

Template Week 5 – Operating Systems

Student number: 589892

Assignment 5.1: Unix-like

- a) Find out what the difference is between UNIX and unix-like operating systems?
Unix-like operating systems behave like UNIX but they are not UNIX, examples are Linux, BSD, macOS which behave like UNIX but aren't the original.

- 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:

He co-created UNIX together with Dennis Ritchie and he developed the B programming language

Dennis Ritchie:

He co-created UNIX together with Ken Thompson and he developed the C programming language in which UNIX is written

Bill Joy:

Is a co-founder of Sun Microsystems and contributed to the development of Berkeley Software Distribution of UNIX. And also he led to the development of the Java Platform.

Richard Stallman:

He is the founder of the GNU Project which is a Unix-like operating system. And he created The General Public License which ensured Software freedom and it's the foundation of linux.

Linus Torvalds:

He is the founder of Linux kernel which is the core, central program of the Linux OS.

- c) What is the philosophy of the GNU movement?
These are the main things behind the GNU movement:
Free software: They wanted to give users the freedom to run, modify and share the software.
Software freedom: They didn't want software restricting users
Collaboration: Open-source collaboration for community improvement
- d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement?
Please explain your answer.
Yes, Ubuntu is based on Linux kernel and GNU software. So therefore conforming to the philosophy of the GNU movement.
- e) Find out what is the Windows Subsystem for Linux?
A WSL is a feature of that allows you to run a Linux environment on a Windows operating system. Without the need for a VM or dual booting.
- f) Find out, which operating system family belongs to Android, iOS and ChromeOS?
Android: Linux-based
iOS: Unix-like
ChromeOS: Linux-based

Assignment 5.2: Supercomputers and gameconsoles

- a) Research on this site what supercomputers are used for and write a short summary of it:
<https://www.computerhistory.org/timeline/search/?q=Supercomputer>

Supercomputers are very powerful computers with massive processing power made and used for complex calculations. They are essentially used for weather forecasting, scientific research, artificial intelligence etc. A supercomputer can do certain tasks up to a million times faster than a regular computer. We rely on supercomputers day to day and they are the foundation of scientific research and solving complex problems

- b) IBM is a company that has already built a number of supercomputers. One of them is IBM's Roadrunner. The CPU developed for this supercomputer was further developed at a later stage as the CPU for the PlayStation 3 console. Find out what a **PlayStation 3 cluster** is and what it was used for?

A PlayStation 3 cluster is basically just as the name says a 'cluster' of PlayStations. They are connected to each other and the performance is stacked making a single high performance computer.

- 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 for ARM





- d) Does Oracle's Raspberry Pi supercomputer appear in the list of the 500 fastest supercomputers in the world? Make a logical decision for this, without going through the entire list.
<https://www.top500.org/lists/top500/list/2023/06/>

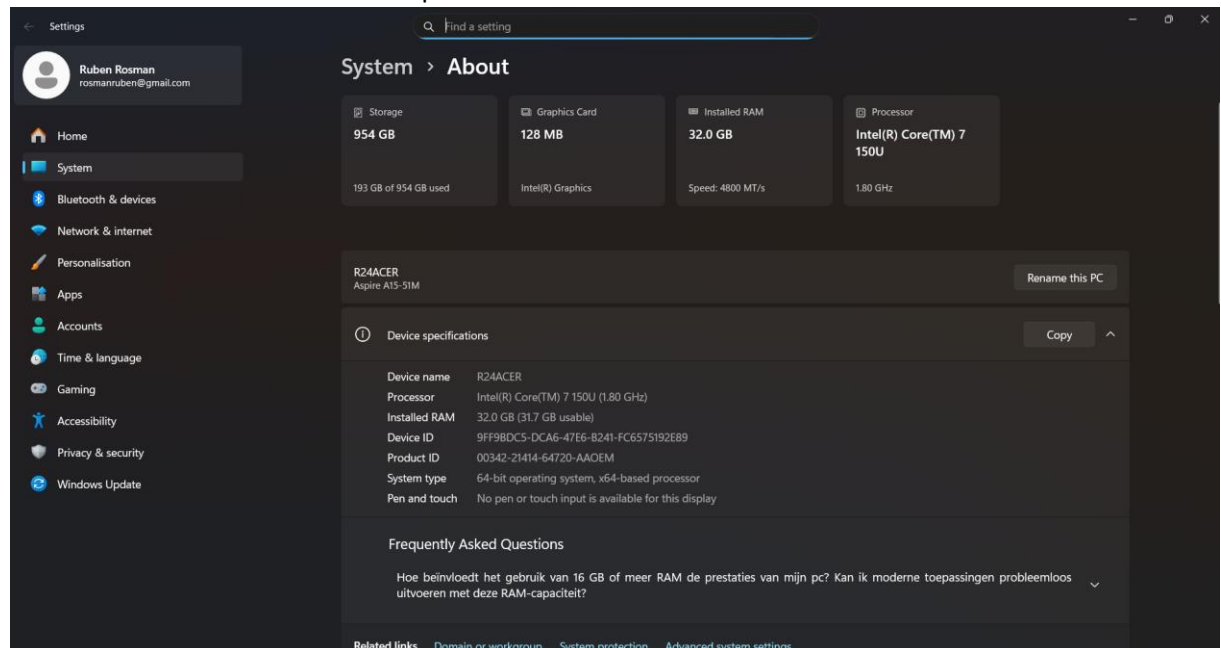
No, the Oracle's Raspberry Pi supercomputer is impressive but it doesn't come close to the top 500 list of supercomputers since these supercomputers are way faster than Oracle's Raspberry Pi supercomputer.

