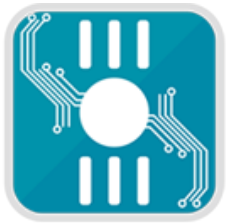


ENGENHARIA DA COMPUTAÇÃO

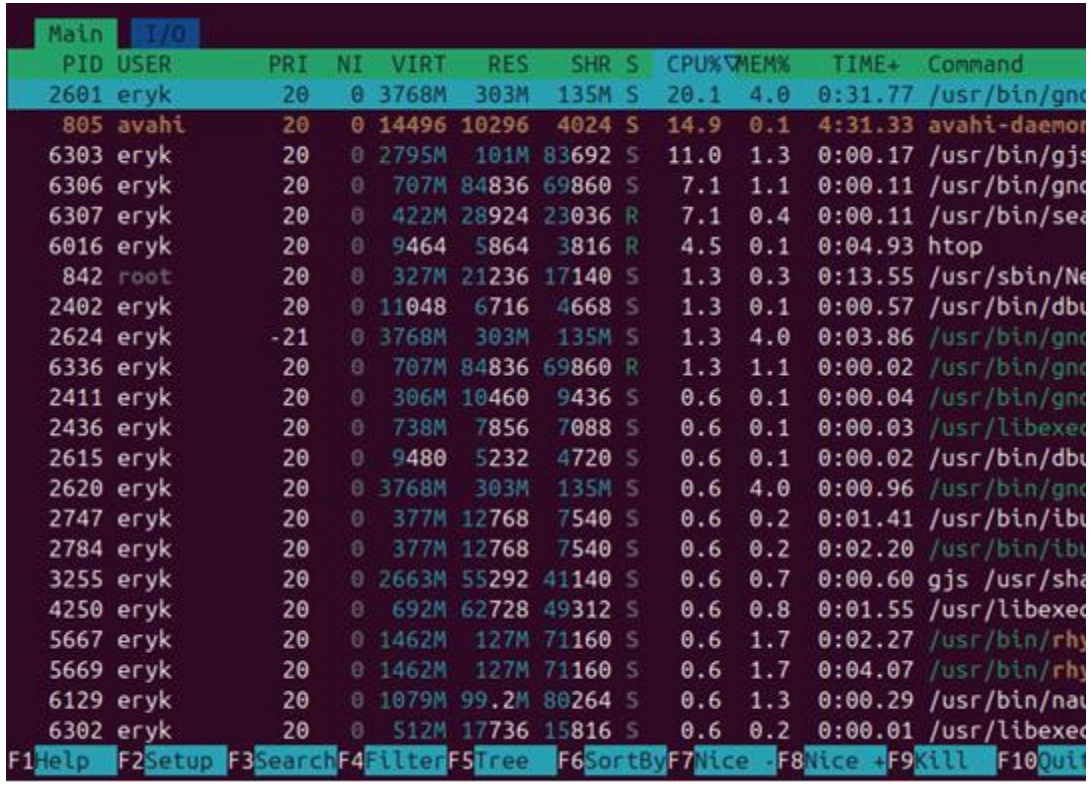
UNIVERSIDADE FEDERAL DO MARANHÃO

Estudo Analítico de um Sistema Operacional Real: UBUNTU 24.04.2 LTS

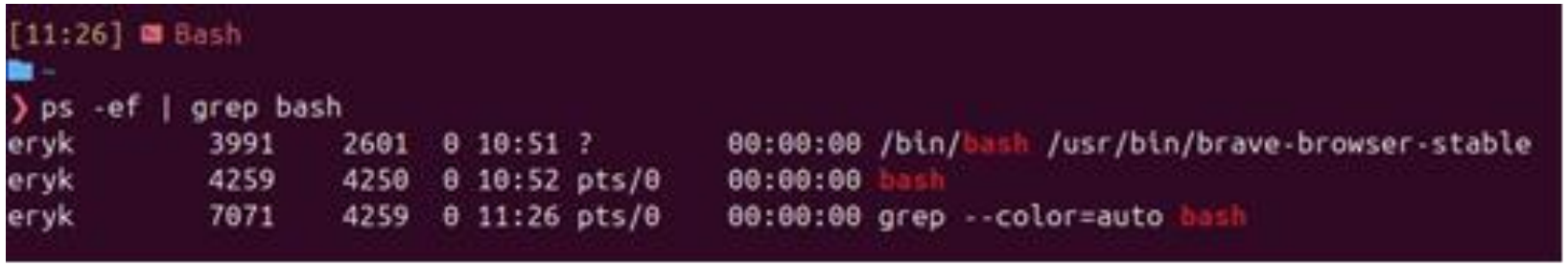
Aluno : Juan Pablo Furtado

1 Gerência de Processos

Como o sistema cria e gerenciaprocessos

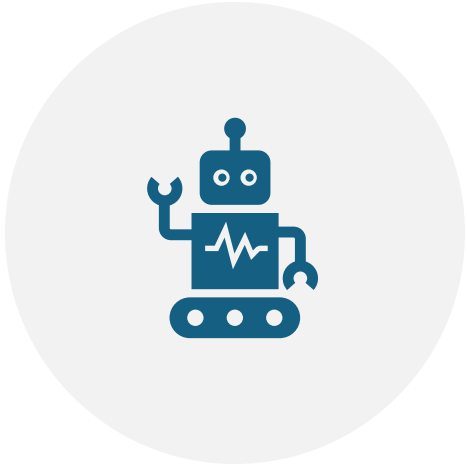


Execução da chamada de sistema fork():

