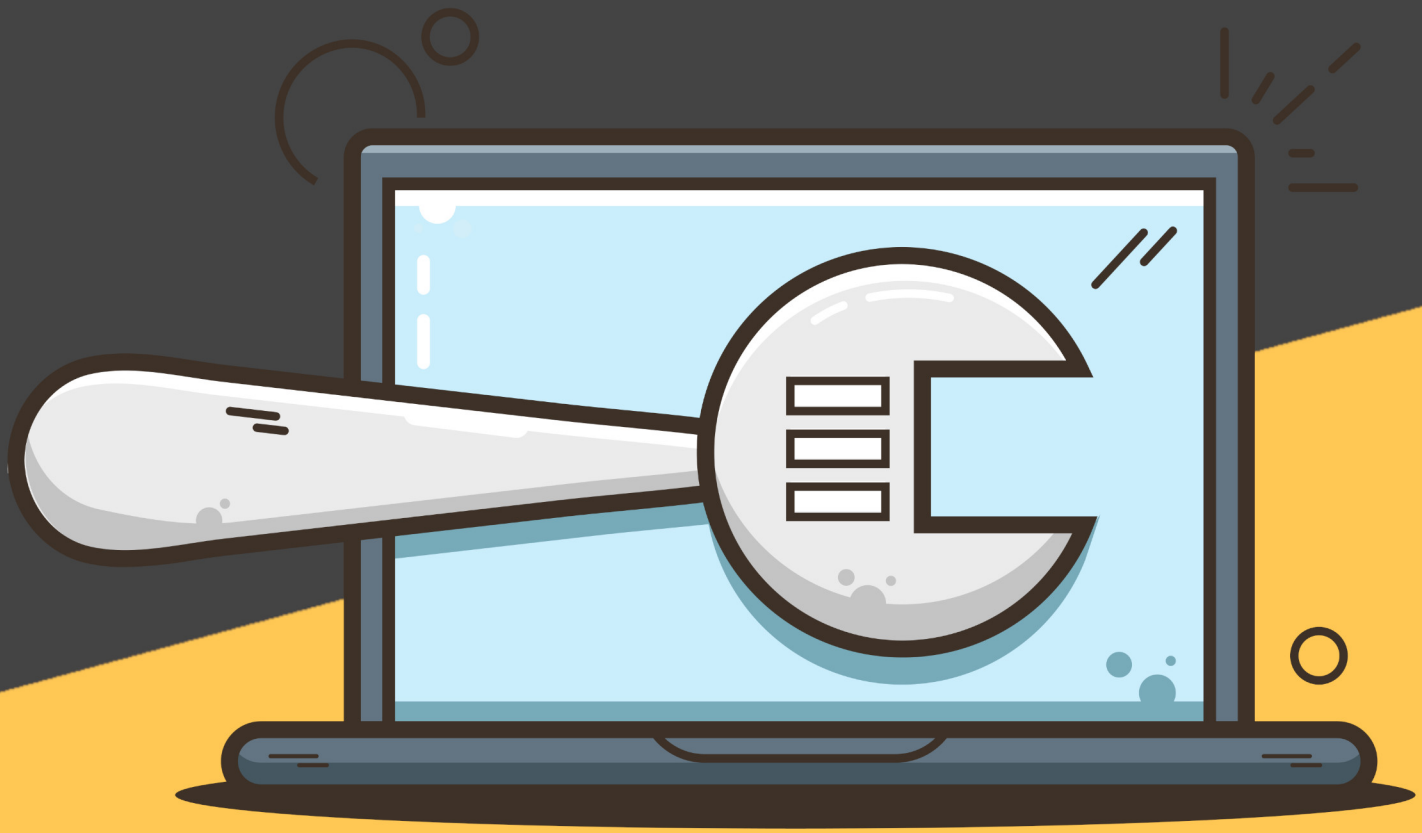
Building your

Mouseless Development Environment



Matthieu Cneude

Building Your Mouseless Development Environment

Contents

Welcome, Mouseless Developers

With this book we'll embark, together, in a creative journey where we'll build an efficient and Mouseless Development Environment. We'll go from the void of an empty hard disk to a complete system you can mostly use with a keyboard. We'll install everything manually at the beginning, and we'll become an omniscient entity able to summon the whole development environment with one command at the end.

There are huge benefits to install a complete system by ourselves: we'll learn a tonne along the way. It's good to use tools to achieve our goals, but it's even better to know a little about how they work. It will also allow us more flexibility to modify whatever we want according to our needs.

Knowledge brings flexibility, and flexibility brings efficiency.

