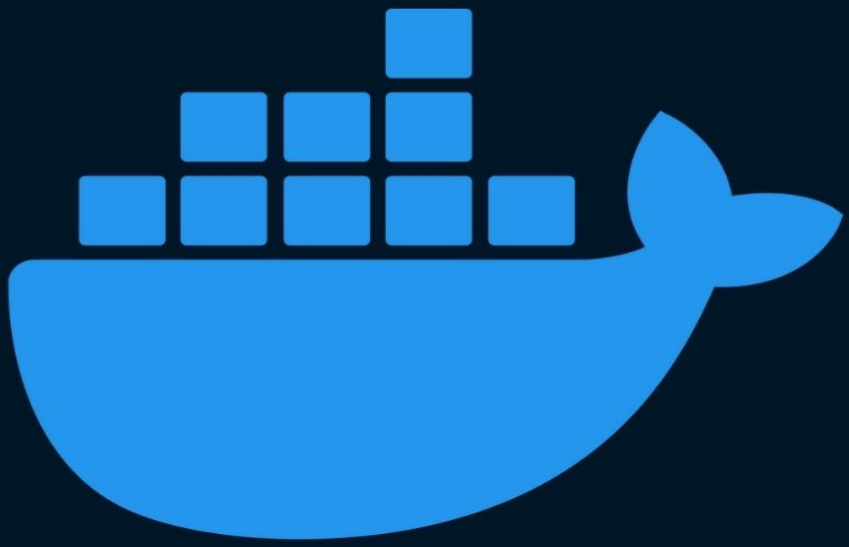
AN OPENSOURCE EBOOK

INTRODUCTION TO



docker®

Bobby Iliev

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About the book

- **This version was published on October 27 2021**

This is an open-source introduction to Docker guide that will help you learn the basics of Docker and how to start using containers for your SysOps, DevOps, and Dev projects. No matter if you are a DevOps/SysOps engineer, developer, or just a Linux enthusiast, you will most likely have to use Docker at some point in your career.

The guide is suitable for anyone working as a developer, system administrator, or a DevOps engineer and wants to learn the basics of Docker.

About the author

My name is Bobby Iliev, and I have been working as a Linux DevOps Engineer since 2014. I am an avid Linux lover and supporter of the open-source movement philosophy. I am always doing that which I cannot do in order that I may learn how to do it, and I believe in sharing knowledge.

I think it's essential always to keep professional and surround yourself with good people, work hard, and be nice to everyone. You have to perform at a consistently higher level than others. That's the mark of a true professional.

For more information, please visit my blog at https://bobbyiliev.com, follow me on Twitter @bobbyiliev_ and YouTube.

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Introduction to Docker

It is more likely than not that **Docker** and containers are going to be part of your IT career in one way or another.

After reading this eBook, you will have a good understanding of the following:

- What is Docker
- What are containers
- What are Docker Images
- What is Docker Hub
- How to installing Docker
- How to work with Docker containers
- How to work with Docker images
- What is a Dockerfile
- How to deploy a Dockerized app
- Docker networking
- What is Docker Swarm
- How to deploy and manage a Docker Swarm Cluster

I'll be using **DigitalOcean** for all of the demos, so I would strongly encourage you to create a **DigitalOcean** account follow along. You would learn more by doing!

To make things even better you can use my referral link to get a free $100 credit that you could use to deploy your virtual machines and test the guide yourself on a few **DigitalOcean servers**:

DigitalOcean $100 Free Credit

Once you have your account here's how to deploy your first

Droplet/server:

https://www.digitalocean.com/docs/droplets/how-to/create/

I'll be using **Ubuntu 21.04** so I would recommend that you stick to the same so you could follow along.

However you can run Docker on almost any operating system including Linux, Windows, Mac, BSD and etc.

What is a container?

According to the official definition from the docker.com website, a container is a standard unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing environment to another. A Docker container image is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries, and settings.

