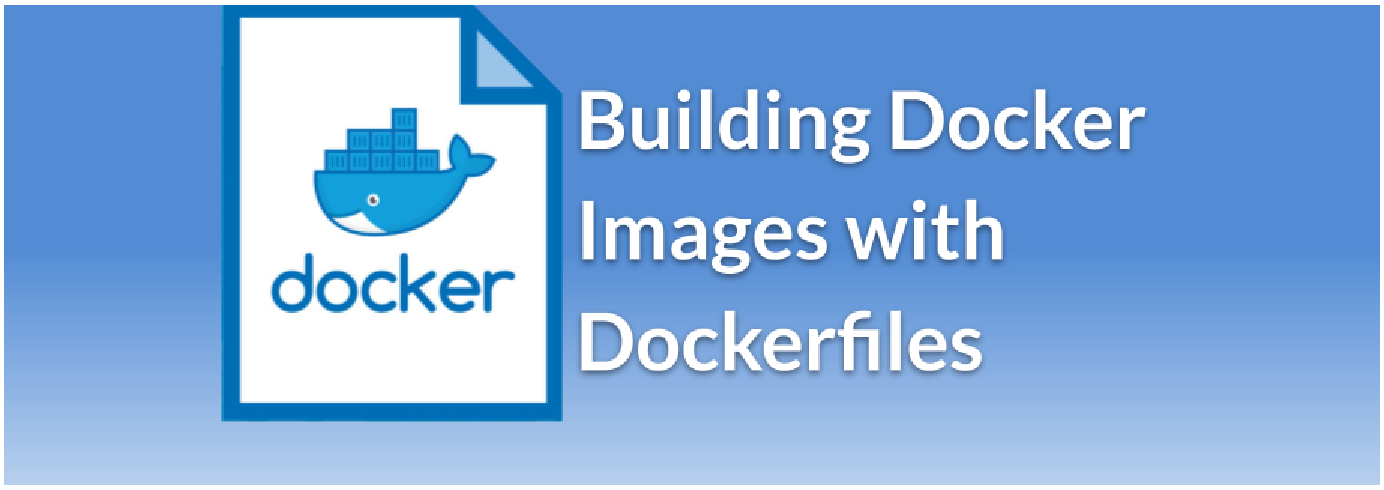


TECHNICAL GUIDES

Building Docker Images with Dockerfiles

5 min read

Contributor · Jun 30, 2019

In this guide we'll learn about the Dockerfile. What it is, how to cr ... and ... configure the basics to bring up your own Dockerized app.

What is a Dockerfile?

A Dockerfile is a text configuration file written using a special syntax

It describes step-by-step instructions of all the commands you need to run to assemble a Docker Image.

The `docker build` command processes this file generating a Docker Image in your Local Image Cache, which you can then start-up using the `docker run` command, or push to a permanent Image Repository.

Create a Dockerfile

Creating a Dockerfile is as easy as creating a new file named "Dockerfile" with your text editor of choice and defining some instructions. The name of the file
does not really matter. Dockerfile is the default name but you can use any filename that you want (and even have multiple dockerfiles in the same folder)

Simple Dockerfile for NGINX

```
#
# Each instruction in this file generates a new layer that gets pushed to you
#

#
# Lines preceeded by # are regarded as comments and ignored
#

#
# The line below states we will base our new image on the Latest Official Ubu
FROM ubuntu:latest

#
# Identify the maintainer of an image
LABEL maintainer="myname@somecompany.com"

#
# Update the image to the latest packages
RUN apt-get update && apt-get upgrade -y

#
# Install NGINX to test.
RUN apt-get install nginx -y

#
```

```
# Expose port 80
EXPOSE 80

#
# Last is the actual command to start up NGINX within our Container
CMD ["nginx", "-g", "daemon off;"]
```

Dockerfile Commands

ADD – Defines files to copy from the Host file system onto the Container

- ADD ./local/config.file /etc/service/config.file

CMD – This is the command that will run when the Container starts

- CMD [“nginx”, “-g”, “daemon off;”]

ENTRYPOINT – Sets the default application used every time a Container is created from the Image. If used in conjunction with CMD, you can remove the application and just define the arguments there

- CMD Hello World!
- ENTRYPOINT echo

ENV – Set/modify the environment variables within Containers created from the Image.

