

Laborator 06

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Task 01 | Configurare si stergere adrese IP

```
student@host:~$ sudo su -
root@host:~# ip address add 192.168.0.1/24 dev veth-red
root@host:~# ip address show dev veth-red
5: veth-red@if4: <BROADCAST,MULTICAST> mtu 1450 qdisc noop state DOWN
group default qlen 1000
    link/ether 0e:ae:52:5c:56:36 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 192.168.0.1/24 scope global veth-red
        valid_lft forever preferred_lft forever

root@host:~# go red
student@red:~$
root@red:~$ ip address add 192.168.0.2/24 dev red-eth0
root@red:~$ ip address show dev red-eth0
4: red-eth0@if5: <BROADCAST,MULTICAST> mtu 1450 qdisc noop state DOWN
group default qlen 1000
    link/ether de:21:e9:1b:b1:48 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 192.168.0.2/24 scope global red-eth0
        valid_lft forever preferred_lft forever
```

```
root@host:~# # Nu exista conectivitate intre cele doua statii
root@host:~# ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
^C
--- 192.168.0.2 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1006ms
```

```
root@host:~# ip link show dev veth-red
5: veth-red@if4: <BROADCAST,MULTICAST> mtu 1450 qdisc noqueue state DOWN
mode DEFAULT group default qlen 1000
    link/ether 0e:ae:52:5c:56:36 brd ff:ff:ff:ff:ff:ff link-netnsid 0
root@host:~# ip link set dev veth-red up
root@host:~# ip link show dev veth-red
5: veth-red@if4: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1450 qdisc noqueue
state LOWERLAYERDOWN mode DEFAULT group default qlen 1000
    link/ether 0e:ae:52:5c:56:36 brd ff:ff:ff:ff:ff:ff link-netnsid 0
root@host:~# # Interfata este in 'LOWERLAYERDOWN', intrucat celalalt capat
al legaturii nu este pornit (UP).

root@host:~# go red
student@red:~$
student@red:~$ sudo su -
root@red:~$ ip link set dev red-eth0 up
root@red:~$ ip link show dev red-eth0
4: red-eth0@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc noqueue
state UP mode DEFAULT group default qlen 1000
    link/ether de:21:e9:1b:b1:48 brd ff:ff:ff:ff:ff:ff link-netnsid 0
```

Testez din nou folosind **ping**:

```
root@red:~$ ping 192.168.0.1
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=64 time=0.046 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=64 time=0.022 ms
^C
--- 192.168.0.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1010ms
rtt min/avg/max/mdev = 0.022/0.034/0.046/0.012 ms
```

```
root@host:~# ping -c 1 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
64 bytes from 192.168.0.2: icmp_seq=1 ttl=64 time=0.033 ms

--- 192.168.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.033/0.033/0.033/0.000 ms
```

```
root@host:~# ip addr flush dev veth-red
root@host:~# ip addr show dev veth-red
5: veth-red@if4: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc noqueue
state UP group default qlen 1000
    link/ether 0e:ae:52:5c:56:36 brd ff:ff:ff:ff:ff:ff link-netnsid 0
```

Reven la configuratia initiala:

```
root@red:~$ ip addr show dev red-eth0
4: red-eth0@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc noqueue
state UP group default qlen 1000
    link/ether de:21:e9:1b:b1:48 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 192.168.0.2/24 scope global red-eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::dc21:e9ff:fe1b:b148/64 scope link
        valid_lft forever preferred_lft forever
root@red:~$ ip addr flush dev red-eth0
root@red:~$ ip addr show dev red-eth0
4: red-eth0@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc noqueue
state UP group default qlen 1000
    link/ether de:21:e9:1b:b1:48 brd ff:ff:ff:ff:ff:ff link-netnsid 0
```

Task 02 | Configurare adrese IP

Atribuire adrese IP:

- Spatiul 10.10.10.0/24
 - host/veth-red: **10.10.10.1/24**
 - red/red-eth0: **10.10.10.2/24**
- Spatiul 10.10.20.0/24
 - host/veth-green: **10.10.20.1/24**
 - green/green-eth0: **10.10.20.2/24**

red(red-eth0) <-> host(veth-red)

Pentru spatiul 10.10.10.0/24:

```
root@host:~# ip link set dev veth-red up
root@host:~# ip address add 10.10.10.1/24 dev veth-red
root@host:~# go red
student@red:~$ sudo su -
root@red:~$ ip link set dev red-eth0 up
root@red:~$ ip addr add 10.10.10.2/24 dev red-eth0
```

Testare conectivitate pentru spatiul 10.10.10.0/24:

```
root@host:~# ping -c 1 10.10.10.2 # IP red
root@red:~$ ping -c 1 10.10.10.1 # IP host/veth-red
```

green(green-eth0) <-> host(veth-green)

Pentru spatiul 10.10.20.0/24:

```
root@host:~# ip link set dev veth-green up
root@host:~# ip address add 10.10.20.1/24 dev veth-green
root@host:~# go green
student@green:~$ sudo su -
root@green:~$ ip link set dev green-eth0 up
root@green:~$ ip addr add 10.10.20.2/24 dev green-eth0
```

Testare conectivitate pentru spatiul 10.10.20.0/24:

```
root@host:~# ping -c 1 10.10.20.2      # IP green
root@green:~$ ping -c 1 10.10.20.1    # IP host/veth-green
```

Task 03 | Adresare IP si rutare

IP host/veth-red = 10.10.10.1

```
root@host:~#
root@host:~# go red
student@red:~$ sudo su -
root@red:~$ ip route add default via 10.10.10.1
root@red:~$ ip route show
default via 10.10.10.1 dev red-eth0
10.10.10.0/24 dev red-eth0 proto kernel scope link src 10.10.10.2
root@red:~$
logout
student@red:~$
exit
root@host:~# go green
student@green:~$ sudo su -
root@green:~$ ip route add default via 10.10.20.1
root@green:~$ ip route show
default via 10.10.20.1 dev green-eth0
10.10.20.0/24 dev green-eth0 proto kernel scope link src 10.10.20.2
```

`ip route del default` sterge **default gateway-ul**.

Testare conectivitate:

```
root@red:~$ ping -c 1 10.10.20.2      # IP green
root@green:~$ ping -c 1 10.10.10.2    # IP red
```

Nu exista conectivitate intre **red** si **green** (pe **host** nu este inca activata rutarea).

```
root@host:~# # Activare rutare
root@host:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@host:~# sysctl net.ipv4.ip_forward # Comanda de verificare
net.ipv4.ip_forward = 1
```

Task 04

Deschid un nou TAB de terminal cu **Ctrl+Shift+T**.

```
# Terminal 1
student@red:~$ ping 10.10.20.2
```

```
# Terminal 2
root@host:~# tcpdump -n -i veth-red
```

Task 04 | Configurare conectivitate completa

Spatiul 10.10.30.0/24:

- host/veth-blue: **10.10.30.1/24**
- blue/blue-eth0: **10.10.30.2/24**

```
root@host:~# ip link set dev veth-blue up
root@host:~# ip addr add 10.10.30.1/24 dev veth-blue
root@host:~# go blue
student@blue:~$ sudo su -
root@blue:~$ ip link set dev blue-eth0 up
root@blue:~$ ip addr add 10.10.30.2/24 dev blue-eth0
root@blue:~$ ip route add default via 10.10.30.1
```

Comenzi de verificare:

- **ip l**
- **ip a**
- **ip r**

Testare conectivitate:

```
root@blue:~$ ping -c 1 10.10.30.1 # IP host/veth-blue
root@blue:~$ ping -c 1 10.10.10.2 # IP red
```

```
root@blue:~$ ping -c 1 10.10.20.2    # IP green
root@green:~$ ping -c 1 10.10.10.2  # IP red
```

