Template Week 5 – Operating Systems

Student number: 547201

Assignment 5.1: Unix-like

a) Find out what the difference is between UNIX and unix-like operating systems?
   - UNIX owned by The Open Group and requires certification while Unix-like system lack of formal certification or direct code

b) Study the image above named UNIX timeline. Find out who Ken Thompson, Dennis Ritchie, Bill Joy, Richard Stallman, and Linus Torvalds are and what they have contributed to the development of UNIX or unix-like systems and to IT in general. **TIP!** English-language sources often contain more detailed information about these individuals.

Ken Thompson	Co-creator of UNIX. Created the B programming language.
Dennis Ritchie	Co-creator of UNIX. Created the C programming language.
Bill Joy	Co-founder of Sun Microsystems. Contributor to BSD Unix
Richard Stallman	Founded the GNU Project and Free Software Foundation. Create GNU
Linus Torvalds	Create the Linux kernel

c) What is the philosophy of the GNU movement?
   - Support free software defined by four freedoms:
     1. Run the program for any purpose
     2. Study how it works and modifies source code
     3. Redistribute copies to help others
     4. Distribute modified versions to the public

d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.
   - Yes, it is largely conforms to the GNU philosophy as it's a system built on the free software. However, Ubuntu sometimes includes proprietary graphics drivers or firmware for hardware compatibility, which are non-free software.

e) Find out what is the Windows Subsystem for Linux?
   - A feature that allows running full Linux directly on Windows without a separate VM

f) Find out, which operating system family belongs to Android, iOS and ChromeOS?
   - Android: based on Linux Kernel
   - IOS: based on BSD Unix
   - ChromeOS: based on Linux Kernel

Assignment 5.2: Supercomputers and gameconsoles

a) Research on this site what supercomputers are used for and write a short summary of it:
https://www.computerhistory.org/timeline/search/?q=Supercomputer
   - Supercomputers are used for computationally intensive tasks: weather forecasting, climate research, molecular modeling, physical simulations, quantum mechanics, cryptanalysis, and analyzing large datasets in fields like astronomy, genomics, and artificial intelligence.

b) IBM is a company that has already built a number of supercomputers. One of them is IBM's Roadrunner. The CPU developed for this supercomputer was further developed at a later stage as the CPU for the PlayStation 3 console. Find out what a **PlayStation 3 cluster** is and what it was used for?
   - A PlayStation 3 cluster is a powerful, low-cost supercomputer built by linking many PS3 consoles together for high performance computing tasks like image analysis or AI. The US Air Force Research Laboratory used it for radar enhancement, satellite image processing, and AI research. PS3s were used because their Cell Broadband Engine processors offered high performance at low cost.

c) You can build a supercomputer by putting a few computers together in a cluster. Here's what Oracle did with a collection of Raspberry Pi's, for example:
https://blogs.oracle.com/developers/post/building-the-worlds-largest-raspberry-pi-cluster
What specific operating system is running on this cluster?
   - Oracle's Raspberry Pi cluster runs Oracle Linux for ARM

d) Does Oracle's Raspberry Pi supercomputer appear in the list of the 500 fastest supercomputers in the world? Make a logical decision for this, without going through the entire list.
https://www.top500.org/lists/top500/list/2023/06/
   - A cluster built from hundreds of Raspberry Pis, even 1,050 of them, would still have far less computational power than even the slowest system on the list. Single Raspberry Pi boards are measured in billion floating-point operations per second, not trillions or quadrillions. Additionally, It's a demo for education only.

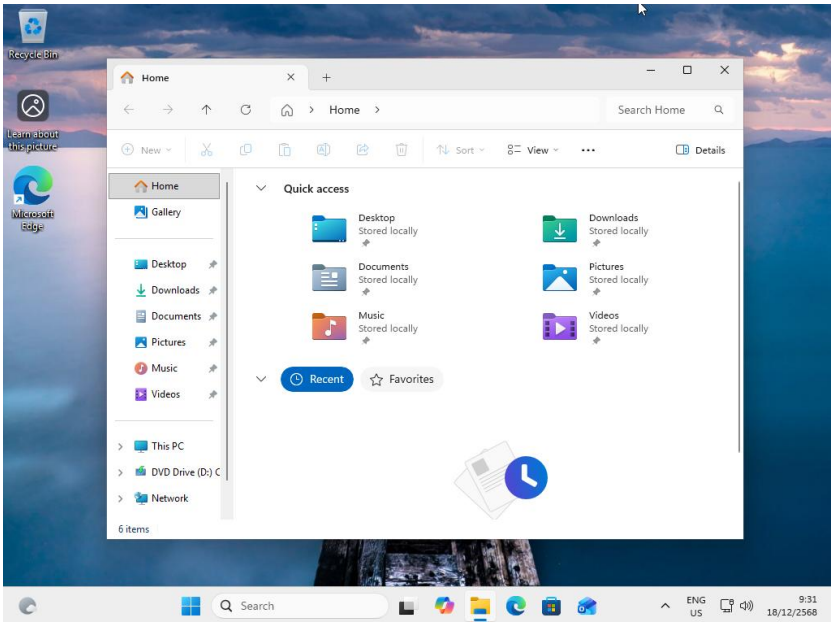
e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?
What operating systems run on these consoles?
What conclusion can you draw from the answer to the previous question?
   - CPU Architecture: Both use AMD x86-64
   - Operating Systems: Both use custom Unix-like operating systems based on FreeBSD (PS5) and Windows 10/Xbox OS kernel (Xbox)
   - Conclusion: Modern consoles use the same x86-64 architecture as PCs, making cross-platform development easier

Assignment 5.3: Working with Windows

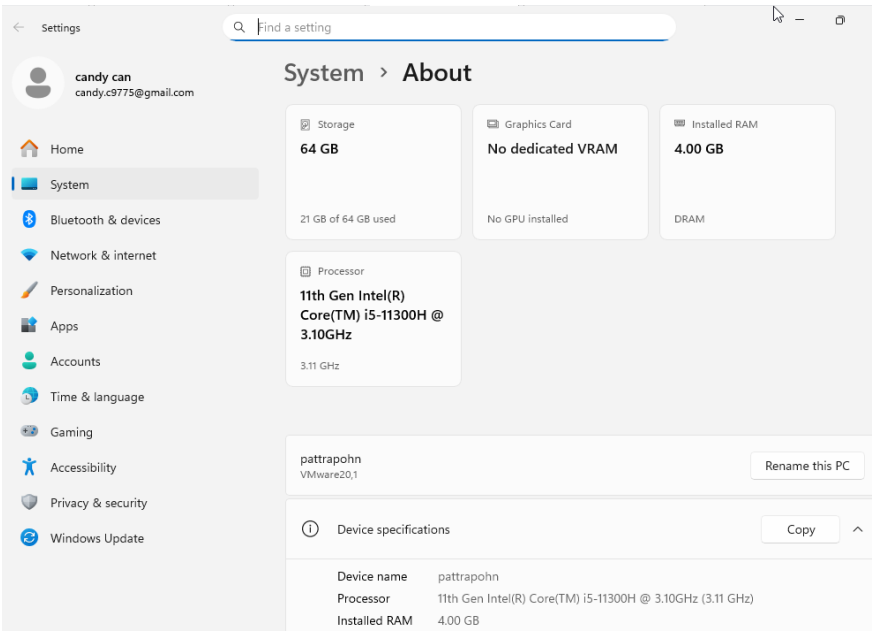
Take relevant screenshots of the assignments below

a) Practice for about 10 minutes with the ⊞ keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.

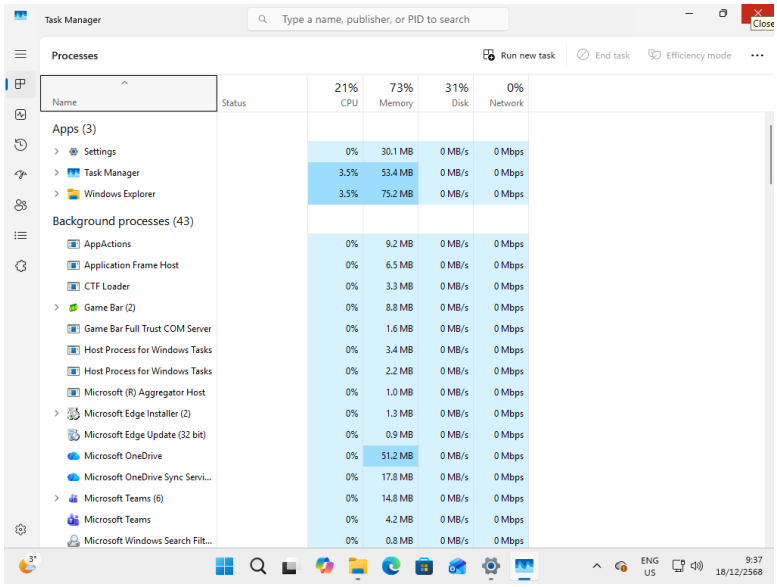
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?
- Win + R then type explorer and press Enter
- Or right-click Start button -> File Explorer

