

JACS

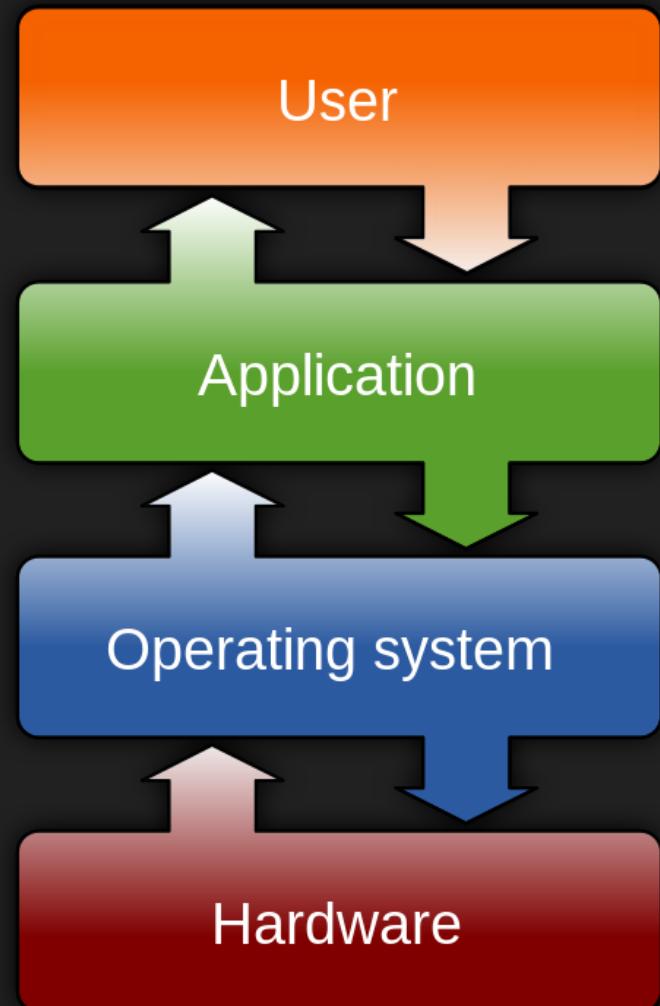
Introduction to Linux

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20th October 2022

Slides adapted from previous versions of this talk given by
Mateusz Malenta and Tom Armitage

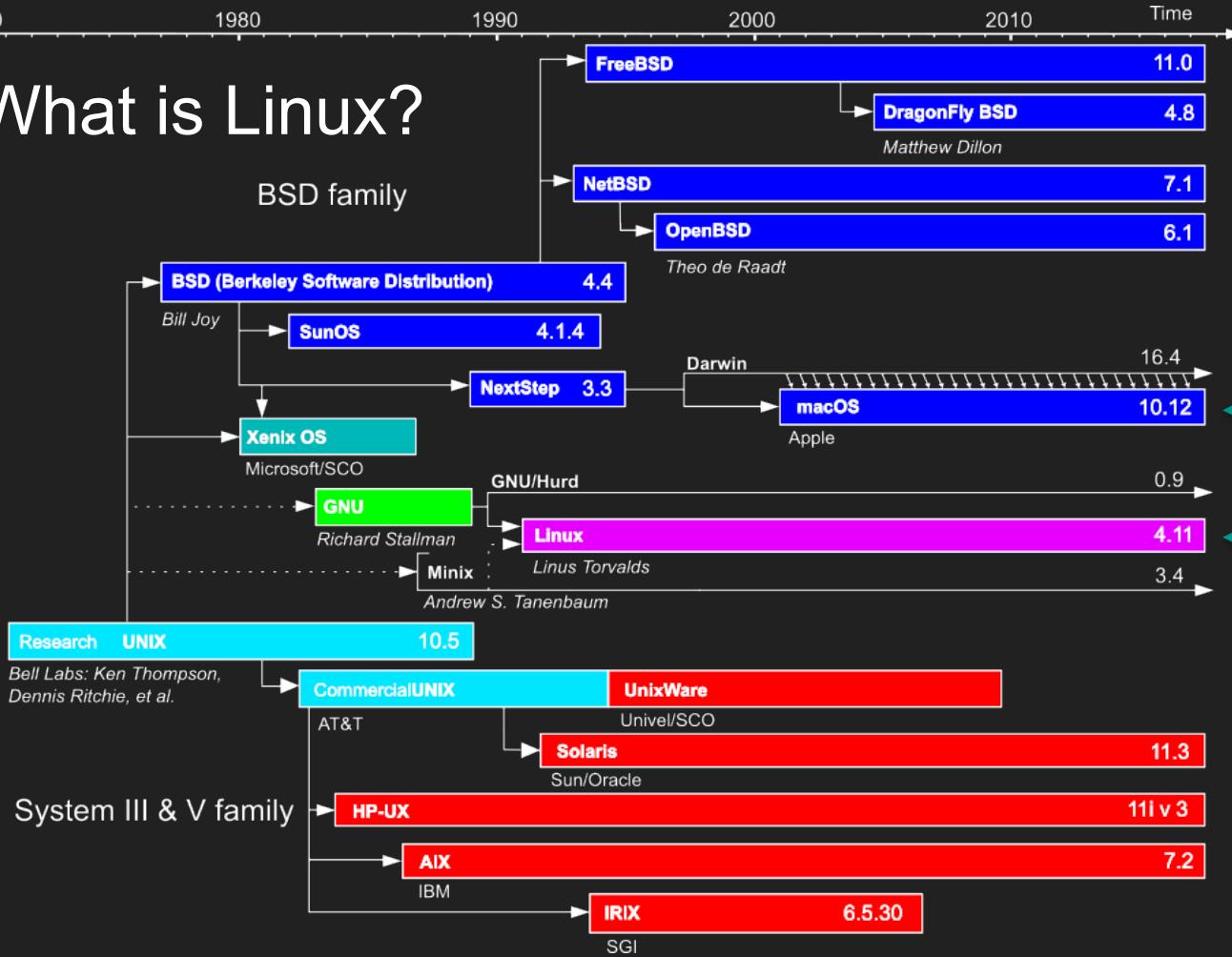
What is Linux?

