

Week 5 – Operating Systems.

Student number: 578856

Assignment 5.1: Unix-like

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

UNIX is the original operating system developed at Bell Labs and is a trademarked system. Only operating systems that have been officially certified under the Single UNIX Specification may be called UNIX (for example Solaris, AIX, HP-UX, macOS).

Unix-like systems are operating systems that behave like UNIX but are not officially certified. Some examples of them are Linux distributions and BSD 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.

Ken Thompson – One of the original creators of UNIX. He designed the early UNIX kernel, the file system, and several core tools. He also developed the B programming language, which later influenced the C language.

Dennis Ritchie – Co-creator of UNIX alongside Thompson. He is also the creator of the C programming language, which became fundamental not only for UNIX but for modern software development in general.

Bill Joy played an integral role in the early development of BSD UNIX. He developed important UNIX tools such as the *vi* editor and was instrumental in the distribution of BSD. He later co-founded Sun Microsystems.

Richard Stallman launched the free software movement and created essential tools such as Emacs and GNU Compiler Collection, as well as the GPL license. Founder of the GNU Project and the Free Software Foundation.

Linus Torvalds – Creator of the Linux kernel (1991). His work made it possible to combine the GNU tools with a free, modern kernel, resulting in today's GNU/Linux systems. He also created Git.

- c) What is the philosophy of the GNU movement?

The main goal is: users control the software, not the companies.

Free software means users have the four essential freedoms: (0) to run the program, (1) to study and change the program in source code form, (2) to redistribute exact copies, and (3) to distribute modified versions. (Quote from gnu.org website)

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

Ubuntu follows GNU philosophy, but only partly. Ubuntu includes lots of free software (Linux kernel, GNU tools, open-source applications) and most of the system is open-source. But Ubuntu also includes proprietary drivers (NVIDIA, Wi-Fi firmware). It encourages installing closed-source software like Spotify and Chrome. So Ubuntu is mostly aligned, but not fully follows strict GNU/FSF ideology.

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

WSL is a compatibility layer in Windows 10/11 that allows running Linux:

- You can install real Linux distributions like Ubuntu, Debian and others.
- Run Linux commands, tools, servers, and development environments directly on Windows.
- And you don't need virtual machine to use it.

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

Android belongs to the Linux operating system family because it is based on the Linux kernel. iOS belongs to the UNIX/BSD family since it is built on Darwin, which uses BSD UNIX components. ChromeOS also belongs to the Linux family because it is developed on top of the Gentoo Linux distribution.

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 extremely powerful machines used for tasks that require huge amounts of calculations. According to the Computer History Museum, they are mainly used for scientific simulations, weather and climate prediction, medical and chemical research, engineering design, and national security tasks like codebreaking. Because they can process massive datasets very quickly, supercomputers help scientists model complex systems, such as the climate, the universe, or molecular behaviour that regular computers cannot handle.

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 a supercomputer made by connecting multiple PS3 consoles using their powerful Cell processors. It was used for scientific research and simulations, such as modelling black holes or analyzing large datasets.

- 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?

It uses 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, Oracle's Raspberry Pi supercomputer would not appear in the top 500 list of the world's fastest supercomputers. The top 500 rankings list only the 500 highest-performance systems based on the LINPACK benchmark, and the lowest performance required to get on the list was on the order of petaflops. Typical Raspberry Pi clusters, even if built from many units, deliver performance in the gigaflops range at best, which is many orders of magnitude slower than even the slowest machines on the top 500 list. Because of this huge difference in performance, a Raspberry Pi cluster would be far too slow to qualify for the list.

- 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 PlayStation 5 and Xbox Series X both use AMD's custom x86-64 CPU architecture. The PS5 runs a custom FreeBSD-based operating system, while the Xbox Series X uses a custom Windows-based OS. This shows that modern consoles are essentially specialized PCs, using similar CPU architecture and software foundations as regular computers.

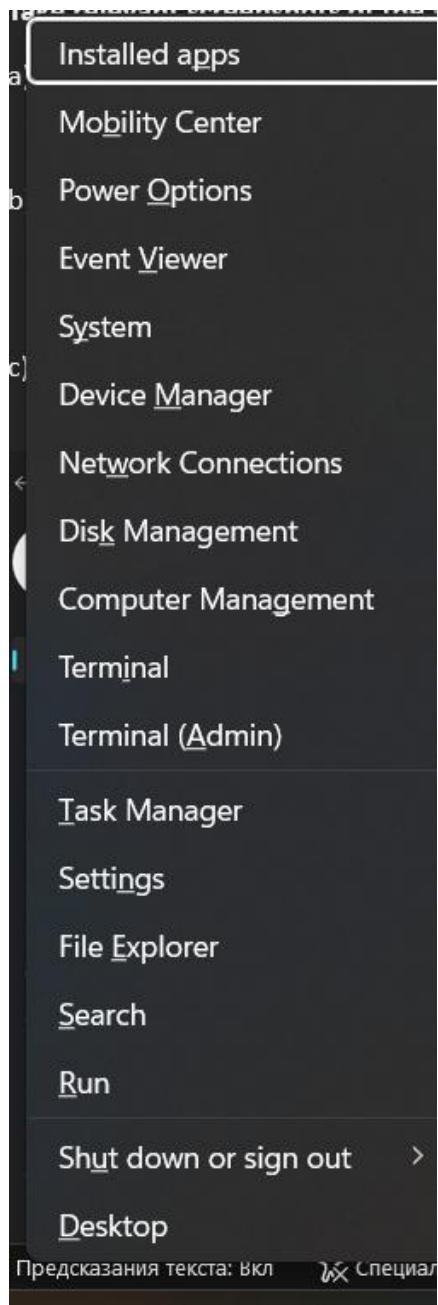
Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

