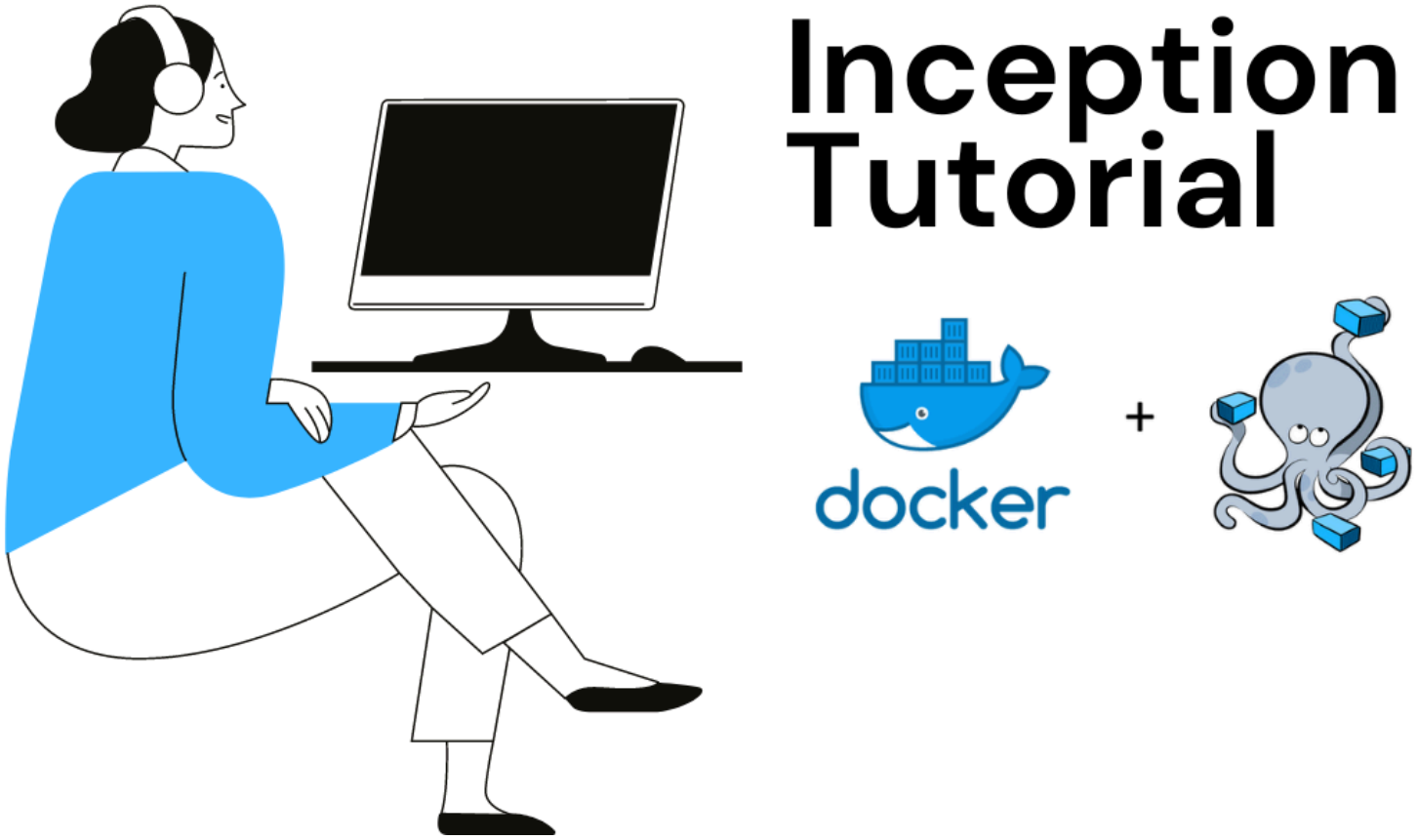


Learning objectives

1. Understanding **Docker** and **Compose** .

5. Set up the container**WordPress**
6. Connect the containers with**Compound**
7. Understanding the volumes of**Compound**
8. Finalizethe project

1. Understanding Docker :

📌 The advantage of Docker is clear, it**solves**one of the biggest **problems for developers** :

👉 Finding yourself creating a great program on your computer, and realizing that it only works on your own computer. To use it elsewhere you will have to install the required dependencies 🤯

Remember this**great program**that you found on **Github** , you install it as planned by the ReadMe tutorial 📄, but the installation**crash**indicating " ***You have missing dependencies*** ", or " ***This version of this file is not compatible with your OS*** " 😣

👉 So yes, you can stay a**good developer** and come up with a great **script that will install those dependencies** , but you can't predict that the user is on Mac, Linux, or has an OS version so old that it doesn't even know your dependencies!

▶ ⚙️ The types of problems that Docker fixes

> Spend 4 hours on **debug** of software that is not ours and realizing that we will not succeed, tends to drive us crazy 🤯

This is what must have happened to **Solomon Hykes** , a French-American who ended up wondering if it was possible to find a**solution**to this kind of problem.
In response to this, he comes out**Docker** **March 20,** 2013 .

🎯 Reminder from the Docker Wiki **: Docker is a tool that can package an application and its dependencies into an isolated container.**

▶ ⚙️ The History of Docker

Why do developers use Docker? 🤔

The great advantage of**Docker**is the ability to model each container as an image that can be stored locally.

🔎 A **container** is a virtual machine without a kernel.
📌 What I call **the kernel** is the entire system that allows the virtual machine to function, the OS, the graphics side, network, etc.
🔎 In other words, a container contains **only the application** *and* **the application's dependencies** .

Docker Hub:

Dockerprovides a kind of App Store, containing images (container) of thousands of people, simplifying its use even more 👍

Imagine you want to host a website, for example you would need to install **NGINX** .
Install it on your computer? You wouldn't have learned your lesson? What if you didn't have the right OS, or the wrong dependencies?

🤔 We would need the Docker container which installs NGINX by itself.
😏That's good, since it is known that the NGINX image has been published by **NGINX on the Docker Hub!** 🥳

Let's look at an example of what an NGINX image might look like:

```
FROM    alpine:3.12

RUN     apk update && apk upgrade && apk add  \
              openssl     \
              nginx     \
              curl      \
              vim       \
              sudo

RUN     rm -f /etc/nginx/nginx.conf

COPY    ./config/nginx.conf /etc/nginx/nginx.conf
COPY    scripts/setup_nginx.sh /setup_nginx.sh

RUN     chmod -R +x /setup_nginx.sh

EXPOSE    443

ENTRYPOINT  ["sh", "setup_nginx.sh"]
```

👉 This file is a **Dockerfile** , it is the name of the main file of your images**Docker**.
Who says **Dockerfile** , says new programming language, but don't run away, it's about knowing these few key words.

▶ FROM

▶ RUN

▶ COPY

▶ EXPOSED

▶ ENTRYPOINT

Here is a site detailing the different types of keywords that can be used in Docker.

> ⚠️ To continue you must have understood the principle of Docker.

Docker-Compose:

Now that you understand the real usefulness of Docker, it is a matter of understanding a functionality of**Docker**called Compose.

📄 Here is what the Docker docs explain about Compose:

> **Docker Compose**is a **tool that was developed to help define and share multi-container applications.**
> With**Compound**, we can create a file**YAML**to define services and, with a single command, put everything inroador alldisassemble.

