Workshop

Introduction to Docker

Welcome to
MLH Localhost: Intro to Docker!

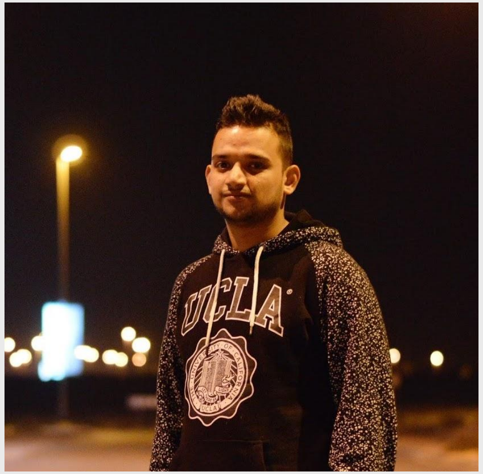
Wifi Network:
[AstrolabsGuest]

Wifi Password:
[MakeItHappen]

Event Hashtag:
#MLHLocalhost
#IBMMEADev

Twitter Handle:
@MLHacks
@IBMMEA

MLH localhost



Welcome! My name is ***Kunal Malhotra.***

1. I'm here to lead this session & help you learn something new today!
2. I'm a Bachelor of Engineering at Birla Institute Of Technology and Science - Pilani, Dubai Campus .
3. My favorite programming language / tool is Python, Java and Go.

1

Using your Web Browser,
Open this URL & Fill out the Form:

http://mlhlocal.host/checkin

2

Afterwards, Check your Email to Find:

- Setup Instructions
- An Invite to the MLH Slack
- The Code Samples
- A Workshop FAQ
- These Workshop Slides
- More Learning Resources

MLH
MAJOR LEAGUE HACKING

Our Mission is to Empower Hackers.

65,000+ HACKERS	**12,000+** PROJECTS CREATED	**3,000+** SCHOOLS

We hope you learn something awesome today!
Find more resources: http://mlh.io/

MLH
MAJOR LEAGUE HACKING

Sign up for the MLH Career Lab!

http://mlhlocal.host/career-lab

- Browse a curated list of hacker jobs.
- Apply for jobs and internships from companies that want to recruit directly from the MLH community.
- Receive updates and career advice from MLH!

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What is Localhost?

mlh localhost

- Build your local hacker community
- Learn skills that are neglected in class
- Engage hackers with fun, pre-built activities and workshops
- Fill the gap between school and hackathons

Workshop Goals

- Understand Docker and Containers
- Download and run our first container
- Build and run a container from scratch
- Upload a container to the Docker Cloud

Share Your Localhost Experience!

We encourage you to take pictures and share your experience!

Tweet pictures @MLHacks and use #MLHLocalhost

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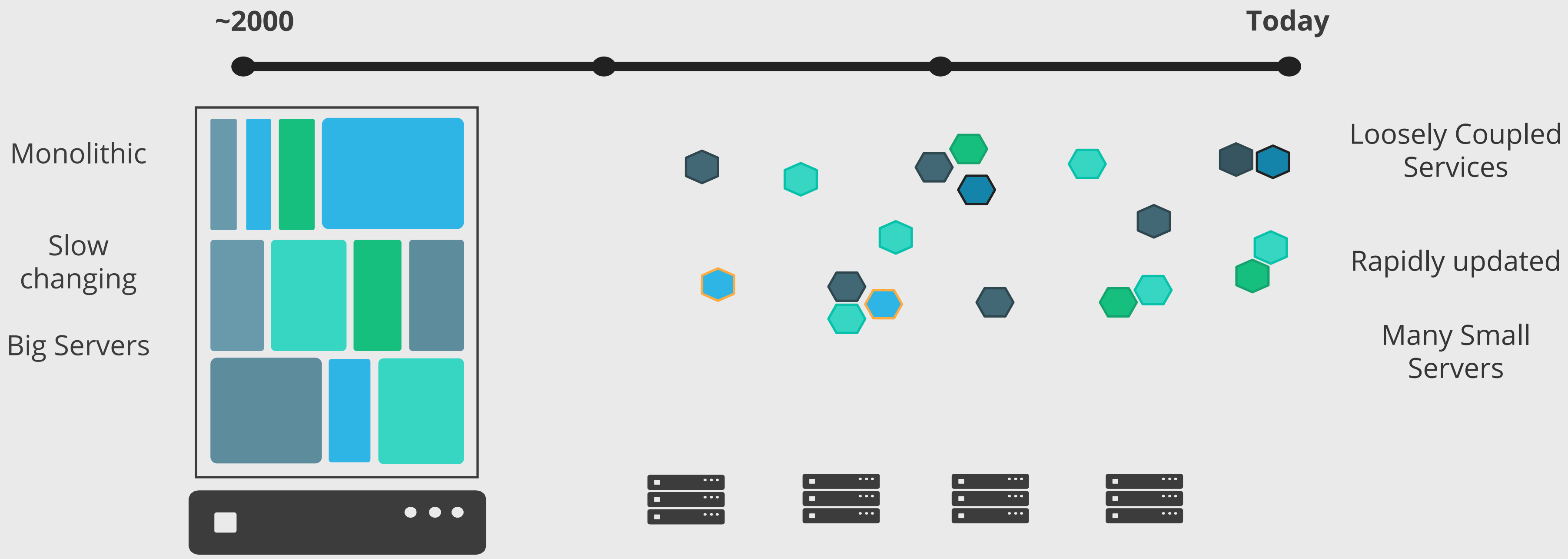
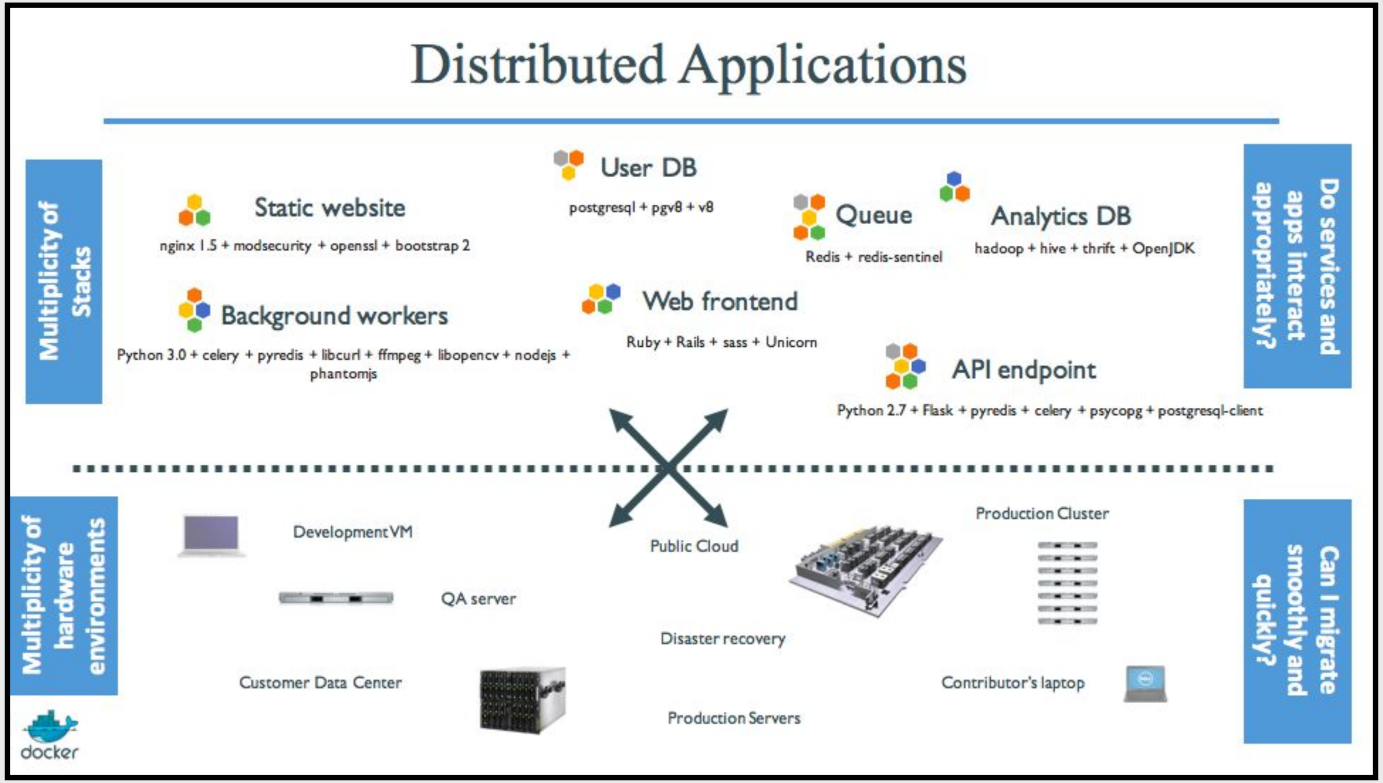
What is Docker?

Docker is a mechanism that helps developers **build, ship and run any application, in any environment.**

Applications are Changing!




Distributed Applications
Multiplicity of Stacks
Static website
nginx 1.5 + modsecurity + openssl + bootstrap 2
User DB
postgresql + pgv8 + v8
Queue
Redis + redis-sentinel
Analytics DB
hadoop + hive + thrift + OpenJDK
Background workers
Python 3.0 + celery + pyredis + libcurl + ffmpeg + libopencv + nodejs + phantomjs
Web frontend
Ruby + Rails + sass + Unicorn
API endpoint
Python 2.7 + Flask + pyredis + celery + psycopg + postgresql-client
Do services and apps interact appropriately?
Multiplicity of hardware environments
Development VM
QA server
Public Cloud
Production Cluster
Disaster recovery
Customer Data Center
Contributor's laptop
Production Servers
Can I migrate smoothly and quickly?
docker

Docker Containers are NOT VMs!

