

Template Week 5 – Operating Systems

Student number: 588963

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; it is usually commercial and certified. Unix-like system behaves like UNIX, but are not official UNIX, most of them are open sources.

- 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 creators of UNIX at Bell Labs, he helped design the first UNIX system.

Dennis Ritchie: Co-creator of UNIX. He invented the C programming language.

Bill Joy: the founder of Sun Microsystems, he influenced networking and UNIX development.

Richard Stallman: the founder of the GNU Project, he created many GNU tools used in Linux today.

Linus Torvalds: The creator of Linus kernel, he changed IT forever by making Linux open source.

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

The GNU philosophy says that software should be free to use and freedom is more important than price.

- d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement?

Please explain your answer.

Yes, most of them. Ubuntu uses the Linus kernel and a lot of GNU tools, and it is an open source and free to use.

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

It lets the user to run Linux command and tools inside the Windows without installing a full Linux OS and you can also run Ubuntu via the terminal.

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

Android: Linux.

iOS: Unix,

ChromeOS: Linux.

Assignment 5.2: Supercomputers and gameconsoles

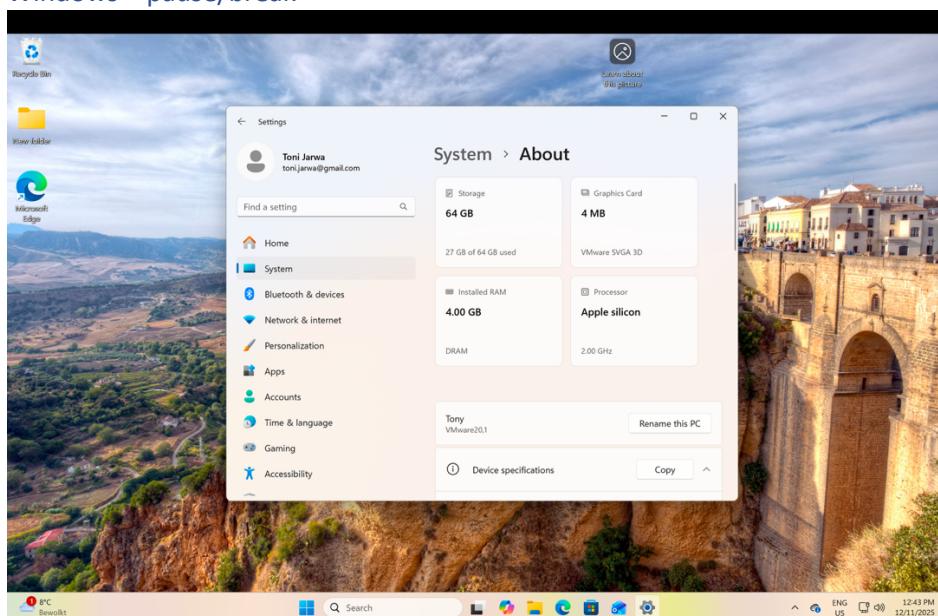
- a) Research on this site what supercomputers are used for and write a short summary of it:
<https://www.computerhistory.org/timeline/search/?q=Supercomputer>
Supercomputers are used for weather forecasting, climate research, scientific simulations, space research, medical research and artificial intelligence. They perform very large and complex calculations.
- 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 PS3 cluster is a group of PlayStation 3 consoles connected together, are used as a cheap supercomputer. It is used for scientific research, physics simulations and military and university research.
- 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?
The cluster runs Linux.
- 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, Raspberry Pi devices are not powerful enough and top 500 systems are extremely fast supercomputers.
- e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?
Both use x86-64 (AMD).
What operating systems run on these consoles?
PS5: Custom UNIX-like OS.
Xbox X: Custom Windows-based OS.
What conclusion can you draw from the answer to the previous question?
Modern consoles use PC-like hardware.
Devices can have different operating systems, but a same CPU.
Modern OS design is very flexible.

Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

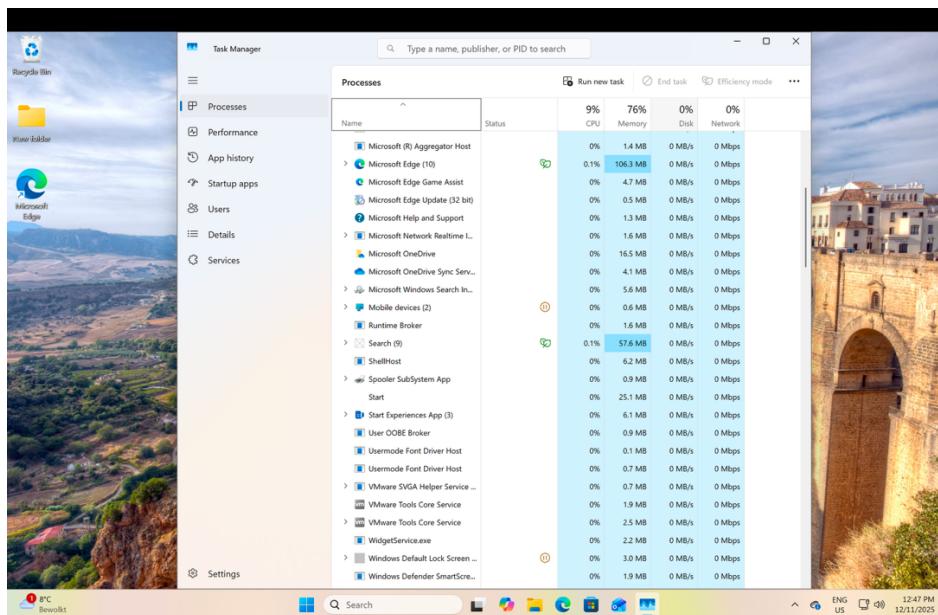
- Practice for about 10 minutes with the **Windows** keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.
- The file explorer can be opened with **Windows + E**, Which key combination could you also use?
Ctrl + N if nothing is open.
- Open the system properties with a **Windows** key combination, take a screenshot of the open screen. Paste this screenshot into this template.

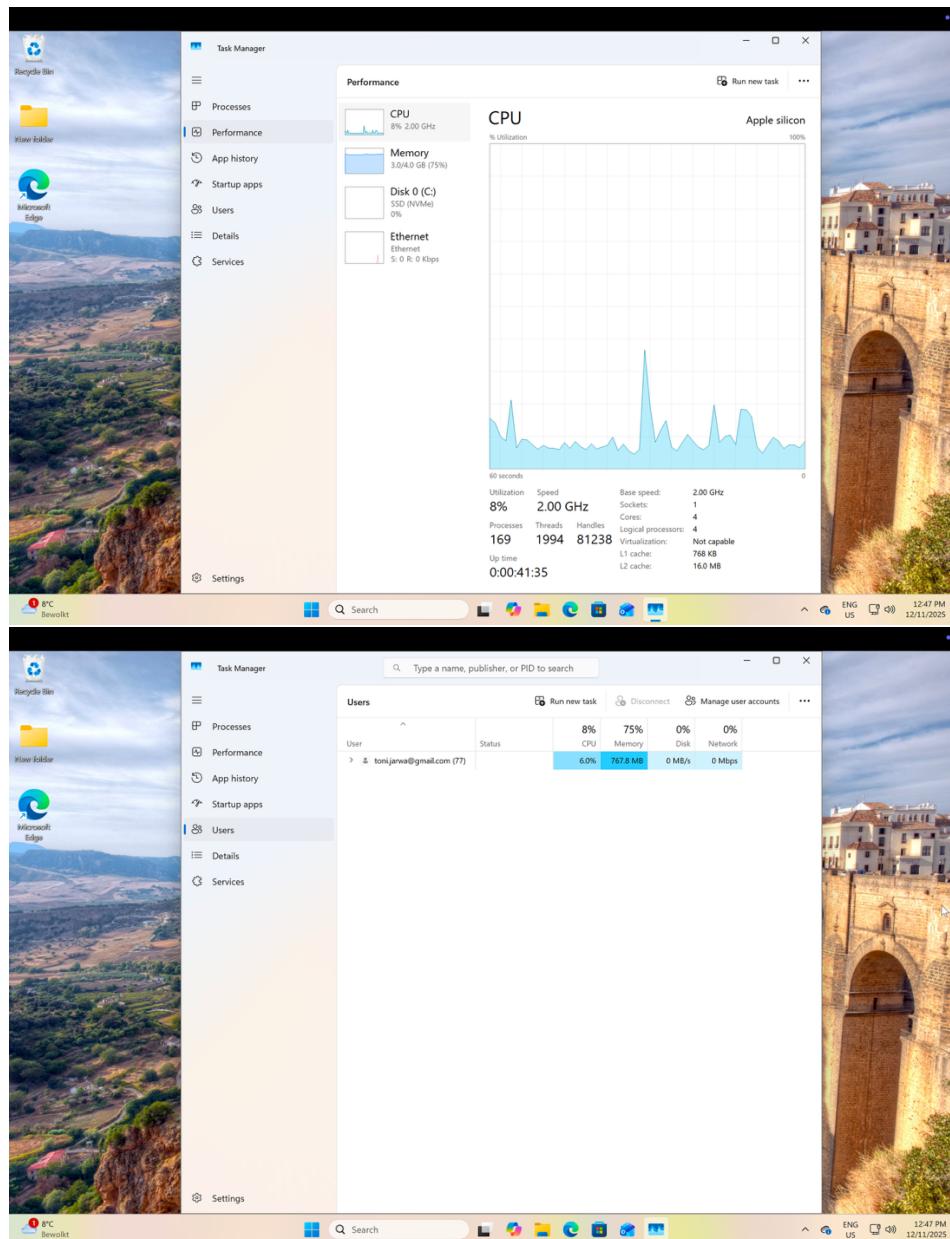
[Windows + pause/break](#)



- 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.

[Shift + Ctrl + 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?

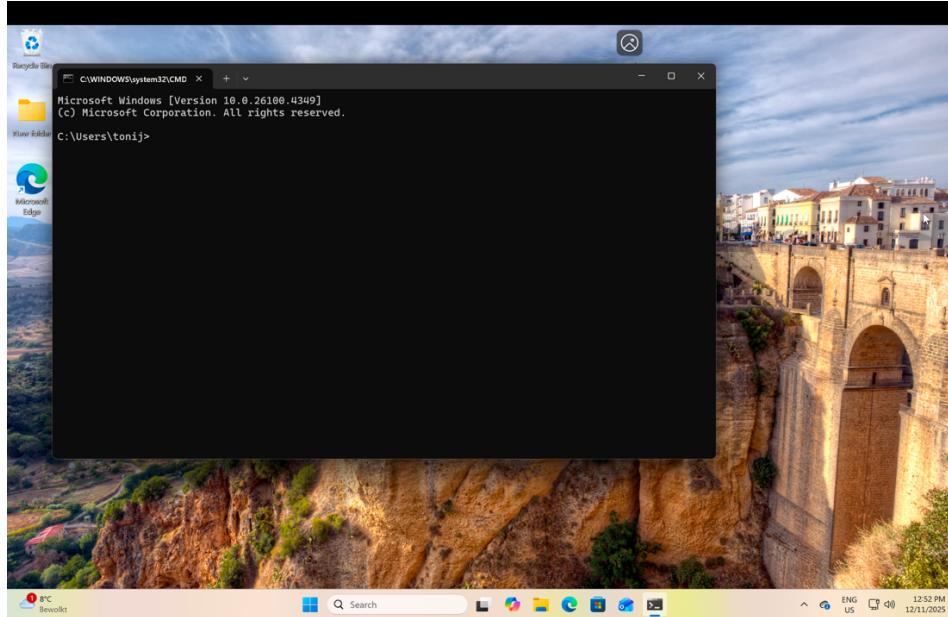
Windows + P

- 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

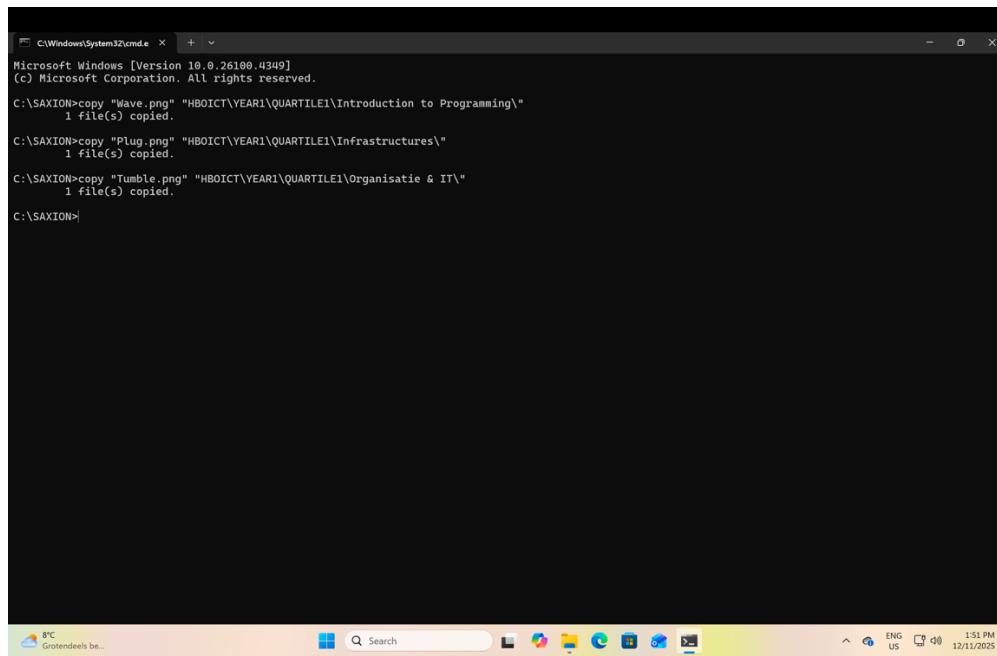
- g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.

