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 and 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 perform more complicated tasks
Bits and Pieces
At First...

$ ls | wc -l

9 / 37
But Later...

```
tr -cs A-Za-z \n |
 tr A-Z a-z |
 sort |
 uniq -c |
 sort -rn |
 sed Artikel
```
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
Manipulating 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`
  - ^0 to save
  - ^X to exit
Task 9

- add some more authors to the authors file
- rerun the previous analysis
- put the analysis command pipeline 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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