While they share some characteristics, Virtual Machines and Docker Containers are very different under the hood.

Key Term **Virtual Machine (VM)**

A software computer that, like a physical computer, runs an operating system and applications.

Major similarities:

- Both provide isolated environment for applications to run inside.
- Both are easily movable between different hosts.

Think Houses vs. Apartments

House = Virtual Machine (VM)

- Each VM has a full copy of the OS with dedicated resources.
- Each new VM creates a full copy of this environment.

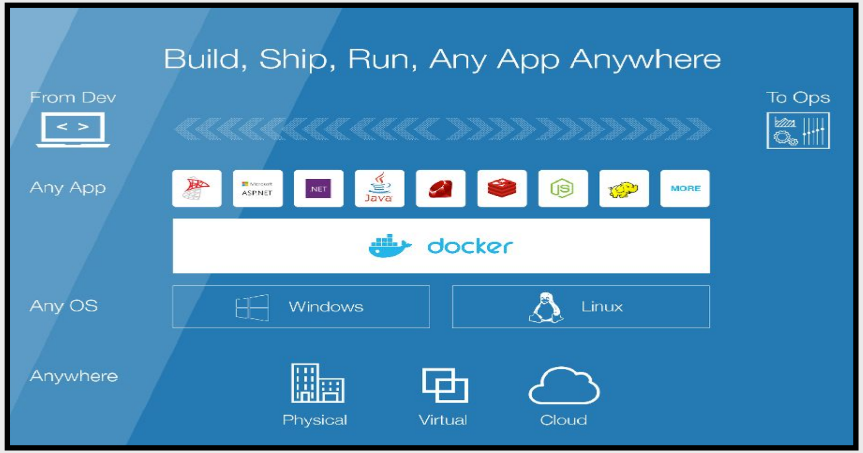
Apartment = Docker Container

- Contains exactly what they need to run their application.
- Share underlying resources.

Build, Ship, Run – Any App Anywhere!

An app written on your laptop will **run exactly the same anywhere:**

- Your Friend's Laptop
- Bare Metal Servers
- The Cloud
- A Raspberry Pi



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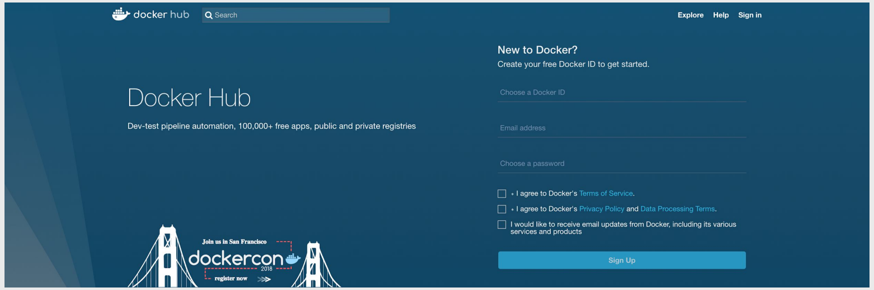
Meet Docker Hub!

What is Docker Hub?

Docker Hub is a registry of Docker images. You can think of the registry as a directory of all available Docker images. You'll be using this later in this tutorial.



Docker Hub

Dev-test pipeline automation, 100,000+ free apps, public and private registries

New to Docker?

Create your free Docker ID to get started.

Choose a Docker ID

Email address

Choose a password

☐ * I agree to Docker's Terms of Service.

☐ * I agree to Docker's Privacy Policy and Data Processing Terms.

☐ I would like to receive email updates from Docker, including its various services and products

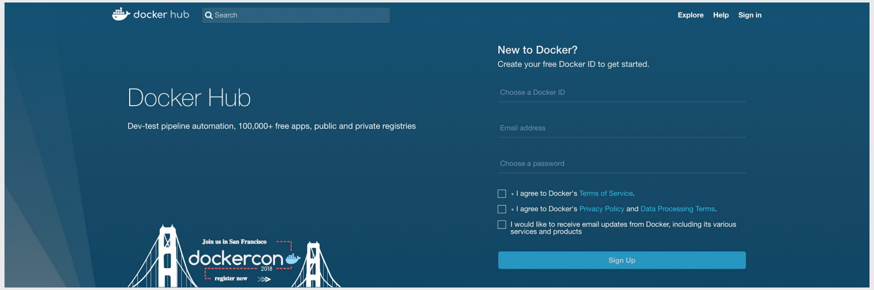
Sign Up

http://mlhlocal.host/docker-hub

Sign up for a Docker ID

Fill out the Form & Verify your Email Address.

Enter your email and chose a Docker ID and password for your account. You'll be asked to verify your email address before being able to log in though. Do that now!



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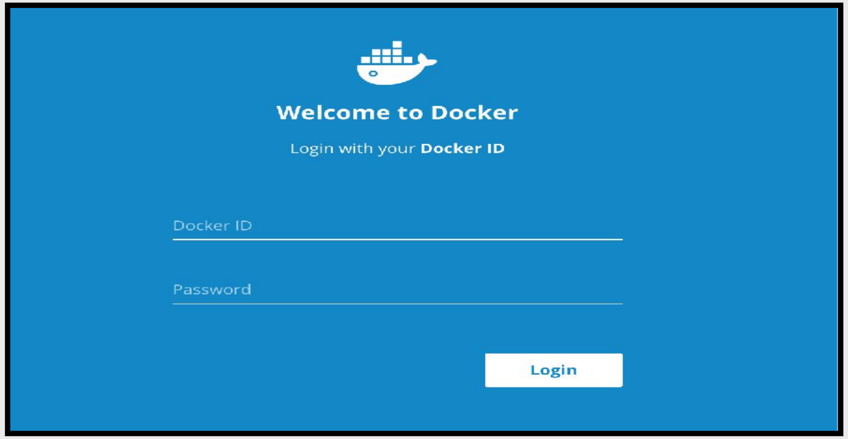
- [ ] I would like to receive email updates from Docker, including its various services and products

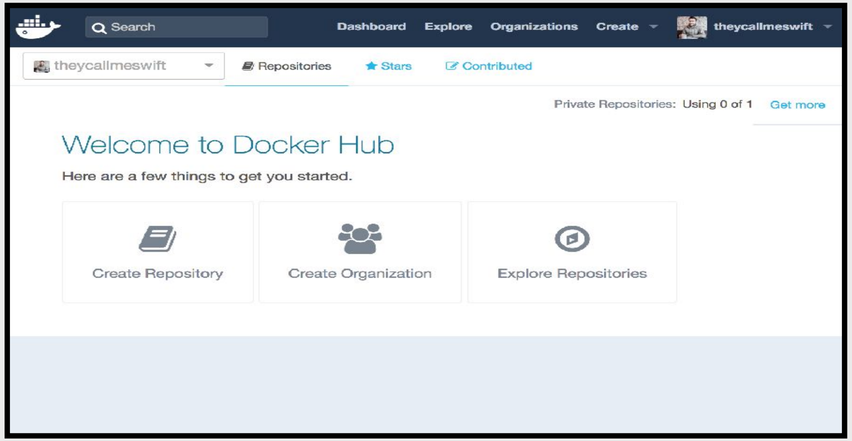
Sign Up

http://mlhlocal.host/docker-hub

Note: *Remember your Docker ID, you'll need it later!*

Login Using your Docker ID





Follow the link you got from Docker Hub's email to verify your account. You can now login using the Docker ID and password you picked!

Let's install Docker on your Machine!

Visit the Appropriate Guide:

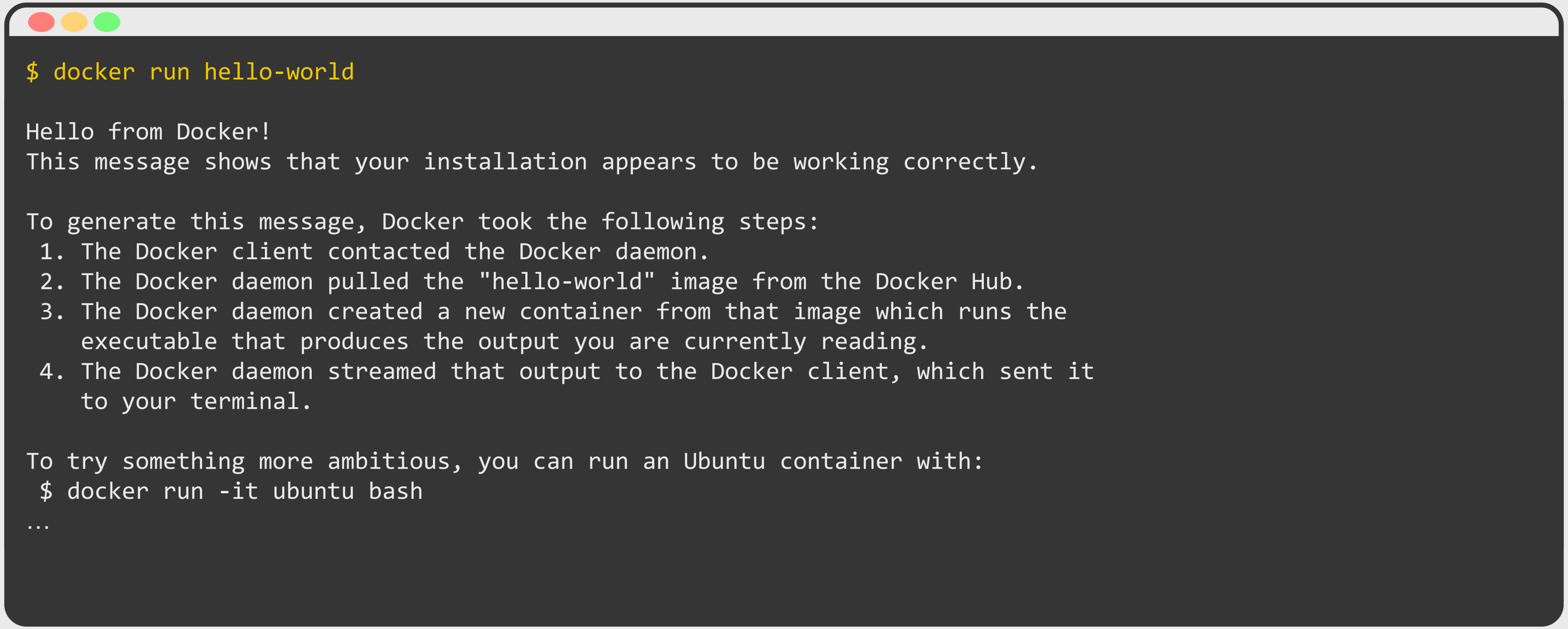
Visit the link for the type of computer you have:

- **Mac** - http://mlhlocal.host/docker-mac
- **Linux** - http://mlhlocal.host/docker-linux
- **Windows (10 Pro Edition only)** - http://mlhlocal.host/docker-windows

__Stuck?__ Raise your hand & someone will come help you!

Test your Installation

Once you are done installing Docker, test your Docker installation by running the following in a command prompt (Terminal, PowerShell, etc):



```
$ docker run hello-world

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash
...
```

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Let’s Run our First Container!

We’re going to run Alpine Linux!

- Alpine Linux is a lightweight Linux distribution.
- We can get a **Docker Image** containing Alpine Linux from **Docker Hub.**

Pull the Alpine Linux Image

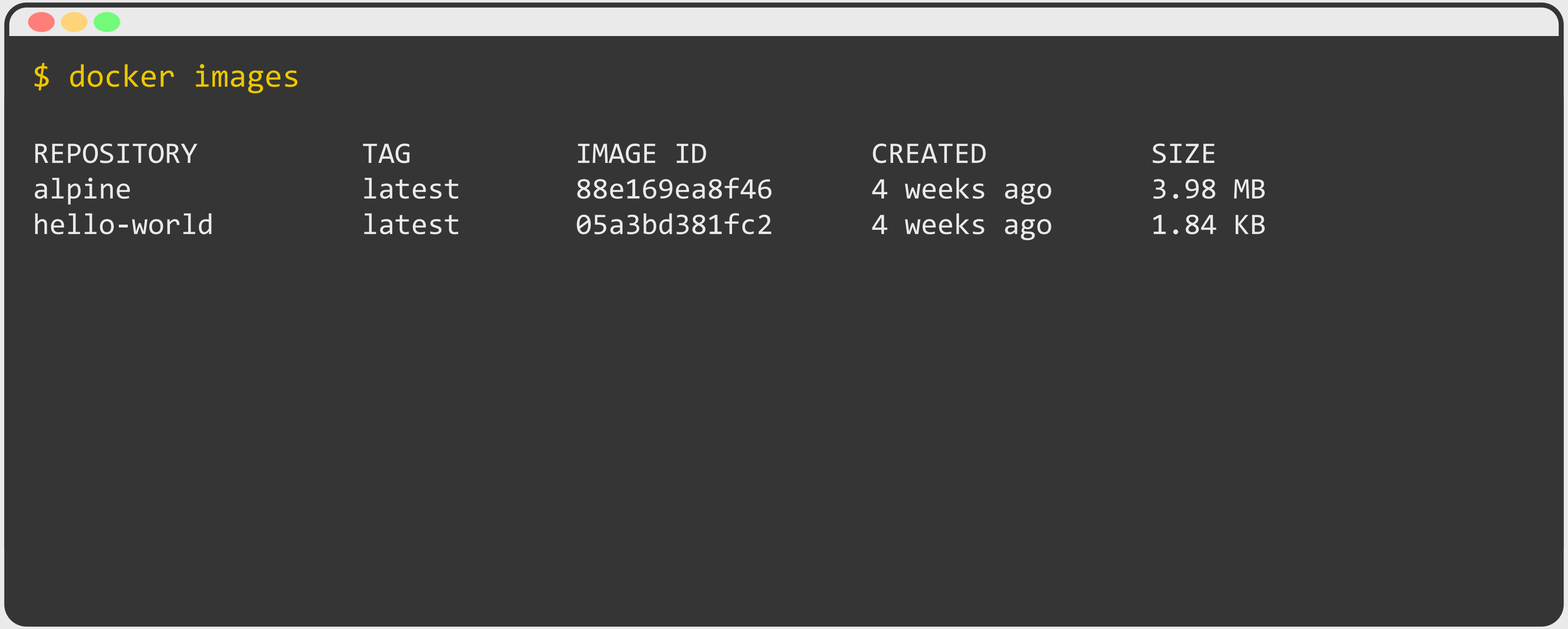
The pull command fetches the Alpine Linux image from the Docker registry (**Docker Hub**) and saves it in our system.

```
$ docker pull alpine

Using default tag: latest
latest: Pulling from library/alpine
0a8490d0dfd3: Pull complete
Digest: sha256:dfbd4a3a8ebca874ebd2474f044a0b33600d4523d03b0df76e5c5986cb02d7e8
Status: Downloaded newer image for alpine:latest
```

Review the List of Local Docker Images

You can use the **docker images** command to see a list of all images on your system.

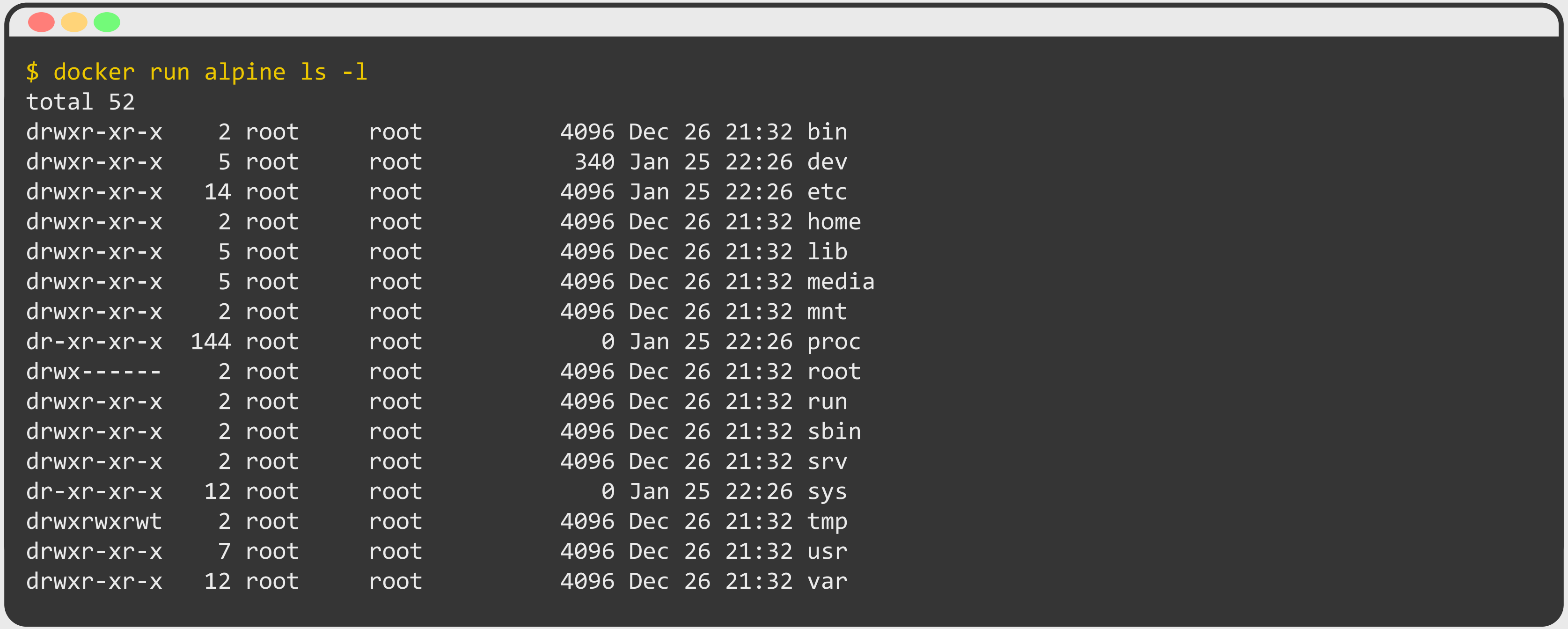


```
$ docker images

REPOSITORY          TAG         IMAGE ID         CREATED          SIZE
alpine              latest      88e169ea8f46     4 weeks ago      3.98 MB
hello-world         latest      05a3bd381fc2     4 weeks ago      1.84 KB
```

Run your First Docker Container!

