

[Fort]Práctica 3: Securizando Aplicaciones

1. Abre un navegador y realiza una descarga

Revisa con el TOP el consumo de CPU

Firefox (Proceso 110216) está consumiendo en torno al 60% de la CPU como podemos ver en la siguiente captura:

| PID | USER | PR | NI | VIRT | RES | SHR | S | %CPU | %MEM | TIME+ | COMMAND |
|--------|------|----|----|--------|--------|--------|---|------|------|---------|----------|
| 110216 | root | 20 | 0 | 10.9g | 395120 | 166124 | S | 54.8 | 19.6 | 0:31.64 | firefox+ |
| 855 | root | 20 | 0 | 448832 | 128244 | 66820 | S | 5.3 | 6.4 | 1:00.46 | Xorg |
| 1139 | root | 20 | 0 | 9612 | 4972 | 4112 | S | 3.0 | 0.2 | 3:07.68 | dbus-da+ |
| 14 | root | 20 | 0 | 0 | 0 | 0 | S | 1.3 | 0.0 | 0:05.68 | ksoftir+ |
| 1260 | root | 20 | 0 | 492548 | 48436 | 31760 | S | 1.0 | 2.4 | 0:06.62 | marco |
| 74216 | root | 20 | 0 | 0 | 0 | 0 | I | 1.0 | 0.0 | 0:00.05 | kworker+ |
| 1140 | root | 20 | 0 | 268132 | 27164 | 17328 | S | 0.7 | 1.3 | 0:35.52 | x-sessi+ |
| 125811 | root | 20 | 0 | 83060 | 18852 | 16760 | R | 0.7 | 0.9 | 0:00.02 | caja |
| 38 | root | 20 | 0 | 0 | 0 | 0 | S | 0.3 | 0.0 | 0:00.01 | kswapd0 |
| 1135 | root | 20 | 0 | 243012 | 11632 | 8584 | S | 0.3 | 0.6 | 0:14.65 | gnome-k+ |
| 1219 | root | 20 | 0 | 229412 | 2196 | 1804 | S | 0.3 | 0.1 | 0:02.78 | VBoxCli+ |
| 1238 | root | 20 | 0 | 9120 | 4564 | 4080 | S | 0.3 | 0.2 | 0:23.16 | dbus-da+ |
| 1254 | root | 20 | 0 | 164388 | 9960 | 7084 | S | 0.3 | 0.5 | 0:15.10 | at-spi2+ |
| 1261 | root | 20 | 0 | 240748 | 11612 | 6688 | S | 0.3 | 0.6 | 0:15.01 | gvfsd |
| 1303 | root | 20 | 0 | 500196 | 34052 | 22548 | S | 0.3 | 1.7 | 0:01.72 | wnck-ap+ |
| 1305 | root | 20 | 0 | 354844 | 14308 | 10116 | S | 0.3 | 0.7 | 0:16.36 | gvfs-ud+ |
| 1325 | root | 20 | 0 | 315784 | 12104 | 6872 | S | 0.3 | 0.6 | 0:14.22 | gvfs-af+ |

Usa cpulimit para reducir el consumo de CPU a 1/5 del que usa

Para realizar esto ejecutaremos los siguientes comandos:

```
cd /sys/fs/cgroup/
mkdir firefox #Creamos el cgroup para firefox
cd firefox
```

```
root@fso2025:~/Downloads# cd /sys/fs/cgroup/
root@fso2025:/sys/fs/cgroup# mkdir firefox
root@fso2025:/sys/fs/cgroup# cd firefox/
root@fso2025:/sys/fs/cgroup/firefox# ls
cgroup.controllers      cpuset.cpus.effective  memory.min
cgroup.events            cpuset.cpus.partition  memory.numa_stat
cgroup.freeze            cpuset.mems           memory.oom.group
cgroup.kill              cpuset.mems.effective memory.peak
cgroup.max.depth        cpu.stat              memory.pressure
cgroup.max.descendants  cpu.weight           memory.reclaim
cgroup.pressure          cpu.weight.nice      memory.stat
cgroup.procs             io.max               memory.swap.current
cgroup.stat              io.pressure          memory.swap.events
cgroup.subtree_control  io.stat              memory.swap.high
cgroup.threads           io.weight           memory.swap.max
cgroup.type              memory.current      memory.zswap.current
cpu.idle                memory.events       memory.zswap.max
cpu.max                 memory.events.local  pids.current
cpu.max.burst            memory.high          pids.events
cpu.pressure             memory.low           pids.max
cpuset.cpus              memory.max          pids.peak
root@fso2025:/sys/fs/cgroup/firefox#
```

Tras eso añadimos firefox al cgroup y procedemos a limitar su consumo de CPU

```
echo 110216 > cgroup.procs#Metemos el proceso de firefox en el cgroup
echo 200000 1000000 > cpu.max #Limitamos el uso de CPU al 20%
```

```
root@fso2025:/sys/fs/cgroup/firefox# echo 110216 > cgroup.procs
root@fso2025:/sys/fs/cgroup/firefox# echo 200000 1000000 > cpu.max
root@fso2025:/sys/fs/cgroup/firefox#
```

Resultado

Como se puede observar, el consumo ha bajado y ahora consume un 20% máximo.

```
top - 15:17:43 up 54 min, 1 user, load average: 0.08, 0.51, 1.27
Tasks: 145 total, 1 running, 144 sleeping, 0 stopped, 0 zombie
%Cpu(s): 12.8 us, 4.7 sy, 0.0 ni, 79.1 id, 0.0 wa, 0.0 hi, 3.4 si, 0.0 st
MiB Mem : 1967.3 total, 700.8 free, 1033.6 used, 439.1 buff/cache
MiB Swap: 1907.0 total, 1865.5 free, 41.5 used. 933.7 avail Mem
```

| PID | USER | PR | NI | VIRT | RES | SHR | S | %CPU | %MEM | TIME+ | COMMAND |
|--------|------|----|-----|---------|--------|--------|---|------|------|---------|----------|
| 110216 | root | 20 | 0 | 3023872 | 337904 | 112236 | S | 20.3 | 16.8 | 3:16.39 | firefox+ |
| 855 | root | 20 | 0 | 490648 | 109572 | 51580 | S | 0.7 | 5.4 | 1:15.46 | Xorg |
| 14 | root | 20 | 0 | 0 | 0 | 0 | S | 0.3 | 0.0 | 0:08.80 | ksoftir+ |
| 15 | root | 20 | 0 | 0 | 0 | 0 | I | 0.3 | 0.0 | 0:05.32 | rcu_pre+ |
| 1209 | root | 20 | 0 | 228896 | 1548 | 1276 | S | 0.3 | 0.1 | 0:01.28 | VBoxCli+ |
| 1219 | root | 20 | 0 | 229412 | 1484 | 1212 | S | 0.3 | 0.1 | 0:04.24 | VBoxCli+ |
| 1 | root | 20 | 0 | 103904 | 11088 | 6424 | S | 0.0 | 0.6 | 0:04.73 | systemd |
| 2 | root | 20 | 0 | 0 | 0 | 0 | S | 0.0 | 0.0 | 0:00.00 | kthreadd |
| 3 | root | 0 | -20 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | rcu_gp |
| 4 | root | 0 | -20 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | rcu_par+ |
| 5 | root | 0 | -20 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | slub_fl+ |
| 6 | root | 0 | -20 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | netns |
| 7 | root | 20 | 0 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:01.66 | kworker+ |
| 10 | root | 0 | -20 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | mm_perc+ |
| 11 | root | 20 | 0 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | rcu_tas+ |
| 12 | root | 20 | 0 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | rcu_tas+ |
| 13 | root | 20 | 0 | 0 | 0 | 0 | I | 0.0 | 0.0 | 0:00.00 | rcu_tas+ |

2. Crea un container Debian y arráncalo

Para arrancar un container debian usamos el siguiente comando:

```
lxc-create -t debian -n deb
```

Establece una contraseña para el usuario root del container

Para ello debemos entrar primero a la máquina con el siguiente comando para abrir la terminal del contenedor:

```
lxc-start #Arrancamos la máquina
lxc-attach -n deb /bin/sh #Llamamos a la terminal
```

```
root@fso2025:~# lxc-st
lxc-start lxc-stop
root@fso2025:~# lxc-start -n deb
root@fso2025:~# lxc-attach -n deb /bin/sh
# █
```

