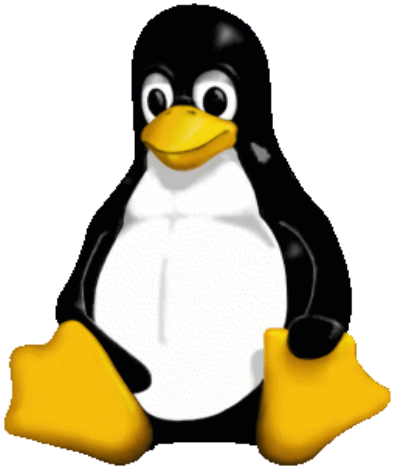
Introduction to Linux



University of Bristol - Advance Computing Research Centre

Operating Systems

- Program running all the time
- Interfaces between other programs and hardware
- Provides abstractions (common interfaces, e.g. filesystems)

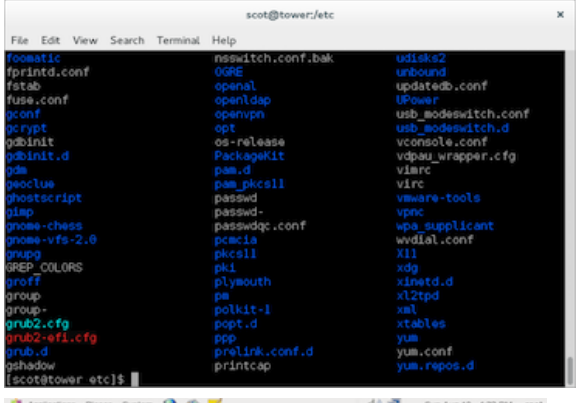
- You may know
  - Windows
  - MacOS
  - iOS
  - Android

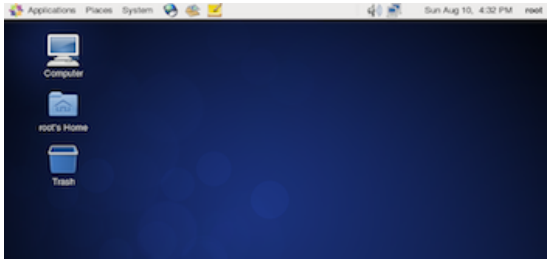
UNIX

- An operating system originating at Bell Labs. circa 1969 in the USA

User Interfaces

- Command Line
- GUI - Graphical User Interface





Kernels and Shells

- The kernel is the core of the operating system
- The shell is the interface between the user aand the operating system

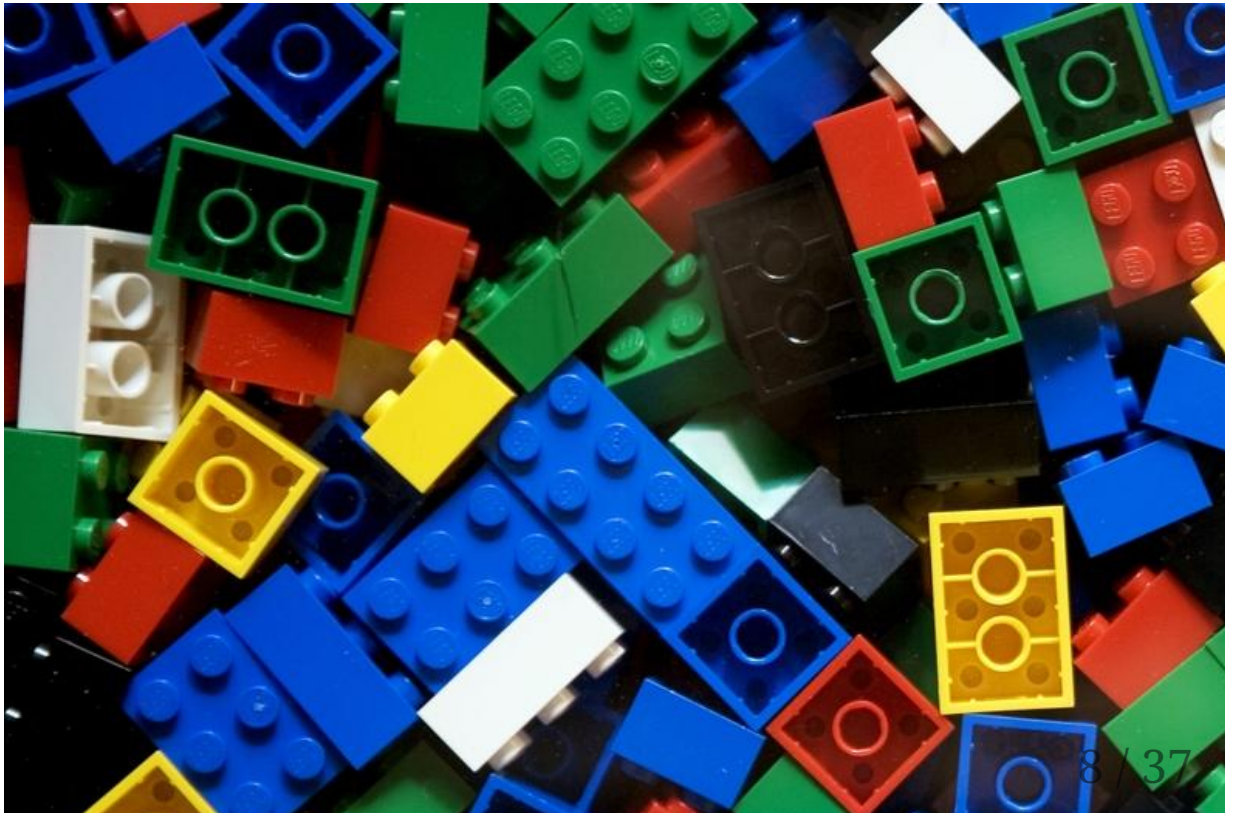
Linux

- A version of UNIX
- Written by Linux Torvalds when he was an undergrad in Finland
- Free (libre, gratis)
- One OS from Desktop -> Supercomputer
- Technically just the kernel
- Distributions bundle kernel, GNU tools and extra software
- BlueCrystal Phase 3 runs CentOS 6

Linux Philosophy

- Kit of parts
- One small thing does one thing well
- Small utilities can be joined together to perfom more complicated tasks

Bits and Pieces



At First...

```
$ ls | wc -l
```

But Later...

```
tr -cs A-Za-z '\n' |
  tr A-Z a-z |
  sort |
  uniq -c |
  sort -rn |
```

Logging On

We'll be working on the HPC (Blue Crystal)

- Start Putty
- Log in to bluecrystal phase 3:

```
train##@bluecrystalp3.bris.ac.uk
```

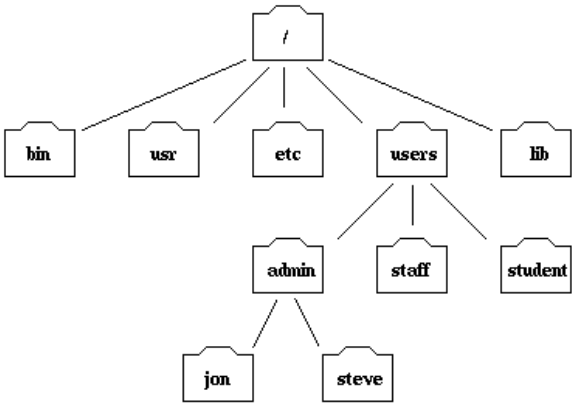
- Where ## is your account number, ie train01

- First commands, get the example data:

```
cp -r ../intro_to_linux .
cd intro_to_linux
```

- And off we go...

Filesystem Hierarchy



Part of the filesystem tree

Directories

- Pathnames and /
- Finding where you are (`pwd`)
- Changing to a different Directory (`cd`)
- The Directories . and ..
- Home directories (~)

Tasks 1

- find out where you are
- what is pathname one level above (go there)
- go back to your home directory (prove it)

New Files and Directories

- Listing files and directories (`ls`)
- Making Directories (`mkdir`)

Tasks 2

- What is in your home directory?
- What is on one level above?
- Make a new directory in your home directory (give it a one word name)

File Manipulation

- Copying Files (`cp`)
- Moving Files (`mv`)
- Removing Files and directories (`rm`)

Tasks 3

- copy `example.txt` to another filename
- rename your new file to something else
- move your new file in to the directory you created earlier
- make another copy of `example.txt`
- delete your second copy

Examining File Contents

- Displaying the contents of a file on the screen (`cat`, `less`)
- The first lines in a file (`head`)
- The last lines in a file (`tail`)
- Searching the contents of a file (`grep`)
- Counting with grep (`-c`)
- UNIX is case sensitive
- `grep -i`

Tasks 4

- What is in `example.txt`
- What are the first 10 lines of `example.txt`
- What are the first 15 lines of `example.txt`
- What are the last 2 lines of `example.txt`
- Read through the whole of `example.txt` a page at a time
- Find all the lines that mention "GNU"
- Count the number of lines that have the word "Linux" (in any capitalisation)

Filenames

- Wildcards
  - `?` Any one character
  - `*` Zero or more characters
- Filename Conventions (e.g. `.c`)

Tasks 5

- list all the two letter commands in `/usr/bin`
- list all the commands with "to" in their name

Getting Help

- `man`
- `man -k`
- Google (other search engines are available)

Tasks 6

- Read the man page for `head`
- Pick a random command from in `/usr/bin` and read it's manpage

Maniputaing Files

- `sort`
- `uniq`

Redirection

- Redirecting the Output
  - `>` (overwrites)
  - `>>` (appends)
- Redirecting the Input
  - `<`

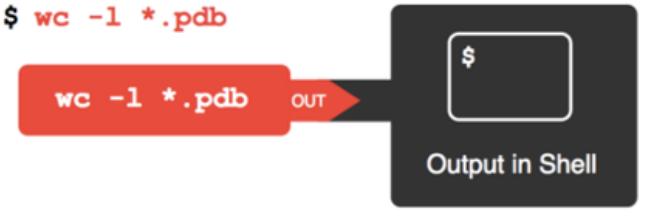
Tasks 7

- sort the file `authors` into alphabetical order
- find the list of unique authors
- find how many time each appears in the original list

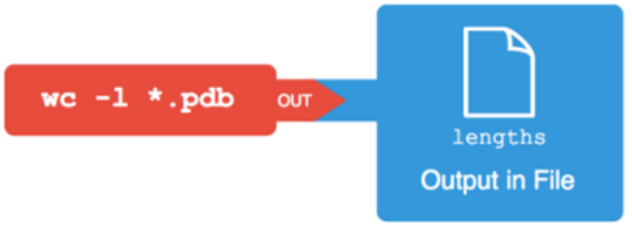
Pipes and Pipelines

- Take the standard output of one command and feed it in to the standard input of the next
- Uses the pipe (vertical bar) symbol |
- No intermediate files!
  - Efficient

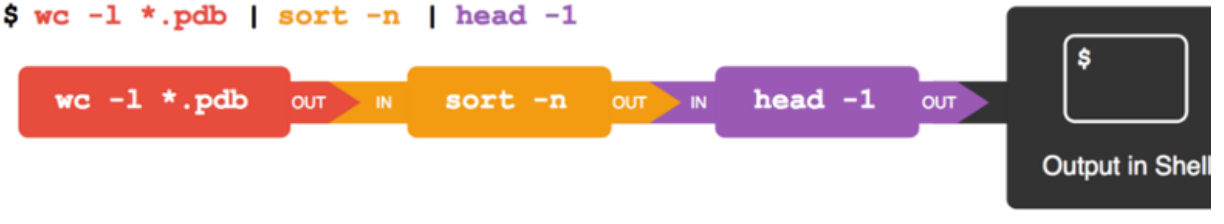
```
$ wc -l *.pdb
```




```
$ wc -l *.pdb > lengths
```




```
$ wc -l *.pdb | sort -n | head -1
```



Tasks 8

- without using intermediate files...
  - sort the authors file
  - find the count of unique authors
  - put that list in to numerical order

Text Editors

- not Word
- `vim` is mentioned a lot but don't use just yet

- we recommend `nano`
  - `^O` to save
  - `^X` to exit

Task 9

- add some more authors to the `authors` file
- rerun the previous analysis
- put the analysis command pipleine in to a file called `author_count`

Any Questions?

Resources - Where to practise

- macOS users can use the terminal
- Windows10 has Windows Subsystem for Linux
- Departmental resources
- Eligible users can apply for an account on the ACRC clusters
- Cloud vendors provide trial subscriptions

Resources

- hpc-help@bristol.ac.uk
- ACRC Website - https://www.bristol.ac.uk/acrc/
- http://swcarpentry.github.io/shell-novice/
- http://www.ee.surrey.ac.uk/Teaching/Unix/

Credits

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