Let's now run a Docker container based on this image.



```
$ docker run alpine ls -l
total 52
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 bin
drwxr-xr-x    5 root     root           340 Jan 25 22:26 dev
drwxr-xr-x   14 root     root          4096 Jan 25 22:26 etc
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 home
drwxr-xr-x    5 root     root          4096 Dec 26 21:32 lib
drwxr-xr-x    5 root     root          4096 Dec 26 21:32 media
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 mnt
dr-xr-xr-x  144 root     root             0 Jan 25 22:26 proc
drwx------    2 root     root          4096 Dec 26 21:32 root
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 run
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 sbin
drwxr-xr-x    2 root     root          4096 Dec 26 21:32 srv
dr-xr-xr-x   12 root     root             0 Jan 25 22:26 sys
drwxrwxrwt    2 root     root          4096 Dec 26 21:32 tmp
drwxr-xr-x    7 root     root          4096 Dec 26 21:32 usr
drwxr-xr-x   12 root     root          4096 Dec 26 21:32 var
```

Wow! What just Happened?

```
$ docker run alpine ls -l
```

1. Locate the requested image.
2. Create a new container using the requested image.
3. Execute the provided command in the container.

Let’s Try Some Other Commands!

What other Unix commands can you run? Try any of these or some of your personal favorites!

```
$ docker run alpine cal
```

```
$ docker run alpine echo "hello World"
```

```
$ docker run alpine pwd
```

```
$ docker run alpine id -u -n
```

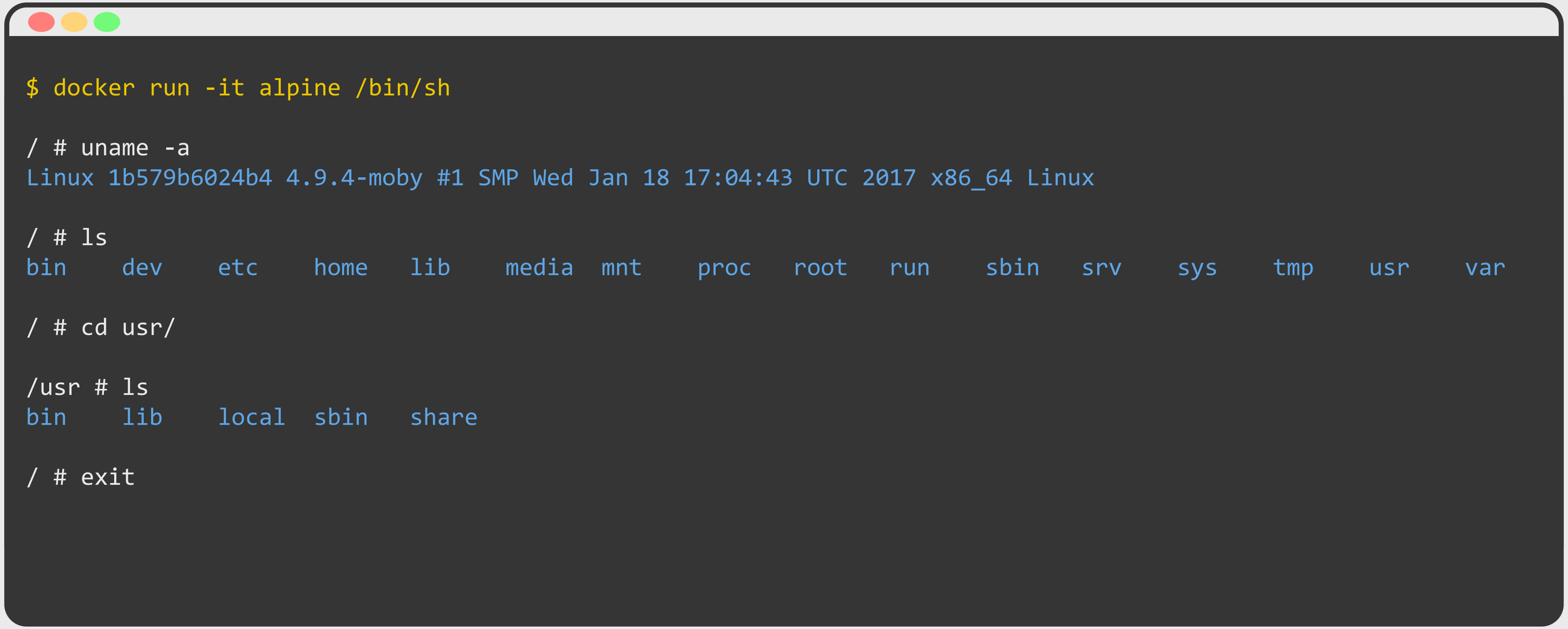
Containers are FAST!

The commands we run execute almost immediately!

- Each time the Docker client runs the command in our container and then exits.
- Booting up a virtual machine, running a command, and then killing it would take *forever!*

Let’s get Interactive!

All of our commands have exited immediately after running them.
How do we run a container interactively?



```
$ docker run -it alpine /bin/sh

/ # uname -a
Linux 1b579b6024b4 4.9.4-moby #1 SMP Wed Jan 18 17:04:43 UTC 2017 x86_64 Linux

/ # ls
bin    dev    etc    home   lib    media  mnt    proc   root   run    sbin   srv    sys    tmp    usr    var

/ # cd usr/

/usr # ls
bin    lib    local  sbin   share

/ # exit
```

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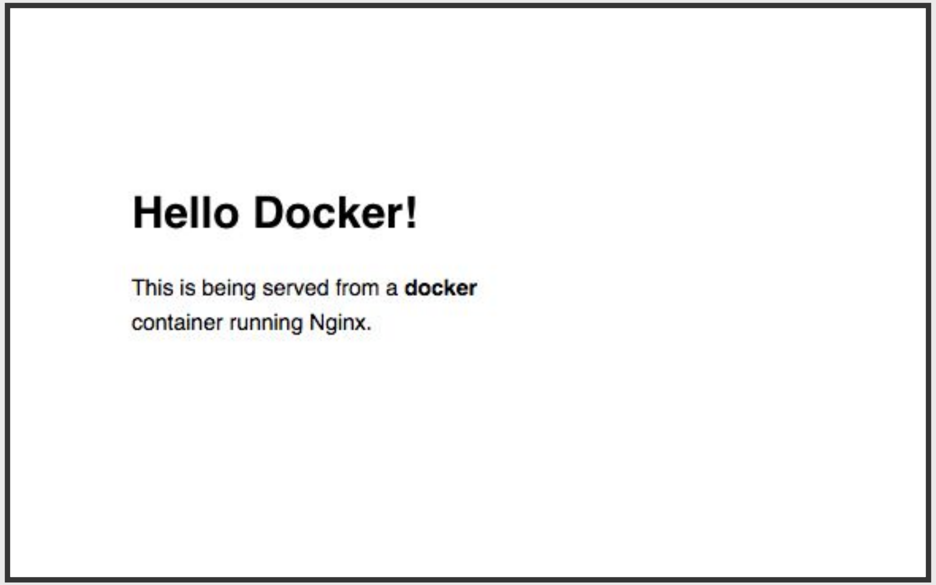
Let’s Run a Web App with Docker!

Time for the real stuff – deploying web applications with Docker!
We’re going to make a website that looks like this:



Hello Docker!

This is being served from a **docker** container running Nginx.

Find the Source Code on GitHub

If you're interested, you can find the code for the website we're going to run on GitHub:

http://mlhlocal.host/docker-static-site-source

or see the site running live on Heroku:

http://mlhlocal.host/docker-static-site

Let’s Run the Image from Docker Hub.

We created an image on Docker Hub that contains the code under **mlhacks/docker-static-site**.

```
$ docker run --name static-site -d -p 8888:80 mlhacks/docker-static-site
Unable to find image ‘mlhacks/docker-static-site:latest' locally
latest: Pulling from mlhacks/docker-static-site
fdd5d7827f33: Pull complete
a3ed95caeb02: Pull complete
716f7a5f3082: Pull complete
7b10f03a0309: Pull complete
aff3ab7e9c39: Pull complete
Digest: sha256:41b286105f913fb7a5fbdce28d48bc80f1c77e3c4ce1b8280f28129ae0e94e9e
Status: Downloaded newer image for mlhacks/docker-static-site:latest
1fd4d53f64d48534ad7db3f8bfa8b745977aab87161f70da56b4672e9e0868eb
```

***Note**: The -d flag enables detached mode, which detaches the running container from the terminal. The -p flag publishes the website on port 8888.*

So, What just Happened?

Notice that we didn't run `docker pull` **before we ran the new image. Here's what happened:**

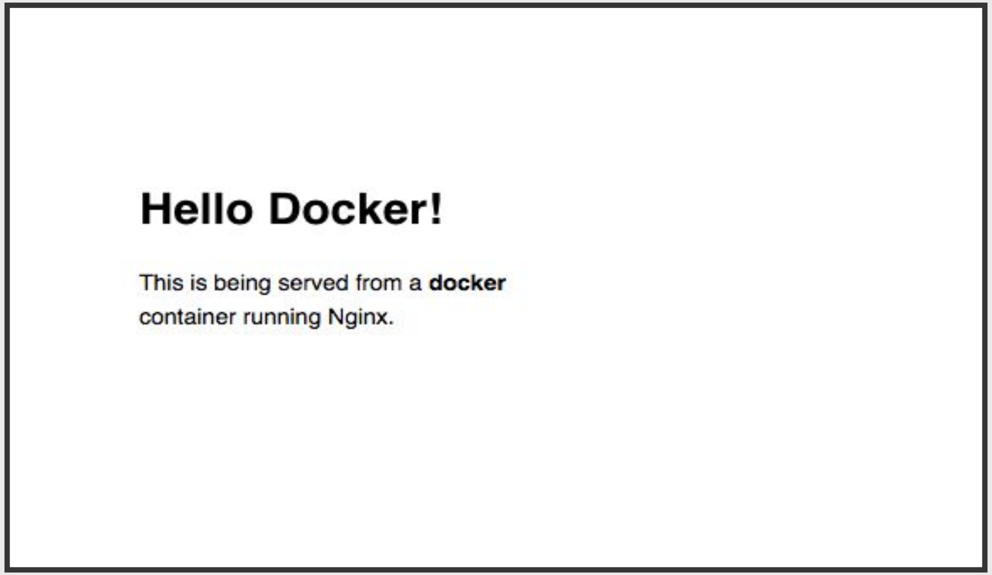
```
$ docker run --name static-site -d -p 8888:80 mlhacks/docker-static-site
```

1. Locate the requested image *(not found locally in this case)*.
2. Download this missing image from Docker Hub.
3. Create a new container using the requested image .
4. Name the container using the --name parameter.
5. Run it in the background (*detached*) and return to the prompt.
6. Expose port 8888.