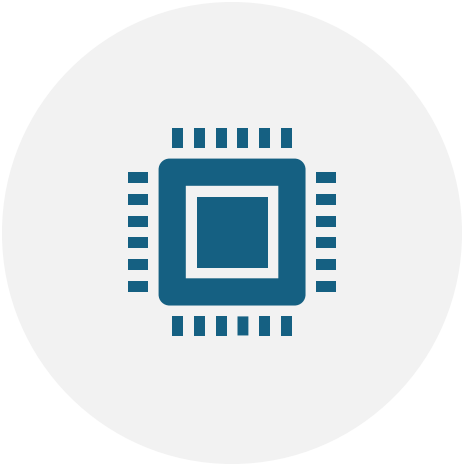


- Assim que um programa é aberto o sistema executa a função fork que cria um clone exatamente igual do programa que está sendo executado, porém com um PID diferentes, pois é tratado como uma instância separada.

Execução da função exec():

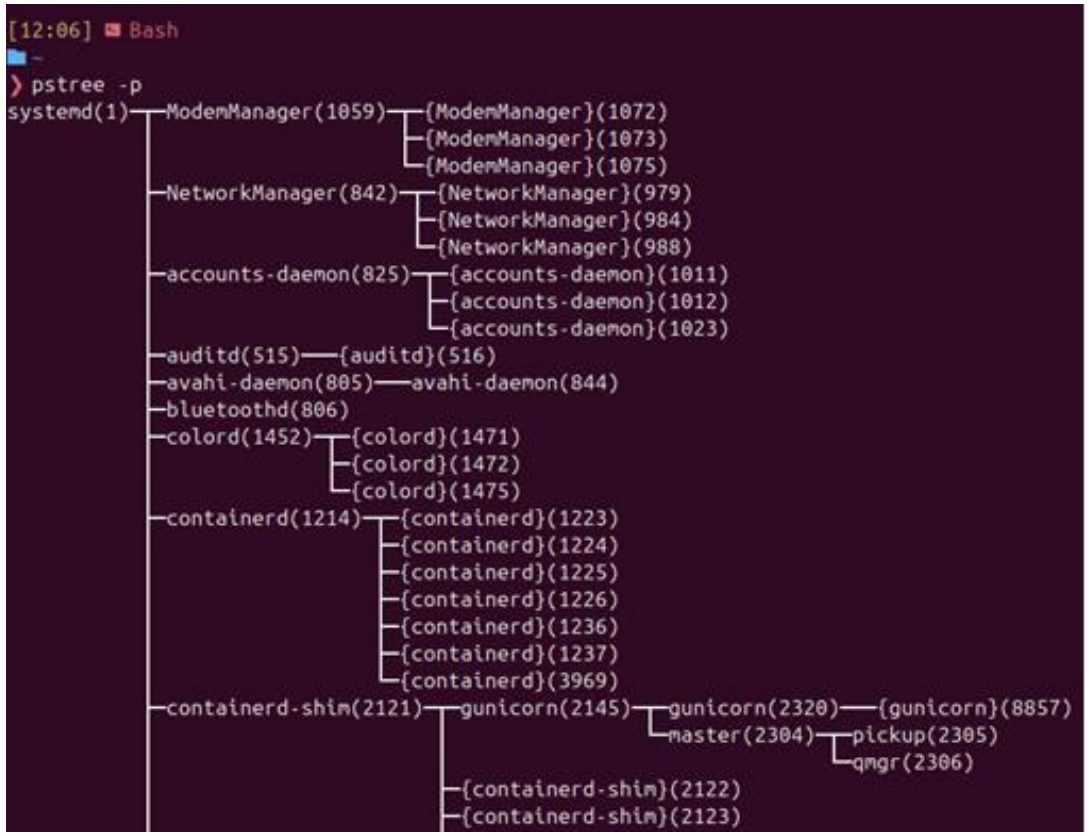


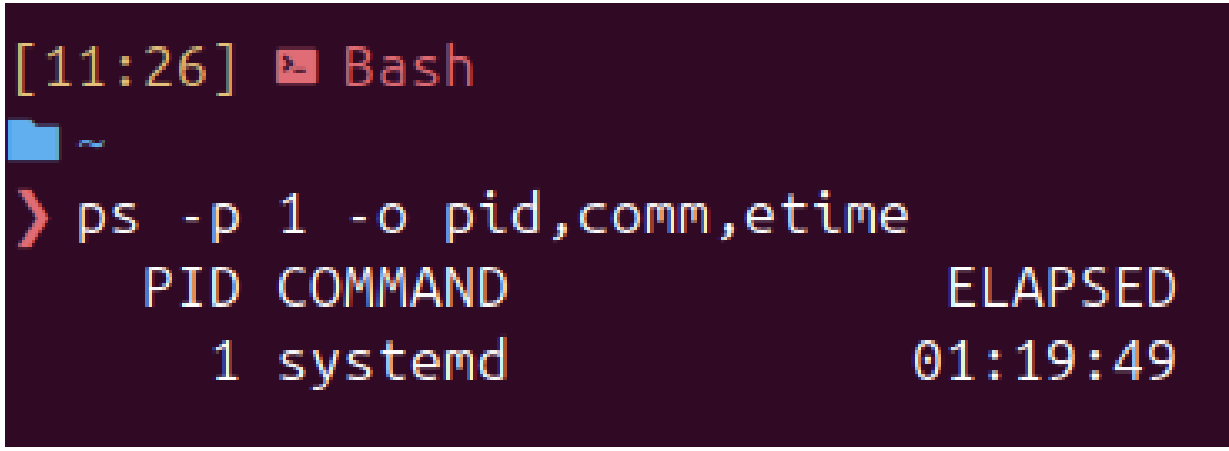
A FUNÇÃO EXEC() NÃO CRIA UM NOVO PROCESSO; ELA **TRANSFORMA** O PROCESSO ATUAL. EM TERMOS DE SISTEMA OPERACIONAL, ELA REALIZA UMA **SUBSTITUIÇÃO SUBSTITUIÇÃO DA IMAGEM DO PROCESSO**.