Our secret weapon? The command-line. We'll use it for almost everything we'll do throughout this book, because it's simply the most powerful tool we can use. It's consistent, it doesn't get out of fashion, it doesn't get in our way, it doesn't dramatically change when new versions are available. It will make your life easier and it will give you tremendous power. Who doesn't want that?

If you need more arguments to convince you that the command-line is what you need to level up to a higher plane of existence (at least), here we go:

1. As developers, we often have to deal with Linux-based systems on servers (or containers) where only the command-line is available.
2. Command-Line Interfaces (CLIs) don't have any graphical interfaces. To use these programs, we have no choice: we need the shell.
3. The shell gives you the ultimate power we all seek: automation. It's difficult to automate the movements of your mouse on a graphical interface; it's easier when you deal with plain text, like the command-line.

Keep the acronym "CLI" in mind: we'll use it often throughout the book.

I'll explain everything for you to understand what we're doing, why we're doing it, and how you can personalize your system according to *your* needs. To *your* workflow. To *your* personality. The goal: acquiring the knowledge you need by practicing and experimenting. Then, you'll be able to transfer this knowledge on any development environment you want, even if it's based on another Linux distribution, or if you want to use a more standard IDE instead of Neovim, for example. You can even use most of the tools described in this book on macOS too.

Now, a bummer: we won't dive deep into everything we'll talk about, or this book would become way too long for us to survive it; both the poor writer and the poor readers. Instead, it will focus on showing how the different tools described in this book can work together.

That said, each chapter of the book concludes on a list of resources you can read to satisfy your infinite curiosity.

Who Should Read This Book?

Everyone can read this book, but not everybody will get the most value out of it. So, should you read this book?

If you're a beginner in software development, this book is for you. I try to explain everything you need to know to understand what we're doing. Yet, it can be a bit tough on you because it's a lot of information to swallow at once. My advice: go slowly, don't hesitate to try things out, to experiment, to play with the command-line. This book will be truly rewarding if you put the effort and some patience.

If you're a seasoned developer but you don't use the command-line often, you're at the right place. This book is for you if you want to know more about Linux, the shell, and if a Mouseless Development Environment sparks your infinite curiosity. Personally, when I discovered it, the spark looked more like an enlightenment! You think I'm exaggerating? Yes, I am. But still.

If you already use the command-line intensively and the tools I describe in this book, you might not learn much from it. I'm sorry. It breaks my heart more than yours. That said, Building Your Mouseless Development Environment can help you fill the gaps in your knowledge. Buying the book can be a good way to support my work, too; if you like my blog, my GitHub, my style, or my limited charisma. You can still offer this book to some poor souls who still work on Windows, too. It's not that I judge you, Windows developers; I was in your situation for decades. It's just that the grass is greener and tastier on the Linux side of the fence.

What Is a Mouseless Development Environment?

The obvious goal of a Mouseless Development Environment is to use less of the mouse. It doesn't mean that you can throw your mice through your windows. First, because you might kill somebody, second because it's not nice to pollute, and third because the mouse is still useful in many cases. I'm not dogmatic.

Using the mouse is great for some endeavors, like graphical manipulation, video editing, or musical creation. I wouldn't draw in a terminal like I wouldn't write a book with a brush; it wasn't meant for that.

I'm sure you noticed but software engineers deal with a lot of text: we spend our time writing code and (hopefully) documentation. It's for this kind of job that our keyboard and our commands really shine. Text never goes out of trend: you can write scripts to parse them and to automate anything you want, thanks to the Holy Shell. Repeat after me: glory to the Holy Shell!

A Mouseless Development Environment lets you keep your hands on the keyboard most of the time, which is a blessing by itself. It's very comfy not to move your hands to reach your mouse, then your keyboard, then your mouse, in an infinite recursion of pain. Even if you think that it doesn't bother you, you'll see the truth by simply trying not to use it. I thought it wasn't a problem for a long time, but trying to stay on the keyboard definitely changed my way of working.

What Do You Need to Follow Along?

To follow this book, you need to have a *place* to install the whole system and its tools: Arch Linux, URxvt, Neovim, Zsh, tmux, and so on. If you have an empty hard disk, that's a very good container for that. You can also use a virtual machine if you want to see first how it looks, or if you just want to follow the book for learning purposes, without the intention to use the final Mouseless Development Environment.

The good news: even if you finish the book on a virtual machine, you'll have a complete installer for the Mouseless Development Environment somewhere on GitHub. It's something we'll build together, too. You can use it on any standard computer you want, even on a MacBook Pro; tested and approved. If you fall in love with your new shiny environment, as I did, you'll be able to install it quickly on a new computer.

You can create virtual machines using Virtualbox. A virtual machine is a simulated computer using the resources of your physical computer. You can install anything you want on it, without your physical computer to know about it. Both systems (host and virtual machine) are decoupled as much as possible. In general, virtual machines are great to try different OS or Linux distributions without too much hassle.

If you install the Mouseless Development Environment on a physical computer, I recommend you to find a way to be able to read this book while installing everything. You can use another computer, a tablet, or a reader for example.

Creating Your Own Cheatsheets

Since a Mouseless Development Environment focuses on using the keyboard when it's appropriate, we'll see many shortcuts (or keystrokes) in this book. We'll go through each tool step by step to understand why and how to use these keystrokes, for you to remember them easily.

Still, you need to be able to go back to these keystrokes if you forget them while using your system. You can of course download ready-made cheatsheets from the Internet, but in my experience they are not very useful for beginners. You risk ending up in an ocean of keystrokes, not really knowing what are the most important ones, suffocating under too many possibilities.

That's why I would advise you to write your own cheatsheets while going through the book. Write one for each tool. If you need to be convinced, here some arguments:

1. Writing will help you to remember the different keystrokes. You can also write some comments, categorize them, and even add some personal mnemonics. You can draw something funny near your keystroke. Humour is a great tool to memorize. In short, you'll make these keystrokes *yours*.
2. You can organize them in a way which makes sense to you.
3. When you'll come back to them, you'll feel they are some extension of your brain, not 10923810938 unknown keystrokes downloaded from a random, cold, and sad Internet corner.

I followed this technique when I learnt to build my own Mouseless Development Environment, and I believe that's one of the reasons why I never found Neovim or anything else to have a high learning curve. I was then able to get things done in this mouseless system very quickly. Believe me, it's not because I'm a genius; I'm a very standard human.

Similarly, you should also write down the different commands you'll see in this book, for the same reasons.

Experimenting Is Key

To learn, you need to practice and experiment. It's a bit more work than passively watching a Youtube video, but it's more effective too. Write your own cheatsheet, comment your configuration files and bash scripts, and don't hesitate to play around with everything. The goal is not to memorize but to understand how it works. Try to modify a command and see what options you can use, for example.

In two words: be curious.

The more you'll learn about the shell in general, the easier it will be for you to learn what you can put on top and how it works.

Styling Conventions

There are only a few special styling conventions in this book. You'll know, while reading the book, what to execute in the shell, and what to write in what config files.

Sometimes, `<something>` will pop up in some commands you need to execute. That is, an expression surrounded with the characters `<` and `>`. For example, `fdisk <your_hard_disk>`, or `su <user_name>`. These are variables you, and only you, know the values of. No worries: I'll tell you each time how you can find the information you need to replace them with a good value.

You might also see arrows at the beginning of specific lines in code blocks. For example:

```
echo "LANG=<language_code>_<country_code>.<character_encoding>" >
 ↪  /etc/locale.conf
```

It means that even if the command appears on two lines in the book, it should be written on one line.

Choose Your Tools

You can replace any tool we'll see in this book with another one or your liking, but I would suggest you to follow the entire book first to understand how they can work together. Then, you can modify any configuration file or replace any tool you want because, instead of copying and pasting the configuration of a random person on the Internet, you'll have built your whole system by yourself. You'll have a great control over it.

We'll use Neovim for every editing task from the start. If you don't want to learn how it works, you can use Nano instead or anything else you prefer.

In a Nutshell

What did we learn in this chapter?

- If you're not already using the command-line and a Mouseless Development Environment daily, you'll learn many things from this book. Otherwise, you can still try to fill some gaps in your knowledge.
- Create your own cheatsheets to maximize your learning. Make the useful information your own.
- Don't be afraid to experiment with the different commands and the tools we'll see throughout the book.

In the next chapter, we'll discuss about some important basics about Linux-based systems.

Part I - Linux

Preparing Your System for Arch Linux

It's time to get our hands dirty! In this chapter, we'll prepare our system for Arch Linux for us to feel at home. More precisely, we'll answer these questions:

- How to burn an Arch Linux ISO on a USB key?
- How to configure the Arch Linux live system?
- How to partition a hard disk using fdisk?
- How to create and mount new filesystems?

This is the very beginning of the journey, so I'll try to explain most things in detail. Ready for the challenge? Let's go!

Prerequisites

To install our new Mouseless Development Environment, we'll need the following:

1. A computer with a 64-bit CPU (not older than 10 years).
2. Internet access via Ethernet *and* Wifi is recommended, in case one or the other doesn't work on the Arch Linux live system.
3. An empty hard disk, or a hard disk you'll wipe out (at least 20 GB to feel comfy).
4. A USB key (at least 1 GB).
5. A second computer, a tablet, or any other device allowing you to read this book while installing everything.
6. Internet access on your second device is highly recommended, in case you have a problem in the first chapters.

As we mentioned already, the computer can be a virtual machine or a physical one.

Burning the Arch Linux ISO

If you wonder what the heck an ISO is, it's a file representing a physical disk. We can burn ISO files on a real disk, which means copying everything from the ISO to the disk.

To install Arch Linux, we need to start (or *boot*) our computer using the Arch Linux live system, and install the OS from there. Here's how to do that:

1. Download the Arch Linux ISO. Find your country, click on the first link, and download `archlinux-<the_last_release_date>-x86_64.iso`.

2. Verify that the ISO is the official one, and has not been modified by horrible hackers. You need to generate the MD5 hash of the ISO and compare it with the one provided on the download page. To get this hash, you can use the following commands:
   - On Windows: `CertUtil -hashfile <path_to_ISO_file> MD5`
   - On Linux: `md5sum <path_to_ISO_file>`
3. Burn the ISO on a USB key. You can use:
   - On Windows: rufus.
   - On Ubuntu: Startup Disk Creator.
   - On another Linux distro: UNetbootin.
4. Change the boot order to read USB devices before your hard disk. You can do that by using your BIOS interface.
5. Plug your USB key and start your computer.

For the fourth point, you can normally access the BIOS interface by hitting a specific key when your computer starts. If you're lucky, it might be displayed at startup long enough for you to see it. It's often `ESC`, `DEL` or `F10`. Every computer is different on this point, so I can't really help you more.

When you found a way to access your BIOS' interface, search for any option concerning the boot. You can normally change the boot order of the devices: the goal is to put your USB device before your hard disk. When you're done with that, there will be some options to save your changes and restart your computer.

If you did everything correctly, your computer will boot from your USB key, and you'll see a menu inviting you to install Arch Linux. Let's do it!

Configuring the Arch Linux Live System

Your screen will then spit out many green "OK" messages telling you what systemd is starting. We'll talk about systemd later in this book. Then, you'll end up in a shell prompt. It will look like this:

```
root@archiso ~ #
```

A prompt is a set of characters indicating that you can execute commands. Here, it indicates what user you are (`root`) and the hostname `archiso`. The hostname is the name of your system as it will appear on a network.

Welcome to the Arch Linux live system! What's a live system? For now, nothing has been installed on your hard disk; instead, the system you have access to is running from your computer's memory (RAM). Many distros provide a live system for you to test it even before installing anything.

It also means that everything you're doing in the live system won't survive if you shut down or restart your computer, except if you deliberately write something on your hard disk. For example, any program you'll install on the live system won't be installed on your hard disk.

The shell we're using now is called the "Z shell", or Zsh. It's similar to the most famous shell, Bash. We'll dig more into Zsh later in this book, too. Here are some functionalities you can use with the shell:

- You can enter any command in a shell prompt and execute it by hitting `ENTER`.

- The shell can save the command history:
  - You can quickly access executed commands with the keys `ARROW UP` and `ARROW DOWN`.
  - You can search through the history with `CTRL+r`.
- You can use Zsh auto completion by hitting `TAB`.
- To stop a running command, you can use the keystroke `CTRL+c`. Be careful with it: patience is sometimes safer. Think about what your command is doing before interrupting it, and consider the price you might have to pay by stopping it before it's done.

You are now the *root user*. You can create different users on a Linux system, but the root user is special. It has almost all power a user can have. Don't confuse the root user and the root directory `/` we saw in the previous chapter. A filesystem and a bunch of users are different things, even if they have both root as their name.

By being the root user, you're in fact the demigod (or demigoddess!) of the "archiso" live system. Why only demi? Because a user can't control directly the kernel. The kernel is the real master around here.

Keyboard Layout

By default, you'll end up with the American keyboard layout on the Arch Linux live system. If you're not comfortable with it, you can change it. Here are the two commands you can use to do so:

1. `ls /usr/share/kbd/keymaps/**/*.map.gz` - List all layout available.
2. `ls /usr/share/kbd/keymaps/**/*.map.gz | grep "<your_language_code>"` - Filter all layout with grep.

For example, if I want to use a French keyboard layout, I can do this:

```
ls /usr/share/kbd/keymaps/**/*.map.gz | grep "fr"
```

The result will look like the following:

```
/usr/share/kbd/keymaps/i386/azerty/fr-latin1.map.gz
/usr/share/kbd/keymaps/i386/azerty/fr-latin9.map.gz
/usr/share/kbd/keymaps/i386/azerty/fr.map.gz
/usr/share/kbd/keymaps/i386/azerty/fr-pc.map.gz
/usr/share/kbd/keymaps/i386/bepo/fr-bepo-latin9.map.gz
/usr/share/kbd/keymaps/i386/bepo/fr-bepo.map.gz
/usr/share/kbd/keymaps/i386/dvorak/dvorak-ca-fr.map.gz
/usr/share/kbd/keymaps/i386/dvorak/dvorak-fr.map.gz
/usr/share/kbd/keymaps/i386/qwertz/fr_CH-latin1.map.gz
/usr/share/kbd/keymaps/i386/qwertz/fr_CH.map.gz
/usr/share/kbd/keymaps/mac/all/mac-fr_CH-latin1.map.gz
/usr/share/kbd/keymaps/mac/all/mac-fr.map.gz
/usr/share/kbd/keymaps/sun/sunt5-fr-latin1.map.gz
```

You can then choose your layout by using the filename without the file extension `map.gz`:

```
loadkeys <filename>
```

For example, I would run the command `loadkeys fr-latin1` for a French keyboard layout.

Write this keymap somewhere, you'll need it again in the next chapter.

Connecting to the Internet

What would we be without Internet? Nothing more than unconscious amoebas lost in a chain of misconceptions we call reality. Without Internet, I wouldn't even be able to write the previous sentence!

To connect to this infinite amount of knowledge and cat pictures, we need some network device. The command `ip link` will show you the truth about them. Let's try to run it in the terminal:

```
ip link
```

Something like this will be output:

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode
↪  DEFAULT group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp0s25: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state
↪  DOWN mode DEFAULT group default qlen 1000
    link/ether f0:de:f1:84:f3:a6 brd ff:ff:ff:ff:ff:ff
3: wlp3s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP mode
↪  DORMANT group default qlen 1000
    link/ether 08:11:96:0a:12:b4 brd ff:ff:ff:ff:ff:ff
```

Don't worry about the first result `lo`. The second one `enp0s25` is my network device for Ethernet cable; it often begins with an 'e'. The third one `wlp3s0` is for the Wi-Fi; this one often begin with a "w". We don't have the same computer, so it's more than likely we won't have the same network devices either.

If you want to connect to Internet using a cable, simply plug it. For the Wi-Fi, you can run the following:

```
iwctl
```

A new shiny prompt will appear. It works similarly to the shell prompt you had before. Here are the commands you can use:

1. `device list` - List all your Wi-Fi devices.
2. `station <device> get-networks` - Replace `<device>` with the name of one of yours, to get a list of networks you can connect to with this particular device.
3. `station <device> connnect "<network>"` - Replace `<device>` and `<network>` by the device you want to use with the network you want to connect to.
4. If a password is required, enter it.
5. `station <device> show` - Show you if you're indeed connected.
6. `exit` - Exit `iwctl`.

If it failed, you might get the friendly message `Operation failed`. Don't worry and try again: even demigods fail, sometimes. Demigoddesses too. Another reason why we're only "demi"

here, and not the full version.

Let's now verify that you're really connected. Millions of people use this command all around the word as we speak, to verify their Internet connection:

```
ping -c 5 thevaluable.dev
```

It will send 5 requests to the address `thevaluable.dev` and display the following:

```
64 bytes from v22017064675050008.supersrv.de (185.183.156.38): icmp_seq=1
↪  ttl=58 time=32.6 ms
64 bytes from v22017064675050008.supersrv.de (185.183.156.38): icmp_seq=2
↪  ttl=58 time=32.6 ms
64 bytes from v22017064675050008.supersrv.de (185.183.156.38): icmp_seq=3
↪  ttl=58 time=32.1 ms
64 bytes from v22017064675050008.supersrv.de (185.183.156.38): icmp_seq=4
↪  ttl=58 time=32.9 ms
64 bytes from v22017064675050008.supersrv.de (185.183.156.38): icmp_seq=5
↪  ttl=58 time=32.2 ms
```

If you've got something similar, you're connected to the infinite Internet! Lucky you.

If it doesn't work, try:

```
ping -c 5 185.183.156.38
```

If this last command works, this means that you can't resolve addresses like `thevaluable.dev` to its IP address `185.183.156.38`. In that case, try to run a DHCP client:

```
dhcpcd &
```

What's `thevaluable.dev`? It's my blog, to show you how to do some subtle product placement in your own book.

System Clock

Let's now use one of the oldest protocols on the Internet. Anxious? Don't worry, Internet is the only stuff which never breaks in the computing world. Not like enterprise Java code.

Run this command:

```
timedatectl set-ntp true
```

We synchronized our system clock with the Network Time Protocol. That's all. Next!

BIOS or UEFI?

You remember the interface you used to change the boot order of your devices, to boot your USB key before another device?

This was the interface of some *firmware*, a piece of software tightly linked to a piece of hardware. In this precise case, this firmware is called a *BIOS* (for `B`asic `I`nput `O`utput `S`ystem) and it's directly embedded in a chip in your motherboard. The BIOS is the first piece of software running when you're booting (starting) your computer.

This BIOS verifies that your hardware works properly. It also makes available an interface for you to configure some basics, like the order of the booting devices. It will also run the *bootloader*, another program which is used to boot an operating system, like Arch Linux.

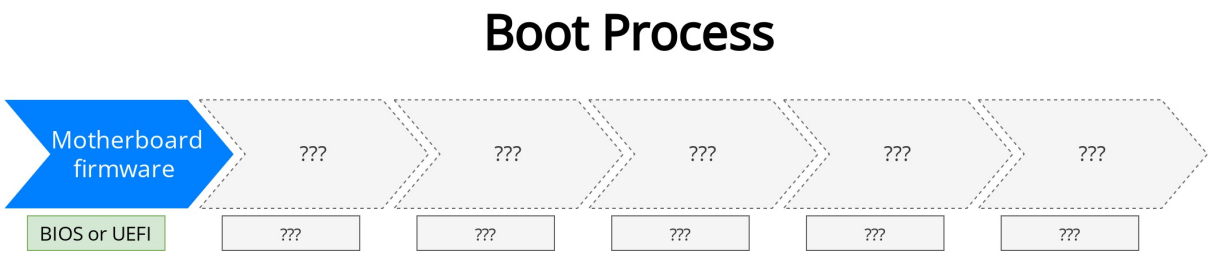
That said, the BIOS is now considered deprecated for a better alternative, called *UEFI* (for `U`nified `E`xtensible `F`irmware `I`nterface). BIOS and UEFI are two different types of firmware, but confusion arises when the UEFI pretends to be a BIOS, sometimes using the term "BIOS" on its own interface! It's often an ironic attempt not to confuse people who are used to having a BIOS.

Long story short, because the firmware of your motherboard starts the bootloader of Arch Linux, we need to know if you have a BIOS or a UEFI on your computer. To verify that, simply run in the shell:

```
ls /sys/firmware/efi/efivars
```

If you see the error `no such file or directory`, this means that your computer has a BIOS. If it outputs a bunch of files, you have a UEFI. You need to remember what kind of firmware you have to install Arch Linux properly. My advice: write it somewhere, on a piece of paper for example. We'll need this information later to create our boot partition and install the bootloader itself.

We've just learned the first piece of software which runs on our computer. You know what we should do? Create a diagram we'll complete as we go, to describe the boot process of a Linux-based system:



This process is followed by all Linux distros out there. The box under the arrow indicates the program (or group of programs) used during this process, sometimes specific to Arch Linux.

Partitioning the Hard Disk

Enough explanations. Let's do some serious stuff now. First, let's run the following in the shell:

```
lsblk
```

This command will display your *block devices*. A block device is a file which represents a physical device. Confused? How can a device, such as a hard disk, be represented as a file?

A Linux-based system tries hard to have a consistent way for you, the applications running on your system, the kernel, and the hardware, to interact with each other. In other words, Linux

offers a consistent *interface* between you and your physical system, and between the programs running and your physical computer.

Indeed, to facilitate this deep and intimate relationships, there is an important principle to understand on a Linux system: **everything is a file**. You don't need to ask yourself how to read a program or write to a device, like your hard disk: the answer will always be via a file.

For example, you can try to run the following in your shell:

```
cat /proc/stat
```

The output will give you the CPU status at the precise time you read the file. That's what I mean when I speak about an interface between you (or some running programs) and a device (your CPU in that case).

We'll come back to this idea over and over: it's central to any Linux-based system. For now, if you look at the output of our command `lsblk`, you'll see something similar to this:

```
NAME    MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda       8:0    0 465.8G  0 disk
  sda1    8:1    0   200M  0 part /boot
  sda2    8:2    0    16G  0 part [SWAP]
  sda3    8:3    0 389.6G  0 part /
```

- `sda` is a file representing my hard disk (`TYPE disk`).
- `sda1` to `sda4` are partitions of the hard disk (`TYPE part` for partition). A partition is a virtual division of a physical hard drive.

If your hard disk is empty, you shouldn't see any partition.

You can see the files representing your hard disk in the `/dev` directory ("dev" for "device").

Wiping Your Hard Disk

If your hard disk is not empty, you need to delete everything on it. All its data will be lost, forever. It can take a long time depending on the size and the type (mechanical or SSD) of the hard disk. As an example, for a mechanical disk of 1 TB, it took me 4 hours to entirely wipe it.

If you're good with that, run the following in your shell:

```
dd if=/dev/zero of=<your_hard_disk> status=progress
```

You need to replace `<your_hard_disk>` with yours.

For example, considering the output above when I run the command `lsblk`, the name of my hard disk is `/dev/sda`.

As a result, to wipe it, I need to run `dd if=/dev/zero of=/dev/sda status=progress`.

If you have multiple hard disks, be sure to select the good one! The command `dd` is merciless; its sweet little nickname is "Disk Destroyer". It won't ask you anything and will wipe out everything you give. You don't want to mess up with `dd`!

Part II - Mouseless Tools

i3: A Deeper Dive

We saw very quickly in the chapter First Steps In Your Mouseless Development Environment how to use i3. In this chapter, we'll dive deeper into i3 configuration to really understand what we can do with this fantastic windows tilling manager. I hope that at the end of this chapter you'll be able to understand i3's excellent documentation and what to modify in your configuration to answer your own needs.

A tiling window manager is often lighter than a full-blown desktop environment. It provides powerful mouseless functionalities to manage the windows displaying your favorite applications: the terminal, your favorite cat pictures viewer, and whatnot.

Do you think resizing windows manually is an activity providing a lot of value? I don't think so. As we saw already, i3 helps you manage your windows for 99% of your use cases, if you're not in dire needs of floating windows. This percentage has no scientific foundation whatsoever, but it doesn't stop me to believe in it. We have to believe my friends!

In this chapter, we'll see:

- The general organization of i3.
- How to configure i3.
- What are workspaces and how to configure them.
- How to configure a locking screen.
- How to set up a wallpaper.
- How to configure floating windows.
- How to configure the colors and styles of i3's graphical interface.
- How to configure scratchpads.
- What's the i3 bar and how to configure it.
- How to create a menu with dmenu to manage your screens (if you have more than one).
- What do we need to update in our dotfiles project.

We'll cover a lot here: take a solid beverage, a nice snack, and let's go exploring the depth of i3 together.

How To Use i3?

General Organization

Like tmux we'll see in a later chapter, i3 stores its information in a tree data structure. Let's see what each node can represent.

Workspaces

At the top of our tree you'll find the *workspaces*. You can think of them as virtual desktops. A workspace can contain *containers*.

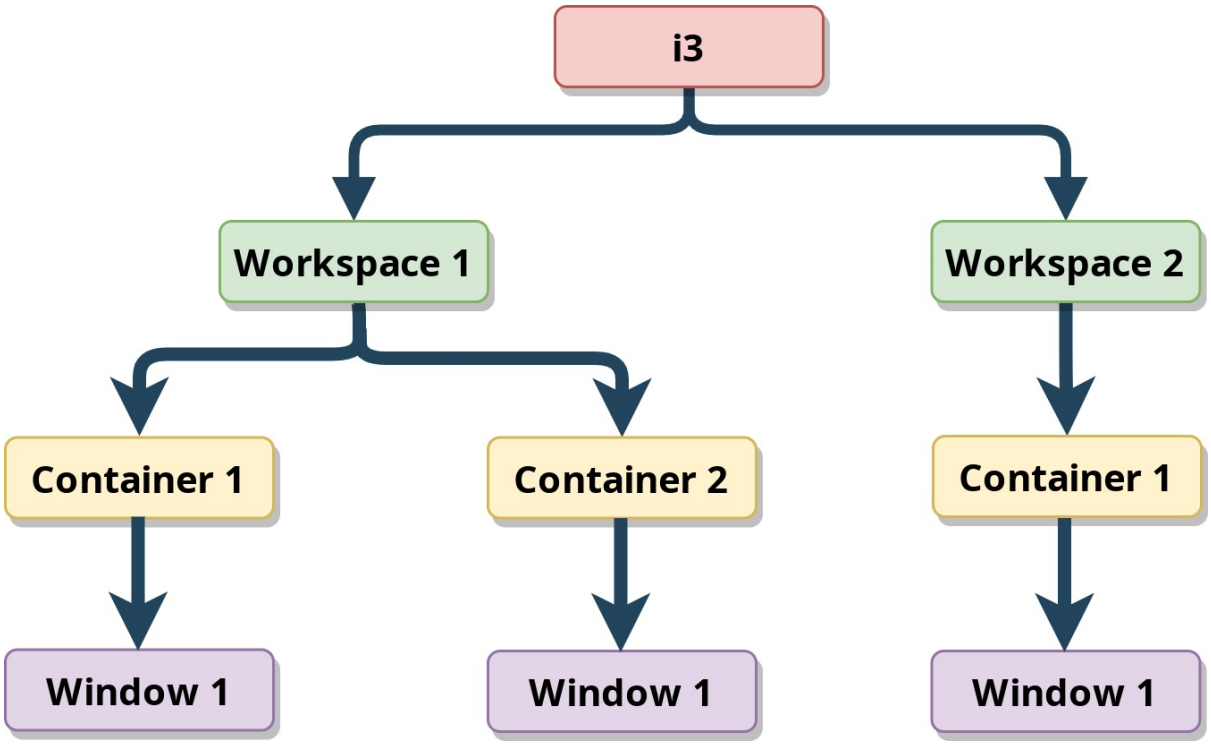
Containers