Try Visiting your Website!

Head over to the following URL and you should see the website below:

```
http://localhost:8888
```

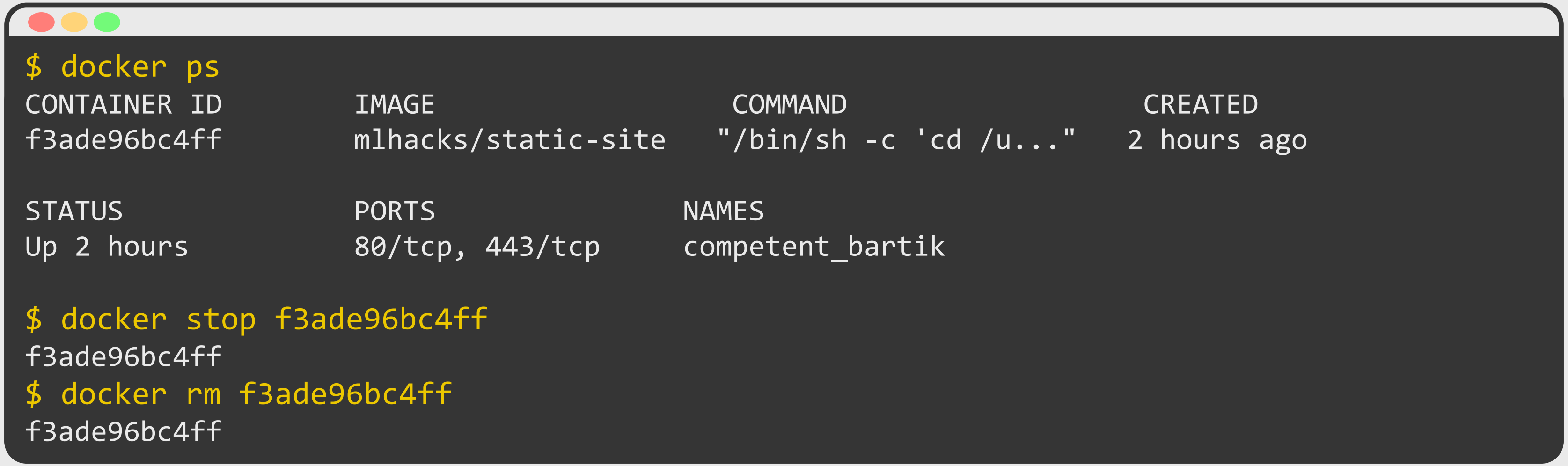


Hello Docker!

This is being served from a **docker** container running Nginx.

How do we Stop a Detached Image?

We can use `docker stop` and `docker rm` to stop and remove a Docker Image that is running in the background.



```
$ docker ps
CONTAINER ID        IMAGE                   COMMAND                CREATED
f3ade96bc4ff        mlhacks/static-site   "/bin/sh -c 'cd /u..."   2 hours ago

STATUS              PORTS                NAMES
Up 2 hours          80/tcp, 443/tcp      competent_bartik

$ docker stop f3ade96bc4ff
f3ade96bc4ff
$ docker rm f3ade96bc4ff
f3ade96bc4ff
```

***Note**: The example above provides the CONTAINER ID on our system; you should use the value that you see in your terminal.*

Let’s Clean Up!

Since we started this process with a name, we don’t need to use `docker ps` to figure out the ID.

```
$ docker stop static-site
static-site

$ docker rm static-site
static-site
```

Let’s Make a Docker Image!

We’ve run other people’s images so far, how do we create our own?
Let’s find out by creating an app that displays cat photos.

Cat Gif of the day

Cat GIFs Courtesy of

BuzzFeed

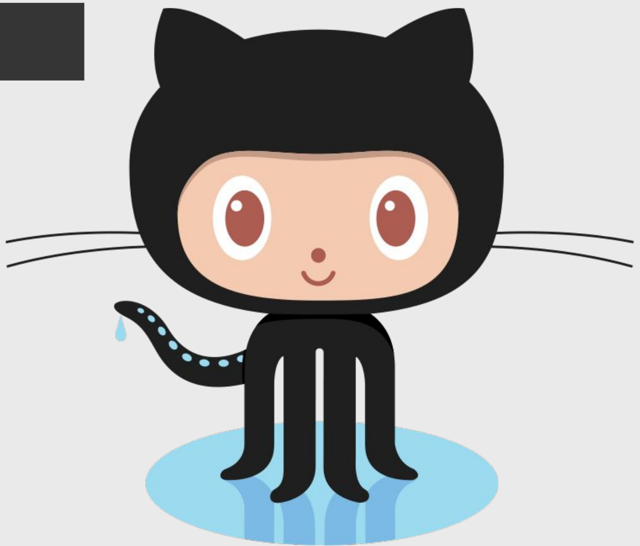
Download the Source Code on GitHub

You can find the code for the website we're going to run on GitHub. Download it from here:

```
http://mlhlocal.host/docker-flask-source
```

or see the site running live on Heroku:

```
http://mlhlocal.host/docker-flask
```

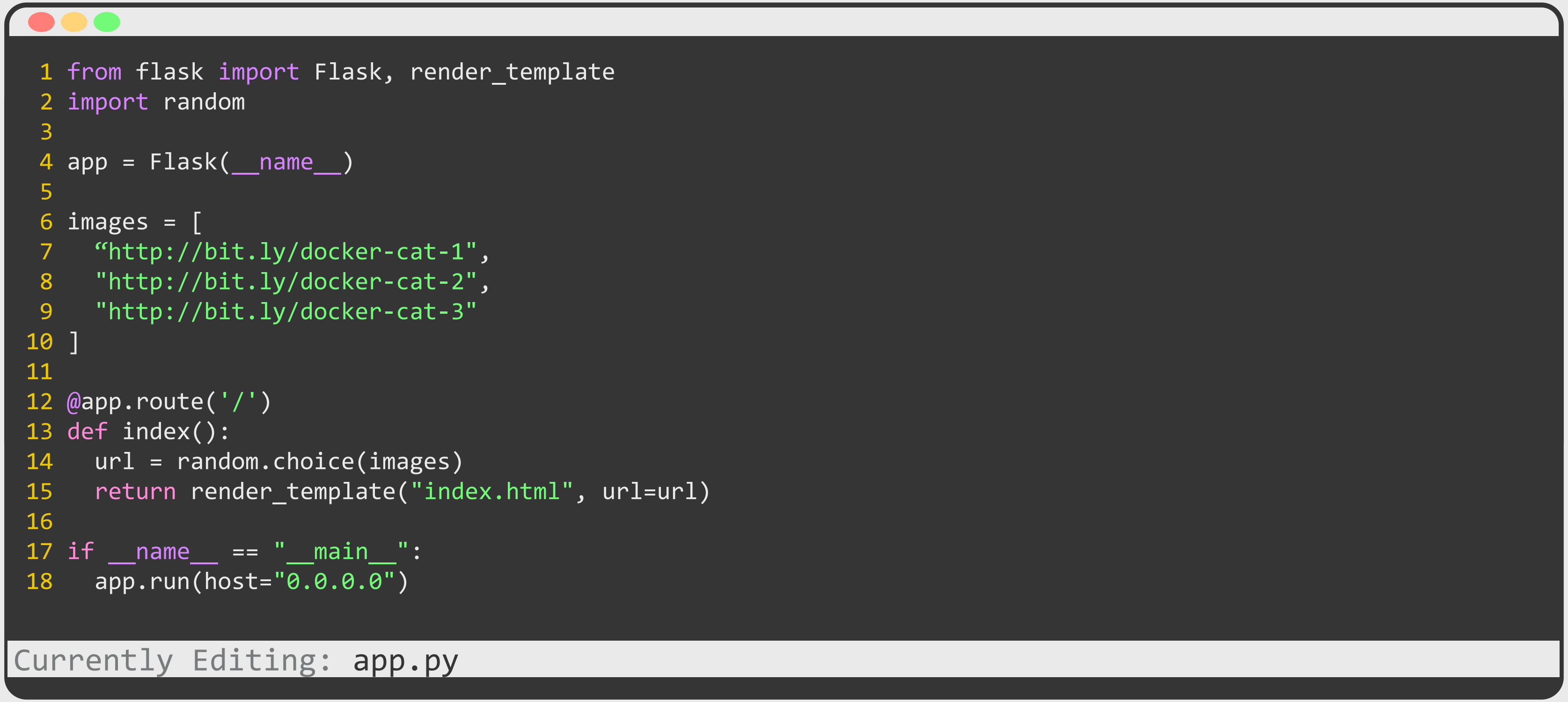


We're Going to Use Python + Flask!

