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Introduction to Unix, Part 2 - Connecting to a remote server

Welcome to the Programming for Evolutionary Biology workshop!!

Giovanni M. Dall'Olio. Data Strategy and Design, GSK. March 2020.

Quick link to slides online: <https://tinyurl.com/evop-unix> (<https://tinyurl.com/evop-unix>)

All materials available here: https://github.com/dalloliogm/peb_unix_intro/archive/master.zip
(https://github.com/dalloliogm/peb_unix_intro/archive/master.zip).

How to use these slides: Press Space to get to the next slide. Use arrows to navigate the subsections.

In [7]:

```
# Configuration - please ignore - this should not appear in the slideshow
alias grep='grep --color'
cd
cd workspace/peb_unix_intro/exercises/
# Please do not run this - it is only to format the slides
# if you did, type "unalias less"
alias less="head"
```

Summary of the course today

- Morning first half: Basic Terminal commands, First Login to Linux
- [Morning second half](#): Login to a Remote Unix server, browsing file contents, nano editing
- Afternoon first half: Finding patterns in a file with grep; piping commands; cut, sort and uniq
- Afternoon second half: awk and sed; makefiles

How many computers are we going to use in this course?

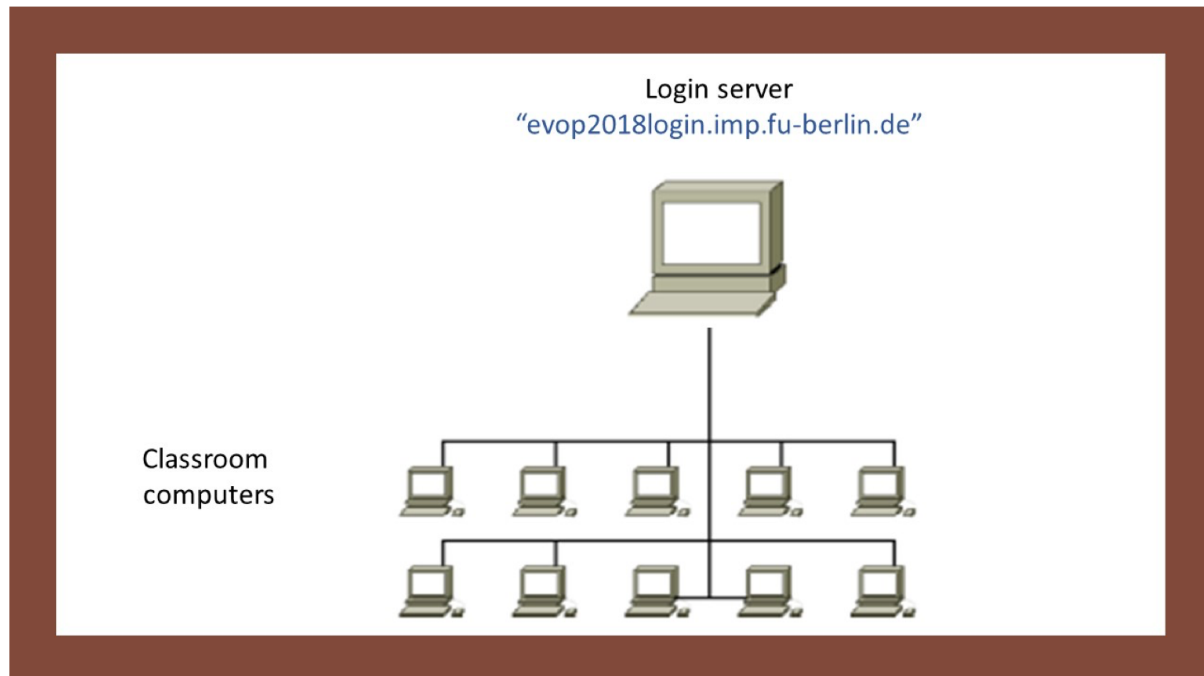
The `classroom computers` are in front of you.

- Use them to follow the slides, and connect to the server/ big computer/ cluster....