- A type of Operating System (OS)
- Personal computers:
 - ~75% Microsoft Windows
 - ~15% macOS
 - ~3% Linux
- Most people won't have used Linux as their personal OS before.



Family tree of Operating Systems (OS)

What is Linux?



Note relation to macOS! Similar but different.

We are here

Why Linux?

- it's free
- it's open source - you can make your own version if you want
- it's very well maintained - Linux kernel often first to get "cutting edge" features
- **arguably** safer than Windows
- something for everyone

Why should you care?

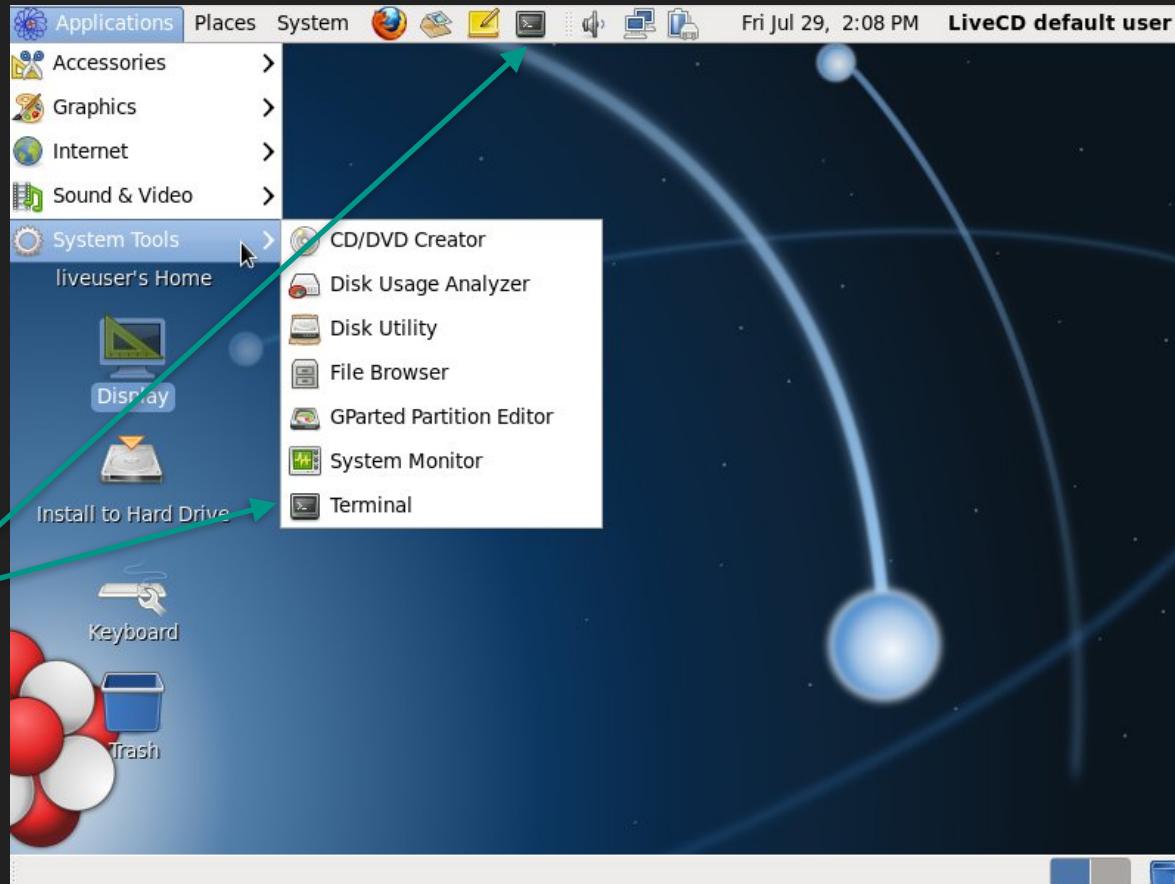
- if you use a PC in the department (what is that?) - it has Linux on (SL6/SL7)
- if you use a cluster in Turing - it has Linux on (most likely CentOS)
- if you use a Macbook - macOS is **Unix-like** - most/all commands from this course will work. Plus can easily use a mac terminal to remotely log into linux machine
- you can use it on Windows with WSL

“But I can manage with using Windows all the time!”

- if you ever use any telescope / instrument / computational facility - it will most likely have Linux on / very limited or more expensive Windows support
- **a lot of scientific software works only on Linux** - no Windows version available at all / very difficult to force it

Linux desktop

- Desktop works like any other.
- Can look through folders, applications etc.
- This is probably the most important icon: the terminal.

