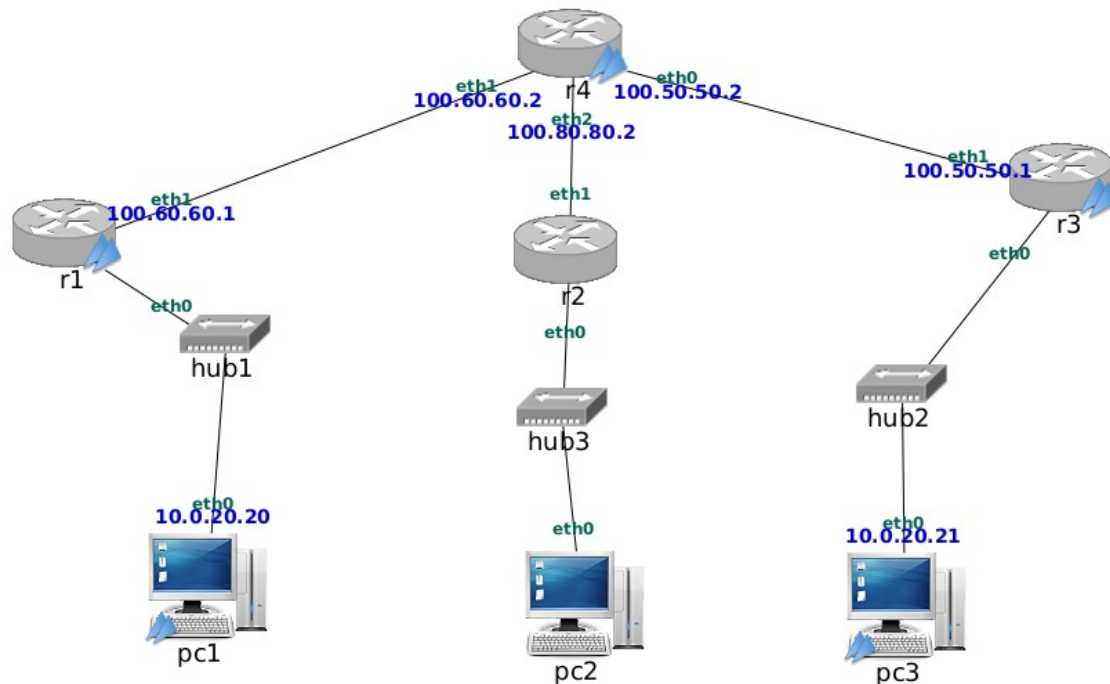




LABORATORIO VPN 3

Redes II, Tecnicatura en Administración de Sistemas y Software Libre

1.



2.

```
pc1:~# ping -c 3 pc3
PING pc3 (10.0.20.21) 56(84) bytes of data.
From pc1 (10.0.20.20) icmp_seq=1 Destination Host Unreachable
From pc1 (10.0.20.20) icmp_seq=2 Destination Host Unreachable
From pc1 (10.0.20.20) icmp_seq=3 Destination Host Unreachable

--- pc3 ping statistics ---
3 packets transmitted, 0 received, +3 errors, 100% packet loss, time 2008ms
, pipe 3
pc1:~#
```

```
pc3:~# ping -c 3 pc1
PING pc1 (10.0.20.20) 56(84) bytes of data.
From pc3 (10.0.20.21) icmp_seq=1 Destination Host Unreachable
From pc3 (10.0.20.21) icmp_seq=2 Destination Host Unreachable
From pc3 (10.0.20.21) icmp_seq=3 Destination Host Unreachable

--- pc1 ping statistics ---
3 packets transmitted, 0 received, +3 errors, 100% packet loss, time 2005ms
, pipe 3
pc3:~#
```



```
r1:~# ifconfig
br0    Link encap:Ethernet HWaddr 00:ff:bd:d3:5c:f5
       inet addr:10.0.20.1 Bcast:10.0.20.255 Mask:255.255.255.0
       inet6 addr: fe80::2ff:bdff:fed3:5cf5/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:7 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:196 (196.0 B) TX bytes:468 (468.0 B)

eth0    Link encap:Ethernet HWaddr 7e:c3:c2:2c:40:aa
       inet6 addr: fe80::7cc3:c2ff:fe2c:40aa/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:20 errors:0 dropped:0 overruns:0 frame:0
       TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:1112 (1.0 KiB) TX bytes:1140 (1.1 KiB)
       Interrupt:5

eth1    Link encap:Ethernet HWaddr aa:bb:cc:00:01:06
       inet addr:100.60.60.1 Bcast:100.60.60.255 Mask:255.255.255.0
       inet6 addr: fe80::9403:e6ff:fe78:2611/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:155 errors:0 dropped:0 overruns:0 frame:0
       TX packets:157 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:14255 (13.9 KiB) TX bytes:14589 (14.2 KiB)
       Interrupt:5

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:16436 Metric:1
       RX packets:2 errors:0 dropped:0 overruns:0 frame:0
       TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:100 (100.0 B) TX bytes:100 (100.0 B)

tap0    Link encap:Ethernet HWaddr 00:ff:bd:d3:5c:f5
       inet6 addr: fe80::2ff:bdff:fed3:5cf5/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:8 errors:0 dropped:0 overruns:0 frame:0
       TX packets:8 errors:0 dropped:12 overruns:0 carrier:0
       collisions:0 txqueuelen:100
       RX bytes:672 (672.0 B) TX bytes:672 (672.0 B)

r1:~#
```



```
r3:~# ifconfig
br0    Link encap:Ethernet HWaddr 00:ff:4b:b8:66:f5
       inet addr:10.0.20.2 Bcast:10.0.20.255 Mask:255.255.255.0
       inet6 addr: fe80::2ff:4bff:feb8:66f5/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:0 (0.0 B) TX bytes:398 (398.0 B)

eth0    Link encap:Ethernet HWaddr 5e:a9:2d:89:71:04
       inet6 addr: fe80::5ca9:2dff:fe89:7104/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:0 (0.0 B) TX bytes:308 (308.0 B)
       Interrupt:5

eth1    Link encap:Ethernet HWaddr aa:bb:cc:00:01:11
       inet addr:100.50.50.1 Bcast:100.50.50.255 Mask:255.255.255.0
       inet6 addr: fe80::ac7e:78ff:fe19:e912/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:0 (0.0 B) TX bytes:308 (308.0 B)
       Interrupt:5

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:16436 Metric:1
       RX packets:2 errors:0 dropped:0 overruns:0 frame:0
       TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:100 (100.0 B) TX bytes:100 (100.0 B)

tap0    Link encap:Ethernet HWaddr 00:ff:4b:b8:66:f5
       inet6 addr: fe80::2ff:4bff:feb8:66f5/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:0 errors:0 dropped:5 overruns:0 carrier:0
       collisions:0 txqueuelen:100
       RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

r3:~#
```

En el caso de r1 y r2 tenemos las interfaces tap0 y br0. Investigando br0 sería un puente que usa alguna de las interfaces de red definidas, y tap0 es una interfaz virtual que usa openvpn para pasar tráfico a los clientes.



Tap0 es como en el caso de los anteriores labs la interfaz usada punto a punto por los clientes vpn. Br0 actua en nivel 2 conectado a los clientes vpn (tap0) a los clientes fisicos que estan en la misma red ethernet (podemos tener conetados equipos fisicos del lado del servidor).

3.

```
r1:~# ifconfig
br0    Link encap:Ethernet HWaddr 00:ff:77:eb:0b:47
       inet addr:10.0.20.1 Bcast:10.0.20.255 Mask:255.255.255.0
       inet6 addr: fe80::2ff:77ff:feeb:b47/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:0 (0.0 B) TX bytes:468 (468.0 B)

eth0    Link encap:Ethernet HWaddr 62:3f:b3:84:9b:c6
       inet6 addr: fe80::603f:b3ff:fe84:9bc6/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:6 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:384 (384.0 B) TX bytes:468 (468.0 B)
       Interrupt:5

eth1    Link encap:Ethernet HWaddr aa:bb:cc:00:01:06
       inet addr:100.60.60.1 Bcast:100.60.60.255 Mask:255.255.255.0
       inet6 addr: fe80::a8ca:99ff:fe80:9777/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:109 errors:0 dropped:0 overruns:0 frame:0
       TX packets:111 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:10684 (10.4 KiB) TX bytes:10346 (10.1 KiB)
       Interrupt:5

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:16436 Metric:1
       RX packets:2 errors:0 dropped:0 overruns:0 frame:0
       TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:100 (100.0 B) TX bytes:100 (100.0 B)

tap0    Link encap:Ethernet HWaddr 00:ff:77:eb:0b:47
```



```
inet addr:10.0.20.239 Bcast:10.0.20.255 Mask:255.255.255.0
inet6 addr: fe80::2ff:77ff:feeb:b47/64 Scope:Link
UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:6 overruns:0 carrier:0
collisions:0 txqueuelen:100
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

r1::~#

r3::~# ifconfig

ifconfig

```
br0    Link encap:Ethernet HWaddr 00:ff:39:d7:3b:f0
       inet addr:10.0.20.2 Bcast:10.0.20.255 Mask:255.255.255.0
       inet6 addr: fe80::2ff:39ff:fed7:3bf0/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:0 (0.0 B) TX bytes:468 (468.0 B)

eth0    Link encap:Ethernet HWaddr fe:c5:12:64:48:b0
       inet6 addr: fe80::fcc5:12ff:fe64:48b0/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:6 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:384 (384.0 B) TX bytes:468 (468.0 B)
       Interrupt:5
```

```
eth1    Link encap:Ethernet HWaddr aa:bb:cc:00:01:11
       inet addr:100.50.50.1 Bcast:100.50.50.255 Mask:255.255.255.0
       inet6 addr: fe80::3ced:fdff:feb7:4718/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:6 errors:0 dropped:0 overruns:0 frame:0
       TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:384 (384.0 B) TX bytes:468 (468.0 B)
       Interrupt:5
```

```
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:16436 Metric:1
       RX packets:2 errors:0 dropped:0 overruns:0 frame:0
```



```
TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:100 (100.0 B) TX bytes:100 (100.0 B)

tap0  Link encap:Ethernet HWaddr 00:ff:39:d7:3b:f0
       inet6 addr: fe80::2ff:39ff:fed7:3bf0/64 Scope:Link
       UP BROADCAST RUNNING PROMISC MULTICAST MTU:1500 Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:0 errors:0 dropped:6 overruns:0 carrier:0
       collisions:0 txqueuelen:100
       RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

r3:~#
```

No noto ningun cambio en las interfaces. Salvo que en el tunel de r1 ahora tenemos una direccion ip, esta direccion es parte de la direccion de la red que estamos usando.

4.

```
pc1:~# arp -a
pc1:~# ping -c 3 pc3
PING pc3 (10.0.20.21) 56(84) bytes of data:
64 bytes from pc3 (10.0.20.21): icmp_seq=1 ttl=64 time=15.3 ms
64 bytes from pc3 (10.0.20.21): icmp_seq=2 ttl=64 time=3.56 ms
64 bytes from pc3 (10.0.20.21): icmp_seq=3 ttl=64 time=4.99 ms

--- pc3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1998ms
rtt min/avg/max/mdev = 3.567/7.981/15.381/5.264 ms
pc1:~#

pc3:~# tcpdump -v
tcpdump: listening on eth0, link-type EN10MB (Ethernet), capture size 96 bytes
20:53:55.457980 arp who-has pc3 tell pc1
20:53:55.464568 arp reply pc3 is-at aa:bb:00:00:cc:03 (oui Unknown)
20:53:55.460464 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto ICMP (1), length 84) pc1
> pc3: ICMP echo request, id 7682, seq 1, length 64
20:53:55.460523 IP (tos 0x0, ttl 64, id 20050, offset 0, flags [none], proto ICMP (1), length
84) pc3 > pc1: ICMP echo reply, id 7682, seq 1, length 64
20:53:56.446170 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto ICMP (1), length 84) pc1
> pc3: ICMP echo request, id 7682, seq 2, length 64
20:53:56.446205 IP (tos 0x0, ttl 64, id 20051, offset 0, flags [none], proto ICMP (1), length
84) pc3 > pc1: ICMP echo reply, id 7682, seq 2, length 64
20:53:57.449413 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto ICMP (1), length 84) pc1
> pc3: ICMP echo request, id 7682, seq 3, length 64
20:53:57.449442 IP (tos 0x0, ttl 64, id 20052, offset 0, flags [none], proto ICMP (1), length
84) pc3 > pc1: ICMP echo reply, id 7682, seq 3, length 64
20:54:00.458157 arp who-has pc1 tell pc3
```



```
20:54:00.460519 arp reply pc1 is-at aa:bb:00:00:aa:01 (oui Unknown)

10 packets captured
10 packets received by filter
0 packets dropped by kernel
pc3:~#
```

Recibe los mensajes como si fueran enviados en la misma red física, recibe el primer mensaje de arp y los posteriores ping.

5.

Primero llevamos las claves para r3, llevamos los archivos ca.crt, r3.crt, r3.key, y dh2048.pem.

En mi caso no use scp, sino que copie y pegue los archivos desde la carpeta r3/etc/openvpn del laboratorio directamente en r2/etc/openvpn.

Creamos bridge y similar al que tenemos en r1.startup

Configure lo siguiente en el r2.startup

```
#ifconfig eth0 10.0.20.3/24 hw ether AA:BB:CC:00:01:09 up
ifconfig eth1 100.80.80.1/24 hw ether AA:BB:CC:00:01:10 up

openvpn --mktun --dev tap0
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 tap0
ifconfig tap0 0.0.0.0 promisc up
ifconfig eth0 0.0.0.0 promisc up

ifconfig br0 10.0.20.3/24

sleep 1
route add default gw 100.80.80.2
```

Luego configuramos client.conf para poder conectarnos al servidor de r3. /etc/openvpn/client.conf

```
client
dev tap0
proto udp
port 1189
remote 100.50.50.1 1189
route-gateway dhcp
redirect-gateway
```



```
resolv-retry infinite
persist-key
persist-tun
ca ca.crt
cert r2.crt
key r2.key
dh dh2048.pem
keepalive 10 120
comp-lzo
status openvpn-status.log
log openvpn.log
verb 3
mute 20
```

Luego de eso probamos la conexión de pc1 a pc2, de pc1 a pc2 y de pc2 a pc1 e pc2 a pc3.

```
pc3:~# ping -c 3 pc2
PING pc2 (10.0.20.22) 56(84) bytes of data.
64 bytes from pc2 (10.0.20.22): icmp_seq=1 ttl=64 time=18.7 ms
64 bytes from pc2 (10.0.20.22): icmp_seq=2 ttl=64 time=5.27 ms
64 bytes from pc2 (10.0.20.22): icmp_seq=3 ttl=64 time=4.15 ms

--- pc2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2016ms
rtt min/avg/max/mdev = 4.153/9.388/18.741/6.629 ms
pc3:~#
```

```
pc1:~# ping -c 3 pc2
PING pc2 (10.0.20.22) 56(84) bytes of data.
64 bytes from pc2 (10.0.20.22): icmp_seq=1 ttl=64 time=17.9 ms
64 bytes from pc2 (10.0.20.22): icmp_seq=2 ttl=64 time=7.31 ms
64 bytes from pc2 (10.0.20.22): icmp_seq=3 ttl=64 time=7.32 ms

--- pc2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1998ms
rtt min/avg/max/mdev = 7.313/10.863/17.951/5.012 ms
pc1:~#
```

```
pc2:~# ping -c 3 pc1
PING pc1 (10.0.20.20) 56(84) bytes of data.
```




```
64 bytes from pc1 (10.0.20.20): icmp_seq=1 ttl=64 time=5.23 ms
64 bytes from pc1 (10.0.20.20): icmp_seq=2 ttl=64 time=7.05 ms
64 bytes from pc1 (10.0.20.20): icmp_seq=3 ttl=64 time=5.16 ms
```

```
--- pc1 ping statistics ---
```

```
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 5.160/5.816/7.050/0.875 ms
```

```
pc2:~# ping -c 3 pc3
```

```
PING pc3 (10.0.20.21) 56(84) bytes of data.
```

```
64 bytes from pc3 (10.0.20.21): icmp_seq=1 ttl=64 time=3.01 ms
64 bytes from pc3 (10.0.20.21): icmp_seq=2 ttl=64 time=3.12 ms
64 bytes from pc3 (10.0.20.21): icmp_seq=3 ttl=64 time=4.01 ms
```

```
--- pc3 ping statistics ---
```

```
3 packets transmitted, 3 received, 0% packet loss, time 2006ms
rtt min/avg/max/mdev = 3.017/3.387/4.017/0.452 ms
```

```
pc2:~#
```

6.

Investigando encuentre los siguientes usos:

- Compatibilidad con sistemas o dispositivos antiguos: algunos equipos industriales o heredados solo funcionan en redes de capa2 o requieren broadcast locales, una vpn de capa 2 permite integrarlos en redes modernas sin reestructurar todo.
- Integracion de servicios de capa2: PXE boot (arranque por red) como los laboratorios de la universidad. DHCP entre sitios, SMB broadcast (protocolo samba).
- Entornos virtualizados: simular redes lan reales, interconectar ipervisores o entornos de nube como si estuvieran en la misma red lan.