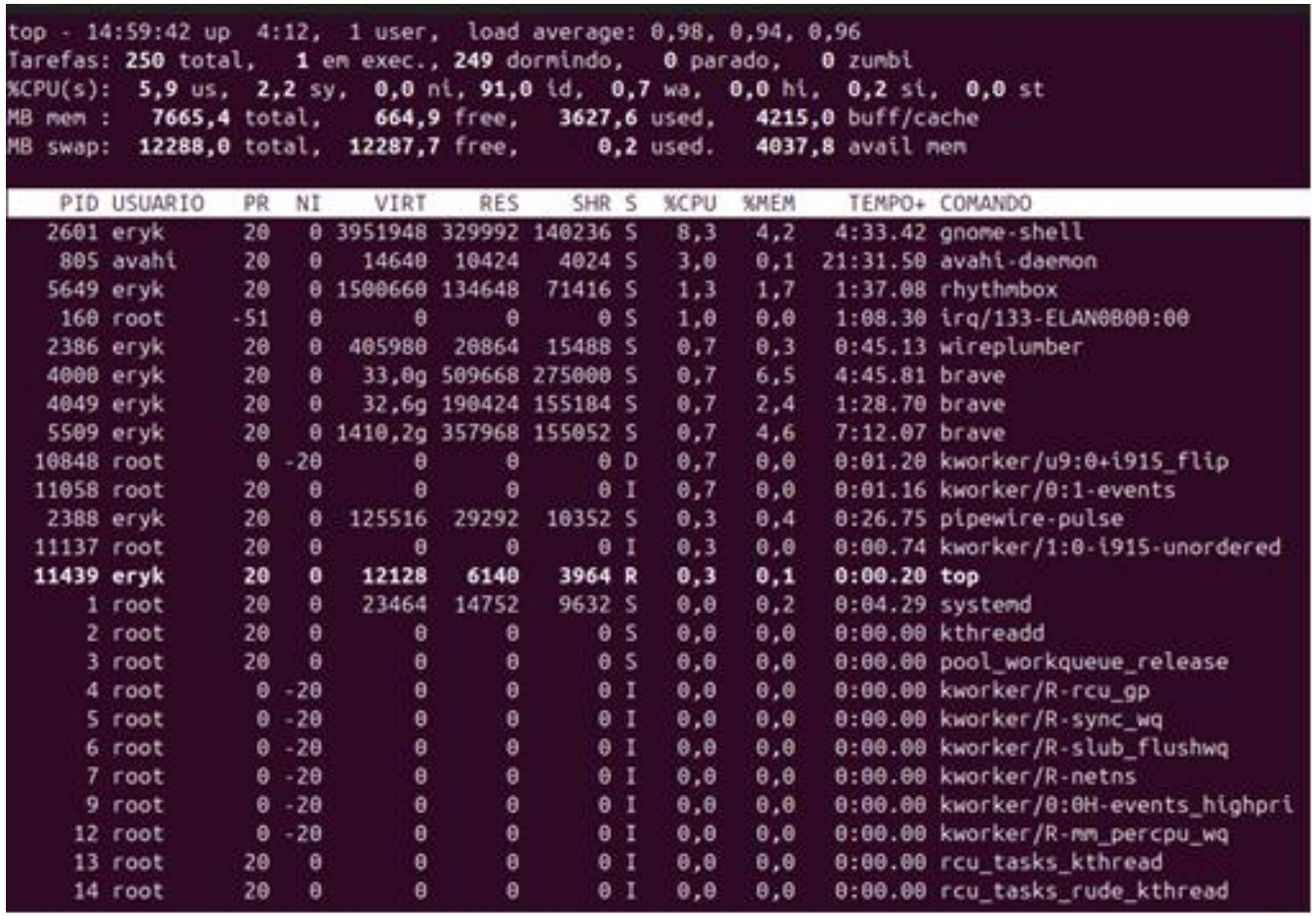


NO LINUX (E, PORTANTO, NO UBUNTU), QUANDO UM PROGRAMA CHAMA EXECVE() (A *SYSCALL* BASE PARA TODAS AS VARIANTES EXECL, EXECP, ETC.)

