

Template Week 5 – Operating Systems

Student number:

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Assignment 5.1: Unix-like

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

Unix is het originele besturingssysteem, en Unix-like systemen zoals Linux en macOS zijn systemen gebouwd van het originele Unix.

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 = Mede ontwikkelaar van Unix in 1969

Dennis Ritchie = bedenker van programmeertaal C

Bill Joy = ontwikkelaar van BSD Unix

Richard Stallman = Startte het GNU Project in 1983 en de Free Software Foundation

Linus Torvalds = ontwikkelde de Linux Kernel in 1991 gebouwd op Unix principes.

c) What is the philosophy of the GNU movement?

De GNU filosofie draait om vrijheid van softwaregebruik. Je bent hierbij vrij om software te gebruiken, bestuderen, wijzigen en delen.

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

Ja, Ubuntu is gebaseerd op GNU/Linux en gebruikt veel vrije software, dat komt erg overeen met het GNU movement dat alles zo veel mogelijk toegankelijk moet zijn voor iedereen.

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

WSL is een functie in Windows waarmee je een Linux omgeving kunt draaien binnen Windows, zonder VM.

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

Android = Unix-like, Gebaseerd op Linux kernel

iOS = Unix-like, gebaseerd op Darwin

ChromeOS = Unix-like, gebaseerd op 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>

- Weersvoorspellingen
- Code kraken
- Medicijn ontwikkeling
- Wetenschappelijk onderzoek

Ze zijn ontworpen om miljoenen berekeningen per seconde uit te voeren en worden vaak gebruikt door overheden, onderzoeksinstellingen en grote bedrijven.

- 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?

Een PlayStation 3 cluster is een netwerk van PS3-consoles die samenwerken als één supercomputer. De PS3 was populair voor clusters omdat hij goedkoop was en Linux kon draaien via de "OtherOS"-functie.

- 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 supercomputer draait op Oracle Autonomous Linux

- 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/>

Nee, een Raspberry Pi is een super kleine laag energie gebruik computertje, in de top 500 lijst staan de grootste machines ter wereld die ver uit het bereik staan van een Raspberry Pi.

- 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?

Console	CPU architectuur	OS
PS5	AMD Zen 2	Custom PlayStation OS
Xbox Series X	AMD Zen 2	Custom Xbox OS


Beide consoles gebruiken dezelfde CPU-architectuur (AMD Zen 2), maar draaien op totaal verschillende besturingssystemen. Dit laat zien dat hardware gelijk kan zijn, maar software bepaalt de gebruikerservaring en ecosysteem.

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.

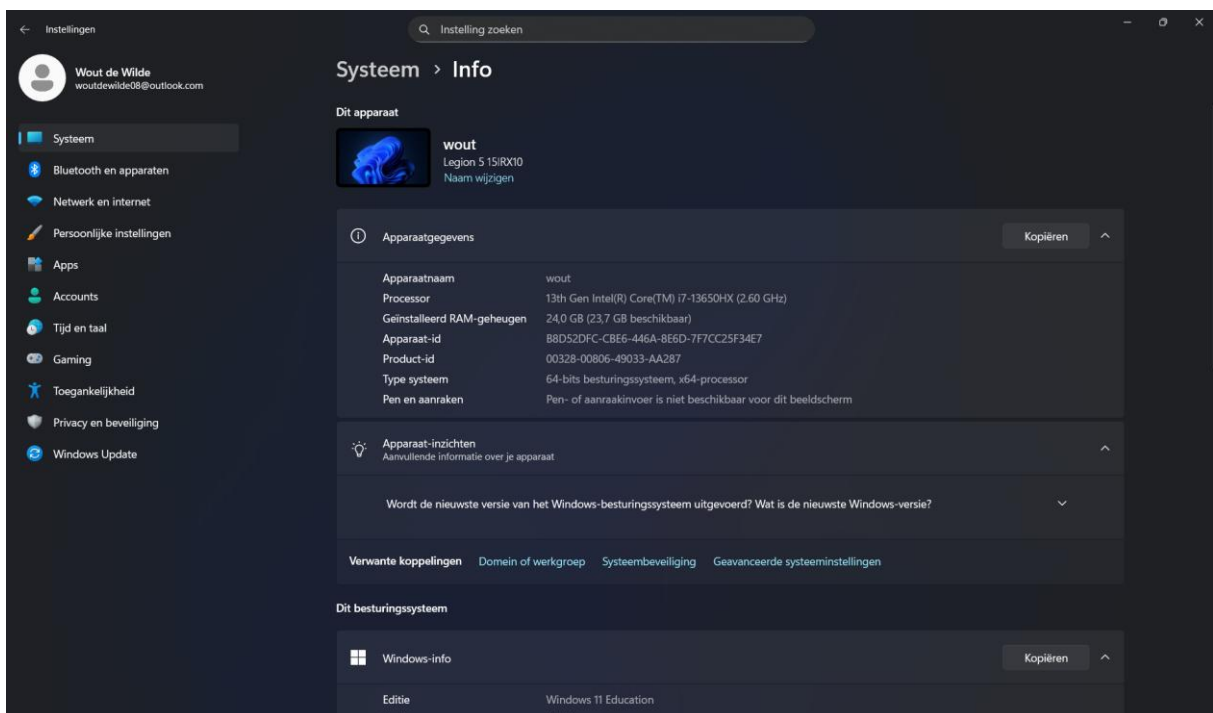
Ik heb 10 minuten geoefend met de windows shortcut combinaties.

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

Windows + E

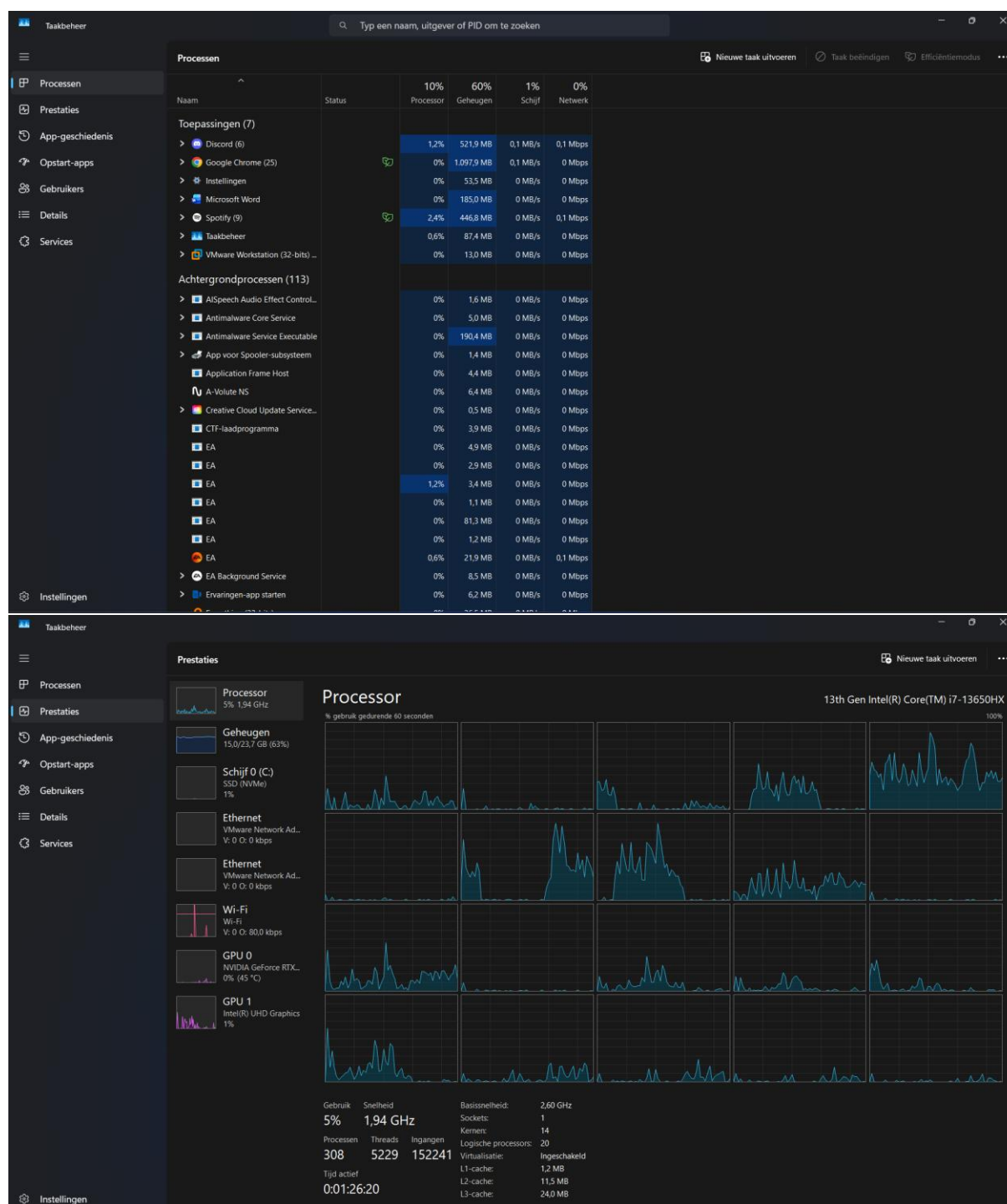
- c) Open the system properties with a  key combination, take a screenshot of the open screen. Paste this screenshot into this template.

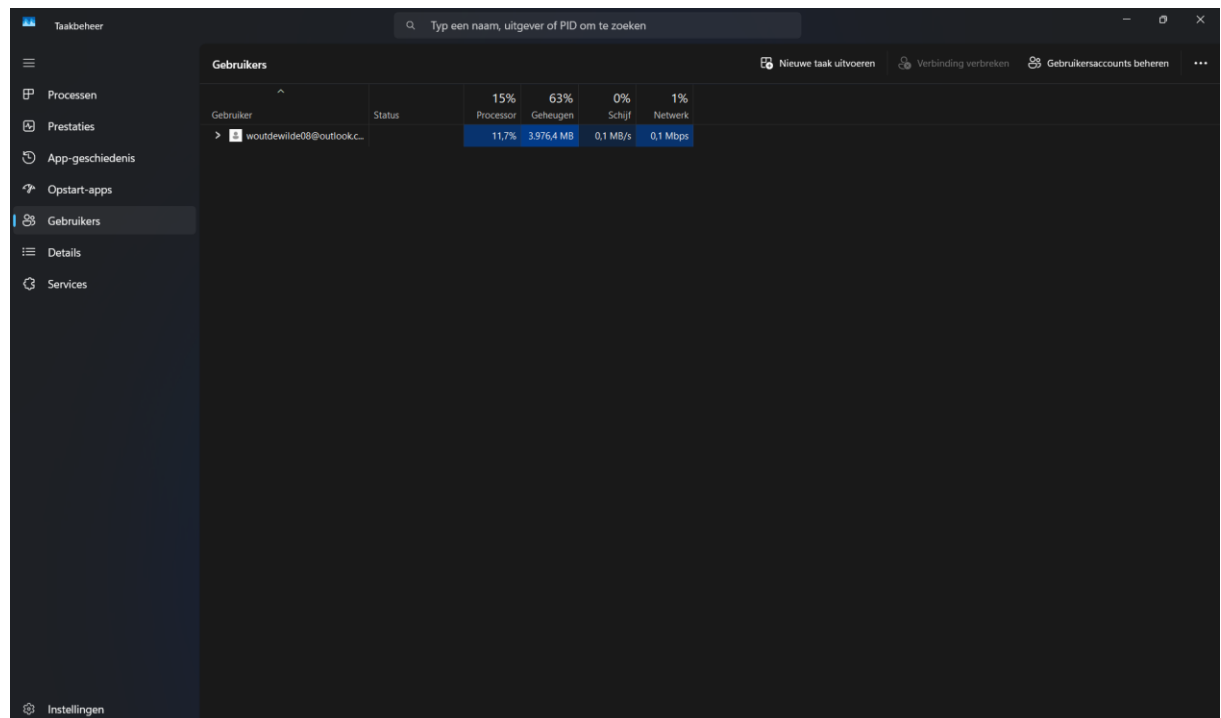
Windows + pause



- 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.

Control + Shift + Escape





- 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 + 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?

Windows + 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.

Windows + R voor het Run scherm

```
C:\Windows\system32\CMD.e x + v
Microsoft Windows [Version 10.0.26200.7462]
(c) Microsoft Corporation. Alle rechten voorbehouden.
C:\Users\woutd>
```

Working in the File Explorer

Relevant screenshots **copy** command:

```
C:\Windows\System32\cmd.e x + v
Microsoft Windows [Version 10.0.26200.6584]
(c) Microsoft Corporation. All rights reserved.

C:\SAXION>copy C:\SAXION\Wave.png C:\SAXION\IntroProgrammeren\
The system cannot find the path specified.
0 file(s) copied.

C:\SAXION>copy C:\SAXION\Wave.png C:\SAXION\YEAR1\QUARTILE1\IntroProgrammeren\
The system cannot find the path specified.
0 file(s) copied.

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

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

C:\SAXION>copy C:\SAXION\Tumble.png C:\SAXION\HBOICT\YEAR1\QUARTILE1\OrganisatieIT\
1 file(s) copied.
'IT\' is not recognized as an internal or external command,
operable program or batch file.

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

C:\SAXION>copy Tumble.png C:\SAXION\HBOICT\YEAR1\QUARTILE1\OrganisatieIT\
Overwrite C:\SAXION\HBOICT\YEAR1\QUARTILE1\OrganisatieIT\Tumble.png? (Yes/No/All): Yes
1 file(s) copied.

C:\SAXION>
```

Relevant screenshots **tree** command:

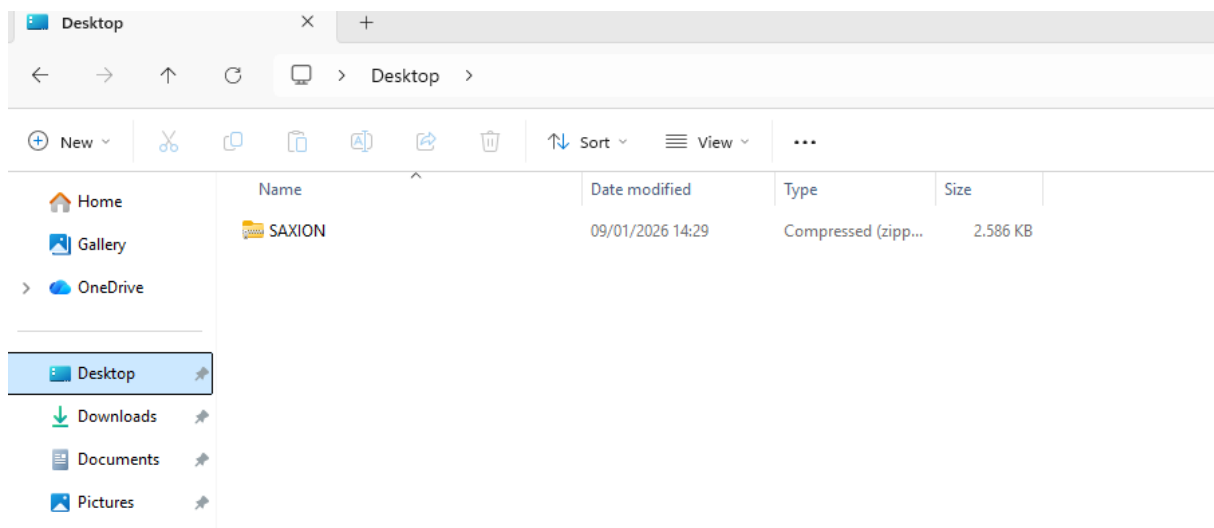
```

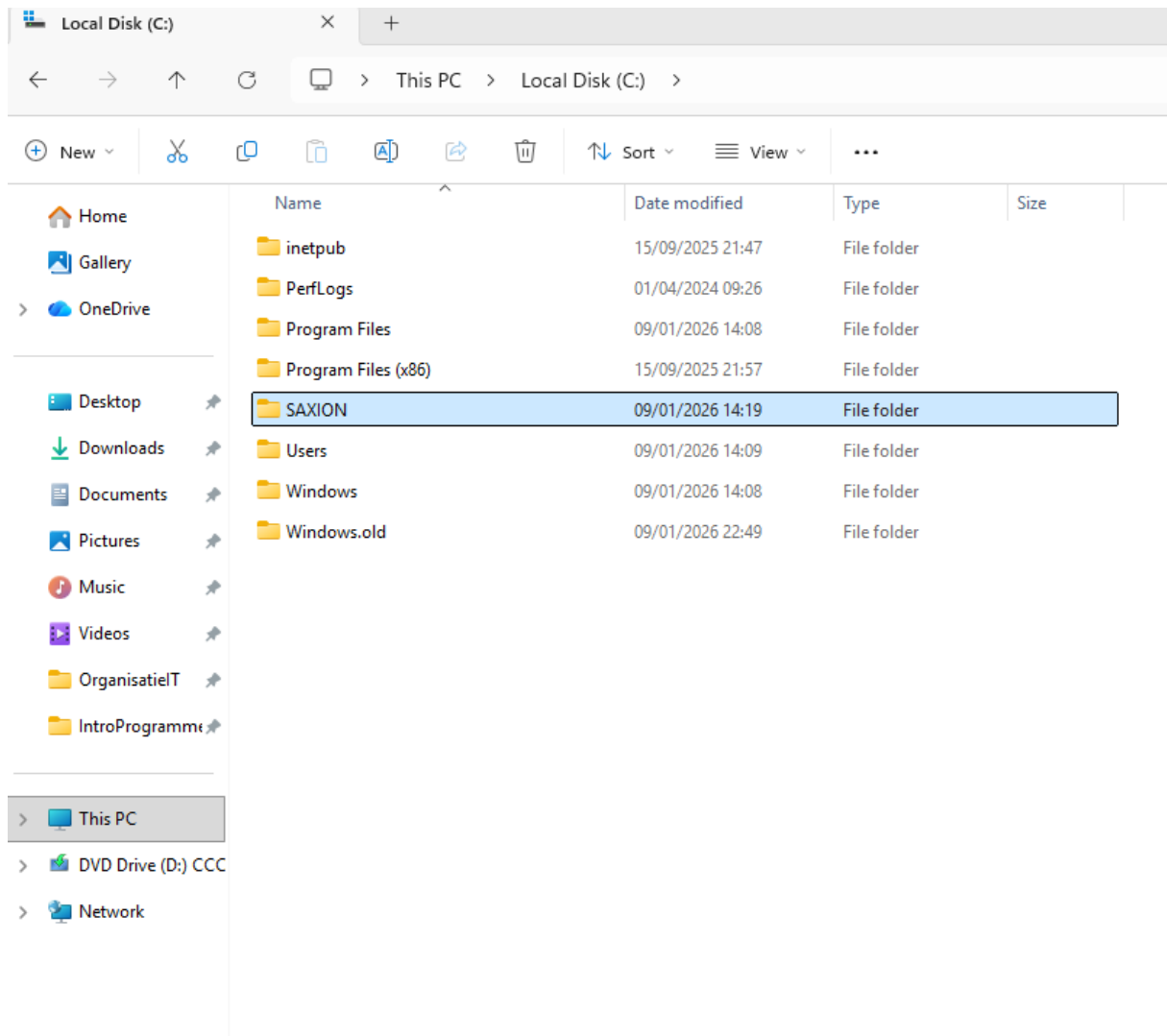
C:\SAXION>tree
Folder PATH listing
Volume serial number is A03E-133A
C:..
|_HBOICT
|   |_YEAR1
|   |   |_QUARTILE1
|   |   |   |_Infrastructuur
|   |   |   |_IntroProgrammeren
|   |   |   |_OrganisatieIT
|   |   |_QUARTILE2
|   |   |   |_Databases
|   |   |   |_IT Fundamentals
|   |   |   |_Its in the Game
|   |   |_QUARTILE3
|   |   |_QUARTILE4
|   |_YEAR2
|   |   |_QUARTILE1
|   |   |_QUARTILE2
|   |   |_QUARTILE3
|   |   |_QUARTILE4
|   |_YEAR3
|   |_YEAR4
|
C:\SAXION>echo %wout%
%wout%

C:\SAXION>