💡 **Compound**would therefore allow to manage applications which use several containers and to communicate between them.

📖 *You also need to make a Makefile which should be located at the root of your directory. It should allow you to set up your entire application (i.e. build the Docker images via docker-compose.yml)*

📖 A text on a blue background like this is always taken from the subject **of Inception** from 42.

📖 This project will consist of you setting up a mini-infrastructure of different services following specific rules.

Now it is certain, the project consists of linking several imagesDocker, and to be able to launch them together, without them losing their independence.
All this thanks toDocker-Composewhich is intended for this type of use.

But is this useful in everyday life?

In fact, the use ofDocker-Composetakes on its full meaning in an IT infrastructure.

Imagine, you launch your startup,Bananeo.
You would need to set up a website, you create your NGINX image*(or you get the one from NGINX on theDockerHub).*
You now have a functional website for your business.

> Obviously this may take more time than 2 sentences to put in place 🤣

Now thatBananeohas about ten employees, it would be nice to set up a badge reader 🪪 at the entrance to avoid too much work for Manu 👮 from security.

So you create a new imageDocker, specially designed to register your employees in a*database*and being directly connected to your *time clock* .
You also quickly deploy another image managing an intra.Bananeo.fr website allowing your employees to manage their working hours.

And Yop! Everything works. But your time clock never communicates with the intra site, and it would be nice to be able to tell your employees when they are late, especially for Eric who has always found the right excuse for the past 2 weeks.

That’s where Compose comes in !

You are going to set up a file.yml, remember this is the formatYAMLwhich allows instructions to be given toCompoundon how to manage these different images.

Let's take a closer look at how the file might be written.ymlofBananeo:

```
version: "3"

  services:       # précise les différents services (images) à utiliser
  nginx:
    build: requirements/website/
    env_file: .env          # indique le fichier optionnel contenant l'environnement
    container_name: website # Le nom du container ( doit porter le meme nom que le service d'apres le sujet )
    ports:
    - "80:80"             # le port, détaillé juste en dessous
    restart: always         # Permet de redémarrer automatiquement le container en cas de crash
  nginx:
    build: requirements/intra/
```

```
container_name: badgeuse
build: mariadb
env_file: .env
restart: always
```

😆 No, this docker-compose.yml does not work on Inception.

This file **.yml** allows to give instructions to **Compound** to manage 3 mariadb images, NGINX and WordPress.
Like a **Dockerfile** which must necessarily begin with **FROM** version tracking, your file **YAML** must start with the version of **Compound**, refer to current versions .

2. Understand the topic:

▶ SUBJECT TO DOWNLOAD

📖 Each service will have to run in a dedicated container.

Here are the different containers to set up according to the subject:

NGINX *(with TLS v1.2)*

WordPress *(with php-fpm configured)*

MARIADB *(without NGINX)*

Here are the two volumes to be set up according to the subject:

Volume containing your **WordPress database**

Volume containing your **WordPress site files**

> These volumes must be available from the `/home/ <login> /data` host machine folder using **Docker**.

We will also need to put in place:

A ***docker network*** that will link your containers.

Users to create in our WordPress database:

An **Admin user** (must not be called admin)

A standard user

📖 For readability reasons, we will need to configure our domain name to point to **our local IP address** . This domain name will be*<login>*.42.fr

---

In order to carry out these different tasks, the subject provides several other details:

📖 The latest tag is **forbidden** .

When you specify a dependency to install, you must specify its version to install, the advantage of the tag***latest***is clear, install the **latest version** of a dependency.
However***latest***also has a big disadvantage , it can bring **compatibility problems** over time.
Example: Today you could configure everything so that the latest versions work correctly with each other, but imagine that 2 years later someone wants to test your software, it could be that some dependencies have evolved and work differently with each other, that's why it is better to indicate the version to use.

📖 No password should be present in your**Dockerfiles**.

Do we really need to explain this point? 😅
It must be said that this is one of the biggest mistakes made by devs using Github.
Yes, it happens that developers push certain sensitive information into their repo, such as API keys or even clear passwords 🤔
Obviously this remains **the number 1 mistake** to avoid.
If this happens to you, don't make the second mistake of re-pushing on top by deleting your key or password, Github commits will eventually betray you ❌
Instead, consider quickly deleting your commit .

This instruction goes with the previous one, so you must use your machine's environment.
This might seem useful for storing passwords or the like.

📖 Setting up a ***. env*** file to store your environment variables is **highly recommended** .

We now know how to store our environment.

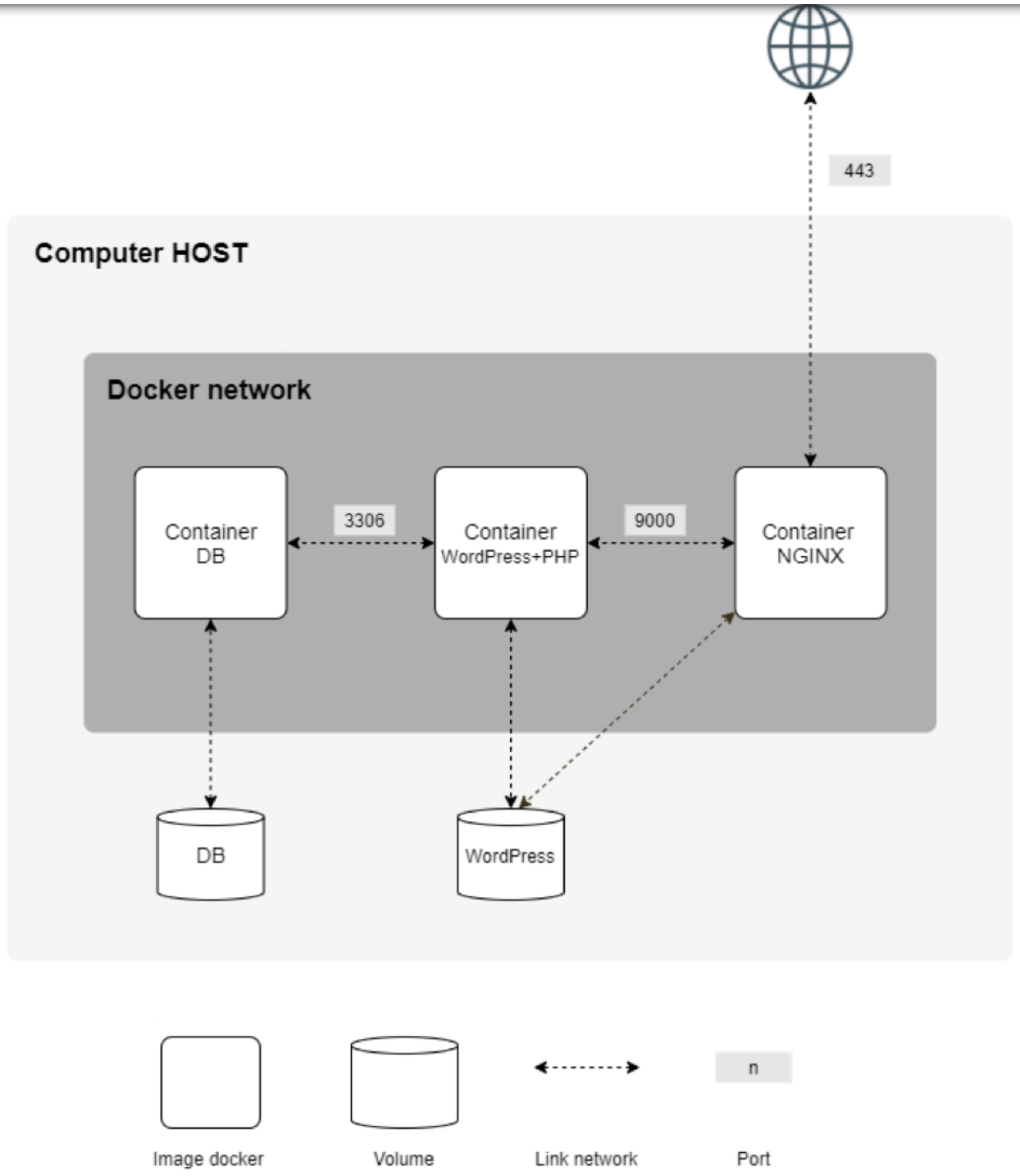
In the topic we also find an example of what this .env file could look like thanks to a `cat srcs/.env` :

```
DOMAIN_NAME=wil.42.fr
# certificates
CERTS_=./XXXXXXXXX
# MYSQL SETUP
MYSQL_ROOT_PASSWORD=XXXXXXXXXX
MYSQL_USER=XXXXXXXXXX
MYSQL_PASSWORD=XXXXXXXXXX
[...]
```