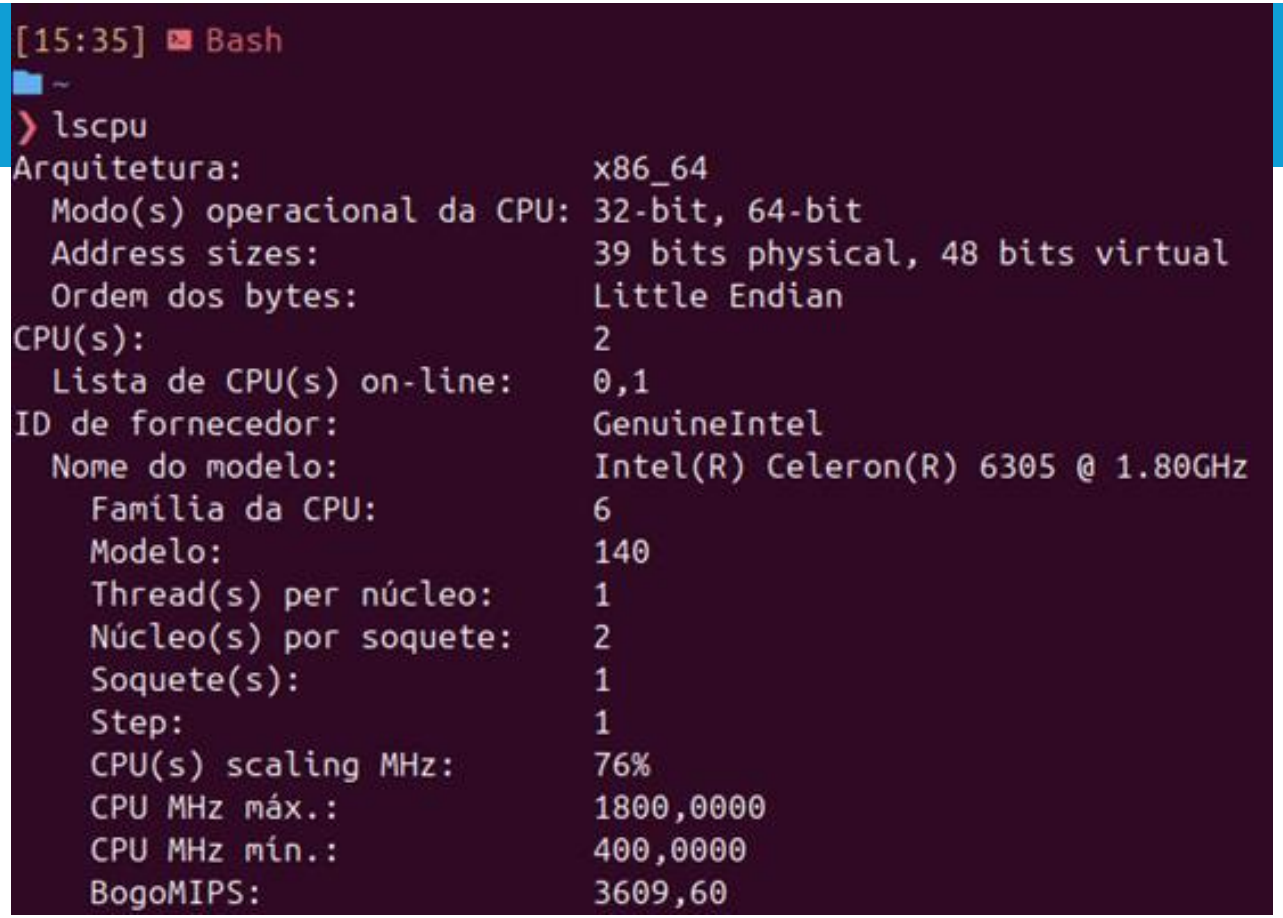
Usa o Init ou systemd como “pai de todos”:






top - 14:59:42 up 4:12, 1 user, load average: 0,98, 0,94, 0,96
Tarefas: 250 total, 1 em exec., 249 dormindo, 0 parado, 0 zumbi
%CPU(s): 5,9 us, 2,2 sy, 0,0 ni, 91,0 id, 0,7 wa, 0,0 hi, 0,2 si, 0,0 st
MB mem : 7665,4 total, 664,9 free, 3627,6 used, 4215,0 buff/cache
MB swap: 12288,0 total, 12287,7 free, 0,2 used. 4037,8 avail mem
PID USUARIO PR NI VIRT RES SHR S %CPU %MEM TEMPO+ COMANDO
2601 eryk 20 0 3951948 329992 140236 S 8,3 4,2 4:33.42 gnome-shell
805 avahi 20 0 14640 10424 4024 S 3,0 0,1 21:31.50 avahi-daemon
5649 eryk 20 0 1500660 134648 71416 S 1,3 1,7 1:37.08 rhythmbox
160 root -51 0 0 0 0 S 1,0 0,0 1:08.30 irq/133-ELAN0B00:00
2386 eryk 20 0 405980 20864 15488 S 0,7 0,3 0:45.13 wireplumber
4000 eryk 20 0 33,0g 509668 275000 S 0,7 6,5 4:45.81 brave
4049 eryk 20 0 32,6g 190424 155184 S 0,7 2,4 1:28.70 brave
5509 eryk 20 0 1410,2g 357968 155052 S 0,7 4,6 7:12.07 brave
10848 root 0 -20 0 0 0 D 0,7 0,0 0:01.20 kworker/u9:0+i915_flip
11058 root 20 0 0 0 0 I 0,7 0,0 0:01.16 kworker/0:1-events
2388 eryk 20 0 125516 29292 10352 S 0,3 0,4 0:26.75 pipewire-pulse
11137 root 20 0 0 0 0 I 0,3 0,0 0:00.74 kworker/1:0-i915-unordered
11439 eryk 20 0 12128 6140 3964 R 0,3 0,1 0:00.20 top
1 root 20 0 23464 14752 9632 S 0,0 0,2 0:04.29 systemd
2 root 20 0 0 0 0 S 0,0 0,0 0:00.00 kthreadd
3 root 20 0 0 0 0 S 0,0 0,0 0:00.00 pool_workqueue_release
4 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/R-rcu_gp
5 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/R-sync_wq
6 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/R-slub_flushwq
7 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/R-netns
9 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/0:0H-events_highpri
12 root 0 -20 0 0 0 I 0,0 0,0 0:00.00 kworker/R-mm_percpu_wq
13 root 20 0 0 0 0 I 0,0 0,0 0:00.00 rcu_tasks_kthread
14 root 20 0 0 0 0 I 0,0 0,0 0:00.00 rcu_tasks_rude_kthread