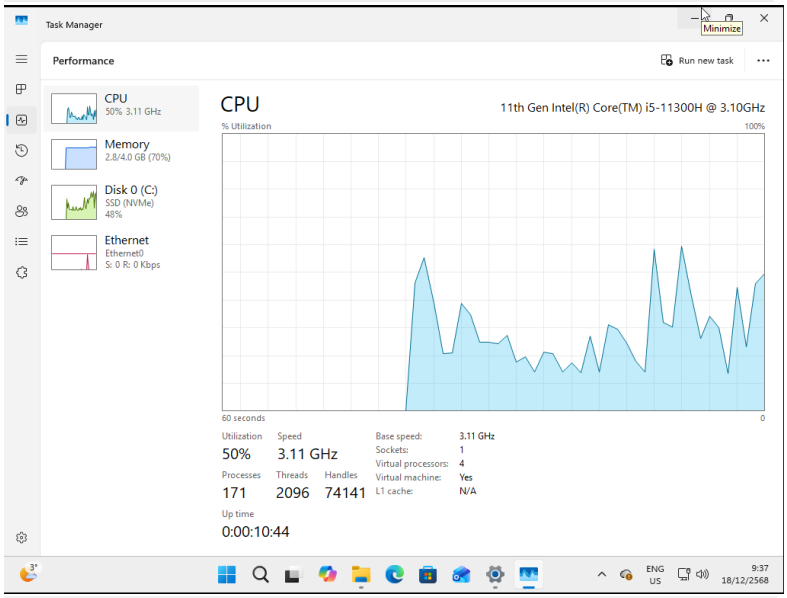


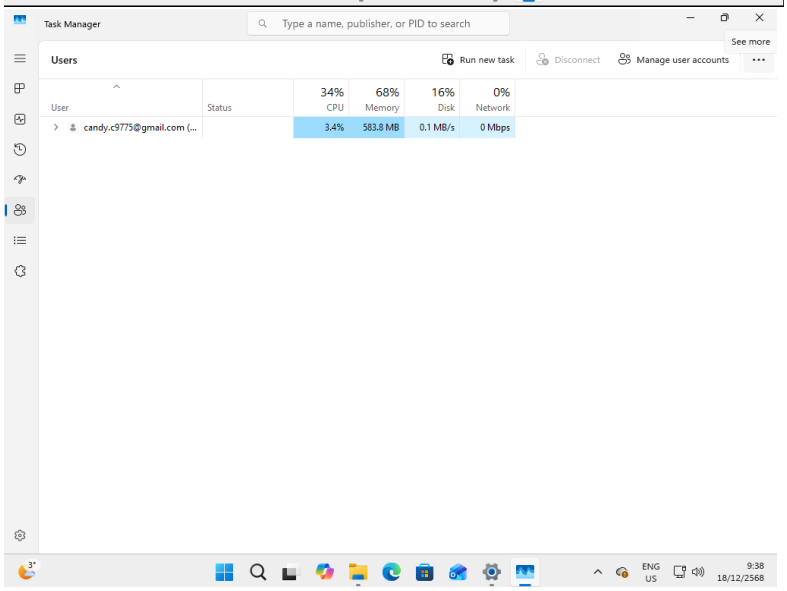
c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.
- Win + Pause/Break



d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.







e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector, or the second screen. Which key combination should you use for this?
   - Win + P

f) If you leave the classroom for a while and you leave your laptop behind, it is wise to lock the screen. Your Apps will continue to run in the background. So, for example, if you're waiting for a download that takes a while, lock the screen and get a cup of coffee. Which key combination do you use for this?
   - Win + L

g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.
   - Win + R

Working in the File Explorer

Relevant screenshots **copy** command:

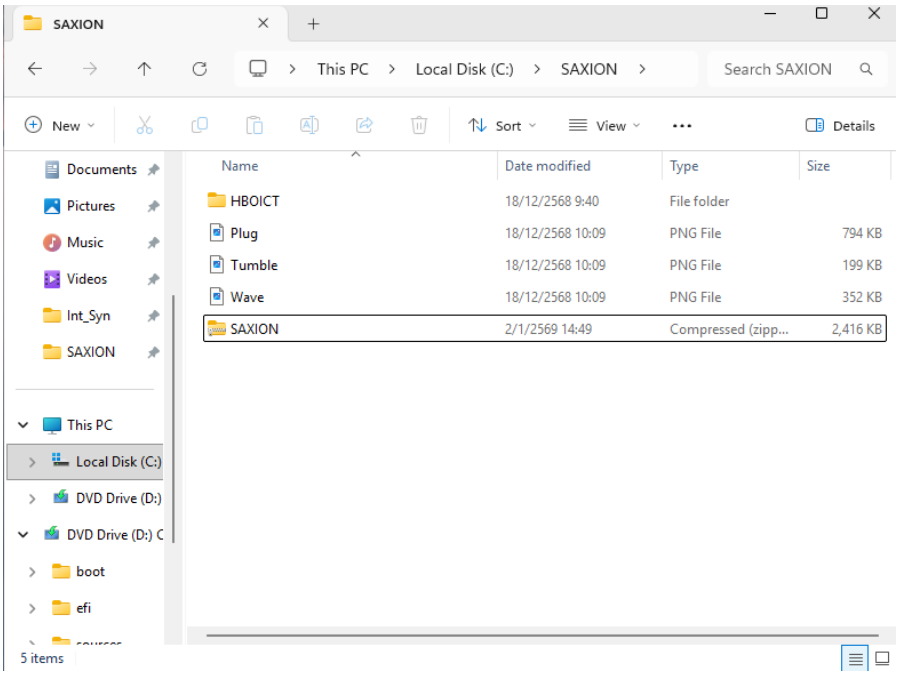
```
C:\SAXION> copy Wave.png HBOICT\YEAR1\QUARTILE1\Intro_Program
        1 file(s) copied.

C:\SAXION> copy Plug.png HBOICT\YEAR1\QUARTILE1\Intro_Infra
        1 file(s) copied.
```

```
C:\SAXION> copy Tumble.png HBOICT\YEAR1\QUARTILE1\Int_Syn
        1 file(s) copied.
```

Relevant screenshots **tree** command:

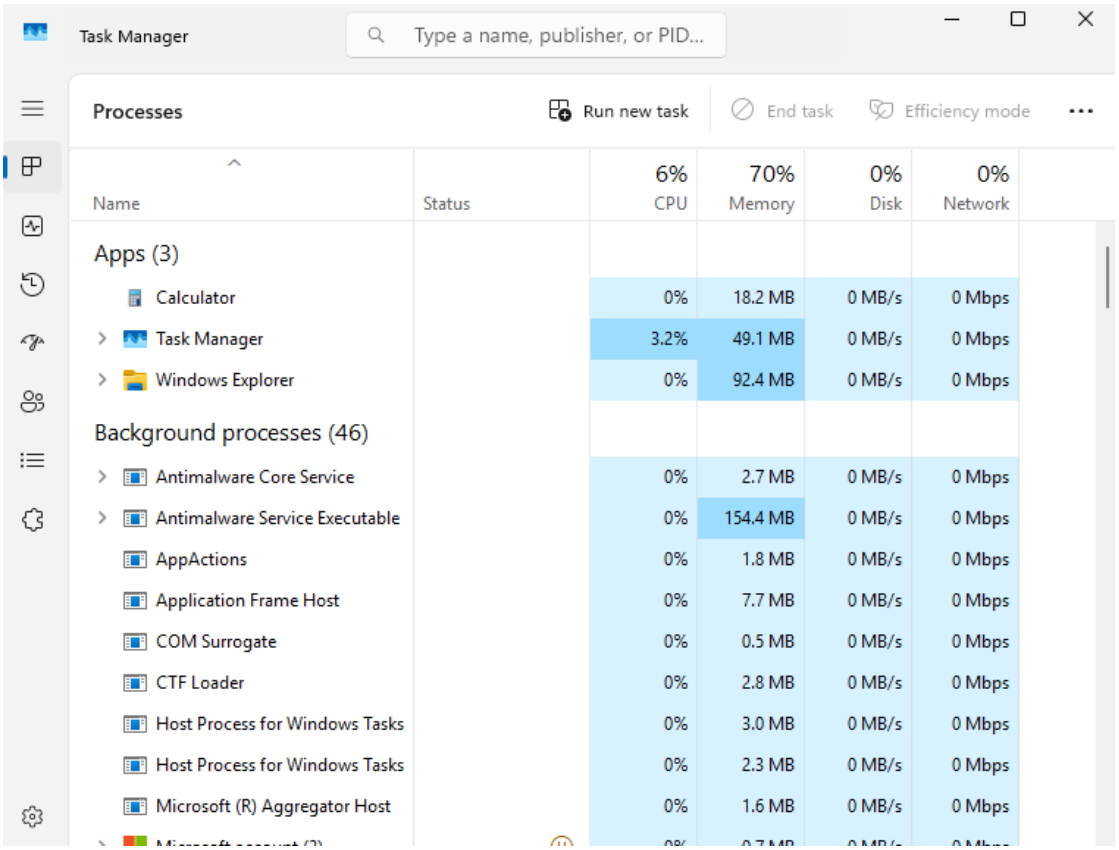
```
C:\SAXION> tree
Folder PATH listing
Volume serial number is A475-632F
C:.
└───HBOICT
    ├───YEAR1
    │   ├───QUARTILE1
    │   │   ├───Intro_Infra
    │   │   ├───Intro_Program
    │   │   └───Int_Syn
    │   ├───QUARTILE2
    │   │   ├───Databases
    │   │   ├───IT_Fund
    │   │   └───Project_IT
    │   ├───QUARTILE3
    │   └───QUARTILE4
    ├───YEAR2
    │   ├───QUARTILE1
    │   ├───QUARTILE2
    │   ├───QUARTILE3
    │   └───QUARTILE4
    ├───YEAR3
    └───YEAR4

C:\SAXION> echo %username%
candy
```

Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



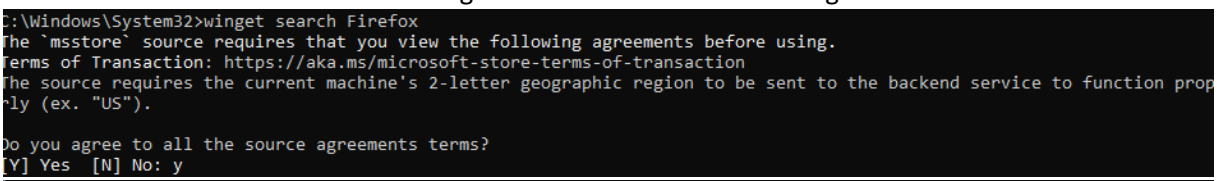
Terminating Processes

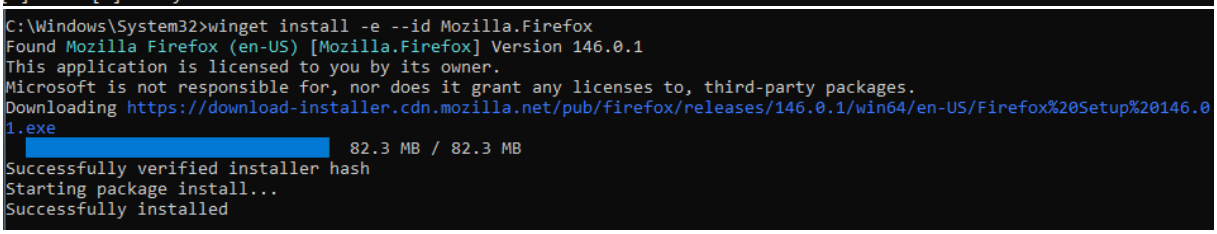
Relevant Screenshots Task Manager Window:



Install Software

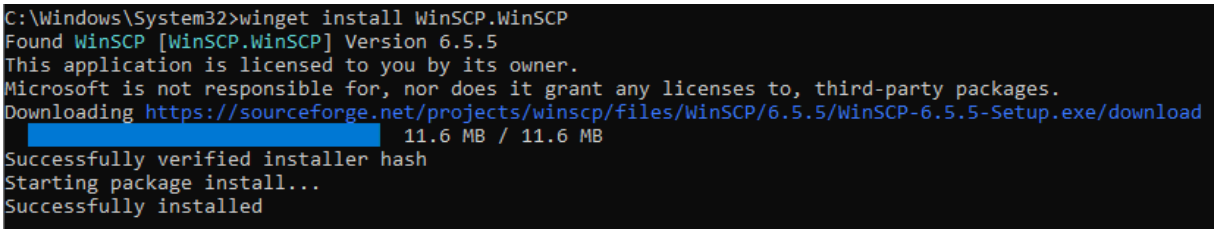
Relevant screenshots that the following software is installed with winget:



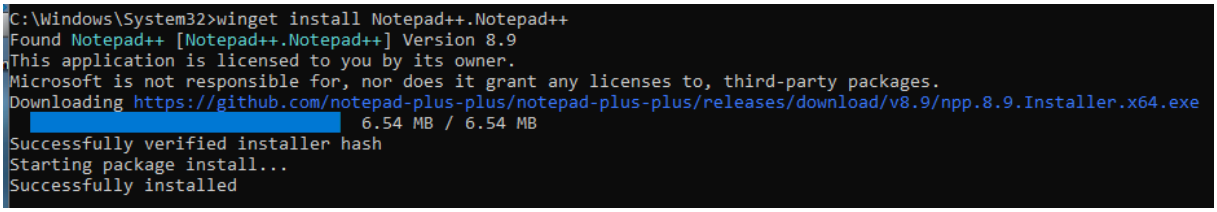


Using --id and -e ensures that winget installs the exact intended software and avoids installing the wrong package.

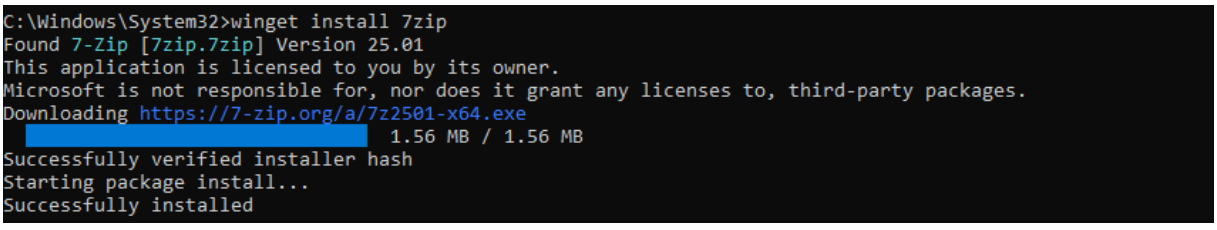
- WinSCP



- Notepad++



- 7zip

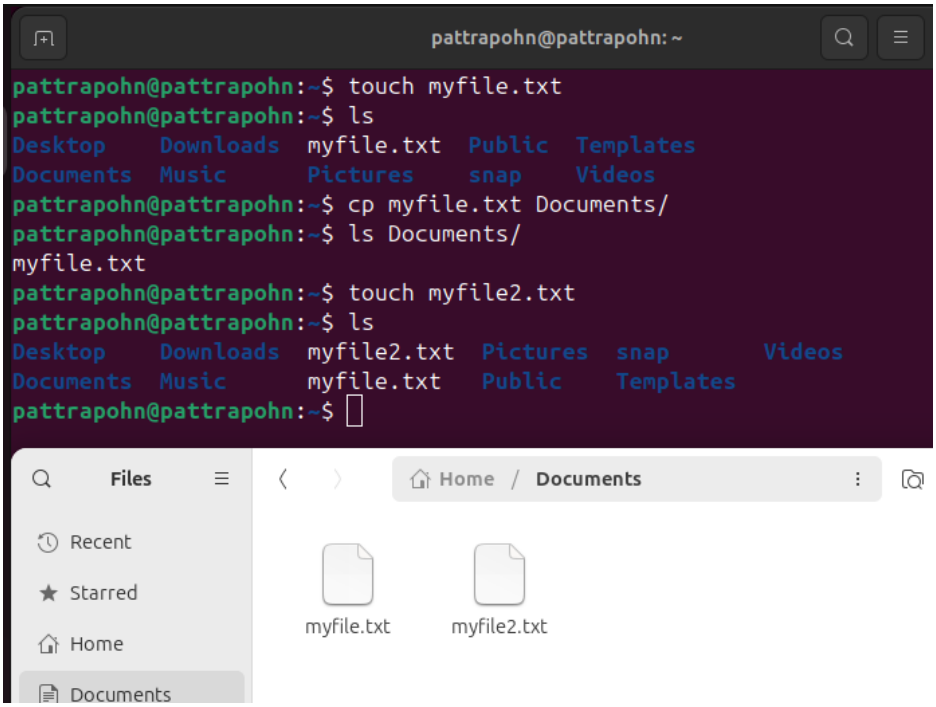


The double name with a dot is the package ID. It consists of the publisher name and the application name.

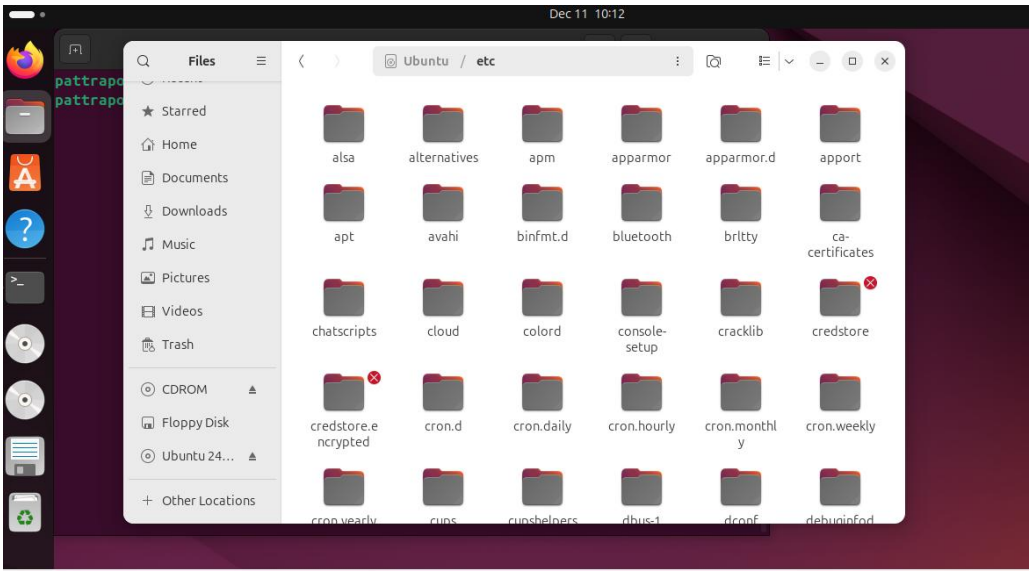
Assignment 5.4: Working with Linux

Relevant screenshots + motivation

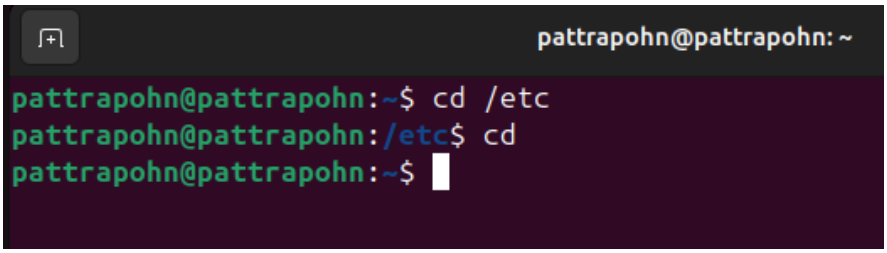
- Touch > create txt file
- Cp > copy to Documents
- Myfile2 is created and copy and paste directly in file explorer



- Navigate to etc in file explorer



- Navigate to etc folder in the terminal
- Cd to get back to home folder



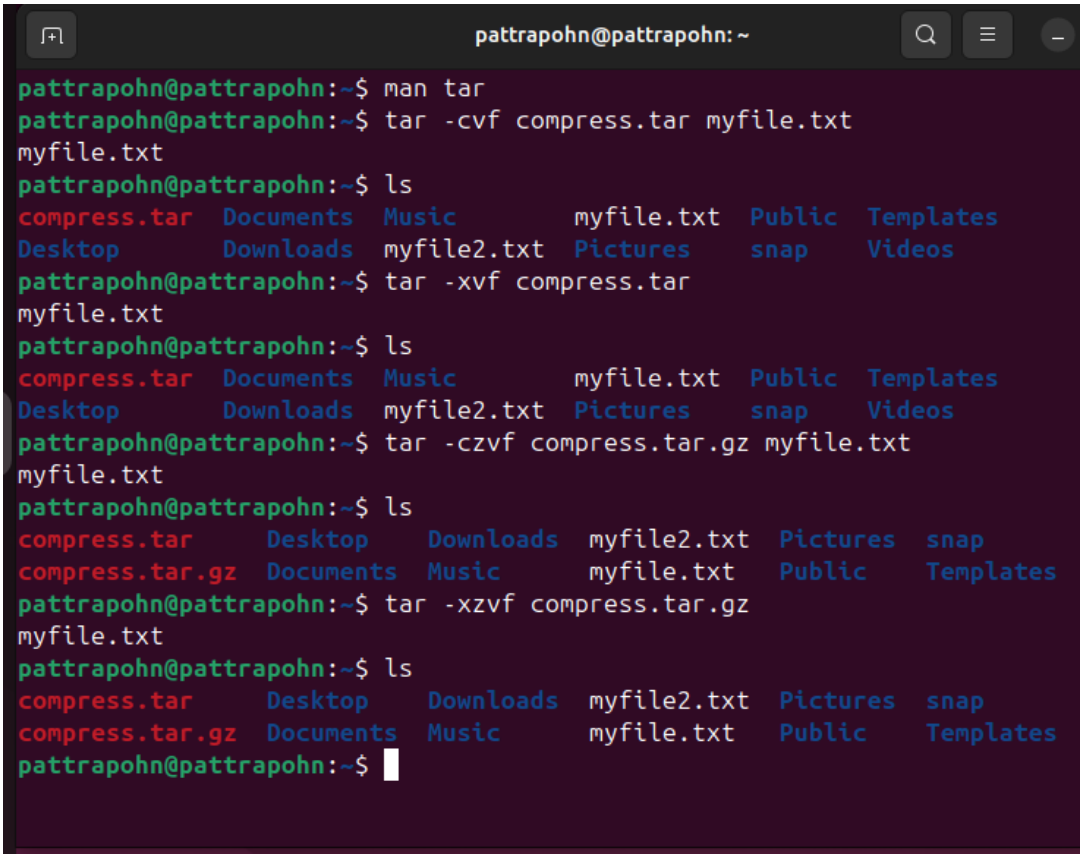
One significant difference in Linux vs Windows file structure?

- Linux uses forward slashes (/) while Windows uses backslashes (\)

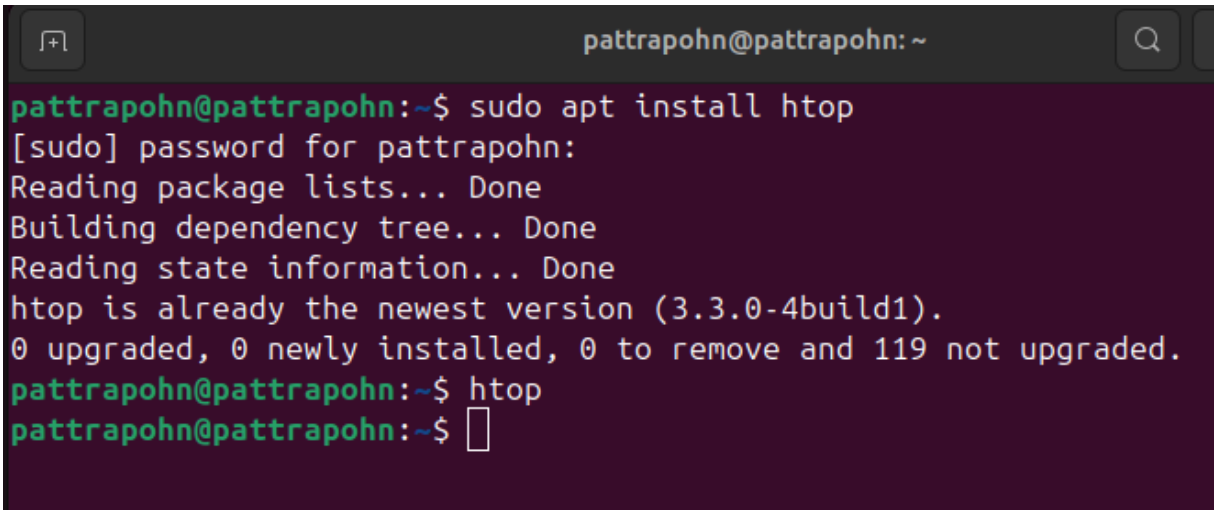
What is /etc directory used for?

- Stores system configuration files

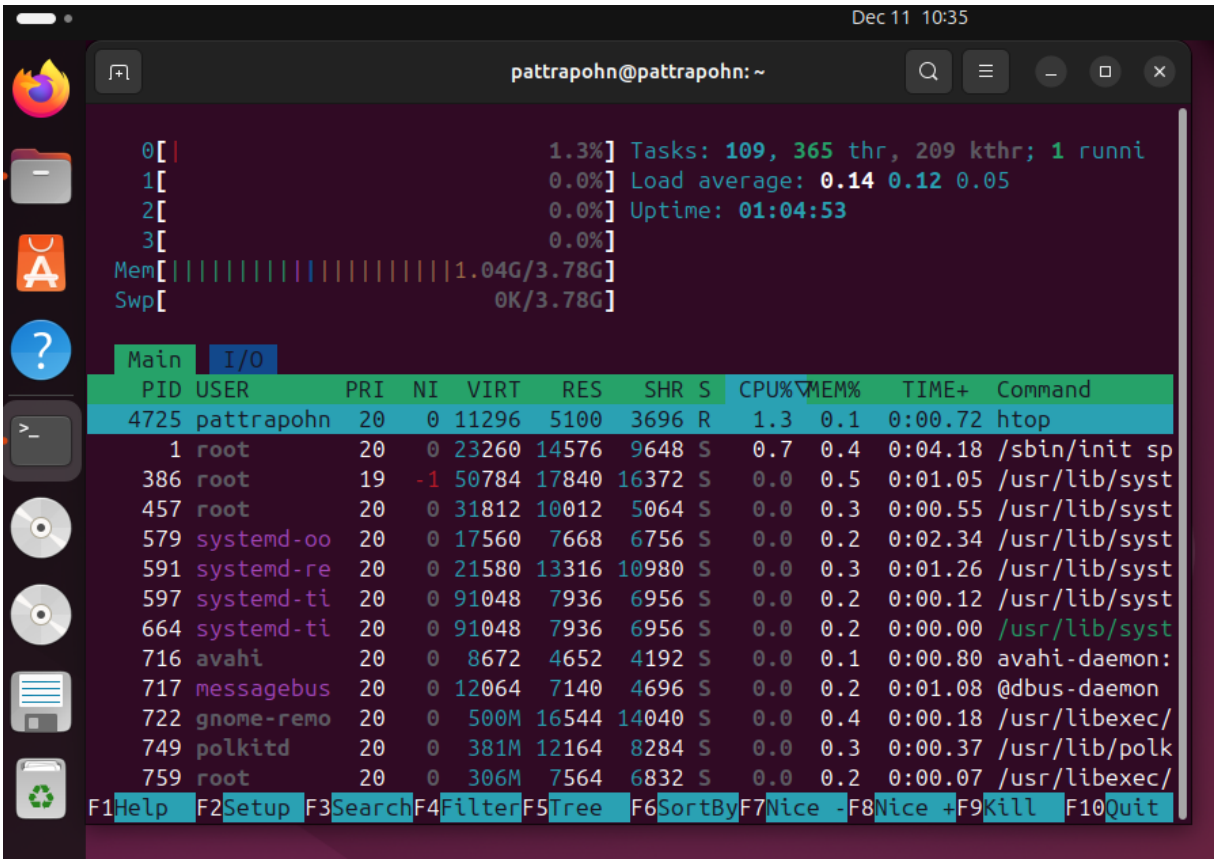
- Tar -cvf > create tar archive
- Tar -xvf > extract tar file
- Tar -czvf > compressed with gzip
- Tar -xzvf > extract compressed tar.gz

