UNIVERSITY OF CAMBRIDGE

An Introduction to the Linux Command Line

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University Information Services (http://www.uis.cam.ac.uk/)

Plan of the Course

10:00 Course Introduction
10:15 Theory and self paced practicals
11:00 BREAK
11.20 Theory and self paced practicals
13:00 LUNCH
14:00 Theory and self paced practicals
16:30 FEEDBACK and CLOSE

Welcome

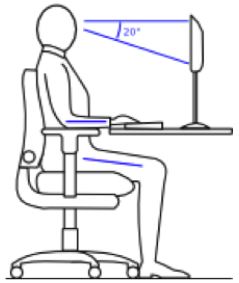
- Please sign in on the attendance sheet.
- Please fill in the online feedback at the end of the course: There is a link to this on your desktop.
- Keep your belongings with you.

Part I: **Introduction**

Health and Safety







UIS: Research and Institutional Services Division

Your trainers for today will be:

- Paul Sumption — Research Computing Technical Liaison
- Mark Sharpley — Research Computing Solutions Specialist
- Please ask questions and let us know if you need assistance.

Paul Sumption

- Advising users on Research Computing Services run by UIS
- Part of the Research Computing Team
- Experienced Linux sysadmin
- Trainer for the introduction to HPC (High Performance Computing) course
- The HPC course is running tomorrow, raise your hand if you are on it!

Mark Sharpley

- Building research computing platforms
- Part of the Research Computing Platforms Team
- Experienced Linux sysadmin

Introduction: Course Material

- Today's course uses a modified version of material that was written for UIS MCS Linux
- UIS MCS facilities: `https://help.uis.cam.ac.uk/service/devices-networks-printing/managed-desktops/mcs/mcr-rooms`
- Details of the MCS Linux service: `https://help.uis.cam.ac.uk/service/devices-networks-printing/managed-desktops/mcs/basiclinux`

Introduction: Material

The course has been designed as 'self paced':

- a) Obtain an MCS account, download the course and then start teaching yourself using a MCS Linux PC and the notes
- b) Book a place on a UIS course. There is an instructor present to help you if you get stuck on the exercises
- Our course is being delivered at the Bioinformatics Training Facility
- We have made quite a few changes to the original material
- We have tested the exercises but please let us know if you find a mistake in the material

Other Courses

- Unix: Introduction to the Command Line Interface (Self-paced) `https://www.training.cam.ac.uk/ucs/Course/ucs-unixintro1`
- The course that runs on MCS Linux
- Shell scripting:
- Unix: Simple Shell Scripting for Scientists `https://www.training.cam.ac.uk/ucs/Course/ucs-scriptsci`

Format for today

- We have split the self paced material into several sections
- Before each section we will present some slides to introduce the topic
- You will then have time to attempt the self paced material for the section
- During self paced work we will assist you, just put your hand up if you are stuck
- Your instructors can demonstrate exercises as needed

Today's Session

- Course material will be displayed on the left and right hand side screen
- The central screen will display the course notes or demonstrating exercises
- Your PC will already be booted into Linux

Usernames and passwords

- Your desktop PC has a local user account
- When we get to the remote server exercise we will give you each a username and password for the remote machine

Course Material

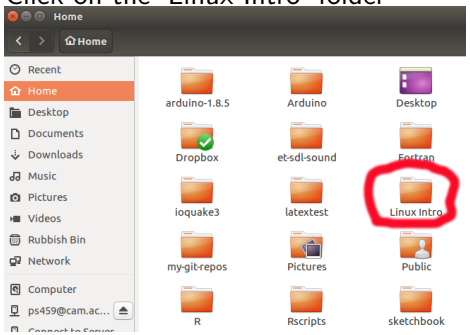
- We will demonstrate how to access the Course Material on your PC
- You will find a copy of the course material in your home folder
- There is a PDF of course notes and exercises
- The folder 'Linux Intro' contains files and folders needed for the exercises
- There is a zip file 'LinuxIntro.tgz' which will be use during the remote server exercises

Files

- Click this icon to start the file manager: 
- This is similar to Explorer on Windows or Finder on a Mac

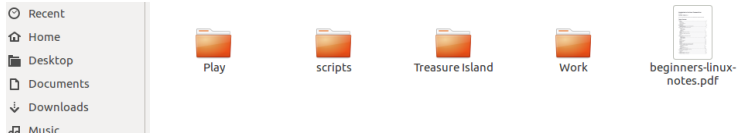
Home Folder

- Click Files
- A window will open and display your home folder
- Click on the 'Linux Intro' folder



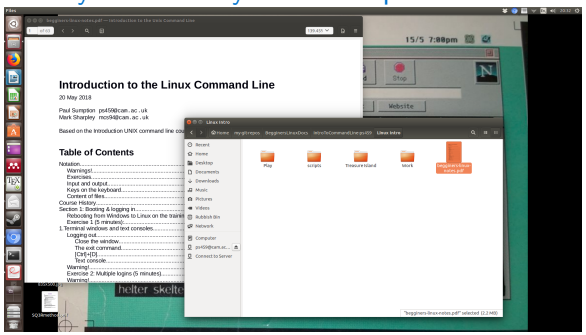
Open the Course Folder

- Click on the 'Beginners-linux-notes.pdf' folder



Your Desktop

- Your desktop should look similar to this, notes open, home folder open
- Raise your hand if you need help



Part II: **Terminals**

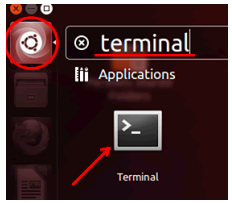
Terminal windows

- Most of our work will be using the Linux terminal
- The icon you click to start the terminal looks like this:

- The bar on the left hand side is called your 'Launcher'

Section 1: The Launcher

- Only a few applications are in your launcher
- You can search for more applications i.e. gedit
- Use the icon in the top left corner:



Section 1: Terminals on remote system

- It is quite common to only have command line terminal access on a remote machine
- I would assume most of you have Mac or Windows laptops
- Mac users, OS X has a built in terminal
- Windows users, you will need to install Putty to get a terminal client
- We have put details about this in the notes

Section 1: Text Consoles

- Linux server administrators often dispense with the graphical environment entirely
- One of the exercises involves starting a text based console
- When you push the keys

  `[Ctrl]+[Alt]+[F2]`

  your desktop will disappear!
- It's not gone, you've just dropped down to a text based console
- Remember that

  `[Ctrl]+[Alt]+[F7]`

  returns you back to the graphical interface

Section 1: Exercises

- In the notes go to Section 1: Terminal windows and text consoles
- Read the notes for Section 1
- Attempt exercises 1 and 2
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part III: **Navigating the file system**

Section 2: The file system

- This section teaches you how to navigate the file system using the command line
- Using cd to move between directories
- Using ls for listing directory contents
- Quoting: How we handle directories and files with spaces in the name
- Escaping: How to ignore special characters
- Renaming and deleting files and directories

Section 2: Tab autocomplete

- If you start typing a filename, path or command and then hit tab...
- Linux tries to autocomplete for you
- This will save you time

Section 2: Navigating the File System

- In the notes go to Section 2: Navigating the File System
- Read the notes for Section 2
- Attempt exercises 3 and 4
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part IV: **Anatomy of a command**

Section 2: Where am I?

- As you move back and forth between directories...
- Its easy to get lost
- cd <dirname> change into a directory
- ls <dirname> list the contents of a directory
- cd or cd ~ change into your home folder
- cd .. change back one folder
- pwd print working directory

Section 3: Commands

- A command is an instruction given by a user telling a computer to do something
- Commands often take options
- Commands often take arguments
- Options can be used in long form i.e.

  ```
  ls --all
  ```
- Options can be used in short form i.e

  ```
  ls -a
  ```

Section 3: Getting help

- Command line help is available as 'man' pages
- This is short for manual
- They can be quite detailed
- Most commands can be used with the switch

  `--help`
- As a beginner

  `--help`

  is an easy way to find which arguments and switches a command can use.

Section 3: Exercises

- In the notes go to Section 3: Anatomy of a command
- Read the notes for Section 3
- Attempt exercises 5 and 6
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part V: **Remote Linux Systems**

Section 4: Remote Linux systems

- Most Linux systems allow remote log in
- Provided you have a user account on the remote machine
- Most of the Linux systems you work with will be remote

Security

1. Keep your password (or private key passphrase) safe.
2. Always choose strong passwords.
3. Your UIS password is used for multiple systems so keep it secure!
4. Keep the software on your laptops/tablets/PCs up to date this includes home computers especially if you are using the VPN to connect in.
5. Don't share accounts (this is against the rules anyway).

Section 4: Remote Access Software

- Remote access is provided by SSH
- Files can be transferred by scp, sftp and rsync
- There are other tools, we cover the ones that most systems have

Section 4: Exercises

- In the notes go to Section 4: Remote Linux systems
- We need to give you a username and password for the remote server
- Read the notes for Section 4
- Attempt exercises 7 and 8
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Section 2: Where am I?

- At the back of your notes there is an SFTP cheat sheet

Part VI: **Launching graphical applications**

Section 5: Exercises

- In the notes go to Section 5: Launching graphical applications
- Read the notes for Section 5
- Attempt exercises 9 to 11
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Section 5: Launching graphical applications

- If your machine has X Windows you can launch graphical applications from the command line
- The HPC course explains more about X Windows and X Window forwarding
- X forwarding is an advanced topic, we will just give an overview

Part VII: **Command line editing**

Section 6: Command line editing

- Often you'll type a command or want to re-type a command
- You can use keyboard shortcuts to find previously typed commands
- The history and ctr + r are very useful

Section 6: Grep

- Often you'll want to search text files
- grep is a powerful tool and can be used to find words or strings
- Advanced users learn tools such as sed and awk to manipulate text
- sed and awk are worth learning once you advance to shell scripting
- sed -ie 's/annote/note/g' Dissertation-2-script.bib
- Changes the word annote to note....

Section 6: The Date

- The date command lets you manipulate the format of the date
- It becomes useful when you start writing scripts

Section 6: The Date in a script

```
#!/bin/bash
#Testing screen recording
####################
# check for lock
if test -f ~/RDS_RSYNC_LOCK
then
    echo ALERT: Rsync is already running! 1>&2
    exit 1
fi

# create lock
touch ~/RDS_RSYNC_LOCK

# output log header

START=$(date +'%F-%T')
RSYNC_OPTIONS="-avz --exclude sshfs-test --progress --delete --stats"
REMOTE="/rds/project/ps459/test/mr-robot-backup"
LOCAL="/home/sumption/"
USER="ps459"
RDS="rds.uis.cam.ac.uk"

#exec &> ~/log/$(date +'%a').backup.$START

touch ~/sumption-backup.log
exec &> ~/sumption-backup.log

        echo "****** STARTING rsync RUN ******"
        echo "Starting server rsync at: $START"
        #All this scripts is doing is the rsync job below but re-directs the jobs output to a logfile
        echo "******"
        echo "$SOURCE $REMOTE"
        rsync -e 'ssh -i ~/.ssh/mr_robot_id_rsa' $RSYNC_OPTIONS $LOCAL $USER@$RDS:$REMOTE
        # output log footer
        echo "******"
        FINISH=$(date +"%F-%T")
        echo "****** FINISHING RSYNC RUN at $FINISH******"

#done

# remove lock
rm ~/RDS_RSYNC_LOCK
exit 1
```

Section 6: Exercises

- In the notes go to Section 6: Command line editing
- Read the notes for Section 6
- Attempt exercises 14 to 16
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part VIII: **Redirecting data and piping comm**

Section 7: Redirecting data and piping commands

- Often you will want to send the output of one command into another
- Maybe you want to combine multiple files
- Combining pipes and the cat command is a good way to do this

Section 7: Exercises

- In the notes go to Section 7: Redirecting data and piping commands
- Read the notes for Section 7
- Attempt exercises 17 to 19
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part IX: **File name wild cards**

Section 8: Exercises

- In the notes go to Section 8: File name wild cards
- Read the notes for Section 8
- Attempt exercises 20
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Section 8: File name wild cards

- Sometimes you may wish to find a file or folder without knowing the full name
- Wild cards can help you do this
- Your are substituting parts of the name
- Different operators have different meanings
- Useful when working with lots of similarly named files i.e. from HPC or Biology software

Part X: **Environment variables**

Section 9: Environment variables

- Sometimes you will need to manipulate your PATH
- A good example is when you install software inside your home folder
- We will manipulate the PATH in the next section on shell scripting

Section 9: Environment variables: Exercises

- In the notes go to Section 9: Environment variables
- Read the notes for Section 9
- There are no exercises for this section
- It is important to understand what PATH does as we will manipulate it in the next section

Part XI: **Shell Scripting**

What are shell scripts?

- An advantage of the command line is that we can run a "script" of commands
- The script can then be kept for later reuse or given to other people for them to use
- Scripting is useful when we have long repeatable tasks

Section 10: Exercises

- In the notes go to Section 10: Trivial shell scripts
- Take time to read the notes, this is a harder section
- Attempt exercises 21 to 24
- Raise your hand if you are stuck
- We can demonstrate or explain an exercise

Part XII: **Closing Session**

Closing Session

- Hopefully you have completed most of the exercises
- Please complete the online feedback form
- Between 4pm and 4.30pm we will take questions
- Please speak to us and give feedback
- We will then start to pack up and leave by 5pm

Closing Session

- Thanks for attending!
- Well done on starting to learn Linux