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A Beginner's Guide to the Dockerfile

About the Author.

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Codeship is a fully customizable hosted Continuous Integration and Delivery platform that helps you build, test, and deploy web applications fast and with confidence.

Learn more about Codeship here.

ABOUT THIS EBOOK

In this book we will give an overview of the Dockerfile – the building block of Docker images and containers. You will learn how to create a Dockerfile from scratch, how to push images to the Docker Hub, and some Dockerfile best practices.

A Beginner's Guide to the Dockerfile

The humble but powerful Dockerfile is the building block of Docker images and containers. In essence, it's a list of commands the Docker engine runs to assemble the image, and thus instances of images as containers.

Let's look at an example before learning to construct our own.

This is the Dockerfile for RethinkDB, a popular open-source, real-time database.

CODE

```
dockerfile FROM debian:jessie

MAINTAINER Daniel Alan Miller dalanmiller@rethinkdb.com

RUN apt-key adv --keyserver pgp.mit.edu --recv-keys
1614552E5765227AEC39EFCFA7E00EF33A8F2399 RUN echo "deb http://download.rethinkdb.
com/apt jessie main" > /etc/apt/sources.list.d/rethinkdb.list

ENV RETHINKDBPACKAGEVERSION 2.0.4~0jessie

RUN apt-get update
apt-get install -y rethinkdb=$RETHINKDBPACKAGEVERSION
rm -rf /var/lib/apt/lists/*

VOLUME ["/data"]

WORKDIR /data

CMD ["rethinkdb", "--bind", "all"]

EXPOSE 28015 29015 808
```

The first `FROM` command is an important Docker command, allowing you to pull dependencies from other images; in this case, the Jessie version of Debian. The next command sets the maintainer of the image, for reference and information.

The `RUN` command is something you will use frequently. These define commands to run from within the container when it's first created. These can be any command line instruction you wish if you have the dependency to support it. For example, if you're using an image that contains a Ruby run-time, these could be Ruby commands.

- `ENV` sets an environment variable available within the container, useful for setting variables that software needs to run.
- `VOLUME` defines a path in the container that Docker exposes to the host system and mapped using the `-v` argument when running a container.
- `WORKDIR` changes the active directory of the container to a specified location, in case you need to run commands from or in a particular location.

While `RUN` issues commands used to prepare the container for use, `CMD` runs the software that the container is designed to run (in the format `CMD ["executable", "parameter1", "parameter2"]`), and is best used for commands that result in an interactive shell, such as Python.

Reflecting Docker's microservice structure, there should ideally only ever be one `CMD`, and if there is more than one, only the last will matter.

If your container needs something more complex, then use the `ENTRYPOINT` command. Used in conjunction with `CMD` for parameters, `ENTRYPOINT` sets the main command for the image, allowing you to run an image as if it were that command.

For example, the following runs the `swarm` command, passing `--help` as a parameter:

CODE

```
1  dockerfile ENTRYPOINT ["/swarm"] CMD ["--help"]
```

Another common use of the `ENTRYPOINT` command is to run a bash script in the image, allowing for more complex operations.

`EXPOSE` exposes the ports that the software uses, ready for you to map to the host when running a container with the `-p` argument.

Create a Dockerfile from Scratch

For this example, I am going to create an image (and thus container) for testing the website and build process for a site built in Jekyll. I'm choosing Jekyll because all my sites use it, it's a simple system to understand, and well, I love it.

> There is an official image, but it doesn't use the latest version of Jekyll, is (in my opinion) over complicated, and anyway, I want to show you how to write your own.

Create a new folder, and then a Dockerfile inside it.

Start by setting the base image, which in this case will be the official Ruby image, and set a maintainer.