- e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?
What operating systems run on these consoles?
What conclusion can you draw from the answer to the previous question?
The CPU architecture used for the PlayStation 5 and Xbox Series X is x86-64.
PlayStation is using an Sony OS (Unix-Like) and Xbox is using an Microsoft OS (Windows kernel)
Conclusion: Consoles use the same OS foundation as computers

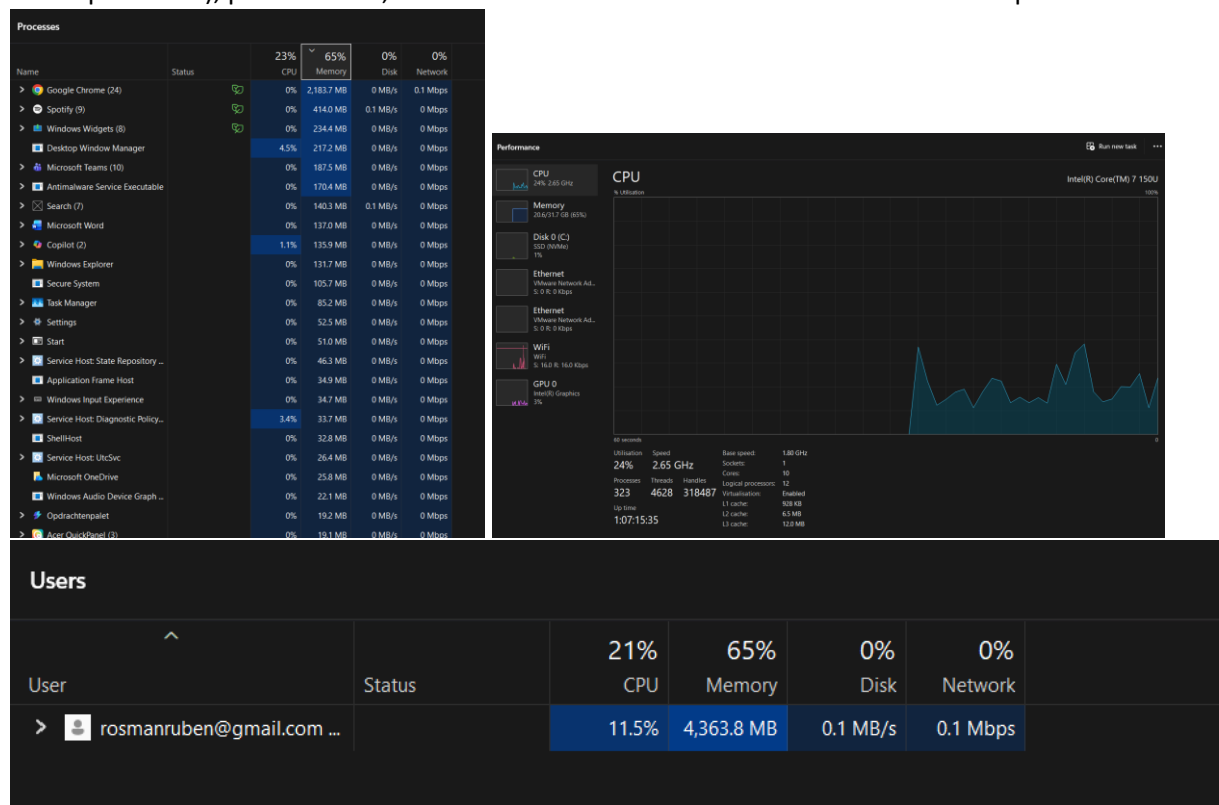
Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

- 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.
- The file explorer can be opened with  + E, Which key combination could you also use?
 + S → f → enter
- Open the system properties with a  key combination, take a screenshot of the open screen. Paste this screenshot into this template.



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



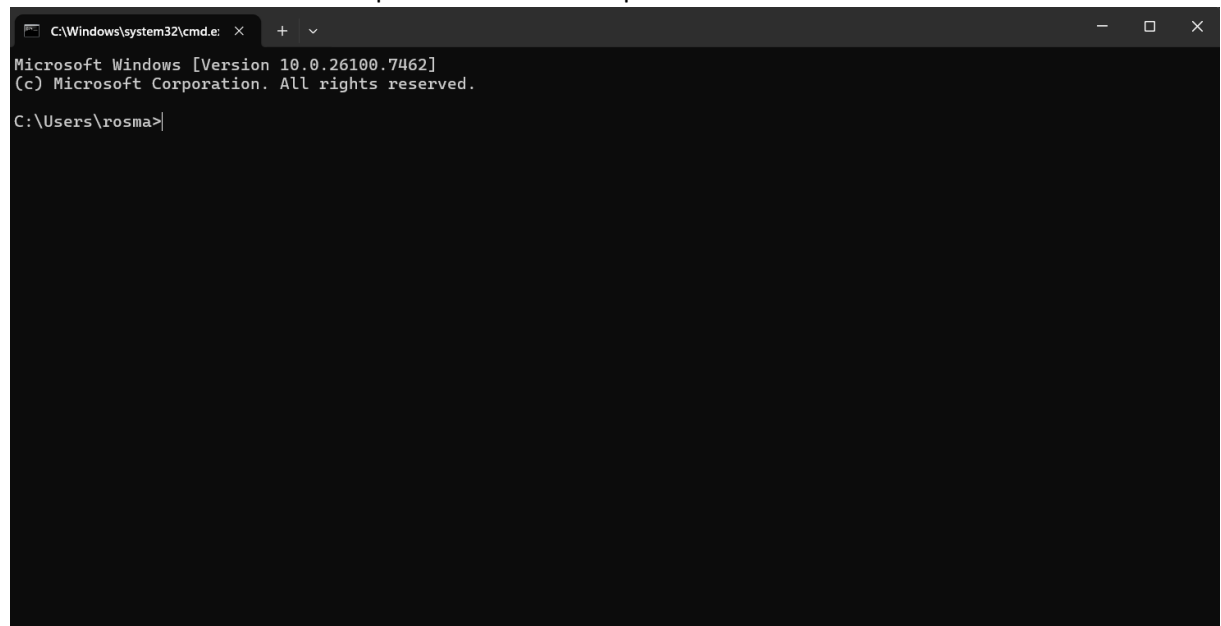
- e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

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?

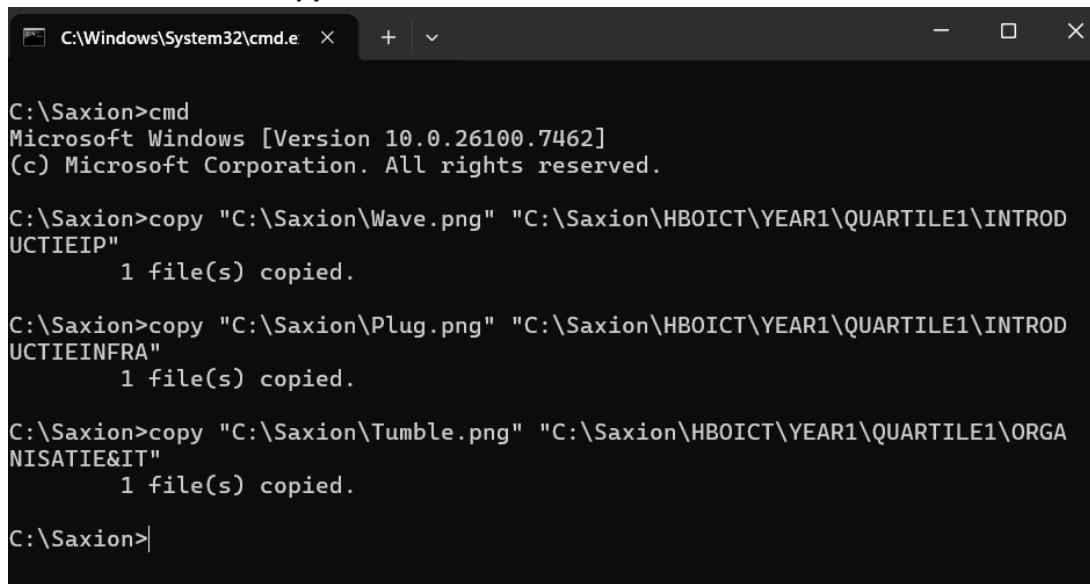
Windows + L

- 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.



Working in the File Explorer

Relevant screenshots **copy** command:



Absolute Path: The complete path to a certain file. (Absolute Path of HBOICT "C:\Saxion\HBOICT"

Relative Path: The Relative Path to a file depending on what file you're currently in. (Relative path to DATABASES from C:\Saxion\HBOICT "YEAR1\QUARTILE2\DATABASES"

Relevant screenshots **tree** command:

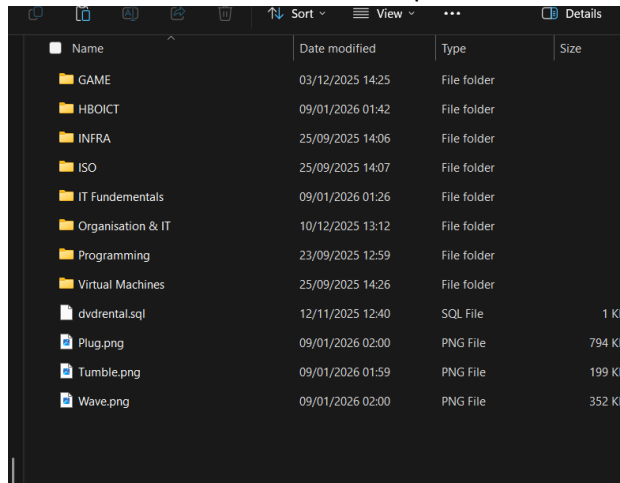


```
C:\Windows\system32\cmd.e: x + v
tree
Database
  ScriptCache
    index-dir
  Session Storage
  WebStorage
Profiles
  FB3E668E
    Titles
    Launcher
steamvr
  input
temp
WindowsPowerShell
  Scripts
  InstalledScriptInfos
WORD
OneDrive - Saxion
  Attachments
  Desktop
  Microsoft Copilot Chat-bestanden
  Pictures
    Acer
    Camera Roll
    Camera-album
    minecraft screenshots
    Roblox
    Saved Pictures
    Schermopnamen
    Screenshots
    UbisoftConnect
    Uplay
    Videoprojecten
  Saved Games
  Searches
  Videos
    Captures

C:\Users\rosma>echo 589892
589892

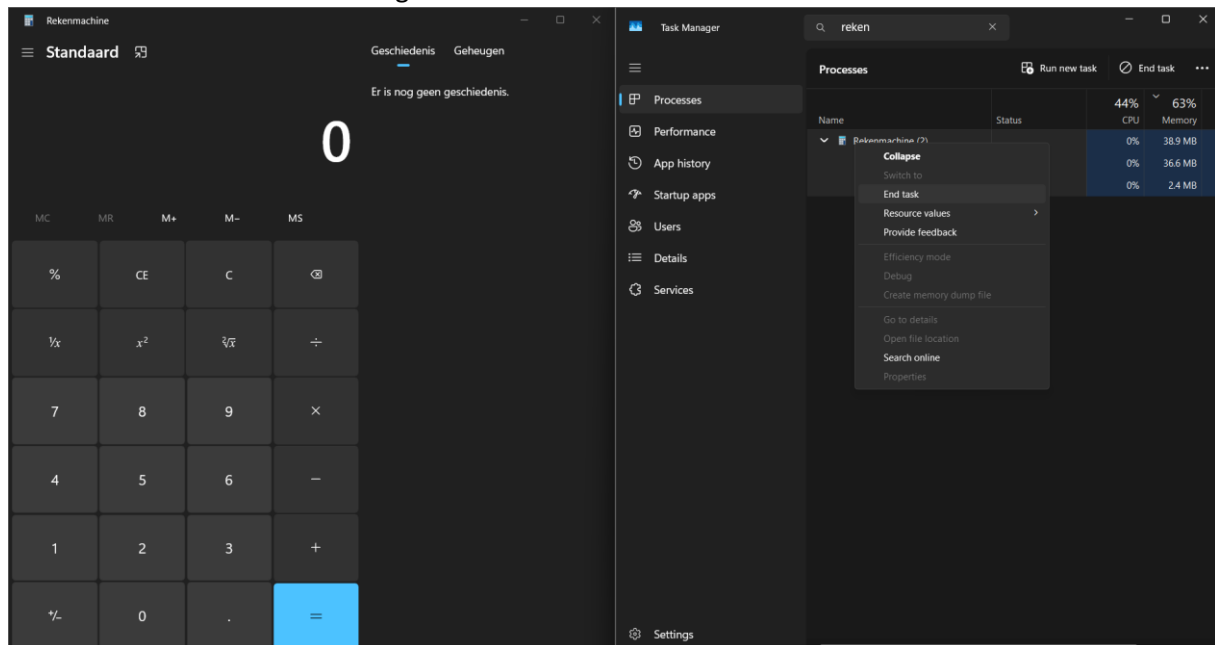
C:\Users\rosma>
```

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
- Firefox

Firefox:

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.26200.6584]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\System32>winget source reset --force
Resetting all sources...Done

C:\Windows\System32>winget source update
Updating all sources...
Updating source: msstore...
Done
Updating source: winget...
Done
Updating source: winget-font... 100%
Done

C:\Windows\System32>winget search 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 service to function properly (e.g., "US").

Do you agree to all the source agreements terms?
[Y] Yes [N] No: Y
-----
Name                               Id                               Version Match    Source
-----
Mozilla Firefox                    9NZVDKPMR9RD                    Unknown          msstore
Mozilla Firefox (en-US)            Mozilla.Firefox                  146.0.1 Moniker: firefox winget
Mozilla Firefox (MSIX)             Mozilla.Firefox.MSIX             146.0.1 Moniker: firefox winget
Mozilla Firefox (ach)              Mozilla.Firefox.ach              146.0.1 Moniker: firefox winget
Mozilla Firefox (af)               Mozilla.Firefox.af               146.0.1 Moniker: firefox winget
Mozilla Firefox (an)               Mozilla.Firefox.an               146.0.1 Moniker: firefox winget
Mozilla Firefox (ar)               Mozilla.Firefox.ar               146.0.1 Moniker: firefox winget
Mozilla Firefox (ast)              Mozilla.Firefox.ast              146.0.1 Moniker: firefox winget
Mozilla Firefox (az)               Mozilla.Firefox.az               146.0.1 Moniker: firefox winget
Mozilla Firefox (be)               Mozilla.Firefox.be               146.0.1 Moniker: firefox winget
Mozilla Firefox (bg)               Mozilla.Firefox.bg               146.0.1 Moniker: firefox winget
Mozilla Firefox (bn)               Mozilla.Firefox.bn               146.0.1 Moniker: firefox winget
Mozilla Firefox (br)               Mozilla.Firefox.br               146.0.1 Moniker: firefox winget
Mozilla Firefox (bs)               Mozilla.Firefox.bs               146.0.1 Moniker: firefox winget
Mozilla Firefox (ca)               Mozilla.Firefox.ca               146.0.1 Moniker: firefox winget
Mozilla Firefox (ca-valencia)      Mozilla.Firefox.ca-valencia      146.0.1 Moniker: firefox winget
Mozilla Firefox (cak)              Mozilla.Firefox.cak              146.0.1 Moniker: firefox winget
```

```
Administrator: Command Prompt
Mozilla.Firefox.ESR.sk 140.6.0 winget
Mozilla.Firefox.ESR.sl 140.6.0 winget
Mozilla.Firefox.ESR.son 140.6.0 winget
Mozilla.Firefox.ESR.sq 140.6.0 winget
Mozilla.Firefox.ESR.sr 140.6.0 winget
Mozilla.Firefox.ESR.sv-SE 140.6.0 winget
Mozilla.Firefox.ESR.sz1 140.6.0 winget
Mozilla.Firefox.ESR.ta 140.6.0 winget
Mozilla.Firefox.ESR.te 140.6.0 winget
Mozilla.Firefox.ESR.tg 140.6.0 winget
Mozilla.Firefox.ESR.th 140.6.0 winget
Mozilla.Firefox.ESR.tl 140.6.0 winget
Mozilla.Firefox.ESR.tr 140.6.0 winget
Mozilla.Firefox.ESR.trs 140.6.0 winget
Mozilla.Firefox.ESR.uk 140.6.0 winget
Mozilla.Firefox.ESR.ur 140.6.0 winget
Mozilla.Firefox.ESR.uz 140.6.0 winget
Mozilla.Firefox.ESR.vi 140.6.0 winget
Mozilla.Firefox.ESR.xh 140.6.0 winget
Mozilla.Firefox.ESR.zh-CN 140.6.0 winget
Mozilla.Firefox.ESR.zh-TW 140.6.0 winget
Mozilla.Firefox.(MSIX).Night... 148.26.0 winget
Firefox - Unbranded Build - ... 147.0b1 winget
Profile Switcher for Firefox... nulldev.ProfileSwitcherFor... 0.1.1 winget
Ablaze Floop 12.10.0 Tag: firefox-fo... winget
Floop 12 Daylight 138.0.0 Tag: firefox-fo... winget
rdfox EclipseCommunity.r3dfox 146.0 Tag: firefox-fo... winget
Pale Moon MoonchildProductions.PaleM... 33.9.1 Tag: firefox-fo... winget
Ghostery Private Browser Ghostery.GhosteryOwn 2024.8.0 Tag: firefoxfork winget
ffsend TimWisee.ffsend 0.2.76 Tag: firefox-se... winget

C:\Windows\System32>winget install -e --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:\Windows\System32>
```

b) winget is a Windows package manager, a tool that can be used to install, upgrade and manage software from cmd line.

-e means –exact and this makes sure it only installs the exact program that I write and

--id mozilla.firefox is the ID of the program which gets installed

WinSCP:

```
Administrator: Command Prompt

C:\Windows\System32>winget search winscp
Name      Id             Version Match      Source
-----
WinSCP     WinSCP.WinSCP  6.5.5           winget
WinSCP RC  WinSCP.WinSCP.RC 5.18.5- Tag: winscp winget

C:\Windows\System32>winget install -e --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...
Successfully installed

C:\Windows\System32>
```


Notepad++:

```
Administrator: Command Prompt

C:\Windows\System32>winget search notepad++
Name          Id          Version Match          Source
-----
Notepad++     Notepad++.Notepad++ 8.9      ProductCode: notepad++ winget
Notepad Next  dail8859.NotepadNext 0.12     Tag: notepad++  winget

C:\Windows\System32>winget install -e --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...
Successfully installed

C:\Windows\System32>
```

7zip:

```
Ruben Ubuntu  Windows 11 x64  My Computer

Administrator: Command Prompt

C:\Windows\System32>winget search 7zip
Name          Id          Version Match          Source
-----
7-Zip         7zip.7zip   25.01    Moniker: 7zip winget
Advanced Archive Password Recovery Elcomsoft.ArchivePassword 4.66.266.6965 Tag: 7zip winget
NanaZip       M2Team.NanaZip 5.0.1263.0 Tag: 7zip winget
NanaZip Preview M2Team.NanaZip.Preview 6.0.1461.0 Tag: 7zip winget
7-Zip ZS      mcmilk.7zip-zstd 25.01 ZS v1.5.7 R2 Tag: 7zip winget
7-Zip Alpha (exe) 7zip.7zip.Alpha.exe 24.01    Tag: 7zip winget
7-Zip Alpha (msi) 7zip.7zip.Alpha.msi 24.01.00.0 Tag: 7zip winget
7zr           7zip.7zr    25.01    Tag: 7zip winget
QNapi        QNapi.QNapi 0.2.3     Tag: p7zip winget

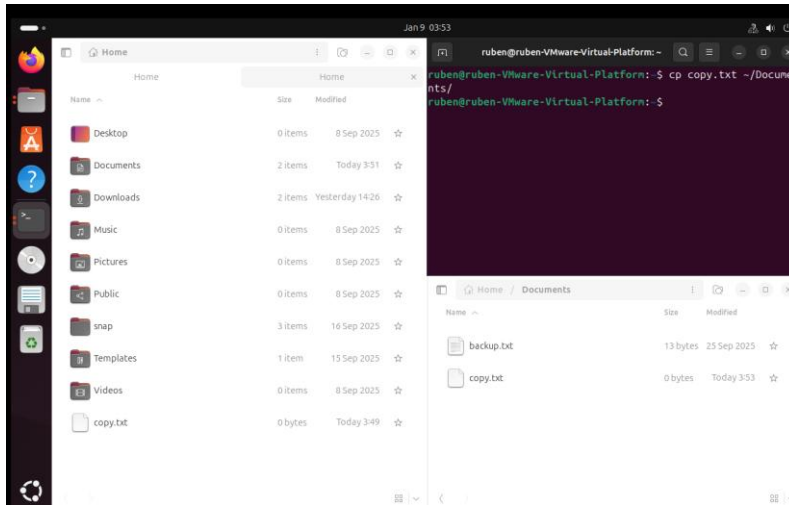
C:\Windows\System32>winget install -e --id 7zip.7zip
Found 7-Zip [7zip.7zip] Version 25.01
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://7-zip.org/a/7z2501-x64.exe
1.56 MB / 1.56 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

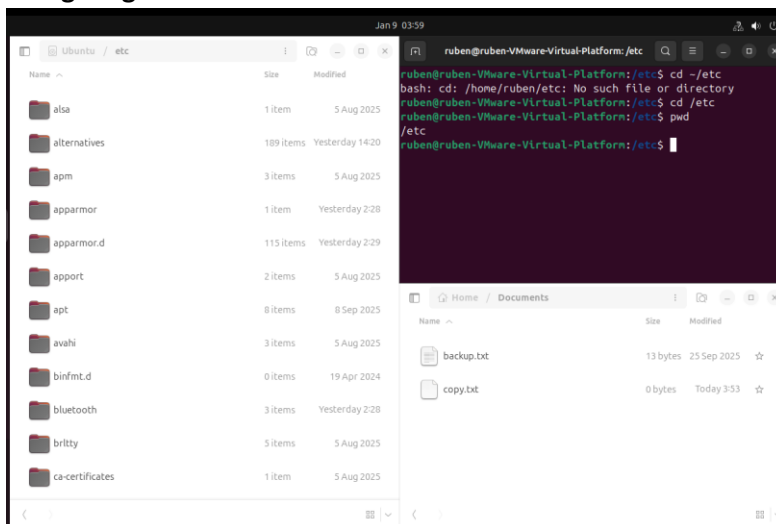
Assignment 5.4: Working with Linux

Relevant screenshots + motivation

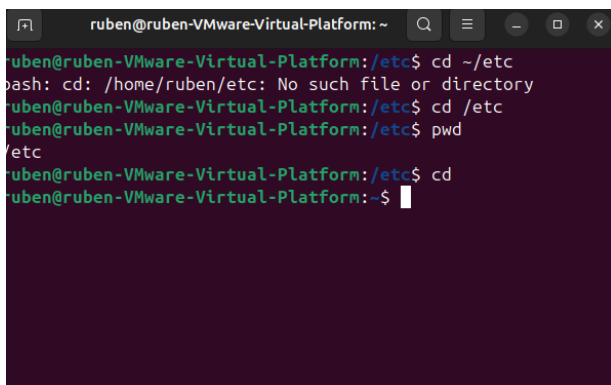
Copying:



Navigating the file structure:



Screenshot of the /etc in the terminal and the file in the file explorer



Screenshot of going back to the home directory

Linux uses a single root / for all directories while windows uses separate drives

Compress files:

Command to extract tar: `tar -xvf 'file'.tar`

```
ruben@ruben-VMware-Virtual-Platform: ~  
ruben@ruben-VMware-Virtual-Platform:/etc$ cd /etc  
ruben@ruben-VMware-Virtual-Platform:/etc$ pwd  
/etc  
ruben@ruben-VMware-Virtual-Platform:/etc$ cd  
ruben@ruben-VMware-Virtual-Platform:~$ ls  
copy.txt  Documents  Music      Public  Templates  
Desktop  Downloads  Pictures  snap    Videos  
ruben@ruben-VMware-Virtual-Platform:~$ tar -czvf copy.tar.gz  
z copy.txt  
z copy.txt  
ruben@ruben-VMware-Virtual-Platform:~$ ls  
copy.tar.gz  Documents  Pictures  Templates  
copy.txt     Downloads  Public    Videos  
Desktop      Music      snap  
ruben@ruben-VMware-Virtual-Platform:~$
```

htop install:

```

ruben@ruben-VMware-Virtual-Platform: ~
ubn@ruben-VMware-Virtual-Platform:~$ sudo apt install httpd -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libllvm19 linux-headers-6.14.0-32-generic linux-hwe-6.14-headers-6.14.0-32
  linux-hwe-6.14-tools-6.14.0-32 linux-image-6.14.0-32-generic
  linux-modules-6.14.0-32-generic linux-modules-extra-6.14.0-32-generic
  linux-tools-6.14.0-32-generic
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  httpd
  upgraded, 1 newly installed, 0 to remove and 11 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 httpd amd64 3.3.0-4build1 [171 kB]
Fetched 171 kB in 0s (1,748 kB/s)
Selecting previously unselected package httpd.
Reading database ... 232779 files and directories currently installed.)
Preparing to unpack .../httpd-3.3.0-4build1_amd64.deb ...
Unpacking httpd (3.3.0-4build1) ...
Setting up httpd (3.3.0-4build1) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...

```

Htop shows all running processes and CPU usage/Memory usage, it's the task manager of ubuntu.

```

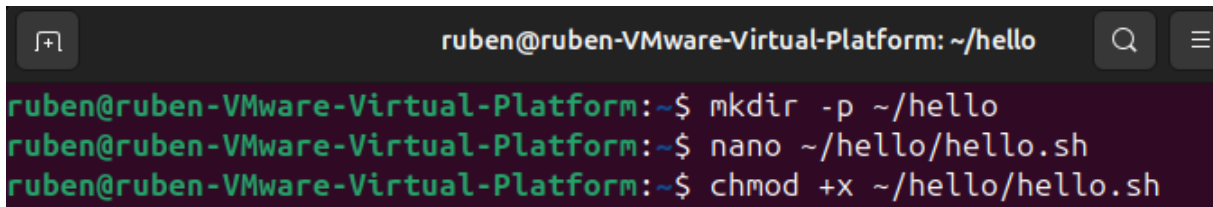
ruben@ruben-VMware-Virtual-Platform: ~
./-/+00SSSSSS00+/-
':+SSSSSSSSSSSSSSSSSSSS+:
++SSSSSSSSSSSSSSSSSSSSySSSS++
.0SSSSSSSSSSSSSSSSSSSSdMMNNySSSS.
/SSSSSSSSSSSShdnNNNNyNNMMMMhSSSSS/
+SSSSSSSSSSShNyNNMMMMNNdddddSSSSSS+
/SSSSSSSSShNNMMh/ hyyyyhNNMMNNhSSSSSS/
SSSSSSSSdMMNNhSSSSSSSSShNNMMddSSSSSSS.
SSSSShhyNNMMYySSSSSSSSSShNNMMYySSSSSS
SSyNNMMYyNNMhSSSSSSSSSSShnnMMhSSSSSS
SSyNNMMYyNNMhSSSSSSSSSSShnnMMhSSSSSSSS
SSSSShhyNNMMYySSSSSSSSSSShNNMMYySSSSSS+
SSSSSSSSShNNMMhSSSSSSSSShNNMMddSSSSSSS.
/SSSSSSSSShNNMMh/ hyyyyhNNMMNNhSSSSSS/
++SSSSSSSSSSShNyNNMMMMNNdddddSSSSSS+
/SSSSSSSSSSShdnNNNNNyNNMMMMhSSSSS/
.0SSSSSSSSSSSSSSSSSSSSdMMNNySSSS.
++SSSSSSSSSSSSSSSSSSSSySSS++
':+SSSSSSSSSSSSSSSSSSSS+:
./-/+00SSSSSS00+/-

ruben@ruben-VMware-Virtual-Platform: ~
OS: Ubuntu 24.04.3 LTS x86_64
Host: VMware Virtual Platform None
Kernel: 6.14.0-37-generic
Uptime: 5 mins
Packages: 1613 (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: Intel 7 180U @ 0.211GHz
GPU: 00:0F.0 VMware SVGA II Adapter
Memory: 1004MiB / 3867MiB


```

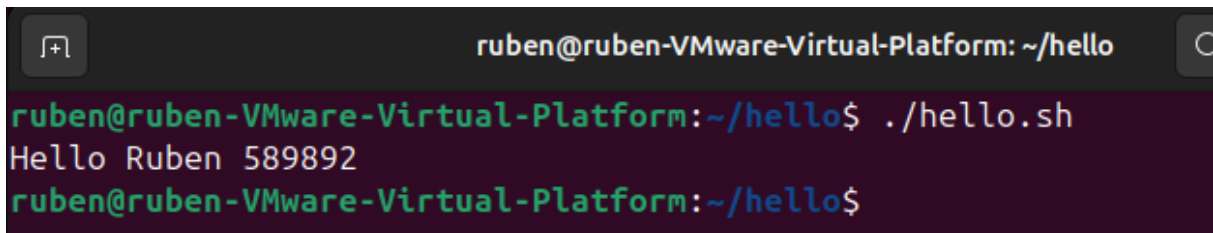
Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation



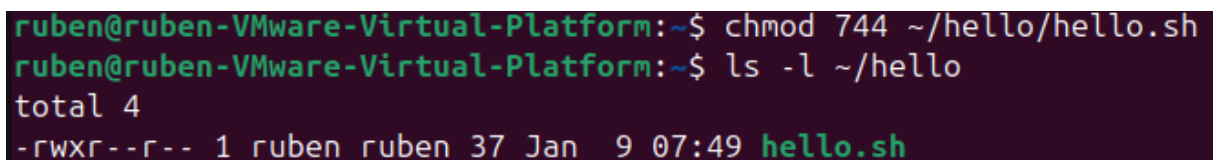
```
ruben@ruben-VMware-Virtual-Platform: ~/hello
ruben@ruben-VMware-Virtual-Platform:~$ mkdir -p ~/hello
ruben@ruben-VMware-Virtual-Platform:~$ nano ~/hello/hello.sh
ruben@ruben-VMware-Virtual-Platform:~$ chmod +x ~/hello/hello.sh
```

Made the file executable



```
ruben@ruben-VMware-Virtual-Platform: ~/hello$ ./hello.sh
Hello Ruben 589892
ruben@ruben-VMware-Virtual-Platform:~/hello$
```

Ran the file



```
ruben@ruben-VMware-Virtual-Platform:~$ chmod 744 ~/hello/hello.sh
ruben@ruben-VMware-Virtual-Platform:~$ ls -l ~/hello
total 4
-rwxr--r-- 1 ruben ruben 37 Jan  9 07:49 hello.sh
```

Made the file executable and writeable for user and readable for others

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat: Displays the whole file in the terminal and can combine files

wc: word count is for counting lines, words and characters in a file

less: with less you can view a file page by page

tail: shows the last lines of a file so if you type tail -n 20 'file'.txt it shows the last 20 lines. (the tail)

head: shows the first lines of a file so if you type head -n 20 'file'.txt it shows the first 20 lines

grep: is a search tool and with it you can search for certain characters, words, sentences in a file

```
ruben@ruben-VMware-Virtual-Platform: ~/Documents
ruben@ruben-VMware-Virtual-Platform:~/Documents$ wc SherlockHolmes.txt
12305 107560 595124 SherlockHolmes.txt
```

