Intro to Linux



EGM Time!

We’re looking for:

Treasurer

- Manage finances
- Apply for funding
- Handle reimbursements

General Member

- Run sessions
- Help out
- Have fun!

https://forms.gle/SR4s8BnqGikVfaMm7



The Legal Bit

- The skills taught in these sessions allow identification and exploitation of security vulnerabilities in systems. We strive to give you a place to practice legally, and can point you to other places to practice. These skills should not be used on systems where you do not have explicit permission from the owner of the system. It is VERY easy to end up in breach of relevant laws, and we can accept no responsibility for anything you do with the skills learnt here.

- If we have reason to believe that you are utilising these skills against systems where you are not authorised you will be banned from our events, and if necessary the relevant authorities will be alerted.

- Remember, if you have any doubts as to if something is legal or authorised, just don't do it until you are able to confirm you are allowed to.

- Relevant UK Law: https://www.legislation.gov.uk/ukpga/1990/18/contents



Code of Conduct

- Before proceeding past this point you must read and agree to our Code of Conduct - this is a requirement from the University for us to operate as a society.
- If you have any doubts or need anything clarified, please ask a member of the committee.
- Breaching the Code of Conduct = immediate ejection and further consequences.
- Code of Conduct can be found at **shefesh.com/conduct**



What is Linux?

An Operating System **Kernel**

Kernel:

- Basic core functionality
- Handles allocation of memory, CPU time, and other resources to **processes**
- Provides an **A**pplication **P**rogramming **I**nterface (API) that can be used by processes
    - Communicate with hardware



Distributions

We have the basis (The Kernel)

- Need to put other things on top to build a full OS
- Lots of different software depending on what we want the OS to do

These collections are referred to as ‘Distributions’

- More commonly known as ‘Distros’

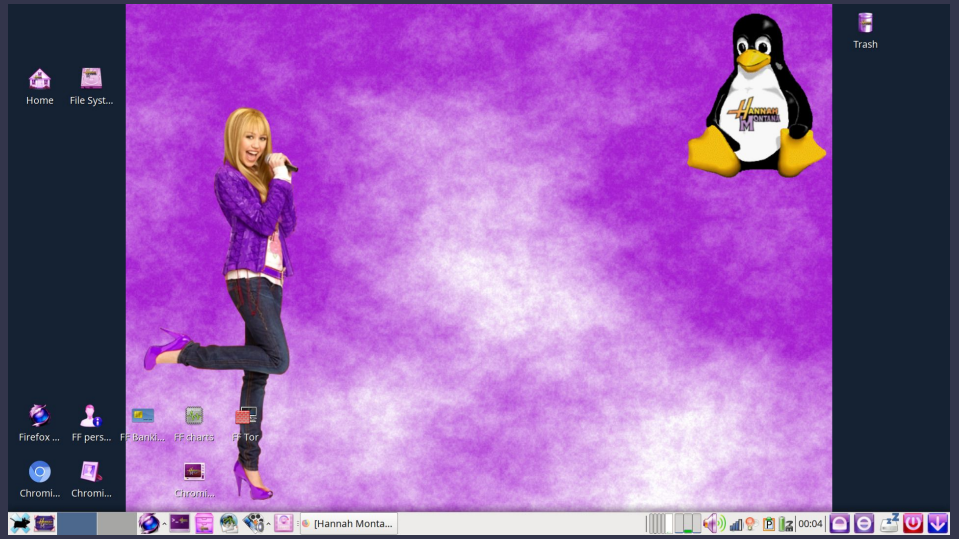
There are over 600 actively maintained linux distributions



More Distros Please

Linux is **Free** and **Open-Source**

- Used literally everywhere
- > 85% of smartphones
  - Android is Linux based
- > 95% of top one million web-servers
- Top 500 fastest supercomputers



Lots of Distros

- Ubuntu, Fedora, Mint
- Arch, Kali, Qubes
- Red Star, Hannah Montana, Justin Bieber