A container can contain one or multiple *windows*. These windows will be positioned depending on the container's layout. There are three different layouts possible:

- **Split** - Each window shares the container space and are split horizontally (*splith*) or vertically (*splitv*). This is the default layout.
- **Stacked** - The focused window is visible on top and the other ones are stacked below. You can change the window's focus via keystrokes easily. You can see the windows' headers at the top of the container itself.
- **Tabbed** - This layout is similar to the stacked layout, except that the windows' headers are vertically split, not horizontally.

Note that a container can contain other containers too.

To understand this tree of workspaces, container, and windows, here's a possible representation:



Of course, you can have more workspace, containers, and windows, if you want to. This is just an example to show the hierarchy of the different elements.

The Default Shortcuts

We've seen that i3 uses a special key for (almost) every keystroke. This key is called a *modifier*; by default, it's the `WIN` key (or `CMD` key, if you like Apple keyboards). The variable `$mod` in the configuration is there to set this modifier key. I'll use this variable in this chapter to express the modifier key for the different keystrokes, and you should always use it in your own configuration.

Enough mumbling. Let's practice!

As we saw already, you can move the windows around and see how they are resized automatically. To do so, try to open multiple windows and hit `$mod+SHIFT+ARROW KEY` to see what happens.

We can try to change the layout of the container, too, by using the following keystrokes:

- `$mod+e` - Switch to *split* layout ("splith" or "splitv" depending on your screen).
- `$mod+s` - Switch to *stacked* layout.
- `$mod+w` - Switch to *tabbed* layout.

You can try to create and move windows using each layout to see the differences.

You also need to know the following keystrokes:

- `$mod+SHIFT+c` - Reload i3's configuration. You need to use it each time you modify your configuration file, to apply the changes to the current i3 session.
- `$mod+SHIFT+e` - Logout and quit i3. We will modify that later.

Configuring i3

Configuration Files

Your config file (`~/.config/i3/config`) should already exists. This is not the only configuration file available for i3: different ones can be loaded in a specific order. Here's the complete list; the configuration files on top can overwrite every other configuration files below.

1. `~/.config/i3/config` (or `$XDG_CONFIG_HOME/i3/config` if `$XDG_CONFIG_HOME` is set).
2. `~/.i3/config` .
3. `/etc/xdg/i3/config` (or `$XDG_CONFIG_DIRS/i3/config` if `$XDG_CONFIG_DIRS` is set).
4. `/etc/i3/config` .

The first file overwriting everything else is `~/.config/i3/config` . That's great, because it's the configuration file we'll use. In practice, this means that any option or keystroke set in this file will overwrite the same options or keystrokes set in other files.

Default Configuration

Let's dive a bit more into i3's config. First, let's open the file with Neovim:

```
nvim ~/.config/i3/config
```

One of the first lines of the config will define your modifier key (`$mod`), as I explained above. You can modify it here if you like.

To see every possible value you can use as modifier, you can run in your shell the command `xmodmap` . It will list everything you can use.

As you can see, you can define variables using the keyword `set` followed by the variable name (`$mod` here) and its value (`Mod4`).

Below in the configuration file, you'll see something like this: