
Chrplr's Linux tips

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This is a collection of Linux tips accumulated over the years. I always welcome suggestions to add new tips, to correct or improve existing ones.

THE SHELL

When you type command lines, you are interacting with a program call the “shell”. Unless otherwise indicated, the tips assume that you are using the *Bash* shell. You can check which shell is running with the command:

```
echo $SHELL
```

For a basic introduction to interacting with the shell, I recommend [Learning the shell](#) and [The Linux command line](#) by William Shott, or any of the following tutorials:

- [UNIX Tutorial for Beginners](#)
- [Openclassrooms Initiation à Linux \(in French\)](#)
- [YouTube series on The Linux Command Line](#)
- [Classic Shell Scripting book](#)

1.1 some useful shortcuts

1.1.1 Editing the current command line

- Ctrl-d : delete character under the cursor
- Ctrl-k : delete everything from the cursor till the end of the line
- Alt-d : delete till the end of the current word
- Ctrl-a : move the cursor to the beginning of the line
- Ctrl-e : move the cursor to the end of the line
- Ctrl-B, Alt-B: move backward, by one char or by one word
- Ctrl-F, Alt-F: move forward, by one char or by one word

1.1.2 Navigating the history of command lines:

- Ctrl-r : interactive backward search in the history of command lines
- Ctrl-p : move to previous command line
- Ctrl-n : move to next command line

1.1.3 Job control

- Ctrl-C: Terminate (kill) the running job
- Ctrl-Z: Stop the running job (you can then put in background with bg)
- Ctrl-D: Terminate the Shell and close the Terminal
- Ctrl-L: Clear the terminal
- Ctrl+S: Stop all output to the screen. This is particularly useful when running commands with a lot of long, verbose output, but you don't want to stop the command itself with Ctrl+C.
- Ctrl+Q: Resume output to the screen after stopping it with Ctrl+S.

1.2 Tab completion and case-insensitivity

To enter the name of a file, you can type the first characters then press the TAB key to autocomplete the end of the name. This also work for commands or environment variables. See https://en.wikipedia.org/wiki/Command-line_completion

Note: bash relies the [readline library](#) to interact with the user. Its behavior can be customized by options in \$HOME/.inputrc. For example, to enable case-insensitive tab completion:

```
echo 'set completion-ignore-case On' >> ~/.inputrc
```

1.3 Commands

When you type something on a command line and press Return, you give an order to the shell. The first token is a command and the following tokens on the line are parameters, a.k.a. arguments.

There are different types of commands:

- programs, that is, executable file located somewhere on your file system (it can be a binary or a script)
- shell built-in functions (e.g. echo)
- user defined functions
- aliases

The `type` command tells you the category of a command.

```
type cp
type ll
type echo
type for
```

The vast majority of commands that you are going to type are programs (scripts or binary). The list of directories containing programs is stored in the environment variable PATH:

```
printenv PATH
```

Directories are separated by `:`.

If you want to add a directory, say `/opt/bin` to the PATH:

```
export PATH="/opt/bin:$PATH"
```

From now on, the shell will search for programs in `/opt/bin`` before scanning the other directories listed in ``PATH``. The program executed is the first encountered in the list. You can scan the list with:

```
which -a command
```

If you “screw up” the PATH, you will no longer have access to programs. In this situation, the best is to close the shell (by pressing `Ctrl-D`) and open a new one. You can test this situation typing just:

```
PATH=
```

If you want a modification of the PATH variable to be permanent, i.e. to be active each time you start a shell, add the `export PATH=...` line to the file `~/.profile`.

1.4 Creating scripts

If you happen to often type the same series of commands, it is a good idea to create a script, that is, basically, a text file gathering the sequence of commands to be executed. Then, you will just have to type the filename of this script to execute all the commands.

If it does not exist yet, create a `bin` directory in your home folder:

```
mkdir $HOME/bin.
```

Use a text editor to create a file `myscript` in this directory, and enter the following on the first line:

```
#!/bin/bash
```

Then type the series of commands (one per line) you want to be executed.

Save the file `myscript` and enter the commands:

```
chmod +x ~/bin/myscript
PATH="$HOME/bin:$PATH"
```

You can now type `myscript` on the command line to execute the series of commands.

To go further, you should learn how to use arguments to scripts.

Note that you write scripts in other languages than bash, e.g. python.

1.5 Startup scripts: .profile, .bashrc, .bash_profile

~/ .bash_profile, ~/ .profile, .bashrc are scripts that are executed automatically when you start a shell. This allows you to set up your environment (prompt, PATH), create aliases for common operations, ...

There are two types of shells: login shells (that open after you type your login and password) and nonlogin shells.

Login shells execute ~/ .profile and ~/ .bash_profile.

Non-login shells only execute ~/ .bashrc, not ~/ .profile nor ~/ .bash_profile

Anything that should be available to graphical applications OR to sh (or bash invoked as sh) MUST be in ~/ .profile

- ~/ .bash_profile should just load .profile and .bashrc (in that order)
- ~/ .profile has the stuff NOT specifically related to bash, such as environment variables (PATH and friends)
- ~/ .bashrc has anything you'd want at an interactive command line. Command prompt, EDITOR variable, bash aliases

A few other notes: * ~/ .bashrc must not output anything * Anything that should be available only to login shells should go in ~/ .profile * Ensure that ~/ .bash_login does not exist.

See: * <https://superuser.com/questions/789448/choosing-between-bashrc-profile-bash-profile-etc> * <https://stackoverflow.com/questions/902946/about-bash-profile-bashrc-and-where-should-alias-be-written-in> * <http://mywiki.woledge.org/DotFiles>

1.6 Jumping directly to directories

If you are tired of typing intermediate directory names when changing directory, check out the *Directory Bookmarks functions for bash* at <https://github.com/icyfork/dirb/>.

