Introduction to GWAS

Basic Linux and the Shell

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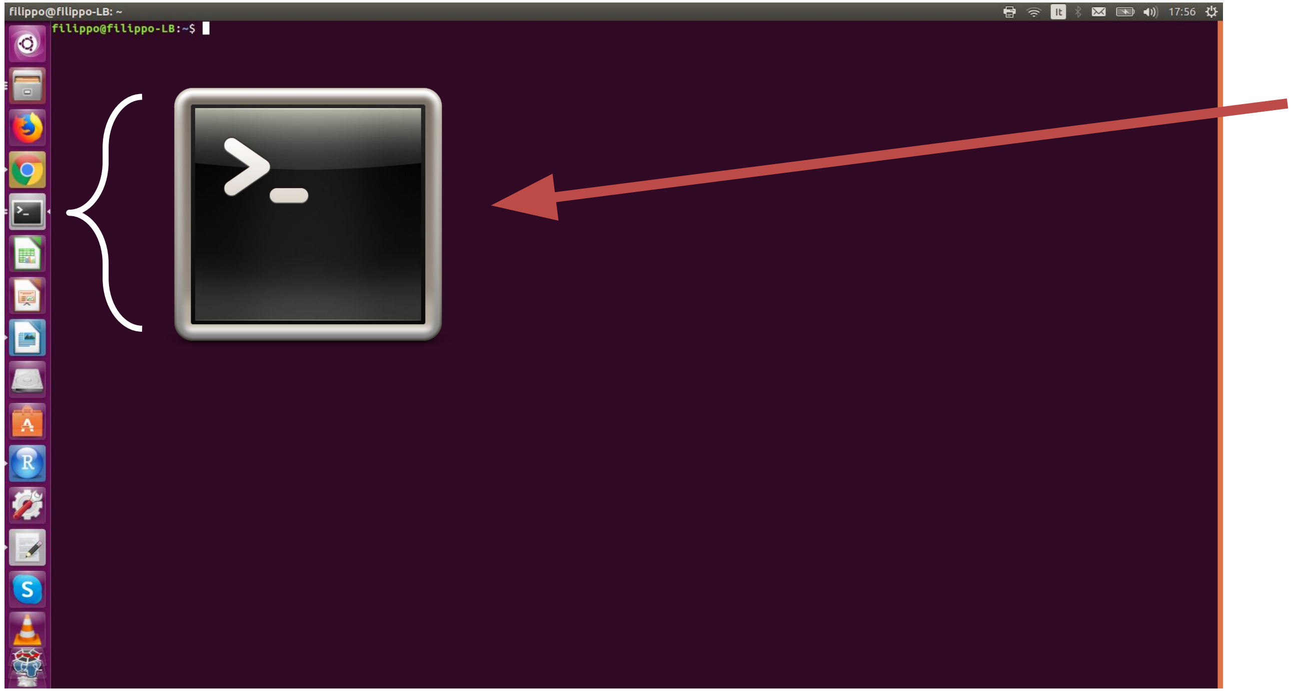
a light touch on Linux and the command line - let’s start!

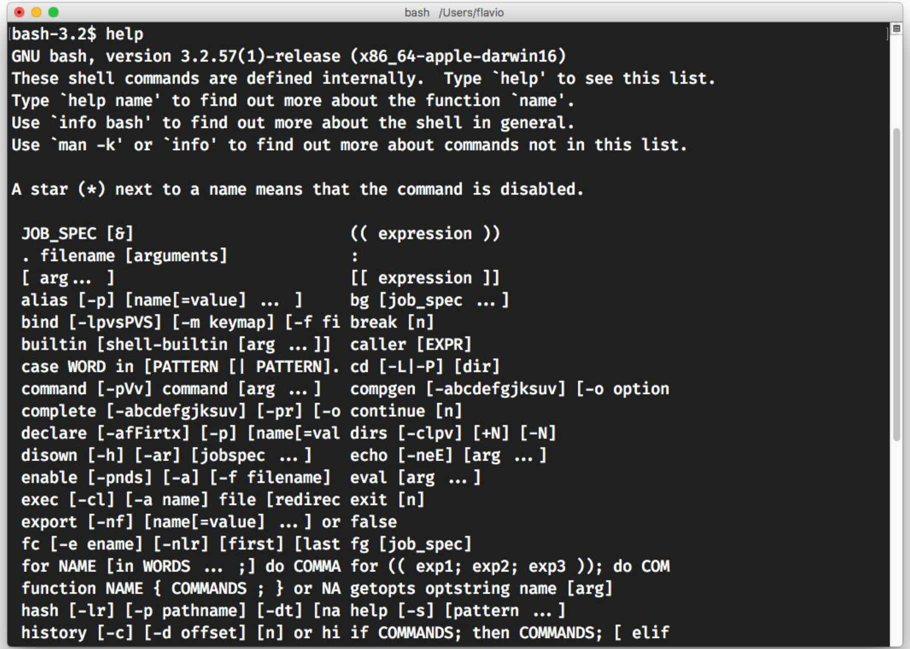


```
filippo@filippo-LB:~$
```

click on the **terminal icon** to launch **“the shell”**

- similar in Mac OS
- On Windows we use MobaXterm

a light touch on Linux and the command line - let’s start!

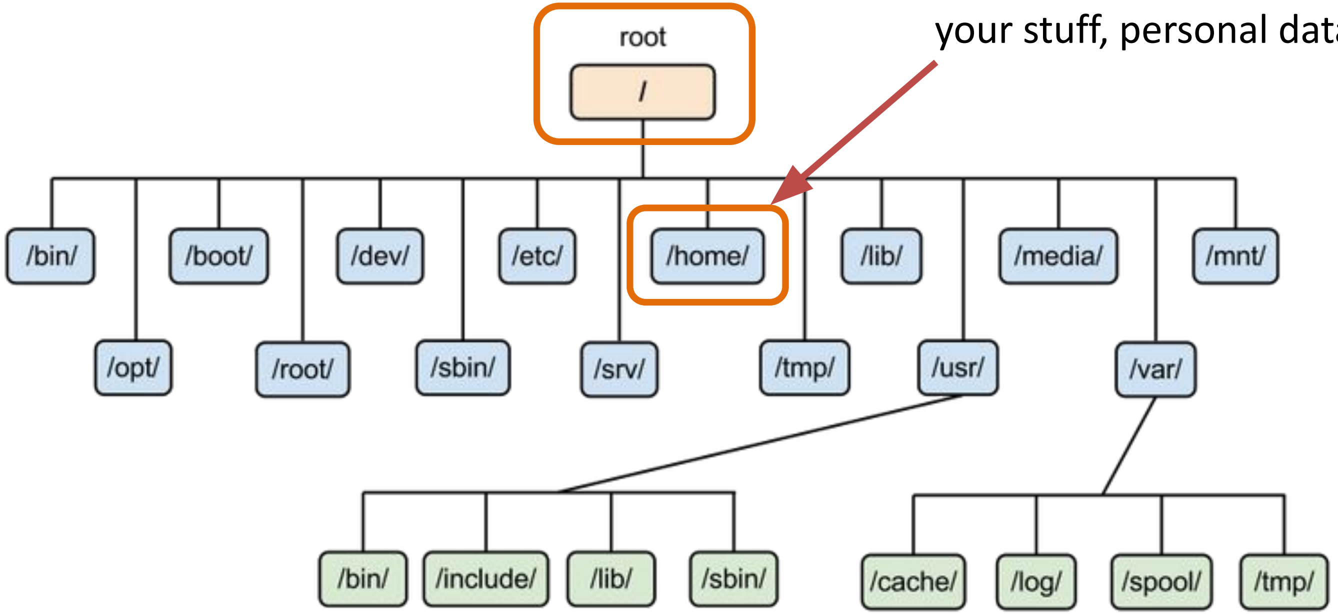


```
bash-3.2$ help
GNU bash, version 3.2.57(1)-release (x86_64-apple-darwin16)
These shell commands are defined internally.  Type `help' to see this list.
Type `help name' to find out more about the function `name'.
Use `info bash' to find out more about the shell in general.
Use `man -k' or `info' to find out more about commands not in this list.

A star (*) next to a name means that the command is disabled.

 JOB_SPEC [&]                       (( expression ))
 . filename [arguments]             :
 [ arg... ]                         [[ expression ]]
 alias [-p] [name[=value] ... ]     bg [job_spec ...]
 bind [-lpvsPVS] [-m keymap] [-f fi break [n]
 builtin [shell-builtin [arg ...]]  caller [EXPR]
 case WORD in [PATTERN [| PATTERN]. cd [-L|-P] [dir]
 command [-pVv] command [arg ...]   compgen [-abcdefgjksuv] [-o option
 complete [-abcdefgjksuv] [-pr] [-o continue [n]
 declare [-afFirtx] [-p] [name[=val dirs [-clpv] [+N] [-N]
 disown [-h] [-ar] [jobspec ...]    echo [-neE] [arg ...]
 enable [-pnds] [-a] [-f filename]  eval [arg ...]
 exec [-cl] [-a name] file [redirec exit [n]
 export [-nf] [name[=value] ...] or false
 fc [-e ename] [-nlr] [first] [last fg [job_spec]
 for NAME [in WORDS ... ;] do COMMA for (( exp1; exp2; exp3 )); do COM
 function NAME { COMMANDS ; } or NA getopts optstring name [arg]
 hash [-lr] [-p pathname] [-dt] [na help [-s] [pattern ...]
 history [-c] [-d offset] [n] or hi if COMMANDS; then COMMANDS; [ elif
```

the shell takes commands from the keyboard (the “**command line**”), interprets them and passes them on to the **operating system**.

Linux file system - hierarchy

Home directory: contains your stuff, personal data etc.



Linux file system - hierarchy

A Path in Linux is a unique location to a file or a folder in a file system

Absolute Path

- Specified location of a file or directory from the root directory (/)
- “Complete path” from the start of the file system
- cd /home/**christian**/music/Katy_Perry

Relative Path\

- path related to the present working directory (pwd)
- Starts from the directory you are in at the moment
- cd music/Katy_Perry

print ***w***orking ***d***irectory

```
$~ pwd
```

Overview

- Change directory
- Check directory content
- Create and remove directories
- Copy and move directories and files
- Check files
- Create, modify and remove files

Linux file system - change directory

***c**hange **d**irectory*

$~ cd

cd has different flavours …

```
•  cd ..              (relative path – one directory up)
•  cd ../..           (relative path – two directories up)
•  cd music/Slayer    (relative path – only move down)
•  cd /user/music/    (absolute path – up and down)
```

Tab key

1x autocomplete path (if unique)

2x show all path options

Linux file system - directory listing

Check out what is in your folder:

***l**ist **s**creen*

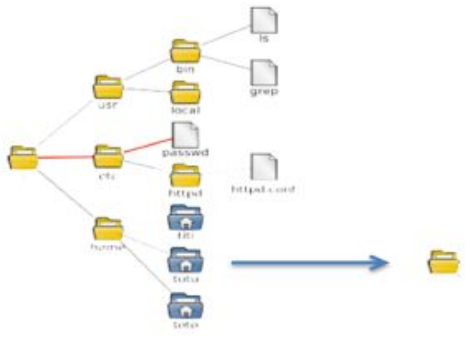
$~ ls *directory* (relative or absolute path)

Enhanced options

- `ls -a   (including hidden files)`
- `ls -l   (long format: more details)`
- `ls -lr  (long + reverse order)`
- `ls -lt  (long + sorted by time)`

Check manual!
$~ man ls

Linux file system - make and remove directories



Taylor_Swift

***make dir**ectory*

```
$~ mkdir  Taylor_Swift
```

***remove dir**ectory*

```
$~ rmdir  Taylor_Swift
```

or

```
$~ rm –R  Taylor_Swift
```

***rm** is more general*

- removes each file specified on the command line
- by default, it does not remove directories (-R is necessary)

Linux file system - move and copy files

***move** a file or directory*

```
$~ mv  <path_to_file>  <path_to_destination>
```

Danger of overwriting!!

Ask if file should be overwritten

```
$~ mv -i  <path_to_file>  <path_to_destination>
```

Do not overwrite file

```
$~ mv -n  <path_to_file>  <path_to_destination>
```

Do overwrite file

```
$~ mv -f  <path_to_file>  <path_to_destination>
```

***copy** a file*

```
$~ cp  <path_to_file>  <path_to_destination>
```

Danger of overwriting!!

```
$~ cp -i  <path_to_file>  <path_to_destination>

$~ cp -n  <path_to_file>  <path_to_destination>

$~ cp -f  <path_to_file>  <path_to_destination>
```

Linux file system - check files without opening

$~ more <path_to_file> {scroll down with Enter/Space; quit with q}

$~ head -n <path_to_file> {n = number or rows to show; e.g. -10}

$~ tail -n <path_to_file> {same as head but from the end}

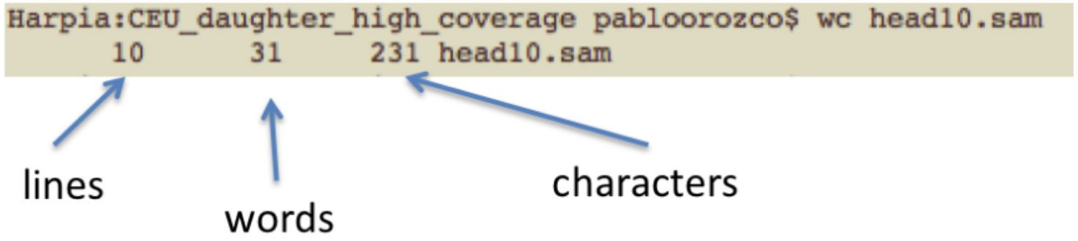
```
tail -n +2 my_file
```

(view everything but first line)

Linux file system - word count

word count

$~ wc <path_to_file>



```
Harpia:CEU_daughter_high_coverage pabloorozco$ wc head10.sam
      10      31     231 head10.sam
```

$~ wc –l <path_to_file>   how many lines?

$~ wc –w <path_to_file>   how many words?

$~ wc –m <path_to_file>   how many characters?

Text editors in the command line

Various text editors to choose from…

vi / vim

gedit

textpad

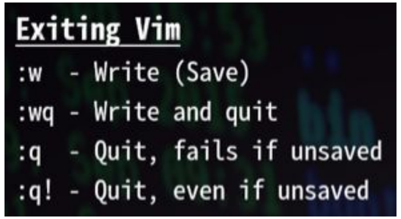
emacs

Text editing in the shell is much more powerful than graphical text editors like notepad.

- Notepad++ is a nice graphical text editor

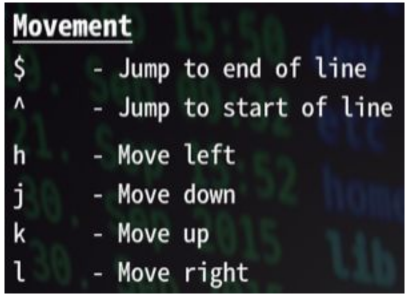
Create and open a file using vim

$~ vim <my_file>



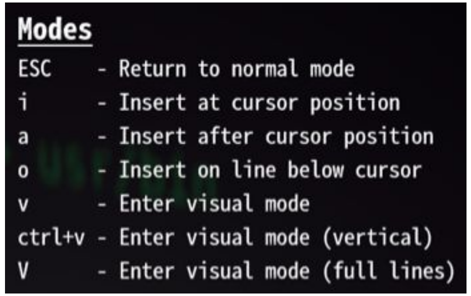
Exiting Vim

:w	- Write (Save)
:wq	- Write and quit
:q	- Quit, fails if unsaved
:q!	- Quit, even if unsaved



Movement

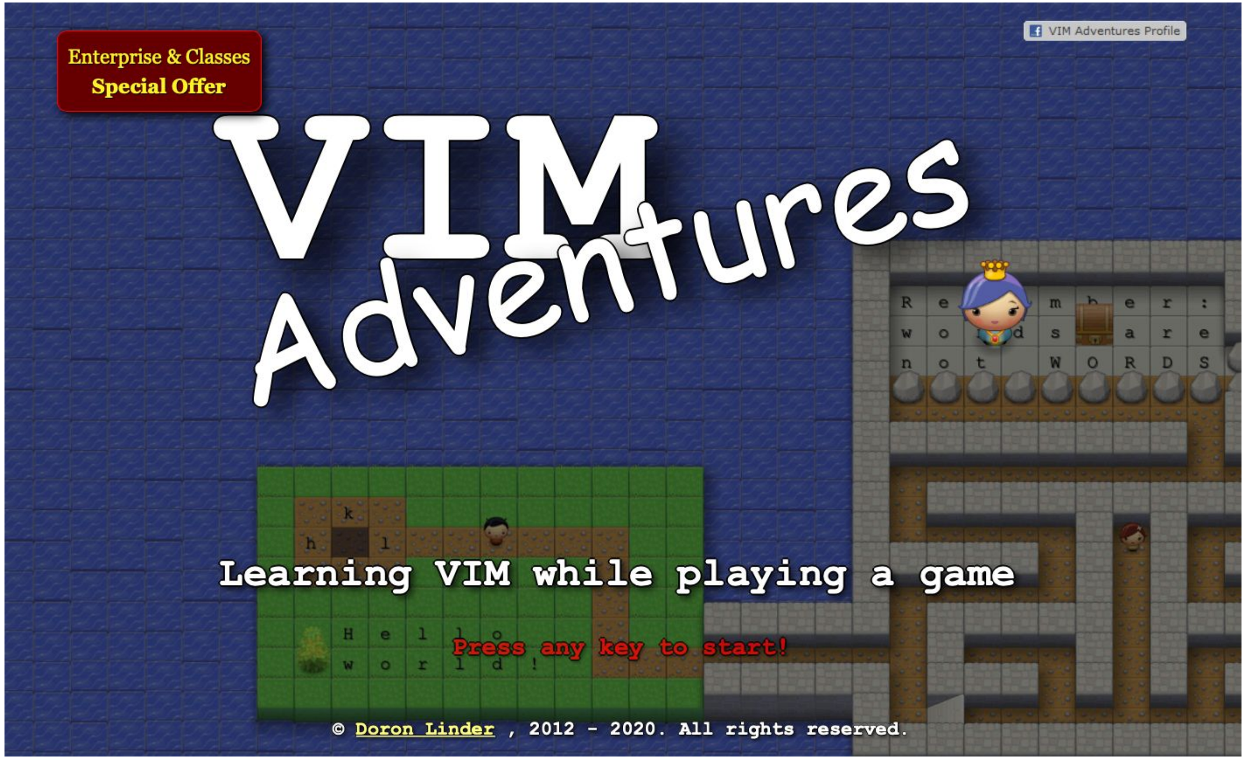
$	- Jump to end of line
^	- Jump to start of line
h	- Move left
j	- Move down
k	- Move up
l	- Move right



Modes

ESC	- Return to normal mode
i	- Insert at cursor position
a	- Insert after cursor position
o	- Insert on line below cursor
v	- Enter visual mode
ctrl+v	- Enter visual mode (vertical)
V	- Enter visual mode (full lines)

vim-adventures.com



Learning VIM while playing a game

Press any key to start!

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Text editors in the command line

bash scripts

- plain text file which contains a series of commands
- Anything you can run normally on the command line can be put into a script and it will do exactly the same thing

```
#!/bin/sh

pwd
ls

COURSE="introduction to GWAS"
echo $COURSE
```

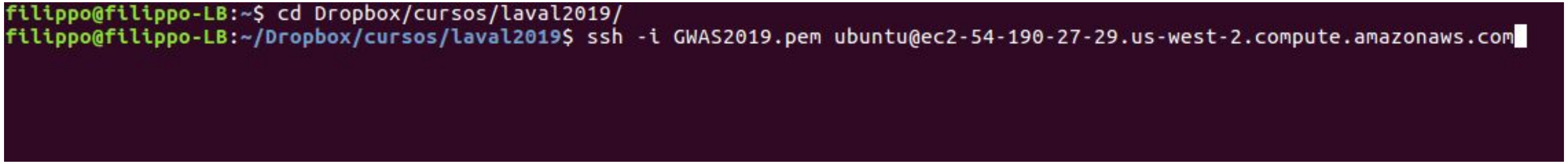
Always starts with the "shebang" (which shell to use)

… followed by commands

Running bash scripts $~ ./<my_script>

Connect to our instance on Amazon Web Services (AWS)

AWS: on-demand cloud computing platform



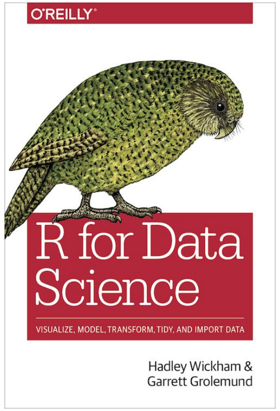
```
filippo@filippo-LB:~$ cd Dropbox/cursos/laval2019/
filippo@filippo-LB:~/Dropbox/cursos/laval2019$ ssh -i GWAS2019.pem ubuntu@ec2-54-190-27-29.us-west-2.compute.amazonaws.com
```

We will set up your connection now.

Windows first, then Mac / Linux.

Advanced R R for Data Science and the tidyverse

https://r4ds.had.co.nz/


O'REILLY
R for Data Science
VISUALIZE, MODEL, TRANSFORM, TIDY, AND IMPORT DATA
Hadley Wickham & Garrett Grolemund

https://www.tidyverse.org/

The tidyverse is an opinionated collection of R packages designed for data science. All packages share an underlying design philosophy, grammar, and data structures.