adicionar mais núcleos na CPU



Barras de utilização da CPU via terminal htop

Como o usuário ou o administrador pode visualizar, controlar ou encerrar processos

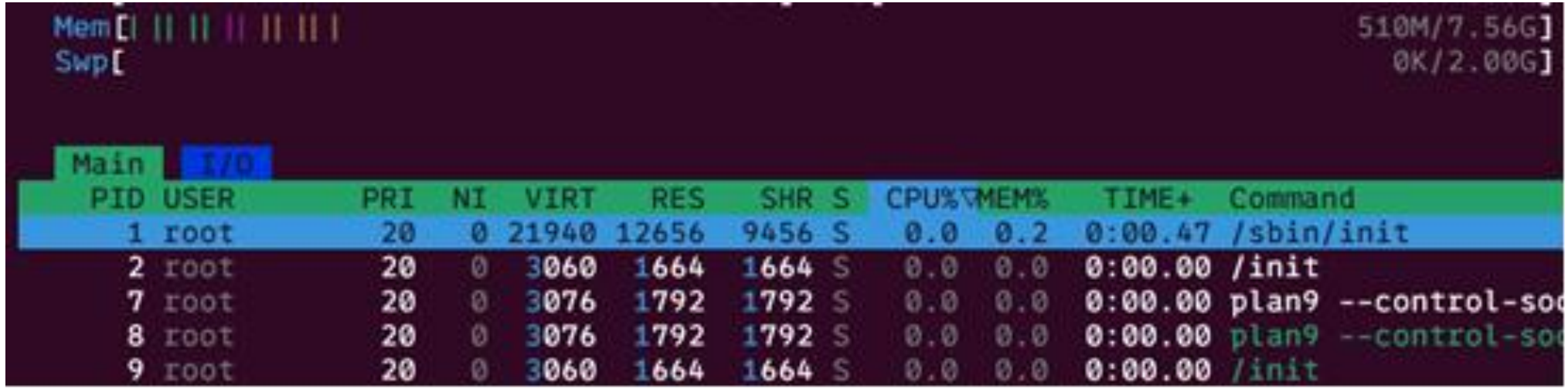
Monitor do Sistema Ubuntu

Comando	Função
kill -STOP <PID>	Pausa temporariamente a execução de um processo
kill -CONT <PID>	Retoma um processo pausado anteriormente
pkill <nome>	Encerra processos pelo nome
xkill	Modo gráfico: clique em uma janela para encerrá-la
stress -c <n>	Simula carga de CPU com n processos paralelos
lscpu	Exibe informações sobre núcleos e threads da CPU
fg %<número>	Retorna um processo do segundo para primeiro plano

2 Gerência de Memória

Swap do sistema Ubuntu.

Tabela com lista de processos



ferramentas para monitoramento

Comando	Descrição
free -h	Mostra o uso atual da memória RAM e da área de swap, com valores legíveis (em MB/GB).
htop	Interface interativa que mostra o uso de CPU, RAM, swap e detalhes de cada processo.
top	Similar ao htop, exibe o uso da CPU e da memória em tempo real, mas de forma mais simples.
vmstat	Mostra estatísticas de memória virtual, processos, E/S e uso da CPU.
cat /proc/meminfo	Exibe detalhes técnicos da memória do sistema, incluindo buffers, cache, swap, etc.
cat /proc/<PID>/status	Mostra o consumo de memória de um processo específico, incluindo VmSize, VmRSS e VmSwap.
cat /proc/vmstat	grep -E 'pg
cat /proc/<PID>/oom_score	Exibe a pontuação de um processo para o OOM Killer (quanto mais alto, maior a chance de ser morto).

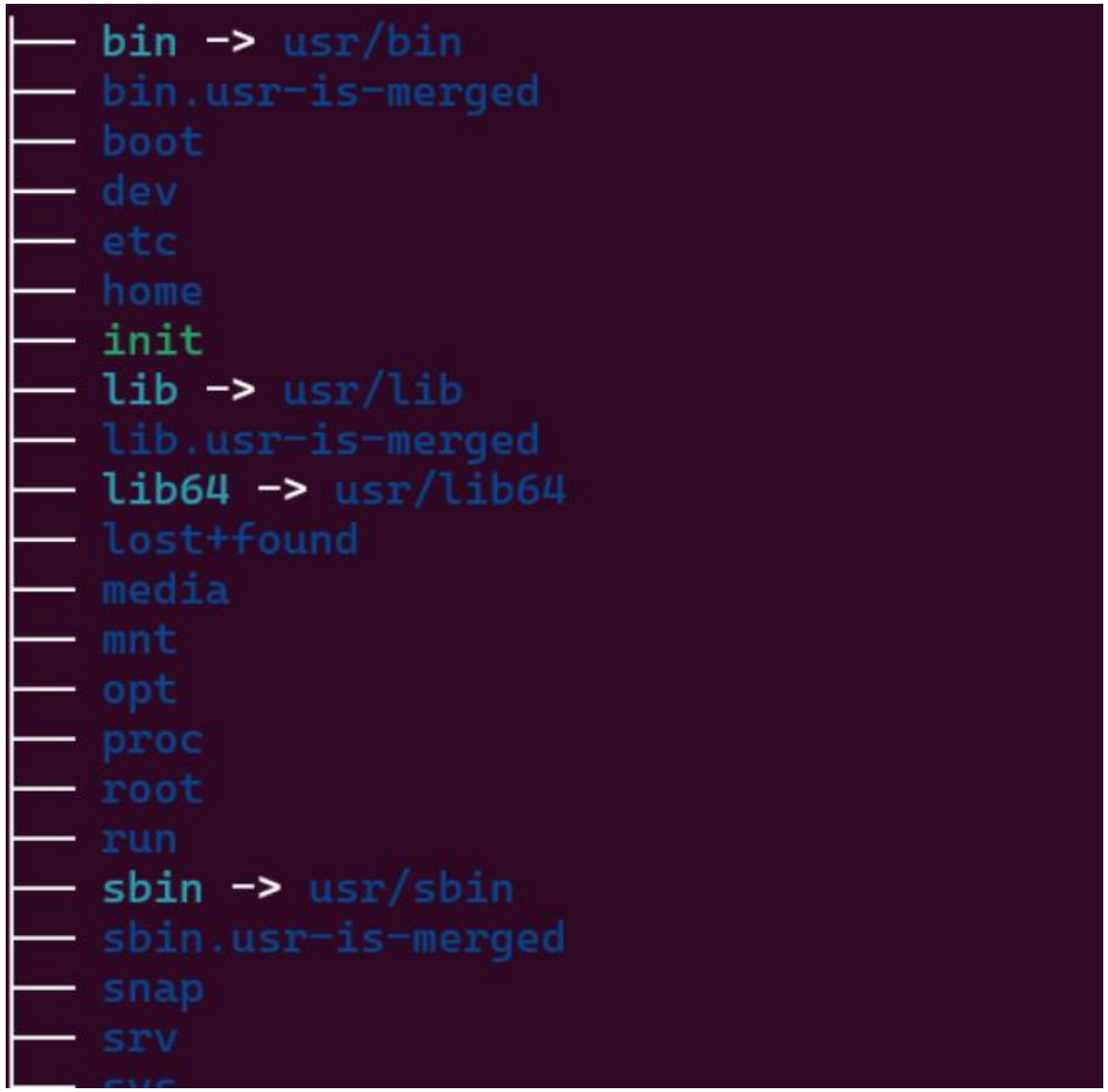
3 Gerência de Arquivos

“ext4” como sistema de arquivos montado

```
ls@JuanPablo484806:~$ df -T -x tmpfs -x devtmpfs
Filesystem     Type     1K-blocks      Used Available Use% Mounted on
none           overlay    1924712         0   1924712   0% /usr/lib/modules/6.6.87.2-microsoft-standard-WSL2
drivers        9p       498406724 219991728 278414996  45% /usr/lib/wsl/drivers
/dev/sdd       ext4    1055762868   3237412 998821984   1% /
none           overlay    1924712         0   1924712   0% /usr/lib/wsl/lib
rootfs         rootfs     1919700      2664   1917036   1% /init
none           overlay    1924712        76   1924636   1% /mnt/wslg/versions.txt
none           overlay    1924712        76   1924636   1% /mnt/wslg/doc
C:\            9p       498406724 219991728 278414996  45% /mnt/c
```