Download <https://raw.githubusercontent.com/icyfork/dirb/master/dirb.sh> in your \$HOME folder and add the following line to the file \$HOME/.bashrc:

```
source $HOME/dirb.sh
```

Once installed, you can save bookmarks for specific directories (command s) and later jump into them directly (command g). Here are all the available operations:

```
s      Save a directory bookmark
g      go to a bookmark or named directory
p      push a bookmark/directory onto the dir stack
r      remove saved bookmark
d      display bookmarked directory path
sl     print the list of directory bookmarks
sl -l                long list
sl -p                path list
```

1.7 Killing a program that is no longer responsive

It may happen that a program monopolizes most of the CPU, but does not longer respond to input. Such a program is crashed and should be “killed”.

For applications running in a terminal, first try to press `Ctrl-C`.

If this does not work, or if the application is running in its own window but refusing to close, open a terminal and type:

```
pkill program_name
```

You can also use the command `ps -ef` to locate the application and note down the “process identification number” in the ‘PID’ column. Then, type:

```
kill PID
```

(in place of PID, use the number associated to the process listed in ‘ps’ output). Check if the program was destroyed with the `ps` command; if not:

```
kill -9 PID
```

If the whole graphics system no longer responds, you can try to open a text mode terminal with `Ctrl-Alt-F1` or `Ctrl-Alt-F4`, log in and kill the programs that causes problem. Sometimes, the only solution is to kill `Xorg`, the display server).

If the keyboard does not repond anymore, before switching off the computer, you can try to connect from another computer on the same network using `ssh` and to kill the applications or do a proper shutdown (typing ‘halt’ on the command line).

REMOTE POWERON AND POWEROFF

Powering off is easy, just type:

```
shutdown
```

If your workstation is switched off, but you can log to a linux computer on the same local area network.

If you have previously noted down the MAC address of your computer's network interface (using `ip a` when the computer was on), and authorized "Wake on lan (WOL)" in the station's BIOS parameters, you can power it on remotely.

Say the MAC address is "c8:f7:50:bc:ea:f5", then the command:

```
wakeonlan c8:f7:50:bc:ea:f5
```

launched on the terminal of another computer will power on your computer.

See <http://doc.ubuntu-fr.org/wakeonlan>

PRINTING

To get a list of available printers:

```
lpstat -p -d
```

To check the status of all printers:

```
lpstat -a
```

To print `file.pdf` (or more precisely to put in the printing queue) of the printer `printername`:

```
lpr -P printername file.pdf
```

To print two copies of a file

```
lpr -# 2 filename.pdf
```

To print 2 pages per side:

```
lpr -o number-up=2 -o sides=two-sides-long-edge filename.pdf
```

To remove a printing job:

```
lprm job-id
```

(`job-id` is the number reported by the `lpr` or `lpstat` commands).

If you use the same printer most of the time, you can create a script like the following in your `~/bin` directory:

```
#!/bin/sh
export PRINTER=my-beautiful-printer
lpr -P "$PRINTER" -o media=A4 "$@"
```

In case of printing problem, first Check that that the cups service is running:

```
systemctl status cups.service
```

If you need to manage or add printers, open a browser on <http://localhost:631>

Check out [Linux 101: Manage printers and printing](#) for more information.

CONFIGURE MULTIPLE DISPLAYS

Use the programs `xrandr` and `arandr`

```
arandr  
xrandr --output eDP1 --rotate left
```

If you have a nvidia graphics card, you can also use `nvidia-settings`

CONNECTING TO A REMOTE COMPUTER USING SSH

A secure method to connect to a remote computer:

```
ssh computername
```

or

```
ssh login@computername
```

if the login id on the remote computer is different than the one on the local computer.

If you plan to launch graphical application on the remote computer, you need to add the `-X` option:

```
ssh -X login@computername
```

Note: you may have to run `xhost +` on the local, client, computer.

If you often connect to a computer, you can create an alias in `$HOME/.profile`:

```
alias ssh-myserver="ssh -X login@computername"
```

Note that:

- the client computer must have the ssh client (`sudo apt install openssh-client`)
- the remote computer must be running a sshd server (run `sudo apt install openssh-server` on it).

You can troubleshoot connection issues with

```
ssh -vv login@computer
```

5.1 Setting up SSH

To avoid having to type your login password each time you use ssh or scp, you can setup SSH to use public and private keys to perform the authentication automatically.

First, you must generate keyfiles, once, on your local computer. To do so:

```
ssh-keygen
```

This generates, among other files, a public key stored in a file `~/.ssh/identity.pub`). You now need to copy this key in the `authorized_keys` file inside the `~/.ssh` directory of the remote computer you want to connect to.

```
ssh-copy-id remotecomputer
```

If you have let an empty passphrase, you can now use ssh or scp without entering your password. But so can do anyone who access your account on your local computer.

So you may prefer to use a passphrase. To avoid having to type it each time you log to the remote computer, copy the following lines in your `~/.bash_profile`:

```
eval `ssh-agent`  
ssh-add < /dev/null
```

You will be prompted for the passphrase only once: when you login on the local computer (See the explanations about ssh-agent at <http://mah.everybody.org/docs/ssh>).

5.2 Executing commands on a remote computer, without login

```
ssh login@computername command
```

5.3 Keeping a remote session alive

Once connected on the remote computer, execute:

```
tmux
```

When you want to leave, press `Ctrl-b d`. The terminal is *detached* but not closed.

Next time you connect to this remote computer, to continue your work, you can access the session:

```
tmux a
```

See <https://danielmiessler.com/study/tmux/> for a primer on tmux, or read the book *Tmux 2: Productive Mouse-Free Development* by Brian Hogan.

5.4 Copy files to or from a remote computer

```
scp -r localdir remotelogs@remotecomputer:remotedir  
rsync -avh localdir/ remotelogs@remotecomputer:remotedir  
tar -cf - dir | ssh login@remotehost tar -xvf -
```

5.5 Setting up X11 forwarding with ssh

To allow graphical applications running on the server to display their windows on the local computer, when using ssh:

From <https://unix.stackexchange.com/questions/12755/how-to-forward-x-over-ssh-to-run-graphics-applications-remotely>
X11 forwarding needs to be enabled on both the client side and the server side.

On the client side, the `-X` (capital X) option to ssh enables X11 forwarding, and you can make this the default (for all connections or for a specific connection) with `ForwardX11 yes` in `~/.ssh/config`.

On the server side, `X11Forwarding yes` must be specified in `/etc/ssh/sshd_config`. Note that the default is no forwarding (some distributions turn it on in their default `/etc/ssh/sshd_config`), and that the user cannot override this setting.

The `xauth` program must be installed on the server side. If there are any X11 programs there, it's very likely that `xauth` will be there. In the unlikely case `xauth` was installed in a nonstandard location, it can be called through `~/.ssh/rc` (on the server!).

Note that you do not need to set any environment variables on the server. `DISPLAY` and `XAUTHORITY` will automatically be set to their proper values. If you run `ssh` and `DISPLAY` is not set, it means ssh is not forwarding the X11 connection.

To confirm that ssh is forwarding X11, check for a line containing `Requesting X11 forwarding` in the `ssh -v -X` output. Note that the server won't reply either way, a security precaution of hiding details from potential attackers.

GETTING INFORMATION ABOUT THE SYSTEM

6.1 Which computer am I currently working on?

To display the network node name (also called the `hostname`):

```
hostname
```

or

```
uname -n
```

6.2 What is my public IP address?

```
sudo apt install curl  
curl ifconfig.me
```

To know your IP address on the local area network:

```
ip addr
```

(you must identify the physical interface (ethernet card or wifi card) and check for the `inet` line)

6.3 Check available space on local disks

```
df -hT -x squashfs -x tmpfs
```

I actually added the following in my `.bashrc`:

```
alias df="df -hT -x squashfs -x tmpfs"
```

if you need to make space you can search for large folders or files using:

```
ncdu  
du -h | sort -hr | less
```

If there is a quota system that limits the amount of space you can use on your account, you can check how much is available:

```
quota -s
```

6.4 Listing available disk partitions

```
lsblk | grep -v loop # excludes loop devices  
blkid
```

6.5 List the processes currently running on the system

To list the processes currently running:

```
ps auf  
ps axuf # also show process no tied to a terminal
```

The most important columns are TIME and RSS which show the time used by process since it started and the amount of real memory it uses.

If you want to list just some programs, for example matlab, type

```
pgrep -a matlab
```

For a real-time display of processes, you can use `top` or `htop` but a more comprehensive too is `glances`:

```
glances
```

Not only does it display CPU and memory usage, but also DISK I/O and network I/O. You can sort processes, for example, by CPU usage, etc (Press `h` in `glances` to see the help). `Glances` is extremely useful to identify bottlenecks (see <https://livebook.manning.com/book/linux-in-action/chapter-13/74>)

You may have to install it with `pip install glances` or `sudo apt install glances`.

6.6 Finds the process owning a file

Sometimes, it can useful to find the process that owns an open file:

```
lsof filename
```

(See <http://www.thegeekstuff.com/2012/08/lsof-command-examples/>)

6.7 Getting detailed information about your system

```
sudo inxi -b  
nvidia-smi # if you have nvidia GPUs
```

To check how many CPU/cores are available on your machine:

```
lscpu -e  
lscpu
```

To check the total amount of RAM installed on your computer and how much is currently being used by Linux:

```
free -h
```

Which Linux distribution is running:

```
inxi -b  
lsb_release -a
```

Note: you may need to install the packages `inxi` and `lsb-core`:

```
# deb based linuxes: sudo apt install lsb-core  
# rpm-based linuxes: yum install redhat-lsb-core  
# redhat/fedora: dnf install redhat-lsb-core
```

Which version of the linux kernel is running:

```
uname -a
```

To display detailed hardware information:

```
lshw -short  
hwinfo --short  
lspci
```

6.8 Monitoring temperatures

```
sudo apt install lm-sensors hddtemp  
sudo sensors-detect  
sensors
```

You can then install `psensor` to have a GUI monitoring the temperatures:

```
sudo apt install psensor  
psensor
```

6.9 Monitoring the performance of your computer

You can monitor your system with glances:

```
glances -t 5
```

or with htop:

```
htop -d 50 --sort-key PERCENT_CPU  
htop -d 50 --sort-key M_RESIDENT
```

There are more specialized tools that focus on subsystems. For example, you can monitor the global activity of the CPUs with:

```
mpstat 5
```

To monitor the memory usage in real-time:

```
vmstat -S M 10
```

If any of the indicators si (swap in) or so (swap out) are high, your computer lacks memory and is using the swap (memory on disk).

You can check the file input/output volume and speed on the local drives:

```
iostat -x 2 5  
iostat -h -d 10
```

Check the speed of your ethernet connection. Three tools are available:

```
mii-tool  
  
ethtool  
  
iperf
```

Or the general network performance:

```
netstat -i 10
```

Large TX-ERR or RX-ERR indicate a problem.

6.10 Benchmark disk IO performance:

```
man fio  
  
fio --name TEST --eta-newline=5s --filename=fio-tempfile.dat --rw=read --size=500m --io_↵  
↵size=10g --blocksize=1024k --ioengine=libaio --fsync=10000 --iodepth=32 --direct=1 --  
↵numjobs=1 --runtime=60 --group_reporting  
  
fio --name TEST --eta-newline=5s --filename=fio-tempfile.dat --rw=write --size=500m --io_↵  
↵size=10g --blocksize=1024k --ioengine=libaio --fsync=10000 --iodepth=32 --direct=1 --  
↵numjobs=1 --runtime=60 --group_reporting
```

(from <https://askubuntu.com/questions/87035/how-to-check-hard-disk-performance>)

6.11 Benchmark 3D video performance

```
glmark2
```

6.12 Create a RAM disk

```
sudo mkdir -p /mnt/ramdisk
sudo mount -t tmpfs tmpfs /mnt/ramdisk -o size=1024M
sudo chown `whoami`:`whoami` /mnt/ramdisk
ls -al /mnt/ramdisk
```

6.13 Check power consumption

Two tools can be used to monitor power usage:

```
sudo powertop
powerstat
```

If you have a nvidia card:

```
nvidia-smi
```

6.14 Check open network connections

```
ss -tr
```

6.15 Perform a security check

```
sudo apt-get install -y lynis rkhunter clamav clamav-daemon -y
sudo lynis audit system
sudo rkhunter -c
```


7.1 Who am I?

As far as the computer is concerned, the identity of the current user (its *user_id*), can be printed with:

```
whoami
```

Note that your login name and home directory are stored in the environment variables `LOGNAME` and `HOME`.

Each login is associated to a UserID (UID), an integer, and to a list of GroupIDs (GUID). You can list the information associated to the current login:

```
id
```

7.2 Check who is logged on the computer

To see who is currently logged on the system, use

```
who
```

or more simply:

```
w
```

If you are superuser, you can see a journal of the logins with the command:

```
sudo last
```

7.3 Who is that user?

To determine a person behind an *user_id*, use `finger`:

```
finger <user_id>
```

7.4 Change your identity

To temporarily become newuser:

```
su - newuser
```

Of course, you will be prompted for newuser's password.

If you want to become root:

```
sudo -i
```

When you are done, type:

```
exit
```

7.5 Change your password

To change your password on the local system:

```
passwd
```

7.6 Change the login shell

To change your login shell, e.g. from `/bin/csh` to `/bin/bash`:

```
chsh -s /bin/bash
```

7.7 Change group

Check which groups you belong to using `id`, then use

```
newgrp group
```

From now, the files and directories you create will belong to group `group`

To modify the group of already existing files in directory `dir`:

```
chgrp -R group dir
```


7.8 Changing you UserID number

Each login is associated to a number called the UID. If for any reason you need to change your UID number, here is how to do it:

```
usermod -u <NEWUID> <LOGIN>
groupmod -g <NEWGID> <GROUP>
find / -user <OLDUID> -exec chown -h <NEWUID> {} \;
find / -group <OLDGID> -exec chgrp -h <NEWGID> {} \;
usermod -g <NEWGID> <LOGIN>
```

7.9 Grant a user the ability to run commands as root (sudo)

```
sudo usermod -aG sudo userlogin
```

Of course, you need to be in the list of sudoers yourself to be able to execute this command.

Using sudo is better than using su, check out why at <https://phoenixnap.com/kb/sudo-vs-su-differences>

FILES AND DIRECTORIES

8.1 Where am i?

To know the current working directory:

```
pwd
```

To change the current working directory:

```
cd subdirectory    # move down inside a subdirectory
cd ..              # move up in the hierarchy of directories
```

Note that you can always go back to your home directory by just typing `cd` (without argument).

8.2 Listing files and subdirectories

```
ls                # list (non hidden) files and subdirectories in the current working_
↳directory
ls -A             # list all files (including hidden ones)
ls -l            # list in a single column
ls -l            # show detailed information (filesize, modification date,...)
ls -t            # sort by modification date (most recent first)
ls -Sl          # sort by size (largest first)

ls PATTERN
```

where PATTERN is a [globbing pattern](#) which can contain “wildcards” characters such as `*` or `?`:

- `*` | matches any string | |
- `?` | matches any character | |
- `my*` | filename starting with `my` | |
- `my?` | filename of 3 characters starting with `my` | |
- `*xyz*` | filename containing `xyz` | |
- `*.tar*` | filenames finishing with `.tar` | |
- `*{md,txt}` | filenames ending in either `md` or `txt` | |
- `*.[ch]*` | filename ending in `.c` or `.h` | |

By default, `ls` only lists the files in the current working directory. To recursively visit the subdirectories:

```
ls -R
ls **/**.py
```

`**` will match the first-level subdirectories. With the option `shopt -s globstar`, subdirectories at all levels are visited.

To only display subdirectories:

```
ls -d */      # only directories
tree -d       # Recursively
tree -d -L 2  # limit depth to 2
```

8.3 Copying, renaming, moving or deleting files

To copy a file inside the same directory, giving it name2:

```
cp file1 file2
```

To copy a file from the current directory to the existing directory `target_dir`:

```
cp file1 target_dir
```

To copy all the files from the current directory to another directory:

```
cp * target_dir
```

To do the same thing but showing a progress bar:

```
rsync --info=progress2 * target_dir
```

To rename a file:

```
mv file1 file2
```

To move a file to the existing directory `dir`:

```
mv file1 dir
```

To delete a file:

```
rm file
```

To avoid being asked for confirmation:

```
rm -f file
```

8.4 Creating, copying, moving or deleting directories

To create a new directory:

```
mkdir -p newdir
```

To copy the directory `dir` inside the destination directory `destdir`:

```
cp -a dir destdir
```

(Note: the `-a` option does a recursive copy, that is, includes the subdirectories and preserves the attributes of files)

Alternatively, you can use `rsync`:

```
rsync -a --info=progress2 dir/ destdir
```

To move the whole directory `dir` inside the existing `destdir`:

```
mv dir1 destdir
```

To rename directory `dir` as `dir2`:

```
mv dir dir2
```

To delete the directory `dir` and all its content:

```
rm -rf dir
```

8.5 Renaming files, replacing their name by their creation date

Here is a script that replaces filenames by creation date (this can be useful for a photo album)

```
#!/bin/bash

for fullfile in "$@";
do
  filename=$(basename "$fullfile")
  extension="${filename##*}"
  filename="${filename%.*}"
  mv -n "$fullfile" "$(date -r "$fullfile" +%Y%m%d_%H%M%S").${extension}";
done
```

8.6 Check or modify the rights of access to a file or a directory

When you use `ls -l` to list the files in a directory, the first string of characters, made of `x`, `r`, `w`, `-`... specifies the *access rights* (Consult [Understanding file permissions on Unix: a brief tutorial](#))

To allow everybody to read a file `aga` in the current directory:

```
chmod a+r aga
```

To allow everyone to enter a directory `mydir` and read its content:

```
chmod a+rx mydir
```

To make all subdirs and files readable by everybody:

```
find -type d -exec chmod a+rx '{}' '+'  
find -type f -exec chmod a+r  '{}' '+'
```

If, when using `ls -l`, there is a + sign is trailing the rights, it means that ACL (Access Control List), is set on the files or directories. The `chmod` command will not work: you must then use the `getfacl` and `setfacl` commands to list or modify the access/write rights

8.7 Linking files

To avoid copying a file in several places on the same disk, it is a better idea to use a *hard link*:

```
ln existingname newname
```

Thus the same file can have several names (and be in several directories at the same time). Importantly, this only works if the directories are on the same filesystem.

To create a symbolic link (somewhat similar to a 'shortcut' in Windows):

```
ln -s filename newname
```

If you delete or move the file, the symbolic links will be 'dangling'.

To find and remove dangling links in a directory:

```
symlinks -rd directory
```

FINDING FILES OR DIRECTORIES

The classic unix command to find files is, well, `find`.

We describe it below, but we first introduce a simpler and user-friendly alternatives: `fd`.

9.1 Using the `fd` command

Examples of usage:

```
fd statement # search for files/directories containing the string "statement" in
↳ their name
fd -t f statement # restrict the search to files (not directories)
fd pdf ~/Downloads/ --changed-within 1hour
```

You can search for filenames matching a regular expression:

```
fd 'April.*docx$'
```

Features of `fd`:

- Regular expression (default) and glob-based patterns
- Very fast due to parallelized directory traversal
- Uses colors to highlight different file types (same as `ls`)
- Supports parallel command execution
- Smart case: the search is case-insensitive by default. It switches to case-sensitive if the pattern contains an uppercase character*.
- Ignores hidden directories and files, by default.
- Ignores patterns from your `.gitignore`, by default.

Note: You may need to install `fd` using `sudo apt install fd-find` or from <https://github.com/sharkdp/fd>, and define alias `fd=fdfind`.

9.2 Using the ag command

Another must know user-friendly search tool is ag which allows to spot text files containing a given string or regular expression:

```
ag --python "import numpy"    # search python files that import numpy
```

Note: To install ag under Ubuntu: `sudo apt install silversearcher-ag`.

9.3 Using the classic unix find command

find is the classic command, which is complex but powerful. The basic syntax is:

```
find -name pattern
```

where `pattern` can be a string, or a [glob pattern](#) (not a regular expression):

```
find -iname 'filename.txt'
find -iname '*.doc'
```

The last command will list all *.doc files in the current directory and its subdirectories. The depth of subdirectories to visit can be limited:

```
find -maxdepth 2 -name '*.doc'
```

If you prefer regular expressions to glob patterns, use the option `-regex` instead of `-name`:

```
find -regex '.*.txt'
```

With `-o` you can specify an 'or'. For example, to search for files with extension `nii` or `img`:

```
find \( -name '*.nii' -o -name '*.img' \)    # files ending in .nii or .img
```

With `!`, you can negate a search:

```
find ! -name '*.nii'    # all files except those ending in .nii
```

You can specify a time-range:

```
find -mtime 0 # find the files created or modified in the last 24hours
find -mtime +30 -mtime -60 # find files modified in the last 30-60 days
find -newermt 20171101 ! -newermt 20171201 -name '*.pdf' -ls # find pdf files modified
↳ between two dates
```

You can specify that you only search for, e.g., directories, using the `-type` argument:

```
find -type d # list all subdirectorectries
find -type d -mtime -10 # find the directories created or modified in the last 10 days:
```

You can find and delete all empty directories:


```
find . -type d -empty -print
find . -type d -empty -delete
```

You can filter on permissions

```
find -perm -o+x -ls -type f # list all file with the execute flag set on 'others'
```

You can also execute a command on each file:

```
find -name '*~' -exec rm '{}' '+' # delete all files '*~'
find -name '*.py' -exec mv -t path '{}' '+' # move all py files to path
find -name '*.txt' -print0 | xargs -0 grep -l Alice # show files
```

Note that xargs can be parallelized with the -P option:

```
find -name '*.nii' -o '*.img' -print0 | xargs -0 -P 10 gzip # gzip all image files
```

Consult `info find` and `info xargs` for more information.

9.4 locate

To accelerate file search, you can generate a database of all filenames on your filesystem:

```
updatedb
```

And then use the command

```
locate PATTERN
```

Note that the locate will return all files where PATTERN matches any substring in the full pathname (including directories).

Read the manual:

```
man locate
```

9.5 Search files by content

```
grep PATTERN file
```

where PATTERN is a regular expression (See `man grep`).

To search files recursively in subdirectories, you can combine `find` and `grep`:

```
find -type f -name "*.tex" -print0 | xargs -0 grep -n PATTERN
```

But this is complex! An interesting alternative is to use `ack` (<https://beyondgrep.com/>). By default, it does a recursive search and it can focus on certain file types.

```
ack --python -w TOKEN # search only python file matching on word 'TOKEN'
```

To install `ack` under ubuntu:

```
sudo apt install ack-grep
```

Another search tool is ag http://conqueringthecommandline.com/book/ack_ag:

```
sudo apt install silversearcher-ag
```

Tools like `grep`, `ack` and `ag` are useful to search within text files but pretty useless for binary files. If you need to search within `.pdf` or `.doc` files, you first need to extract the textual content and then index it. Then, you will be able to search files by their content. To this end, you can install and use a tool like `recoll` (see <http://www.lesbonscomptes.com/recoll/>). One issue though it that the index can quickly grow very large.

COMPARING FILES OR DIRECTORIES

10.1 Comparing two files

To list all the lines that differ between file1 and file2:

```
diff file1 file2
```

meld provides a nicer, graphical way to show the differences between two files or two directories.

```
meld file1 file2
```

When comparing text file, you may want to ignore changes in whitespaces (e.g. wrapping of paragraphs), then use `wdiff`.

```
wdiff file1.txt file.txt
```

To compare two latexfiles:

```
latexdiff file1.tex file2.tex
```

To create a patch listing the changes from version1 to version2:

```
diff -aur version1 version2 >dir2.diff
```

To apply the patch to version1 and generate version2:

```
patch -p1 <dir2.diff
```

10.2 Compare two directories

To compare two directories:

```
diff -r --brief dir1 dir2
```

`diff` compares the contents of the files. For large directory, this may be too slow. To run a faster comparison based on file sizes, you can use:

```
rsync --dry-run --recursive --size-only -i source/ target/
```

10.3 Synchronizing two directories bidirectionaly

```
unison
```

10.4 Backups

To back up my laptop, I use `rsnapshot`. I use an external harddrive with a large ext4 partition (~4 times the size of my laptop harddrive).

```
sudo apt install rsnapshot
```

Configuring `rsnapshot` essentially consists of editing `/etc/rsnapshot.conf` to specify where to save snapshots. In my case:

```
snapshot_root    /media/cp983411/WD_BLACK/rsnapshot/
```

Another nice backup utility, with a graphical interface, is:

```
backintime
```

It can be set up to automatically start so that you just have to plug your backup harddrive to performe a backup. Check out <http://backintime.readthedocs.io>.

11.1 Aspiring pages from web sites

```
wget URL  
wget --recursive --level 2 --no-cookies --page-requisites --convert-links URL  
curl address
```

11.2 Nice ftp programs

If you need to transfer files using the ftp protocol, you can use the following clients

```
ncftp  
lftp
```


12.1 Use git to keep an history of your projects and collaborate

Another approach to synchronise dirs is to use git repositories.

Learn about git by reading <https://git-scm.com/book/en/v2>

See also [git-annex](#)

12.2 Create a copy of a local git repository on github.com

```
git push --mirror git@github.com:username/project.git
```


DISABLE THE TOUCHPAD WHILE TYPING

```
killall syndaemon  
syndaemon -i 1 -KRd
```


UNFREEZE THE MOUSE

```
sudo rmmmod psmouse  
sudo modprobe psmouse
```


THE SYSTEM IS NOT RESPONDING

Try `Ctrl-Alt-F1` to open a terminal. From there, you might be able to do:

```
sudo shutdown now
```

Alternatively, press `Alt+PrintScr`, and, keeping this key pressed, type, slowly, `reisub`. This mysterious sequence is explained at <https://linuxconfig.org/how-to-enable-all-sysrq-functions-on-linux#h6-the-sysrq-magic-key> or https://en.wikipedia.org/wiki/Magic_SysRq_key

CHANGE THE BRIGHTNESS OF THE DISPLAY

```
sudo brightness -r    # read
sudo brightness -i 10 # increase
sudo brightness -d 10 # decrease
```

or

```
xbacklight -set 50
```

or

```
xrandr --output eDP1 --brightness 0.5
```

16.1 Lock the screen under X11

Assuming that `xscreensaver` is running in the background.

```
xscreensaver-command -lock
```

or:

```
i3lock -d 30 # if you use i3wm
```

16.2 Suspend to RAM

```
systemctl suspend
```

16.3 Suspend to disk

```
systemctl hibernate
```

Note: To hibernate on disk, the size of the swap partition must be larger than the RAM size.

16.4 Reboot

```
systemctl reboot
```

16.5 Shutdown

```
systemctl poweroff
```


GENERATING PASSWORDS

pwgen

18.1 Manipulating Images

Make sure to have [ImageMagick](#) installed (e.g. `sudo apt install imagemagick` on a Debian-based system)

To get information about an image:

```
identify image.png
```

To display an image (gif, .jpg, .png, .tiff, eps, ...) use:

```
display file.gif  
eog image.png
```

To convert from one format to another:

```
convert file.jpg file.png
```

To resize an image:

```
convert img.png -resize 66% img_small.png  
convert img.png -resize 400x400 img_400.png
```

To juxtapose several images:

```
montage -tile 4x4 *.png -geometry 1024x768 output.png
```

To superimpose images:

```
composite img1.png img2.png result.png
```

For more complex manipulations of bitmap image, I mostly use [The Gimp](#)

```
gimp file.jpg
```

18.2 Photography

To manipulate photographs, checkout:

- darktable
- Lightzone
- RawTherapee

18.3 Drawing

To draw on canvas (with pencils, brush, ...)

- mypaint
- krita

18.4 Creating graphics

To edit vector graphics files, e.g. .svg:

```
inkscape
```

To create graphs:

```
dot
```

To plot data, I use R or `Python`:

```
import matplotlib.pyplot as plt
import numpy as np
```

18.5 Take a screenshot

To take a snapshot, that is, copy a portion of the screen into an image file, you can use ImageMagick's command `import`:

```
import file.png
```

You will then be able to select a rectangle on the screen with the mouse, which will be copied in `file.png`.

Other screenshot programs include `gnome-screenshot`, `ksnapshot`, `scrot`, `maim`... See https://wiki.archlinux.org/index.php/Screen_capture for a list.

MAKE A SCREENCAST

Voir <http://www.linuxlinks.com/article/20090720142023520/Screencasting.html>

Under `i3`, see <https://github.com/synaptiko/.files/blob/4a6a549dfe0c22d19f38e32129b5c05de2bb6d34/i3/record-screen.sh>

Assuming that your Linux distribution is running the pulseaudio sound server — which can be checked with `pactl list` —, install `pavucontrol` to control the sound levels and which sound card each software is using.

20.1 Connect a MIDI instrument

Follow the instructions at <http://tedfelix.com/linux/linux-midi.html>. In a nutshell:

```
sudo apt install jackd2 jack-tools fluidsynth aconnectgui vmpk qjackctl qsynth fluid-  
↪soundfont-gm
```

1. To avoid potential latencies, you may want to install a kernel with the `PREEMPT` option:
`sudo apt-get install linux-lowlatency-hwe-20.04`
2. Launch `qjackctl`, in the setup tab, set `Frame/period` to 128 to reduce latency, and press 'start'
3. Use `aconectgui` to connect your MIDI keyboard
4. Launch `qsynth`, add the soundfounds in setup and restart it.
5. In `qjackctl`, use `connect` and the `patchbay`.

MISCELLANEOUS

21.1 Access files on a data CD or on a floppy

With some Linux systems, you just insert the CD or the floppy and the content become available in the directory `/mnt/cdrom` or `/mnt/floppy`:

```
ls /mnt/cdrom
ls /mnt/floppy
```

If the floppy is not write-protected, you can create or copy files in `/mnt/floppy` just like in any ordinary folder.

Note that if you have several cdrom or floppy drives, they may have names `cdrom1`, `cdrom2`, `floppy1`,...

In some Linux systems, it is necessary to manually *mount* the cdrom or the floppy before accessing the files, and *umount* it before ejecting it. For the cdrom:

```
mount /mnt/cdrom
ls /mnt/cdrom
...
umount /mnt/cdrom
eject
```

For the floppy:

```
mount /mnt/floppy
ls /mnt/floppy
umount /mnt/floppy
```

If you get an error message like `mount: only root can do that`, ask the system administrator to grant you right to mount floppies by adding the `user` option the configuration file `/etc/fstab`. More information in the manual pages of `mount` and `fstab`:

```
man mount
man fstab
```

Concerning floppies, some systems have `mtools` installed (see `man mtools`) which provide `thmdir` and `mcopy` commands that emulate the old DOS commands `dir` and `copy`. It is not necessary to mount the floppy to use them.

21.2 Format a floppy

To format the floppy with an ext2 filesystem, and mount it:

```
fdformat /dev/fd0
mkfs -t ext2 /dev/fd0
mount -t ext2 /dev/fd0 /mnt/floppy
```

This floppy can be read only on other linux systems. To be able to read it under Windows/DOS, you should use a DOS filesystem with `mkdosfs` in place of `mkfs -t ext2`:

```
mkdosfs /dev/fd0
```

21.3 Split a large file on several floppies

First compress the file, with `gzip` or `bzip2` (see section 41). If it still does not fit on a single floppy (1.4Mb), you can use the command `split`:

```
split -b1m file
```

This create a series of `x??` files which you can copy on separate floppies.

To reassemble the files:

```
cat x* >file
```

21.4 Rip an audio CD

to extract all tracks from an audio CD:

```
cdparanoia -B
```

To just extract one track:

```
cdparanoia -w track_number file.wav
```

If you prefer GUI, you can open `konqueror`, and type `'audiocd:/'` in the address bar. This will show you the content of the CD, which you can copy somewhere else. Copying from the `mp3` or `ogg` folders will do the automatic translations for you.

There are various programs with graphical interface which allow you to rip audio CD: `grip` and `kaudiocreator`, `rhythmbox`.

21.5 Convert from wav to mp3

I use lame:

```
lame file.wav file.mp3
```

21.6 Convert from wav to ogg vorbis

I use oggenc:

```
oggenc file.wav -o file.ogg
```

21.7 Rip an Audio cd into mp3 or oggenc

You could write a script calling `cdparanoia` then `lame` but there is a nifty command line tool, `abcde`, which queries music databases to find the tracks' song titles.

```
abcde -o mp3 # rip an audio cd track and converts into mp3
```

If you prefer a GUI, use `asunder`

21.8 Rip a DVD

Use (handbrake)[<https://handbrake.fr/>]

21.9 Create a data CD

1. Gather all the files you want to save in a given directory, e.g. `/tmp/mycd`
2. Create an iso image:

```
mkisofs -o cd.iso -J -R /tmp/mycd  
ls -l cd.iso
```

Check that the resulting file `cd.iso` file is not too large to fit on the CD; if it less than 650Mb, this should be ok.

3. Record on the cd (you must be root).

You must know which is the device is associated to the CD writer drive.

```
cdrecord -scanbus
```

To determine the `x,y,z` scsi coordinates of your cd writer. If it does not appear listed, it may be because the `ide-scsi` parameter was no passed to the Linux kernel (See the HOWTO about CD Writing).

To record, do:

```
cdrecord dev=x,y,z -multi speed=0 -data cd.iso
```

21.10 Create an audio CD

To record on an audio CD all the *.wav files which are in the current directory:

```
cdrecord dev=x,y,z -pad speed=0 -audio *.wav
```

(x,y,z must be replaced by the numbers returned by `cdrecord -scanbus`)

21.11 Make backups

You can write backup scripts using `rsync` but it has already been done many time. I have used `backintime`, but `borgbackup` looks interesting.

21.12 Connect to a bluetooth device

```
sudo service bluetooth start
sudo service bluetooth status
```

```
rfkill list
rfkill unlock 0:
```

```
bluetoothctl
power on
devices
scan on
pair XXXXXX
connect XXXXXX
```

21.13 Convert doc or odt documents to pdf

```
libreoffice --headless --convert-to pdf *.odt
```

21.14 List the hosts in a NIS domain

If you are connected on a local network administrated by NIS (yellow pages), you can display the list of other computers on the network:

```
ypcat hosts
```

21.15 Mounting a Samba Share

Assuming you have a SAMBA server with IP 192.168.0.50

```
smbclient -L 192.168.0.50
sudo mount -t cifs //192.168.0.50/BACKUPS /mnt -o username=chrplr,file_mode=0777,dir_
↪mode=0777
```

21.16 Which shell is running?

When you enter commands on the command line in a terminal, the text you type is interpreted by a program called the 'shell'. There are different shells that speak different dialects. To determine the shell you are communicating with, type:

```
echo $SHELL
```

Note: this does not work well for subshells:

```
bash
echo $SHELL
csh
echo $SHELL
exit
exit
```

21.17 Get help. Find manuals

Many commands have associated `man` pages. To read the man page associated, for example, to the command `cp`:

```
man cp
```

Some commands also have manuals in the form of `info` files:

```
info gawk
```

On many linux systems, there is additional documentation in the `/usr/share/doc` folder. The HOWTOs can be especially helpful.

To browse them, install `dwww`:

```
sudo apt install dwww
sudo a2enmod cgi
sudo systemctl restart apache2
sudo dwww-index++
```

Then:

```
dwww
```

21.18 Cut'n paste

Cutting & pasting under linux is not always straightforward. This is due to the fact that there are various systems of cut'n paste cohabitating.

To copy text, the following works with most applications:

- Click the left button and drag the cursor over the text to be copied.
- Click on the middle button to paste.

Note that this is very convenient: there no need to explicitly 'copy' the text.

If you use the window manager 'kde', there is a useful applet called 'klipper' located on the panel. Klipper keeps copies of the most recent clipboard contents. If a cut'n paste operation does not work, you may open klipper, select the relevant line, and retry to paste. It usually works.

If it does not work, then you can try the Cut/Copy/Paste functions from the applications' menus. Sometimes, it is necessary to save the region as a file in the first application, and insert this file in the second application.

21.19 set up tap to click in i3

```
sudo mkdir -p /etc/X11/xorg.conf.d && sudo tee <<'EOF' /etc/X11/xorg.conf.d/90-touchpad.conf 1> /dev/null
Section "InputClass"
    Identifier "touchpad"
    MatchIsTouchpad "on"
    Driver "libinput"
    Option "Tapping" "on"
EndSection
EOF
```

Tip from <https://cravencode.com/post/essentials/enable-tap-to-click-in-i3wm/>

21.20 Mount a partition of a usb drive

Insert the USB drive, use `lsblk` or `dmesg` to find partitions, then use `pmount` or `udisksctl`:

```
lsblk
pmount /dev/sdb1
udisksctl mount -b /dev/sdb1
```

21.21 Check an SD card

```
sudo apt install f3
lsblk # to find out which DEVICE the card is associated to
f3probe sudo ./f3probe --destructive --time-ops DEVICE
```

21.22 Setup an ethernet card to access the internet

You need to know IP, MASK, GATEWAY, DNS, HOSTNAME and DOMAIN:

```
ifconfig eth0 IP netmask MASK up
route add -net default gw GATEWAY netmask 0.0.0.0 eth0
hostname HOSTNAME
echo "domain DOMAIN" >/etc/resolv.conf
echo "nameserver DNS" >>/etc/resolv.conf
```

21.23 Changing/Editing network connection

```
nmtui # text mode
nmcli # text mode
unity-control-center
```

21.24 Install new software

If it come as a .tar.gz and contain a configure script

```
tar xzf package.tar.gz
cd package
./configure --prefix=$HOME & make & make install
```

This install the software in your home directory. To install it for every user, you need to omit the prefix option and be root when calling make install.

If you are on a apt-based system (Debian, Ubuntu):

```
sudo apt install packagename
```

If you have the .deb file:

```
sudo dpkg -i file.deb
```

If you are on a rpm-based linux system, to install an rpm file:

```
rpm -i package.rpm
```

To check if the package is correctly installed:

```
rpm -V package
```

To remove it:

```
rpm -e package
```

21.25 Check if a software package is installed

To check if, say, ghostscript is installed:

```
rpm -q ghostscript
```

You can get the list of all installed packages:

```
rpm -qa
```

21.26 Dynamic libraries

To run, some programs need to access functions in dynamic libraries. Dynamic libraries have the extension `.so`. They are located in `/lib`, `/usr/lib`, `/usr/local/lib`...

To list the libraries needed by a program:

```
ldd program
```

After adding new a new dynamic library, e.g. in `/usr/local/lib`, you must run, as superuser:

```
ldconfig -n /usr/local/lib
```

It is possible, as a user, to tell linux to search libraries in a particular place, using the `LD_LIBRARY_PATH` variable. For more information about how dynamic libraries are accessed, consult the manual of `ld.so`:

```
man ld.so
```

21.27 Command-line fun

```
sudo apt install cmatrix  
cmatrix
```


21.28 Get back your sanity with a productive environment

The following works for me.

- Use a window manager that allows you that launch applications pinned on some workspace and to have the workspaces accessible by a fixed keystroke. The tiling window manager i3wm fits the bill.
- use Emacs/Spacemacs or vim as an editor
- Use Linux rather than Windows
- use anaconda3 for Python
- use git for projects

21.29 Common file types

e xtension	file type	application(s)
txt	text or ascii file	cat, less (view), vim, emacs (edit)
pdf	Adobe PDF	evince, okular (view, annotate), pdfarranger
ps, eps	postscript	gv (view) pstops (rearrange) ps2pdf (convert)
html, htm	web page	links, konqueror, mozilla (view) soffice (create)
png, jpg, gif...	graphic files	display (view) import (snapshot) convert (convert) gimp (manipulate)
doc, xls, ppt	Office document	soffice
sxc, sxi, sxw	OpenOffice document	soffice
tex	TeX and LaTeX documents	tex, latex, pdflatex (process)
dvi	Dvi documents	xdvi (view) dvips, dvipdf (convert to ps or pdf)
gz, Z, xz, bzip	Compressed file	gunzip, xz, unxz, zip, bunzip2, bzip2
tar	tar archive	tar tf (view) tar xf (extract) tar cf (create)
tar.gz	compressed archive	tar xzf (extract)
tar.bz2	Compressed tar archive	tar xjf
zip	zip archive	unzip -l (view) unzip (extract) zip (create)

SIMILAR RESOURCES:

- [Linux Commands Cheat Sheet](#)