Week 5 – Operating Systems

Student number: 579444

Assignment 5.1: Unix-like

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

UNIX is a certified family of operating systems, while unix-like operating systems are systems that mimic the design and behavior, but they lack the certification and are mostly open-source and independent.

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 are the inventors of the UNIX OS family, Ken Thompson created the programming language B, which later served as a base for the programming language C, which was developed by Dennis Ritchie.

Richard Stallman is the author of many things – the most important is the GNU general public license, which is the most famous and used license that grants the public the freedom to share, study, run or modify the software that uses it.

Linus Torvalds is known for creating the Linux kernel – a free and open source unix-like kernel that was created to be a free replacement for the UNIX systems.

c) What is the philosophy of the GNU movement?

The GNU movement promotes free software, meaning users will have the freedom to do anything with software, focusing on open collaboration.

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

Ubuntu mostly conforms to the GNU philosophy because it is based on GNU and uses mostly open-source software.

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

The Windows Subsystem for Linux is a feature that allows users to run Linux environments and commands directly on Windows without even using dual boot or virtual machine.

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

Android is Linux-based (unix-like), iOS is UNIX-based (certified), ChromeOS is Linux-based (unix-like).

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 complex calculations such as scientific research, space exploration, cryptography and so on.

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 group of PS3 consoles connected together and used as a low-cost supercomputer, mainly for simulations.

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 cluster runs Linux, specifically a Raspberry Pi OS-based Linux distribution.

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, because Raspberry Pi clusters are experimental and not powerful enough to compete with true supercomputers.

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?

The CPU architecture is x86-64, the operating systems are: OrbisOS for PS5 (UNIX-like); custom OS based on Windows for Xbox Series X.

The conclusion is that modern consoles use PC-like hardware and operating systems which makes development easier and more efficient.

Assignment 5.3: Working with Windows

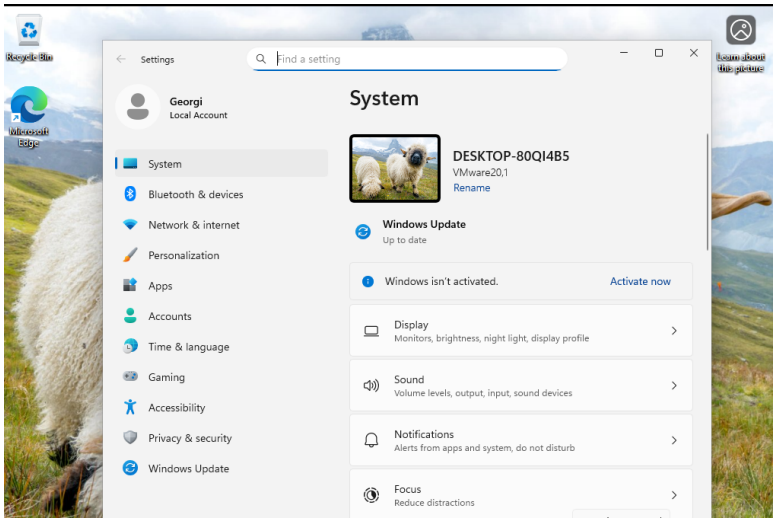
Take relevant screenshots of the assignments below

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.

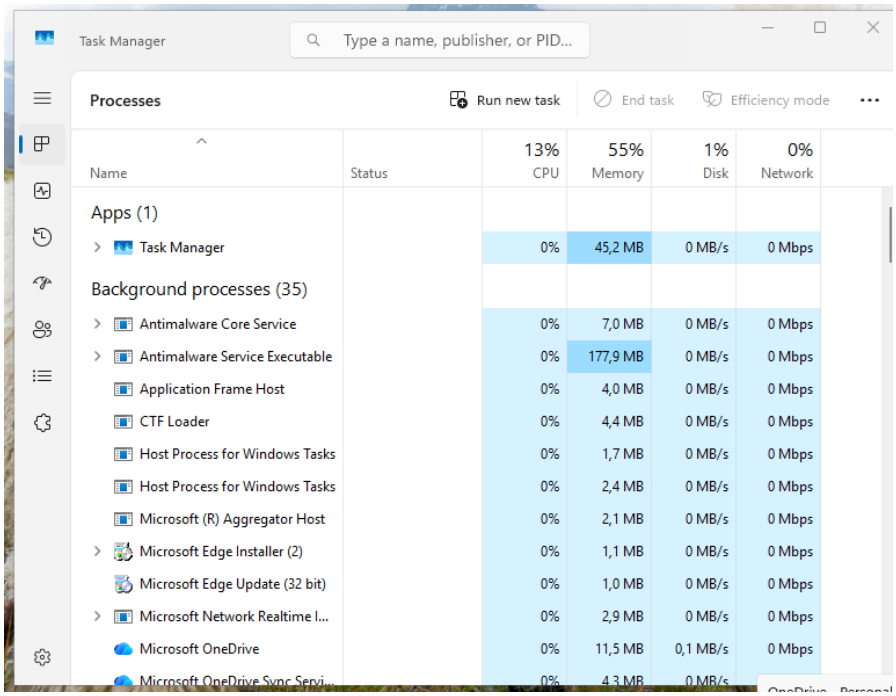
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?

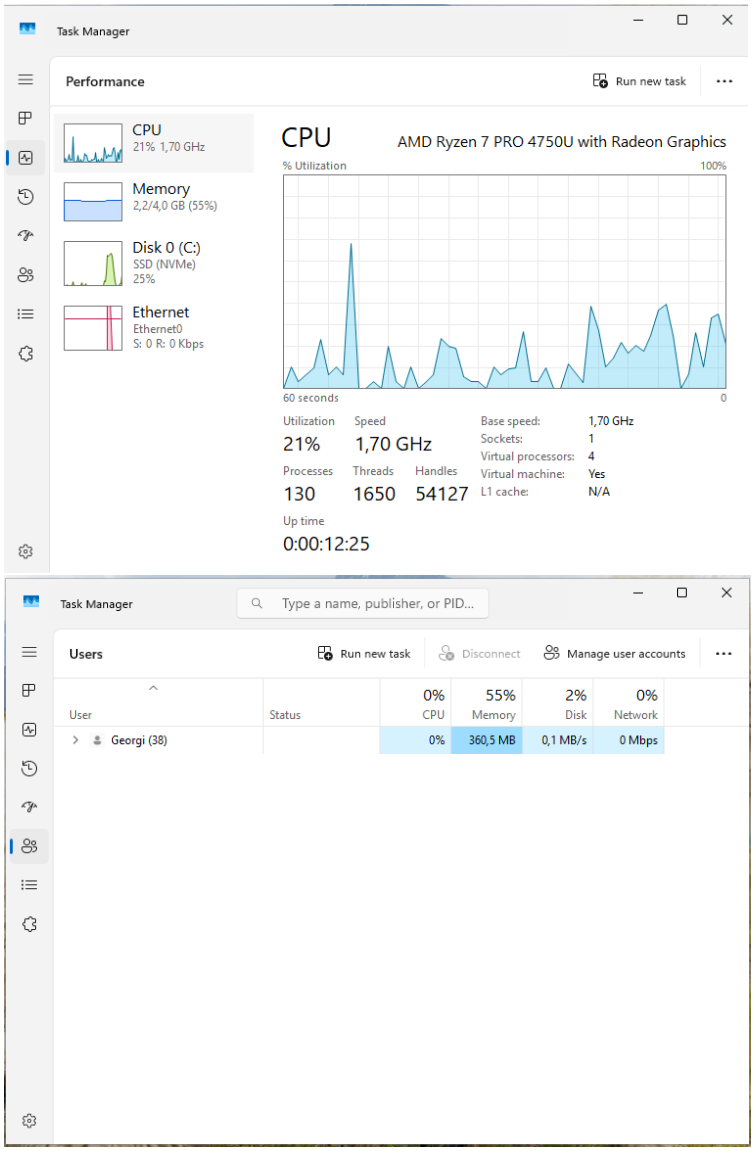
The ⊞ + number could also be used if the file explorer is pinned in the task bar.

c) Open the system properties with a ⊞ 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.





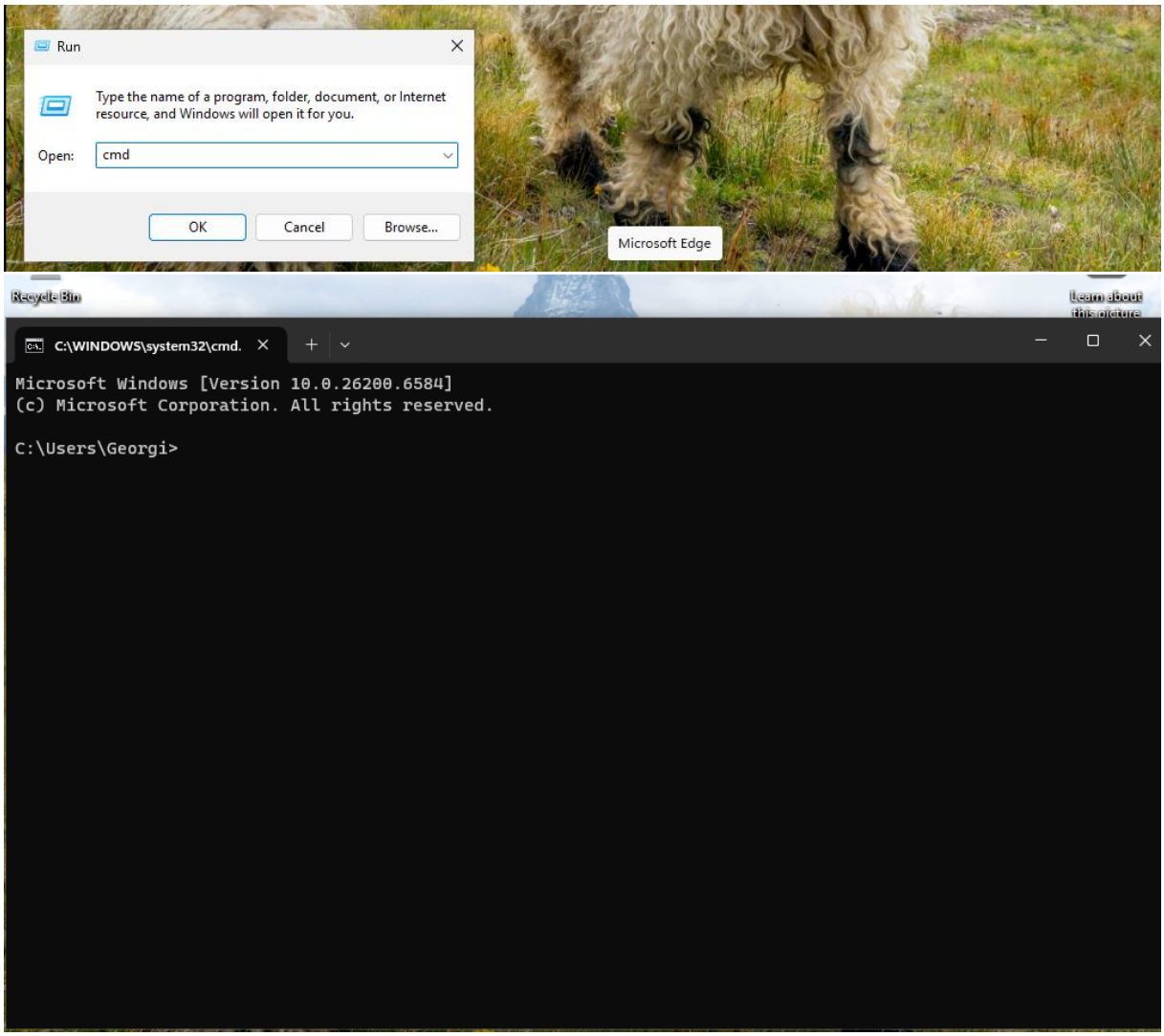
e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

⊞ + 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?

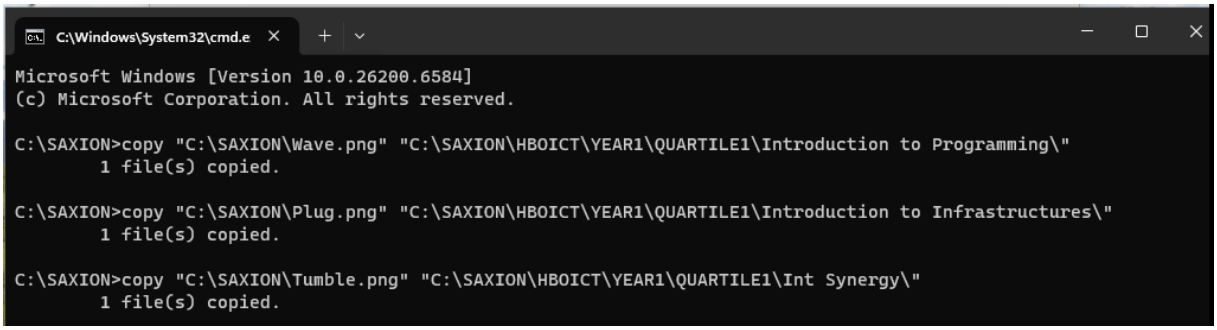
⊞ + L

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.

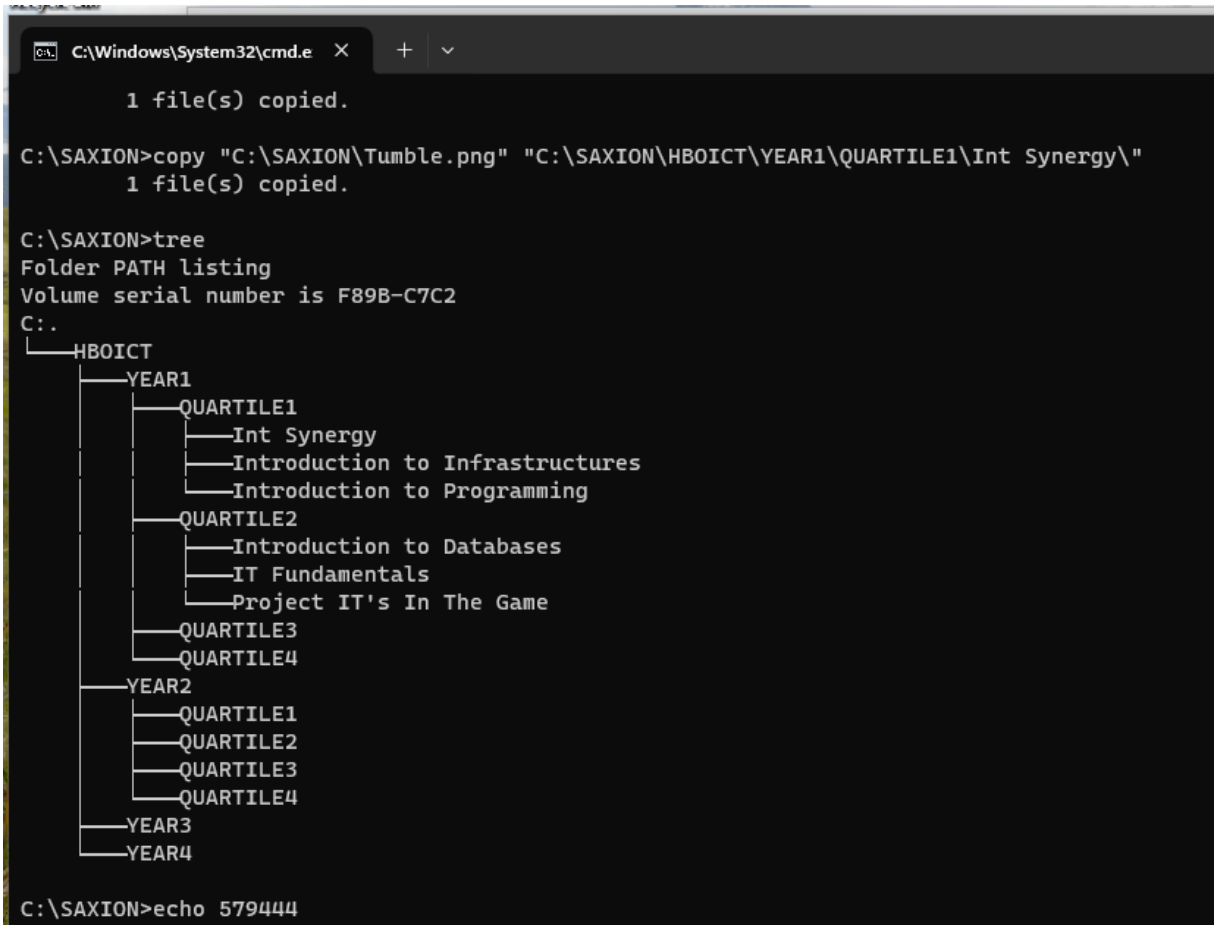


Working in the File Explorer

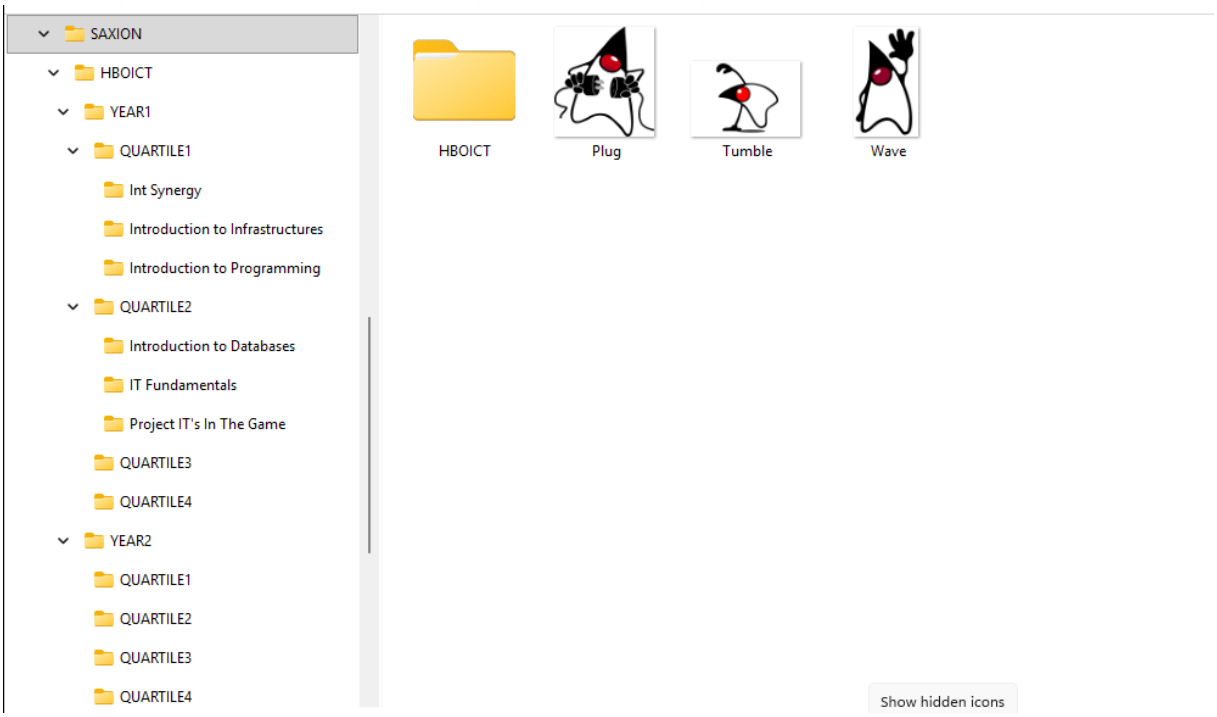
Relevant screenshots **copy** command:



Relevant screenshots **tree** command:

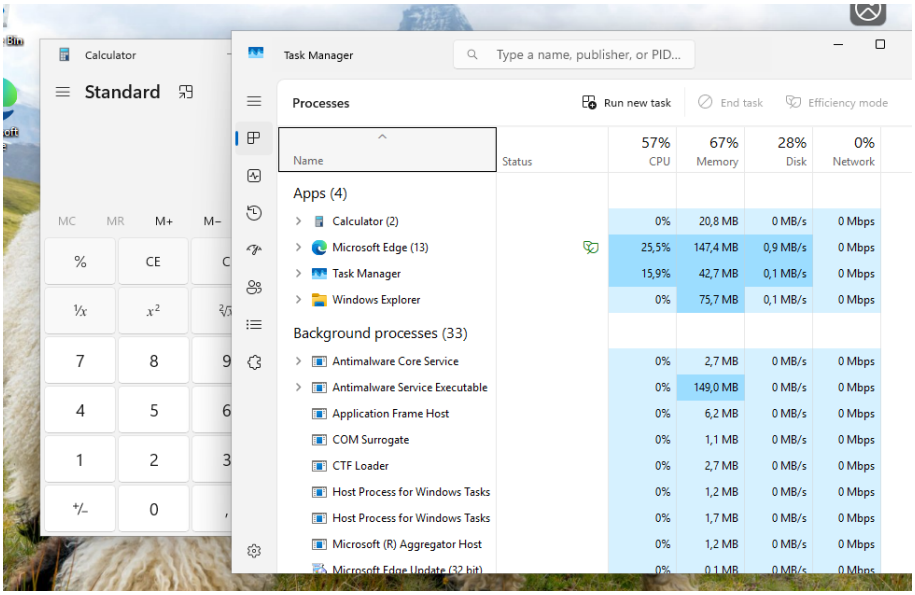


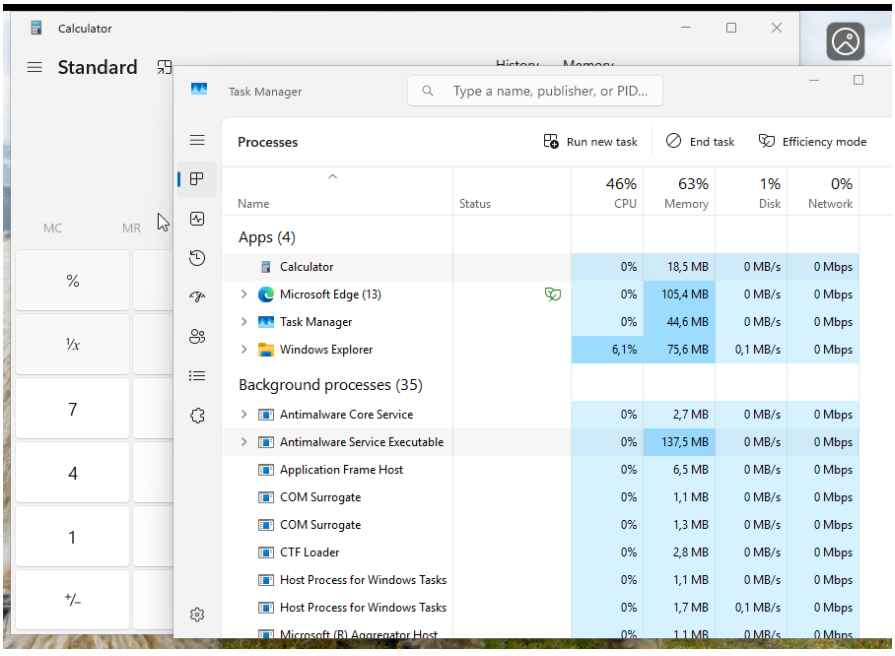
Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



Terminating Processes

Relevant Screenshots Task Manager Window:

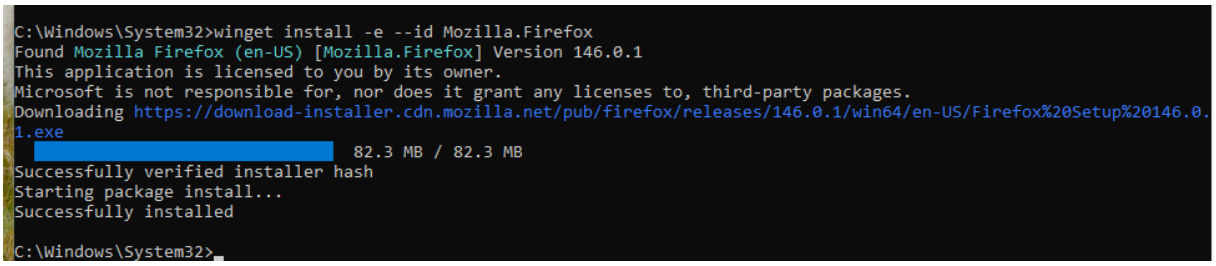




Install Software

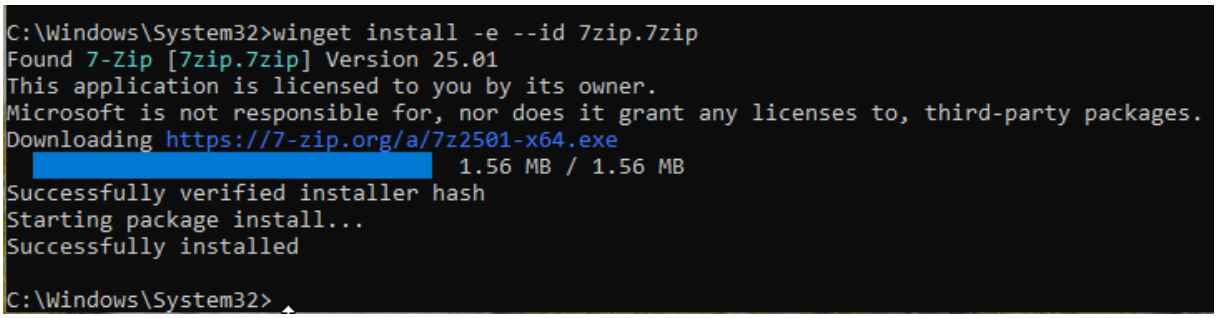
Relevant screenshots that the following software is installed with winget:

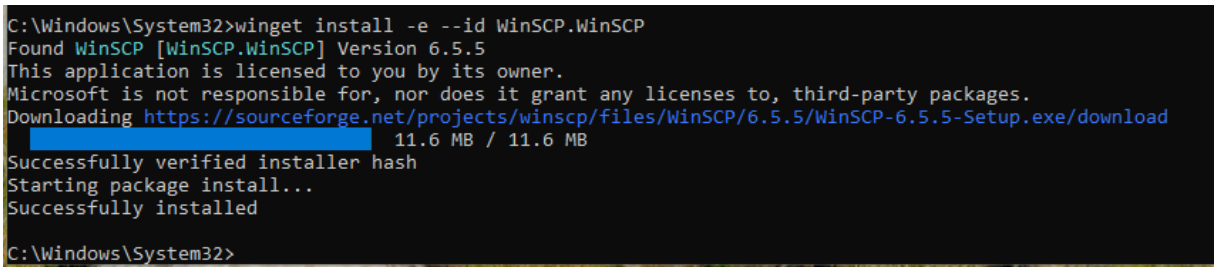
- WinSCP
- Notepad++
- 7zip

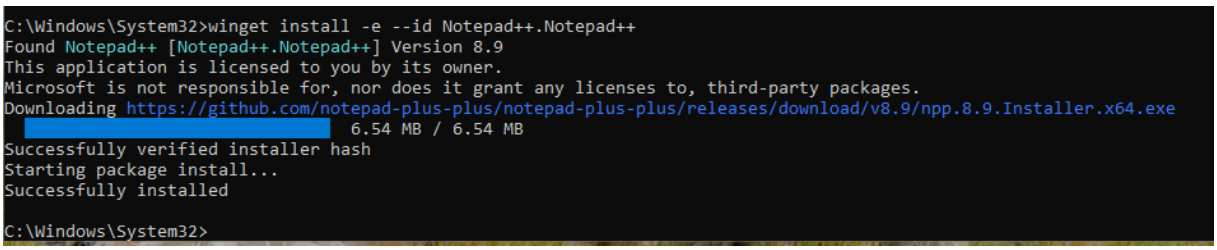


--id is used to specify that the application installed should have this id;

--e is short for exact, which means that it checks the exact string in the query, including a case-sensitivity check.







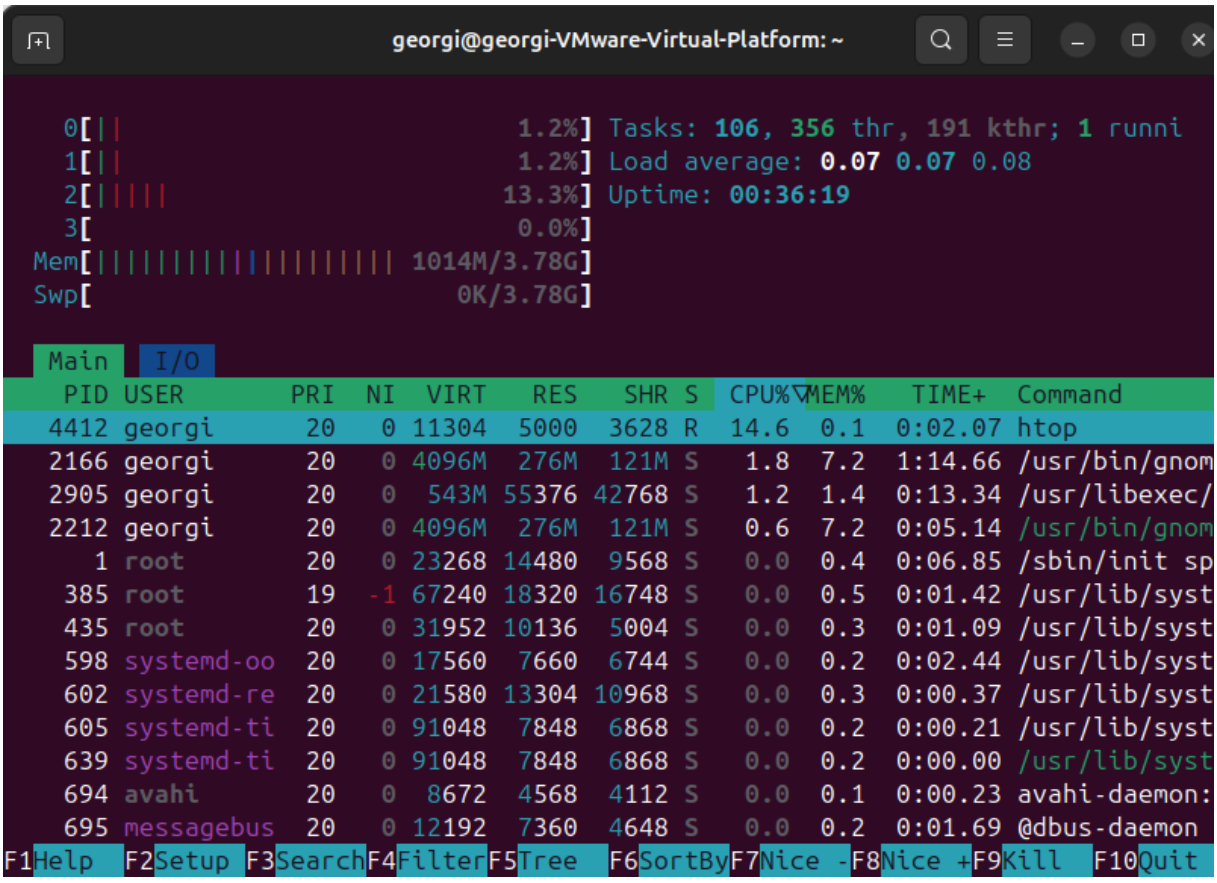
Assignment 5.4: Working with Linux

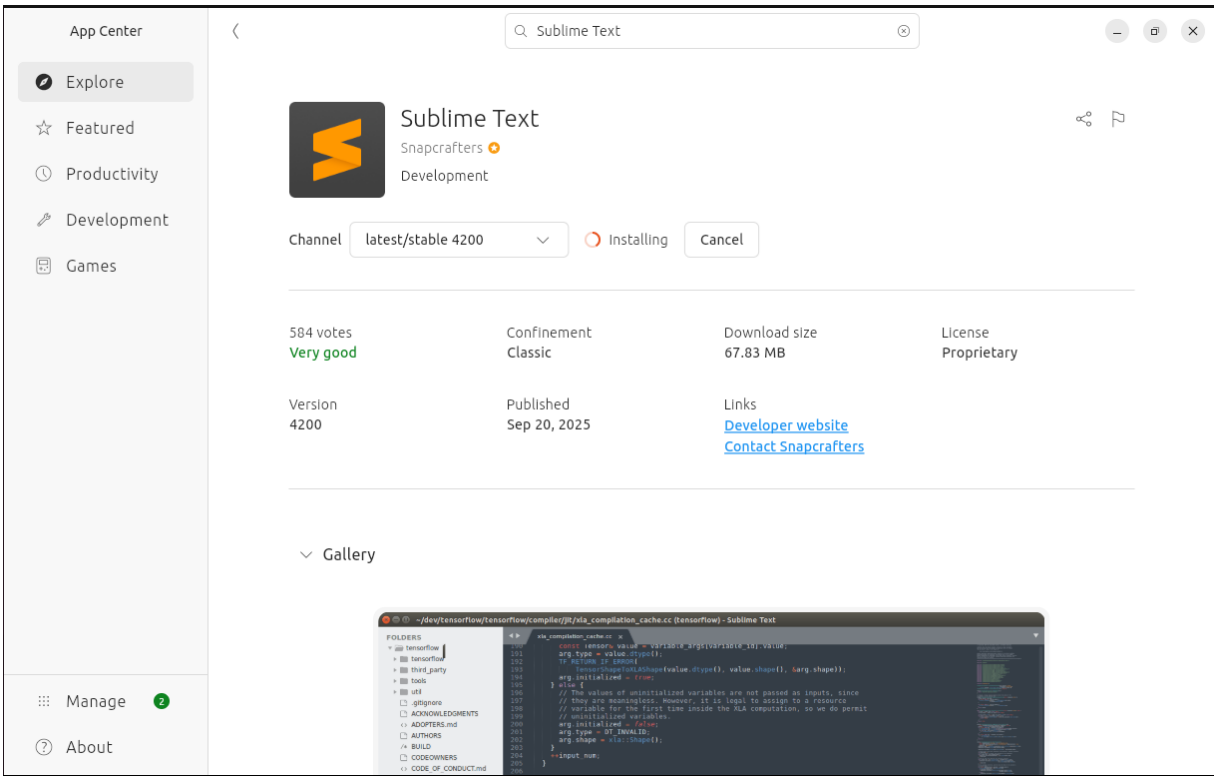
Relevant screenshots + motivation

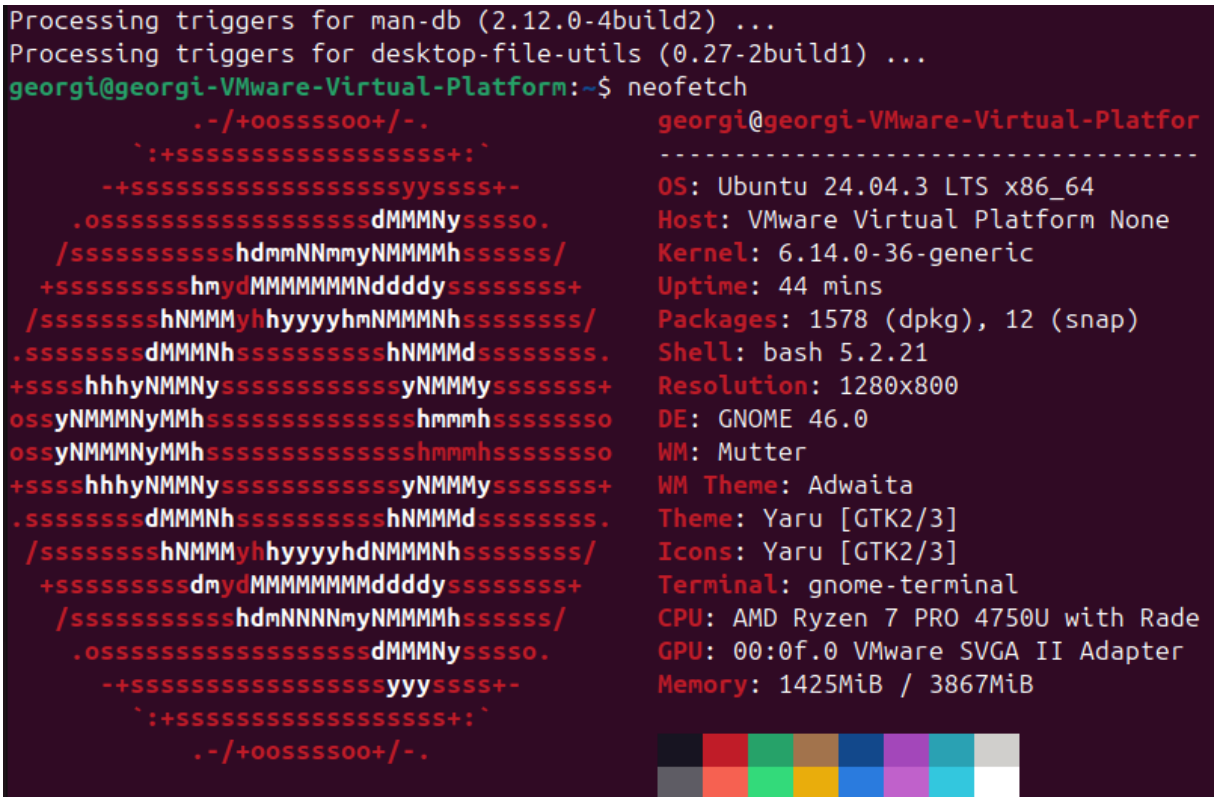
```
georgi@georgi-VMware-Virtual-Platform:~$ ls
Desktop    Downloads  Pictures  simple    snap       test.txt
Documents  Music      Public    simple.c  Templates  Videos
georgi@georgi-VMware-Virtual-Platform:~$ cp ~/test.txt ~/Documents
georgi@georgi-VMware-Virtual-Platform:~$ cd Documents
georgi@georgi-VMware-Virtual-Platform:~/Documents$ ls
test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$
```

```
georgi@georgi-VMware-Virtual-Platform:~$ cd /
georgi@georgi-VMware-Virtual-Platform:/$ ls
bin                home               mnt   sbin.usr-is-merged  usr
bin.usr-is-merged  lib                opt   snap                var
boot               lib64              proc  srv
cdrom              lib.usr-is-merged  root  swap.img
dev                lost+found         run   sys
etc                media              sbin  tmp
georgi@georgi-VMware-Virtual-Platform:/$ cd etc
georgi@georgi-VMware-Virtual-Platform:/etc$ cd ~
georgi@georgi-VMware-Virtual-Platform:~$ ls
Desktop    Downloads  Pictures  simple    snap       test.txt
Documents  Music      Public    simple.c  Templates  Videos
georgi@georgi-VMware-Virtual-Platform:~$
```

```
georgi@georgi-VMware-Virtual-Platform: ~/Documents
georgi@georgi-VMware-Virtual-Platform:~/Documents$ ls
test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ tar -cvf test.tar /home/Docum
ents
tar: Removing leading `/' from member names
tar: /home/Documents: Cannot stat: No such file or directory
tar: Exiting with failure status due to previous errors
georgi@georgi-VMware-Virtual-Platform:~/Documents$ ls
test.tar  test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ tar cvzf test.tar.gz test.txt
test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ ls -l
total 28
-rw-rw-r-- 1 georgi georgi 10240 Dec 11 10:10 test.tar
-rw-rw-r-- 1 georgi georgi   129 Dec 11 10:13 test.tar.gz
-rw-rw-r-- 1 georgi georgi 10240 Dec 11 10:06 test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ rm test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ tar xvzf test.tar.gz
test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$ ls
test.tar  test.tar.gz  test.txt
georgi@georgi-VMware-Virtual-Platform:~/Documents$
```

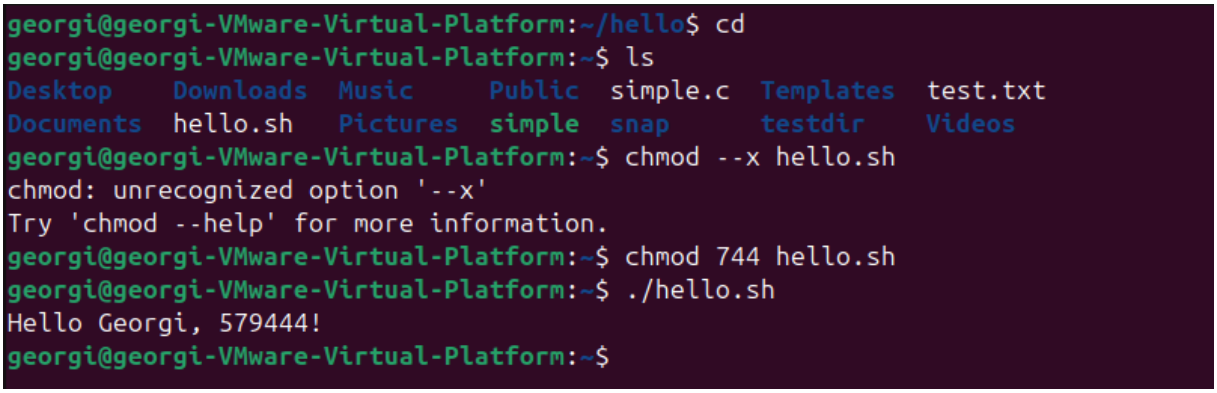

georgi@georgi-VMware-Virtual-Platform: ~
0[|| 1.2%] Tasks: 106, 356 thr, 191 kthr; 1 runni
1[|| 1.2%] Load average: 0.07 0.07 0.08
2[||||| 13.3%] Uptime: 00:36:19
3[0.0%]
Mem[|||||||||||||||||| 1014M/3.78G]
Swp[0K/3.78G]
Main I/O
PID USER PRI NI VIRT RES SHR S CPU%▽MEM% TIME+ Command
4412 georgi 20 0 11304 5000 3628 R 14.6 0.1 0:02.07 htop
2166 georgi 20 0 4096M 276M 121M S 1.8 7.2 1:14.66 /usr/bin/gnom
2905 georgi 20 0 543M 55376 42768 S 1.2 1.4 0:13.34 /usr/libexec/
2212 georgi 20 0 4096M 276M 121M S 0.6 7.2 0:05.14 /usr/bin/gnom
1 root 20 0 23268 14480 9568 S 0.0 0.4 0:06.85 /sbin/init sp
385 root 19 -1 67240 18320 16748 S 0.0 0.5 0:01.42 /usr/lib/syst
435 root 20 0 31952 10136 5004 S 0.0 0.3 0:01.09 /usr/lib/syst
598 systemd-oo 20 0 17560 7660 6744 S 0.0 0.2 0:02.44 /usr/lib/syst
602 systemd-re 20 0 21580 13304 10968 S 0.0 0.3 0:00.37 /usr/lib/syst
605 systemd-ti 20 0 91048 7848 6868 S 0.0 0.2 0:00.21 /usr/lib/syst
639 systemd-ti 20 0 91048 7848 6868 S 0.0 0.2 0:00.00 /usr/lib/syst
694 avahi 20 0 8672 4568 4112 S 0.0 0.1 0:00.23 avahi-daemon:
695 messagebus 20 0 12192 7360 4648 S 0.0 0.2 0:01.69 @dbus-daemon
F1Help F2Setup F3SearchF4FilterF5Tree F6SortByF7Nice -F8Nice +F9Kill F10Quit


App Center
Explore
Featured
Productivity
Development
Games
Manage
About
Sublime Text
Sublime Text
Snapcrafters
Development
Channel
latest/stable 4200
Installing
Cancel
584 votes
Very good
Confinement
Classic
Download size
67.83 MB
License
Proprietary
Version
4200
Published
Sep 20, 2025
Links
Developer website
Contact Snapcrafters
Gallery



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 content of a file

wc – used to count lines, words and bytes of the content in the file

less – used to view the content of a file one page at a time

tail – prints the last couple of lines of a file

head – prints the first few lines of a file

grep – allows the user to search for specific patterns in the content

```
georgi@georgi-VMware-Virtual-Platform:~$ ls
Desktop    hello.sh  Public        simple.c   testdir
Documents  Music     sherlock.txt  snap       test.txt
Downloads  Pictures  simple        Templates  Videos
georgi@georgi-VMware-Virtual-Platform:~$ wc sherlock.txt
 12306 107562 607504 sherlock.txt
georgi@georgi-VMware-Virtual-Platform:~$ 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
```

```
georgi@georgi-VMware-Virtual-Platform:~$ head -n 500 sherlock.txt | tail -21
“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.”

“And for present expenses?”

The King took a heavy chamois leather bag from under his cloak and laid
it on the table.

“There are three hundred pounds in gold and seven hundred in notes,” he
said.
```

```
georgi@georgi-VMware-Virtual-Platform:~$ head -n 1134 sherlock.txt | tail -21

The King stared at him in amazement.

“Irene’s photograph!” he cried. “Certainly, if you wish it.”

“I thank your Majesty. Then there is no more to be done in the matter.
I have the honour to wish you a very good morning.” He bowed, and,
turning away without observing the hand which the King had stretched
out to him, he set off in my company for his chambers.

And that was how a great scandal threatened to affect the kingdom of
Bohemia, and how the best plans of Mr. Sherlock Holmes were beaten by a
woman’s wit. He used to make merry over the cleverness of women, but I
have not heard him do it of late. And when he speaks of Irene Adler, or
when he refers to her photograph, it is always under the honourable
title of _the_ woman.



II. THE RED-HEADED LEAGUE
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

Camera Brand
motorola

Camera Model
moto g(6) play

Coordinates
53.194355° N 6.536917° E (42 m)


```
georgi@georgi-VMware-Virtual-Platform:~$ 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
georgi@georgi-VMware-Virtual-Platform:~$
```

```
georgi@georgi-VMware-Virtual-Platform:~$ man base64
georgi@georgi-VMware-Virtual-Platform:~$ base64 -d email-base64.txt > result.gif
georgi@georgi-VMware-Virtual-Platform:~$ ls
Desktop     email-base64.txt  oldcar     result.gif    simple.c   testdir
Documents   hello.sh          Pictures   sherlock.txt  snap       test.txt
Downloads   Music             Public     simple        Templates  Videos
```

Assignment 5.8: Steganography

Relevant screenshots + motivation

```
georgi@georgi-VMware-Virtual-Platform:~$ steghide extract -sf "apple2.jpg"
Enter passphrase:
wrote extracted data to "message.txt".
georgi@georgi-VMware-Virtual-Platform:~$
```

Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

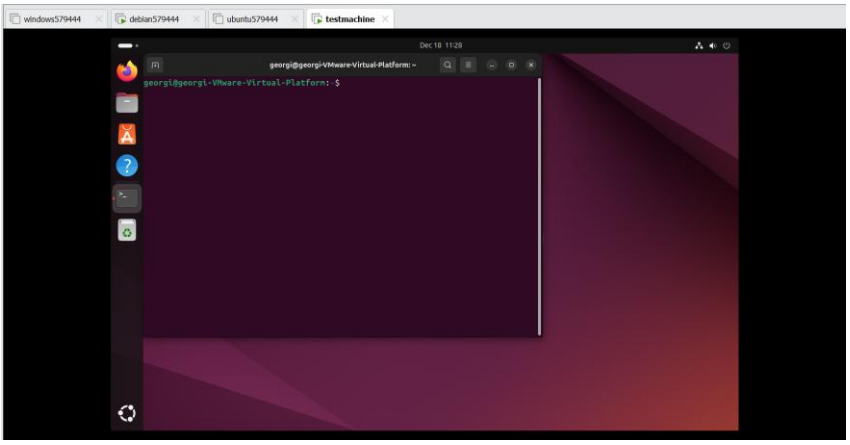
- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.

```
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh geor
gi@192.168.139.133 "cat > /srv/images/ubuntu2404_vm.img.gz"
georgi@192.168.139.133's password:
68572676096 bytes (69 GB, 64 GiB) copied, 816 s, 84.0 MB/s
16384+0 records in
16384+0 records out
68719476736 bytes (69 GB, 64 GiB) copied, 817.728 s, 84.0 MB/s
```

```
root@omv:~# ls -l /srv/images
total 5945516
-rw-rw-r-- 1 georgi georgi 6088203675 Dec 18 10:27 ubuntu2404_vm.img.gz
root@omv:~#
```

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

```
ubuntu@ubuntu:~$ ssh georgi@192.168.139.133 "cat /srv/images/ubuntu2404_vm.img.g
z" | gzip -d | sudo dd of=/dev/nvme0n1 bs=4M status=progress
The authenticity of host '192.168.139.133 (192.168.139.133)' can't be establishe
d.
ED25519 key fingerprint is SHA256:GrrXXzH08eRQib1TNvqHL6rNo8HWL1XqOFkyFZVtQY8.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.133' (ED25519) to the list of known host
s.
georgi@192.168.139.133's password:
68705320960 bytes (69 GB, 64 GiB) copied, 457 s, 150 MB/s
0+2039809 records in
0+2039809 records out
68719476736 bytes (69 GB, 64 GiB) copied, 458.554 s, 150 MB/s
ubuntu@ubuntu:~$
```



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