Windows + R



Working in the File Explorer

Relevant screenshots **copy** command:



Relevant screenshots **tree** command:

```
C:\Windows\System32\cmd.exe + 
Microsoft Windows [Version 10.0_26100_4349]
(c) Microsoft Corporation. All rights reserved.

C:\SAXION>copy "Wave.png" "HBOICT\YEAR1\QUARTILE1\Introduction to Programming\"
1 file(s) copied.

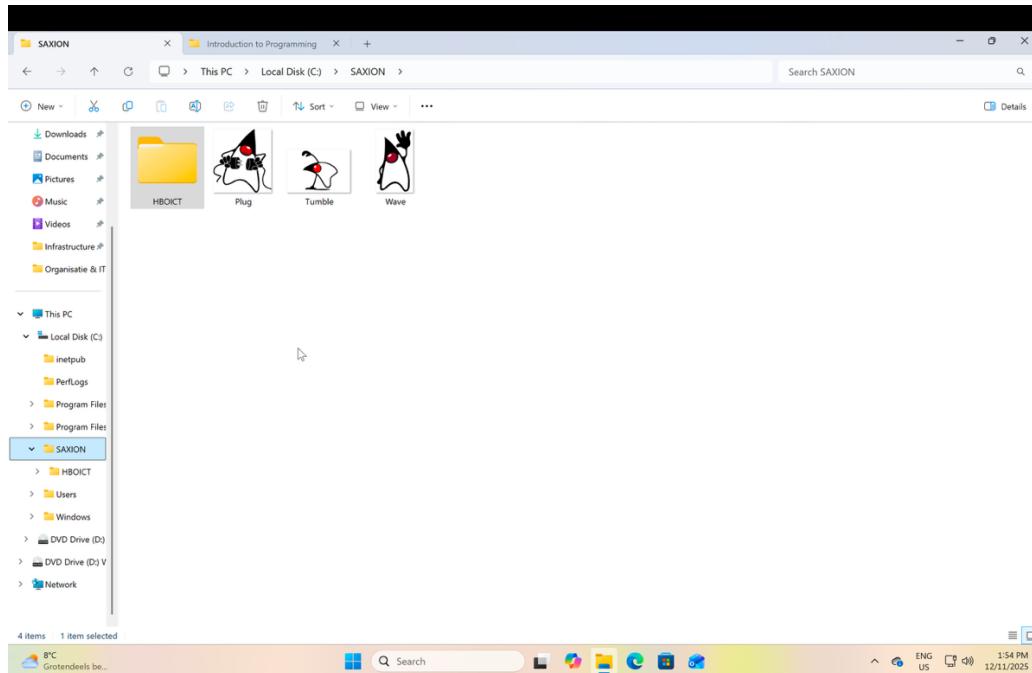
C:\SAXION>copy "Plug.png" "HBOICT\YEAR1\QUARTILE1\Infrastructures\"
1 file(s) copied.

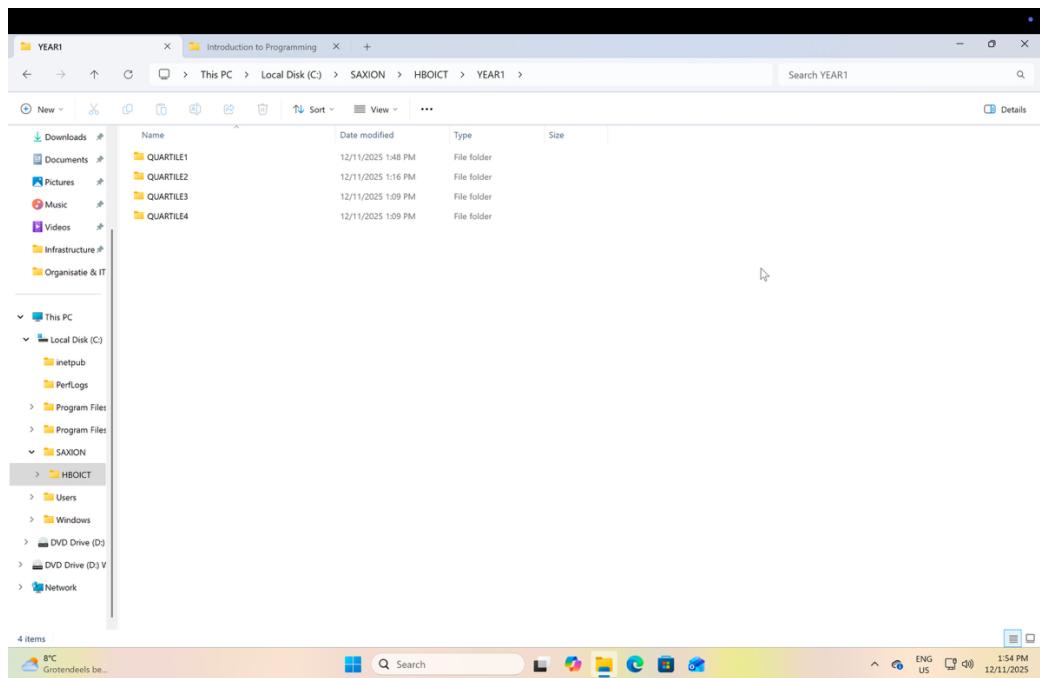
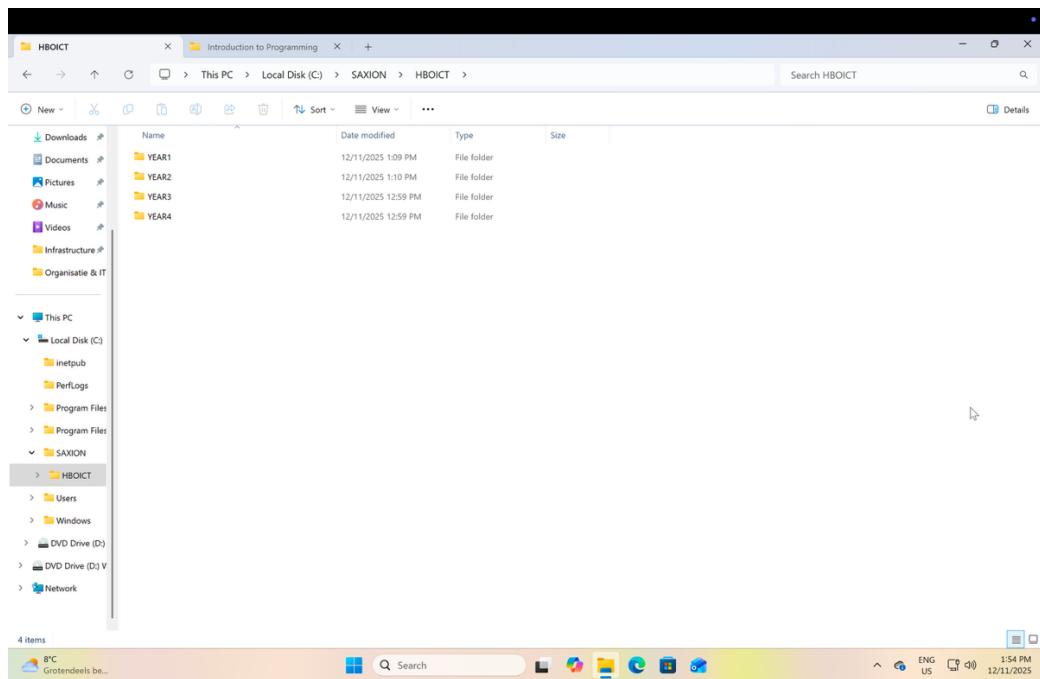
C:\SAXION>copy "Tumble.png" "HBOICT\YEAR1\QUARTILE1\Organisatie & IT\"
1 file(s) copied.

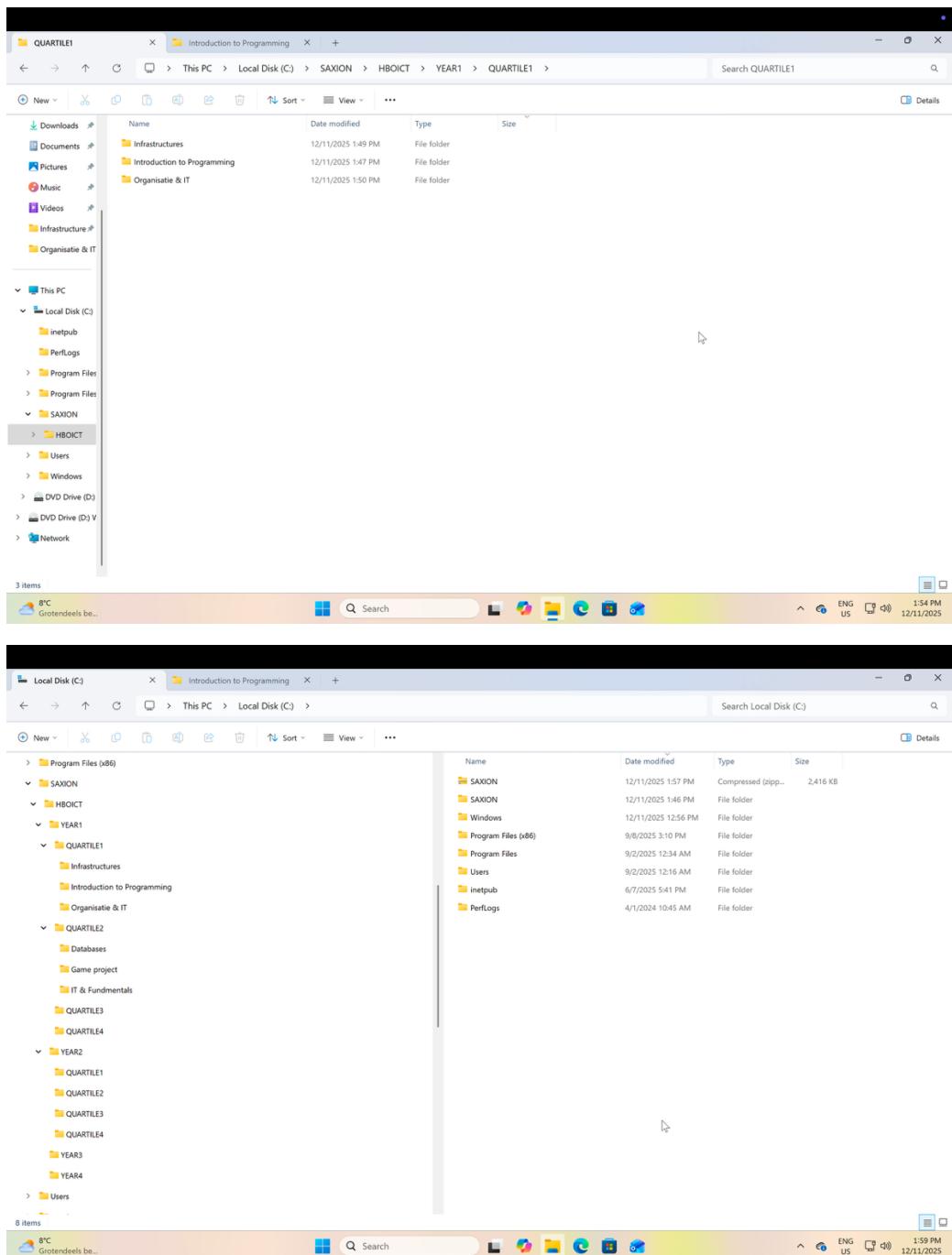
C:\SAXION>tree
Folder PATH listing
Volume serial number is 000001FF 0A7B:E6B1
C:.
└── HBOICT
    ├── YEAR1
    │   ├── QUARTILE1
    │   │   ├── Infrastructures
    │   │   │   ├── Introduction to Programming
    │   │   │   └── Organisatie & IT
    │   ├── QUARTILE2
    │   │   ├── Databases
    │   │   │   ├── Game project
    │   │   │   └── IT & Fundamentals
    │   ├── QUARTILE3
    │   ├── QUARTILE4
    │   └── YEAR2
    │       ├── QUARTILE1
    │       ├── QUARTILE2
    │       ├── QUARTILE3
    │       └── QUARTILE4
    └── YEAR3
        └── YEAR4

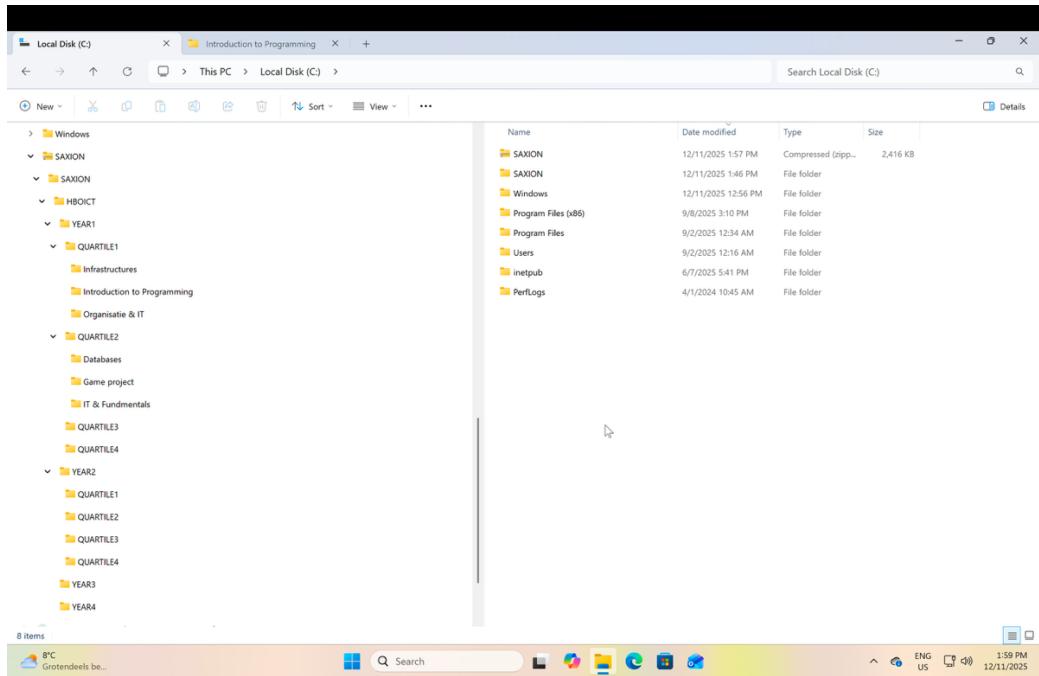
C:\SAXION>echo %username%
tonij
C:\SAXION>
```