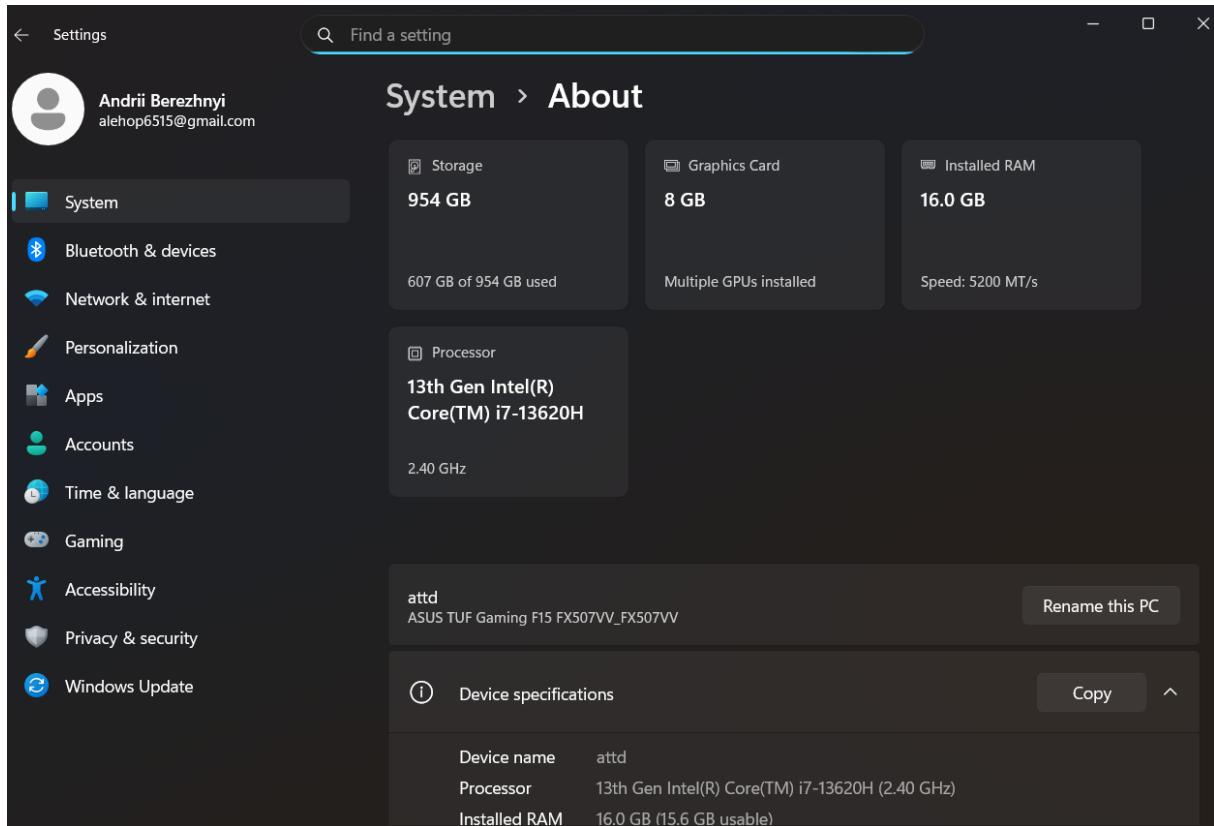
- a) Practice for about 10 minutes with the  keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.

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

It is also possible to use Win + X and pick a file explorer there, in shortcuts menu.

