

LAB 1:

Name: Laura Ferrer Haba.

1. Firts step: vagrant up.

```
Seleccionar vagrant@alice: ~
El número de serie del volumen es: 1265-CF99

Directorio de C:\Users\lferr

18/11/2020 19:21 <DIR> .
18/11/2020 19:21 <DIR> ..
15/11/2020 11:57 <DIR> .dotnet
25/06/2020 21:38 <DIR> .Origin
25/06/2020 21:38 <DIR> .QtWebEngineProcess
25/09/2020 08:48 <DIR> .templateengine
15/11/2020 18:01 <DIR> .thumbnails
18/11/2020 19:01 <DIR> .VirtualBox
15/11/2020 13:32 <DIR> .Xilinx
15/11/2020 11:44 <DIR> 3D Objects
30/06/2020 17:14 <DIR> ansel
15/11/2020 12:52 <DIR> Autodesk
15/11/2020 11:44 <DIR> Contacts
18/11/2020 19:19 <DIR> Desktop
18/11/2020 17:56 <DIR> Documents
18/11/2020 19:21 <DIR> Downloads
24/07/2020 11:33 <DIR> Dropbox
15/11/2020 11:44 <DIR> Favorites
15/11/2020 11:44 <DIR> Links
15/11/2020 11:44 <DIR> Music
15/11/2020 17:13 <DIR> OneDrive
15/11/2020 13:10 <DIR> Pictures
15/11/2020 11:44 <DIR> Saved Games
15/11/2020 11:45 <DIR> Searches
22/06/2020 16:15 <DIR> source
18/11/2020 19:18 1.873 Vagrantfile
18/11/2020 19:02 247.574.528 vagrant_2.2.13_x86_64.msi
15/11/2020 11:44 <DIR> Videos
16/11/2020 10:43 <DIR> VirtualBox VMs
2 archivos 247.576.401 bytes
27 dirs 675.182.354.432 bytes libres

C:\Users\lferr>vagrant up
```

2. Second step: vagrant ssh alice.

```
Seleccionar vagrant@alice: ~
C:\Users\lferr>vagrant ssh alice
Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 packages can be updated.
0 updates are security updates.

New release '18.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

vagrant@alice:~$
```

3. Thrid step: ifconfig.

```
Seleccionar vagrant@alice: ~  
  
vagrant@alice:~$ ifconfig  
enp0s3      Link encap:Ethernet  HWaddr 02:e0:65:d0:24:0e  
            inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0  
            inet6 addr: fe80::e0:65ff:fed0:240e/64  Scope:Link  
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
            RX packets:2074 errors:0 dropped:0 overruns:0 frame:0  
            TX packets:1141 errors:0 dropped:0 overruns:0 carrier:0  
            collisions:0 txqueuelen:1000  
            RX bytes:953517 (953.5 KB)  TX bytes:193591 (193.5 KB)  
  
enp0s8      Link encap:Ethernet  HWaddr 08:00:27:d1:64:a6  
            inet addr:192.168.10.10  Bcast:192.168.10.255  Mask:255.255.255.0  
            inet6 addr: fe80::a00:27ff:fed1:64a6/64  Scope:Link  
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
            RX packets:219 errors:0 dropped:0 overruns:0 frame:0  
            TX packets:8 errors:0 dropped:0 overruns:0 carrier:0  
            collisions:0 txqueuelen:1000  
            RX bytes:20256 (20.2 KB)  TX bytes:648 (648.0 B)  
  
lo          Link encap:Local Loopback  
            inet addr:127.0.0.1  Mask:255.0.0.0  
            inet6 addr: ::1/128  Scope:Host  
            UP LOOPBACK RUNNING  MTU:65536  Metric:1  
            RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
            TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  
            collisions:0 txqueuelen:1  
            RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

4. Fourth step: tracepath 192.168.10.11.

```
vagrant@alice: ~  
vagrant@alice:~$ tracepath 192.168.10.11  
1?: [LOCALHOST] pmtu 1500  
1: 192.168.10.11 0.579ms reached  
1: 192.168.10.11 0.315ms reached  
Resume: pmtu 1500 hops 1 back 1
```

5. Fith step: tracepath 192.168.10.5.

```
vagrant@alice:~$ tracepath 192.168.10.5  
1?: [LOCALHOST] pmtu 1500  
1: 192.168.10.5 0.532ms reached  
1: 192.168.10.5 0.290ms reached  
Resume: pmtu 1500 hops 1 back 1
```

6. Sixth step: tracepath 192.168.3.5.

```
vagrant@alice:~$ tracepath 192.168.10.5  
1?: [LOCALHOST] pmtu 1500  
1: 192.168.10.5 0.532ms reached  
1: 192.168.10.5 0.290ms reached  
Resume: pmtu 1500 hops 1 back 1  
vagrant@alice:~$ tracepath 192.168.3.5  
1?: [LOCALHOST] pmtu 1500  
1: 10.0.2.2 0.143ms  
1: 10.0.2.2 0.152ms  
2: no reply  
3: no reply  
4: no reply  
5: no reply  
6: no reply  
^C
```

7. Seventh step: netstat -rn.

```
vagrant@alice:~$ netstat -rn  
Kernel IP routing table  
Destination Gateway Genmask Flags MSS Window irtt Iface  
0.0.0.0 10.0.2.2 0.0.0.0 UG 0 0 0 enp0s3  
10.0.2.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s3  
192.168.10.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s8  
vagrant@alice:~$
```

8. **Eighth step:** `sudo route add -net 192.168.3.0 netmask 255.255.255.0 gw 192.168.10.5` and `tracepath 192.168.3.5`.

```
vagrant@alice:~$ sudo route add -net 192.168.3.0 netmask 255.255.255.0 gw 192.168.10.5
vagrant@alice:~$ tracepath 192.168.3.5
1?: [LOCALHOST] pmtu 1500
1: 192.168.3.5 0.270ms reached
1: 192.168.3.5 0.339ms reached
Resume: pmtu 1500 hops 1 back 1
vagrant@alice:~$
```

9. **Ninth step:** `tracepath 192.168.3.5`.

```
Seleccionar vagrant@alice: ~
vagrant@alice:~$ tracepath 192.168.3.5
1?: [LOCALHOST] pmtu 1500
1: 192.168.3.5 0.270ms reached
1: 192.168.3.5 0.339ms reached
Resume: pmtu 1500 hops 1 back 1
```

10. **Tenth step:** `tracepath 192.168.20.11`.

```
vagrant@alice:~$ tracepath 192.168.20.11
1?: [LOCALHOST] pmtu 1500
1: 10.0.2.2 0.186ms
1: 10.0.2.2 0.194ms
2: no reply
3: no reply
4: no reply
^C
```

Question 1: Why the tracepath 192.168.20.11 is falling?

Because the externally facing interface of the router is not on the same network. The command will fail at 10.0.2.2, as your host machine does not know how to route the traffic to the appropriate network. The traffic is not being routed properly, there is no routing entry for the 192.168.20.0 network, it is going to the default route defined for the 0.0.0.0 network eth0. Since your host machine does not know how to Access 192.168.20.11 either, the tracepath fails. If we want to fix the problem, we must add a new entry in Alice's routing table to direct traffic through arouter and properly configure arouter as a router.

```
vagrant@alice:~$ netstat -rn
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
0.0.0.0 10.0.2.2 0.0.0.0 UG 0 0 0 enp0s3
10.0.2.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s3
192.168.3.0 192.168.10.5 255.255.255.0 UG 0 0 0 enp0s8
192.168.10.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s8
```

11. **Eleventh step:** `vagrtn ssh arouter`.

```
Seleccionar vagrant@arouter: ~
C:\Users\lferr>vagrant ssh arouter
Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage

0 packages can be updated.
0 updates are security updates.

New release '18.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

vagrant@arouter:~$
```

12. Twelfth step: sudo vim /etc/sysctl.conf.

