

Template Week 5 – Operating Systems

Student number:

Assignment 5.1: Unix-like

- a) Find out what the difference is between UNIX and unix-like operating systems?
 - UNIX: Originally the operating system developed at Bell Labs, and today also a trademark/certification (“UNIX®”) for systems that meet the Single UNIX Specification.
 - Unix-like: Operating systems that behave like UNIX (similar design + tools + APIs such as POSIX), but are not necessarily certified UNIX. Examples: Linux, BSDs (FreeBSD/OpenBSD/NetBSD), macOS, Android.
- 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
 - Co-creator of UNIX at Bell Labs (late 1960s/early 1970s).
 - Co-created the C predecessor language B and contributed to early systems programming.
 - Big impact on OS design, tools, and the “small tools” culture.
 - Dennis Ritchie
 - Co-creator of UNIX with Thompson.
 - Creator of the C programming language, which made UNIX portable and shaped modern software development.
 - C + UNIX are foundational for today’s operating systems and tooling.
 - Bill Joy
 - Key figure behind BSD Unix at UC Berkeley
 - Created major Unix tools (famously vi editor) and helped push TCP/IP into Unix distributions.
 - Co-founded Sun Microsystems and influenced workstation/server computing.
 - Richard Stallman
 - Founder of the GNU Project and the Free Software Foundation (FSF).
 - Started building a complete free Unix-like system (GNU), and created core tools like GCC and GNU Emacs.
 - Wrote the GNU General Public License (GPL), hugely influential in open-source licensing.
 - Linus Torvalds
 - Creator of the Linux kernel (1991).
 - Linux + GNU tools together formed what many call GNU/Linux, enabling modern Linux distributions (including Ubuntu).
 - Linux became dominant in servers, cloud, embedded, and Android.

c) What is the philosophy of the GNU movement?

- GNU's philosophy is software freedom. The core idea is that users must have the four freedoms:
- Run the program for any purpose
- Study how it works (source code access) and change it
- Redistribute copies
- Distribute modified versions

So: control should belong to the user, not the vendor.

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

Partly, but not fully in the strict Stallman/FSF sense.

- Yes (aligned):
 - Ubuntu is based on GNU + Linux, and most of the system is free/open-source.
 - You can use, study, modify, and redistribute most components.
- Not fully (where it diverges):
 - Ubuntu makes it easy to install proprietary drivers/firmware and includes non-free options in practice (especially for hardware support).
 - Some packaging/distribution choices prioritize convenience and compatibility over "100% free software" purity.

So, Ubuntu is GNU/Linux-based and open-source-friendly, but it's a pragmatic distro, not a strict "free software only" distribution.

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

WSL is a Windows feature that lets you run a Linux userland on Windows:

- Run Linux command-line tools and many Linux apps directly on Windows.
- **WSL1** translated Linux system calls.
- **WSL2** runs a real Linux kernel inside a lightweight virtualized environment for better compatibility.

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

- **Android: Linux-based** (Unix-like)
- **iOS: Unix-based** via Apple's **Darwin/XNU** (BSD/Mach roots) → Unix-like
- **ChromeOS: Linux-based** (originally Gentoo-derived) → Unix-like

Assignment 5.2: Supercomputers and gameconsoles

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

From the Computer History Museum timeline examples: supercomputers are used for massive simulations and data processing, like scientific modeling (climate/seismology/astrophysics), and highly compute-intensive work in areas like medicine, finance, and physics.

- 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 a distributed/parallel computer built from multiple PS3 consoles (leveraging the Cell processor for cheap HPC). It was used for things like:
Astrophysics simulations (e.g., PS3 "Gravity Grid")
 - The US Air Force "**Condor Cluster**" for **analyzing high-definition satellite imagery** (~500 TFLOPS claimed)
 - **Folding@home** research (protein folding / disease research)
- 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 used **Oracle Linux for ARM** on the Raspberry Pi cluster.
- 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 (very unlikely). The June 2023 TOP500 list's lowest ranked systems are around **~1.87 PFLOP/s Rmax**.

A Raspberry Pi cluster like Oracle's is orders of magnitude below that and also TOP500 entries are typically **submitted with Linpack (HPL) benchmark results**, which this demo cluster isn't aimed at

- What CPU architecture is used for the PlayStation 5 and Xbox Series X?

CPU architecture

- a. PS5: AMD Zen 2, x86-64. Wikipedia+1
- b. Xbox Series X: AMD Zen 2, x86-64.

What operating systems run on these consoles?

- **PS5:** “PlayStation 5 system software” (successor to PS4’s Orbis OS, which is FreeBSD/Unix-like).
- **Xbox Series X: Xbox System Software** (Microsoft’s console OS line).

What conclusion can you draw from the answer to the previous question?

Modern consoles are basically **x86-64 PCs with heavily customized operating systems**, which makes cross-platform development much easier than in the old “weird CPU” eras

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.

-  + I → Settings
-  + A → Quick Settings / Action Center (Win10/11 variant)
-  + D → Show desktop
-  + L → Lock screen
-  + R → Run
-  + X → Power User menu
-  + Tab → Task view
-  + P → Project (second screen options)
-  + V → Clipboard history
-  + S → Search
-  + . → Emoji panel

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

- Ctrl + Shift + Esc does not open Explorer (that opens Task Manager)
- A valid alternative is:

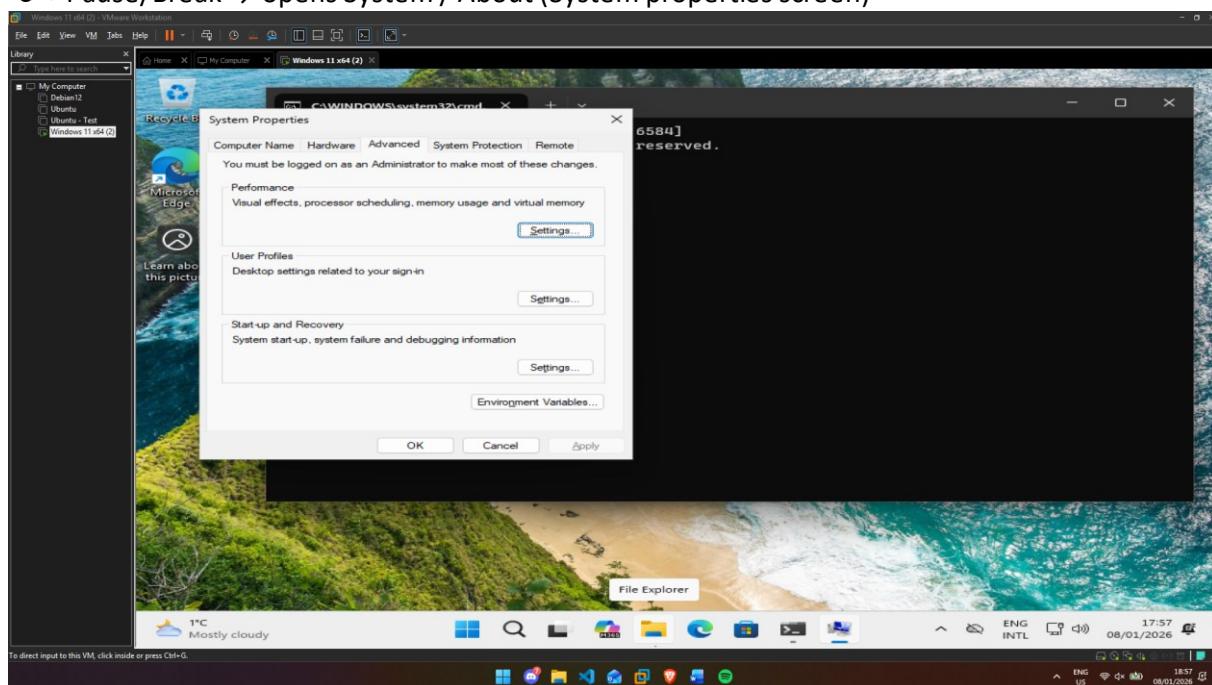
 + R, type explorer, press Enter

That's the standard "second way" using only keys.)

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

Use:

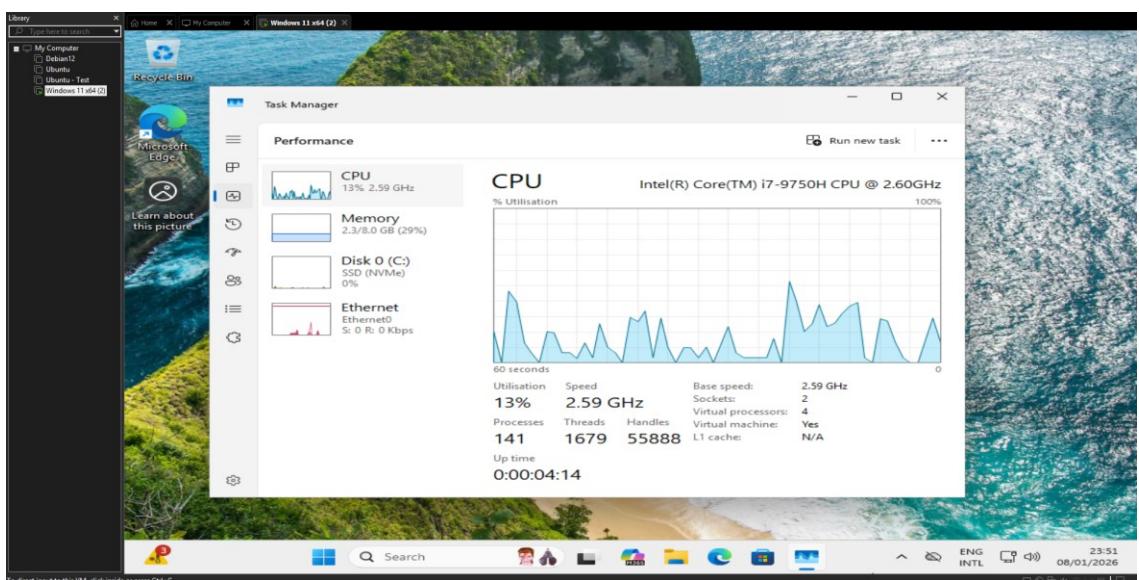
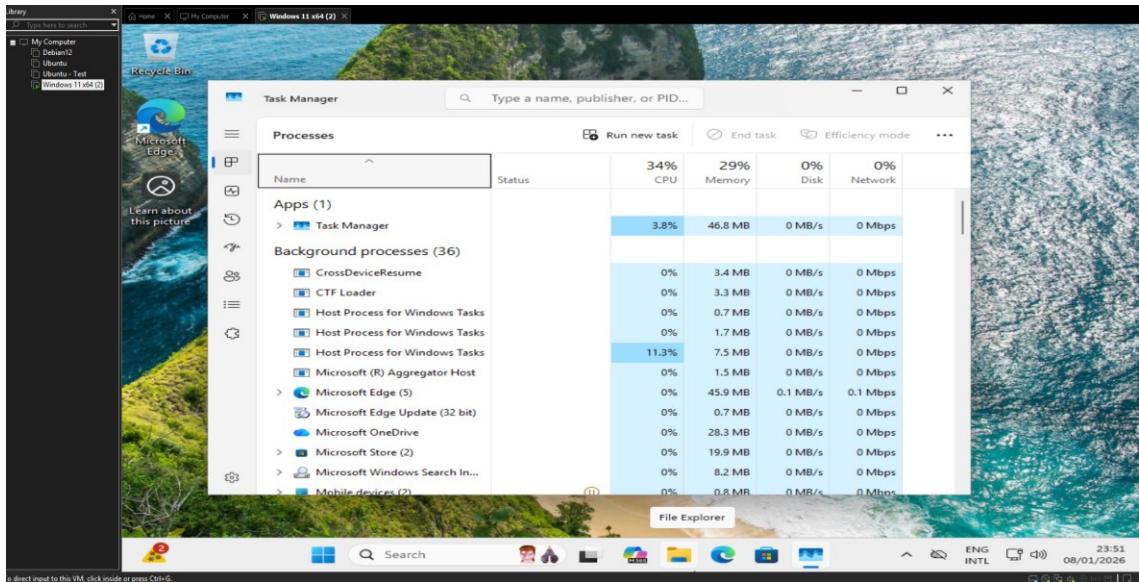
-  + Pause/Break → opens System / About (System properties screen)

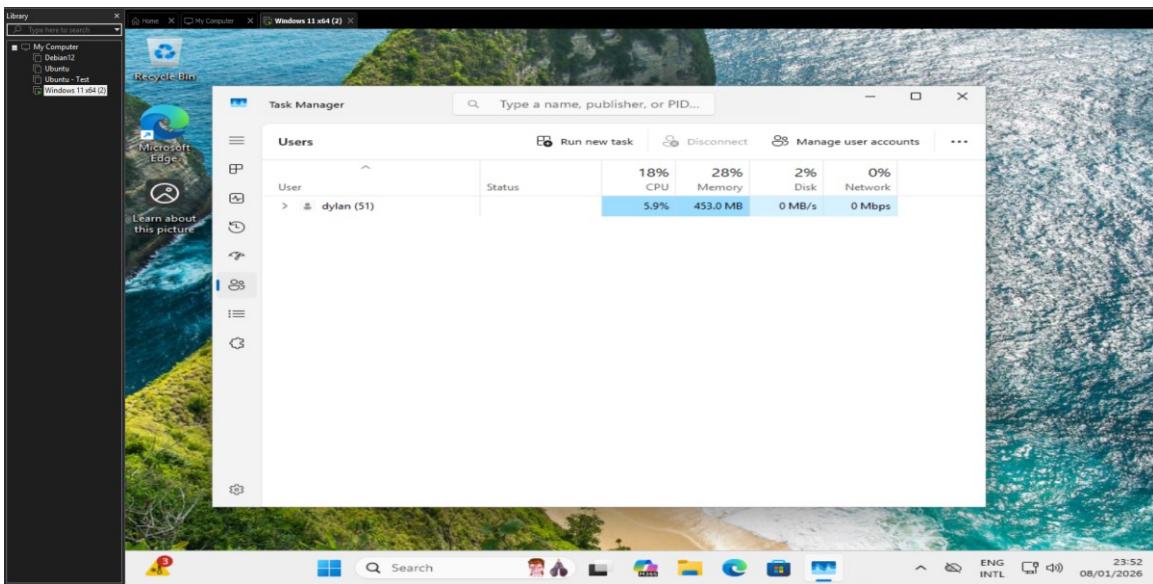


- d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.