- ENV VERSION 1.0

EXPOSE – Define which Container ports to expose

- EXPOSE 80

FROM – Select the base image to build the new image on top of

- FROM ubuntu:latest

LABEL maintainer – Optional field to let you identify yourself as the maintainer of this image. This is just a label (it used to be a dedicated Docker directive).

- LABEL maintainer=someone@xyz.xyz”

RUN – Specify commands to make changes to your Image and subsequently the Containers started from this Image. This includes updating packages, installing software, adding users, creating an initial database, setting up certificates, etc. These are the commands you would run at the command line to install and configure your application. This is one of the most important dockerfile directives.

- RUN apt-get update && apt-get upgrade -y && apt-get install -y nginx && rm -rf /var/lib/apt/lists/*

USER – Define the default User all commands will be run as within any Container created from your Image. It can be either a UID or username

- USER docker

VOLUME – Creates a mount point within the Container linking it back to file systems accessible by the Docker Host. New Volumes get populated with the pre-existing contents of the specified location in the image. It is specially relevant to mention is that defining Volumes in a Dockerfile can lead to issues. Volumes should be managed with docker-compose or "docker run" commands. Volumes are optional. If your application does not have any state (and most web applications work like this) then you don't need to use volumes.

- VOLUME /var/log

WORKDIR – Define the default working directory for the command defined in the "ENTRYPOINT" or "CMD" instructions

- WORKDIR /home

Building and Testing Dockerfiles

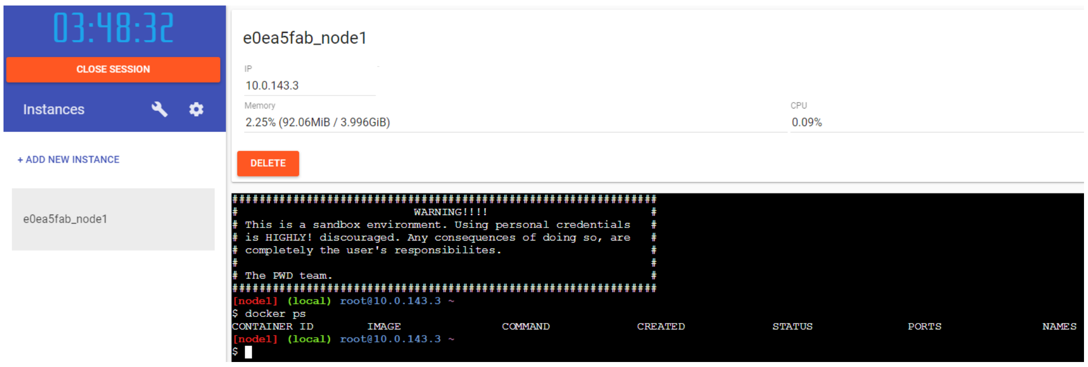
There's a free service that lets you quickly spin up Docker instances through a web interface called: "Play With Docker"

1. First of all, head over to http://play-with-docker.com and start a new session. You need to create an account first.

2. Once your session is active click on "Add New Instance":

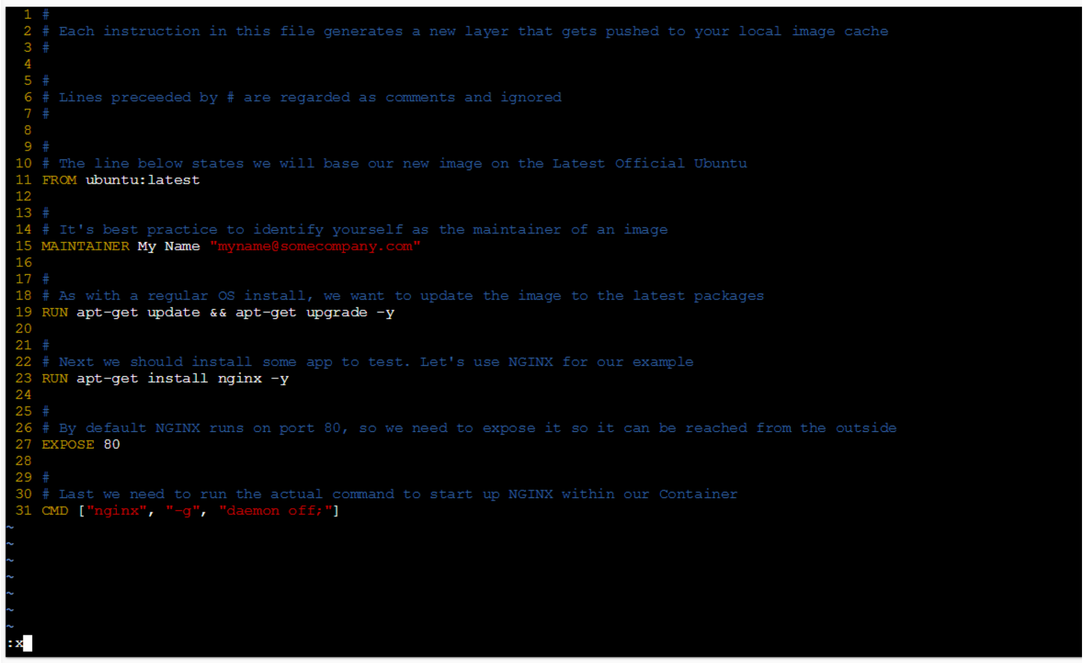
dockerfile play with docker codefresh

3. A new instance will start with a Docker Engine ready to accept commands



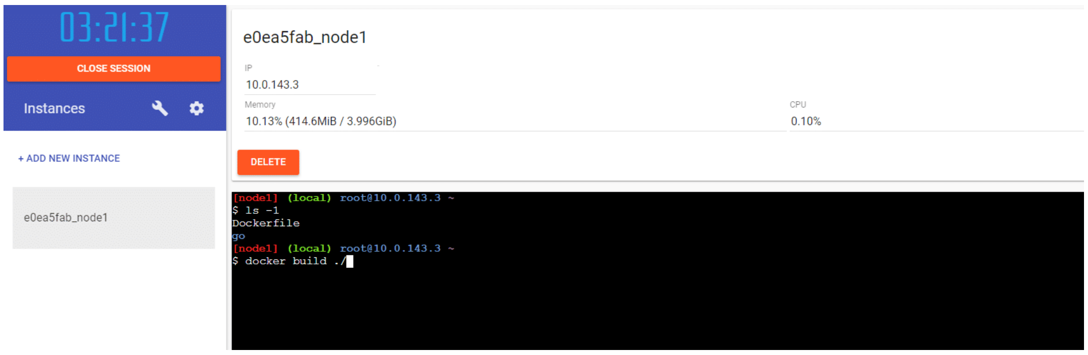
```
##################################################################
#                          WARNING!!!!                           #
# This is a sandbox environment. Using personal credentials      #
# is HIGHLY! discouraged. Any consequences of doing so, are      #
# completely the user's responsibilites.                         #
#                                                                #
# The PWD team.                                                  #
##################################################################
[node1] (local) root@10.0.143.3 ~
$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS              PORTS               NAMES
[node1] (local) root@10.0.143.3 ~
$
```

4. Next create/edit the Dockerfile. Run “vi Dockerfile”, press “i” to switch to “Insert Mode”, copy/paste the contents of our Dockerfile, press “Esc” to exit “Insert Mode”, and save+exit by typing “:x”



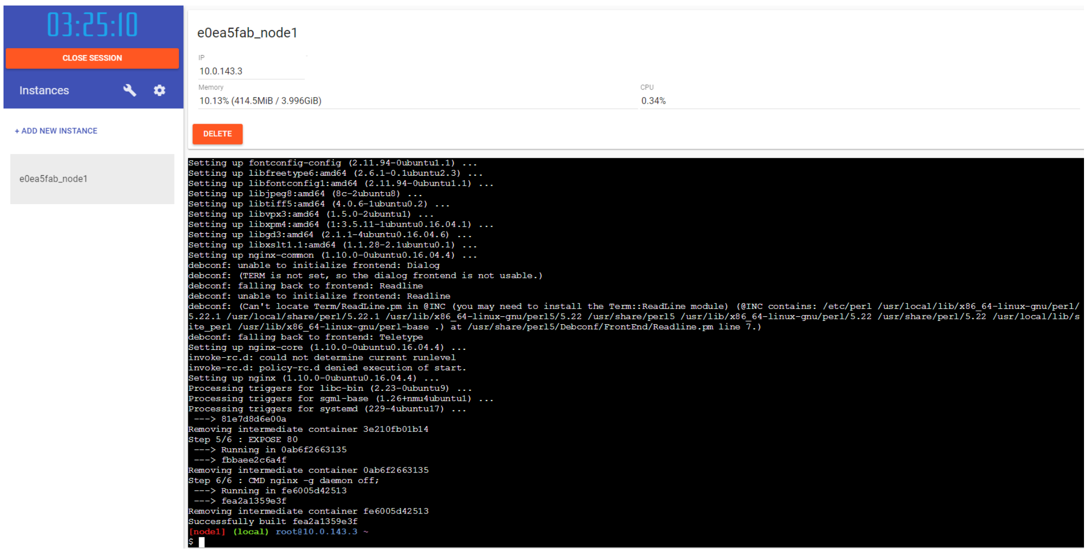
```
#
# Each instruction in this file generates a new layer that gets pushed to your local image cache
#

#
# Lines preceeded by # are regarded as comments and ignored
#

#
# The line below states we will base our new image on the Latest Official Ubuntu
FROM ubuntu:latest

#
# It's best practice to identify yourself as the maintainer of an image
MAINTAINER My Name "myname@somecompany.com"

#
# As with a regular OS install, we want to update the image to the latest packages
RUN apt-get update && apt-get upgrade -y

#
# Next we should install some app to test. Let's use NGINX for our example
RUN apt-get install nginx -y

#
# By default NGINX runs on port 80, so we need to expose it so it can be reached from the outside
EXPOSE 80

#
# Last we need to run the actual command to start up NGINX within our Container
CMD ["nginx", "-g", "daemon off;"]
~
~
~
~
~
~
~
:x
```

5. Build the new image using the command `docker build <path>` . Path refers to the directory containing the Dockerfile.



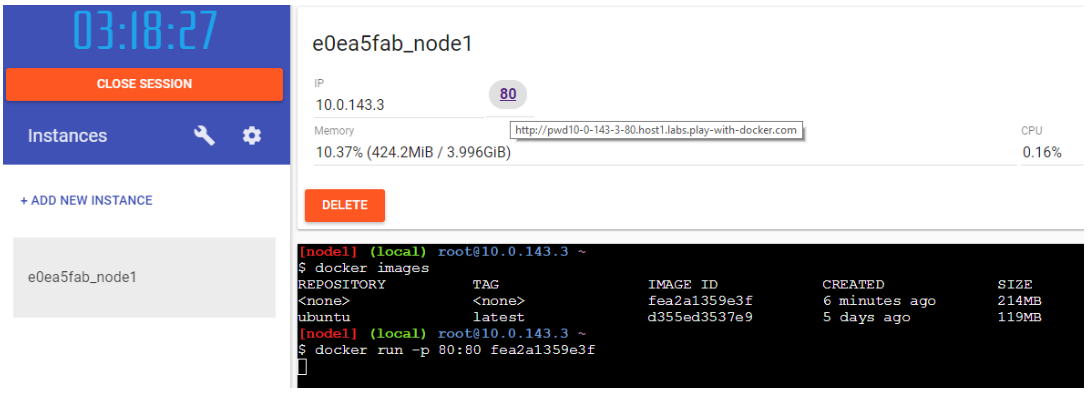
```
[node1] (local) root@10.0.143.3 ~
$ ls -l
Dockerfile
go
[node1] (local) root@10.0.143.3 ~
$ docker build ./
```