Task 05 | Tabela ARP

```
root@host:~# # Printare tabela ARP
root@host:~# ip neighbour show
10.9.0.100 dev eth0 lladdr fa:16:3e:cb:12:ab STALE
10.9.0.1 dev eth0 lladdr a2:05:9c:00:00:02 REACHABLE
10.10.30.2 dev veth-blue lladdr 7a:91:83:1c:df:5c STALE
10.10.20.2 dev veth-green lladdr 3a:b9:86:42:0e:8b STALE
10.10.10.2 dev veth-red lladdr de:21:e9:1b:b1:48 STALE
fe80::a9fe:a9fe dev eth0 lladdr fa:16:3e:cb:12:ab STALE
```

STALE: intrari nesigure.

```
root@host:~# ping -c 1 10.10.10.2    # IP red
root@host:~# ping -c 1 10.10.20.2    # IP green
root@host:~# ping -c 1 10.10.30.2    # IP blue

root@host:~# ip neighbor show
10.9.0.100 dev eth0 lladdr fa:16:3e:cb:12:ab STALE
10.9.0.1 dev eth0 lladdr a2:05:9c:00:00:02 REACHABLE
10.10.30.2 dev veth-blue lladdr 7a:91:83:1c:df:5c DELAY
10.10.20.2 dev veth-green lladdr 3a:b9:86:42:0e:8b REACHABLE
10.10.10.2 dev veth-red lladdr de:21:e9:1b:b1:48 REACHABLE
fe80::a9fe:a9fe dev eth0 lladdr fa:16:3e:cb:12:ab STALE
```

```
root@red:~$ ip neighbour show
10.10.10.1 dev red-eth0 lladdr 0e:ae:52:5c:56:36 STALE

root@red:~$ ping -c 1 10.10.10.1    # IP host/veth-red

root@red:~$ ip neighbour show
10.10.10.1 dev red-eth0 lladdr 0e:ae:52:5c:56:36 REACHABLE
```

```
root@green:~$ ip neighbour show
10.10.20.1 dev green-eth0 lladdr 5e:bb:b0:db:be:90 STALE

root@green:~$ ping -c 1 10.10.20.1  # IP host/veth-green

root@green:~$ ip neighbour show
10.10.20.1 dev green-eth0 lladdr 5e:bb:b0:db:be:90 DELAY
```

```
root@green:~$ ping -c 1 10.10.10.2 # IP red
root@green:~$ ping -c 1 10.10.30.2 # IP blue

root@green:~$ ip neighbour show
10.10.20.1 dev green-eth0 lladdr 5e:bb:b0:db:be:90 REACHABLE
```

```
root@blue:~$ ip neighbour show
10.10.30.1 dev blue-eth0 lladdr 8a:86:9d:5d:86:23 STALE

root@blue:~$ ping -c 1 10.10.30.1 # IP host/veth-blue

root@blue:~$ ip neighbour show
10.10.30.1 dev blue-eth0 lladdr 8a:86:9d:5d:86:23 DELAY

root@blue:~$ ping -c 1 10.10.30.1 # IP host/veth-blue

root@blue:~$ ip neighbour show
10.10.30.1 dev blue-eth0 lladdr 8a:86:9d:5d:86:23 REACHABLE
```

ARP request-urile pot lua ceva timp pana sa updateze tabela.

Task 06 | Depanare problema configurare adresa IP

```
root@host:~# start_lab ip ex6
```

Atribuirea corecta adreselor IP:

- host/veth-red: **7.7.7.1/24**
- red/red-eth0: **7.7.7.2/24**

IP-ul pentru red/red-eth0 a fost configurat gresit (cu masca gresita de **/32**).

```
root@host:~# ip addr delete 7.7.7.1/32 dev veth-red
root@host:~# ip addr add 7.7.7.1/24 dev veth-red
```

```
root@host:~# ping 7.7.7.2 # IP red
PING 7.7.7.2 (7.7.7.2) 56(84) bytes of data.
64 bytes from 7.7.7.2: icmp_seq=1 ttl=64 time=0.044 ms
64 bytes from 7.7.7.2: icmp_seq=2 ttl=64 time=0.021 ms
^C
--- 7.7.7.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1018ms
rtt min/avg/max/mdev = 0.021/0.032/0.044/0.011 ms
```