```

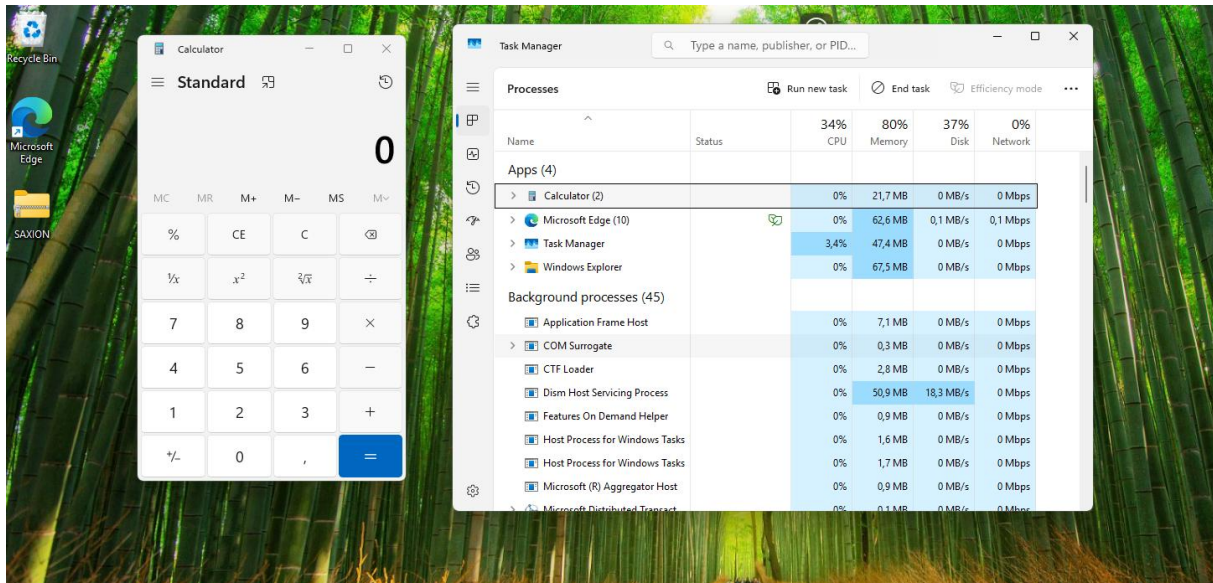
Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



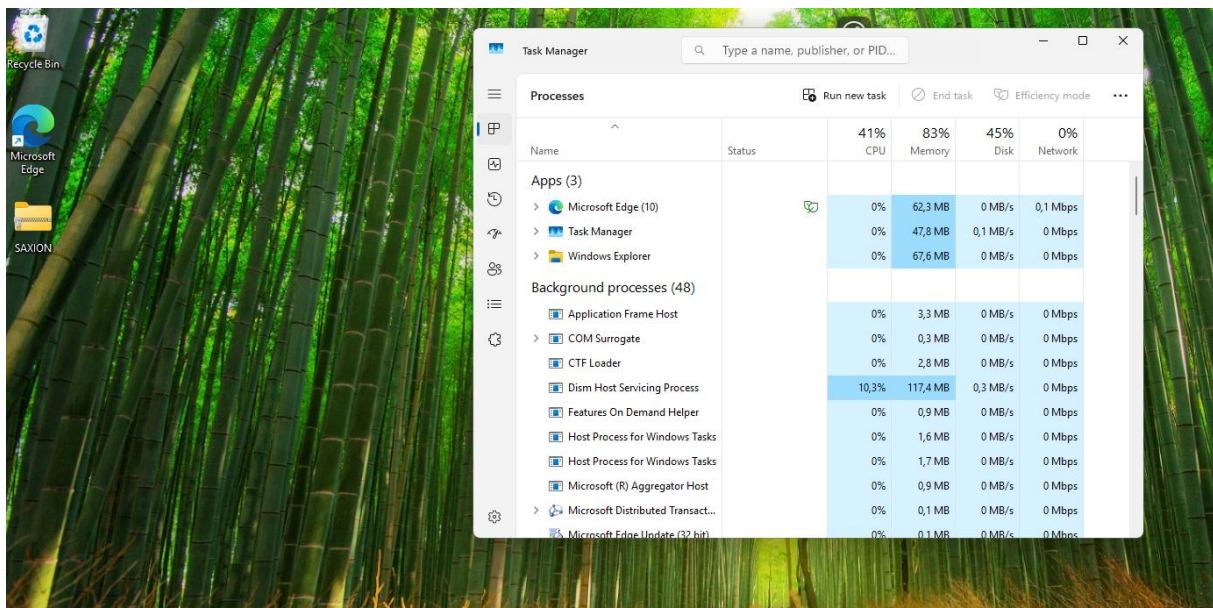


Terminating Processes

Relevant Screenshots Task Manager Window:



Taak beëindigt:



Install Software

Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++
- 7zip

Installeer Firefox:

```
Command Prompt
Firefox - Unbranded Build - Mozilla.Firefox.Unbranded... 147.0b1 winget
Profile Switcher for Firefox... nulldev.ProfileSwitcherfor... 0.1.1 winget
Ablaze Floorp Ablaze.Floorp 12.10... Tag: firefox-fo... winget
Floorp 12 Daylight Ablaze.Floorp.Daylight 138.0... Tag: firefox-fo... winget
r3dfox EclipseCommunity.r3dfox 146.0 Tag: firefox-fo... winget
Pale Moon MoonchildProductions.PaleM... 33.9.1 Tag: firefox-fo... winget
Ghostery Private Browser Ghostery.GhosteryDawn 2024.8... Tag: firefoxfork winget
ffsend TimVisee.ffsend 0.2.76 Tag: firefox-se... winget

C:\Users\wout>winget install -e --id Mozilla.Firefox
Failed when searching source: msstore
An unexpected error occurred while executing the command:
0x8a15005e : The server certificate did not match any of the expected values.

The following packages were found among the working sources.
Please specify one of them using the --source option to proceed.
Name Id Source
-----
Mozilla Firefox (en-US) Mozilla.Firefox winget

C:\Users\wout>winget install --source winget --id Mozilla.Firefox
Found Mozilla Firefox (en-US) [Mozilla.Firefox] Version 146.0.1
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://download-installer.cdn.mozilla.net/pub/firefox/releases/146.0.1/win64/en-US/Firefox%20Setup%20146.0.1.exe
82.3 MB / 82.3 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Users\wout>
```

De -e staat voor dat wat ik opgeef exact overeen moet komen met wat er gedownload moet worden.

De --id geeft aan dat je een specifiek pakket wilt installeren op basis van zijn unieke identificatiecode.

Alle overige apps gedownload:

```
C:\Users\wout>winget install --source winget --id 7zip.7zip
Found 7-Zip [7zip.7zip] Version 25.01
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://7-zip.org/a/7z2501-x64.exe
1.56 MB / 1.56 MB
Successfully verified installer hash
Starting package install...
The installer will request to run as administrator, expect a prompt.
Successfully installed

C:\Users\wout>winget install --source winget --id Notepad++.Notepad++
Found Notepad++ [Notepad++.Notepad++] Version 8.9
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://github.com/notepad-plus-plus/notepad-plus-plus/releases/download/v8.9/npp.8.9.Installer.x64.exe
6.54 MB / 6.54 MB
Successfully verified installer hash
Starting package install...
The installer will request to run as administrator, expect a prompt.
Successfully installed

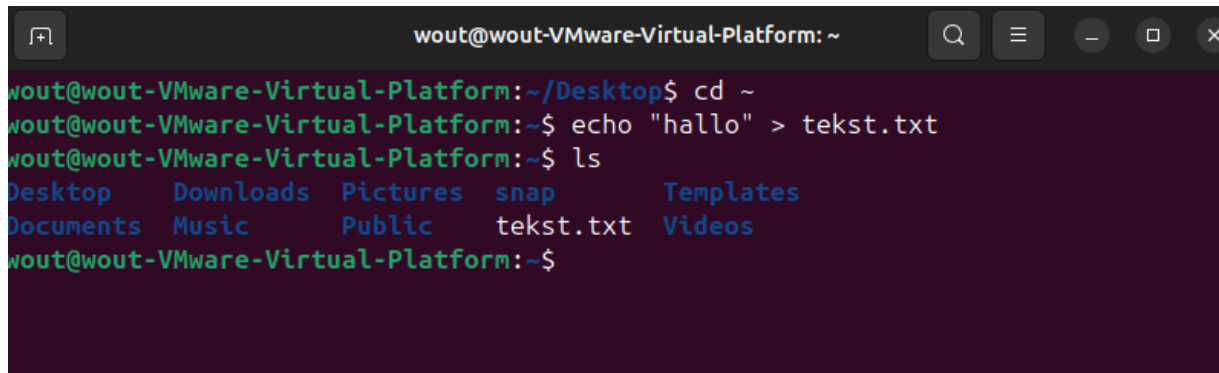
C:\Users\wout>winget install --source winget --id WinSCP.WinSCP
Found WinSCP [WinSCP.WinSCP] Version 6.5.5
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://sourceforge.net/projects/winscp/files/WinSCP/6.5.5/WinSCP-6.5.5-Setup.exe/download
11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
The installer will request to run as administrator, expect a prompt.
Successfully installed
```