```
vagrant@arouter: ~  
  
# /etc/sysctl.conf - Configuration file for setting system variables  
# See /etc/sysctl.d/ for additional system variables.  
# See sysctl.conf (5) for information.  
#  
  
#kernel.domainname = example.com  
  
# Uncomment the following to stop low-level messages on console  
#kernel.printk = 3 4 1 3  
  
#####3  
# Functions previously found in netbase  
#  
  
# Uncomment the next two lines to enable Spoof protection (reverse-path filter)  
# Turn on Source Address Verification in all interfaces to  
# prevent some spoofing attacks  
#net.ipv4.conf.default.rp_filter=1  
#net.ipv4.conf.all.rp_filter=1  
  
# Uncomment the next line to enable TCP/IP SYN cookies  
# See http://lwn.net/Articles/277146/  
# Note: This may impact IPv6 TCP sessions too  
#net.ipv4.tcp_syncookies=1  
  
# Uncomment the next line to enable packet forwarding for IPv4  
net.ipv4.ip_forward=1  
  
# Uncomment the next line to enable packet forwarding for IPv6  
# Enabling this option disables Stateless Address Autoconfiguration  
# based on Router Advertisements for this host  
#net.ipv6.conf.all.forwarding=1  
  
#####  
# Additional settings - these settings can improve the network  
# security of the host and prevent against some network attacks  
# including spoofing attacks and man in the middle attacks through  
# redirection. Some network environments, however, require that these  
# settings are disabled so review and enable them as needed.  
#  
# Do not accept ICMP redirects (prevent MITM attacks)  
#net.ipv4.conf.all.accept_redirects = 0  
#net.ipv6.conf.all.accept_redirects = 0  
#_or_  
# Accept ICMP redirects only for gateways listed in our default  
# gateway list (enabled by default)  
# net.ipv4.conf.all.secure_redirects = 1  
#  
# Do not send ICMP redirects (we are not a router)  
#net.ipv4.conf.all.send_redirects = 0  
#  
# Do not accept IP source route packets (we are not a router)  
#net.ipv4.conf.all.accept_source_route = 0  
#net.ipv6.conf.all.accept_source_route = 0  
#  
# Log Martian Packets  
#net.ipv4.conf.all.log_martians = 1  
#  
~  
~
```

13. Thirteenth step: sudo sysctl -p.

```
vagrant@arouter: ~  
vagrant@arouter:~$ vagrant@arouter:~$ sudo vim /etc/sysctl.conf  
vagrant@arouter:~$ vagrant@arouter:~$ sudo sysctl -p  
net.ipv4.ip_forward = 1  
vagrant@arouter:~$ _
```

14. Fourteenth step: sudo /etc/init.d/networking restart.

```
vagrant@arouter: ~  
vagrant@arouter:~$ sudo /etc/init.d/networking restart  
[ ok ] Restarting networking (via systemctl): networking.service.  
vagrant@arouter:~$
```

- 15. Fifteenth step:** `sudo iptables -t nat -A POSTROUTING -o eth2 -j MASQUERADE` and `sudo route add -net 192.168.20.0 netmask 255.255.255.0 gw 192.168.3.6`.

```
vagrant@arouter: ~  
vagrant@arouter:~$ sudo /etc/init.d/networking restart  
[ ok ] Restarting networking (via systemctl): networking.service.  
vagrant@arouter:~$ sudo iptables -t nat -A POSTROUTING -o eth2 -j MASQUERADE  
vagrant@arouter:~$ sudo iptables -t nat -A POSTROUTING -o enp0s9 -j MASQUERADE  
vagrant@arouter:~$ sudo route add -net 192.168.20.0 netmask 255.255.255.0 gw 192.168.3.6  
vagrant@arouter:~$
```

- 16. Seventeenth step:** same steps with brouter.

```
Seleccionar vagrant@brouter: ~  
==> brouter: flag to force provisioning. Provisioners marked to run always will still run.  
  
C:\Users\lferr>vagrant ssh brouter  
Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)  
  
 * Documentation:  https://help.ubuntu.com  
 * Management:    https://landscape.canonical.com  
 * Support:       https://ubuntu.com/advantage  
  
0 packages can be updated.  
0 updates are security updates.  
  
New release '18.04.5 LTS' available.  
Run 'do-release-upgrade' to upgrade to it.  
  
Last login: Wed Nov 18 19:42:55 2020 from 10.0.2.2  
Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)  
  
 * Documentation:  https://help.ubuntu.com  
 * Management:    https://landscape.canonical.com  
 * Support:       https://ubuntu.com/advantage  
  
0 packages can be updated.  
0 updates are security updates.  
  
New release '18.04.5 LTS' available.  
Run 'do-release-upgrade' to upgrade to it.  
  
Last login: Wed Nov 18 19:42:55 2020 from 10.0.2.2  
vagrant@brouter:~$ sudo vim /etc/sysctl.conf  
vagrant@brouter:~$ vagrant@brouter:~$ sudo sysctl -p  
net.ipv4.ip_forward = 1  
vagrant@brouter:~$ sudo /etc/init.d/networking restart  
[ ok ] Restarting networking (via systemctl): networking.service.  
vagrant@brouter:~$ sudo iptables -t nat -A POSTROUTING -o eth2 -j MASQUERADE  
vagrant@brouter:~$ sudo iptables -t nat -A POSTROUTING -o enp0s9 -j MASQUERADE  
vagrant@brouter:~$ sudo route add -net 192.169.10.0 netmask 255.255.255.0 gw 192.168.3.5  
vagrant@brouter:~$
```

- 17. Eighteenth step:** `sudo router del default`, `sudo ip route add default via 192.168.10.5` and `tracert 192.168.20.5`.

```
vagrant@alice: ~  
vagrant@alice:~$ sudo router del default  
sudo: router: command not found  
vagrant@alice:~$ sudo route del default  
vagrant@alice:~$ sudo ip route add default via 192.168.10.5  
Error: either "to" is duplicate, or "vai" is a garbage.  
vagrant@alice:~$ sudo ip route add default via 192.168.10.5  
vagrant@alice:~$ tracert 192.168.20.5  
1?: [LOCALHOST] pmtu 1500  
1: 192.168.10.5 0.589ms  
1: 192.168.10.5 0.346ms  
2: 192.168.20.5 0.912ms reached  
Resume: pmtu 1500 hops 2 back 2  
vagrant@alice:~$
```

18. Nineteenth step: netstat -rn.

```
vagrant@alice: ~  
vagrant@alice:~$ netstat -rn  
Kernel IP routing table  
Destination      Gateway          Genmask         Flags   MSS Window  irtt  Iface  
0.0.0.0          192.168.10.5    0.0.0.0         UG        0  0          0 enp0s8  
10.0.2.0         0.0.0.0         255.255.255.0   U         0  0          0 enp0s3  
192.168.3.0      192.168.10.5    255.255.255.0   UG        0  0          0 enp0s8  
192.168.10.0     0.0.0.0         255.255.255.0   U         0  0          0 enp0s8
```

Question 2: What information is available in the Windows routing table?

A routing table is a set of rules, often viewed in table format, that is used to determine where data packets traveling over an Internet Protocol (IP) network will be directed. There are four entries in the routing table:

- The 0.0.0.0 network (the default network if no other networks apply).
 - The 10.0.2.0 network (the network shared with your host machine, allowing vagrant ssh to work).
 - The 192.168.10.0 network (the local network).
 - The 192.168.3.0 network (a new static route).
-
- ❖ The Destination column: identifies the destination network.
 - ❖ The Gateway column: identifies the defined gateway for the specified network.
 - ❖ The Genmask column: shows the netmask for the network; in this case, it is 255.255.255.0.
 - ❖ The Flag column: The U flag means the route is up, and the G flag means that specified gateway should be used for this route.
 - ❖ The MSS column: indicates the default Maximum Segment Size for TCP connections over this route.
 - ❖ The Window column: indicates the default window size for TCP connections over this route, and the Irtt column indicates the Initial Round Trip Time for this route.
 - ❖ The irtt column: The kernel uses this to guess about the best TCP protocol parameters without waiting on (possibly slow) answers.
 - ❖ The Iface column: shows the network interface.

19. Twentieth step: ping -O 192.168.20.11.

```
vagrant@alice:~$ ping -O 192.168.20.11  
PING 192.168.20.11 (192.168.20.11) 56(84) bytes of data.  
no answer yet for icmp_seq=1  
no answer yet for icmp_seq=2  
no answer yet for icmp_seq=3  
no answer yet for icmp_seq=4  
^C  
--- 192.168.20.11 ping statistics ---  
5 packets transmitted, 0 received, 100% packet loss, time 4031ms  
vagrant@alice:~$ _
```

Question 3: Why are you not getting a response yet?

Because Bob's router knows how to get back to Alice's network, but Bob is not configured to use that router as the default gateway.

20. Twenty-first step: the same step with Bob.