Task 07 | Depanare problema de conectivitate

```
root@host:~# start_lab ip ex7
```

Probleme:

- IP-uri pe legatura host-blue folosesc masca pe **/32** (practic masca asta nu are niciun host)
- Pe langa faptul ca host/veth-blue foloseste o masca cu totul gresita (**/32**), pare ca IP-ul (fara masca) este unul de retea (**15.15.15.0**)
- Legatura de pe blue nu este pornita (este **DOWN**)
- blue nu are **default gateway**

O masca **/30** poate avea 2 host-uri asignabile.

```
root@host:~# ip addr delete 15.15.15.0/32 dev veth-blue
root@host:~# ip addr add 15.15.15.1/30 dev veth-blue
```

```
root@blue:~$ ip addr delete 15.15.15.2/32 dev blue-eth0
root@blue:~$ ip addr add 15.15.15.2/30 dev blue-eth0

root@blue:~$ ip link set dev blue-eth0 up
root@blue:~$ ip route add default via 15.15.15.1
```

```
root@blue:~$ ping -c 1 15.15.15.1      # IP host/veth-blue
root@blue:~$ ping -c 1 192.168.1.2    # IP green
root@blue:~$ ping -c 1 192.168.2.2    # IP red
```

Tabk 08 | IPv6

Adresare IPv:

- Spatiul 2201::/64
 - host/veth-red: **2201::1/64**
 - red/red-eth0: **2201::2/64**
- Spatiul 2202::/64
 - host/veth-green: **2202::1/64**
 - green/green-eth0: **2202::2/64**
- Spatiul 2203::/64
 - host/veth-blue: **2203::1/64**

- blue/blue-eth0: **2203::2/64**

```
root@host:~# sysctl -w net.ipv6.conf.all.forwarding=1
net.ipv6.conf.all.forwarding = 1

root@host:~# sysctl net.ipv6.conf.all.forwarding    # Comanda de verificare
net.ipv6.conf.all.forwarding = 1

root@host:~#
```

NU da **flush** pe nicio interfata!

```
root@host:~# ip -6 addr add 2201::1/64 dev veth-red
root@host:~# ip -6 addr add 2202::1/64 dev veth-green
root@host:~# ip -6 addr add 2203::1/64 dev veth-blue
root@host:~# ip -6 a      # Comanda de verificare
```

```
root@red:~$ ip -6 addr add 2201::2/64 dev red-eth0
root@red:~$ ip -6 a      # Comanda de verificare
root@red:~$ ip -6 route add default via 2201::1
root@red:~$ ip -6 r      # Comanda de verificare
```

```
root@green:~$ ip -6 addr add 2202::2/64 dev green-eth0
root@green:~$ ip -6 a      # Comanda de verificare
root@green:~$ ip -6 route add default via 2202::1
root@green:~$ ip -6 r      # Comanda de verificare
```

```
root@blue:~$ ip -6 addr add 2203::2/64 dev blue-eth0
root@blue:~$ ip -6 a      # Comanda de verificare
root@blue:~$ ip -6 route add default via 2203::1
root@blue:~$ ip -6 r      # Comanda de verificare
```

Testare conectivitate:

```
root@host:~# ping -c 1 2201::2    # IP red
root@host:~# ping -c 1 2202::2    # IP green
root@host:~# ping -c 1 2203::2    # IP blue
```

```
root@red:~$ ping -6 -c 1 2201::1 # IP host/veth-red
root@red:~$ ping -6 -c 1 2202::2 # IP green
root@red:~$ ping -6 -c 1 2203::2 # IP blue
```

```
root@green:~$ ping -6 -c 1 2201::2 # IP red
root@green:~$ ping -6 -c 1 2202::1 # IP host/veth-green
root@green:~$ ping -6 -c 1 2203::2 # IP blue
```

```
root@blue:~$ ping -6 -c 1 2201::2 # IP red
root@blue:~$ ping -6 -c 1 2202::2 # IP green
root@blue:~$ ping -6 -c 1 2203::1 # IP host/veth-blue
```