Container images become containers at runtime and in the case of Docker containers - images become containers when they run on Docker Engine. Available for both Linux and Windows-based applications, containerized software will always run the same, regardless of the infrastructure. Containers isolate software from its environment and ensure that it works uniformly despite differences for instance between development and staging.

What is a Docker image?

A **Docker Image** is just a template used to build a running Docker Container, similar to the ISO files and Virtual Machines. The containers are essentially the running instance of an image. Images are used to share a containerized applications. Collections of images are stored in registries like DockerHub or private registries.

What is Docker Hub?

DockerHub is the default **Docker image registry** where we can store our **Docker images**. You can think of it as GitHub for Git projects.

Here's a link to the Docker Hub:

https://hub.docker.com

You can sign up for a free account. That way you could push your Docker images from your local machine to DockerHub.

Installing Docker

Nowadays you can run Docker on Windows, Mac and of course Linux. I will only be going through the Docker installation for Linux as this is my operating system of choice.

I'll deploy an **Ubuntu server on DigitalOcean** so feel free to go ahead and do the same:

Create a Droplet DigitalOcean

Once your server is up and running, SSH to the Droplet and follow along!

If you are not sure how to SSH, you can follow the steps here:

https://www.digitalocean.com/docs/droplets/how-to/connect-with-ssh/

The installation is really straight forward, you could just run the following command, it should work on all major **Linux** distros:

```
wget -qO- https://get.docker.com | sh
```

It would do everything that's needed to install **Docker on your Linux machine**.

After that, set up Docker so that you could run it as a non-root user with the following command:

```
sudo usermod -aG docker ${USER}
```

To test **Docker** run the following:

```
docker version
```

To get some more information about your Docker Engine, you can run the following command:

```
docker info
```

With the `docker info` command, we can see how many running containers that we've got and some server information.

The output that you would get from the docker version command should look something like this:

In case you would like to install Docker on your Windows PC or on your Mac, you could visit the official Docker documentation here:

https://docs.docker.com/docker-for-windows/install/

And:

https://docs.docker.com/docker-for-mac/install/

That is pretty much it! Now you have Docker running on your machine!

Now we are ready to start working with containers! We will pull a **Docker image** from the **DockerHub**, we will run a container, stop it, destroy it and more!