```
Seleccionar vagrant@bob: ~
Connection to 127.0.0.1 closed.

C:\Users\lferr>vagrant ssh bob
Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 packages can be updated.
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New release '18.04.5 LTS' available.
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Welcome to Ubuntu 16.04.7 LTS (GNU/Linux 4.4.0-194-generic x86_64)

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 * Support:       https://ubuntu.com/advantage

0 packages can be updated.
0 updates are security updates.

New release '18.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

vagrant@bob:~$ sudo route del default
vagrant@bob:~$ sudo ip route add default via 192.168.20.5
vagrant@bob:~$
```

21. Twenty-first step: ping -O 192.168.20.11.

```
Seleccionar vagrant@alice: ~

Last login: Wed Nov 18 19:55:52 2020 from 10.0.2.2
vagrant@alice:~$ ping -O 192.168.20.11
PING 192.168.20.11 (192.168.20.11) 56(84) bytes of data.
64 bytes from 192.168.20.11: icmp_seq=1 ttl=62 time=0.933 ms
64 bytes from 192.168.20.11: icmp_seq=2 ttl=62 time=1.02 ms
64 bytes from 192.168.20.11: icmp_seq=3 ttl=62 time=1.08 ms
64 bytes from 192.168.20.11: icmp_seq=4 ttl=62 time=1.07 ms
64 bytes from 192.168.20.11: icmp_seq=5 ttl=62 time=1.56 ms
64 bytes from 192.168.20.11: icmp_seq=6 ttl=62 time=0.879 ms
64 bytes from 192.168.20.11: icmp_seq=7 ttl=62 time=1.12 ms
^C
--- 192.168.20.11 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 0.879/1.098/1.562/0.209 ms
vagrant@alice:~$
```

Question 4: What changed in Alice's pings? Why did the new default gateway have this effect?

The thing that change in Alice's pings is that now Alice is reciving the message of Bob. And the new default gateway has effect because we use de command `sudo ip route add default via 192.168.20.5` that tells Bob to use his router's interface as the default gateway.

22. Twenty-second step: exit and vagrant destroy -f.

```
C:\> Símbolo del sistema
vagrant@alice:~$ exit
logout
Connection to 127.0.0.1 closed.

C:\Users\lferr>vagrant destroy -f
==> brouter: Forcing shutdown of VM...
==> brouter: Destroying VM and associated drives...
==> bob: Forcing shutdown of VM...
==> bob: Destroying VM and associated drives...
==> arouter: Forcing shutdown of VM...
==> arouter: Destroying VM and associated drives...
==> amy: Forcing shutdown of VM...
==> amy: Destroying VM and associated drives...
==> alice: Forcing shutdown of VM...
==> alice: Destroying VM and associated drives...

C:\Users\lferr>_
```

Question 5: What is the difference between Alice's original routing table and the Update table?

The difference between Alice's original routing table and the Update table is that there is a new Destination, in specify *192.168.10.0* and the Getaway of the first destination, which is now *192.168.10.5* when before it was *10.0.2.2*.

First netstat -rn:

```
vagrant@alice:~$ netstat -rn
Kernel IP routing table
Destination    Gateway         Genmask         Flags         MSS Window  irtt Iface
0.0.0.0        10.0.2.2        0.0.0.0         UG            0 0          0 enp0s3
10.0.2.0       0.0.0.0         255.255.255.0   U             0 0          0 enp0s3
192.168.10.0   0.0.0.0         255.255.255.0   U             0 0          0 enp0s8
vagrant@alice:~$
```

Last netstat -rn:

```
vagrant@alice:~$ netstat -rn
Kernel IP routing table
Destination    Gateway         Genmask         Flags         MSS Window  irtt Iface
0.0.0.0        192.168.10.5    0.0.0.0         UG            0 0          0 enp0s8
10.0.2.0       0.0.0.0         255.255.255.0   U             0 0          0 enp0s3
192.168.3.0    192.168.10.5    255.255.255.0   UG            0 0          0 enp0s8
192.168.10.0   0.0.0.0         255.255.255.0   U             0 0          0 enp0s8
vagrant@alice:~$
```