

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 Besturingssystemen zijn gemaakt door AT&T in de jaren 60. Unix-like systemen zoals Linux en MACOS gebruiken de zelfde basis als UNIX besturingssystemen. Daarom worden ze unix-like genoemd.

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 en Dennis Ritchie zijn mede-ontwikkelaars van Unix bij Bell Labs. Bill Joy heeft belangrijke unix tools gemaakt zoals: vi, C shell en TCP/IP implementaties. Richard Stallman is oprichter van de GNU movement. Linus Torvalds heeft de linux-kernel ontwikkeld.

c) What is the philosophy of the GNU movement?

Vrijheid om software te gebruiken, vrijheid om broncode te bekijken en aan te passen, vrijheid om te kopiëren en verspreiden en de vrijheid om verbeterde versies te delen.

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

Ja, want Ubuntu maakt gebruik van linux en gebruikt veel GNU software. Broncode is beschikbaar. Ubuntu is door gebruikers aan te passen.

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

WSL

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

Android: Linux

iOS: UNIX / BSD

ChromeOS: Linux

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 worden voornamelijk gebruikt bij operaties die enorm veel computerkracht vereisen. Het bekendste voorbeeld hiervan is NASA die supercomputers gebruikt voor de ruimtevaart en onderzoek. Ook worden ze gebruikt voor medische en chemisch onderzoek. Voor AI worden ook supercomputers gebruikt. IBM heeft een sleutelrol gespeeld in het ontwikkelen van supercomputers.

- 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 PS3 cluster was een groep van Playstation 3 consoles die aan elkaar verbonden waren om zware taken uit te voeren. De PS3 clusters werden gebruikt voornamelijk voor onderzoek op verschillende gebieden. De PS3 clusters waren een goedkope optie voor een supercomputer totdat Sony Linux support verwijderde in software updates.

- c) You can build a supercomputer by putting a few computers together in a cluster. Here's what Oracle did with a collection of Raspberry Pi's, for example:
- <https://blogs.oracle.com/developers/post/building-the-worlds-largest-raspberry-pi-cluster>
- What specific operating system is running on this cluster?

Oracle Linux ARM.

- d) Does Oracle's Raspberry Pi supercomputer appear in the list of the 500 fastest supercomputers in the world? Make a logical decision for this, without going through the entire list.

<https://www.top500.org/lists/top500/list/2023/06/>

Nee ik denk van niet. Ook al heeft Oracle 1050 Raspberry Pi's samengevoegd tot supercomputer denk ik dat het bij lange na niet de kracht heeft als moderne supercomputers die beschikken over veel betere onderdelen.

- 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?

CPU architecture: beide PS5 en Xbox Series X gebruiken x86-64 (AMD Zen 2) architectuur.

Operating systems: PS5 gebruikt een op UNIX gebaseerde Sony OS. Xbox Series X gebruikt een aangepaste versie van windows.

Conclusie: Het zijn beide gewoon krachtige computers met een aangepast besturingssysteem speciaal gemaakt om makkelijk te kunnen gamen.

Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

- a) Practice for about 10 minutes with the **Windows key + S** keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.

- b) The file explorer can be opened with **Windows key + E**, Which key combination could you also use?
Windows button + File Explorer + enter key.

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

Systeemoverzicht	
Bestand	Bewerken
Beeld	Help
Systemoverzicht	
Hardwarebronnen	
Onderdelen	
Softwareomgeving	
Item	Waarde
Naam van besturingssysteem	Microsoft Windows 11 Education
Versie	10.0.26200 Build 26200
Andere beschrijving van bestu...	Niet beschikbaar
Leverancier van besturingssyst...	Microsoft Corporation
Systeemnaam	SILVEREN-STRAAL
Systeemfabrikant	LENOVO
Systeemmodel	82FG
Systeemtype	x64-based PC
Systeem-SKU	LENOVO_MT_82FG_BU_idea_FM_IdeaPad 5 15ITL05
Processor	11th Gen Intel(R) Core(TM) i7-1165G7 @ 2.80GHz, 2803 MHz, 4 core(s), 8 thread(s)
BIOS-versie/datum	LENOVO FHCN24WW, 14/01/2021
SMBIOS-versie	3.3
Versie van ingesloten controller	1.24
BIOS-modus	UEFI
Basisbordfabrikant	LENOVO
Basisbordproduct	LNVNB161216
Basisbordversie	SDK040709 WIN
Platformfunctie	Mobiel
Status beveiligd opstarten	Ingeschakeld
PCR7-configuratie	Uithouding van bevoegdheden vereist om te kunnen weergeven

- 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.

Taakbeheer			
<input type="text"/> Taakbeheer	<input type="text"/> Typ een naam, uitgever of PID...		
<input type="button"/> Processen	<input type="button"/> Nieuwe taak uitvoeren		
<input type="button"/> Prestaties			
<input type="button"/> App-geschiedenis			
<input type="button"/> Opstart-apps			
<input type="button"/> Gebruikers			
<input type="button"/> Details			
<input type="button"/> Services			
Processen			
Naam	Status	Processor	Geheugen
> Google Chrome (23)		0%	741.1 MB
> Steam Client WebHelper (8)		0%	313.6 MB
> Discord (6)		0%	311.9 MB
> Antimalware Service Executable		0%	159.1 MB
Beheer van bureaubladvensters		1.4%	138.8 MB
> Microsoft Word (2)		0%	137.3 MB
> Zoeken (7)		0%	123.9 MB
Windows Verkenner		0%	100.8 MB
> Taakbeheer		2.8%	87.3 MB
> SQL Server Windows NT - 64 Bit		0%	67.6 MB
> Lunar Client (5)		1.4%	54.8 MB
Secure System		0%	53.6 MB

The screenshot shows the Windows Task Manager interface with two main tabs displayed: 'Prestaties' (Performance) and 'Gebruikers' (Users).

Prestaties Tab:

- Processor:** 32% 1.28 GHz
- Geheugen:** 12.1/15.8 GB (77%)
- Schijf 0 (C: D:)**: SSD (RAID) 2%
- Ethernet:** Hamachi V: 0 O: 0 kbps
- Ethernet:** VMware Network Adapter V: 0 O: 0 kbps
- Ethernet:** VMware Network Adapter V: 0 O: 0 kbps
- Wi-Fi:** Wi-Fi V: 0 O: 0 kbps

GPU Tab:

- NVIDIA** GPU
- 3D:** 0% **Copy:** 0%
- Copy 1:** 0% **Copy 2:** 0%

Gebruikers Tab:

Gebruiker	Status	Processor	Geh
Lucas Bourgonje (139)	22%	9.7%	2,469

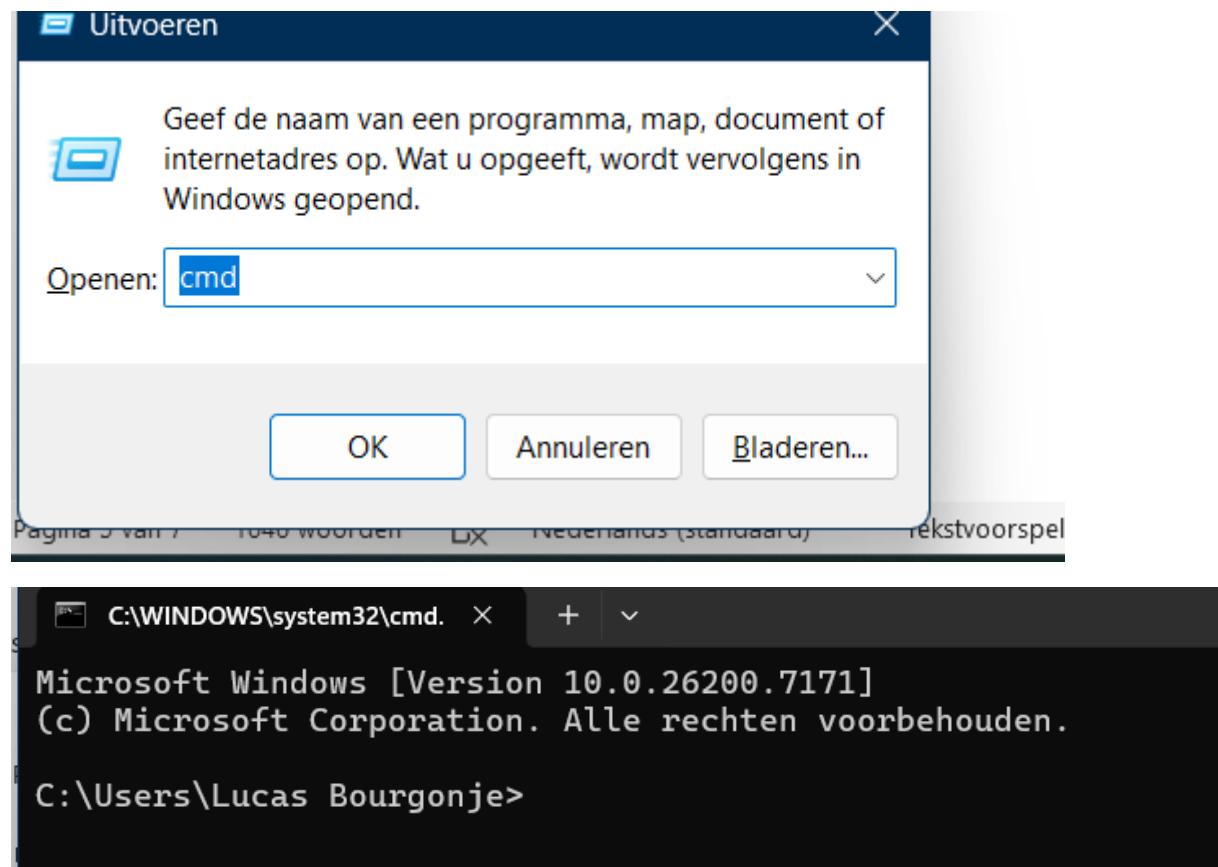
- e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

Windows key + 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 key + 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

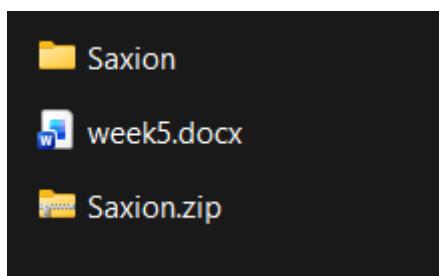
Relevant screenshots **copy** command:

```
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>copy wave.png HBOICT\YEAR1\QUARTILE1\Introductie_Programmeren  
1 file(s) copied.  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>copy Plug.png HBOICT\YEAR1\QUARTILE1\Infrastructure  
1 file(s) copied.  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>copy Tumble.png HBOICT\YEAR1\QUARTILE1\Organisatie&IT  
1 file(s) copied.  
'IT' is not recognized as an internal or external command,  
operable program or batch file.  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>copy Tumble.png HBOICT\YEAR1\QUARTILE1\OrganisatieIT  
1 file(s) copied.  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>
```

Relevant screenshots **tree** command:

```
Volume serial number is D45F-789F  
D:  
└── HBOICT  
    ├── YEAR1  
    │   ├── QUARTILE1  
    │   │   ├── Infrastructure  
    │   │   ├── Introductie_Programmeren  
    │   │   └── OrganisatieIT  
    │   ├── QUARTILE2  
    │   │   ├── Databases  
    │   │   ├── ItFundamentals  
    │   │   └── Project_Its_in_the_game  
    │   ├── QUARTILE3  
    │   └── QUARTILE4  
    ├── YEAR2  
    │   ├── QUARTILE1  
    │   ├── QUARTILE2  
    │   ├── QUARTILE3  
    │   └── QUARTILE4  
    ├── YEAR3  
    │   ├── QUARTILE1  
    │   ├── QUARTILE2  
    │   ├── QUARTILE3  
    │   └── QUARTILE4  
    └── YEAR4  
        ├── QUARTILE1  
        ├── QUARTILE2  
        ├── QUARTILE3  
        └── QUARTILE4  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>echo %username%  
Lucas Bourgonje  
  
D:\Saxion\Semester 2\ItFundamentals\week5\Saxion>
```

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

```
C:\Users\Lucas Bourgonje>winget install -e --id Mozilla.firefox
The `msstore` source requires that you view the following agreements before using.
Terms of Transaction: https://aka.ms/microsoft-store-terms-of-transaction
The source requires the current machine's 2-letter geographic region to be sent to the backend
rly (ex. "US").

Do you agree to all the source agreements terms?
[Y] Yes [N] No: [
```

I already have the other applications installed on my device.

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

Copy command:

```
lucas@lucas-VMware-Virtual-Platform:~$ touch test.txt  
lucas@lucas-VMware-Virtual-Platform:~$ cp test.txt Documents  
lucas@lucas-VMware-Virtual-Platform:~$ █
```

Screenshots of etc folder in file explorer and in terminal:



How to get back to your home folder in the terminal? By using the command `cd ~`

Name one significant difference in Linux's file structure when comparing it to Windows. Linux uses one root while Windows can have multiple when having multiple drives.

What is the /etc directory usually used for? Storing configuration files such as settings, services and network.

Which command in the terminal would you use to compress a text file into a tar archive? `tar [options] tar_file_name file1 file2`

With which command in the terminal would you be able to extract a tar file? `Tar -xvf file.tar`

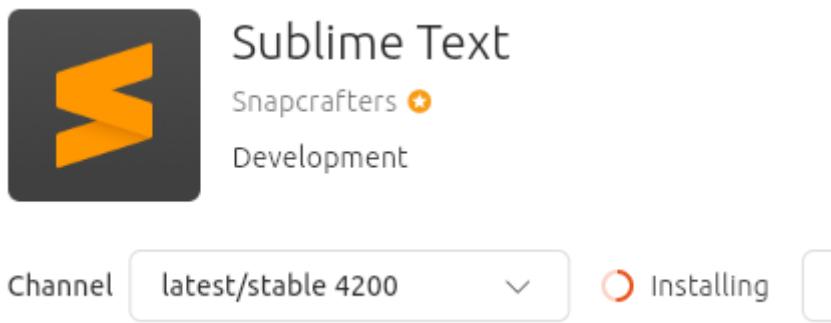
```
lucas@lucas-VMware-Virtual-Platform:~$ tar -cf archive.tar.gz test.txt  
lucas@lucas-VMware-Virtual-Platform:~$ tar -xvf archive.tar.gz  
test.txt  
lucas@lucas-VMware-Virtual-Platform:~$
```

Installing Htop:

```
lucas@lucas-VMware-Virtual-Platform:~$ sudo apt install htop  
[sudo] password for lucas:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done
```

Launch the htop application. Explain what this application shows. It shows how many tasks are running and other stats just like task manager from Windows.

Sublime text:



Neofetch install via terminal:

```
lucas@lucas-VMware-Virtual-Platform:~$ sudo apt install neofetch
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  caca-utils chafa imagemagick imagemagick-6-common imagemagick-6.q
  libavif16 libchafa0t64 libdav1d7 libfftw3-double3 libgav1-1 libgc
  libhwv1+64 libid3tag0 libimath-3.1.29+64 libimlib2+64 libixl0_7.1.
```

Neofetch:

```
.-/+oooooooo+-.
`:+ssssssssssssssssssssssss+:'
-+ssssssssssssssssssssssyyssss+-+
.osssssssssssssssssssdMMMNyssssso.
/sss:sssssssshdmmNNmyNMMMHssssss/
+ssssssssshmydMMMMMMMdffffdyssssssss+
/sss:sssssshhNMMyhyyyyhmNMMMNhssssssss/
.sssssssssdMMMNhsssssssssshNMMMdssssssss.
+sssshhhyNMMNyssssssssssssyNMMMyssssss+
osyNMMMNyMMhsssssssssssssshhmmhssssssso
osyNMMMNyMMhsssssssssssssshhmmhssssssso
+sssshhhyNMMNyssssssssssssyNMMMyssssss+
.sssssssssdMMMNhsssssssssssshNMMMdssssssss.
/sss:sssssshhNMMyhyyyyhdNMMMNhssssssss/
+sssssssssdmydMMMMMMMdffffdyssssssss+
/sss:sssssssshdmmNNNmyNMMMHssssssss/
.osssssssssssssssssssdMMMNyssssso.
-+ssssssssssssssssssssyyssss+-+
`:+ssssssssssssssssssss+:'
.-/+oooooooo+-.
```

lucas@lucas-VMware-Virtual-Platform

OS: Ubuntu 24.04.3 LTS x86_64
Host: VMware Virtual Platform None
Kernel: 6.14.0-37-generic
Uptime: 6 hours, 34 mins
Packages: 1579 (dpkg), 12 (snap)
Shell: bash 5.2.21
Resolution: 1280x800
DE: GNOME 46.0
WM: Mutter
WM Theme: Adwaita
Theme: Yaru [GTK2/3]
Icons: Yaru [GTK2/3]
Terminal: gnome-terminal
CPU: 11th Gen Intel i7-1165G7 (4) @
GPU: 00:0f.0 VMware SVGA II Adapter
Memory: 1331MiB / 3867MiB

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
$ chmod +x hello.sh
```

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ ./hello.sh  
Hello Lucas 589020!
```

```
$ chmod 744 hello.sh
```

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

Linux commands:

cat: Shows the content inside of a file.

wc: Counts number of lines, words and characters inside a file.

less: You can view a file page by page and scroll through the file.

tail: Shows the last 10 lines of a file.

head: Shows the first 10 lines of a file.

grep: Searches for a specific string inside a file and then marks it red.

Wc command:

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ wc gutenberg.txt  
12306 107562 607504 gutenberg.txt
```

12306 lines, 107562 words and 607504 characters.

Grep -n command:

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ grep -n "kingdom" gutenberg.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
```

The word “kingdom” appears on line 490 and on line 1124.

10 lines before and after the word kingdom on line 490 using the command: head -n 500 gutenberg.txt | tail -n 21

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ head -n 500 gutenberg.txt | tail -n 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.
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ exif oldcar.jpg
EXIF tags in 'oldcar.jpg' ('Motorola' byte order):
-----
Tag | Value
-----+
Manufacturer |motorola
Model |moto g(6) play
X-Resolution |72
Y-Resolution |72
Resolution Unit |Inch
Software |aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys
Date and Time |2020:11:07 15:08:57
YCbCr Positioning |Centered
Compression |JPEG compression
X-Resolution |72
Y-Resolution |72
Resolution Unit |Inch
Exposure Time |1/33 sec.
F-Number |f/2.0
Exposure Program |Normal program
ISO Speed Ratings |64
Exif Version |Exif Version 2.2
Date and Time (Original) |2020:11:07 15:08:57
Date and Time (Digitized) |2020:11:07 15:08:57
```

Identify phone brand/type: Motorola g6 play

Are there GPS coordinates known? yes

If yes: look up the location in Google maps and Streetview or In which city was this photo taken?

Groningen



Does Ubuntu still consider it to be a jpg file after removing the extension?

Yes

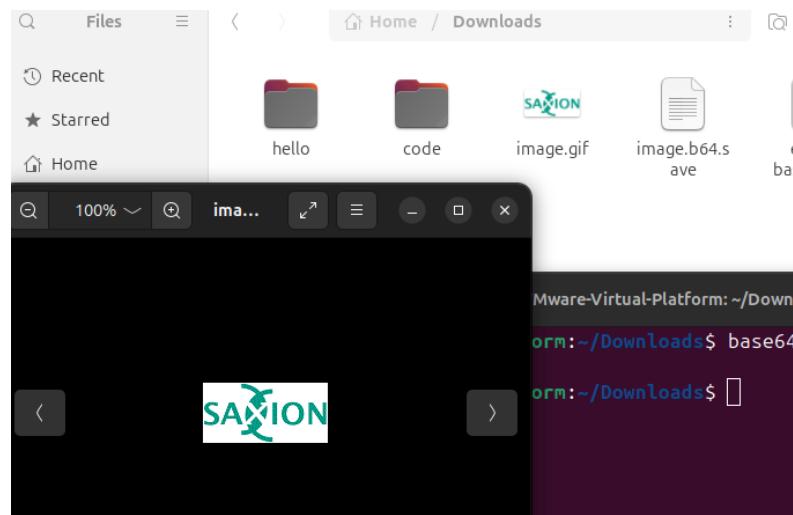
```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment
length 16, Exif Standard: [TIFF image data, big-endian, direntries=10, manufac-
turer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolution
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
```

BASE64

Base64 string to gif:

```
lucas@lucas-VMware-Virtual-Platform:~/Downloads$ base64 -d email-base64.txt > image.gif
```

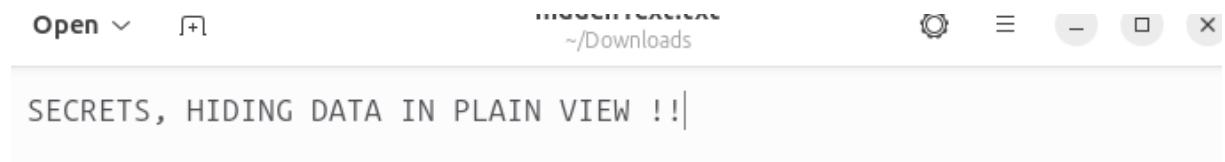
The gif:



Assignment 5.8: Steganography

Relevant screenshots + motivation

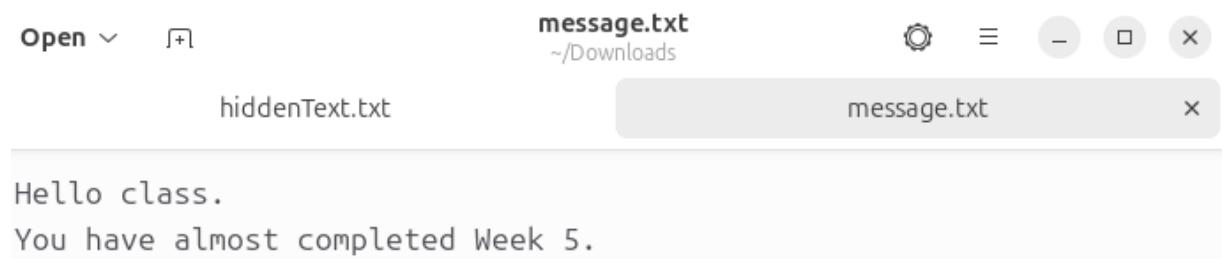
Hidden text:



Steghide extract:

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

Into this message:



Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

Debian 13 ip address: 192.168.139.134

Connection with Debian:

```
C:\Users\Lucas Bourgonje>ssh lucas@192.168.139.134
The authenticity of host '192.168.139.134 (192.168.139.134)' can't be established.
ED25519 key fingerprint is SHA256:3A4ZKrzjHUU3dvd+1Mjw9CdpxxF/SSnQ6mFe8c+7SKtQ.
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 hosts.
lucas@192.168.139.134's password:
Linux lucas 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.
lucas@lucas:~$
```

Ubuntu live:

```
lucas@lucas:~$ lsblk
NAME           MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sda            8:0    0   20G  0 disk 
└─sda1          8:1    0     1M  0 part 
  └─sda2          8:2    0   1.8G  0 part /boot
  └─sda3          8:3    0   18.2G 0 part
    └─ubuntu--vg-ubuntu--lv 252:0    0   10G  0 lvm   /
sr0           11:0    1 1024M 0 rom 

lucas@lucas:~$ _
```

Copying:

```
lucas@lucas:~$ sudo dd if=/dev/sda bs=4M status=progress | gzip | ssh lucas@192.168.139.134 "cat > /srv/images/ubuntu2404_vm.img.gz"
lucas@192.168.139.134's password:
12259950592 bytes (12 GB, 11 GiB) copied, 158 s, 77.6 MB/s
```

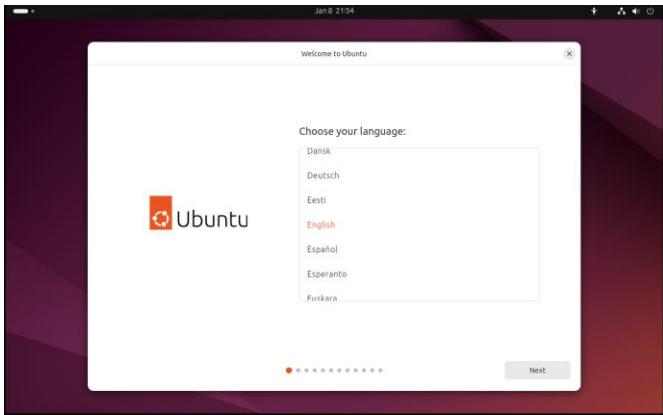
- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.

```
lucas@lucas:~$ sudo dd if=/dev/sda bs=4M status=progress | gzip | ssh lucas@192.168.139.134 "cat > /srv/images/ubuntu2404_vm.img.gz"
lucas@192.168.139.134's password:
21399339008 bytes (21 GB, 20 GiB) copied, 207 s, 103 MB/s
5120+0 records in
5120+0 records out
21474836480 bytes (21 GB, 20 GiB) copied, 207.437 s, 104 MB/s
lucas@lucas:~$ _
```

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

```
ubuntu@ubuntu:~$ ssh lucas@192.168.139.132 "cat /srv/images/ubuntu2404_vm.img.gz"
" | gzip -d | sudo dd if=/dev/sda bs=4M status=progress
21437087744 bytes (21 GB, 20 GiB) copied, 330 s, 65.0 MB/s
5120+0 records in
5120+0 records out
21474836480 bytes (21 GB, 20 GiB) copied, 330.912 s, 64.9 MB/s
```

Ubuntu boots after removing the iso and rebooting it.



Ready? Save this file and export it as a pdf file with the name: [week5.pdf](#)