



UNIVERSIDAD DE LA INTEGRACIÓN DE LAS AMÉRICAS

Facultad de Ingeniería
Carreras de Ingeniería en Informática e
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SISTEMAS OPERATIVOS

Informe de Laboratorio 5 Rendimiento y Optimización

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Introducción

Este laboratorio tuvo como objetivo evaluar el rendimiento actual del sistema operativo Linux (Ubuntu en entorno virtualizado) y aplicar optimizaciones para mejorar su eficiencia. Se llevaron a cabo mediciones iniciales, pruebas de benchmark y ajustes progresivos, finalizando con un monitoreo continuo para observar patrones de consumo.

Baseline de Rendimiento

Para obtener una línea base del rendimiento, se realizaron las siguientes pruebas:

- Tiempo de arranque: usando systemd-analyze.
- Uso en reposo: monitoreado con htop.
- Benchmark de CPU y Memoria: utilizando sysbench.

Se obtuvieron los siguientes resultados (Antes y Después de la optimización):

Antes:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ systemd-analyze
Startup finished in 3.466s (kernel) + 10.844s (userspace) = 14.310s
graphical.target reached after 10.810s in userspace.
```

Después:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ systemd-analyze
Startup finished in 4.249s (kernel) + 9.783s (userspace) = 14.032s
graphical.target reached after 9.733s in userspace.
```

Antes:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ sysbench cpu run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 1
Initializing random number generator from current time

Prime numbers limit: 10000

Initializing worker threads...

Threads started!

CPU speed:
  events per second:  4666.65

General statistics:
  total time:          10.0002s
  total number of events: 46670

Latency (ms):
  min:                 0.20
  avg:                 0.21
  max:                 1.71
  95th percentile:    0.23
  sum:                 9981.81

Threads fairness:
  events (avg/stddev): 46670.0000/0.00
  execution time (avg/stddev): 9.9818/0.00
```

Después:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ sysbench cpu run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 1
Initializing random number generator from current time

Prime numbers limit: 10000

Initializing worker threads...

Threads started!

CPU speed:
  events per second:  4733.83

General statistics:
  total time:          10.0001s
  total number of events: 47343

Latency (ms):
  min:                 0.20
  avg:                 0.21
  max:                 0.78
  95th percentile:    0.23
  sum:                 9987.89

Threads fairness:
  events (avg/stddev): 47343.0000/0.00
  execution time (avg/stddev): 9.9879/0.00
```

Antes:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ sysbench memory run  
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)
```

Running the test with following options:

Number of threads: 1

Initializing random number generator from current time

Running memory speed test with the following options:

block size: 1KiB

total size: 102400MiB

operation: write

scope: global

Initializing worker threads...

Threads started!

Total operations: 51998992 (5199531.14 per second)

50780.27 MiB transferred (5077.67 MiB/sec)

General statistics:

total time:	10.0001s
-------------	----------

total number of events:	51998992
-------------------------	----------

Latency (ms):

min:	0.00
------	------

avg:	0.00
------	------

max:	0.83
------	------

95th percentile:	0.00
------------------	------

sum:	3560.09
------	---------

Threads fairness:

events (avg/stddev):	51998992.0000/0.00
----------------------	--------------------

execution time (avg/stddev):	3.5601/0.00
------------------------------	-------------

Después:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ sysbench memory run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 1
Initializing random number generator from current time

Running memory speed test with the following options:
  block size: 1KiB
  total size: 102400MiB
  operation: write
  scope: global

Initializing worker threads...

Threads started!

Total operations: 54264969 (5425948.78 per second)
52993.13 MiB transferred (5298.78 MiB/sec)

General statistics:
  total time:                               10.0001s
  total number of events:                   54264969

Latency (ms):
  min:                                     0.00
  avg:                                     0.00
  max:                                     0.55
  95th percentile:                        0.00
  sum:                                     3534.09

Threads fairness:
  events (avg/stddev):       54264969.0000/0.00
  execution time (avg/stddev): 3.5341/0.00
```

Se observó que el CPU logró ejecutar miles de eventos por segundo y que la memoria mantuvo una tasa de transferencia elevada, lo que permitió definir el comportamiento inicial del sistema antes de aplicar mejoras.

Optimización Guiada

Se aplicaron ajustes puntuales para reducir el consumo de recursos:

- Se deshabilitaron servicios no esenciales como cups, avahi-daemon, modemmanager, entre otros.
- Se eliminaron programas de inicio innecesarios utilizando systemctl disable.
- Se realizaron ajustes visuales al entorno GNOME para disminuir los efectos gráficos.

Antes:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ systemctl list-units --type=service --state=running
UNIT                                LOAD    ACTIVE SUB    DESCRIPTION
accounts-daemon.service            loaded active running Accounts Service
apache2.service                    loaded active running The Apache HTTP Server
avahi-daemon.service               loaded active running Avahi mDNS/DNS-SD Stack
colord.service                     loaded active running Manage, Install and Generate Color Profiles
cron.service                       loaded active running Regular background program processing daemon
cups-browsed.service               loaded active running Make remote CUPS printers available locally
cups.service                       loaded active running CUPS Scheduler
dbus.service                       loaded active running D-Bus System Message Bus
fprintd.service                   loaded active running Fingerprint Authentication Daemon
gdm.service                        loaded active running GNOME Display Manager
gnome-remote-desktop.service       loaded active running GNOME Remote Desktop
kerneloops.service                loaded active running Tool to automatically collect and submit kernel crash signatures
ModemManager.service              loaded active running Modem Manager
NetworkManager.service            loaded active running Network Manager
polkit.service                     loaded active running Authorization Manager
power-profiles-daemon.service       loaded active running Power Profiles daemon
rsyslog.service                   loaded active running System Logging Service
rtkit-daemon.service              loaded active running RealtimeKit Scheduling Policy Service
snappd.service                     loaded active running Snap Daemon
switcheroo-control.service         loaded active running Switcheroo Control Proxy service
systemd-journald.service           loaded active running Journal Service
systemd-logind.service             loaded active running User Login Management
systemd-oomd.service              loaded active running Userspace Out-Of-Memory (OOM) Killer
systemd-resolved.service           loaded active running Network Name Resolution
systemd-udev.service               loaded active running Rule-based Manager for Device Events and Files
udisks2.service                   loaded active running Disk Manager
unattended-upgrades.service        loaded active running Unattended Upgrades Shutdown
upower.service                     loaded active running Daemon for power management
user@1000.service                  loaded active running User Manager for UID 1000
virtualbox-guest-utils.service     loaded active running Virtualbox guest utils
wpa_supplicant.service             loaded active running WPA supplicant
```

```
sole-cardozo@sole-cardozo-VirtualBox:~$ sudo systemctl disable cups.service
[sudo] contraseña para sole-cardozo:
Synchronizing state of cups.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install disable cups
Removed "/etc/systemd/system/sockets.target.wants/cups.socket".
Removed "/etc/systemd/system/multi-user.target.wants/cups.service".
Removed "/etc/systemd/system/multi-user.target.wants/cups.path".
Removed "/etc/systemd/system/printer.target.wants/cups.service".
Disabling 'cups.service', but its triggering units are still active:
cups.socket, cups.path
sole-cardozo@sole-cardozo-VirtualBox:~$ sudo systemctl disable cups-browsed.service
Removed "/etc/systemd/system/multi-user.target.wants/cups-browsed.service".
sole-cardozo@sole-cardozo-VirtualBox:~$ sudo systemctl disable avahi-daemon.service
Removed "/etc/systemd/system/sockets.target.wants/avahi-daemon.socket".
Removed "/etc/systemd/system/multi-user.target.wants/avahi-daemon.service".
Removed "/etc/systemd/system/dbus-org.freedesktop.Avahi.service".
Disabling 'avahi-daemon.service', but its triggering units are still active:
avahi-daemon.socket
sole-cardozo@sole-cardozo-VirtualBox:~$ sudo systemctl disable ModemManager.service
Removed "/etc/systemd/system/dbus-org.freedesktop.ModemManager1.service".
Removed "/etc/systemd/system/multi-user.target.wants/ModemManager.service".
sole-cardozo@sole-cardozo-VirtualBox:~$ sudo systemctl disable gnome-remote-desktop.service
Removed "/etc/systemd/system/graphical.target.wants/gnome-remote-desktop.service".
sole-cardozo@sole-cardozo-VirtualBox:~$
```


Después:

```
sole-cardozo@sole-cardozo-VirtualBox:~$ systemctl list-unit-files --type=service | grep enabled
```

accounts-daemon.service	enabled	enabled
alsa-utils.service	masked	enabled
anacron.service	enabled	enabled
apache-htcacheclean.service	disabled	enabled
apache-htcacheclean@.service	disabled	enabled
apache2.service	enabled	enabled
apache2@.service	disabled	enabled
apparmor.service	enabled	enabled
apport.service	enabled	enabled
avahi-daemon.service	disabled	enabled
bluetooth.service	enabled	enabled
brltty.service	disabled	enabled
cloud-config.service	enabled	enabled
cloud-final.service	enabled	enabled
cloud-init-local.service	enabled	enabled
cloud-init.service	enabled	enabled
console-setup.service	enabled	enabled
cron.service	enabled	enabled
cryptdisks-early.service	masked	enabled
cryptdisks.service	masked	enabled
cups-browsed.service	disabled	enabled
cups.service	disabled	enabled
dmesg.service	enabled	enabled
e2scrub_reap.service	enabled	enabled
getty@.service	enabled	enabled
gnome-remote-desktop.service	disabled	enabled
gpu-manager.service	enabled	enabled
grub-common.service	enabled	enabled
grub-initrd-fallback.service	enabled	enabled
hwclock.service	masked	enabled
kerneloops.service	enabled	enabled
keyboard-setup.service	enabled	enabled
ModemManager.service	disabled	enabled
netplan-ovs-cleanup.service	enabled-runtime	enabled
networkd-dispatcher.service	enabled	enabled

```
sole-cardozo@sole-cardozo-VirtualBox:~$ systemctl list-units --type=service --state=running
```

UNIT	LOAD	ACTIVE	SUB	DESCRIPTION
accounts-daemon.service	loaded	active	running	Accounts Service
apache2.service	loaded	active	running	The Apache HTTP Server
avahi-daemon.service	loaded	active	running	Avahi mDNS/DNS-SD Stack
colord.service	loaded	active	running	Manage, Install and Generate Color Profiles
cron.service	loaded	active	running	Regular background program processing daemon
cups-browsed.service	loaded	active	running	Make remote CUPS printers available locally
cups.service	loaded	active	running	CUPS Scheduler
dbus.service	loaded	active	running	D-Bus System Message Bus
fwupd.service	loaded	active	running	Firmware update daemon
gdm.service	loaded	active	running	GNOME Display Manager
gnome-remote-desktop.service	loaded	active	running	GNOME Remote Desktop
kerneloops.service	loaded	active	running	Tool to automatically collect and submit kernel crash signatures
ModemManager.service	loaded	active	running	Modem Manager
NetworkManager.service	loaded	active	running	Network Manager
polkit.service	loaded	active	running	Authorization Manager
power-profiles-daemon.service	loaded	active	running	Power Profiles daemon
rsyslog.service	loaded	active	running	System Logging Service
rtkit-daemon.service	loaded	active	running	RealtimeKit Scheduling Policy Service
snapsd.service	loaded	active	running	Snap Daemon
switcheroo-control.service	loaded	active	running	Switcheroo Control Proxy service
systemd-journald.service	loaded	active	running	Journal Service
systemd-logind.service	loaded	active	running	User Login Management
systemd-oomd.service	loaded	active	running	Userspace Out-Of-Memory (OOM) Killer
systemd-resolved.service	loaded	active	running	Network Name Resolution
systemd-udevd.service	loaded	active	running	Rule-based Manager for Device Events and Files
udisks2.service	loaded	active	running	Disk Manager
unattended-upgrades.service	loaded	active	running	Unattended Upgrades Shutdown
upower.service	loaded	active	running	Daemon for power management
user@1000.service	loaded	active	running	User Manager for UID 1000
virtualbox-guest-utils.service	loaded	active	running	Virtualbox guest utils
wpa_supplicant.service	loaded	active	running	WPA supplicant

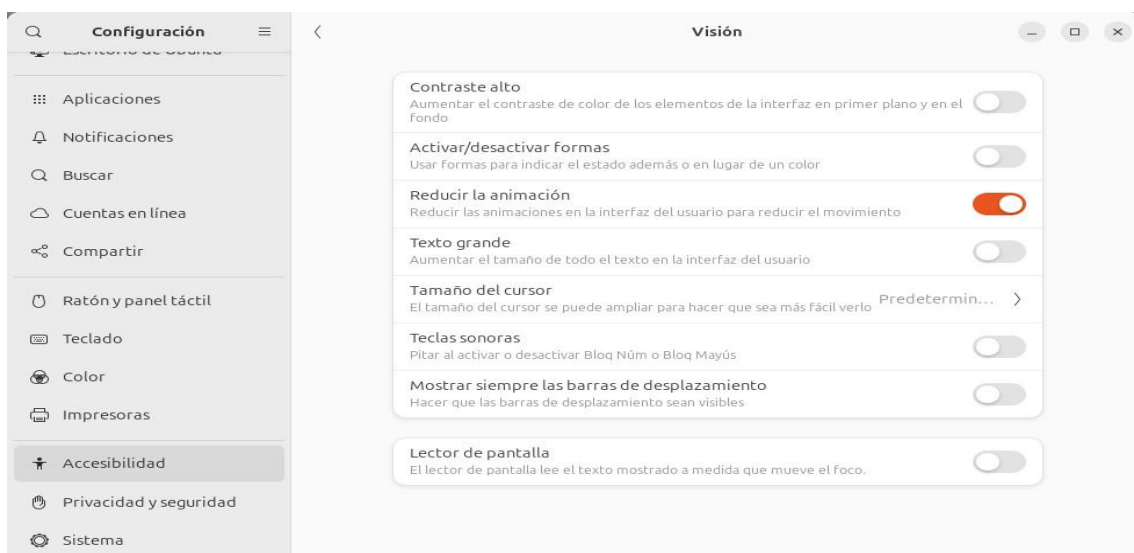
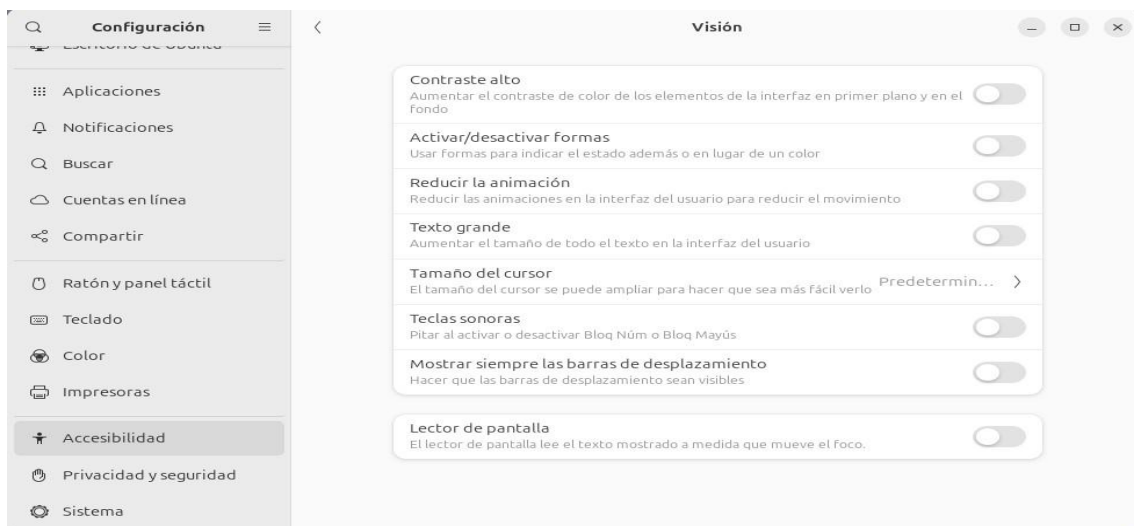
Disminución de efectos gráficos:

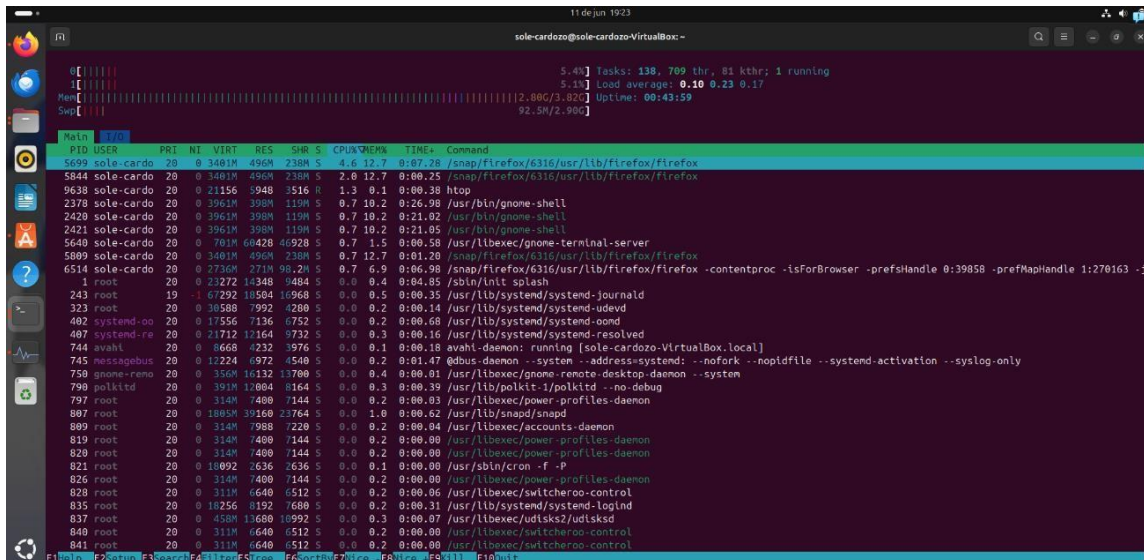
Se desactivaron las animaciones gráficas del entorno GNOME mediante el comando gsettings, lo cual contribuyó a reducir el uso de recursos gráficos y mejoró la fluidez del sistema durante la ejecución de múltiples procesos.

```
~$ sudo apt install gnome-tweaks
```

```
~$ gsettings set org.gnome.desktop.interface enable-animations false
```

O también se puede hacer lo siguiente:





Como resultado, el sistema mostró una ligera mejora en el uso de recursos en reposo. El entorno se volvió más ágil y con menor consumo al iniciar.

Monitoreo Continuo

Se mantuvo el sistema en funcionamiento durante 24 horas con actividades comunes, como navegación con Firefox y monitoreo con herramientas del sistema.



```
sole-cardozo@sole-cardozo-VirtualBox:~  
Tasks: 141, 713 thr, 79 kthr; 1 running  
Load average: 0.41 0.25 0.25  
Uptime: 01:25:32  
453M/2.9GB  
Main | 7.0M  
PID USER PRI NI VIRT RES SHR S CPU% MEM% TIME+ Command  
2378 sole-cardo 20 0 3994M 409M 131M S 45.5 10.4 1:00.73 /usr/bin/gnome-shell  
26734 sole-cardo 20 0 2690M 64012 49380 S 15.2 1.6 0:00.31 gjs /usr/share/gnome-shell/extensions/ding@rastersoft.com/app/ding.js -E -P /usr/share/gnome-shell/extensions/ding@ra  
2136 sole-cardo 20 0 21196 12476 9660 S 12.5 0.3 0:01.80 /usr/lib/systemd/systemd --user  
26765 sole-cardo 20 0 717M 87392 65984 S 7.9 2.2 0:00.12 /usr/bin/file-roller --service  
26759 sole-cardo 20 0 3415M 414M 211M S 7.3 10.6 0:00.11 /snap/firefox/6316/usr/lib/firefox/firefox  
2179 sole-cardo 20 0 11440 7024 4560 S 6.6 0.2 0:01.66 /usr/bin/dbus-daemon --session --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only  
2420 sole-cardo 20 0 3994M 409M 131M S 5.3 10.4 1:06.48 /usr/bin/gnome-shell  
2486 sole-cardo 20 0 3994M 409M 131M S 4.6 10.4 0:01.47 /usr/bin/gnome-shell  
2421 sole-cardo 20 0 3994M 409M 131M S 4.6 10.4 1:06.58 /usr/bin/gnome-shell  
5809 sole-cardo 20 0 3415M 414M 211M S 3.3 10.6 0:01.91 /snap/firefox/6316/usr/lib/firefox/firefox  
9638 sole-cardo 20 0 21184 5692 3260 R 2.6 0.1 2:28.65 htop  
26769 sole-cardo 20 0 3415M 414M 211M S 1.3 10.6 0:00.02 /snap/firefox/6316/usr/lib/firefox/firefox  
26772 sole-cardo 20 0 717M 87392 65984 S 1.3 2.2 0:00.02 /usr/bin/file-roller --service  
2412 sole-cardo 21 0 3994M 409M 131M S 0.7 10.4 0:04.45 /usr/bin/gnome-shell  
2588 sole-cardo 20 0 388M 11348 7248 S 0.7 0.3 0:00.62 /usr/bin/ibus-daemon --panel disable  
2738 sole-cardo 20 0 388M 11348 7248 S 0.7 0.3 0:00.93 /usr/bin/ibus-daemon --panel disable  
2960 sole-cardo 20 0 788M 40500 25280 S 0.7 1.0 0:00.08 /usr/libexec/xdg-desktop-portal-gnome  
5649 sole-cardo 20 0 785M 62504 47340 S 0.7 1.6 0:11.27 /usr/libexec/gnome-terminal-server  
5699 sole-cardo 20 0 3415M 414M 211M S 0.7 10.6 0:11.26 /snap/firefox/6316/usr/lib/firefox/firefox  
26766 sole-cardo 20 0 717M 87392 65984 S 0.7 2.2 0:00.01 /usr/bin/file-roller --service  
26779 sole-cardo 20 0 2690M 64012 49380 S 0.7 1.6 0:00.01 gjs /usr/share/gnome-shell/extensions/ding@rastersoft.com/app/ding.js -E -P /usr/share/gnome-shell/extensions/ding@ra  
1 root 20 0 23272 13964 5484 S 0.0 0.3 0:04.95 /sbin/init splash  
243 root 19 1 67292 16348 14812 S 0.0 0.4 0:00.42 /usr/lib/systemd/systemd-journald  
323 root 20 0 30588 7864 4280 S 0.0 0.2 0:00.15 /usr/lib/systemd/systemd-udev  
482 systemd-oo 20 0 17556 7136 6752 S 0.0 0.2 0:01.32 /usr/lib/systemd/systemd-oomd  
407 systemd-re 20 0 21712 10084 6452 S 0.0 0.3 0:00.22 /usr/lib/systemd/systemd-resolved  
744 avahi 20 0 8668 4232 3976 S 0.0 0.1 0:00.34 avahi-daemon: running [sole-cardozo-VirtualBox.local]  
745 messagebus 20 0 12224 6972 4540 S 0.0 0.2 0:02.17 @dbus-daemon -system --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only  
750 gnome-remo 20 0 356M 15236 12804 S 0.0 0.4 0:00.01 /usr/libexec/gnome-remote-desktop-daemon --system  
790 polkitd 20 0 391M 10272 6224 S 0.0 0.3 0:00.43 /usr/lib/polkit-1/polkitd --no-debug
```

Durante ese tiempo, se observó un aumento progresivo en el uso de RAM (más del 85 %) y de la memoria swap (hasta 450 MB), lo que indica que el sistema comenzó a depender de la memoria virtual. Se identificaron procesos persistentes como gnome-shell, snapd, firefox, que se mantuvieron como principales consumidores.

Conclusión

El sistema mostró un comportamiento adecuado al inicio, pero bajo un uso prolongado comenzó a consumir memoria swap, lo que puede generar una caída en el rendimiento general. Las optimizaciones aplicadas permitieron mejorar levemente el desempeño en reposo (Se recomienda revisar servicios en segundo plano, evitar tener múltiples instancias de Firefox abiertas, y considerar el uso de entornos gráficos más ligeros en equipos con recursos limitados).