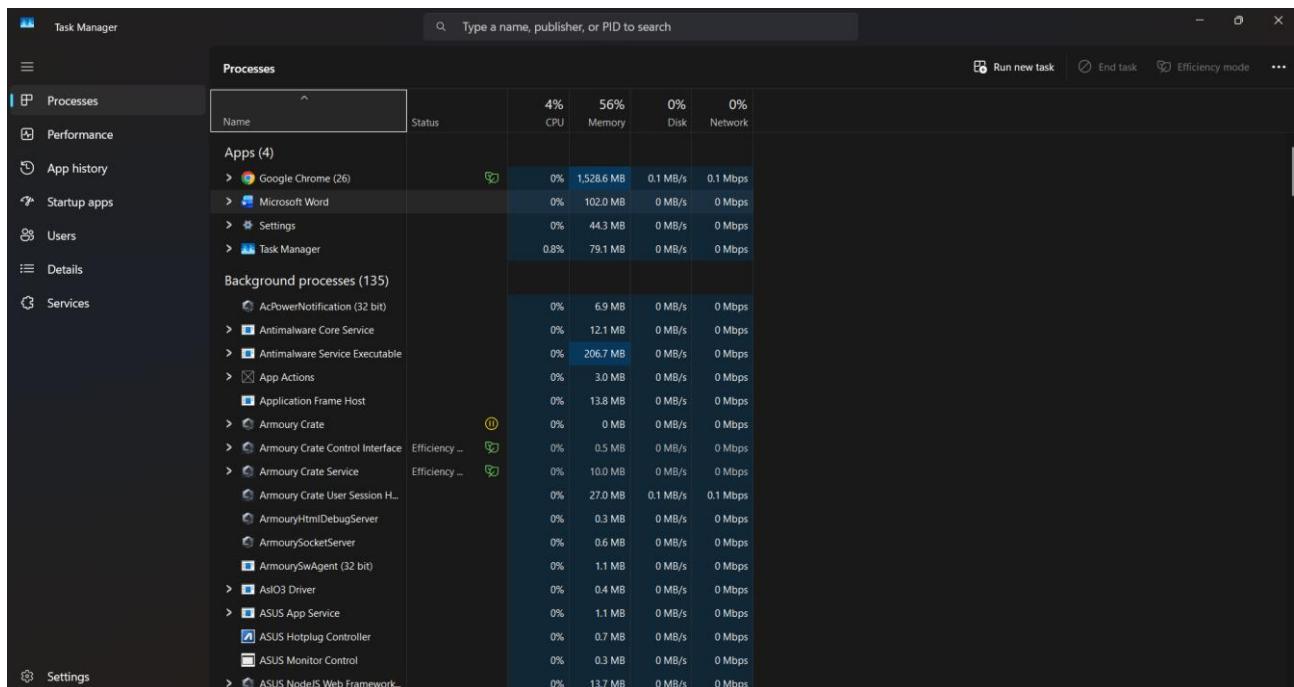


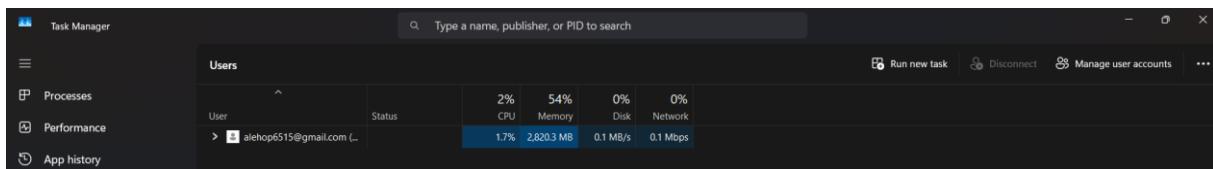
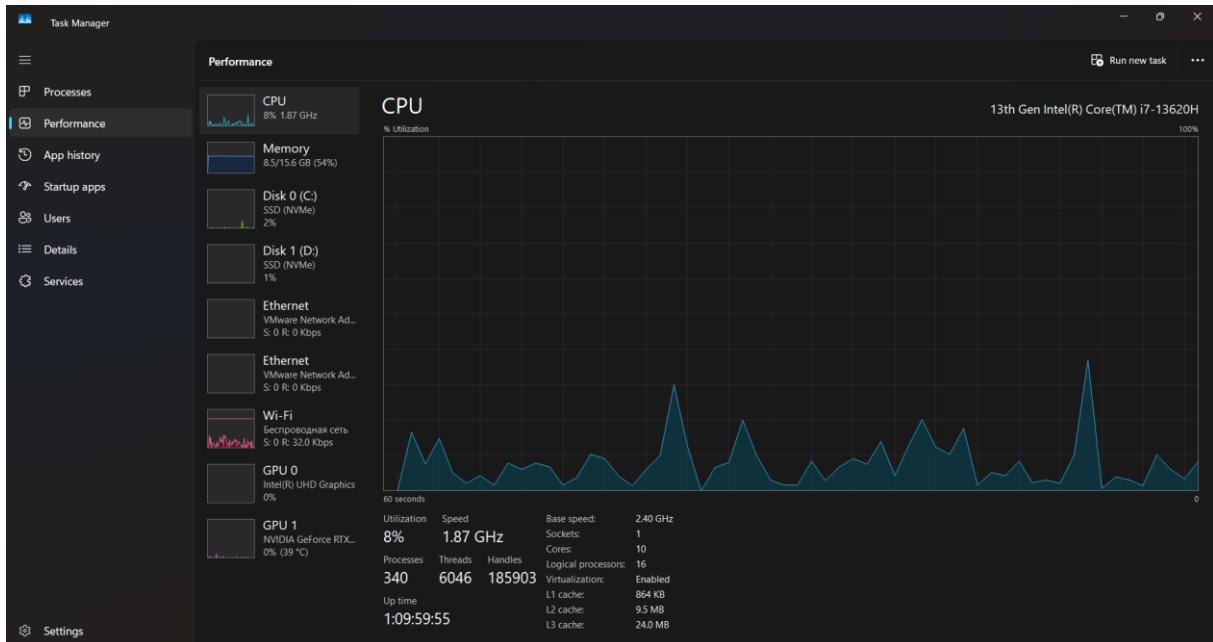
- c) Open the system properties with a **Win + R** key combination, take a screenshot of the open screen. Paste this screenshot into this template.



I used Win + Pause

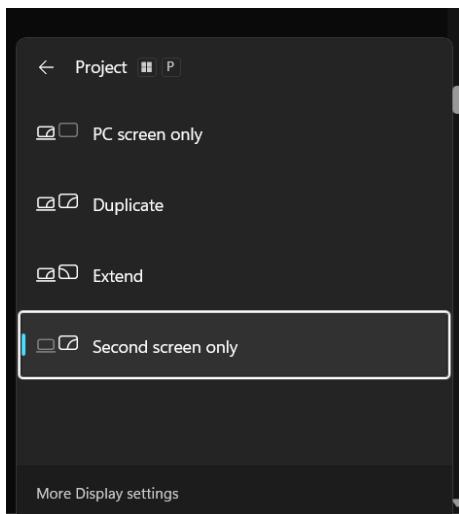
- d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.





- 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?

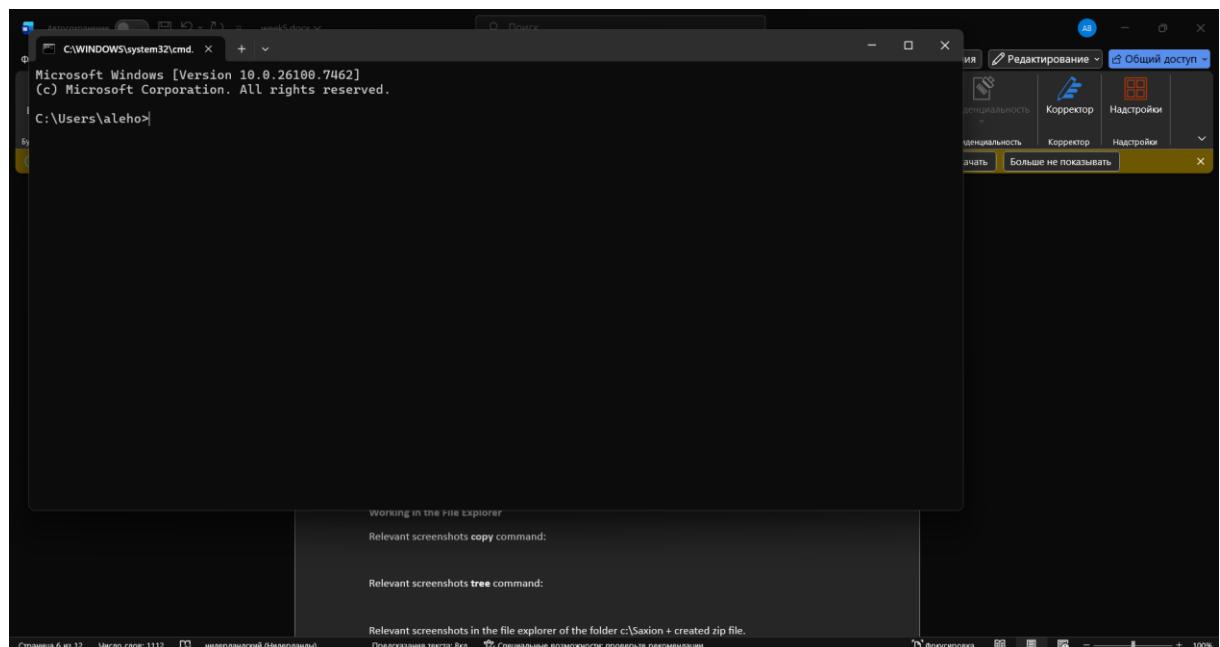
You should use the Windows + P key combination. This opens the Project menu where you can choose Extend, Duplicate, or Second screen only, allowing you to use the projector as a second screen for your presentation



- 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?

I can use Win + L combination to lock the screen.

- 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:

```
C:\Windows\System32\cmd.e... Microsoft Windows [Version 10.0.26200.7462] (c) Microsoft Corporation. All rights reserved. C:\SAXION>copy Wave.png "HBOICT\Year 1\QUARTILE1\Intro to Programming" 1 file(s) copied. C:\SAXION>copy C:\SAXION\Plug.png "C:\SAXION\HBOICT\Year 1\QUARTILE1\Intro to Infrastructures" 1 file(s) copied. C:\SAXION>copy C:\SAXION\Tumble.png "C:\SAXION\HBOICT\Year 1\QUARTILE1\Int Synergy" 1 file(s) copied. C:\SAXION>
```

Relevant screenshots **tree** command:

```
Folder PATH listing
Volume serial number is EEA1-ED73
C:.
└── HBOICT
    ├── Year 1
    │   ├── QUARTILE1
    │   │   ├── int Synergy
    │   │   ├── Intro to Infrostructures
    │   │   └── Intro to Programming
    │   ├── QUARTILE2
    │   │   ├── Databases
    │   │   ├── IT Fundamentals
    │   │   └── Project it's in the game
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── Year 2
    │   ├── QUARTILE1
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── Year 3
    │   ├── QUARTILE1
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    └── Year 4
        ├── QUARTILE1
        ├── QUARTILE2
        ├── QUARTILE3
        └── QUARTILE4
```

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

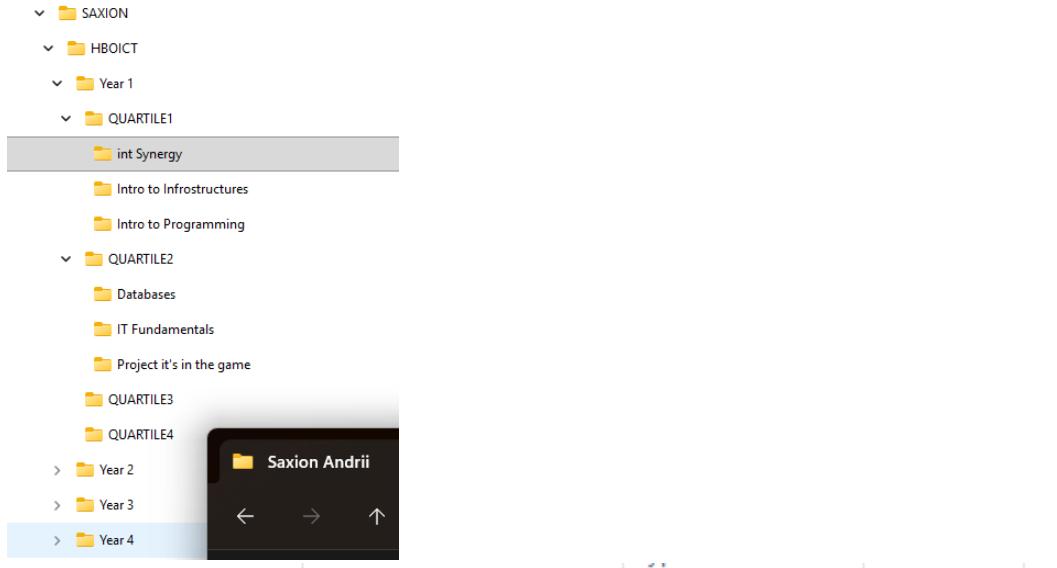
```
C:\SAXION>
```

Saxion Andrii

X

+

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



HBOICT	12/12/2025 22:12	File folder	
Plug	26/06/2020 15:13	PNG File	937 KB
SAXION	12/12/2025 19:28	Compressed (zipp...)	5.430 KB
Tumble	12/12/2025 19:06	PNG File	37 KB
Wave	12/12/2025 13:37	PNG File	1.792 KB

Terminating Processes

Relevant Screenshots Task Manager Window:



Install Software

Relevant screenshots that the following software is installed with winget:

```

C:\Windows\System32>winget install -e --id Mozilla.Firefox
Found Mozilla Firefox (en-US) [Mozilla.Firefox] Version 146.0
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/win64/en-US/Firefox%20Setup%20146.0.exe
82.2 MB / 82.2 MB
Successfully verified installer hash
Starting package install...
Successfully installed
a) C:\Windows\System32>

```

- b) The command tells Winget to install the official Firefox browser. The `-e` option means exact match, so Winget only uses the package whose name or ID is exactly the same. The `--id` option specifies the

unique package identifier in the Winget database. This guarantees Winget installs the correct Firefox installer.

- WinSCP
- Notepad++
- 7zip

c)

```
C:\Users\user>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 24.09 ZS v1.5.7 R1 Tag: 7zip winget
7-Zip Alpha (exe) 7zip.7zip.Alpha.exe 24.01      winget
7-Zip Alpha (msi) 7zip.7zip.Alpha.msi 24.01.00.0 winget
7zr            7zip.7zr        25.01       winget
QNapi          QNapi.QNapi    0.2.3       Tag: p7zip winget

C:\Users\user>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\user>winget search notepad++
Name           Id             Version      Match      Source
Notepad++      Notepad++.Notepad++ 8.8.9   ProductCode: notepad++ winget
Notepad Next   dail8859.NotepadNext 0.12    Tag: notepad++ winget

C:\Users\user>winget install -e --id Notepad++.Notepad++
Found Notepad++ [Notepad++.Notepad++] Version 8.8.9
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/v8.8.9/npp.8.8.9.Installer.x64.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
```

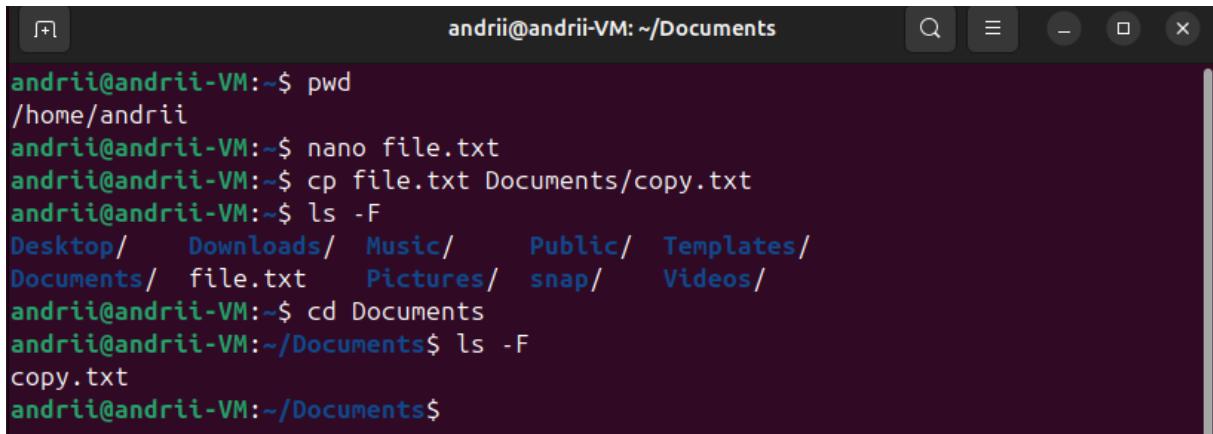
```
C:\Windows\System32>winget install -e --id WinSCP.WinSCP
Found WinSCP [WinSCP.WinSCP] Version 6.5.5
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://sourceforge.net/projects/winscp/files/WinSCP/6.5.5/WinSCP-6.5.5-Setup.exe/download
[██████████] 11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

Assignment 5.4: Working with Linux

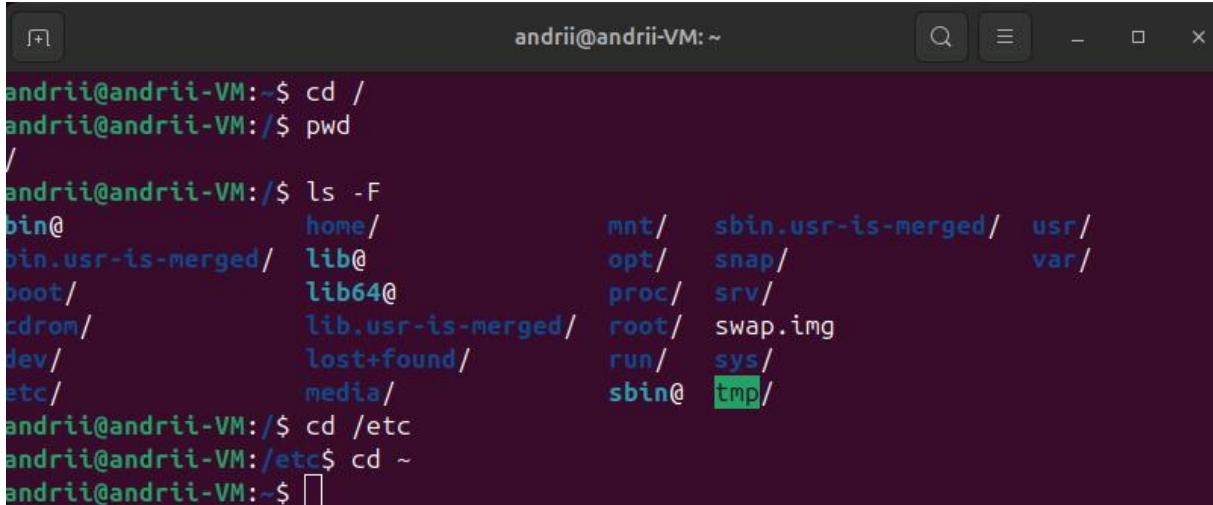
Relevant screenshots + motivation

- Copying files



