# DOCKER

**What is Docker?**

Is a virtualization software that makes developing and deploying applications much easier. Docker package application with all the necessary dependencies, configuration, system tools and runtime.

**Differences between Docker and Virtual Machine**

| Docker | Virtual Machine |
|---|---|
| Docker images, couple of MB | Virtual Machine images, couple of GB |
| Containers takes seconds to start.<br>- Reuses the host kernel and you just start de application layer on top of it | VM takes minutes to start.<br>- Put up a kernel every time it starts |
| Compatible only with Linux distros | Compatible with all OS |

[Download Docker Desktop]

**Docker Desktop includes:**

- **Docker Engine**
  - A server with a long-running daemon process "dockerd"
  - Manage images & containers.
- **Docker CLI – Client**
  - Command Line Interface ("docker") to interact with Docker Server
  - Execute Docker commands to start/stop .. containers
- **GUI Client**
  - To manage your containers and images with a graphical user interface.

**Differences between Docker Images and Docker Containers**

| | Docker Images | Docker Containers |
|---|---|---|
| **Definition** | Read-only templates that contain everything needed to run an application. | Running instances of Docker Images |
| **Purpose** | Used for creating and distributing applications and complete reproducible environments. | Used to run isolated applications with their own resources and environment. |
| **Content** | Include the operating system, libraries, dependencies, and application code. | Docker images running in an isolated environment, containing the application code and resources. |
| **Size** | Can have variable sizes, usually larger than containers. | Lighter than images as they share the operating system and only add additional layers for container-specific changes. |
| **Mutability** | Immutable and cannot be modified once created, only new | Ephemeral and can be modified at runtime, but any changes made will |

| | | |
|---|---|---|
| | images can be generated from them. | be lost once the container is stopped. |
| **Usage** | Used for building, sharing, and distributing consistent applications and environments. | Used to run applications in an isolated environment, enabling portability and resource management. |
| **Data Persistence** | Can include static data that is part of the image, but changes to the data are not reflected in the original image. | Containers can have mounted data volumes, allowing data persistence even after the container is stopped and restarted. |
| **Scalability** | Do not scale directly. Multiple containers can be generated from the same image. | Can be horizontally scaled by generating multiple instances of identical containers. |
| **Relationship** | Containers are based on images and run from them. | Images are used to create and generate containers, which are running instances of the images. |

**Docker Official Images**

- A dedicated team responsible for reviewing and publishing all content in the Docker Official Images Repositories
- Works in collaboration with software maintainers, security experts.
- However, anyone can participate as collaboration takes places openly on Github.

**Pull new Docker Image with the latest version:**

```
$ docker pull <nombre_de_lo_que_te_quieres_descargar>
```

**Pull new Docker Image with another version (not the latest one):**

```
$ docker pull <nombre_de_lo_que_te_quieres_descargar>:<versión>
```

**To see which Docker Images you have installed:**

```
$ docker images
```

**Remove Docker Image:**

- **If the Docker Image is not used by any container.**

```
$  docker rmi <ID_de_la_imagen>
```

- **If you want to delete an image regardless of whether it is in use or not, add the `-f` option to the command.**

```
$  docker rmi -f <ID_de_la_imagen>
```

- **If you want to remove an Image that have the same ID, but each Image has different version.**

```
$ docker rmi <nombre_del_repositorio>:<tag>
```

**Run an Image as a Container:**

```
$ docker run <nombre_del_repositorio>:<tag>
```

**To run a container in the <u>background</u> without blocking the terminal (-d):**

```
$ docker run -d <nombre_del_repositorio>:<tag>
```

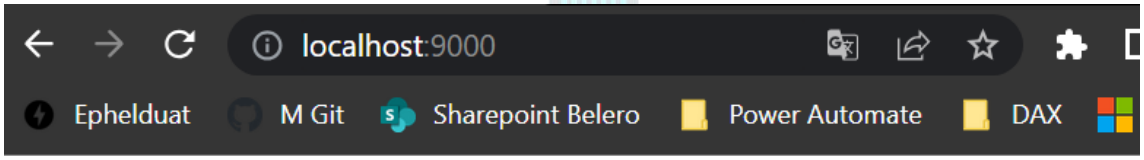
*It returns the container ID.*

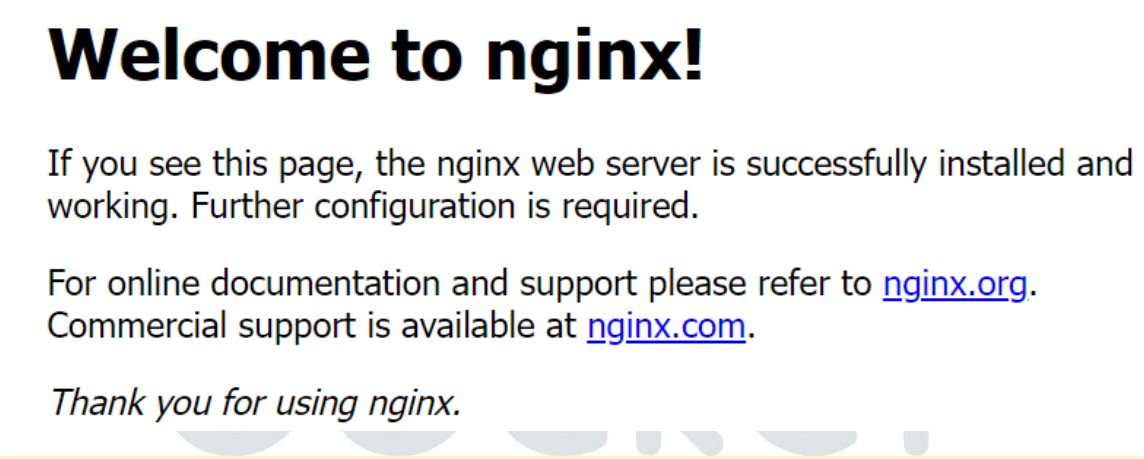
**To run a container in the background especifying the host port and the container port name:**

```
$ docker run -d -p HOST_PORT:CONTAINER_PORT
      <nombre_del_repositorio>:<tag>
```

```
$ docker run -d -p 9000:80 nginx:latest
a1228ea90b9a83724120553802f7eac9b476dca89423f8b99ece0367fb7d43bb
```

```
$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS          PORTS                    NAMES
a1228ea90b9a   nginx:latest   "/docker-entrypoint.…"   13 seconds ago   Up 9 seconds    0.0.0.0:9000->80/tcp     hungry_keldysh
```




