

Template Week 5 – Operating Systems

Student number: 586146

Assignment 5.1: Unix-like

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

A Unix-like operating system behaves in similar manners to a UNIX system but it's not conforming to being certified to any version of the Single UNIX Specification

Linux and macOS are examples of Unix-like systems

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.

We can see that Ken Thompson and Dennis Ritchie contributed in the research of UNIX back when they were working at Bell Labs. Ken also wrote the first versions of UNIX, which ended up influencing all later systems shown in the timeline. He had a big impact.

Dennis Ritchie is the inventor of the C programming language, impacting the whole future of programming.

Bill Joy is the co-founder of Sun Microsystems or better called SunOS. Darwin developed later on macOS.

Richard Stallman introduced the Free Software philosophy which had impact on the world we're living in now. He's also the founder of GNU.

Linus Torvalds created the Linux kernel which leads to the Linux we know today, which powers a lot, servers, androids, embedded systems and more.

c) What is the philosophy of the GNU movement?

The Free Software philosophy, so like letting the user run the software for any purpose, let him/her study it how it works, let him/her modify it and share it modified. AKA "Open Source".

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

Yes, Ubuntu is Linux based and is open-source and also free to use and download.

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

WSL allows Linux distributions like Ubuntu to be run on Windows without the need of VMs, it also lets developers use Linux tools on Windows.

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

Android makes use of Linux, iOS makes use of UNIX-like operating system made by Darwin coming all the way from BSD. ChromeOS is also 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 mainly used by big corporates that need lot of computing powers to do analysis, science, math and or simulations (which are all heavy).

- 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?

It was used for in mid 2007 by Gaurav Khanna for astrophysical simulations of large supermassive black holes capturing smaller compact objects. It was used as a supercomputer.

- 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 it doesn't.

- 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?

They use a x86-64 architectures and run on custom made AMD Zen 2 CPU's by the company AMD.

Playstation uses a Unix-like operating system FreeBSD and Xbox runs on a operating system based on Windows (XboxOS).

Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

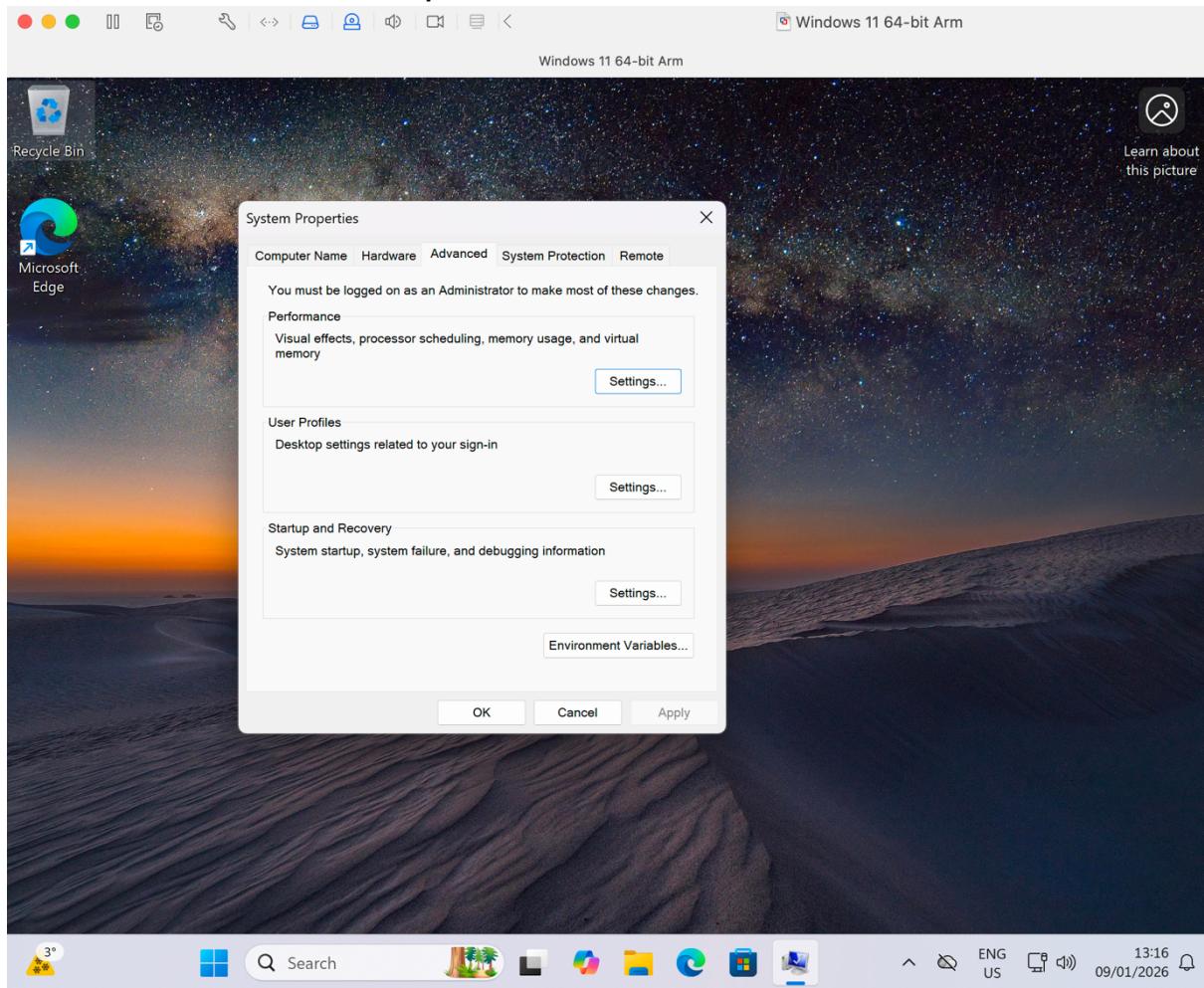
- a) Practice for about 10 minutes with the **Windows + S** keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.

Done

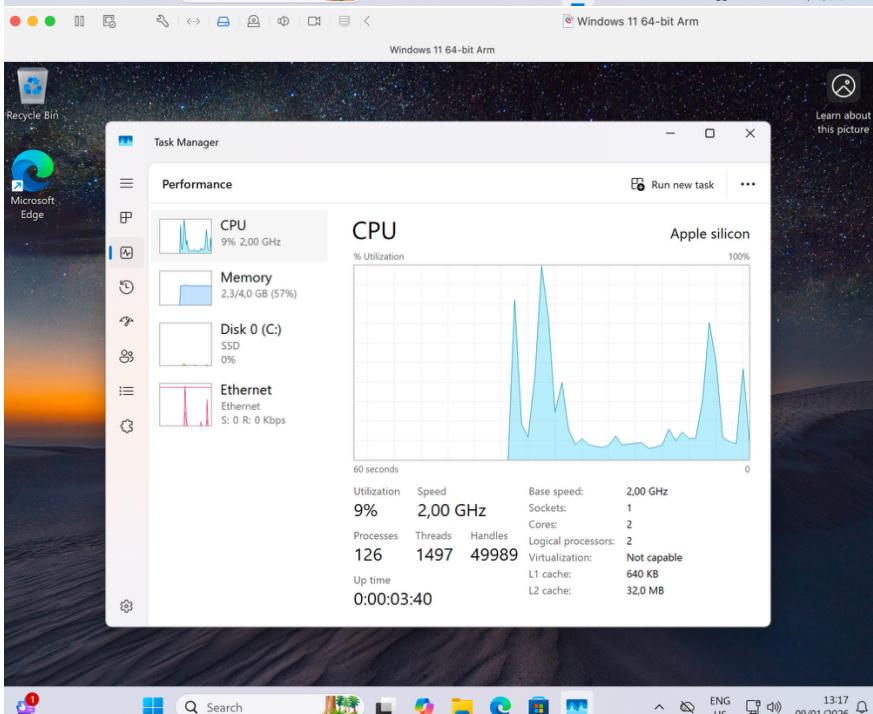
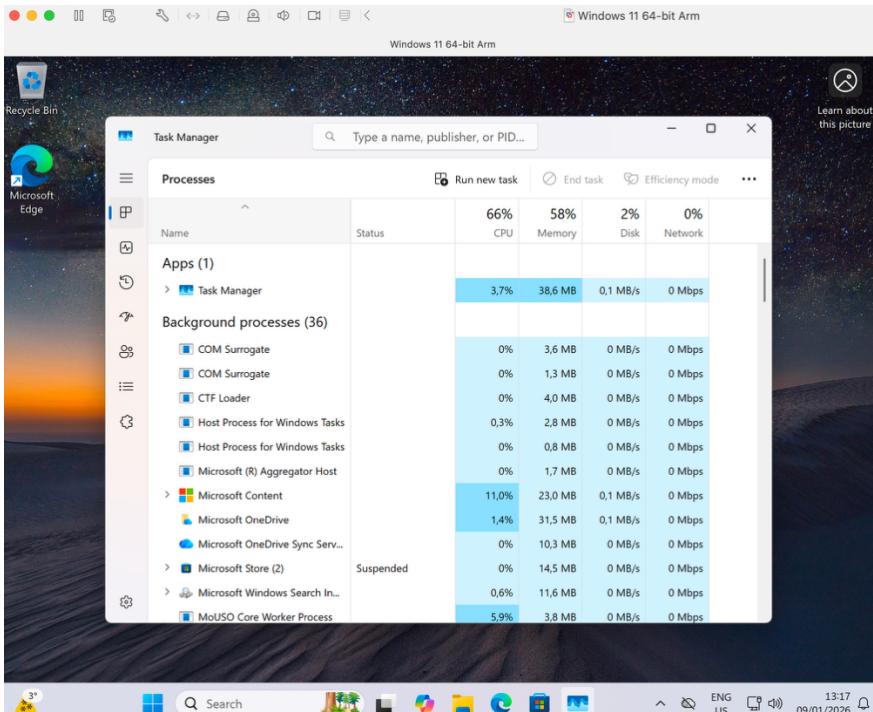
- b) The file explorer can be opened with **Windows + E**, Which key combination could you also use?

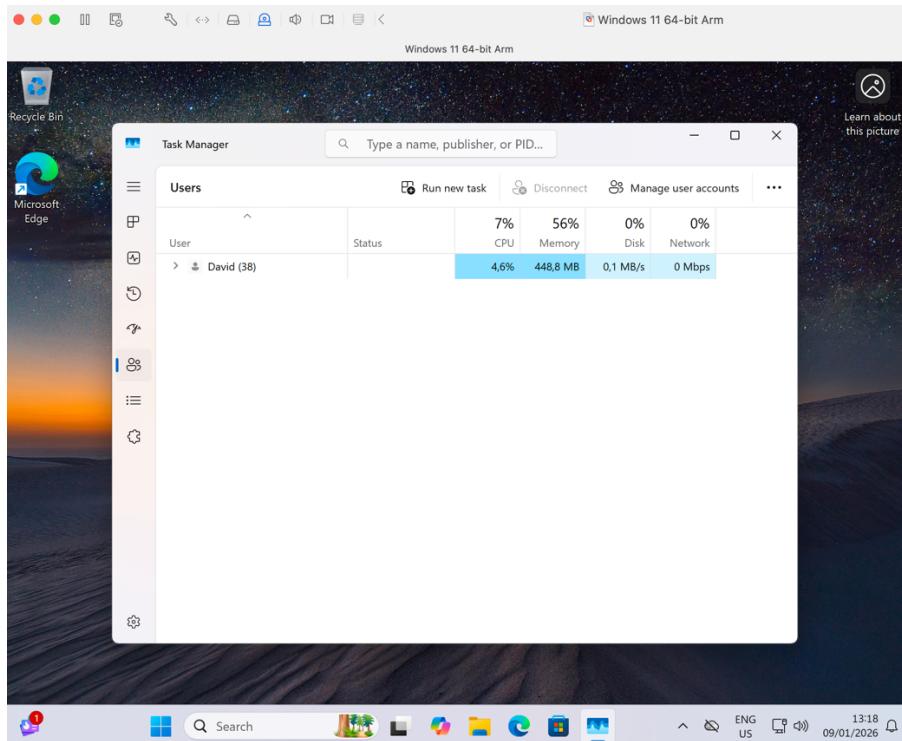
Windows + X

- c) Open the system properties with a **Windows + I** 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.





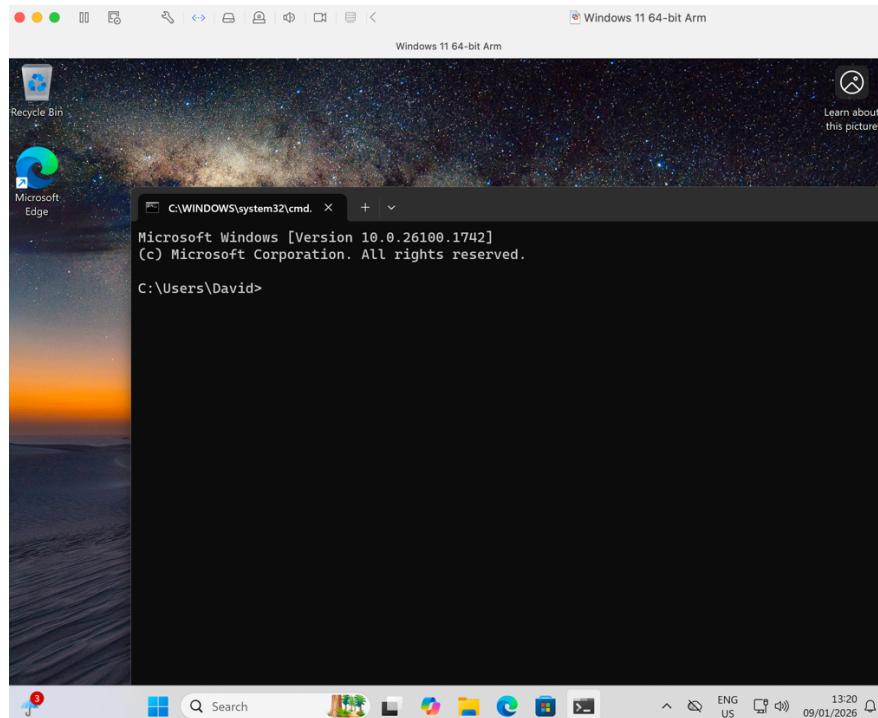
- e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

```
Command Prompt + ▾

Microsoft Windows [Version 10.0.26100.1742]
(c) Microsoft Corporation. All rights reserved.

C:\Users\David>mkdir C:\Saxion

C:\Users\David>
```

```
C:\Saxion>copy C:\Saxion\Hello.txt \Desktop
      1 file(s) copied.

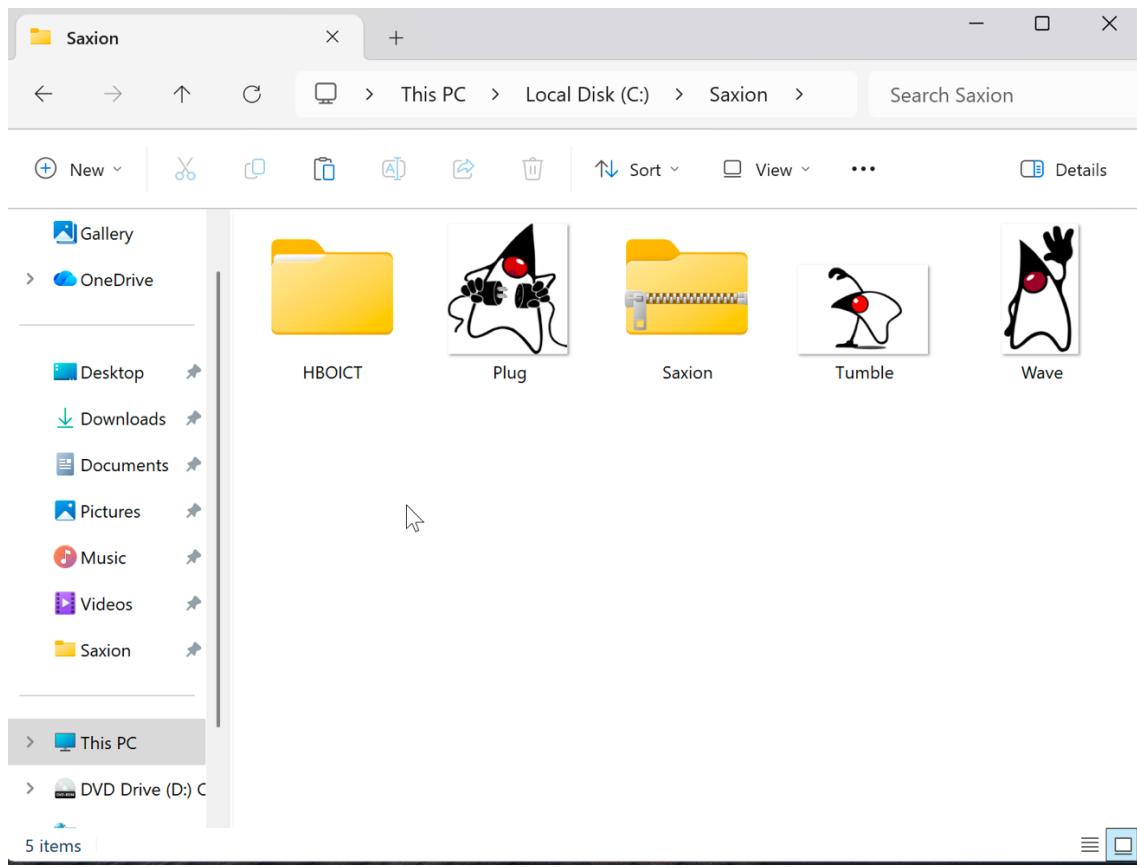
C:\Saxion>
```

Relevant screenshots **tree** command:

```
C:\Saxion>tree
Folder PATH listing
Volume serial number is 00000203 0E3F:D2B9
C:.
└── HBOICT
    ├── YEAR1
    │   ├── QUARTILE1
    │   │   ├── INTRODCTION TO PROGRAMMING
    │   │   ├── INTRODUCTION TO INFRASTRUCTURES
    │   │   └── SYNERGY
    │   ├── QUARTILE2
    │   │   ├── DATABASES
    │   │   ├── IT FUNDAMENTALS
    │   │   └── PROJECTS IT IN THE NAME
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── YEAR2
    │   ├── QUARTILE1
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── YEAR3
    └── YEAR4

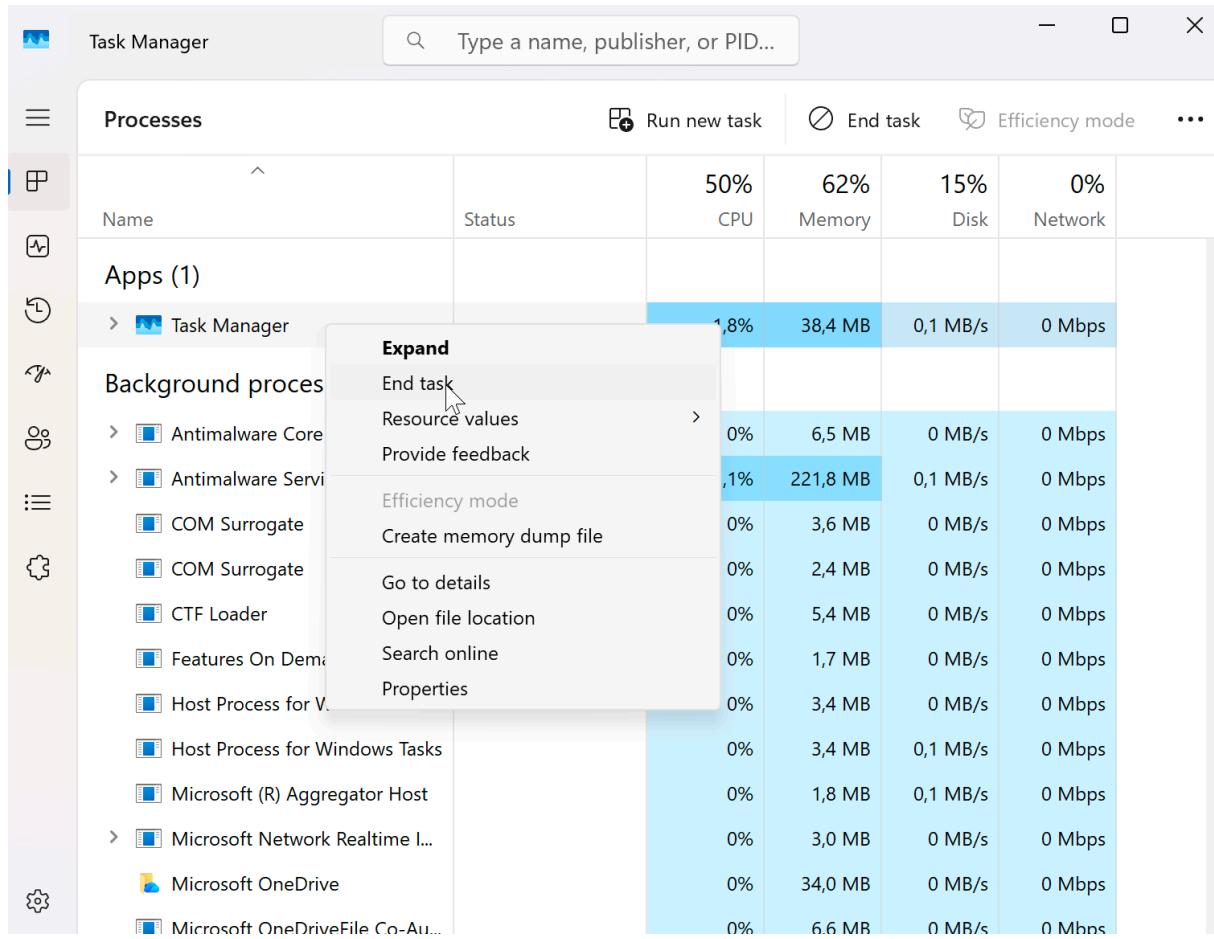
C:\Saxion>
```

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:\Windows\System32>winget install --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.arm64.exe
████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████ 6.25 MB / 6.25 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

```
C:\Windows\System32>winget install --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-arm64.exe
████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████ 1.51 MB / 1.51 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

```
david@david586146:/home$ cd david
david@david586146:~$ ls
Desktop Documents Downloads Music Pictures Public snap Templates Videos
david@david586146:~$ sudo nano text.txt
[sudo] password for david:
david@david586146:~$ ls
Desktop Downloads Pictures snap text.txt
Documents Music Public Templates Videos
david@david586146:~$ cp ./text.txt Documents/
david@david586146:~$ ls Documents/
text.txt
david@david586146:~$ █
```

The sudo nano command let's us create a text file and also with the sudo permission (administrator). Afterwards, we use the command 'ls' to check if it's in the (current) directory. As last, we use the command 'cp' to copy paste the file text.txt to the directory /Documents/

```
david@david586146:/etc$ cd ..
david@david586146:~$ ls
bin          etc          media    run          swap.img
bin usr-is-merged home        mnt      sbin          sys
boot         lib          opt      sbin usr-is-merged tmp
cdrom        lib usr-is-merged proc      snap          usr
dev          lost+found   root     srv          var
david@david586146:~$ cd etc/
david@david586146:/etc$ cd ../home
david@david586146:/home$ █
```

The etc/ folder contains configuration files that control how the system and apps behave.

In linux everything is inside one tree (root folder '/') instead of windows being in the C drive and has also different ones, and it uses letters to differentiate which drive is which.

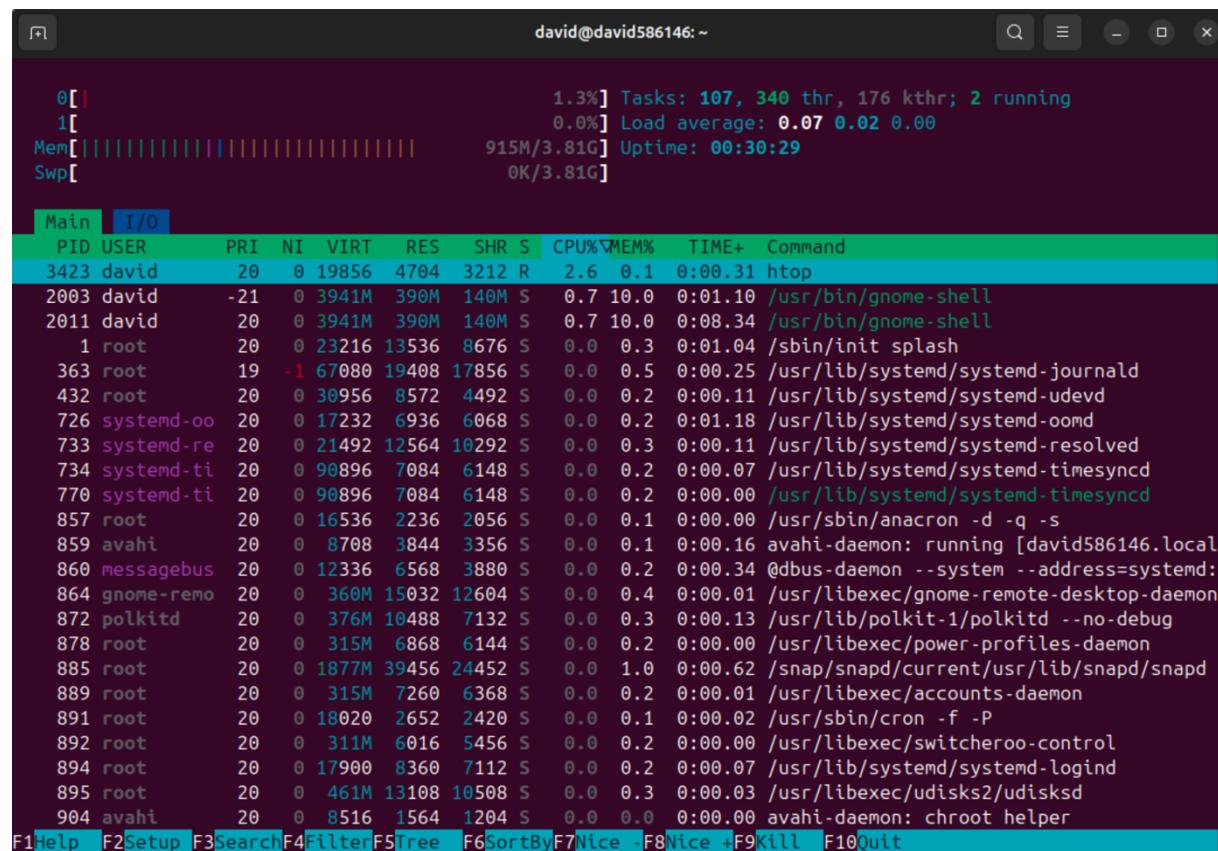
```
david@david586146:/etc$ cd ..  
david@david586146:$ ls  
bin          etc          media    run          swap.img  
bin usr-is-merged home        mnt      sbin          sys  
boot         lib          opt      sbin usr-is-merged tmp  
cdrom        lib usr-is-merged proc      snap          usr  
dev          lost+found   root     srv           var  
david@david586146:$ cd etc/  
david@david586146:/etc$ cd ../home  
david@david586146:/home$ ls  
david  
david@david586146:/home$ cd david  
david@david586146:~$ ls  
Desktop  Downloads  Pictures  snap      text.txt  
Documents  Music    Public    Templates  Videos  
david@david586146:~$ cd Desktop  
david@david586146:~/Desktop$ ls  
code.  code.zip  simple  simple.c  
david@david586146:~/Desktop$ tar -zcvf code..tar.gz ./  
./  
./code./  
./code./runall.sh  
./code./Fibonacci.java  
./code./fib.sh  
./code./fib.py  
./code./fib.c  
./simple  
./simple.c  
./code..tar.gz  
./code.zip  
david@david586146:~/Desktop$ ls  
code.  code..tar.gz  code.zip  simple  simple.c
```

```
david@david586146:~/Desktop$ tar -zxvf code..tar.gz ./  
./  
./code./  
./code./runall.sh  
./code./Fibonacci.java  
./code./fib.sh  
./code./fib.py  
./code./fib.c  
./simple  
./simple.c  
./code..tar.gz  
./code.zip  
david@david586146:~/Desktop$ ls  
code.  code..tar.gz  code.zip  simple  simple.c  
david@david586146:~/Desktop$ █
```

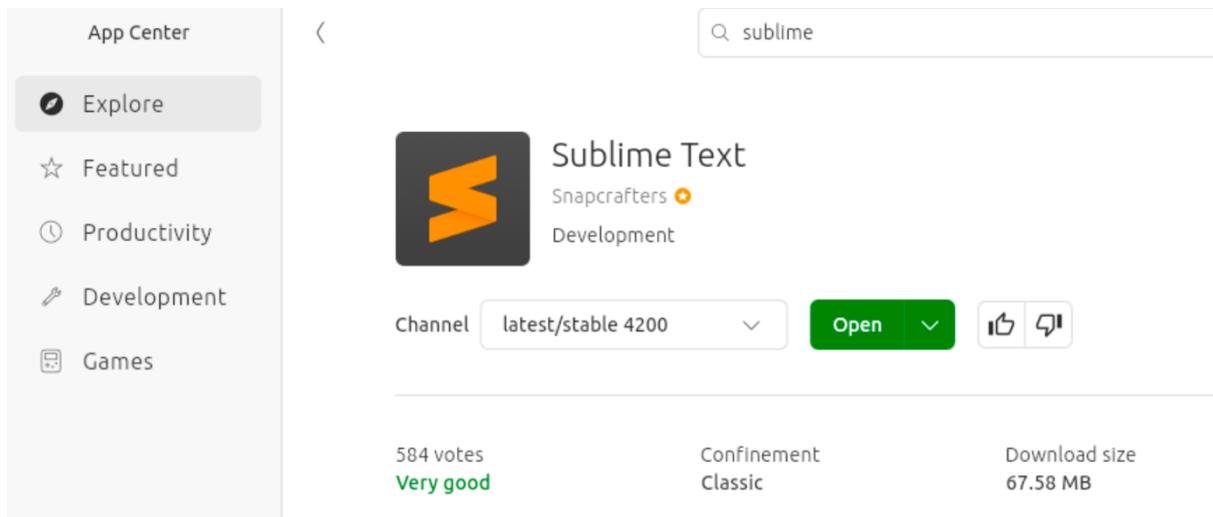
```
david@david586146:~/Desktop$ cd ..
david@david586146:~$ ls
Desktop  Downloads  Pictures  snap      text.txt
Documents  Music     Public    Templates  Videos
david@david586146:~$ tar -zxvf text.txt

gzip: stdin: not in gzip format
tar: Child returned status 1
tar: Error is not recoverable: exiting now
david@david586146:~$ tar -zxvf text.txt ./

gzip: stdin: not in gzip format
tar: Child returned status 1
tar: Error is not recoverable: exiting now
david@david586146:~$ gzip text.txt
david@david586146:~$ ls
Desktop  Downloads  Pictures  snap      text.txt.gz
Documents  Music     Public    Templates  Videos
david@david586146:~$
```



The htop is used as a taskmanager, it shows all the processes that are running on the device.



```
david@david586146:~$ sudo apt install neofetch
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
```

```
david@david586146:~$ neofetch
      .-/+oossssoo+-.
      `:+ssssssssssssssssss+-`:
      -+ssssssssssssssssssyyssss+-+
      .osssssssssssssssssdMMMNyssso.
      /sssssssssshdmmNNmmyNMMMHhssssss/
      +ssssssssshmydMMMMMMMdffffyssssssss+
      /ssssssssshNMMMyhyyyyhmNMMMNhssssssss/
      .sssssssssdMMMNhsssssssssshNMMMdssssssss.
      +sssshhhyNMMNyssssssssssssyNMMMyssssssss+
      ossyNMMMNyMMhssssssssssssshmmhssssssso
      ossyNMMMNyMMhssssssssssssshmmhssssssso
      +sssshhhyNMMNyssssssssssssyNMMMyssssssss+
      .ssssssssdMMMNhsssssssssshNMMMdssssssss.
      /ssssssssshNMMMyhyyyyhdNMMMNhssssssss/
      +sssssssssdmydMMMMMMMdffffyssssssss+
      /sssssssssshdmNNNmyNMMMHhssssssss/
      .osssssssssssssssssdMMMNyssso.
      -+ssssssssssssssssssyyssss+-+
      `:+ssssssssssssssssss+-`:
      .-/+oossssoo+-.
```

david@david586146

OS: Ubuntu 24.04.3 LTS aarch64
Host: VMware20_1 1
Kernel: 6.14.0-36-generic
Uptime: 33 mins
Packages: 1711 (dpkg), 11 (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: (2)
GPU: 00:0f.0 VMware Device 0406
Memory: 1203MiB / 3899MiB

```
david@david586146:~$ █
```

Neofetch when launched shows information about your OS and your device.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
david@david586146:~$ ls
Desktop Documents Downloads Music Pictures Public snap Templates text.txt.gz
david@david586146:~$ mkdir hello
david@david586146:~$ ls
Desktop Downloads Music Public Templates Videos
Documents hello Pictures snap text.txt.gz
david@david586146:~$ cd hello
david@david586146:~/hello$ nano hello.sh
david@david586146:~/hello$ chmod +x ./hello.sh
david@david586146:~/hello$ ls
hello.sh
david@david586146:~/hello$ chmod -x ./hello.sh
david@david586146:~/hello$ chmod 744
chmod: missing operand after '744'
Try 'chmod --help' for more information.
david@david586146:~/hello$ chmod 744 ./hello.sh
david@david586146:~/hello$ ls
hello.sh
david@david586146:~/hello$ █
```

The command ‘mkdir’ is used for creating a new directory, ‘nano’ for creating a text file and to turn it into an executable we use the command ‘chmod’ following the numbers ‘744’ to give read/write/execution permissions to all logged in users.

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

The command ‘cat’ prints out in the terminal what’s inside the (text)file.

The command ‘wc’ calculates a file’s word, line and character or byte count.

The command ‘less’ show’s the content of a file, the same way cat does but page per page instead.

The command ‘tail’ shows the last line(s) of a (text)file in the terminal.

The command ‘grep’ is to search for specific words, phrases or patterns inside a text file.

The command ‘head’ shows the first line(s) of a (text)file in the terminal.

```
david@david586146:~/hello$ ls
1661-0.txt hello.sh
david@david586146:~/hello$ wc 1661-0.txt
12306 107562 607504 1661-0.txt
david@david586146:~/hello$ grep -n kingdom 1661-0.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
```

```
david@david586146:~/hello$ tail -n 480 1661-0.txt | head -n 21  
long light ladder against the eaves. That is how he did it."
```

"But it is impossible," said Miss Hunter; "the ladder was not there when the Rucastles went away."

"He has come back and done it. I tell you that he is a clever and dangerous man. I should not be very much surprised if this were he whose step I hear now upon the stair. I think, Watson, that it would be as well for you to have your pistol ready."

The words were hardly out of his mouth before a man appeared at the door of the room, a very fat and burly man, with a heavy stick in his hand. Miss Hunter screamed and shrunk against the wall at the sight of him, but Sherlock Holmes sprang forward and confronted him.

"You villain!" said he, "where's your daughter?"

The fat man cast his eyes round, and then up at the open skylight.

"It is for me to ask you that," he shrieked, "you thieves! Spies and thieves! I have caught you, have I? You are in my power. I'll serve

```
david@david586146:~/hello$
```

```
david@david586146:~/hello$ tail -n 1114 1661-0.txt | head -n 21
```

"But you would not advise me to refuse?"

"I confess that it is not the situation which I should like to see a sister of mine apply for."

"What is the meaning of it all, Mr. Holmes?"

"Ah, I have no data. I cannot tell. Perhaps you have yourself formed some opinion?"

"Well, there seems to me to be only one possible solution. Mr. Rucastle seemed to be a very kind, good-natured man. Is it not possible that his wife is a lunatic, that he desires to keep the matter quiet for fear she should be taken to an asylum, and that he humours her fancies in every way in order to prevent an outbreak?"

"That is a possible solution—in fact, as matters stand, it is the most probable one. But in any case it does not seem to be a nice household for a young lady."

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

Tag	Value
Manufacturer	motorola
Model	moto g(6) play
X-Resolution	172
Y-Resolution	172

North or South Latitude	N
Latitude	53, 11, 39.6794
East or West Longitude	E
Longitude	6, 32, 12.9018
Altitude Reference	Sea level
Altitude	42.066

The phone brand is Motorola and the coordinates are 53°11'39.7"N 6°32'12.9"E





```
david@david586146:~/Downloads$ ls
oldcar.jpg
david@david586146:~/Downloads$ mv oldcar.jpg oldcar
david@david586146:~/Downloads$ ls
oldcar
david@david586146:~/Downloads$ oldcar
oldcar: command not found
david@david586146:~/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, datetim
e=2020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
david@david586146:~/Downloads$ 
```

It still considers it as a jpg file after renaming it and removing the extension in its name.

```
david@david586146:~/Downloads$ base64
^C
david@david586146:~/Downloads$ sudo apt install base64
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package base64
david@david586146:~/Downloads$ ls
oldcar.jpg
david@david586146:~/Downloads$ nano email.txt
david@david586146:~/Downloads$ ls
email.txt oldcar.jpg output.gif
david@david586146:~/Downloads$ base64 -d email.txt > output.gif
david@david586146:~/Downloads$ ls
email.txt oldcar.jpg output.gif
david@david586146:~/Downloads$ file output.gif
output.gif: GIF image data, version 89a, 108 x 52
david@david586146:~/Downloads$ 
```

Assignment 5.8: Steganography

Relevant screenshots + motivation

```
david@david586146:~$ steghide extract -sf apple2.jpg
Enter passphrase:
steghide: could not open the file "apple2.jpg".
david@david586146:~$ cd Downloads
david@david586146:~/Downloads$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
```

Had to install Steghide first using sudo apt install steghide and then using steghide –help it would give us information on what to use in the command line.

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.

```
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh david-586146@192.168.79.129 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.79.129 (192.168.79.129)' can't be established.
ED25519 key fingerprint is SHA256:2Qe2yp0ksbVL0vfHkp/YMInYuCGgsIsfw90s4/0+eD8.
This key is not known by any other names.
230686720 bytes (231 MB, 220 MiB) copied, 1 s, 229 MB/syngerprint])?
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.79.129' (ED25519) to the list of known hosts.
david-586146@192.168.79.129's password:
6375342080 bytes (6.4 GB, 5.9 GiB) copied, 45 s, 142 MB/s
```

```
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh david-586146@192.168.79.129 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.79.129 (192.168.79.129)' can't be established.
ED25519 key fingerprint is SHA256:2Qe2yp0ksbVL0vfHkp/YMInYuCGgsIsfw90s4/0+eD8.
This key is not known by any other names.
230686720 bytes (231 MB, 220 MiB) copied, 1 s, 229 MB/syngerprint])?
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.79.129' (ED25519) to the list of known hosts.
david-586146@192.168.79.129's password:
21277704192 bytes (21 GB, 20 GiB) copied, 111 s, 192 MB/s
5120+0 records in
5120+0 records out
21474836480 bytes (21 GB, 20 GiB) copied, 112.139 s, 192 MB/s
ubuntu@ubuntu:~$
```

```
david-586146@debian-586146:~$ ls -lh /srv/images/ubuntu2404_vm.img.gz
-rw-rw-r-- 1 david-586146 david-586146 20M Jan  9 14:21 /srv/images/ubuntu2404_vm.img.gz
david-586146@debian-586146:~$ _  
david-586146@192.168.79.129:~$ password:  
ubuntu@ubuntu:~$ ssh david-586146@192.168.79.129 "cat /srv/images/ubuntu2404?vm.  
img.gz" | gzip -d | sudo dd of=/dev/nvme0n1 bs=4M status=progress  
david-586146@192.168.79.129's password:  
1642004480 bytes (1.6 GB, 1.5 GiB) copied, 10 s, 164 MB/s
```

```
david-586146@192.168.79.129 ~ % password.  
ubuntu@ubuntu:~$ ssh david-586146@192.168.79.129 "cat /srv/images/ubuntu2404?vm.  
img.gz" | gzip -d | sudo dd of=/dev/nvme0n1 bs=4M status=progress  
david-586146@192.168.79.129's password:  
21248344064 bytes (21 GB, 20 GiB) copied, 95 s, 224 MB/s  
0+650877 records in  
0+650877 records out  
21474836480 bytes (21 GB, 20 GiB) copied, 96.2754 s, 223 MB/s  
ubuntu@ubuntu:~$
```

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