```
andrii@andrii-VM:~$ pwd
/home/andrii
andrii@andrii-VM:~$ nano file.txt
andrii@andrii-VM:~$ cp file.txt Documents/copy.txt
andrii@andrii-VM:~$ ls -F
Desktop/ Downloads/ Music/ Public/ Templates/
Documents/ file.txt Pictures/ snap/ Videos/
andrii@andrii-VM:~$ cd Documents
andrii@andrii-VM:~/Documents$ ls -F
copy.txt
andrii@andrii-VM:~/Documents$
```

- Navigating the file structure

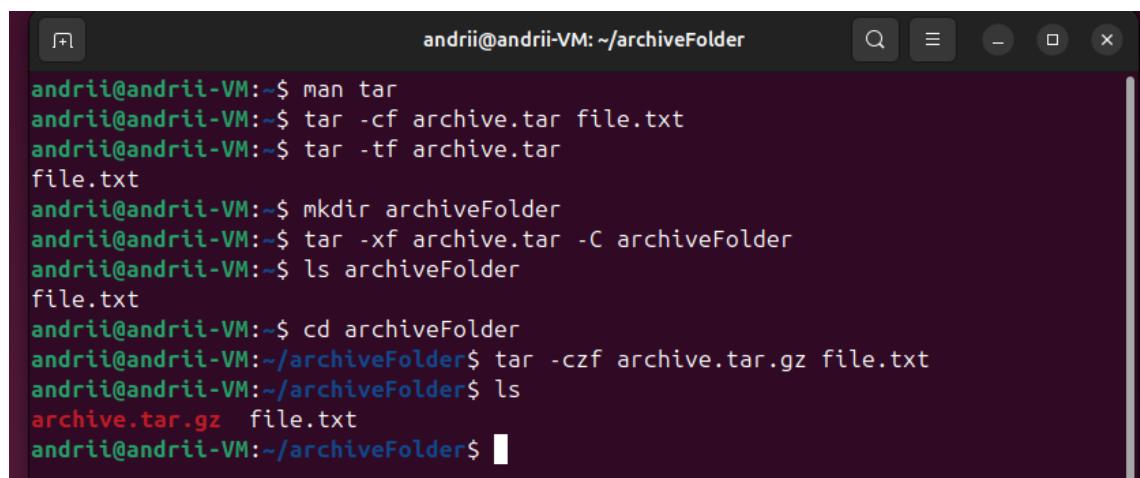


```
andrii@andrii-VM:~$ cd /
andrii@andrii-VM:$ pwd
/
andrii@andrii-VM:$ ls -F
bin@          home/           mnt/    sbin usr-is-merged/  usr/
bin usr-is-merged/ lib@          opt/    snap/           var/
boot/         lib64@          proc/   srv/
cdrom/        lib usr-is-merged/ root/   swap.img
dev/          lost+found/     run/    sys/
etc/          media/          sbin@   tmp/
andrii@andrii-VM:$ cd /etc
andrii@andrii-VM:/etc$ cd ~
andrii@andrii-VM:~$
```

In Linux everything starts from a single root directory `/`, whereas in Windows everything starts from drives like `C:\` or `D:\`.

`/etc` is a folder where Linux stores system configuration files.

- Compress files



```
andrii@andrii-VM:~$ man tar
andrii@andrii-VM:~$ tar -cf archive.tar file.txt
andrii@andrii-VM:~$ tar -tf archive.tar
file.txt
andrii@andrii-VM:~$ mkdir archiveFolder
andrii@andrii-VM:~$ tar -xf archive.tar -C archiveFolder
andrii@andrii-VM:~$ ls archiveFolder
file.txt
andrii@andrii-VM:~$ cd archiveFolder
andrii@andrii-VM:~/archiveFolder$ tar -czf archive.tar.gz file.txt
andrii@andrii-VM:~/archiveFolder$ ls
archive.tar.gz  file.txt
andrii@andrii-VM:~/archiveFolder$
```

- View processes

The screenshot shows the htop command-line interface. At the top, it displays system statistics: CPU usage (0[|||] 2.6%, 1[|||] 4.0%, 2[|||] 5.3%, 3[|||] 3.3%), Load average (0.32 0.17 0.06), Uptime (00:01:23), Memory usage (Mem[|||||] 1.01G/3.78G), and Swap usage (Swp[] 0K/3.78G). Below this is a table of processes. The first few rows show user processes like 'andrii' and system daemons like 'root'. The table includes columns for PID, USER, PRI, NI, VIRT, RES, SHR, S, CPU%, %MEM%, TIME+, and Command. The bottom of the screen shows a series of function keys: F1Help, F2Setup, F3Search, F4Filter, F5Tree, F6SortBy, F7Nice, F8Nice +, F9Kill, and F10Quit.

	Main	I/O									
PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	%MEM%	TIME+	Command
3290	andrii	20	0	543M	55288	42976	S	6.6	1.4	0:00.54	/usr/libexec/
2444	andrii	20	0	4380M	288M	126M	S	5.3	7.5	0:03.14	/usr/bin/gnom
3494	andrii	20	0	11472	5116	3608	R	2.0	0.1	0:00.75	htop
2488	andrii	-21	0	4380M	288M	126M	S	0.7	7.5	0:00.17	/usr/bin/gnom
2793	andrii	20	0	379M	12408	7100	S	0.7	0.3	0:00.07	/usr/bin/ibus
3095	andrii	20	0	3074M	64604	49048	S	0.7	1.6	0:00.23	gjs /usr/shar
1	root	20	0	23132	14340	9544	S	0.0	0.4	0:01.43	/sbin/init sp
381	root	19	-1	42656	17836	16260	S	0.0	0.5	0:00.21	/usr/lib/syst
416	root	20	0	148M	1652	1352	S	0.0	0.0	0:00.00	vmware-vmbloc
417	root	20	0	148M	1652	1352	S	0.0	0.0	0:00.00	vmware-vmbloc
418	root	20	0	148M	1652	1352	S	0.0	0.0	0:00.00	vmware-vmbloc
439	root	20	0	32312	10488	5004	S	0.0	0.3	0:00.17	/usr/lib/syst
601	systemd-oo	20	0	17560	7644	6736	S	0.0	0.2	0:00.05	/usr/lib/syst

htop that shows real-time CPU, memory, and process usage. It lets you see which programs are using the most resources and manage processes.

- Install Software

The screenshot shows a terminal window with a decorative banner at the top. The banner contains a stylized ASCII art logo on the left and system information on the right. The system information includes:

- OS: Ubuntu 24.04.3 LTS x86_64
- Host: VMware Virtual Platform None
- Kernel: 6.14.0-36-generic
- Uptime: 5 mins
- Packages: 1651 (dpkg), 10 (snap)
- Shell: bash 5.2.21
- Resolution: 1718x878
- DE: GNOME 46.0
- WM: Mutter
- WM Theme: Adwaita
- Theme: Yaru [GTK2/3]
- Icons: Yaru [GTK2/3]
- Terminal: gnome-terminal
- CPU: 13th Gen Intel i7-13620H (4) @ 2.50GHz
- GPU: 00:0f.0 VMware SVGA II Adapter
- Memory: 1039MiB / 3867MiB

At the bottom of the terminal, there is a color palette consisting of a 4x4 grid of colored squares.

Neofetch shows a summary of your system's hardware, OS, and resource information in the terminal.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
andrii@andrii-VM:~$ mkdir ~/hello
andrii@andrii-VM:~$ ls
archiveFolder  Documents      file.txt  Music       Pictures  Templates
archive.tar    Downloads       hello     oldcar.    Public    Videos
Desktop        email-base64.txt ii.jpg    output.gif snap
andrii@andrii-VM:~$ nano hello/hello.sh
andrii@andrii-VM:~$ cd hello
andrii@andrii-VM:~/hello$ chmod +x hello.sh
andrii@andrii-VM:~/hello$ ./hello.sh
Hello Andrii, 578856!
andrii@andrii-VM:~/hello$
```

```
andrii@andrii-VM:~$ mkdir ~/hello
andrii@andrii-VM:~$ ls
archiveFolder  Documents      file.txt  Music       Pictures  Templates
archive.tar    Downloads       hello     oldcar.    Public    Videos
Desktop        email-base64.txt ii.jpg    output.gif snap
andrii@andrii-VM:~$ nano hello/hello.sh
andrii@andrii-VM:~$ cd hello
andrii@andrii-VM:~/hello$ chmod +x hello.sh
andrii@andrii-VM:~/hello$ ./hello.sh
Hello Andrii, 578856!
andrii@andrii-VM:~/hello$ man chmod
andrii@andrii-VM:~/hello$ man chmod
andrii@andrii-VM:~/hello$ chmod 744 hello.sh
andrii@andrii-VM:~/hello$ ls -l hello.sh
-rwxr--r-- 1 andrii andrii 39 Dec 12 20:05 hello.sh
andrii@andrii-VM:~/hello$
```

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

```
andrii@andrii-VM:~$ wc -l sherlock.txt
12304 sherlock.txt
andrii@andrii-VM:~$ wc -w sherlock.txt
107560 sherlock.txt
andrii@andrii-VM:~$ wc -m sherlock.txt
593837 sherlock.txt
andrii@andrii-VM:~$ grep -n "kingdom" sherlock.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
andrii@andrii-VM:~$ head -n 500 sherlock.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.

andrii@andrii-VM:~$
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

```
--usage                               Display brief usage message
andrii@andrii-VM:~$ 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
YCbcCr 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
F-Number -- . . . |f/2.0
Exposure Program |Normal program
ISO Speed Ratings |64
Exif Version  |Exif Version 2.2
Date and Time (Origin) |2020:11:07 15:08:57
Date and Time (Digit) |2020:11:07 15:08:57
Components Configuration |Y Cb Cr -
Shutter Speed   |5.05 EV (1/33 sec.)
Aperture       |2.00 EV (f/2.0)
Brightness      |-1.00 EV (1.71 cd/m^2)
Exposure Bias   |0.00 EV
Maximum Aperture Value |2.00 EV (f/2.0)
Metering Mode   |Center-weighted average
```

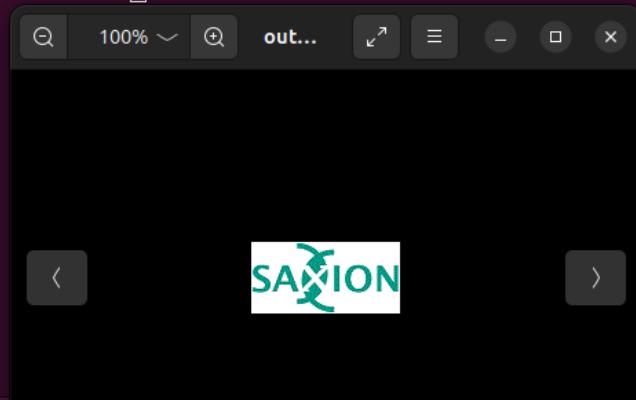
Phone: moto g(6) play.

Location: the photo was made in Groningen.

```
andrii@andrii-VM:~$ 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, 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
```

It still recognises it as a jpeg file.