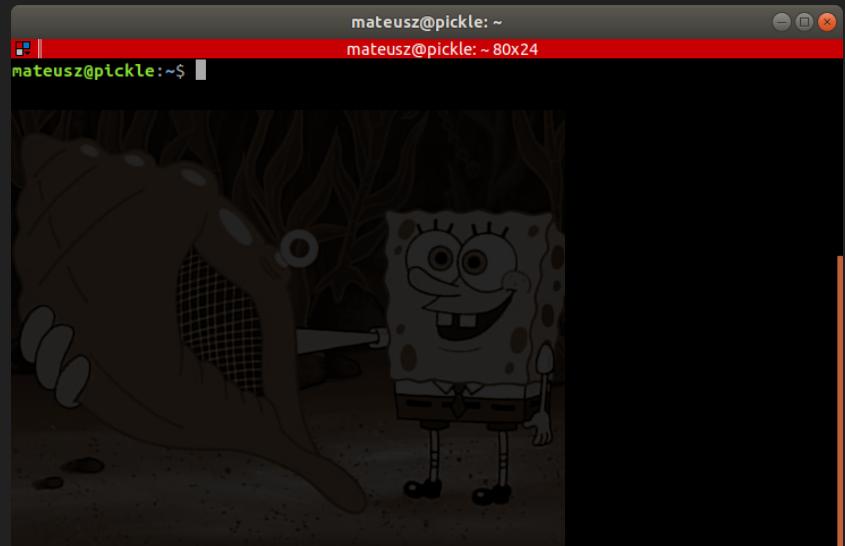


Linux terminal

At some point you will have to use shell - that's where 'real' Linux begins

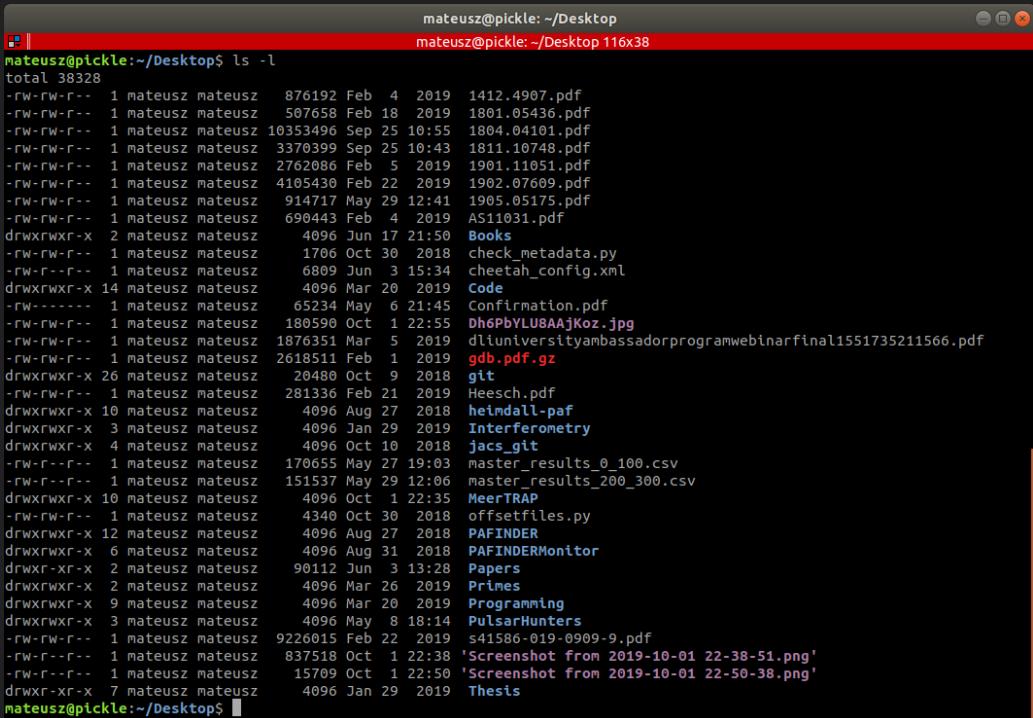
Shell - a program that acts as an interface between the user and the operating system. You type, shell tells OS what to do, OS does that (maybe, maybe not)

That's technically not a shell - that's a terminal (emulator). It lets you 'talk' to the shell



First command

- Navigate and perform tasks in the terminal via typed commands.



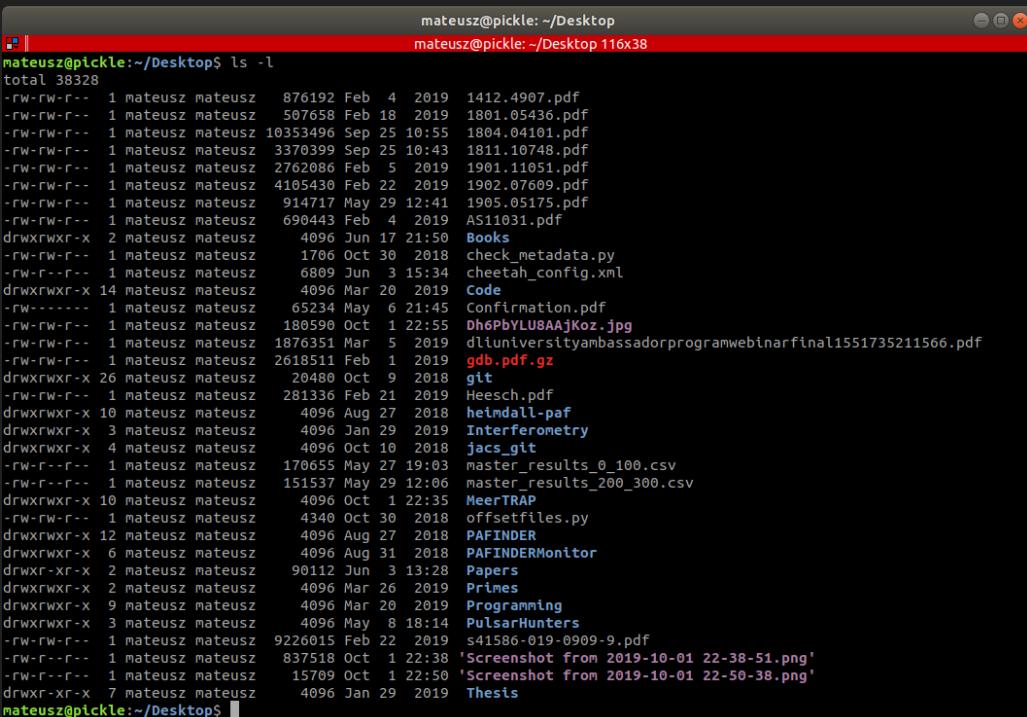
```
mateusz@pickle:~/Desktop$ ls -l
total 38328
drwxrwxr-x  2 mateusz mateusz  4096 Jun 17 21:50 Books
drwxrwxr-x 14 mateusz mateusz 4096 Mar 20 2019 Code
drwxrwxr-x 26 mateusz mateusz 4096 Oct  9  2018 gbt
drwxrwxr-x 10 mateusz mateusz 4096 Aug 27 2018 heimdall-paf
drwxrwxr-x  3 mateusz mateusz 4096 Jan 29 2019 Interferometry
drwxrwxr-x  4 mateusz mateusz 4096 Oct 10  2018 jacs_gbt
drwxrwxr-x  1 mateusz mateusz 170655 May 27 19:03 master_results_0_100.csv
drwxrwxr-x 10 mateusz mateusz 151537 May 29 12:06 master_results_200_300.csv
drwxrwxr-x 12 mateusz mateusz 4096 Oct  1  22:35 MeerTRAP
drwxrwxr-x  6 mateusz mateusz 4096 Aug 31 2018 PAFINDER
drwxr-xr-x  2 mateusz mateusz 90112 Jun  3 13:28 Papers
drwxrwxr-x  2 mateusz mateusz 4096 Mar 26 2019 Primes
drwxrwxr-x  9 mateusz mateusz 4096 Mar 20  2019 Programming
drwxrwxr-x  3 mateusz mateusz 4096 May  8 18:14 PulsarHunters
drwxrwxr-x  1 mateusz mateusz 9226015 Feb 22 2019 s41586-019-0909-9.pdf
drwxr-xr-x  7 mateusz mateusz 837518 Oct  1 22:38 'Screenshot from 2019-10-01 22-38-51.png'
drwxr-xr-x  1 mateusz mateusz 15709 Oct  1 22:50 'Screenshot from 2019-10-01 22-50-38.png'
mateusz@pickle:~/Desktop$
```