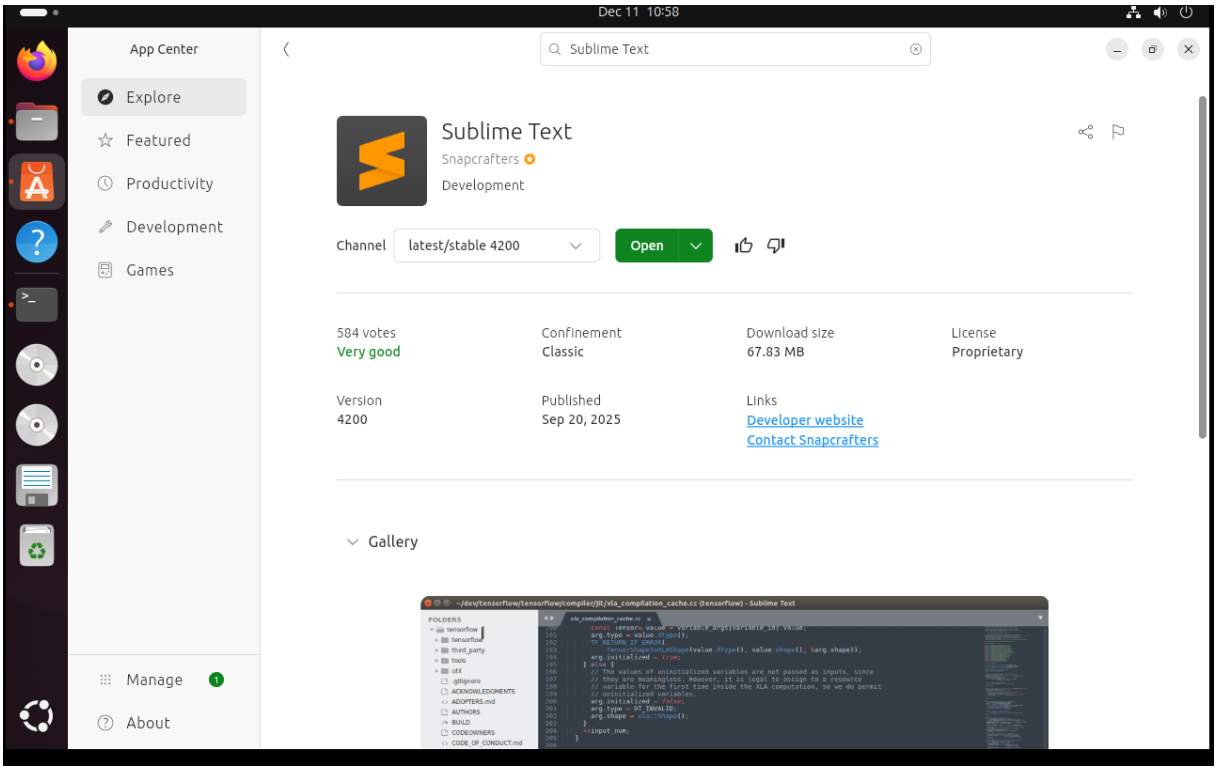


- Install and Launch htop

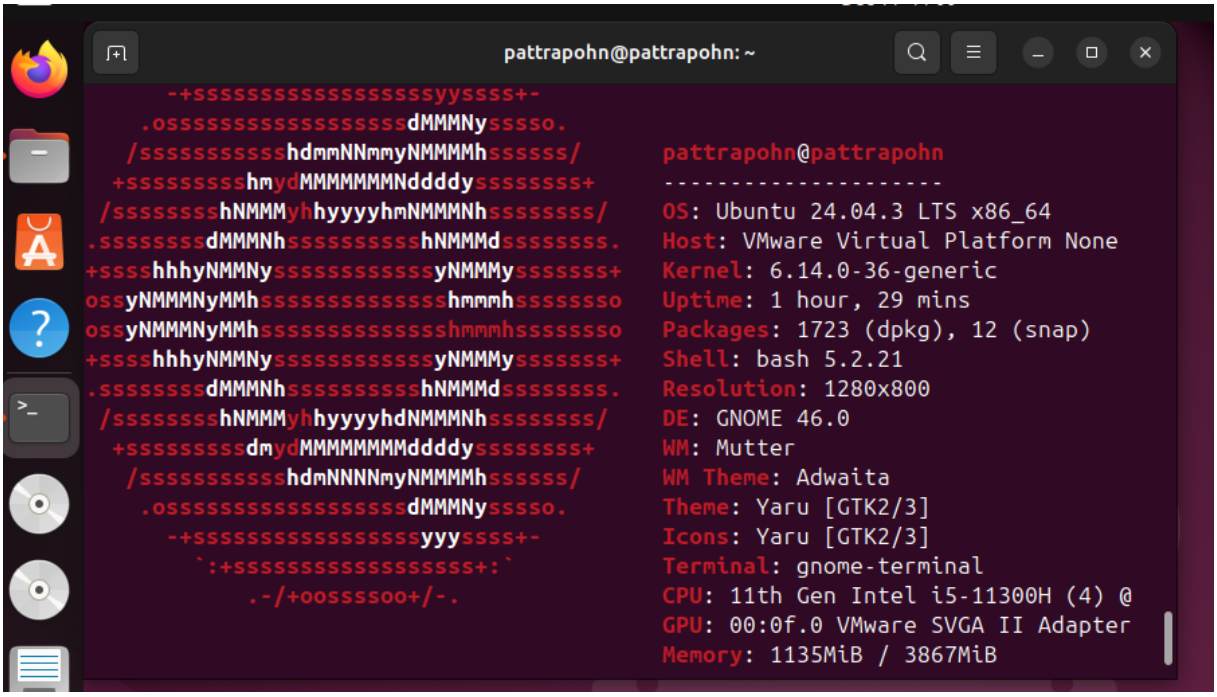


- It shows CPU usage, running processes with PID, user, command, load average, uptime and task statistics





- Install and launch neofetch

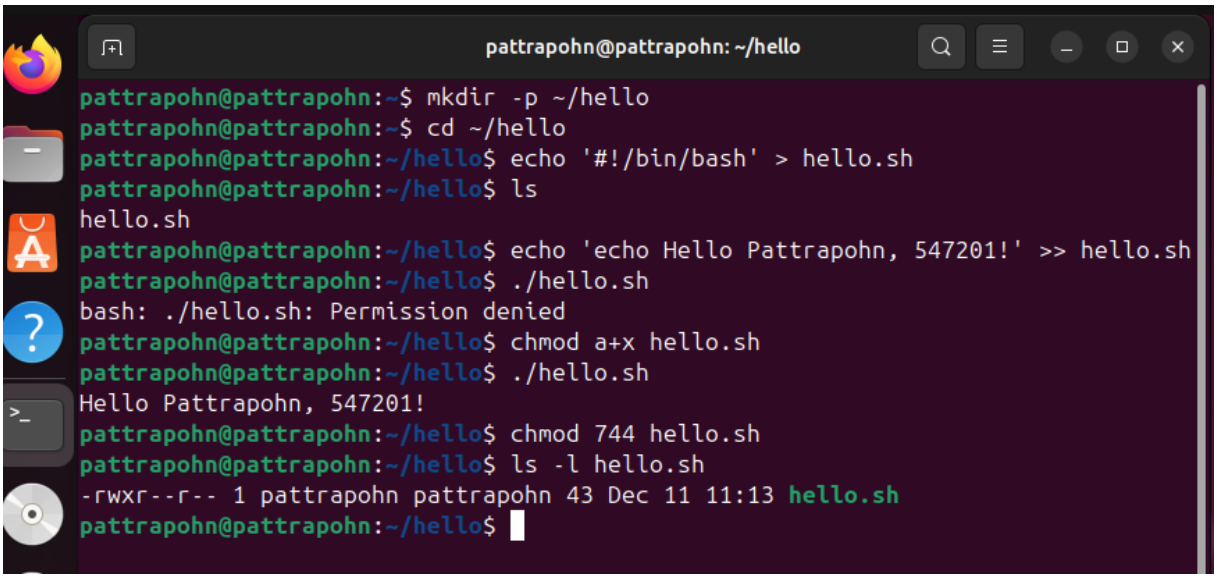


- It shows
- system infomation: OS, kernel version
- hardware: CPU, GPU, memory
- shell bash, zsh, etc.
- ASCII art logo of my OS

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

- Mkdir to create a directory
- -p ensure parent directory is create
- Cd change to directory hello
- Echo print text and redirect to hello
- ./hello to execute
- Chmod a+x to add execute(+x) permission for all user(a) then run again
- Chomd 744 to change permission
  (7 owner- read, write, execute, 4 group- read only, 4 others- read only)
- Ls -l to show details
- -rwxr—r—is permission details, 1 link count, pattrapohn is owner, 43 file size in bytes, timestamp and filename at the end