```
andrii@andrii-VM:~$ man base64  
andrii@andrii-VM:~$ base64 -d email-base64.txt > output.gif  
andrii@andrii-VM:~$ file output.gif  
output.gif: GIF image data, version 89a, 108 x 52  
andrii@andrii-VM:~$
```



Assignment 5.8: Steganography

Relevant screenshots + motivation

```
andrii@andrii-VM:~/Downloads  
-sf, --stegofile      select stego file  
  -sf <filename>    extract data from <filename>  
-p, --passphrase      specify passphrase  
  -p <passphrase>   use <passphrase> to extract data  
-xf, --extractfile    select file name for extracted data  
  -xf <filename>    write the extracted data to <filename>  
-f, --force            overwrite existing files  
-q, --quiet           suppress information messages  
-v, --verbose          display detailed information  
  
options for the info command:  
-p, --passphrase      specify passphrase  
  -p <passphrase>   use <passphrase> to get info about embedded data  
  
To embed emb.txt in cvr.jpg: steghide embed -cf cvr.jpg -ef emb.txt  
To extract embedded data from stg.jpg: steghide extract -sf stg.jpg  
andrii@andrii-VM:~/Downloads$ steghide extract -sf apple2.jpg  
Enter passphrase:  
wrote extracted data to "message.txt".  
andrii@andrii-VM:~/Downloads$ cat message.txt  
Hello class.  
You have almost completed Week 5.  
andrii@andrii-VM:~/Downloads$
```

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.

```
andrii@debian13:~$ sudo apt update
[sudo] password for andrii:
Hit:1 http://deb.debian.org/debian trixie InRelease
Get:2 http://deb.debian.org/debian trixie-updates InRelease [47.3 kB]
Get:3 http://security.debian.org/debian-security trixie-security InRelease [43.4 kB]
Get:4 http://security.debian.org/debian-security trixie-security/main Sources [112 kB]
Get:5 http://security.debian.org/debian-security trixie-security/main amd64 Packages [82.1 kB]
Get:6 http://security.debian.org/debian-security trixie-security/main Translation-en [51.9 kB]
Fetched 336 kB in 0s (1,940 kB/s)
1 package can be upgraded. Run 'apt list --upgradable' to see it.
andrii@debian13:~$ sudo apt install openssh-server -y
openssh-server is already the newest version (1:10.0+1-7).
openssh-server set to manually installed.
Summary:
  Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 1
andrii@debian13:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
andrii@debian13:~$ sudo mkdir -p /srv/images
andrii@debian13:~$ sudo chown $USER:$USER /srv/images
andrii@debian13:~$ ls /srv/images
andrii@debian13:~$ ls -ld /srv/images
drwxr-xr-x 2 andrii andrii 4096 Dec 13 20:22 /srv/images
andrii@debian13:~$ _
```

```
andrii@andrii-VM:~$ ssh andrii@192.168.139.135
The authenticity of host '192.168.139.135 (192.168.139.135)' can't be established.
ED25519 key fingerprint is SHA256:kPc4h6REgh03s7vP9gj2PRSRkh+n4oYl1V9BDTGEWCo.
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 '192.168.139.135' (ED25519) to the list of known hosts.
andrii@192.168.139.135's password:
Linux debian13 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.
andrii@debian13:~$
```

```

ubuntu@ubuntu:~$ lsblk
NAME      MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0      7:0     0  1.7G  1 loop /rofs
loop1      7:1     0 535.4M  1 loop
loop2      7:2     0  926M  1 loop
loop3      7:3     0    4K  1 loop /snap/bare/5
loop4      7:4     0 73.9M  1 loop /snap/core22/2111
loop5      7:5     0 246.4M  1 loop /snap/firefox/6738
loop6      7:6     0 11.1M  1 loop /snap/firmware-updater/167
loop7      7:7     0  516M  1 loop /snap/gnome-42-2204/202
loop8      7:8     0 10.8M  1 loop /snap/snap-store/1270
loop9      7:9     0  91.7M  1 loop /snap/gtk-common-themes/1535
loop10     7:10    0  226M  1 loop /snap/thunderbird/796
loop11     7:11    0  50.8M  1 loop /snap/snapd/25202
loop12     7:12    0  576K  1 loop /snap/snapd-desktop-integration/315
loop13     7:13    0 112.6M  1 loop /snap/ubuntu-desktop-bootstrap/413
sr0        11:0    1  5.9G  0 rom /cdrom
nvme0n1    259:0   0   64G  0 disk
└─nvme0n1p1 259:1   0    1M  0 part
└─nvme0n1p2 259:2   0   64G  0 part
ubuntu@ubuntu:~$ 

```

```

| nvme0n1p1 259:1   0    1M  0 part
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh andrii@192.168.139.135 "cat > /srv/images/ubuntu2404_vm.img.gz"
The authenticity of host '192.168.139.135 (192.168.139.135)' can't be established.
ED25519 key fingerprint is SHA256:kPc4h6REgh03s7vP9gj2PRSRkh+n4oYl1V9BDTGEWCo.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.135' (ED25519) to the list of known hosts.
andrii@192.168.139.135's password:
Permission denied, please try again.
andrii@192.168.139.135's password:
68484595712 bytes (68 GB, 64 GiB) copied, 559 s, 123 MB/s
16384+0 records in
16384+0 records out
68719476736 bytes (69 GB, 64 GiB) copied, 560.012 s, 123 MB/s
ubuntu@ubuntu:~$ 

```

```

| andrii@debian13:~/Downloads$ ls /srv/images
| ubuntu2404_vm.img.gz
| andrii@debian13:~/Downloads$ 

```

I forgot to take a screenshot after doing `sudo dd if=/dev/sda bs=4M status=progress | gzip | ssh @ "cat > /srv/images/ubuntu2404_vm.img.gz"`, but I attached screenshots from restored VM.

