Template Week 5 – Operating Systems

Student number:

578848

Assignment 5.1: Unix-like

a) Find out what the difference is between UNIX and unix-like operating systems?
UNIX is separate operating system, while Unix-like system are other systems that resemble UNIX behaviour but are different in some ways.

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: He created UNIX, B programming language.
Dennis Ritchie: He created the C programming language and co-developed UNIX.
Bill Joy: He was a major contributor to BSD UNIX and he also helped design early versions of TCP/IP.
Richard Stallman: He founded the Free Software Movement/Foundation and the GNU Project. He also developed GCC compiler.
Linus Torvalds: He created Linux and GIT.

c) What is the philosophy of the GNU movement?
It says that users should have freedom to run, study, share, and modify software.

d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.
Eventhough Ubuntu is mostly built using GNU components, Ubuntu doesn't follow the GNU movement's idea of 100% free software.

e) Find out what is the Windows Subsystem for Linux?
It allows you to run Linux environment on your Windows machine.

f) Find out, which operating system family belongs to Android, iOS and ChromeOS?
Android and ChromeOS are UNIX-like and are based on Linux, while iOS is also UNIX-like but based on BSD/macOS.

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 in fields that require heavy calculations, like: Weather forecasting, Engineering and Aerospace, Medicine, Biology and Scientific Researches.

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?
Basically, people were making supercomputers out of PS3 consoles, because it was cheaper to just use PS3's Cell CPU than buying specialized hardware.
Even U.S. Air Force used it; They built a computer called Condor Cluster, that housed 1760 PS3 Consoles and it was ranked 33rd most powerful supercomputer.

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 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/
No, it doesn't even come close. Raspberry Pi's are super low-power, you would need tenth of thousands of them to even come close.

e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?
They use a custom AMD Zen 2 architecture.

What operating systems run on these consoles?
PS5 uses Orbis OS (Based on FreeBSD).
Xbox uses Xbox OS (Based on Windows NT)

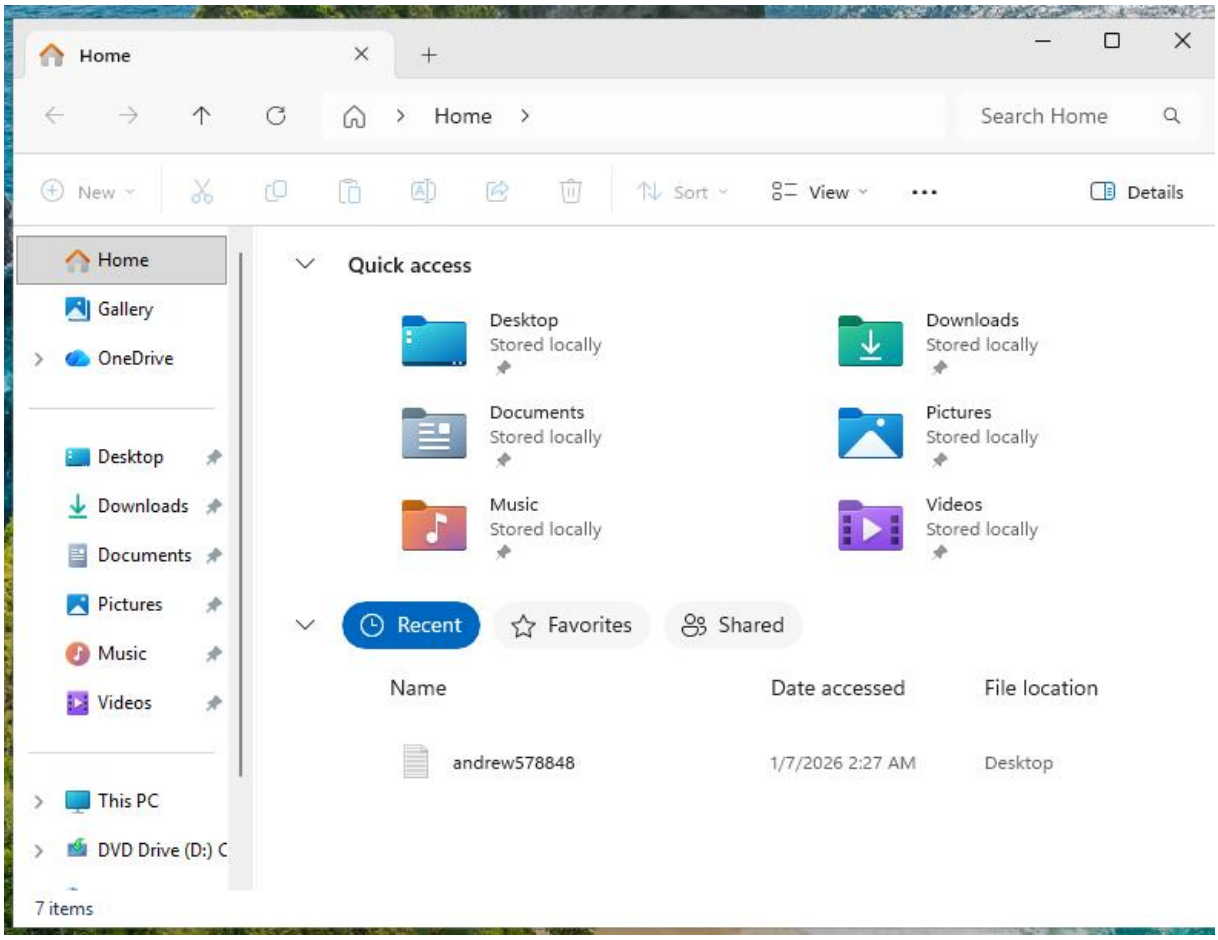
What conclusion can you draw from the answer to the previous question?
PS5 and Xbox are just computers, optimized and marketed as gaming consoles.

Assignment 5.3: Working with Windows

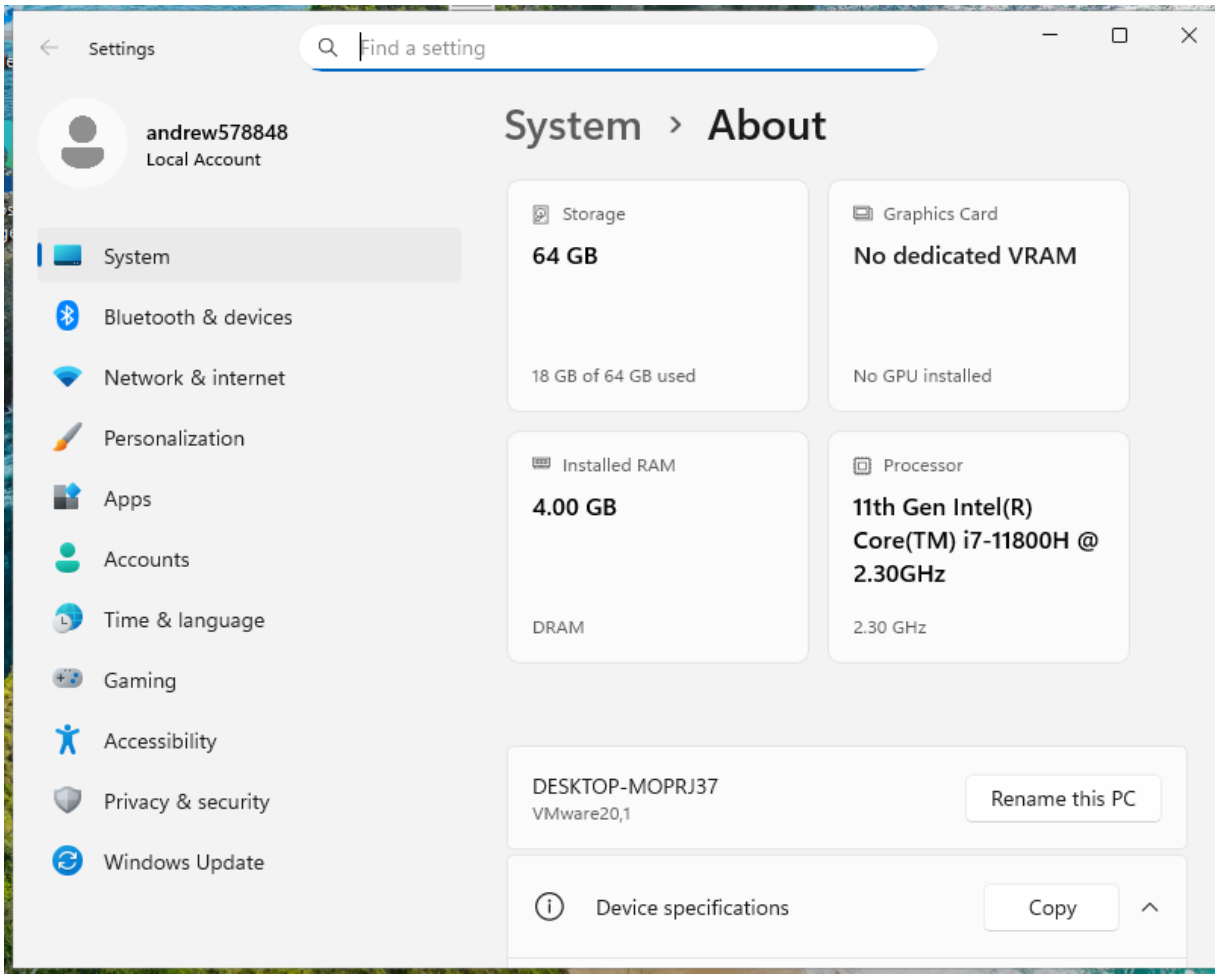
Take relevant screenshots of the assignments below

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.

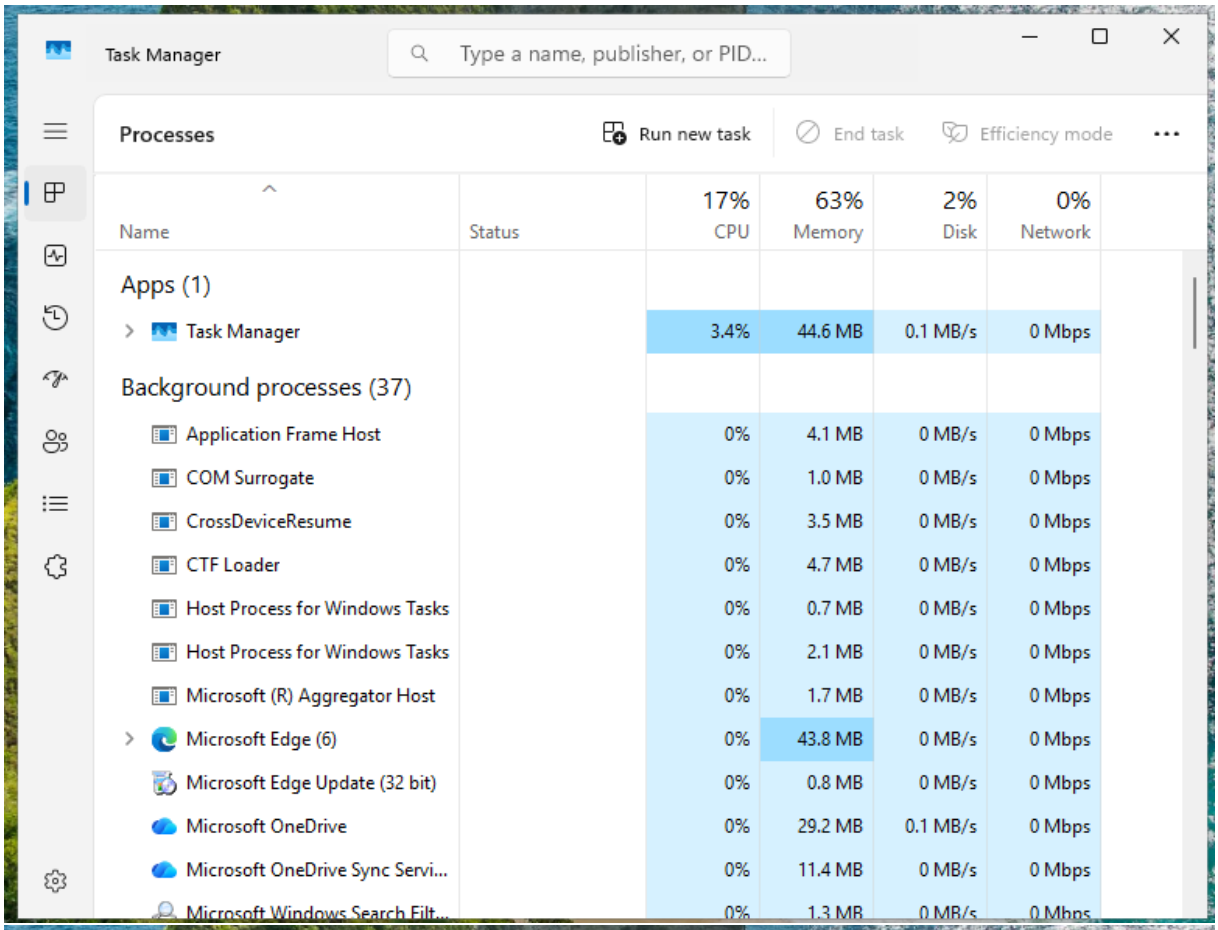
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?
Win + X + E

