# Lab Exercise Sheet 0

**Linux Operating System and Command-line Fundamentals – get familiar with the operating system image**

The Practical Computer Networks and Applications module focuses on network devices, transmission media, protocols, and software tools from computer networks and how to work with them in practice.

To complete the lab exercises in this module, it is necessary to have a basic knowledge of the Linux operating system and the command line interface. If you already have a good understanding of Linux and the command-line from the Operating Systems module or your everyday work, you will already know most of the contents of this exercise sheet. However, if that is not the case, use this exercise sheet to review and improve your knowledge of Linux and the command-line interface.

Group number:

First name:

Last name:

Student number:

For this exercise sheet, you will use a Debian Linux operating system image where access to the Internet already works.

Note the steps performed inside and outside the command-line interface. For this Lab Exercise, you don't need to prepare and submit slides or any documentation but be able to tell in class about the commands you used to solve the Lab Exercise and your findings.

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**Demonstration Exercise Sheet 0**

You should be able to demonstrate and explain the following things:

- The commands you used on the command-line interface

- The resulting output of the commands you use

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1. **How did I get in here? Get familiar with the operating system!**

    a) Start the operating system image, log in and get familiar with the graphical user interface.

    b) Check the icons of tools and the application menu. You should have at least one internet browser, one graphical editor tool, one file manager, as well as one terminal emulator (`xterm`, `gnome-terminal`, `konsole`, `xfce4-terminal`, `lxterm`, or something similar).

2. **Please, can I have a mouse? Get familiar with the command-line interface!**

    > Some command-line tools that help you in solving this question are...
    >
    > `cat`, `cd`, `chmod`, `cp`, `echo`, `head`, `history`, `joe`, `ls`, `mkdir`, `nano`, `pico`, `pwd`, `rm`, `rmdir`, `tail`, `touch`, `vi`, `wc`

    a) Open a terminal emulator.

    b) Find out what your current working directory is (it should be your home directory).

    c) Navigate to the root directory.

    d) Navigate back to your home directory with a shortcut.

    e) Create a new directory inside your home directory `1st_steps`.

    f) Navigate into the directory `1st_steps`.

    g) Create an empty file with the filename `File1.txt`

    h) Check the content of the directory `1st_steps` in a way that you learn about the files inside the directory and their size, permissions, date of last modification, and ownership.

    i) Create a new file in the shell `File2.txt` and insert two lines of text as content into the new file.

    j) Print out the first line of the file `File2.txt`.

    k) Print out the last line of the file `File2.txt`.

    l) Open the file `File1.txt` with a text editor (e.g. `nano`, `joe`, `pico`,...), write some lines of text into the file, write the modification, and quit the editor.

    m) Open the file `File1.txt` with the text editor `vi`, add some more lines of text into the file, write the modification, and quit the editor (attention: If you have never used vi before, it will be quite a challenge for you!).

n) Print out the number of lines, words, and characters of the file `File1.txt`.

o) Append the content of `File2.txt` to `File1.txt`.

p) Remove the write permission of the file `File1.txt`.

q) Try to append the content of `File2.txt` to `File1.txt` again. What happened?

r) Add the write permission to the file `File1.txt`.

s) Overwrite the content of `File1.txt` with the content of `File2.txt`.

t) Copy the file `File2.txt` into a new file `File3.txt`.

u) Remove the files `File2.txt` and `File3.txt`.

v) Remove the directory `1st_steps` inside your home directory.

w) Get a list of all the commands you executed since you logged in.

x) Copy the list of all the commands you executed since you logged into a new file `my1stday.txt` inside your home directory.

y) Create a new file `script.sh` inside your home directory and insert all the commands you need to carry out the steps up to this point (except for the steps that required an editor application to solve them).

z) Add the execute permission to the file `script.sh` and run it.

3. **What is going on here? Learn how to monitor devices and events on your machine!**

> Some command-line tools that help you in solving in this question are...
>
> `cd`, `cat`, `find`, `grep`, `less`, `ls`, `lspci`, `lshw`, `more`, `ps`, `pstree`

a) Check a list of devices your operating system image has detected. Do you see any network interfaces?

b) The directories and files behind `/sys/class/net/<interface>/` contain relevant information about your network devices. Check what information can be found here.

c) The pseudo-file `/proc/net/dev` contains status information of your network devices. Check what information can be found here.

d) Inside the directory `/var/log/` you can find essential log files of your operating system. Check the content and find out which log files contain computer networks related information. Use appropriate tools to investigate these log files and search for relevant information inside.

e) Check a list of all processes on your system.

f) Check an overview of the parent/child relationships of the processes on your system.

4. **Where can I store my data permanently? Learn to work with external storage media!**

> Some command-line tools that help you in solving this question are. . .
>
> `df`, `dmesg`, `fdisk`, `find`, `grep`, `ls`, `lsblk`, `less`, `more`, `mount`, `mv`, `umount`

a) Connect a USB flash media drive to the workstation.

b) Connect and disconnect the file system of the USB flash memory drive securely from your local file system hierarchy by using a graphical tool like a file manager.

c) Check which log files of the Linux operating system inform about the presence of the USB flash media drive and its characteristics. You can find such files in the directories `/dev`, `/proc` and `/var/log`. Use appropriate tools to investigate these log files and search for relevant information.

d) One command prints out information about the kernel's latest operations. Try it out and check what happens when you connect and disconnect the USB flash memory drive to your computer.

e) Connect the file system of the USB flash memory drive with your local file system hierarchy by just using the command-line interface.

f) Check the drive space utilization

g) Move `script.sh` and `my1stday.txt` from question 2 to your USB flash memory drive.

h) Disconnect the file system of the USB flash memory drive securely from your local file system hierarchy by just using the command-line interface.

5. **How can I get this computer network working? Learn working with computer network interfaces using the command-line interface!**

> Some command-line tools that help you in solving this question are. . .
>
> `ethtool`, `ip`, `ping`, `scp`, `nc`, `nmap`, `nslookup`, `ss`, `ssh`, `traceroute`

a) Find out the addresses of Data Link Layer (MAC addresses) and Network Layer (IP addresses), network mask, and default gateway of the network interfaces of your workstation.

b) Find out what UDP sockets do exist on your workstation.

c) Find out what TCP sockets do exist on your workstation.

d) Find out what processes use TCP and UDP sockets on your workstation.

e) Check the list of known neighbors (ARP cache).

f) Check the routing tables.

g) Check the network connectivity to a host on the Internet.

h) Get the list of hops on the path to a host on the Internet.

i) Query the Internet domain name servers for a host on the Internet.

j) Check the network connectivity to another computer at your table in the lab.

k) Check which ports the other computer at your lab table has open.

l) Log into this other computer via the network securely (encrypted).

m) Transfer a file to this other computer and check if the file was successfully transferred.

n) Find out what Ethernet performance standards (link modes) and data rates (speed), transfer modes (full or half duplex) the Ethernet interface(s) of your workstation supports, and what the link state is.

o) Let the LED of one of your workstation's Ethernet interface(s) blink to identify it via a visible port identification.

p) Obtain for the Ethernet interface(s) of your workstation some statistics about the number of bytes and packets that have been transmitted and received and errors that have been detected.

q) Disable a network interface.

r) Enable a network interface.

s) Have some fun with MAC spoofing. Modify the MAC address of your workstation.

t) Modify the IP address of your workstation.

u) Check if you can still communicate with hosts on the Internet and with another computer at your lab table.