University of Warwick Computing Society

Linux 101 – A Practical Introduction

What's the Computing Society?

We're the society for anyone with an interest in Computer Science (believe it or not)

Academic Events

Revision sessions, industry talks, courses, student talks, workshops, competitions, and support sessions. No matter your experience, we're here to help you pick up some skills.

Weekly gaming nights with PCs, consoles and VR, a termly 48h LAN packed with events, and WASD, the UK's largest student-run charity speedrunning event - raising >£6000!

Gaming Events

Get to know us and your coursemates at our socials. We run both sober and drinking events; so join one of our barbecues, circles or pub meals - whatever takes your fancy!

Social Events

Made for Everyone!

Our society is free-to-join, and open to all types of degrees and backgrounds. We have dedicated inclusivity officers running events for under-represented genders in the society - Wildcards!

What's Linux?

- GNU/Linux is an operating system like Windows or macOS
  - Primarily the Linux Kernel and various utility programs to interact with it
  - There are lots of different distributions, each with their own default programs and configurations

- It's distributed freely, with source code available online
  - Maintained by a community of over 22k developers

- Used by the DCS Lab computers, and most web servers.
  - Including the department's and UWCS's
  - Also popular among programmers as a desktop OS

The DCS Machines

The departmental machines run Rocky Linux 8, which should give a similar feeling to Windows or MacOS. There desktop environment is KDE 5

The default layout is very similar to Windows, but you can customise it if you wish

Installed Programs

These machines have familiar (and maybe unfamiliar) software installed:

Browsers

Chrome

Firefox

Konqueror

Text Editors

VS Code

Vim

Emacs

Kate

Atom

PDF Viewers

Okular

Evince

The Command Line

- The main way to interact with the OS

- Interact with via a terminal emulator (such as Konsole)

- A typical line in the terminal might look like:

```
bash-4.2$ ls -lh ~/public_html/css
```

Prompt

Command

Flags

Arguments

Aside: Remote Access

Sometimes, you may want to connect to the DCS Machines, but not want to have to be in the department (common reasons include laziness and/or not wanting to walk through campus at 4am)

To start set up a remote connection to the terminal,
you can follow the instructions at:

https://uwcs.co.uk/resources/remotedcs/

We'll give a brief outline of how to connect over the next few slides.

Windows/Mac/Linux Access

- You can access DCS systems remotely using the ssh command, if present:

```
$ ssh uXXXXXXX@remote-YY.dcs.warwick.ac.uk
```

- Here, the X's should be replaced by your university ID, and the Y's should be the last two digits of it.

```
$ ssh u1234567@remote-67.dcs.warwick.ac.uk
```

- For security purposes, the password prompt will not display your input

Graphical Remote Access

- The way we described will only give you access to the command line.

- You can remotely access DCS systems with a GUI using a VNC server.
  - This would be useful for something like the CS118 coursework.

- Instructions to set this up can be found in the DCS Systems User Guide.
  - https://warwick.ac.uk/fac/sci/dcs/intranet/user_guide/remote-login/

VS Code Remote Access

- The way we described will only give you access to the command line.

- This is a middle level of access, not full desktop, but better than just terminal

- Allows using VS Code as usual as if it were on your own system, except all files and terminals are on DCS.

- Install the Remote-SSH extension and follow the instructions on https://uwcs.co.uk/resources/remotedcs/
  - This also includes setting up an authentication key for easier access.

The Linux Filesystem

- Linux's filesystem is a single-rooted tree
  - Removable media is mounted to this tree, not given its own tree

- Every item is considered a file, with a few variations:
  - Ordinary file, Directory (or Folder), Device file, Sockets, …

- Directories are just files with a list of associated sub-files

Directories and Paths

- The terminal will initially load into your home directory
- To navigate around you use the `cd` command
  - The `cd` command takes a path to the directory you want to move to
- Paths in Linux are **case sensitive** and shouldn't (but may) contain spaces
- Paths can be **relative** to the current directory or **absolute**

`../../foobar`

Relative path

`/var/www/html/`

Absolute path

Directories and Paths

Linux has some special relative path symbols

.

Current Directory

. .

Parent Directory
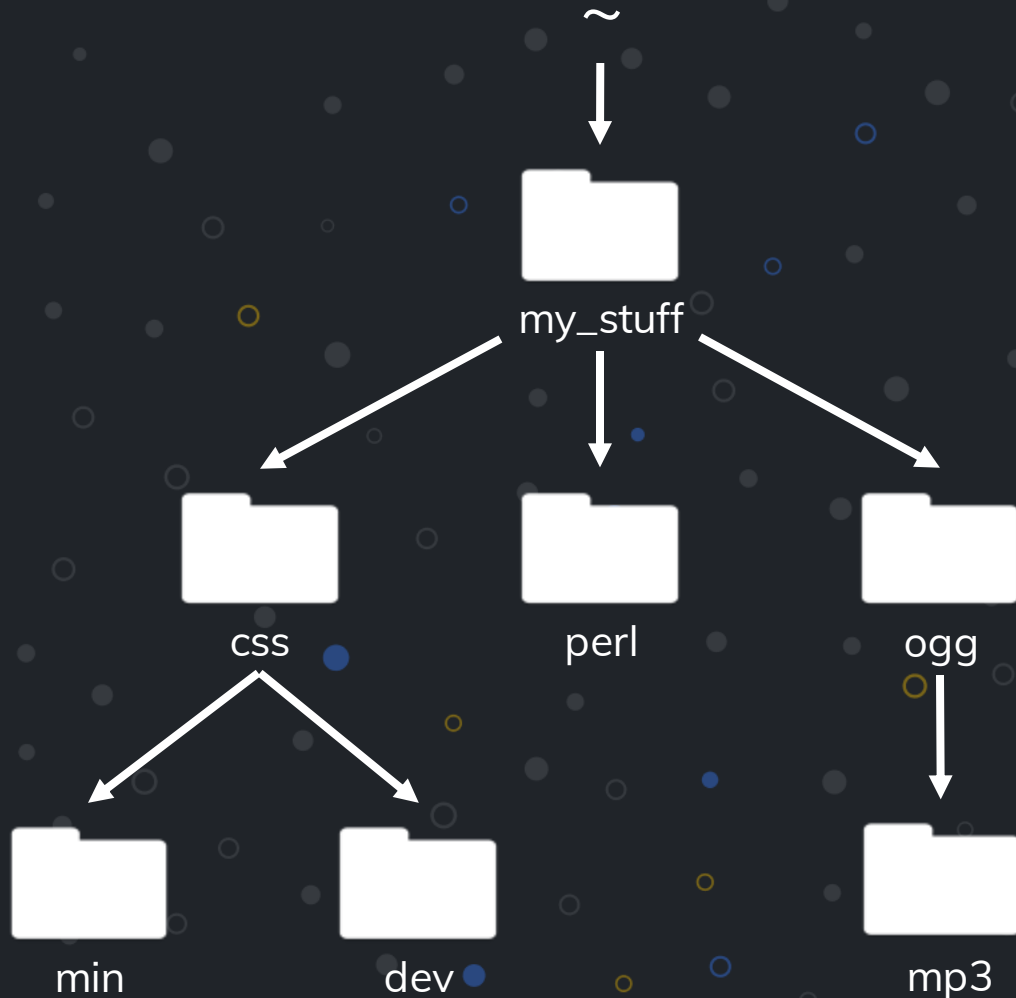
~

Home Directory

Example:

```
$ cd ~/foobar/./Baz/../../blat

$ cd ~/blat
```

Navigation Example

Navigation Example

```
~/my_stuff
├────── css
        ├────── min
        └────── dev
├────── perl
└────── ogg
        └────── mp3  ←
```

Navigation Example

```
~/my_stuff
├───── css
│       ├───── min
│       └───── dev
├───── perl
└───── ogg
        └───── mp3  ⬅
```

$ cd .

Navigation Example

```
~/my_stuff
├───── css
│       ├──── min
│       └──── dev
├──── perl
└──── ogg  ←
        └──── mp3  ←
```

$ cd ..

Navigation Example

```
~/my_stuff
├── css
│       ├── min
│       └── dev
├── perl
└── ogg  ⟵
        └── mp3
```

$ cd css/min

No such file or directory: css/min/

Navigation Example

```
~/my_stuff
├─────── css
│        ├──────── min   ⬅
│        └──────── dev
├─────── perl
└─────── ogg   ⬅
         └──────── mp3
```

$ cd ../css/min

Navigation Example

```
~/my_stuff
├──────── css
│         ├──────── min     ⬅
│         │
│         └──────── dev
│
├──────── perl     ⬅
│
└──────── ogg
          └──────── mp3
```

$ cd ~/my_stuff/perl

Listing Files and Folders

- Okay, we can move around directories, but it would be nice to actually know what's in them.

- You can list files and folders using the `ls` command.

- `ls` lists the contents of the current directory by default
  - You can give `ls` a path to list that specific directory

```
$ ls ~

Desktop Documents Downloads Music Pictures
Public README Templates Videos
```

Listing Files and Folders

To format the output into a detailed list, we can type:

```
$ ls -l
total 1337
drwxrwxrwx      3 u2XXXXXX    dcsugrad      102 31 Oct  2014 Baz
drwxr-xr-x      4 u2XXXXXX    dcsugrad      136 10 Aug 13:39 Foobar
```

Permissions   Owner user/group   Size   Date modified   Name
                                               (in bytes)

- `ls -a` includes hidden files/folders (those that begin with a dot)
- These options can be combined (`ls -al`)

Creating Files and Folders

- To make files and folders you use touch and mkdir respectively
  - Write permissions are needed in the parent folder to do this
- touch <file path>   creates an empty file
- mkdir <directory path>   creates an empty directory

```
$ touch foo.txt                    $ mkdir -p ~/baz/blat
```

Removing Files and Folders

- `rm <path>` removes file(s) on the given path(s)
  - Write permissions are needed in the parent folder to do this
- Using `rm` is typically irreversible and does not use the 'recycle bin'
- `rm -r` recursively removes all files and folders in a given directory

```
$ rm -r ~/stuff_i_dont_need
```

- You can use the graphical 'recycle bin' in the desktop.
- Files are backed up nightly, you can get a backup restored if needed.

Manipulating Files

- You can copy a file using the cp command
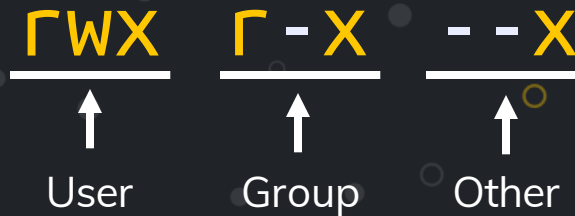
```
$ cp original.txt ../copied_file.txt
```

- You can move a file using the mv command
  - This is also how you rename a file

```
$ mv original.txt ../new_dir
```

```
$ mv original.txt renamed.txt
```

File Permissions

- Perhaps the most confusing part of Linux
- Everything in the Linux file system is owned by a user and a group
- Users not in these categories are classed as 'other'

rwx   r-x   --x

↑   ↑   ↑

User   Group   Other

Permission	Char	Meaning
Read	r	Can view the contents
Write	w	Can change the contents
Execute	x	Can run as a program

Disk Space

- In 1st Year, you are given 12GB of disk space by DCS
  - Your quota increases by 3GB each year
  - You can email the dep'ts. tech help if you require more

- You can check your remaining disk quota using `quota`

- You may not be able to log in graphically if you run out of space

```
$ quota -vs
Disk quotas for user u2XXXXXX (uid 12345):
    Filesystem    space    quota    limit    grace    files
/export/ug_w/21   5510M    6055M    6641M                55731
```

Printing

- Each student in the department is given 350 credits for free printing
  - You can check your total credits when on the DCS network by heading to https://printcredits.dcs.warwick.ac.uk/ and signing in with your DCS account

- You can print PDFs and plain text files using `lpr -P <printer> <file>`

- You can check the print queue using `lpq`

- Removing a print job is done using `lprm <job id>`

- The printers in the atrium are `dcs006a` for mono and `dcs001c` for colour

```
$ lpr -P dcs006a ~/cs132_coursework_1.pdf
```

Command Manuals & Help

- Use `man <command>` or `<command> --help` to display help menus

- These menus have in-depth information about commands
  - Optional arguments, command operation, etc

- A lot of the command information in these slides is also in man pages

`$ man man`

Handy Shortcuts

- Clearing the terminal window is done with `clear` or pressing `Ctrl+L`
- Exiting a terminal program is done using `Ctrl+C`

  - Where this doesn't work, use `Ctrl+Z` – this will put the process in the background

  - If that hasn't worked, try pressing 'q' or ':q' (this is to exit vim if you get stuck in it)

  - If you get this far, restart the terminal window

  - Still doesn't work? Get in touch with the DCS Systems Team

A Practical Example

We've got a lab sheet for you!

- This will put the things we've discussed today in action.

- By the end, you'll have a public webpage on the DCS website!

- Head to https://go.uwcs.uk/linux101 for the sheet, and these slides.

UWCS Linux 101 Lab
A practical introduction to Linux

Logging In

Before we start, you'll need to gain access to the department machines - the information needed for this should have been sent to your university email address. If you have any issues logging in, let a lab tutor know! They'll also be around to help if you get stuck.

Now that you've (hopefully) logged in, let's get started with the terminal!

Getting Around

First, click the colourful start button at the bottom-left corner of the screen.
Then, click the "terminal" menu item. You should see something like this:

LAB: *https://go.uwcs.uk/linux101*

- Questions about the DCS systems? Send to tech@dcs.warwick.ac.uk

- More in-depth resources are available at https://warwick.ac.uk/fac/sci/dcs/intranet/user_guide/

- Any other questions after the talk? Hop on our Discord: https://discord.uwcs.uk and ask questions in #linux-101

go.uwcs.uk/links