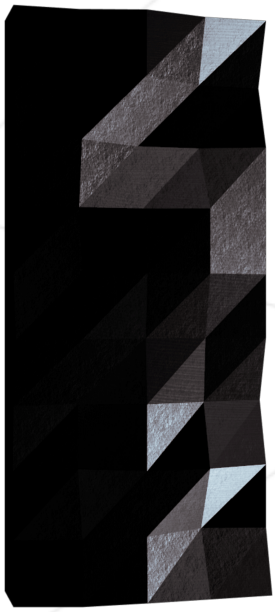


Born2beRoot

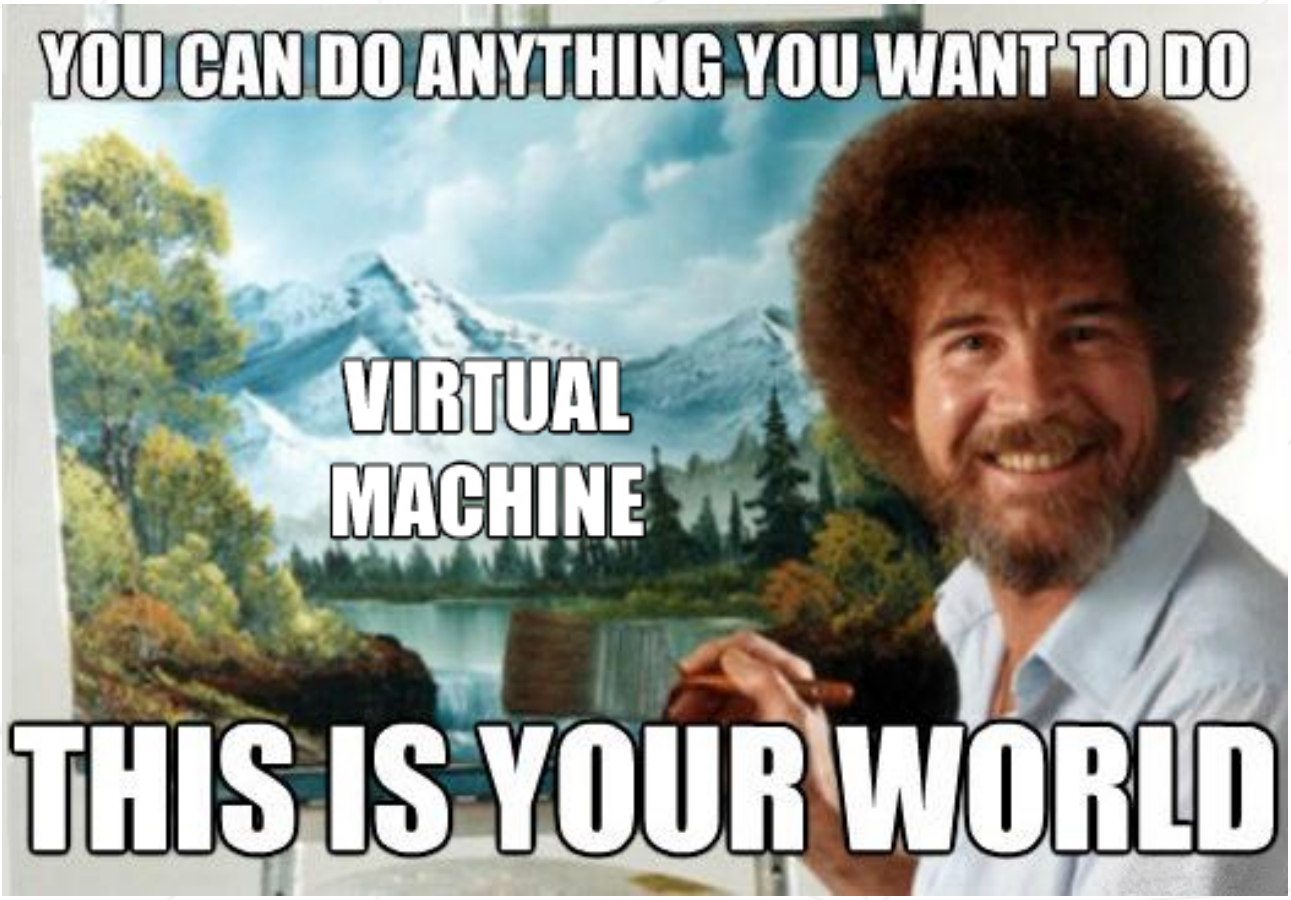
Summary: This document is a System Administration related exercise.

Version: 5.2

Contents

Chapter I

Preamble



Chapter II

Introduction

This project aims to introduce you to the wonderful world of virtualization.

You will create your first machine in `VirtualBox` (or `UTM` if you cannot use `VirtualBox`) using specific instructions. Then, at the end of this project, you will be able to set up your own operating system while implementing strict rules.

Chapter III

AI Instructions

Context

This project is designed to help you discover the fundamental building blocks of your 42 training.

To properly anchor key knowledge and skills, it's essential to adopt a thoughtful approach to using AI tools and support.

True foundational learning requires genuine intellectual effort — through challenge, repetition, and peer-learning exchanges.

For a more complete overview of our stance on AI — as a learning tool, as part of the 42 training, and as an expectation in the job market — please refer to the dedicated FAQ on the intranet.

Main message

- 👉 Build strong foundations without shortcuts.
- 👉 Really develop tech & power skills.
- 👉 Experience real peer-learning, start learning how to learn and solve new problems.
- 👉 The learning journey is more important than the result.
- 👉 Learn about the risks associated with AI, and develop effective control practices and countermeasures to avoid common pitfalls.

Learner rules:

- You should apply reasoning to your assigned tasks, especially before turning to AI.

- You should not ask for direct answers to the AI.
- You should learn about 42 global approach on AI.

Phase outcomes:

Within this foundational phase, you will get the following outcomes:

- Get proper tech and coding foundations.
- Know why and how AI can be dangerous during this phase.

Comments and example:

- Yes, we know AI exists — and yes, it can solve your projects. But you're here to learn, not to prove that AI has learned. Don't waste your time (or ours) just to demonstrate that AI can solve the given problem.
- Learning at 42 isn't about knowing the answer — it's about developing the ability to find one. AI gives you the answer directly, but that prevents you from building your own reasoning. And reasoning takes time, effort, and involves failure. The path to success is not supposed to be easy.
- Keep in mind that during exams, AI is not available — no internet, no smartphones, etc. You'll quickly realise if you've relied too heavily on AI in your learning process.
- Peer learning exposes you to different ideas and approaches, improving your interpersonal skills and your ability to think divergently. That's far more valuable than just chatting with a bot. So don't be shy — talk, ask questions, and learn together!
- Yes, AI will be part of the curriculum — both as a learning tool and as a topic in itself. You'll even have the chance to build your own AI software. In order to learn more about our crescendo approach you'll go through in the documentation available on the intranet.

✓ Good practice:

> I'm stuck on a new concept. I ask someone nearby how they approached it. We talk for 10 minutes — and suddenly it clicks. I get it.

✗ Bad practice:

> I secretly use AI, copy some code that looks right. During peer evaluation, I can't explain anything. I fail. During the exam — no AI — I'm stuck again. I fail.

Chapter IV

General guidelines

- The use of `VirtualBox` (or `UTM` if you can't use `VirtualBox`) is mandatory.
- You only have to submit a `signature.txt` file at the root of your repository. You must paste the signature of your machine's virtual disk in it. See the "Submission and peer-evaluation" section for more information.
- No snapshots may exist at the beginning of each evaluation.

Chapter V

Mandatory part

This project consists of setting up your first server by following specific rules.

Since it is a matter of setting up a server, you will install a minimal set of services. For this reason, a graphical interface is of no use here. It is therefore forbidden to install X.org, Wayland, or any other equivalent graphics server. Otherwise, your grade will be 0.

You must choose as your operating system either the latest stable version of `Debian` (no testing/unstable) or the latest stable version of `Rocky`. `Debian` is highly recommended if you are new to system administration.

Setting up Rocky is quite complex. Therefore, you do not have to set up KDump. However, SELinux must be running at startup and its configuration has to be adapted for the project's needs. AppArmor for Debian must be running at startup too.

You must create at least 2 encrypted partitions using `LVM`. Below is an example of a possible partitioning:

```
wil@wil:~$ lsblk
NAME                  MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                     8:0    0    8G  0 disk
├─sda1                  8:1    0  487M  0 part  /boot
├─sda2                  8:2    0    1K  0 part
└─sda5                  8:5    0  7.5G  0 part
  └─sda5_crypt        254:0    0  7.5G  0 crypt
    ├─wil--vg-root    254:1    0  2.8G  0 lvm   /
    ├─wil--vg-swap_1  254:2    0  976M  0 lvm   [SWAP]
    └─wil--vg-home    254:3    0  3.8G  0 lvm   /home
sr0                    11:0    1 1024M  0 rom
wil@wil:~$ _
```

During the defense, you will be asked a few questions about the operating system you chose. For instance, you should know the differences between aptitude and apt, or what SELinux or AppArmor is. In short, understand what you use!

An SSH service must be running on port 4242 in your virtual machine. For security reasons, it must not be possible to connect using SSH as root.

The use of SSH will be tested during the defense by setting up a new account. You must therefore understand how it works.

You have to configure your operating system with the UFW firewall (or firewalld for Rocky) firewall and leave only port 4242 open in your virtual machine.

The example shows arbitrary disk sizes. You need to determine the appropriate size for each partition to ensure proper operation while avoiding unnecessary disk usage.

Your firewall must be active when you launch your virtual machine. For Rocky, you have to use firewalld instead of UFW.

- The hostname of your virtual machine must be your login ending with 42 (e.g., wil42).
  You will have to modify this hostname during your peer review.
- You have to implement a strong password policy.
- You have to install and configure sudo following strict rules.
- In addition to the root user, a user with your login as the username has to be present.
- This user has to belong to the user42 and sudo groups.

During your peer review, you will have to create a new user and assign it to a group.

To set up a strong password policy, you have to comply with the following requirements:

- Your password has to expire every 30 days.

- The minimum number of days between password changes must be set to 2.
- The user has to receive a warning message 7 days before their password expires.
- Your password must be at least 10 characters long. It must contain an uppercase letter, a lowercase letter, and a number. Also, it must not contain more than 3 consecutive identical characters.
- The password must not include the name of the user.
- The following rule does not apply to the root password: the password must contain at least 7 characters that were not part of the previous password.
- Of course, your root password has to comply with this policy.

`After setting up your configuration files, you will have to change all the passwords of the accounts present on the virtual machine, including the root account.`

To set up a strong configuration for your `sudo` group, you have to comply with the following requirements:

- Authentication using `sudo` has to be limited to 3 attempts in the event of an incorrect password.
- A custom message of your choice has to be displayed if an incorrect password is entered when using `sudo`.
- Each action performed with `sudo` has to be logged, including both inputs and outputs. The log file has to be saved in the `/var/log/sudo/` folder.
- The `TTY` mode has to be enabled for security reasons.
- For security reasons, the paths that can be used by `sudo` must also be restricted. Example:
  `/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/snap/bin`

Finally, you have to create a simple script called `monitoring.sh`. It must be written in `bash`.

At server startup, the script will display the information listed below on all terminals, and every 10 minutes (take a look at `wall`). The banner is optional. No errors should be displayed.

Your script must always be able to display the following information:

- The architecture of your operating system and its kernel version.
- The number of physical processors.
- The number of virtual processors.
- The currently available RAM on your server and its utilization rate as a percentage.
- The currently available storage on your server and its utilization rate as a percentage.
- The current CPU utilization rate as a percentage.
- The date and time of the last reboot.
- Whether LVM is active or not.
- The number of active connections.
- The number of users using the server.
- The IPv4 address of your server and its MAC (Media Access Control) address.
- The number of commands executed with the `sudo` program.

During your peer review, you will be asked to explain how this script works. You will also have to interrupt it without modifying it. Take a look at cron.

This is an example of how the script is expected to work:

```
Broadcast message from root@wil (tty1) (Sun Apr 25 15:45:00 2021):

    #Architecture: Linux wil 4.19.0-16-amd64 #1 SMP Debian 4.19.181-1 (2021-03-19) x86_64 GNU/Linux
    #Physical CPU: 1
    #vCPU: 1
    #Memory Usage: 74/987MB (7.50%)
    #Disk Usage: 1009/2Gb (49%)
    #CPU load: 6.7%
    #Last boot: 2021-04-25 14:45
    #LVM use: yes
    #TCP Connections: 1 ESTABLISHED
    #User log: 1
    #Network: IP 10.0.2.15 (08:00:27:51:9b:a5)
    #Sudo: 42 cmd
```

Below are two commands you can use to check some of the subject's requirements:

For `Rocky`:

```
[root@wil wil]# head -n 2 /etc/os-release
NAME="Rocky Linux"
VERSION="8.7 (Green Obsidian)"
[root@wil wil]# sestatus
SELinux status:                 enabled
SELinuxfs mount:                /sys/fs/selinux
SELinux root directory:         /etc/selinux
Loaded policy name:             targeted
Current mode:                   enforcing
Mode from config file:          enforcing
Policy MLS status:              enabled
Policy deny_unknown status:     allowed
Memory protection checking:     actual (secure)
Max kernel policy version:      33
[root@wil wil]# ss -tunlp
Netid State  Recv-Q Send-Q  Local Address:Port   Peer Address:Port Process
tcp   LISTEN 0      128           0.0.0.0:4242       0.0.0.0:*     users:(("sshd",pid=28429,fd=6))
tcp   LISTEN 0      128              [::]:4242          [::]:*     users:(("sshd",pid=28429,fd=4))
[root@wil wil]# firewall-cmd --list-service
ssh
[root@wil wil]# firewall-cmd --list-port
4242/tcp
[root@wil wil]# firewall-cmd --state
running
[root@wil wil]# _
```

For `Debian`:

```
root@wil:~# head -n 2 /etc/os-release
PRETTY_NAME="Debian GNU/Linux 10 (buster)"
NAME="Debian GNU/Linux"
root@wil:/home/wil# /usr/sbin/aa-status
apparmor module is loaded.
root@wil:/home/wil# ss -tunlp
Netid State  Recv-Q Send-Q Local Address:Port  Peer Address:Port

tcp   LISTEN 0      128          0.0.0.0:4242       0.0.0.0:*     users:(("sshd",pid=523,fd=3))
tcp   LISTEN 0      128             [::]:4242          [::]:*     users:(("sshd",pid=523,fd=4))
root@wil:/home/wil# /usr/sbin/ufw status
Status: active

To                         Action      From
--                         ------      ----
4242                       ALLOW       Anywhere
4242 (v6)                  ALLOW       Anywhere (v6)
```

Chapter VI

Readme Requirements

A `README.md` file must be provided at the root of your Git repository. Its purpose is to allow anyone unfamiliar with the project (peers, staff, recruiters, etc.) to quickly understand what the project is about, how to run it, and where to find more information on the topic.
The `README.md` must include at least:

- The very first line must be italicized and read: *This project has been created as part of the 42 curriculum by <login1>[, <login2>[, <login3>[...]]].*
- A "**Description**" section that clearly presents the project, including its goal and a brief overview.
- An "**Instructions**" section containing any relevant information about compilation, installation, and/or execution.
- A "**Resources**" section listing classic references related to the topic (documentation, articles, tutorials, etc.), as well as a description of how AI was used — specifying for which tasks and which parts of the project.

➠ **Additional sections may be required depending on the project** (e.g., usage examples, feature list, technical choices, etc.).

Any required additions will be explicitly listed below.

- A **Project description** section must also explain your choice of operating system (`Debian` or `Rocky`), including their respective advantages and disadvantages. It must describe the main design choices made during the setup (partitioning, security policies, user management, services installed) and provide a comparison between:
  - Debian vs Rocky Linux
  - AppArmor vs SELinux
  - UFW vs firewalld
  - VirtualBox vs UTM

English is recommended; alternatively, you may use the main language of your campus.

