

Contents

Introduction	2
In this project, I will explore Linux, primarily focusing on Ubuntu but also exploring other distributions. I'll be cautious about potential challenges with virtualization, documenting the results. Using practical examples and visuals, I will cover fundamental Linux commands and concepts, culminating in some hands-on shell scripting.....	
Theory	2
Kommandon och symboler	2
Grundläggande systemdata	2
Prestanda och processer	3
Results.....	4
Kommandon och symboler	4
Grundläggande systemdata	11
Prestanda och processer	16
References	19

Introduction

In this project, I will explore Linux, primarily focusing on Ubuntu but also exploring other distributions. I'll be cautious about potential challenges with virtualization, documenting the results. Using practical examples and visuals, I will cover fundamental Linux commands and concepts, culminating in some hands-on shell scripting.

Theory

Kommandon och symboler

1.

a) `ls` Lists the contents of a directory. For example `ls -l /home/user/` would list all the files and directories in `/home/user/` in long format, showing permissions, ownership, size, and modification date.ⁱ

b) `mkdir` creates a new directory. `mkdir /home/Desktop/new_folder` would create a new directory named `new_folder` in the `/home/Desktop/` directory.ⁱⁱ

c) `mv` moves a file or directory, or renames it. Take `mv old_name.txt new_name.txt` as an example would rename a file from `old_name.txt` to `new_name.txt`. If `new_name.txt` is a directory, `old_name.txt` would be moved into that directory.ⁱⁱⁱ

d) `which` shows the full path of shell commands. `which ls` would show the full path of the `ls` command, typically something like `/bin/ls`.^{iv}

e) `cat` concatenates and displays the content of files. For instance, `cat file.txt` would display the content of `file.txt` to the terminal.^v

f) `chmod` changes the file mode bits (permissions) of a file or directory. `chmod 755 script.sh` would set the permissions of `script.sh` to be readable and executable by everyone, but only writable by the owner.^{vi}

2.

the `|`^{vii} symbol is used as a pipe, which allows the output of one command to be used as the input for another. The `>` symbol is used for output redirection, which redirects the standard output of a command to a file, overwriting its contents. The `<` symbol is used for input redirection, which redirects the contents of a file to be used as the input for a command.^{viii}

Grundläggande systemdata

a) `uname` displays system information. `uname -a` would give all the system information, including kernel name, kernel release, kernel version, machine, processor, hardware platform, operating system, and the hostname.^{ix}

b) free displays the total amount of free and used physical and swap memory in the system, as well as the buffers and caches used by the kernel. Used, free -m would display the memory information in megabytes.^x

c) df reports the amount of disk space used and available on file systems. How its used, df -h would show the amount of disk space used and available on all mounted file systems with human-readable formats (e.g., in GBs or MBs).^{xi}

d) vmstat reports information about processes, memory, paging, block IO, traps, and CPU activity. Usage, vmstat -s would give you a table of various statistics, including memory usage.^{xii}

e) /proc File System is A virtual file system that provides detailed information about different aspects of the operating system, including hardware and current running processes. Used to Read different files under /proc gives real-time system information. For instance, cat /proc/meminfo provides detailed memory information, cat /proc/swaps shows swap usage, and cat /proc/cpuinfo provides detailed CPU information.^{xiii}

Prestanda och processer

In the process lifecycle, a new process enters the running or runnable state where it utilizes CPU resources to execute its tasks. If preempted, it enters a run queue, transitioning to a runnable state until its turn for execution. These states are collectively denoted by the character R. During execution, a process may encounter I/O operations, prompting it to enter a sleeping state. This state is further classified into interruptible (S) and uninterruptible (D) sleeping states. While the D state waits for resources, such as network responses, the S state responds to signals and resource availability, like waiting for user input. Processes can also be stopped (T) using signals, with SIGSTOP forcing a stop and SIGTSTP optionally ignorable. A process in the zombie state (Z) has completed execution but remains in limbo until the parent process clears it from the process table by reading its exit value. These states collectively define the dynamic behavior of processes within the operating system.

Kommandon och symboler

1. A) LS: When it comes to displaying files or directories in Linux and other Unix-based operating system.

Image:

```

Terminal
File Edit View Search Terminal Help
saal2107@CSVL209PC09:~$ ls
Desktop      Dokument      Favorites     Pictures     public_html  Templates
Documents    Downloads    Music        Public       Skrivbord    Videos
saal2107@CSVL209PC09:~$ ls Dokument
Autodesk
desktop.ini
IIEExpress
'Inventor Server for AutoCAD'
labb2_fixa
labb3.1.PNG
labb3.2.PNG
MATLAB
'My Music'
'My Pictures'
'My Videos'
'My Web Sites'
'$RECYCLE.BIN'
'SOLIDWORKS Visual Studio Tools for Applications'
'Visual Studio 2005'
'Visual Studio 2015'
saal2107@CSVL209PC09:~$ █

```

LS can be used with flags that display files and directories in the terminal differently, or how the command works.

- List files in a specific directory (ls [directory])

Example:

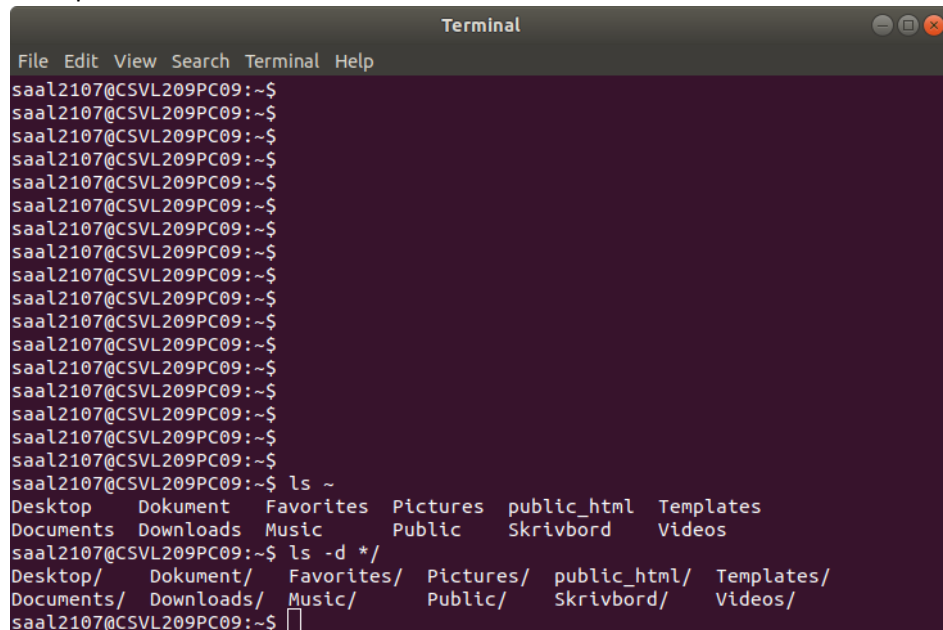
- (Ls /) to show the files in the root directory

Example:

[illegible]

- Difference between listing files in the home directory and only directories is command which is `(ls ~)` and `(ls -d */)` respectively.

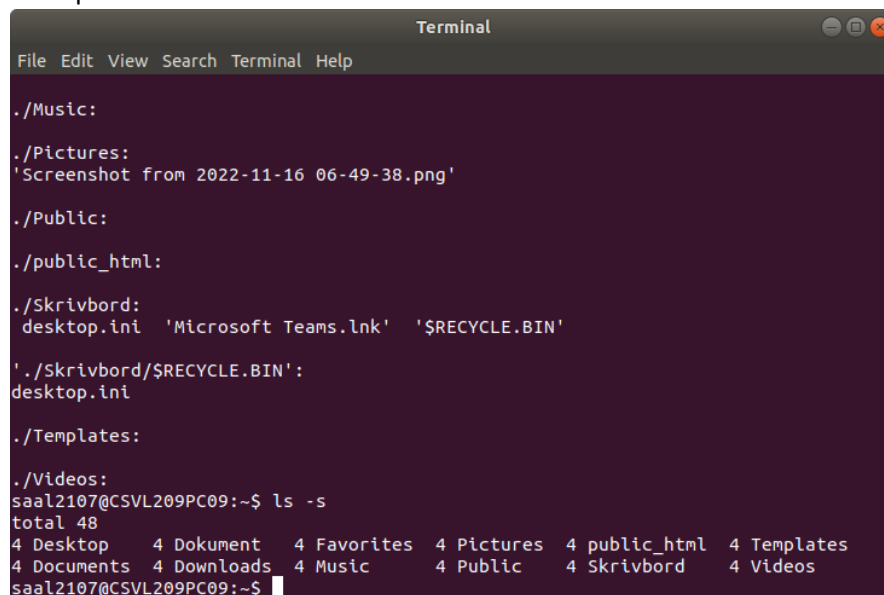
Example:



```
Terminal
File Edit View Search Terminal Help
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$
saal2107@CSVL209PC09:~$ ls ~
Desktop  Dokument  Favorites  Pictures  public_html  Templates
Documents Downloads Music      Public      Skrivbord    Videos
saal2107@CSVL209PC09:~$ ls -d */
Desktop/  Dokument/  Favorites/  Pictures/  public_html/  Templates/
Documents/ Downloads/  Music/      Public/      Skrivbord/    Videos/
saal2107@CSVL209PC09:~$
```

- To display all files, directories and their subdirectories, use the command (ls -R)
Example: is difficult to show
- Listing files with their corresponding sizes by using (ls -s)

Example:



```
Terminal
File Edit View Search Terminal Help
./Music:
./Pictures:
'Screenshot from 2022-11-16 06-49-38.png'
./Public:
./public_html:
./Skrivbord:
desktop.ini 'Microsoft Teams.lnk' '$RECYCLE.BIN'
'./Skrivbord/$RECYCLE.BIN':
desktop.ini
./Templates:
./Videos:
saal2107@CSVL209PC09:~$ ls -s
total 48
4 Desktop    4 Dokument  4 Favorites  4 Pictures  4 public_html  4 Templates
4 Documents  4 Downloads  4 Music      4 Public    4 Skrivbord    4 Videos
saal2107@CSVL209PC09:~$
```

B) MV

```
Terminal
File Edit View Search Terminal Help
saal2107@CSVL209PC09:~$ mv --help
Usage: mv [OPTION]... [-T] SOURCE DEST
       or: mv [OPTION]... SOURCE... DIRECTORY
       or: mv [OPTION]... -t DIRECTORY SOURCE...
Rename SOURCE to DEST, or move SOURCE(s) to DIRECTORY.

Mandatory arguments to long options are mandatory for short options too.
  -b, --backup[=CONTROL]  make a backup of each existing destination file
                           like --backup but does not accept an argument
  -f, --force              do not prompt before overwriting
  -i, --interactive        prompt before overwrite
  -n, --no-clobber         do not overwrite an existing file
If you specify more than one of -i, -f, -n, only the final one takes effect.
  --strip-trailing-slashes remove any trailing slashes from each SOURCE
                           argument
  -S, --suffix=SUFFIX      override the usual backup suffix
  -t, --target-directory=DIRECTORY move all SOURCE arguments into DIRECTORY
  -T, --no-target-directory treat DEST as a normal file
  -u, --update              move only when the SOURCE file is newer
                           than the destination file or when the
                           destination file is missing
  -v, --verbose             explain what is being done
  -Z, --context             set SELinux security context of destination
                           file to default type
      --help               display this help and exit
      --version             output version information and exit

The backup suffix is '~', unless set with --suffix or SIMPLE_BACKUP_SUFFIX.
The version control method may be selected via the --backup option or through
the VERSION_CONTROL environment variable. Here are the values:

   none, off      never make backups (even if --backup is given)
   numbered, t    make numbered backups
   existing, nil  numbered if numbered backups exist, simple otherwise
   simple, never  always make simple backups

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/mv>
or available locally via: info '(coreutils) mv invocation'
saal2107@CSVL209PC09:~$
```

- Moving one or multiple files from one Directory to another, using the command (mv [file_name(s)] [Directory])
- Rename files and directories by typing (mv [File1/Directory1] [File2/Directory2])
Where file1/ directory1 is the name of the first file and file2/Directory2 is the new name for it.
- When moving file(s) to a directory where the same files' name(s) exists then the files will overwrite the file(s) in the destined directory. Therefore, using some commands to either avoid or at least ask before overwriting which is shown as follows:
 - o -i/ -n/ -u/ -f/ -b [file] [Directory]
 - o -i prompt before overwriting
 - o -f doesn't prompt before overwriting
 - o -n don't overwrite an existing file

C) CAT

```
Terminal
File Edit View Search Terminal Help
saal2107@CSVL209PC09:~$ cat --help
Usage: cat [OPTION]... [FILE]...
Concatenate FILE(s) to standard output.

With no FILE, or when FILE is -, read standard input.

  -A, --show-all           equivalent to -vET
  -b, --number-nonblank     number nonempty output lines, overrides -n
  -e                       equivalent to -vE
  -E, --show-ends           display $ at end of each line
  -n, --number              number all output lines
  -s, --squeeze-blank       suppress repeated empty output lines
  -t                       equivalent to -vT
  -T, --show-tabs           display TAB characters as ^I
  -u                       (ignored)
  -v, --show-nonprinting    use ^ and M- notation, except for LFD and TAB
      --help               display this help and exit
      --version            output version information and exit

Examples:
  cat f - g  Output f's contents, then standard input, then g's contents.
  cat        Copy standard input to standard output.

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/cat>
or available locally via: info '(coreutils) cat invocation'
saal2107@CSVL209PC09:~$
```

- View: file, multiple files and contents of a file with their corresponding line, command used as follows (cat [file]), (cat [file1] [file2]) and (cat -n [file]) respectively
- To suppress repeated empty lines in output command use (cat -s [file]) and if trying to append content of one file to end of another file use command (cat [file1] >> [file2])
- User has also the ability to display contents in reverse or highlight the end of the line by typing the following command (tac [file]) or (cat -E [file])

Example:

```
Terminal
File Edit View Search Terminal Help
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Music
drwx----- 2 saal2107 studenter 4096 nov 16 08:47 Pictures
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Public
drwxr-xr-x 2 saal2107 studenter 4096 nov 14 07:32 public_html
-rwx----- 1 saal2107 studenter  0 nov 16 08:11 sai
drwx----- 3 saal2107 studenter 4096 nov 10 14:55 Skrivbord
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Templates
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Videos
saal2107@CSVL209PC11:~$ uname -a
Linux CSVL209PC11 4.15.0-196-generic #207-Ubuntu SMP Thu Oct 27 21:24:58 UTC 2022
2 x86_64 x86_64 x86_64 GNU/Linux
saal2107@CSVL209PC11:~$ uname
Linux
saal2107@CSVL209PC11:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="18.04.2 LTS (Bionic Beaver)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.2 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=bionic
UBUNTU_CODENAME=bionic
saal2107@CSVL209PC11:~$
```

```
Terminal
File Edit View Search Terminal Help
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Templates
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Videos
saal2107@CSVL209PC11:~$ uname -a
Linux CSVL209PC11 4.15.0-196-generic #207-Ubuntu SMP Thu Oct 27 21:24:58 UTC 202
2 x86_64 x86_64 x86_64 GNU/Linux
saal2107@CSVL209PC11:~$ uname
Linux
saal2107@CSVL209PC11:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="18.04.2 LTS (Bionic Beaver)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.2 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-poli
cy"
VERSION_CODENAME=bionic
UBUNTU_CODENAME=bionic
saal2107@CSVL209PC11:~$ grep MemTotal /proc/meminfo
MemTotal:      8071772 kB
saal2107@CSVL209PC11:~$ free -m
              total        used          free      shared  buff/cache   available
Mem:          7882         2071          1130           522         4680         5007
Swap:          2047              0           2047
```

```
Terminal
File Edit View Search Terminal Help
saal2107@CSVL209PC11:~$ free -m
              total        used          free      shared  buff/cache   available
Mem:          7882         2071          1130           522         4680         5007
Swap:          2047              0           2047
saal2107@CSVL209PC11:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 6
model          : 60
model name     : Intel(R) Core(TM) i7-4790 CPU @ 3.60GHz
stepping      : 3
microcode     : 0x28
cpu MHz       : 2934.073
cache size    : 8192 KB
physical id   : 0
siblings      : 8
core id       : 0
cpu cores     : 4
apicid        : 0
initial apicid: 0
fpu           : yes
fpu_exception : yes
cpuid level   : 13
wp            : yes
flags          : fpu vme de pse tsc mtr pae mce cx8 apic sep ntrr pge mca cmov pat pse36 clflush dts aopl mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant tsc arch perfmon pebs bts re
n_dedup nopl xopidlow nonstop tsc cpuid eperf mtrr pni poimwqld dtrnd monitor ds_cpl vmm vmmx estl tm2 ssse3 sdbg fma cx16 xtpr pdcm puid sse4_1 sse4_2 x2apic mwaitx ppcrrt tsc deadline timer x86 state avx
f16c rdrand lahr lm abm cpuid_fault epb invpcid_single pti scsd tbs bpb stpb tpr_shadow vmmi flexpriority ept vpid fsgsbase tsc_adjust bti1 avx2 snap bmt2 erms invpcid xsaveopt dtherm ida arat pln pts
mg_clear_flush_id
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swappg tlb_multihit srbsd
bogomips      : 7183.37
clflush size   : 64
cache_alignme : 64
address sizes  : 39 bits physical, 48 bits virtual
power managem :
processor       : 1
vendor_id      : GenuineIntel
cpu family     : 6
model          : 60
model name     : Intel(R) Core(TM) i7-4790 CPU @ 3.60GHz
stepping      : 3
microcode     : 0x28
cpu MHz       : 2932.477
cache size    : 8192 KB
physical id   : 0
siblings      : 8
core id       : 1
cpu cores     : 4
apicid        : 2
initial apicid: 2
fpu           : yes
fpu_exception : yes
cpuid level   : 13
wp            : yes
flags          : fpu vme de pse tsc mtr pae mce cx8 apic sep ntrr pge mca cmov pat pse36 clflush dts aopl mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant tsc arch perfmon pebs bts re
```

D) mkdir allows the user to create directory or multiple directories and set the permissions for them at the same time


```
Terminal
File Edit View Search Terminal Help
cat      Copy standard input to standard output.

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/cat>
or available locally via: info '(coreutils) cat invocation'
saal2107@CSVL209PC09:~$ cat -t
^Z
[1]+  Stopped                  cat -t
saal2107@CSVL209PC09:~$ mkdir --help
Usage: mkdir [OPTION]... DIRECTORY...
Create the DIRECTORY(ies), if they do not already exist.

Mandatory arguments to long options are mandatory for short options too.
-m, --mode=MODE      set file mode (as in chmod), not a=rwx - umask
-p, --parents         no error if existing, make parent directories as needed
-v, --verbose         print a message for each created directory
-Z                   set SELinux security context of each created directory
                     to the default type
--context[=CTX]      like -Z, or if CTX is specified then set the SELinux
                     or SMACK security context to CTX
--help               display this help and exit
--version            output version information and exit

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/mkdir>
or available locally via: info '(coreutils) mkdir invocation'
saal2107@CSVL209PC09:~$
```

- To display a message after creating every directory with the name of the directory use the command (mkdir -v [directory])
Example:
- In order to set the files mode of the created directory which specifies the access given for the users. The command used is (mkdir -m a=rwx [Directory]) where r, w, x stand for Read, write, execute respectively.
Example:

E) “Which” is the command used to determine the location in the PATH environment variable then list the full path of the command specified.

```
hani@hani-VirtualBox: ~
hani@hani-VirtualBox:~$ which firefox
/snap/bin/firefox
hani@hani-VirtualBox:~$
```

F) “chmod” allows users to set permissions on file(s), it could be by permitting, preventing a file from reading, modifying or executing.

The permission statement is set to a group of people, who are they?

- U: user or owner
- G: Group, members of group the file belongs to

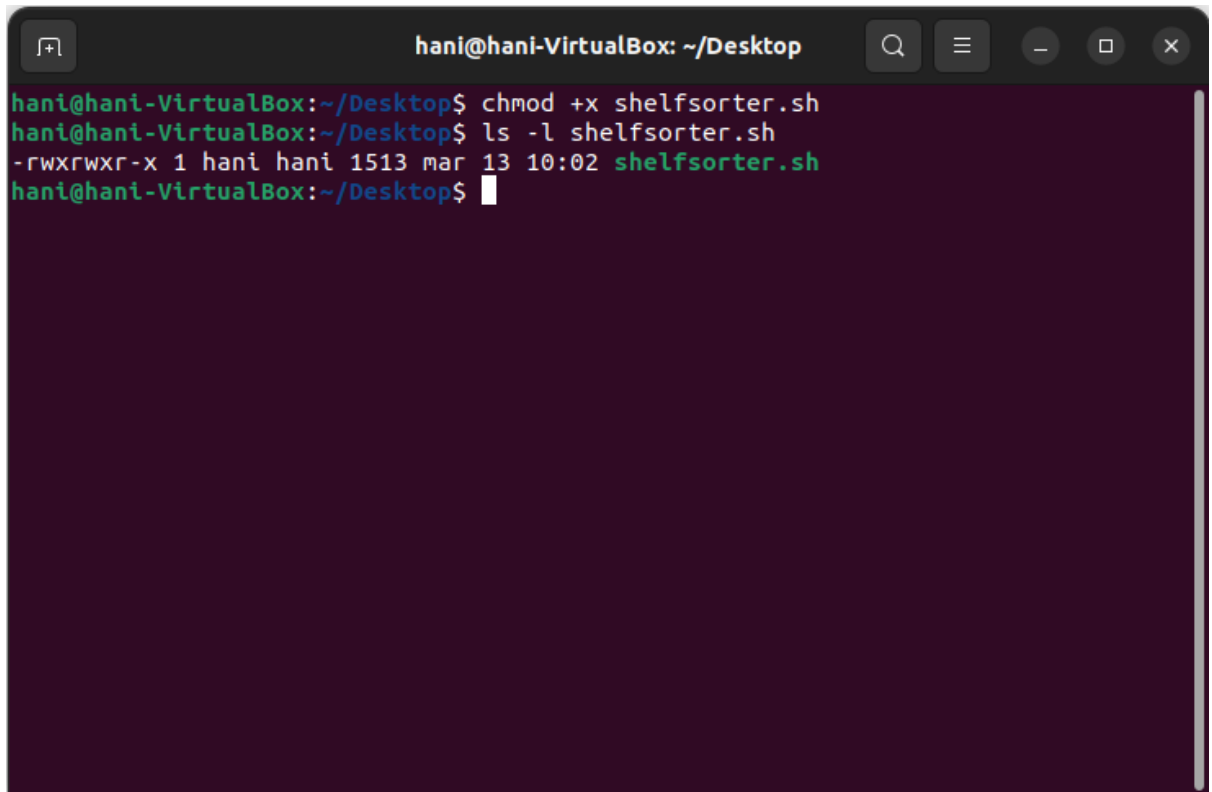
- O: Other, not u or g
- A: All, the previous groups.

What are the permissions set?

- -: removes the permission
- +: to grant the permission
- =: to set the permission

Which permission statements?

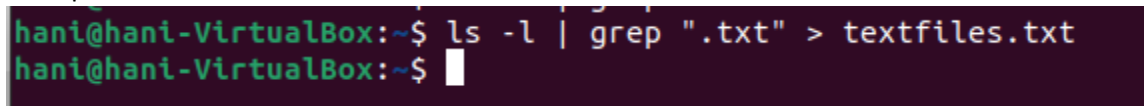
- R: read
- W: write
- X: execute

A terminal window titled 'hani@hani-VirtualBox: ~/Desktop'. The window has a dark background with green and white text. The user has entered three commands: 'chmod +x shelfsorter.sh', 'ls -l shelfsorter.sh', and the prompt is now ready for the next command. The output of the second command shows the file permissions as '-rwxrwxr-x' for user 'hani' and group 'hani', with a size of 1513 bytes, dated Mar 13 10:02, and the filename 'shelfsorter.sh'.

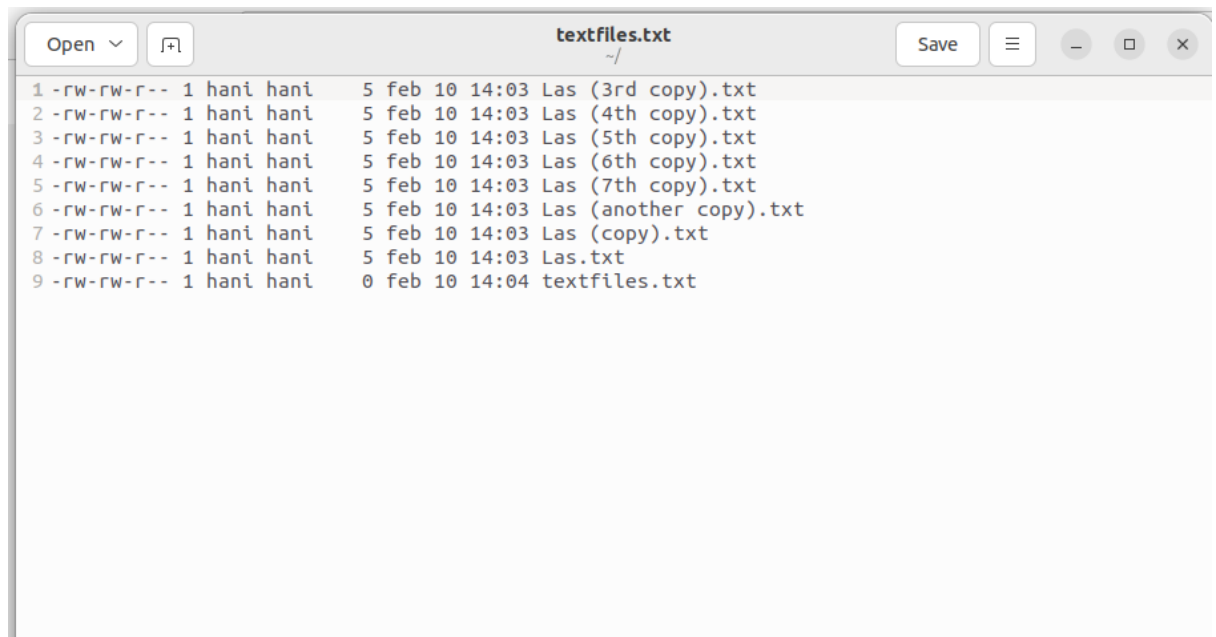
```
hani@hani-VirtualBox: ~/Desktop
hani@hani-VirtualBox:~/Desktop$ chmod +x shelfsorter.sh
hani@hani-VirtualBox:~/Desktop$ ls -l shelfsorter.sh
-rwxrwxr-x 1 hani hani 1513 mar 13 10:02 shelfsorter.sh
hani@hani-VirtualBox:~/Desktop$
```

2.

Example:

A terminal window showing a single command being executed: 'ls -l | grep ".txt" > textfiles.txt'. The prompt is now ready for the next command.

```
hani@hani-VirtualBox:~$ ls -l | grep ".txt" > textfiles.txt
hani@hani-VirtualBox:~$
```



```
1 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (3rd copy).txt
2 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (4th copy).txt
3 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (5th copy).txt
4 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (6th copy).txt
5 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (7th copy).txt
6 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (another copy).txt
7 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las (copy).txt
8 -rw-rw-r-- 1 hani hani 5 feb 10 14:03 Las.txt
9 -rw-rw-r-- 1 hani hani 0 feb 10 14:04 textfiles.txt
```

This line performs the following tasks:

ls -l lists the contents of the current directory with detailed information (permissions, owner, size, etc.).

The output of the ls -l command is then passed as input to grep.

grep ".txt" filters the output of ls -l to show only the lines that contain the ".txt" extension.

The output of the grep command is then redirected using the > operator to a file named "textfiles.txt".

In this way, the line performs a simple chore of listing all the files in the current directory with the ".txt" extension and saving the result to a file named "textfiles.txt".

Grundläggande systemdata

3. Uname, df, free and vmstat

a) Uname -a: to state operating system, kernel version and hardware.

Example:

```
Terminal
File Edit View Search Terminal Help
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Music
drwx----- 2 saal2107 studenter 4096 nov 16 08:47 Pictures
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Public
drwxr-xr-x 2 saal2107 studenter 4096 nov 14 07:32 public_html
-rwx----- 1 saal2107 studenter 0 nov 16 08:11 sa1
drwx----- 3 saal2107 studenter 4096 nov 10 14:55 Skrivbord
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Templates
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Videos
saal2107@CSVL209PC11:~$ uname -a
Linux CSVL209PC11 4.15.0-196-generic #207-Ubuntu SMP Thu Oct 27 21:24:58 UTC 202
2 x86_64 x86_64 x86_64 GNU/Linux
saal2107@CSVL209PC11:~$ uname
Linux
saal2107@CSVL209PC11:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="18.04.2 LTS (Bionic Beaver)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.2 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=bionic
UBUNTU_CODENAME=bionic
saal2107@CSVL209PC11:~$
```

The image shows the operating system used is Linux and version used is "18.04.2 LTS (Bionic Beaver)"

Another way to that is using the command (cat /etc/os-release)

- b) Free -m displays the physical and cache memory as shown below:
Which means that the total physical memory is 7882 GB

```
Terminal
File Edit View Search Terminal Help
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Templates
drwx----- 2 saal2107 studenter 4096 nov 16 06:21 Videos
saal2107@CSVL209PC11:~$ uname -a
Linux CSVL209PC11 4.15.0-196-generic #207-Ubuntu SMP Thu Oct 27 21:24:58 UTC 2022 x86_64 x86_64 x86_64 GNU/Linux
saal2107@CSVL209PC11:~$ uname
Linux
saal2107@CSVL209PC11:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="18.04.2 LTS (Bionic Beaver)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.2 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=bionic
UBUNTU_CODENAME=bionic
saal2107@CSVL209PC11:~$ grep MemTotal /proc/meminfo
MemTotal:      8071772 kB
saal2107@CSVL209PC11:~$ free -m
              total        used        free      shared  buff/cache   available
Mem:           7882         2071         1130          522         4680         5007
Swap:          2047           0          2047
```

- c) Using the previous command to show the swap memory which is 2047 (or inactive memory)
- d) To check the primary memory available (cat /proc/meminfo) USE (FREE)
The value of primary memory available for new processes is MemAvailable which is listed as 5075844 kB, which takes into account MemFree, and the memory that can be reclaimed from buffers and cached resources.

```

File Edit View Search Terminal Help
cflush size : 64
cache alignment : 64
address sizes : 39 bits physical, 48 bits virtual
power management:

saal2107@CSVL209PCI1:~$ cat /proc/meminfo
MemTotal: 8071772 kB
MemFree: 1095480 kB
MemAvailable: 5075844 kB
Buffers: 226892 kB
Cached: 4313420 kB
SwapCached: 0 kB
Active: 2922424 kB
Inactive: 3474476 kB
Active(anon): 1044940 kB
Inactive(anon): 548932 kB
Active(file): 1077484 kB
Inactive(file): 2925544 kB
Unevictable: 20 kB
Mlocked: 20 kB
SwapTotal: 2097148 kB
SwapFree: 2097148 kB
Dirty: 24 kB
Writeback: 0 kB
AnonPages: 1056040 kB
Mapped: 727948 kB
Shmem: 551008 kB
Slab: 428964 kB
SReclaimable: 279528 kB
SUnreclaim: 148536 kB
KernelStack: 15440 kB
PageTables: 56368 kB
Mks_unstable: 0 kB
Bounce: 0 kB
WritebackTmp: 0 kB
CommitLimit: 6133832 kB
Committed AS: 7477016 kB
VmallocTotal: 34359738367 kB
VmallocUsed: 0 kB
VmallocChunk: 0 kB
HardwareCorrupted: 0 kB
AnonHugePages: 0 kB
ShmemHugePages: 0 kB
ShmemPmdHugePages: 0 kB
CmaTotal: 0 kB
CmaFree: 0 kB
HugePages_Total: 0
HugePages_Free: 0
HugePages_Rsvd: 0
HugePages_Surp: 0
Hugepagesize: 2048 kB
DirectMap4k: 359148 kB
DirectMap2M: 7933952 kB
DirectMap1G: 1048576 kB
saal2107@CSVL209PCI1:~$

File Edit View Search Terminal Help
saal2107@CSVL209PCI1:~$ free -m
              total        used        free      shared  buff/cache   available
Mem:           7882         2071         1130          522         4680         5007
Swap:           2047              0         2047

saal2107@CSVL209PCI1:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 6
model          : 60
model name     : Intel(R) Core(TM) i7-4790 CPU @ 3.60GHz
stepping       : 3
microcode      : 0x28
cpu MHz        : 2834.873
cache size     : 8192 KB
physical id    : 0
siblings       : 8
core id        : 0
cpu cores      : 4
apicid         : 0
initial apicid : 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts re
p_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 sse3 sdbg fma cx16 xtpr pdcm pcid sse4.1 sse4.2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx
f16c rdrand lahf_lm abm cpuid_fault epb invpcid_single pti ssbd ibrs lbrs lsbp stibp tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bti1 avx2 smep bti2 erms invpcid xsaves dtherm ida arat pln pts
rd_clear flush_l3d
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit srbds
bogomips       : 7183.37
cflflush size  : 64
cache alignment : 64
address sizes   : 39 bits physical, 48 bits virtual
power management:

processor       : 1
vendor_id      : GenuineIntel
cpu family     : 6
model          : 60
model name     : Intel(R) Core(TM) i7-4790 CPU @ 3.60GHz
stepping       : 3
microcode      : 0x28
cpu MHz        : 2892.477
cache size     : 8192 KB
physical id    : 0
siblings       : 8
core id        : 1
cpu cores      : 4
apicid         : 2
initial apicid : 2
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts re

```

- e) The command used to identify the capacity of every file system is (df -h --total) which shows the total capacity size: 213G and the used size: 23G

```
File Edit View Search Terminal Help
/dev/loop12 148M 148M 0 100% /snap/gnome-3-26-1004/102
/dev/loop18 787K 787K 0 100% /snap/gnome-logs/115
/dev/loop19 230M 230M 0 100% /snap/gnome-3-34-1804/72
/dev/loop21 435M 435M 0 100% /snap/gnome-42-2204/29
/dev/loop20 2,8M 2,8M 0 100% /snap/gnome-calculator/920
/dev/loop22 173M 173M 0 100% /snap/gnome-3-28-1804/101
/dev/loop23 787K 787K 0 100% /snap/gnome-characters/741
/dev/loop26 77M 77M 0 100% /snap/core22/310
/dev/loop24 2,8M 2,8M 0 100% /snap/gnome-system-monitor/178
/dev/loop25 59M 59M 0 100% /snap/core18/2620
/dev/loop27 74M 74M 0 100% /snap/core22/275
tmpfs 827M 17K 827M 1% /run/user/120
/dev/loop28 67M 67M 0 100% /snap/core20/1695
themsto.stud.mh.se:/users/sa/saal2107 3,7T 3,2T 479G 87% /userhome/saal2107
tmpfs 827M 148K 827M 1% /run/user/338015
saal2107@CSVL209PC11:~$ df -H --output=source,size,used,avail
Filesystem Size Used Avail
udev 4,1G 0 4,1G
tmpfs 827M 2,1M 825M
/dev/sda1 211G 21G 179G
tmpfs 4,2G 0 4,2G
tmpfs 5,3M 4,1k 5,3M
tmpfs 4,2G 0 4,2G
/dev/loop2 121M 121M 0
/dev/loop0 2,7M 2,7M 0
/dev/loop1 230M 230M 0
/dev/loop4 86M 86M 0
/dev/loop5 656K 656K 0
/dev/loop6 97M 97M 0
/dev/loop8 67M 67M 0
/dev/loop8 132K 132K 0
/dev/loop10 1,6M 1,6M 0
/dev/loop9 121M 121M 0
/dev/loop7 525K 525K 0
/dev/loop11 364M 364M 0
/dev/loop13 364M 364M 0
/dev/loop17 148M 148M 0
/dev/loop14 59M 59M 0
/dev/loop16 171M 171M 0
/dev/loop12 148M 148M 0
/dev/loop18 787K 787K 0
/dev/loop19 230M 230M 0
/dev/loop21 435M 435M 0
/dev/loop20 2,8M 2,8M 0
/dev/loop22 173M 173M 0
/dev/loop23 787K 787K 0
/dev/loop26 77M 77M 0
/dev/loop24 2,8M 2,8M 0
/dev/loop25 59M 59M 0
/dev/loop27 74M 74M 0
tmpfs 827M 17K 827M 0
/dev/loop28 67M 67M 0
themsto.stud.mh.se:/users/sa/saal2107 3,7T 3,2T 479G
tmpfs 827M 132K 827M
saal2107@CSVL209PC11:~$
```

- f) The type of file systems used in the largest local size is: ext4 which is found using the command (df -h --total --local --print-type)

```
File Edit View Search Terminal Help
FILELIST is a comma-separated list of columns to be included. Valid
field names are: 'source', 'fstype', 'total', 'used', 'avail', 'pcent',
'size', 'used', 'avail', 'pcent', 'file' and 'target' (see info page).
GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/df>
or available locally via: info '(coreutils) df invocation'
saal2107@CSVL209PC11:~$ df -h --total --local --type
df: option '-t' requires an argument
Try 'df --help' for more information.
saal2107@CSVL209PC11:~$ df -h --total --local -t
df: option requires an argument '-t'
Try 'df --help' for more information.
saal2107@CSVL209PC11:~$ df -h --total --local --type=TYPE
df: no file systems processed
saal2107@CSVL209PC11:~$ df -h --total --local --print-type
Filesystem Type Size Used Avail Use% Mounted on
udev devtmpfs 3,9G 0 3,9G 0% /dev
tmpfs tmpfs 789M 2,0M 787M 1% /run
/dev/sda1 ext4 186G 20G 167G 11% /
tmpfs tmpfs 3,9G 0 3,9G 0% /dev/shm
tmpfs tmpfs 5,0M 4,0K 5,0M 1% /run/lock
tmpfs tmpfs 3,9G 0 3,9G 0% /sys/fs/cgroup
/dev/loop3 squashfs 115M 115M 0 100% /snap/core/13886
/dev/loop2 squashfs 2,5M 2,5M 0 100% /snap/gnome-calculator/884
/dev/loop0 squashfs 219M 219M 0 100% /snap/gnome-3-34-1804/77
/dev/loop1 squashfs 82M 82M 0 100% /snap/gtk-common-themes/1534
/dev/loop4 squashfs 640K 640K 0 100% /snap/gnome-logs/112
/dev/loop5 squashfs 92M 92M 0 100% /snap/gtk-common-themes/1535
/dev/loop6 squashfs 64M 64M 0 100% /snap/core20/1634
/dev/loop8 squashfs 128K 128K 0 100% /snap/barefs/5
/dev/loop10 squashfs 1,5M 1,5M 0 100% /snap/gnome-system-monitor/181
/dev/loop9 squashfs 115M 115M 0 100% /snap/core/13741
/dev/loop7 squashfs 512K 512K 0 100% /snap/gnome-characters/781
/dev/loop11 squashfs 347M 347M 0 100% /snap/gnome-3-38-2004/115
/dev/loop13 squashfs 347M 347M 0 100% /snap/gnome-3-38-2004/119
/dev/loop17 squashfs 141M 141M 0 100% /snap/gnome-3-26-1004/104
/dev/loop14 squashfs 50M 50M 0 100% /snap/core18/2566
/dev/loop16 squashfs 163M 163M 0 100% /snap/gnome-3-28-1804/145
/dev/loop12 squashfs 141M 141M 0 100% /snap/gnome-3-26-1004/102
/dev/loop18 squashfs 768K 768K 0 100% /snap/gnome-logs/115
/dev/loop19 squashfs 219M 219M 0 100% /snap/gnome-3-34-1804/72
/dev/loop21 squashfs 415M 415M 0 100% /snap/gnome-42-2204/29
/dev/loop20 squashfs 2,7M 2,7M 0 100% /snap/gnome-calculator/920
/dev/loop22 squashfs 165M 165M 0 100% /snap/gnome-3-28-1804/101
/dev/loop23 squashfs 768K 768K 0 100% /snap/gnome-characters/741
/dev/loop26 squashfs 73M 73M 0 100% /snap/core22/310
/dev/loop24 squashfs 2,7M 2,7M 0 100% /snap/gnome-system-monitor/178
/dev/loop25 squashfs 50M 50M 0 100% /snap/core18/2620
/dev/loop27 squashfs 71M 71M 0 100% /snap/core22/275
tmpfs tmpfs 789M 16K 789M 1% /run/user/120
/dev/loop28 squashfs 64M 64M 0 100% /snap/core20/1695
tmpfs tmpfs 789M 128K 789M 1% /run/user/338015
total 215G 23G 180G 12% -
saal2107@CSVL209PC11:~$
```

- g) Using the "which" command for each command reveals that they are stored in the /usr/bin/ directory.
- h) To retrieve information about the processor, the command "cat /proc/cpuinfo" is used. This command displays details such as the processor model, which in this case is identified as "Intel® Core™ i7-4790 CPU @ 3.60GHZ". Additionally, it provides information on the cache size, reported as 8192 KB, and the clock frequency (measures the number of cycles your CPU executes per second, measured in GHz) at which the CPU operates, listed as 2194.921 MHz.

Prestanda och processer

a) The process states in total are:

- Running or Runnable (R)
- Uninterruptible Sleep (D)
- Interruptible Sleep (S)
- Stopped (T)
- Zombie (Z)

The process states found are S, R and I, where "I" stands for "idle" in the new state that was introduced in latest versions of Linux kernel. The Idle state replaces "Task_interruptible"

```
File Edit View Search Terminal Help
top - 14:06:17 up 23 min, 1 user, load average: 0.02, 0.11, 0.11
tasks: 302 total, 1 running, 231 sleeping, 1 stopped, 0 zombie
Cpu(s): 2.9 us, 1.3 sy, 0.0 ni, 95.6 id, 2.0 wa, 0.0 hi, 0.1 si, 0.0 st
Mem: 8071780 total, 4364844 free, 1481884 used, 2225052 buff/cache
Mem Swap: 2097148 total, 2097148 free, 0 used, 6002792 avail Mem

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM     TIME+ COMMAND
 3160 saal2107  20   0 3836180 243440 128804 S   5.3   3.0   0:09.97 gnome-shell
 3820 saal2107  20   0 1301604 53996 38636 S   5.3   0.7   0:01.03 nautilus
 3827 saal2107  20   0 535704 76492 58628 S   4.6   0.9   0:05.94 Xorg
 3516 saal2107  20   0 797760 39112 28136 S   1.3   0.5   0:02.67 gnome-terminal-
 3417 saal2107  20   0 362700 7752  6660 S   1.0   0.1   0:00.04 gvfsd-trash
 3934 saal2107  20   0 427900  9112  7824 D   1.0   0.1   0:00.03 zeitgeist-daemo
 165 root      0 -20   0      0      0 I   0.7   0.0   0:00.07 kworker/7:1H
 3035 saal2107  20   0 71308  5812  4296 S   0.7   0.1   0:00.27 dbus-daemon
 3734 saal2107  20   0 56188  4780  3880 R   0.7   0.1   0:03.49 top
 75 root      0   0      0      0 I   0.3   0.0   0:00.06 kworker/6:1
 788 message+  20   0 69528  7184  4312 S   0.3   0.1   0:01.14 dbus-daemon
 971 root      0   0 326932 12756  8040 S   0.3   0.2   0:00.48 polkitd
1572 colord     20   0 332860 14592  9656 S   0.3   0.2   0:00.09 colord
 3806 saal2107  20   0 77044  8668  6496 S   0.3   0.1   0:00.17 systemd
 3038 saal2107  20   0 574568 15116 12500 S   0.3   0.2   0:00.14 gnome-session-b
 3286 saal2107  20   0 447288  9456  7972 S   0.3   0.1   0:00.02 gsd-sharing
 3295 saal2107  20   0 488948 22272 17112 S   0.3   0.3   0:00.09 gsd-xsettings
 3324 saal2107  20   0 492328 21812 16396 S   0.3   0.3   0:00.08 gsd-keyboard
 3406 saal2107  20   0 912588 64892 51124 S   0.3   0.8   0:00.04 nautilus-deskto
 1 root      0   0 225592  9200  6548 S   0.0   0.1   0:01.56 systemd
 2 root      0   0      0      0 S   0.0   0.0   0:00.00 kthread
 4 root      0 -20   0      0 I   0.0   0.0   0:00.00 kworker/0:0H
 6 root      0 -20   0      0 I   0.0   0.0   0:00.00 kworker/0:1H
 7 root      0 -20   0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
 8 root      0   0      0      0 S   0.0   0.0   0:00.01 ksoftirqd/0
 9 root      0   0      0      0 I   0.0   0.0   0:00.18 rcu_sched
10 root      0   0      0      0 I   0.0   0.0   0:00.00 rcu_bh
11 root      0   0      0      0 S   0.0   0.0   0:00.00 migration/0
12 root      0   0      0      0 S   0.0   0.0   0:00.00 watchdog/0
13 root      0   0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
14 root      0   0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
15 root      0   0      0      0 S   0.0   0.0   0:00.00 watchdog/1
16 root      0   0      0      0 S   0.0   0.0   0:00.03 migration/1
17 root      0   0      0      0 S   0.0   0.0   0:00.01 ksoftirqd/1
18 root      0   0      0      0 I   0.0   0.0   0:00.00 kworker/1:0
19 root      0 -20   0      0 I   0.0   0.0   0:00.00 kworker/1:0H
20 root      0   0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
21 root      0   0      0      0 S   0.0   0.0   0:00.00 watchdog/2
22 root      0   0      0      0 S   0.0   0.0   0:00.00 migration/2
23 root      0   0      0      0 S   0.0   0.0   0:00.00 ksoftirqd/2
24 root      0   0      0      0 I   0.0   0.0   0:00.04 kworker/2:0
25 root      0 -20   0      0 I   0.0   0.0   0:00.00 kworker/2:0H
26 root      0   0      0      0 S   0.0   0.0   0:00.00 cpuhp/3
27 root      0   0      0      0 S   0.0   0.0   0:00.00 watchdog/3
28 root      0   0      0      0 S   0.0   0.0   0:00.03 migration/3
29 root      0   0      0      0 S   0.0   0.0   0:00.00 ksoftirqd/3
31 root      0 -20   0      0 I   0.0   0.0   0:00.00 kworker/3:0H
32 root      0   0      0      0 S   0.0   0.0   0:00.00 cpuhp/4
```

The images shows a total of 302 processors, where 1 is in running state, 231 sleeping, 1 stopped and 0 zombies

b) Running (R): The process is either running on a CPU or waiting to run.

Sleeping (S): The process is waiting for an event or for a resource.

Uninterruptible Sleep (D): The process is waiting for I/O and cannot be interrupted.

Zombie (Z): The process has completed execution but still has an entry in the process table.

Stopped (T): The process is stopped, often by a signal.^{xiv}

PID (Process ID) represents the unique identifier of a process. USER denotes the username of the user who initiated the process. PR, short for "Priority," displays scheduling priorities from the kernel's perspective. It is calculated by adding +20 to the process's "niceness" value (maps to a kernel call of the same name). A value indicating "rt" signifies that the process is running in real-time. NI shows the "niceness" value of

the process. Niceness is how the Linux system measures priority. A process with a **high** Niceness has **low** priority, while processes with **negative** Niceness are **highest** priority. Processes inherit priority from a parent process. **RES** indicates the amount of **physical** memory a process is using. **SHR** displays the amount of **memory shared** with other processes. **S** displays the processor **state** in the form of a letter, where **D** is **uninterruptible** sleep, I is idle, R is running, S is sleeping (waiting for user input), T is stopped by a control signal, t is stopped by a debugger during a trace, and finally, Z denotes a zombie process that wants to terminate but needs to be killed by its parent. %CPU represents the percentage of CPU time used, while %MEM signifies the same for physical memory. TIME+ denotes the total CPU time used by a process since it started. Lastly, COMMAND represents the name of the process.

- c) 1012 root uses the most memory, uses 5.7% of memory

Terminal

File Edit View Search Terminal Help

1 [0.0s] 5 [0.0%]
2 [0.0s] 6 [0.0%]
3 [0.2s] 7 [0.0%]
4 [1.3s] 8 [0.0%]
1.70G/7.70G Tasks: 151, 394 thr: 1 running
BK/2.00s Load average: 0.24 0.17 0.13
Sat: 00:25:17 uptime: 00:25:17

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
3102	saal2107	20	0	37458	236M	117M	S	0.7	3.0	0:10.71	/usr/sbin/ssd -D
3162	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3163	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
3164	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.20	/usr/sbin/gnome-shell
3166	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3189	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3190	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3191	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
3192	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
3193	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3194	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3195	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3196	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
3197	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3198	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
3199	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.00	/usr/sbin/gnome-shell
3200	saal2107	20	0	37458	236M	117M	S	0.0	3.0	0:00.01	/usr/sbin/gnome-shell
1010	root	0	0	620M	165M	159M	S	0.0	2.1	0:03.31	/usr/lib/x86_64-linux-gnu/sss/sss_nss -uid 0 --gid 0 --logger-files
1295	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1296	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.17	/usr/sbin/gnome-shell
1297	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1334	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1335	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1359	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1376	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1377	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1378	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1379	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1380	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1381	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1382	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1383	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1384	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1385	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1386	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1387	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:00.00	/usr/sbin/gnome-shell
1282	sdm	20	0	37428	164M	111M	S	0.0	2.1	0:02.87	/usr/sbin/gnome-shell
3576	saal2107	20	0	1303M	158M	393M	S	0.0	2.0	0:00.03	/usr/sbin/gnome-software --application-service
3577	saal2107	20	0	1303M	158M	393M	S	0.0	2.0	0:00.03	/usr/sbin/gnome-software --application-service
3577	saal2107	20	0	1303M	158M	393M	S	0.0	2.0	0:00.00	/usr/sbin/gnome-software --application-service
3576	saal2107	20	0	1303M	158M	393M	S	0.0	2.0	0:02.36	/usr/sbin/gnome-software --application-service
1760	root	0	0	477M	78M	45M	S	1.1	0.0	0:00.00	/usr/bin/containerd

PID: P2: P3: P4: P5: P6: P7: P8: P9: P10: P11: P12: P13: P14: P15: P16: P17: P18: P19: P20: P21: P22: P23: P24: P25: P26: P27: P28: P29: P30: P31: P32: P33: P34: P35: P36: P37: P38: P39: P40: P41: P42: P43: P44: P45: P46: P47: P48: P49: P50: P51: P52: P53: P54: P55: P56: P57: P58: P59: P60: P61: P62: P63: P64: P65: P66: P67: P68: P69: P70: P71: P72: P73: P74: P75: P76: P77: P78: P79: P80: P81: P82: P83: P84: P85: P86: P87: P88: P89: P90: P91: P92: P93: P94: P95: P96: P97: P98: P99: P100: P101: P102: P103: P104: P105: P106: P107: P108: P109: P110: P111: P112: P113: P114: P115: P116: P117: P118: P119: P120: P121: P122: P123: P124: P125: P126: P127: P128: P129: P130: P131: P132: P133: P134: P135: P136: P137: P138: P139: P140: P141: P142: P143: P144: P145: P146: P147: P148: P149: P150: P151: P152: P153: P154: P155: P156: P157: P158: P159: P160: P161: P162: P163: P164: P165: P166: P167: P168: P169: P170: P171: P172: P173: P174: P175: P176: P177: P178: P179: P180: P181: P182: P183: P184: P185: P186: P187: P188: P189: P190: P191: P192: P193: P194: P195: P196: P197: P198: P199: P200: P201: P202: P203: P204: P205: P206: P207: P208: P209: P210: P211: P212: P213: P214: P215: P216: P217: P218: P219: P220: P221: P222: P223: P224: P225: P226: P227: P228: P229: P230: P231: P232: P233: P234: P235: P236: P237: P238: P239: P240: P241: P242: P243: P244: P245: P246: P247: P248: P249: P250: P251: P252: P253: P254: P255: P256: P257: P258: P259: P260: P261: P262: P263: P264: P265: P266: P267: P268: P269: P270: P271: P272: P273: P274: P275: P276: P277: P278: P279: P280: P281: P282: P283: P284: P285: P286: P287: P288: P289: P290: P291: P292: P293: P294: P295: P296: P297: P298: P299: P300: P301: P302: P303: P304: P305: P306: P307: P308: P309: P310: P311: P312: P313: P314: P315: P316: P317: P318: P319: P320: P321: P322: P323: P324: P325: P326: P327: P328: P329: P330: P331: P332: P333: P334: P335: P336: P337: P338: P339: P340: P341: P342: P343: P344: P345: P346: P347: P348: P349: P350: P351: P352: P353: P354: P355: P356: P357: P358: P359: P360: P361: P362: P363: P364: P365: P366: P367: P368: P369: P370: P371: P372: P373: P374: P375: P376: P377: P378: P379: P380: P381: P382: P383: P384: P385: P386: P387: P388: P389: P390: P391: P392: P393: P394: P395: P396: P397: P398: P399: P400: P401: P402: P403: P404: P405: P406: P407: P408: P409: P410: P411: P412: P413: P414: P415: P416: P417: P418: P419: P420: P421: P422: P423: P424: P425: P426: P427: P428: P429: P430: P431: P432: P433: P434: P435: P436: P437: P438: P439: P440: P441: P442: P443: P444: P445: P446: P447: P448: P449: P450: P451: P452: P453: P454: P455: P456: P457: P458: P459: P460: P461: P462: P463: P464: P465: P466: P467: P468: P469: P470: P471: P472: P473: P474: P475: P476: P477: P478: P479: P480: P481: P482: P483: P484: P485: P486: P487: P488: P489: P490: P491: P492: P493: P494: P495: P496: P497: P498: P499: P500: P501: P502: P503: P504: P505: P506: P507: P508: P509: P510: P511: P512: P513: P514: P515: P516: P517: P518: P519: P520: P521: P522: P523: P524: P525: P526: P527: P528: P529: P530: P531: P532: P533: P534: P535: P536: P537: P538: P539: P540: P541: P542: P543: P544: P545: P546: P547: P548: P549: P550: P551: P552: P553: P554: P555: P556: P557: P558: P559: P560: P561: P562: P563: P564: P565: P566: P567: P568: P569: P570: P571: P572: P573: P574: P575: P576: P577: P578: P579: P580: P581: P582: P583: P584: P585: P586: P587: P588: P589: P590: P591: P592: P593: P594: P595: P596: P597: P598: P599: P600: P601: P602: P603: P604: P605: P606: P607: P608: P609: P610: P611: P612: P613: P614: P615: P616: P617: P618: P619: P620: P621: P622: P623: P624: P625: P626: P627: P628: P629: P630: P631: P632: P633: P634: P635: P636: P637: P638: P639: P640: P641: P642: P643: P644: P645: P646: P647: P648: P649: P650: P651: P652: P653: P654: P655: P656: P657: P658: P659: P660: P661: P662: P663: P664: P665: P666: P667: P668: P669: P670: P671: P672: P673: P674: P675: P676: P677: P678: P679: P680: P681: P682: P683: P684: P685: P686: P687: P688: P689: P690: P691: P692: P693: P694: P695: P696: P697: P698: P699: P700: P701: P702: P703: P704: P705: P706: P707: P708: P709: P710: P711: P712: P713: P714: P715: P716: P717: P718: P719: P720: P721: P722: P723: P724: P725: P726: P727: P728: P729: P730: P731: P732: P733: P734: P735: P736: P737: P738: P739: P740: P741: P742: P743: P744: P745: P746: P747: P748: P749: P750: P751: P752: P753: P754: P755: P756: P757: P758: P759: P760: P761: P762: P763: P764: P765: P766: P767: P768: P769: P770: P771: P772: P773: P774: P775: P776: P777: P778: P779: P780: P781: P782: P783: P784: P785: P786: P787: P788: P789: P790: P791: P792: P793: P794: P795: P796: P797: P798: P799: P800: P801: P802: P803: P804: P805: P806: P807: P808: P809: P810: P811: P812: P813: P814: P815: P816: P817: P818: P819: P820: P821: P822: P823: P824: P825: P826: P827: P828: P829: P830: P831: P832: P833: P834: P835: P836: P837: P838: P839: P840: P841: P842: P843: P844: P845: P846: P847: P848: P849: P850: P851: P852: P853: P854: P855: P856: P857: P858: P859: P860: P861: P862: P863: P864: P865: P866: P867: P868: P869: P870: P871: P872: P873: P874: P875: P876: P877: P878: P879: P880: P881: P882: P883: P884: P885: P886: P887: P888: P889: P890: P891: P892: P893: P894: P895: P896: P897: P898: P899: P900: P901: P902: P903: P904: P905: P906: P907: P908: P909: P910: P911: P912: P913: P914: P915: P916: P917: P918: P919: P920: P921: P922: P923: P924: P925: P926: P927: P928: P929: P930: P931: P932: P933: P934: P935: P936: P937: P938: P939: P940: P941: P942: P943: P944: P945: P946: P947: P948: P949: P950: P951: P952: P953: P954: P955: P956: P957: P958: P959: P960: P961: P962: P963: P964: P965: P966: P967: P968: P969: P970: P971: P972: P973: P974: P975: P976: P977: P978: P979: P980: P981: P982: P983: P984: P985: P986: P987: P988: P989: P990: P991: P992: P993: P994: P995: P996: P997: P998: P999: P1000: P1001: P1002: P1003: P1004: P1005: P1006: P1007: P1008: P1009: P1010: P1011: P1012: P1013: P1014: P1015: P1016: P1017: P1018: P1019: P1020: P1021: P1022: P1023: P1024: P1025: P1026: P1027: P1028: P1029: P1030: P1031: P1032: P1033: P1034: P1035: P1036: P1037: P1038: P1039: P1040: P1041: P1042: P1043: P1044: P1045: P1046: P1047: P1048: P1049: P1050: P1051: P1052: P1053: P1054: P1055: P1056: P1057: P1058: P1059: P1060: P1061: P1062: P1063: P1064: P1065: P1066: P1067: P1068: P1069: P1070: P1071: P1072: P1073: P1074: P1075: P1076: P1077: P1078: P1079: P1080: P1081: P1082: P1083: P1084: P1085: P1086: P1087: P1088: P1089: P1090: P1091: P1092: P1093: P1094: P1095: P1096: P1097: P1098: P1099: P1100: P1101: P1102: P1103: P1104: P1105: P1106: P1107: P1108: P1109: P1110: P1111: P1112: P1113: P1114: P1115: P1116: P1117: P1118: P1119: P1120: P1121: P1122: P1123: P1124: P1125: P1126: P1127: P1128: P1129: P1130: P1131: P1132: P1133: P1134: P1135: P1136: P1137: P1138: P1139: P1140: P1141: P1142: P1143: P1144: P1145: P1146: P1147: P1148: P1149: P1150: P1151: P1152: P1153: P1154: P1155: P1156: P1157: P1158: P1159: P1160: P1161: P1162: P1163: P1164: P1165: P1166: P1167: P1168: P1169: P1170: P1171: P1172: P1173: P1174: P1175: P1176: P1177: P1178: P1179: P1180: P1181: P1182: P1183: P1184: P1185: P1186: P1187: P1188: P1189: P1190: P1191: P1192: P1193: P1194: P1195: P1196: P1197: P1198: P1199: P1200: P1201: P1202: P1203: P1204: P1205: P1206: P1207: P1208: P1209: P1210: P1211: P1212: P1213: P1214: P1215: P1216: P1217: P1218: P1219: P1220: P1221: P1222: P1223: P1224: P1225: P1226: P1227: P1228: P1229: P1230: P1231: P1232: P1233: P1234: P1235: P1236: P1237: P1238: P1239: P1240: P1241: P1242: P1243: P1244: P1245: P1246: P1247: P1248: P1249: P1250: P1251: P1252: P1253: P1254: P1255: P1256: P1257: P1258: P1259: P1260: P1261: P1262: P1263: P1264: P1265: P1266: P1267: P1268: P1269: P1270: P1271: P1272: P1273: P1274: P1275: P1276: P1277: P1278: P1279: P1280: P1281: P1282: P1283: P1284: P1285: P1286: P1287: P1288: P1289: P1290: P1291: P1292: P1293: P1294: P1295: P1296: P1297: P1298: P1299: P1300: P1301: P1302: P1303: P1304: P1305: P1306: P1307: P1308: P1309: P1310: P1311: P1312: P1313: P1314: P1315: P1316: P1317: P1318: P1319: P1320: P1321: P1322: P1323: P1324: P1325: P1326: P1327: P1328: P1329: P1330: P1331: P1332: P1333: P1334: P1335: P1336: P1337: P1338: P1339: P1340: P1341: P1342: P1343: P1344: P1345: P1346: P1347: P1348: P1349: P1350: P1351: P1352: P1353: P1354: P1355: P1356: P1357: P1358: P

```
Terminal
File Edit View Search Terminal Help

0.0% 5 [ 0.0%]
0.0% 6 [ 0.0%]
0.0% 7 [ 0.0%]
0.0% 8 [ 0.0%]
Mem [|||||] 1.71G/7.70G Tasks: 151, 394 thr: 1 running
Swap [|||||] 88/2.00G Load average: 0.07 0.05 0.08
Uptime: 00:34:09

PID USER PR NI VIRT RES SHR S CPU% MEM% TIME+ Command
1371 rtkit RT 1 179M 2908 2648 S 0.0 0.0 0:00.00 /usr/lib/rtkit/rtkit-daemon
3185 saal2107 -6 0 1633M 17908 13424 S 0.0 0.2 0:00.00 /usr/bin/pulseaudio --start --log-target=syslog
3186 saal2107 -6 0 1633M 17908 13424 S 0.0 0.2 0:00.01 /usr/bin/pulseaudio --start --log-target=syslog
3187 saal2107 -6 0 1633M 17908 13424 S 0.0 0.2 0:00.00 /usr/bin/pulseaudio --start --log-target=syslog
3188 saal2107 9 1 1633M 17908 13424 S 0.0 0.2 0:00.11 /usr/bin/pulseaudio --start --log-target=syslog
363 root 19 1 114M 31756 36712 S 0.0 0.4 0:00.29 /lib/systemd/systemd-journald
1012 root 20 0 874M 453M 127K S 0.0 5.7 0:02.02 /usr/lib/x86_64-linux-gnu/sss/sssd_autofs --uid 0 --gid 0 --logger=files
3189 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3190 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3191 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3192 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3193 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3194 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3195 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3196 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3197 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3198 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3199 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3200 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3201 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3162 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3163 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3164 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.30 /usr/bin/gnome-shell
3166 saal2107 20 0 3746M 238M 118K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
1010 root 20 0 628M 165M 118K S 0.0 2.1 0:03.31 /usr/lib/x86_64-linux-gnu/sss/sssd_nss --uid 0 --gid 0 --logger=files
1295 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1296 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.17 /usr/bin/gnome-shell
1297 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1334 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1335 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1359 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1376 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1377 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.01 /usr/bin/gnome-shell
1378 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1379 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1380 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1381 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1382 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1383 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1384 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1385 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1386 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1387 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
F1:0.0% F2:0.0% F3:0.0% F4:0.0% F5:0.0% F6:0.0% F7:0.0% F8:0.0% F9:0.0% F10:0.0%

Terminal
File Edit View Search Terminal Help

0.0% 5 [ 0.0%]
0.0% 6 [ 0.0%]
0.0% 7 [ 0.0%]
0.0% 8 [ 0.0%]
Mem [|||||] 1.71G/7.70G Tasks: 151, 397 thr: 1 running
Swap [|||||] 88/2.00G Load average: 0.15 0.07 0.08
Uptime: 00:34:12

PID USER PR NI VIRT RES SHR S CPU% MEM% TIME+ Command
1012 root 20 0 874M 453M 127K S 0.0 5.7 0:02.02 /usr/lib/x86_64-linux-gnu/sss/sssd_autofs --uid 0 --gid 0 --logger=files
3189 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3190 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3191 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3192 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3193 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3194 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3195 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3196 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3197 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3198 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3199 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3200 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3201 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3162 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
3163 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.01 /usr/bin/gnome-shell
3164 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.30 /usr/bin/gnome-shell
3166 saal2107 20 0 3747M 239M 119K S 0.0 3.0 0:00.00 /usr/bin/gnome-shell
1010 root 20 0 628M 165M 118K S 0.0 2.1 0:03.31 /usr/lib/x86_64-linux-gnu/sss/sssd_nss --uid 0 --gid 0 --logger=files
1295 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1296 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.17 /usr/bin/gnome-shell
1297 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1334 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1335 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1359 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1376 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1377 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.01 /usr/bin/gnome-shell
1378 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1379 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1380 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1381 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1382 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1383 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1384 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1385 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1386 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1387 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:00.00 /usr/bin/gnome-shell
1282 gdm 20 0 3742M 164M 111K S 0.0 2.1 0:02.97 /usr/bin/gnome-software --gapplication-service
3570 saal2107 20 0 1383M 158M 3936 S 0.0 2.0 0:00.04 /usr/bin/gnome-software --gapplication-service
3573 saal2107 20 0 1383M 158M 3936 S 0.0 2.0 0:00.05 /usr/bin/gnome-software --gapplication-service
3577 saal2107 20 0 1383M 158M 3936 S 0.0 2.0 0:00.00 /usr/bin/gnome-software --gapplication-service
3569 saal2107 20 0 1383M 158M 3936 S 0.0 2.0 0:02.38 /usr/bin/gnome-software --gapplication-service
F1:0.0% F2:0.0% F3:0.0% F4:0.0% F5:0.0% F6:0.0% F7:0.0% F8:0.0% F9:0.0% F10:0.0%
```

- e) PR (Priority): The kernel's internal scheduling priority.
NI (Nice): A user-space concept to adjust the priority of a process.
- f) Theoretical Framework: The nice value influences a process's scheduling precedence. A greater nice value (toward the positive) correlates with a diminished scheduling priority (manifesting as an elevated PR value), whereas a lesser nice value (toward the negative) confers enhanced priority (evidenced by a reduced PR value). It should be noted that a PRI-NI differential of 20 emerges solely in instances where the PRI exhibits a negative magnitude, exclusive of real-time processes.

- g) In this instance, the Process ID (PID) for Firefox is 2216. The nice value of this process was successfully altered to 10 with the command `renice 10 2216`. While attempts to raise the niceness to 100 failed, reflecting the system-enforced maximum of 19, it's also critical to note that once the nice value of a process is increased within the 0 to 19 range, it cannot be decreased again in this session, indicating a one-way adjustment limitation. Similarly, attempts to set the nice value to -19 reached the lower limit, and my permissions restrict setting a niceness lower than 10. Therefore, it's crucial to ensure that the desired niceness level is set correctly on the first attempt, as further decreases are not permitted.
- h) Pressing [Ctrl + Z] suspends the process, transitioning it into the background and **halting** its execution, which results in an uninterruptible stop state for the application—indicated by the 'T' status in `htop`. If we issue the `fg` command, this suspension is interrupted, and the process **resumes**, bringing it back into the foreground for user interaction.
- i) When closing the terminal, it also closes Firefox because the terminal acts as a parent process to Firefox; terminating the terminal effectively kills its child processes. This occurs as closing the terminal issues a SIGHUP signal to the foreground process group, leading to the termination of associated processes if they have not been disowned or moved to the background.

References

- [1] "ls(1) - Linux man page," man7.org. [Online]. Available: <https://man7.org/linux/man-pages/man1/ls.1.html> [Accessed: Mar. 17, 2024].
- [2] "mkdir(1) - Linux man page," man7.org. [Online]. Available: <https://man7.org/linux/man-pages/man1/mkdir.1.html> . [Accessed: Mar. 17, 2024].
- [3] "mv(1) - Linux man page," man7.org. [Online]. Available: <https://man7.org/linux/man-pages/man1/mv.1.html> . [Accessed: Mar. 17, 2024].
- [4] "Which Command in Linux With Examples," GeeksforGeeks. [Online]. Available: <https://www.geeksforgeeks.org/which-command-in-linux-with-examples/> . [Accessed: Mar. 17, 2024].

[5] "Linux cat," javatpoint. [Online]. Available: <https://www.javatpoint.com/linux-cat> . [Accessed: Mar. 17, 2024].

[6] "What Is chmod?," Nexcess. [Online]. Available: <https://www.nexcess.net/help/what-is-chmod/> . [Accessed: Mar. 17, 2024].

[7] "Piping in Unix or Linux," GeeksforGeeks. [Online]. Available: <https://www.geeksforgeeks.org/piping-in-unix-or-linux/> . [Accessed: Mar. 17, 2024].

[8] "Linux Redirection," guru99. [Online]. Available: <https://www.guru99.com/linux-redirection.html> . [Accessed: Mar. 17, 2024].

[9] "uname," Wikipedia. [Online]. Available: <https://en.wikipedia.org/wiki/Uname> . [Accessed: Mar. 17, 2024].

[10] "How to Use the Linux free Command," Turing. [Online]. Available: <https://www.turing.com/kb/how-to-use-the-linux-free-command> . [Accessed: Mar. 17, 2024].

[11] "How to use the df command," Red Hat. [Online]. Available: <https://www.redhat.com/sysadmin/linux-df-command> . [Accessed: Mar. 17, 2024].

[12] "How to Use the vmstat Command," phoenixNAP. [Online]. Available: <https://phoenixnap.com/kb/vmstat-command> . [Accessed: Mar. 17, 2024].

[13] "The Linux Filesystem Hierarchy," tldp.org. [Online]. Available: <https://tldp.org/LDP/Linux-Filesystem-Hierarchy/html/proc.html> . [Accessed: Mar. 17, 2024].

[14] "Understanding Linux Process States," Baeldung. [Online]. Available: <https://www.baeldung.com/linux/process-states> . [Accessed: Mar. 17, 2024].