6. At the end of the process you should see the message "Successfully built <image ID>"



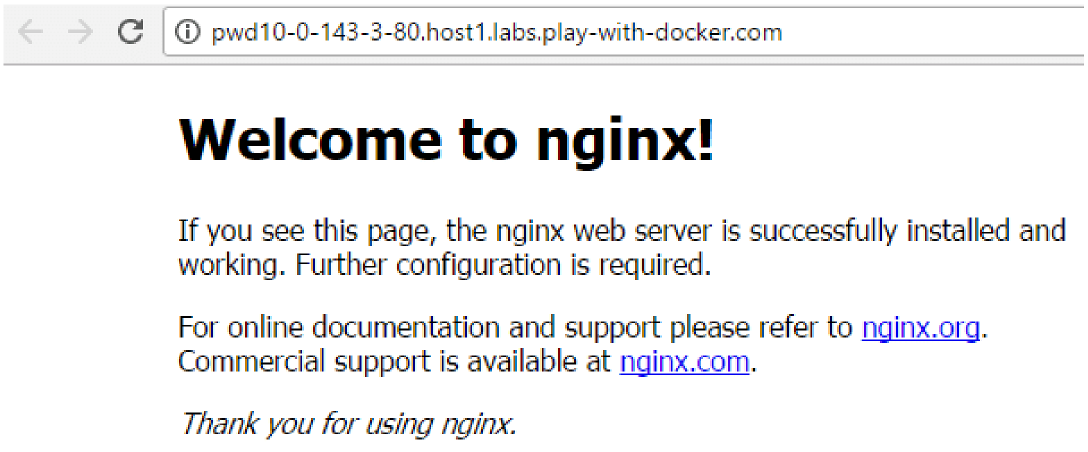
```
Setting up fontconfig-config (2.11.94-0ubuntu1.1) ...
Setting up libfreetype6:amd64 (2.6.1-0.1ubuntu2.3) ...
Setting up libfontconfig1:amd64 (2.11.94-0ubuntu1.1) ...
Setting up libjpeg8:amd64 (8c-2ubuntu8) ...
Setting up libtiff5:amd64 (4.0.6-1ubuntu0.2) ...
Setting up libvpx3:amd64 (1.5.0-2ubuntu1) ...
Setting up libxpm4:amd64 (1:3.5.11-1ubuntu0.16.04.1) ...
Setting up libgd3:amd64 (2.1.1-4ubuntu0.16.04.6) ...
Setting up libxslt1.1:amd64 (1.1.28-2.1ubuntu0.1) ...
Setting up nginx-common (1.10.0-0ubuntu0.16.04.4) ...
debconf: unable to initialize frontend: Dialog
debconf: (TERM is not set, so the dialog frontend is not usable.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/ReadLine.pm in @INC (you may need to install the Term::ReadLine module) (@INC contains: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/
5.22.1 /usr/local/share/perl/5.22.1 /usr/lib/x86_64-linux-gnu/perl5/5.22 /usr/share/perl5 /usr/lib/x86_64-linux-gnu/perl/5.22 /usr/share/perl/5.22 /usr/local/lib/s
ite_perl /usr/lib/x86_64-linux-gnu/perl-base .) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 7.)
debconf: falling back to frontend: Teletype
Setting up nginx-core (1.10.0-0ubuntu0.16.04.4) ...
invoke-rc.d: could not determine current runlevel
invoke-rc.d: policy-rc.d denied execution of start.
Setting up nginx (1.10.0-0ubuntu0.16.04.4) ...
Processing triggers for libc-bin (2.23-0ubuntu9) ...
Processing triggers for sgml-base (1.26+nmu4ubuntu1) ...
Processing triggers for systemd (229-4ubuntu17) ...
 ---> 81e7d8d6e00a
Removing intermediate container 3e210fb01b14
Step 5/6 : EXPOSE 80
 ---> Running in 0ab6f2663135
 ---> fbbaee2c6a4f
Removing intermediate container 0ab6f2663135
Step 6/6 : CMD nginx -g daemon off;
 ---> Running in fe6005d42513
 ---> fea2a1359e3f
Removing intermediate container fe6005d42513
Successfully built fea2a1359e3f
[node1] (local) root@10.0.143.3 ~
$
```