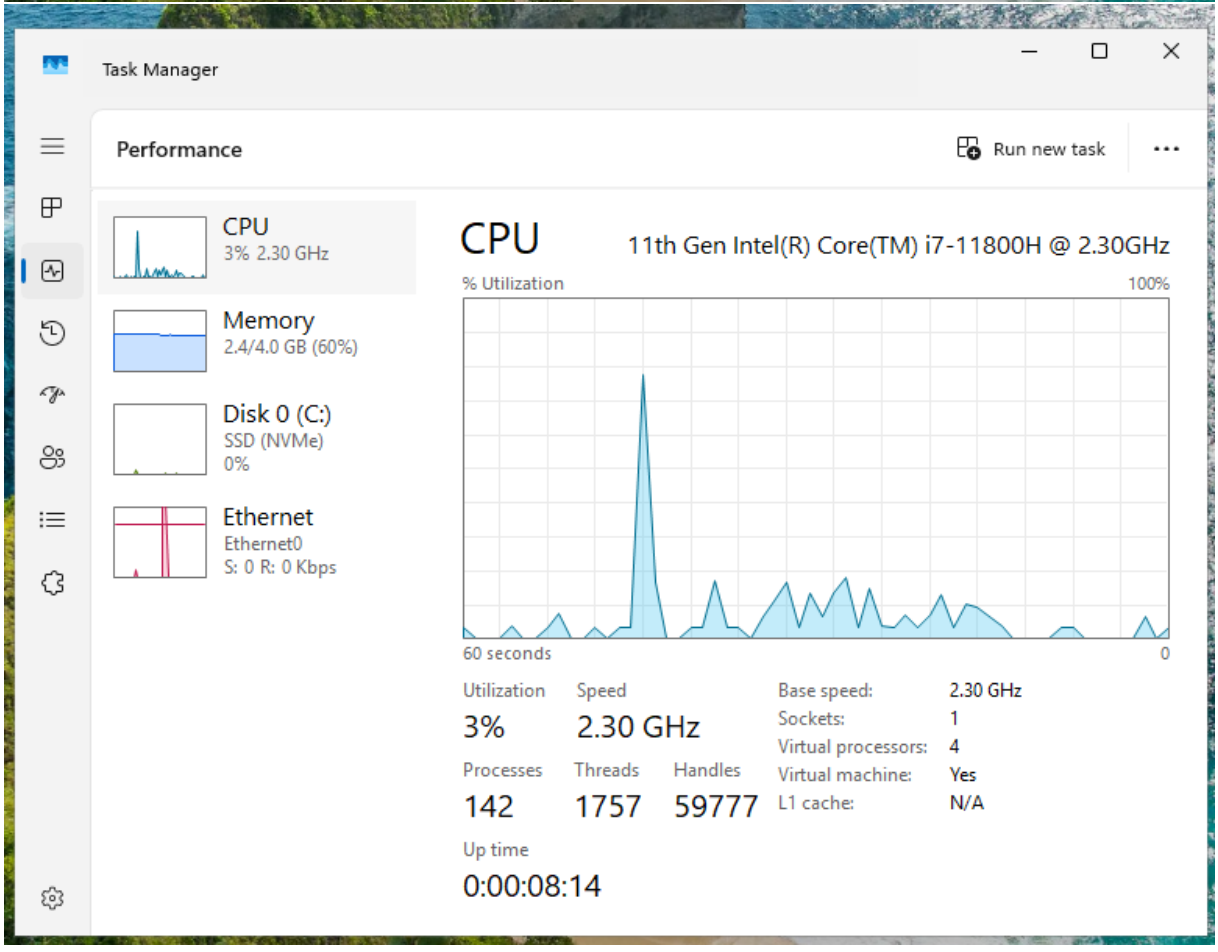


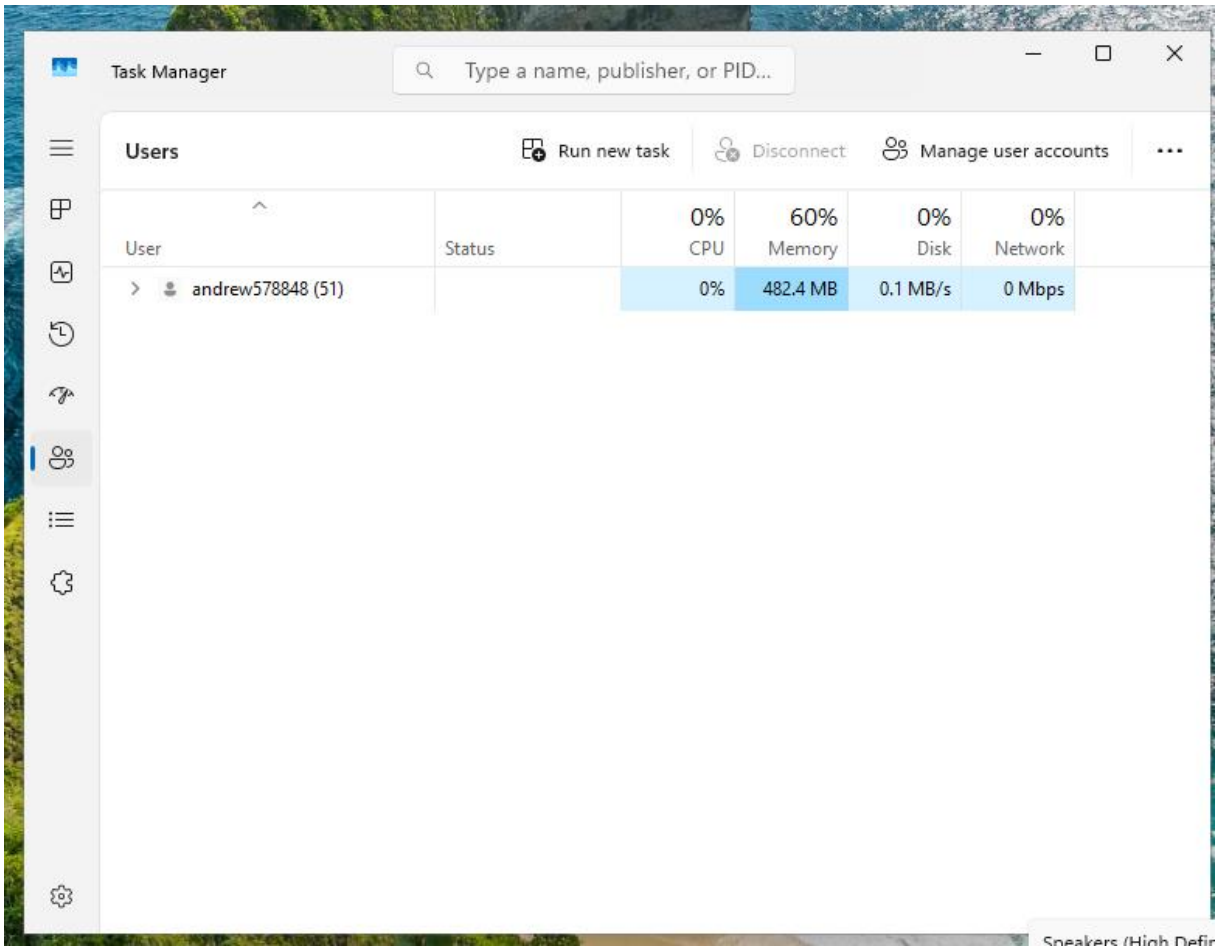
c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.
Win + X + Y



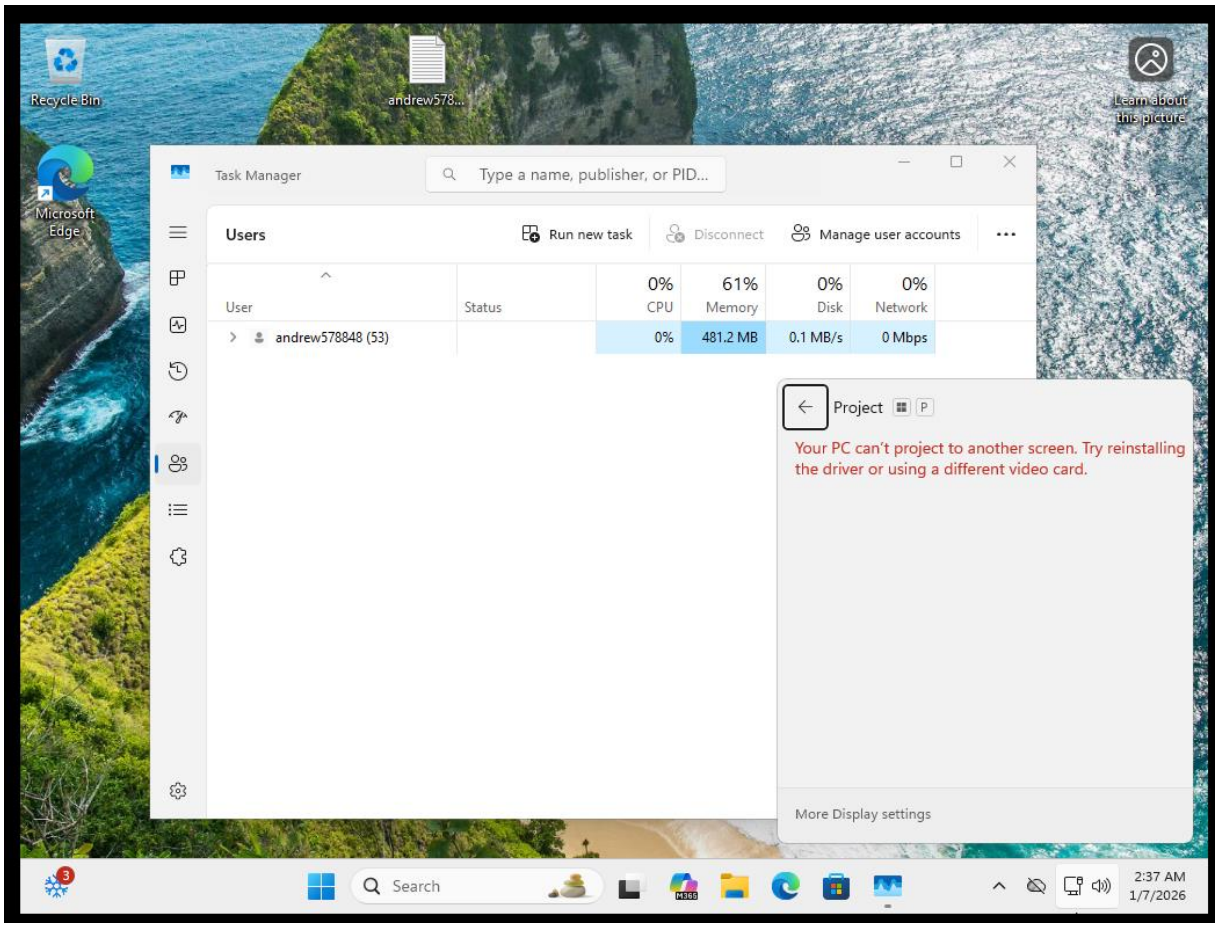
d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.
Ctrl + Shift + Esc


Task Manager
Type a name, publisher, or PID...
Processes
Run new task
End task
Efficiency mode
Name
Status
17%
CPU
63%
Memory
2%
Disk
0%
Network
Apps (1)
Task Manager
3.4%
44.6 MB
0.1 MB/s
0 Mbps
Background processes (37)
Application Frame Host
COM Surrogate
CrossDeviceResume
CTF Loader
Host Process for Windows Tasks
Host Process for Windows Tasks
Microsoft (R) Aggregator Host
Microsoft Edge (6)
Microsoft Edge Update (32 bit)
Microsoft OneDrive
Microsoft OneDrive Sync Servi...
Microsoft Windows Search Filt...


Task Manager
Performance
Run new task
CPU
3% 2.30 GHz
Memory
2.4/4.0 GB (60%)
Disk 0 (C:)
SSD (NVMe)
0%
Ethernet
Ethernet0
S: 0 R: 0 Kbps
CPU
11th Gen Intel(R) Core(TM) i7-11800H @ 2.30GHz
% Utilization
100%
60 seconds
0
Utilization
3%
Speed
2.30 GHz
Processes
142
Threads
1757
Handles
59777
Up time
0:00:08:14
Base speed:
2.30 GHz
Sockets:
1
Virtual processors:
4
Virtual machine:
Yes
L1 cache:
N/A

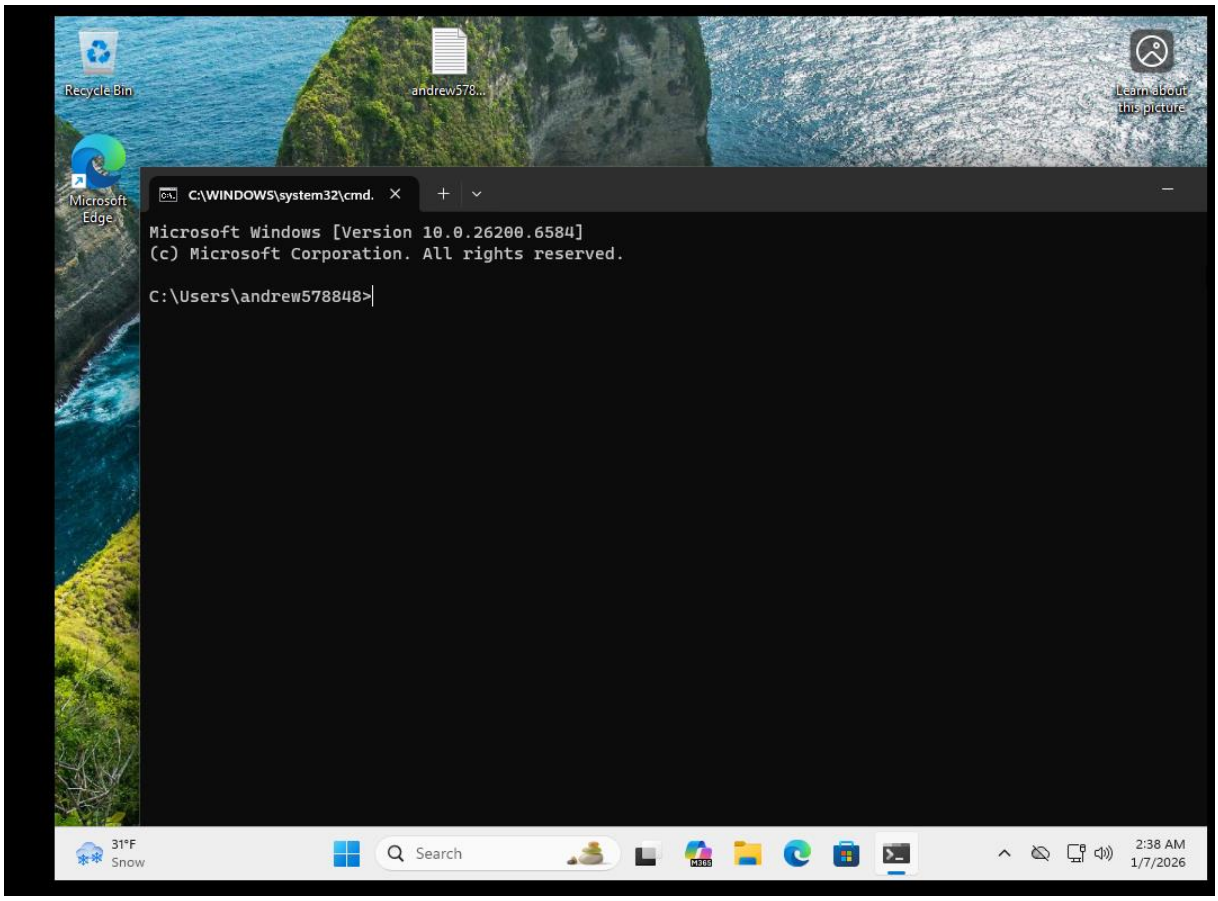


e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector, 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

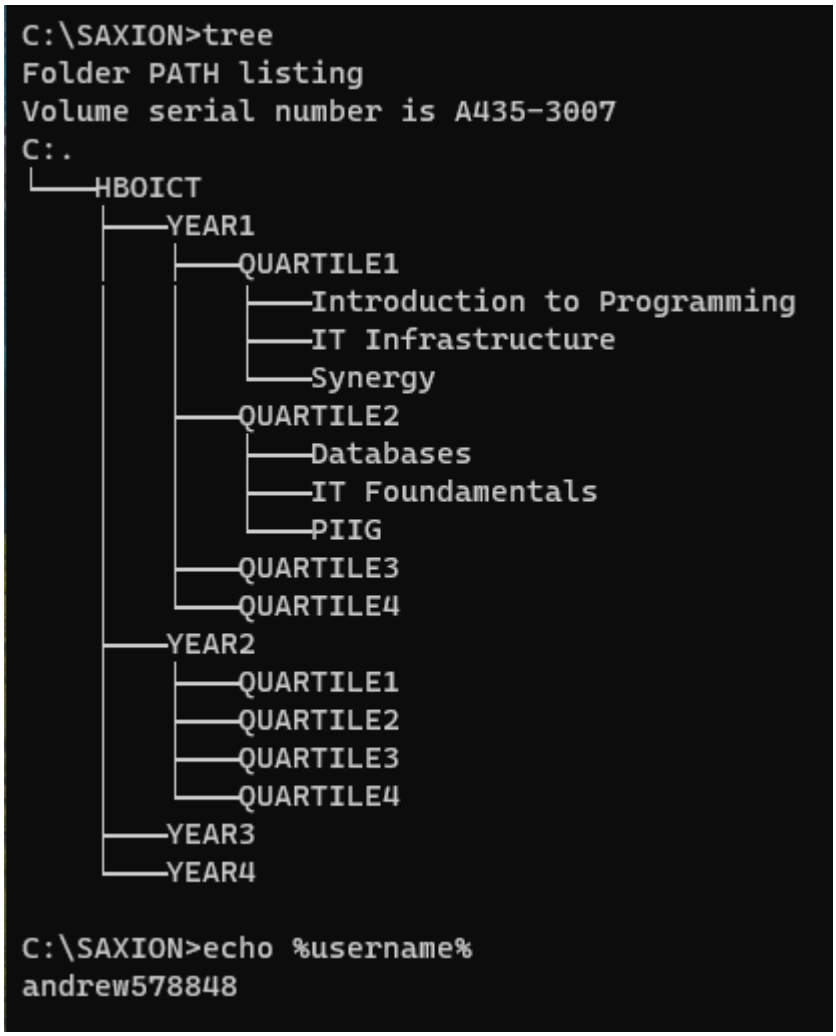


Working in the File Explorer

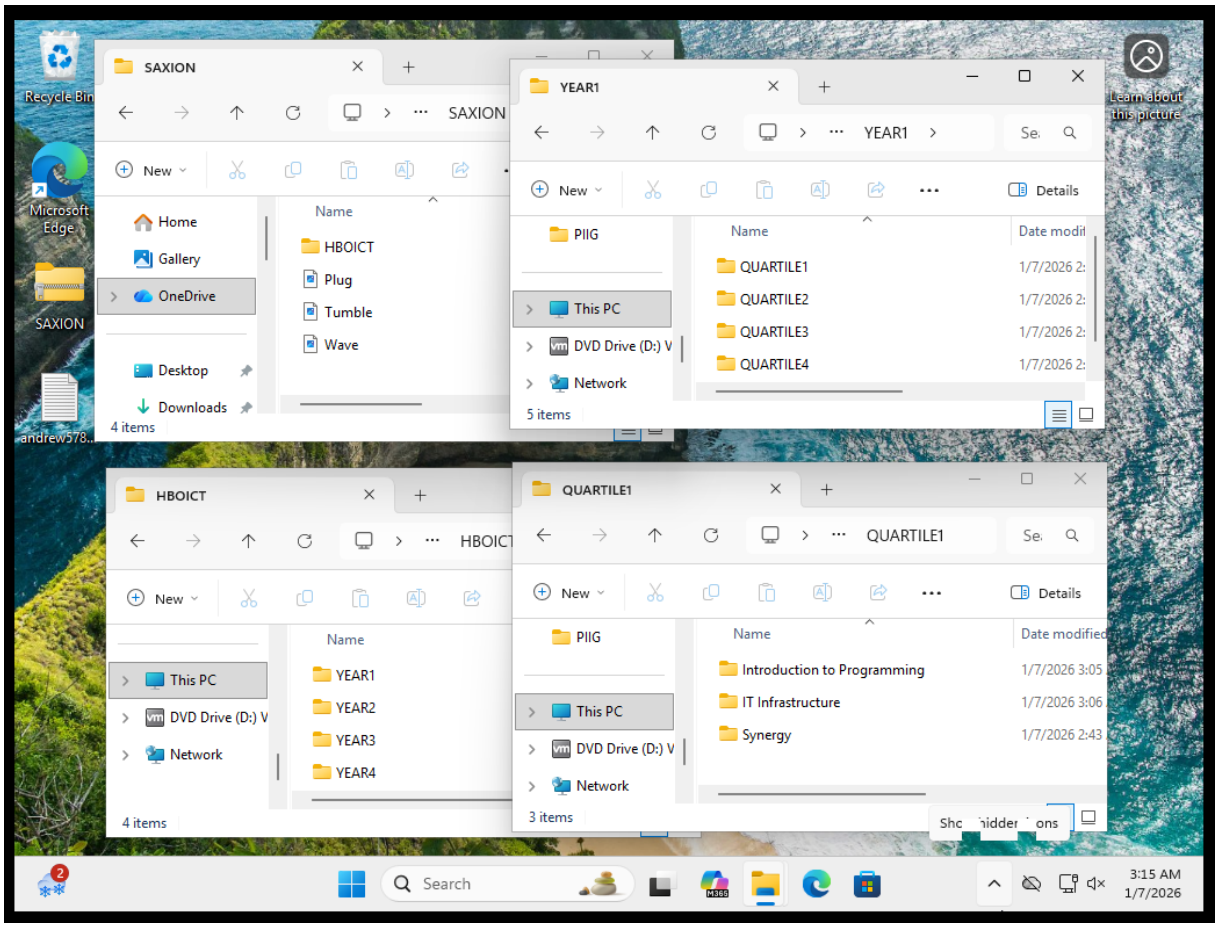
Relevant screenshots **copy** command:

```
C:\SAXION>copy Wave.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction to Programming"
        1 file(s) copied.

C:\SAXION>copy Plug.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1\IT Infrastructure"
        1 file(s) copied.

C:\SAXION>copy Tumble.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1Synergy"
        1 file(s) copied.
```

Relevant screenshots **tree** command:

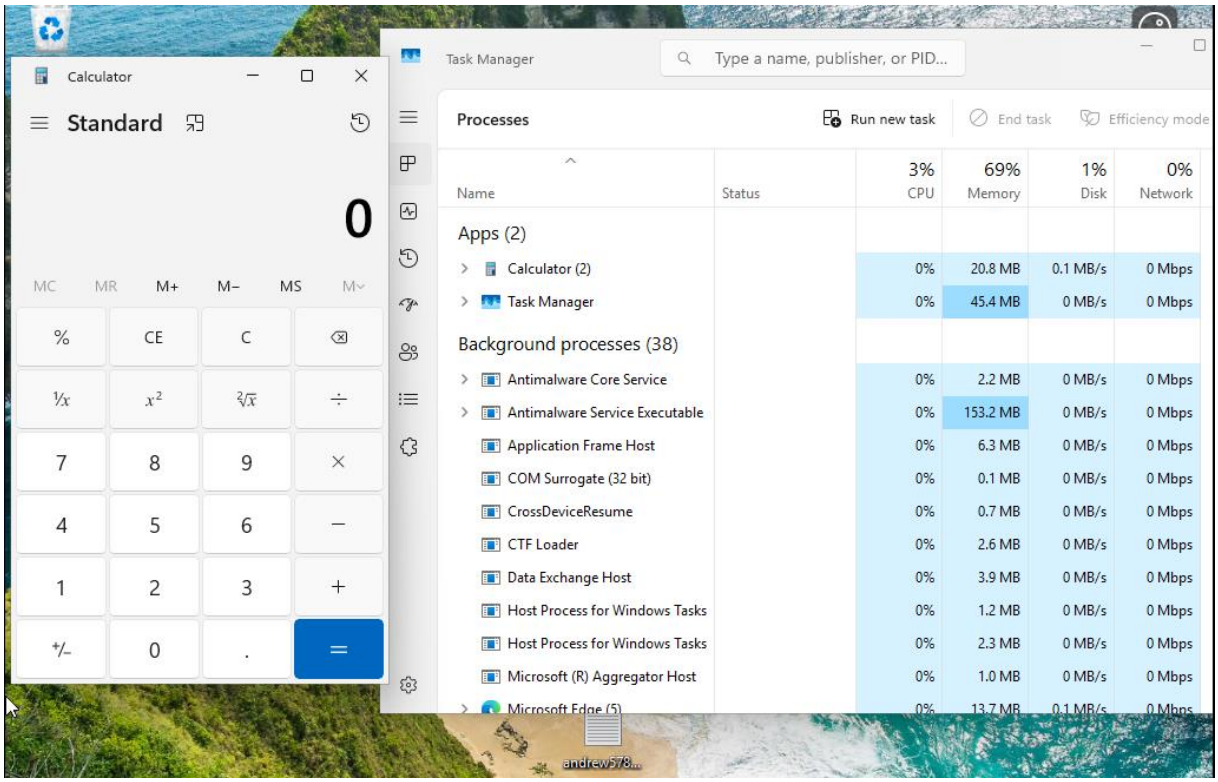


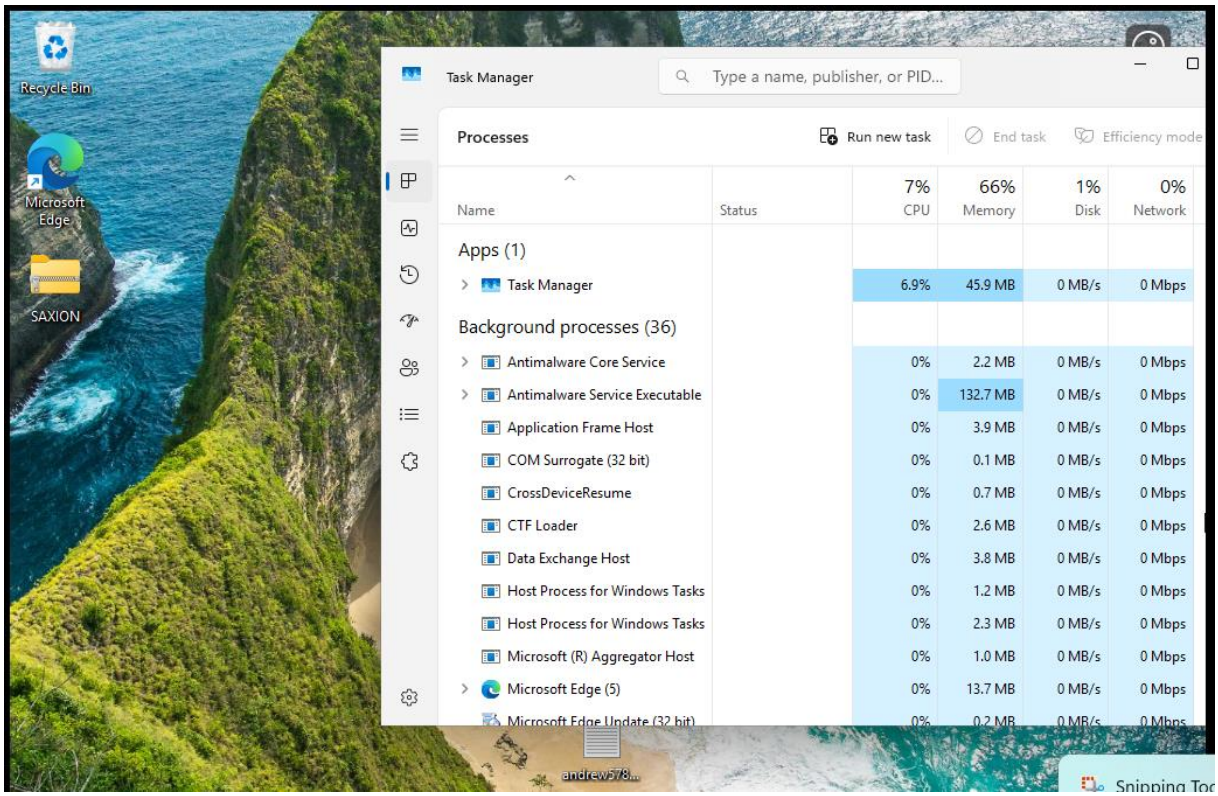
Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



Terminating Processes

Relevant Screenshots Task Manager Window:





Install Software

Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++

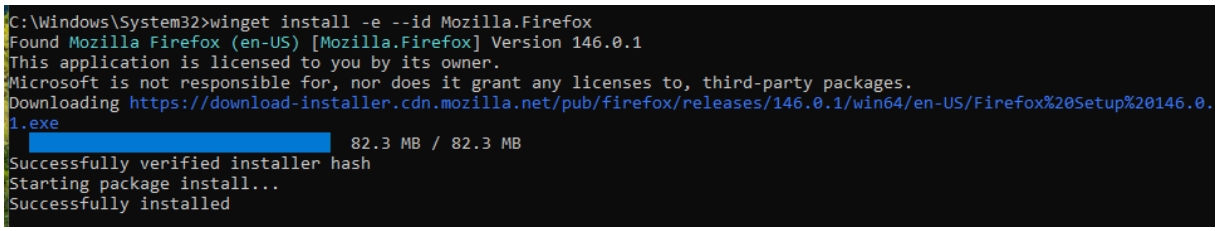
- 7zip

In winget install -e --id Mozilla.Firefox:

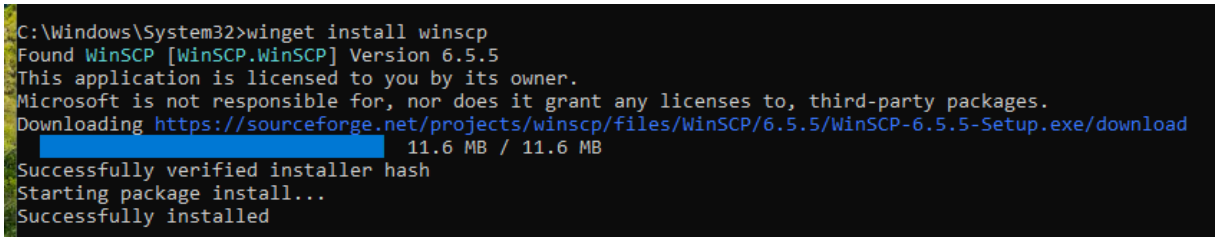
-e: Matches the exact provided string

--id: Allows you to provide a specific ID for installation

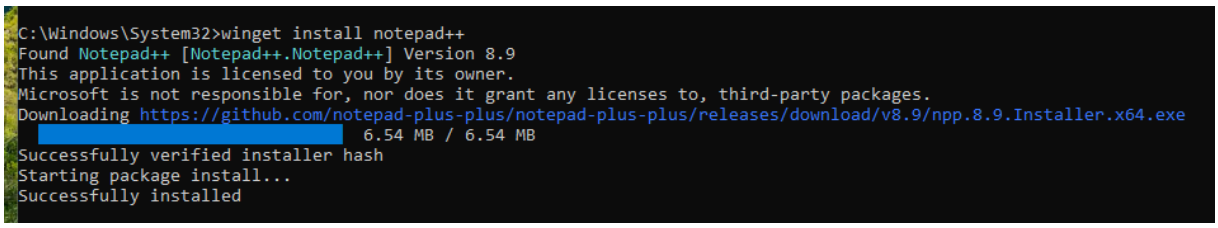
Firefox:



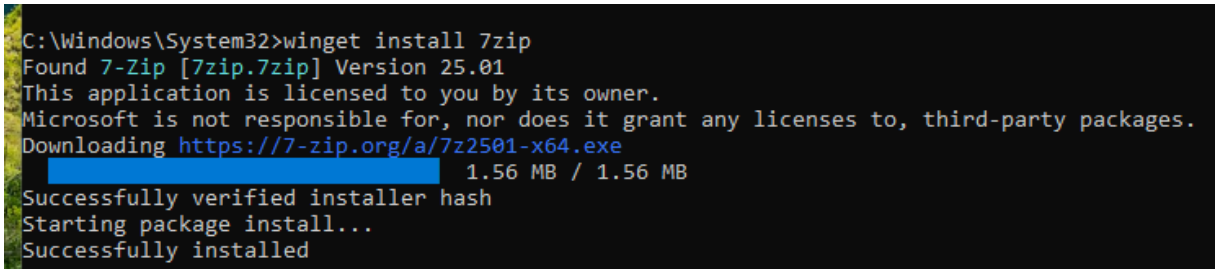
WinSCP:



Notepad++:



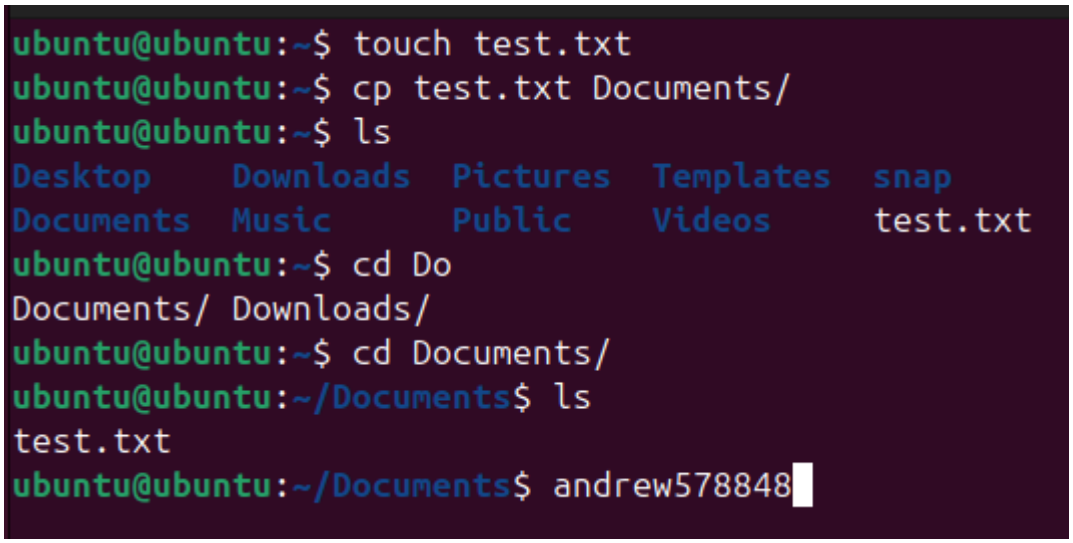
7zip:

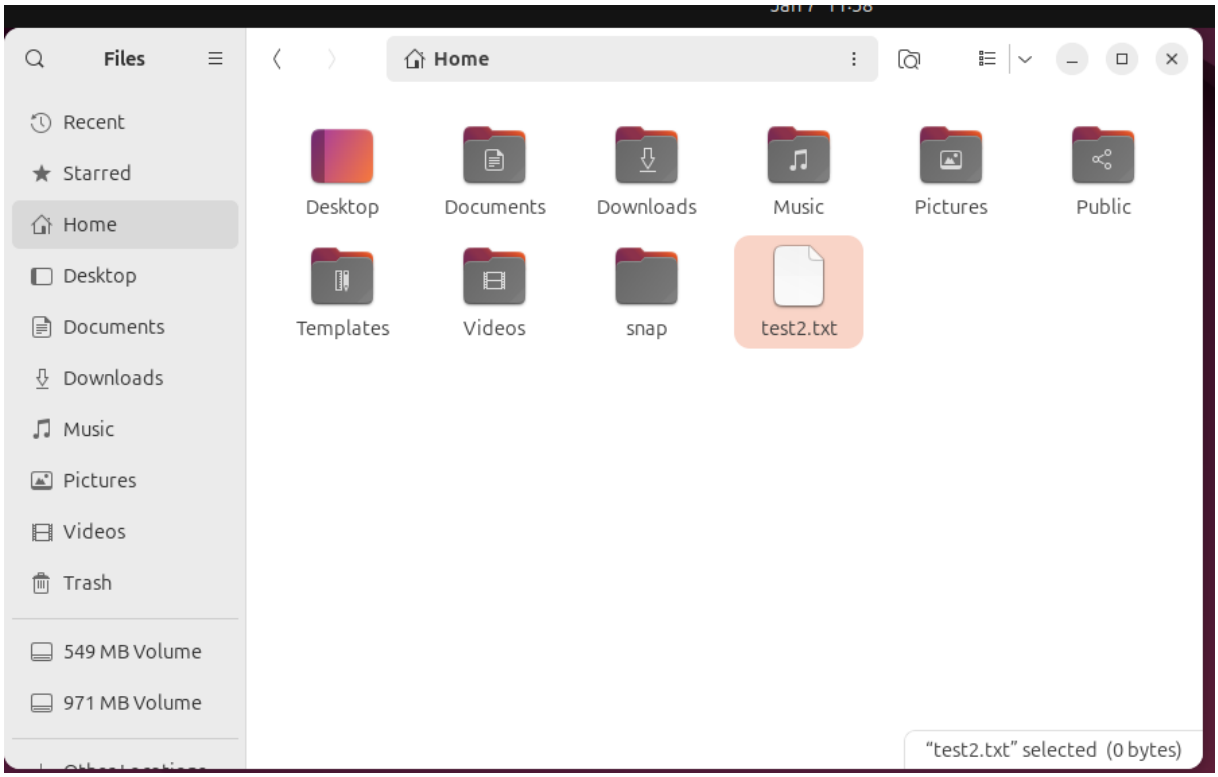


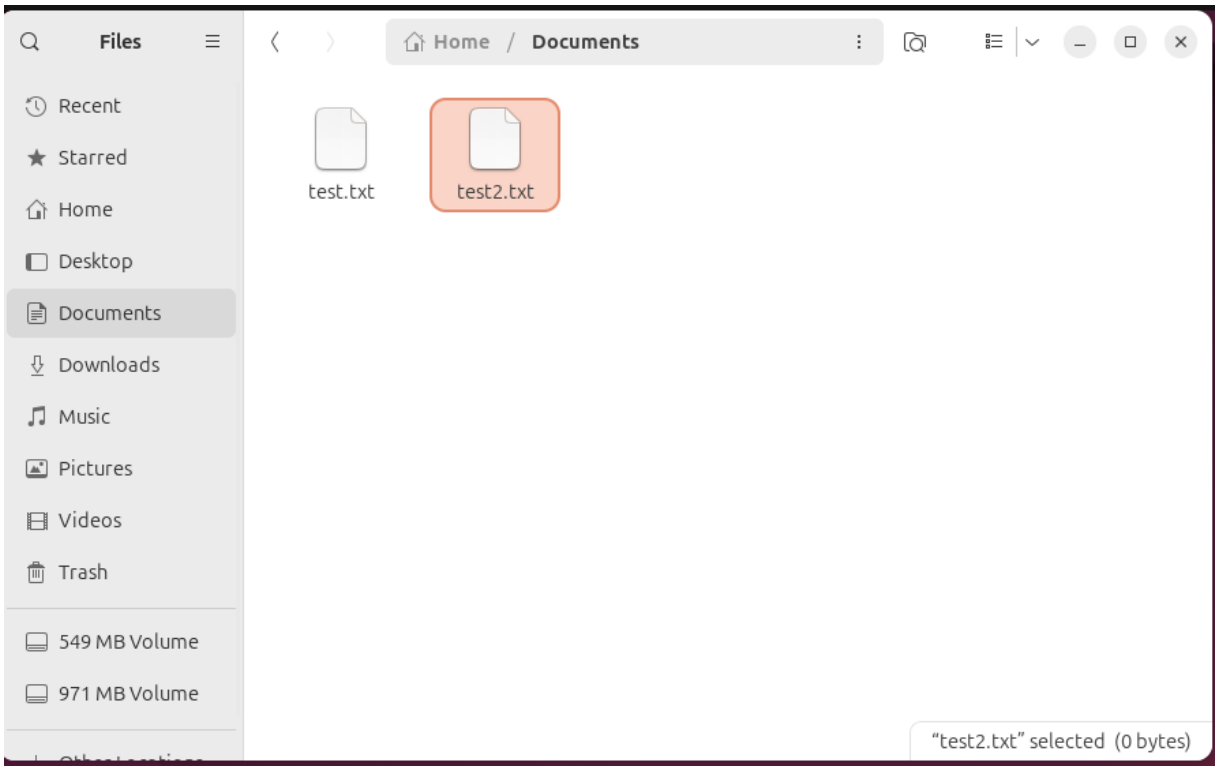
Assignment 5.4: Working with Linux

Relevant screenshots + motivation

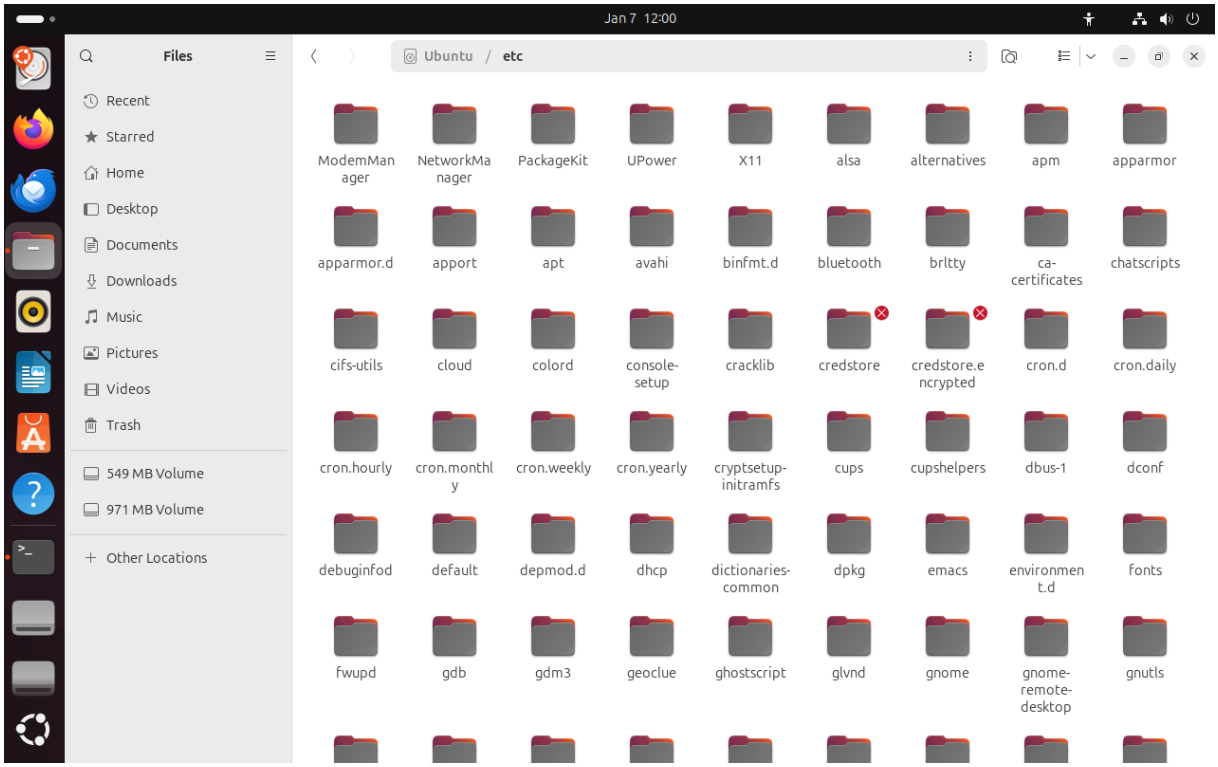
Copying files:







Navigating the file structure:



```
ubuntu@ubuntu:/$ ls
bin                dev   lib.usr-is-merged  opt   run                srv  var
bin.usr-is-merged  etc   lib64              proc  sbin               sys
boot               home  media              rofs  sbin.usr-is-merged tmp
cdrom              lib   mnt                root  snap               usr
ubuntu@ubuntu:/$ cd etc
ubuntu@ubuntu:/etc$ cd -
/
ubuntu@ubuntu:/$ andrew578848
```

The main difference in Linux and Windows FS's, is that Linux stores everything in unified root directory (/), while Widows uses drives. (C:, D:)

The /etc directory stores all system configuration files.

Compress files:

tar -czf [name] [file] – command for compressing.

-c stands for create

-z stands for gzip compression

-f stands for output name

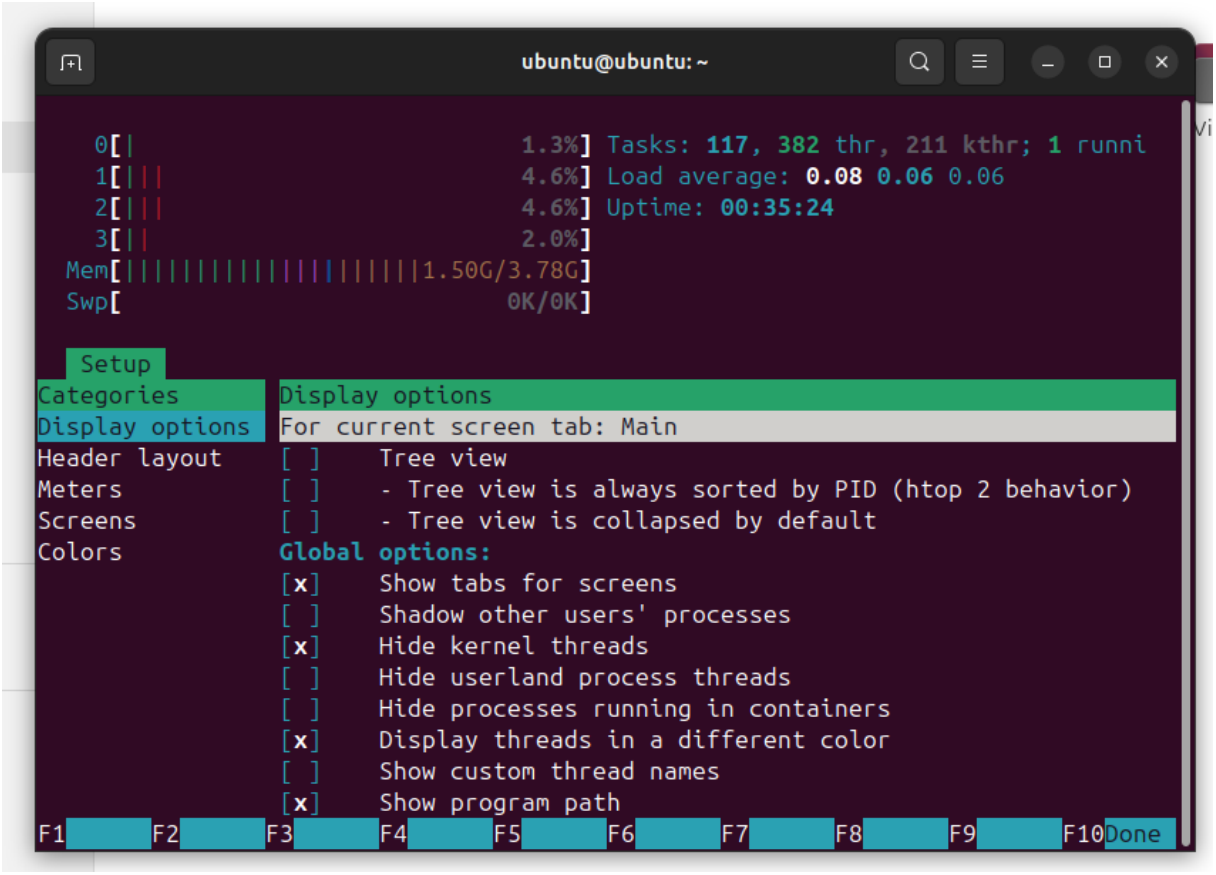
tar -zxf [name] [file] – command for extracting.

-x stands for extract

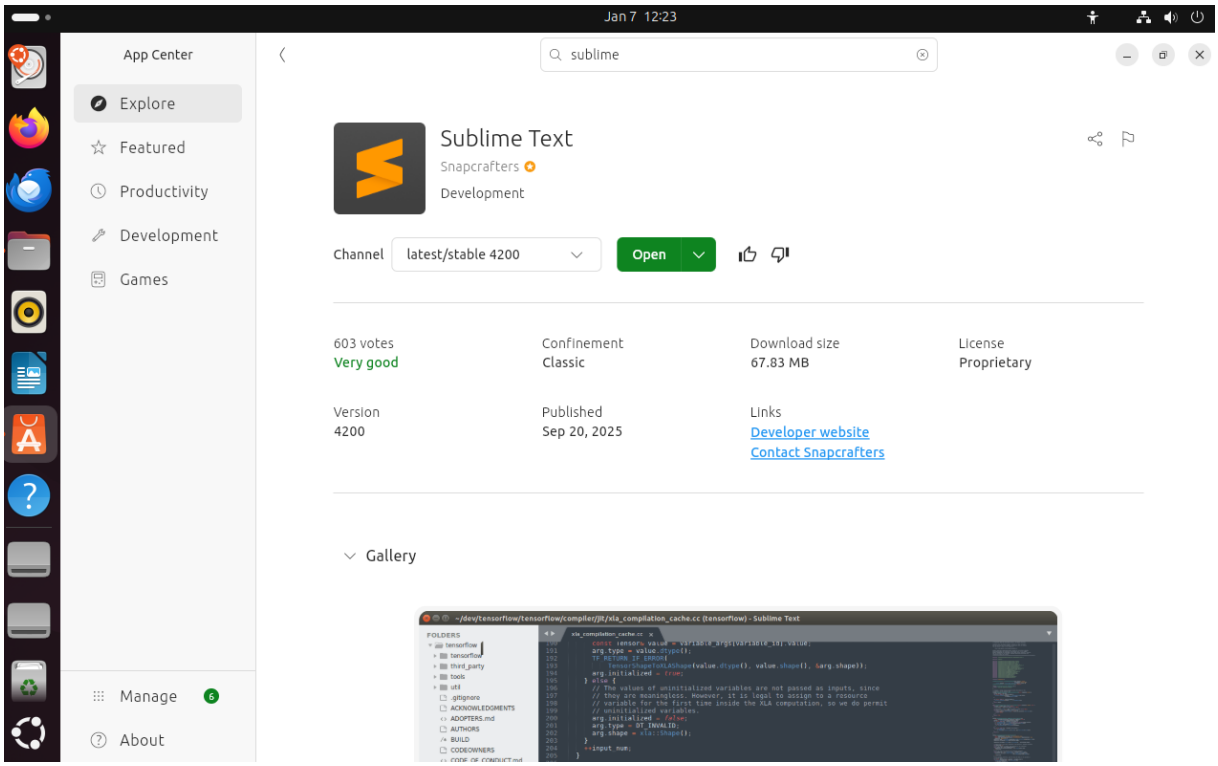
```
ubuntu@ubuntu:~$ tar -zxf compressed.tar.gz test.txt
ubuntu@ubuntu:~$ ls
Desktop    Downloads  Pictures  Templates  snap
Documents  Music      Public    Videos     test.txt
ubuntu@ubuntu:~$ tar -czf compressed.tar.gz test.txt
ubuntu@ubuntu:~$ ls
Desktop    Downloads  Pictures  Templates  compressed.tar.gz  test.txt
Documents  Music      Public    Videos     snap
ubuntu@ubuntu:~$ tar -zxf compressed.tar.gz test.txt
ubuntu@ubuntu:~$ ls
Desktop    Downloads  Pictures  Templates  compressed.tar.gz  test.txt
Documents  Music      Public    Videos     snap
ubuntu@ubuntu:~$ rm -rf test.txt
ubuntu@ubuntu:~$ ls
Desktop    Downloads  Pictures  Templates  compressed.tar.gz
Documents  Music      Public    Videos     snap
ubuntu@ubuntu:~$ tar -zxf compressed.tar.gz test.txt
ubuntu@ubuntu:~$ ls
Desktop    Downloads  Pictures  Templates  compressed.tar.gz  test.txt
Documents  Music      Public    Videos     snap
ubuntu@ubuntu:~$ andrew578848
```

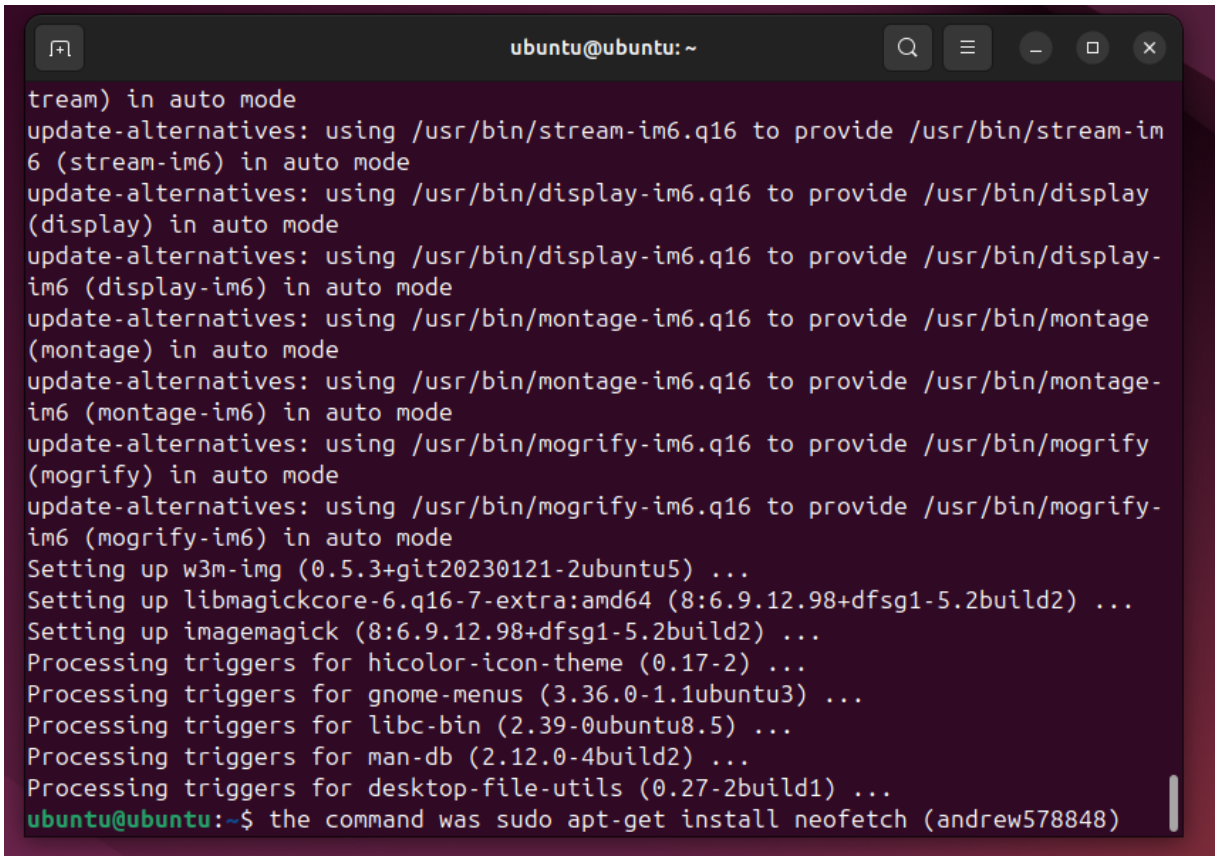
View processes:

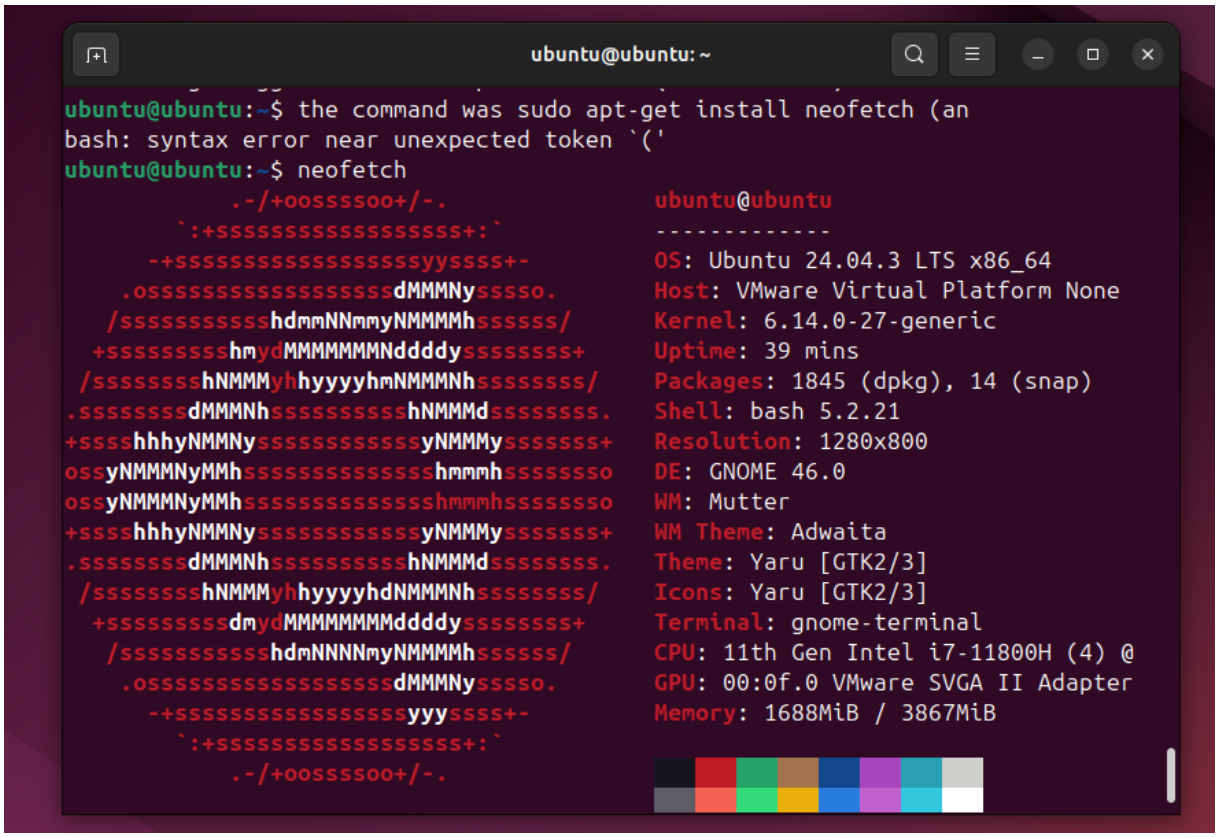
htop works like a task manager in Windows. It shows information about all your processes and memory usage.



Installing Software:


Jan 7 12:23
App Center
Explore
Featured
Productivity
Development
Games
Manage
About
sublime
Sublime Text
Snapcrafters
Development
Channel
latest/stable 4200
Open
603 votes
Very good
Confinement
Classic
Download size
67.83 MB
License
Proprietary
Version
4200
Published
Sep 20, 2025
Links
Developer website
Contact Snapcrafters
Gallery

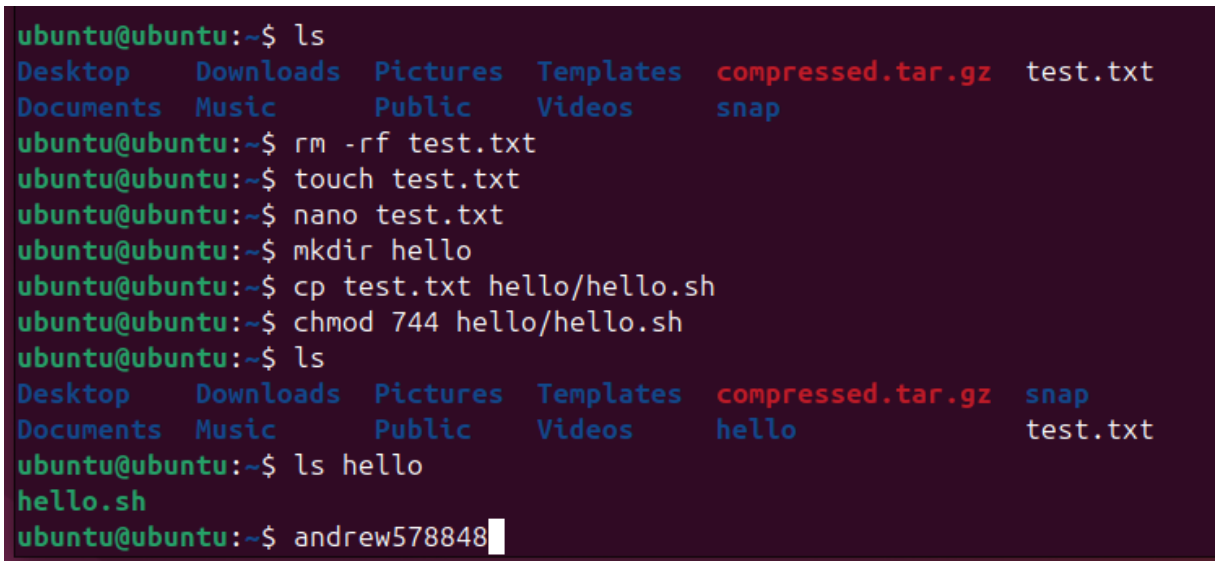

ubuntu@ubuntu: ~
tream) in auto mode
update-alternatives: using /usr/bin/stream-im6.q16 to provide /usr/bin/stream-im
6 (stream-im6) in auto mode
update-alternatives: using /usr/bin/display-im6.q16 to provide /usr/bin/display
(display) in auto mode
update-alternatives: using /usr/bin/display-im6.q16 to provide /usr/bin/display-
im6 (display-im6) in auto mode
update-alternatives: using /usr/bin/montage-im6.q16 to provide /usr/bin/montage
(montage) in auto mode
update-alternatives: using /usr/bin/montage-im6.q16 to provide /usr/bin/montage-
im6 (montage-im6) in auto mode
update-alternatives: using /usr/bin/mogrify-im6.q16 to provide /usr/bin/mogrify
(mogrify) in auto mode
update-alternatives: using /usr/bin/mogrify-im6.q16 to provide /usr/bin/mogrify-
im6 (mogrify-im6) in auto mode
Setting up w3m-img (0.5.3+git20230121-2ubuntu5) ...
Setting up libmagickcore-6.q16-7-extra:amd64 (8:6.9.12.98+dfsg1-5.2build2) ...
Setting up imagemagick (8:6.9.12.98+dfsg1-5.2build2) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1.1ubuntu3) ...
Processing triggers for libc-bin (2.39-0ubuntu8.5) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
ubuntu@ubuntu:~$ the command was sudo apt-get install neofetch (andrew578848)



It shows details about my system.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

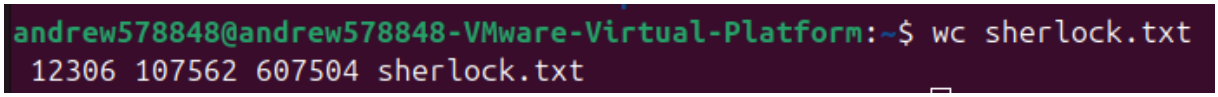


Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat, wc, less, tail, head & grep:

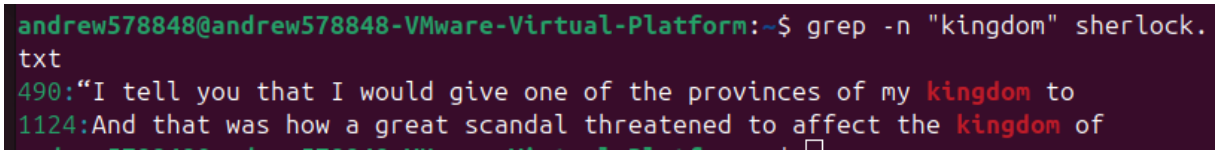
- **cat: Displays the contents of the file.**
- **wc: Basically, means word count, it counts words.**
- **less: Also opens a file, but with a scrollable thingy**
- **tail: Shows last 10 lines of the file**
- **head: Show first 10 lines of the file**
- **grep: Searches for text inside of a file**



Lines: 12306

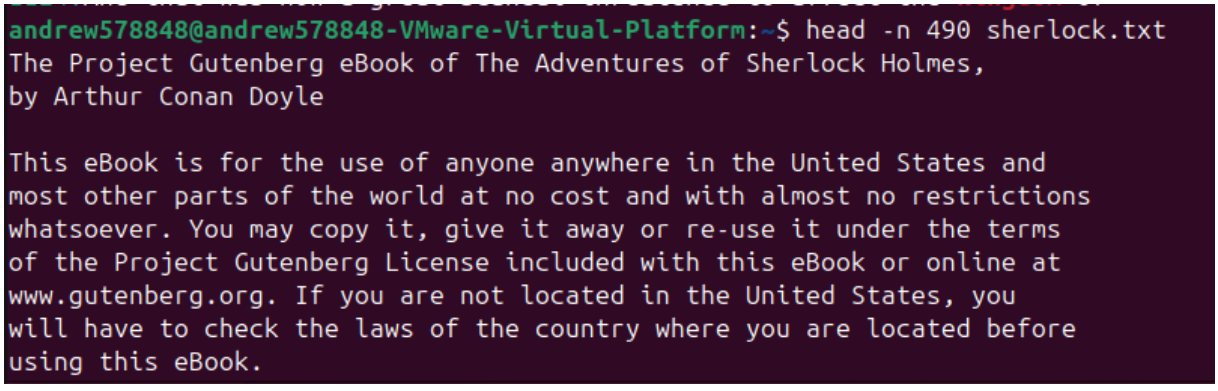
Words: 107562

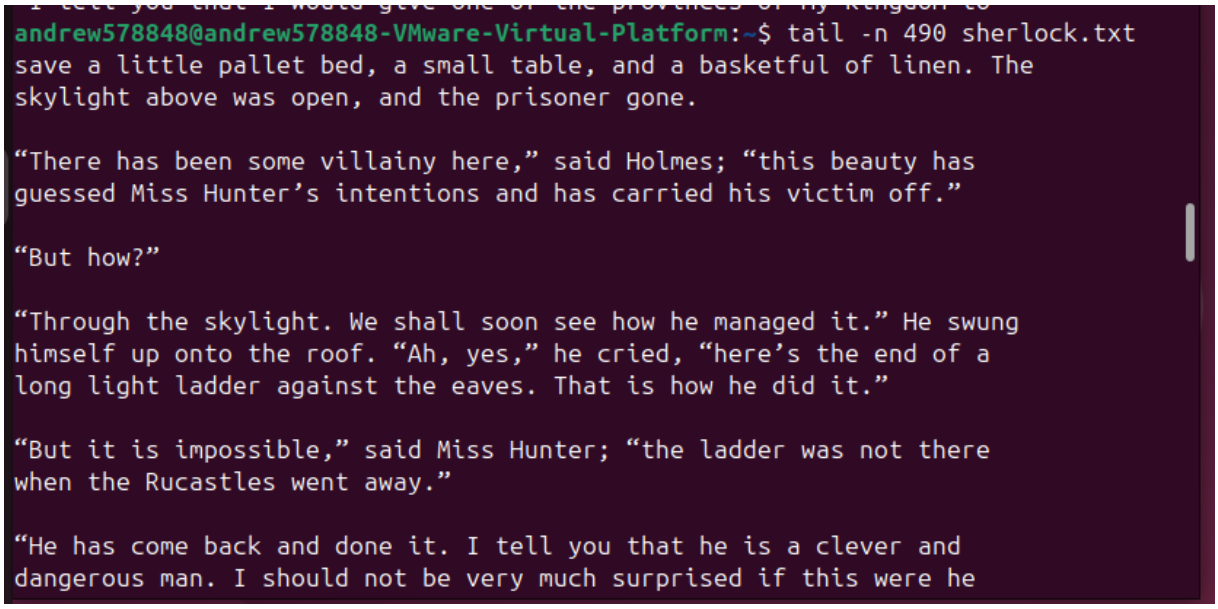
Characters: 607504



Lines with word “kingdom”: 2

Above and below the word kingdom:





Assignment 5.7: Digital forensics

Relevant screenshots + motivation

EXIF:

```
andrew578848@andrew578848-VMware-Virtual-Platform:~$ exif oldcar.jpg
EXIF tags in 'oldcar.jpg' ('Motorola' byte order):
--------------------+------------------------------------------------------------
Tag                 |Value
--------------------+------------------------------------------------------------
Manufacturer        |motorola
Model               |moto g(6) play
X-Resolution        |72
Y-Resolution        |72
Resolution Unit     |Inch
Software            |aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys
Date and Time       |2020:11:07 15:08:57
YCbCr Positioning   |Centered
Compression         |JPEG compression
X-Resolution        |72
Y-Resolution        |72
Resolution Unit     |Inch
Exposure Time       |1/33 sec.
F-Number            |f/2.0
Exposure Program    |Normal program
ISO Speed Ratings   |64
Exif Version        |Exif Version 2.2
Date and Time (Origi|2020:11:07 15:08:57
Date and Time (Digit|2020:11:07 15:08:57
Components Configura|Y Cb Cr -
Shutter Speed       |5.05 EV (1/33 sec.)
Aperture            |2.00 EV (f/2.0)
Brightness          |-1.00 EV (1.71 cd/m^2)
Exposure Bias       |0.00 EV
Maximum Aperture Val|2.00 EV (f/2.0)
```

Brand: Motorola

Type: Moto G(6) play

There are coordinates and they point to:
https://www.google.com/maps/place/53%C2%B011'39.7%22N+6%C2%B032'12.9%22E/@53.1944263,6.5357258,17z/data=!4m4!3m3!8m2!3d53.1943556!4d6.5369167?entry=ttu&g_ep=EgoyMDI1MTIwOS4wIKXMDSoASAFQAw%3D%3D

Located in Groningen, Netherlands.

Filename extensions:

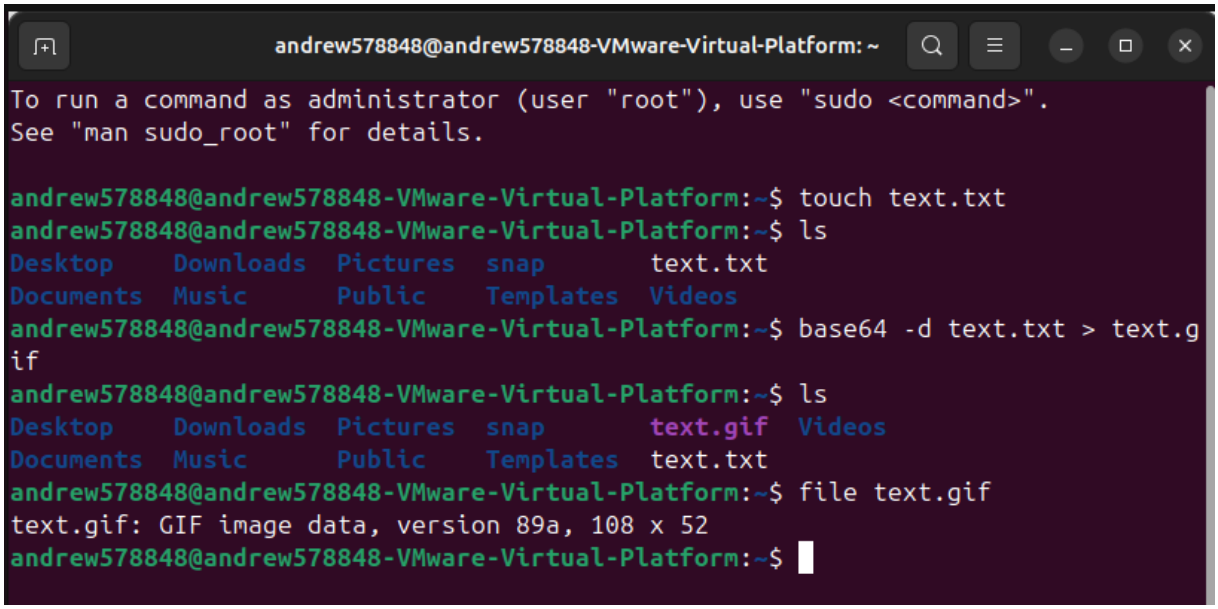
```
andrew578848@andrew578848-VMware-Virtual-Platform:~$ cp oldcar.jpg oldcar
andrew578848@andrew578848-VMware-Virtual-Platform:~$ ls
Desktop  Documents  Downloads  Music  oldcar  oldcar.jpg  Pictures  Public  snap  Templates  Videos
andrew578848@andrew578848-VMware-Virtual-Platform:~$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment length 16, Exif Standard: [TIFF image da
ta, big-endian, direntries=10, manufacturer=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=2020:11:07 15:08:57, GPS-Data], baseline,
 precision 8, 4160x3120, components 3
andrew578848@andrew578848-VMware-Virtual-Platform:~$
```

Surprisingly, yes, it does still consider it a JPEG file.

Assignment 5.8: Steganography

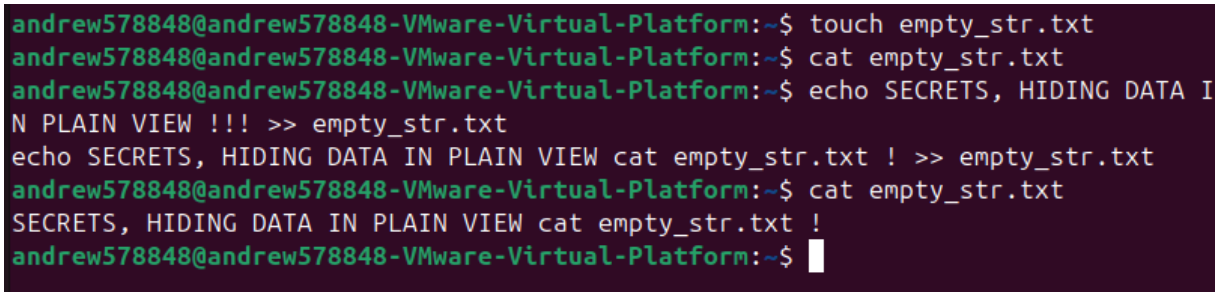
Relevant screenshots + motivation

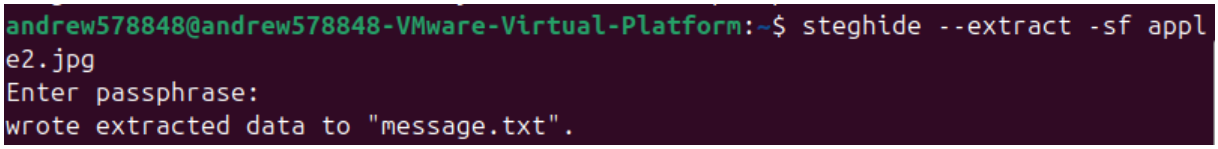
File extensions:



The command is: base64 -d text.txt > text.gif

Steganography:





The command is: steghide –extract -sf 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.