First command

ls - list directory contents

Plus options:

- l - use long listing format**
- d - list directories only, not what's inside**
- a - show 'hidden' directories (starting with .)**
- h - human-readable format (kB, MB, GB)**
- t - sort by modification time**
- r - reverse sorting order**



The screenshot shows a terminal window titled 'mateusz@pickle: ~/Desktop\$'. The command 'ls -l' is run, displaying a long listing of files and directories. The output includes columns for permissions, file size, modification date, and names. Several files are highlighted in green, including 'Confirmation.pdf', 'gdb.pdf.gz', 'Heesch.pdf', 'Interferometry', 'Jacs_glt', 'MeerTRAP', 'PAFINDER', 'PAFINDERMonitor', 'Papers', 'Primes', 'Programming', 'PulsarHunters', 'Screenshot from 2019-10-01 22-38-51.png', and 'Screenshot from 2019-10-01 22-50-38.png'. The terminal window has a red header bar with the title and a red status bar at the bottom.

```
mateusz@pickle:~/Desktop$ ls -l
total 38328
-rw-rw-r-- 1 mateusz mateusz 876192 Feb  4  2019 1412.4907.pdf
-rw-rw-r-- 1 mateusz mateusz 507658 Feb 18  2019 1801.05436.pdf
-rw-rw-r-- 1 mateusz mateusz 10353496 Sep 25 10:55 1804.04101.pdf
-rw-rw-r-- 1 mateusz mateusz 3370399 Sep 25 10:43 1811.10748.pdf
-rw-rw-r-- 1 mateusz mateusz 2762086 Feb  5  2019 1901.11051.pdf
-rw-rw-r-- 1 mateusz mateusz 4105430 Feb 22  2019 1902.07609.pdf
-rw-rw-r-- 1 mateusz mateusz 914717 May 29 12:41 1905.05175.pdf
-rw-rw-r-- 1 mateusz mateusz 690443 Feb  4  2019 A$11031.pdf
drwxrwxr-x 2 mateusz mateusz 4096 Jun 17 21:50 Books
-rw-rw-r-- 1 mateusz mateusz 1706 Oct 30 2018 check_metadata.py
-rw-r--r-- 1 mateusz mateusz 6809 Jun  3 15:34 cheetah_config.xml
drwxrwxr-x 14 mateusz mateusz 4096 Mar 20 2019 Code
-rw----- 1 mateusz mateusz 65234 May  6 21:45 Confirmation.pdf
-rw-rw-r-- 1 mateusz mateusz 180590 Oct  1 22:55 Dh6pbYLUBAAjkoz.jpg
-rw-rw-r-- 1 mateusz mateusz 1876351 Mar  5 2019 dluniwersytambassadorprogramwebinarfinal1551735211566.pdf
-rw-rw-r-- 1 mateusz mateusz 2618511 Feb  1 2019 gdb.pdf.gz
drwxrwxr-x 26 mateusz mateusz 20480 Oct  9 2018 git
-rw-rw-r-- 1 mateusz mateusz 281336 Feb 21 2019 Heesch.pdf
drwxrwxr-x 10 mateusz mateusz 4096 Aug 27 2018 heimdall-paf
drwxrwxr-x 3 mateusz mateusz 4096 Jan 29 2019 Interferometry
drwxrwxr-x 4 mateusz mateusz 4096 Oct 10 2018 Jacs_glt
-rw-r--r-- 1 mateusz mateusz 170655 May 27 19:03 master_results_0_100.csv
-rw-r--r-- 1 mateusz mateusz 151537 May 29 12:06 master_results_200_300.csv
drwxrwxr-x 10 mateusz mateusz 4096 Oct  1 22:35 MeerTRAP
-rw-rw-r-- 1 mateusz mateusz 4340 Oct 30 2018 offsetfiles.py
drwxrwxr-x 12 mateusz mateusz 4096 Aug 27 2018 PAFINDER
drwxrwxr-x 6 mateusz mateusz 4096 Aug 31 2018 PAFINDERMonitor
drwxr-xr-x 2 mateusz mateusz 90112 Jun  3 13:28 Papers
drwxrwxr-x 2 mateusz mateusz 4096 Mar 26 2019 Primes
drwxrwxr-x 9 mateusz mateusz 4096 Mar 20 2019 Programming
drwxrwxr-x 3 mateusz mateusz 4096 May  8 18:14 PulsarHunters
-rw-rw-r-- 1 mateusz mateusz 9226615 Feb 22 2019 s41586-019-0909-9.pdf
-rw-r--r-- 1 mateusz mateusz 837518 Oct  1 22:38 'Screenshot from 2019-10-01 22-38-51.png'
-rw-r--r-- 1 mateusz mateusz 15709 Oct  1 22:50 'Screenshot from 2019-10-01 22-50-38.png'
drwxr-xr-x 7 mateusz mateusz 4096 Jan 29 2019 Thesis
```

First command

d - directory

- - regular file

l - symbolic link

```
drwxrwxr-x  2 mateusz mateusz  4096 Jun 17 21:50 Books
-rw-rw-r--  1 mateusz mateusz 1706 Oct 30 2018 check_metadata.py
-rw-r--r--  1 mateusz mateusz 6809 Jun  3 15:34 cheetah_config.xml
drwxrwxr-x 14 mateusz mateusz 4096 Mar 20 2019 Code
-rw-------  1 mateusz mateusz 65234 May  6 21:45 Confirmation.pdf
```

Permissions:

r - read (4)

w - write (2)

x - execute (1)

directory	owner name	group name	last modification time	
d rwx rwx r-x 2 mateusz mateusz 4096 Jun 17 21:50 Books				
owner group others links			size (kind of)	folder name

First command - there is more

I want to check what books I have,
how?

```
cd Books  
ls -l
```

cd Books; ls -l - run cd,
immediately followed by ls

cd Books && ls -l - run ls ONLY
if cd was run successfully
(notice it's **&&** and NOT **&** - that
means something different)

```
mateusz@pickle:~/Desktop$ cd Books/  
mateusz@pickle:~/Desktop/Books$ ls -l  
total 168360  
-rw-rw-r-- 1 mateusz mateusz 26217005 Aug 21 2018 2009_Book_NeutronStarsAndPulsars.pdf  
-rw-r--r-- 1 mateusz mateusz 9894382 Oct 25 2018 2013_Book_ToolsOfRadioAstronomy.pdf  
-rw-rw-r-- 1 mateusz mateusz 17744484 Sep 9 2018 2015_Book_OrbitalMechanicsAndAstrodynamics.pdf  
-rw-rw-r-- 1 mateusz mateusz 17176142 Feb 18 2019 2017_Book_ComputationalPhysics.pdf  
-rw-r--r-- 1 mateusz mateusz 19792413 Oct 25 2018 2017_Book_InterferometryAndSynthesisInRa.pdf  
-rw-rw-r-- 1 mateusz mateusz 1865343 May 29 16:26 2018_Book_ExercisesAndProblemsInMathematics.pdf  
-rw-rw-r-- 1 mateusz mateusz 18257068 May 8 13:09 2018_Book_InsideSolidStateDrivesSSDs.pdf  
-rw-rw-r-- 1 mateusz mateusz 4271251 May 29 16:26 2018_Book_LinearAlgebraAndAnalyticGeometry.pdf  
-rw-rw-r-- 1 mateusz mateusz 6299104 May 8 13:08 2018_Book_QuantumMechanicsForPedestrians_1.pdf  
-rw-rw-r-- 1 mateusz mateusz 8901400 May 8 13:08 2018_Book_QuantumMechanicsForPedestrians_2.pdf  
-rw-rw-r-- 1 mateusz mateusz 5885455 May 8 13:07 2018_Book_SupervisedLearningWithQuantumC.pdf  
-rw-r--r-- 1 mateusz mateusz 6904794 Oct 25 2018_gamedevelopmentpatternsandbestpractices.pdf  
-rw-rw-r-- 1 mateusz mateusz 12610152 Jun 17 20:54 Kubernetes_in_Action.pdf  
-rw-rw-r-- 1 mateusz mateusz 4206689 Sep 29 2018 Ng_MLY01_13.pdf  
-rw-r--r-- 1 mateusz mateusz 12328313 Oct 25 2018 progit.pdf  
mateusz@pickle:~/Desktop/Books$
```

I don't trust the cd command...

```
mateusz@pickle:~/Desktop/Books$ pwd  
/home/mateusz/Desktop/Books  
mateusz@pickle:~/Desktop/Books$
```

pwd - print working directory,
just to make sure

Some interesting directories

cd ~ - go to home directory

```
mateusz@pickle:~$ cd ~
mateusz@pickle:~ 80x24
total 4520
drwxr-xr-x 23 root root 4096 Aug 13 2018 anaconda3
drwxr-xr-x 16 mateusz mateusz 4096 Oct 1 23:33 Desktop
drwxr-xr-x 3 mateusz mateusz 4096 Nov 7 2018 Documents
drwxr-xr-x 2 mateusz mateusz 4096 Oct 1 23:22 Downloads
-rw-r--r-- 1 mateusz mateusz 8980 Aug 12 2018 examples.desktop
drwxrwxr-x 4 mateusz mateusz 4096 Jun 15 21:45 gcloud
```

cd / - go to root directory

```
mateusz@pickle:/$ ls -l
total 120
drwxr-xr-x 2 root root 4096 Sep 14 14:31 bin
drwxr-xr-x 3 root root 4096 Oct 2 09:45 boot
drwxrwxr-x 2 root root 4096 Aug 12 2018 cdrom
drwxr-xr-x 21 root root 4820 Oct 2 09:45 dev
drwxr-xr-x 147 root root 12288 Sep 30 20:25 etc
drwxr-xr-x 4 root root 4096 Aug 12 2018 home
lrwxrwxrwx 1 root root 33 Oct 1 22:16 initrd.img -> boot/initrd.img-4.15.0-65-generic
lrwxrwxrwx 1 root root 33 Oct 1 22:16 initrd.img.old -> boot/initrd.img-4.15.0-64-generi
c
```

cd ../ - go to parent directory

```
mateusz@pickle:~/Desktop/Books$ pwd
/home/mateusz/Desktop/Books
mateusz@pickle:~/Desktop/Books$ cd ../
mateusz@pickle:~/Desktop$ pwd
/home/mateusz/Desktop
mateusz@pickle:~/Desktop$
```

How do I deal with this file?

Back to Books - I like my `progit.pdf` book so much, I want to have a copy of it.

```
cp progit.pdf progit_copy.pdf
```

```
mateusz@pickle:~/Desktop/Books$ cp progit.pdf progit_copy.pdf
mateusz@pickle:~/Desktop/Books$ ls -l progit*
-rw-r--r-- 1 mateusz mateusz 12328313 Oct  2 09:58 progit_copy.pdf
-rw-r--r-- 1 mateusz mateusz 12328313 Oct 25  2018 progit.pdf
```

Introduced a **wildcard** '*' here - it matched any number of any characters

Other wildcards:

? - matches a single character

[...] - matches single given characters, e.g. [abDF=]

[...-...] - matches from a set, e.g.