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

Create a text file in your user home directory:

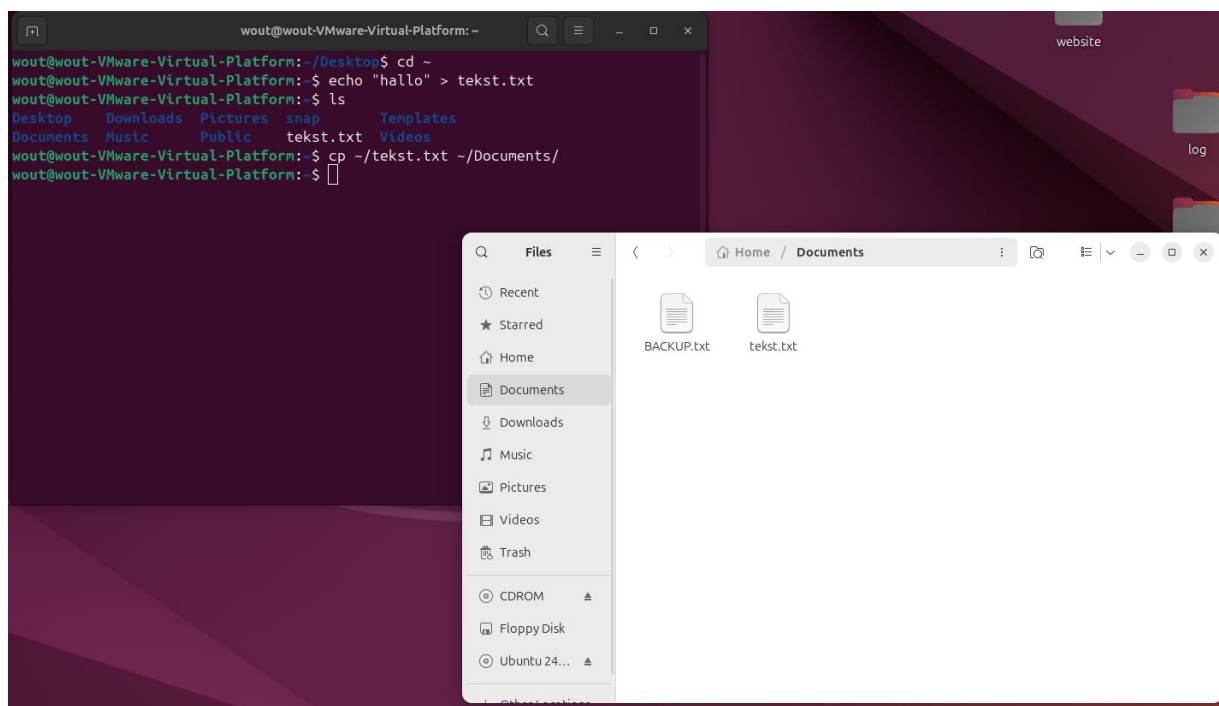
Tekst aanmaken met terminal:

A terminal window titled 'wout@wout-VMware-Virtual-Platform: ~' with a dark purple background. The user navigates from ~/Desktop to ~, creates a file 'tekst.txt' containing 'hallo', and lists the contents of the home directory. The output shows standard Linux directories plus 'snap' and 'tekst.txt'.

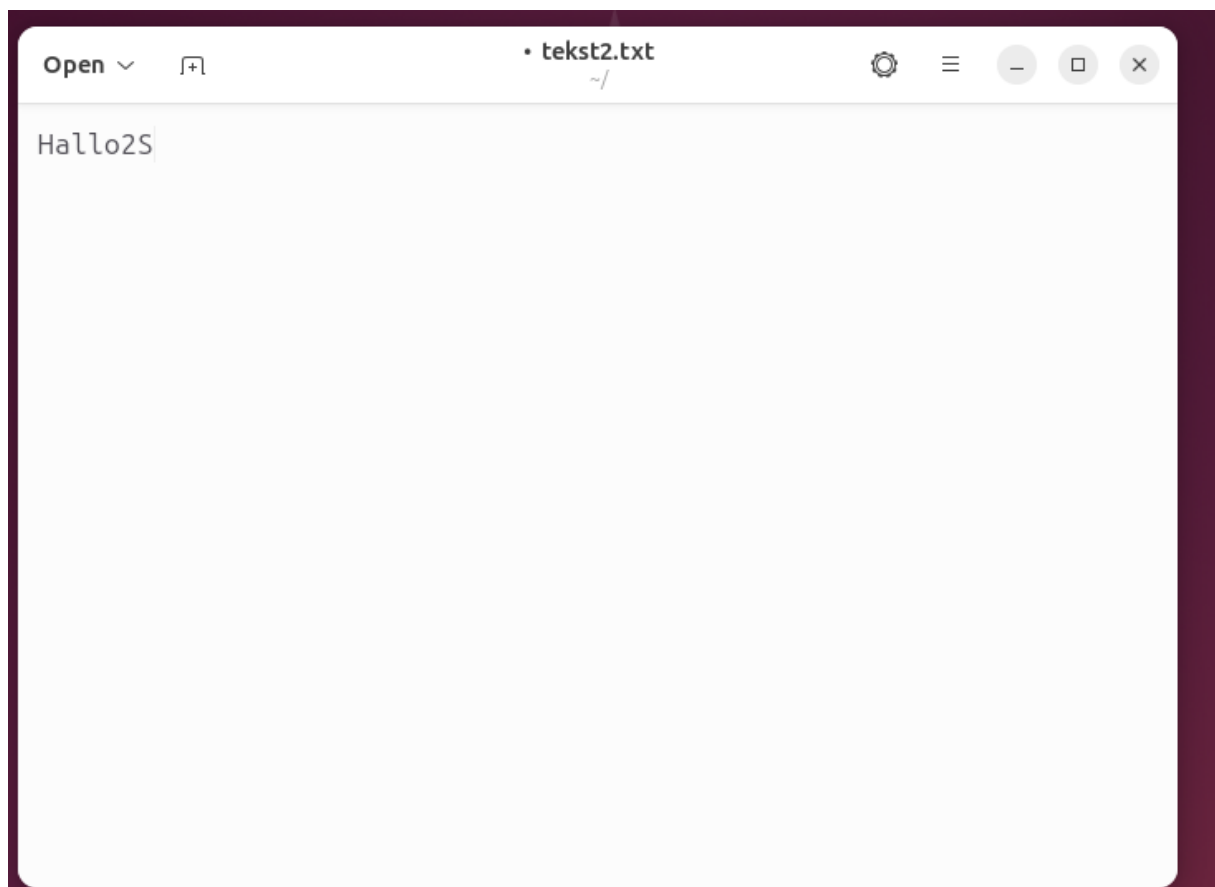
```
wout@wout-VMware-Virtual-Platform:~/Desktop$ cd ~
wout@wout-VMware-Virtual-Platform:~$ echo "hallo" > tekst.txt
wout@wout-VMware-Virtual-Platform:~$ ls
Desktop  Downloads  Pictures  snap      Templates
Documents Music      Public   tekst.txt Videos
wout@wout-VMware-Virtual-Platform:~$
```

Show that you can copy this file from the home directory to the Documents directory both in the file explorer and in the terminal.