Open Task Manager:

- Ctrl + Shift + Esc



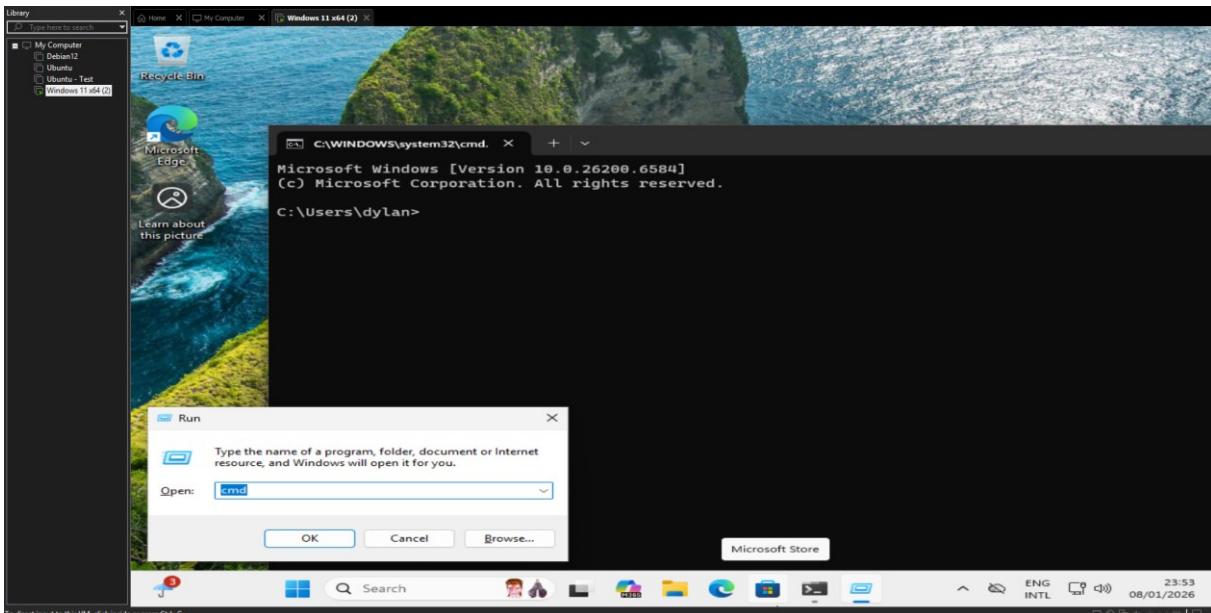


- e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector, or the second screen. Which key combination should you use for this?
Windows + P (Choose Duplicate / Extend / Second screen only)
- f) If you leave the classroom for a while and you leave your laptop behind, it is wise to lock the screen. Your Apps will continue to run in the background. So, for example, if you're waiting for a download that takes a while, lock the screen and get a cup of coffee. Which key combination do you use for this?

Windows + L

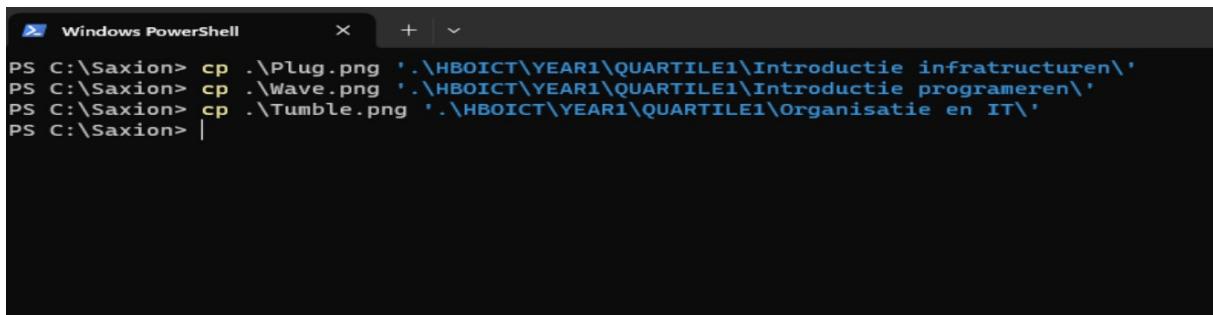
- g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.

Windows + r



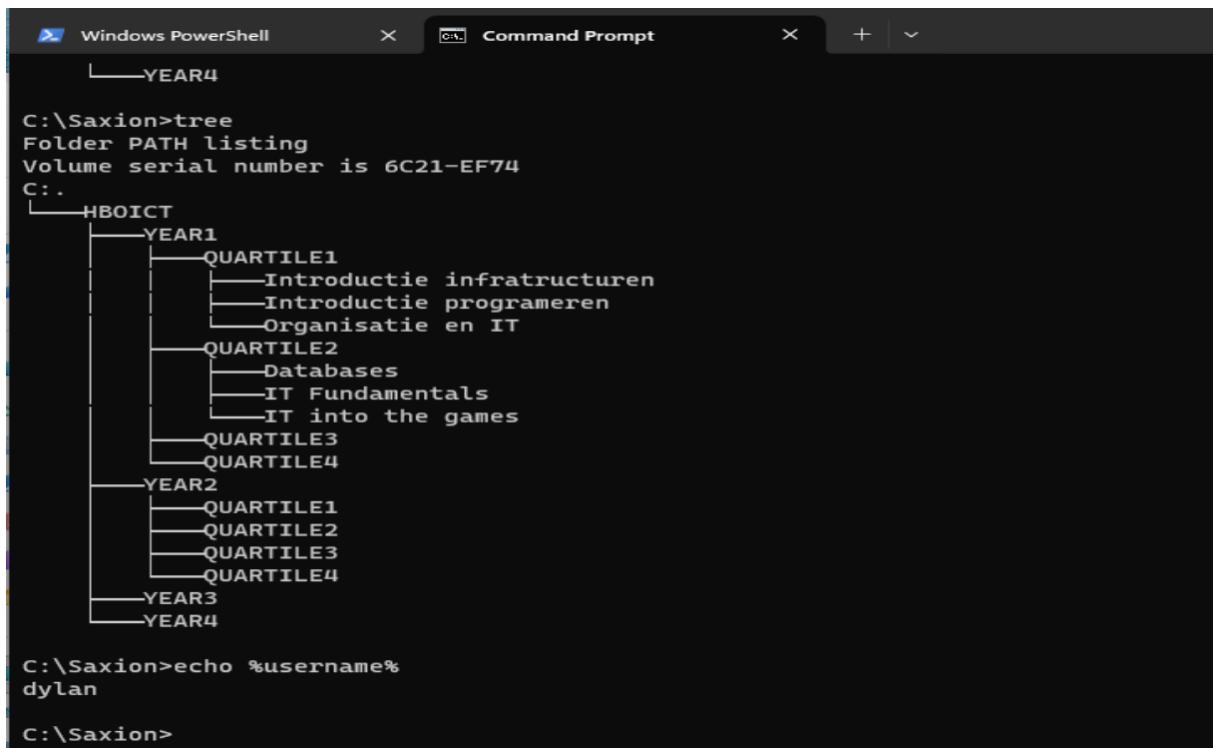
Working in the File Explorer

Relevant screenshots **copy** command:



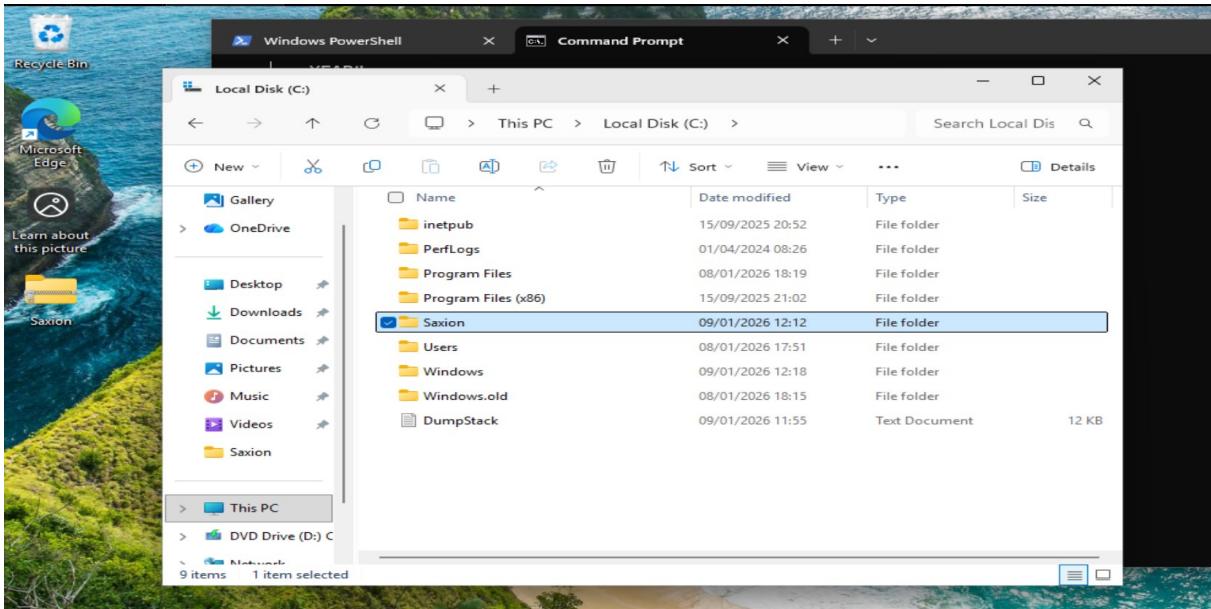
```
PS C:\Saxion> cp .\Plug.png '..\HBOICT\YEAR1\QUARTILE1\Introductie infrastructuren\'  
PS C:\Saxion> cp .\Wave.png '..\HBOICT\YEAR1\QUARTILE1\Introductie programmeren\'  
PS C:\Saxion> cp .\Tumble.png '..\HBOICT\YEAR1\QUARTILE1\Organisatie en IT\'  
PS C:\Saxion> |
```

Relevant screenshots **tree** command:



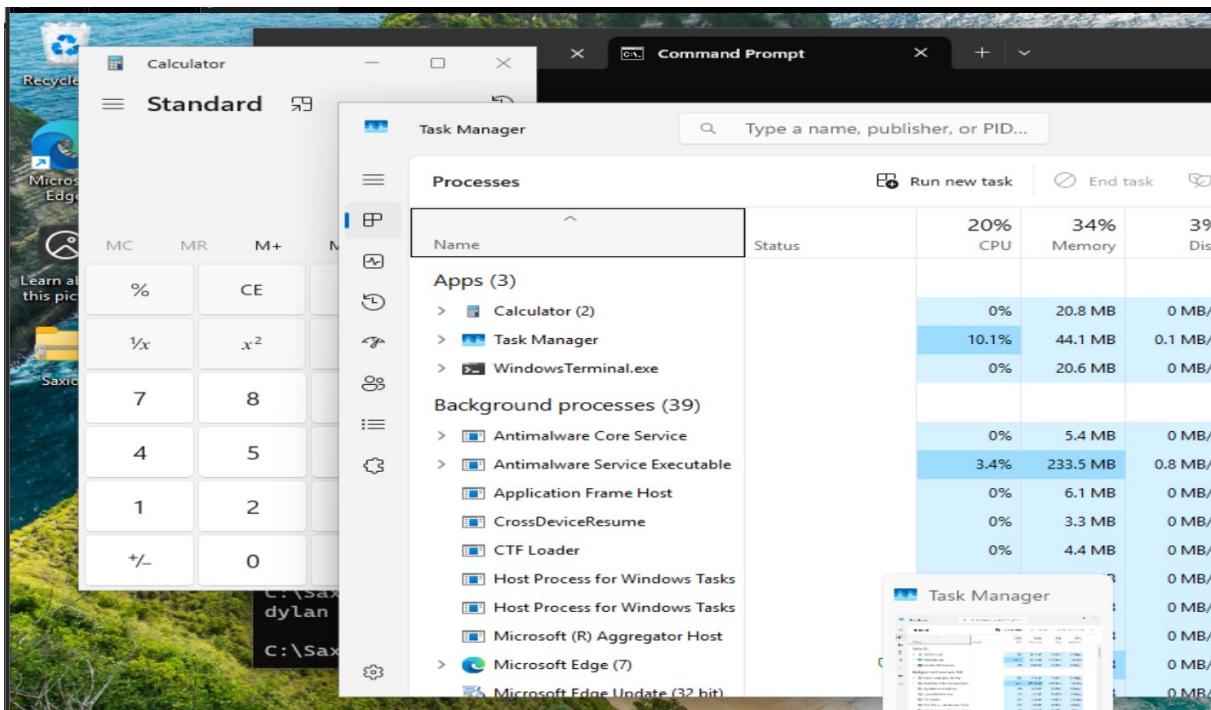
```
└──YEAR4  
  
C:\Saxion>tree  
Folder PATH listing  
Volume serial number is 6C21-EF74  
C:  
└──HBOICT  
    ├──YEAR1  
    │   ├──QUARTILE1  
    │   │   └──Introductie infrastructuren  
    │   ├──QUARTILE2  
    │   │   └──Databases  
    │   │       └──IT Fundamentals  
    │   │           └──IT into the games  
    │   ├──QUARTILE3  
    │   └──QUARTILE4  
    ├──YEAR2  
    │   ├──QUARTILE1  
    │   ├──QUARTILE2  
    │   ├──QUARTILE3  
    │   └──QUARTILE4  
    ├──YEAR3  
    └──YEAR4  
  
C:\Saxion>echo %username%  
dylan  
  
C:\Saxion>
```

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



Terminating Processes

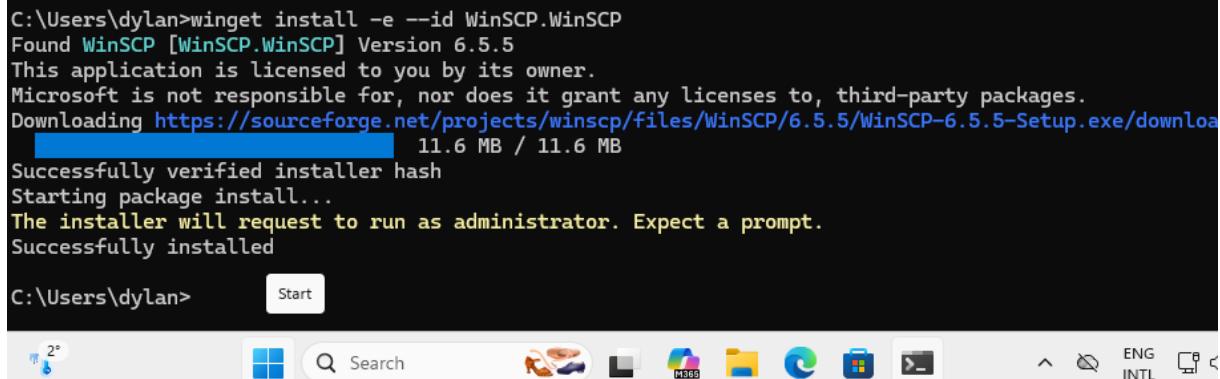
Relevant Screenshots Task Manager Window:



Install Software

Relevant screenshots that the following software is installed with winget:

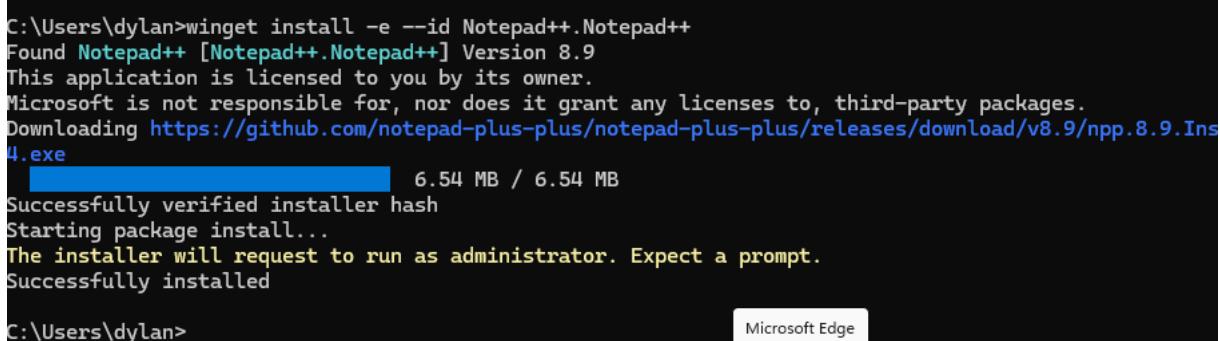
- WinSCP



```
C:\Users\dylan>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/downloa
| 11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
The installer will request to run as administrator. Expect a prompt.
Successfully installed

C:\Users\dylan>
```

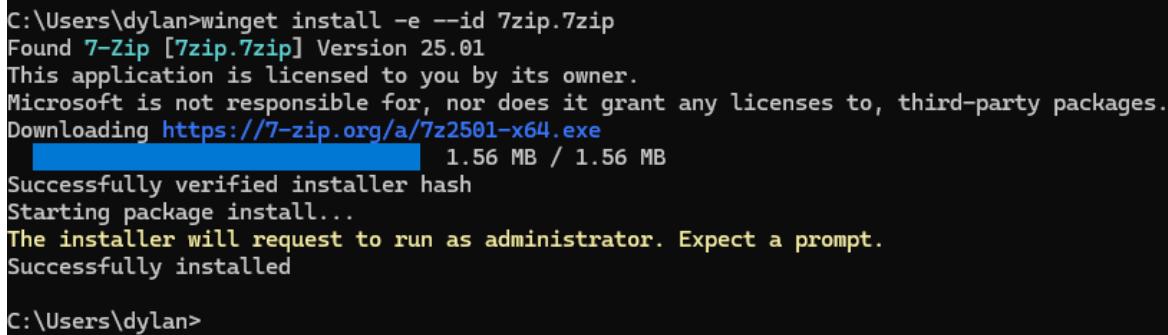
- Notepad++



```
C:\Users\dylan>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.Ins
4.exe
| 6.54 MB / 6.54 MB
Successfully verified installer hash
Starting package install...
The installer will request to run as administrator. Expect a prompt.
Successfully installed

C:\Users\dylan>
```

- 7zip



```
C:\Users\dylan>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...
The installer will request to run as administrator. Expect a prompt.
Successfully installed

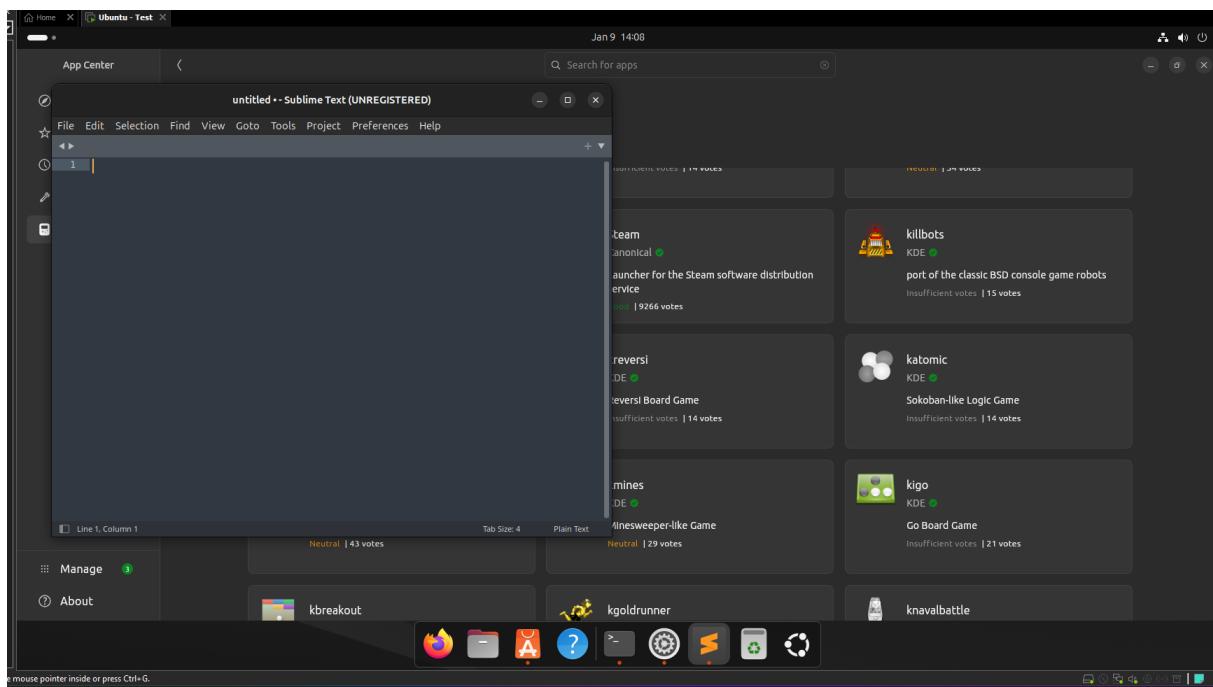
C:\Users\dylan>
```

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

A terminal window displaying system statistics and a tasklist. The top part shows memory usage (Mem: 1.28G/3.78G, Swap: 0K/3.78G) and system load (Tasks: 121, 407 thr, 212 kthr; 1 running, Load average: 0.13 0.30 0.18). The bottom part is a tasklist with columns: PID, USER, PRI, NI, VIRT, RES, SHR, S, CPU%, MEM%, TIME+, and Command. It lists various processes including dylan, root, and system daemons like vntoolsd, splash, and vntoolsd.

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
2678	dylan	20	0	4255M	288M	128M	S	9.0	7.5	0:24.80	/usr/bin/gnome-shell
5264	dylan	20	0	686M	60996	48276	S	3.5	1.5	0:00.68	/usr/libexec/gnome-terminal-server
5454	dylan	20	0	11892	5668	3612	R	2.6	0.1	0:00.24	htop
2710	dylan	-21	0	4255M	288M	128M	S	1.2	7.5	0:02.82	/usr/bin/gnome-shell
745	root	20	0	239M	9268	7828	S	0.4	0.2	0:00.63	/usr/bin/vntoolsd
2483	dylan	9	-11	113M	13548	9488	S	0.4	0.3	0:00.08	/usr/bin/pipewire-pulse
2900	dylan	20	0	210M	39112	30644	S	0.4	1.0	0:00.77	/usr/bin/vntoolsd -n vmusr --blockFd 3 --uninputFd 4
1	root	20	0	23640	14664	9484	S	0.0	0.4	0:03.63	/sbin/init splash
387	root	19	-1	67244	18344	16704	S	0.0	0.5	0:00.54	/usr/lib/systemd/systemd-journald
425	root	20	0	148M	1732	1428	S	0.0	0.0	0:00.00	vmware-vmblock-fuse /run/vmblock-fuse -o rw,subtype=vmware-vmblock,default_permissions,allow_other,dev,
426	root	20	0	148M	1732	1428	S	0.0	0.0	0:00.00	vmware-vmblock-fuse /run/vmblock-fuse -o rw,subtype=vmware-vmblock,default_permissions,allow_other,dev,
427	root	20	0	148M	1732	1428	S	0.0	0.0	0:00.00	vmware-vmblock-fuse /run/vmblock-fuse -o rw,subtype=vmware-vmblock,default_permissions,allow_other,dev,
455	root	20	0	32260	10468	5612	S	0.0	0.3	0:00.39	/usr/lib/systemd/systemd-udevd
602	systemd-oo	20	0	17560	7648	6744	S	0.0	0.2	0:00.17	/usr/lib/systemd/systemd-oond
605	systemd-re	20	0	21580	12912	10596	S	0.0	0.3	0:00.15	/usr/lib/systemd/systemd-resolved
615	systemd-ti	20	0	91048	7864	6888	S	0.0	0.2	0:00.07	/usr/lib/systemd/systemd-timesyncd
739	root	20	0	56064	11789	10208	S	0.0	0.3	0:00.09	/usr/bin/VGUauthService
831	root	20	0	239M	9268	7828	S	0.0	0.2	0:00.00	/usr/bin/vntoolsd
840	root	20	0	239M	9268	7828	S	0.0	0.2	0:00.01	/usr/bin/vntoolsd
841	root	20	0	239M	9268	7828	S	0.0	0.2	0:00.00	/usr/bin/vntoolsd
842	systemd-ti	20	0	91048	7864	6888	S	0.0	0.2	0:00.00	/usr/lib/systemd/systemd-timesyncd
1122	avahi	20	0	6672	4548	4696	S	0.0	0.1	0:00.10	avahi-daemon: running [helpdesk.local]
1126	messagebus	20	0	12212	7520	4676	S	0.0	0.2	0:00.61	@ibus-daemon --system --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only



```

PROCESSING CRITTERS FOR DESKTOP-F11E-001 (0.27+200101) ...
dylan@edu: $ neofetch
  .-/+oossssoo+/-.
  `:+ssssssssssssssssssssss+`:
  -+ssssssssssssssssssssyssss+-+
  .osssssssssssssssssdMMMNyssso.
 /sssssssssshdmmNNmyNMMMNyssso/
 +ssssssssshmydMMMMMNdddyssssss+/
 /ssssssssshNMMMyhyyyyhmNMMMNhssssss/
 .ssssssssdMMMNhssssssssshNMMMdssssss.
 +ssshhyNMMNyssssssssssyNMMNyssssss+/
 ossyNMMMNyMlhsssssssssssshhmmhssssso
 ossyNMMMNyMlhsssssssssssshhmmhssssso
 +ssshhyNMMNyssssssssssyNMMNyssssss+/
 .ssssssssdMMMNhssssssssshNMMMdssssss.
 /ssssssssshNMMMyhyyyyhdNMMMNhssssss/
 +ssssssssdmydMMMMMNdddyssssss+/
 /sssssssssshdmmNNNmyNMMMNhssssss/
 .osssssssssssssssssdMMMNyssso.
 -+ssssssssssssssssyyssss+-
 `:+ssssssssssssssssss+`:
  .-/+oossssoo+/-.

dylan@edu
-----
OS: Ubuntu 24.04.3 LTS x86_64
Host: VMware Virtual Platform None
Kernel: 6.14.0-37-generic
Uptime: 11 mins
Packages: 1716 (dpkg), 18 (snap)
Shell: bash 5.2.21
Resolution: 1718x920
DE: GNOME 46.0
WM: Mutter
WM Theme: Adwaita
Theme: Yaru-dark [GTK2/3]
Icons: Yaru [GTK2/3]
Terminal: gnome-terminal
CPU: Intel i7-9750H (4) @ 2.592GHz
GPU: 00:0f.0 VMware SVGA II Adapter
Memory: 1864MiB / 3867MiB

```



dylan@edu: \$

Motivation – htop

I installed htop because it gives a clear, real-time overview of system performance. It helps me quickly see which processes use the most CPU or RAM and makes it easy to manage or stop a process if something is slowing down the VM.

Motivation – Sublime Text

I installed Sublime Text because it is a fast and lightweight text editor that is useful for writing code and editing configuration files. It supports syntax highlighting and extensions, which makes working on assignments easier and more efficient.

Motivation – neofetch

I installed neofetch because it quickly shows the most important system information in one command. This is useful for documenting my VM setup (OS version, kernel, hardware info) and for troubleshooting when I need to confirm system details.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
dylan@edu:~/Desktop/testings$ chmod 744 hello.sh
dylan@edu:~/Desktop/testings$ ./hello.sh
Hello Dylan, 593201!
dylan@edu:~/Desktop/testings$
```

Set permissions to: **owner = read/write/execute, group = read-only, others = read-only** → 744

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

What each command does:

- cat: prints a file to the terminal (can also concatenate multiple files).
- wc: counts lines, words, and bytes/chars in a file.
- less: view a file page-by-page (scroll/search without loading everything at once).
- head: shows the first lines of a file (default 10).
- tail: shows the last lines of a file (default 10).
- grep: searches for text/patterns in files and prints matching lines.

```
dylan@edu:~/Desktop/testings$ wget -O SherlockHolmes.txt https://www.gutenberg.org/files/1661/1661-0.txt
--2026-01-09 14:14:05-- https://www.gutenberg.org/files/1661/1661-0.txt
Resolving www.gutenberg.org (www.gutenberg.org)... 152.19.134.47, 2610:28:3090:3000:0:bad:cafe:47
Connecting to www.gutenberg.org (www.gutenberg.org)|152.19.134.47|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 607504 (593K) [text/plain]
Saving to: 'SherlockHolmes.txt'

SherlockHolmes.txt          100%[=====] 593.27K  1000KB/s   in 0.6s

2026-01-09 14:14:06 (1000 KB/s) - 'SherlockHolmes.txt' saved [607504/607504]
dylan@edu:~/Desktop/testings$
```

```
dylan@edu:~/Desktop/testings$ 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
dylan@edu:~/Desktop/testings$
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

Digital forensics tries to recover deleted or damaged data and to check if data is hidden inside other files. This requires knowledge of bits and bytes, because computers store everything in raw binary.

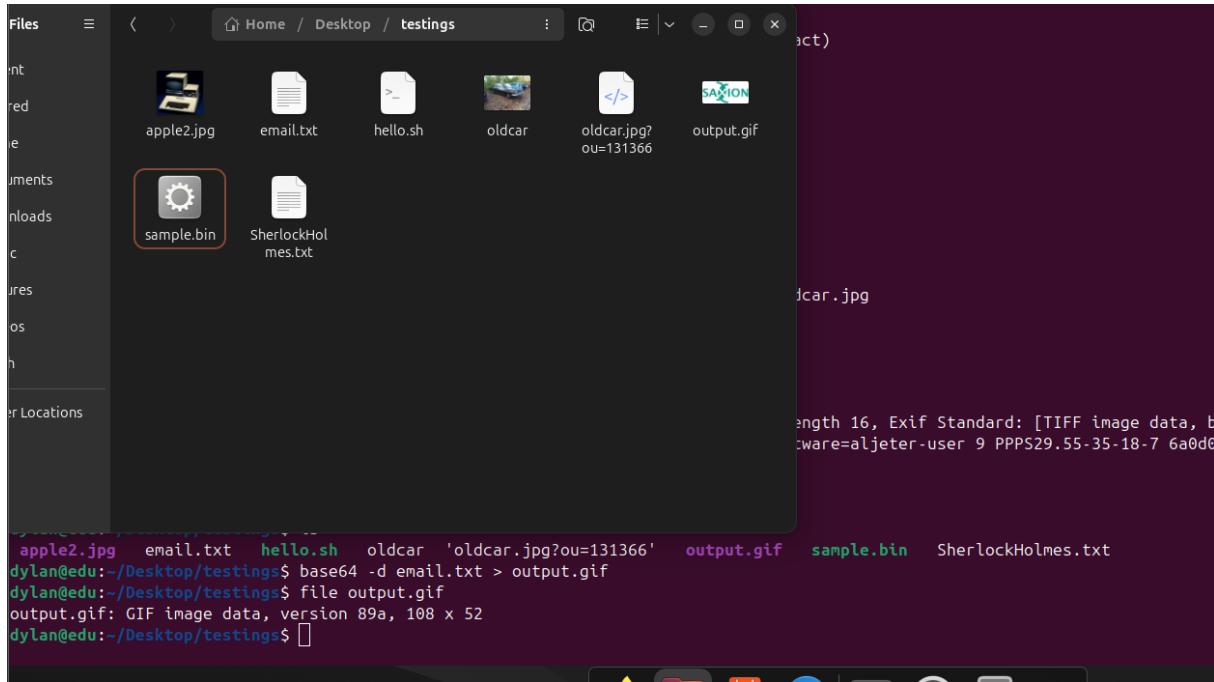
- Deleted files: often not really gone; the bytes may still be on the disk until overwritten.
- Corrupted files: you can sometimes repair them by analyzing the file's byte structure.
- Hidden data: extra bytes can be hidden in images, PDFs, or other binary files and can be found by inspecting the raw data.

```
dylan@edu:~/Desktop/testings$ cp /bin/ls sample.bin
dylan@edu:~/Desktop/testings$ echo "SECRET_MESSAGE: hello from hidden bytes" >> sample.bin
dylan@edu:~/Desktop/testings$ strings sample.bin | grep SECRET_MESSAGE
SECRET_MESSAGE: hello from hidden bytes
dylan@edu:~/Desktop/testings$ tail -c 200 sample.bin | xxd
00000000: 4900 0000 0000 0000 0000 0000 0000 I .. .....
000000010: 0100 0000 0000 0000 0000 0000 0000 .. .....
000000020: 2001 0000 0100 0000 0000 0000 0000 .. .....
000000030: 0000 0000 0000 0000 c422 0200 0000 0000 .. ."..
000000040: 3400 0000 0000 0000 0000 0000 0000 4 .. .....
000000050: 0400 0000 0000 0000 0000 0000 0000 .. .....
000000060: 0100 0000 0300 0000 0000 0000 0000 .. .....
000000070: 0000 0000 0000 f822 0200 0000 0000 .. ..."..
000000080: 2f01 0000 0000 0000 0000 0000 0000 / .. .....
000000090: 0100 0000 0000 0000 0000 0000 0000 .. .....
0000000a0: 5345 4352 4554 5f4d 4553 5341 4745 3a20 SECRET_MESSAGE:
0000000b0: 6865 6c6c 6f20 6672 6f6d 2068 6964 6465 hello from hidde
0000000c0: 6e20 6279 7465 730a n bytes.
dylan@edu:~/Desktop/testings$
```

```
dylan@edu:~/Desktop/testings$ exiftool -Make -Model oldcar.jpg
Make : motorola
Camera Model Name : moto g(6) play
dylan@edu:~/Desktop/testings$
```

```
dylan@edu:~/Desktop/testings$ exiftool -Make -Model oldcar.jpg
Make : motorola
Camera Model Name : moto g(6) play
dylan@edu:~/Desktop/testings$ exiftool -GPSLatitude -GPSLongitude -GPSPosition oldcar.jpg
GPS Latitude : 53 deg 11' 39.68" N
GPS Longitude : 6 deg 32' 12.90" E
GPS Position : 53 deg 11' 39.68" N, 6 deg 32' 12.90" E
dylan@edu:~/Desktop/testings$
```

```
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment length 16, Exif Standard: [TIFF image data, big-endian, direntries=10, manufacturer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolutionunit=2, software=aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys, datetime=2020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
dylan@edu:~/Desktop/testings$
```



Assignment 5.8: Steganography

Relevant screenshots + motivation

```
Setting up steghide (0.5.1-15) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
dylan@edu:~/Desktop/testings$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
dylan@edu:~/Desktop/testings$
dylan@edu:~/Desktop/testings$ cat message.txt
Hello class.
You have almost completed Week 5.

dylan@edu:~/Desktop/testings$
```

I used **steghide** for the first time because images can look harmless while secretly containing hidden files (like passwords), and this tool lets me extract that evidence during forensic analysis.

Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

```
ssh [-Q query_option]
dylan@edu:~$ ssh 192.168.139.138
The authenticity of host '192.168.139.138 (192.168.139.138)' can't be established.
ED25519 key fingerprint is SHA256:fQy2Hdv5wQ7ZXgscPFL732gTqi94Z3aMwliludJF7K0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.138' (ED25519) to the list of known hosts.
dylan@192.168.139.138's password:
Permission denied, please try again.
dylan@192.168.139.138's password:
Permission denied, please try again.
dylan@192.168.139.138's password:
Linux debian 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.

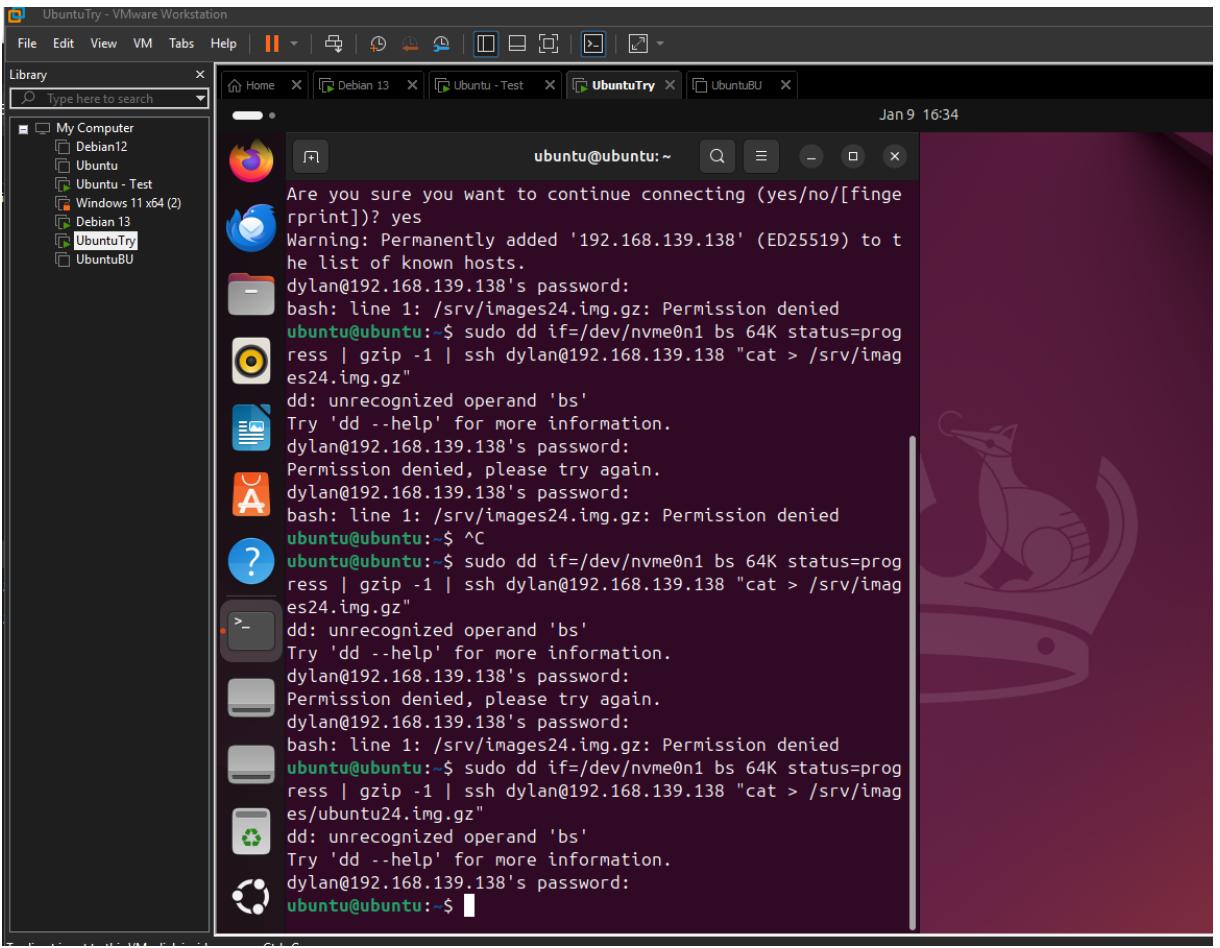
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
dylan@debian:~$
```

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

```
password: dylan
Password:
Linux debian 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.
dylan@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: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:90:25:d0 brd ff:ff:ff:ff:ff:ff
        altname enp2s1
        altname enx000c299025d0
        inet 192.168.139.138/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
            valid_lft 1257sec preferred_lft 1032sec
        inet6 fe80::96a9:6b5b:2e8c:489d/64 scope link
            valid_lft forever preferred_lft forever
dylan@debian:~$ cd /srv/images/
dylan@debian:/srv/images$ ls
ubuntu24.img.gz
dylan@debian:/srv/images$ _
```



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

```

ubuntu@ubuntu:~$ ssh dylan@192.168.139.138 "cat /srv/images/ubuntu24.img.gz" | gzip -d | sudo dd of=/dev/nvme0n1 bs=64K
status=progress
The authenticity of host '192.168.139.138 (192.168.139.138)' can't be established.
ED25519 key fingerprint is SHA256:fQy2Hdv5wQ7ZXgscPFL732gTqi94Z3aMwliludJF7K0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.138' (ED25519) to the list of known hosts.
dylan@192.168.139.138's password:
0+0 records in
0+0 records out
0 bytes copied, 13.6433 s, 0.0 kB/s
ubuntu@ubuntu:~$ 

```



This approach worked well because I was able to successfully **create a full disk backup** to the Debian server and later **restore the image back to a disk**, proving the backup file was complete and usable for recovery.

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