diretórios

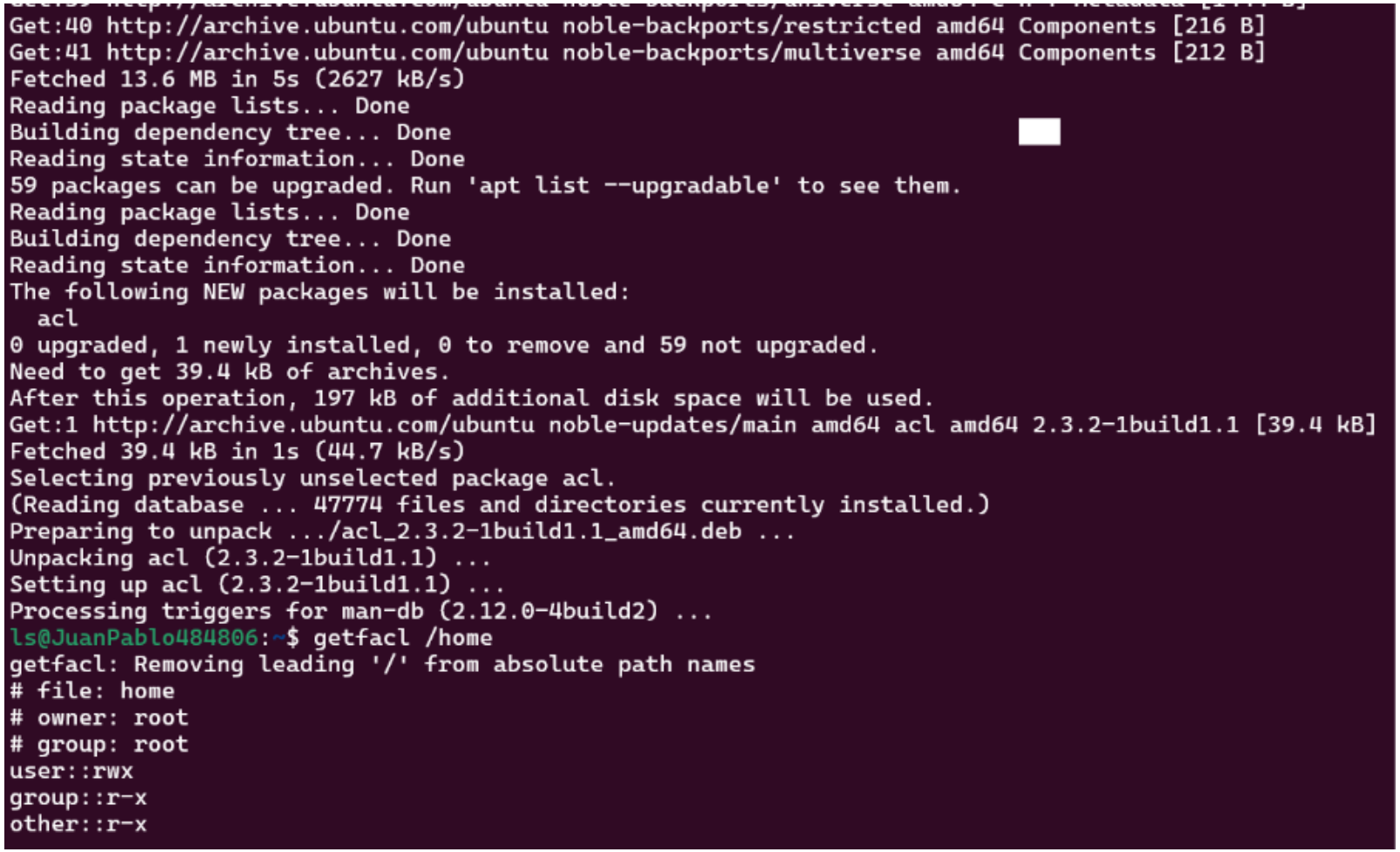
/bin e /sbin:	Comandos essenciais para todos os usuários e para operações em modo de usuário único
/etc	Arquivos de configuração do sistema, com lógica de "tudo que não é binário" que permanece estático;
/usr	Hierarquia secundária, destinada a utilitários e aplicações de múltiplos usuários, geralmente em modo somente-leitura;
/var	Dados variáveis (logs, caches, spools), cujo conteúdo muda continuamente em tempo de execução;
/home	Diretórios pessoais dos usuários, onde residem documentos e configurações individuais;
/tmp	Área para arquivos temporários, frequentemente limpa a cada reinicialização.



nível da hierarquia de diretórios

permissões

```
ls@JuanPablo484806:~$ sudo apt update && sudo apt install acl
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1391 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1684 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [225 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [9504 B]
Get:10 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [916 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [207 kB]
Get:12 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [71.5 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [19.4 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2286 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/main Translation-en [311 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:17 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [523 kB]
Get:18 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:19 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:20 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.8 kB]
Get:21 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1506 kB]
Get:22 http://archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [306 kB]
Get:23 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:24 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.4 kB]
Get:25 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [2413 kB]
Get:26 http://archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [550 kB]
Get:27 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:28 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 c-n-f Metadata [516 B]
Get:29 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [30.3 kB]
Get:30 http://archive.ubuntu.com/ubuntu noble-updates/multiverse Translation-en [6048 B]
Get:31 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:32 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 c-n-f Metadata [488 B]
Get:33 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Packages [40.4 kB]
Get:34 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7288 B]
Get:35 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 c-n-f Metadata [368 B]
Get:36 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [29.5 kB]
```