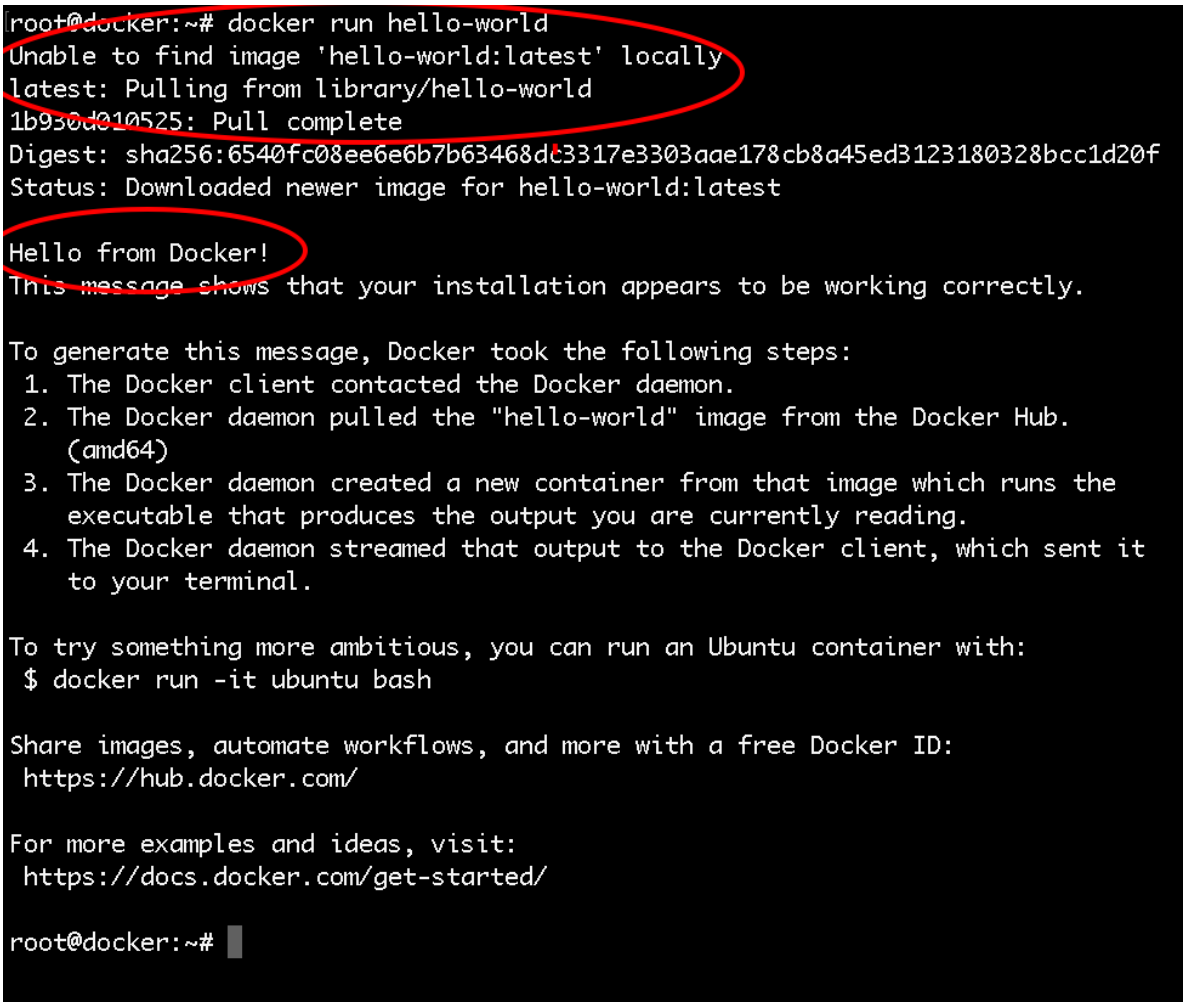
Working with Docker containers

Once you have your **Ubuntu Droplet** ready, ssh to the server and follow along!

So let's run our first Docker container! To do that you just need to run the following command:

```
docker run hello-world
```

You will get the following output:



We just ran a container based on the **hello-world Docker Image**, as we did not have the image locally, docker pulled the image from the **DockerHub** and then used that image to run the container. All that happened was: the **container ran**, printed some text on the screen and then exited.

Then to see some information about the running and the stopped containers run:

```
docker ps -a
```

You will see the following information for your **hello-world container** that you just ran:

```
root@docker:~# docker ps -a
CONTAINER ID        IMAGE               COMMAND
CREATED             STATUS                      PORTS
NAMES
62d360207d08        hello-world         "/hello"            5
minutes ago       Exited (0) 5 minutes ago
focused_cartwright
```

In order to list the locally available Docker images on your host run the following command:

```
docker images
```

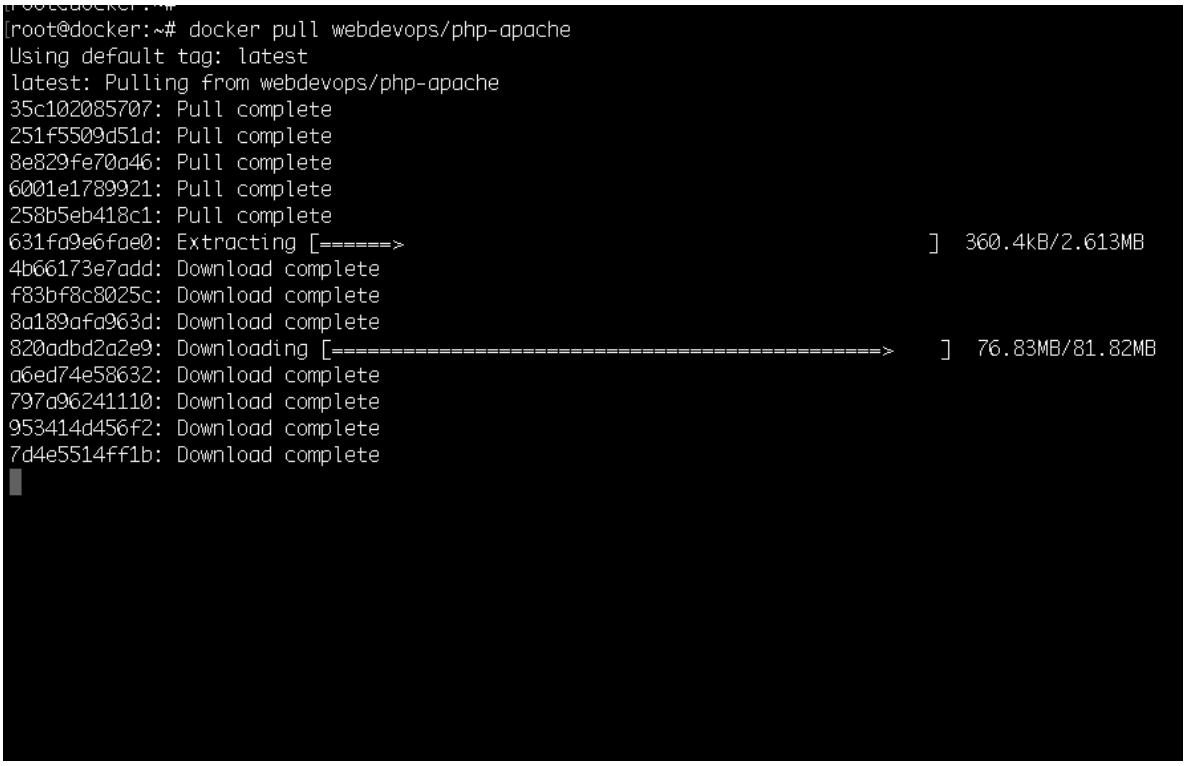
Pulling an image from Docker Hub

Let's run a more useful container like an **Apache** container for example.

First, we can pull the image from the docker hub with the **docker pull command**:

```
docker pull webdevops/php-apache
```

You will see the following output:



Then we can get the image ID with the docker images command:

```
docker images
```

The output would look like this:

```
root@docker:~# docker images
REPOSITORY              TAG                 IMAGE ID            CREATED             SIZE
webdevops/php-apache    latest              fd4f7e58ef4b        8 hours ago         531MB
hello-world             latest              fce289e99eb9        7 months ago        1.84kB
root@docker:~#
```

Note, you do not necessarily need to pull the image, this is just for demo pourpouses. When running the `docker run` command, if the image is not available locally, it will automatically be pulled from Docker Hub.

After that we can use the **docker run** command to spin up a new container:

```
docker run -d -p 80:80 IMAGE_ID
```

Quick rundown of the arguments that I've used:

- `-d`: it specifies that I want to run the container in the background. That way when you close your terminal the container would remain running.

- `-p 80:80`: this means that the traffic from the host on port 80 would be forwarded to the container. That way you could access the Apache instance which is running inside your docker container directly via your browser.

With the docker info command now we can see that we have 1 running container.

And with the `docker ps` command we could see some useful information about the container like the container ID, when the container was started and etc.:

```
root@docker:~# docker ps
CONTAINER ID        IMAGE               COMMAND
CREATED             STATUS              PORTS
NAMES
7dd1d512b50e        fd4f7e58ef4b        "/entrypoint supervi…"
About a minute ago   Up About a minute   443/tcp,
0.0.0.0:80->80/tcp, 9000/tcp   pedantic_murdock
```

Stopping and restarting a Docker Container

Then you can stop the running container with the docker stop command followed by the container ID:

```
docker stop CONTAINER_ID
```

If you need to you can start the container again:

```
docker start CONTAINER_ID
```

In order to restart the container you can use the following:

```
docker restart CONTAINER_ID
```

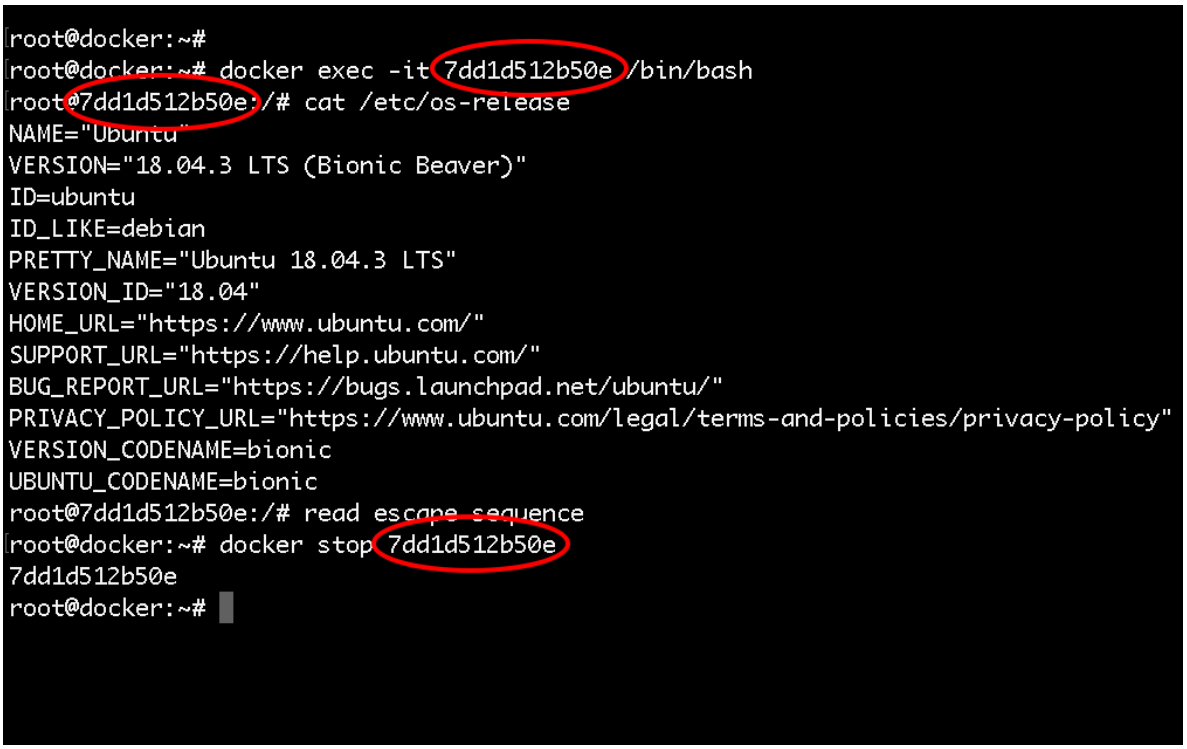
Accessing a running container

If you need to attach to the container and run some commands inside the container use the `docker exec` command:

```
docker exec -it CONTAINER_ID /bin/bash
```

That way you will get to a **bash shell** in the container and execute some commands inside the container itself.

Then to detach from the interactive shell press `CTRL+PQ` that way you will not stop the container but just detached from the interactive shell.



Deleting a container

To delete the container run first make sure that the container is not running and then run:

```
docker rm CONTAINER_ID
```

If you would like to delete the container and the image all together, just run:

```
docker rmi IMAGE_ID
```

With that you now know how to pull Docker images from the **Docker Hub**, run, stop, start and even attach to Docker containers!