Task 09 (Bonus) | Configurare persistentă

```
root@host:~# # Setup
root@host:~# start_lab ip ex9
root@host:~# ip address flush dev veth-red
```

Se folosesc adresele IPv6 de la task-ul precedent.

```
root@host:~# grep -H -n "net.ipv6.conf.all.forwarding" /etc/sysctl.conf
/etc/sysctl.conf:33:#net.ipv6.conf.all.forwarding=1
```

Rutarea IPv6 este la linia **33** din `/etc/sysctl.conf`.

```
root@host:~# nano -l /etc/sysctl.conf # Line 33
```

```
root@host:~# nano -l /etc/network/interfaces
```

```
# Persistent network interfaces (ifupdown-ng)
# RTFM: https://github.com/ifupdown-ng/ifupdown-ng/blob/main/doc/interfaces.scd

# The loopback network interface
auto lo

# The primary network interface
```

```
auto eth0
iface eth0
    use dhcp

# Load everything inside interfaces.d subdirectory (recommended)
source-directory /etc/network/interfaces.d/

auto veth-red
iface veth-red inet6 static
    address 2201::1/64

auto veth-green
iface veth-green inet6 static
    address 2202::1/64

auto veth-blue
iface veth-blue inet6 static
    address 2203::1/64
```

```
root@host:~# # Verificare
root@host:~# ifdown veth-red veth-green veth-blue ; ifup veth-red veth-
green veth-blue ; ip -6 a
```

```
root@red:~$ nano -l /etc/network/interfaces
```

```
# Persistent network interfaces (ifupdown-ng)
# RTFM: https://github.com/ifupdown-ng/ifupdown-ng/blob/main/doc/interfaces.scd

# The loopback network interface
auto lo

# The primary network interface
auto eth0
iface eth0
    use dhcp

# Load everything inside interfaces.d subdirectory (recommended)
source-directory /etc/network/interfaces.d/

auto red-eth0
iface red-eth0 inet6 static
    address 2201::2/64
    gateway 2201::1
```

```
root@red:~$ # Verificare
root@red:~$ ifdown red-eth0 ; ifup red-eth0 ; ip -6 a
```

```
root@green:~$ nano -l /etc/network/interfaces
```

```
# Persistent network interfaces (ifupdown-ng)
# RTFM: https://github.com/ifupdown-ng/ifupdown-ng/blob/main/doc/interfaces.scd

# The loopback network interface
auto lo

# The primary network interface
auto eth0
iface eth0
    use dhcp

# Load everything inside interfaces.d subdirectory (recommended)
source-directory /etc/network/interfaces.d/

auto green-eth0
iface green-eth0 inet6 static
    address 2202::2/64
    gateway 2202::1
```

```
root@green:~$ # Verificare
root@green:~$ ifdown green-eth0 ; ifup green-eth0 ; ip -6 a
```

```
root@blue:~$ nano -l /etc/network/interfaces
```

```
# Persistent network interfaces (ifupdown-ng)
# RTFM: https://github.com/ifupdown-ng/ifupdown-ng/blob/main/doc/interfaces.scd

# The loopback network interface
auto lo

# The primary network interface
auto eth0
iface eth0
```

```
use dhcp

# Load everything inside interfaces.d subdirectory (recommended)
source-directory /etc/network/interfaces.d/

auto blue-eth0
iface blue-eth0 inet6 static
    address 2203::2/64
    gateway 2203::1
```

```
root@blue:~$ # Verificare
root@blue:~$ ifdown blue-eth0 ; ifup blue-eth0 ; ip -6 a
```

Testul final

```
root@host:~# reboot # Va iese din SSH....nu m-am putut reconecta instant
(a trebuit sa astept un pic)
```