Chapter VII

Bonus part

Bonus features:

- Set up the partitions correctly so that you obtain a structure similar to the one below:

```
# lsblk
NAME                    MAJ:MIN RM   SIZE RO TYPE  MOUNTPOINT
sda                       8:0    0  30.8G  0 disk
├─sda1                    8:1    0   500M  0 part  /boot
├─sda2                    8:2    0     1K  0 part
└─sda5                    8:5    0  30.3G  0 part
  └─sda5_crypt          254:0    0  30.3G  0 crypt
    ├─LVMGroup-root     254:1    0    10G  0 lvm   /
    ├─LVMGroup-swap     254:2    0   2.3G  0 lvm   [SWAP]
    ├─LVMGroup-home     254:3    0     5G  0 lvm   /home
    ├─LVMGroup-var      254:4    0     3G  0 lvm   /var
    ├─LVMGroup-srv      254:5    0     3G  0 lvm   /srv
    ├─LVMGroup-tmp      254:6    0     3G  0 lvm   /tmp
    └─LVMGroup-var--log 254:7    0     4G  0 lvm   /var/log
sr0                      11:0    1  1024M  0 rom
```

- Set up a functional WordPress website with the following services: lighttpd, MariaDB, and PHP.
- Set up a service of your choice that you think is useful (NGINX / Apache2 excluded!). During the defense, you will have to justify your choice.

The example shows arbitrary disk sizes. You need to determine the appropriate size for each partition to ensure proper operation while avoiding unnecessary disk usage.

To complete the bonus part, you have the possibility to set up extra services. In this case, you may open more ports to suit your needs. Of course, the UFW/firewalld rules have to be adapted accordingly.

The bonus part will only be assessed if the mandatory part is PERFECT. Perfect means the mandatory part has been fully completed and works without any malfunctions. If you have not passed ALL the mandatory requirements, your bonus part will not be evaluated at all.

Chapter VIII

Submission and peer-evaluation

You only need to submit the expected README.md file, and a `signature.txt` file at the root of your `Git` repository. You must paste the signature of your machine's virtual disk into this file. To get this signature, you first have to open the default installation folder (it is the folder where your VMs are saved):

- Windows: `%HOMEDRIVE%%HOMEPATH%\VirtualBox VMs\`
- Linux: `~/VirtualBox VMs/`
- MacM1: `~/Library/Containers/com.utmapp.UTM/Data/Documents/`
- MacOS: `~/VirtualBox VMs/`

Then, retrieve the signature from the `".vdi"` file (or `".qcow2"` for `UTM` users) of your virtual machine in `sha1` format. Below are four command examples for a `rocky_serv.vdi` file:

- Windows: `certUtil -hashfile rocky_serv.vdi sha1`
- Linux: `sha1sum rocky_serv.vdi`
- For Mac M1: `shasum rocky.utm/Images/disk-0.qcow2`
- MacOS: `shasum rocky_serv.vdi`

This is an example of the output you will get:

- `6e657c4619944be17df3c31faa030c25e43e40af`

Please note that your virtual machine's signature will be altered as soon as you start the virtual machine again. To allow signature verification for all your evaluations, you can either duplicate the virtual machine disk file, or use a snapshots for each evaluation.

It is of course FORBIDDEN to include your virtual machine in your Git repository. During the defense, the signature of the signature.txt file will be compared with the one of your virtual machine. If the two of them are not identical, your grade will be 0.

The use of snapshots is restricted. Each defense must start without any snapshots. A snapshot dedicated to the defense will then be created and deleted at the end of the defense. You are encouraged to make tests with the snapshot features before submitting your project.

During the evaluation, a brief **modification of the project** may occasionally be requested. This could involve a minor behaviour change, a few lines of code to write or rewrite, or an easy-to-add feature.

While this step may **not be applicable to every project**, you must be prepared for it if it is mentioned in the evaluation guidelines.

This step is meant to verify your actual understanding of a specific part of the project. The modification can be performed in any development environment you choose (e.g., your usual setup), and it should be feasible within a few minutes — unless a specific time frame is defined as part of the evaluation.
You can, for example, be asked to make a small update to a function or script, modify a display, or adjust a data structure to store new information, etc.

The details (scope, target, etc.) will be specified in the **evaluation guidelines** and may vary from one evaluation to another for the same project.