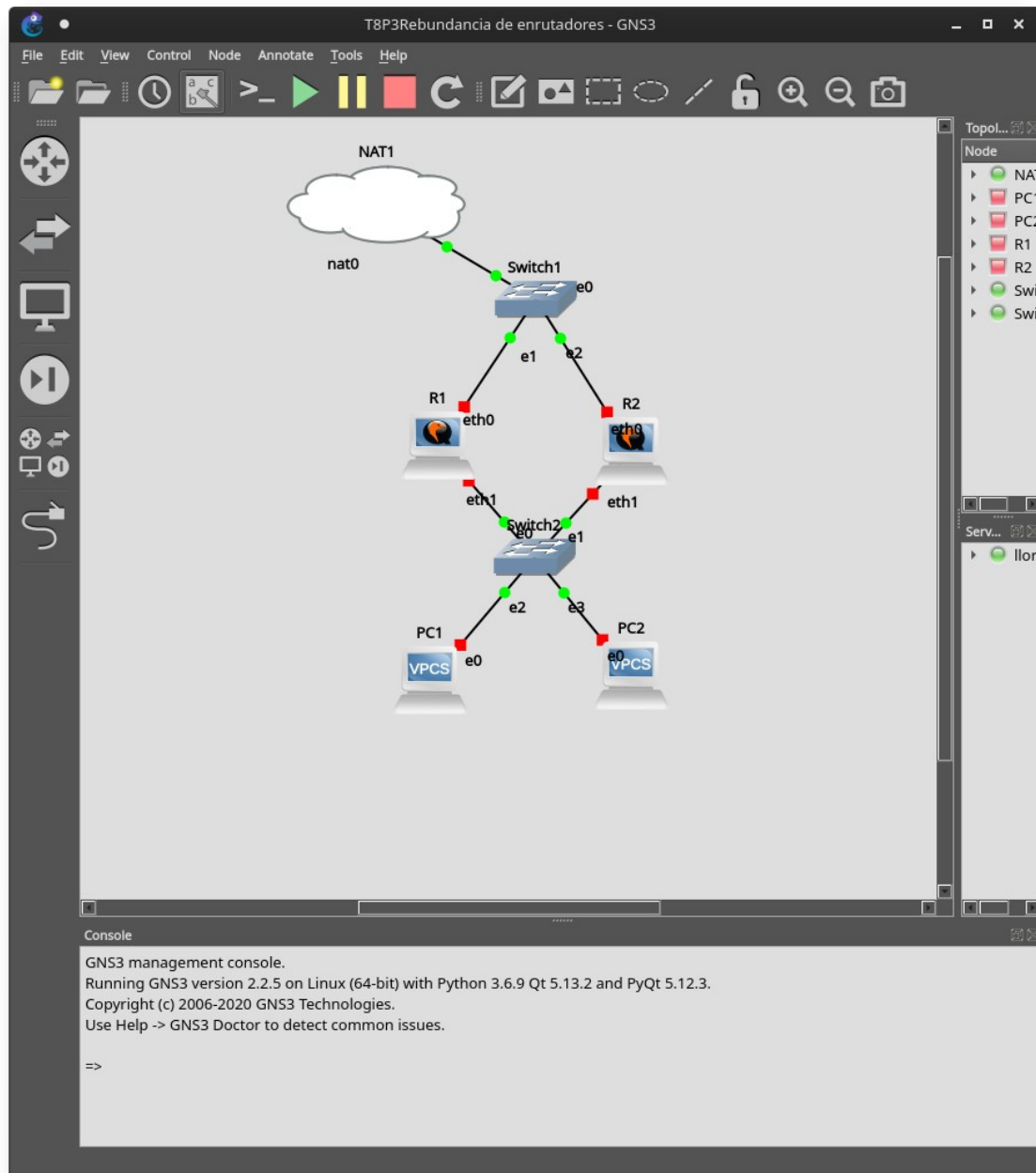


Redundancia de enrutadores

Esta practica la realizaremos con GNS3 la verdad que el programa esta bien pero es un continuo tira y afloja con el por problemas de configuración, las ventanas por VNC a veces me da problemas por que se visualiza mal,etc.

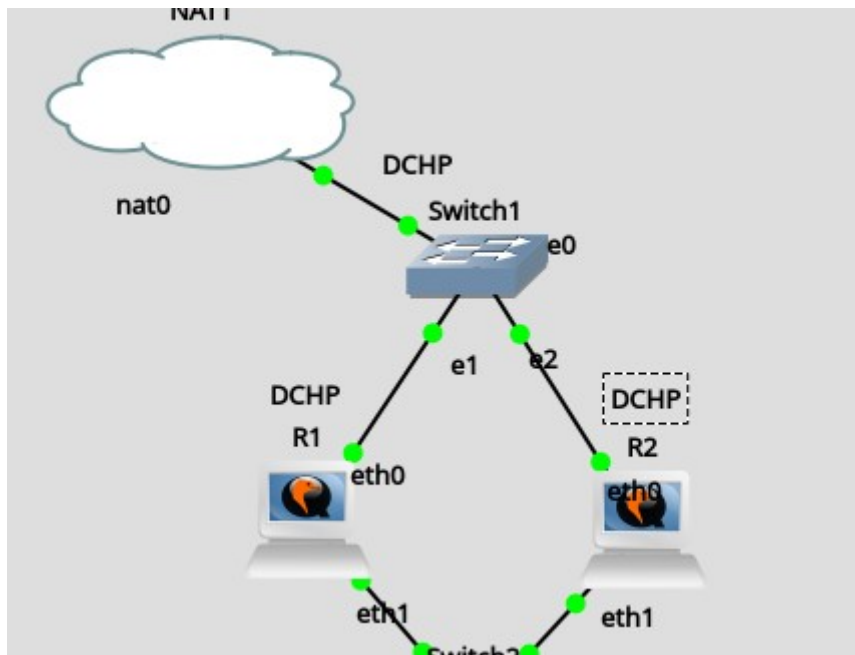
De todas formas vamos a por el.

Primeramente preparo el proyecto como sugieres en el enunciado de la practica.



Redundancia de enrutadores

Seguidamente preparamos para que todos los routers tengan internet que como siempre la nube NAT debe estar en DHCP para que logre conectar por lo tanto las interfaces eth0 del dibujo estarán en DHCP para que el router les asigne una IP.



Seguidamente para que a los VPCS que harán de cliente vamos a configurar el firewall de los 2 routers para que tengan internet. En practicas anteriores ya lo hicimos. Dejo el recorte por mera información.

Redundancia de enrutadores

Habilitar ip forwarding

Para habilitar el **ip forwarding** (enrutamiento) en GNU/Linux se puede proceder de la siguiente forma:

- Editar como root el `/etc/sysctl.conf` y poner `net.ipv4.ip_forward=1`
- Aplicar con `sysctl -p`

Habilitar NAT de origen

Para habilitar el **NAT** de origen (realmente es PAT) en el router de la sede, de forma que enmascare las direcciones privadas reemplazándolas por la dirección ip de su interfaz pública, se puede ejecutar como root el comando:

```
iptables -t nat -A POSTROUTING -s 172.20.0.0/24 -o eth0 -j  
MASQUERADE
```

Este comando se realizaría en el equipo que hace de router en la sede 1, suponiendo que la interfaz WAN con la ip 192.168.0.20 de la figura, es la eth0. En un entorno de producción, este comando debería ejecutarse en un script de inicio en el sistema, para que sea persistente entre reinicios del router.

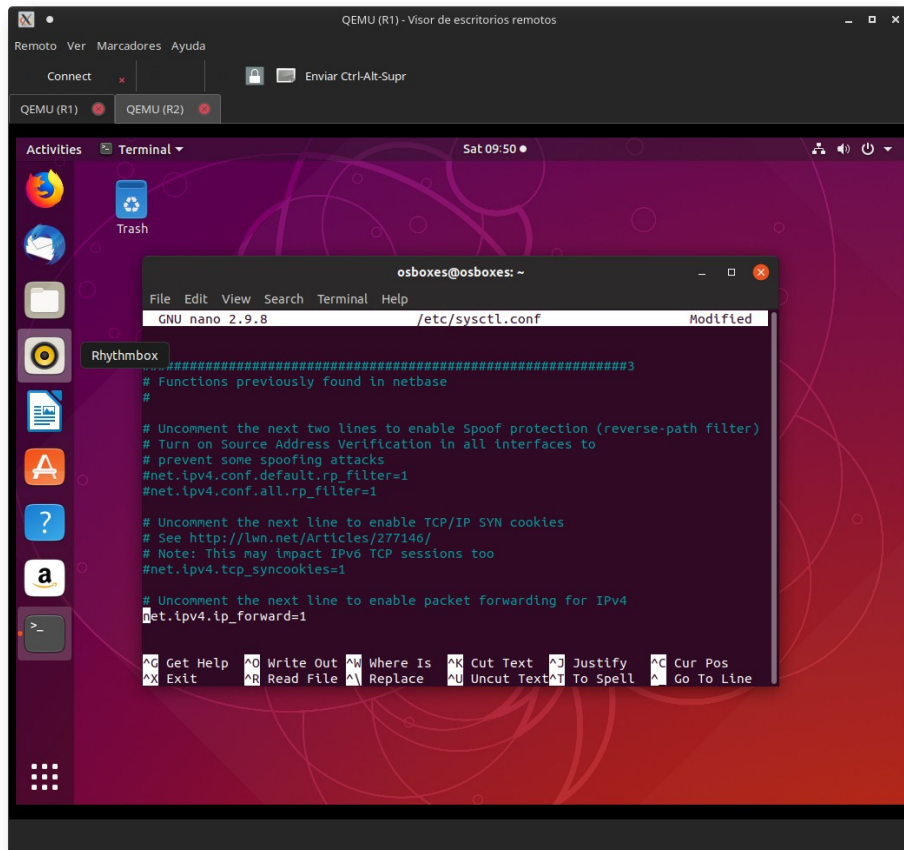
Problemas que podemos encontrarnos

Depende de la distribución GNU/Linux usada, en el router puede haber reglas de firewall o no. En caso de que las haya, es necesario deshabilitarlas para la práctica, bien con **iptables -F** o con el comando necesario para parar el firewall como **service iptables stop** o **systemctl stop firewalld.service**. Consultar la documentación de la distribución.

Es posible que tengas que **deshabilitar el firewall de Windows** si los clientes son Windows (pueden ser GNU/Linux perfectamente), para que funcione el ping entre ambos PC una vez establecida la VPN. Puedes pensar que no funciona la VPN y realmente es el firewall de Windows que elimina el ICMP entrante por defecto. La solución más elegante es crear una regla de entrada que permita el ICMP entrante en ambos PC.

Editamos el archivo sysctl.conf

Redundancia de enrutadores

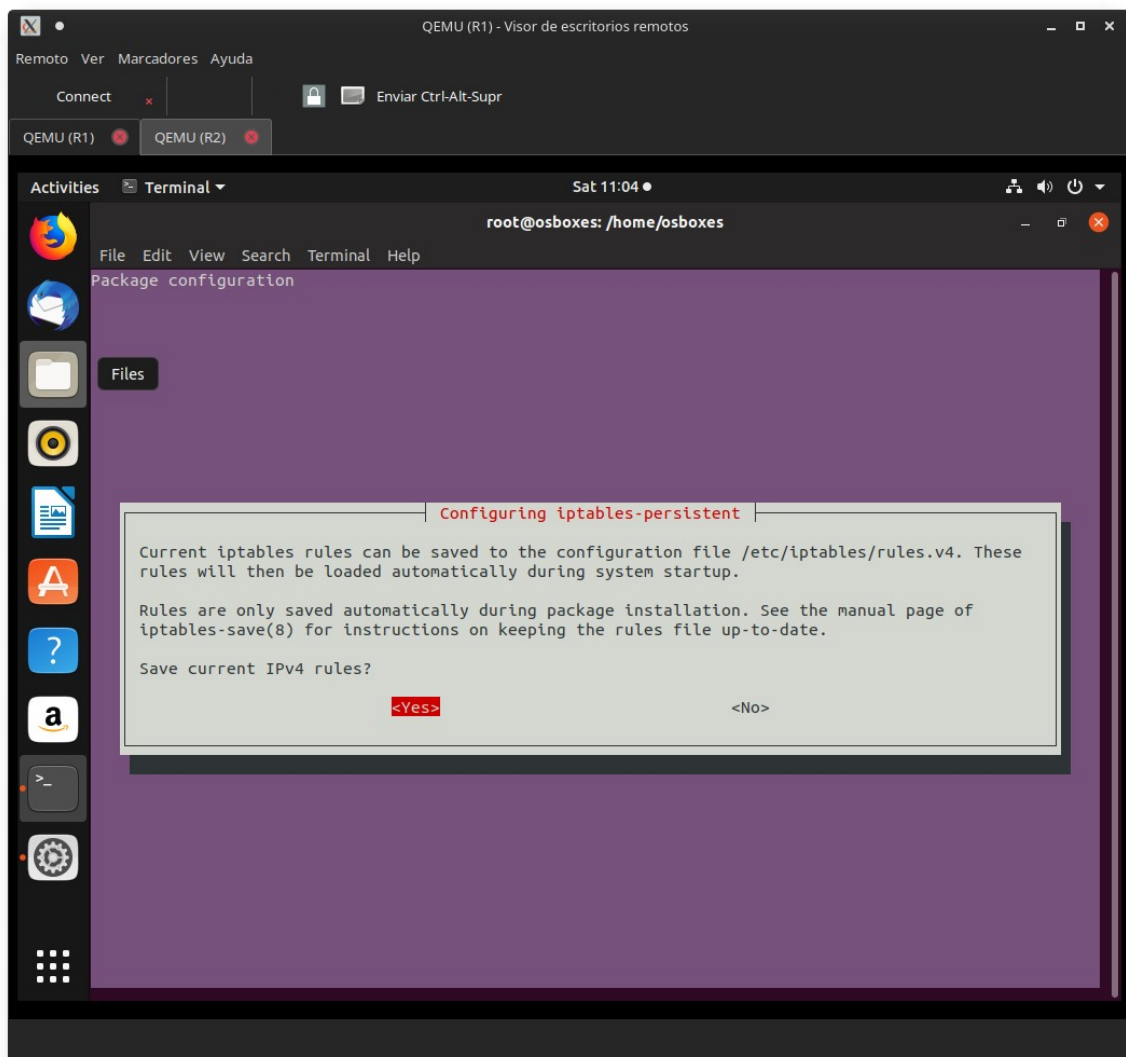


Aplicamos la regla del firewall

```
[sudo] password for osboxes:
root@osboxes:/home/osboxes# iptables -t nat -A POSTROUTING -s 192.168.100.1/24 -o ens3 -j MASQUERADE
root@osboxes:/home/osboxes#
```

Despues instalamos `iptables-persistent` (aprendido de la web de la practica anterior) para que se mantenga la reglas del firewall cuando reiniciemos.

Redundancia de enrutadores



Seguidamente ya configuramos la red interna y el cliente que ahora describire para documentarlo dado que el GNS3 lo malo es que las maquinas tienen las interfaces un nombre y el dibujo otra. Se que se puede configurar editar pero falta tiempo xD

Pero comprobamos que el cliente VPCS tiene internet con un ping a 8.8.8.8

```
PC1> ping 8.8.8.8
84 bytes from 8.8.8.8 icmp_seq=1 ttl=54 time=9.975 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=54 time=9.785 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=54 time=10.404 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=54 time=9.587 ms
84 bytes from 8.8.8.8 icmp_seq=5 ttl=54 time=10.291 ms
```

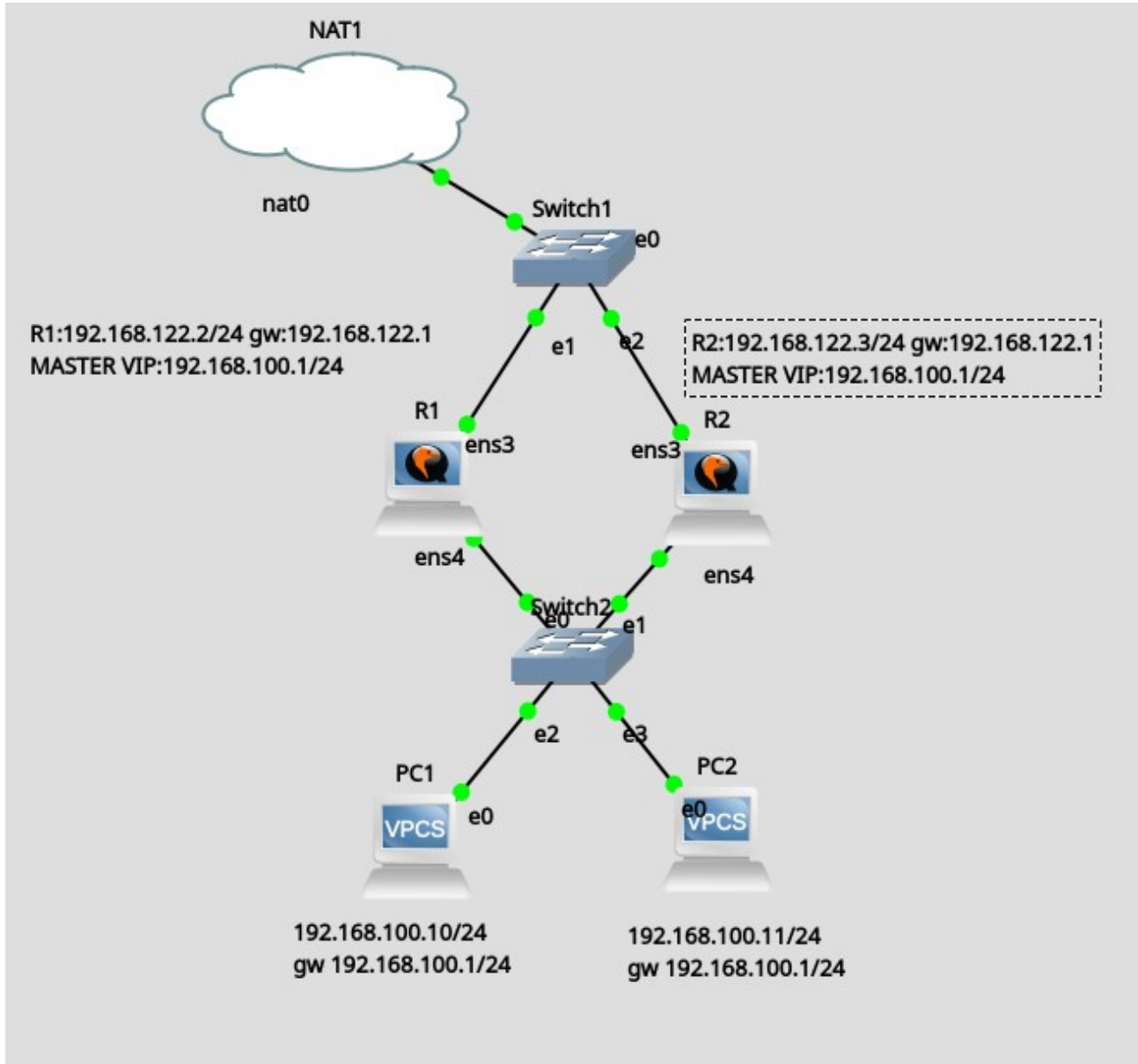
NAT en GNS3

Ahora vamos averiguar la NAT en GNS3 mirando por internet sabemos 2 cosas

Redundancia de enrutadores

que si queremos Internet debe de tener un rango de IP 192.168.122.0/24 y el la puerta de enlace es 192.168.122.1 que es el que asigna el DHCP automáticamente y es la primera IP de la red

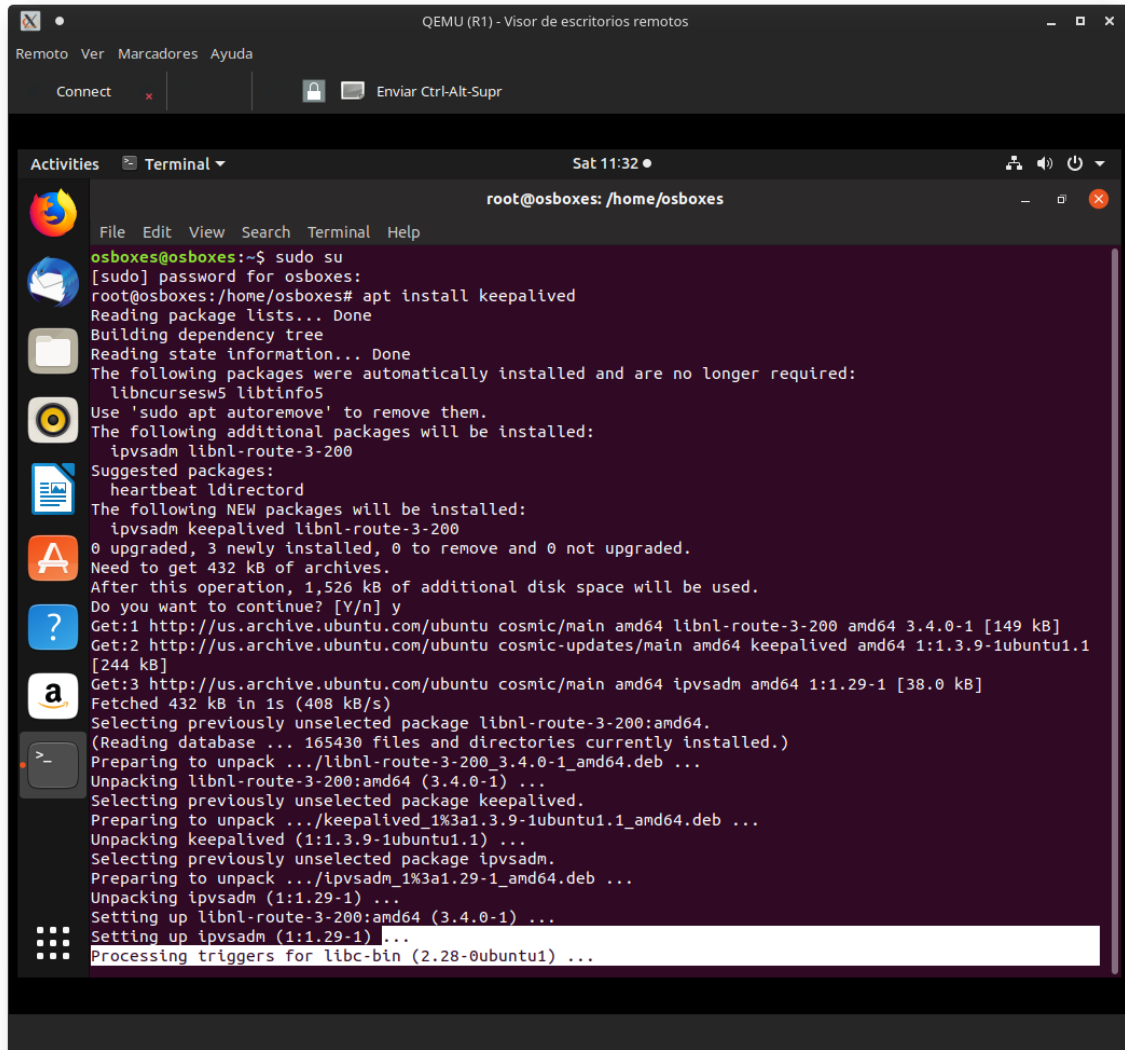
Por lo tanto asi queda la topologia.



Instalación de Keepalived

Redundancia de enrutadores

Siguiendo la practica pasamos a configurar el router1



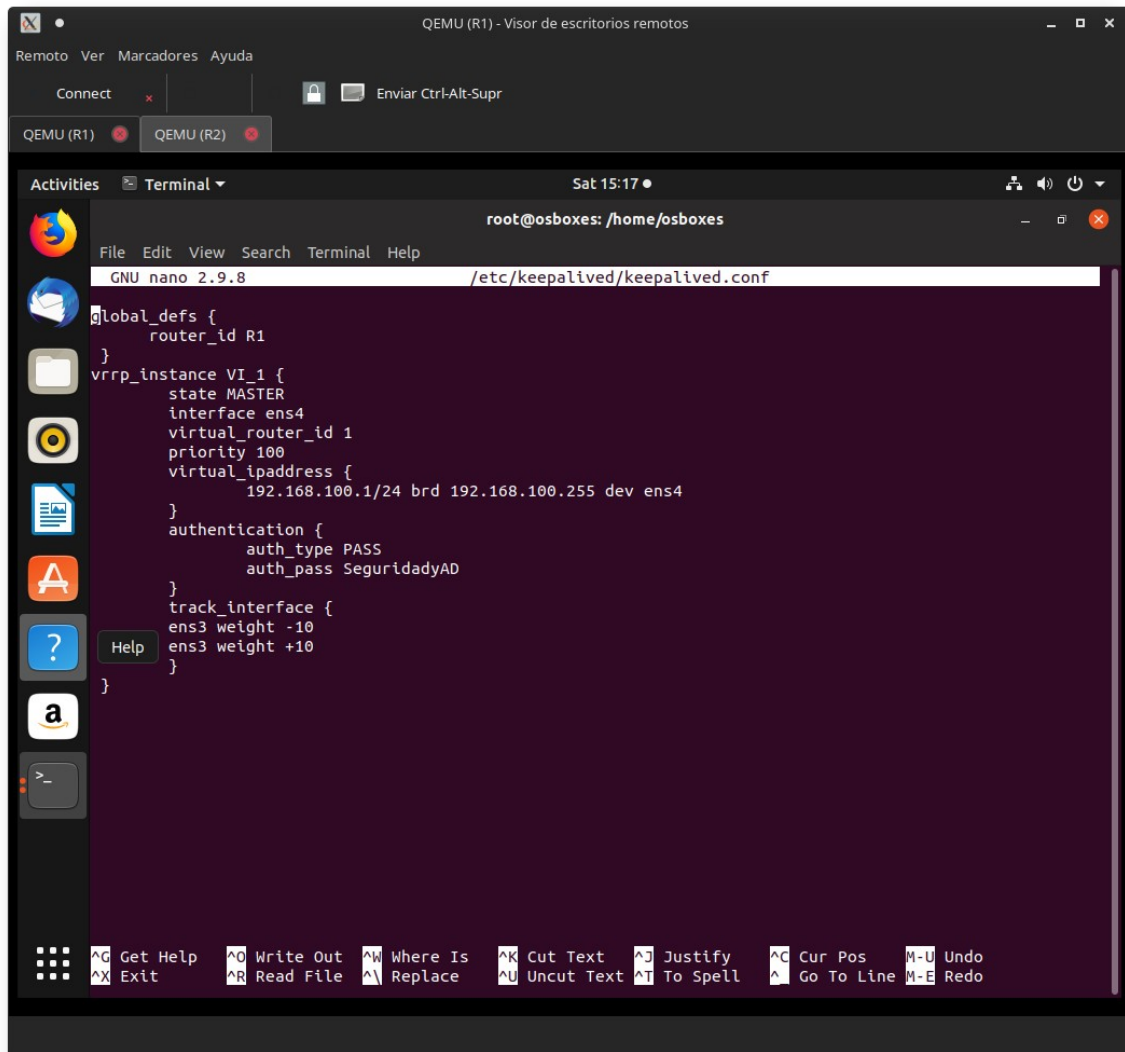
```
QEMU (R1) - Visor de escritorios remotos
Remoto Ver Marcadores Ayuda
Connect x Enviar Ctrl-Alt-Supr

Activities Terminal Sat 11:32
root@osboxes: /home/osboxes

File Edit View Search Terminal Help
osboxes@osboxes:~$ sudo su
[sudo] password for osboxes:
root@osboxes:/home/osboxes# apt install keepalived
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libncursesw5 libtinfo5
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  ipvsadm libnl-route-3-200
Suggested packages:
  heartbeat ldirectord
The following NEW packages will be installed:
  ipvsadm keepalived libnl-route-3-200
0 upgraded, 3 newly installed, 0 to remove and 0 not upgraded.
Need to get 432 kB of archives.
After this operation, 1,526 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 libnl-route-3-200 amd64 3.4.0-1 [149 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 keepalived amd64 1:1.3.9-1ubuntu1.1 [244 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 ipvsadm amd64 1:1.29-1 [38.0 kB]
Fetched 432 kB in 1s (408 kB/s)
Selecting previously unselected package libnl-route-3-200:amd64.
(Reading database ... 165430 files and directories currently installed.)
Preparing to unpack .../libnl-route-3-200_3.4.0-1_amd64.deb ...
Unpacking libnl-route-3-200:amd64 (3.4.0-1) ...
Selecting previously unselected package keepalived.
Preparing to unpack .../keepalived_1%3a1.3.9-1ubuntu1.1_amd64.deb ...
Unpacking keepalived (1:1.3.9-1ubuntu1.1) ...
Selecting previously unselected package ipvsadm.
Preparing to unpack .../ipvsadm_1%3a1.29-1_amd64.deb ...
Unpacking ipvsadm (1:1.29-1) ...
Setting up libnl-route-3-200:amd64 (3.4.0-1) ...
Setting up ipvsadm (1:1.29-1) ...
Processing triggers for libc-bin (2.28-0ubuntu1) ...
```

Creamos el archivo de configuración de keepalived

Redundancia de enrutadores



The screenshot shows a QEMU (R1) - Visor de escritorios remotos window. Inside, a terminal window is open, displaying the configuration of a Keepalived router. The terminal shows the following configuration:

```
root@osboxes: /home/osboxes
GNU nano 2.9.8 /etc/keepalived/keepalived.conf

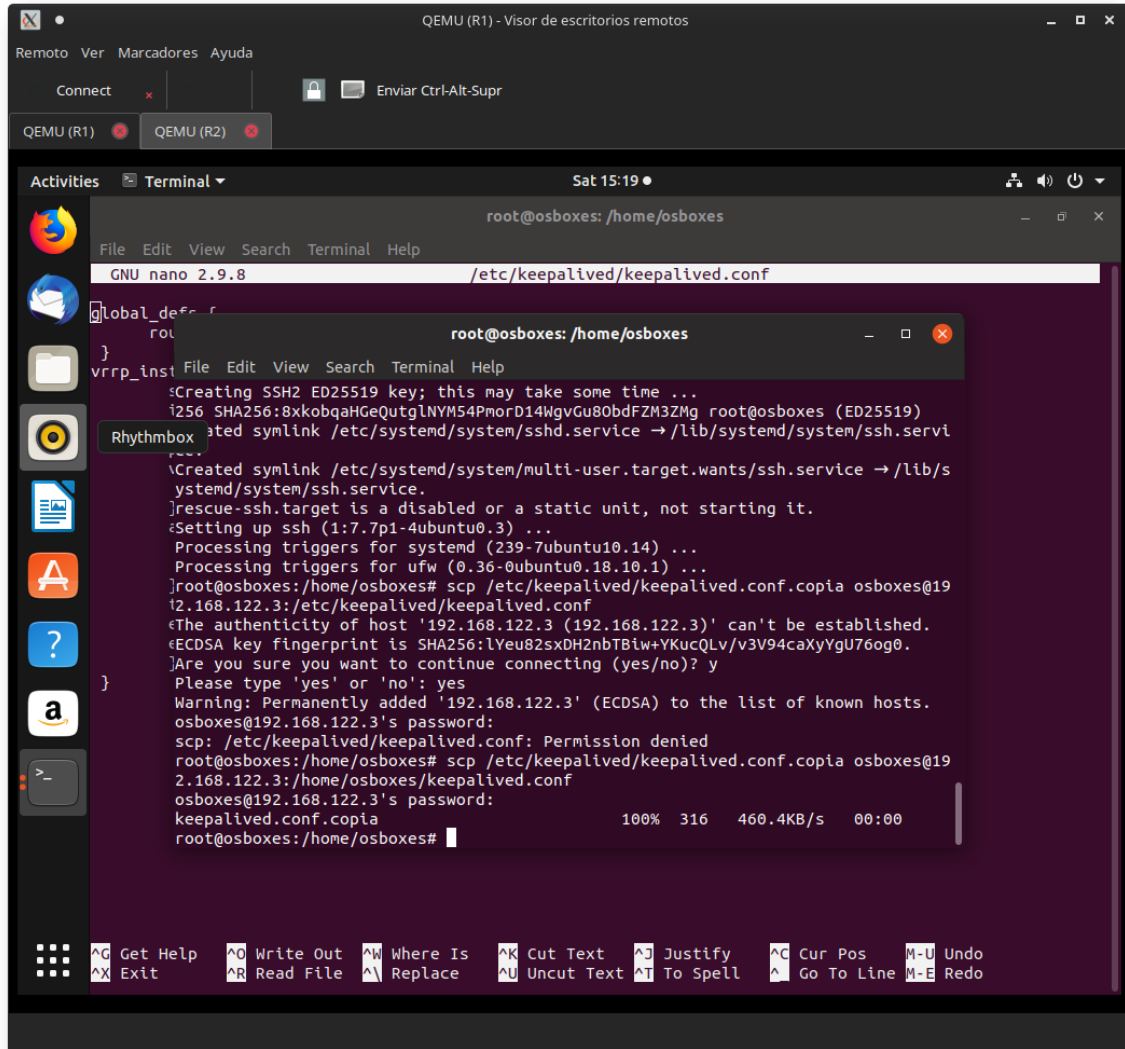
global_defs {
    router_id R1
}

vrrp_instance VI_1 {
    state MASTER
    interface ens4
    virtual_router_id 1
    priority 100
    virtual_ipaddress {
        192.168.100.1/24 brd 192.168.100.255 dev ens4
    }
    authentication {
        auth_type PASS
        auth_pass SeguridadyAD
    }
    track_interface {
        ens3 weight -10
        ens3 weight +10
    }
}
```

The terminal window also shows a sidebar with application icons and a bottom status bar with keyboard shortcuts.

Redundancia de enrutadores

Instalamos SSH y mandamos una copia del archivo al R2 dado que lo he escrito a mano y mas adelante nos ara falta para configurarlo.



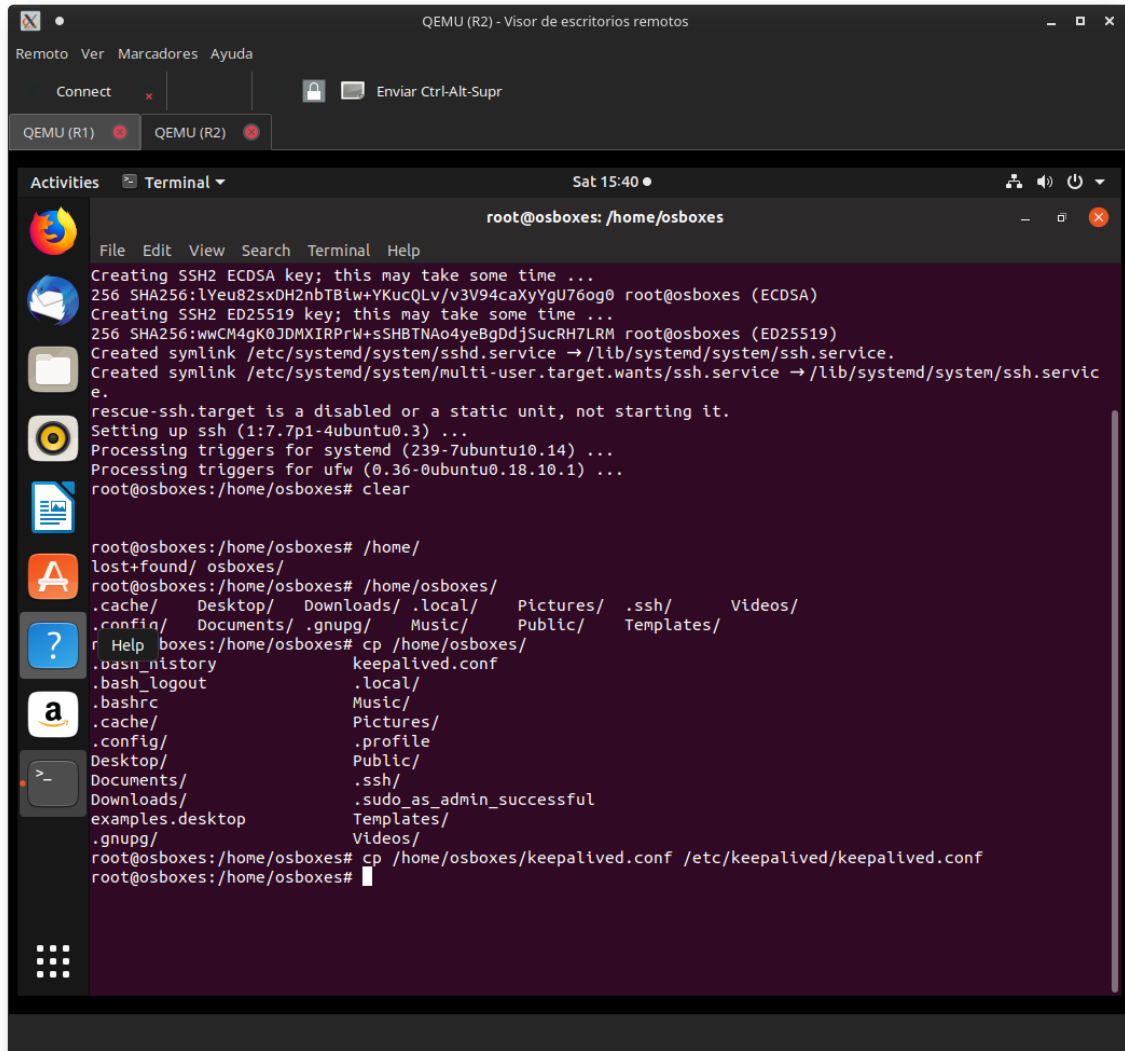
```
QEMU (R1) - Visor de escritorios remotos
Remoto Ver Marcadores Ayuda
Connect x Enviar Ctrl-Alt-Supr
QEMU (R1) QEMU (R2)

Activities Terminal Sat 15:19
root@osboxes: /home/osboxes
File Edit View Search Terminal Help
GNU nano 2.9.8 /etc/keepalived/keepalived.conf

root@osboxes: /home/osboxes
File Edit View Search Terminal Help
Creating SSH2 ED25519 key; this may take some time ...
1256 SHA256:8xkobqaHGeQutglNYM54PmorD14WgvGu80bdFZM3ZMg root@osboxes (ED25519)
Created symlink /etc/systemd/system/ssh.service → /lib/systemd/system/ssh.service.
rescue-ssh.target is a disabled or a static unit, not starting it.
Setting up ssh (1:7.7p1-4ubuntu0.3) ...
Processing triggers for systemd (239-7ubuntu10.14) ...
Processing triggers for ufw (0.36-0ubuntu0.18.10.1) ...
root@osboxes: /home/osboxes# scp /etc/keepalived/keepalived.conf copia osboxes@19
12.168.122.3:/etc/keepalived/keepalived.conf
The authenticity of host '192.168.122.3 (192.168.122.3)' can't be established.
ECDSA key fingerprint is SHA256:lYeu82sxDH2nbTbiw+YKucQLv/v3V94caXyYgU76og0.
Are you sure you want to continue connecting (yes/no)? y
Please type 'yes' or 'no': yes
Warning: Permanently added '192.168.122.3' (ECDSA) to the list of known hosts.
osboxes@192.168.122.3's password:
scp: /etc/keepalived/keepalived.conf: Permission denied
root@osboxes: /home/osboxes# scp /etc/keepalived/keepalived.conf copia osboxes@19
2.168.122.3:/home/osboxes/keepalived.conf
osboxes@192.168.122.3's password:
keepalived.conf.copia 100% 316 460.4KB/s 00:00
root@osboxes: /home/osboxes#
```

Redundancia de enrutadores

Ahora nos vamos al R2 y copiamos el archivo de configuración que esta en /home/osboxes y lo editaremos según indica la practica.



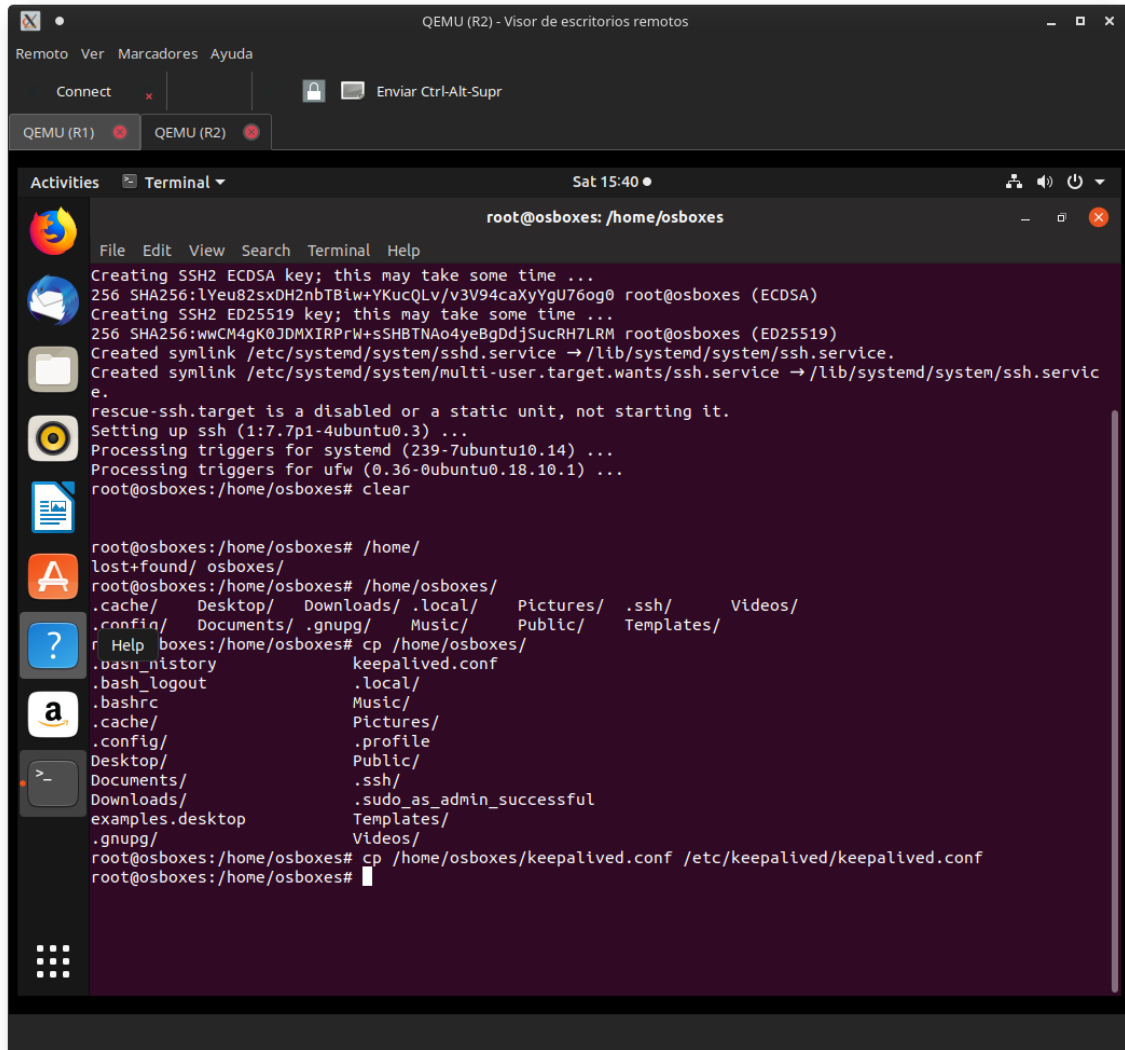
The screenshot shows a QEMU (R2) - Visor de escritorios remotos window. The terminal displays the following output:

```
root@osboxes: /home/osboxes
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:lYeu82sxDH2nbTBiW+YKucQLv/v3V94caXyYgU76og0 root@osboxes (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:wwCM4gK0JDMXIRPrW+sSHBTNAo4yeBgDdjSucRH7LRM root@osboxes (ED25519)
Created symlink /etc/systemd/system/ssh.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.service.
rescue-ssh.target is a disabled or a static unit, not starting it.
Setting up ssh (1:7.7p1-4ubuntu0.3) ...
Processing triggers for systemd (239-7ubuntu10.14) ...
Processing triggers for ufw (0.36-0ubuntu0.18.10.1) ...
root@osboxes:/home/osboxes# clear

root@osboxes:/home/osboxes# /home/
lost+found/ osboxes/
root@osboxes:/home/osboxes# /home/osboxes/
.cache/ Desktop/ Downloads/ .local/ Pictures/ .ssh/ Videos/
.config/ Documents/ .gnupg/ Music/ Public/ Templates/
r Help boxes:/home/osboxes# cp /home/osboxes/
.bash_history keepalived.conf
.bash_logout .local/
.bashrc Music/
.cache/ Pictures/
.config/ .profile
Desktop/ Public/
Documents/ .ssh/
Downloads/ .sudo_as_admin_successful
examples.desktop Templates/
.gnupg/ Videos/
root@osboxes:/home/osboxes# cp /home/osboxes/keepalived.conf /etc/keepalived/keepalived.conf
root@osboxes:/home/osboxes#
```

Redundancia de enrutadores

Editamos...



The screenshot shows a QEMU (R2) remote desktop viewer window. The terminal is running as root on a system named osboxes. The user is in the /home/osboxes directory. The terminal output shows the creation of SSH2 ECDSA and ED25519 keys, the creation of symlinks for the sshd.service and multi-user.target.wants/ssh.service, and the processing of triggers for systemd and ufw. The user then runs the command 'clear' and lists the contents of the /home/osboxes directory, which includes a .keepalived.conf file. Finally, the user runs the command 'cp /home/osboxes/keepalived.conf /etc/keepalived/keepalived.conf' to copy the configuration file to the system's configuration directory.

```
QEMU (R2) - Visor de escritorios remotos
Remoto Ver Marcadores Ayuda
Connect x Enviar Ctrl-Alt-Supr
QEMU (R1) x QEMU (R2) x

Activities Terminal Sat 15:40
root@osboxes: /home/osboxes

File Edit View Search Terminal Help
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:lYeu82sxDH2nbTBlw+YKucQLv/v3V94caXyYgU76og0 root@osboxes (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:wwCM4gK0JDMXIRPrW+sSHBTNAo4yeBgDdjSucRH7LRM root@osboxes (ED25519)
Created symlink /etc/systemd/system/sshd.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.servic
e.
rescue-ssh.target is a disabled or a static unit, not starting it.
Setting up ssh (1:7.7p1-4ubuntu0.3) ...
Processing triggers for systemd (239-7ubuntu10.14) ...
Processing triggers for ufw (0.36-0ubuntu0.18.10.1) ...
root@osboxes:/home/osboxes# clear

root@osboxes:/home/osboxes# /home/
lost+found/ osboxes/
root@osboxes:/home/osboxes# /home/osboxes/
.cache/ Desktop/ Downloads/ .local/ Pictures/ .ssh/ Videos/
.conf/ Documents/ .gnupg/ Music/ Public/ Templates/
r Help boxes:/home/osboxes# cp /home/osboxes/
.bash_history keepalived.conf
.bash_logout .local/
.bashrc Music/
.cache/ Pictures/
.config/ .profile
Desktop/ Public/
Documents/ .ssh/
Downloads/ .sudo_as_admin_successful
examples.desktop Templates/
.gnupg/ Videos/
root@osboxes:/home/osboxes# cp /home/osboxes/keepalived.conf /etc/keepalived/keepalived.conf
root@osboxes:/home/osboxes#
```

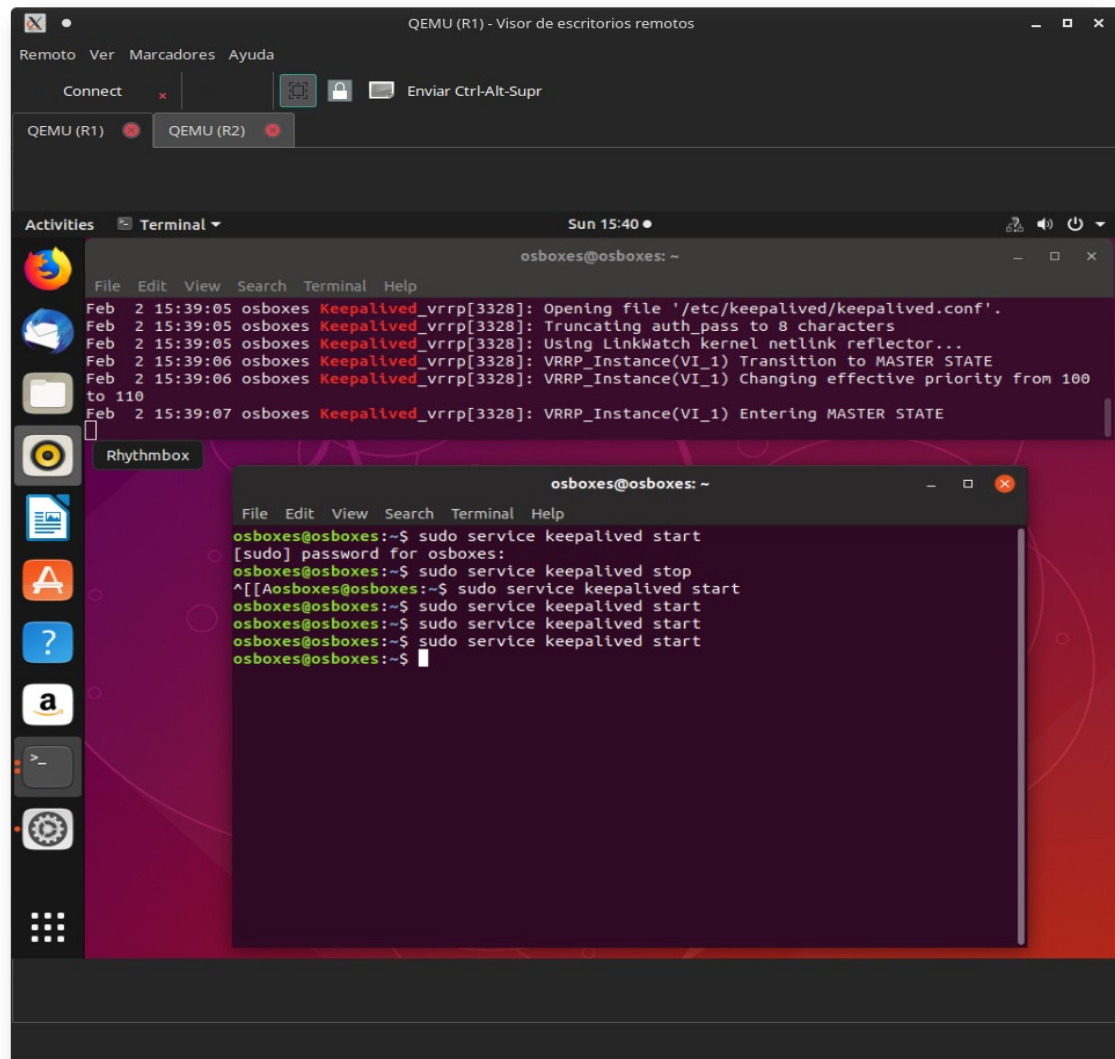
Y finalmente activaremos el servicio.

Redundancia de enrutadores

Pruebas

Ya con los 2 servicios activos comprobamos el estado actual

R1 esta en MASTER



QEMU (R1) - Visor de escritorios remotos

Remoto Ver Marcadores Ayuda

Connect x Enviar Ctrl-Alt-Supr

QEMU (R1) QEMU (R2)

Activities Terminal Sun 15:40

osboxes@osboxes: ~

```
Feb 2 15:39:05 osboxes Keepalived_vrrp[3328]: Opening file '/etc/keepalived/keepalived.conf'.
Feb 2 15:39:05 osboxes Keepalived_vrrp[3328]: Truncating auth_pass to 8 characters
Feb 2 15:39:05 osboxes Keepalived_vrrp[3328]: Using LinkWatch kernel netlink reflector...
Feb 2 15:39:06 osboxes Keepalived_vrrp[3328]: VRRP_Instance(VI_1) Transition to MASTER STATE
Feb 2 15:39:06 osboxes Keepalived_vrrp[3328]: VRRP_Instance(VI_1) Changing effective priority from 100 to 110
Feb 2 15:39:07 osboxes Keepalived_vrrp[3328]: VRRP_Instance(VI_1) Entering MASTER STATE
```

Rhythmbox

osboxes@osboxes: ~

```
File Edit View Search Terminal Help
osboxes@osboxes:~$ sudo service keepalived start
[sudo] password for osboxes:
osboxes@osboxes:~$ sudo service keepalived stop
^[[Aosboxes@osboxes:~$ sudo service keepalived start
osboxes@osboxes:~$ sudo service keepalived start
osboxes@osboxes:~$ sudo service keepalived start
osboxes@osboxes:~$ sudo service keepalived start
osboxes@osboxes:~$
```

Redundancia de enrutadores

Y el R2 estara en BACKUP

The screenshot shows a QEMU (R2) - Visor de escritorios remotos window. The main terminal displays the following logs:

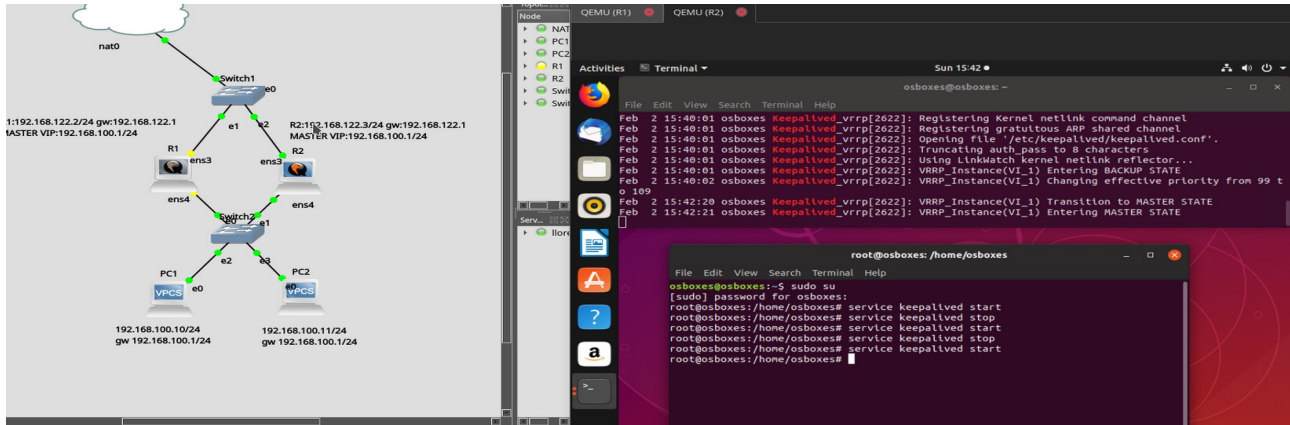
```
Feb 2 15:40:01 osboxes Keepalived_healthcheckers[2621]: Opening file '/etc/keepalived/keepalived.conf'.
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Registering Kernel netlink reflector
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Registering Kernel netlink command channel
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Registering gratuitous ARP shared channel
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Opening file '/etc/keepalived/keepalived.conf'.
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Truncating auth_pass to 8 characters
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: Using Linkwatch kernel netlink reflector...
Feb 2 15:40:01 osboxes Keepalived_vrrp[2622]: VRRP_Instance(VI_1) Entering BACKUP STATE
Feb 2 15:40:02 osboxes Keepalived_vrrp[2622]: VRRP_Instance(VI_1) Changing effective priority from 99 to 109
```

A second terminal window, titled 'root@osboxes: /home/osboxes', shows the following commands and output:

```
osboxes:~$ sudo su
[sudo] password for osboxes:
root@osboxes:/home/osboxes# service keepalived start
root@osboxes:/home/osboxes# service keepalived stop
root@osboxes:/home/osboxes# service keepalived start
root@osboxes:/home/osboxes# service keepalived stop
root@osboxes:/home/osboxes# service keepalived start
root@osboxes:/home/osboxes#
```

Redundancia de enrutadores

Sin embargo como se aprecia en la misma captura suspendemos R1 y el estado del servicio R2 se vuelve MASTER automaticamente



Y vemos como los clientes aun siguen teniendo acceso a Internet

```
PC2> ping 8.8.8.8
84 bytes from 8.8.8.8 icmp_seq=1 ttl=54 time=10.864 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=54 time=10.729 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=54 time=10.658 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=54 time=10.873 ms
84 bytes from 8.8.8.8 icmp_seq=5 ttl=54 time=11.101 ms
```