[0-9] matches digits between 0 and 9

I don't like the name `progit_copy.pdf`, how do rename it? No `rn` or `rename` command! You move it!

```
mv progit_copy.pdf progit_book.pdf
```

```
mateusz@pickle:~/Desktop/Books$ mv progit_copy.pdf progit_book.pdf
mateusz@pickle:~/Desktop/Books$ ls -l progit*
-rw-r--r-- 1 mateusz mateusz 12328313 Oct  2 09:58 progit_book.pdf
-rw-r--r-- 1 mateusz mateusz 12328313 Oct 25  2018 progit.pdf
mateusz@pickle:~/Desktop/Books$ █
```

How to keep this file safe?

I would like to keep this file separate from other files.

```
mkdir GitBook;  
mv progit_book.pdf GitBook
```

```
mateusz@pickle:~/Desktop/Books$ cd GitBook/  
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-rW-r--r-- 1 mateusz mateusz 12328313 Oct  2 09:58 progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ █
```

You know what, I don't need a second copy after all

Either:

rm progit_book.pdf - remove just the book
rm -r GitBook - remove the whole directory (need to include the **-r** option to remove directories and contents *recursively*)

rm - your best friend that will kill you

It **removes** files - no bin, no other staging area.
Once you `rm` file, it's gone.

`rm -r *` - removes

EVERYTHING in the
current directory that you have
permission to remove. This can
even be your supervisor's data -
as long as you have valid
permissions

How to make sure you / other people don't
remove the data accidentally?

CHANGE PERMISSIONS! (or remove people)

Use `chmod` command

chmod to the rescue

Make sure other people cannot edit your file

```
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-rw-r--r-- 1 mateusz mateusz 12328313 Oct 2 13:13 progit_book.pdf
```

chmod 777 progit_book.pdf

```
mateusz@pickle:~/Desktop/Books/GitBook$ chmod 777 progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-rwxrwxrwx 1 mateusz mateusz 12328313 Oct 2 13:13 progit_book.pdf
```

Now anyone can do anything with this file - not what we are looking for

```
mateusz@pickle:~/Desktop/Books/GitBook$ chmod 400 progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-r----- 1 mateusz mateusz 12328313 Oct 2 13:13 progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ rm progit_book.pdf  
rm: remove write-protected regular file 'progit_book.pdf'? y
```

chmod 400 - only you can read the file

chmod can work with numbers, as in

chmod 724 - 7 = 4(r) + 2(w) + 1(x) for owner; 2(w) for group; 4(r) for others

chmod can also work with letters

chmod +x - add eXecute to owner, group and others

```
mateusz@pickle:~/Desktop/Books/GitBook$ chmod +x progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-rwxr-xr-x 1 mateusz mateusz 12328313 Oct 2 13:23 progit_book.pdf
```

chmod o-r - remove Read from others

```
mateusz@pickle:~/Desktop/Books/GitBook$ chmod o-r progit_book.pdf  
mateusz@pickle:~/Desktop/Books/GitBook$ ls -l  
total 12040  
-rwxr-x--x 1 mateusz mateusz 12328313 Oct 2 13:23 progit_book.pdf
```

chmod u=rx,g+w,o=r - ??

NEVER EVER! (or do, I don't care, not my PC)

rm -rf /

New shells require you to specifically say
`--no-preserve--root`

Editing files

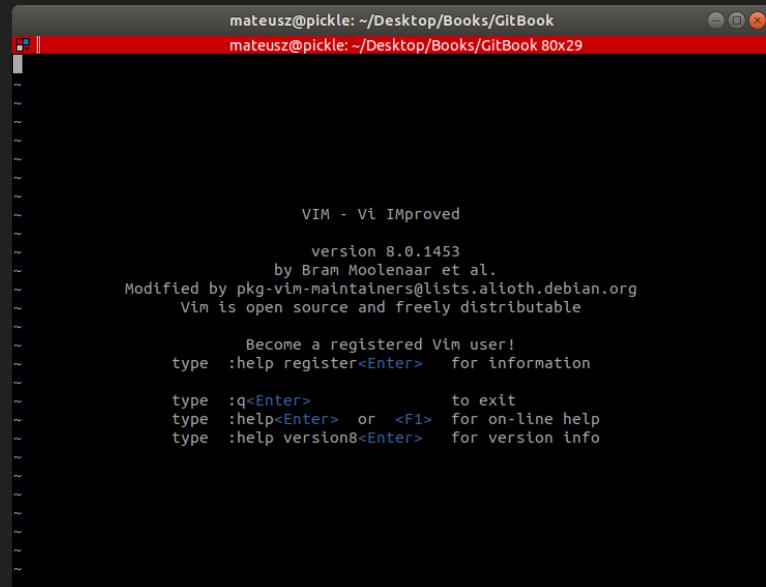
You have a write permission to a file. Now what?

Local machine:

- LibreOffice (+ something to numb the pain)
- LaTeX (+ even more to numb the pain)
- Google Docs
- gedit
- IDEs for code editing: VS Code, Atom, Code::Blocks, etc. etc.

Remote machine, very likely with no GUI:

- nano, pico for the most basic operations
- vim vs emacs (but we all know it's vim)



A screenshot of a terminal window titled "mateusz@pickle: ~/Desktop/Books/GitBook". The window shows the Vim 8.0.1453 welcome screen. The text reads:

```
VIM - Vi IMproved
version 8.0.1453
by Bram Moolenaar et al.
Modified by pkg-vim-maintainers@lists.alioth.debian.org
Vim is open source and freely distributable

Become a registered Vim user!
type :help register<Enter> for information

type :q<Enter> to exit
type :help<Enter> or <F1> for on-line help
type :help version8<Enter> for version info
```

Remote machines - ssh

Use ssh to connect to a remote machine:

```
ssh username@example.com  
ssh username@127.0.0.1  
ssh 127.0.0.1 -l username
```

Want to connect to your JBCA PC? Need to go through external.

```
ssh  
username@external.jb.man.ac.uk
```



Note: not the same as your UoM username

.ssh/config - file in your home directory - configure your most common connections and you don't have to type them in full

```
Host external
```

```
HostName external.jb.man.ac.uk  
User username
```

```
ssh external
```

Even faster if you set a key pair and don't use password

Remote machines - keys

Use `ssh-keygen` to generate a public-private key pair

```
ssh-keygen -t rsa -b 4096
```

Public key stored in `~/.ssh/id_rsa.pub` - add it to a `~/.ssh/authorized_keys` file and enjoy passwordless login

And did I mention GlobalProtect?