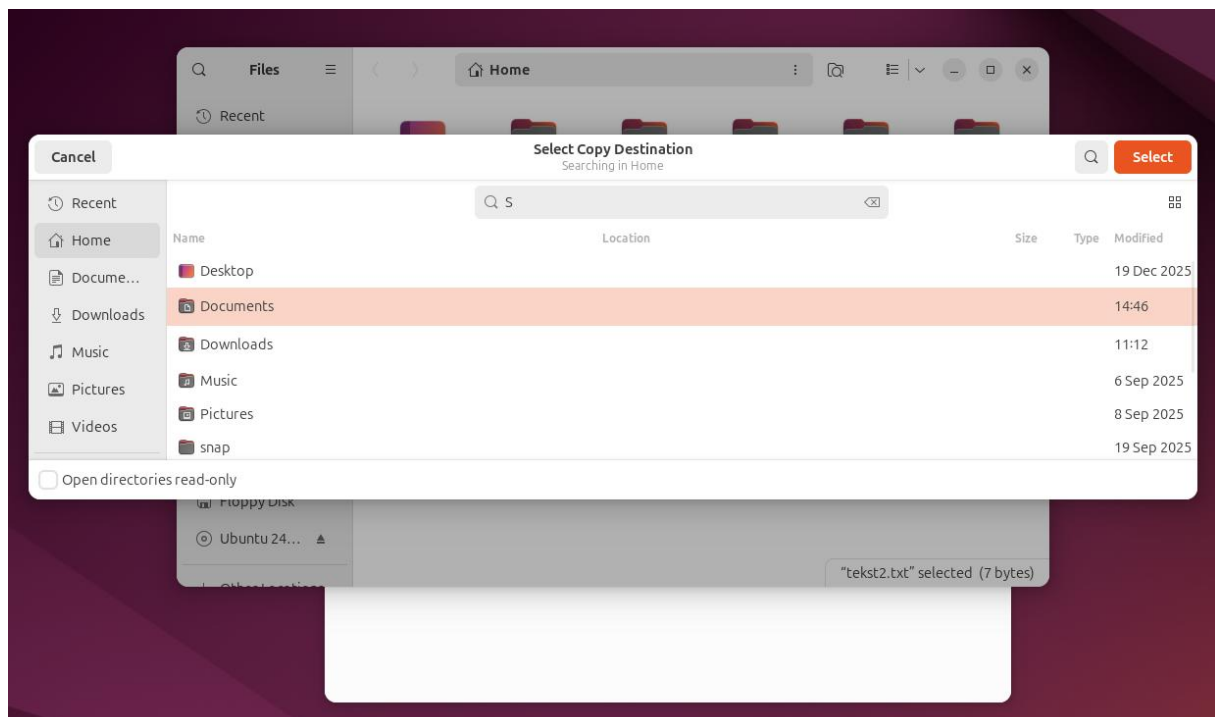
Kopieer bestand met de terminal:



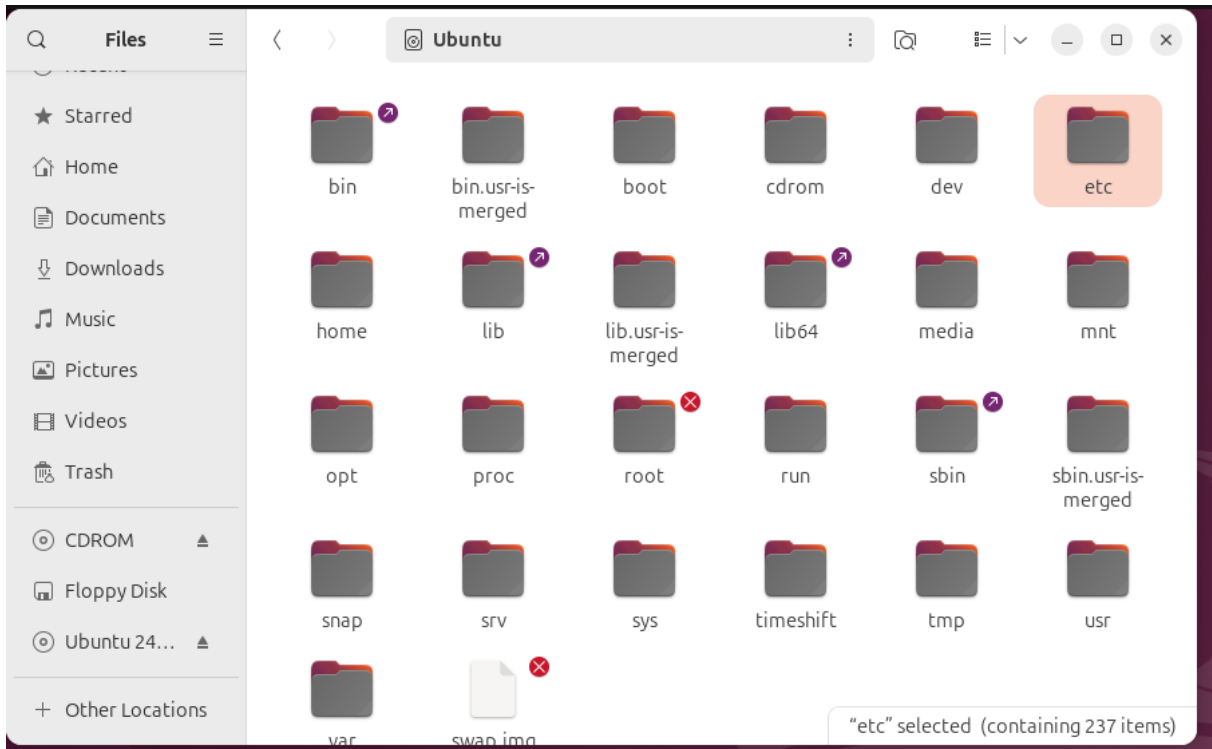
Normaal een tekst bestand aanmaken:



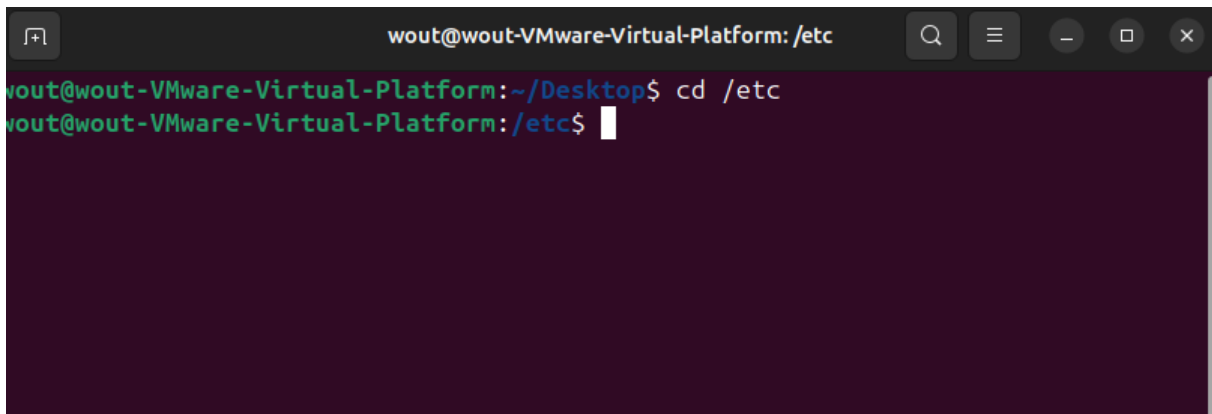
Normaal een bestand kopiëren:



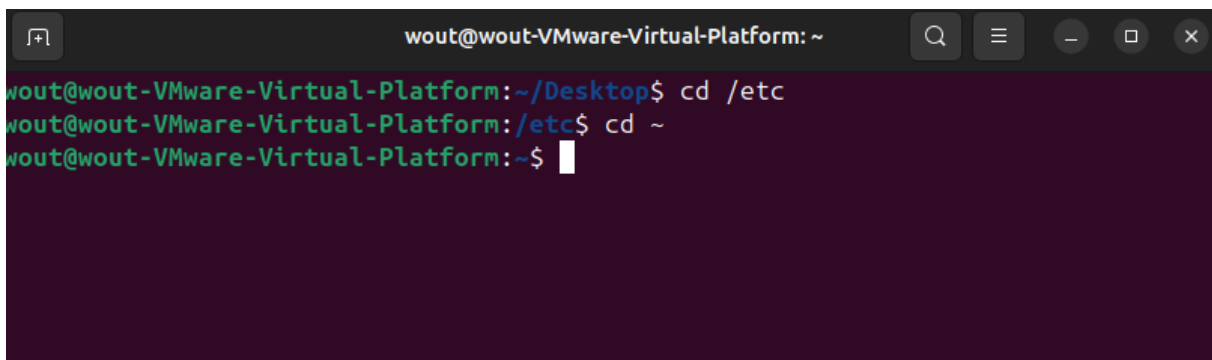
Navigate to the /etc folder in the file explorer:



Navigate to the /etc folder in the terminal:



How to get back to your home folder in the terminal?



Name one significant difference in Linux's file structure when comparing it to Windows:

Linux heeft een enkele root directory, waar alles onder hangt.

Windows gebruikt meerdere schijven met letters, zoals C:\

What is the /etc directory usually used for?

- netwerkconfiguratie
- gebruikersbeheer
- services
- systeeminstellingen

Which command in the terminal would you use to compress a text file into a tar archive?

