Template Week 5 – Operating Systems

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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 dat in 1969 werd ontwikkeld door Ken Thompson en Dennis Ritchie bij Bell Labs. Het is meestal gesloten bron en wordt commercieel aangeboden. Unix-like systemen zijn besturingssystemen die lijken op UNIX qua structuur en gedrag, maar niet noodzakelijk gecertificeerd zijn volgens de officiële UNIX-standaard. Voorbeelden zijn Linux, FreeBSD en macOS.

b) Who are Ken Thompson, Dennis Ritchie, Bill Joy, Richard Stallman, and Linus Torvalds, and what have they contributed?

- Ken Thompson: Mede-oprichter van UNIX in 1969 bij Bell Labs. Hij ontwierp de eerste versie van UNIX en ontwikkelde de programmeertaal B.
- Dennis Ritchie: Co-ontwikkelaar van UNIX en bedenker van de programmeertaal C, waarmee UNIX herschreven werd in 1973.
- Bill Joy: Mede-oprichter van Sun Microsystems. Hij ontwikkelde de vi-editor en was betrokken bij BSD UNIX, een belangrijke Unix-variant.
- Richard Stallman: Oprichter van het GNU-project in 1983 en de Free Software Foundation. Hij promoot softwarevrijheid en ontwikkelde tools zoals Emacs.
- Linus Torvalds: Ontwikkelaar van de Linux-kernel in 1991. Zijn werk vormt de basis van moderne Unix-like systemen zoals Ubuntu.

c) What is the philosophy of the GNU movement?
De GNU-filosofie draait om **softwarevrijheid**. Gebruikers moeten vier essentiële vrijheden hebben:

1. De vrijheid om het programma te gebruiken voor elk doel
2. De vrijheid om de broncode te bestuderen en aan te passen
3. De vrijheid om kopieën te verspreiden
4. De vrijheid om aangepaste versies te verspreiden

Het doel is om controle over technologie terug te geven aan gebruikers en samenwerking te bevorderen.

d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.
Ubuntu is grotendeels gebaseerd op GNU/Linux en gebruikt veel GNU-tools. Het ondersteunt vrije en open source software en biedt gebruikers de vrijheid om software te gebruiken, aan te passen en te delen. Echter, Ubuntu bevat ook enkele propriëtaire onderdelen (zoals drivers en codecs), waardoor het gedeeltelijk voldoet aan de GNU-filosofie.

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

Het Windows Subsystem for Linux (WSL) is een functie in Windows waarmee je een echte Linux-omgeving kunt draaien binnen Windows, zonder een virtuele machine. Je kunt Linux-distributies zoals Ubuntu installeren en uitvoeren, inclusief command-line tools en zelfs GUI-apps. WSL is bedoeld voor ontwikkelaars die Windows en Linux tegelijk willen gebruiken.

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

Systeem	familie
Android	Unix-like (Linux-kernel)
IOS	Unix-like (gebaseerd op Darwin/BSD)
ChromeOS	Unix-like (Linux-kernel)

Assignment 5.2: Supercomputers and gameconsoles

a) What are supercomputers used for?
Supercomputers worden gebruikt voor extreem rekenintensieve taken die gewone computers niet aankunnen. Volgens de informatie over supercomputers worden ze ingezet voor o.a.:

- **Weersvoorspelling en klimaatonderzoek**
- **Moleculaire modellering** (eiwitten, chemische structuren)
- **Fysische simulaties** zoals aerodynamica, nucleaire simulaties en universummodellen
- **Olie- en gasexploratie**
- **Cryptanalyse** (het kraken van codes)

Korte samenvatting:
Supercomputers worden gebruikt voor wetenschappelijke simulaties, natuurkunde, klimaatonderzoek, moleculaire modellering, energie-exploratie en beveiligingsonderzoek.

b) What is a PlayStation 3 cluster and what was it used for?
Een **PlayStation 3 cluster** is een supercomputer opgebouwd uit meerdere PS3-consoles die samenwerken via een netwerk.
Volgens de zoekresultaten:

- Een PS3-cluster is een distributed system gebaseerd op PS3-consoles.
- De krachtige **IBM Cell-processor** maakte de PS3 geschikt voor goedkope high-performance computing.
- De US Air Force bouwde in 2010 de **Condor Cluster**, bestaande uit 1760 PS3's, voor het verwerken van **satellietbeelden** en andere militaire berekeningen.
- Universiteiten gebruikten PS3-clusters voor wetenschappelijk onderzoek en Folding@home (ziekteonderzoek).

Kort:
PS3-clusters werden gebruikt als goedkope supercomputers voor beeldverwerking, wetenschappelijk onderzoek en militaire toepassingen.

c) What operating system runs on Oracle's Raspberry Pi cluster?
Oracle's Raspberry Pi supercomputer draait op:
Oracle Linux
Dit blijkt uit Oracle's documentatie over Raspberry Pi clusterprojecten, waarin Oracle Linux wordt gebruikt als OS voor de nodes.

d) Is Oracle's Raspberry Pi cluster in the TOP500 list?
Logische redenering:

- De TOP500 bevat alleen de snelste supercomputers ter wereld, met prestaties in de petaflop-range.
- Raspberry Pi's hebben zeer beperkte rekenkracht.
- Zelfs duizenden Pi's halen niet in de buurt van de prestaties van echte HPC-systemen.

Conclusie:
Nee, Oracle's Raspberry Pi cluster staat niet in de TOP500. Het is een educatief/demonstratieproject, geen high-performance supercomputer.

e) CPU architecture of PS5 and Xbox Series X + their operating systems

PlayStation 5

- **CPU architecture:** AMD **Zen 2**, 8-core
- **Operating system:** Aangepaste **FreeBSD-gebaseerde** OS-variant (Orbis OS)

Xbox Series X

- **CPU architecture:** AMD **Zen 2**, 8-core
- **Operating system:** Aangepaste Windows-kernel (Xbox OS)

Hoewel beide consoles dezelfde CPU-architectuur gebruiken (AMD Zen 2), draaien ze op totaal verschillende besturingssystemen:

- PS5 → Unix-like (FreeBSD-basis)
- Xbox Series X → Windows-kernel

Conclusie:
De hardware is vrijwel identiek, maar de software-ecosystemen zijn compleet verschillend. De OS-keuze bepaalt dus vooral de gebruikerservaring, compatibiliteit en ontwikkelomgeving — niet de hardware

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.

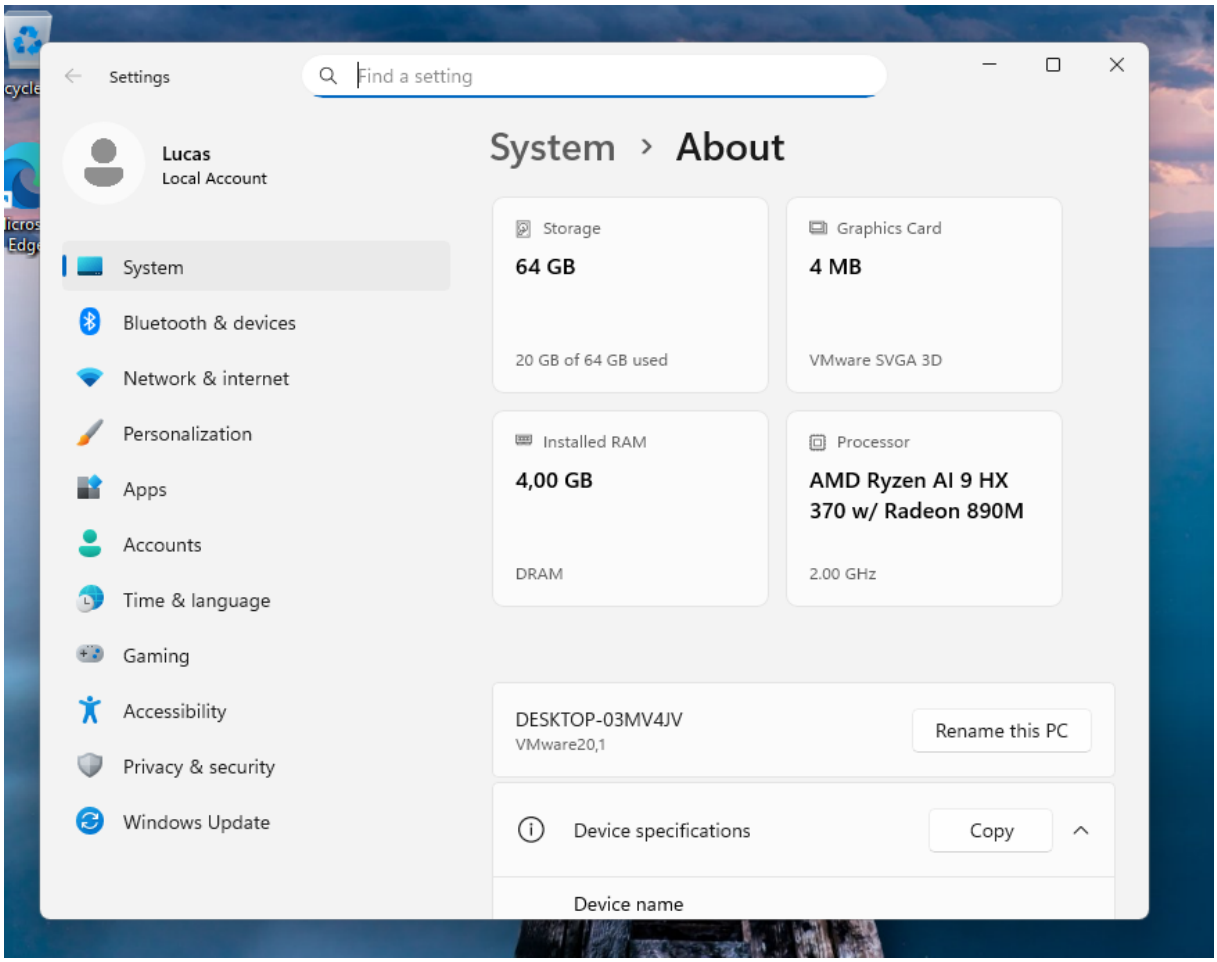
Ik heb ongeveer 10 minuten geoefend met verschillende Windows-toets combinaties om te zien welke schermen en functies hiermee geopend worden.

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

Windows + R → typ: explorer → Enter
Dit opent ook de file expolrer

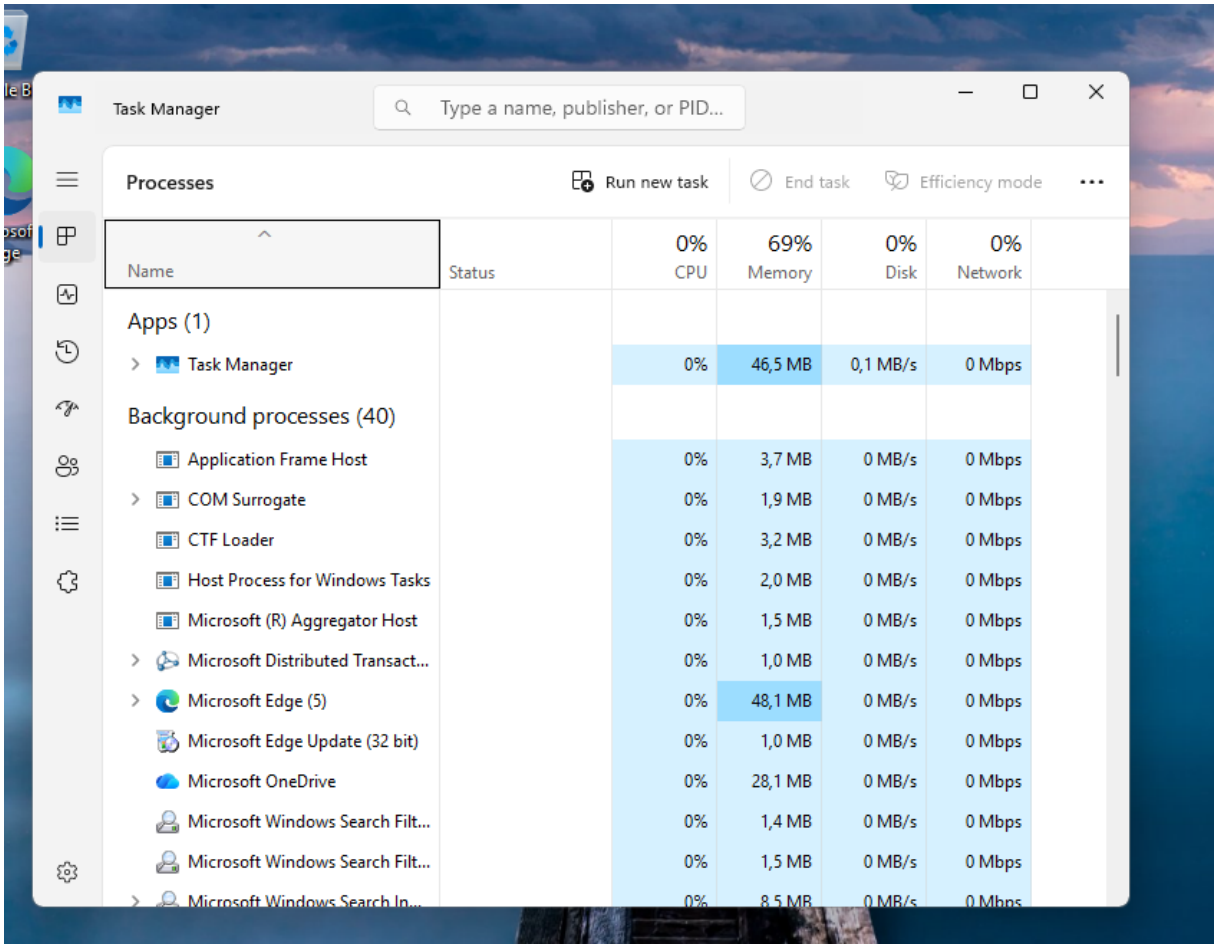
c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.

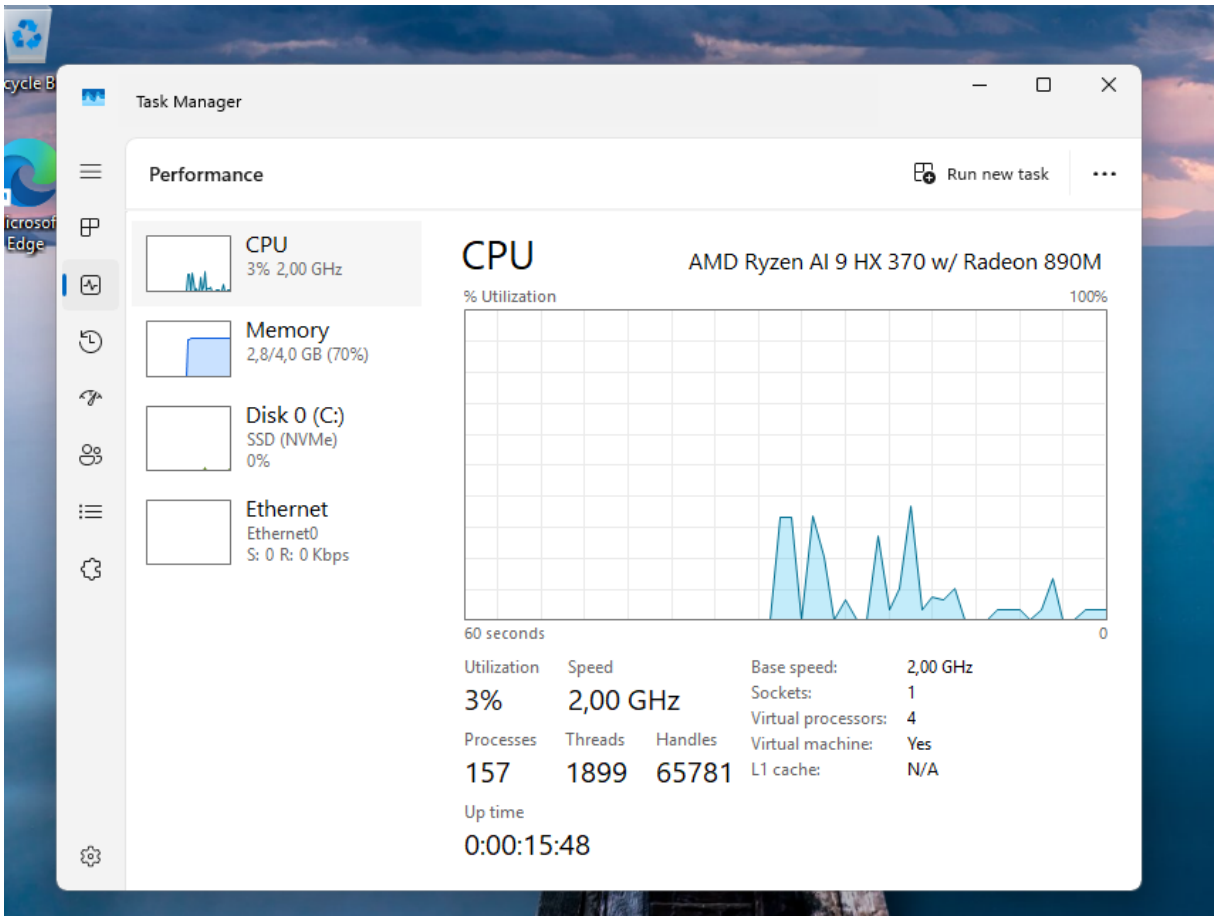
Gebruikte toetscombinatie:
Windows + Pause/Break

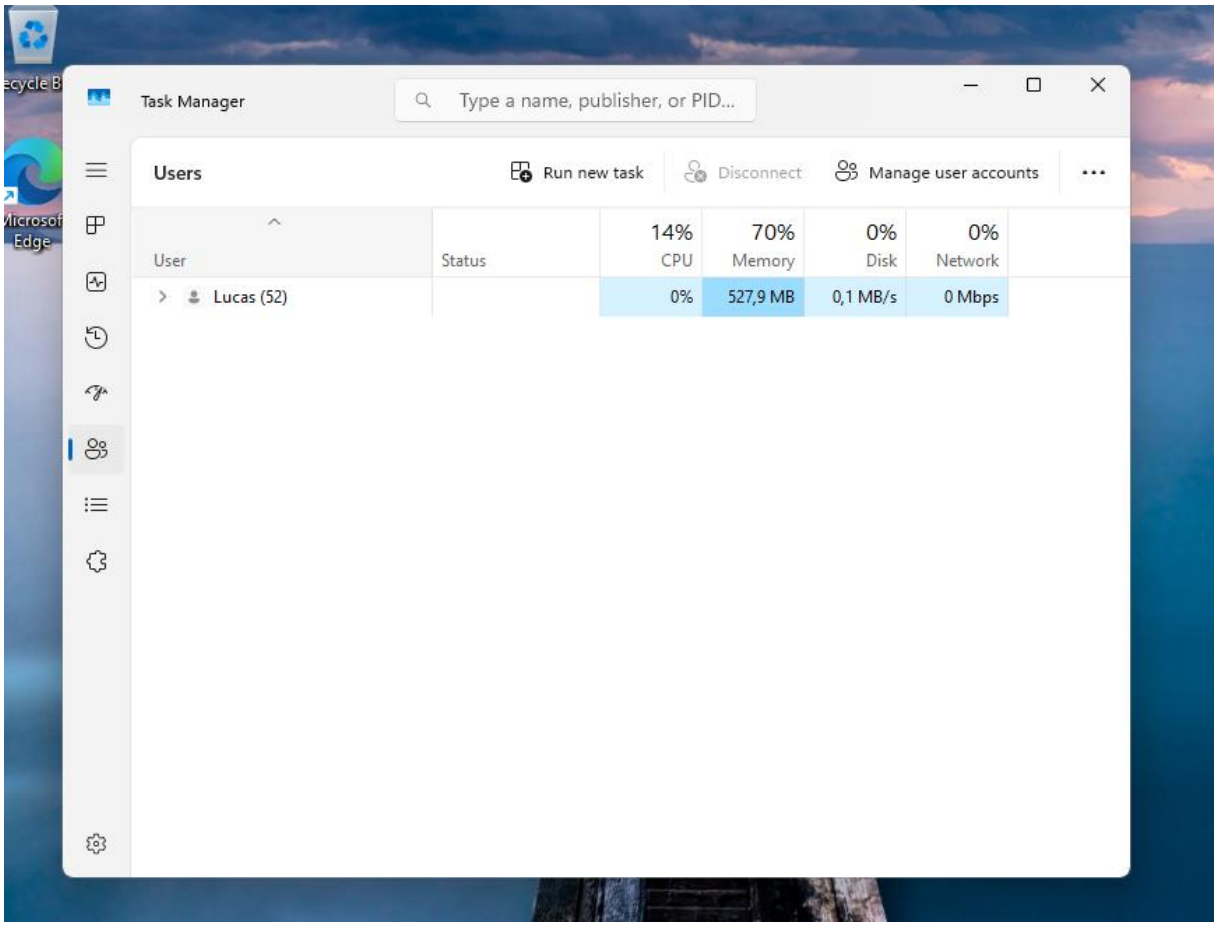


d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.

Gebruikte toetscombinatie:
Ctrl + Shift + Esc
Hiermee wordt **Taakbeheer** direct geopend.




Task Manager
Performance
Run new task
CPU
3% 2,00 GHz
Memory
2,8/4,0 GB (70%)
Disk 0 (C:)
SSD (NVMe)
0%
Ethernet
Ethernet0
S: 0 R: 0 Kbps
CPU
AMD Ryzen AI 9 HX 370 w/ Radeon 890M
% Utilization
100%
60 seconds
0
Utilization
3%
Speed
2,00 GHz
Processes
157
Threads
1899
Handles
65781
Up time
0:00:15:48
Base speed: 2,00 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?

Wanneer je een PowerPoint-presentatie geeft en je sluit je laptop aan op een projector of tweede scherm, kun je kiezen hoe Windows het tweede scherm moet gebruiken.
De toetscombinatie hiervoor is:
Windows + P
Met deze combinatie kun je kiezen uit:

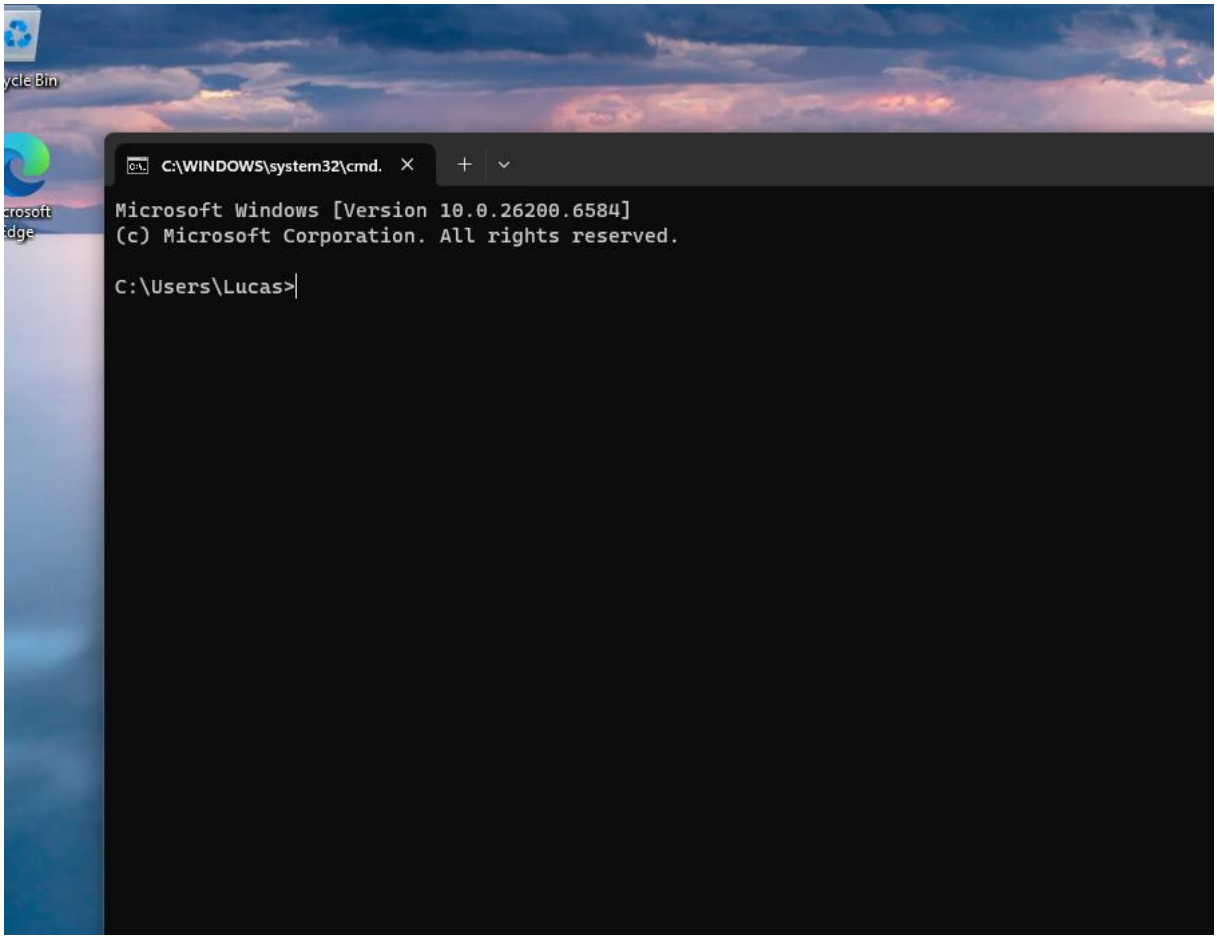
- Alleen pc-scherm
- Dupliceren
- Uitbreiden
- Alleen tweede scherm

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?

Wanneer je even wegloopt van je laptop, is het verstandig om je scherm te vergrendelen zodat niemand anders toegang heeft tot je bestanden of applicaties. Je apps blijven gewoon op de achtergrond draaien.
De toetscombinatie hiervoor is:
Windows + L
Dit vergrendelt direct je scherm

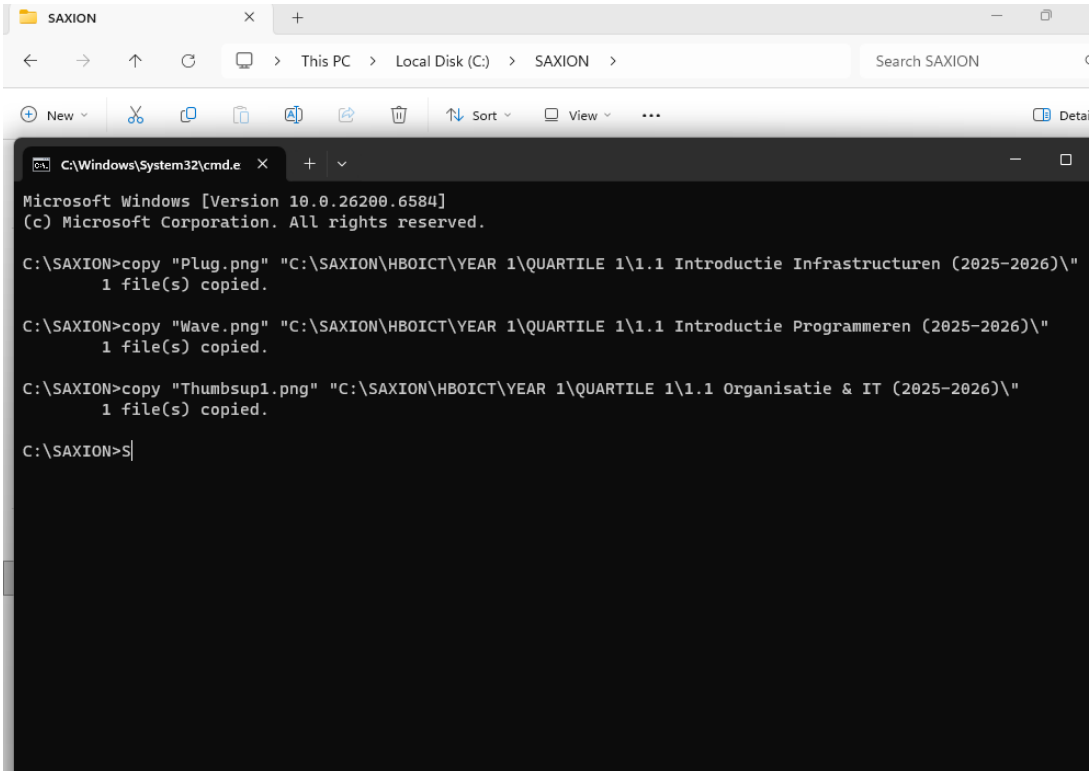
g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.

Gebruikte toetscombinatie:
Windows + R
Daarna heb ik in het Run-venster het volgende getypt: CMD



Working in the File Explorer

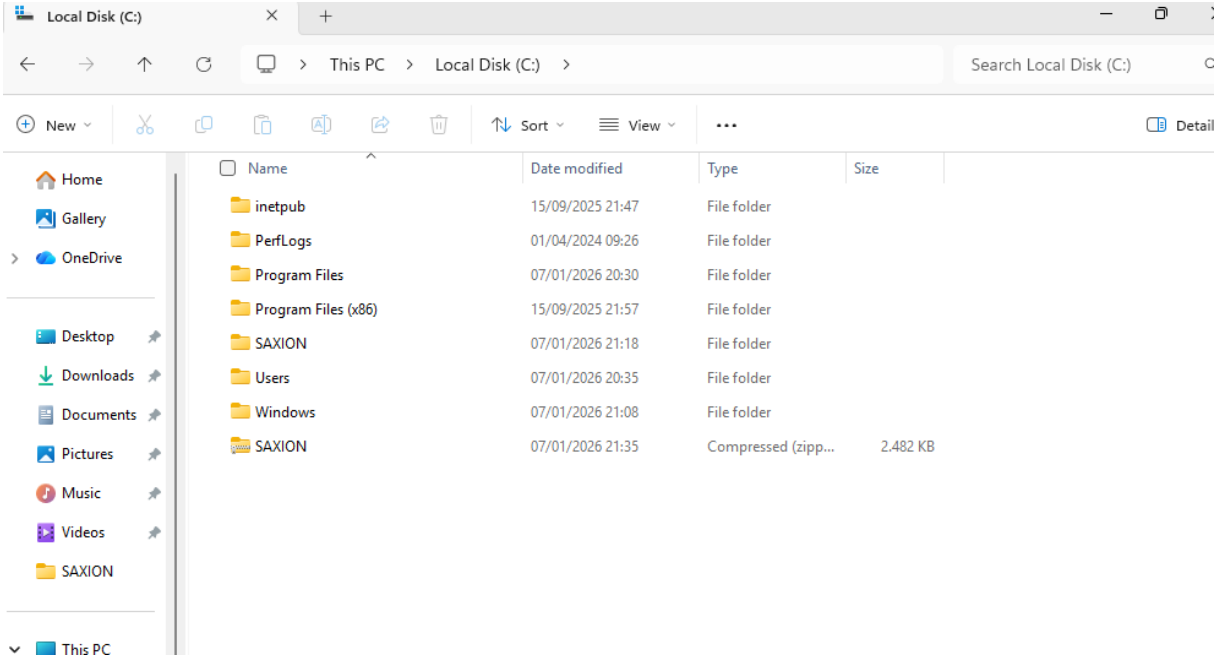
Relevant screenshots **copy** command:

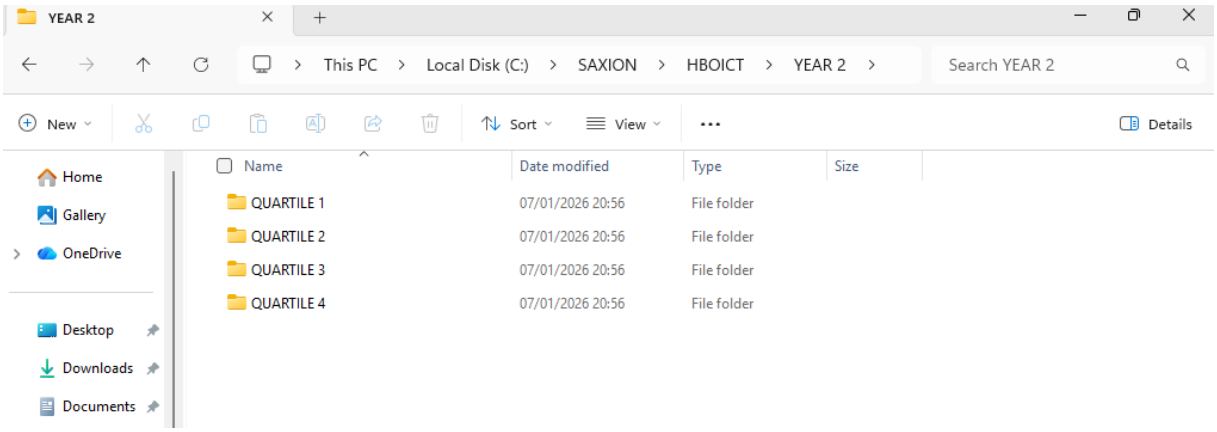


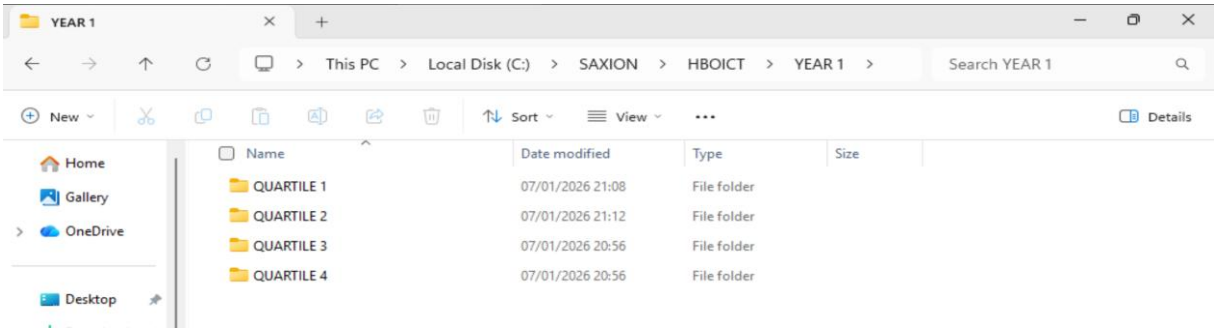
Relevant screenshots **tree** command:

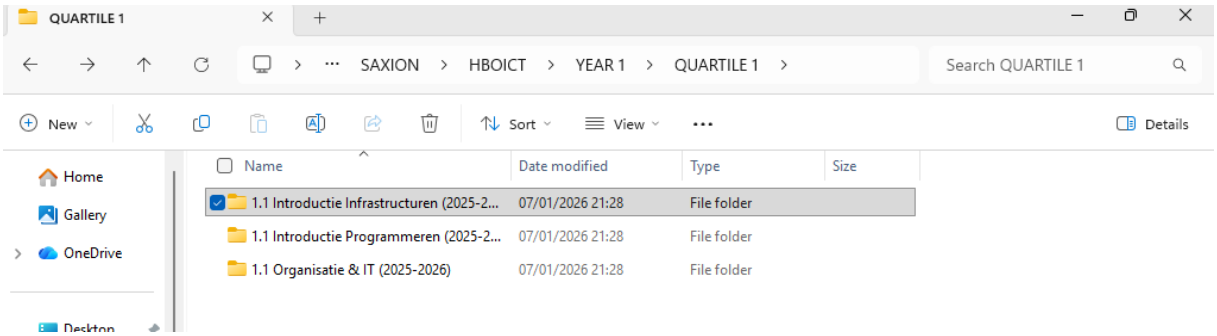
```
C:\SAXION> tree
Folder PATH listing
Volume serial number is 7A7A-EC4F
C:.
└───HBOICT
    ├───YEAR 1
    │   ├───QUARTILE 1
    │   │   ├───1.1 Introductie Infrastructuren (2025-2026)
    │   │   ├───1.1 Introductie Programmeren (2025-2026)
    │   │   └───1.1 Organisatie & IT (2025-2026)
    │   ├───QUARTILE 2
    │   │   ├───1.2 Databases (2025-2026 NL)
    │   │   ├───1.2 IT Fundamentals (2025-2026 NL)
    │   │   └───1.2 Project IT's in the Game (2025-2026 NL)
    │   ├───QUARTILE 3
    │   └───QUARTILE 4
    └───YEAR 2
        ├───QUARTILE 1
        ├───QUARTILE 2
        ├───QUARTILE 3
        └───QUARTILE 4

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

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



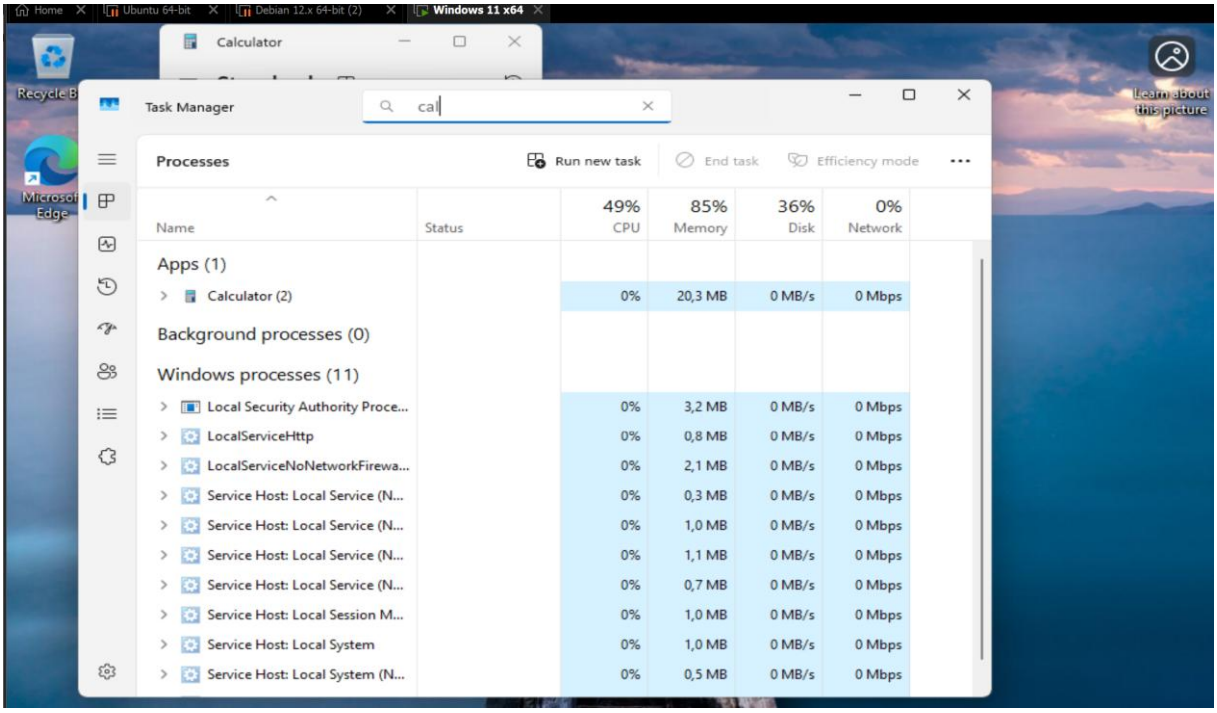


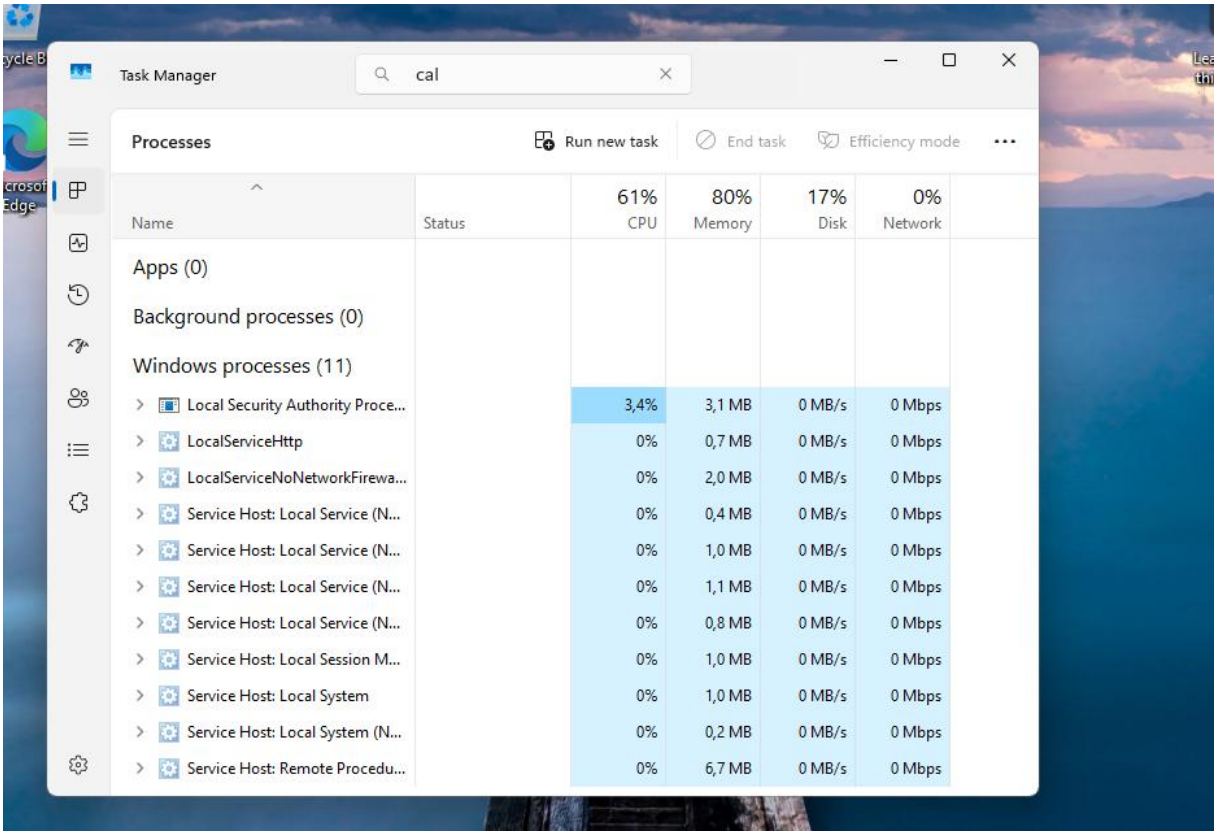




Terminating Processes

Relevant Screenshots Task Manager Window:

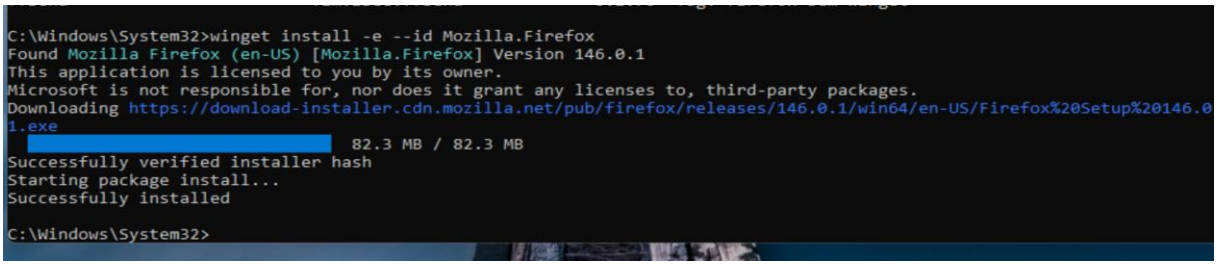


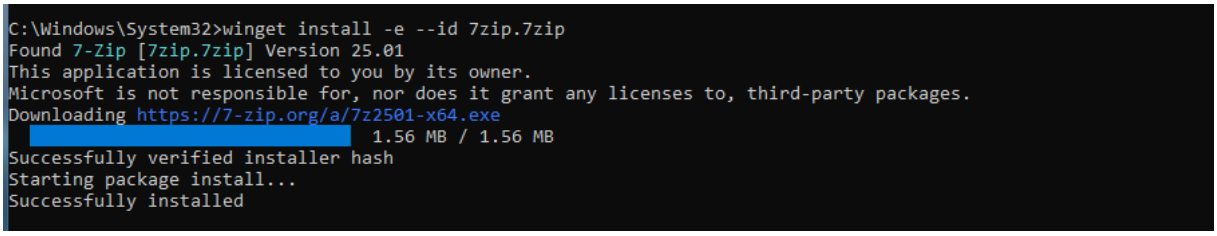


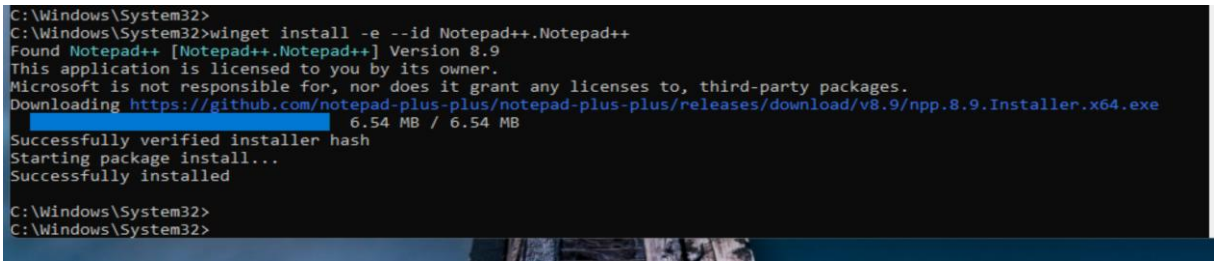
Install Software

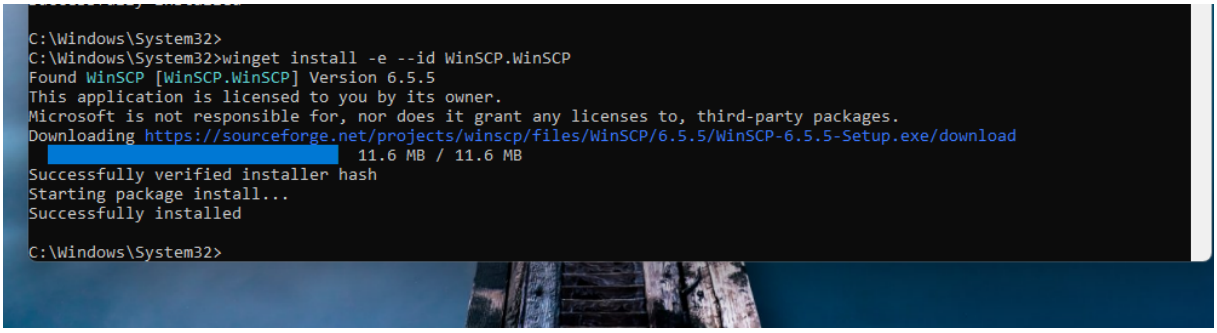
Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++
- 7zip





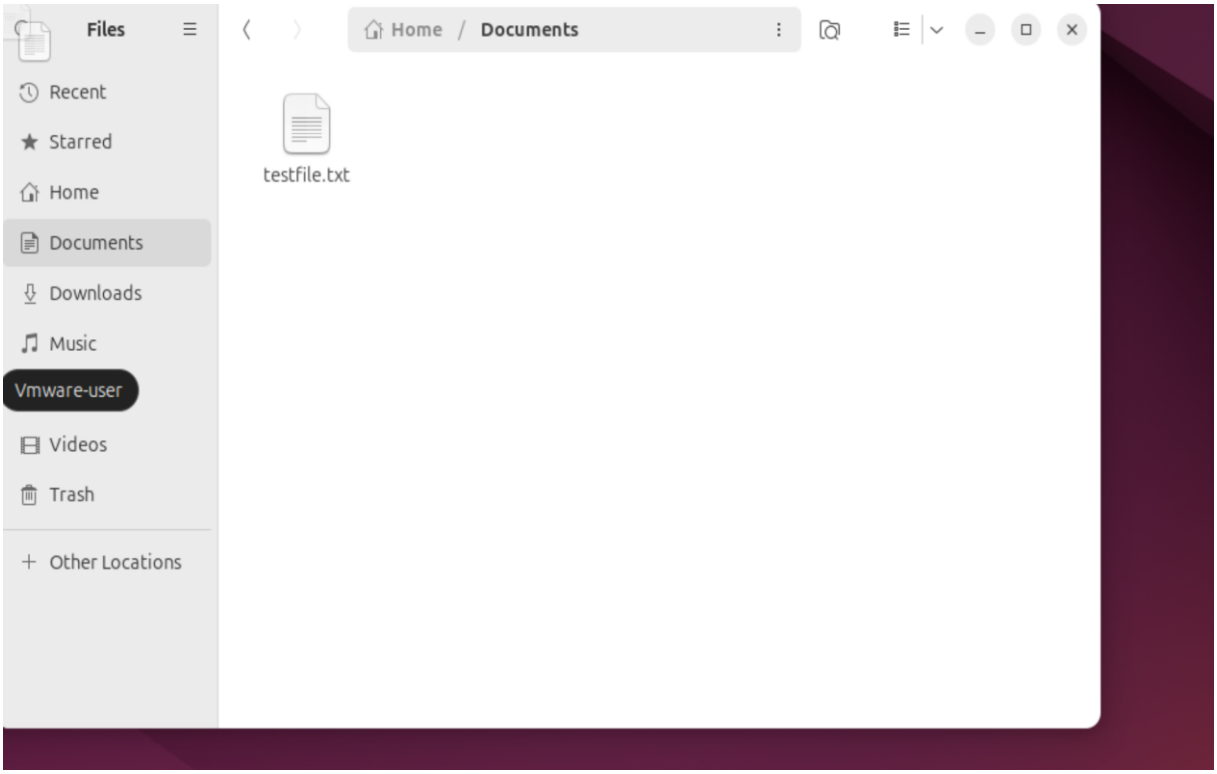


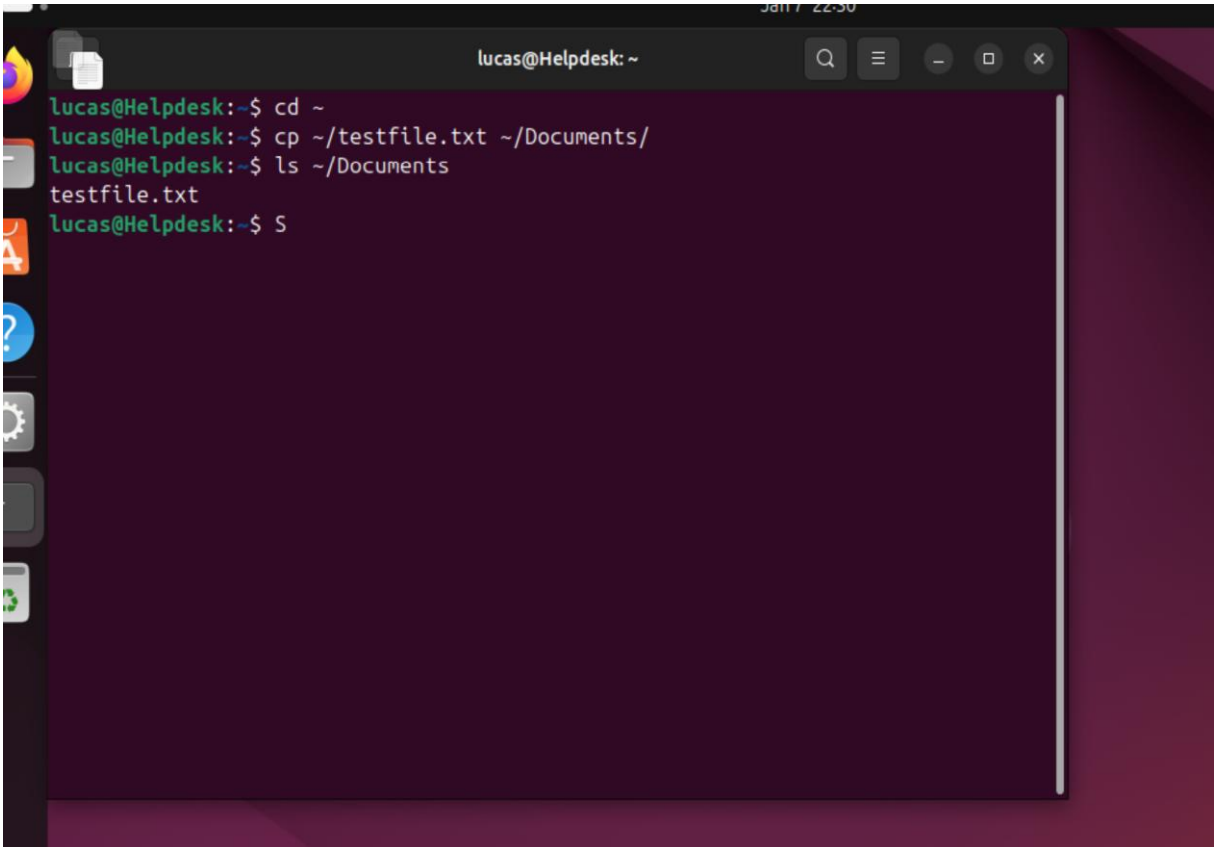


Assignment 5.4: Working with Linux

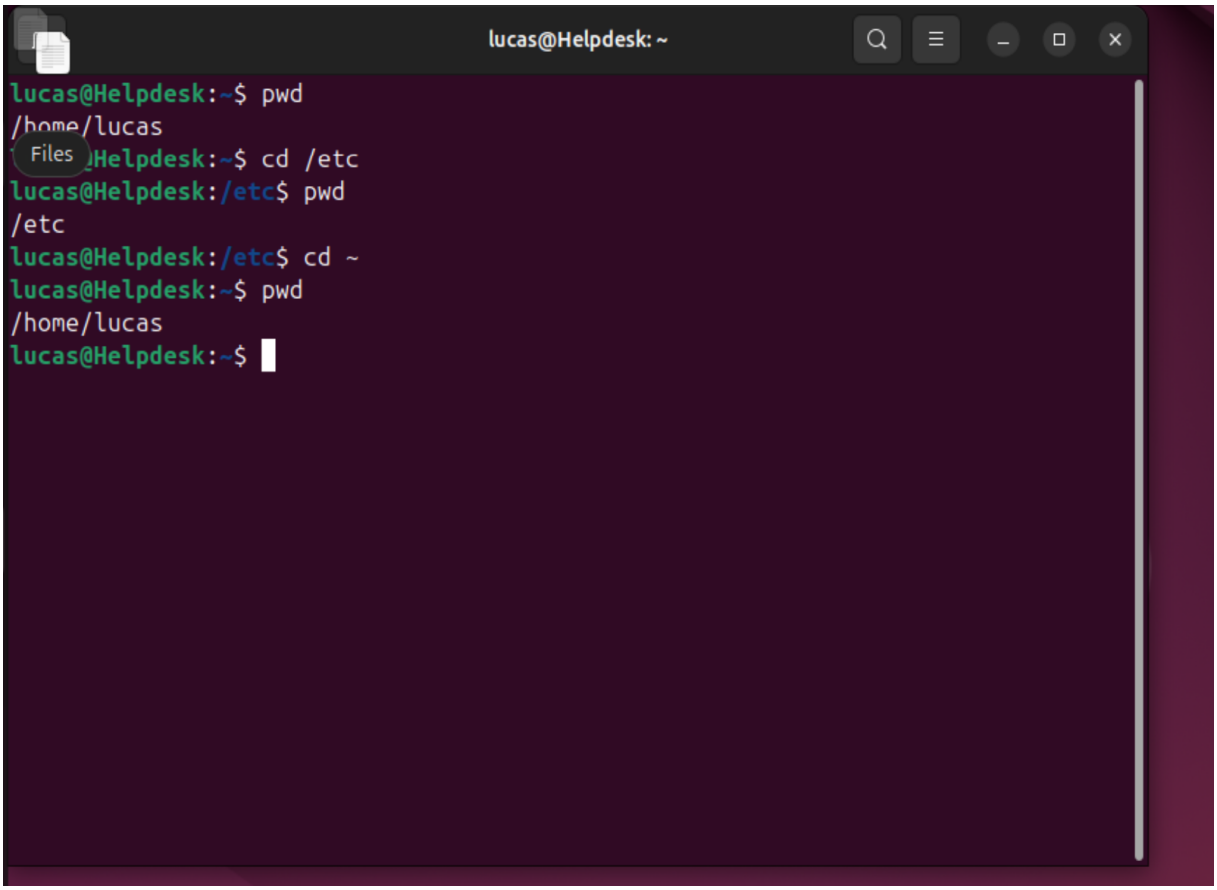
Relevant screenshots + motivation

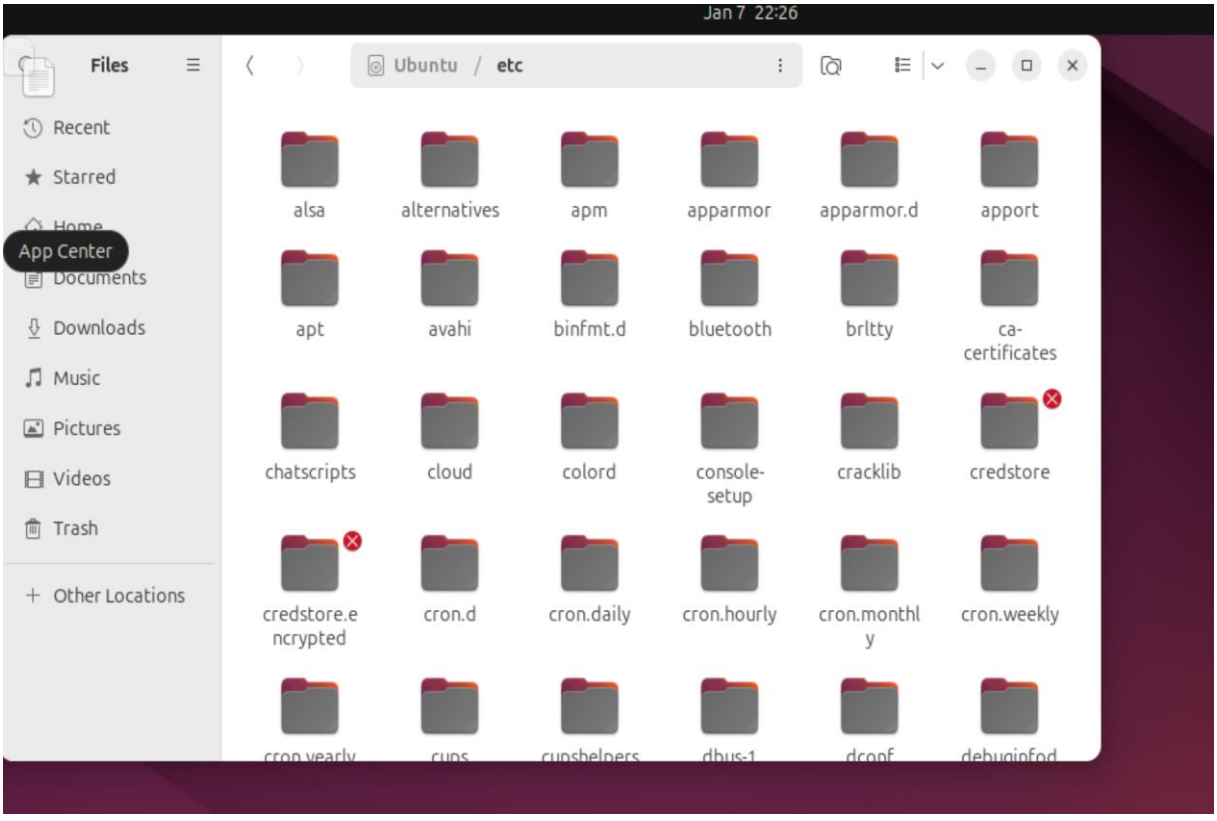
Copying files





Navigating the file structure





Navigate to the /etc folder in the file explorer

Je navigeert naar de map /etc in de file explorer door *Bestanden* te openen, vervolgens *Andere locaties* te kiezen, daarna *Computer*, en daar de map etc te openen.

Navigate to the /etc folder in the terminal

Je gaat naar de map /etc in de terminal met het commando: cd /etc

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

Je gaat terug naar je home folder met het commando: cd ~ (of gewoon cd)

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

Een belangrijk verschil is dat Linux één centrale rootmap (/) heeft waar alles onder hangt, terwijl Windows werkt met schijfletters zoals C:\, D:\ en E:\.

What is the /etc directory usually used for?

De map /etc wordt gebruikt voor systeemconfiguratiebestanden, zoals netwerkconfiguratie, services, gebruikersinstellingen en andere systeeminstellingen.

Compress files

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

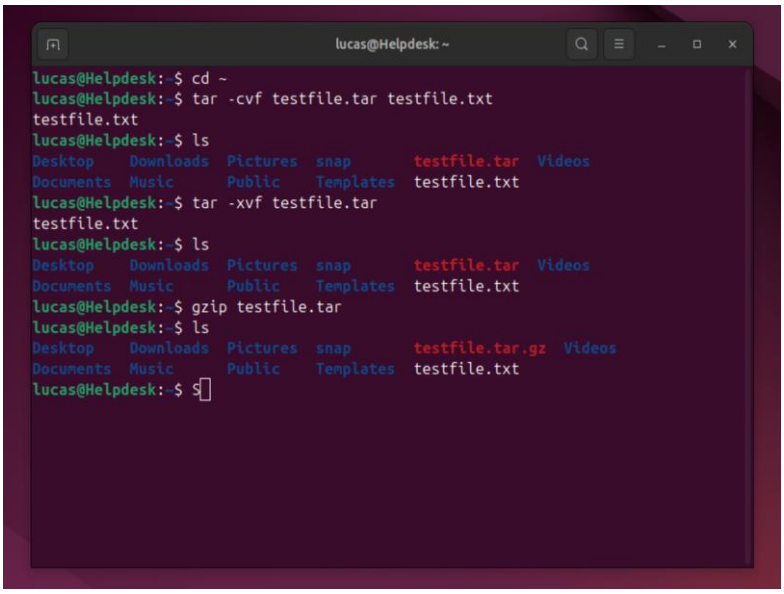
Om een tekstbestand te comprimeren in een tar-archief gebruik je: tar -cvf archiefnaam.tar bestandsnaam.txt

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

Om een tar-bestand uit te pakken gebruik je: tar -xvf archiefnaam.tar

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

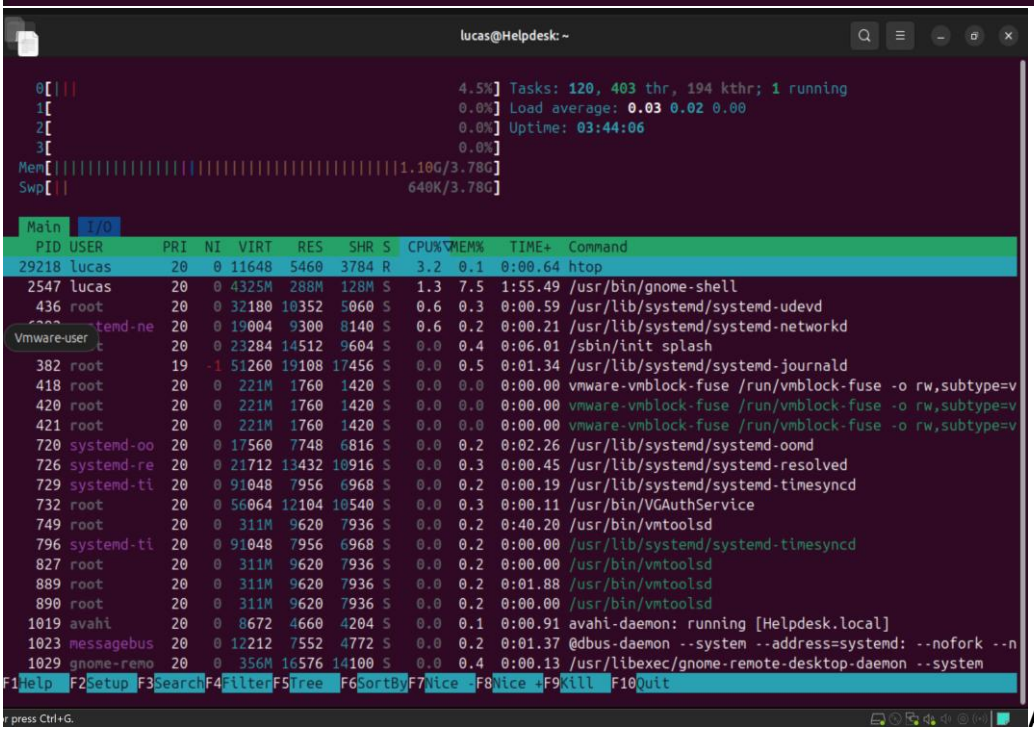
Eerst maak je een tar-archief: tar -cvf archiefnaam.tar bestandsnaam.txt Daarna comprimeer je het tar-bestand met gzip: gzip archiefnaam.tar Dit maakt een bestand: archiefnaam.tar.gz



View processes

De applicatie htop toont een overzicht van alle actieve processen op het systeem. Je ziet het CPU-gebruik, RAM-gebruik, uptime, en een lijst van processen met hun PID, status, gebruiker en geheugengebruik. Het is een interactieve tool waarmee je processen kunt sorteren, zoeken en eventueel beëindigen.

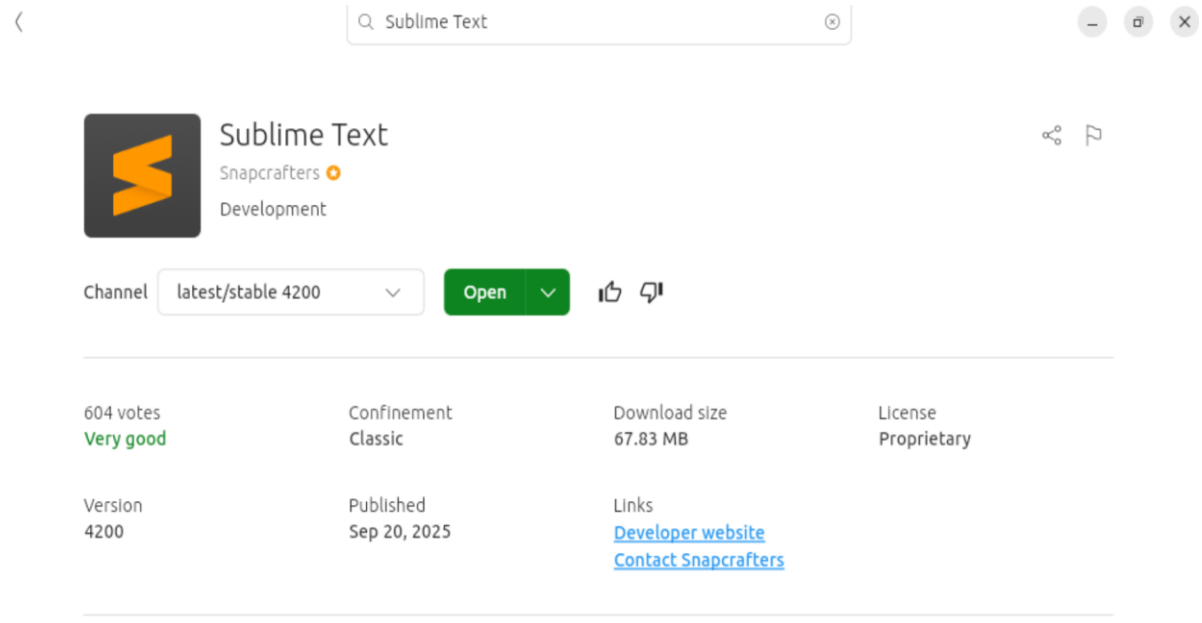
```
lucas@Helpdesk:~$ sudo apt install htop
[sudo] password for lucas:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libllvm19
Use 'sudo apt autoremove' to remove it.
Suggested packages:
  lm-sensors
The following NEW packages will be installed:
  htop
0 upgraded, 1 newly installed, 0 to remove and 154 not upgraded.
Need to get 171 kB of archives.
After this operation, 434 kB of additional disk space will be used.
Get:1 http://nl.archive.ubuntu.com/ubuntu noble/main amd64 htop amd64 3.3.0-4build1 [171 kB]
Fetched 171 kB in 0s (1,593 kB/s)
Selecting previously unselected package htop.
(Reading database ... 153081 files and directories currently installed.)
Preparing to unpack .../htop_3.3.0-4build1_amd64.deb ...
Unpacking htop (3.3.0-4build1) ...
Setting up htop (3.3.0-4build1) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1.1ubuntu3) ...
Processing triggers for man-db (2.12.0-4build2) ...
lucas@Helpdesk:~$ S
```



Assignment

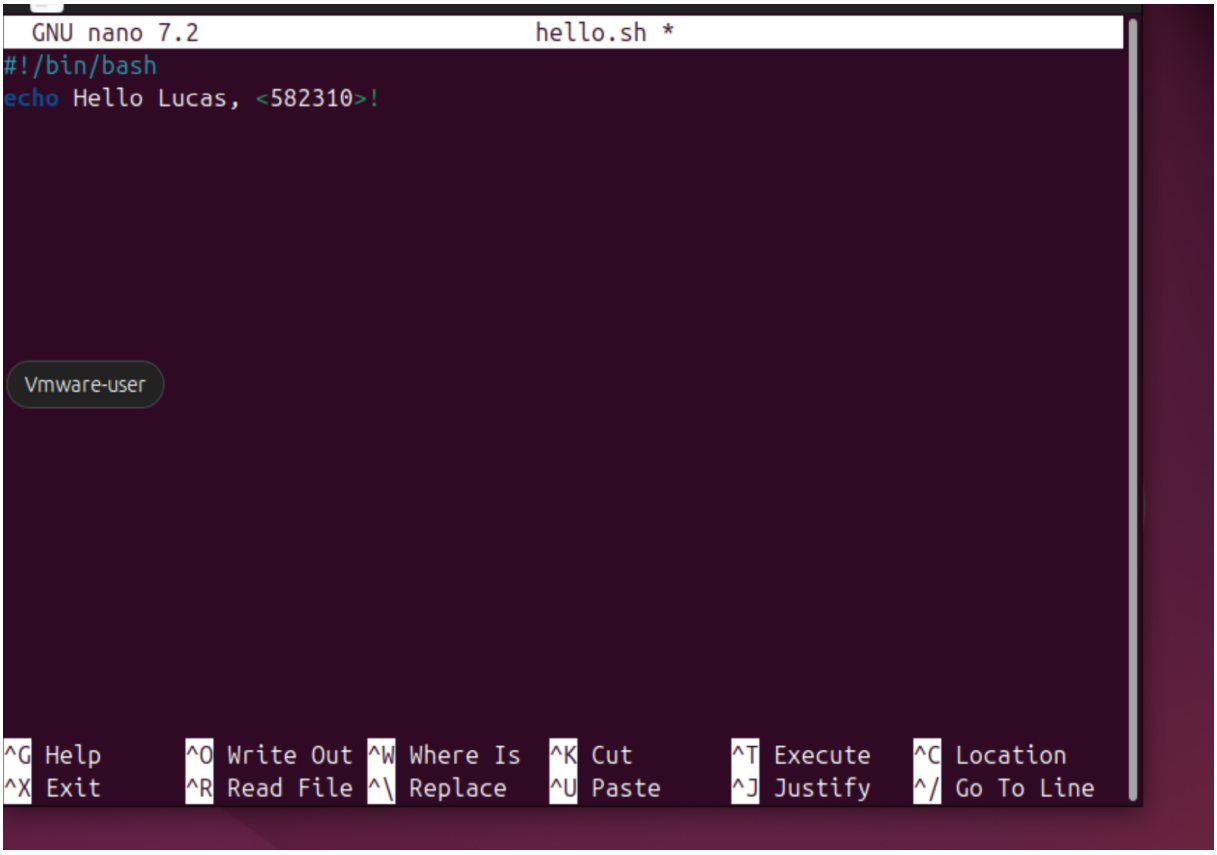
Install Software

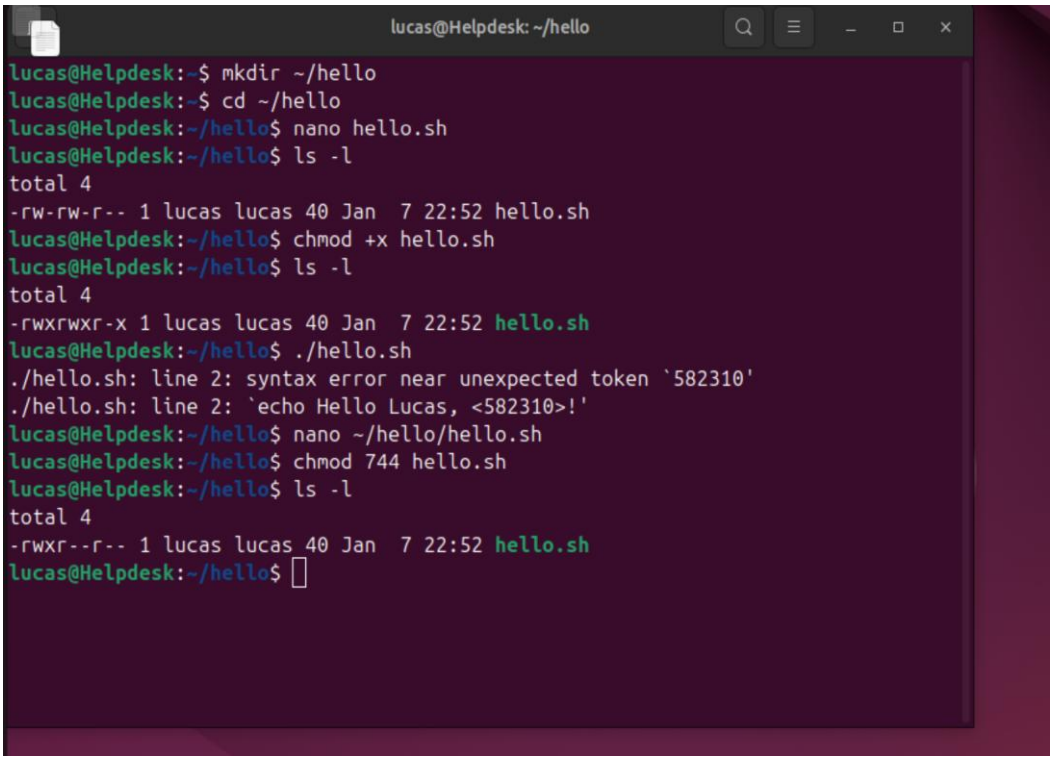
Sublime Text kan in Ubuntu geïnstalleerd worden via het Software Center. Daarnaast kan software zoals *neofetch* via de terminal worden geïnstalleerd. Hieronder staan de stappen die ik heb uitgevoerd, inclusief de screenshots die dit aantonen.



5.5: Users and permissions on Linux

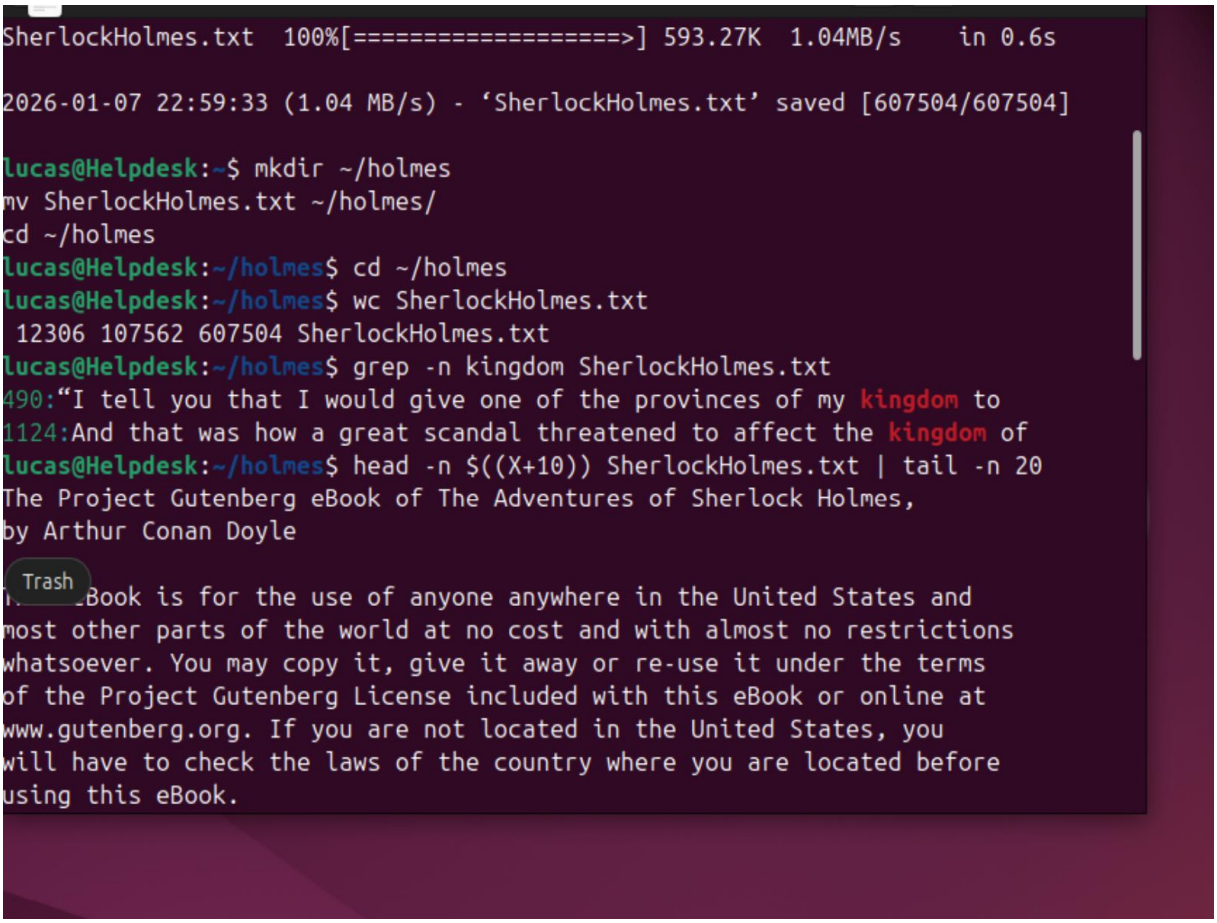
Relevant screenshots + motivation





Assignment 5.6: View the contents of files

- **cat** → toont de volledige inhoud van een bestand
- **wc** → telt regels, woorden en karakters
- **less** → bladert interactief door een bestand
- **head** → toont de eerste regels van een bestand
- **tail** → toont de laatste regels van een bestand
- **grep** → zoekt naar tekst in een bestand


SherlockHolmes.txt 100%[==========>] 593.27K 1.04MB/s in 0.6s
2026-01-07 22:59:33 (1.04 MB/s) - 'SherlockHolmes.txt' saved [607504/607504]
lucas@Helpdesk:~$ mkdir ~/holmes
mv SherlockHolmes.txt ~/holmes/
cd ~/holmes
lucas@Helpdesk:~/holmes$ cd ~/holmes
lucas@Helpdesk:~/holmes$ wc SherlockHolmes.txt
12306 107562 607504 SherlockHolmes.txt
lucas@Helpdesk:~/holmes$ 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
lucas@Helpdesk:~/holmes$ head -n $((X+10)) SherlockHolmes.txt | tail -n 20
The Project Gutenberg eBook of The Adventures of Sherlock Holmes,
by Arthur Conan Doyle
Trash
Book is for the use of anyone anywhere in the United States and
most other parts of the world at no cost and with almost no restrictions
whatsoever. You may copy it, give it away or re-use it under the terms
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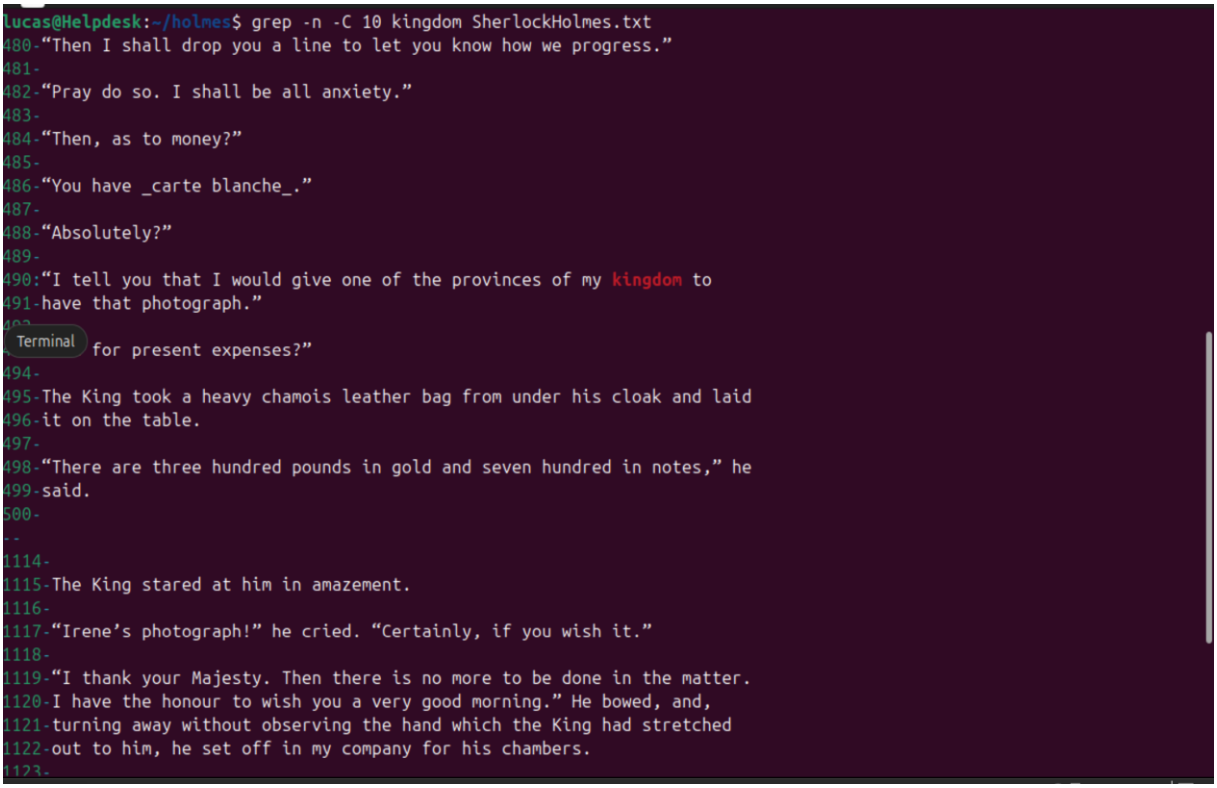
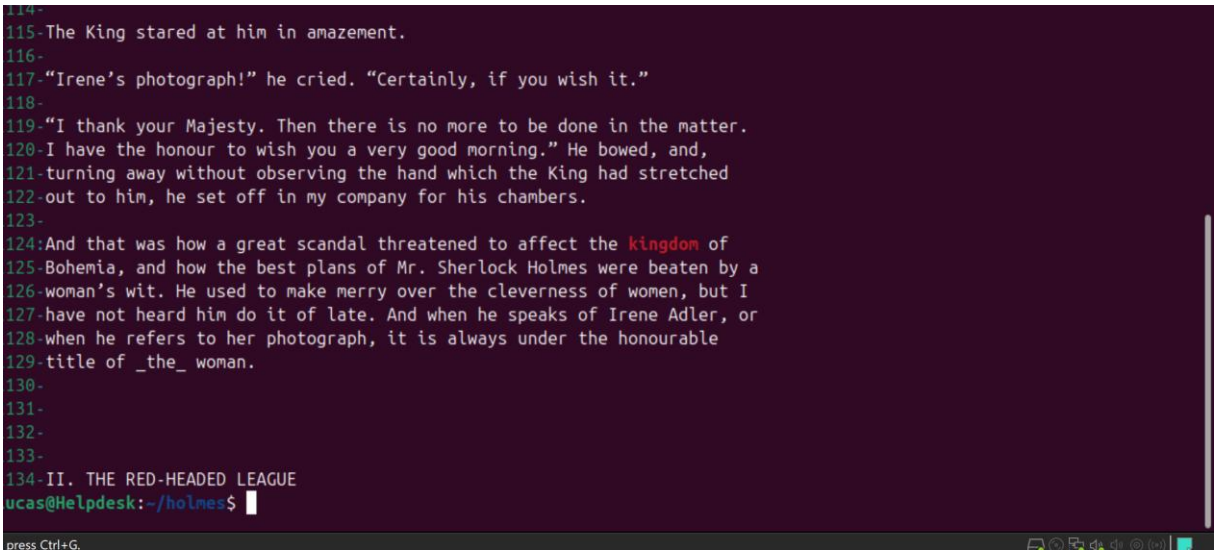
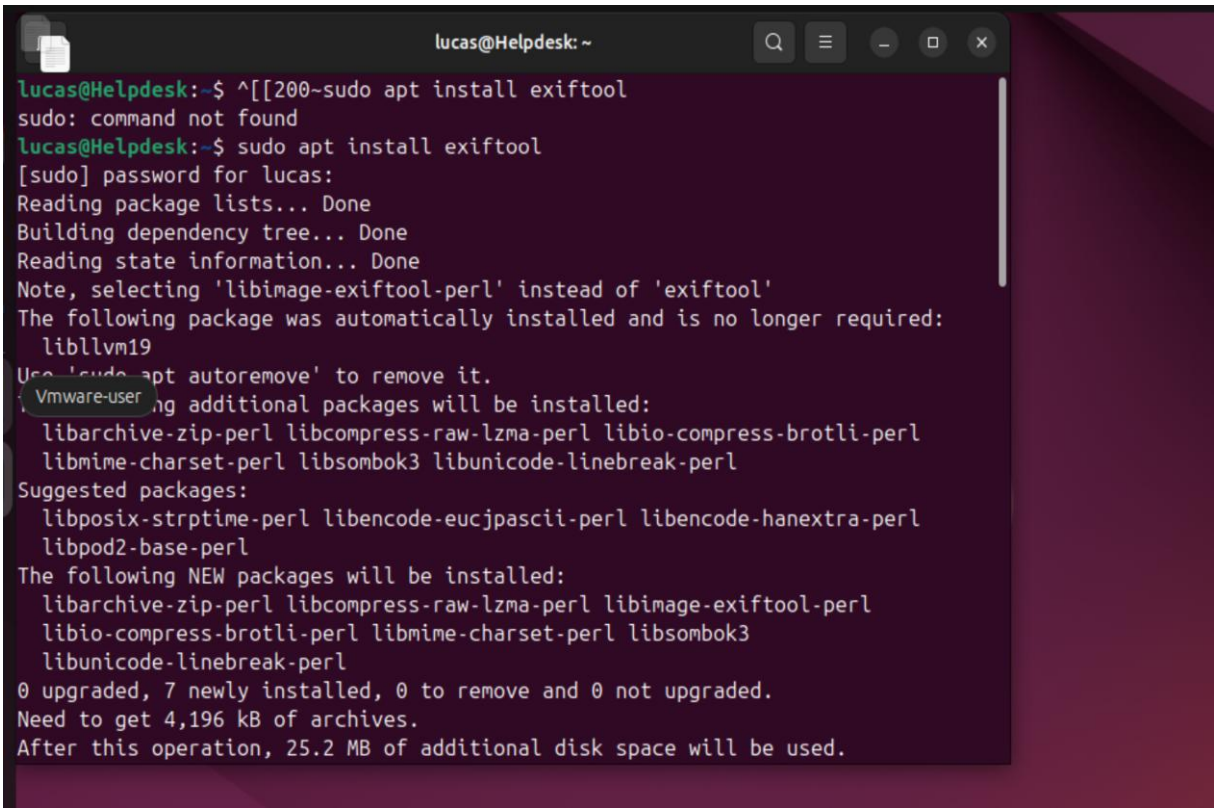
www.gutenberg.org. If you are not located in the United States, you
will have to check the laws of the country where you are located before
using this eBook.

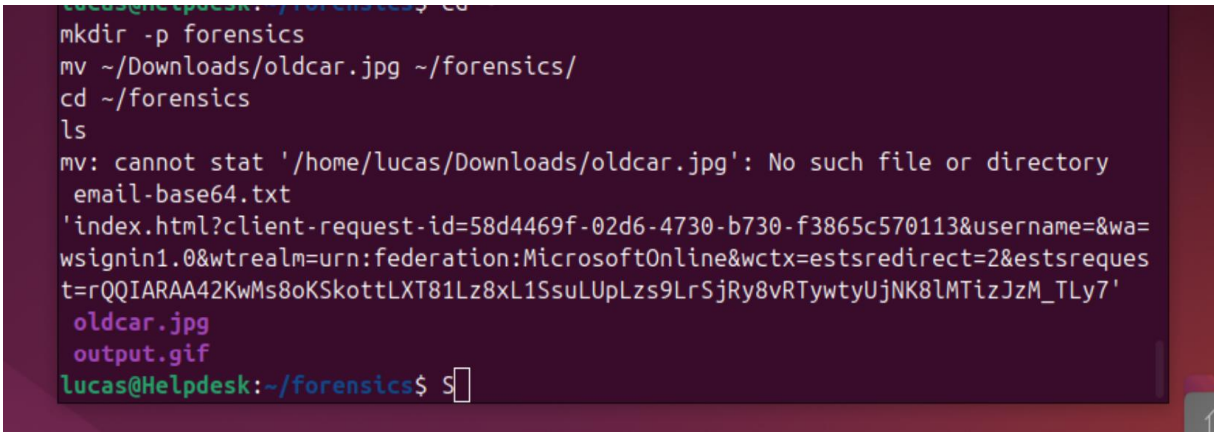

lucas@Helpdesk:~/holmes$ grep -n -C 10 kingdom SherlockHolmes.txt
480-"Then I shall drop you a line to let you know how we progress."
481-
482-"Pray do so. I shall be all anxiety."
483-
484-"Then, as to money?"
485-
486-"You have _carte blanche_."
487-
488-"Absolutely?"
489-
490:"I tell you that I would give one of the provinces of my kingdom to
491-have that photograph."
Terminal
for present expenses?"
494-
495-The King took a heavy chamois leather bag from under his cloak and laid
496-it on the table.
497-
498-"There are three hundred pounds in gold and seven hundred in notes," he
499-said.
500-
--
1114-
1115-The King stared at him in amazement.
1116-
1117-"Irene's photograph!" he cried. "Certainly, if you wish it."
1118-
1119-"I thank your Majesty. Then there is no more to be done in the matter.
1120-I have the honour to wish you a very good morning." He bowed, and,
1121-turning away without observing the hand which the King had stretched
1122-out to him, he set off in my company for his chambers.

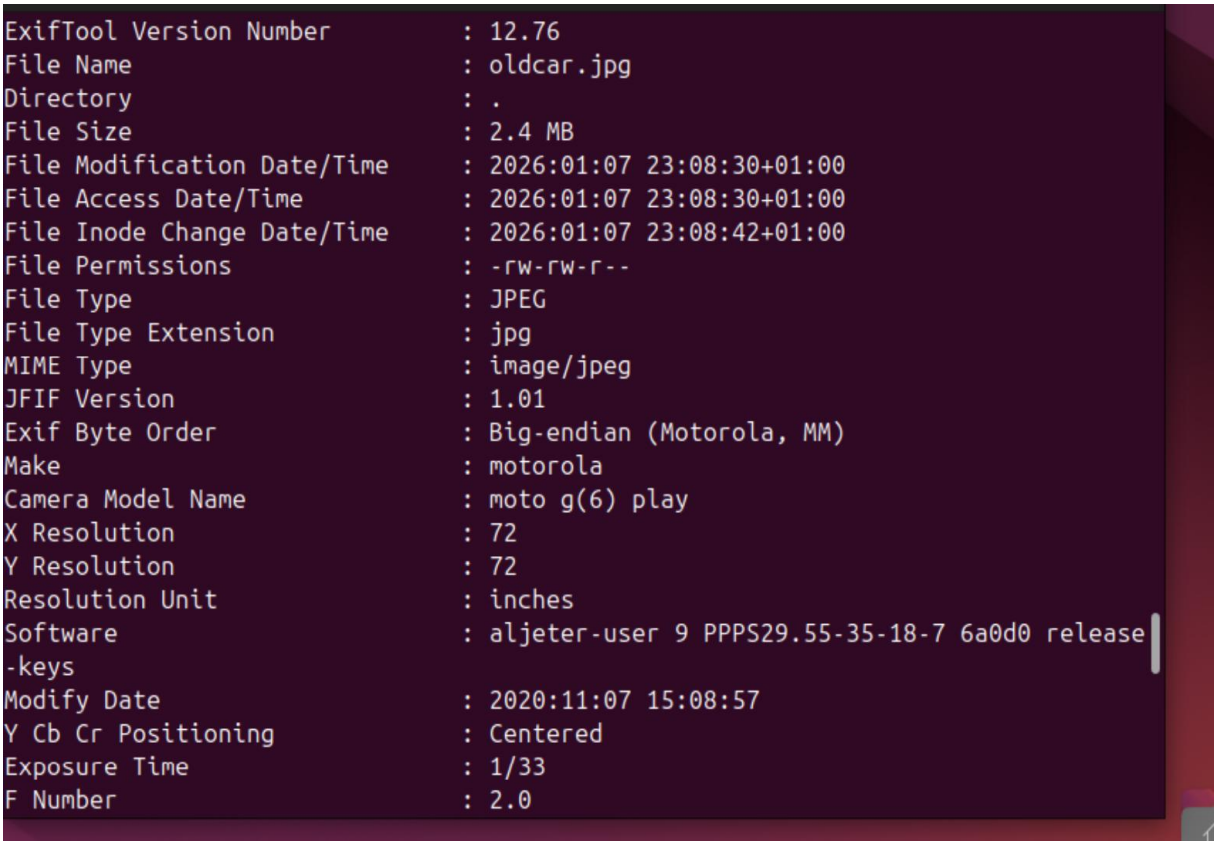


Assignment 5.7: Digital forensics

In deze opdracht analyseer je metadata van een foto, onderzoek je bestandstypes zonder extensie en decodeer je BASE64-data naar een GIF-bestand. Hieronder staan de stappen die ik heb uitgevoerd, inclusief de screenshots die dit aantonen.







Door gebruik te maken van exiftool op oldcar.jpg heb ik vastgesteld dat de foto is gemaakt met een Motorola Moto G6 Play-smartphone. De EXIF-data bevatte ook GPS-coördinaten: 53°11'39.68" N, 6°32'12.90" E.

Filename extensions

```
lucas@Helpdesk:~/forensics$ ls
email-base64.txt  oldcar  output.gif
lucas@Helpdesk:~/forensics$
```

```
lucas@Helpdesk:~/forensics$ 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
lucas@Helpdesk:~/forensics$
```

```
lucas@Helpdesk:~/forensics$ file output.gif
output.gif: GIF image data, version 89a, 108 x 52
lucas@Helpdesk:~/forensics$
```

Assignment 5.8: Steganography

Relevant screenshots + motivation

```
lucas@Helpdesk:~$ cd ~
mkdir -p steganography
cd steganography
lucas@Helpdesk:~/steganography$ mv ~/Downloads/apple2.jpg ~/steganography/
ls
apple2.jpg
lucas@Helpdesk:~/steganography$ sudo apt install steghide
[sudo] password for lucas:
Help
g package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libllvm19
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  libmcrypt4 libmhash2
Suggested packages:
  libmcrypt-dev mcrypt
The following NEW packages will be installed:
  libmcrypt4 libmhash2 steghide
Document is voor het laatst opgeslagen: Zojuist
0 upgraded, 3 newly installed, 0 to remove and 0 not upgraded.
Need to get 307 kB of archives.
After this operation, 910 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

```
steghide version 0.5.1

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
```

Terminal

```
  -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
lucas@Helpdesk:~/steganography$
```

Help

```
lucas@Helpdesk:~/steganography$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
lucas@Helpdesk:~/steganography$ cat message.txt
Hello class.
You have almost completed Week 5.

lucas@Helpdesk:~/steganography$
```

Met behulp van steghide heb ik het verborgen bestand uit apple2.jpg gehaald.

Ik heb hiervoor het commando 'steghide extract -sf apple2.jpg' gebruikt met het wachtwoord apple2.

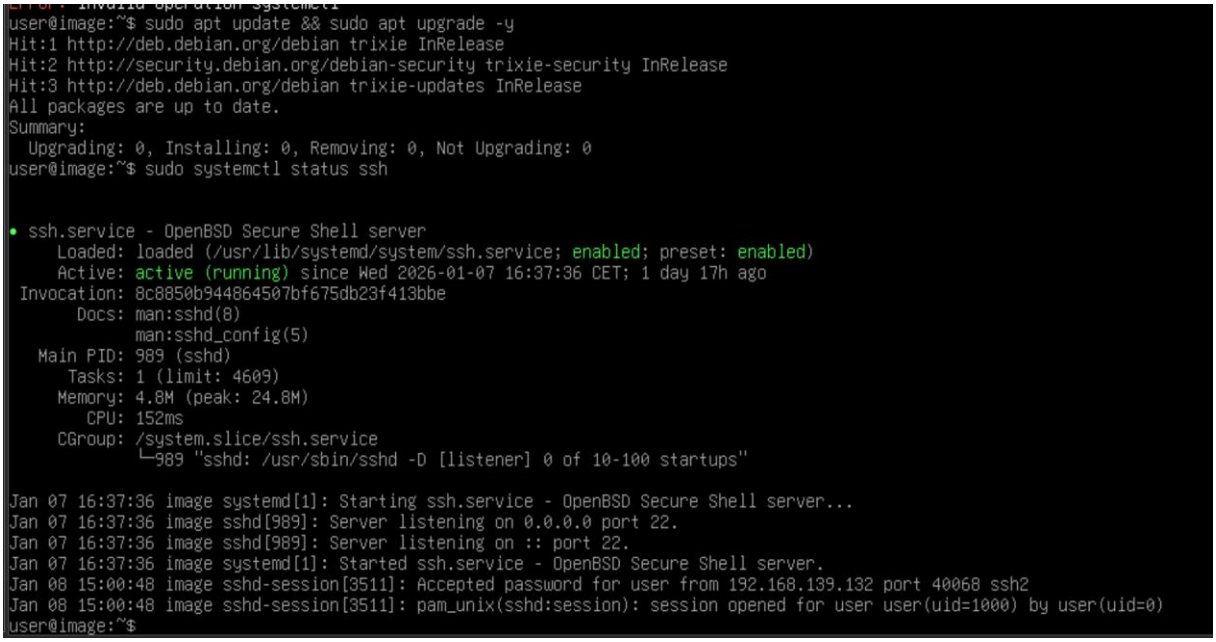
Steghide heeft hierbij het bestand message.txt aangemaakt.

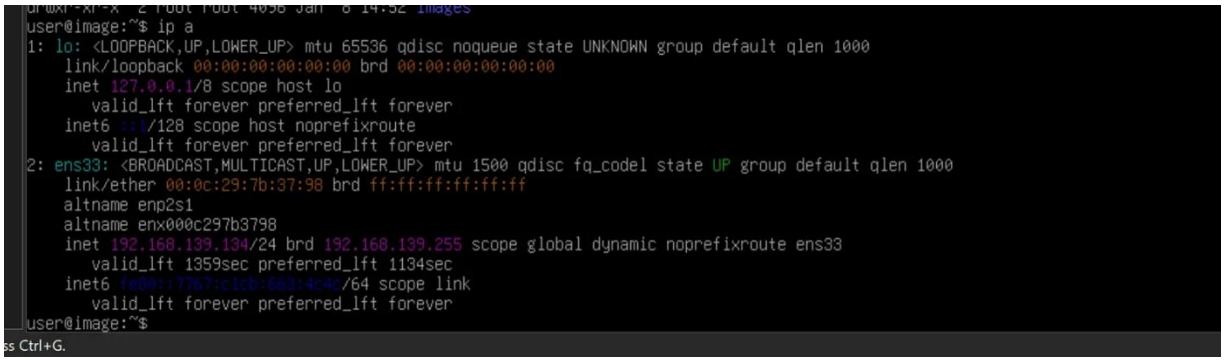
Met 'cat message.txt' heb ik de inhoud bekeken.

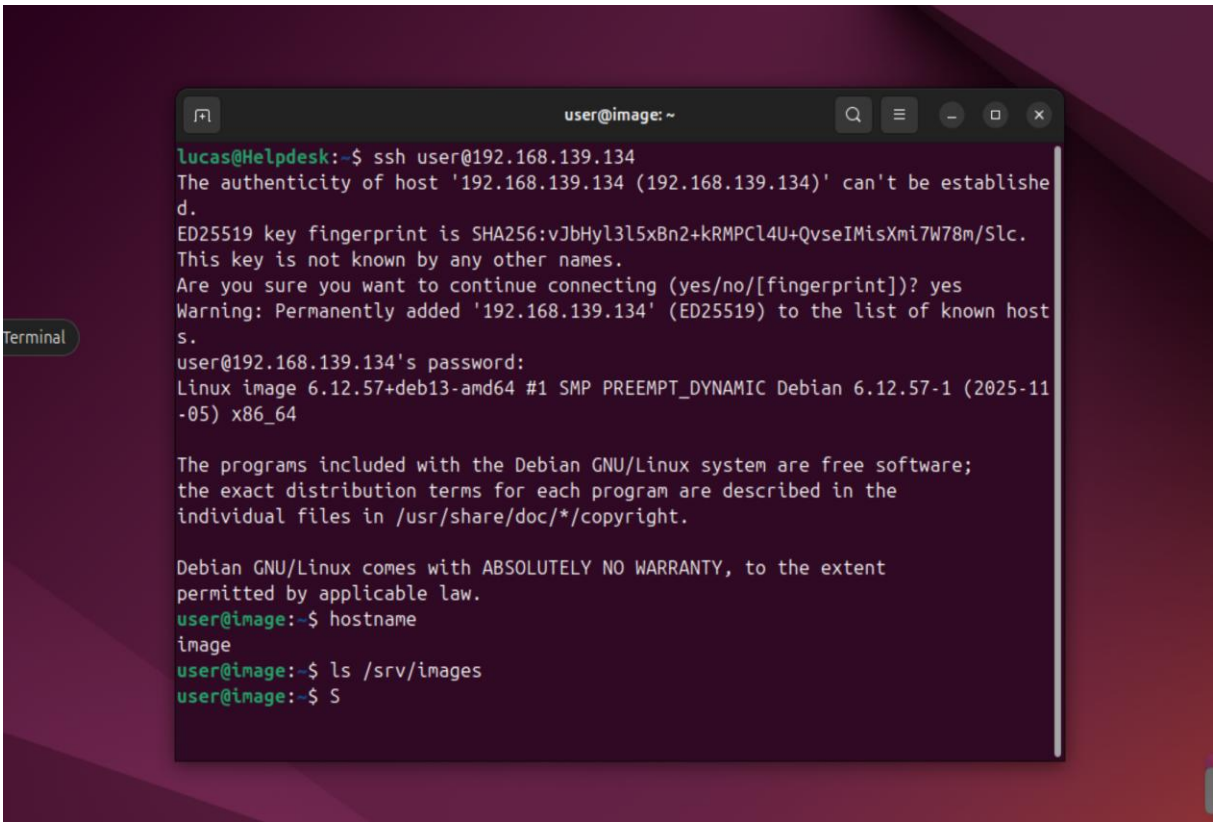
Assignment 5.9: Capture disk images

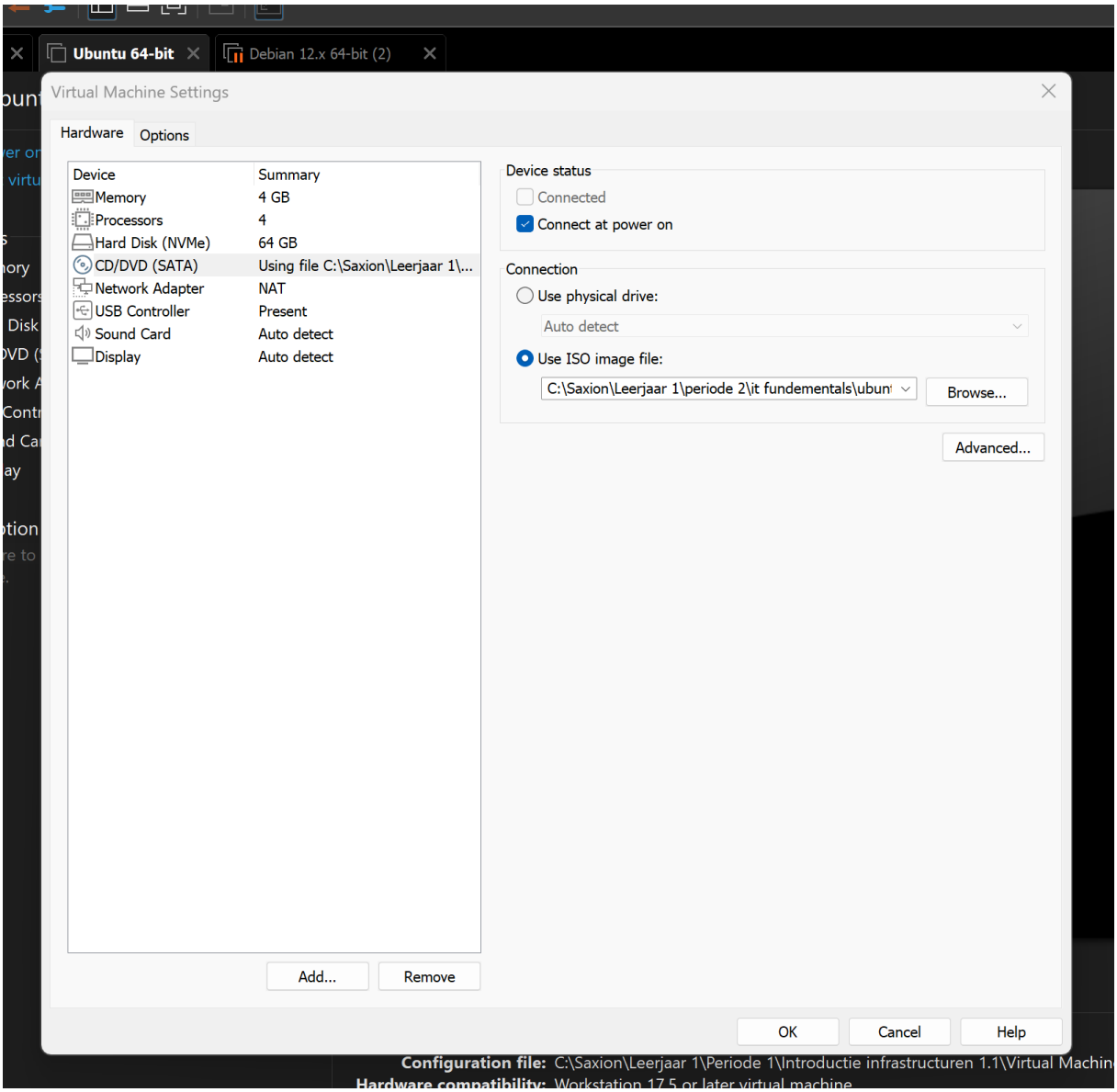
Make relevant screenshots + motivation:

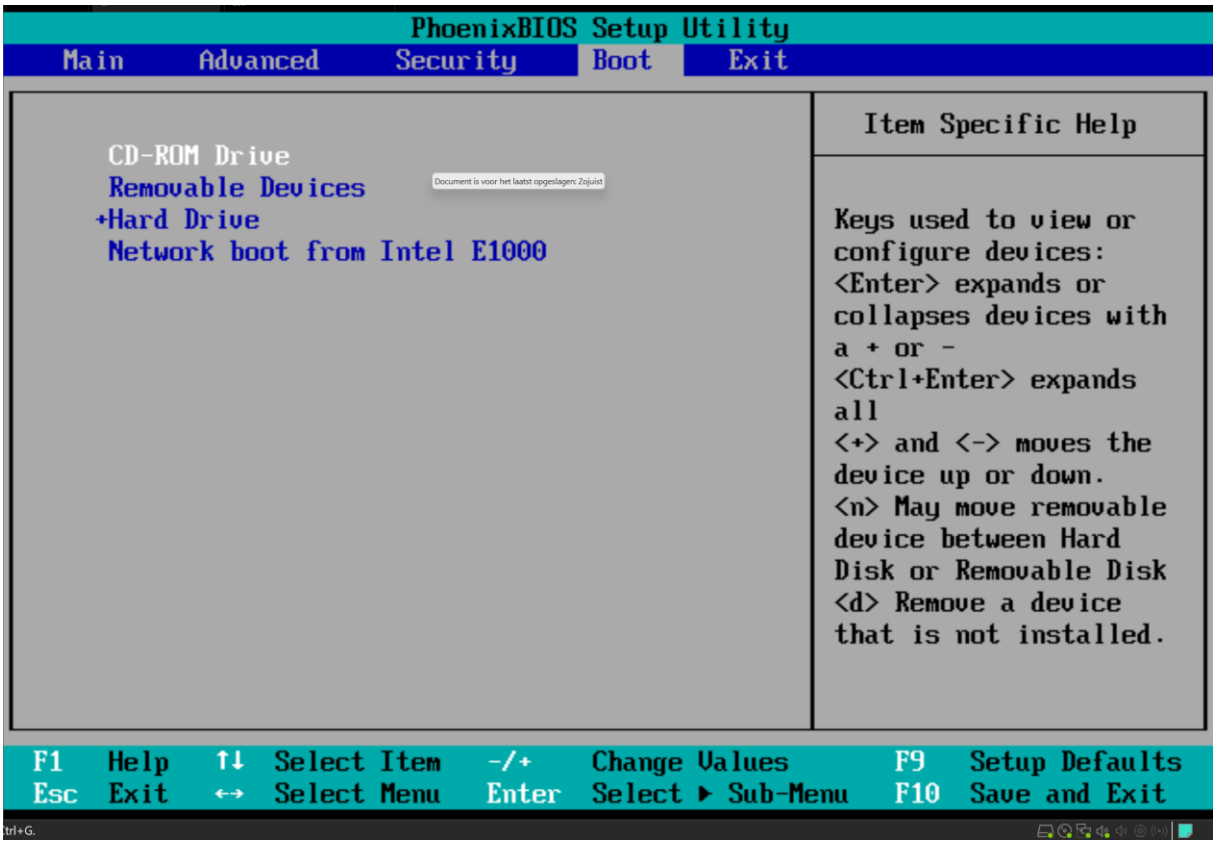
- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.
- Proof that you can restore the back-up image into an empty VM.

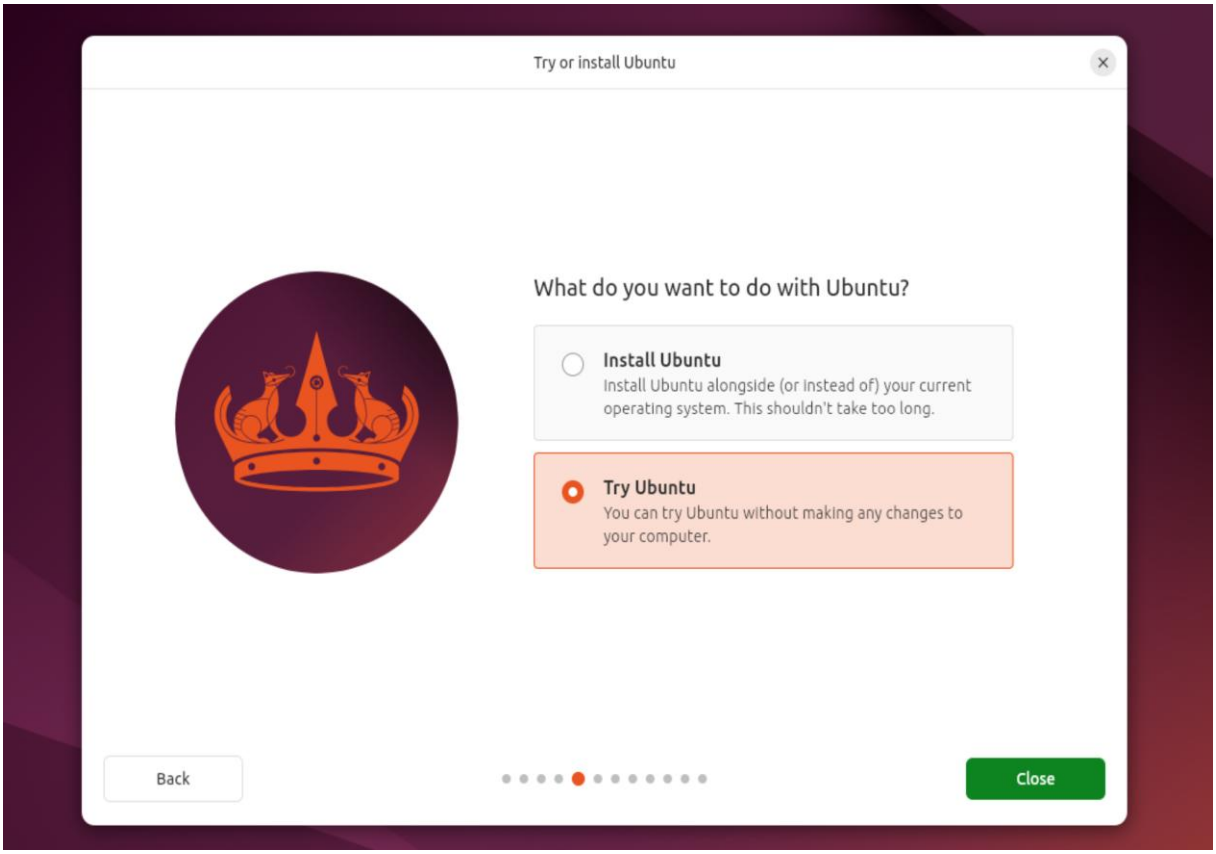


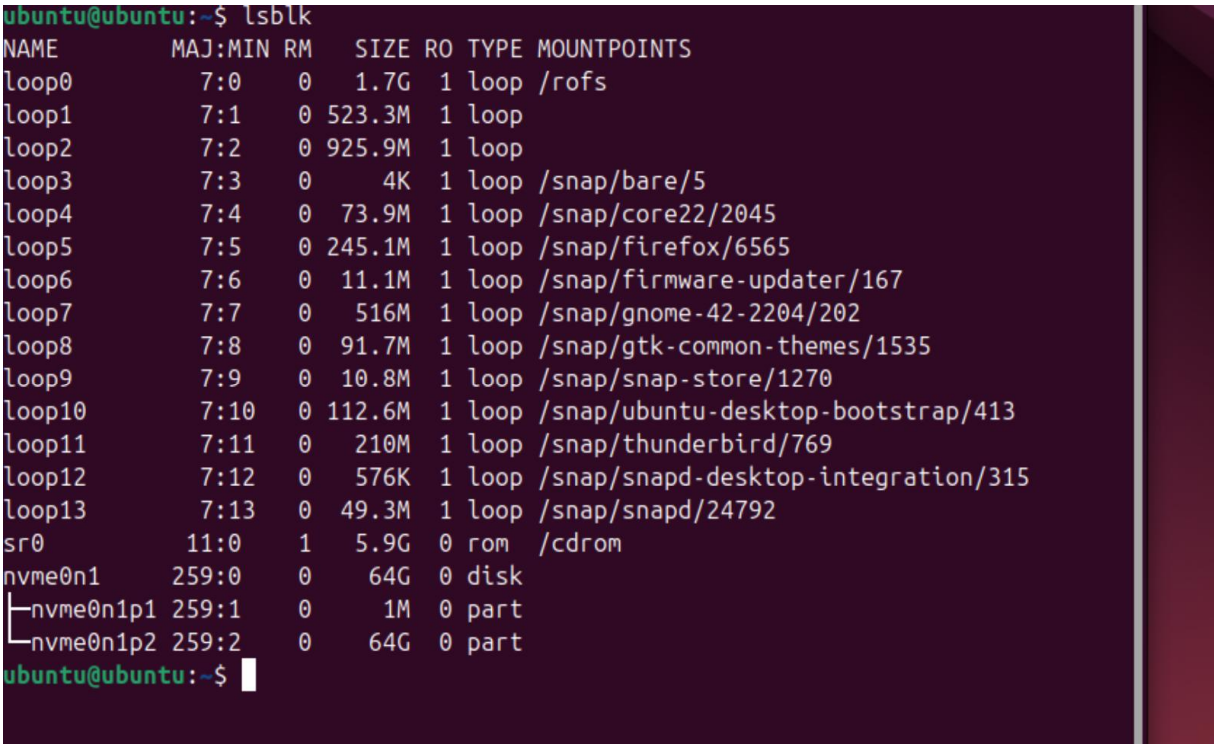

drwxr-xr-x 2 root root 4096 Jan 8 14:32 images
user@image:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope 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:29:7b:37:98 brd ff:ff:ff:ff:ff:ff
altname enp2s1
altname enx000c297b3798
inet 192.168.139.134/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
valid_lft 1359sec preferred_lft 1134sec
inet6 fe80::770b:7c1b:6a3:4c4c/64 scope link
valid_lft forever preferred_lft forever
user@image:~$
ss Ctrl+G.

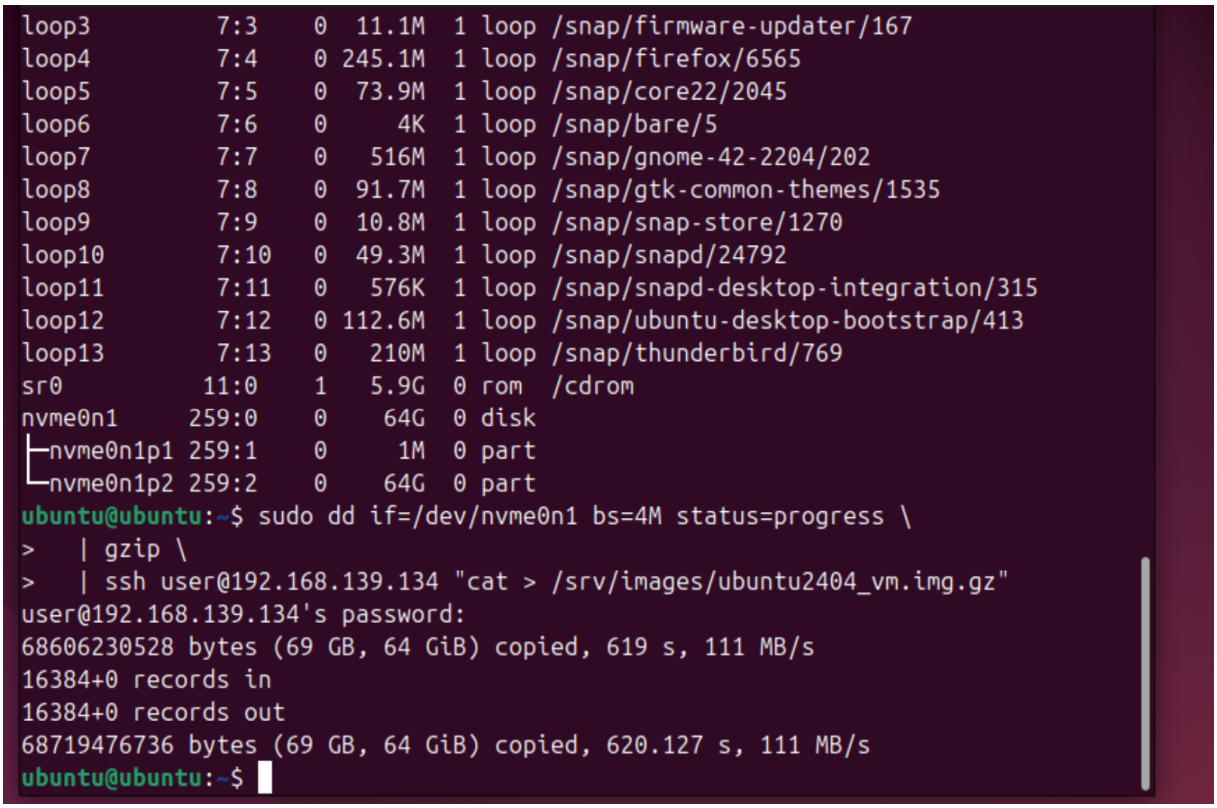

Terminal
user@image: ~
lucas@Helpdesk:~$ ssh user@192.168.139.134
The authenticity of host '192.168.139.134 (192.168.139.134)' can't be establishe
d.
ED25519 key fingerprint is SHA256:vJbHyl3l5xBn2+kRMPCl4U+QvseIMisXmi7W78m/Slc.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.134' (ED25519) to the list of known host
s.
user@192.168.139.134's password:
Linux image 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/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
user@image:~$ hostname
image
user@image:~$ ls /srv/images
user@image:~$ S


Ubuntu 64-bit
Debian 12.x 64-bit (2)
Virtual Machine Settings
Hardware
Options
Device
Summary
Memory
4 GB
Processors
4
Hard Disk (NVMe)
64 GB
CD/DVD (SATA)
Using file C:\Saxion\Leerjaar 1\...
Network Adapter
NAT
USB Controller
Present
Sound Card
Auto detect
Display
Auto detect
Add...
Remove
Device status
Connected
Connect at power on
Connection
Use physical drive:
Auto detect
Use ISO image file:
C:\Saxion\Leerjaar 1\periode 2\it fundementals\ubun
Browse...
Advanced...
OK
Cancel
Help
Configuration file: C:\Saxion\Leerjaar 1\Periode 1\Introductie infrastructuren 1.1\Virtual Machin
Hardware compatibility: Workstation 17.5 or later virtual machine


PhoenixBIOS Setup Utility
Main
Advanced
Security
Boot
Exit
CD-ROM Drive
Removable Devices
+Hard Drive
Network boot from Intel E1000
Item Specific Help
Keys used to view or configure devices:
<Enter> expands or collapses devices with a + or -
<Ctrl+Enter> expands all
<+> and <-> moves the device up or down.
<n> May move removable device between Hard Disk or Removable Disk
<d> Remove a device that is not installed.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults
Esc Exit ↔ Select Menu Enter Select ▸ Sub-Menu F10 Save and Exit

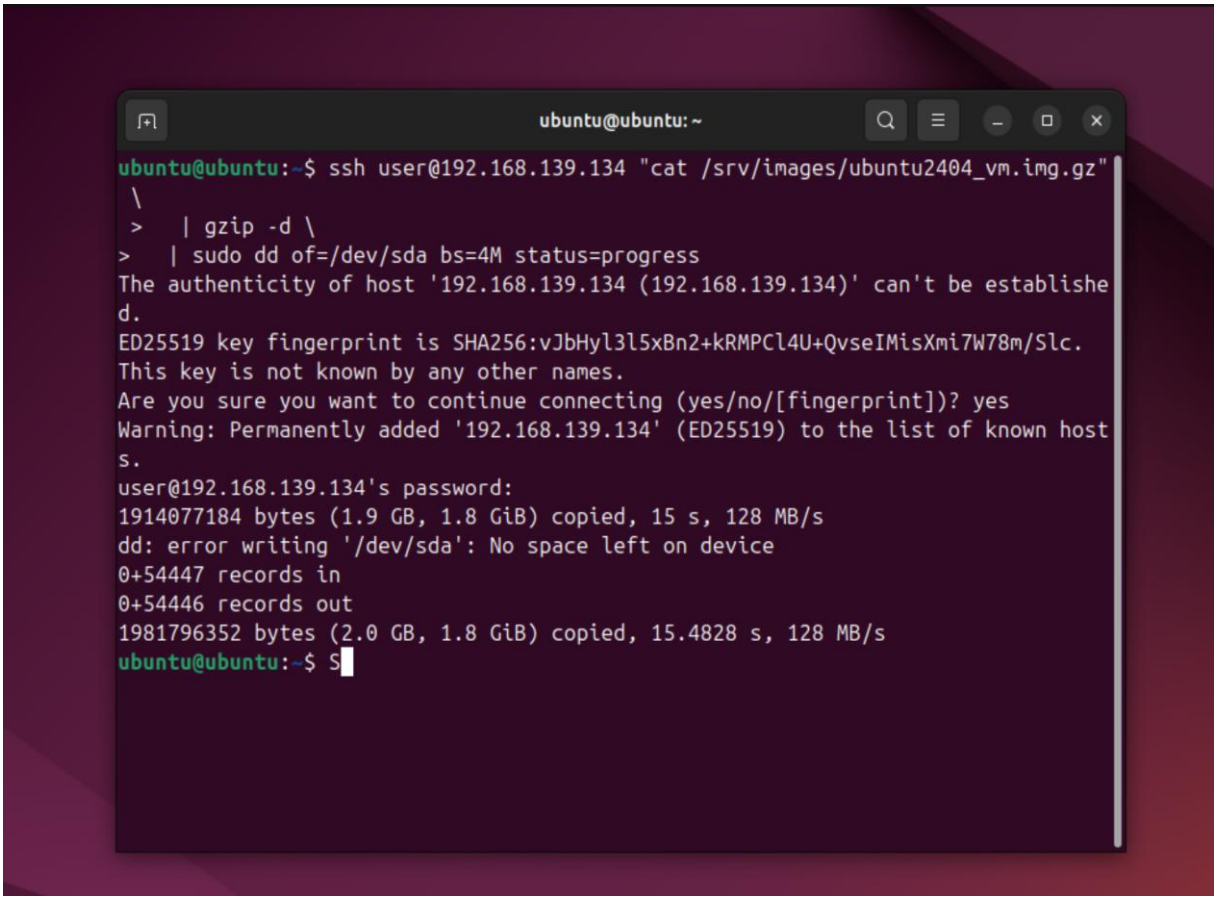

Try or install Ubuntu
What do you want to do with Ubuntu?
Install Ubuntu
Install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long.
Try Ubuntu
You can try Ubuntu without making any changes to your computer.
Back
Close

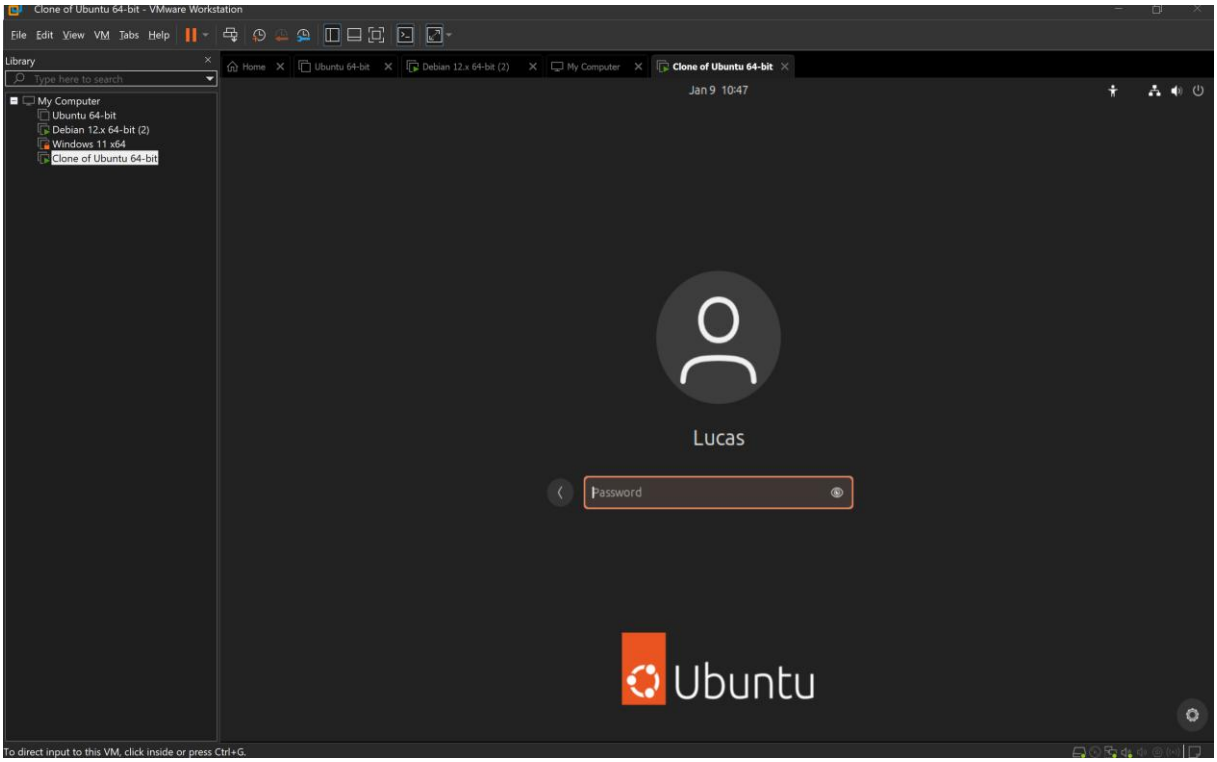

ubuntu@ubuntu:~$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
loop0 7:0 0 1.7G 1 loop /rofs
loop1 7:1 0 523.3M 1 loop
loop2 7:2 0 925.9M 1 loop
loop3 7:3 0 4K 1 loop /snap/bare/5
loop4 7:4 0 73.9M 1 loop /snap/core22/2045
loop5 7:5 0 245.1M 1 loop /snap/firefox/6565
loop6 7:6 0 11.1M 1 loop /snap/firmware-updater/167
loop7 7:7 0 516M 1 loop /snap/gnome-42-2204/202
loop8 7:8 0 91.7M 1 loop /snap/gtk-common-themes/1535
loop9 7:9 0 10.8M 1 loop /snap/snap-store/1270
loop10 7:10 0 112.6M 1 loop /snap/ubuntu-desktop-bootstrap/413
loop11 7:11 0 210M 1 loop /snap/thunderbird/769
loop12 7:12 0 576K 1 loop /snap/snapd-desktop-integration/315
loop13 7:13 0 49.3M 1 loop /snap/snapd/24792
sr0 11:0 1 5.9G 0 rom /cdrom
nvme0n1 259:0 0 64G 0 disk
├─nvme0n1p1 259:1 0 1M 0 part
└─nvme0n1p2 259:2 0 64G 0 part
ubuntu@ubuntu:~$


loop3 7:3 0 11.1M 1 loop /snap/firmware-updater/167
loop4 7:4 0 245.1M 1 loop /snap/firefox/6565
loop5 7:5 0 73.9M 1 loop /snap/core22/2045
loop6 7:6 0 4K 1 loop /snap/bare/5
loop7 7:7 0 516M 1 loop /snap/gnome-42-2204/202
loop8 7:8 0 91.7M 1 loop /snap/gtk-common-themes/1535
loop9 7:9 0 10.8M 1 loop /snap/snap-store/1270
loop10 7:10 0 49.3M 1 loop /snap/snapd/24792
loop11 7:11 0 576K 1 loop /snap/snapd-desktop-integration/315
loop12 7:12 0 112.6M 1 loop /snap/ubuntu-desktop-bootstrap/413
loop13 7:13 0 210M 1 loop /snap/thunderbird/769
sr0 11:0 1 5.9G 0 rom /cdrom
nvme0n1 259:0 0 64G 0 disk
├─nvme0n1p1 259:1 0 1M 0 part
└─nvme0n1p2 259:2 0 64G 0 part
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress \
> | gzip \
> | ssh user@192.168.139.134 "cat > /srv/images/ubuntu2404_vm.img.gz"
user@192.168.139.134's password:
68606230528 bytes (69 GB, 64 GiB) copied, 619 s, 111 MB/s
16384+0 records in
16384+0 records out
68719476736 bytes (69 GB, 64 GiB) copied, 620.127 s, 111 MB/s
ubuntu@ubuntu:~$

```
sudo chmod
sudo chmod 75 /suser@image:~$  /srv/images
-bash: /srv/images: Is a directory
user@image:~$
user@image:~$ ls -ld /srv/images
drwxr-xr-x 2 user user 4096 Jan  9 10:10 /srv/images
user@image:~$ touch /srv/images/testfile
user@image:~$ ls -lh /srv/images
total 6.8G
-rw-rw-r-- 1 user user    0 Jan  9 10:15 testfile
-rw-rw-r-- 1 user user 6.8G Jan  9 10:26 ubuntu2404_vm.img.gz
user@image:~$
```

```
-rw-rw-r-- 1 user user    0 Jan  9 10:15 testfile
-rw-rw-r-- 1 user user 6.8G Jan  9 10:26 ubuntu2404_vm.img.gz
user@image:~$ cd /srv/images
user@image:/srv/images$ qemu-img create -f raw ubuntu2404_vm_disk.raw 64G
ls -bash: qemu-img: command not found
-lhuser@image:/srv/images$ ls -lh
total 6.8G
-rw-rw-r-- 1 user user    0 Jan  9 10:15 testfile
-rw-rw-r-- 1 user user 6.8G Jan  9 10:26 ubuntu2404_vm.img.gz
user@image:/srv/images$ gunzip -c ubuntu2404_vm.img.gz | dd of=ubuntu2404_vm_disk.raw bs=4M status=progress
220495872 bytes (220 MB, 210 MiB) copied, 1 s, 220 MB/s
68672651264 bytes (69 GB, 64 GiB) copied, 305 s, 225 MB/s
0+1895609 records in
0+1895609 records out
68719476736 bytes (69 GB, 64 GiB) copied, 305.188 s, 225 MB/s
user@image:/srv/images$ sync
user@image:/srv/images$ _
```





Na het capturen en overzetten van mijn originele Ubuntu VM-image naar de Debian server, heb ik het image via SSH teruggezet naar een nieuwe virtuele disk binnen een lege VM.

Vervolgens heb ik de VM opnieuw opgestart zonder ISO, waardoor het systeem direct bootte vanaf de restored disk.

Het login scherm van mijn oude Ubuntu-omgeving verscheen, wat bevestigt dat de restore succesvol is uitgevoerd.

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