💡 Thanks to this `cat` we can imagine the information we will need to set up our project.

📖 **Your NGINX** container must be the only entry point to your infrastructure through port **443 only using TLSv1.2** or **TLSv1.3** protocol

The only entry point of our Compose must be through the NGINX container, going through port **443** .
That is to say that the only port that Docker-Compose will open on your machine will be **443** *(tips: this is the port that allows access via https://, and 80 via http://)*
This ***diagram*** provided in the topic should clear things up:


443
Computer HOST
Docker network
Container DB
3306
Container WordPress+PHP
9000
Container NGINX
DB
WordPress
Image docker
Volume
Link network
n
Port

💡 **It is stated that we should use TLSv1.2** or **TLSv1.3** protocol

But what is ***TLS*** ?

Wikipedia tells us:
Transport ***Layer Security*** *(* ***TLS*** *)* is a protocol securing exchanges via computer networks , particularly via the Internet .

TLS allows:

- server authentication
- confidentiality of exchanged data*(or encrypted session)*
- the integrity of the data exchanged
- optionally, client authentication*(but in reality this is often ensured by the application layer)*

I don't know about you, but **TLS** seems to me to be very similar to **SSL** , the famous protocol that adds a**green padlock**when you access a site**secure**, like most sites today.

💡 This is the protocol that changes your **URLs** from *http* to *https* .

So my question is quickly,

What is the difference between**TLS**And**SSL**?

SSL and **TLS** are two protocols that allow authentication and encryption of data that passes between servers.

In fact, **SSL** is the predecessor of **TLS** . Over time, new versions of these protocols have emerged to address vulnerabilities and support ever stronger, ever more secure encryption suites and algorithms 🔐

The History of SSL/TSL:

Initially developed by **Netscape** , SSL was released in **1995** in its SSL 2.0 version.*(SSL 1.0 was never released)*.
But after the discovery of several vulnerabilities 🔓 in **1996** , version 2.0 was quickly replaced by SSL 3.0.

Based on SSL 3.0, TLS was introduced in **1999** as ***the new version of SSL.***

The TSL protocol is therefore simply the **replacement for SSL** . It corrects certain ***security vulnerabilities*** in older **SSL** protocols .

We will therefore have to make our system secure, by a protocol similar to SSL, the **TSL**.

Before starting our project, let's look at the last document provided with the topic, the **expected structure of our project** :

```
$> ls -alR

total XX
drwxrwxr-x 3 wil wil 4096 avril 42 20:42 .
drwxrwxrwt 17 wil wil 4096 avril 42 20:42 ..
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 Makefile
drwxrwxr-x 3 wil wil 4096 avril 42 20:42 srcs

./srcs:
total XX
drwxrwxr-x 3 wil wil 4096 avril 42 20:42 .
drwxrwxr-x 3 wil wil 4096 avril 42 20:42 ..
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 docker-compose.yml
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 .env
drwxrwxr-x 5 wil wil 4096 avril 42 20:42 requirements

./srcs/requirements:
total XX
drwxrwxr-x 5 wil wil 4096 avril 42 20:42 .
drwxrwxr-x 3 wil wil 4096 avril 42 20:42 ..
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 bonus
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 mariadb
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 nginx
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 tools
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 wordpress

./srcs/requirements/mariadb:
total XX
drwxrwxr-x 4 wil wil 4096 avril 42 20:45 .
drwxrwxr-x 5 wil wil 4096 avril 42 20:42 ..
drwxrwxr-x 2 wil wil 4096 avril 42 20:42 conf
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 Dockerfile
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 .dockerignore
drwxrwxr-x 2 wil wil 4096 avril 42 20:42 tools
[...]

./srcs/requirements/nginx:
total XX
drwxrwxr-x 4 wil wil 4096 avril 42 20:42 .
drwxrwxr-x 5 wil wil 4096 avril 42 20:42 ..
drwxrwxr-x 2 wil wil 4096 avril 42 20:42 conf
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 Dockerfile
-rw-rw-r-- 1 wil wil XXXX avril 42 20:42 .dockerignore
drwxrwxr-x 2 wil wil 4096 avril 42 20:42 tools
```

💡 Let's not neglect this kind of information provided with the subject, it can already help us start the project.

Reminder of the **3 containers** to put in place:

NGINX *(with TLS v1.2)*

WordPress *(with php-fpm configured)*

MARIADB *(without NGINX)*

As I explained at the beginning, each container is represented by a `dossier` symbol bearing its name.
In each container folder there must be its**Dockerfile**, otherwise**Docker**would be lost.
Remember, in addition to the**Dockerfile**we can add different configuration files/folders that it would then be interesting to copy into our container using the**Dockerfile**and its keyword**COPY**.

The diagram provided with the subject directly tells us which files it would be interesting to provide with our containers, here they are:

- ***A conf*** file that could contain the container configuration file*(the NGINX config for its associated container for example)*
- ***A .dockerignore*** file . Just like the ***.gitignore*** file , it tells**Docker**files that should not be looked at, because they will probably have no use for you**Docker**.
- A folder `tools` that will probably store other tools that we might need.

We can already reproduce the requested file structure to see things more clearly 🤓

Now that we understand what the subject expects from us, it would be interesting to ask ourselves:

Where to start?

Once we have our `dossiers` required files, we should start by creating one of the three required containers.

💡 No need to tackle the game**Compound**for now, how would you connect 3 containers together if you don't own any?

3. NGINX Container:

Let's start with our least fuzzy container, **NGINX** .
NGINX allows you to set up a web server .

We will start step by step in order to better understand how to use and walk around with it.**Docker**.

Most developers would have gone straight through this, but here **42** forbids us from doing so, so we can recreate it ourselves.

If you followed correctly, you should know which line to write first, at least the first keyword in the Dockerfile.

▶ **SPOILER** 🔎

📖 For performance reasons, the containers will have to be built either under Alpine Linux with the penultimate stable version, or under Debian Buster.

So for the OS we have the choice between*debian:buster*Or*alpine:X.XX(check the penultimate stable version here).*

What is the difference between Alpine and Debian ?

Alpine Linuxis a lightweight, security-oriented Linux distribution , it contains as few files and tools as possible in order to allow the developer to install them themselves if necessary.

Debianis the universal operating system. Debian systems currently use the Linux kernel or the **FreeBSD** kernel .

For my part, being more comfortable with this system, I will use**Debian**.

💡 The rest of the tutorial is shown for**Debian**. But you should easily be able to adapt this to**Alpine**.

So we can start by writing: `FROM debian:buster` in our**Dockerfile**.

Now I want to tell you, if this line is the only mandatory line, could our container start?

We have specified an OS to install, we should be able to launch it.

The coolest thing is that**Docker**can allow us to launch a*“virtual machine”*, but by specifying it, we can also access its terminal! Useful for seeing what's inside or performing our own tests.

To do this, you need to know the essential commands for Docker containers.

The essential commands of a Docker container:

A container**Docker**must be **build** before launching.

💡 Every Docker command starts with the keyword `docker`

Build a Docker container: `docker build`

😵 I hope you wouldn't dare try this command without having fully understood it!

🤪 In any case, the command is not functional, docker necessarily asks for a path where the Dockerfile of the image to be built is located.

In our case, it would be `docker build srcs/requirements/nginx/`

Or even simpler, `docker build .` by finding yourself directly in the NGINX folder.

You can also specify a name for your build, with the flag `-t`

Example : `docker build -t nginx .`

💡 If you get an error like this `Cannot connect to the Docker daemon` , check that Docker is open and running .

Know the current images*(after a successful build):* `docker image ls`

🥳 You should see your first image!

😕 However this one does not have a name below **REPOSITORY,** it is indicated*<none>*, even if we can link this image to its ID present in the fourth column, the subject asks us that the name of the image bears the name of the associated container, here **NGINX** .

And we can do that! We simply need to specify when we build the image, its name, using the flag `-t`

Start an image*(run)* : `docker run <image_name>`

📌 You will need to provide the name of your image to run.

👉 By specifying `-it` the name of your image before, you will directly access the terminal of your container when it is launched.

Know the containers currently launched: `docker ps`

👉 You can even get the Docker containers stopped by adding the flag `-a`

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/d7c6c85d-8a9e-46e3-8b31-2898d714aa14/use.txt

---

We are now ready to attempt to launch our mini**Dockerfile**.
Let's start by **building** our container.
In the folder containing the**Dockerfile**`NGINX` : `docker build -t nginx .`

Now let's launch the **container** we just **built** : `docker run -it nginx`

❯ `-it` allows you to open the container terminal when it is launched.

Welcome to your container!
To exit the terminal of a **container** , it's a classic, you have to type ' `exit` '

If you do a `ls` , you will immediately see:

```
bin   dev  home  lib64  mnt  proc  run   srv  tmp  var
boot  etc  lib   media  opt  root  sbin  sys  usr
```

This is the famous Debian kernel **!**
In itself, the files that allow the operating system to function properly.

Now you are in your container, you can install whatever you want.
Let's start by updating ***apt*** *in the container terminal*

💡 **APT** is a command-line utility for installing, updating, removing, and managing deb packages on Ubuntu, Debian, and related Linux distributions.

So APT is a package manager for Debian, to be sure that the version of **APT** installed on this container knows the latest versions of the packages, we will ask it to check for updates using: `apt update` , if all goes well APT should respond: **All packages are up to date.**
We can add `apt upgrade` to install any updates of packages found.

just type: `apt install nginx`

Great! Now we have a container that has **NGINX** .

But small problem: if we close our container, and we open it again, **NGINX** is gone! 😩
This would mean that you will have to enter the terminal each time you open the container to install it again? 😔
Fortunately not, and that's where our**Dockerfile**🤩
Remember, there is a keyword**RUN**which allows you to indicate to Docker a command to carry out when creating the container.

So we could simply add to our**Dockerfile**: `RUN apt install nginx` ❯ **install NGINX**

▶ **SPOILER** 🔎

Now our build goes further! But there is still one**error**…
You may notice that the penultimate line says: `Do you want to continue? [Y/n] Abort.`
Huh? But yes I want to continue! However when**Docker** **build** a container, there is no prompt to respond**YES**to this question…
Anyway the idea of a**Dockerfile**It is to be able to create your project without asking your opinion during installation.
How to do it?

APT provides an option `-y` to automatically respond**YES**to this kind of question when installing a package.
So it would be a good idea to get into the habit of adding it when adding a line using **APT** , otherwise your container will not be able to create itself.
So you just have to add a **-y** at the end of the line which concerns the installation of **NGINX** by **APT** .
This gives: `RUN apt install nginx -y`

Let's try to build again... It works!
You can now re-enter your container with it `docker run -it nginx` and find yourself in the container again, but this time the N **ginx** installation is already done!

In order to be able to be comfortable accessing the container terminal, I will install **vim** and **curl** . Feel free to install the packages that seem useful to you:

```
RUN apt install vim -y
RUN apt install curl -y
```

Ok now on to **the TSL** !
We will create a folder, which will store the certificate and the key for a**secure connection**.
Let's add: `RUN mkdir -p /etc/nginx/ssl`

It would also be important to download the main tool for SSL certificate management/creation, **OpenSSL**
For this, like other packages, we install it with **apt** .

```
RUN apt install OpenSSL -y
```

```
openssl req
```

The req command primarily creates and processes certificate requests in PKCS#10 format. It can also create self-signed certificates.

We will then add the keyword ***-x509*** to specify the type of certificate.

```
openssl req -x509
```

Now if we create our certificate, OpenSSL will ask us for a password, and remember, if we ask for something to enter in the container startup, it will not be able to **build** . So we must avoid this at all costs!

Fortunately, **OpenSSL** has anticipated this, with the **-nodes** option , our private key will simply be left without a password.

```
openssl req -x509 -nodes
```

You then need to tell OpenSSL where you want to store the certificate and key for our SSL by adding the **-out** and **-keyout options.**

```
openssl req -x509 -nodes -out /etc/nginx/ssl/inception.crt -keyout /etc/nginx/ssl/inception.key
```

If we launch this command we risk having a***prompt***which requires certain information for the certificate.

Fortunately, OpenSSL has planned for this again and allows us to pre-fill them by adding an option called `-subj`

```
openssl req -x509 -nodes -out /etc/nginx/ssl/inception.crt -keyout /etc/nginx/ssl/inception.key -subj "/C=FR/ST=IDF/L=Paris/O=42/OU=42/CN=login.42.fr/UID=login"
```

All that remains is to enter this preceded by a `RUN` in our**Dockerfile.**

Well done !Your TSL key and certificate are now automatically created when you start your **container** !

We will then create a folder that will allow us to store the NGINX config files.

```
RUN mkdir -p /var/run/nginx
```

Now we should modify the **NGINX** configuration *file* as we wish. To do this, we could **redirect** certain sentences in the ***config*** file , but we will instead use the keyword**COPY**of**Dockerfile**, which seems made for that.

So we're going to take the base NGINX config file and modify it afterwards. It **'s** located **in** `/etc/nginx/nginx.conf`

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/a97aeef6-ffc4-4d2e-835d-36986aacdff5/nginx.conf

`COPY conf/nginx.conf /etc/nginx/nginx.conf`

The NGINX configuration file should be replaced by ours when the container starts, let's do a test by adding the sentence *"yes we can"* commented out at the beginning of our *nginx.conf* file in the `conf` .

If all goes well, by ***building*** the container, and **launching it** , you should see your NGINX conf file modified *by* accessing it with vim for example.

Before launching **NGINX** , you should tell **NGINX** which configuration you want to use within Inception .

The NGINX configuration file:

This page helps us configure **NGINX** for **ssl** .

Here is the basic configuration that can be found:

```
server {
  listen 443;                    ❯ Depuis la version 1.12 de NGINX, il faut préciser ssl.
  ssl on;                       ❯ Inutile depuis la version 1.12
  ssl_protocols TLSv1 TLSv1.1 TLSv1.2;        ❯ Gardons TLSv1.2 & TLSv1.3
  ssl_certificate /etc/nginx/ssl/bundle.crt;      ❯ Indiquons notre certificat
  ssl_certificate_key /etc/nginx/ssl/private.key;   ❯ et notre clef
  ...
}
```

The config file therefore becomes:

```
server {
  listen 443 ssl;
  ssl_protocols TLSv1.2 TLSv1.3;
  ssl_certificate /etc/nginx/ssl/inception.crt;
  ssl_certificate_key /etc/nginx/ssl/inception.key;
  ...
}
```

Now we have the **SSL/TSL** part working with **NGINX** .

I will clarify the home folder by adding `root /var/www/wordpress;`

This is the folder where WordPress will be located and therefore its first page to display.

I will also specify which page to display first, in WordPress **you** have to indicate **index.php** , but I will also add others that seem important to me.

`index index.php index.html index.htm;`

Since the connection will be made from localhost, I indicate it in **server_name:** `server_name localhost;`

The config file now looks like this:

```
server {
  #SSL/TLS Configuration
  listen 443 ssl;
  ssl_protocols TLSv1.2 TLSv1.3;
  ssl_certificate /etc/nginx/ssl/inception.crt;
  ssl_certificate_key /etc/nginx/ssl/inception.key;

  #root and index and server_name
  root /var/www/html;
  server_name localhost;
  index index.php index.html index.htm;
}
```

Next, you need to add rental rules for **WordPress** .
First we need to tell NGINX to return any request we don't know about with a **404 error** .
This *topic on stackoverflow* explains this well. So we add the rule:

```
location / {
  try_files $uri $uri/ =404;
}
```

💡 For all files, we try to open the specified file, if it fails we will return **404** .

We still need to install **PHP to be able to** handle WordPress **PHP** requests .

🚫 The topic indicates that PHP must be installed on the **WordPress** container and not NGINX.

No worries! So we **'ll** just tell NGINX how to handle PHP **and** tell it where to return our **php** code .

```
location ~ \.php$ {               # Pour toutes les requetes php
  include snippets/fastcgi-php.conf;
  fastcgi_pass wordpress:9000;        # Comment renvoyer les requetes php sur le port 9000
}
```

`RUN chown -R www-data:www-data /var/www/html` (the main user)

Now all that remains is to launch NGINX, we will use the keyword `CMD` : `CMD [ "nginx", "-g", "daemon off;" ]`
This will start **NGINX** in the foreground so the container does not stop.

You could see the NGINX homepage by going to localhost , using **https** (because you have not opened the**http**). You should also change the **root** of the configuration file and remove it `wordpress:9000` for php, because you don't have the PHP container yet(WordPress)

A container completed!

Which container should I continue with?
We will need **MariaDB** to install **WordPress** .
When installing **WordPress** , it requires a web server(NGINX), and a database, here **MariaDB** .
So it would be wiser to understand everything about databases and start by creating this container.

4. MARIADB Container:

MariaDB is a database management system released under the GPL license. It is a community fork of **MySQL** : the project is governed by the **MariaDB Foundation.**

Basically, **MariaDB** is almost a copy of **MySQL** , but why?
MySQL was initially completely open-source , then it was acquired by **Oracle** .
Since then, several organizations have been concerned about the possibility that **Oracle** could make**paying**his software.
To prevent this, the **MariaDB** Foundation created a version that was almost identical to MySQL, but completely**open-source**.

How a database like MySQL works:
Data management is based on a table model; all data processed on **MySQL** is stored in tables that can be linked to each other via keys. Here is an example:

1	1	Le seigneur des anneaux	1954
2	1	Le Hobbit	1937
3	1	Le Silmarillion	1977
4	2	Le guide du voyageur galactique	1979
5	2	Le dernier restaurant avant la fin du monde	1980
6	2	La vie, l'univers et le reste	1984

This tutorial perfectly shows how to create a database with **MariaDB** on Debian 10 .
UPDATE: This tutorial perfectly shows how to create a database with **MariaDB** on Debian 11 .

Tutorial for using MySQL/MariaDB:

To start and be able to do your tests on your side too, we will create a**Dockerfile**minimum for **MariaDB.** If you remember what we did for the beginning of **NGINX** , we simply need to start by writing `FROM debian:buster` .
From there, you can **build** and launch the container by entering your terminal(go back up to find out how if necessary)
Now we find ourselves in our container and we can carry out our test orders there.

Let's start with the famous, essential, `apt update -y` .
Let's also add the `apt upgrade -y` .
APT now contains up-to-date dependencies, we can install **MariaDB.**

Since MariaDB version 10.3 is the most common, we can install it using **APT** .

```
apt-get install mariadb-server -y
```

💡 Think about the -y, otherwise docker will have trouble**build**your container because it will wait for confirmation from **y** ***/n*** …

Next, let's visit the MySQL configuration file, called `50-server.cnf` and located at `etc/mysql/mariadb.conf.d/50-server.cnf`
This is what the base file looks like:

```
# The MariaDB configuration file
#
# The MariaDB/MySQL tools read configuration files in the following order:
# 1. "/etc/mysql/mariadb.cnf" (this file) to set global defaults,
# 2. "/etc/mysql/conf.d/*.cnf" to set global options.
# 3. "/etc/mysql/mariadb.conf.d/*.cnf" to set MariaDB-only options.
# 4. "~/.my.cnf" to set user-specific options.
```

```
#
# This group is read both both by the client and the server
# use it for options that affect everything
#
[client-server]

# Import all .cnf files from configuration directory
!includedir /etc/mysql/conf.d/
!includedir /etc/mysql/mariadb.conf.d/
```

Ok, what if we *remove* the comments?

```
[client-server]
!includedir /etc/mysql/conf.d/
!includedir /etc/mysql/mariadb.conf.d/
```

The MariaDB configuration file :

So that's the gist of the basic config file , except we don't need that part that concerns the client side.

We start with the brackets in the file to indicate which category the next configuration will follow (this is how the **MySQL** `[mysqld]` configuration file works)
This is where we can tell **MySQL** which port to communicate on, indicated by the subject, it is **3306** 📡 with `port = 3306`
Afterwards, we also specify that all IPs on the network can connect, for this it is the line `bind_address=*` , which roughly means: `bind_address=XXX.XXX.XX.XX`
We can also specify our folder which will store our database with `datadir=/var/lib/mysql`
I add the user with `user=mysql`
I'm not sure if this is required since it's the base path, but I also specify where MySQL can find the **socket** to communicate with: `socket = /run/mysqld/mysqld.sock`

Ok good!

So our configuration file should be:

```
[mysqld]
datadir = /var/lib/mysql
socket  = /run/mysqld/mysqld.sock
bind_address=*
port = 3306
user = mysql
```

Now we need to save this file in a folder `conf` as requested by the project structure, I give it the same name, `50-server.cnf` .

Now that **MySQL** is correctly**installed,**you need to create a **database** and an associated **user .**

For this I will go through a script that I will ask the**Dockerfile**to execute.
This script must create with MySQL the table system, thanks to the command `mysql -e`

In this script we can first**to start up**MySQL, otherwise it will be difficult to configure.

```
service mysql start;
```

❱ The service command is used to start MySQL with the associated command.

Next we need to create our table!

```
mysql -e "CREATE DATABASE IF NOT EXISTS \`${SQL_DATABASE}\`;"
```

❱ I ask to create a table if it does not already exist, named after the environment variableSQL_DATABASE, indicated in my .env file which will be sent by thedocker-compose.yml.

The table is created! I will then create a user who will be able to manipulate it.

```
mysql -e "CREATE USER IF NOT EXISTS \`${SQL_USER}\`@'localhost' IDENTIFIED BY '${SQL_PASSWORD}';"
```

❱ I create the userSQL_USERif it does not exist, with the passwordSQL_PASSWORD, always to be indicated in the .env

I give all rights to this user.

```
mysql -e "GRANT ALL PRIVILEGES ON \`${SQL_DATABASE}\`.* TO \`${SQL_USER}\`@'%' IDENTIFIED BY '${SQL_PASSWORD}';"
```

❱ I give the rights to the userSQL_USERwith passwordSQL_PASSWORDfor the tableSQL_DATABASE

I will then change my **root user** ~~with localhost rights~~with this command:

```
mysql -e "ALTER USER 'root'@'localhost' IDENTIFIED BY '${SQL_ROOT_PASSWORD}';"
```

```
mysql -e "FLUSH PRIVILEGES;"
```

❯ Quite simply.

Now we just need to restart MySQL for all this to take effect!

```
mysqladmin -u root -p$SQL_ROOT_PASSWORD shutdown
```

❯ I start by turning off MySQL.

```
exec mysqld_safe
```

❯ Here I run the famous command that MySQL constantly recommends when it starts.

My script that configures our database is now functional and should launch the **mariadb** container without any problems.
Let's try to launch the container using a: `docker build -t mariadb .`
Then from a `docker run -it mariadb`
If all goes well, you should have a little [OK] which indicates that MySQL was launched without problems, and if all goes well, you should also have a***error***!

This should indicate that you did not specify any password or user during configuration, normal! You specified environment variables and these will be sent by docker-compose. Since you are starting the container alone, it does not find these variables.

Nothing to do, if **MySQL** starts and indicates at least [**OK**] is that you have completed this part.

---

5. WordPress Container:

Let's set up **WordPress** !

Luckily, **WordPress** is used by over **43% of** the world 's websites , as their homepage says. Therefore, we should find a lot of documentation about it.

Let's start as usual with a**Dockerfile**under ***debian:buster*** .
Then comes the traditional `apt-get update` and `apt-get upgrade`

```
RUN apt-get -y install wget
```

As the topic tells us, we also need to install **PHP** with **WordPress** .
Remember, it will communicate on port **9000** with **NGINX** .
For this I also use **APT** to install ***php7.3*** and its dependencies like *php-fpm and php-mysql.*

```
RUN apt-get install -y php7.3\
php-fpm\
php-mysql\
mariadb-client
```

It's finally time to install the famous **WordPress** in our container!
So we use *wget* indicating the installation link. I took the **FR 6.0 version.**
It's up to you to choose, you will find the different versions here .

wget has several options, including one that will allow us to indicate in which folder we want to download the file using -P.
In which folder? **/var/www** obviously! This is where we indicated our main folder to display in the **NGINX** container .

```
RUN wget https://fr.wordpress.org/wordpress-6.0-fr_FR.tar.gz -P /var/www
```

❯ Very good, great, but now we need to untar it, or rather uncompress it!

Come on, I'll help you, let's go to the **/var/www** folder and use `tar -xvf` the filename to unzip it and get the famous folder `wordpress` !

Then we can delete the *.tar* which is no longer useful.

```
RUN cd /var/www && tar -xzf wordpress-6.0-fr_FR.tar.gz && rm wordpress-6.0-fr_FR.tar.gz
```

❯ Here we are in `wordpress` the form of a file.

Now let's make sure to give root permissions to write to this folder.

```
RUN   chown -R root:root /var/www/wordpress
```

💡 PHP is a free programming language, primarily used to produce dynamic web pages via an HTTP server, but can also function as any locally interpreted language.

Once it is installed with **APT** , we can modify its configuration file.

Here I took the base configuration file and changed only 2 small things.

I added a line `clear_env = no` , I think this line is clear enough not to have to explain it, it's for the environment.
But I also changed the line `listen` . I indicated that it should listen at the WordPress port, **9000** .
Roughly speaking, this gives: `listen=wordpress:9000`

PHP is ready, and yes, finally after that you obviously have to ask the**Dockerfile**to copy the configuration file to the right place in the container, but there is no point in explaining it to you, you should already be experts in the field.

Now let's configure our friend **WordPress** .
What do I need to configure it for? 😣

WordPress needs a database to work, at least to know its **password** , **name** and **host** .
All this is configured in the **wp-config.php file** *(something like that)*

If you don't do this, you will arrive directly at the site configuration page, which is not bad, but the subject requires automatic configuration.

But I have good news for you! A developer has simply created a **CLI** that allows you to configure this kind of information almost automatically for you.
Take a look at *this great tutorial* .

💡 A CLI is a text-based interface that processes commands to a **computer** program . There are different command line interfaces, such as DOL and Bash Shell.

I'm going for this idea which seems really nice to me, you already have to reuse **wget** to install the CLI.

```
RUN wget https://raw.githubusercontent.com/wp-cli/builds/gh-pages/phar/wp-cli.phar
```

🤔 Another possibility would have been to directly modify the file `wp-config.php` by typing `sed` to enter the information directly into the file.

```
RUN chmod +x wp-cli.phar
RUN mv wp-cli.phar /usr/local/bin/wp
```

Ok great ! We installed the WordPress **CLI** 📄

Now we should use it, for that we will do as with **MariaDB** , create a small bash script that we will copy and which will carry out the commands for us when launching the container.

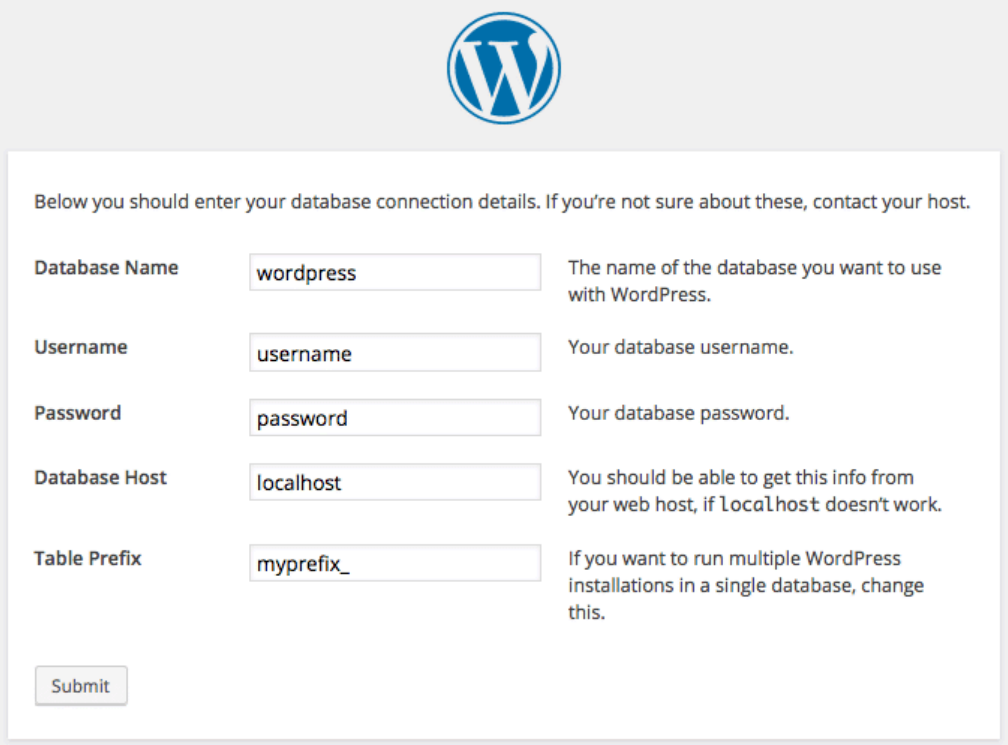
So I create one `auto_config.sh` that I place in the `conf` WordPress folder **.**

In this one, I will, as a precaution, put a in order to be certain that the **MariaDB** `sleep 10` database has had time to launch correctly.

Then, and only if our file `wp-config.php` does not exist(we wouldn't want*reconfigure* **WordPress**at every launch right?), we use the **CLI** `wp config create` command to specify the information that **WordPress** needs.

We could fill this information manually directly by accessing localhost while launching our container.

It would look like this:



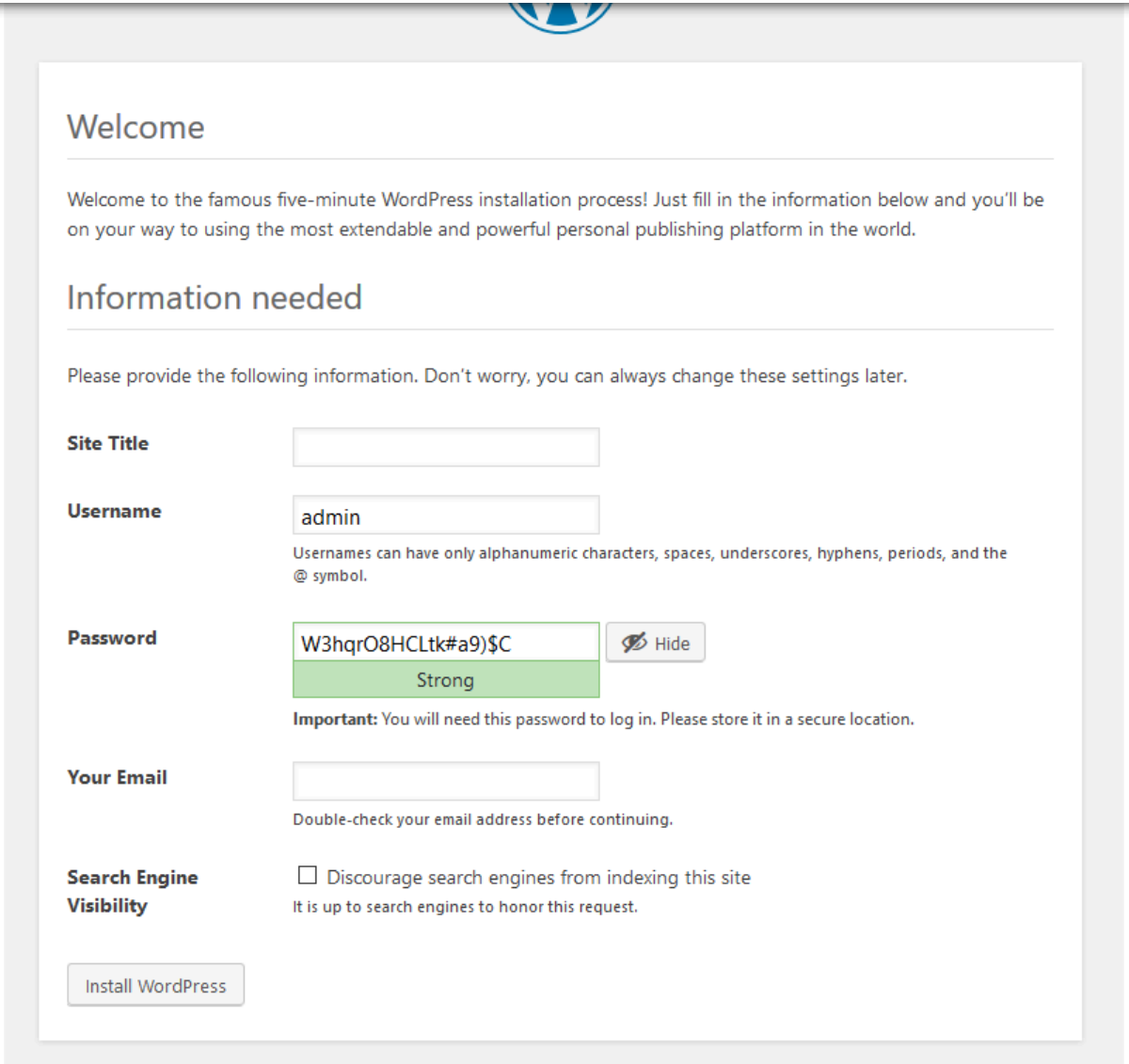
❯ This is the first page WordPress presents when it is launched.

It would look something like this:

```
wp config create  --allow-root \
          --dbname=$SQL_DATABASE \
          --dbuser=$SQL_USER \
          --dbpass=$SQL_PASSWORD \
          --dbhost=mariadb:3306 --path='/var/www/wordpress'
```

❯ To be indicated directly after our sleep in our auto_config.sh file

Now if we launch the **WordPress** container , it should no longer be the page that I showed you just above but the second one, this one is much nicer.



This is the page that asks you to choose a **title** for your site, as well as **a username** and **password** , but it's impossible to get it wrong because it's up to you to choose it 😎

For me it would be normal to leave this configuration page to be filled, but the subject asks that it also be automatically configured, because it asks that there are 2 **WordPress** users , and it is on this page that we can configure the first one.

I'll let you look at the CLI documentation but it offers to configure this second page automatically with the command `wp core install` and even to add another user with the command `wp user create` . Frankly I'll leave you the simplest part.

All you have to do is copy the file `auto_config.sh` into your container and run it with the keyword**ENTRYPOINT.**

Finally, I launch **php-fpm** with the command:

```
/usr/sbin/php-fpm7.3 -F
```

You have completed configuring your **WordPress** container !

---

6. Connect containers with Compose:

Make way for the famous docker-compose.yml !

Well, first learn how to write a **docker-compose** file .
This always starts with the version of**docker-compose**, the last one, the 3rd one.

The first line will therefore be: `version: '3'`

⛔ Be careful with the indentation of the **docker-compose.yml** ! As with Python, it's the indentation that matters.

Then we indicate the line `services:`
And there, with an indentation of **1 tab** , we can list our different services.
I start with **MariaDB:**

```
mariadb:
container_name: mariadb     # Le nom du container, oui vraiment.
networks:
- inception                 # à quel network il appartient
build:
context: requirements/mariadb   # ou se trouve son Dockerfile
dockerfile: Dockerfile      # le nom du Dockerfile ?!
env_file: .env                  # le fichier d'environnement pour transmettre les variables
volumes:                        # Voir plus bas
- mariadb:/var/lib/mysql
restart: unless-stopped         # redémarre tant qu'il n'est pas stoppé
expose:                         # le port à exposer
- "3306"
```

Let's move on to the NGINX service . Here it's the same principle, except for two things that change and the ***names/paths*** obviously.

```
nginx:
  container_name: nginx
  volumes:
  - wordpress:/var/www/wordpress
  networks:
  - inception
  depends_on:              # Nouvelle ligne, indiquant de ne pas démarrer NGINX tant que WordPress n'a pas démarré.
  - wordpress
  build:
  context: requirements/nginx
  dockerfile: Dockerfile
  env_file: .env
  ports:
  - "443:443"     # on indique le port qui sera exposé a la machine locale
  restart: on-failure     # Ici nous changeons, le container redémarrera uniquement en cas de crash.
```

Alright, you got it? Let's do the same for **WordPress** .

```
wordpress:
  container_name: wordpress
  env_file: .env
  volumes:
  - wordpress:/var/www/wordpress
  networks:
  - inception
  build:
  context: requirements/wordpress
  dockerfile: Dockerfile
  depends_on:             # WordPress démarrera uniquement après MariaDB (sinon il ne pourra pas configurer la base de données...)
  - mariadb
  restart: on-failure
  expose:
  - "9000"
```

❯ And there you have it! (I wish someone had done the work of reading the documentation for me)

---

7. Volumes to configure:

Let’s quickly talk about the Volumes line :

We assign a volume to **MariaDB** , as we will do with **WordPress** .
This is a *prerequisite* of the topic. We need to enable data persistence , for this we will store some folders directly on our computer locally.

In the case of Inception, we will store the files of**MySQL**located in `/var/lib/mysql` and WordPress in `var/www/wordpress` . These are the**paths**that I indicate after the line*volume*. Once again it is the subject that asks us.

Here in the volume line we indicate **MariaDB** *(this is the name of the volume, we could have called it vol_maria or something else, obviously it will involve a line concerning the volumes in the**docker-compose.yml**which will indicate where to store it locally)*followed by `:` with the location we want to copy from the container.

All that remains is to specify the volumes that we have indicated:

```
volumes:
  wordpress:
    driver: local # ici nous stockons le volume en local
    driver_opts:
    type: 'none'                  # aucun type spécifique
    o: 'bind
    device: '/Users/login/data/wordpress'     #Ou stocker le dossier sur votre ordinateur en local
  mariadb:
    driver: local
    driver_opts:
    type: 'none'
    o: 'bind'                    # Les Bind Mounts sont des volumes qui se montent sur un chemin d'accès à l'hôte, et ils peuvent être modifiés par d'autres processus en dehors de doc
    device: '/Users/login/data/mariadb'     #Ou stocker le dossier sur votre ordinateur en local
```

❯ *This docker doc* explains well how to manage volumes in a docker-compose.

📖 Your volumes will be available in the /home/login/data folder of the host machine running Docker.

❯ So remember to modify the path of the device: line accordingly.

All we have to do now is create the network part, be careful, it's very simple.

```
networks:
  inception:
  driver: bridge
```

❯ Yes, that's all.

💡 Here `bridge` tells Docker to automatically install rules that will allow the 3 containers to communicate in bridge.

```
docker-compose -f <path_docker_compose> -d –build
```

To stop **it** : `docker-compose -f <path_docker_compose> stop`

To **remove** the build: `docker-compose -f <path_docker_compose> down -v`

If you have problems with docker you can use the command:

```
docker system prune -af
```

Be careful, this deletes all containers, images, etc.

---

8. Finalize the project:

Small corrections:

Since testing all this, I've noticed a few small bugs, so I've added a few small clarifications to the NGINX configuration file .

I added `nginx.conf` the keyword in the first line of the file `events {}` because **NGINX** was asking for it with an error of the type `missing events{}` .

In this same file, I also added the line `include /etc/nginx/mime.types;` just below the **http** keyword .

Why? The CSS was not loading, and after a long investigation I noticed that these were indicated with a Content-Type of **html** ?!

After long visits to the StackOverFlow site I finally added this line which specifies the **content-types** , and everything is back in order!

Basically, all you have to do is create a Makefile and **you're good to go** 🤩

Oh yes, I chose to add a mini bash script that automatically configures the right paths in docker-compose.yml, always nice when a friend wants to test the project on his computer, he doesn't have to search for each path in all the files to change them.

If you try to connect to localhost or 127.0.0.1 from your browser*(after launching your container obviously)*you probably won't see anything appear. Normal we only opened port **443** as a listening port.

Port **443** corresponds to the **SSL** port so we must connect to it using `https://` and not `http://` , because the latter would take us to the standard port **80** , which we would surely have configured on a classic site (this would have redirected to 443). But here the subject**forbidden**the opening of a port other than **443** .

Another concern, depending on your browser, it should display an **alert** message indicating that this sitesurely trying to yousteal sensitive information.

And there you have it, you should arrive at your site.

📖 For readability reasons, you will need to configure your domain name to point to your local IP address.
This domain name will be login.42.fr . Once again, you will use your login.

❯ **This is only a configuration to be carried out on your machine locally.**

Basically you can already access the site from **localhost** , which*(this word)*actually redirects to IP **127.0.0.1** , without telling you, but all of this is actually written to a file on your computer.

> This file is very sensitive and you will need to edit it with a `sudo` . Indeed, it is a file very targeted by hackers, it would allow you to easily redirect to a fake Google when you type google.fr , for example.

By editing this file which is usually found here: `/etc/hosts` you can easily request the redirection of **127.0.0.1** to the IP you want, like **login.42.fr**

💡 Don't forget to modify this IP in the NGINX conf file in the box `server_name` , the best would be to do it also in the generation of the **SSL** certificate , but hey, this one is not authenticated...

You now seem to be following all the rules of the topic.

Good luck with the correction! 🔎