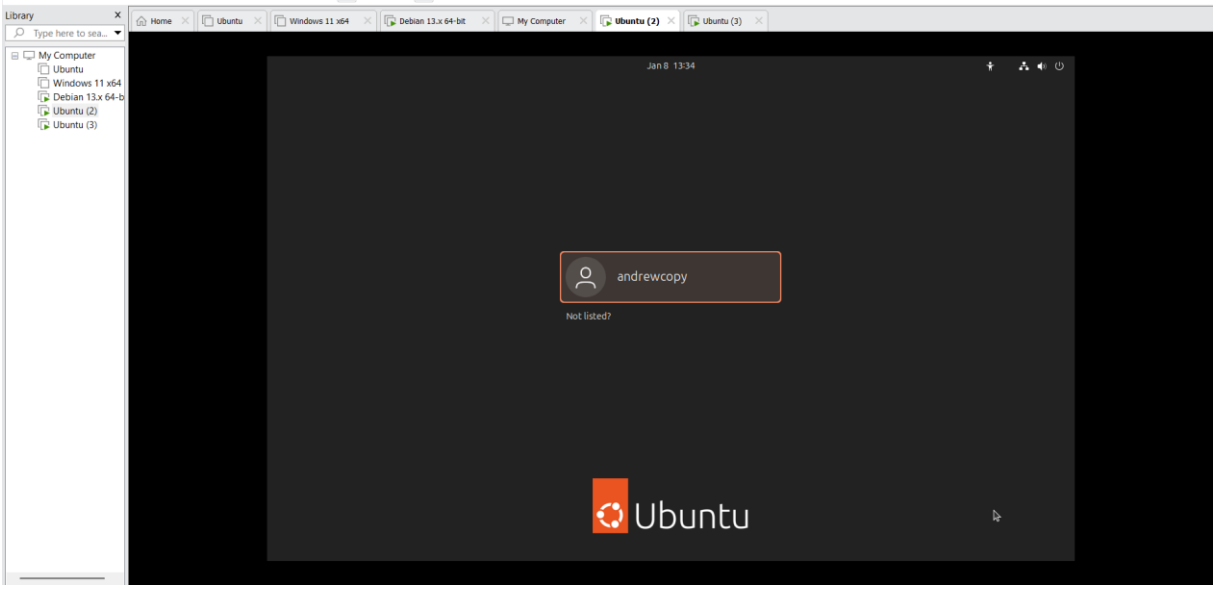
Debian configuration:

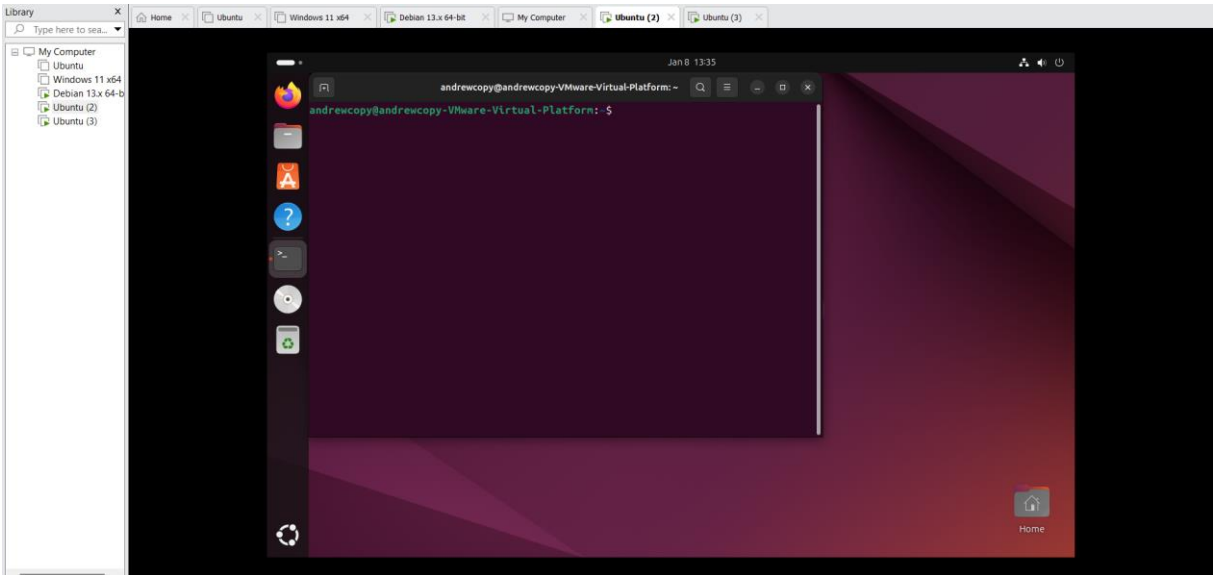
```
andrew@andrew578848:/srv/images$ sudo apt update
[sudo] password for andrew:
Hit:1 http://deb.debian.org/debian trixie InRelease
Hit:2 http://deb.debian.org/debian trixie-updates InRelease
Hit:3 http://security.debian.org/debian-security trixie-security InRelease
All packages are up to date.
andrew@andrew578848:/srv/images$ sudo mkdir -p /srv/images
andrew@andrew578848:/srv/images$ sudo chown $USER:$USER /srv/images
```

(The dir had been created previously; I just forgot to screenshot)

Ubuntu (Getting image) configuration:

```
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh andr
ew@192.168.110.134 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.110.134 (192.168.110.134)' can't be establishe
d.
ED25519 key fingerprint is SHA256:K4fix2Wp/eCLSVsQ5RK3TDNUm3yRbfzaVJavJW4k2vE.
This key is not known by any other names.
230686720 bytes (231 MB, 220 MiB) copied, 1 s, 229 MB/syeserprint])?
Warning: Permanently added '192.168.110.134' (ED25519) to the list of known host
s.
andrew@192.168.110.134's password:
21281898496 bytes (21 GB, 20 GiB) copied, 90 s, 236 MB/s
5120+0 records in
5120+0 records out
21474836480 bytes (21 GB, 20 GiB) copied, 91.0199 s, 236 MB/s
ubuntu@ubuntu:~$
```



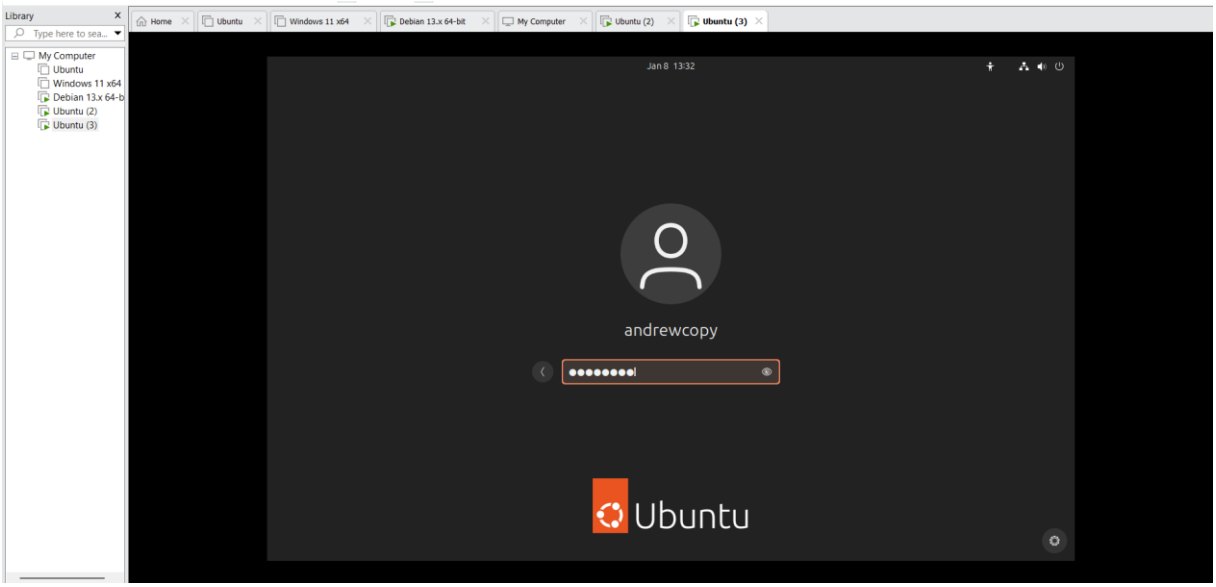


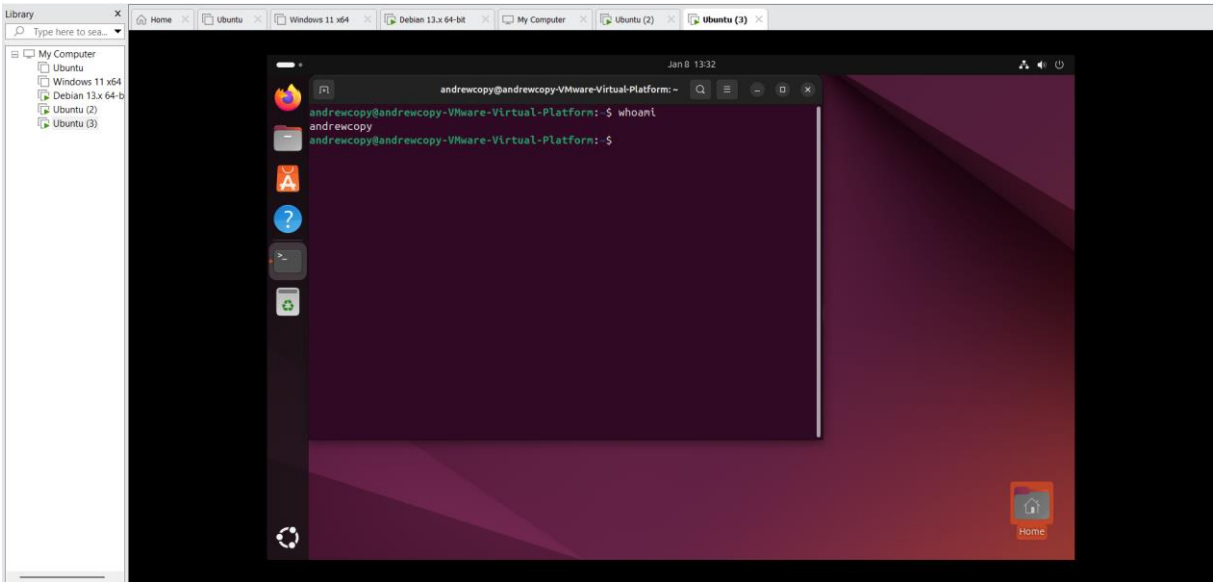
The system is going to look the same once I transfer it.

```
andrew@andrew578848:/srv/images$ ls
ubuntu2404_vm.img.gz
```

Ubuntu (Restoring image) configuration:

```
ubuntu@ubuntu:~$ ssh andrew@192.168.110.134 "cat /srv/images/ubuntu2404_vm.img.g
z" | gzip -d | sudo dd of=/dev/sda bs=4M status=progress
The authenticity of host '192.168.110.134 (192.168.110.134)' can't be establishe
d.
ED25519 key fingerprint is SHA256:K4fix2Wp/eCLSVsQ5RK3TDNUm3yRbfzaVJavJW4k2vE.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.110.134' (ED25519) to the list of known host
s.
andrew@192.168.110.134's password:
21356249088 bytes (21 GB, 20 GiB) copied, 77 s, 277 MB/s
0+651057 records in
0+651057 records out
21474836480 bytes (21 GB, 20 GiB) copied, 77.7985 s, 276 MB/s
```





Same user and data as in first VM.

Ready? Save this file and export it as a pdf file with the name: **week5.pdf**