Flask is a Framework for Python

- Makes it easy to build web applications by providing a standard set of tools.
- You don't need to know flask to understand this example.

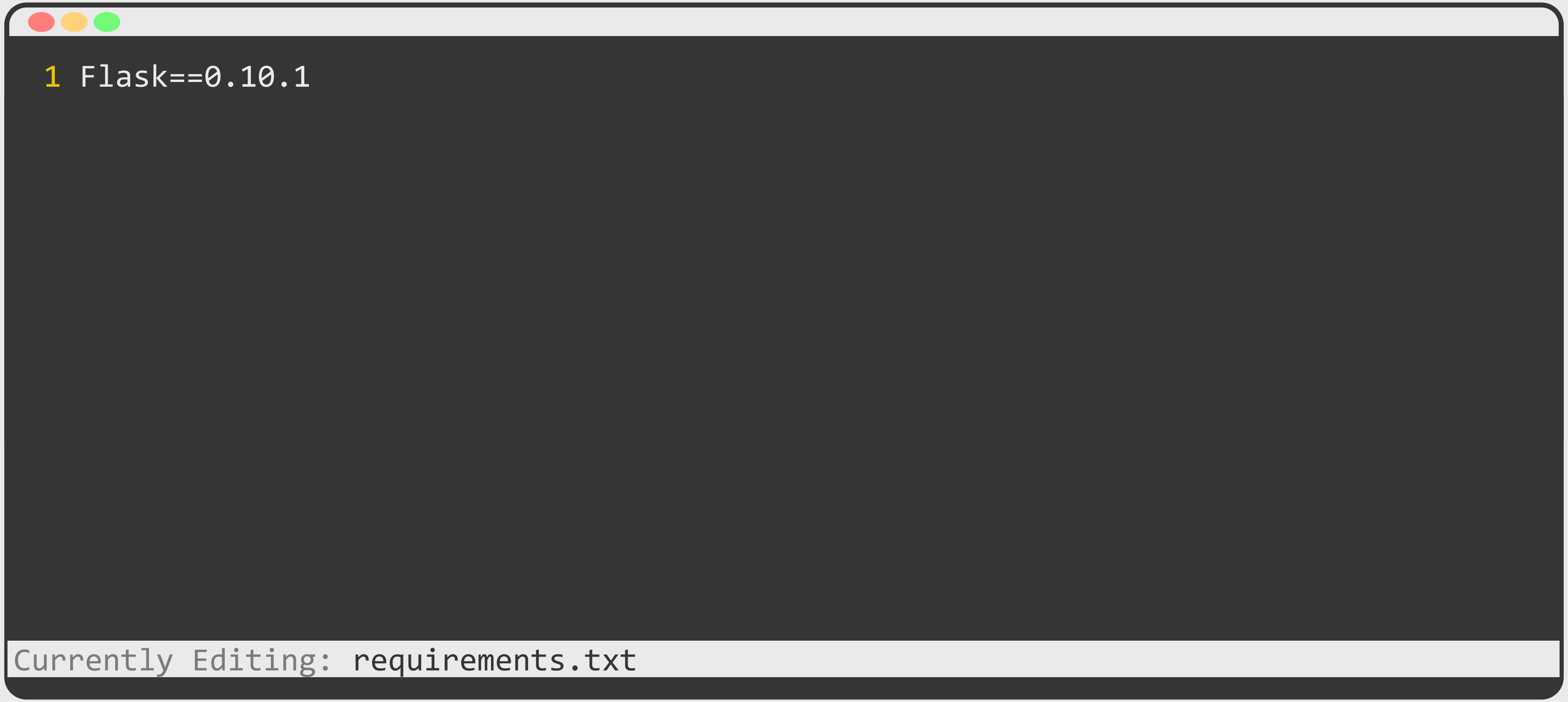
app.py



```python
from flask import Flask, render_template
import random

app = Flask(__name__)

images = [
  “http://bit.ly/docker-cat-1",
  "http://bit.ly/docker-cat-2",
  "http://bit.ly/docker-cat-3"
]

@app.route('/')
def index():
  url = random.choice(images)
  return render_template("index.html", url=url)

if __name__ == "__main__":
  app.run(host="0.0.0.0")
```

Currently Editing: app.py

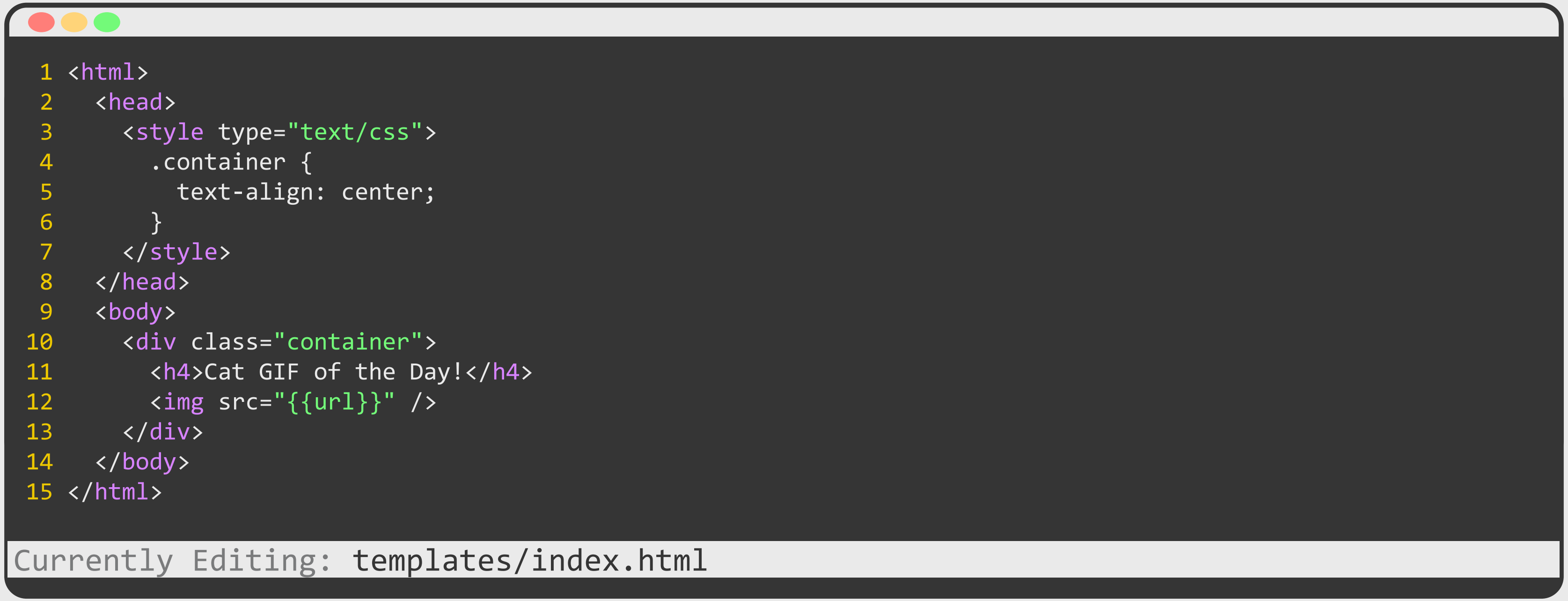
requirements.txt



```
Flask==0.10.1
```

Currently Editing: requirements.txt

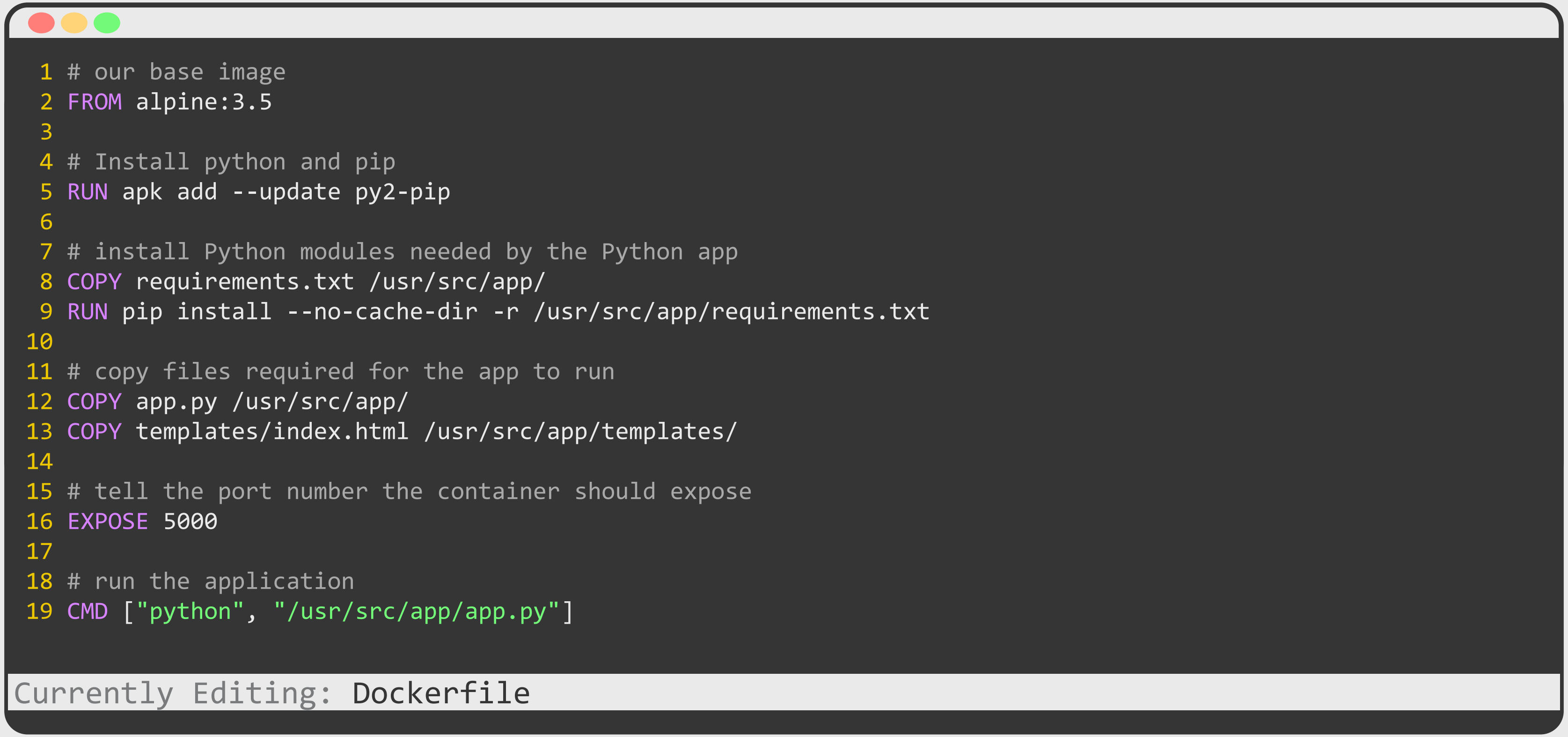
templates/index.html



```html
<html>
  <head>
    <style type="text/css">
      .container {
        text-align: center;
      }
    </style>
  </head>
  <body>
    <div class="container">
      <h4>Cat GIF of the Day!</h4>
      <img src="{{url}}" />
    </div>
  </body>
</html>
```

