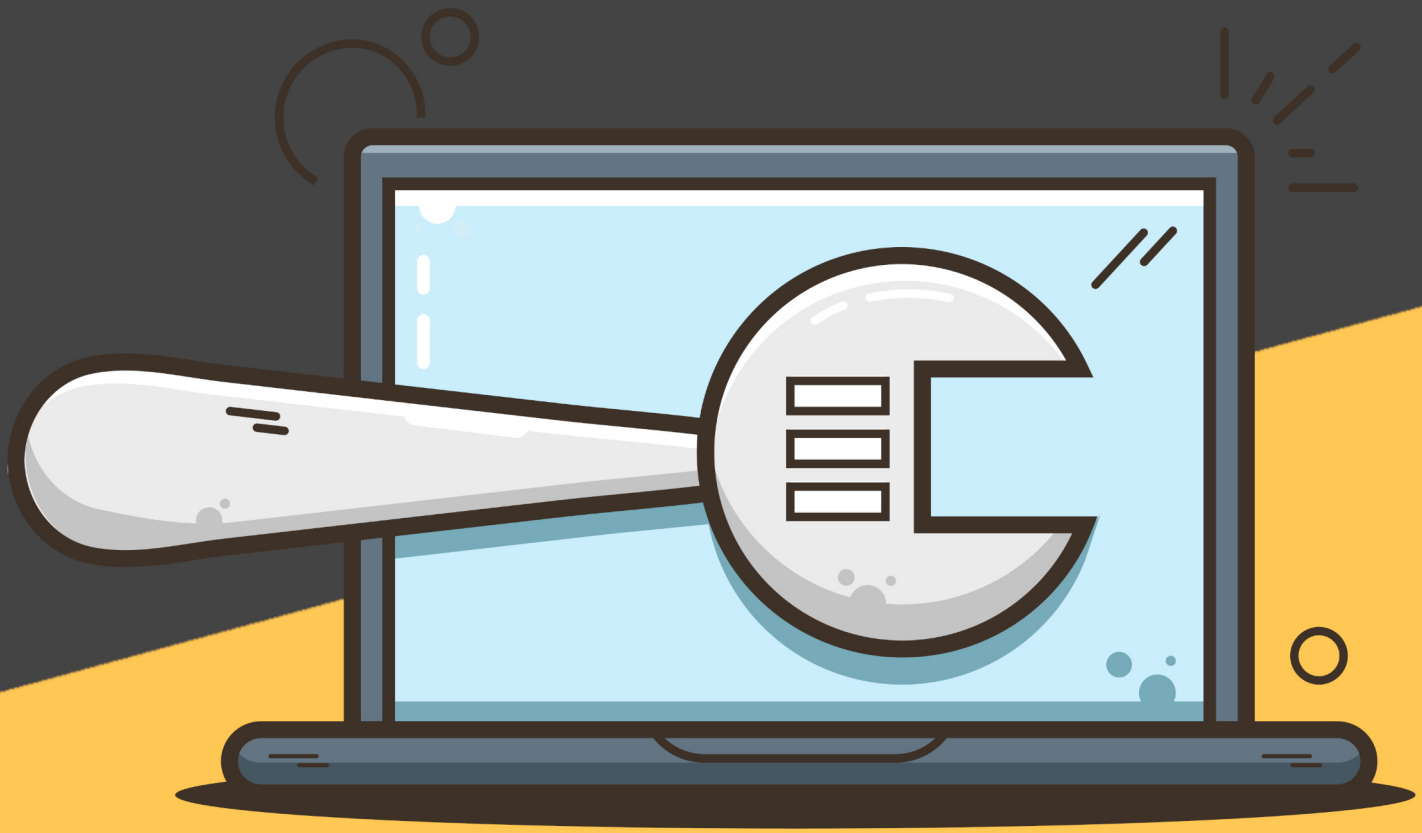
Building your

Mouseless Development Environment



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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.
    - On Windows, you can use the command `CertUtil -hashfile <path_to_ISO_file> MD5`.
    - On Linux, you can use the command `md5sum <path_to_ISO_file>` to get the MD5 of the 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, for my French keyboard layout, I would run the command `loadkeys fr-latin1`. 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:

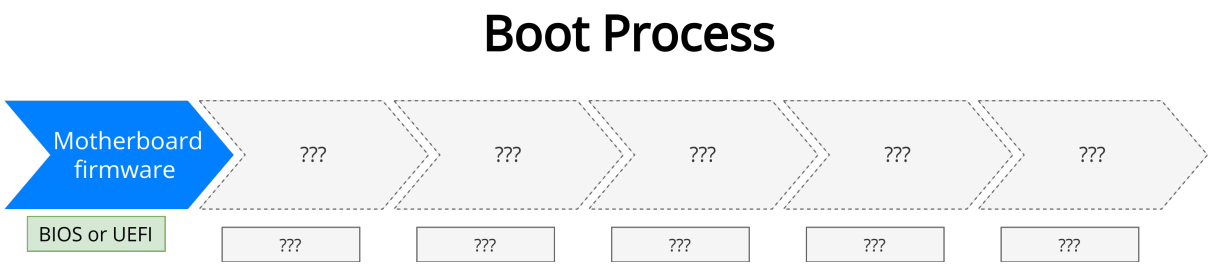

Figure 3: The boot process: BIOS and UEFI

This process is followed by all Linux distros out there. The green 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.

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:

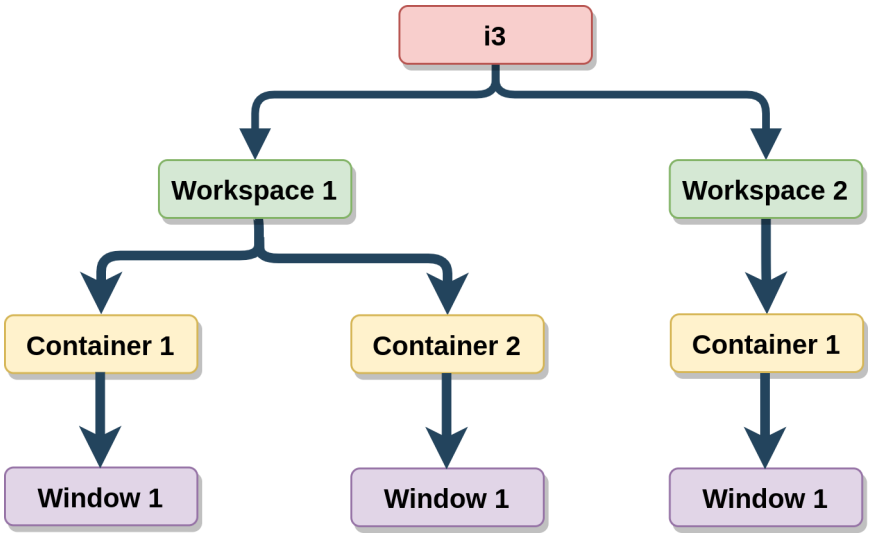

Figure 8: i3 general organization

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:

```
bindsym $mod+Return exec i3-sensible-terminal
```

The keyword `bindsym` allows you to bind a symbol to a command. Internally, a symbol is mapped to a keycode (a key on your keyboard). To see this mapping, you can run in your terminal `xmodmap -pke | less`.

Here, the symbol `Return` is used. If you prefer using a keycode directly instead of a symbol, you can use the command `bindcode` instead of `bindsym`.

This keystroke will execute (using the command `exec`) `i3-sensible-terminal`, a script trying to find and open an instance of your terminal. Since we use URxvt, we can replace this line with:

```
bindsym $mod+Return exec urxvtc
```

Don't forget to hit `$mod+SHIFT+r` to apply the changes.

Let's continue our exploration. Below you'll find the line:

```
bindsym $mod+Shift+q kill
```

It allows you to kill a window. Depending on the application running in that window, some operations might be done before closing. For example, Firefox will save the current session.

Program Launcher

Again, as we saw, there is no start menu where you can find the applications installed on your system. Instead, you can launch your favorite software using a program launcher.

Let's look at the following line:

```
bindsym $mod+d exec --no-startup-id dmenu_run
```

It defines a keystroke to launch dmenu, as we saw in a previous chapter.

If you don't like the launcher, you can install and use another one if you want later. As stated in the configuration, rofi is a good alternative.

Moving Windows and Changing Focus

You can focus or move the different windows in your current workspace using `$mod+jkl;` or `$mod+SHIFT+jkl;`. Since we use Neovim, it would make sense to use `hjkl` instead. It's not only Neovim: other CLIs uses `hjkl` too, being consistent will save you some headaches.

Let's modify the binding for focusing windows:

```
# change focus
bindsym $mod+h focus left
bindsym $mod+j focus down
bindsym $mod+k focus up
bindsym $mod+l focus right
```

You'll find below in the file the keystrokes to move focused windows. You can also change them:

```
bindsym $mod+Shift+h move left
bindsym $mod+Shift+j move down
```