<http://www.itservices.manchester.ac.uk/ourservices/popular/vpn/>

Or Google 'manchester vpn'

Very useful if you need to copy files over from your JBCA PC to personal computer - need to go through ssh

```
rsync -e "ssh external ssh"  
remote:/path/to/file.dat ./local/  
file
```

Need to make sure you can connect to your remote from external without password!

Generate key pair on external, and upload to remote.

Feeling lazy? Aliases

Aliases - give your long and boring commands you use every day, a nice and shorter name.

```
mateusz@pickle:~$ cd Desktop/Books/  
mateusz@pickle:~/Desktop/Books$ alias hd='cd ~; pwd'  
mateusz@pickle:~/Desktop/Books$ hd  
/home/mateusz
```

Useful, but please do not overdo it!

```
mateusz@pickle:~$ alias e='ssh external'  
mateusz@pickle:~$ e  
Last login: Wed Oct 2 13:50:38 2019 from 10.247.224.7
```

That can quickly become confusing!

Need to edit *rc file in your home directory, to make sure your aliases are not reset every time you turn your computer off.

I use bash, so I had to edit .bashrc

```
alias ll='ls -l'
```

```
mateusz@pickle:~$ . .bashrc  
mateusz@pickle:~$ ll  
total 4520  
drwxr-xr-x 23 root root 4096 Aug 13 2018 anaconda3  
drwxr-xr-x 17 mateusz mateusz 4096 Oct 2 14:05 Desktop
```

. .bashrc - apply changes to current session
source .bashrc does the same

Stuck? Have questions?

There most likely is an answer!

The screenshot shows the Stack Overflow homepage with a search bar containing "[linux]". Below the search bar, a section titled "Meet The Overflow" describes it as a newsletter for developers. A large button labeled "Ask Question" is visible. On the left, a sidebar shows navigation links for Home, PUBLIC, Stack Overflow, Tags, Users, Jobs, TEAMS, and a "First 10 Free" section. The main content area displays a list of "Questions tagged [linux]" with 179,944 results. At the bottom, there's a cartoon illustration of four penguins with question marks above their heads, followed by the text "LinuxQuestions.org".

Want to learn a bit more?



Ask office mates, supervisor(s), Slack, Discord...

Learn the art of specific Googling “How do I do X in context Y?”

#help-me-senpai

how the hell do you numerically integrate a function again

For when people want to ask questions from the other people who hopefully know more about things



Anyone know how to make entries in an enumerate align without using a table (overleaf mnras template)? (edited)

anyone used .hs files much? Need to trim some columns down from one but struggling to work out how I'd do it

can I get some help understanding what is going on here

I have a list (staggered_x_data). It has a length = 100.

I make a new list (new_staggered_x_data) and add a value to it. new_staggered_x_data now has a length = 10

I am trying to install AIPS on a mac, I believe I have followed the correct procedure form the NRAO website, however, I can only start it when I am at the same directory as the LOGIN.SH file - surprisinly, when I restart the computer it wont start even when I am in

However, the new len
print(len(staggered_x_data))
new_staggered_x_data
new_staggered_y_data
new_staggered_z_data
the same dir

Any ideas anyone ?

```
new_staggered_x_data.insert(0,new_x_lower)  
print(len(staggered_x_data))  
exit()
```

Anyone else get this weird thing where their plots go all dark????

Best error ever help!

I have followed the correct procedure form

ray from shape (1172000) into shape (16,

ure why I have an error

Afternoon. Is anyone else having an issue with Global Protect today? I have been unable to connect to my work network

Does anybody know how to get a scale like this in python?

mobileprint is for black and white but I can't find a link for colour??

what are CTYPES in astropy?

Is it possible to do an inset plot solely using aladin?

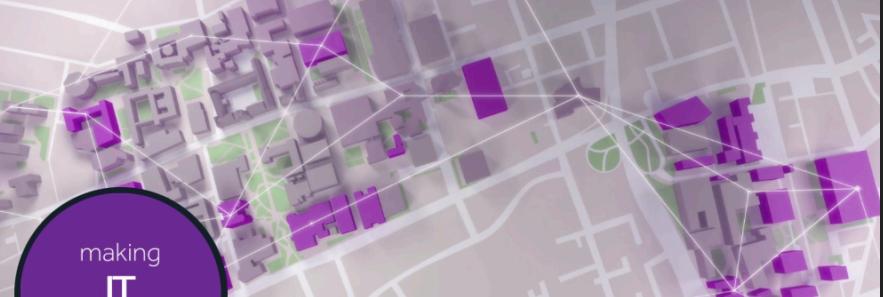
"Oopsies ive deleted the supercomputer" - my emails to the cambridge tech support

Does anyone know how I can put in the solar mass symbol in the graph label using matplotlib?

Is there a smart way in astropy to find the time(s) that the earth is at a specific/given ecliptic longitude?

Is it me or is it the network?

UoM IT Services
9,943 Tweets



... 📧 🔔 Following

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IT news & announcements for The University of Manchester @officialUoM. Online 9am-5pm Mon to Fri. Please direct any technical queries to the IT Support Centre.

Manchester, UK manchester.ac.uk/itservices/help
Joined September 2012

235 Following 6,856 Followers



Use a cheat sheet!