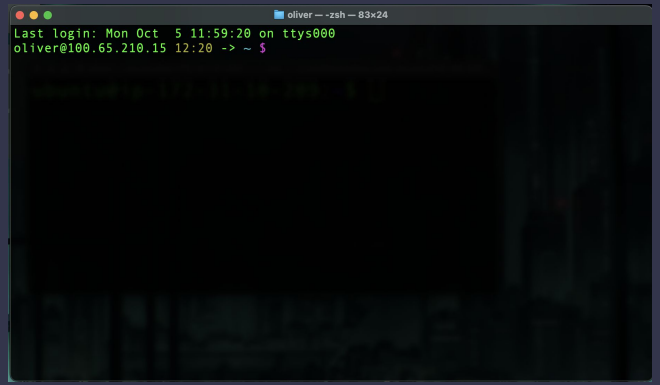
Basic Commands

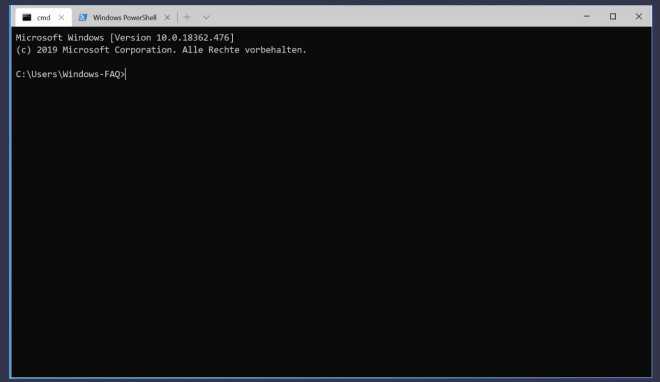
Primarily use Linux systems through the command line (CLI)

- Interact with files, programs + services directly
- Harder to visualise what's changed

Can do this on Mac + Windows too

- Less common as they are built for GUI use
- Mac uses similar commands to Linux - Windows not so much







pwd

Print Working Directory

- Absolute file path to your current directory

```
ubuntu@ip-172-31-10-209:~$ pwd
/home/ubuntu
ubuntu@ip-172-31-10-209:~$ cd /etc/ssh/
ubuntu@ip-172-31-10-209:/etc/ssh$ pwd
/etc/ssh
```

Typically pair with other commands / scripts



ls

List Directory

- Lists all files + folders in the specified directory
- (leave blank for the current one)

```
ubuntu@ip-172-31-10-209:~/Desktop$ ls
cat.png  homework.txt  music.mp3
```

cd <directory>

Change Directory
- Move folders

cd .. < go back one level
cd ~ < go to home folder
cd / < go to root

```
ubuntu@ip-172-31-10-209:~$ pwd
/home/ubuntu
ubuntu@ip-172-31-10-209:~$ tree
.
├── Desktop
└── Downloads
```

```
:~$ cd Desktop
:~/Desktop$
```

```
:~/Desktop$ cd ../Downloads/
:~/Downloads$
```



mdkir <name>

Make Directory

```
ubuntu@ip-172-31-10-209:~$ ls
Desktop  Downloads
ubuntu@ip-172-31-10-209:~$ mkdir Documents
ubuntu@ip-172-31-10-209:~$ ls
Desktop  Documents  Downloads
```



touch <filename>

Creates a new file if it doesn't already exist

```
ubuntu@ip-172-31-10-209:~/Documents$ touch todo.txt
ubuntu@ip-172-31-10-209:~/Documents$ touch newDoc
ubuntu@ip-172-31-10-209:~/Documents$ ls
newDoc  todo.txt
```



cat <file>

Reads the specified file(s)

```
ubuntu@ip-172-31-10-209:~/Documents$ cat todo.txt
- Shopping
- ShefESH Slides
- Dissertation
```



cp <orignal> <new>

Makes a copy of the file

```
ubuntu@ip-172-31-10-209:~/Documents$ ls
doc  todo.txt
ubuntu@ip-172-31-10-209:~/Documents$ cp doc newDoc
ubuntu@ip-172-31-10-209:~/Documents$ ls
doc  newDoc  todo.txt
```

rm <file>

Removes the specified file(s)

Can also removed directories: rm -r <directory>

- The ‘r’ stands for recursive

```
ubuntu@ip-172-31-10-209:~/Documents$ ls
doc  newDoc  todo.txt
ubuntu@ip-172-31-10-209:~/Documents$ rm newDoc
ubuntu@ip-172-31-10-209:~/Documents$ ls
doc  todo.txt
```

mv <orignal> <new>

Move a file to a new location

Can be used to rename a file too

- (change its name but keep it in the same location)

```
ubuntu@ip-172-31-10-209:~/Documents$ ls
doc  todo.txt
ubuntu@ip-172-31-10-209:~/Documents$ mv todo.txt "To-Do List"
ubuntu@ip-172-31-10-209:~/Documents$ ls
'To-Do List'   doc
```



nano <file>

Opens a basic text editor (like notepad)