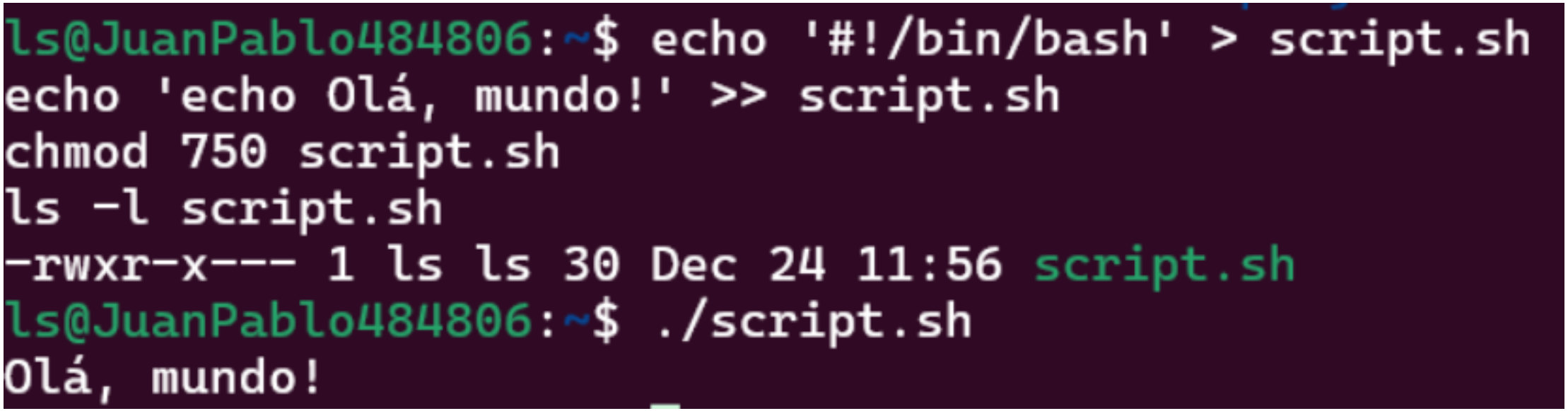
entradas estendidas de ACL

```
ls@JuanPablo484806:~$ # 1. Preparar o ambiente (criar arquivos que faltam)
mkdir -p backup entrega
touch documento.pdf relatório.docx arquivo_antigo.tmp

# 2. Executar as operações da imagem
touch novo_arquivo.txt
mkdir -p projeto_exemplo
cp documento.pdf backup/documento.pdf
mv relatório.docx entrega/relatorio.docx
rm -i arquivo_antigo.tmp  # Responda 'y' se pedir confirmação
ls -lah
rm: remove regular empty file 'arquivo_antigo.tmp'?
total 72K
drwxr-x--- 13 ls   ls   4.0K Dec 24 11:52 .
drwxr-xr-x  3 root root 4.0K Nov 24 18:19 ..
-rw-------  1 ls   ls    841 Nov 26 17:04 .bash_history
-rw-r--r--  1 ls   ls    220 Nov 24 18:19 .bash_logout
-rw-r--r--  1 ls   ls   3.7K Nov 24 18:19 .bashrc
drwx------  4 ls   ls   4.0K Nov 26 15:05 .cache
drwxr-xr-x  3 ls   ls   4.0K Nov 26 15:05 .dotnet
drwxr-xr-x  3 ls   ls   4.0K Nov 26 15:59 .ipython
drwxr-xr-x  2 ls   ls   4.0K Nov 26 15:01 .landscape
-rw-r--r--  1 ls   ls      0 Dec 24 11:26 .motd_shown
-rw-r--r--  1 ls   ls    807 Nov 24 18:19 .profile
-rw-r--r--  1 ls   ls      0 Nov 24 18:51 .sudo_as_admin_successful
drwxr-xr-x  4 ls   ls   4.0K Nov 26 15:03 .vscode-remote-containers
drwxr-xr-x  5 ls   ls   4.0K Nov 26 15:05 .vscode-server
-rw-r--r--  1 ls   ls    268 Nov 26 15:05 .wget-hsts
drwxr-xr-x  3 ls   ls   4.0K Nov 24 18:28 Documentos
-rw-r--r--  1 ls   ls      0 Dec 24 11:52 arquivo_antigo.tmp
drwxr-xr-x  2 ls   ls   4.0K Dec 24 11:52 backup
-rw-r--r--  1 ls   ls      0 Dec 24 11:52 documento.pdf
drwxr-xr-x  2 ls   ls   4.0K Dec 24 11:52 entrega
-rw-r--r--  1 ls   ls      0 Dec 24 11:52 novo_arquivo.txt
drwxr-xr-x  3 ls   ls   4.0K Nov 26 15:55 pipeline_dados
drwxr-xr-x  2 ls   ls   4.0K Dec 24 11:51 projeto_exemplo
```

Exemplos de operações básicas

Saída do comando



4 Proteção e Segurança

```
ls@JuanPablo484806:~$ cat /etc/pam.d/common-auth
#
# /etc/pam.d/common-auth - authentication settings common to all services
#
# This file is included from other service-specific PAM config files,
# and should contain a list of the authentication modules that define
# the central authentication scheme for use on the system
# (e.g., /etc/shadow, LDAP, Kerberos, etc.).  The default is to use the
# traditional Unix authentication mechanisms.
#
# As of pam 1.0.1-6, this file is managed by pam-auth-update by default.
# To take advantage of this, it is recommended that you configure any
# local modules either before or after the default block, and use
# pam-auth-update to manage selection of other modules.  See
# pam-auth-update(8) for details.

# here are the per-package modules (the "Primary" block)
auth    [success=1 default=ignore]      pam_unix.so nullok
# here's the fallback if no module succeeds
auth    requisite                       pam_deny.so
# prime the stack with a positive return value if there isn't one already;
# this avoids us returning an error just because nothing sets a success code
# since the modules above will each just jump around
auth    required                        pam_permit.so
# and here are more per-package modules (the "Additional" block)
auth    optional                        pam_cap.so
# end of pam-auth-update config
```

Configuração típica de autenticação PAM em Ubuntu

Partições em Ubuntu 24.04.2 LTS.

```
ls@JuanPablo484806:~$ lsblk -o NAME,FSTYPE,SIZE,TYPE,MOUNTPOINT | grep crypt
cryptsetup status /dev/mapper/ubuntu--vg-root
Command 'cryptsetup' not found, but can be installed with:
sudo apt install cryptsetup-bin
```

Usuários com Permissão para Sudo

verificação do SELinux com sestatus.

```
ls@JuanPablo484806:~$ aa-status
sestatus
apparmor module is loaded.
apparmor filesystem is not mounted.
Command 'sestatus' not found, but can be installed with:
sudo apt install policycoreutils
```