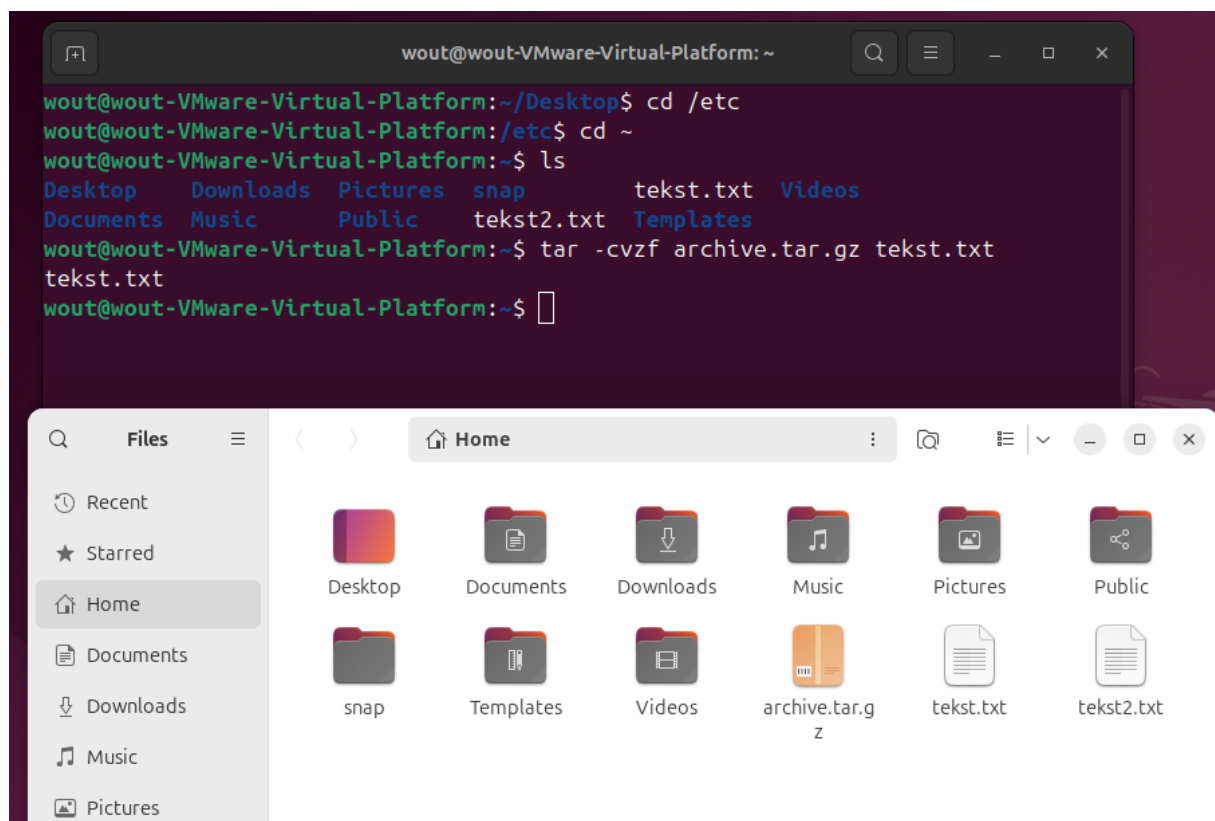
`tar -cvf archive.tar tekst.txt`

With which command in the terminal would you be able to extract a tar file?

`tar -xvf archive.tar`

Compress a text file in a tar archive and compress it with gzip.

`tar -cvzf archive.tar.gz tekst.txt`



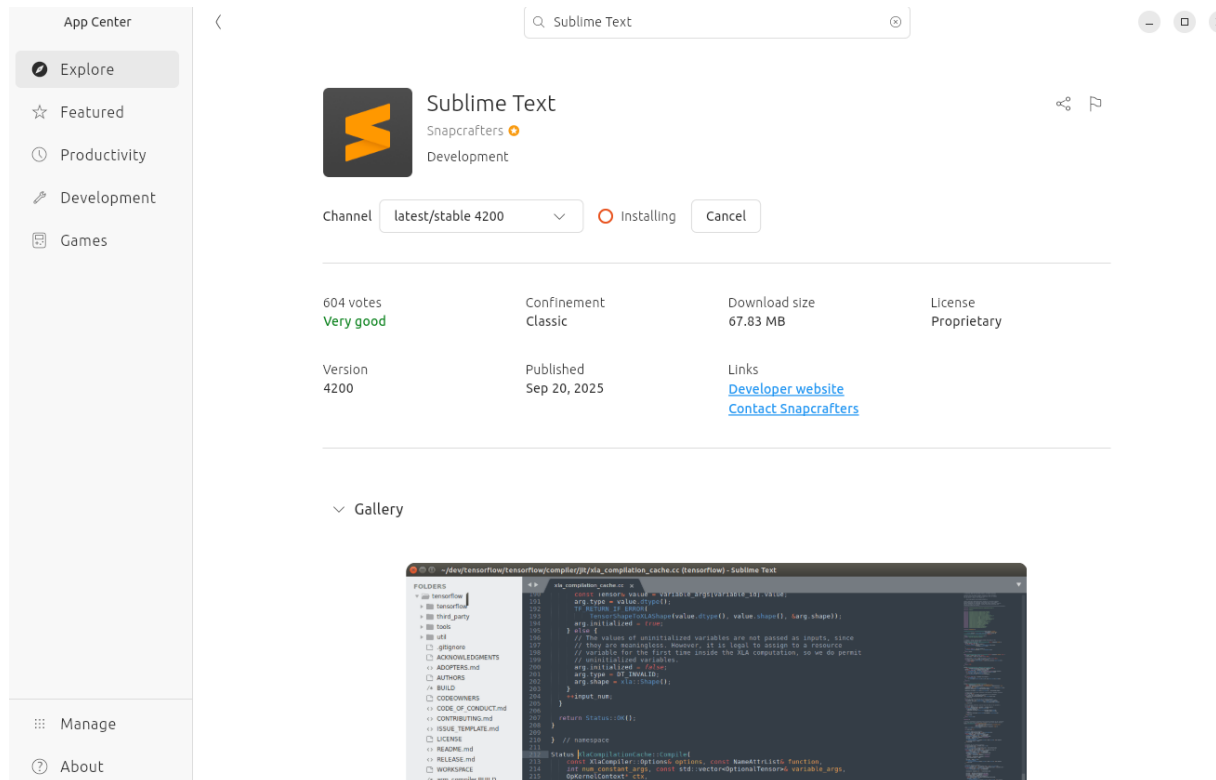
Install the application http via a terminal command

`sudo apt install http`

Launch the htop application. Explain what this application shows.

De applicatie geeft een real-time overzicht van alle actieve processen.

Software can be installed via the terminal in Ubuntu as we just did in the previous assignment, but it can also be installed in Ubuntu via the Software center. Find and install the Sublime Text application on your Ubuntu VM.



Using a terminal command, install the neofetch application. What does this application show when you launch it?

Het toont:

OS-versie, Kernel, CPU, GPU, RAM, Shell

```
lm6 (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-
lm6 (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 (3.36.0-1ubuntu3) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
wout@wout-VMware-Virtual-Platform:~$ neofetch

  .-/+oosssso+/-.
  `:+ssssssssssssss++:`
    -+ssssssssssssssyyssss+-
    .ossssssssssssssdMMMMyssso.
    /ssssssssshdmmNNmyNMMMMhssssss/
    +ssssssshmydMMMMMMNdddyssssss+
    /ssssssshNMMMyhhyyyhmNMMNhssssss/
    .sssssssdMMMNhssssssshNMMMdssssss.
    +ssssshhhyNMMNysssssssssyNMMMyssssss+
    ssyyNMMMNyMMhssssssssssshmmhssssssso
    ssyNMMMNyMMhssssssssssshmmhssssssso
    +ssssshhhyNMMNysssssssssyNMMMyssssss+
    ssssssssdMMMNhssssssssshNMMMdssssss.
    /ssssssshNMMMyhhyyyhdNMMNhssssss/
    +sssssssdnydMMMMMMNdddyssssss+
    /ssssssssshdmmNNmyNMMMMhssssss/
    .ossssssssssssssdMMMMyssso.
    -+ssssssssssssssyyssss+-
    `:+ssssssssssssss++:`
    .-/+oosssso+/-.

wout@wout-VMware-Virtual-Platform
-----
OS: Ubuntu 24.04.3 LTS x86_64
Host: VMware Virtual Platform None
Kernel: 6.14.0-37-generic
Uptime: 19 mins
Packages: 1716 (dpkg), 12 (snap)
Shell: bash 5.2.21
Resolution: 1720x920
DE: GNOME 46.0
WM: Mutter
WM Theme: Adwaita
Theme: Yaru [GTK2/3]
Icons: Yaru [GTK2/3]
Terminal: gnome-terminal
CPU: 13th Gen Intel i7-13650HX (4) @
GPU: 00:0f.0 VMware SVGA II Adapter
Memory: 1791MiB / 3867MiB

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

Assignment 5.5: Users and permissions on Linux

Use the chmod command to make the file executable only for the logged-in user. Other users are only allowed to view the file via a text edit command such as cat or less. See the man pages of chmod how you could do this. TIP! Use chmod Numeric notation.

```
wout@wout-VMware-Virtual-Platform:~$ mkdir ~/hello
wout@wout-VMware-Virtual-Platform:~$ nano ~/hello/hello.sh
wout@wout-VMware-Virtual-Platform:~$ chmod +x ~/hello/hello.sh
wout@wout-VMware-Virtual-Platform:~$ cd ~/hello
wout@wout-VMware-Virtual-Platform:~/hello$ ./hello.sh
Hallo Wout 587889!
wout@wout-VMware-Virtual-Platform:~/hello$ chmod 744 ~/hello/hello.sh
wout@wout-VMware-Virtual-Platform:~/hello$ ls -l ~/hello/hello.sh
-rwxr--r-- 1 wout wout 36 Jan  9 15:10 /home/wout/hello/hello.sh
wout@wout-VMware-Virtual-Platform:~/hello$
```


Assignment 5.6: View the contents of files

cat	Toont de volledige inhoud van een bestand op het scherm.
wc	Telt regels, woorden en karakters die in een bestand zitten.
less	Bekijkt een bestand pagina voor pagina
head	Toont de eerste regels van een bestand
tail	Toont de laatste regels van een bestand
grep	Zoekt naar tekst in een bestand

Hoeveel regels, woorden en karakters?