CODE

```
dockerfile FROM ruby:latest MAINTAINER Name <info@example.com>
```

Now create a user and group for Jekyll, set appropriate permissions and install the Jekyll gem:

CODE

```
dockerfile RUN
mkdir -p /home/jekyll
groupadd -rg 1000 jekyll
useradd -rg jekyll -u 1000 -d /home/jekyll jekyll
chown jekyll:jekyll /home/jekyll
gem install jekyll
```

I'm working on the source files for the project locally, so create a mount point where the Docker container can access files on the host system.

```
CODE
1  dockerfile VOLUME /home/jekyll
```

You can also copy the files into the container, but this makes the image less flexible:

```
CODE
1  dockerfile COPY . /home/jekyll/
```

There are a folders you don't need in the container, so create a new `.dockerignore` file to ignore certain paths:

```
CODE
1  dockerfile .bundle .git _site
```

Next, set the directory that contains the site, and serve the site.

```
CODE
1  dockerfile WORKDIR /home/jekyll ENTRYPOINT ["jekyll", "serve"] EXPOSE 4000
```

You can now build the image with:

```
CODE
1  dockerfile docker build .
```

Create a container based on the image with any variation of the `docker run` command you wish. However, something like the command below will create a container based on the image that sets a name and mounts a local volume at the mount point. You can get the `IMAGE_ID` from the Docker images command:

CODE

```
1  docker run --name cs_jk -it -d -P -v <PATH_TO_SITE>:/home/jekyll <IMAGE_ID>
```

So far, so good. But remember, as the Jekyll site grows, you'll add gems and other dependencies that also need to be available in the container. Let's fix that by adding these lines below the `WORKDIR` command:

CODE

```
1  dockerfile COPY Gemfile /home/jekyll COPY Gemfile.lock /home/jekyll
   RUN bundle install
```

Now when you rebuild and rerun the container, the gems added will be available.

Push Image to Docker Hub

Great! You now have a simple custom image. The next step is to get it onto the Docker Hub, where it can be more useful to you and other Docker users. Create an account on the Docker Hub and then log in from your terminal with the same credentials:

CODE

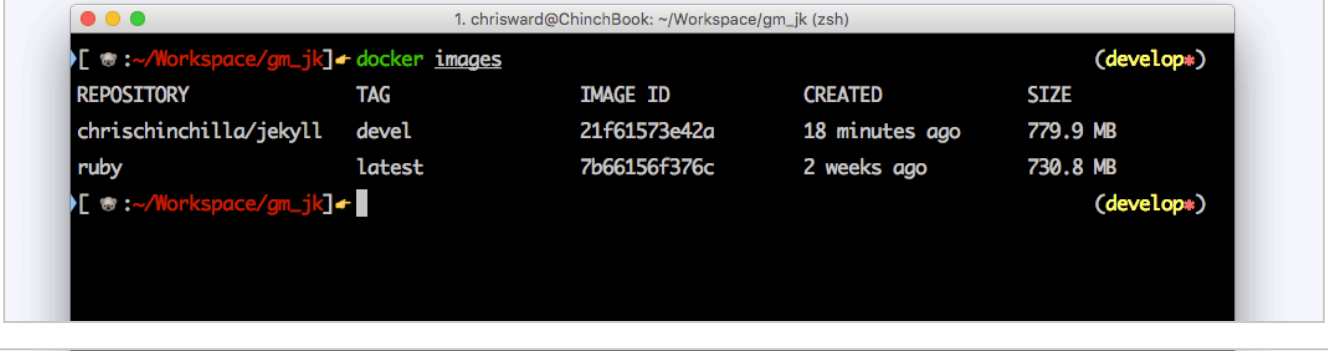
```
1  docker login
```

Now, tag your image:

CODE

```
1  docker tag <IMAGE_ID> <USERNAME>/jekyll:devel
```

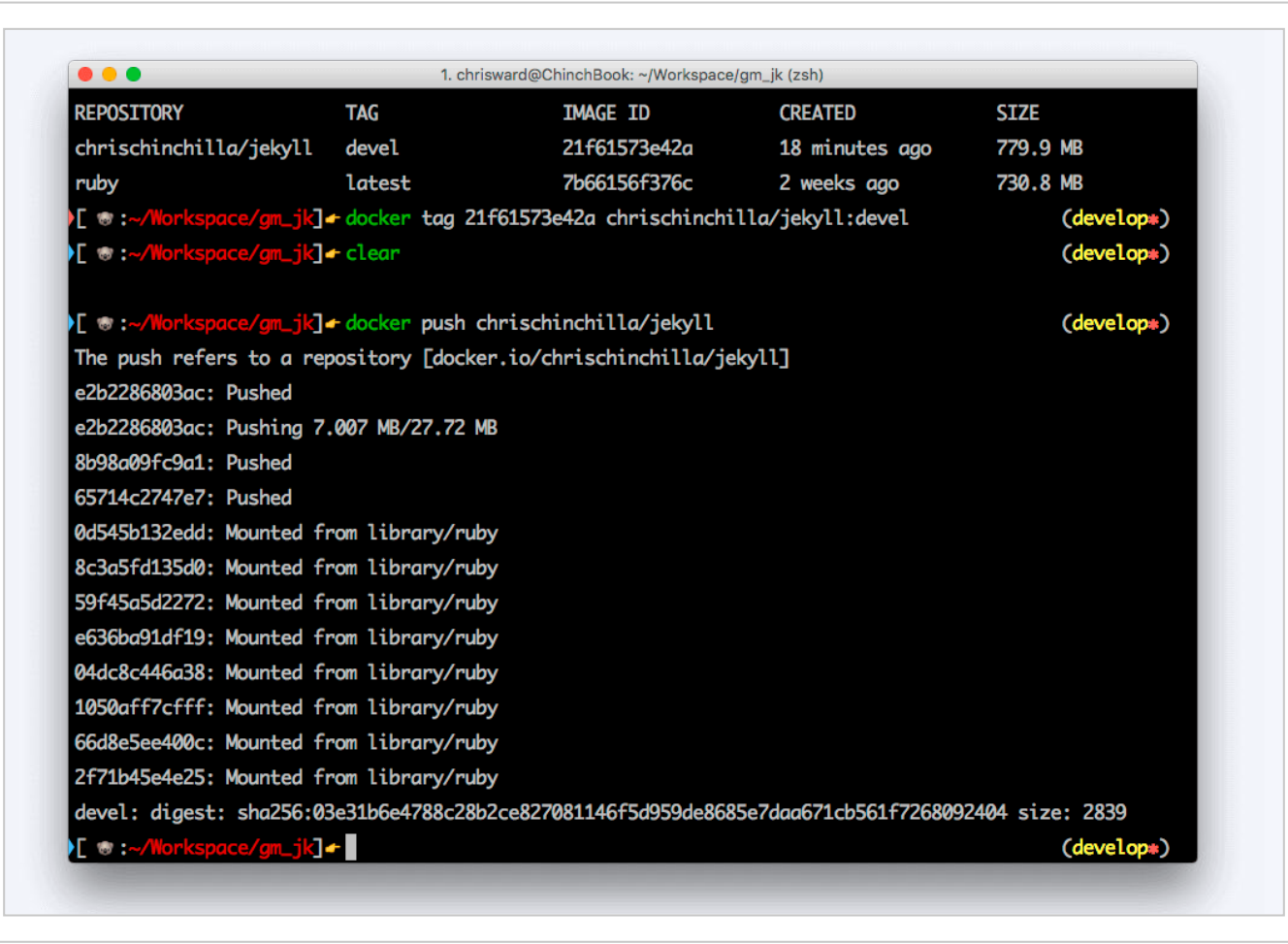
Of course, feel free to change all the values to something else. They can be anything that works for you, but there are some standard tags that users expect. Now if you run Docker images, you finally see a user-readable name in the **REPOSITORY** column.



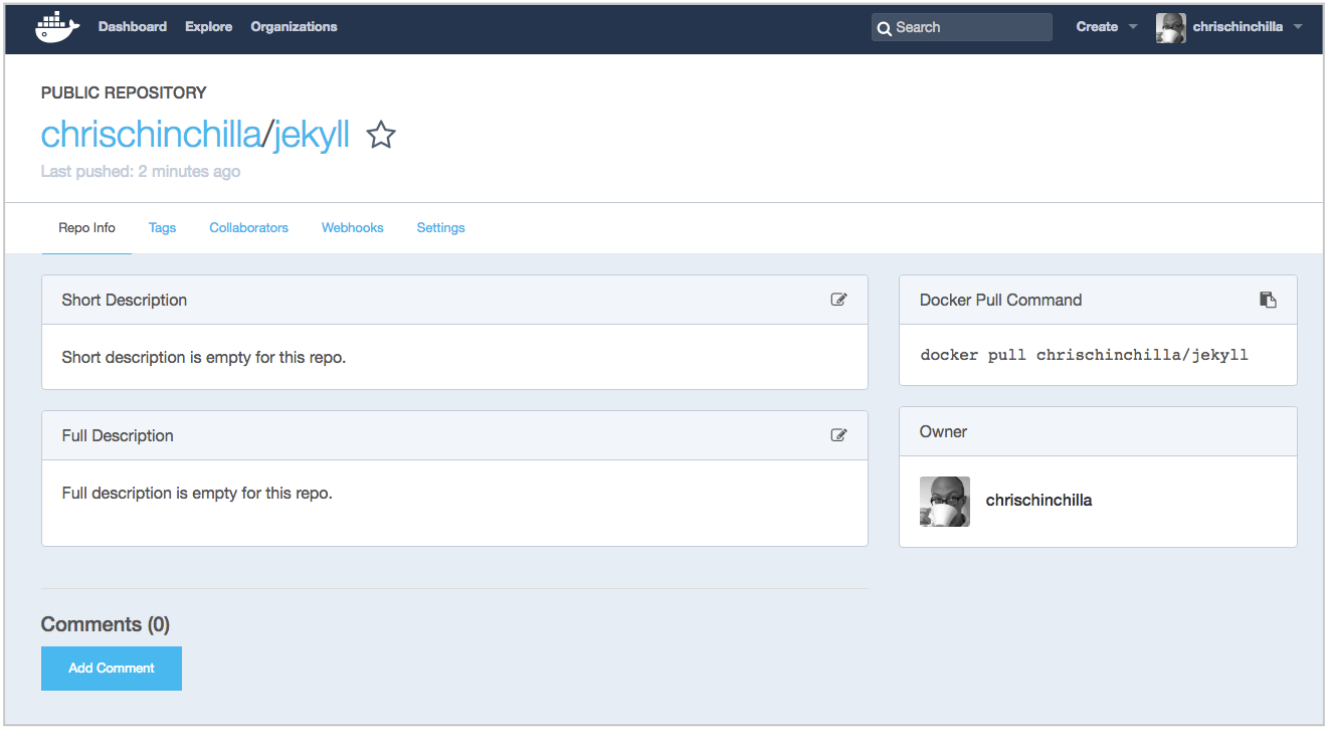
And push it to the Docker Hub:

CODE

```
1  docker push <USERNAME>/jekyll
```



If you log in in to your Hub account, you will see the image listed and ready for others to use with a `docker pull <USERNAME>/jekyll` command.



Next Steps and Best Practices

A Dockerfile is simple, and this is intentional. One of the core concepts of Docker is for each component to be as small and discrete as possible, with each container ideally performing one task each.

Take, for example, a Jekyll site. Perhaps you also want to lint your code and text for errors, then create another image and container. Want to generate an ePub of your text? Create another container with a Pandoc process. Need Search on your site? Hook up an Elasticsearch image and container. You can then link these together

and share the same code base with Docker Compose, allowing you to create complex, interconnected containers and applications.

Dockerfiles are the building blocks of Docker, and nothing else in the toolchain works without them. While they are simple, in practice it can be difficult to understand the best way to write them to provide maximum flexibility. If you want to read more, I recommend Docker's official guide, and I welcome any of your comments or questions.

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In this eBook you will learn how to easily recreate a microservice architecture with Docker Compose.

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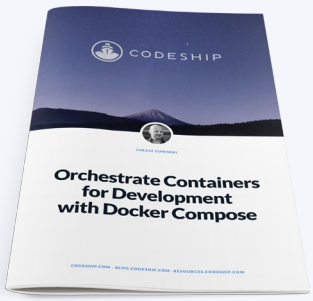

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Codeship is a hosted Continuous Integration service that fits all your needs. Codeship Basic provides pre-installed dependencies and a simple setup UI that let you incorporate CI and CD in only minutes. Codeship Pro has native Docker support and gives you full control of your CI and CD setup while providing the convenience of a hosted solution.

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Quick & simple setup

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Deploy anywhere

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