**Each container runs in different port. Redis don't run as the same port as nginx**

**To assign a name to a container:**

```
$ docker run --name <nombre> -d -p HOST_PORT:CONTAINER_PORT
      <nombre_del_repositorio>:<tag>
```

**To see the actives container:**

```
$ docker ps
```

```
$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED         STATUS
      PORTS     NAMES
403a66a4d11e   nginx:latest   "/docker-entrypoint.…"   4 minutes ago   Up 4 minu
tes   80/tcp    peaceful_wright
```

*Docker generates a random name for the container automatically if you don't specify one.*

**To see all the containers (stopped and running):**

```
$ docker ps -a
```

**To stop an image:**

```
$ docker stop <id o nombre_del_contenedor (última columna al
hacer docker ps>
```

**To stop all the containers that are running:**

```
$ docker stop $(docker ps -q)
```

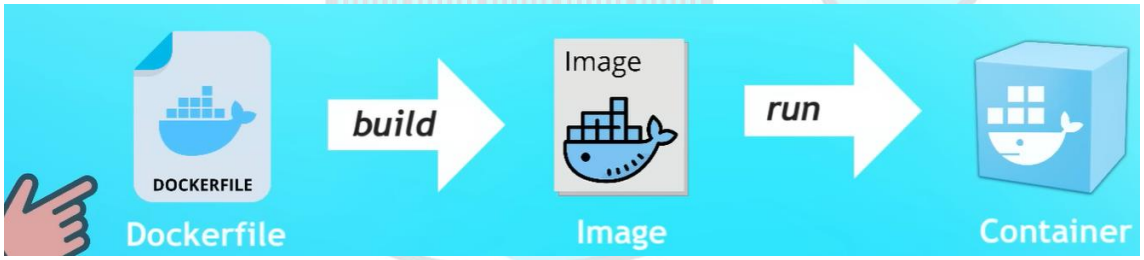
**To resume a container that are stopped:**

```
$ docker start <nombre_del_contenedor>
```

or

```
$ docker start <container_id>
```

## Dockerfile – Create own Images




Docker file is a text document that contains commands to assemble an image.

Docker can then build an image by reading those instructions.

**Structure of Dockerfile**

- Dockerfiles start from a parent image of "base image".
- It's a Docker Image that your image is based on.
    - You choose the base image, depending on which tools you need to have available

FROM

- Build this image from the specified image.

WORKDIR

- Sets the working directory for all following commands.
- Like changing into a directory: `cd ..`

RUN

- Will execute any command in a shell inside the container environment.

CMD

- The instruction that is to be executed when a Docker container starts.
- There can only be one “CMD” instruction in a Dockerfile.

**Let’s create an example:**

[Click here to go to the example repository]

- We will write a Dockerfile for Node.js application.
- Then, build a Docker image from it.

```
# Utilizamos la imagen de Node.js como base
FROM node:latest

# Copia el archivo package.json desde el directorio local
#  al directorio /app/ dentro del contenedor
COPY package.json /app/
# Copia el contenido del directorio src desde el directorio local
# al directorio /app/ dentro del contenedor
COPY src /app/

# Establece el directorio de trabajo en /app
WORKDIR /app

# Ejecuta el comando npm install para instalar las dependencias
# en el archivo package.json en el directorio /app/
RUN npm install

# Define el comando predeterminado para ejecutar el archivo server.js
# utilizando Node.js dentro del contenedor
CMD ["node", "server.js"]
```

**To create a new Docker Image from a Dockerfile:**

```
$ docker build -t node-app:1.0 .
```

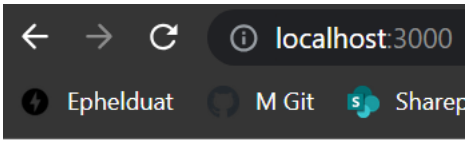
- **`docker build`**: start the process of building a new Docker Image.
- **`-t node-app:1.0`** : the `-t` option is used to assign a label (name and version) to the image being built. In this case, the tag `node-app:1.0` is set, where node-app is the name of the image and 1.0 is the version.
- **`.`** : the dot represents the build context. It specifies that the Dockerfile and related files are located in the current directory. Docker will use this context to build the image.

```
$ docker images
REPOSITORY   TAG       IMAGE ID       CREATED              SIZE
node-app     1.0       fd6ab0d545c2   About a minute ago   1.1GB
nginx        latest    021283c8eb95   8 days ago           187MB
```

Run the following command:

```
$ docker run -d -p 3000:3000 node-app:1.0
```

We go to the address localhost:3000 because that is where we have told it to run.




Welcome to my awesome app!

**To see the logs generated by a specific container:**

```
$ docker logs c84fc9fda90e
```

```
$ docker logs c84fc9fda90e
Server listening on port 3000
```

[Click here to go to the example repository]

**Visual example of how Docker works:**