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



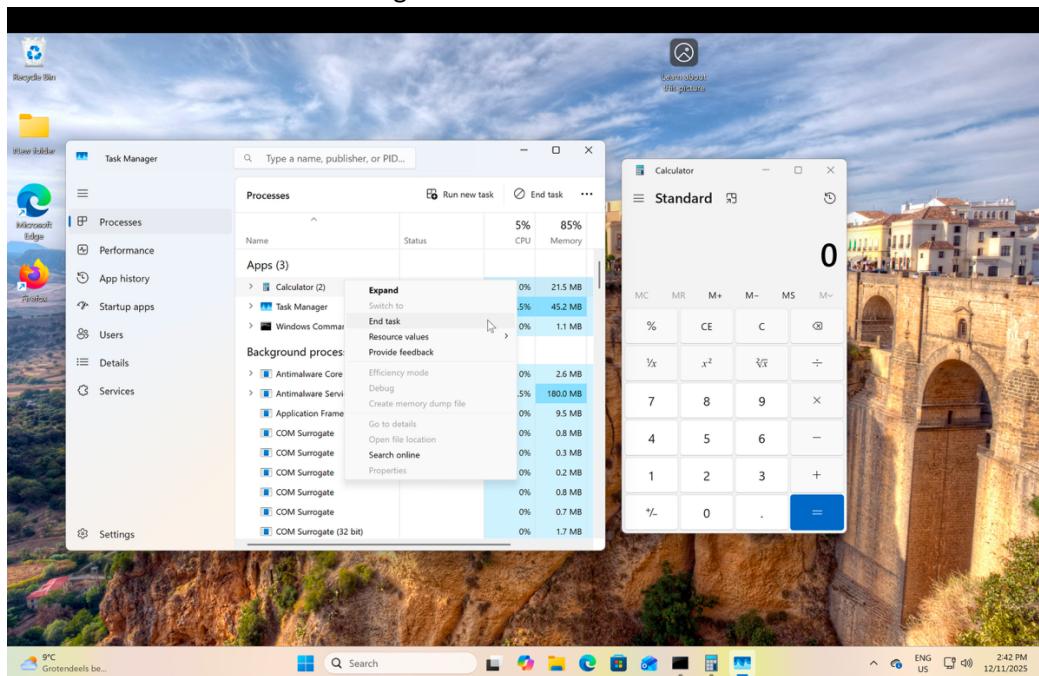


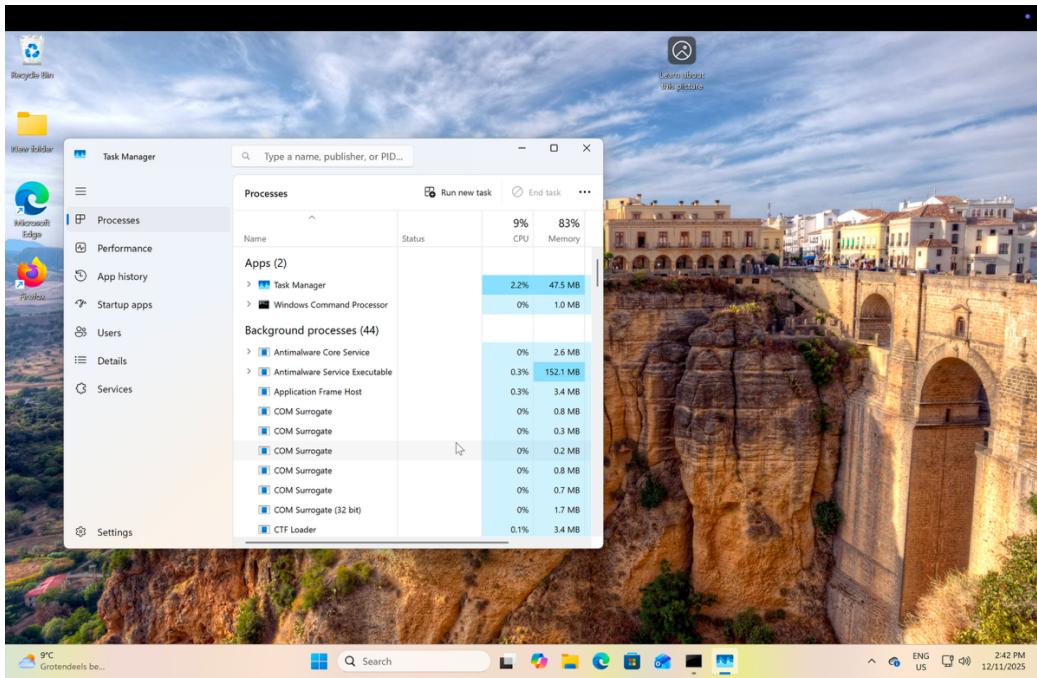




Terminating Processes

Relevant Screenshots Task Manager Window:





Install Software

Relevant screenshots that the following software is installed with winget:

```

Administrator: Command Prompt
C:\Windows\system32>winget install -e --id Mozilla.Firefox
Found Mozilla Firefox (en-US) [Mozilla.Firefox] Version 146.0
This package is licensed under your Microsoft License Agreement.
Microsoft is not responsible for any licenses it does not grant to third-party packages.
Downloading https://download-installer.cdn.mozilla.net/pub/firefox/releases/146.0/win64-aarch64/en-US/firefox%20Setup%20146.0.exe
  75.4 MB / 75.4 MB
Successfully verified installer hash
Starting package install...
Successfully Installed

C:\Windows\System32>

```

-e is for exact, searching for the exact package ID from Firefox, not something with a similar name.

--id this is the unique identifier for Firefox package in the Winget repository.

- WinSCP

```

Administrator: Command Prompt
Mozilla Firefox ESR (Ur) Mozilla.Firefox.ESR.ur 140.5.0 winget
Mozilla Firefox ESR (Uz) Mozilla.Firefox.ESR.uz 140.5.0 winget
Mozilla Firefox ESR (Vi) Mozilla.Firefox.ESR.vi 140.5.0 winget
Mozilla Firefox ESR (Xh) Mozilla.Firefox.ESR.xh 140.5.0 winget
Mozilla Firefox ESR (Zh-CN) Mozilla.Firefox.ESR.zh-CN 140.5.0 winget
Mozilla Firefox ESR (Zh-TW) Mozilla.Firefox.ESR.zh-TW 140.5.0 winget
Mozilla Firefox (MSIX) Night Mozilla.Firefox.MSIX.Night. 147.20 winget
Profile Switcher for Firefox nulldev.ProfileSwitcherfor... 0.1.1 winget
Abaze Floorp Abaze.Floorp 12.8.3... Tag: firefox-fo... winget
Floorp 12 Daylight Abaze.Floorp.Daylight 138.0... Tag: firefox-fo... winget
Moonbeam MoonbeamProductions.PaleM... 2024.8... Tag: firefoxfo... winget
Ghostry Ghostry.GhosteryDown TimVisee.ffmpeg 0.2.76 Tag: firefox-se... winget

C:\Windows\System32>winget install -e -id Mozilla.Firefox
Found Mozilla Firefox [Mozilla.Firefox] Version 145.0
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-aarch64/en-US/firefox%20setup%20146.0.exe
75.4 MB / 75.4 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>Explain in your own words what exactly the above command does, explain the -e and
-e:id options used as well.Explain in your own words what exactly the above command does, explain the -e and
-e:id is not recognized as an internal or external command,
operable program or batch file.

C:\Windows\System32>-id options used as well.Explain in your own words what exactly the above command does, explain the -e and
-e:id is not recognized as an internal or external command,
operable program or batch file.

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
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>Explain in your own words what exactly the above command does, explain the -e and
-e:id is not recognized as an internal or external command,
operable program or batch file.

C:\Windows\System32>-id options used as well.Explain in your own words what exactly the above command does, explain the -e and
-e:id is not recognized as an internal or external command,
operable program or batch file.

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>winget install -e -id Notepad++.Notepad++
Found Notepad++ [Notepad++.Notepad+] Version 8.8.8
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/v8.8.8/npp.8.8.8.Installer.arm64.exe
6.31 MB / 6.31 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>

```

Activate Windows
Go to Settings to activate Windows.

- 7zip

```
C:\Windows\System32>winget install -e --id WinSCP.WinSCP
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>winget install -e --id Notepad++.Notepad++
Found Notepad++ [Notepad++.Notepad+] Version 8.3.8
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/v8.8.8/npp.8.8.8.Installer.arm64.exe
  6.31 MB / 6.31 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id 7zip.7zip
Found 7zip [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://7zip.org/a/7z2501-arm64.exe
  1.51 MB / 1.51 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

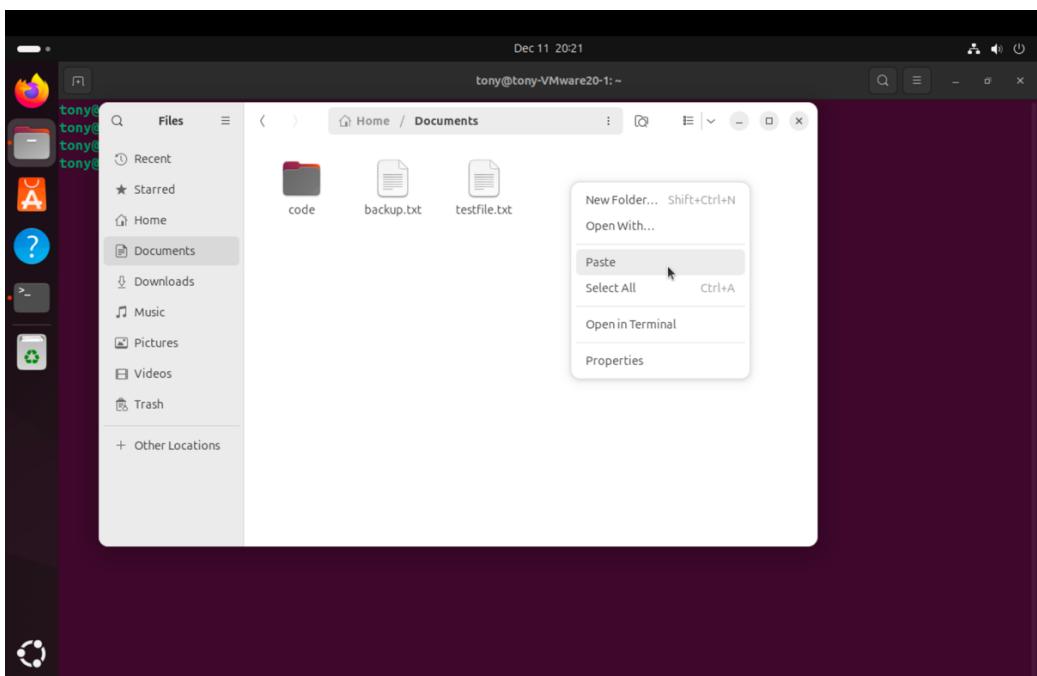
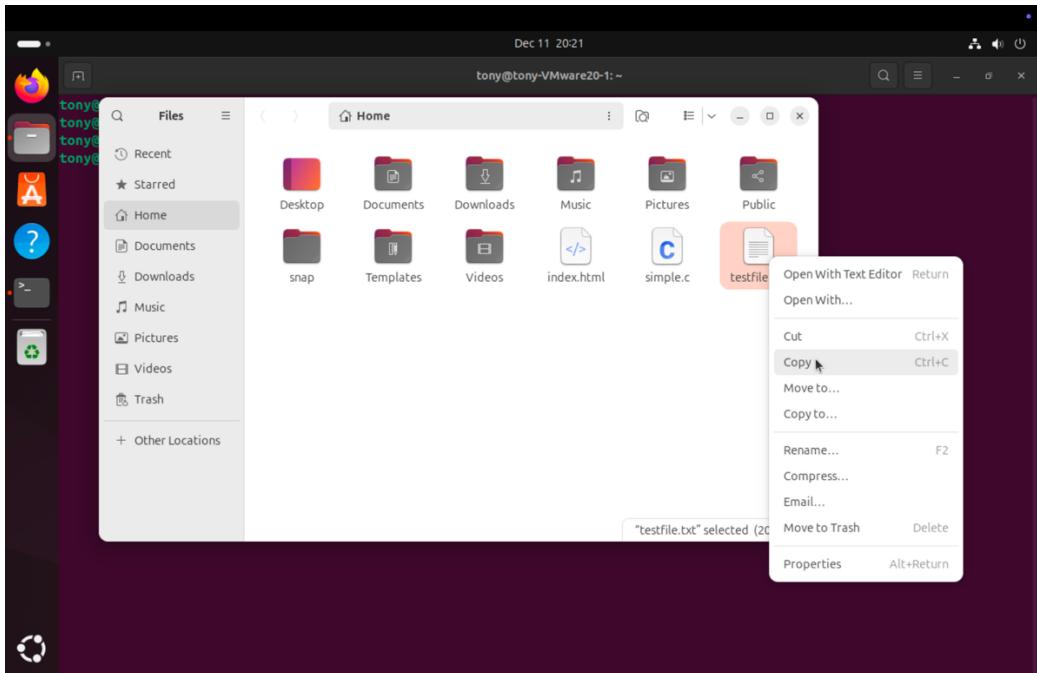
Assignment 5.4: Working with Linux

Relevant screenshots + motivation

- Copying files

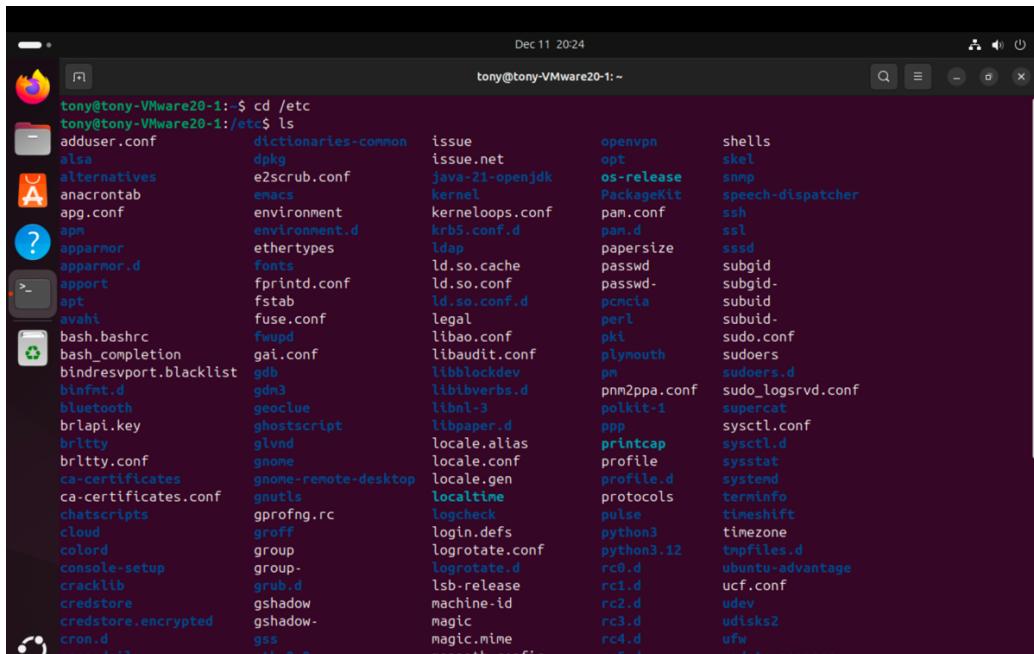
```
Dec 11 20:21
tony@tony-VMware20-1:~
```

```
tony@tony-VMware20-1: $ cd ~
tony@tony-VMware20-1: $ echo "This is a test file" > testfile.txt
tony@tony-VMware20-1: $ cp testfile.txt ~/Documents/testfile.txt
tony@tony-VMware20-1: $
```

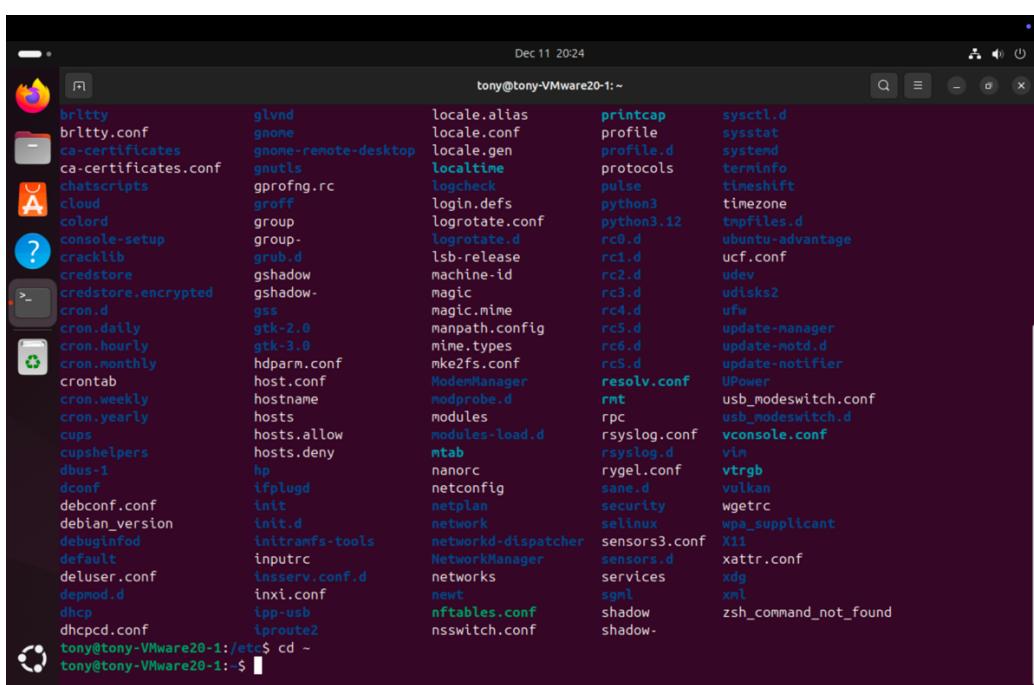


This is understandings of basic file operations, shows ability to manipulate files both in terminal and file explorer

- Navigating the file structure

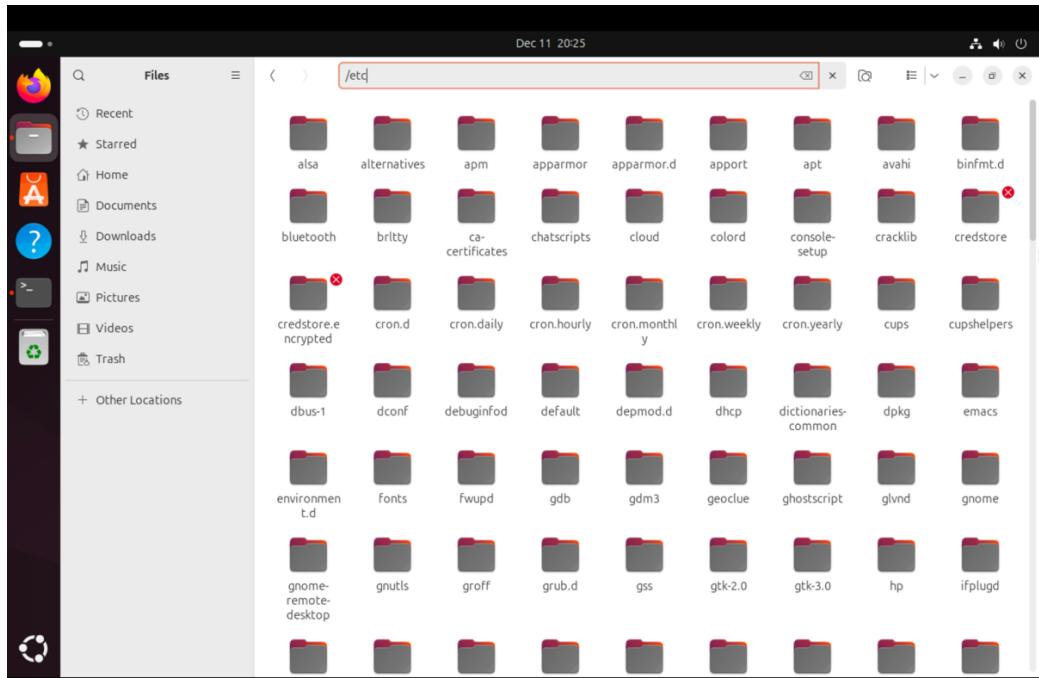


```
tony@tony-VMware20-1:~$ cd /etc
tony@tony-VMware20-1:/etc$ ls
adduser.conf           dictionaries-common   issue          openvpn       shells
alsa                  dpkg                   issue.net      opt          skel
alternatives          e2scrub.conf        java-21-openjdk os-release   snmp
anacrontab            emacs                  kernel        PackageKit  speech-dispatcher
apg.conf              environment        kerneLoops.conf pam.conf     ssh
apm                  environment.d      krb5.conf.d    pam.d       ssl
apparmor             ethertypes        ldap          papersize   sssd
apparmor.d            fonts                 ld.so.cache   passwd      subgid
apport               fprintd.conf      ld.so.conf.d  passwd-    subgid-
apt                  fuse.conf        legal         pcmcia     subuid
avahi                gdb                   libao.conf    perl       subuid-
bash.bashrc          gai.conf        libaudit.conf plymouth    sudo.conf
bash_completion       gdm3                 libblockdev  pm        sudoers
bindresvport.blacklist ghostscript      libibverbs.d pm2ppa.conf sudo_logsrvd.conf
binfmt.d             gnome-remote-desktop  libnl-3       polkit-1   supercat
bluetooth            geoClue        libpaper.d   ppp        sysctl.conf
brlapi.key           ghostscript      locale.alias  printcap   sysctl.d
brltty               glvnd        locale.conf   profile    sysstat
brltty.conf          gnome          locale.gen    profile.d  systemd
ca-certificates      gnutls        localtime   protocols  terminal
ca-certificates.conf gprofng.rc      logcheck    pulse      timeshift
chatscripts          grub.d        lsb-release  logrotate.d rc0.d      tmpfiles.d
cloud                groff        machine-id  logrotate.d rc0.d      ubuntu-advantage
colord               group        magic        protocols  rc1.d      ucf.conf
console-setup        group-        magic.mime   pulse      rc2.d      udev
cracklib             grub.d        manpath.config rc0.d      rc3.d      udisks2
credstore            gshadow        magic        rc2.d      rc4.d      ufw
credstore.encrypted gshadow-       manpath.config rc0.d      rc5.d      update-manager
cron.d               gss          mime.types   rc2.d      rc6.d      update-motd.d
cron.daily           gtk-2.0       nuke2fs.conf  resolv.conf UPower
cron.hourly          gtk-3.0       modules      rmt        usb_modeswitch.conf
cron.monthly          hdparm.conf    modules-load.d rpc       usb_modeswitch.d
cron.weekly          host.conf     modules      rsyslog.conf vconsole.conf
cron.yearly          hostname     netplan      rsyslog.d  vim
cups                 hosts        hosts.allow  netplan      vtrgb
cupshelpers          hosts        hosts.deny   network     sane.d      vulkan
dbus-1               hp          ifplugd     network     security    wgetrc
dconf                init        inputrc     networkd-dispatcher sensors3.conf X11
debconf.conf         init.d      insserv.conf NetworkManager sensors.d  xattr.conf
debian_version       init.d      inxi.conf    networks    services    xdg
debuginfod          initramfs-tools  inxi.conf    neut       sgml       xml
default              inputrc     nftables.conf nftables.conf shadow     zsh_command_not_found
deluser.conf         insserv.conf
depmod.d            inxi.conf
dhcp                ipp-usb      nftable2     nftswitch.conf
dhpcd.conf          iproute2
tony@tony-VMware20-1:/etc$ cd ~
tony@tony-VMware20-1:~$
```



```
tony@tony-VMware20-1:~$ ls
brltty               glvnd        locale.alias  printcap   sysctl.d
brltty.conf          gnome        locale.conf   profile    sysstat
ca-certificates      gnome-remote-desktop  locale.gen  profile.d  systemd
ca-certificates.conf gnutls        localtime   protocols  terminal
chatscripts          gprofng.rc      logcheck    pulse      timeshift
cloud                groff        login.defs  python3   timezone
colord               group        logrotate.conf python3.12 tmpfiles.d
console-setup        group-        logrotate.d  rc0.d      ubuntu-advantage
cracklib             grub.d        lsb-release  rc1.d      ucf.conf
credstore            gshadow        machine-id  rc2.d      udev
credstore.encrypted gshadow-       magic        rc3.d      udisks2
cron.d               gss          manpath.config rc4.d      ufw
cron.daily           gtk-2.0       manpath.config rc5.d      update-manager
cron.hourly          gtk-3.0       nuke2fs.conf  rc5.d      update-motd.d
cron.monthly          hdparm.conf    modules      resolv.conf UPower
cron.weekly          host.conf     modules-load.d rpc       usb_modeswitch.conf
cron.yearly          hostname     netplan      rsyslog.conf vconsole.conf
cups                 hosts        hosts.allow  network     vim
cupshelpers          hosts        hosts.deny   networkd-dispatcher sensors3.conf X11
dbus-1               hp          ifplugd     NetworkManager sensors.d  xattr.conf
dconf                init        inputrc     nftables.conf shadow     zsh_command_not_found
debconf.conf         init.d      insserv.conf  services    xdg
debian_version       init.d      inxi.conf    sgml       xml
debuginfod          initramfs-tools  inxi.conf    neut       zsh_command_not_found
default              inputrc     nftable2     nftswitch.conf
deluser.conf         insserv.conf
depmod.d            inxi.conf
dhcp                ipp-usb      iproute2
dhpcd.conf          iproute2
tony@tony-VMware20-1:/etc$ cd ~
tony@tony-VMware20-1:~$
```

With `cd /etc` you can navigate to etc file in terminal and with `cd ~` back to home folder.



With Ctrl + L you can search for /etc file in files.

Difference between Linus and Windows file structure?

Linus uses one single root, and Windows uses drive letters.

What is /etc used for?

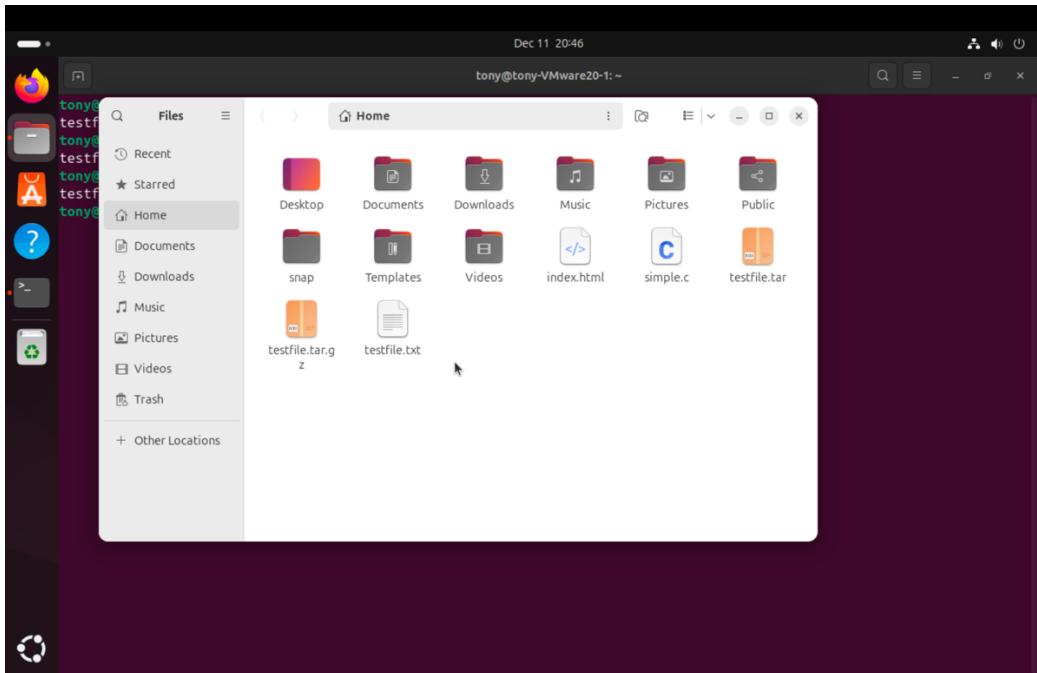
almost all system-wide configuration files are under /etc.

This knowledge includes Linux directories and how to navigate between files, both in the terminal and in files.

- Compress files

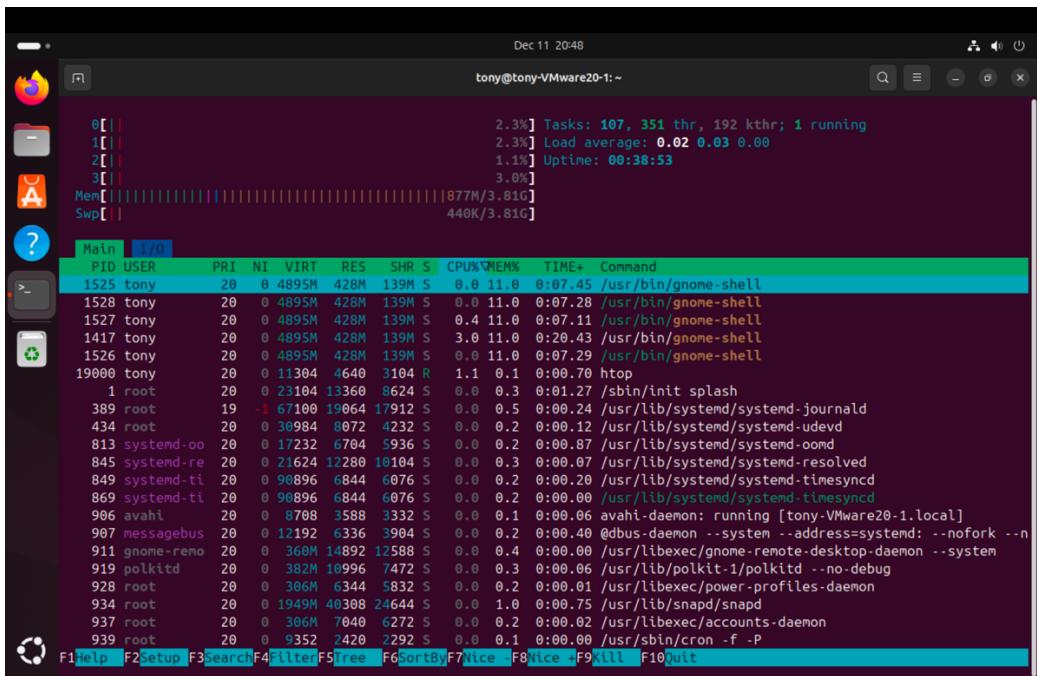
A screenshot of a terminal window titled 'tony@tony-VMware20-1:~'. The terminal shows the following commands being run:

```
tony@tony-VMware20-1:~$ tar -cvf testfile.tar testfile.txt
testfile.txt
tony@tony-VMware20-1:~$ tar -xvf testfile.tar
testfile.txt
tony@tony-VMware20-1:~$ tar -czvf testfile.tar.gz testfile.txt
testfile.txt
tony@tony-VMware20-1:~$
```



This shows the ability to compress files with terminal in Linux.

- View processes



This shows how to monitor system performance and manage active processes in Linux.

Upper Left:

- CPU usage per core
- Colored bars showing user/system/I/O load
- Memory (RAM) usage
- Swap usage

Upper Right:

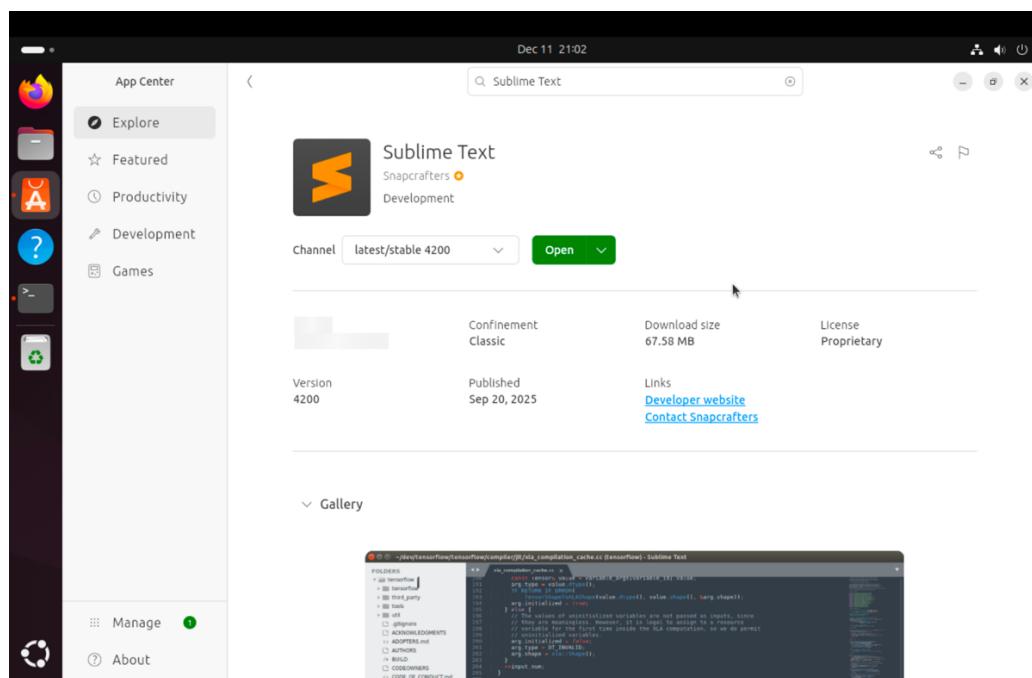
- Tasks (total processes, running processes)
- Threads
- Load averages
- Uptime (how long the system has been running)

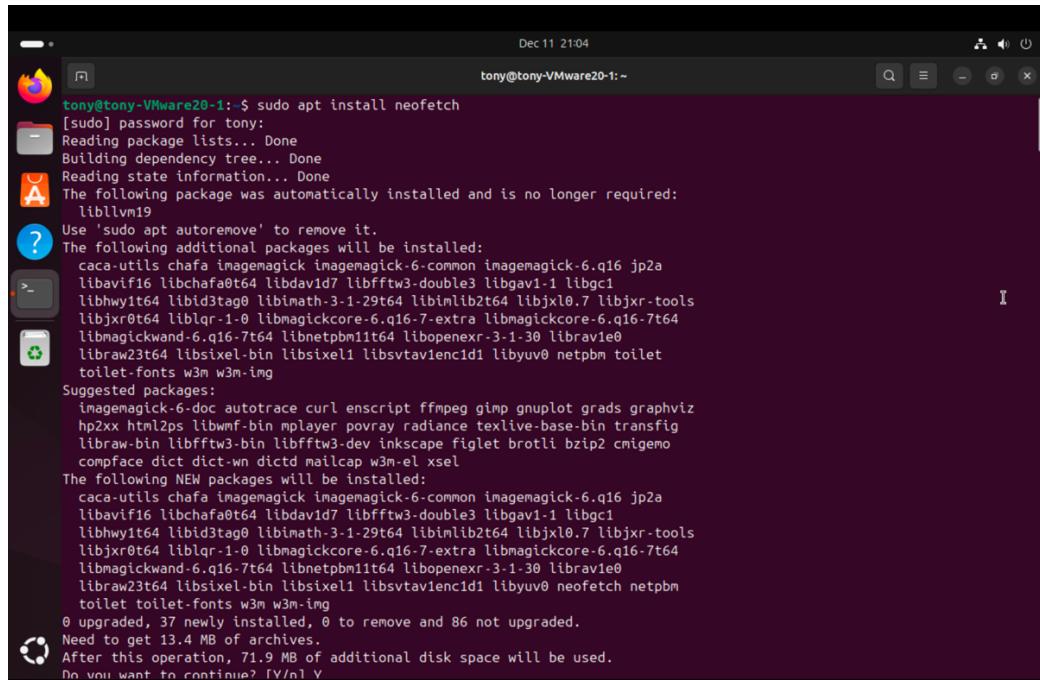
Middle section (main table):

- PID → Process ID
- USER → Which user started the process
- PRI / NI → Priority & Nice value
- VIRT / RES / SHR → Memory usage
- S → State (R = running, S = sleeping, Z = zombie)
- %CPU → CPU usage %
- %MEM → Memory usage %
- TIME+ → Total CPU time used
- Command → The program/process name

Bottom:

- Key shortcuts (F1 Help, F2 Setup, F3 Search, F4 Filter, F5 Tree, F6 SortBy, F7 Nice -, F8 Nice +, F9 Kill, F10 Quit)
- Install Software

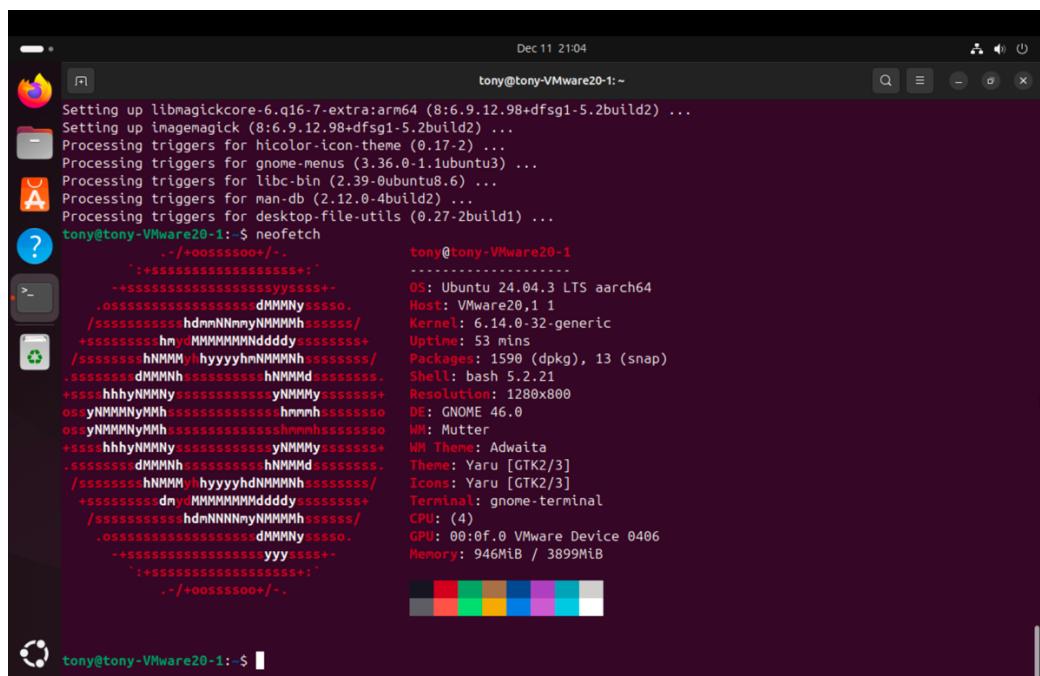