We are ready to learn how to work with **Docker images!**

What are Docker Images

A Docker Image is just a template used to build a running Docker Container, similar to the ISO files and Virtual Machines. The containers are essentially the running instance of an image. Images are used to share a containerized applications. Collections of images are stored in registries like DockerHub or private registries.

Working with Docker images

The `docker run` command downloads and runs images at the same time. But we could also only download images if we wanted to wit the docker pull command. For example:

```
docker pull ubuntu
```

Or if you want to get a specific version you could also do that with:

```
docker pull ubuntu:14.04
```

Then to list all of your images use the docker images command:

```
docker images
```

You would get a similar output to:

The images are stored locally on your docker host machine.

To take a look a the docker hub, go to: https://hub.docker.com and you would be able to see where the images were just downloaded from.

For example, here's a link to the **Ubuntu image** that we've just downloaded:

https://hub.docker.com/_/ubuntu

There you could find some useful information.

As Ubuntu 14.04 is really outdated, to delete the image use the `docker rmi` command:

```
docker rmi ubuntu:14.04
```

Modifying images ad-hoc

One of the ways of modifying images is with ad-hoc commands. For example just start your ubuntu container.

```
docker run -d -p 80:80 IMAGE_ID
```

After that to attach to your running container you can run:

```
docker exec -it container_name /bin/bash
```

Install whatever packages needed then exit the container just press `CTRL+P+Q`.

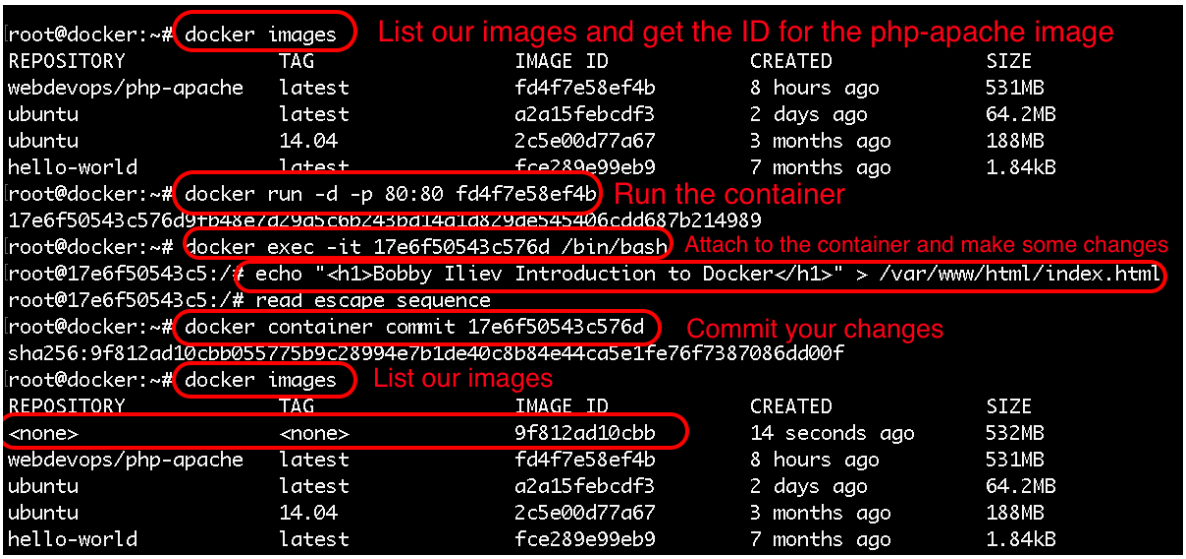
To then save your changes run the following:

```
docker container commit ID_HERE
```

Then list your images and note your image ID:

```
docker images ls
```

The process would look as follows:



As you would notice your newly created image would not have a name nor a tag, so in order tag your image run:

```
docker tag IMAGE_ID YOUR_TAG
```

Now if you list your images you would see the following output: