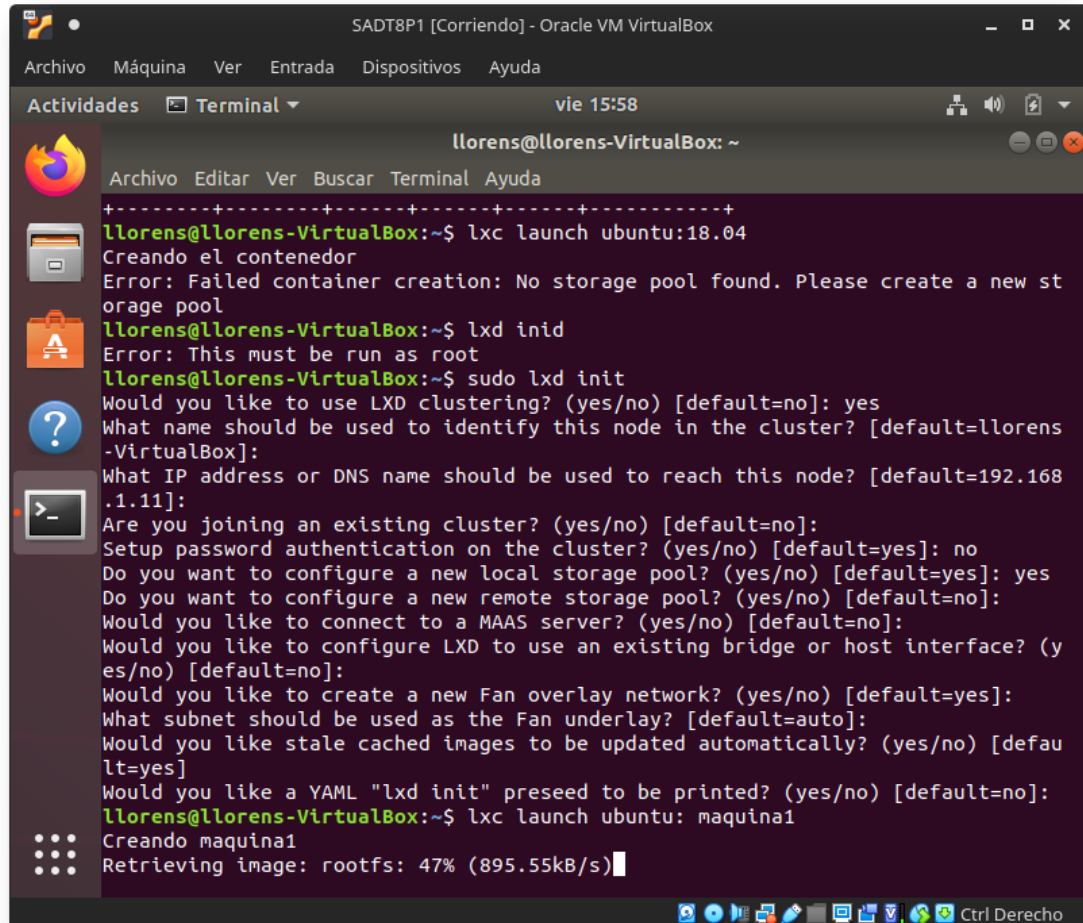


## Práctica de virtualización con contenedores LXC

Primeramente preparamos la maquina virtual de Ubuntu donde vamos a realizar la practica con LXC instalado

Las opciones elegimos como es habitualmente la configuración predeterminada.

Empezamos creando la Maquina1



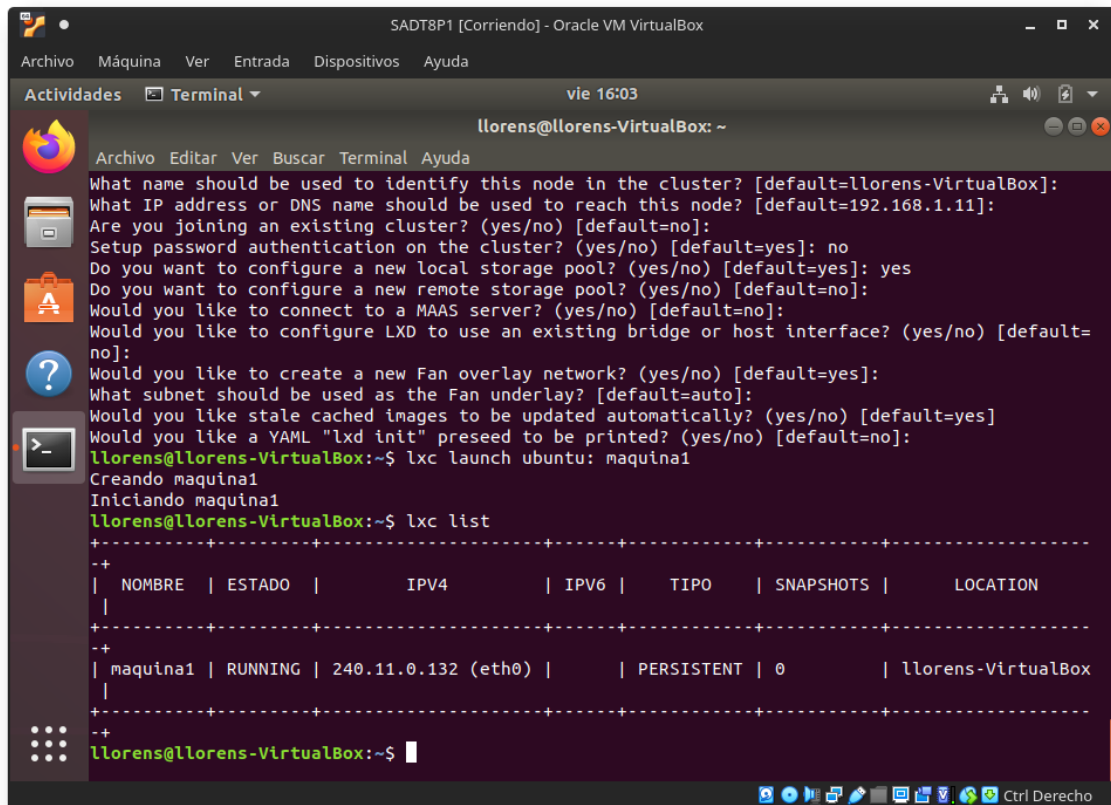
```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo  Máquina  Ver  Entrada  Dispositivos  Ayuda

Actividades  Terminal  vie 15:58

llorens@llorens-VirtualBox: ~
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
+-----+-----+-----+-----+-----+
llorens@llorens-VirtualBox:~$ lxc launch ubuntu:18.04
Creando el contenedor
Error: Failed container creation: No storage pool found. Please create a new storage pool
llorens@llorens-VirtualBox:~$ lxd init
Error: This must be run as root
llorens@llorens-VirtualBox:~$ sudo lxd init
Would you like to use LXD clustering? (yes/no) [default=no]: yes
What name should be used to identify this node in the cluster? [default=llorens-VirtualBox]:
What IP address or DNS name should be used to reach this node? [default=192.168.1.11]:
Are you joining an existing cluster? (yes/no) [default=no]:
Setup password authentication on the cluster? (yes/no) [default=yes]: no
Do you want to configure a new local storage pool? (yes/no) [default=yes]: yes
Do you want to configure a new remote storage pool? (yes/no) [default=no]:
Would you like to connect to a MAAS server? (yes/no) [default=no]:
Would you like to configure LXD to use an existing bridge or host interface? (yes/no) [default=no]:
Would you like to create a new Fan overlay network? (yes/no) [default=yes]:
What subnet should be used as the Fan underlay? [default=auto]:
Would you like stale cached images to be updated automatically? (yes/no) [default=yes]:
Would you like a YAML "lxd init" preseed to be printed? (yes/no) [default=no]:
llorens@llorens-VirtualBox:~$ lxc launch ubuntu: maquina1
Creando maquina1
Retrieving image: rootfs: 47% (895.55kB/s)
```

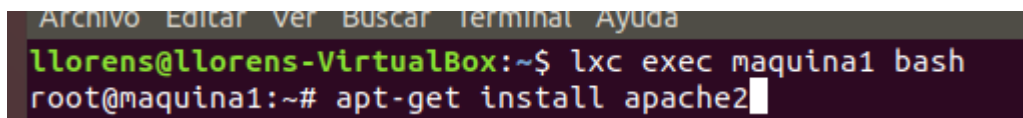
## Práctica de virtualización con contenedores LXC

Una vez creado listaremos para comprobarlo



```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo Máquina Ver Entrada Dispositivos Ayuda
Actividades Terminal vie 16:03
llorens@llorens-VirtualBox: ~
Archivo Editar Ver Buscar Terminal Ayuda
What name should be used to identify this node in the cluster? [default=llorens-VirtualBox]:
What IP address or DNS name should be used to reach this node? [default=192.168.1.11]:
Are you joining an existing cluster? (yes/no) [default=no]:
Setup password authentication on the cluster? (yes/no) [default=yes]: no
Do you want to configure a new local storage pool? (yes/no) [default=yes]: yes
Do you want to configure a new remote storage pool? (yes/no) [default=no]:
Would you like to connect to a MAAS server? (yes/no) [default=no]:
Would you like to configure LXD to use an existing bridge or host interface? (yes/no) [default=no]:
Would you like to create a new Fan overlay network? (yes/no) [default=yes]:
What subnet should be used as the Fan underlay? [default=auto]:
Would you like stale cached images to be updated automatically? (yes/no) [default=yes]:
Would you like a YAML "lxd init" preseed to be printed? (yes/no) [default=no]:
llorens@llorens-VirtualBox:~$ lxc launch ubuntu: maquina1
Creando maquina1
Iniciando maquina1
llorens@llorens-VirtualBox:~$ lxc list
+-----+-----+-----+-----+-----+-----+-----+-----+
+ NOMBRE | ESTADO | IPV4 | IPV6 | TIPO | SNAPSHOTS | LOCATION |
+-----+-----+-----+-----+-----+-----+-----+-----+
+ maquina1 | RUNNING | 240.11.0.132 (eth0) | | PERSISTENT | 0 | llorens-VirtualBox |
+-----+-----+-----+-----+-----+-----+-----+-----+
+
llorens@llorens-VirtualBox:~$
```

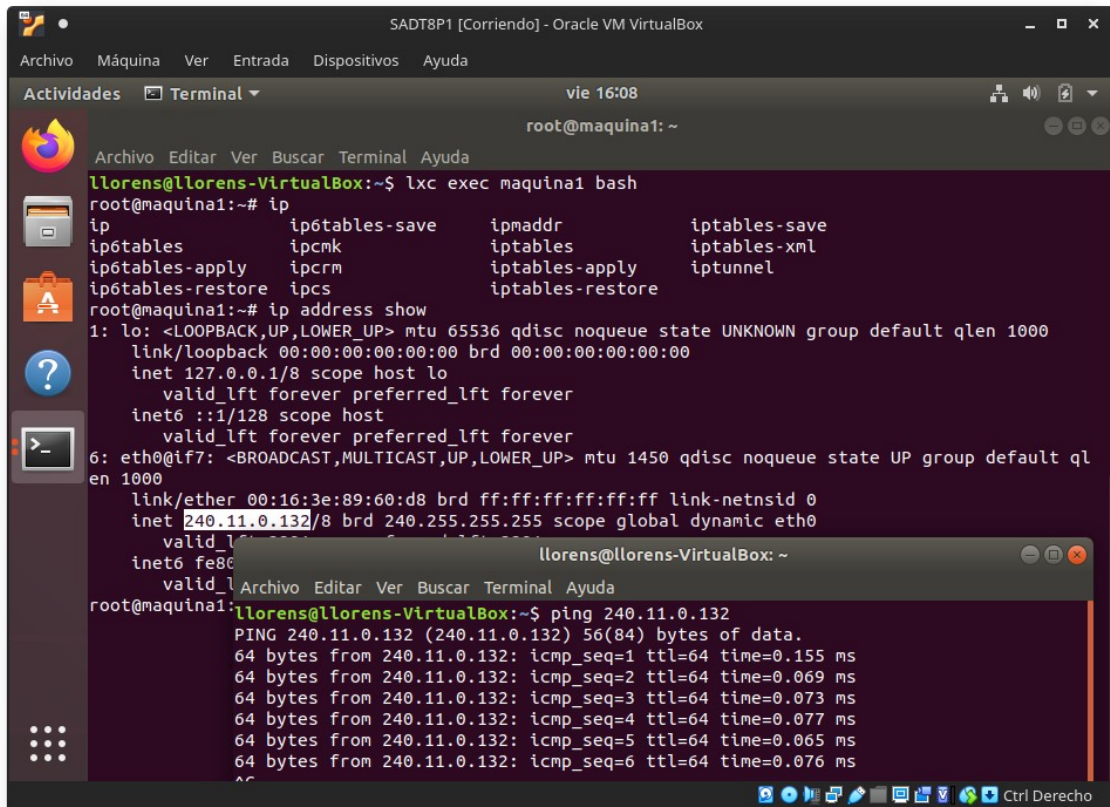
Entramos dentro del shell bash de la maquina



```
Archivo Editar Ver Buscar Terminal Ayuda
llorens@llorens-VirtualBox:~$ lxc exec maquina1 bash
root@maquina1:~# apt-get install apache2
```

## Práctica de virtualización con contenedores LXC

Seguidamente hago mis comprobaciones por ejemplo como indicaba anteriormente la ip de esta maquina es 240.11.0.132/8



```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo  Máquina  Ver  Entrada  Dispositivos  Ayuda

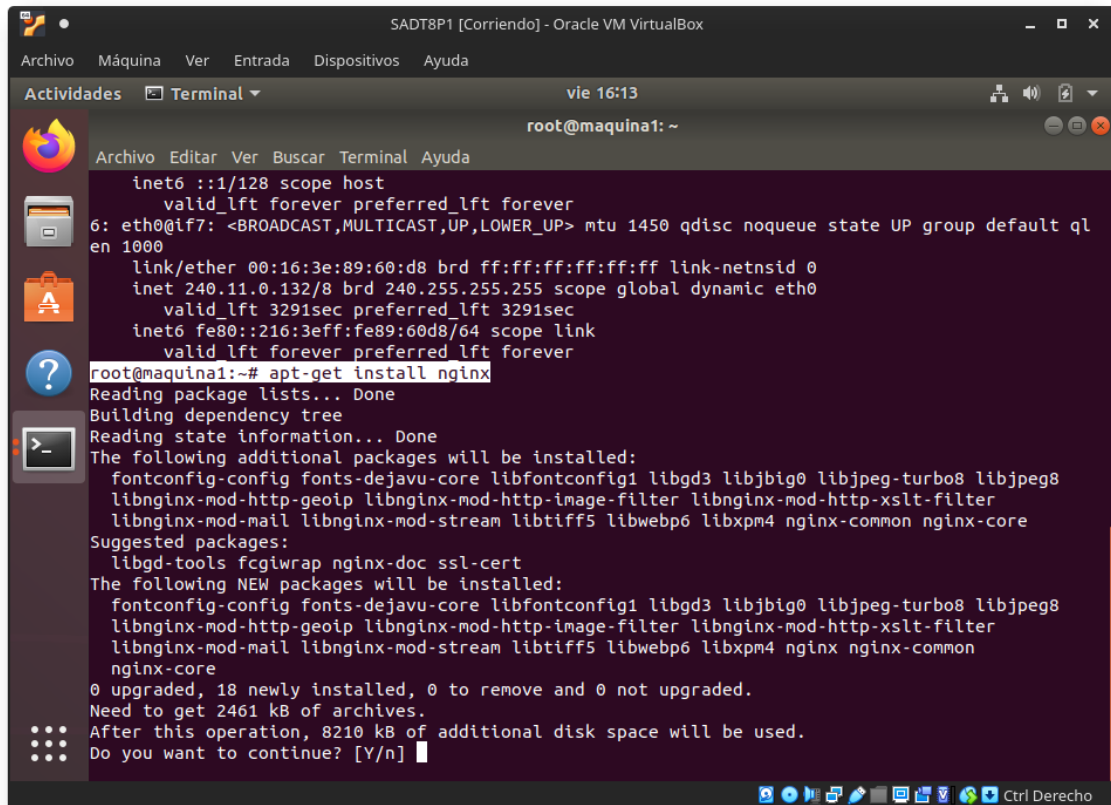
Actividades  Terminal v
vie 16:08
root@maquina1: ~

Archivo  Editar  Ver  Buscar  Terminal  Ayuda
llorens@llorens-VirtualBox:~$ lxc exec maquina1 bash
root@maquina1:~# ip
ip
ip6tables      iptables-save  ipnaddr        iptables-save
ip6tables      ipcmk          iptables        iptables-xml
ip6tables-apply ipcrm          iptables-apply iptunnel
ip6tables-restore ipcs           iptables-restore
root@maquina1:~# ip address show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
6: eth0@if7: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc noqueue state UP group default ql
en 1000
    link/ether 00:16:3e:89:60:d8 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 240.11.0.132/8 brd 240.255.255.255 scope global dynamic eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::163e:8960:d8d8:fffe scope link
        valid_lft forever preferred_lft forever
root@maquina1:~# llorens@llorens-VirtualBox:~$ ping 240.11.0.132
PING 240.11.0.132 (240.11.0.132) 56(84) bytes of data.
 64 bytes from 240.11.0.132: icmp_seq=1 ttl=64 time=0.155 ms
 64 bytes from 240.11.0.132: icmp_seq=2 ttl=64 time=0.069 ms
 64 bytes from 240.11.0.132: icmp_seq=3 ttl=64 time=0.073 ms
 64 bytes from 240.11.0.132: icmp_seq=4 ttl=64 time=0.077 ms
 64 bytes from 240.11.0.132: icmp_seq=5 ttl=64 time=0.065 ms
 64 bytes from 240.11.0.132: icmp_seq=6 ttl=64 time=0.076 ms
^C
```

Se aprecia que tiene ping desde el huesped.

## Práctica de virtualización con contenedores LXC

Ahora instalaremos en Maquina1 el server web Nginx y comprobaremos como esta operativo

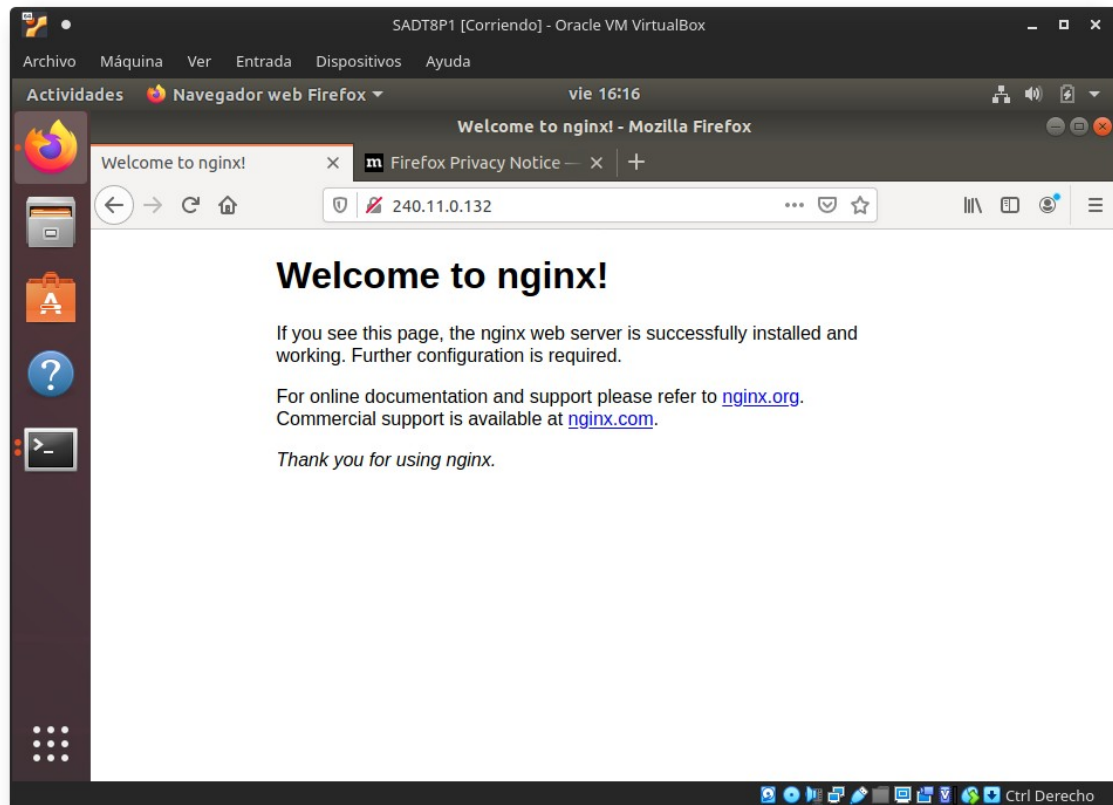


The screenshot shows a terminal window titled "SADT8P1 [Corriendo] - Oracle VM VirtualBox". The terminal is running on a system named "Maquina1" with the prompt "root@maquina1: ~". The user has entered the command "apt-get install nginx". The terminal output shows the following:

```
root@maquina1:~# apt-get install nginx
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  fontconfig-config fonts-dejavu-core libfontconfig1 libgd3 libjpeg-turbo8 libjpeg8
  libnginx-mod-http-geoip libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter
  libnginx-mod-mail libnginx-mod-stream libtiff5 libwebp6 libxpm4 nginx-common nginx-core
Suggested packages:
  libgd-tools fcgiwrap nginx-doc ssl-cert
The following NEW packages will be installed:
  fontconfig-config fonts-dejavu-core libfontconfig1 libgd3 libjpeg-turbo8 libjpeg8
  libnginx-mod-http-geoip libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter
  libnginx-mod-mail libnginx-mod-stream libtiff5 libwebp6 libxpm4 nginx nginx-common
  nginx-core
0 upgraded, 18 newly installed, 0 to remove and 0 not upgraded.
Need to get 2461 kB of archives.
After this operation, 8210 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

## Práctica de virtualización con contenedores LXC

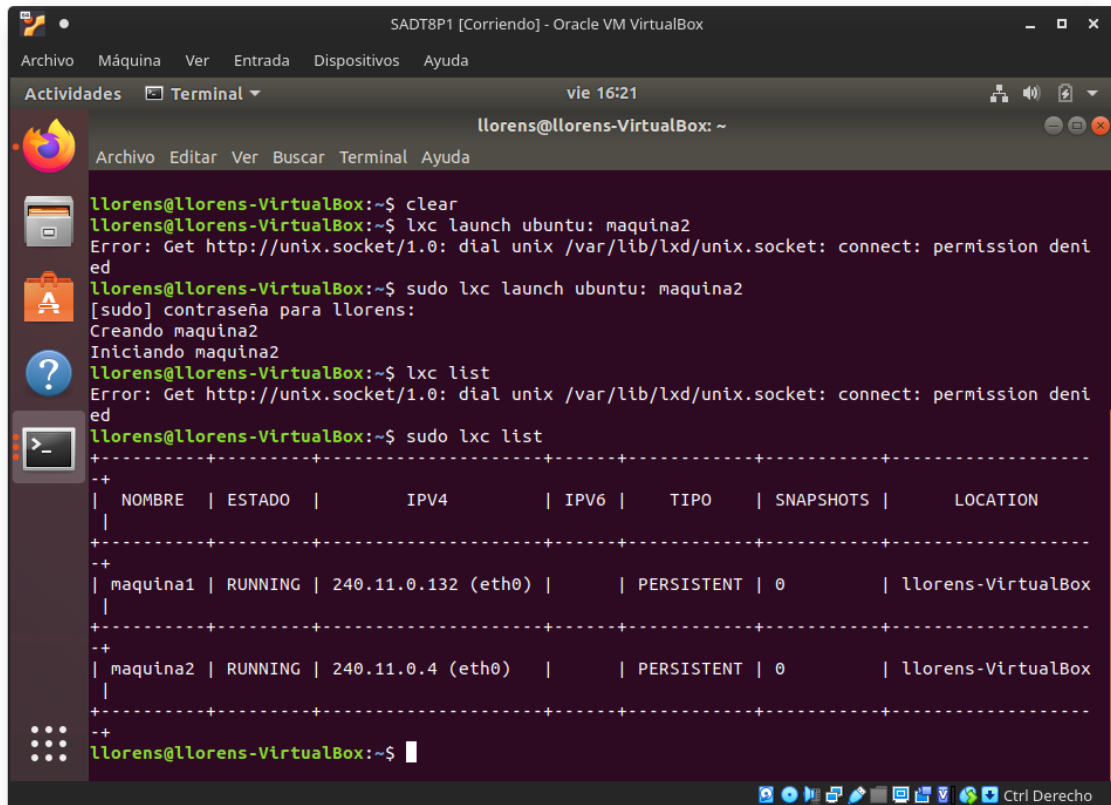
Se aprecia que el servicio ya esta operativo desde la IP 240.11.0.132



## Práctica de virtualización con contenedores LXC

Ahora vamos a instalar la maquina2 y la listaremos.

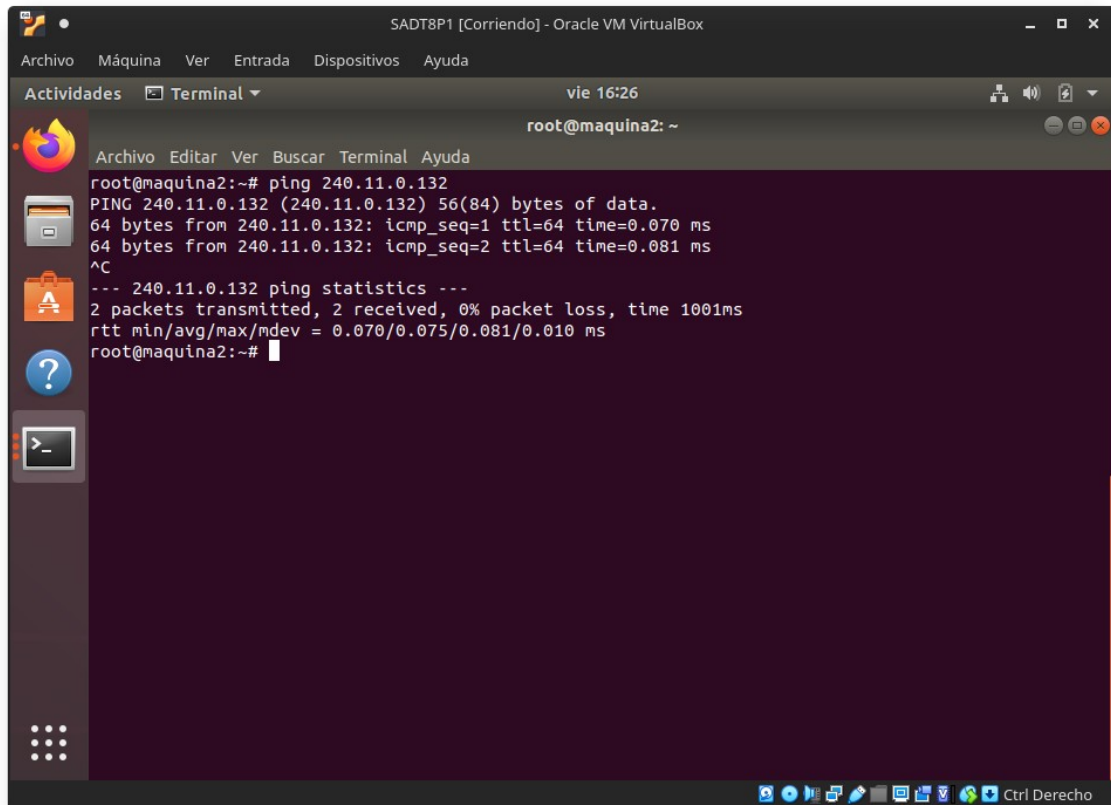
Esta vez a tardado menos tiempo en crearla



```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo  Máquina  Ver  Entrada  Dispositivos  Ayuda
Actividades  Terminal
vie 16:21
llorens@llorens-VirtualBox: ~
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
llorens@llorens-VirtualBox:~$ clear
llorens@llorens-VirtualBox:~$ lxc launch ubuntu: maquina2
Error: Get http://unix.socket/1.0: dial unix /var/lib/lxd/unix.socket: connect: permission denied
llorens@llorens-VirtualBox:~$ sudo lxc launch ubuntu: maquina2
[sudo] contraseña para llorens:
Creando maquina2
Iniciando maquina2
llorens@llorens-VirtualBox:~$ lxc list
Error: Get http://unix.socket/1.0: dial unix /var/lib/lxd/unix.socket: connect: permission denied
llorens@llorens-VirtualBox:~$ sudo lxc list
+-----+-----+-----+-----+-----+-----+-----+
+ | NOMBRE | ESTADO | IPV4 | IPV6 | TIPO | SNAPSHTS | LOCATION |
+ |-----+-----+-----+-----+-----+-----+-----+
+ | maquina1 | RUNNING | 240.11.0.132 (eth0) | | PERSISTENT | 0 | llorens-VirtualBox |
+ |-----+-----+-----+-----+-----+-----+-----+
+ | maquina2 | RUNNING | 240.11.0.4 (eth0) | | PERSISTENT | 0 | llorens-VirtualBox |
+ |-----+-----+-----+-----+-----+-----+-----+
+
llorens@llorens-VirtualBox:~$
```

## Práctica de virtualización con contenedores LXC

Aquí comprobamos que entre maquina1 y maquina2 se ven mediante PING



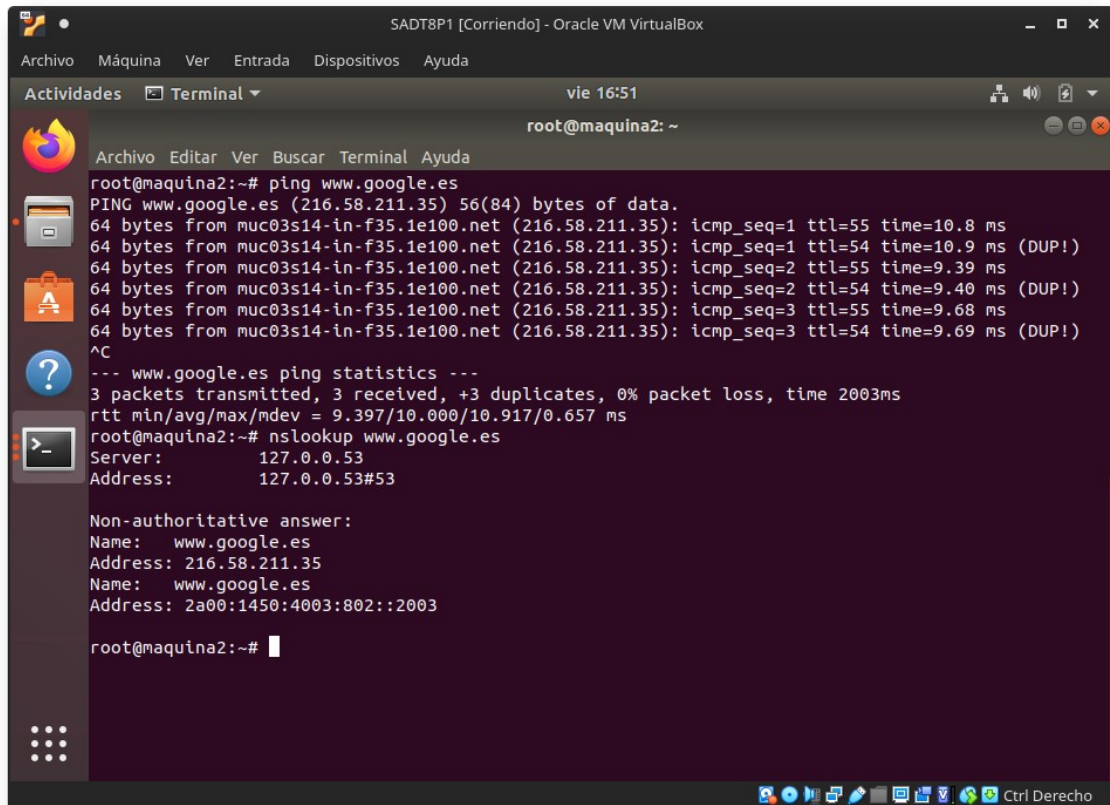
The screenshot shows a terminal window titled "SADT8P1 [Corriendo] - Oracle VM VirtualBox". The window has a menu bar with "Archivo", "Máquina", "Ver", "Entrada", "Dispositivos", and "Ayuda". Below the menu bar, there is a status bar showing "vie 16:26" and "root@maquina2: ~". The terminal content shows a ping command being executed from root@maquina2 to 240.11.0.132. The output indicates that the ping was successful, with 2 packets transmitted, 2 received, and 0% packet loss. The round-trip time (rtt) is shown as 0.070/0.075/0.081/0.010 ms.

```
root@maquina2:~# ping 240.11.0.132
PING 240.11.0.132 (240.11.0.132) 56(84) bytes of data:
64 bytes from 240.11.0.132: icmp_seq=1 ttl=64 time=0.070 ms
64 bytes from 240.11.0.132: icmp_seq=2 ttl=64 time=0.081 ms
^C
--- 240.11.0.132 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.070/0.075/0.081/0.010 ms
root@maquina2:~#
```



## Práctica de virtualización con contenedores LXC

También comprobamos que tenga acceso al Internet Exterio con un ping a [www.google.es](http://www.google.es) y pese que he realizado un nslookup, confirmamos que también funciona la resolución de nombre DNS



The screenshot shows a terminal window titled "SADT8P1 [Corriendo] - Oracle VM VirtualBox". The terminal is running commands to test internet connectivity and DNS resolution. The user is logged in as root on a machine named maquina2.

```
root@maquina2:~# ping www.google.es
PING www.google.es (216.58.211.35) 56(84) bytes of data.
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=1 ttl=55 time=10.8 ms
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=1 ttl=54 time=10.9 ms (DUP!)
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=2 ttl=55 time=9.39 ms
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=2 ttl=54 time=9.40 ms (DUP!)
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=3 ttl=55 time=9.68 ms
64 bytes from muc03s14-in-f35.1e100.net (216.58.211.35): icmp_seq=3 ttl=54 time=9.69 ms (DUP!)
^C
--- www.google.es ping statistics ---
3 packets transmitted, 3 received, +3 duplicates, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 9.397/10.000/10.917/0.657 ms
root@maquina2:~# nslookup www.google.es
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   www.google.es
Address: 216.58.211.35
Name:   www.google.es
Address: 2a00:1450:4003:802::2003

root@maquina2:~#
```

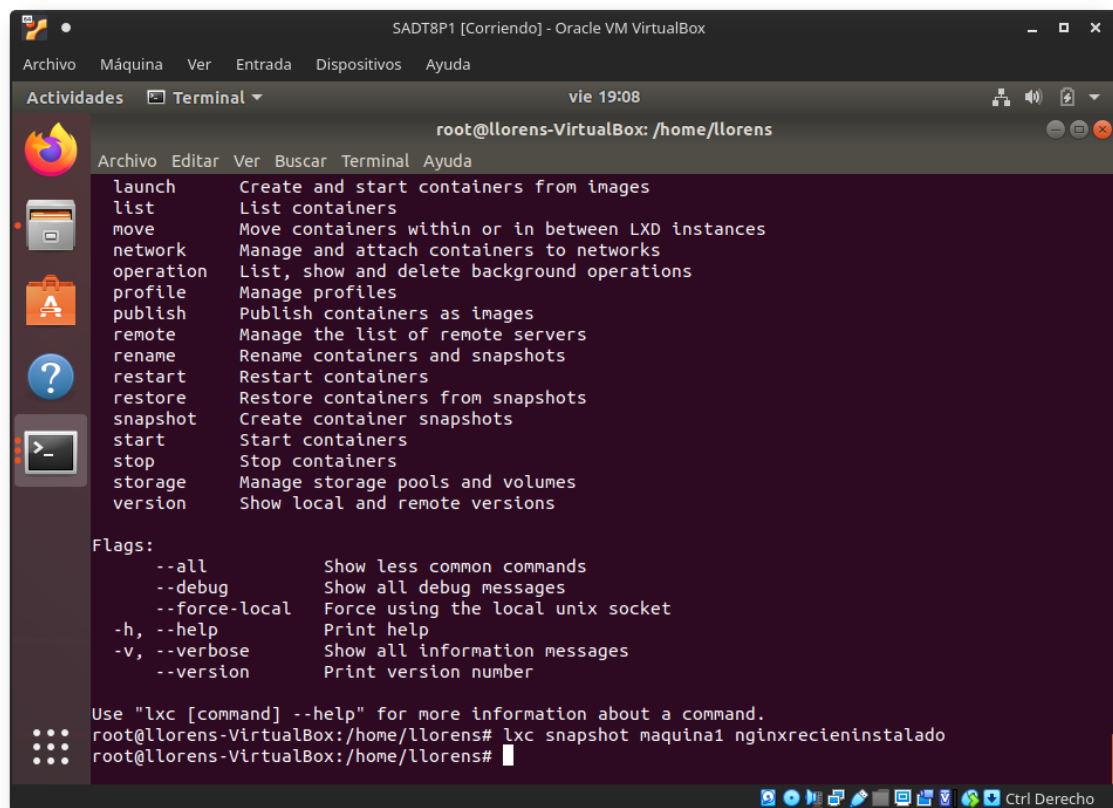


## Práctica de virtualización con contenedores LXC

Ahora vamos a probar a gestionar los contenedores, pararlos ,etc

Primero imaginemos que la maquina1 que tiene Nginx recién instalado vamos a realizar unas pruebas y necesitamos crear un snapshot

Como se aprecia en la captura se crea un snapshot “nginxrecieninstalado”



```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo  Máquina  Ver  Entrada  Dispositivos  Ayuda
Actividades  Terminal vie 19:08
root@llorens-VirtualBox: /home/llorens

Archivo Editar Ver Buscar Terminal Ayuda
launch Create and start containers from images
list List containers
move Move containers within or in between LXD instances
network Manage and attach containers to networks
operation List, show and delete background operations
profile Manage profiles
publish Publish containers as images
remote Manage the list of remote servers
rename Rename containers and snapshots
restart Restart containers
restore Restore containers from snapshots
snapshot Create container snapshots
start Start containers
stop Stop containers
storage Manage storage pools and volumes
version Show local and remote versions

Flags:
--all Show less common commands
--debug Show all debug messages
--force-local Force using the local unix socket
-h, --help Print help
-v, --verbose Show all information messages
--version Print version number

Use "lxc [command] --help" for more information about a command.
root@llorens-VirtualBox:/home/llorens# lxc snapshot maquina1 nginxrecieninstalado
root@llorens-VirtualBox:/home/llorens#
```

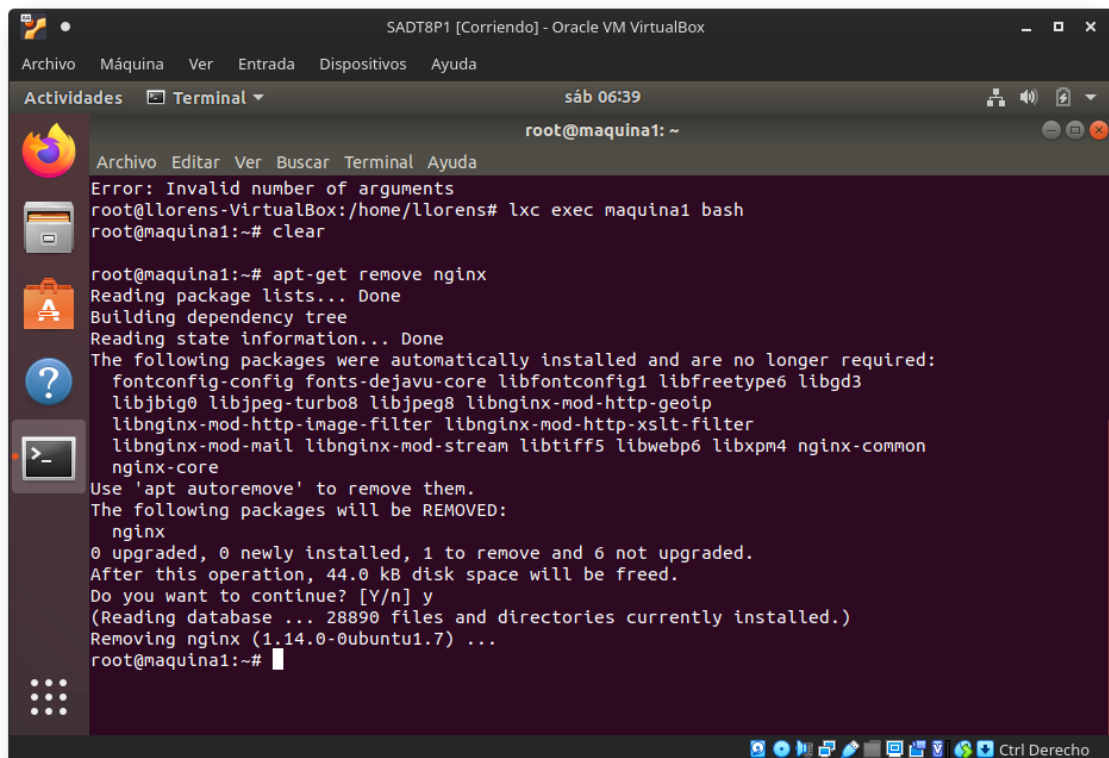
# Práctica de virtualización con contenedores LXC

## Snapshots

Las pruebas serán las siguiente:

Entraremos en la shell de maquina1 desinstalamos el Nginx, trataremos de entrar desde el navegador web como hicimos anteriormente. Trataremos de restaurar la maquina desde el screenshot de “nginxrecieninstalado” y luego si se ha restaurado lo deberíamos tener otra vez instalado el servicio web. Queda claro que a la practica es algo absurda pero asi veremos su funcionamiento.

Desinstalamos



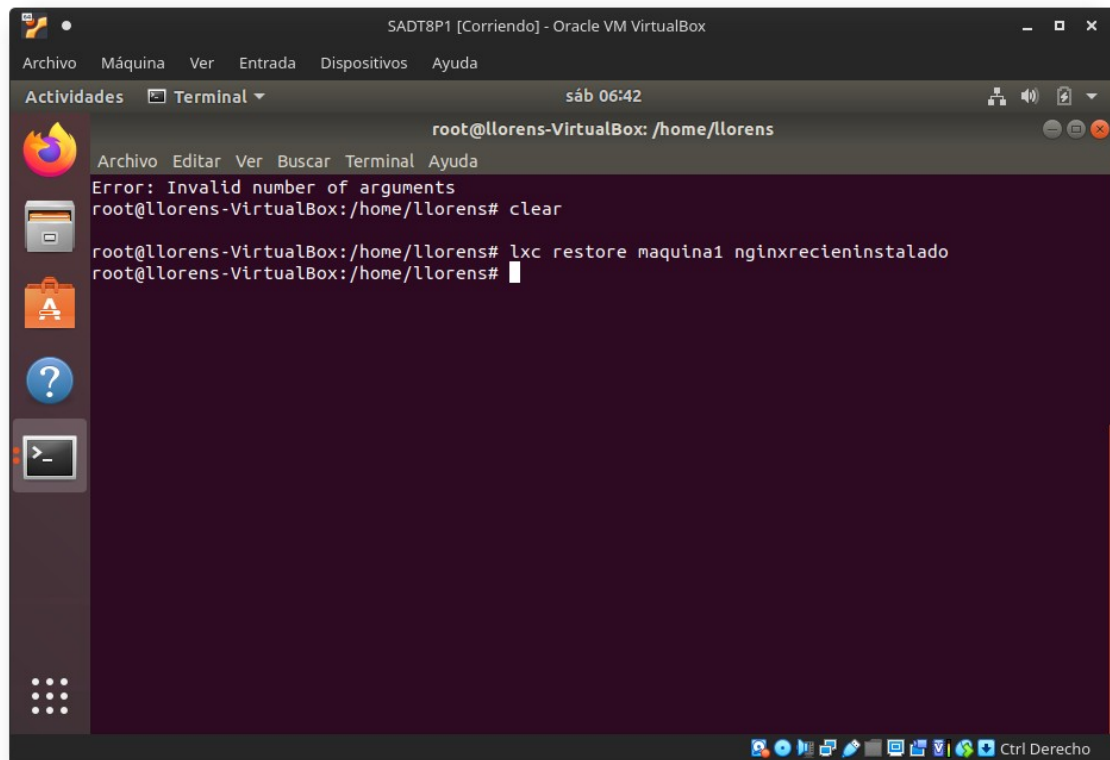
```
SADT8P1 [Corriendo] - Oracle VM VirtualBox
Archivo  Máquina  Ver  Entrada  Dispositivos  Ayuda
Actividades  Terminal  sáb 06:39
root@maquina1: ~

Archivo  Editar  Ver  Buscar  Terminal  Ayuda
Error: Invalid number of arguments
root@llorens-VirtualBox:/home/llorens# lxc exec maquina1 bash
root@maquina1:~# clear

root@maquina1:~# apt-get remove nginx
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  fontconfig-config fonts-dejavu-core libfontconfig1 libfreetype6 libgd3
  libjbig0 libjpeg-turbo8 libjpeg8 libnginx-mod-http-geoip
  libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter
  libnginx-mod-mail libnginx-mod-stream libtiff5 libwebp6 libxpm4 nginx-common
  nginx-core
Use 'apt autoremove' to remove them.
The following packages will be REMOVED:
  nginx
0 upgraded, 0 newly installed, 1 to remove and 6 not upgraded.
After this operation, 44.0 kB disk space will be freed.
Do you want to continue? [Y/n] y
(Reading database ... 28890 files and directories currently installed.)
Removing nginx (1.14.0-0ubuntu1.7) ...
root@maquina1:~#
```

# Práctica de virtualización con contenedores LXC

Restauramos el screenshot



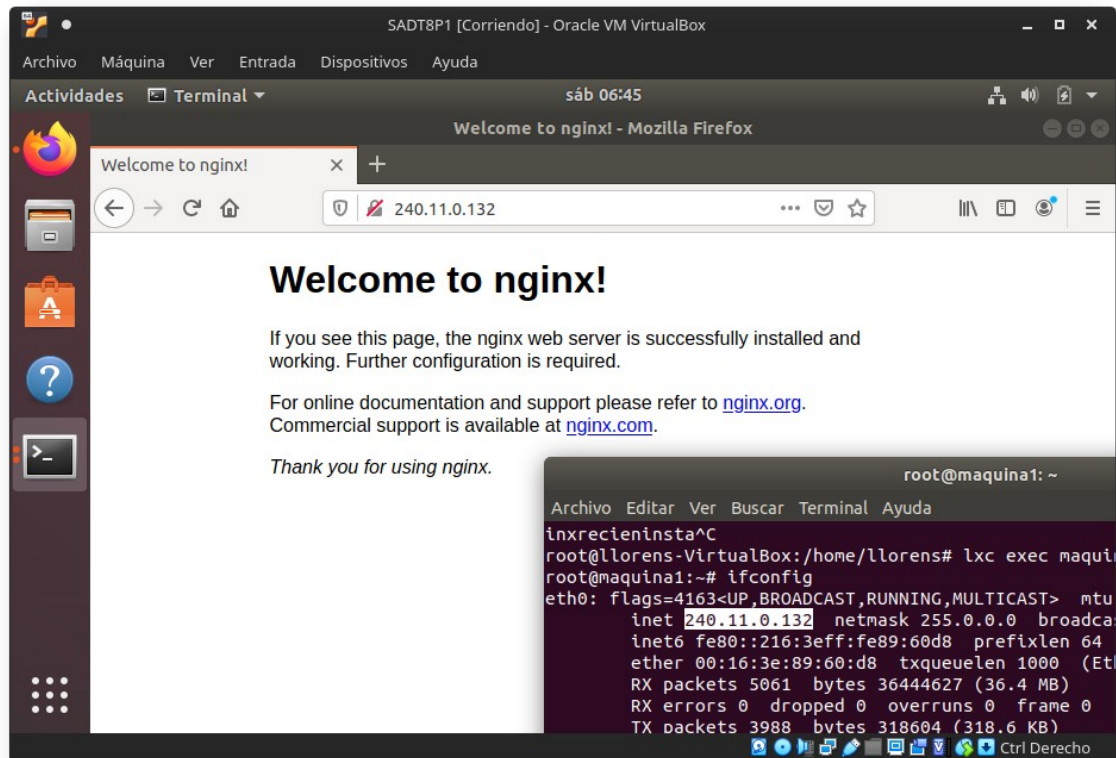
The screenshot shows a terminal window titled "SADT8P1 [Corriendo] - Oracle VM VirtualBox". The window has a menu bar with "Archivo", "Máquina", "Ver", "Entrada", "Dispositivos", and "Ayuda". Below the menu bar, there is a status bar showing "sáb 06:42" and a window title bar with "root@llorens-VirtualBox: /home/llorens". The terminal content shows the following commands and output:

```
root@llorens-VirtualBox: /home/llorens
Error: Invalid number of arguments
root@llorens-VirtualBox: /home/llorens# clear
root@llorens-VirtualBox: /home/llorens# lxc restore maquina1 nginxrecieninstalado
root@llorens-VirtualBox: /home/llorens#
```

The terminal window is part of a desktop environment with a sidebar on the left containing icons for "Actividades", "Terminal", and other applications. The bottom of the window shows a system tray with various icons and the text "Ctrl Derecho".

## Práctica de virtualización con contenedores LXC

Y como se aprecia se puede restaurar.



# Práctica de virtualización con contenedores LXC

## “Sacar los contenedores fuera”

Ahora vamos configuraremos los contenedores para que al menos alguno de ellos se vean/funcionen servicios, etc desde cualquier maquina externa. Como la maquina virtual de la maquina de la practica esta en modo Adaptador Puente podre ver la web de Nginx desde la maquina huésped.

Para ello tendremos que crear unas reglas en el cortafuegos con IPTABLES

Primeramente averiguamos las IPs tanto del contenedor como de la maquina virtual

Maquina virtual: 192.168.1.11

IP maquina1: 240.11.0.132

Creamos la regla

Sin querer por copiar y pegar se me paso editar la interfaz de red dado que la primera estaba con “eth0” y la correcta era “enp0s3”

```
PORT=80 PUBLIC_IP=192.168.1.11 CONTAINER_IP=240.11.0.132 \  
sudo -E bash -c 'iptables -t nat -I PREROUTING -i enp0s3 -p TCP -d $PUBLIC_IP --dport $PORT -j DNAT --to-destination $CONTAINER_IP:$PORT -m comment --comment "regla de maquina1"'
```



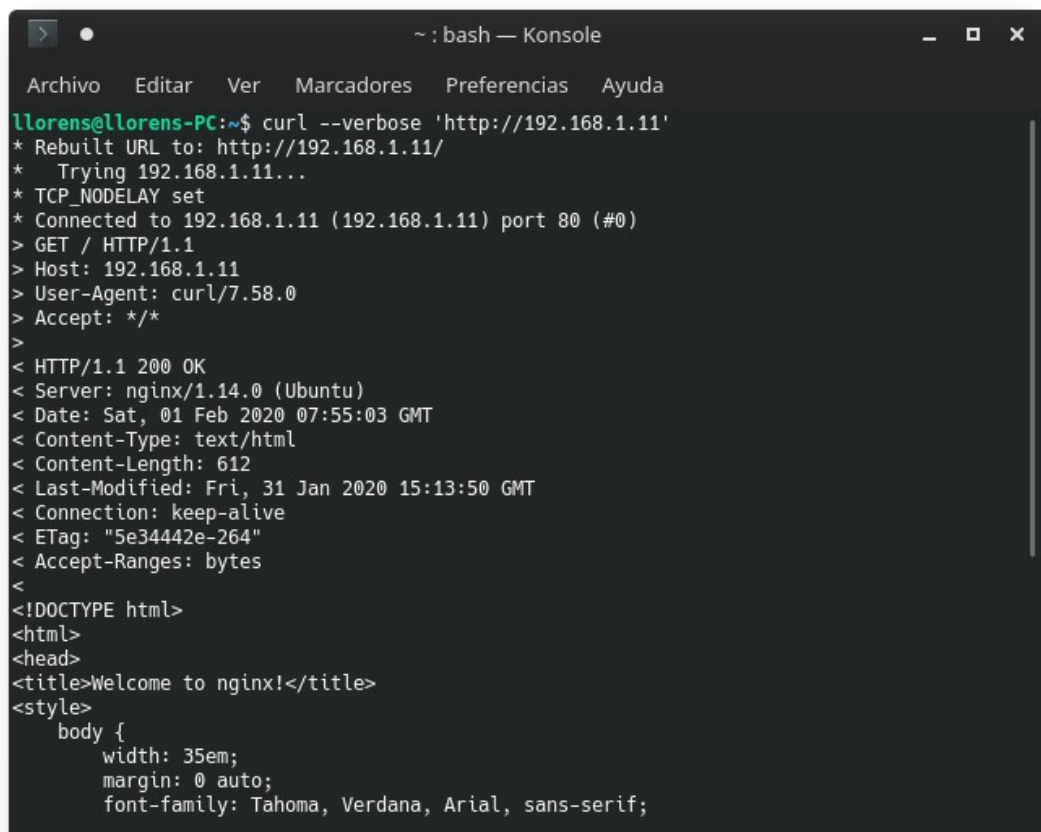
```
SADT8P1 [Corriendo] - Oracle VM VirtualBox  
Archivo Máquina Ver Entrada Dispositivos Ayuda  
Actividades Terminal  
sáb 08:52  
root@llorens-VirtualBox: /home/llorens  
root@llorens-VirtualBox:/home/llorens# PORT=80 PUBLIC_IP=192.168.1.11 CONTAINER_IP=240.11.0.132 \  
> sudo -E bash -c 'iptables -t nat -I PREROUTING -i enp0s3 -p TCP -d $PUBLIC_IP --dport $PORT -j DNAT --to-destination $CONTAINER_IP:$PORT -m com  
ment --comment "regla de maquina1"  
root@llorens-VirtualBox:/home/llorens# sudo iptables -t nat -L PREROUTING  
Chain PREROUTING (policy ACCEPT)  
target prot opt source destination  
DNAT tcp -- anywhere llorens-VirtualBox tcp dpt:http /* regla de maquina1 */ to:240.11.0.132:80  
DNAT tcp -- anywhere llorens-VirtualBox tcp dpt:http /* forward to the Nginx container */ to:240.11.0.132:80  
root@llorens-VirtualBox:/home/llorens#
```

## Práctica de virtualización con contenedores LXC

como podremos comprobar ya funciona

tanto en el terminal de mi portatil

```
PORT=80 PUBLIC_IP=192.168.1.11 CONTAINER_IP=240.11.0.132 \  
sudo -E bash -c 'iptables -t nat -I PREROUTING -i enp0s3 -p TCP -d $PUBLIC_IP --dport  
$PORT -j DNAT --to-destination $CONTAINER_IP:$PORT -m comment --comment "regla de  
maquina1"'
```



```
~ : bash — Konsole  
Archivo  Editar  Ver  Marcadores  Preferencias  Ayuda  
llorens@llorens-PC:~$ curl --verbose 'http://192.168.1.11'  
* Rebuilt URL to: http://192.168.1.11/  
* Trying 192.168.1.11...  
* TCP_NODELAY set  
* Connected to 192.168.1.11 (192.168.1.11) port 80 (#0)  
> GET / HTTP/1.1  
> Host: 192.168.1.11  
> User-Agent: curl/7.58.0  
> Accept: */*  
>  
< HTTP/1.1 200 OK  
< Server: nginx/1.14.0 (Ubuntu)  
< Date: Sat, 01 Feb 2020 07:55:03 GMT  
< Content-Type: text/html  
< Content-Length: 612  
< Last-Modified: Fri, 31 Jan 2020 15:13:50 GMT  
< Connection: keep-alive  
< ETag: "5e34442e-264"  
< Accept-Ranges: bytes  
<  
<!DOCTYPE html>  
<html>  
<head>  
<title>Welcome to nginx!</title>  
<style>  
  body {  
    width: 35em;  
    margin: 0 auto;  
    font-family: Tahoma, Verdana, Arial, sans-serif;
```

## Práctica de virtualización con contenedores LXC

como el propio navegador web con la ip local de la maquina virtual