SSH

SSH - **S**ecure **Sh**ell

Common way to connect to a remote server

ssh userX@linux.shefesh.com

passwordX

Replace X with a number 1-30



Directories

Directories on linux based systems start from ‘/’

- There is no concept of ‘drives’ (No C: drive like Windows)

Your user accounts home directory is located at ‘/home/<username>’

- Often shown on terminals as ‘~’

Usually your personal files go in your user directory

- On distros with a ‘Desktop Environment’ you might have folders like ‘Download’, ‘Documents’ premade
- You can do the same yourself by using mkdir

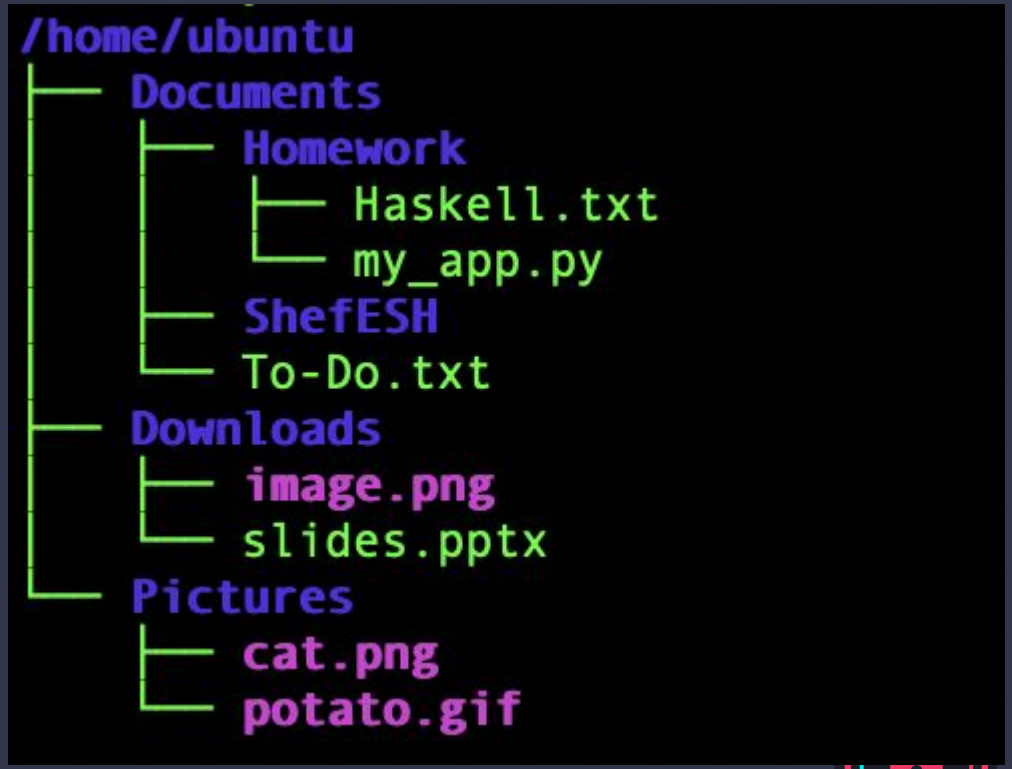


File paths

/home/ubuntu - same as ~
- As my user account is ‘ubuntu’

To read my Haskell Homework
- cat ~/Documents/To-Do.txt

To delete my cat image
- rm ~/Pictures/cat.png



Default Directories

/bin	Contains essential binaires to launch the system
/boot	Stores files needed to boot the system
/dev	Device files - linux treats keyboards, mice, etc as files
/etc	System config files
/home	User directories
/lib	Shared libraries
/mnt	Temporary mount point for filesystems
/media	Mount point for removable media (USBs, CDs, etc)
/root	Home directory for superuser account
/sbin	System binaries
/temp	Temporary files - lost on reboot
/usr	User system resources - applications, binaries, etc



Ownership

Ownership

Every file and folder has three ‘ownership’ parts

- ‘Owner’ - who owns the file / folder
- ‘Group’
  - On larger systems / servers you would have groups for developers, database admins, etc
  - On personal systems you would likely belong to groups such as ‘sudo’
- ‘Other’ - Everyone else on the system who isn’t the owner or in the group



File Bits

```
ubuntu@ip-172-31-10-209:~$ ls -l
total 0
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 11:37 myfile
```

Split into 4 parts:

- `-` File type bit
- `rw-` Owner permissions
- `rw-` Group permissions
- `r--` Other user permissions