Linux Command Cheat Sheet

Basic commands

```
! Pipe (redirect) output
sudo [command] run < command> in superuser mode
nohup [command] run < command> immune to hangup signal
man [command] display help pages of < command>
[command] & run < command> and send task to background
>> [fileA] append to fileA, preserving existing contents
> [fileA] output to fileA, overwriting contents
echo -n display a line of text
xargs build command line from previous output
1>& Redirect stdout to stderr
fg %N go to task N
jobs list task
ctrl-z suspend current task
```

File permission

```
chmod -cR chmod file read, write and executable permission
touch -a -t modify (or create) file timestamp
chown -cR change file ownership
chgrp -cR change file group permission
touch -a -t modify (or create) file timestamp
```

Network

```
netstat -r -v print network information, routing and connections
telnet user interface to the TELNET protocol
tcpdump dump network traffic
ssh -i openSSH client
ping -c print routing packet trace to host network
```

File management

```
find search for a file
ls -a -C -h list content of directory
rm -rf remove files and directory
locate -i find file, using updatedb(8) database
cp -a R -i copy files or directory
du -s disk usage
file -b i identify the file type
mv f -i move files or directory
grep, egrep, fgrep -i -v print lines matching pattern
```

File compression

```
tar xvfz create or extract .tar or .tgz files
gzip, gunzip, zcat create, extract or view .gz files
uuencode, uudecode create or extract .Z files
zip, unzip -v create or extract .ZIP files
rpm create or extract .rpm files
bzip2, bunzip2 create or extract .bz2 files
rar create or extract .rar files
```

File Editor

```
ex basic editor
vi visual editor
nano pico clone
view view file only
emacs extensible, customizable editor
sublime yet another text editor
sed stream editor
pico simple editor
```

Directory Utilities

```
mkdir create a directory
rmdir remove a directory
```

File Utilities

```
tr -d translate or delete character
uniq <-u report or omit repeated lines
split -l split file into pieces
wc -w print newline, word, and byte counts for each file
head -n output the first part of files
cut -s remove section from file
diff -q file compare, line by line
join -i join lines of two files on a common field
more, less view file content, one page at a time
sort -n sort lines in text file
comm -3 compare two sorted files, line by line
cat -s concatenate files to the standard output
tail -f output last part of the file
```

Scripting

```
awk, gawk pattern scanning
tsh tiny shell
++ anything within double quotes is unchanged except \ and $
++ anything within single quote is unchanged
python "object-oriented programming language"
```

```
bash GNU bourne-again Shell
ksh korn shell
php general-purpose scripting language
csh, tcsh Practical Extraction and Report Language
```

```
source [file] load any functions file into the current shell, requires the file to be executable
```

Share This Cheat Sheet

Memory & Processes

```
free -m display free and used system memory
killall stop all process by name
sensors CPU temperature
top display current processes, real time monitoring
kill -1 -9 send signal to process
service [start|stop|restart] manage or run sysv init script
ps aux display current processes, snapshot
dmesg -k display system messages
```

Disk Utilities

```
df -h, -i File system usage
mkfs -t -V create file system
resize2fs update a filesystem, after lvextend*
fsck -A -N file system check & repair
pvcreate create physical volume
mount -a -t mount a filesystem
fdisk -l edit disk partition
lvcreate create a logical volume
umount -f -v unmount a filesystem
```

Misc Commands

```
pwd -P print current working directory
bc high precision calculator
expr evaluate expression
cal print calendar
export assign or remove environment variable
` [command] backquote, execute command
date -d print formatted date
${variable} if set, access the variable
```

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bit.ly/Linux-Commands

File commands

```
ls list files
ls -a list files with hidden files
cd dir change directory to dir
cd .. change to home
pwd show current directory
mkdir dir Create a directory
rm file Delete file
rm -r dir Delete directory
rm -f file Force remove file
rm -rf dir For remove directory dir
cp file1 file2 Create a copy of file1 to file2
cp -r dir1 dir2 Copy dir1 to dir2 if it doesn't exist
mv file1 file2 Rename or move file to file2, if file2 is an existing directory, moves file1 into directory file2
ln file1 file2 Create a link to file1
ln -s file1 file2 Create or update file
cat > file Places standard input into file
more file Output the contents of file
head file Output the first 10 lines of file
tail file Output the last 10 lines of file
tail -f file Output the contents of file as it grows, starting with the last 10 lines
```

Process Management

```
ps display all currently active processes
top display all running processes
kill pid kill process id
killall proc kill all processes named proc *
bg lists stopped or background jobs; resume a stopped job in the background
fg brings the most recent job to the foreground
fg a brings job a to the foreground
```

File Permissions

```
chmod octal file change the permissions of file to octal, which can be found separately for user, group, and world by adding:
• 4 - read [r]
• 2 - write [w]
• 1 - execute [x]
Examples:
chmod 755 -rwx for owner, rx for group and world. For more options, see man chmod.
```

SSH

```
ssh user@host connect to host as user
ssh -p port user@host connect to host on port port as user
ssh-copy-id user@host add your key to host for user to enable a keyed or passwordless login
```

Searching

```
grep pattern files search for pattern in files
grep -r pattern dir search recursively for pattern in dir
command | grep pattern search for pattern in the output of command
locate file find all instances of file
```

System Info

```
date show the current date and time
cal show this month's calendar
uptime show current uptime
whoami display who is online
whoml finger user
uname -a show kernel information
cpuinfo show processor information
meminfo memory information
man command show the manual for command
df show disk usage
du free show directory space usage
swappiness show memory and swap usage
whereis app show possible locations of app
which app show which app will be run by default
```

Compression

```
tar cf file.tar files extract the files from file.tar
tar xf file.tar extract a tar with Gzip compression
tar czf file.tar.gz create a tar with Bzip2 compression
tar jzf file.tar.bz2 extract a tar using Bzip2
gzip file compresses file.gz back to file
gunzip file.gz decompresses file.gz back to file
```

Network

```
ping host ping host and output results
whois domain get whois information for domain
dig domain get DNS information for domain
dig +x host reverse lookup host
wget file download file
wget -c file continue a stopped download
```

Installation

```
Install from source:
./configure
make
make install
dpkg -i pkg.deb
rpm -Uhv pkg.rpm
install a package (Debian)
install a package (RPM)
```

Shortcuts

```
Ctrl+C halts the current command
Ctrl+D stops the current command, resume with fg in the foreground or bg in the background
Ctrl+D log out of current session, similar to exit
Ctrl+H erase one word in the current line
Ctrl+R erases the whole line
Type to bring up a recent command
!! repeats the last command
exit log out of current session
use with extreme caution
```

One final thing

- Everyone is in the same boat as you!
- No one really knows what they're doing
- Find what works best for you
- Good luck!