Currently Editing: templates/index.html

Dockerfile

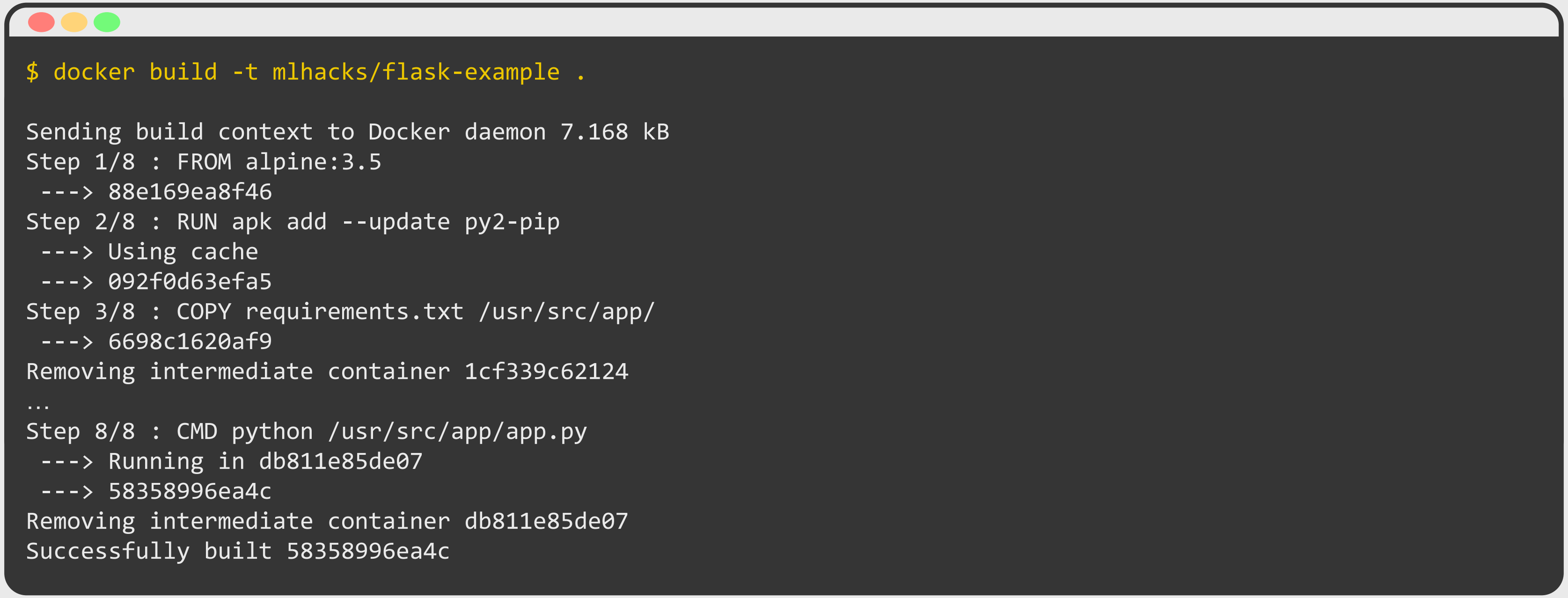


```
# our base image
FROM alpine:3.5

# Install python and pip
RUN apk add --update py2-pip

# install Python modules needed by the Python app
COPY requirements.txt /usr/src/app/
RUN pip install --no-cache-dir -r /usr/src/app/requirements.txt

# copy files required for the app to run
COPY app.py /usr/src/app/
COPY templates/index.html /usr/src/app/templates/

# tell the port number the container should expose
EXPOSE 5000

# run the application
CMD ["python", "/usr/src/app/app.py"]
```

Currently Editing: Dockerfile

Build the Docker Image

Now that you have your Dockerfile, you can build your image. The `docker build` command does this:



```
$ docker build -t mlhacks/flask-example .

Sending build context to Docker daemon 7.168 kB
Step 1/8 : FROM alpine:3.5
 ---> 88e169ea8f46
Step 2/8 : RUN apk add --update py2-pip
 ---> Using cache
 ---> 092f0d63efa5
Step 3/8 : COPY requirements.txt /usr/src/app/
 ---> 6698c1620af9
Removing intermediate container 1cf339c62124
…
Step 8/8 : CMD python /usr/src/app/app.py
 ---> Running in db811e85de07
 ---> 58358996ea4c
Removing intermediate container db811e85de07
Successfully built 58358996ea4c
```

Run your Docker Image

Use the `docker run` command to run the image we just built.
Replace `mlhacks` with your Docker ID.

```
$ docker run -p 8888:5000 mlhacks/flask-example

 * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
```

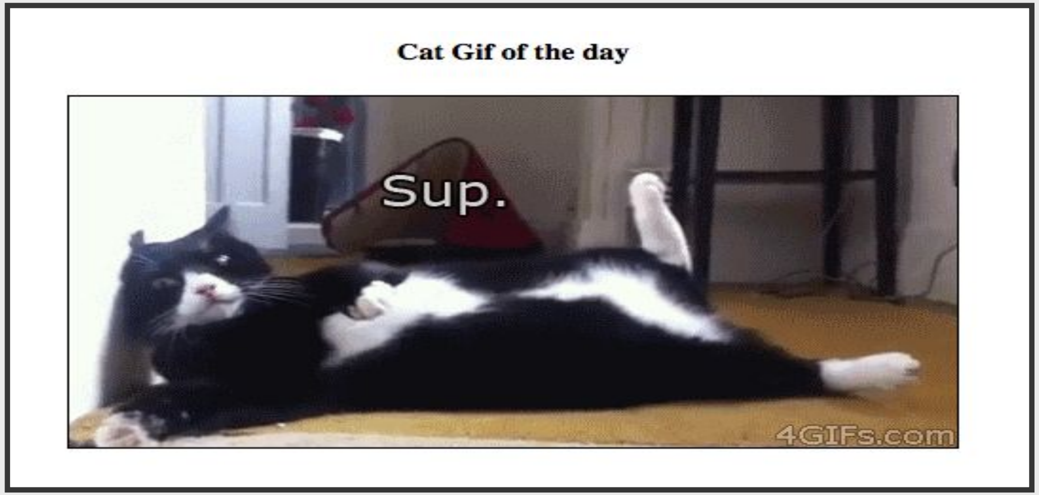
Head over to the following URL to see your handy work:

http://localhost:8888

Try Visiting your Website!

Head over to the following URL and you should see the website below:

```
http://localhost:8888
```



Cat Gif of the day

Cat GIFs Courtesy of
BuzzFeed

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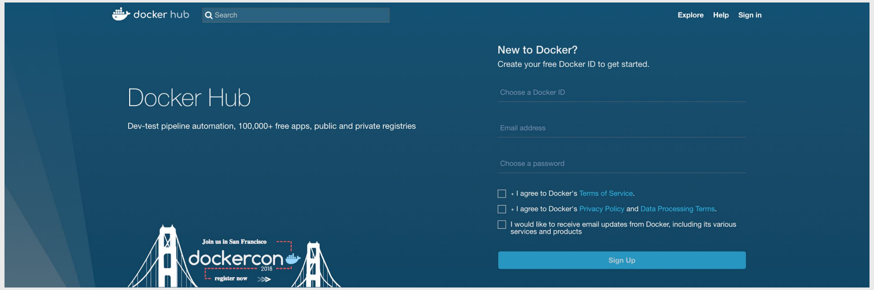
Host your Images on Docker Hub

Now that you've created you first Docker Image, you can publish it on Docker Hub for later use.



Docker Hub

Dev-test pipeline automation, 100,000+ free apps, public and private registries

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Email address

Choose a password

☐ • I agree to Docker's Terms of Service.

☐ • I agree to Docker's Privacy Policy and Data Processing Terms.

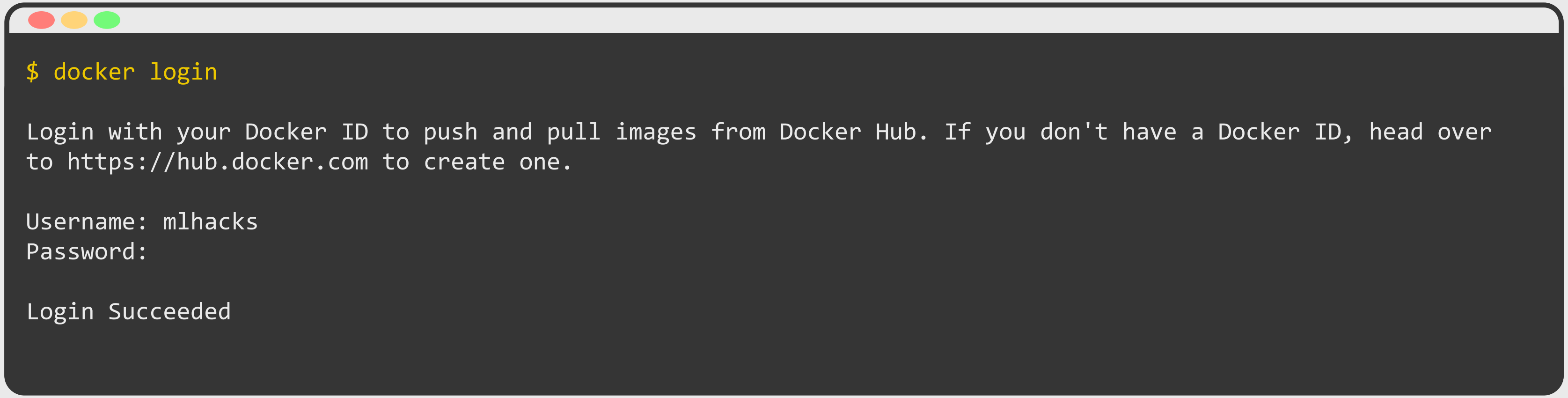
☐ I would like to receive email updates from Docker, including its various services and products

Sign Up

Login to your Docker Hub Account

In order to publish your image on Docker Hub, you need to login on the command line.

***Note**: Replace `mlhacks` with the Docker ID you created at the beginning of the workshop. Your password will be hidden when you type it out.*

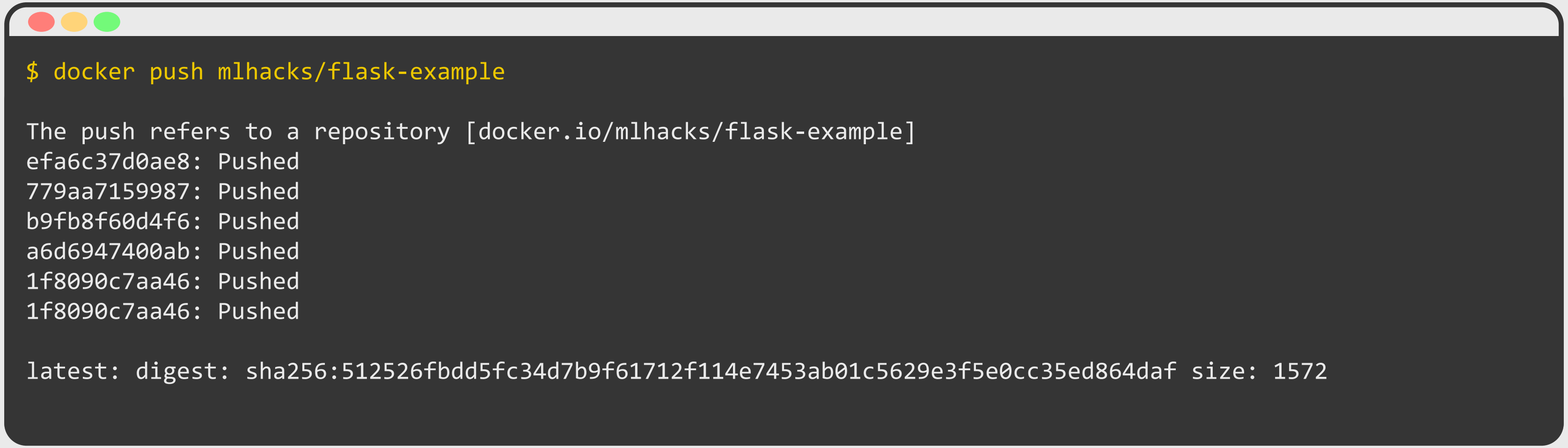


```
$ docker login

Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over
to https://hub.docker.com to create one.

Username: mlhacks
Password:

Login Succeeded
```

Push your Image to Docker Hub

We can use the `docker push` command to publish an image we have locally on Docker Hub for later use.

***Note**: Replace `mlhacks` with the Docker ID you created at the beginning of the workshop.*

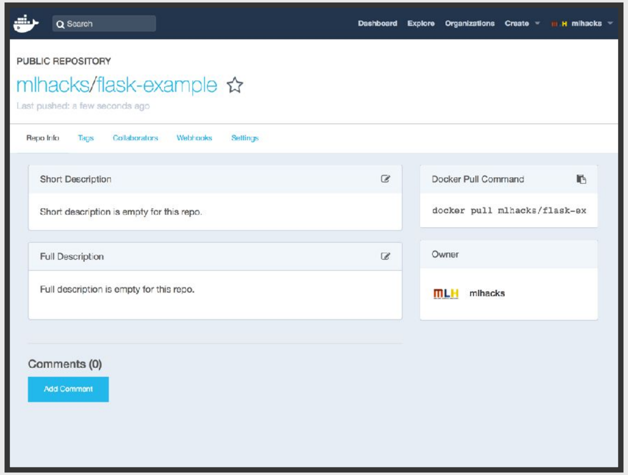


```
$ docker push mlhacks/flask-example

The push refers to a repository [docker.io/mlhacks/flask-example]
efa6c37d0ae8: Pushed
779aa7159987: Pushed
b9fb8f60d4f6: Pushed
a6d6947400ab: Pushed
1f8090c7aa46: Pushed
1f8090c7aa46: Pushed

latest: digest: sha256:512526fbdd5fc34d7b9f61712f114e7453ab01c5629e3f5e0cc35ed864daf size: 1572
```

Find your Image on Docker Hub

Log into your Docker Hub Account to see your Image!

You just published your first Docker Image on the Docker Hub Registry. Other developers can download and install your image by using `docker run` now!



PUBLIC REPOSITORY
mlhacks/flask-example
Last pushed: a few seconds ago

Short Description
Short description is empty for this repo.

Docker Pull Command
```
docker pull mlhacks/flask-ex
```

Full Description
Full description is empty for this repo.

Owner
MLH mlhacks

Comments (0)

http://mlhlocal.host/docker-hub

Deploy your App on Docker Cloud!

Docker Cloud is the best way to deploy and manage Dockerized applications.

- Makes it easy for new Docker users to manage and deploy everything form single container apps to distributed microservices stacks.
- Deploy to any cloud or on-premise infrastructure.

IBM **Cloud**

Table of Contents

What did you learn today?

We created a fun quiz to test your knowledge and see what you learned from this workshop.

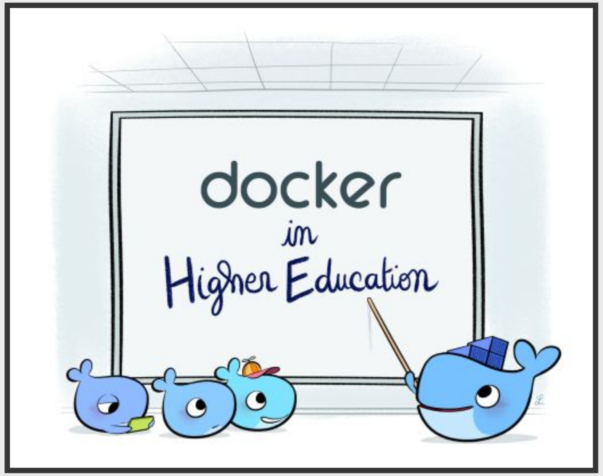
http://mlhlocal.host/quiz

Welcome to the Docker Student Community!

http://mlhlocal.host/docker-students

Sign up & receive the following:

- Access to our free Docker Student Kit!
- Latest product updates and release notes
- Invitations and promo codes just for students for Docker community events
- Ability to participate in raffles for Docker Swag
- Chance to get priority access to product betas
- Opportunity to become a Docker Campus Ambassador
- A listing on the Docker Student Community Directory without sharing your email (built in direct messaging system)
- Access to the Docker Community Slack



Join the Docker Community Slack Team!

- An instant messenger to communicate easily with the Docker Team and members of the Docker Community
- Join channels centered around interest in specific Docker-centric projects / topics, locations, languages etc.
- #docker-students: a dedicated channel to converse with other students from all over the world about Docker

Become a Docker Campus Ambassador

Are you an intermediate to advanced Docker user? Are you a leader on campus with a knack for bringing people together? Do you want to help your peers learn Docker?Become a Docker Campus Ambassador!

`mlhlocal.host/docker-ambassador`

Benefits include:

- Technical & professional training directly from the Docker team
- Privileged access to latest Docker editions
- Free tickets to community events like DockerCon
- Lots of swag!

Workshop

Introduction to Docker