```
wout@wout-VMware-Virtual-Platform:~/hello$ cd ~
wout@wout-VMware-Virtual-Platform:~$ cd ~/holmes/
bash: /home/wout/holmes/: No such file or directory
wout@wout-VMware-Virtual-Platform:~$ cd hello
wout@wout-VMware-Virtual-Platform:~/hello$ ls
hello.sh  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ ls
hello.sh  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ wc SherlockHolmes.txt
12306 107562 607504 SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$
```

12306 = aantal regels

107562 = aantal woorden

607504 = aantal karakters

Op welke regels staat het woord "kingdom"?

```
wout@wout-VMware-Virtual-Platform: ~/hello
wout@wout-VMware-Virtual-Platform:~/hello$ cd ~
wout@wout-VMware-Virtual-Platform:~$ ~/holmes/
bash: /home/wout/holmes/: No such file or directory
wout@wout-VMware-Virtual-Platform:~$ cd hello
wout@wout-VMware-Virtual-Platform:~/hello$ ls
hello.sh  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ ls
hello.sh  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ wc SherlockHolmes.txt
12306 107562 607504 SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ grep -n "kingdom" SherlockHolmes.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
wout@wout-VMware-Virtual-Platform:~/hello$
```

Regelnummer: 490 en 1124

Toon de 10 regels boven en onder het woord "kingdom"

Ik hier hiervoor om regel 490 te gebruiken.

```
wout@wout-VMware-Virtual-Platform:~/hello$ grep -n "kingdom" SherlockHolmes.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
wout@wout-VMware-Virtual-Platform:~/hello$ head -n 500 SherlockHolmes.txt | tail -n 20

"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.

wout@wout-VMware-Virtual-Platform:~/hello$ S
```

Assignment 5.7: Digital forensics

```
wout@wout-VMware-Virtual-Platform

Setting up libunicode-linebreak-perl (0.0.20190101-1build7) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
wout@wout-VMware-Virtual-Platform:~/hello$ ls
hello.sh  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$
wout@wout-VMware-Virtual-Platform:~/hello$ exiftool oldcar.jpg
Error: File not found - oldcar.jpg
wout@wout-VMware-Virtual-Platform:~/hello$ exiftool oldcar.jpg
ExifTool Version Number      : 12.76
File Name                    : oldcar.jpg
Directory                   : .
File Size                    : 2.4 MB
File Modification Date/Time   : 2026:01:09 15:30:36+01:00
File Access Date/Time        : 2026:01:09 15:30:56+01:00
File Inode Change Date/Time   : 2026:01:09 15:30:56+01:00
File Permissions              : -rw-rw-r--
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
Exposure Time                 : 1/33
F Number                      : 2.0
Exposure Program              : Program AE
ISO                           : 64
Exif Version                  : 0220
Date/Time Original            : 2020:11:07 15:08:57
Create Date                   : 2020:11:07 15:08:57
Components Configuration      : Y, Cb, Cr, -
Shutter Speed Value           : 1/33
Aperture Value                : 2.0
Brightness Value              : -1
Exposure Compensation         : 0
Max Aperture Value            : 2.0
Metering Mode                 : Center-weighted average
Flash                         : Auto, Did not fire
Focal Length                  : 3.5 mm
Build Number                  : PPPS29.55-35-18-7
Sensor                       : BACK,mot_s5k3l8
Manufacture Date              : 14Oct2018
Flashpix Version              : 0100
Color Space                   : sRGB
Exif Image Width              : 4160
Exif Image Height             : 3120
er inside or press Ctrl+G.
```

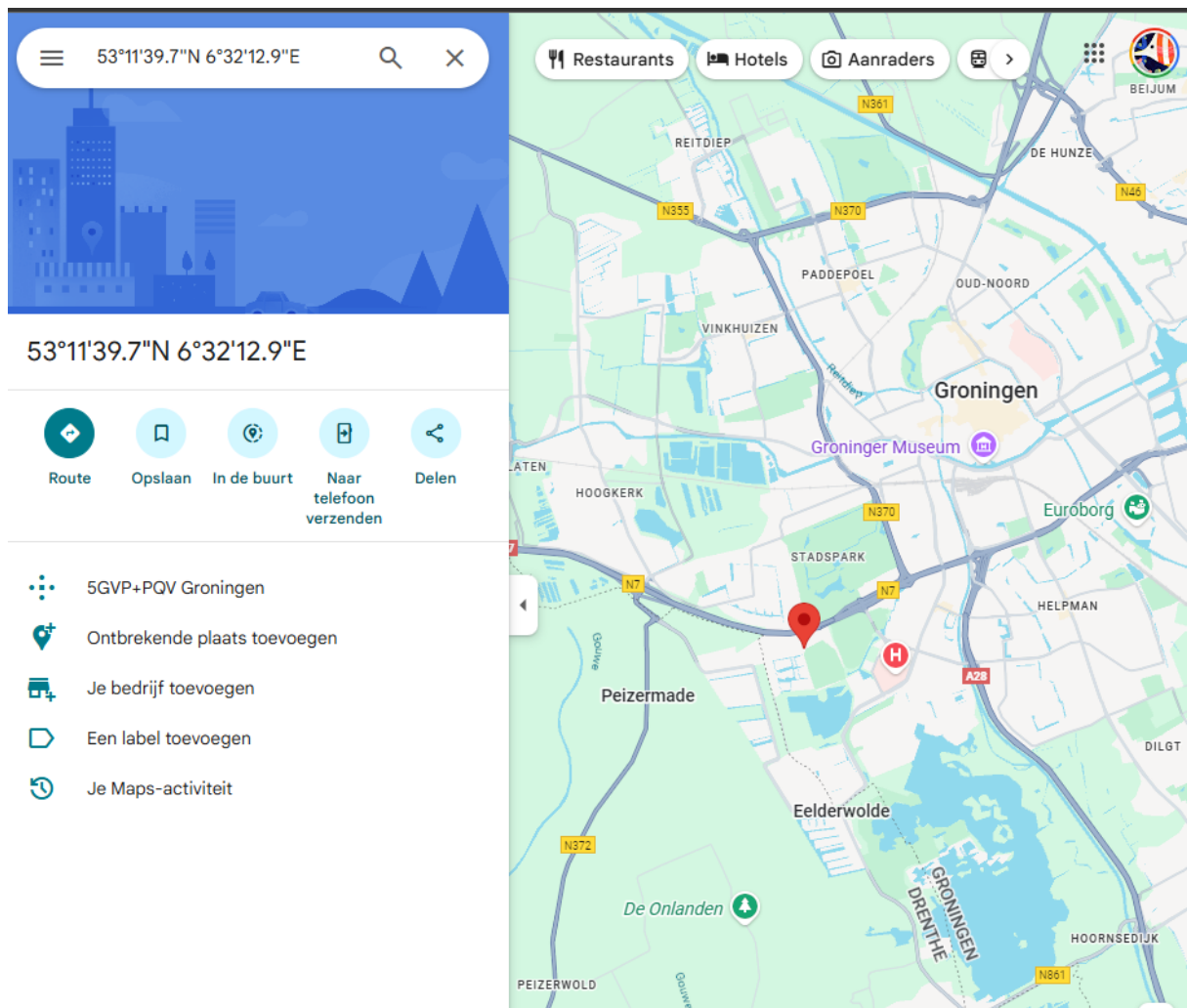
```

Exif Image Width           : 4160
Exif Image Height          : 3120
Interoperability Index     : R98 - DCF basic file (sRGB)
Interoperability Version   : 0100
Scene Type                  : Directly photographed
Custom Rendered             : Normal
Exposure Mode               : Auto
White Balance               : Auto
Digital Zoom Ratio         : 1
Scene Capture Type         : Standard
Contrast                    : Normal
Saturation                  : Low
Sharpness                   : Soft
GPS Version ID              : 2.2.0.0
GPS Latitude Ref            : North
GPS Longitude Ref           : East
GPS Altitude Ref           : Above Sea Level
GPS Time Stamp              : 14:08:57
GPS Map Datum               : WGS-84
GPS Processing Method       : ASCII
GPS Date Stamp              : 2020:11:07
Compression                 : JPEG (old-style)
Thumbnail Offset            : 2862
Thumbnail Length            : 59453
Image Width                 : 4160
Image Height                : 3120
Encoding Process            : Baseline DCT, Huffman coding
Bits Per Sample             : 8
Color Components            : 3
Y Cb Cr Sub Sampling        : YCbCr4:2:0 (2 2)
Aperture                    : 2.0
Image Size                  : 4160x3120
Megapixels                  : 13.0
Shutter Speed               : 1/33
Thumbnail Image             : (Binary data 59453 bytes, use -b option to extract)
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
wout@wout-VMware-Virtual-Platform:~/hello$

```

Merk telefoon en model: Motorola g6 play

De foto is gemaakt in Groningen.



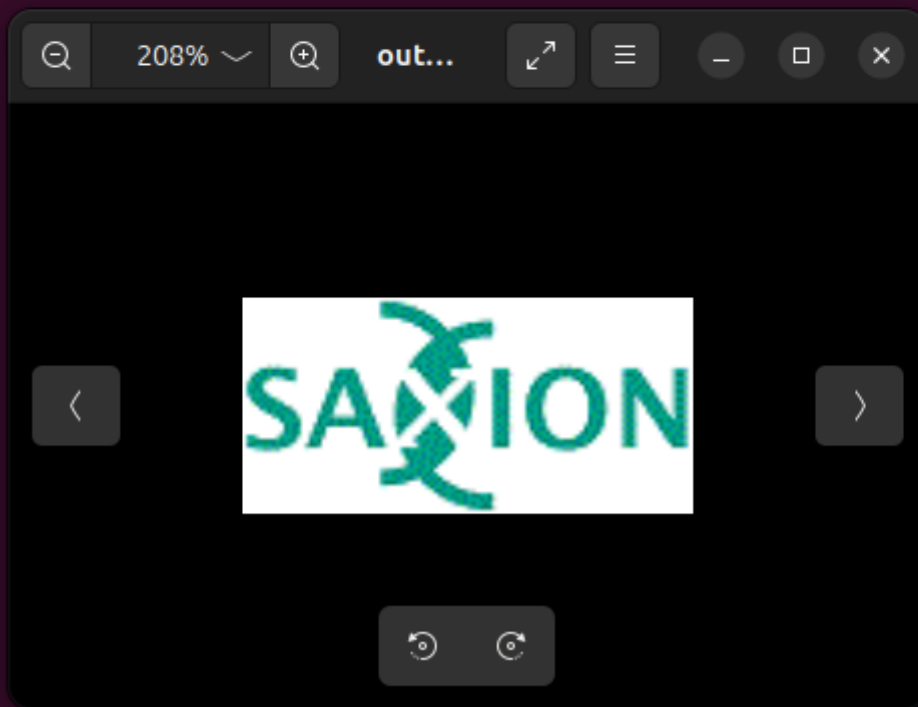
Filename extensions

Het bestand word nog steeds herkend als een jpg file.

```
wat@beut-Virtual-Platform: ~/oldcar.jpg$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment length 16, Exif Standard: [TIFF image data, big-endian, dentries=18, manufacturer=Motorola, model=Motorola g(6) play, x-resolution=160, y-resolution=160, resolutionunit=2, software=aljet
er-user 9 pps29.55-35-28-7 6400 release-keys, datetime=2020:11:07 15:00:57, GPS-data], baseline, precision 8, 4160x3120, components 3
wat@beut-Virtual-Platform: ~/oldcar.jpg$
```

Tekst file -> Gif file

```
wout@wout-VMware-Virtual-Platform:~/hello$ base64 -d email.txt > output.gif
base64: email.txt: No such file or directory
wout@wout-VMware-Virtual-Platform:~/hello$ ls
email-base64.txt  hello.sh  oldcar  output.gif  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ base64 -d email-base64.txt > output.gif
wout@wout-VMware-Virtual-Platform:~/hello$ ls
email-base64.txt  hello.sh  oldcar  output.gif  SherlockHolmes.txt
wout@wout-VMware-Virtual-Platform:~/hello$ file output.gif
output.gif: GIF image data, version 89a, 108 x 52
wout@wout-VMware-Virtual-Platform:~/hello$ xdg-open output.gif
wout@wout-VMware-Virtual-Platform:~/hello$
```



Assignment 5.8: Steganography

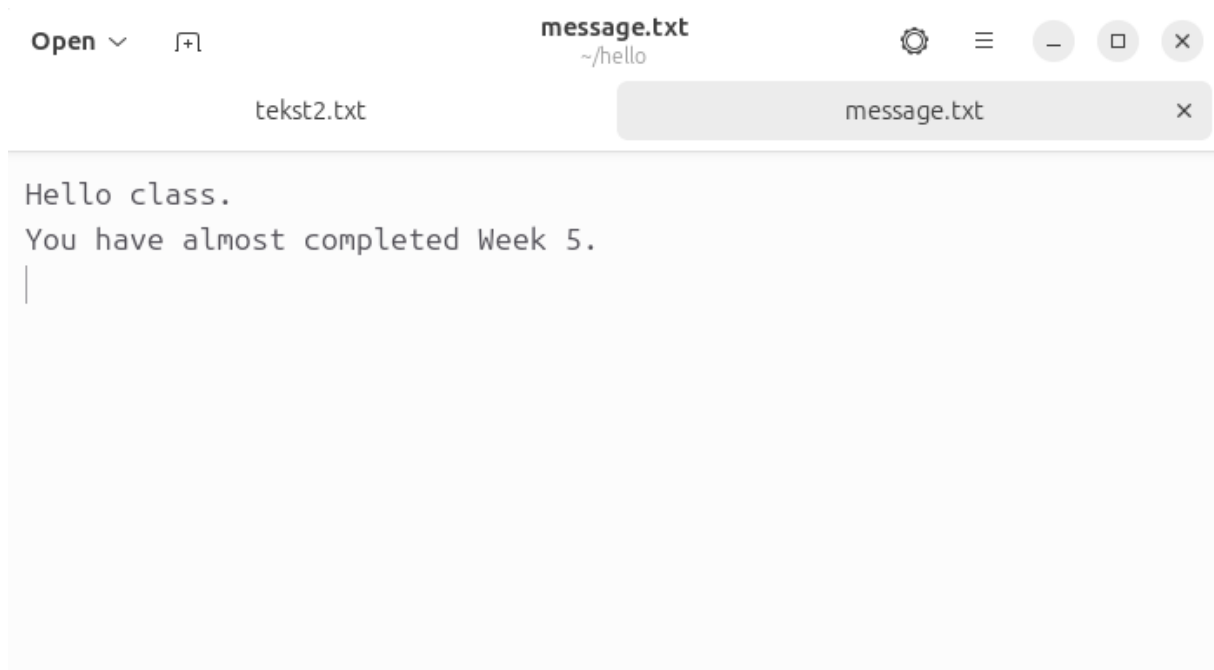
```
the first argument must be one of the following:
embed, --embed          embed data
extract, --extract       extract data
info, --info            display information about a cover- or stego-file
    info <filename>     display information about <filename>
encinfo, --encinfo      display a list of supported encryption algorithms
version, --version       display version information
license, --license      display steghide's license
help, --help            display this usage information

embedding options:
-ef, --embedfile        select file to be embedded
    -ef <filename>      embed the file <filename>
-cf, --coverfile        select cover-file
    -cf <filename>      embed into the file <filename>
-p, --passphrase        specify passphrase
    -p <passphrase>     use <passphrase> to embed data
-sf, --stegofile        select stego file
    -sf <filename>      write result to <filename> instead of cover-file
-e, --encryption        select encryption parameters
    -e <a>[<m>][<m>[<a>] specify an encryption algorithm and/or mode
    -e none             do not encrypt data before embedding
-z, --compress          compress data before embedding (default)
    -z <l>              using level <l> (1 best speed...9 best compression)
-Z, --dontcompress      do not compress data before embedding
-K, --nochecksum         do not embed crc32 checksum of embedded data
-N, --dontembedname     do not embed the name of the original file
-f, --force             overwrite existing files
-q, --quiet             suppress information messages
-v, --verbose           display detailed information

extracting options:
-sf, --stegofile        select stego file
    -sf <filename>      extract data from <filename>
-p, --passphrase        specify passphrase
    -p <passphrase>     use <passphrase> to extract data
-xf, --extractfile      select file name for extracted data
    -xf <filename>      write the extracted data to <filename>
-f, --force             overwrite existing files
-q, --quiet             suppress information messages
-v, --verbose           display detailed information

options for the info command:
-p, --passphrase        specify passphrase
    -p <passphrase>     use <passphrase> to get info about embedded data

To embed emb.txt in cvr.jpg: steghide embed -cf cvr.jpg -ef emb.txt
To extract embedded data from stg.jpg: steghide extract -sf stg.jpg
wout@wout-VMware-Virtual-Platform:~/hello$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
wout@wout-VMware-Virtual-Platform:~/hello$
```



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.

```
wout@omv587889:~$ systemctl status ssh
• ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; preset: enabled)
   Active: active (running) since Fri 2026-01-09 16:56:25 CET; 3min 3s ago
     Docs: man:sshd(8)
           man:sshd_config(5)
  Main PID: 1025 (sshd)
    Tasks: 1 (limit: 4593)
   Memory: 2.6M
      CPU: 31ms
   CGroup: /system.slice/ssh.service
           └─1025 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Warning: some journal files were not opened due to insufficient permissions.
wout@omv587889:~$ _
```

```
wout@omv587889:~$ sudo mkdir -p /srv/images
wout@omv587889:~$ sudo chown $USER:$USER /srv/images
wout@omv587889:~$
```



```

wout@omv587889:~$ 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 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 group default qlen 1000
    link/ether 00:0c:29:0b:f7:02 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.11/24 brd 192.168.139.255 scope global ens33
        valid_lft forever preferred_lft forever
3: docker0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default
    link/ether f2:68:b9:81:a5:11 brd ff:ff:ff:ff:ff:ff
    inet 172.17.0.1/16 brd 172.17.255.255 scope global docker0
        valid_lft forever preferred_lft forever
4: br-900f2eacde0c: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 32:de:9a:49:8c:8a brd ff:ff:ff:ff:ff:ff
    inet 172.18.0.1/16 brd 172.18.255.255 scope global br-900f2eacde0c
        valid_lft forever preferred_lft forever
    inet6 fe80::30de:9aff:fe49:8c8a/64 scope link
        valid_lft forever preferred_lft forever
5: vethc772191@if2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master br-900f2eacde0c state UP group default
    link/ether ba:e8:22:b6:e9:7b brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet6 fe80::b0e8:22ff:feb6:e97b/64 scope link
        valid_lft forever preferred_lft forever
6: vethe4370ae@if2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master br-900f2eacde0c state UP group default
    link/ether aa:d9:40:e6:28:5a brd ff:ff:ff:ff:ff:ff link-netnsid 1
    inet6 fe80::a8d9:40ff:fee6:285a/64 scope link
        valid_lft forever preferred_lft forever
wout@omv587889:~$

```

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