Sherlock Holmes got 12305 lines, 107560 words and 595124 characters

```
ruben@ruben-VMware-Virtual-Platform:~/Documents$ 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
```

kingdom is on line 490 and 1124

```
ruben@ruben-VMware-Virtual-Platform:~/Documents$ grep -n -A 10 -B 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."
492-
493-"And 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
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

```
Make : motorola
Camera Model Name : moto g(6) play
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
```

Photo taken in: Almelo

```
ruben@ruben-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, manufactu
rer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolution
unit=2, software=aljetter-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
```

Yes, its still considered a jpg image

The screenshot shows a terminal window on the left and a file manager on the right. The terminal window displays the output of several commands: `apt list --upgradable` showing updates for `liblvm19`, `sudo apt install` (which installed `liblvm19`), and `base64 -d email.txt > decoded_image.gif`. The file manager on the right shows the contents of the `Documents` directory, including `backup.txt`, `copy.txt`, `decoded_image.gif`, `email.txt`, and `SherlockHolmes.txt`.

```
ruben@ruben-VMware-Virtual-Platform: ~/Documents
Hit:1 http://nl.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://nl.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:4 http://nl.archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
10 packages can be upgraded. Run 'apt list --upgradable' to see them.
ruben@ruben-VMware-Virtual-Platform:~/Documents$ sudo apt install
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  liblvm19
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 10 not upgraded.
ruben@ruben-VMware-Virtual-Platform:~/Documents$ sudo apt install BASE64
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package BASE64
ruben@ruben-VMware-Virtual-Platform:~/Documents$ base64 -d email.txt > decoded_i
mage.gif
```

Name	Size	Modified
backup.txt	13 bytes	25 Sep 2025
copy.txt	0 bytes	Today 3:53
decoded_image.gif	1.9 kB	Today 9:30
email.txt	2.5 kB	Today 9:28
SherlockHolmes.txt	595.1 kB	Today 8:06

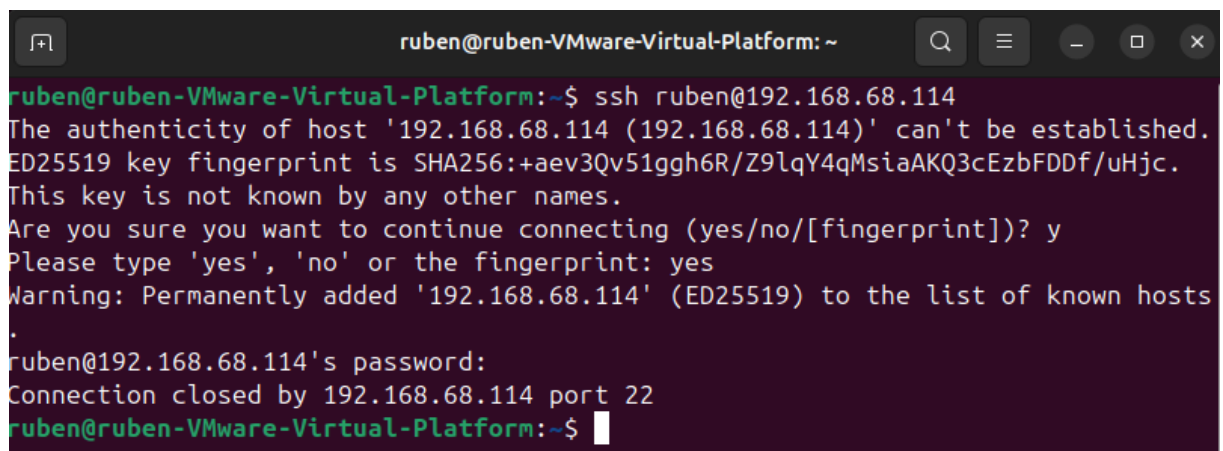
Assignment 5.8: Steganography

Relevant screenshots + motivation

```
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ steghide extract -sf apple2.jpg
Enter passphrase:
steghide: could not extract any data with that passphrase!
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ ls
apple2.jpg  code  code.zip  message.txt  oldcar
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ message.txt
message.txt: command not found
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ ./message.txt
bash: ./message.txt: Permission denied
ruben@ruben-VMware-Virtual-Platform:~/Downloads$ cat message.txt
Hello class.
You have almost completed Week 5.
```

Assignment 5.9: Capture disk images

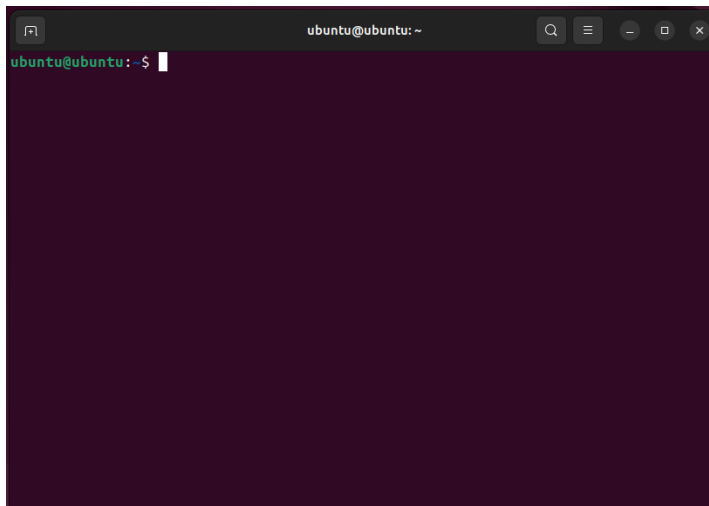
Make relevant screenshots + motivation:



```
ruben@ruben-VMware-Virtual-Platform: ~
ruben@ruben-VMware-Virtual-Platform:~$ ssh ruben@192.168.68.114
The authenticity of host '192.168.68.114 (192.168.68.114)' can't be established.
ED25519 key fingerprint is SHA256:+aev3Qv51ggh6R/Z9lqY4qMsiaAKQ3cEzbFDDf/uHjc.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? y
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.68.114' (ED25519) to the list of known hosts
ruben@192.168.68.114's password:
Connection closed by 192.168.68.114 port 22
ruben@ruben-VMware-Virtual-Platform:~$
```

Connectivity test

- 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.



Terminal opened on try ubuntu

```
ubuntu@ubuntu: ~$ lsblk
Command 'lsblk' not found, did you mean:
  command 'lsblk' from deb util-linux (2.39.3-9ubuntu6.2)
Try: sudo apt install <deb name>
ubuntu@ubuntu: ~$ lsblk
NAME      MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
fd0        2:0    1    1.4M  0 disk
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  11.1M  1 loop /snap/firmware-updater/167
loop6      7:6    0 245.1M  1 loop /snap/firefox/6565
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
sda        8:0    0   32G   0 disk
├─sda1     8:1    0     1M   0 part
└─sda2     8:2    0   32G   0 part
```

lsblk command


```

Static hostname: debian
Icon name: computer-vm
Chassis: vm
Machine ID: a41323b936b84c47b3b7d73715ede03f
Boot ID: 9cde8ab71a224991a0011a62f79a2e59
AF_VSOCK CID: 2371138475
Virtualization: vmware
Operating System: Debian GNU/Linux 13 (trixie)
Kernel: Linux 6.12.57+deb13-amd64
Architecture: x86-64
Hardware Vendor: VMware, Inc.
Hardware Model: VMware20,1
Firmware Version: VMW201.00V.24006586.B64.2406042154
Firmware Date: Tue 2024-06-04
Firmware Age: 1y 7month 6d
ruben@debian:~$ lsb_release -a
No LSB modules are available.
Distributor ID: Debian
Description: Debian GNU/Linux 13 (trixie)
Release: 13
Codename: trixie
ruben@debian:~$ 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: ens160: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:54:b3:ab brd ff:ff:ff:ff:ff:ff
    altname enp3s0
    altname enx00c2954b3ab
    inet 192.168.68.107/24 brd 192.168.68.255 scope global dynamic noprefixroute ens160
        valid_lft 6639sec preferred_lft 5739sec
    inet6 fe80::12b:4826:ba2d:d9e9/64 scope link
        valid_lft forever preferred_lft forever

```

Debian server setup

```

ubuntu@ubuntu:~$ sudo dd if=/dev/sda bs=4M status=progress | gzip | ssh ruben@192.168.68.107 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.68.107 (192.168.68.107)' can't be established.
ED25519 key fingerprint is SHA256:+aev3Qv51ggh6R/Z9lqY4qMsiaAKQ3cEzbFDDf/uHjc.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.68.107' (ED25519) to the list of known hosts
.
ruben@192.168.68.107's password:
34347155456 bytes (34 GB, 32 GiB) copied, 767 s, 44.8 MB/s
8192+0 records in
8192+0 records out
34359738368 bytes (34 GB, 32 GiB) copied, 767.488 s, 44.8 MB/s
ubuntu@ubuntu:~$

```

Disk Capture

```

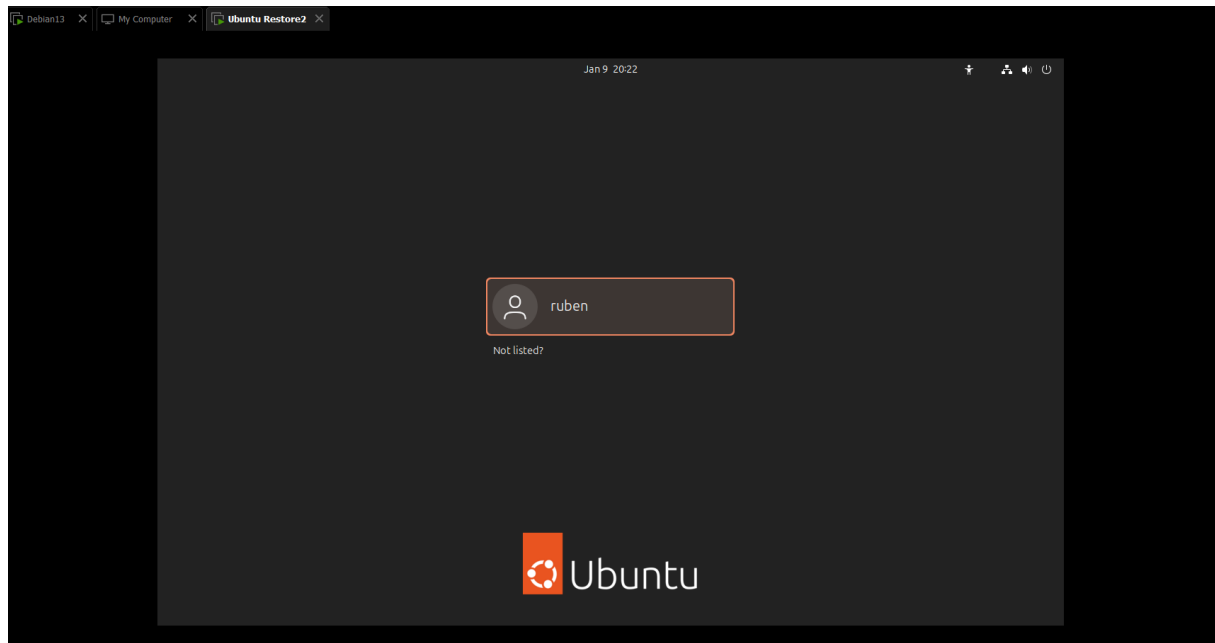
ruben@debian:~$ ls -lh /srv/images
total 15G
-rw-rw-r-- 1 ruben ruben 15G Jan  9 13:33 ubuntu2404_vm.img.gz

```

Image Storage

```
ubuntu@ubuntu:~$ ssh ruben@192.168.68.107 "cat /srv/images/ubuntu2404_vm.img.gz"
| gzip -d | sudo dd of=/dev/sda bs=4M status=progress
ruben@192.168.68.107's password:
34349481984 bytes (34 GB, 32 GiB) copied, 412 s, 83.4 MB/s
0+1030457 records in
0+1030457 records out
34359738368 bytes (34 GB, 32 GiB) copied, 412.479 s, 83.3 MB/s
```

Restore Process



Ubuntu Restored booted from hard disk

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