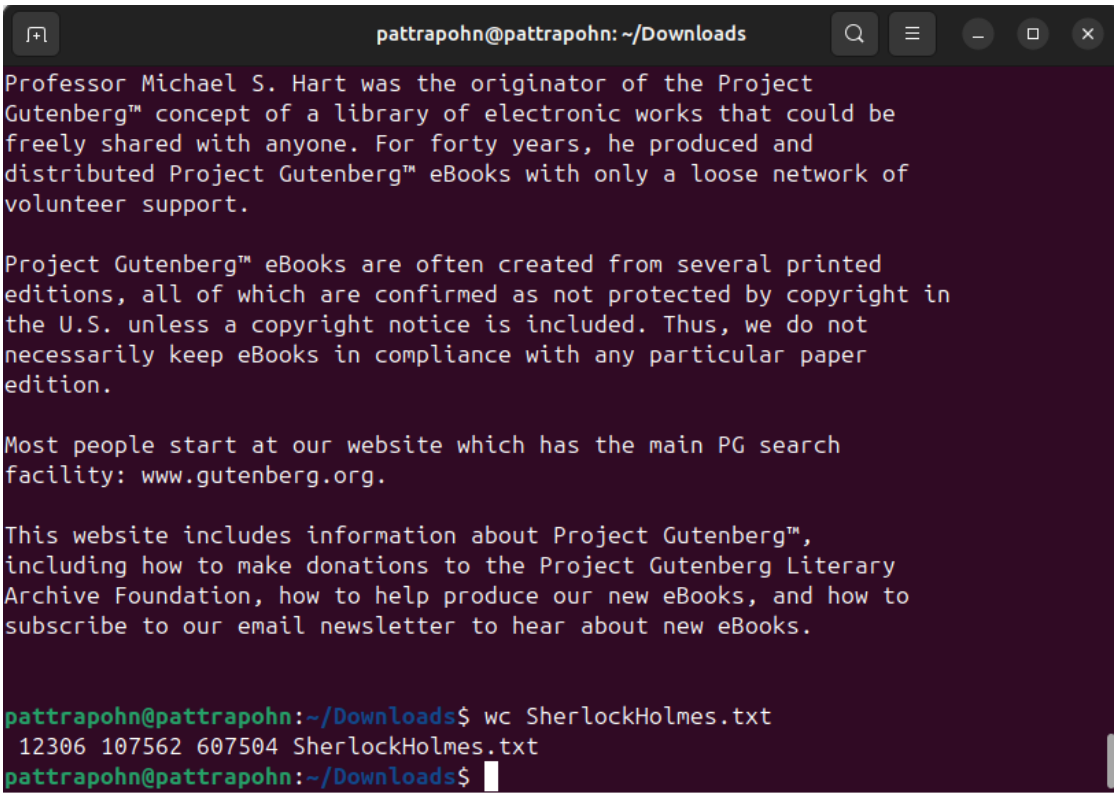


Assignment 5.6: View the contents of files

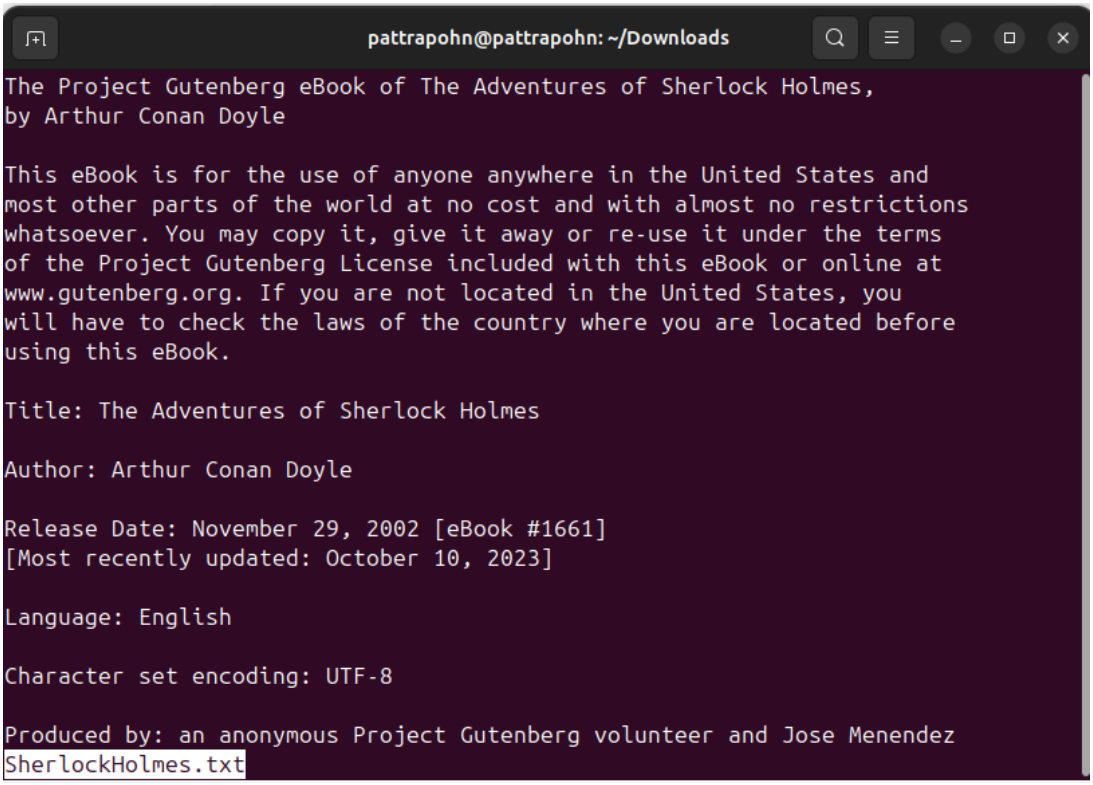
Relevant screenshots + motivation

Used cat command and it shows the entire file content at once

Wc: counts lines, words, and character > 12306 lines, 107562 words, 607504 characters, file name SherlockHolmes.txt

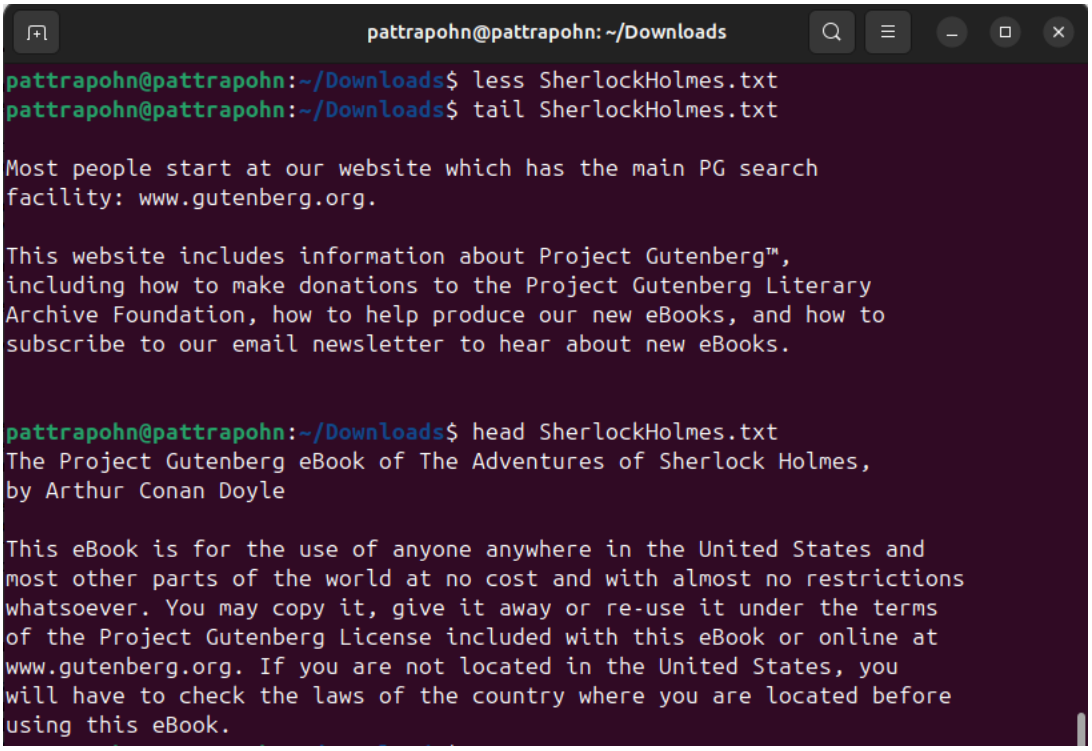


Less: view file page by page

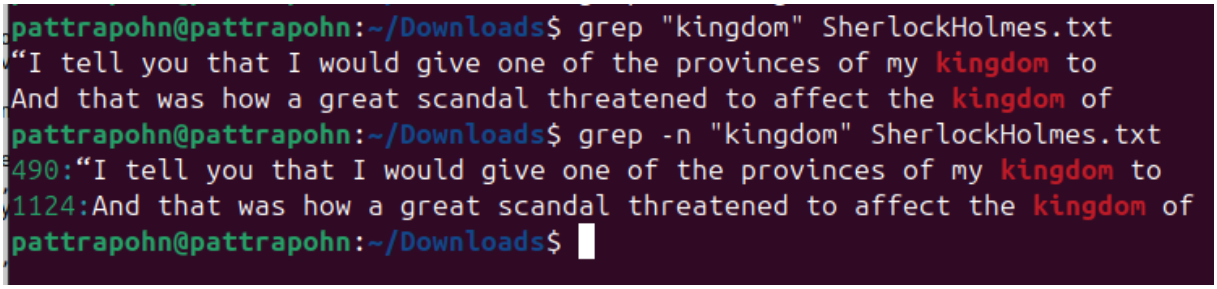


Tail: Shows the last lines of a file

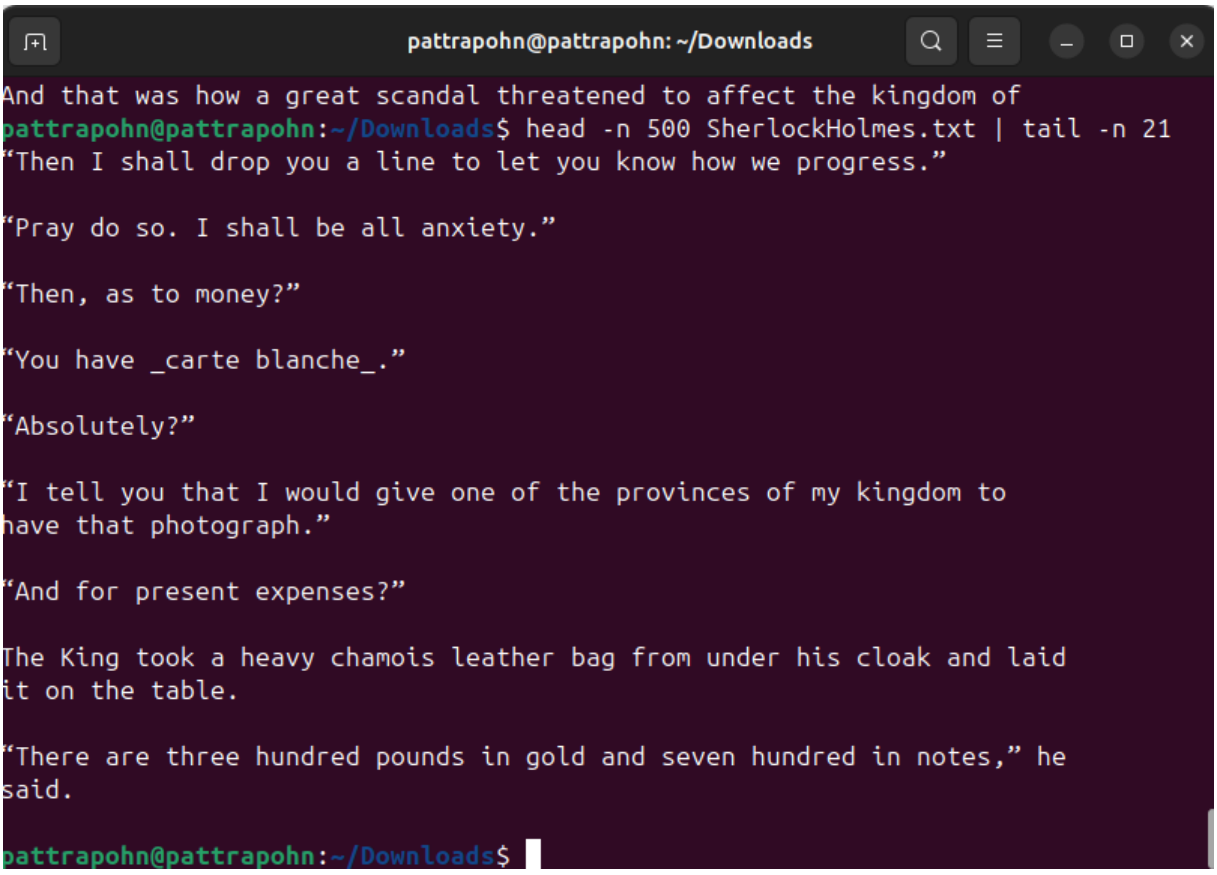
Head: Shows the first lines of a file



Show which lines have “kingdom”

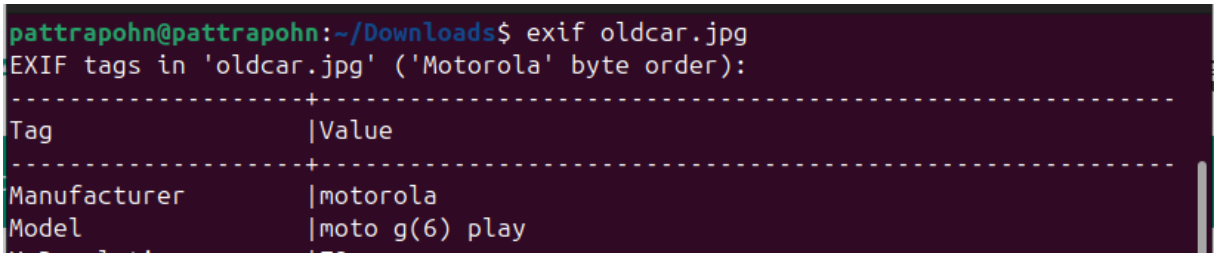


10 lines before and after kingdom



Assignment 5.7: Digital forensics

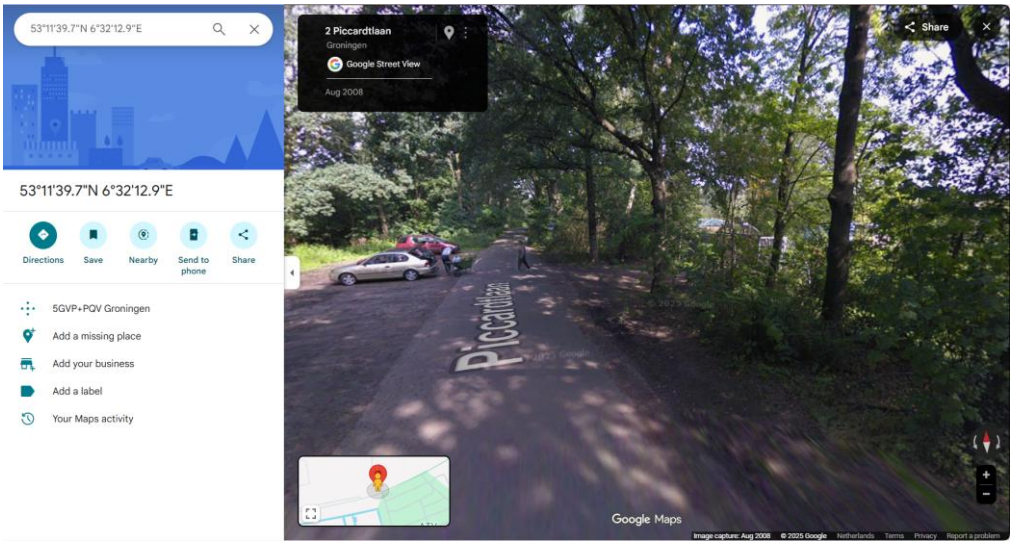
Part 1 EXIF- Phone/brand: Motorola



Coordinates found

```
pattrapohn@pattrapohn: ~/Downloads
Sharpness           |Soft
GPS Tag Version     |2.2.0.0
North or South Latit|N
Latitude            |53, 11, 39.6794
East or West Longitu|E
Longitude           | 6, 32, 12.9018
Altitude Reference  |Sea level
Altitude            |42.066
GPS Time (Atomic Clo|14:08:57.00
Geodetic Survey Data|WGS-84
Name of GPS Processi|ASCII
GPS Date            |2020:11:07
Interoperability Ind|R98
Interoperability Ver|0100
--------------------+-----------------------------------
EXIF data contains a thumbnail (59453 bytes).
```

The picture was taken at Groningen



Part 2 Rename oldcar.jpg to oldcar and is still considered as JPEG

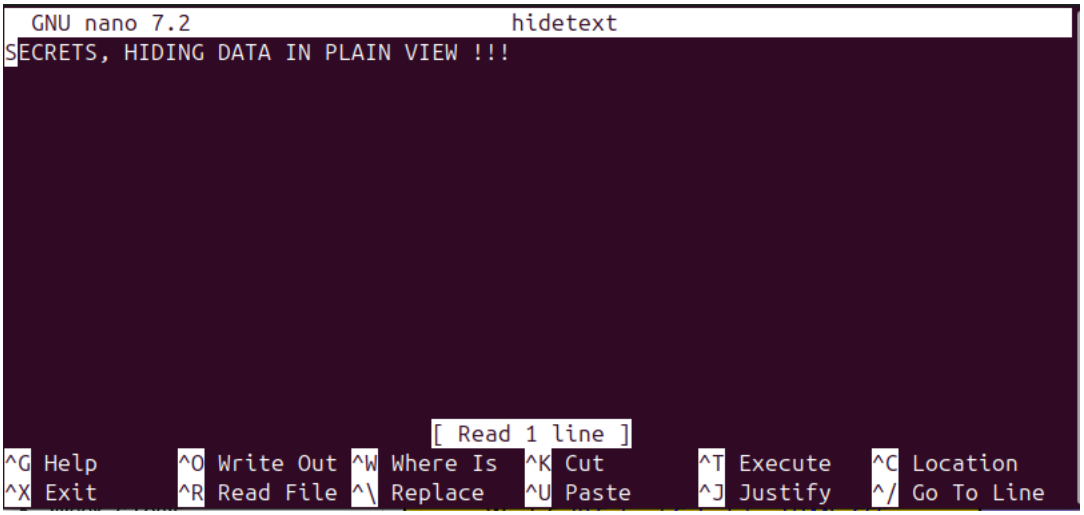
```
pattrapohn@pattrapohn:~/Downloads$ mv oldcar.jpg oldcar
pattrapohn@pattrapohn:~/Downloads$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment
length 16, Exif Standard: [TIFF image data, big-endian, direntries=10, manufactu
rer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolution
unit=2, software=aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys, datetime=2
020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
pattrapohn@pattrapohn:~/Downloads$
```

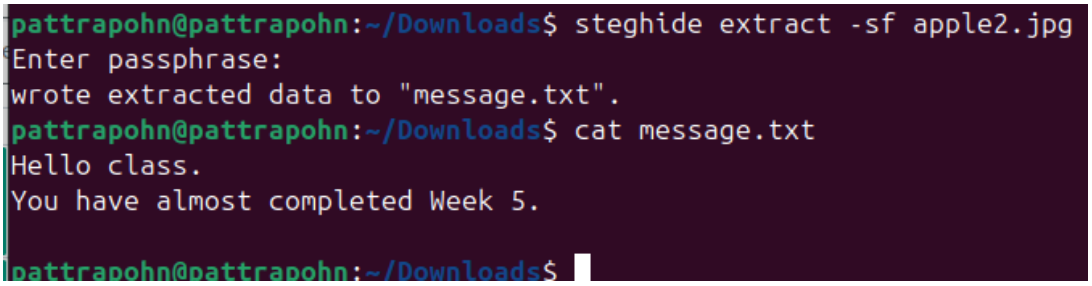
Part 3 decode gif **--> is a SAXION logo**

```
pattrapohn@pattrapohn:~/Downloads$ ls
apple2.jpg  code.zip          hello      oldcar
code        email-base64.txt  hello.zip  SherlockHolmes.txt
pattrapohn@pattrapohn:~/Downloads$ base64 -d email-base64.txt > decoded.gif
pattrapohn@pattrapohn:~/Downloads$ file decoded.gif
decoded.gif: GIF image data, version 89a, 108 x 52
pattrapohn@pattrapohn:~/Downloads$
```

Assignment 5.8: Steganography

Look for hidden text – using stephide extract, -sh to specify the file apple2.jpg



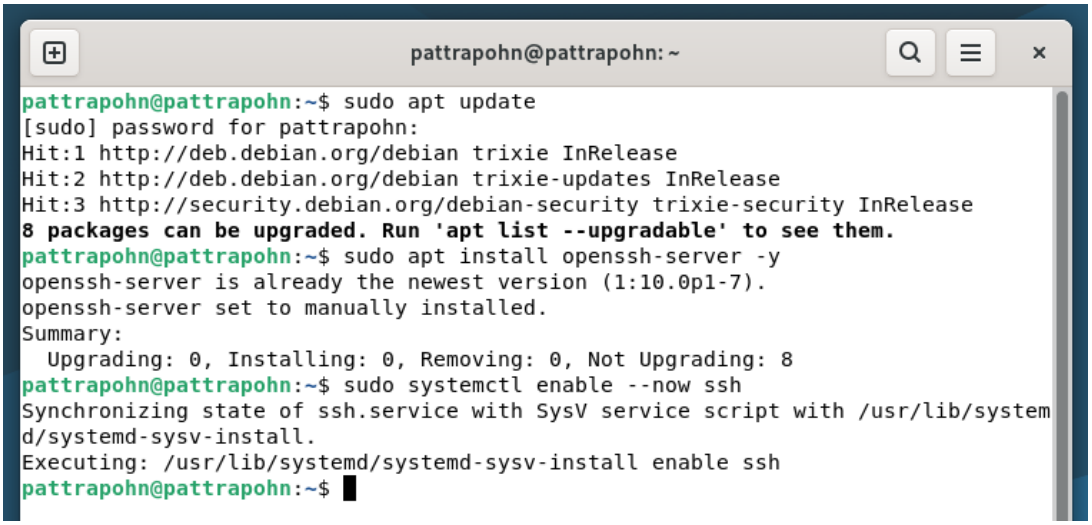


Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.
- Proof that you can restore the back-up image into an empty VM.

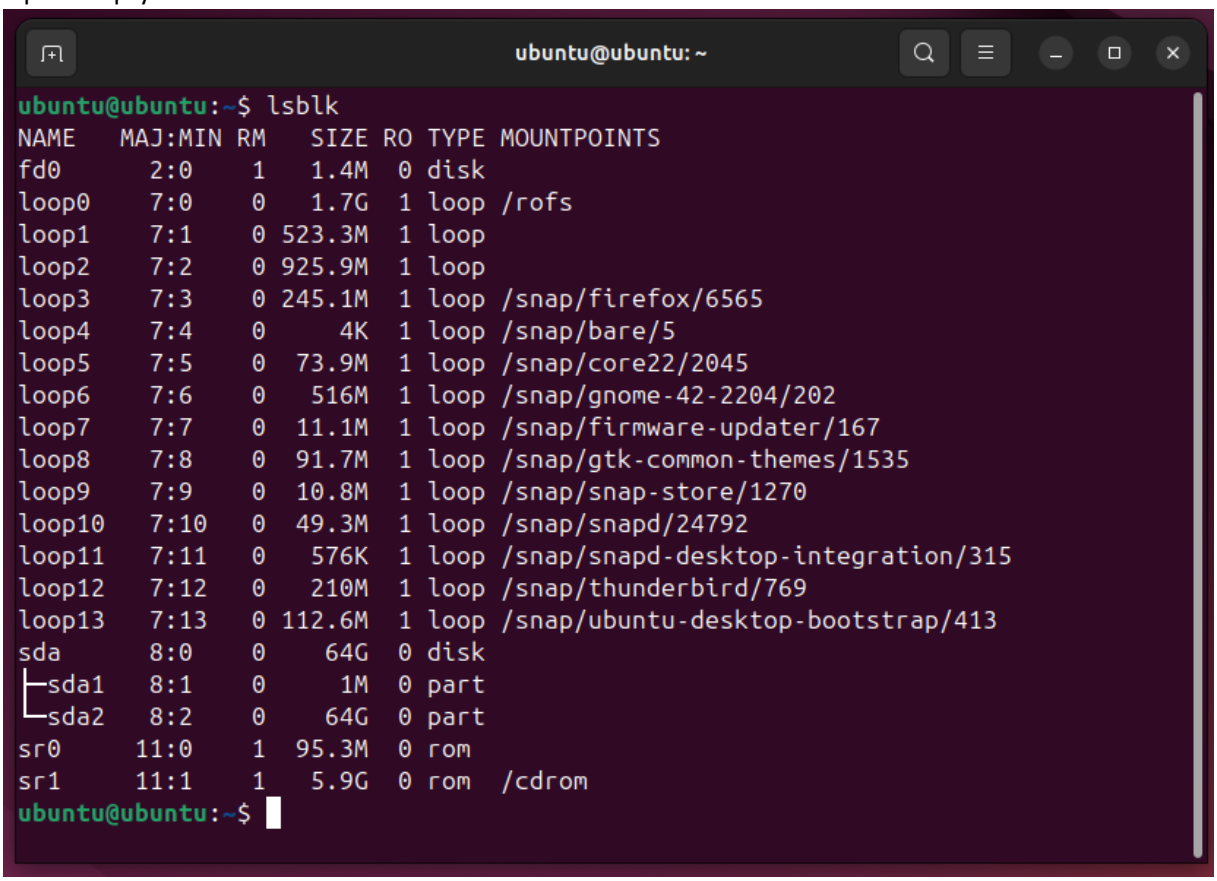
In debain, update and install openssh server first



Create directory then change ownership to $USER then ip a to show ip

```
pattrapohn@pattrapohn:~$ sudo mkdir -p /srv/images
pattrapohn@pattrapohn:~$ sudo chown $USER:$USER /srv/images
pattrapohn@pattrapohn:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gro
up default qlen 1000
    link/ether 00:0c:29:3c:3b:6b brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    altname enx000c293c3b6b
    inet 192.168.139.135/24 brd 192.168.139.255 scope global dynamic noprefixrou
te ens33
       valid_lft 1200sec preferred_lft 1200sec
    inet6 fe80::20c:29ff:fe3c:3b6b/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
pattrapohn@pattrapohn:~$
```

Open empty live ubuntu and run lasblk to show devices



Compress image from live ubuntu system disk and sent over to network 192.168.139.135 then save as ububtu image

```
ubuntu@ubuntu:~$ sudo dd if=/dev/sda bs=4M status=progress | gzip | ssh pattrapo
hn@192.168.139.135 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.139.135 (192.168.139.135)' can't be establishe
d.
ED25519 key fingerprint is SHA256:ypJ+QwLalSWM9PiWxuYETgFH8j2EkScAjIETOZgUuHA.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.135' (ED25519) to the list of known host
s.
pattrapohn@192.168.139.135's password:
68719476736 bytes (69 GB, 64 GiB) copied, 703 s, 97.7 MB/s
16384+0 records in
16384+0 records out
68719476736 bytes (69 GB, 64 GiB) copied, 703.096 s, 97.7 MB/s
ubuntu@ubuntu:~$
```

Go back to debain, list directory to see if the image has sent over

```
pattrapohn@pattrapohn: ~
attrapohn@pattrapohn:~$ ls -lh /srv/images
otal 5.6G
rw-rw-r-- 1 pattrapohn pattrapohn 5.6G Jan  3 05:17 ubuntu2404_vm.img.gz
attrapohn@pattrapohn:~$
```

Open live ubuntu then use the command to restore the image

```
ubuntu@ubuntu:~$ ssh pattrapohn@192.168.139.135 "cat /srv/images/ubuntu2404_vm.i
mg.gz" | gzip -d | sudo dd of=/dev/sda bs=4M status=progress
The authenticity of host '192.168.139.135 (192.168.139.135)' can't be establishe
d.
ED25519 key fingerprint is SHA256:ypJ+QwLalSWM9PiWxuYETgFH8j2EkScAjIETOZgUuHA.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.135' (ED25519) to the list of known host
s.
pattrapohn@192.168.139.135's password:
68603641856 bytes (69 GB, 64 GiB) copied, 519 s, 132 MB/s
0+2071391 records in
0+2071391 records out
68719476736 bytes (69 GB, 64 GiB) copied, 519.868 s, 132 MB/s
ubuntu@ubuntu:~$
```