Tras eso procedemos a establecer la contraseña del root con el siguiente comando:

```
passwd root
```

```
root@fso2025:~# lxc-start -n deb
root@fso2025:~# lxc-attach -n deb /bin/sh
# passwd root
New password:
Retype new password:
passwd: password updated successfully
#
```

Añade 3 usuarios

Desde el mismo sitio que hemos establecido la contraseña para el root procedemos a crear los 3 usuarios:

```
su - root
useradd -m -s /bin/bash usuario1
useradd -m -s /bin/bash usuario2
useradd -m -s /bin/bash usuario3
```

```
# su - root
root@deb:~# sudo useradd -m -s /bin/bash usuario1
-bash: sudo: command not found
root@deb:~# useradd -m -s /bin/bash usuario1
root@deb:~# useradd -m -s /bin/bash usuario2
root@deb:~# useradd -m -s /bin/bash usuario3
root@deb:~# █
```

Instala apache 2 y ssh en el container

Comenzamos instalando apache 2:

```
root@deb:~# apt install apache2
Reading package lists... Done
Building dependency tree... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap libbrotlii
  libcurl4 libexpat1 libgdbm-compat4 libgdbm6 libicu72 libjansson4 libldap-2.5-0 libldap-common liblua5.3-0
  libnnghttp2-14 libperl5.36 libpsl5 librtmp1 libsasl2-2 libsasl2-modules libsasl2-modules-db libsqlite3-0
  libssh2-1 libxml2 media-types perl perl-modules-5.36 publicsuffix ssl-cert
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser gdbm-110n libsasl2-modules-gssapi-mit
  | libsasl2-modules-gssapi-heimdal libsasl2-modules-ldap libsasl2-modules-otp libsasl2-modules-sql perl-doc
  libterm-readline-gnu-perl | libterm-readline-perl-perl make libtap-harness-archive-perl
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap
  libbrotlii libcurl4 libexpat1 libgdbm-compat4 libgdbm6 libicu72 libjansson4 libldap-2.5-0 libldap-common
  liblua5.3-0 libnnghttp2-14 libperl5.36 libpsl5 librtmp1 libsasl2-2 libsasl2-modules libsasl2-modules-db
  libsqlite3-0 libssh2-1 libxml2 media-types perl perl-modules-5.36 publicsuffix ssl-cert
0 upgraded, 33 newly installed, 0 to remove and 0 not upgraded.
Need to get 22.3 MB of archives.
```

Tras eso procedemos a instalar SSH:

```
root@deb:~# apt install ssh
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  ssh
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 174 kB of archives.
After this operation, 187 kB of additional disk space will be used.
Get:1 http://deb.debian.org/debian stable/main amd64 ssh all 1:9.2p1-2+deb12u4 [174 kB]
Fetched 174 kB in 0s (946 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
Selecting previously unselected package ssh.
(Reading database ... 12070 files and directories currently installed.)
Preparing to unpack .../ssh_1%3a9.2p1-2+deb12u4_all.deb ...
Unpacking ssh (1:9.2p1-2+deb12u4) ...
Setting up ssh (1:9.2p1-2+deb12u4) ...
root@deb:~#
```

Cambia la dirección de red en el container para usar una dirección de red estática

Para establecer una IP estática usamos el siguiente comando:

```
sudo ifconfig eth0 10.0.3.68 netmask 255.255.255.0 up
```

```
root@deb:~# ifconfig eth0 10.0.3.68 netmask 255.255.255.0 up
root@deb:~# ping google.es
PING google.es (142.250.200.131) 56(84) bytes of data.
64 bytes from mad41s14-in-f3.1e100.net (142.250.200.131): icmp_seq=1 ttl=114 time=26.4 ms
64 bytes from mad41s14-in-f3.1e100.net (142.250.200.131): icmp_seq=2 ttl=114 time=26.8 ms
^C
--- google.es ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 26.444/26.641/26.839/0.197 ms
root@deb:~#
```