7. Start the new image and test connectivity to NGINX. Run the command `docker run -p 80:80 <image ID>` . The option `-p 80:80` exposes the Container port 80 as the Host port 80 to the world



```
[node1] (local) root@10.0.143.3 ~
$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
<none>              <none>              fea2a1359e3f        6 minutes ago       214MB
ubuntu              latest              d355ed3537e9        5 days ago          119MB
[node1] (local) root@10.0.143.3 ~
$ docker run -p 80:80 fea2a1359e3f
```

8. As a result a port 80 link should have become active next to the IP. Click on it to access your NGINX service



Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org. Commercial support is available at nginx.com.

Thank you for using nginx.

Building Docker images for your own applications

In the previous section we have seen an example Docker image for nginx. But what if you want to package your own application in a Docker image?

In this case you can create a Dockerfile in the same folder as your source code. Then put instructions in the dockerfile that mirror what you do locally on your workstation to compile/package the code.

The first step should be to find a public docker images that uses your programming language. Some examples are:

- Node base image
- Java base image

- Ruby base image
- Python base image
- Php base image
- Go base image

Once you find a proper base image you can use it to package your own application. Here is an example for Python

```
FROM python:3.6.4-alpine3.6
ENV FLASK_APP=minitwit

COPY . /app
WORKDIR /app

RUN pip install --editable .
RUN flask initdb

EXPOSE 5000

CMD [ "flask", "run", "--host=0.0.0.0" ]
```

Here is another example for Node.js

```
FROM node:10

WORKDIR /usr/src/app

# Install app dependencies
COPY package*.json ./

RUN npm install

# Bundle app source
COPY . .

EXPOSE 8080
CMD [ "node", "server.js" ]
```

How to create an optimized Docker image from your dockerfile

Once you become familiar with building docker images you also need to pay attention to two more topics

- Creating docker images with the smallest file size possible
- Using multi-stage builds in order to package only what is actually needed

For the first subject be sure to check out our Docker layer tutorial. For multi-stage builds see also our dedicated tutorial.

If you want to know all the best practices about creating and using dockerfiles in you team see our in-depth docker best practices guide.

Here is an example with a Node application that is using multi-stage builds:

```
FROM node:8.16 as build-deps
WORKDIR /usr/src/app
COPY package.json yarn.lock ./
RUN yarn
COPY . ./
RUN yarn build

FROM nginx:1.12-alpine
COPY --from=build-deps /usr/src/app/build /usr/share/nginx/html
EXPOSE 80
CMD ["nginx", "-g", "daemon off;"]
```

Go have fun building your own Images!

For more examples of Dockerfile templates, login to Codefresh (it's free), click add Repository and checkout the many templates and examples.

Ready to try Codefresh, the CI/CD platform for Docker/Kubernetes/Helm? Create Your Free Account Today!

Contributor

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