The server `evop-login.imp.fu-berlin.de` is a remote computer (the login node of a cluster)

- This machine are physically located outside of this room
- It is only accessible through the terminal (e.g. no keyboard attached to it)
- Most exercises will be done in this server, as all the software needed is installed there

Our course - computers infrastructure



Connecting to a remote server

Please refer to the login sheet **Passwords and Computer Infrastructure** for access credentials

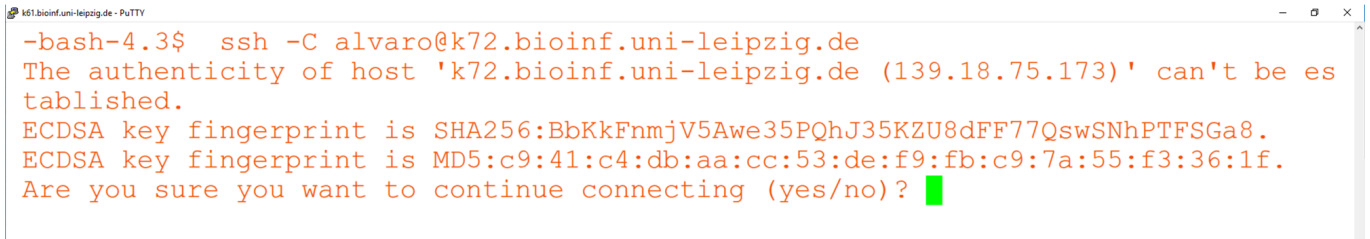
To connect to a remote server, we will use the `ssh` bash command:

```
ssh -C k00nnnn##@evop-login.imp.fu-berlin.de
```

Note: the `-C` flag (use compression) is recommended, to reduce the network load

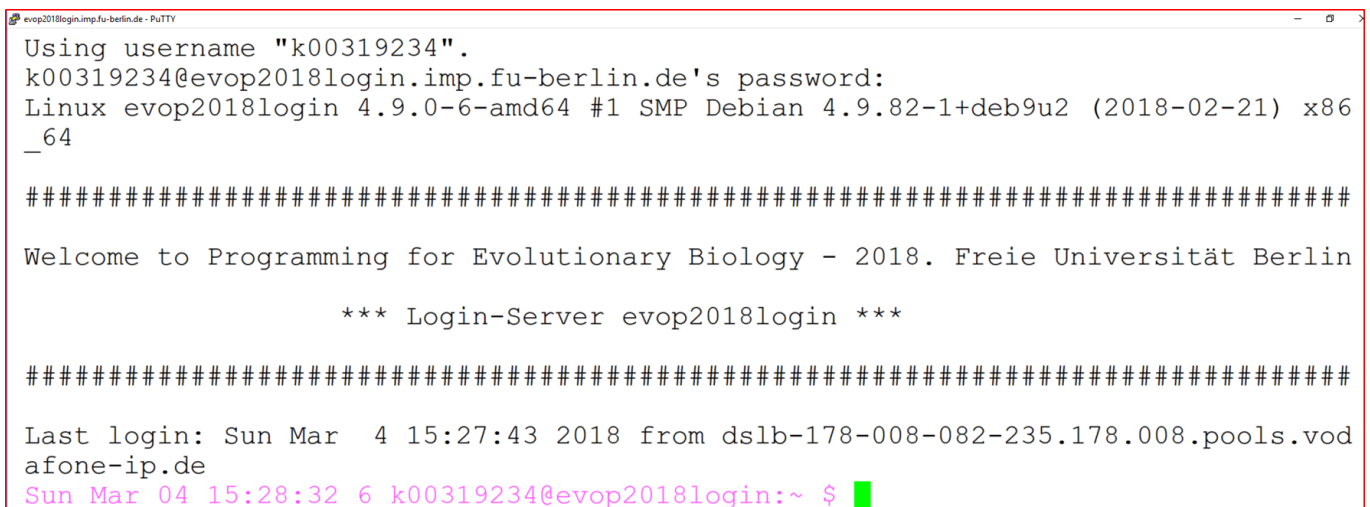
Connecting to evop-login.imp.fu-berlin.de - RSA key fingerprint

When you connect to a remote server for the first time, you may get the following prompt:



```
k61.bioinf.uni-leipzig.de - PuTTY
-bash-4.3$ ssh -C alvaro@k72.bioinf.uni-leipzig.de
The authenticity of host 'k72.bioinf.uni-leipzig.de (139.18.75.173)' can't be es
tablished.
ECDSA key fingerprint is SHA256:BbKkFnmjV5Awe35PQhJ35KZU8dFF77QswSNhPTFSGa8.
ECDSA key fingerprint is MD5:c9:41:c4:db:aa:cc:53:de:f9:fb:c9:7a:55:f3:36:1f.
Are you sure you want to continue connecting (yes/no)?
```

Type `yes` and press `Enter` to continue. Note that typing `y` will not be enough.



```
evop2018login.imp.fu-berlin.de - PuTTY
Using username "k00319234".
k00319234@evop2018login.imp.fu-berlin.de's password:
Linux evop2018login 4.9.0-6-amd64 #1 SMP Debian 4.9.82-1+deb9u2 (2018-02-21) x86
_64

#####

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*** Login-Server evop2018login ***

#####

Last login: Sun Mar  4 15:27:43 2018 from dslb-178-008-082-235.178.008.pools.vod
afone-ip.de
Sun Mar 04 15:28:32 6 k00319234@evop2018login:~ $
```

Connecting to evop-login - Password

If the connection is working, you should now get a message asking you for the password.

```
k61.bioinf.uni-leipzig.de - PuTTY
-bash-4.3$ ssh -C k00319234@evop2018login.imp.fu-berlin.de
k00319234@evop2018login.imp.fu-berlin.de's password: █
```

Type the password and press Enter to continue.

Is it possible to change the password? Yes but please no

use:

```
k61.bioinf.uni-leipzig.de - PuTTY
Sun Mar 04 15:54:02 10 k00319234@evop2018login:~ $ passwd
Current Password:
New password:
BAD PASSWORD: The password is the same as the old one
New password:
BAD PASSWORD: The password fails the dictionary check - it is based on a dictionary word
New password:
Retype new password:
passwd: password updated successfully
Sun Mar 04 15:55:21 11 k00319234@evop2018login:~ $ █
```

Special considerations for the new passwords:

1. If you change the password of your **k00nnnn##**'s account, please do it wisely, choose a **strong** one.
2. The workshop server and the 30 desktop PCs are accessible from "the world" via SSH, so chances are that attackers will try out easily guessable passwords on these computers. If you **choose a new and weak** password for your account, **it might get compromised!**

Are you in evop-login Server?

If the connection worked correctly, you should see something like:

```

evop2018login.imp.fu-berlin.de - PuTTY
Using username "k00319234".
k00319234@evop2018login.imp.fu-berlin.de's password:
Linux evop2018login 4.9.0-6-amd64 #1 SMP Debian 4.9.82-1+deb9u2 (2018-02-21) x86_64

#####

Welcome to Programming for Evolutionary Biology - 2018. Freie Universität Berlin

*** Login-Server evop2018login ***

#####

Last login: Sun Mar  4 15:27:43 2018 from dslb-178-008-082-235.178.008.pools.vodafone-ip.de
Sun Mar 04 15:28:32 6 k00319234@evop2018login:~ $ █

```

You can also type `uname -n` to confirm that you are in the correct machine.

Connection error?

If you get a connection error, try the following:

- make sure you are using the `-C` option
- Wait 1-2 minutes and try again
- Ask for help (TAs)

If the connection doesn't work at all - downloading the materials on your computer

If the connection to the server doesn't work at all, you can download the exercises file to your computer directly:

```
$: wget https://github.com/dalloliogm/peb_unix_intro/archive/master.zip
```

```
$: unzip master.zip
```

NOTE: There is a directory exported via NFS from the login server to the **desktop PCs** (`/opt/evop/public/`) and can be accessed as **read-only** on each machine.

Executing graphical applications from a remote server

By default, graphical applications like `firefox` or `kate` will not work from remote:

```
evop2018login.imp.fu-berlin.de - PuTTY
Sun Mar 04 16:26:37 75 k00319234@evop2018login:~ $ firefox
Error: GDK_BACKEND does not match available displays
Sun Mar 04 16:26:39 76 k00319234@evop2018login:~ $ █
```

Executing graphical applications remotely is very demanding for the network, so they are disabled by default.

To run graphical application remotely, you would need to `logout` and `re-login` on the server, using the `-X` option in `ssh` :

```
ssh -C -X k00nnnn##@evop-login.imp.fu-berlin.de
```

Which folder am I?

By default, when you login you are positioned in your home folder.

Use the `pwd` command to see where are you exactly:

```
evop2018login.imp.fu-berlin.de - PuTTY
Sun Mar 04 16:31:51 77 k00319234@evop2018login:~ $ pwd
/home/k00319234
Sun Mar 04 16:31:53 78 k00319234@evop2018login:~ $ █
```

How to navigate to another folder?

The `cd` command allows to navigate the file system, moving to a different folder.

```
evop2018login.imp.fu-berlin.de - PuTTY
Sun Mar 04 16:36:45 102 k00319234@evop2018login:~ $ ls
Desktop Downloads MyDocuments testfile2.txt testfile.txt
Sun Mar 04 16:36:47 103 k00319234@evop2018login:~ $ █
```

The 'cd' man page

The `cd` command is documented inside the "bash" man page.

- Type `man bash` and then look for `cd`

You can also look at:

- `man dir`
- `info coreutils cd`

Exercise: get lost in the Unix File System

- Enter the `/` folder. What are its contents?
- Enter the `/homes` folder in the remote server. Is this folder also present in your classroom computer?
- Type `cd` without arguments, and use `pwd` to see what happened

Exercise results

- the `/` folder contains several system folders
- the `homes` folder contains users main directories
- the contents of this server are different than your classroom computer
- Typing `cd` without arguments will bring you back to your home directory.

How to refer to the current (.) and parent (..) folders

In Unix the current folder is also referred to as `.`

- `cd .` will move you to `..` the current folder again

The parent folder is referred to as `..`

- `cd ..` will bring you to the parent folder

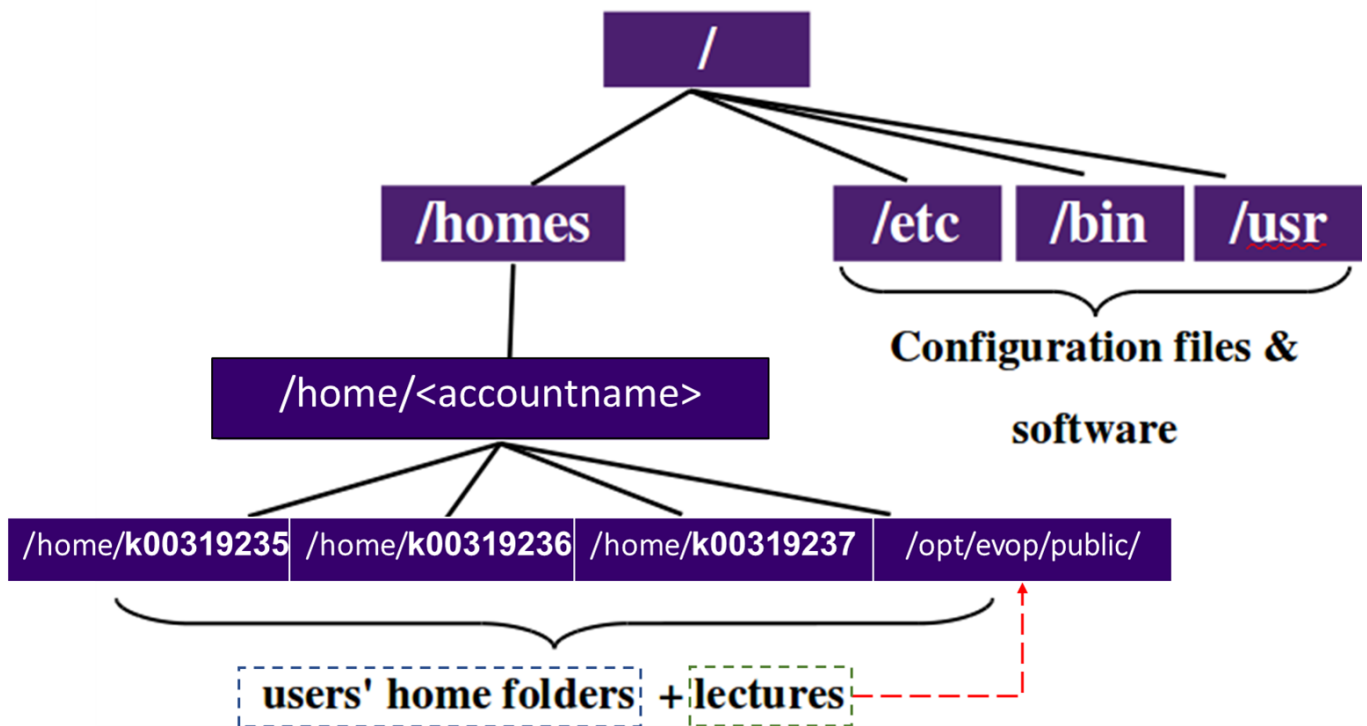
Structure of the Unix file system

Directories in a Unix file are organized as a "tree" of subdirectories.

The root folder, equivalent to `C:\` in Windows, is indicated by a single slash, `/`

All the other folders are subfolders of the root, e.g. `/homes/home/k003192##`

The Unix file tree



Contents of the /root directory

Type `ls /` to see the contents of the root directory:

- `/bin`, `/usr`, `/local` : all the software is usually installed here
- `/etc`, `/var` : system-wide configuration
- `/homes`, `/home` : Users' private directories

The course materials

The `/home/` folder contains a folder `k00#####` for each student in this course

There is also a special folder called `/opt/evop/public/`, containing the materials, slides, and Data sets

```
(/opt/evop/public/ )
```

All the materials for this course are in `/opt/evop/public/unix_intro`

```
( /opt/evop/public/unix_intro)
```

NOTE: `/opt/evop/public/` directory is exported via NFS from the login server to the **desktop PCs** and can be accessed as **read-only** on these machines

Copy the course materials in your home

Copy the exercise files to your home folder:

```
cp -r /opt/evop/public/unix_intro ~
```

Explanation:

- `cp` is the command to copy files
- the `-r` (recursive) option is mandatory when copying folders
- `/opt/evop/public/unix_intro` is the location of the folder you want to copy
- `~` (tilde key) is a short-cut to represent your home folder

To make sure the files are copied correctly, you can do:

```
cd
cd unix_intro
ls
```

The exercises files

Let's move to the `unix_intro/exercises` folder to see the exercise files.

In [8]:

```
cd exercises
ls
```

```
bash: cd: exercises: No such file or directory
1_browsing_textfiles.txt      chr20      multiplef
iles
2_searching_patterns.txt      chr8       ngs
'Unconfirmed 563806.crdownload' exercise_sequences.fasta old_files
bos_taurus.txt                genes      redirect_
me_here.txt
```

There is a file called 1_browsing_textfiles.txt.

Accessing the contents of a file: head, cat, less

To access the contents of a file, we can use several Unix commands:

command	description	example
head	print the first lines of the file	head start_here.txt
tail	print the last lines of the file	tail start_here.txt
cat	print the contents of the file to the screen	cat start_here.txt
less	allows to navigate contents of the file	less start_here.txt

The `head` command can be used to see the first line of a file.

Let's use it on the file `1_browsing_textfiles.txt` :

In [9]:

```
head 1_browsing_textfiles.txt
```

```

/ the Unix command "head" allows to see the first lines of a file.
\
|
|
| You can use the -n option to specify how many lines to show. For e
xample, try printing |
| the first 40 lines of this file.
|
\
/
-----
\      ^  ^
 \    (oo)\_____
  (__) \         )\/\
```

The -n option in head

The first lines of the file seemed to suggest something. Let's use the `-n 40` option to print the first 40 lines of this file:

In [10]:

```
head -n 40 1_browsing_textfiles.txt
```

```
/ the Unix command "head" allows to see the first lines of a file.
```

```
\
```

```
|
| You can use the -n option to specify how many lines to show. For e
| xample, try printing |
| the first 40 lines of this file.
```

```
|
```

```
\
```

```
/
```

```

\      ^__^
\      (oo)\_______
          (_____)\/    )\/\
              ||----w |
              ||     ||
```

```
/
```

```
| Well Done!
```

```
| Another way to see the contents of a file is
| using the less command. Try typing:
```

```
    less start_here.txt
```

```
| and scroll down with the arrow keys.
```

```
\
```

```

\      ^__^
\      (oo)\_______
          (_____)\/    )\/\
              ||----w |
              ||     ||
```

```
+++++
```

Browsing the contents of a file with less

The `less` unix command allows to browse the contents of file, read-only, in a modality similar to what we saw with the `man` pages:

```
less 1_browsing_textfiles.txt
```

Scroll down and follow the instructions in the file to see more.

Editing files with nano

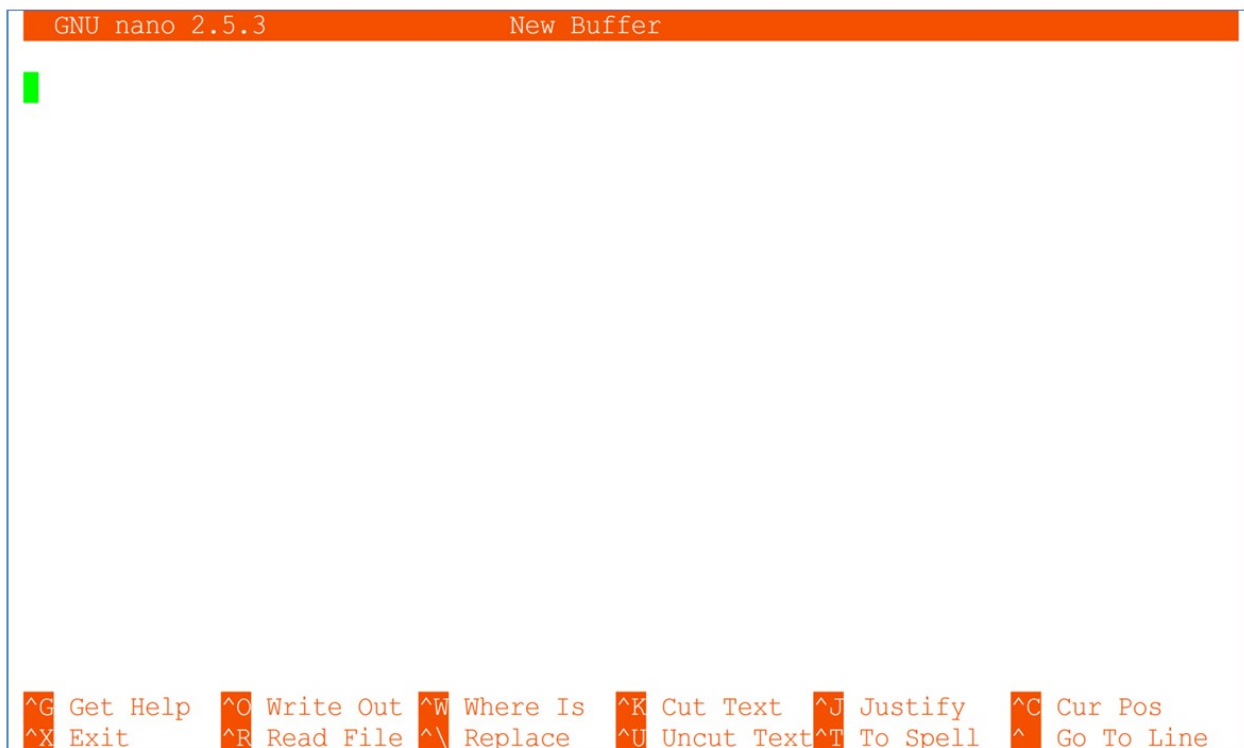
In the following days you will have to write several scripts into `evop2018Server`.

There are two alternatives:

- connect using the `-X` option, then use `gedit` -> however if too many people use it, the network will crash
- `nano` is a powerful command-line editor

The nano text editor

Type `nano` on the command line to access the text editor:



How to use nano

Type `nano` on the command line to access the text editor

`type nano filename.txt` to open a file directly

Keyboard shortcuts:

- save a file: `CTRL-o`
- read a file: `CTRL-r`
- exit: `CTRL-x`
- undo/redo: `ALT-u` and `ALT-e`
- Copy/paste: `CTRL-SHIFT-c` and `CTRL-SHIFT-v`

Nano exercise

- Create a new folder `my_folder` in your home area, using the `mkdir` command
- `cd` into it
- Create a file named `myfile.txt`, using `nano`
- Write `hello world` in it
- Save it using the `CTRL-o` shortcut
- Exit the editor using `CTRL-x`
- use `ls` to see if the file is there

Other useful Unix commands (moving and copying files)

- `mkdir` : create a folder
- `rm` : delete files (note: no trash bin!)
- `mv` : move or rename a file (note: overwritten files will be lost)

Other Unix commands

- `clear` : clear the terminal output
- `history` : see all the commands typed so far
- `dos2unix` : clean files edited in MS Windows notepad for Unix (see also `unix2dos`)
- `echo` : print a message (useful in scripts)

Time for lunch!

See you at 14.00!