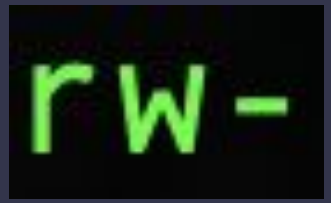


Permissions

Three types of permissions for every file and folder

- Read
- Write - Including renaming, moving and deleting
- Execute - If the file is a script

Permissions are **NOT** suitable to protect sensitive files




```
ubuntu@ip-172-31-10-209:~$ cat myfile
here is some data
```

```
ubuntu@ip-172-31-10-209:~$ mv myfile renameit
ubuntu@ip-172-31-10-209:~$ ls -l
total 4
-rw-rw-r-- 1 ubuntu ubuntu 18 Oct  5 11:44 renameit
```

```
ubuntu@ip-172-31-10-209:~$ ./renameit
-bash: ./renameit: Permission denied
```

Changing Ownership

Change **own**ership of a file or folder, to the specified user or group

chown [user][:group] <file>

- chown user1 file.txt
- chown group1 file.txt
- chown user1:group1 file.txt

```
ubuntu@ip-172-31-10-209:~$ ls -l
total 4
-rw-rw-r-- 1 ubuntu ubuntu 18 Oct  5 11:44 myfile
ubuntu@ip-172-31-10-209:~$ sudo chown user1 myfile
ubuntu@ip-172-31-10-209:~$ ls -l
total 4
-rw-rw-r-- 1 user1 ubuntu 18 Oct  5 11:44 myfile
```



Changing Permissions

Change file **mod**e bits

chmod [mode] <file>

- Can be done using characters or a number code
- u = users g = group o = others “ = all
- + = grant- = remove ‘=’ = set
- r = read w = write x = execute

```
ubuntu@ip-172-31-10-209:~$ ls -l
total 4
---------- 1 ubuntu ubuntu 18 Oct  5 11:44 myfile
```

```
chmod =rwx myfile
```

```
-rwxrwxr-x 1 ubuntu u
```

Sudo

Sudo - Superuser Do

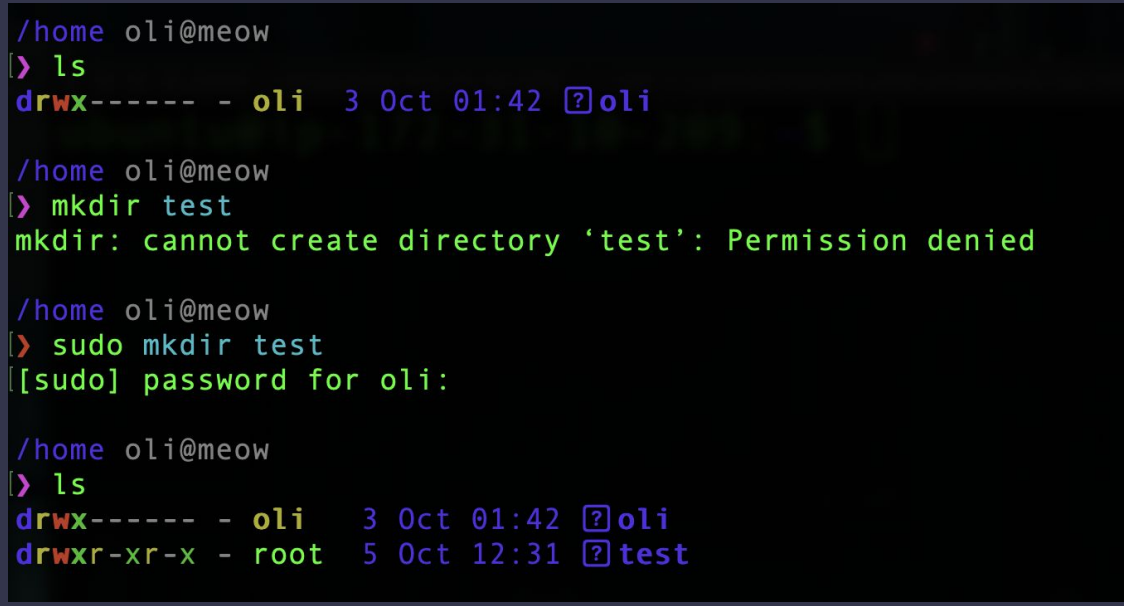
Can be very dangerous

- Usually requires a password
- May leave an audit log

Temporary elevation

Allows you to modify system files, install software

- Can easily break things
- Most of the time it won't stop you!



Commands, Commands, Commands

uptime
- Shows how long your system has been running

ping
- Used to send a request to a web server
- Try ‘ping google.com’

man [command]
- Shows an inbuilt manual on how to use a command
- Google is probably better but if you don’t have internet it can be helpful

stat [file]
- Detailed stats about a file

find
- Searches for files or directories
- Can use regex, just like grep

top
- Bit like task manager
- Shows running processes, memory, etc



Changing the output

The output of commands write to the ‘standard output’
Terminal window by default

a | b
- Result of a goes into the input of b
- ls | wc -l

a >> b
- Output of a is appended to b
- b is usually a file (i.e “text.txt”)

a > b
- Output of a overwrites contents of b

a < b
- Redirects a file (b) into the input of a
- sort < output.txt



Pipe Operator!!!

```
ubuntu@ip-172-31-25-16:~$ ls -l
total 0
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file1.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file10.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file11.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file12.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file13.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file14.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file15.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file16.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file17.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file18.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file19.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file2.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file20.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file3.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file4.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file5.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file6.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file7.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file8.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Oct  5 22:11 file9.txt
```

```
ubuntu@ip-172-31-25-16:~$ ls | wc -l
20
```



Redirections

```
[ubuntu@ip-172-31-25-16:~$ !!
 cat test.txt
 THIS IS A TEST
[ubuntu@ip-172-31-25-16:~$ echo "not a test" >> test.txt
[ubuntu@ip-172-31-25-16:~$ cat test.txt
 THIS IS A TEST
 not a test
[ubuntu@ip-172-31-25-16:~$ echo "maybe it is" > test.txt
[ubuntu@ip-172-31-25-16:~$ cat test.txt
 maybe it is
```



(More) Redirections

```
ubuntu@ip-172-31-25-16:~$ cat test.txt
e
r
t
y
a
c
w
q
g
t
a
v
n
r
a
g
t
w
a
g
```

```
ubuntu@ip-172-31-25-16:~$ sort < test.txt

a
a
a
a
c
e
g
g
g
n
q
r
r
t
t
t
v
w
w
y
```



grep

Grep is a handy command for searching for text patterns in files

- It allows us to use regex (Regular Expression) to find these patterns

grep “pattern” <file>

grep “fruit$” fruits.txt

- The $ means any line that ends in “fruit”

```
ubuntu@ip-172-31-25-16:~/Documents$ grep "fruit$" fruits.txt
Dragonfruit
Grapefruit
Jackfruit
Passionfruit
Starfruit
Breadfruit
```

```
ubuntu@ip-172-31-25-16:~/Documents$ cat fruits.txt
Apple
Banana
Cherry
Date
Elderberry
Fig
Grape
Honeydew
Kiwi
Lemon
Mango
Nectarine
Orange
Papaya
Quince
Raspberry
Strawberry
Tangerine
UgliFruit
Watermelon
Apricot
Blackberry
Blueberry
Cantaloupe
Cranberry
Dragonfruit
Durian
Gooseberry
Grapefruit
Guava
Jackfruit
Jujube
Kiwano
Kumquat
Lychee
Mandarin
Mulberry
Olive
Passionfruit
Peach
Pear
Persimmon
Pineapple
Plum
Pomegranate
PricklyPear
Rambutan
Redcurrant
Starfruit
SugarApple
Tamarind
Tamarillo
Tomato
```

Flags

Most commands accept flags

- Extra instructions
- Modify behaviour of command

Common flags

- ‘--force’ or ‘-f’ -> tries to force something
- ‘--verbose’ or ‘-v’ -> print out as much information as possible
- ‘--quiet’ or ‘-q’ -> print out as little information as possible
- ‘--recursive’ or ‘-r’ -> recursively run the command - used for copying/moving/deleting directories
- ‘-c’ -> count - can be used to either limit something or to get the count of something



Challenges

1. Make a folder
2. Rename this folder
3. Delete this folder
4. List all files in your current directory
    - Can you send the output to a text file?

5. Make a new text file
    - Write something and print it to the terminal
    - Can you modify the permissions so that you can not read it anymore?

6. Can you print out your name to the terminal?
    - Can you save this to a file called yourname.txt

7. Can you ping ‘shefesh.com’?
    - Can you write its output to a file?
    - Make sure to pass ‘-c’ flag to limit responses

8. Find the secret folder
    - Find the secret FLAG{ } inside the file in this folder

9. Make a new folder and download the tar at shefesh.com/rp/intro_to_linux.tar
    - Extract it and read its contents

10. Follow the instructions from Q9