```

tony@tony-VMware20-1:~$ sudo apt install neofetch
[sudo] password for tony:
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.
The following additional packages will be installed:
  caca-utils chafa imagemagick imagemagick-6-common imagemagick-6.q16 jp2a
  libavif16 libchafa0t64 libdavid7 libfftw3-double3 libgavl1 libgcl
  libhwy1t64 libid3tag0 libimath-3.1-29t64 libimlib2t64 libjxl0.7 libjxr-tools
  libjxr0t64 liblqr-1-0 libmagickcore-6.q16-7-extra libmagickcore-6.q16-7t64
  libmagickwand-6.q16-7t64 libnetpbm1t64 libopenexr-3.1-30 libravie0
  libraw23t64 libixel-bin libixel1 libsvtavenc1d1 libuyuv0 netpbm toilet
  toilet-fnts w3m w3m-img
Suggested packages:
  imagemagick-6-doc autotrace curl enscript ffmpeg gimp gnuplot grads graphviz
  hp2xx html2ps libwmf-bin mplayer povray radiance texlive-base-bin transfig
  libraw-bin libfftw3-bin libfftw3-dev inkscape figlet brotli bzip2 cmigemo
  compface dict dict-wm mailcap w3m-el xsel
The following NEW packages will be installed:
  caca-utils chafa imagemagick imagemagick-6-common imagemagick-6.q16 jp2a
  libavif16 libchafa0t64 libdavid7 libfftw3-double3 libgavl1 libgcl
  libhwy1t64 libid3tag0 libimath-3.1-29t64 libimlib2t64 libjxl0.7 libjxr-tools
  libjxr0t64 liblqr-1-0 libmagickcore-6.q16-7-extra libmagickcore-6.q16-7t64
  libmagickwand-6.q16-7t64 libnetpbm1t64 libopenexr-3.1-30 libravie0
  libraw23t64 libixel-bin libixel1 libsvtavenc1d1 libuyuv0 neofetch netpbm
  toilet toilet-fnts w3m w3m-img
0 upgraded, 37 newly installed, 0 to remove and 86 not upgraded.
Need to get 13.4 MB of archives.
After this operation, 71.9 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y

```



```

tony@tony-VMware20-1:~$ neofetch
Setting up libmagickcore-6.q16-7-extra:arm64 (8:6.9.12.98+dfsg1-5.2build2) ...
Setting up imagemagick (8:6.9.12.98+dfsg1-5.2build2) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1.1ubuntu3) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
tony@tony-VMware20-1:~$ neofetch
      _.-/+o0sssssoo+-/.._
      :+ssssssssssssssssssss+-+
      .+ssssssssssssssssss+ dMMMy ssso.
      /sssssssssshdmmNmmNyNmmMmhdssssss/
      +ssssssss hMvdMMmmmmMmdddyssssss+
      /ssssssss hNMMMyhyyyyyhmNNNNhssssss/
      .ssssssss dMMMNhssssssssssNmmMdssssss.
      +ssss hhhNMNMyssssssssssyNMMMyssssss/
      ossyNMMMNyMhssssssssssssssNmmhssssss
      ossyNMMMNyMhssssssssssssssNmmhssssss
      +sss hhhNMNMyssssssssssyNMMMyssssss+
      .ssssssss dMMMNhssssssssssNmmMdssssss.
      /ssssssss hNMMMyhyyyyyhdNMMNhssssss/
      +ssssssss dMvddMMmmmmMmdddyssssss+
      /sssssssssshdmmNNNmmNyNmmMhssssss/
      .osssssssssssssss dMMMy ssso.
      +-+ssssssssssssssssssssssssyss+-+
      :+ssssssssssssssssssssssssssssss+-+
      .-/+o0sssssoo+-/.._
      -----
      05: Ubuntu 24.04.3 LTS aarch64
      Host: VMware20_1 1
      Kernel: 6.14.0-32-generic
      Uptime: 53 mins
      Packages: 1590 (dpkg), 13 (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: (4)
      GPU: 00:0F.0 VMware Device 0406
      Memory: 946MiB / 3899MiB
      -----
      [Color Bar]

```

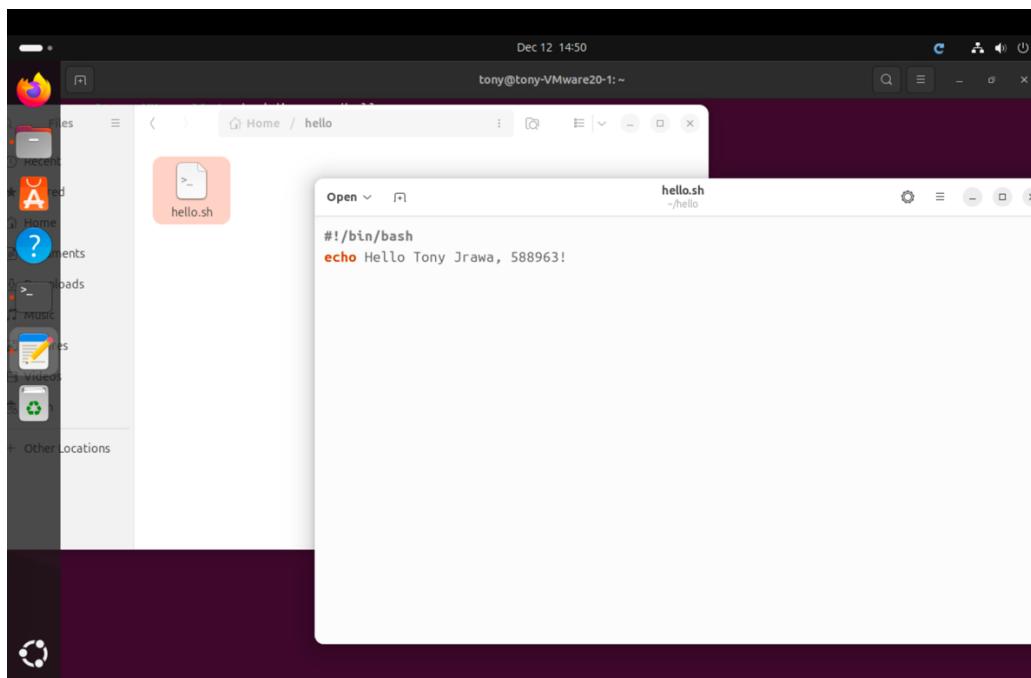
neofetch displays some system information (OS, kernel, CPU, GPU, RAM, uptime) with ASCII logo when it launches.

This shows the ability to install the software and how to know and understand system info.

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
Dec 12 14:49
tony@tony-VMware20-1: ~
tony@tony-VMware20-1: $ mkdir -p ~/hello
tony@tony-VMware20-1: $ nano ~/hello/hello.sh
tony@tony-VMware20-1: $ chmod +x ~/hello/hello.sh
tony@tony-VMware20-1: $ ./hello/hello.sh
Hello Tony Jrawa, 588963!
tony@tony-VMware20-1: $ chmod 744 ~/hello/hello.sh
tony@tony-VMware20-1: $ ls -l ~/hello/hello.sh
-rwxr--r-- 1 tony tony 43 Dec 12 14:48 /home/tony/hello/hello.sh
tony@tony-VMware20-1: $
```



I have created a hello directory and in it a hello.sh file, and I have made the file executable using chmod. Using chmod 744 to make that only the owner can run the script, while others users can only view it with commands like cat.

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

```
Dec 12 15:07
tony@tony-VMware20-1:~/Documents
tony@tony-VMware20-1:~/Documents$ wc SherlockHolmes.txt
12307 107562 595196 SherlockHolmes.txt
tony@tony-VMware20-1:~/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
tony@tony-VMware20-1:~/Documents$ head -n 490 SherlockHolmes.txt | tail -n 10
"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
tony@tony-VMware20-1:~/Documents$ tail -n 490 SherlockHolmes.txt | head -n 10
skylight above was open, and the prisoner gone.
"There has been some villainy here," said Holmes; "this beauty has
guessed Miss Hunter's intentions and has carried his victim off."
"But how?"
"Through the skylight. We shall soon see how he managed it." He swung
himself up onto the roof. "Ah, yes," he cried, "here's the end of a
long light ladder against the eaves. That is how he did it."
tony@tony-VMware20-1:~/Documents$
```

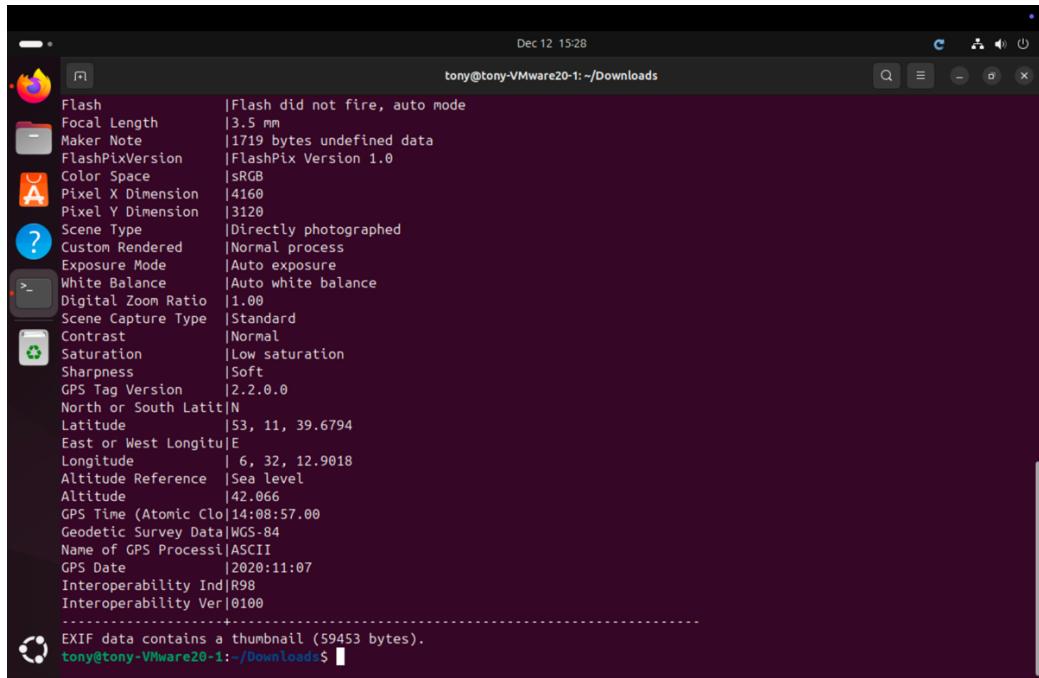
In this assignment I used commands wc, head, tail and grep. With wc I counted the number of lines, words, and characters. With grep I have searched for the word 'kingdom'. Finally using head and tail I displayed 10 lines above and below the word 'kingdom' in line 490.

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

EXIF

```
Dec 12 15:28
tony@tony-VMware20-1:~/Downloads
Processing triggers for man-db (2.12.0-4build2) ...
tony@tony-VMware20-1:~/Downloads$ exif oldcar.jpg
EXIF tags in 'oldcar.jpg' ('Motorola' byte order):
-----
Tag          |Value
-----
Manufacturer |motorola
Model        |moto g(6) play
X-Resolution |72
Y-Resolution |72
Resolution Unit |Inch
Software     |aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys
Date and Time |2020:11:07 15:08:57
YCbCr Positioning |Centered
Compression   |JPEG compression
X-Resolution |72
Y-Resolution |72
Resolution Unit |Inch
Exposure Time |1/33 sec.
F-Number      |f/2.0
Exposure Program |Normal program
ISO Speed Ratings |64
Exif Version  |Exif Version 2.2
Date and Time (Original) |2020:11:07 15:08:57
Date and Time (Digitized) |2020:11:07 15:08:57
Components Configuration |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
```

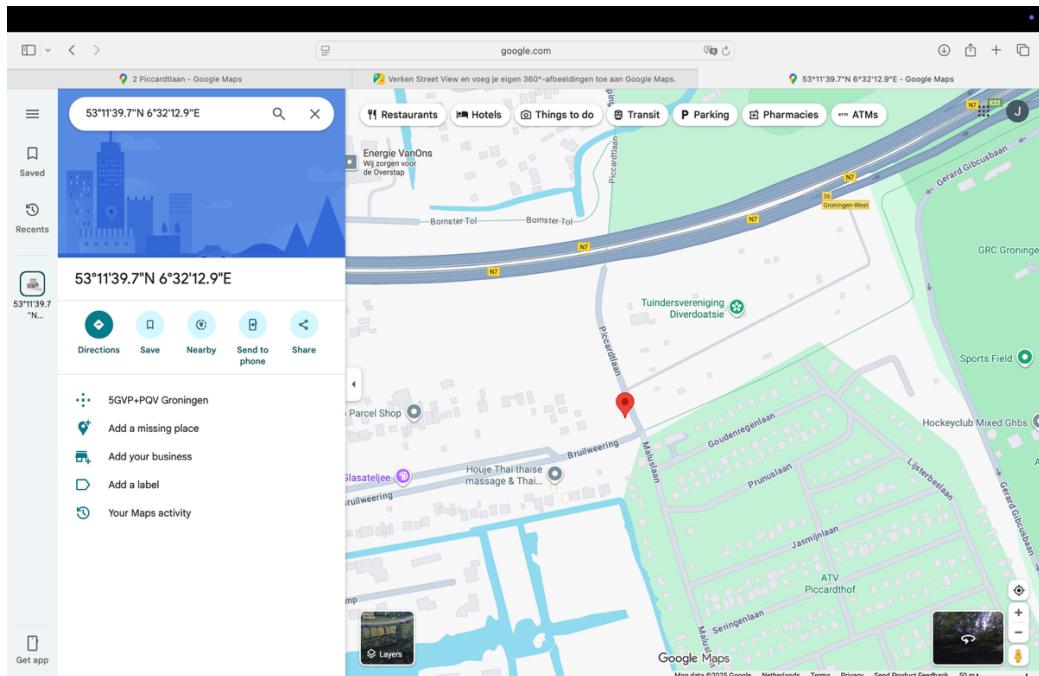


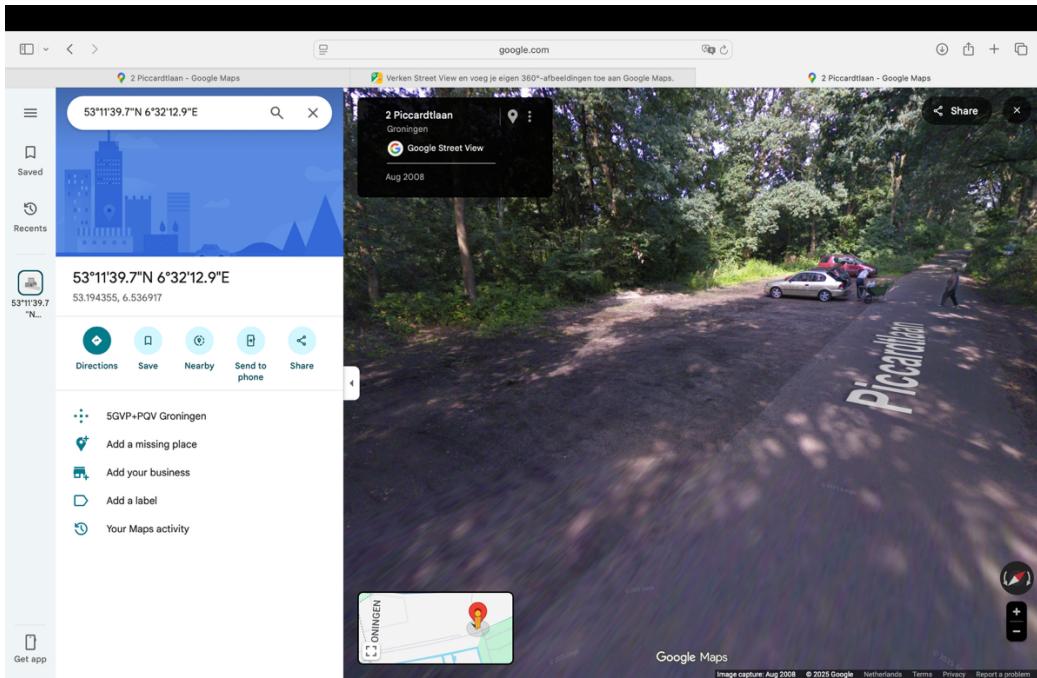
```

tony@tony-VMware20-1:~/Downloads$ exiftool photo.jpg
Flash          |Flash did not fire, auto mode
Focal Length   |3.5 mm
Marker Note    |1719 bytes undefined data
FlashPixVersion|FlashPix Version 1.0
Color Space    |sRGB
Pixel X Dimension|4160
Pixel Y Dimension|3120
Scene Type     |Directly photographed
Custom Rendered|Normal process
Exposure Mode  |Auto exposure
White Balance   |Auto white balance
Digital Zoom Ratio|1.00
Scene Capture Type|Standard
Contrast        |Normal
Saturation      |Low saturation
Sharpness       |Soft
GPS Tag Version|2.2.0.0
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
GPS Time (Atomic Clock)|14:08:57.00
Geodetic Survey Data|WGS-84
Name of GPS Processor|ASCII
GPS Date        |2020:11:07
Interoperability Index|R98
Interoperability Version|0100
-----
EXIF data contains a thumbnail (59453 bytes).
tony@tony-VMware20-1:~/Downloads$ 

```

Using EXIF, I identified the information about the photo, like the phone type (Motorola moto g(6) play) and the GPS coordinates to find the exact location in Google Maps and the street view (Latitude and Longitude).





Filename extensions

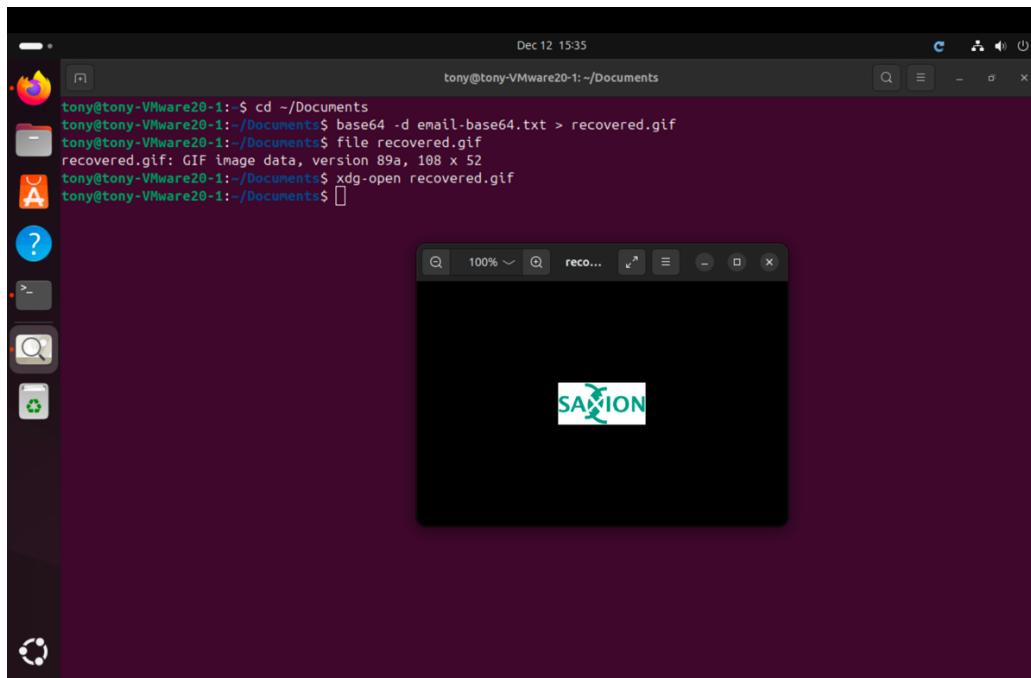
```

Pixel Y Dimension | 3120
Scene Type | Directly photographed
Custom Rendered | Normal process
Exposure Mode | Auto exposure
White Balance | Auto white balance
Digital Zoom Ratio | 1.00
Scene Capture Type | Standard
Contrast | Normal
Saturation | Low saturation
Sharpness | Soft
GPS Tag Version | 2.2.0.0
North or South Latit|N
Latitude | 53, 11, 39.6794
East or West Longitu|E
Longitude | 6, 32, 12.9018
Altitude Reference | Sea level
Altitude | 42.066
GPS Time (Atomic Clo|14:08:57.00
Geodetic Survey Data|WGS-84
Name of GPS Process|ASCII
GPS Date |2020:11:07
Interoperability Ind|R98
Interoperability Ver|0100
-----
EXIF data contains a thumbnail (59453 bytes).
tony@tony-VMware20-1:~/Downloads$ mv oldcar.jpg oldcar
tony@tony-VMware20-1:~/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, manufacturer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolution unit=2, software=aljeter-user 9 PPPS29.55-35-18-7 6a6d0 release-keys, datetime=2020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
tony@tony-VMware20-1:~/Downloads$ 

```

I also renamed the file in terminal using commands.

Base64



The screenshot shows a terminal window with the following command history:

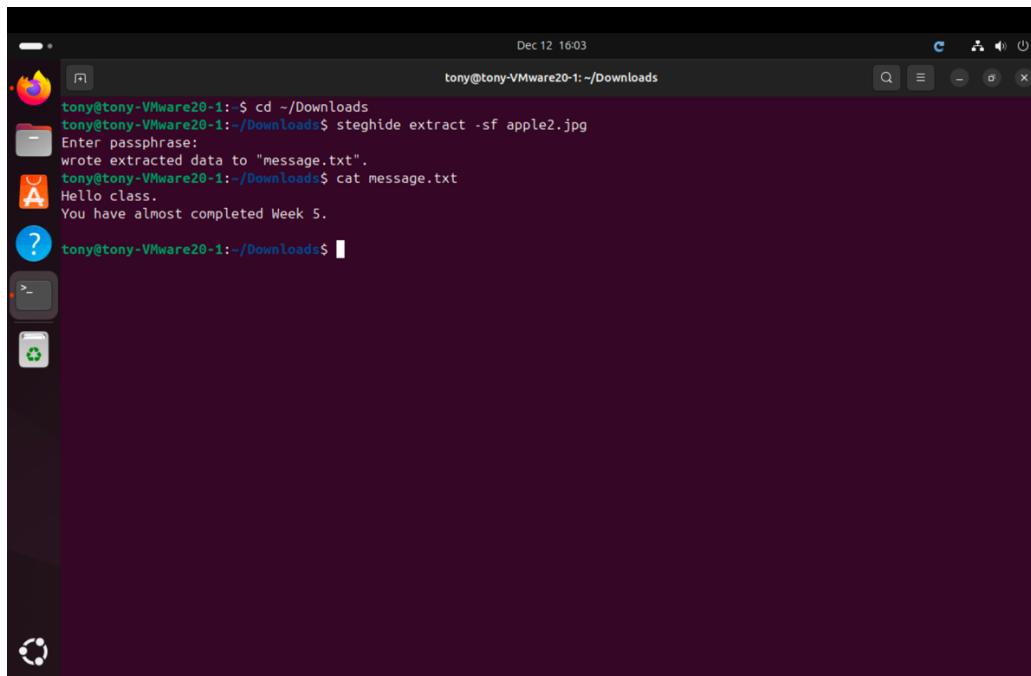
```
tony@tony-VMware20-1: $ cd ~/Documents
tony@tony-VMware20-1:~/Documents$ base64 -d email-base64.txt > recovered.gif
tony@tony-VMware20-1:~/Documents$ file recovered.gif
recovered.gif: GIF image data, version 89a, 108 x 52
tony@tony-VMware20-1:~/Documents$ xdg-open recovered.gif
tony@tony-VMware20-1:~/Documents$
```

Below the terminal, a small window titled "reco..." displays a black background with a green "SAKION" logo.

