.42.254: icmp_seq=10 ttl=255 time=0.955 ms
^C
--- 192.168.42.255 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9051ms
rtt min/avg/max/mdev = 0.808/0.917/0.976/0.066 ms
```

PC4 regarde sur Wireshark :



On conclut que les adresses du sous réseau 2 est 192.168.42.131 et 192.168.42.132.

Exercice 8

Lorsque l'on fait un ping en broadcast, l'adresse Mac du destinataire est FF.FF.FF.FF.FF.FF.

» Destination: Broadcast (ff:ff:ff:ff:ff:ff)