UNIVERSIDAD DE LA INTEGRACIÓN DE LAS AMÉRICAS

Facultad de Ingeniería

Carreras de Ingeniería en Informática e Ingeniería en Sistemas

SISTEMAS OPERATIVOS

Informe de Laboratorio 5

Rendimiento y Optimización

Nombre: Gonzalo Aquino Alvarenga
Materia: Sistemas Operativos
Fecha: 21/06/25

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
```

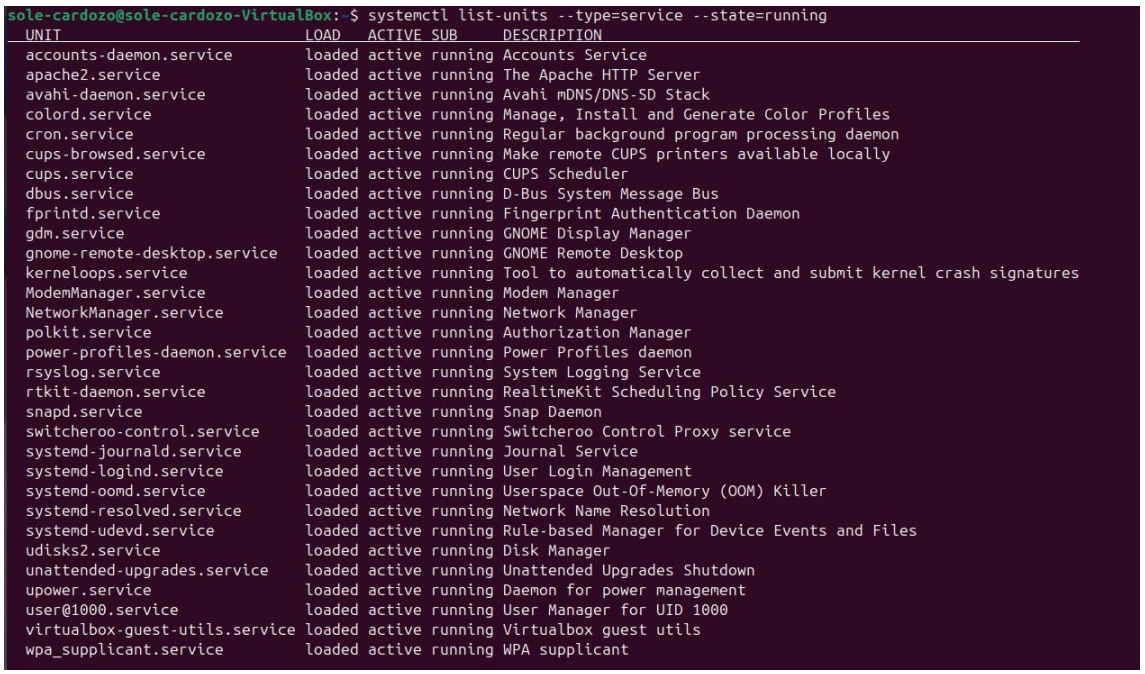
Se observó que el CPU logró ejecutar miles de eventos por segundo y que la memoria mantuvo una tasa de transferencia elevada, lo que permitió definir el comportamiento inicial del sistema antes de aplicar mejoras.

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
  snapd.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
```

```
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
  snapd.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
```

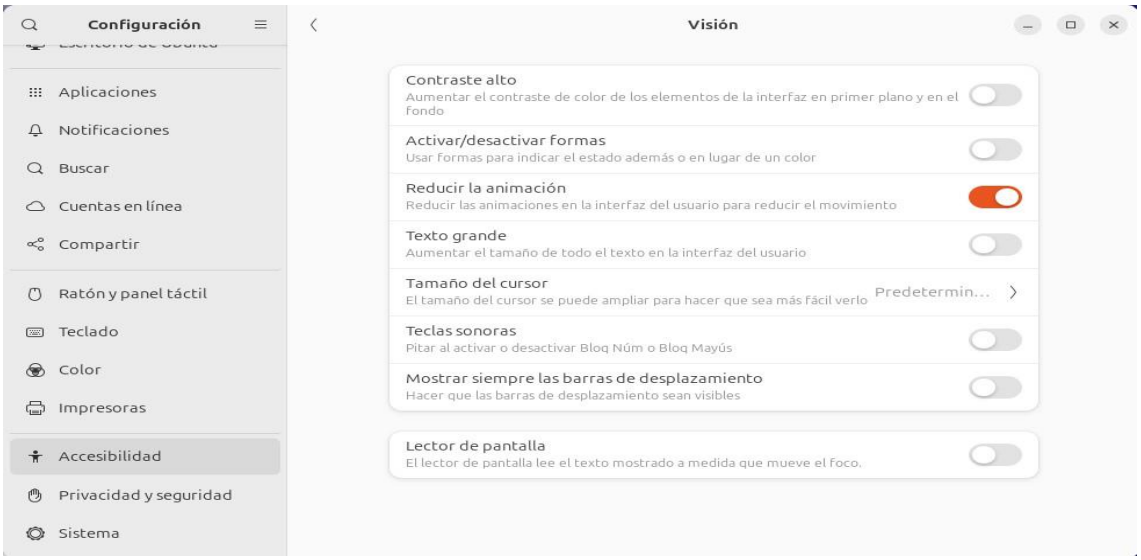
Disminución de efectos gráficos:

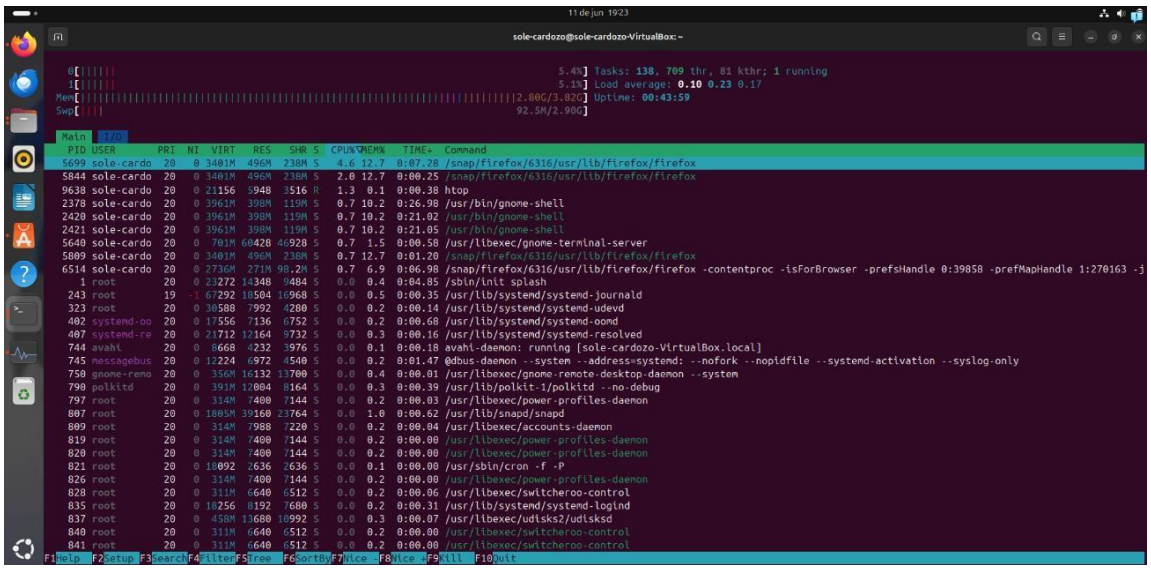
Se desactivaron las animaciones gráficas del entorno GNOME mediante el comando gsettings, lo cual contribuyó a reducir el uso de recursos gráficos y mejoró la fluidez del sistema durante la ejecución de múltiples procesos.

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

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

O también se puede hacer lo siguiente:

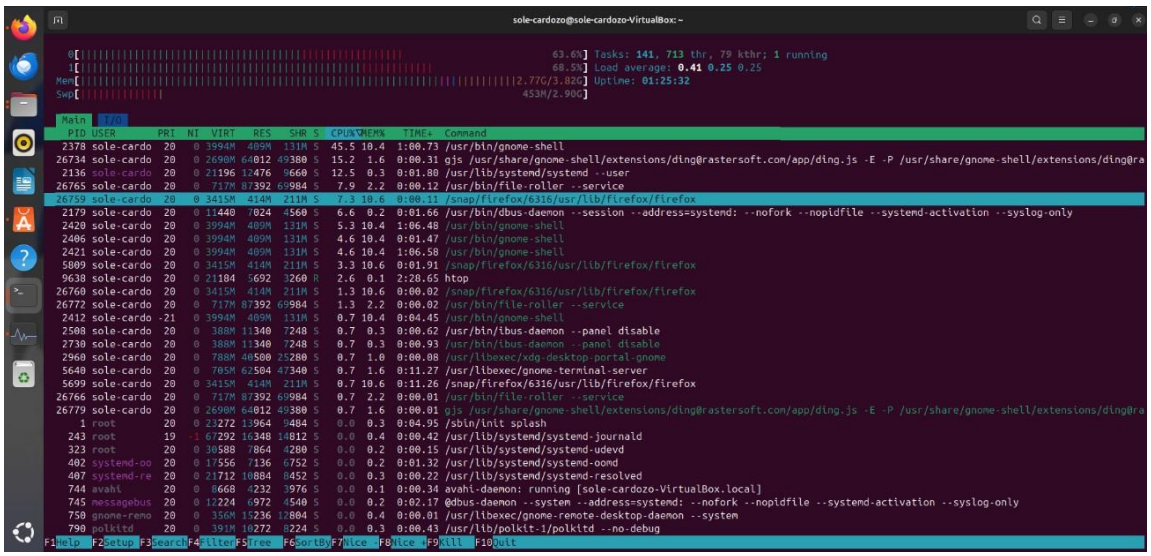




Como resultado, el sistema mostró una ligera mejora en el uso de recursos en reposo. El entorno se volvió más ágil y con menor consumo al iniciar.

Monitoreo Continuo

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



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).