Finally, I used Base64 -d to decode a Base63-encoded email attachment and recovered a GIF image from the binary data.

Assignment 5.8: Steganography

Relevant screenshots + motivation



The screenshot shows a terminal window with the following command history:

```
tony@tony-VMware20-1: $ cd ~/Downloads
tony@tony-VMware20-1:~/Downloads$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
tony@tony-VMware20-1:~/Downloads$ cat message.txt
Hello class.
You have almost completed Week 5.
tony@tony-VMware20-1:~/Downloads$
```

Steganography be used to hide information inside another file, in this assignment was a text file hidden inside an image file. By using steghide tool, I extracted the hidden text from the image.

Assignment 5.9: Capture disk images

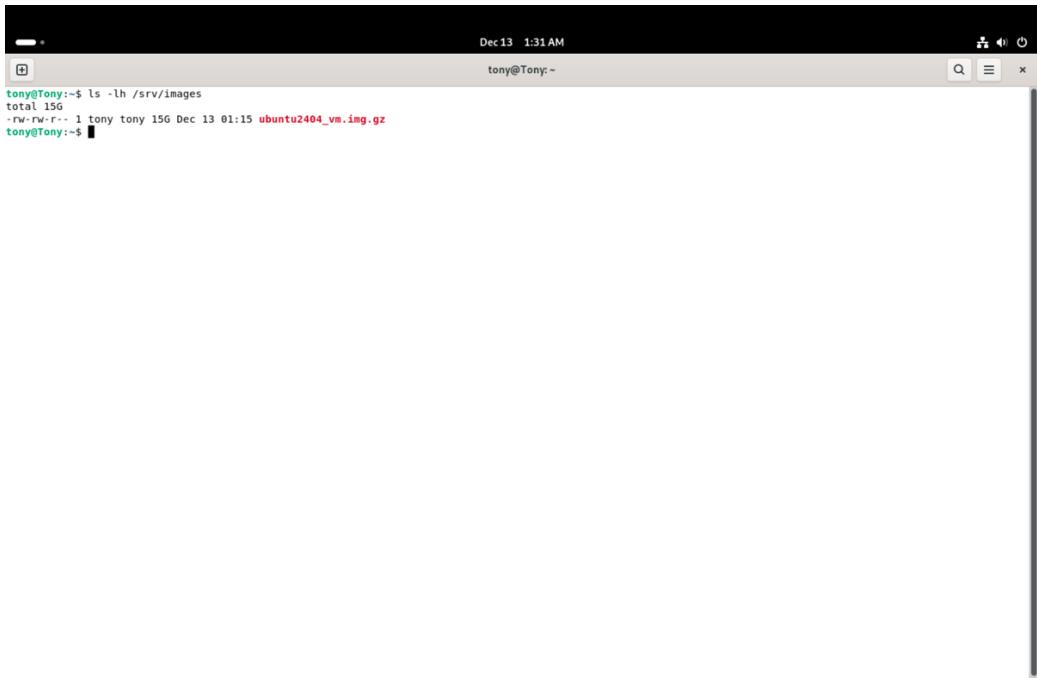
Make relevant screenshots + motivation:

```
Dec 12 08:28 PM tony@Tony:~  
tony@Tony:~$ sudo apt update  
[sudo] password for tony:  
Hit:1 http://security.debian.org/debian-security trixie-security InRelease  
Hit:2 http://deb.debian.org/debian trixie InRelease  
Hit:3 http://deb.debian.org/debian trixie-updates InRelease  
All packages are up to date.  
tony@Tony:~$ sudo apt install openssh-server -y  
openssh-server is already the newest version (1:10.0p1-7).  
openssh-server set to manually installed.  
Summary:  
Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 0  
tony@Tony:~$ 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  
tony@Tony:~$ sudo mkdir -p /srv/images  
tony@Tony:~$ id  
1: lo NOQUEUE,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  
    inetc6 ::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:e1:ea:33 brd ff:ff:ff:ff:ff:ff  
    altname ensp250  
    altname ens160-29e1ea33  
    inet 172.16.12.137/24 brd 172.16.12.255 scope global dynamic noprefixroute ens160  
        valid_lft 1567sec preferred_lft 1567sec  
        inetc6 fe80::20c:29ff:fe1:ea33/64 scope link noprefixroute  
            valid_lft forever preferred_lft forever  
tony@Tony:~$
```

I installed Debian 13 server and configured as an image server, SSH was installed to allow connections and file transfers and the directory image was created to store virtual machine disk images.

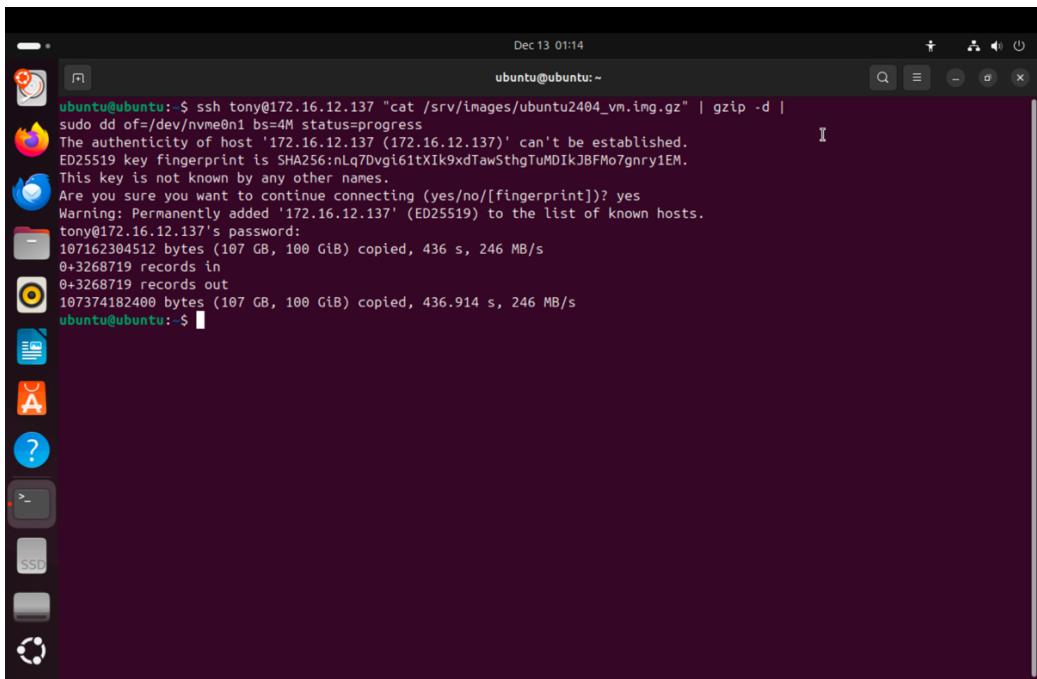
```
Dec 13 00:15 ubuntu@ubuntu:~  
ubuntu@ubuntu:~$ lsblk  
NAME      MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS  
loop0       7:0     0  1.6G  1 loop /rofs  
loop1       7:1     0 450.1M  1 loop  
loop2       7:2     0   961M  1 loop  
loop3       7:3     0    4K  1 loop /snap/bare/5  
loop4       7:4     0  68.9M  1 loop /snap/core22/2049  
loop5       7:5     0 230.5M  1 loop /snap/firefox/6563  
loop6       7:6     0 104.5M  1 loop /snap/ubuntu-desktop-bootstrapping/414  
loop7       7:7     0 204.5M  1 loop /snap/thunderbird/770  
loop8       7:8     0  91.7M  1 loop /snap/gtk-common-themes/1535  
loop9       7:9     0   10M  1 loop /snap/snap-store/1271  
loop10      7:10    0  42.9M  1 loop /snap/snapd/24787  
loop11      7:11    0   552K  1 loop /snap/snapd-desktop-integration/316  
loop12      7:12    0 493.5M  1 loop /snap/gnome-42-2204/201  
sr0        11:0    1   3.2G  0 rom /cdrom  
nvme0n1    259:0   0 100G  0 disk  
└─nvme0n1p1 259:1   0   1G  0 part  
  └─nvme0n1p2 259:2   0  62.9G 0 part  
ubuntu@ubuntu:~$ sudo dd if=/dev/nvme0n1 bs=4M status=progress | gzip | ssh tony@172.16.12.137 "cat > /srv/images/ubuntu_2404_vn.img.gz"  
tony@172.16.12.137's password:  
107143495680 bytes (107 GB, 100 GiB) copied, 953 s, 112 MB/s  
25600+0 records in  
25600+0 records out  
107374182400 bytes (107 GB, 100 GiB) copied, 953.897 s, 113 MB/s  
ubuntu@ubuntu:~$
```

Here my Ubuntu VM was booted from live Ubuntu without installing (Try Ubuntu) and that can you see from the name above the terminal. The lsblk command was used to identify the correct disk device. The dd command was used to capture the full disk, gzip compressed the data and ssh transferred securely the image to the Debain server.



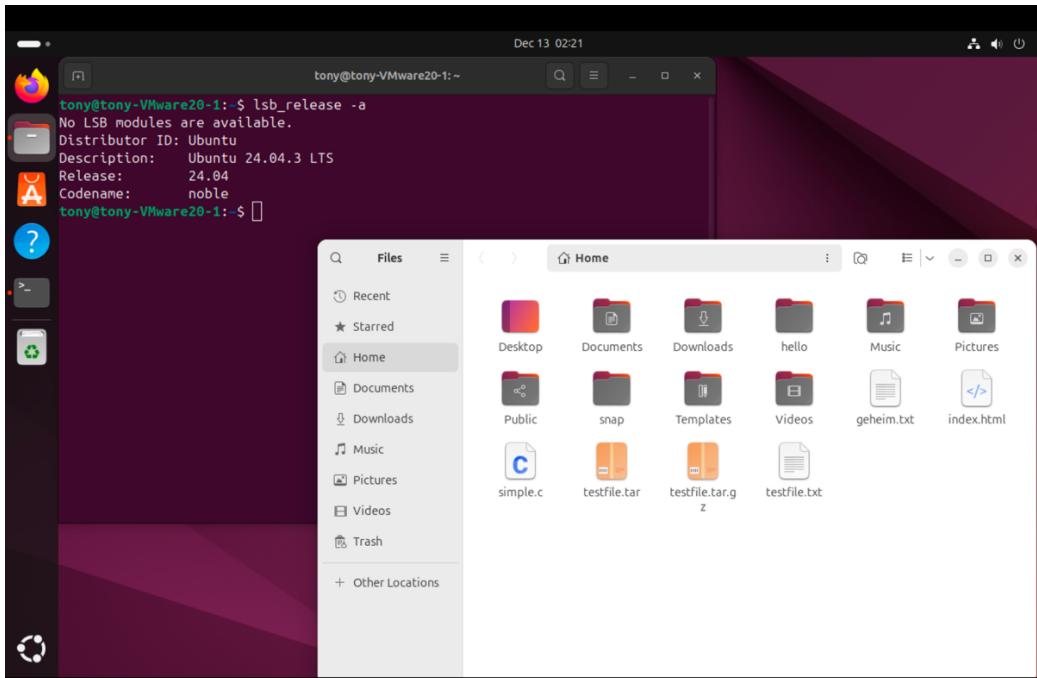
```
Dec 13 1:31 AM tony@Tony:~  
tony@Tony:~$ ls -lh /srv/images  
total 15G  
-rw-rw-r-- 1 tony tony 15G Dec 13 01:15 ubuntu2404_vm.img.gz  
tony@Tony:~$
```

This conform that the image was successfully saved on the Debain server.



```
Dec 13 01:14 ubuntu@ubuntu:~  
ubuntu@ubuntu:~$ ssh tony@172.16.12.137 "cat /srv/images/ubuntu2404_vm.img.gz" | gzip -d |  
sudo dd of=/dev/nvme0n1 bs=4M status=progress  
The authenticity of host '172.16.12.137 (172.16.12.137)' can't be established.  
ED25519 key fingerprint is SHA256:nlq7Dvgi61txIK9xdTaw5thgTuMDIkJBFMo7gnry1EM.  
This key is not known by any other names.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
Warning: Permanently added '172.16.12.137' (ED25519) to the list of known hosts.  
tony@172.16.12.137's password:  
107162304512 bytes (107 GB, 100 GiB) copied, 436 s, 246 MB/s  
0+3268719 records in  
0+3268719 records out  
107374182400 bytes (107 GB, 100 GiB) copied, 436.914 s, 246 MB/s  
ubuntu@ubuntu:~$
```

Here was a new Ubuntu VM created on live Ubuntu without installing (Try Ubuntu) to check if the backup will really work and here the backup was completed.



Then here was the Ubuntu on the hard disk rebooted and the backup was successfully restored to this new VM, and this image shows that everything on my original Ubuntu on this Ubuntu now, so, the backup was success.

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