Cambial el puerto de SSH al 222

Vamos a la ruta /etc/ssh y modificamos el archivo sshd_config:

```
GNU nano 7.2                               sshd_config *

# This is the sshd server system-wide configuration file. See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/usr/bin:/bin:/usr/games

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented. Uncommented options override the
# default value.

Include /etc/ssh/sshd_config.d/*.conf

Port 222
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

#HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_ecdsa_key

^G Help          ^O Write Out      ^W Where Is      ^K Cut          ^T Execute       ^C Location      M-U Undo
^X Exit         ^R Read File      ^\ Replace       ^U Paste         ^J Justify       ^/ Go To Line   M-E Redo
```

Modifica el archivo de configuración del container

```
GNU nano 7.2                               /var/lib/lxc/deb/config *
# (Be aware this has security implications)

lxc.net.0.type = veth
lxc.net.0.hwaddr = 00:16:3e:3b:74:2a
lxc.net.0.link = lxcbr0
lxc.net.0.flags = up
lxc.apparmor.profile = generated
lxc.apparmor.allow_nesting = 1
lxc.rootfs.path = dir:/var/lib/lxc/deb/rootfs

# Common configuration
lxc.include = /usr/share/lxc/config/debian.common.conf

# Container specific configuration
lxc.tty.max = 4
lxc.uts.name = deb
lxc.arch = amd64
lxc.pty.max = 1024
lxc.start.auto = 1
lxc.start.delay = 3
```

3. Crea un cgroup

Creamos un nuevo csgroup con el siguiente comando:

```
cd /sys/fs/cgroup/
mkdir grupo #Creamos el nuevo cgroup
cd grupo
```

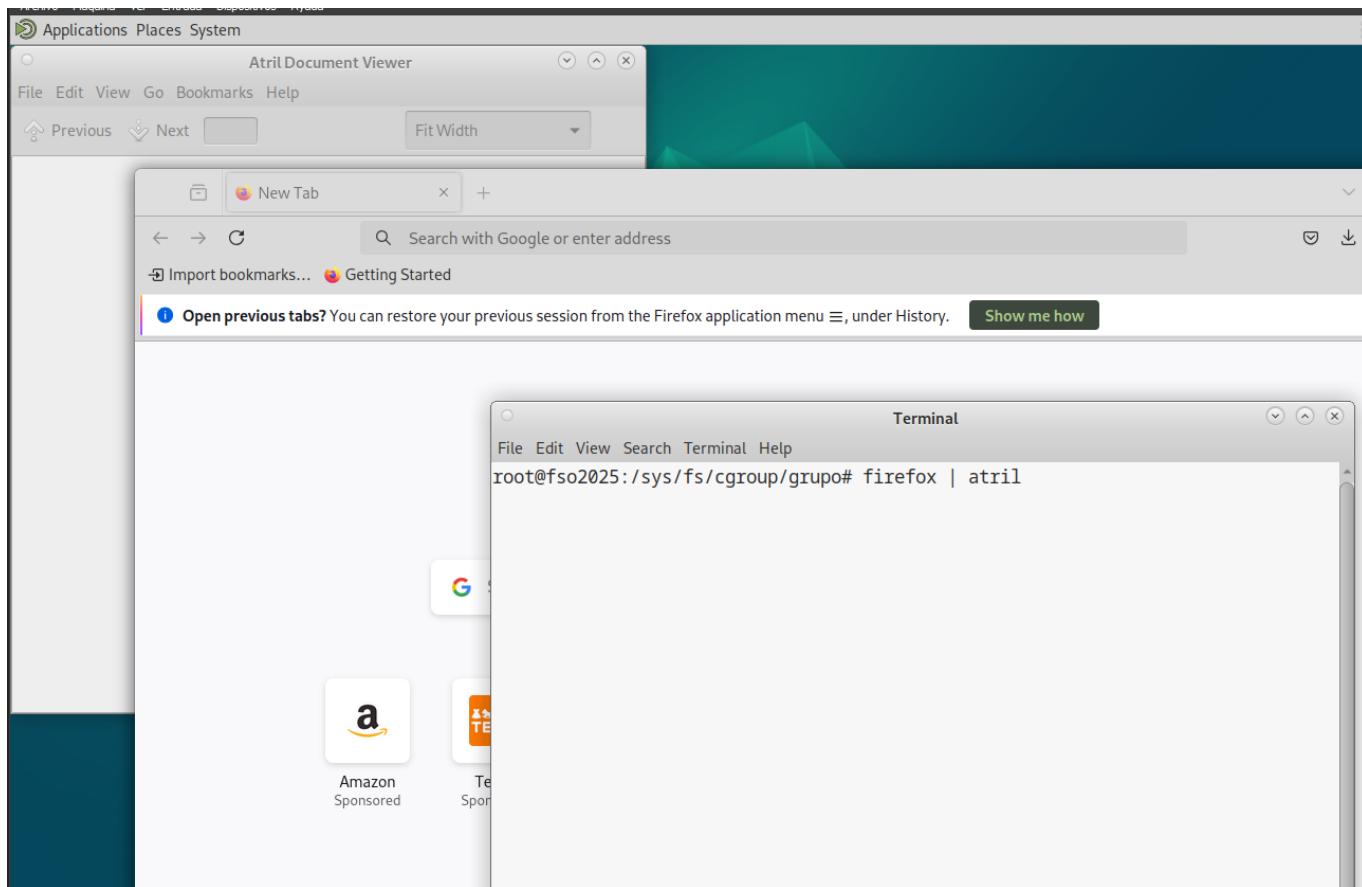
```
root@fso2025:/sys/fs# cd cgroup/
root@fso2025:/sys/fs/cgroup# mkdir grupo
root@fso2025:/sys/fs/cgroup# cd grupo/
root@fso2025:/sys/fs/cgroup/grupo# ls
cgroup.controllers      cpu.stat          memory.numa_stat
cgroup.events            cpu.weight        memory.oom.group
cgroup.freeze            cpu.weight.nice   memory.peak
cgroup.kill              hugetlb.2MB.current memory.pressure
cgroup.max.depth        hugetlb.2MB.events  memory.reclaim
cgroup.max.descendants  hugetlb.2MB.events.local memory.stat
cgroup.pressure          hugetlb.2MB.max    memory.swap.current
cgroup.procs             hugetlb.2MB.numa_stat  memory.swap.events
cgroup.stat              hugetlb.2MB.rsvd.current memory.swap.high
cgroup.subtree_control  hugetlb.2MB.rsvd.max   memory.swap.max
cgroup.threads           io.max            memory.zswap.current
cgroup.type              io.pressure       memory.zswap.max
cpu.idle                io.stat            misc.current
cpu.max                 io.weight          misc.events
cpu.max.burst           memory.current    misc.max
cpu.pressure            memory.events     pids.current
cpuset.cpus              memory.events.local pids.events
cpuset.cpus.effective   memory.high       pids.max
cpuset.cpus.partition    memory.low        pids.peak
cpuset.mems              memory.max       rdma.current
cpuset.mems.effective   memory.min       rdma.max
root@fso2025:/sys/fs/cgroup/grupo#
```

Abre un terminal y añade el shell de este al cgroup

```
echo $$ #Obtenemos el ID del proceso del Shell (En este caso 1709)
echo 1709 > cgroup.procs #Añadimos el proceso del shell al ggroup
```

```
root@fso2025:/sys/fs/cgroup/grupo# echo $$
1709
root@fso2025:/sys/fs/cgroup/grupo# echo 1709 > cgroup.procs
root@fso2025:/sys/fs/cgroup/grupo#
```

Desde ese mismo shell abre firefox y atril



Revisa el contenido de cgroup.procs y memory.current

```
root@fso2025:/sys/fs/cgroup/grupo# cat cgroup.procs
1709
17940
17941
18036
18060
18140
18229
18238
18245
18252
root@fso2025:/sys/fs/cgroup/grupo# cat memory.current
556228608
root@fso2025:/sys/fs/cgroup/grupo#
```

Pon un 1 en cgroups.freeze ¿Que pasa? ¿Que hay ahora en memory.current?

Los programas que abrimos antes quedan congelados. El contenido de memory.current es ahora este:

```
root@fso2025:/sys/fs/cgroup/grupo# echo 1 > cgroup.freeze
root@fso2025:/sys/fs/cgroup/grupo# cat memory.current
555556864
root@fso2025:/sys/fs/cgroup/grupo# echo 1 > cgroup.freeze
```

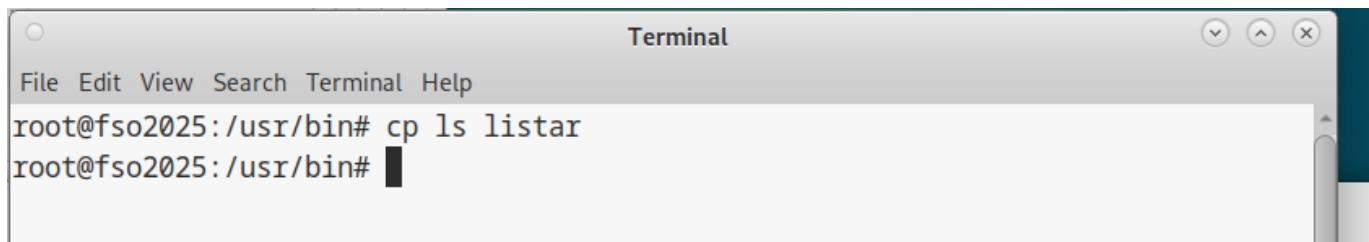
Este valor que podemos observar es la memoria consumida por los procesos de cgroup en bytes. Ahora el valor parece ser superior al que vimos anteriormente. Tras esto descongelamos el proceso poniendo un 0 en groups.freeze

Pon los valores 30000 100000 en cpu.max ¿Que pasa?

```
root@fso2025:/sys/fs/cgroup/grupo# echo 30000 100000 > cpu.max
root@fso2025:/sys/fs/cgroup/grupo#
```

Estamos limitando cuanto pueden consumir los procesos del cgroup, en este caso estamos limitando los procesos a un 30%

4. Crea una copia de ls, llámala listar y crea un perfil de apparmor vacío para ella



```
aa-easyprof /usr/bin/listar #Creamos archivo de configuración plantilla que
debemos editar
aa-easyprof /usr/bin/listar > /etc/apparmor.d/usr.bin.listar #Copiamos el
archivo generado al apparmor
nano /etc/apparmor.d/usr.bin.listar
```

Editamos el archivo añadiendo las reglas de denegación debajo de "# No read paths specified"

```

GNU nano 7.2
f# vim:syntax=apparmor
# AppArmor policy for listar
# ##AUTHOR##
# ##COPYRIGHT##
# ##COMMENT##


#include <tunables/global>

# No template variables specified

/usr/bin/listar {
    #include <abstractions/base>

    # No abstractions specified

    # No policy groups specified

    # No read paths specified
    /      r,
    /**  r,
    deny  /etc/  r,
    deny  /etc/** r,
    # No write paths specified
}

```



Tras eso parseamos el archivo modificado para apparmor y habilitamos la política con enforce:

```

apparmor_parser -r /etc/apparmor.d/usr.bin.listar
aa-enforce /usr/bin/listar

```

¿Que pasa cuando se usa listar para mostrar /etc?

Nos sale que no tenemos permisos para ver el directorio

```

root@fso2025:~# listar /etc/
listar: cannot open directory '/etc/': Permission denied
root@fso2025:~#

```

¿Que pasa cuando usas -l con otros directorios?

Se muestran pero sin nombres de usuario al que pertenecen ni grupos:

```
root@fso2025:~# listar -l /home/
total 444
-rw----- 1 0 0 12288 Feb 18 15:50 aquota.group
-rw----- 1 0 0 12288 Feb 18 15:50 aquota.user
drwx----- 2 0 0 16384 Jan 27 17:35 lost+found
drwxr-xr-x 2 1001 1001 4096 Jan 27 19:04 user001
drwxr-xr-x 2 1002 1002 4096 Jan 27 19:04 user002
drwxr-xr-x 2 1003 1003 4096 Jan 27 19:04 user003
drwxr-xr-x 2 1004 1004 4096 Jan 27 19:04 user004
drwxr-xr-x 2 1005 1005 4096 Jan 27 19:04 user005
```

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