

Template Week 5 – Operating Systems

Student number:

Assignment 5.1: Unix-like

- a) Find out what the difference is between UNIX and unix-like operating systems?

The difference is that Unix refers to the original, certified operating systems developed in the 1970s (like AIX, HP-UX, Solaris), while Unix-like refers to systems that imitate Unix's design and behavior (like Linux, FreeBSD, OpenBSD) but are not officially certified under the Single UNIX Specification.

- 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 and Dennis Ritchie created Unix and the C programming language at Bell Labs. Bill Joy expanded Unix into BSD and co-founded Sun Microsystems. Richard Stallman launched the GNU Project and the Free Software Foundation, pioneering free software ideals. Linus Torvalds created the Linux kernel and Git, shaping modern open-source computing.

- c) What is the philosophy of the GNU movement?

The philosophy of the GNU movement is centered on software freedom: users should have the right to run, study, modify, and share software. It rejects proprietary restrictions and promotes collaboration, transparency, and ethical use of technology.

- d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.

Ubuntu partly follows the GNU philosophy by being built on free software and GNU/Linux tools, but it diverges by including and promoting proprietary drivers and components for usability, which the GNU movement strictly opposes. In short, it balances GNU ideals with practical compromises to reach a wider audience.

- e) Find out what is the Windows Subsystem for Linux?

The Windows Subsystem for Linux (WSL) is a compatibility layer in Windows 10 and Windows 11 that allows users to run a full Linux environment (including distributions like Ubuntu, Debian, and Kali) directly on Windows, without needing a virtual machine or dual boot.

- f) Find out, which operating system family belongs to Android, iOS and ChromeOS?

All three (Android, iOS, ChromeOS) belong to the Unix-like family, but with different foundations—Android and ChromeOS directly on Linux, while iOS is built on Darwin (BSD + Mach).

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 climate modeling, nuclear simulations, aerospace research, advanced engineering, artificial intelligence, and national defense. Their role has consistently been to tackle problems too large and complex for ordinary computers, pushing the boundaries of science and technology.

- 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 was essentially a low-cost supercomputer built from PS3 consoles, used for scientific research, military satellite image analysis, and academic experiments in parallel computing. It demonstrated how consumer technology could be repurposed for advanced computing tasks.

- 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?

The Oracle Raspberry Pi supercomputer cluster runs on 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/>

Because the Top500 supercomputers are measured in petaflops and Oracle's Raspberry Pi cluster was built for educational and experimental purposes, not maximum speed, it does not appear in the Top500 list.

- e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?

Both the PlayStation 5 and Xbox Series X use AMD's Zen 2 CPU architecture with integrated custom Radeon graphics.

What operating systems run on these consoles?

The PlayStation 5 runs Orbis OS, a proprietary operating system based on FreeBSD.

The Xbox Series X runs a customized version of Windows, incorporating DirectX and Hyper-V virtualization.

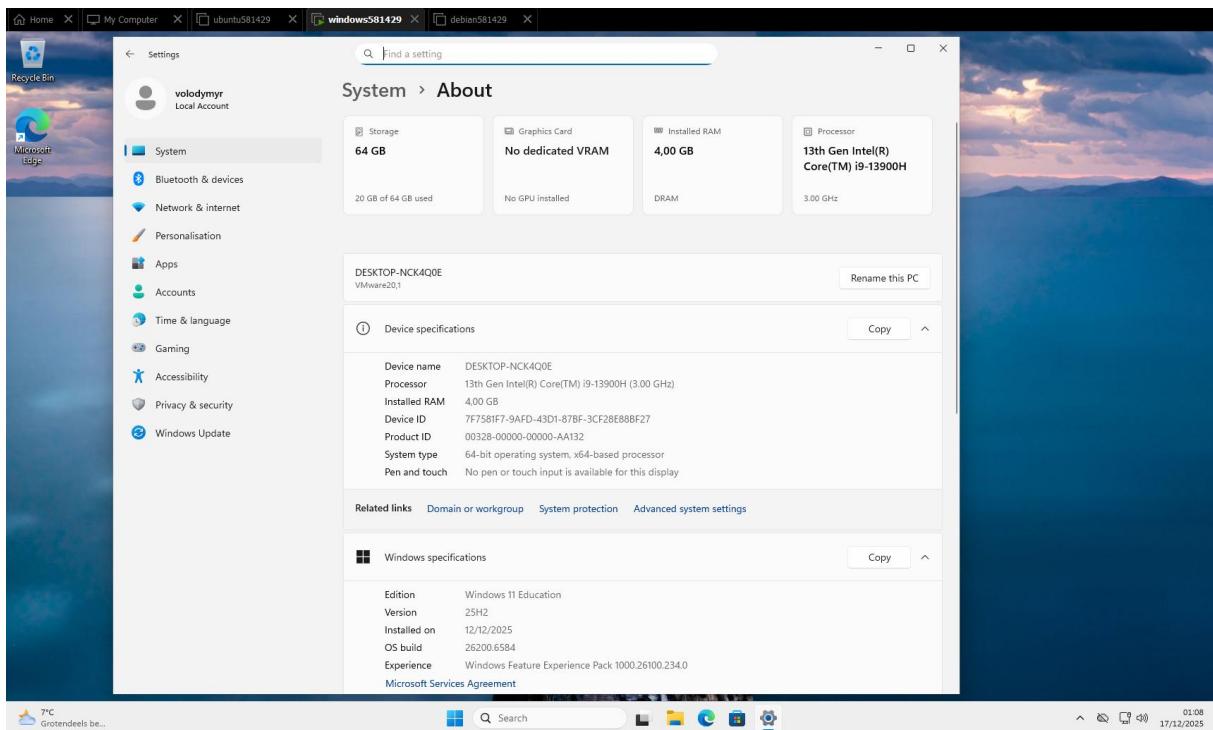
What conclusion can you draw from the answer to the previous question?

Conclusion: Despite being gaming consoles, both systems rely on mainstream CPU architectures (x86-64, Zen 2) and OS kernels derived from general-purpose operating systems (FreeBSD for PS5, Windows for Xbox). This shows how modern consoles are essentially specialized PCs optimized for gaming.

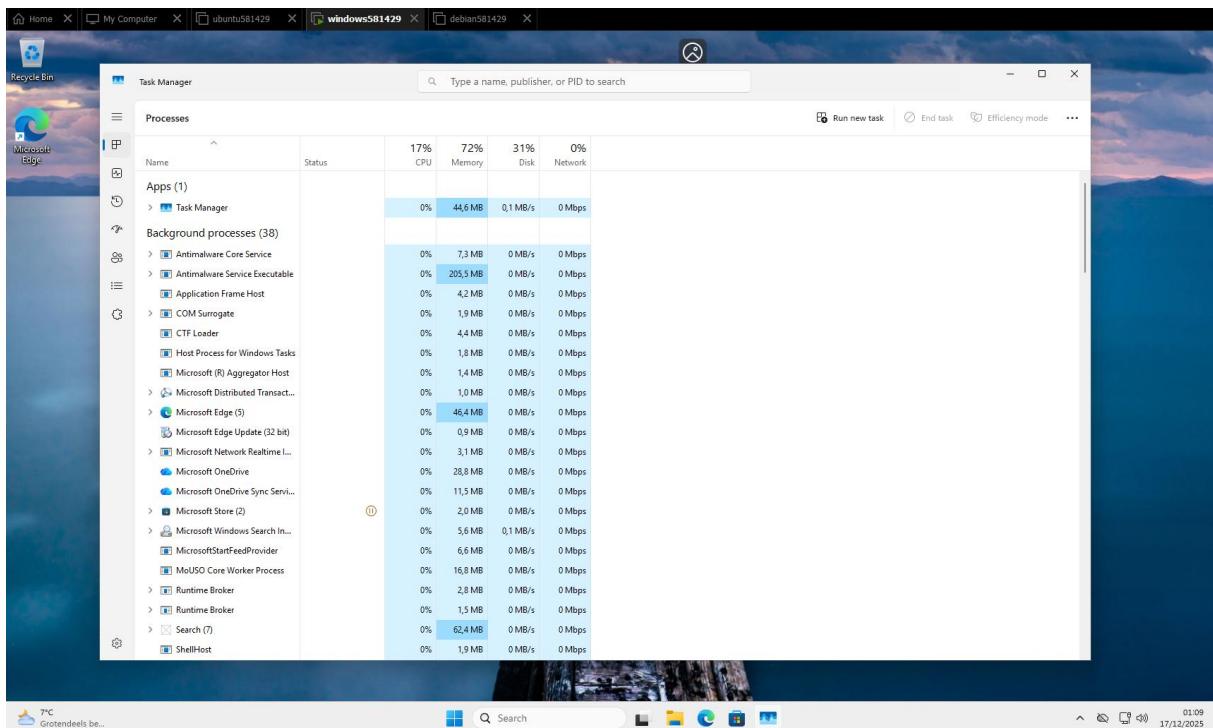
Assignment 5.3: Working with Windows

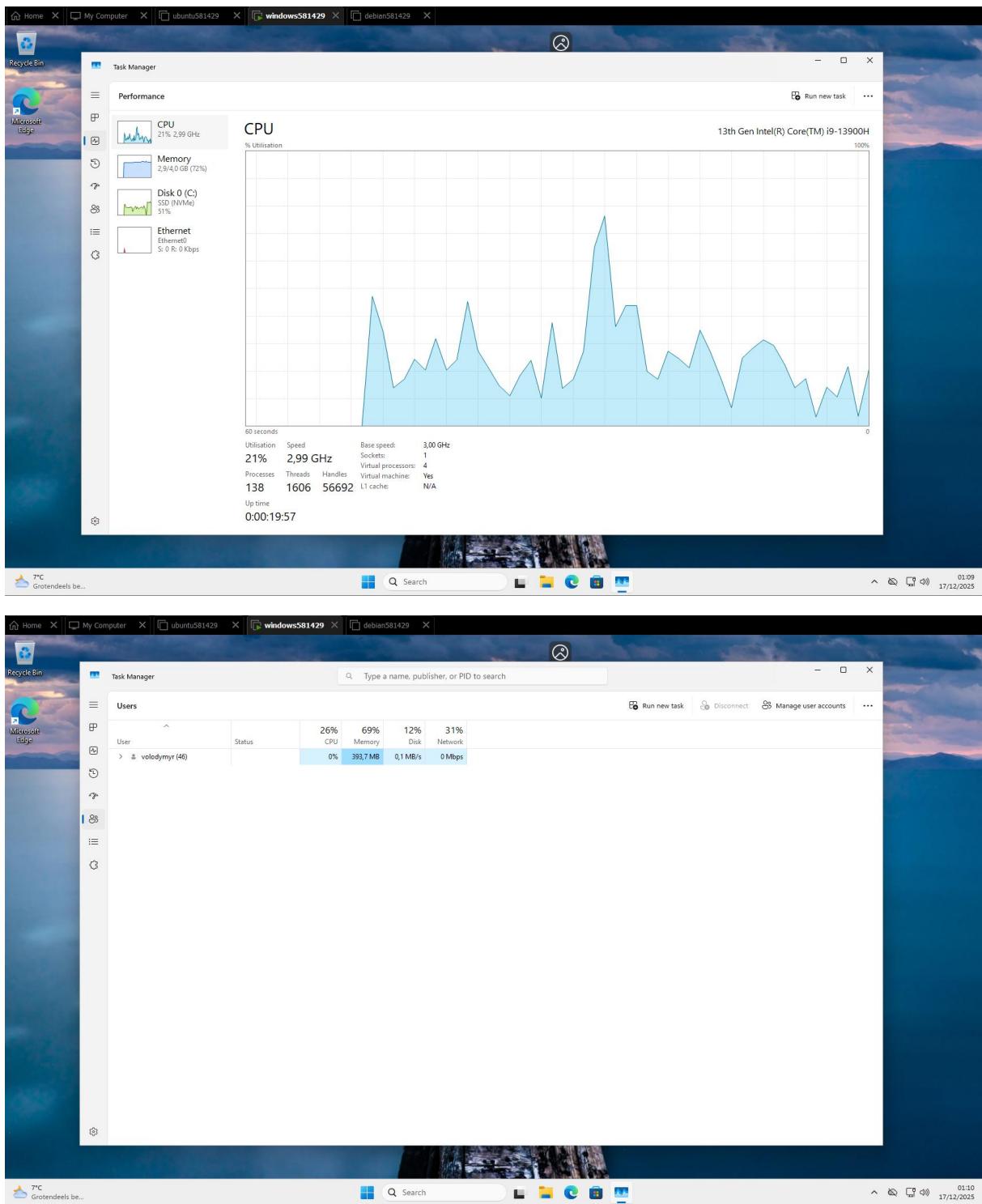
Take relevant screenshots of the assignments below

- a) Practice for about 10 minutes with the **Windows** 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 **Windows + E**, Which key combination could you also use?
Windows + R, then type “explorer”.
- c) Open the system properties with a **Windows** key combination, take a screenshot of the open screen. Paste this screenshot into this template.



- 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.





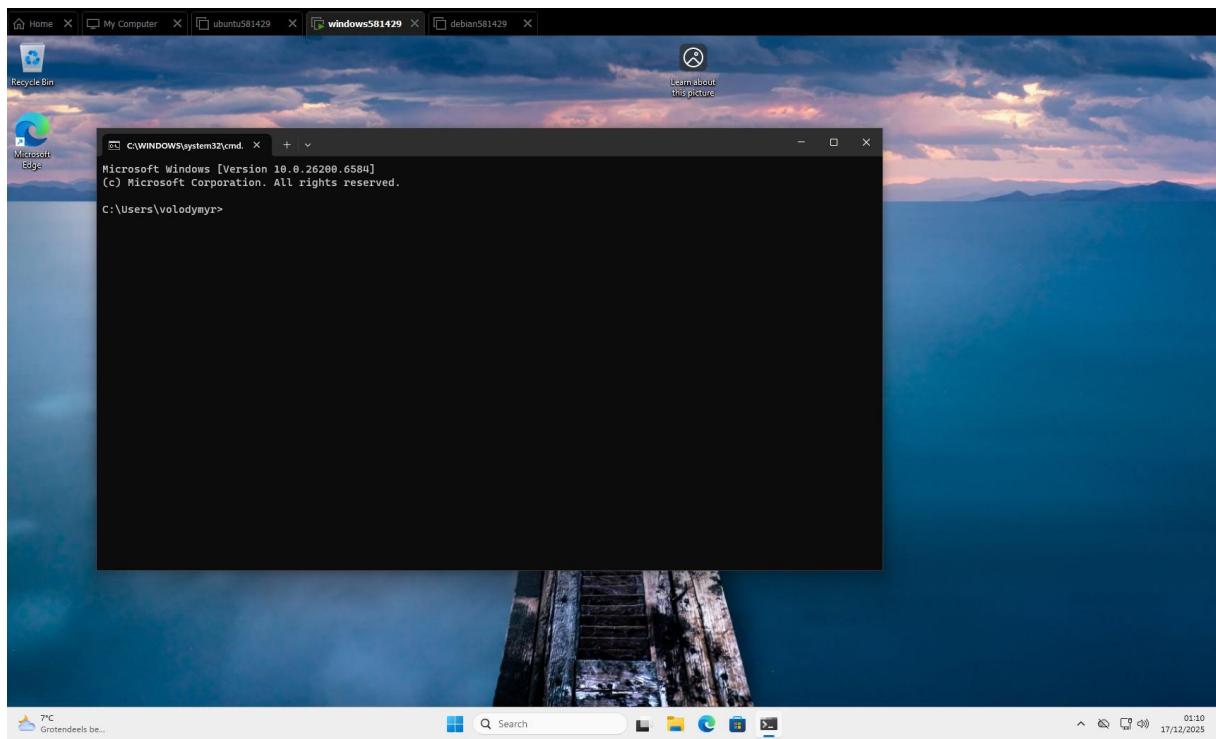
- e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

Windows logo + 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?

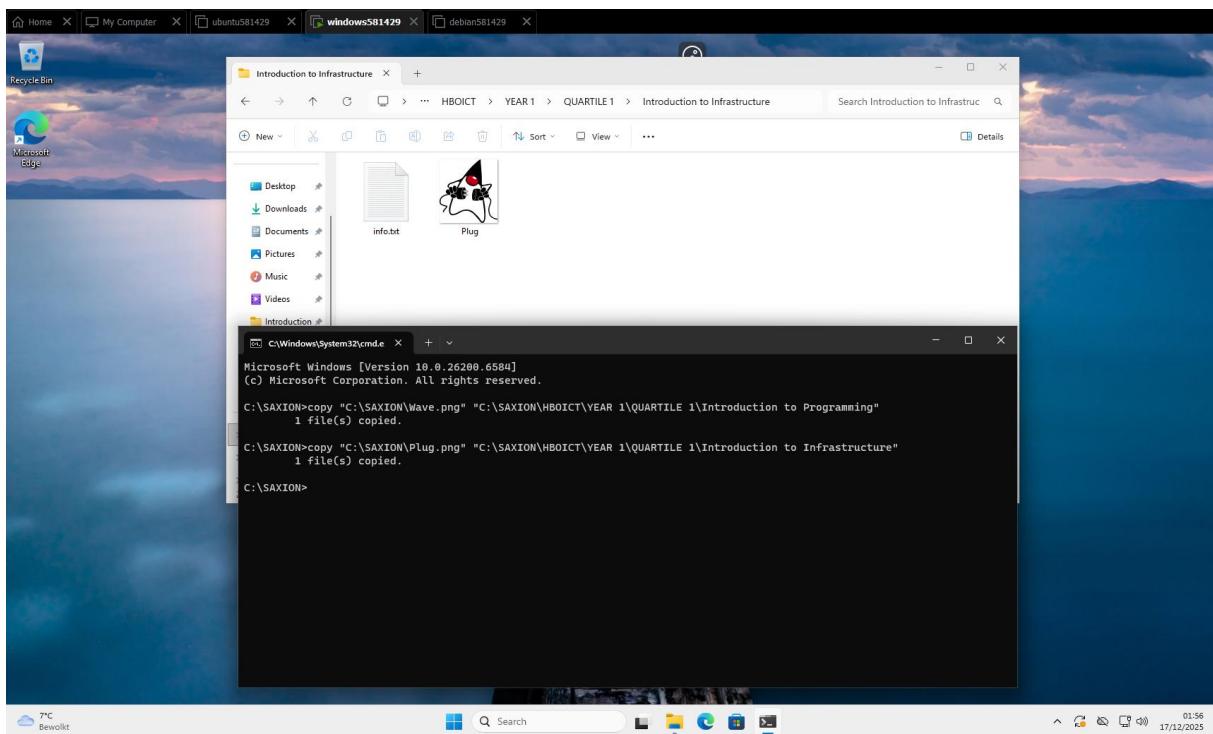
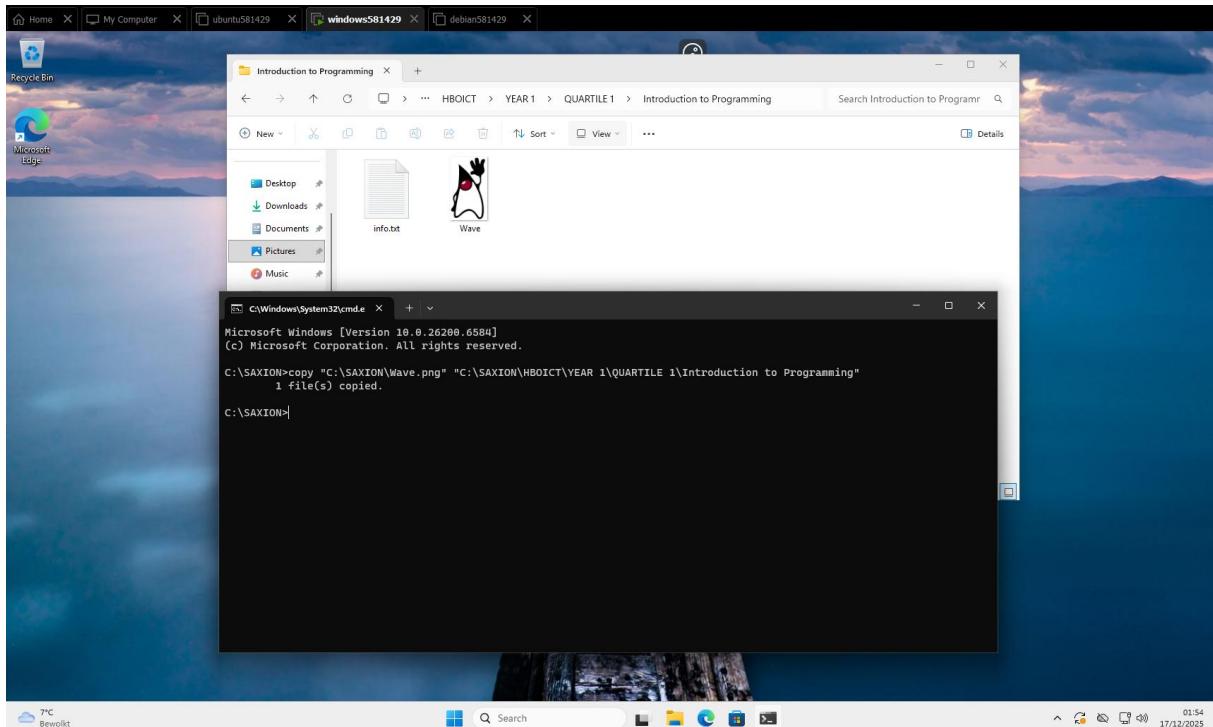
 + L

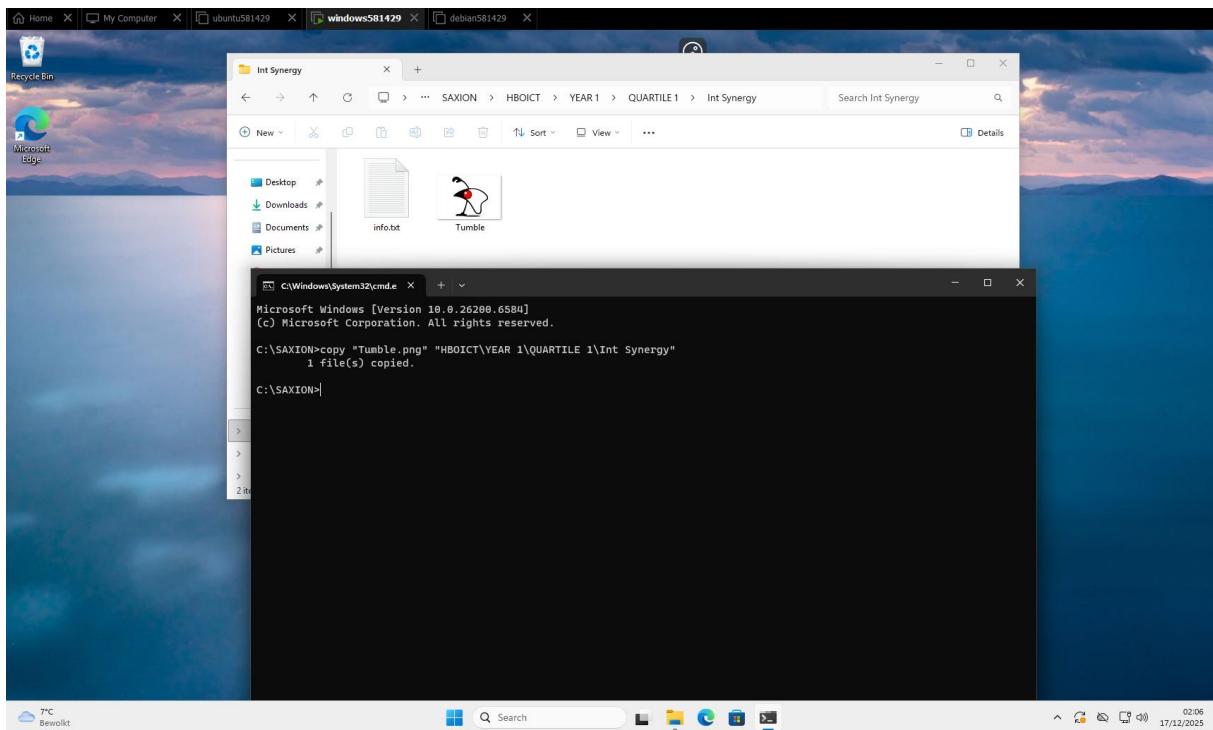
- g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.



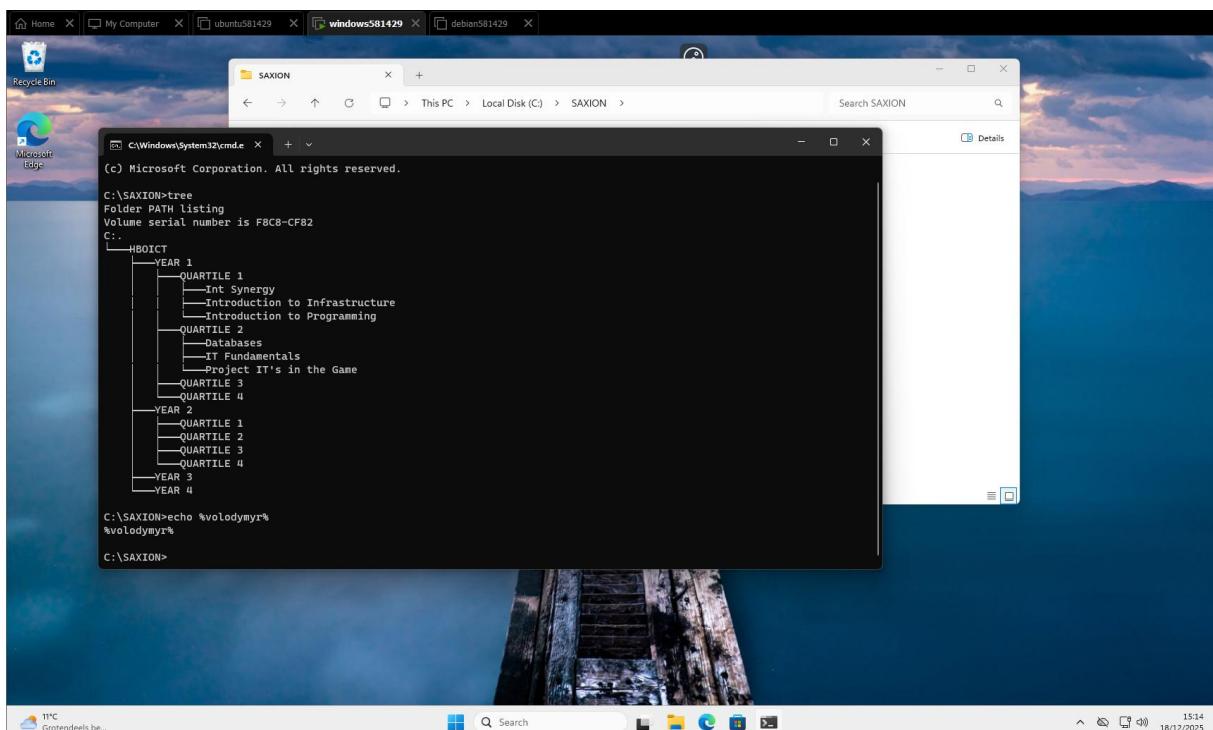
Working in the File Explorer

Relevant screenshots **copy** command:

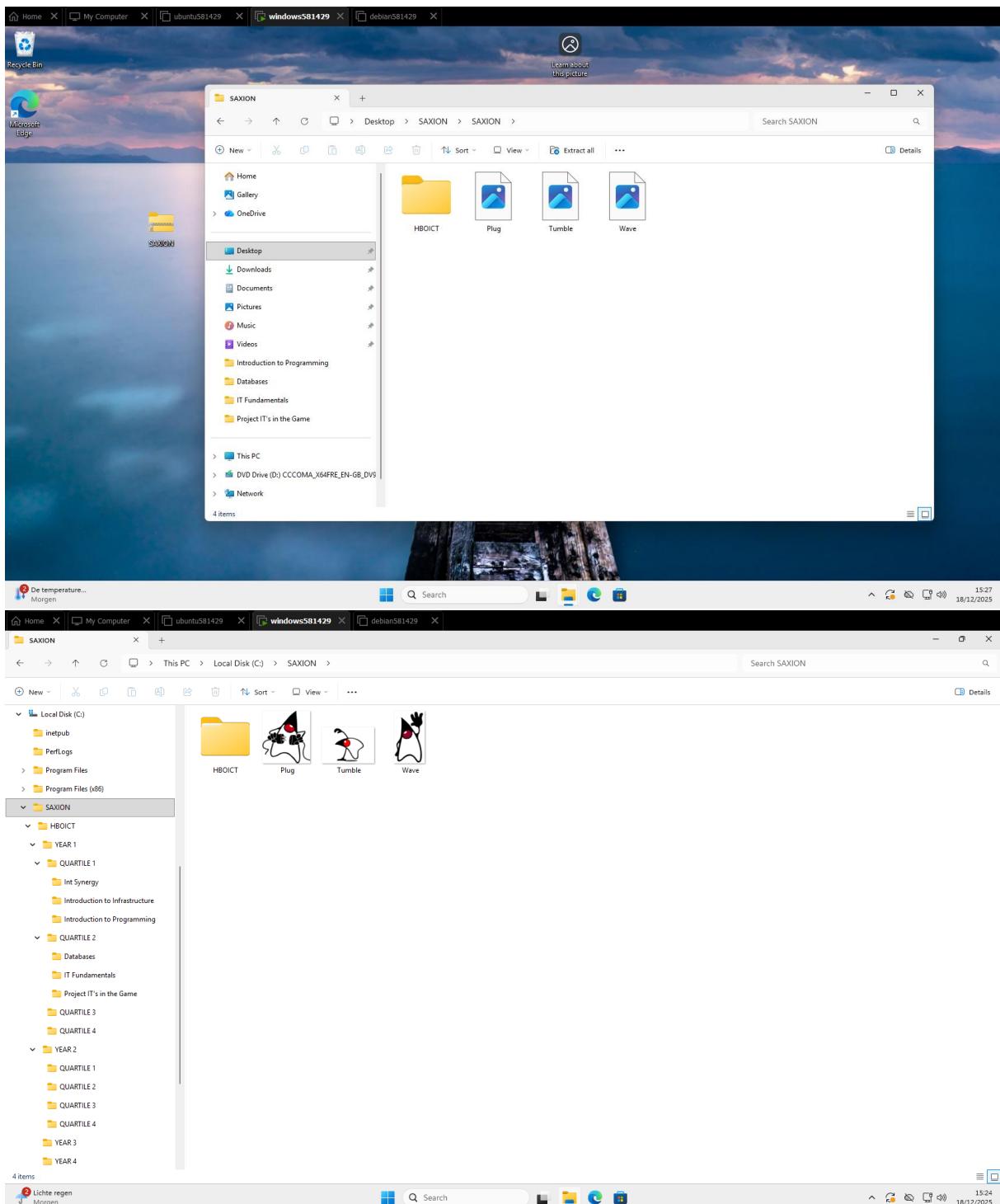




Relevant screenshots tree command:

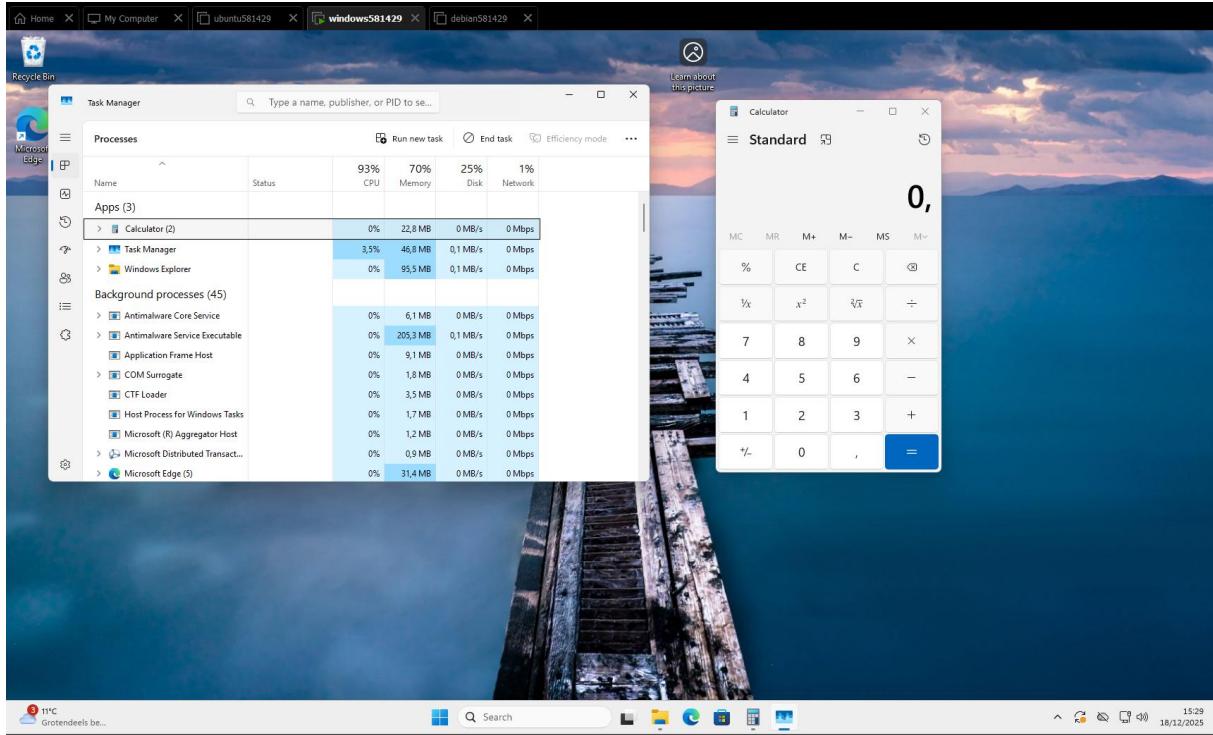


Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



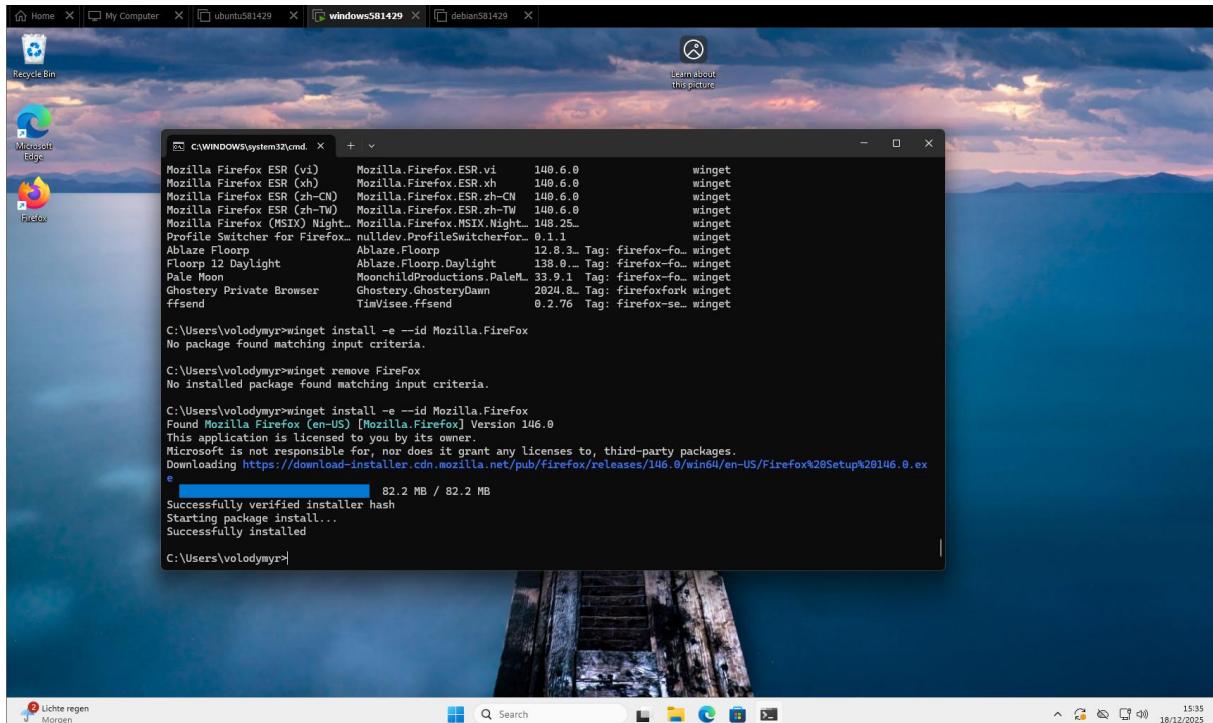
Terminating Processes

Relevant Screenshots Task Manager Window:



Install Software

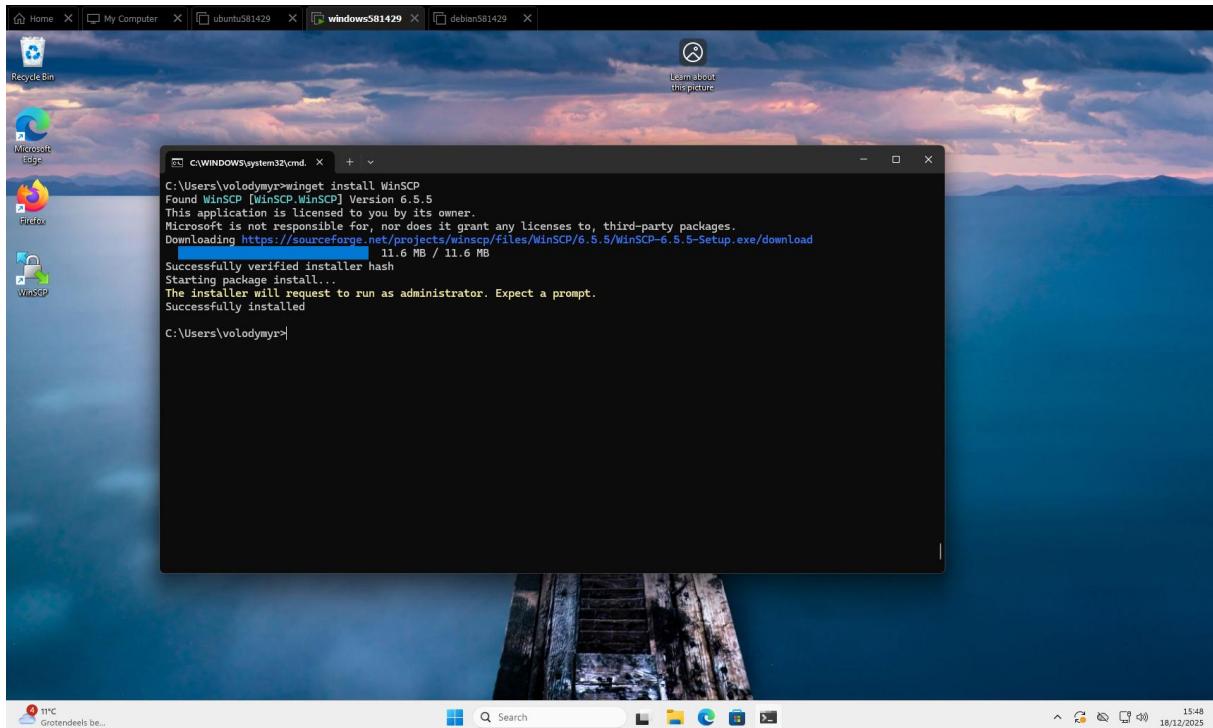
Relevant screenshots that the following software is installed with winget:



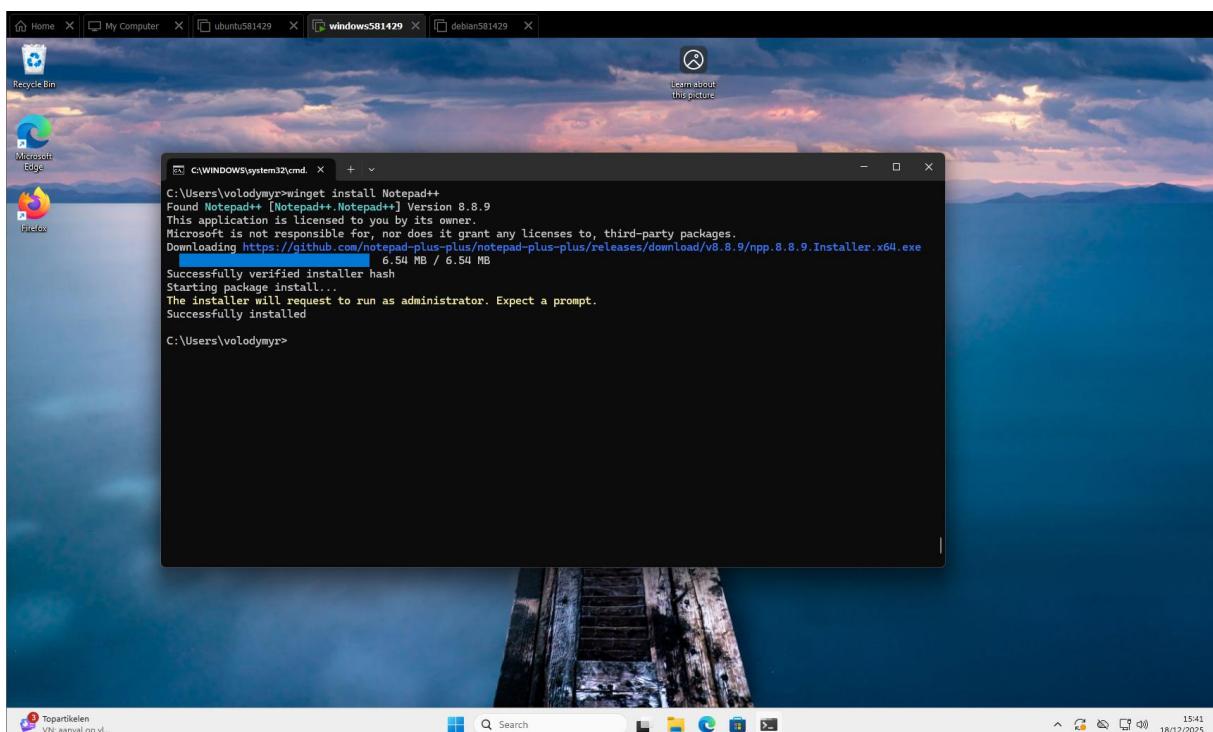
-e Ensures it installs exactly the package with ID Mozilla.Firefox, not something else with “Firefox” in its name.

--id specifies the exact package.

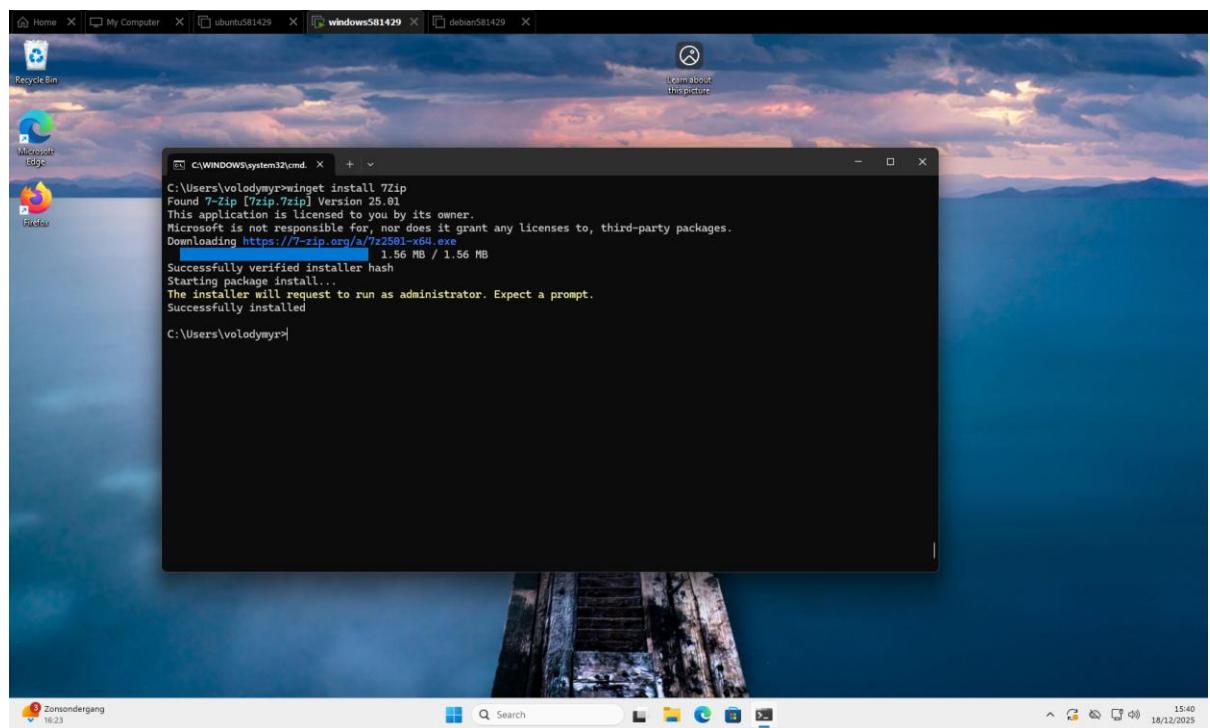
- WinSCP



- Notepad++



- 7zip

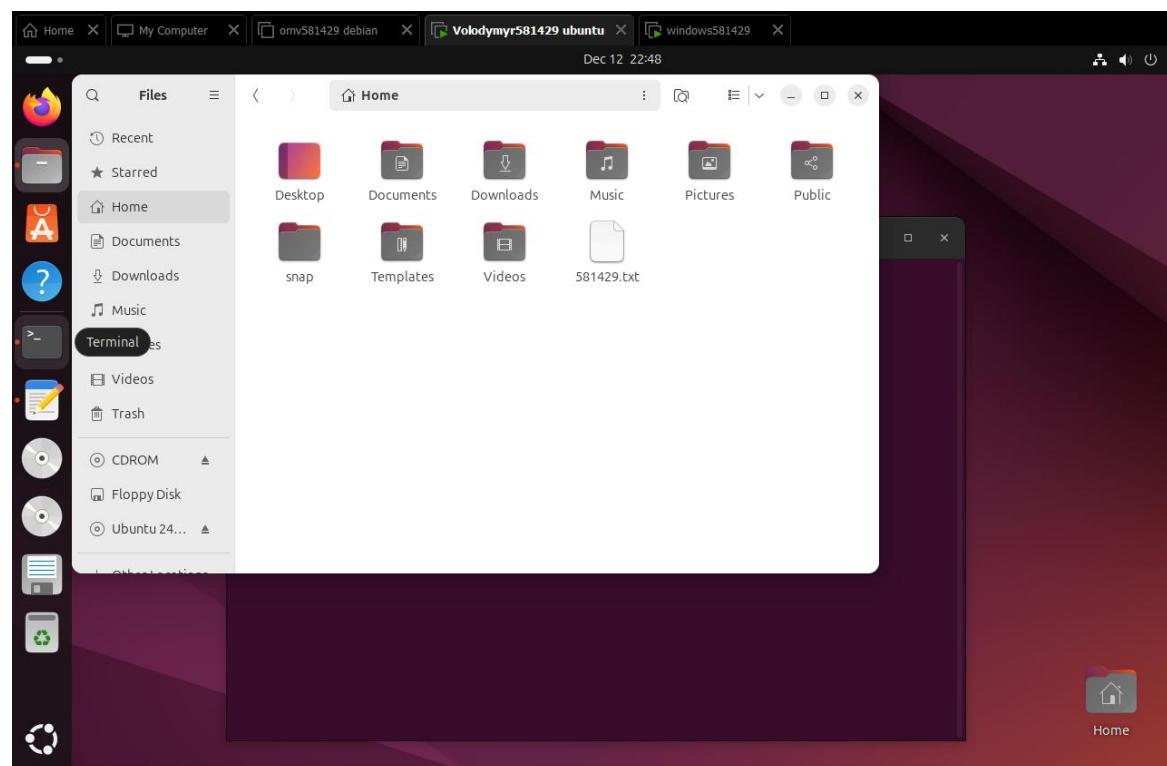


Assignment 5.4: Working with Linux

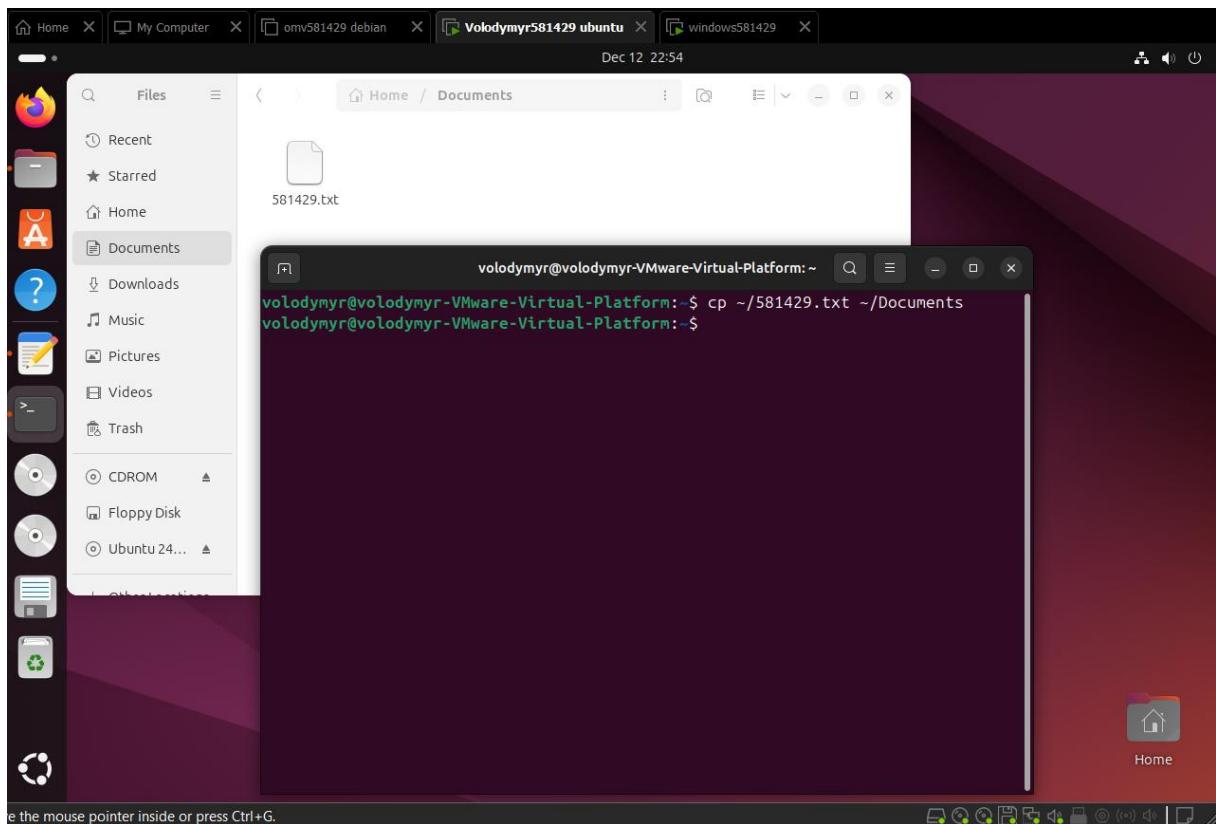
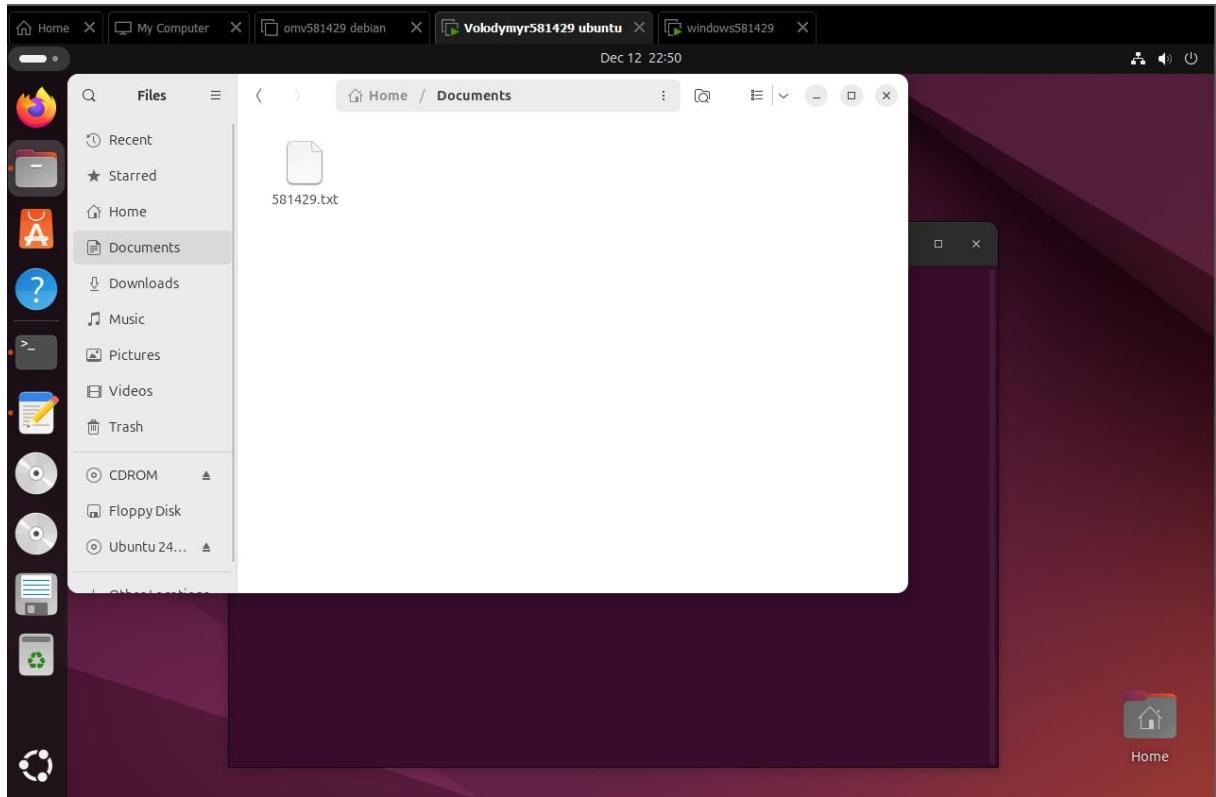
Relevant screenshots + motivation

Copying files:

1.

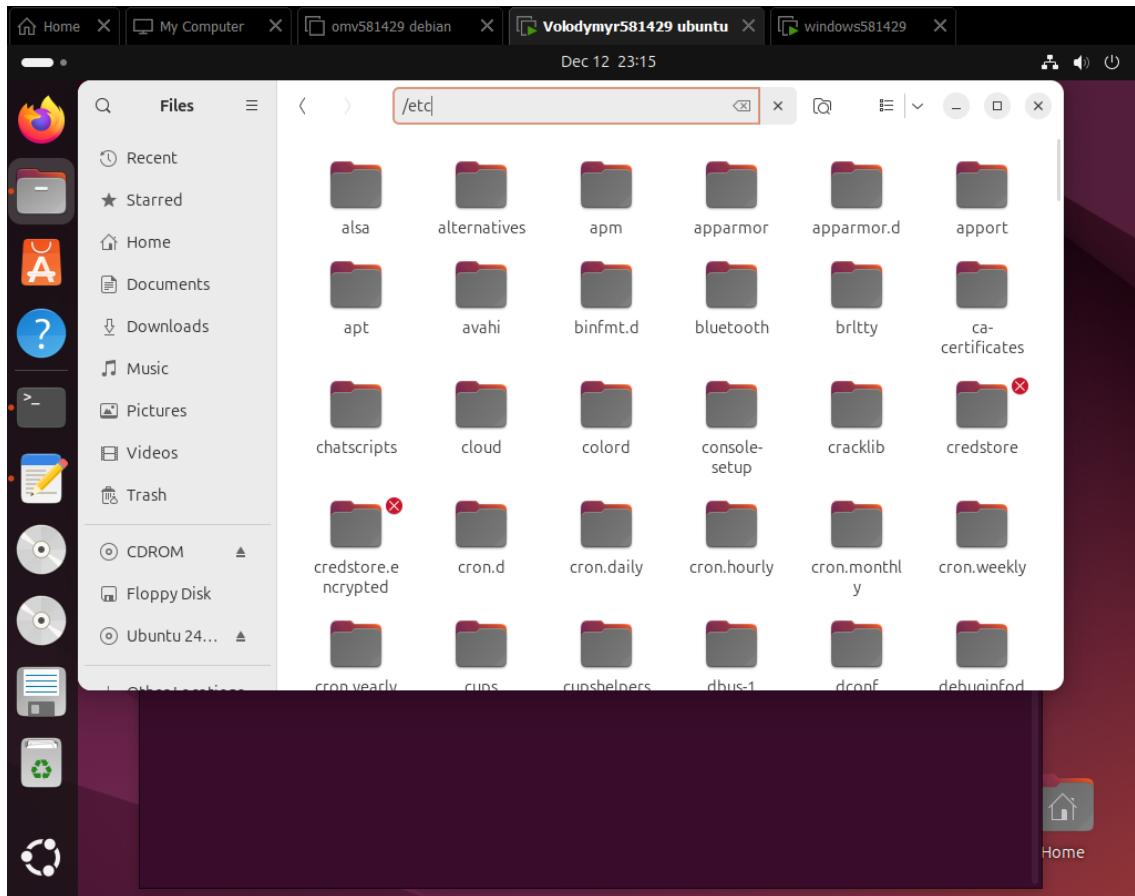


2.

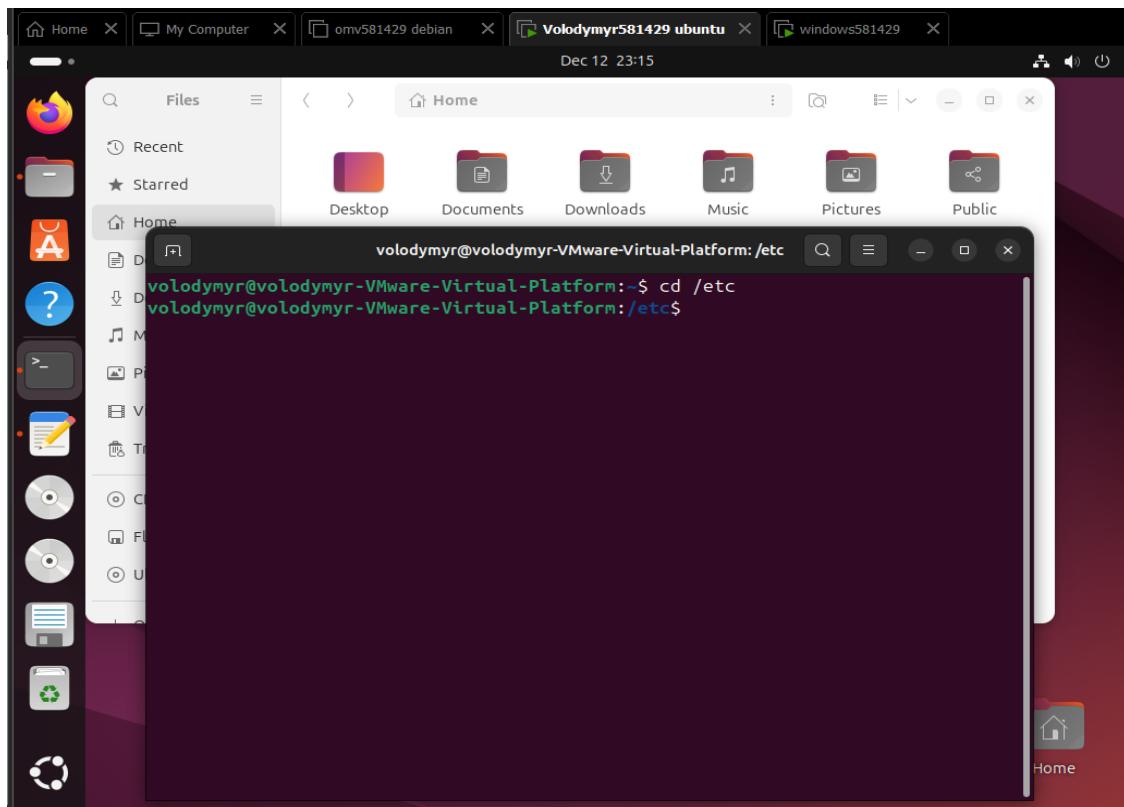


Navigating the file structure:

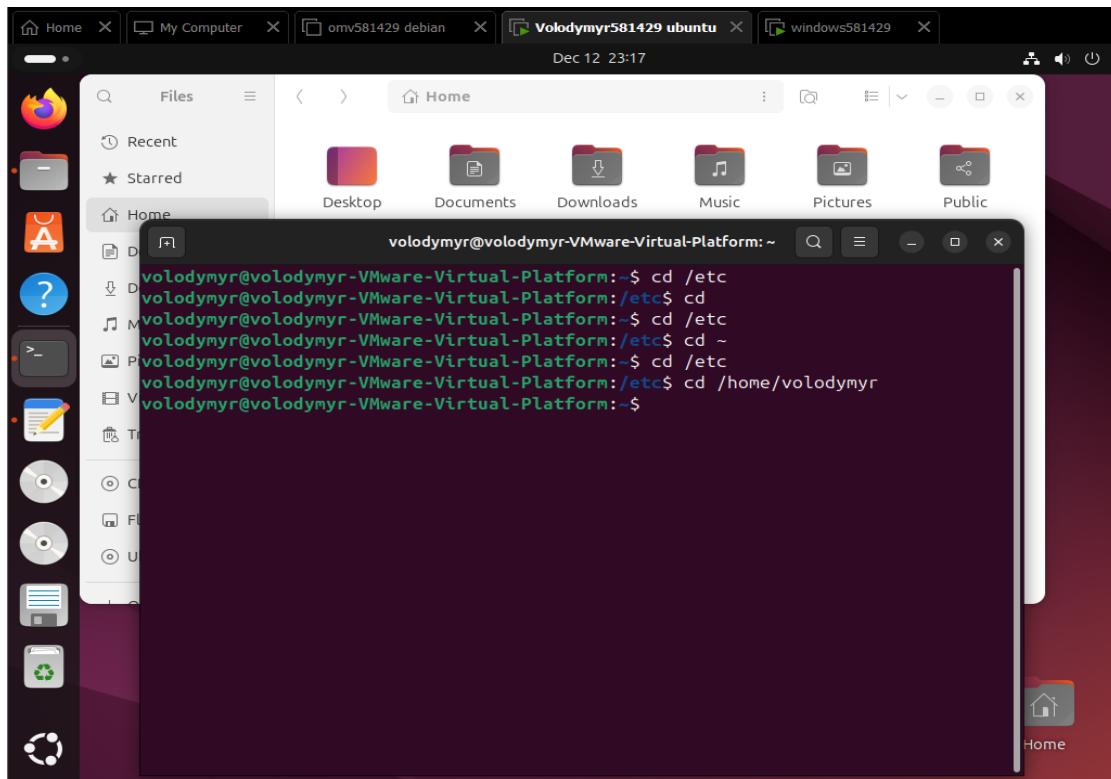
1.



2.



3. 3 ways to do it

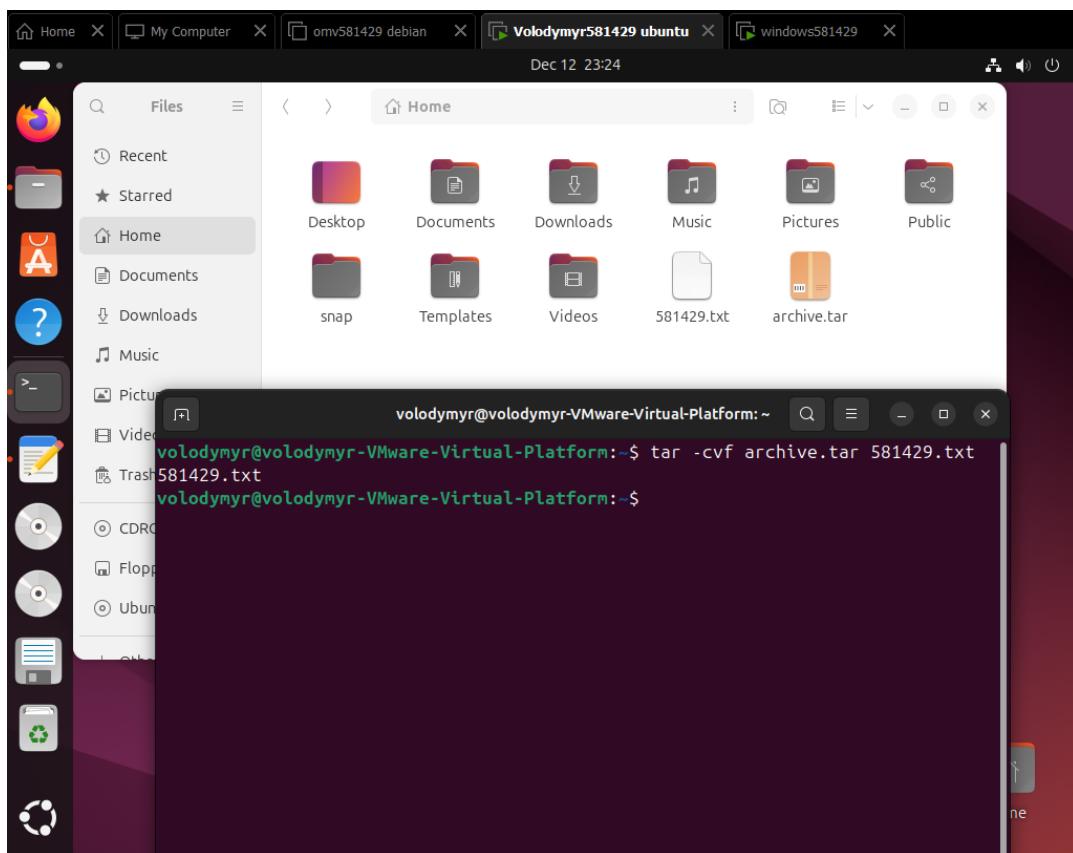


4. Linux has one unified filesystem tree starting at /, while Windows splits its filesystem into separate drive roots.

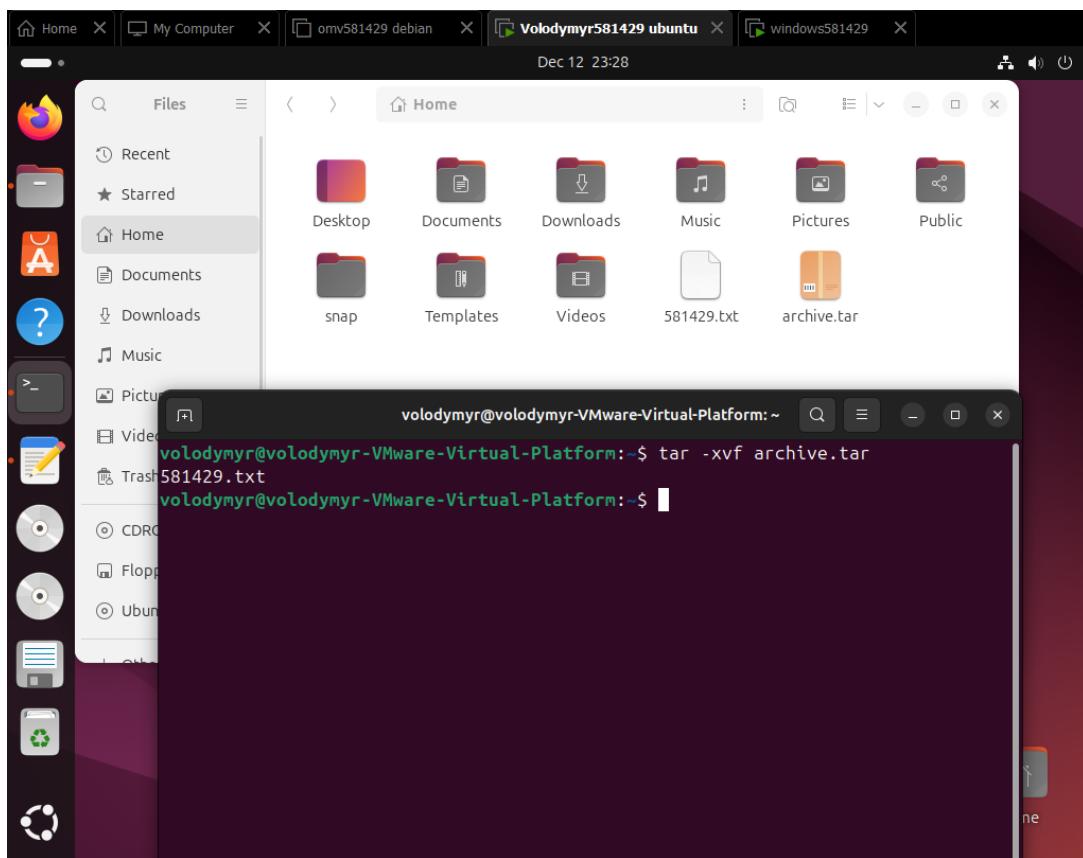
5. It acts as the central hub for settings that control how the operating system and its services behave

Compress files:

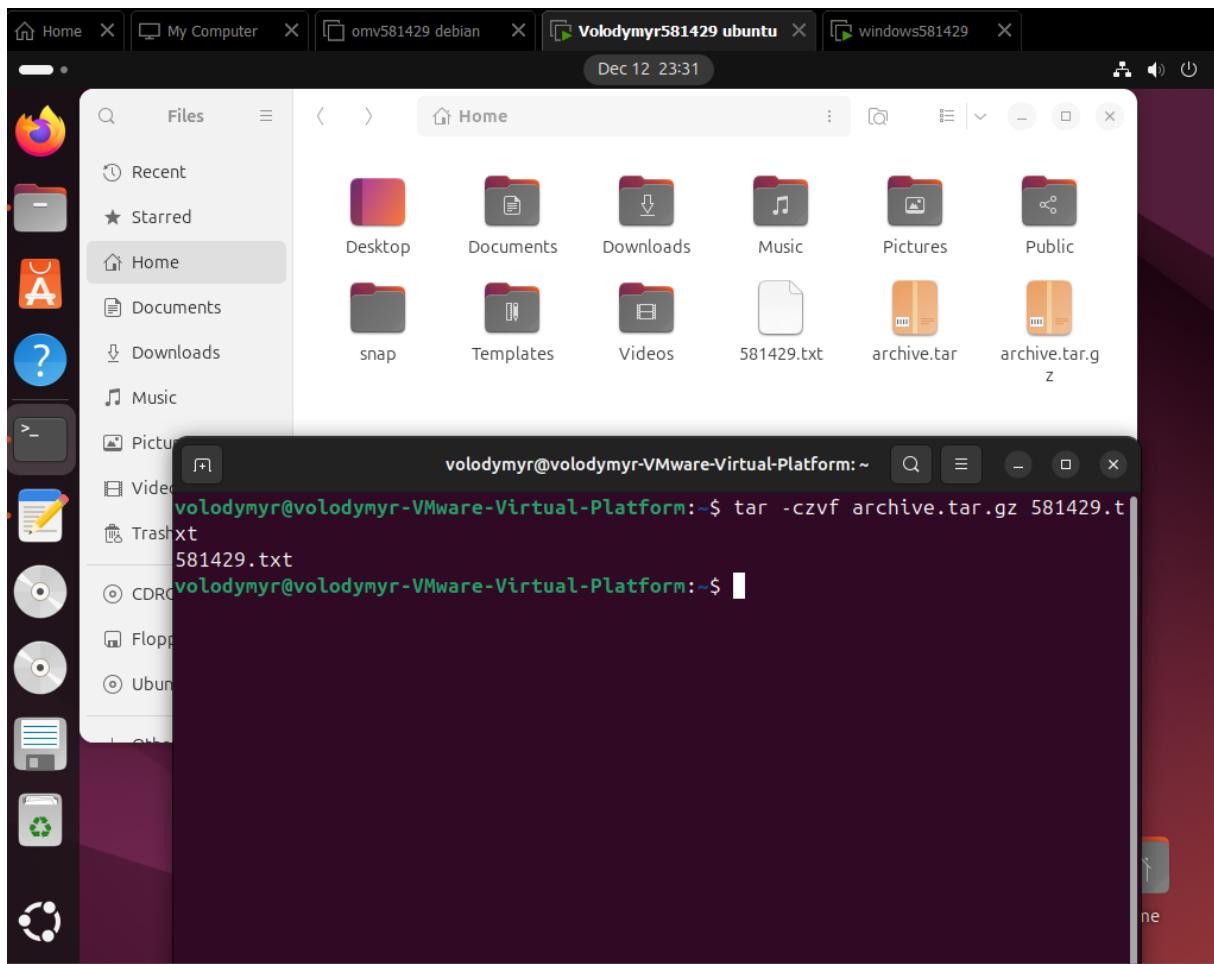
1.



2.

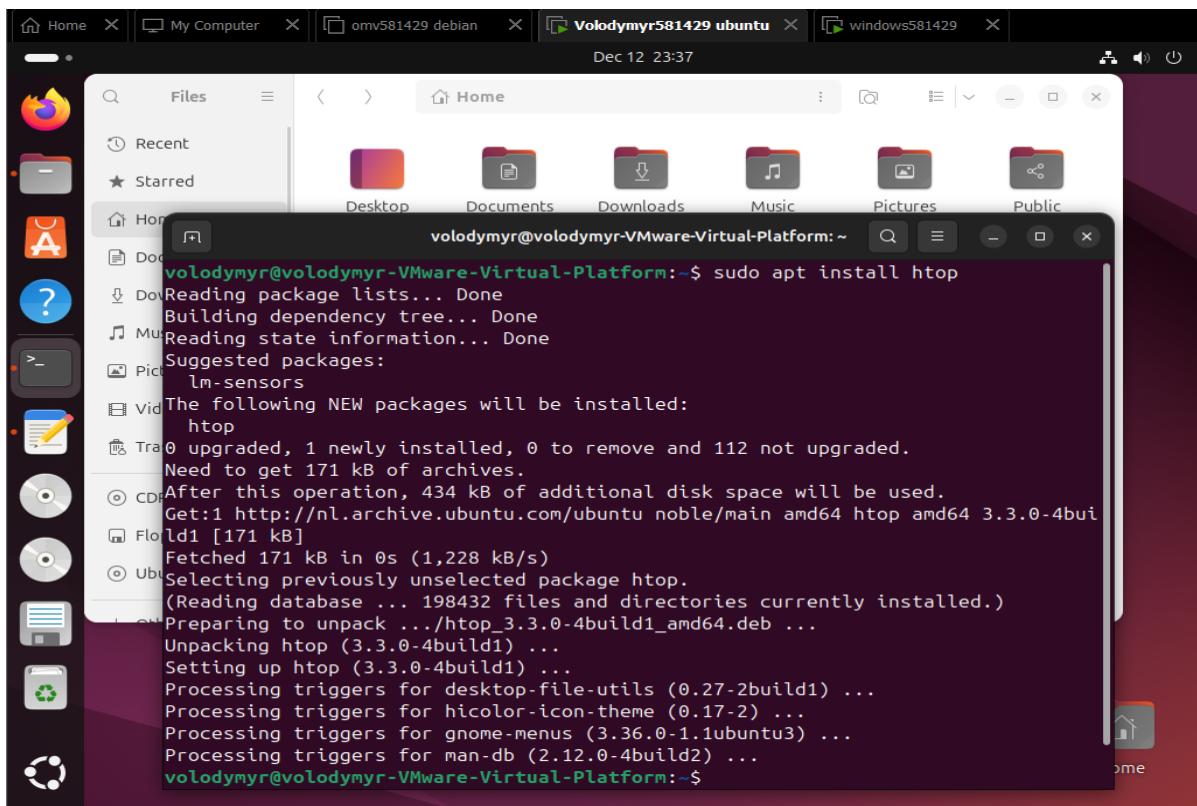


3.

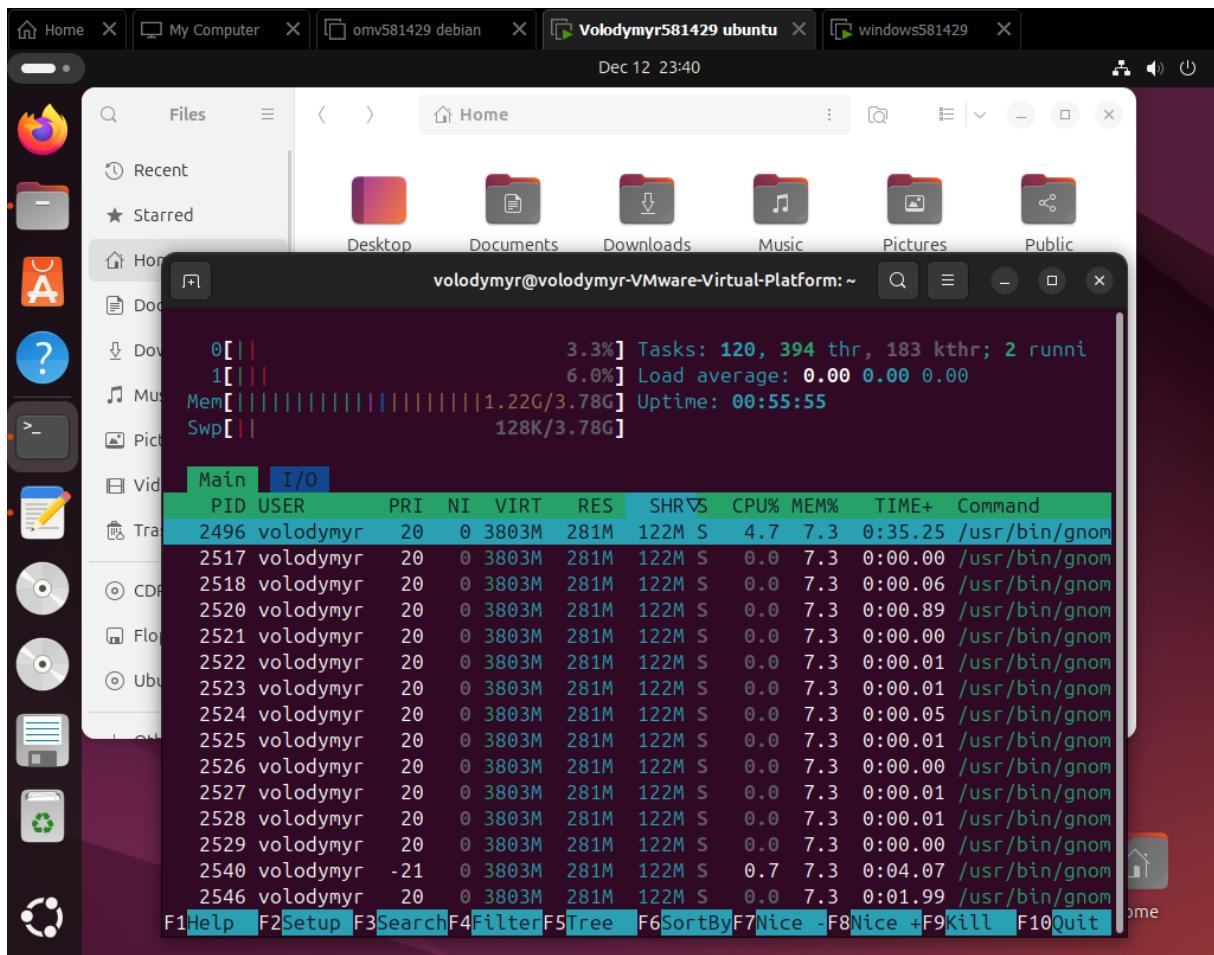


View processes:

1.



2.

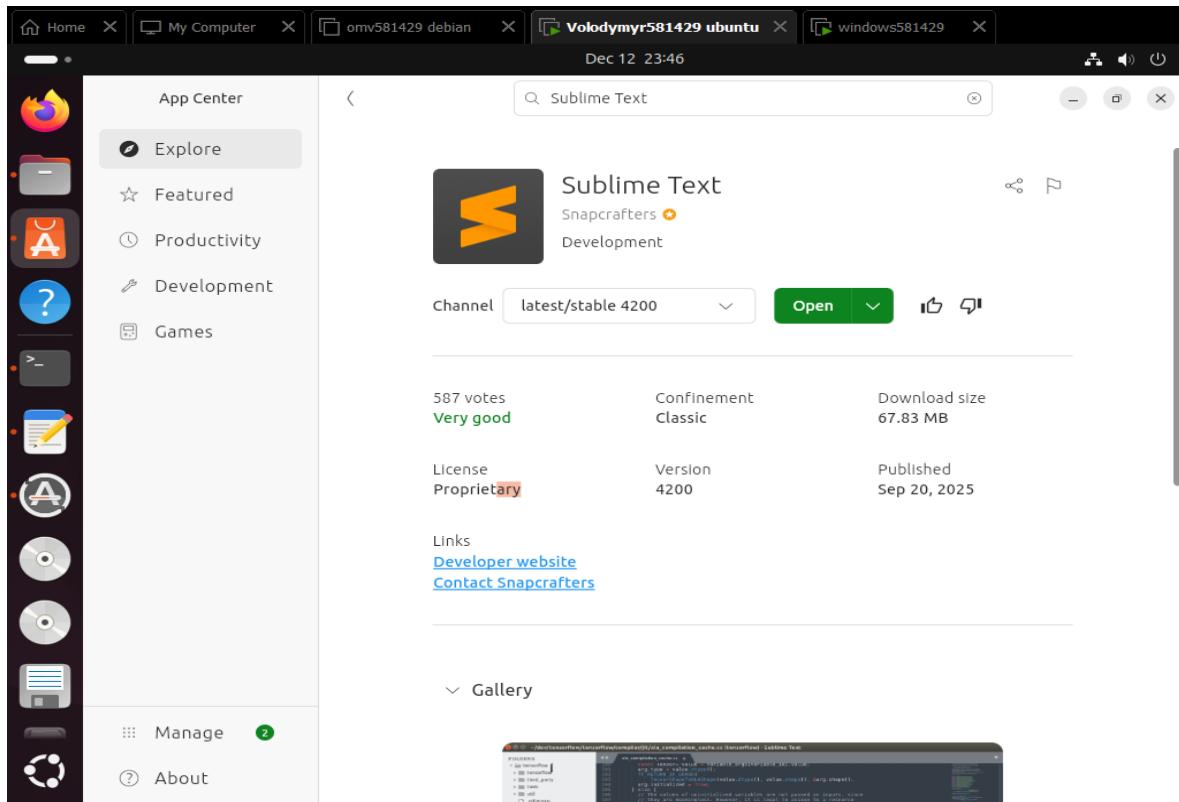


	Main		I/O									
	PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
Tray	2496	volodymyr	20	0	3803M	281M	122M	S	4.7	7.3	0:35.25	/usr/bin/gnom
(CDP)	2517	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.00	/usr/bin/gnom
Flo	2518	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.06	/usr/bin/gnom
(Ubuntu)	2520	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.89	/usr/bin/gnom
L	2521	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.00	/usr/bin/gnom
G	2522	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.01	/usr/bin/gnom
U	2523	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.01	/usr/bin/gnom
o	2524	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.05	/usr/bin/gnom
m	2525	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.01	/usr/bin/gnom
e	2526	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.00	/usr/bin/gnom
h	2527	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.01	/usr/bin/gnom
g	2528	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.01	/usr/bin/gnom
h	2529	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:00.00	/usr/bin/gnom
g	2540	volodymyr	-21	0	3803M	281M	122M	S	0.7	7.3	0:04.07	/usr/bin/gnom
h	2546	volodymyr	20	0	3803M	281M	122M	S	0.0	7.3	0:01.99	/usr/bin/gnom

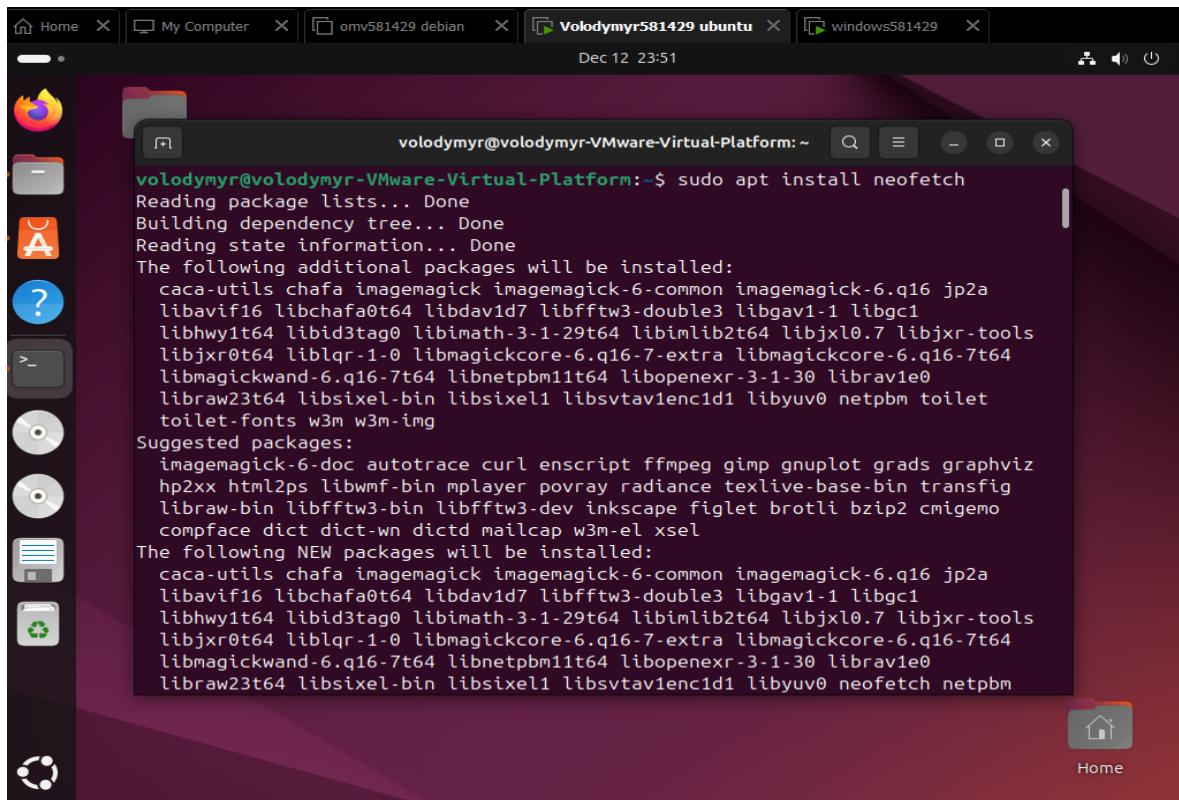
It shows a real-time, interactive view of system's processes, CPU and memory usage, and overall performance.

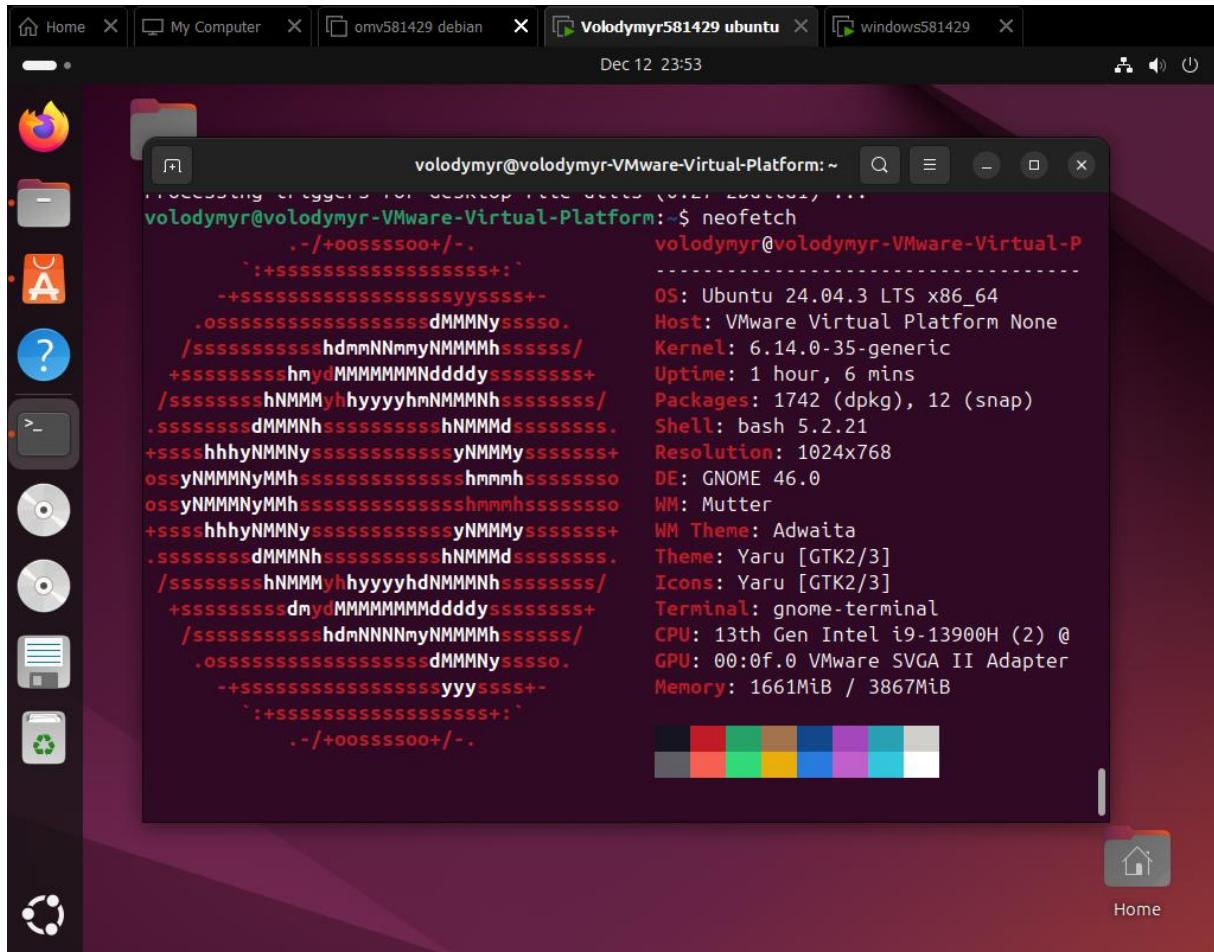
Install Software:

1.



2.

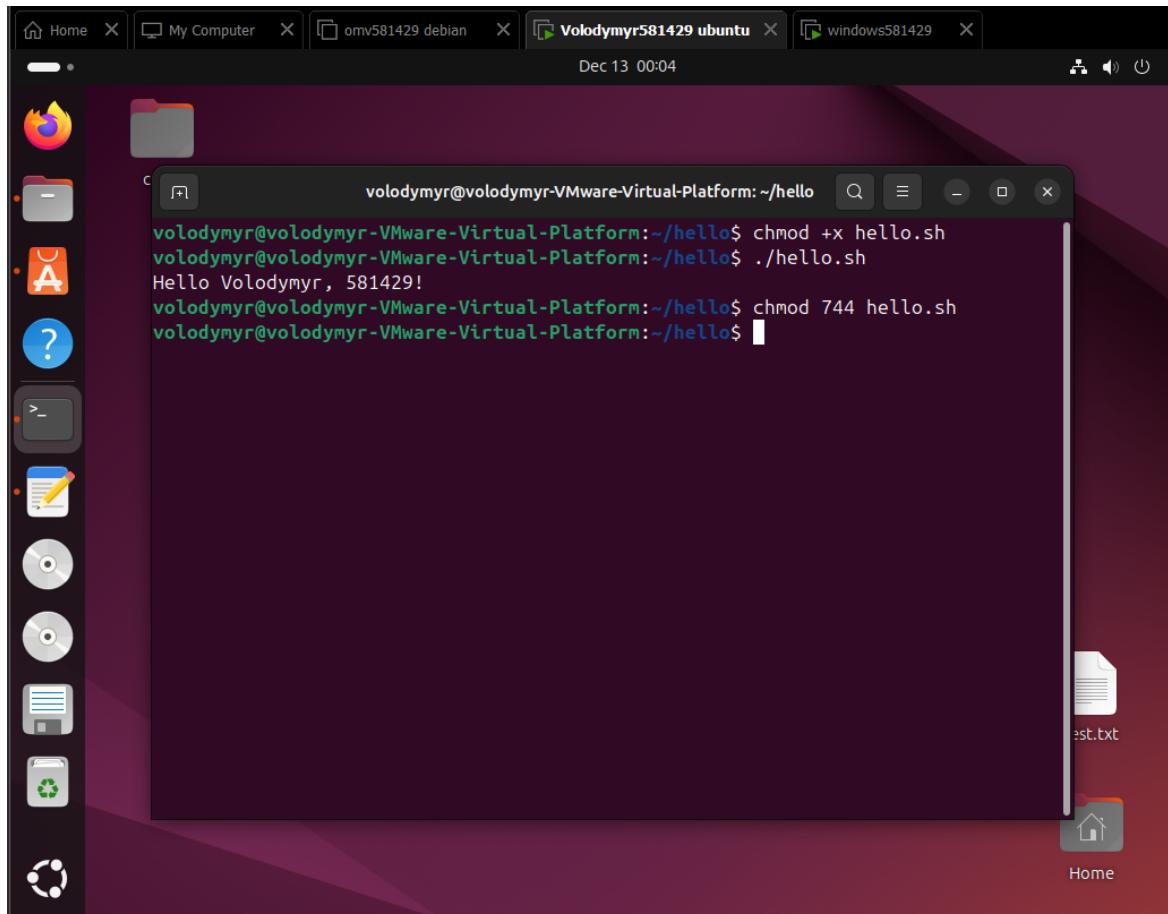
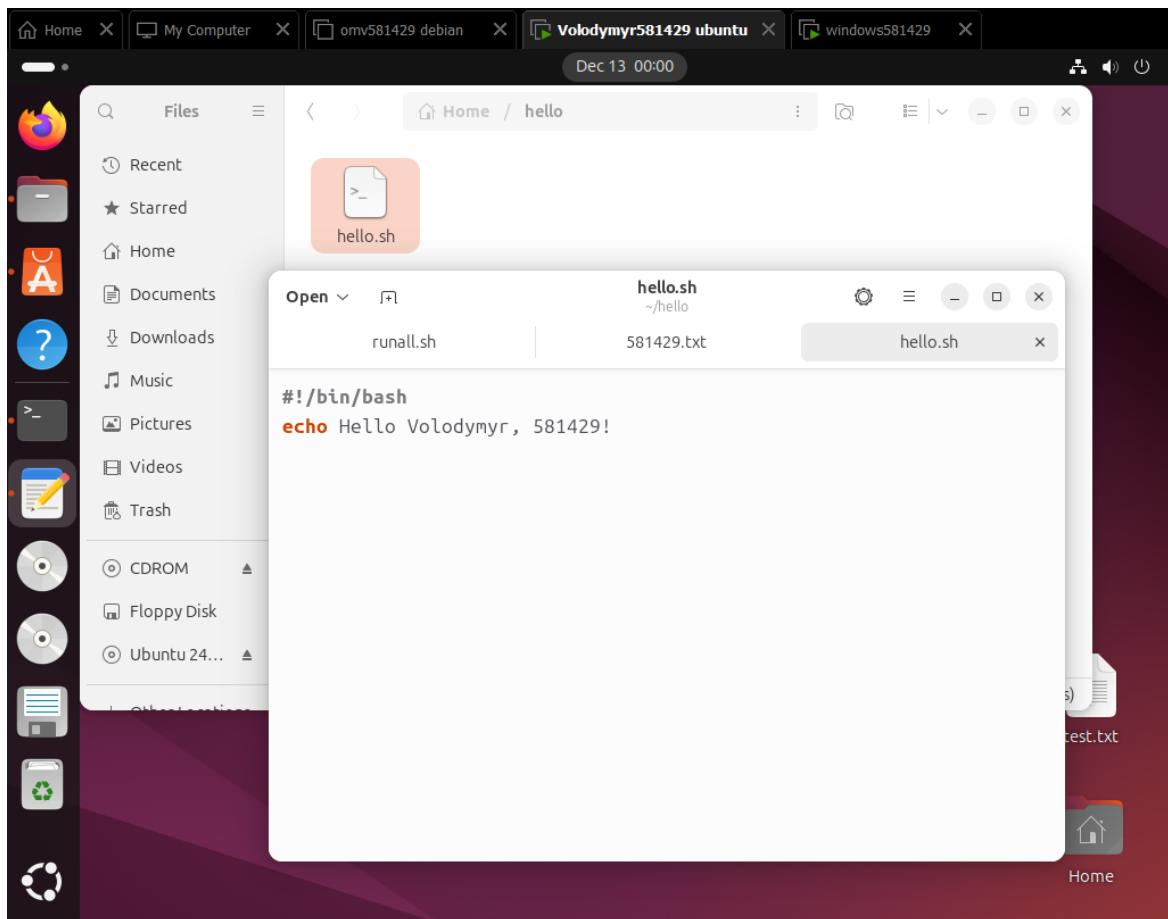




It shows system information alongside an ASCII logo of your Linux distribution.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation



Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat → Displays the contents of a file directly in the terminal.

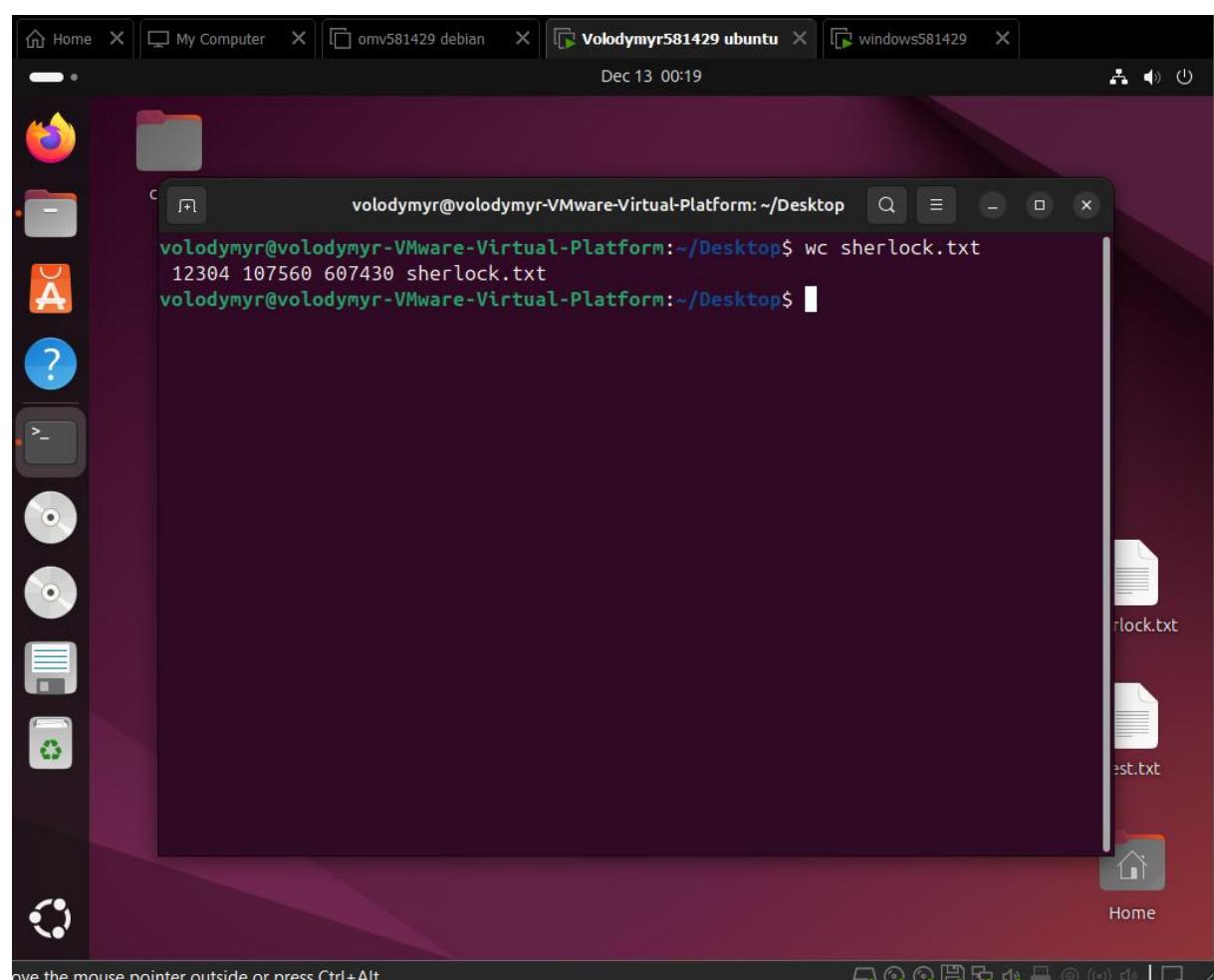
wc → Counts words, lines, and bytes in a file.

less → Opens a file for viewing one screen at a time (scrollable, quit with q).

tail → Shows the last part of a file (default: last 10 lines).

head → Shows the first part of a file (default: first 10 lines).

grep → Searches for specific text patterns inside files or command output.



first number is lines, then words, then characters.

A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for Home, My Computer, omv581429 debian, Volodymyr581429 ubuntu (which is active), and windows581429. The main window shows a terminal session:

```
volodymyr@volodymyr-Virtual-Platform:~/Desktop$ cd ~/Desktop
volodymyr@volodymyr-Virtual-Platform:~/Desktop$ grep -n "kingdom" sherlock.txt
490:"I tell you that I would give one of the provinces of my kingdom to
1124:And that was how a great scandal threatened to affect the kingdom of
volodymyr@volodymyr-Virtual-Platform:~/Desktop$
```

On lines 490 and 1124.

A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for Home, My Computer, omv581429 debian, Volodymyr581429 ubuntu (active), and windows581429. The main window shows a terminal session:

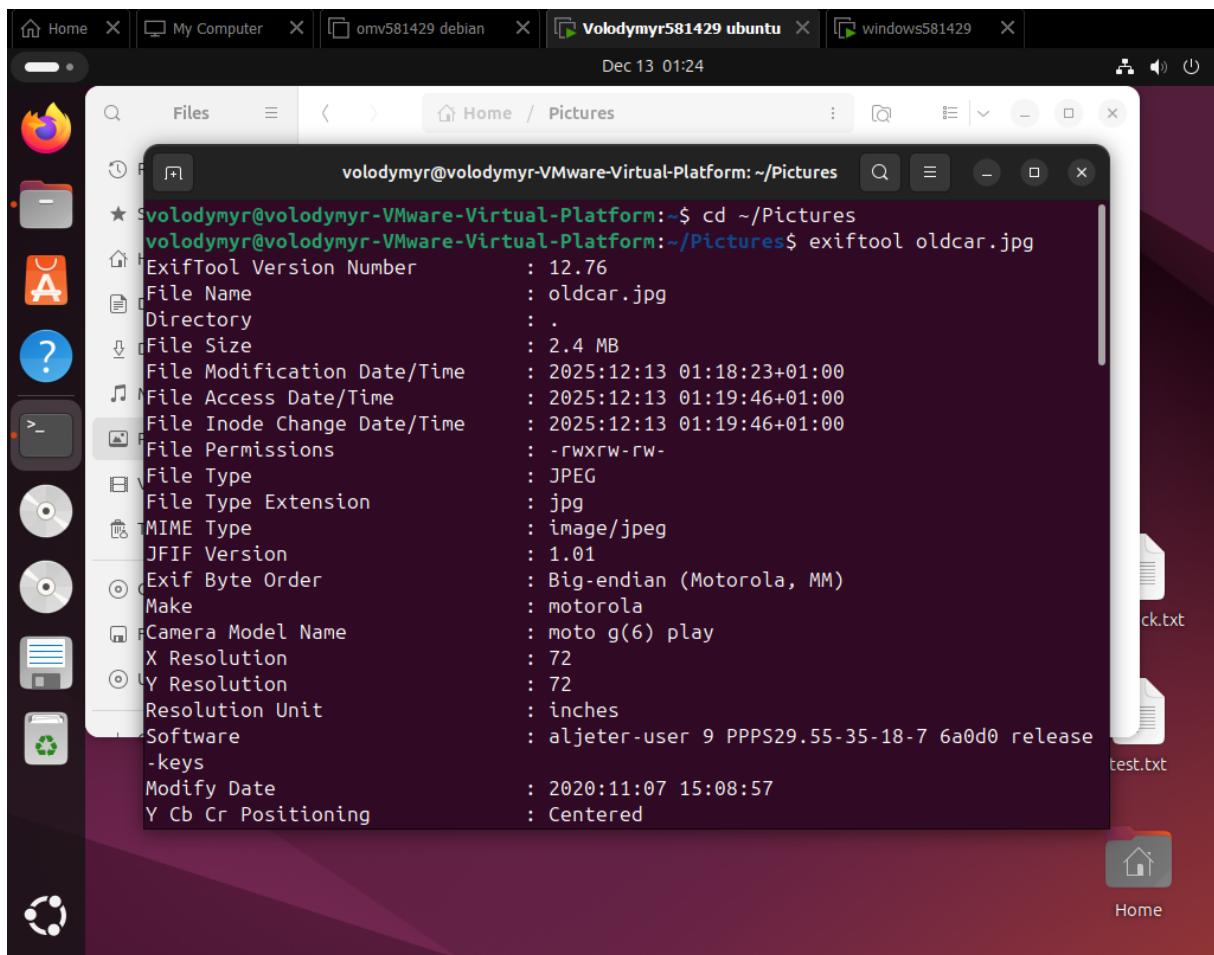
```
volodymyr@volodymyr-Virtual-Platform:~/Desktop$ head -n 510 sherlock.txt
| tail -n 41
betrothal was publicly proclaimed. That will be next Monday."
"Oh, then we have three days yet," said Holmes with a yawn. "That is
very fortunate, as I have one or two matters of importance to look into
just at present. Your Majesty will, of course, stay in London for the
present?"
"Certainly. You will find me at the Langham under the name of the Count
Von Kramm."
"Then I shall drop you a line to let you know how we progress."
"Pray do so. I shall be all anxiety."
"Then, as to money?"
"You have _carte blanche_."
"Absolutely?"
"I tell you that I would give one of the provinces of my kingdom to
```

have that photograph."

On the desktop, there are icons for sherlock.txt, test.txt, and Home.

Assignment 5.7: Digital forensics

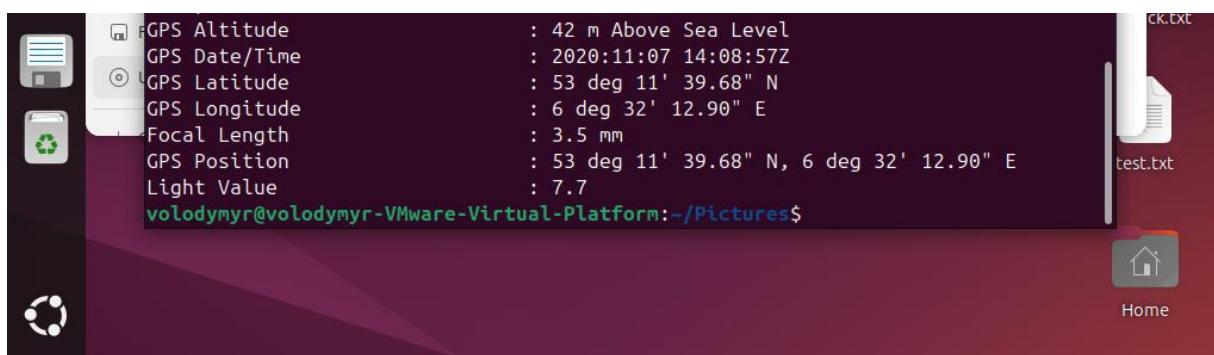
Relevant screenshots + motivation



A screenshot of a Linux desktop environment with a terminal window open. The terminal window title is "volodymyr@volodymyr-Virtual-Platform: ~/Pictures". The terminal displays the output of the command "exiftool oldcar.jpg". The output shows various file metadata fields and their values, including camera model (moto g(6) play), resolution (72x72 inches), and software (aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release). The desktop background is a purple gradient, and there are icons for Home, test.txt, and ck.txt on the right side.

```
volodymyr@volodymyr-Virtual-Platform:~/Pictures$ cd ~/Pictures
volodymyr@volodymyr-Virtual-Platform:~/Pictures$ exiftool oldcar.jpg
ExifTool Version Number      : 12.76
File Name                   : oldcar.jpg
Directory                  : .
File Size                   : 2.4 MB
File Modification Date/Time : 2025:12:13 01:18:23+01:00
File Access Date/Time       : 2025:12:13 01:19:46+01:00
File Inode Change Date/Time: 2025:12:13 01:19:46+01:00
File Permissions            : -rwxrw-rw-
File Type                  : JPEG
File Type Extension         : jpg
MIME Type                  : image/jpeg
JFIF Version               : 1.01
Exif Byte Order             : Big-endian (Motorola, MM)
Make                        : motorola
Camera Model Name          : moto g(6) play
X Resolution                : 72
Y Resolution                : 72
Resolution Unit             : inches
Software                     : aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release
-keys
Modify Date                 : 2020:11:07 15:08:57
Y Cb Cr Positioning        : Centered
```

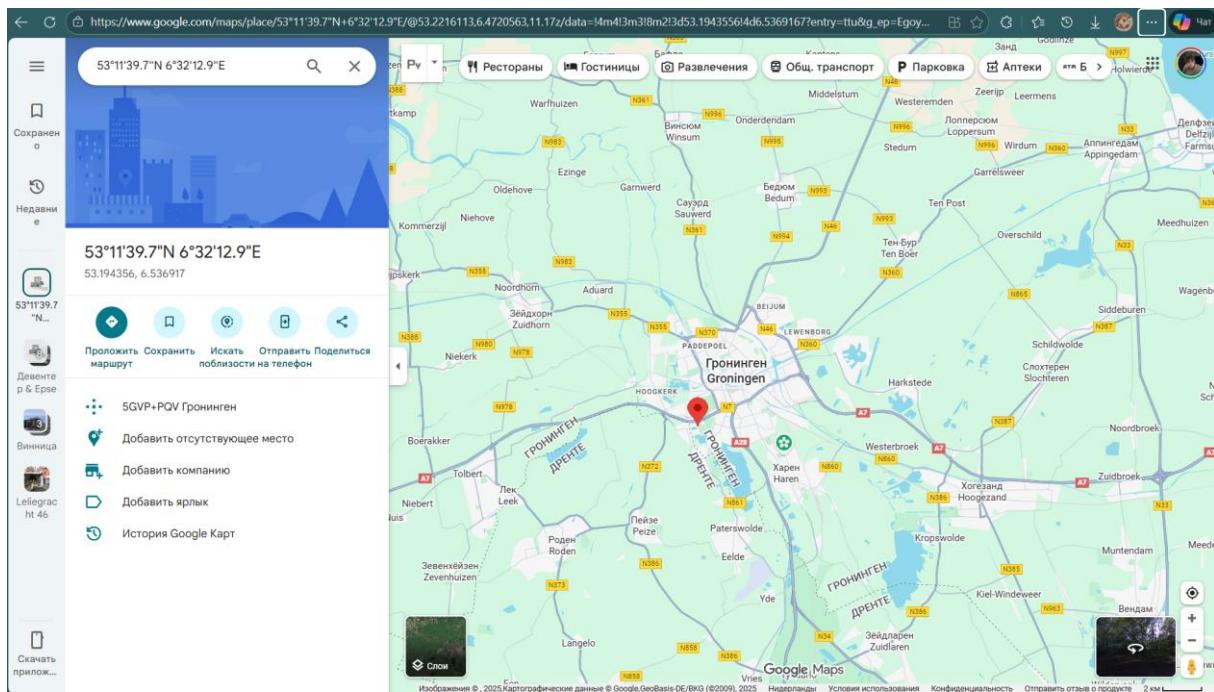
Phone brand: Motorola.



A screenshot of a Linux desktop environment with a terminal window open. The terminal window title is "volodymyr@volodymyr-Virtual-Platform: ~/Pictures". The terminal displays the output of the command "exiftool oldcar.jpg". The output shows GPS metadata including altitude (42 m Above Sea Level), latitude (53 deg 11' 39.68" N), longitude (6 deg 32' 12.90" E), focal length (3.5 mm), and GPS position (53 deg 11' 39.68" N, 6 deg 32' 12.90" E). The desktop background is a purple gradient, and there are icons for Home, test.txt, and ck.txt on the right side.

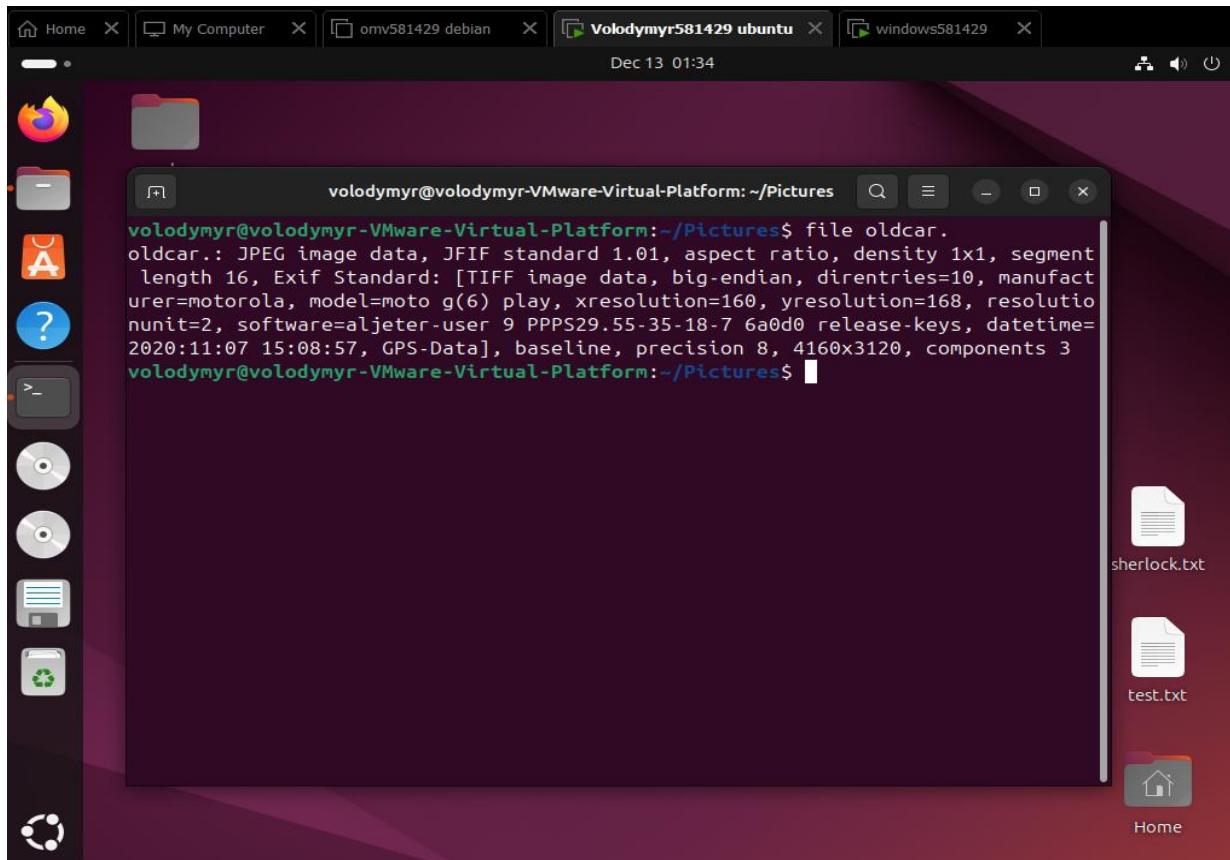
```
GPS Altitude              : 42 m Above Sea Level
GPS Date/Time              : 2020:11:07 14:08:57Z
GPS Latitude               : 53 deg 11' 39.68" N
GPS Longitude              : 6 deg 32' 12.90" E
Focal Length               : 3.5 mm
GPS Position               : 53 deg 11' 39.68" N, 6 deg 32' 12.90" E
Light Value                : 7.7
volodymyr@volodymyr-Virtual-Platform:~/Pictures$
```

GPS is known.



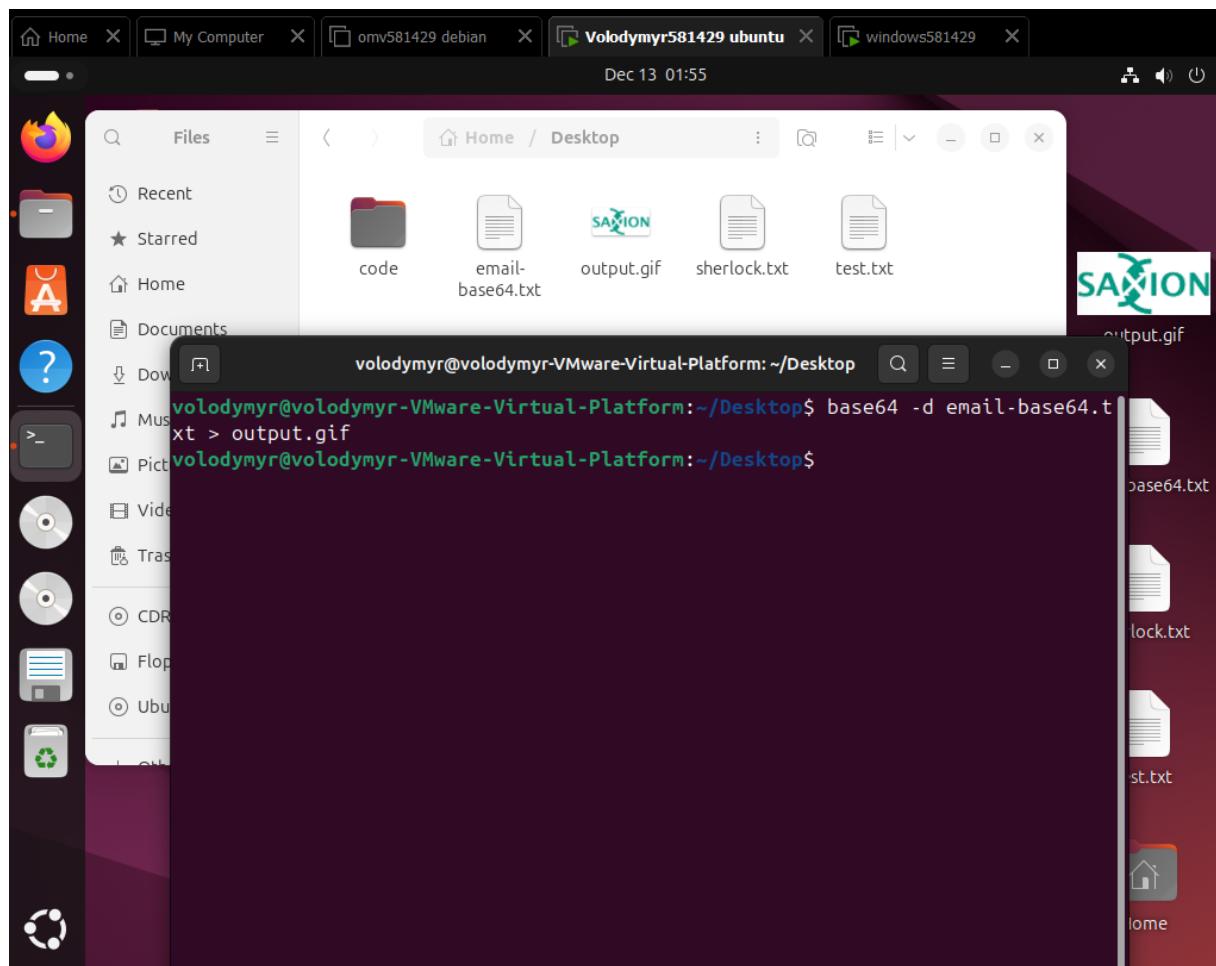
If you enter this GPS in Google Maps, you will find this city (Groningen).

Filename extensions:



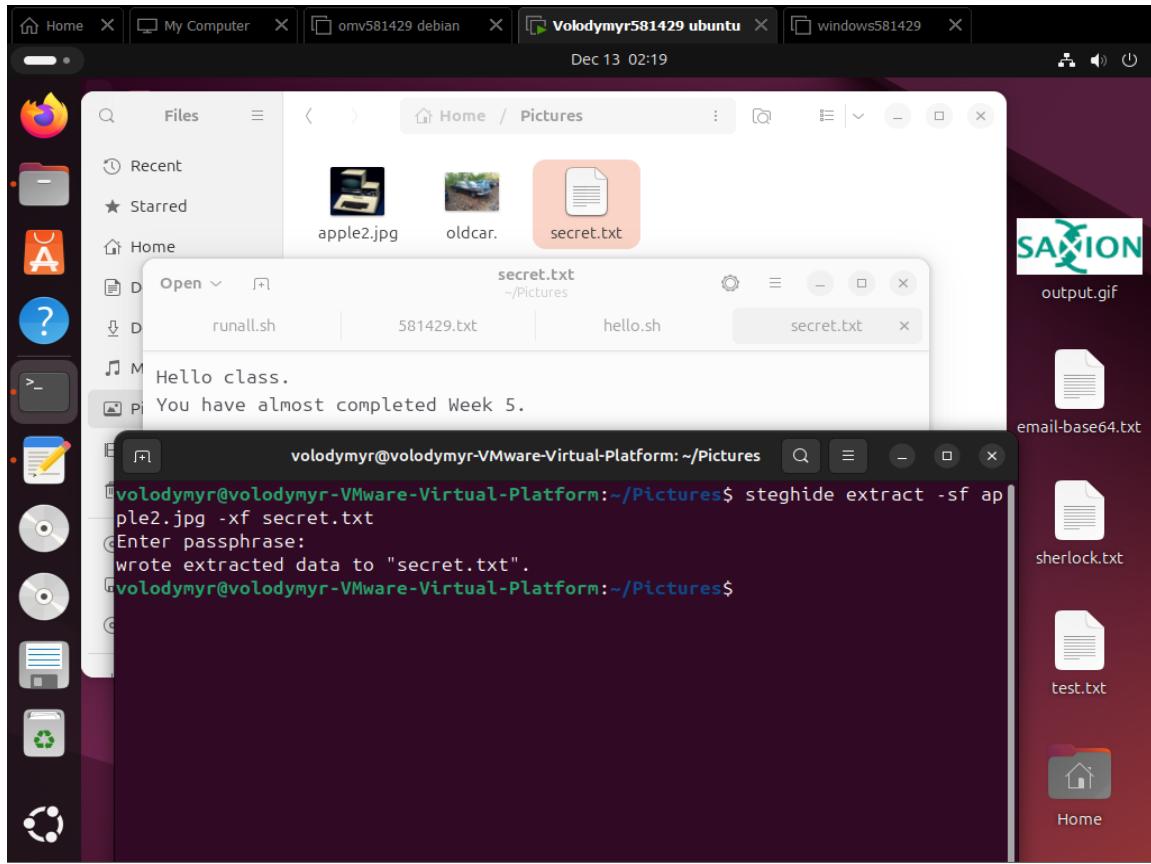
As it can be seen, Ubuntu still sees this file as JPEG.

BASE64:



Assignment 5.8: Steganography

Relevant screenshots + motivation



Assignment 5.9: Capture disk images

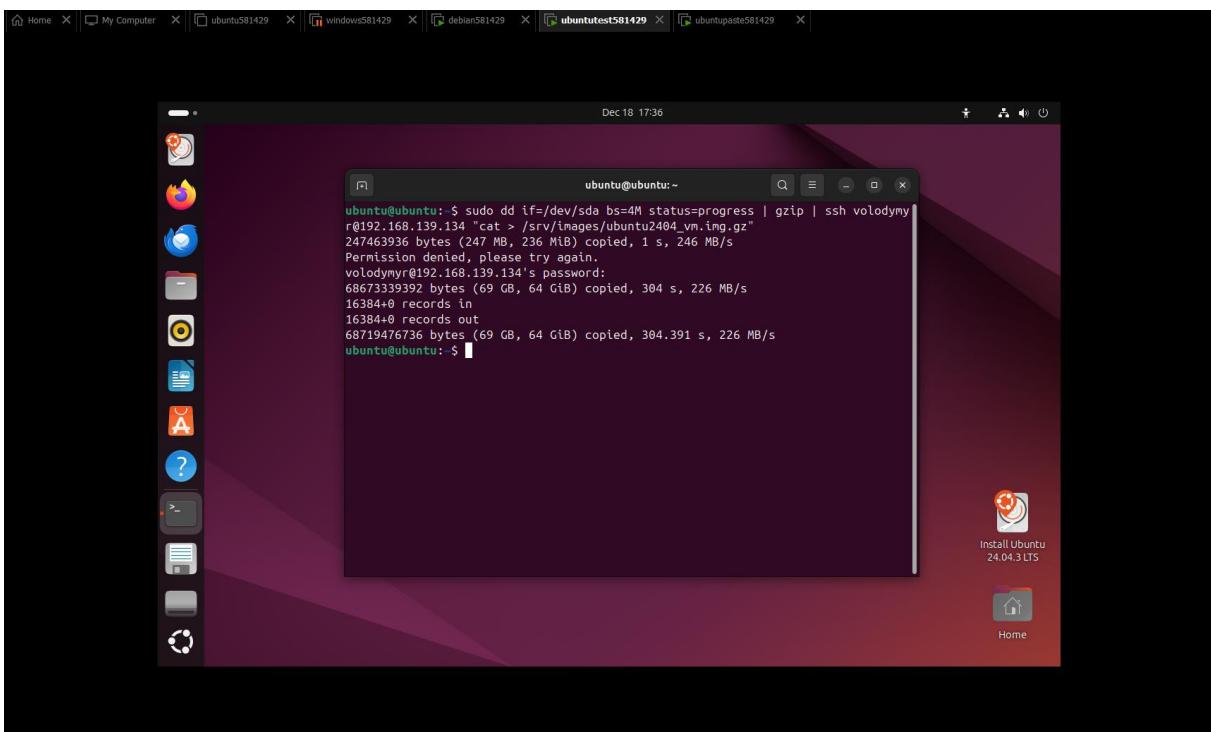
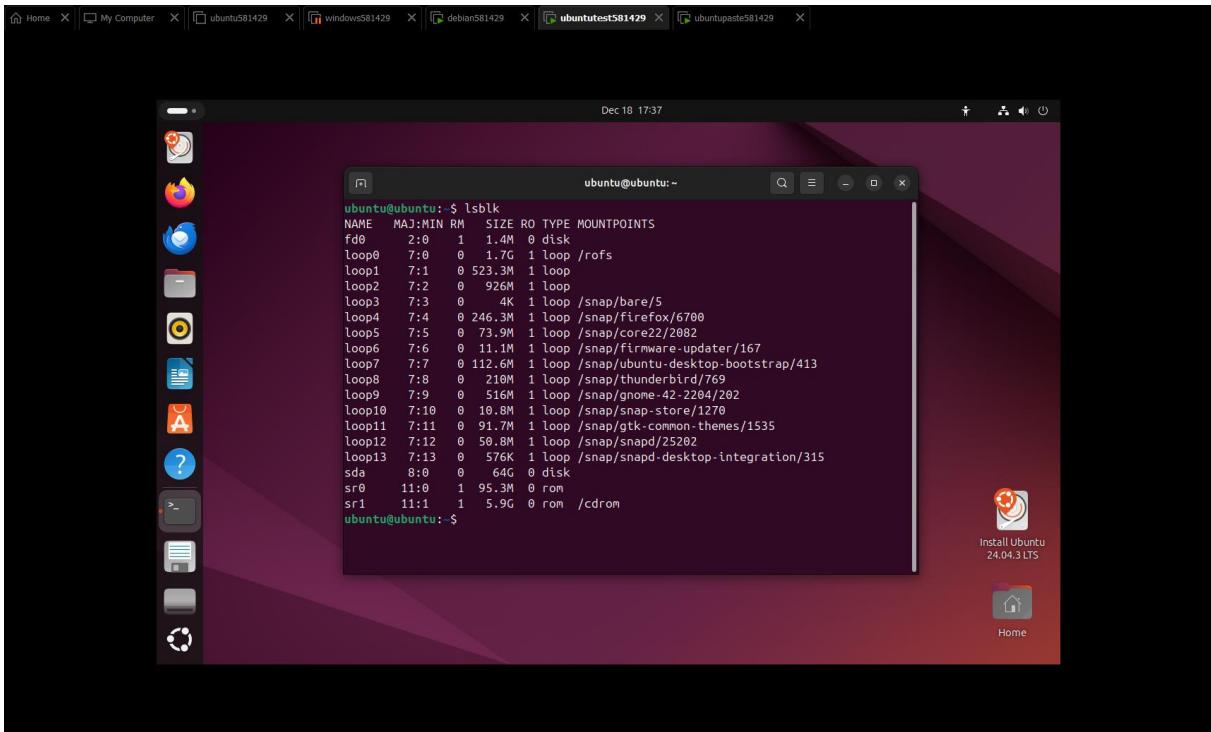
Make relevant screenshots + motivation:

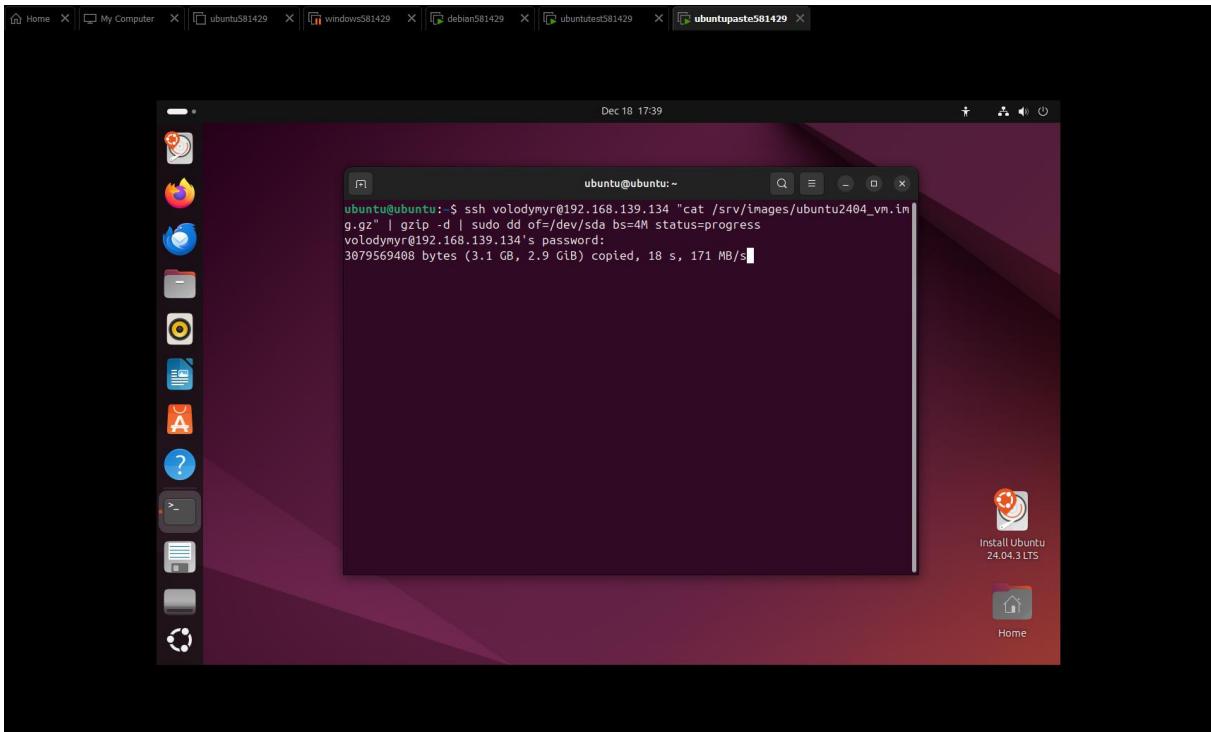
- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.

```
Login incorrect
581429 login: volodymyr
Password:
Linux 581429 6.12.57+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.12.57-1 (2025-11-05) x86_64

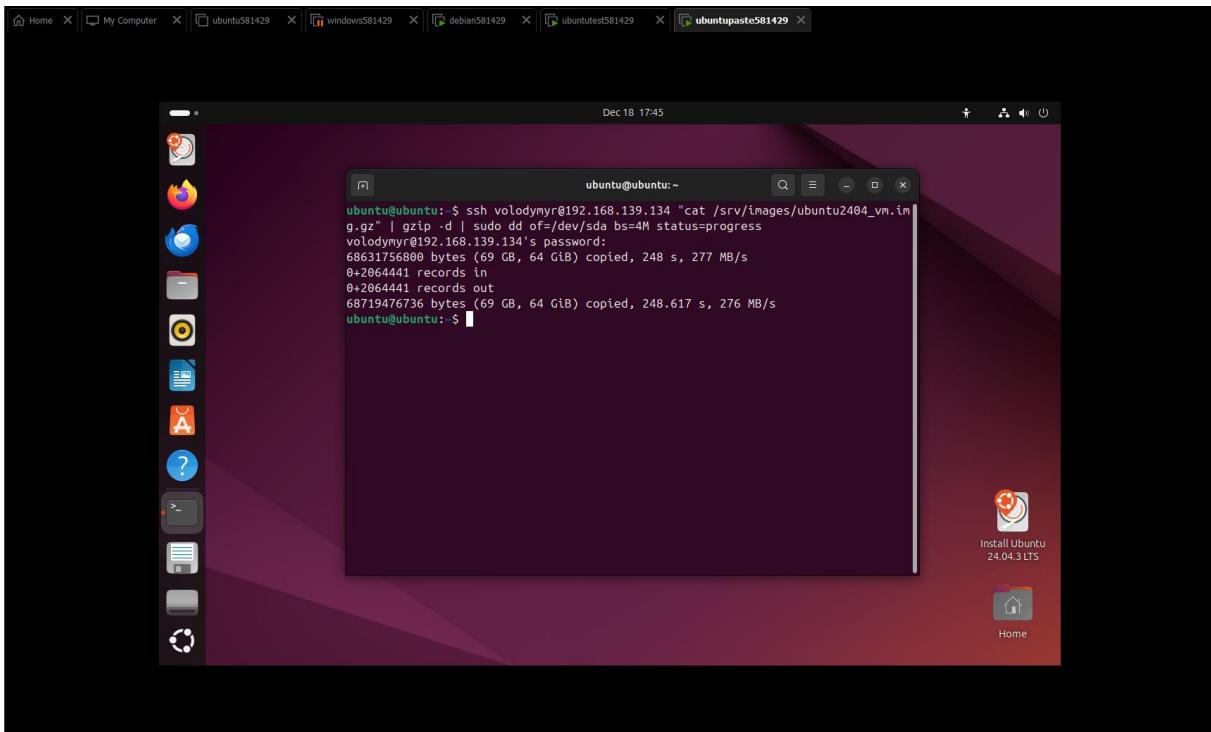
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/<package>/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
volodymyr@581429:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 brd 127.0.0.1 scope host
        valid_lft forever preferred_lft forever
        inets 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 group default qlen 1000
    link/ethernet 00:0c:29:12:0f:37 brd ff:ff:ff:ff:ff:ff
    altname ens3
    altname enx000c29120f37
    inet 192.168.139.134/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
        valid_lft 1687sec preferred_lft 1462sec
        inets 2:134:1:134/128 brd ff:ff:ff:ff:ff:ff scope link
        valid_lft forever preferred_lft forever
volodymyr@581429:~$ sudo apt update
[sudo] password for volodymyr:
Hit:1 http://deb.debian.org/debian trixie InRelease
Get:2 http://security.debian.org/debian-security/trixie-security InRelease [43.4 kB]
Get:3 http://security.debian.org/debian-security/trixie-security InRelease [47.3 kB]
Get:4 http://security.debian.org/debian-security/trixie-security/main Sources [113 kB]
Get:5 http://security.debian.org/debian-security/trixie-security/main Packages [85.2 kB]
Get:6 http://security.debian.org/debian-security/trixie-security/main Translation-en [53.6 kB]
Fetched 449 kB in 0s (1632 kB/s)
Reading package lists... Done
volodymyr@581429:~$ sudo apt install openssh-server -y
openssh-server is already the newest version (1:10.0p1-7).
Summary:
Upgrading 0, Installing: 0, Removing: 0, Not upgrading: 0
volodymyr@581429:~$ sudo systemctl enable -now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
volodymyr@581429:~$ sudo mkdir -p /srv/images
volodymyr@581429:~$ sudo chown $USER:$USER /srv/images
```





- Proof that you can restore the back-up image into an empty VM.



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