



Objectives

- Docker motivation
- Docker components
- Install Docker
- Describe how to make a Docker container from scratch
- Introduce Docker Hub
- Docker volumes
- Docker command reference
- References

Docker motivation



From founder and CTO of Docker Solomon Hykes, as motivation for Docker:

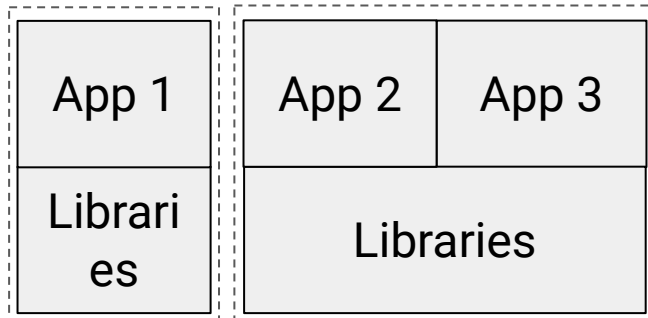
“Shipping code to the server should not be hard.”

The developer can specify what's inside the container, and IT just needs to handle the container.

No matter where the container goes, what's inside will work the same way.

Container 1

Container 2



Docker Engine

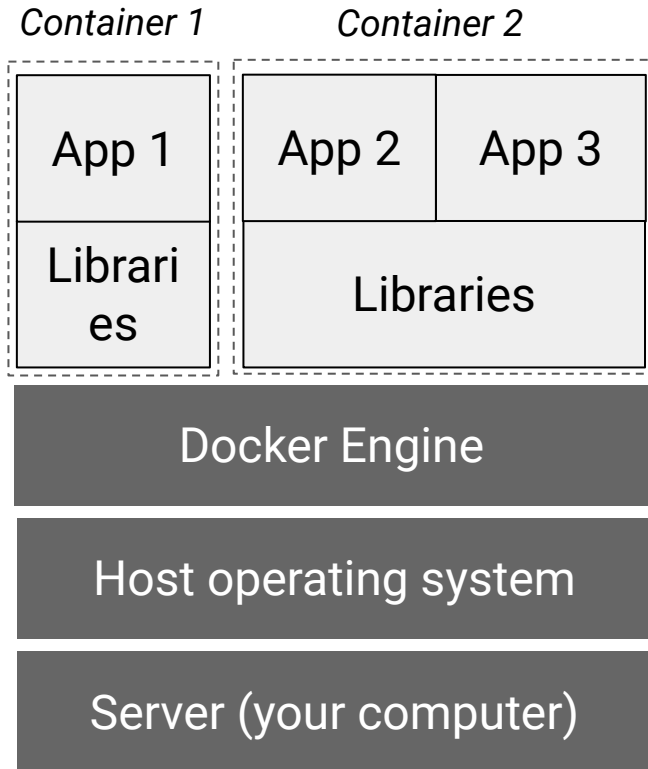
Host operating system

Server (your computer)

What is Docker

- Docker is an open-source project based on Linux containers.
- Docker is a software *containerization* platform.
- A docker *container* is a stand-alone piece of software that includes everything needed to run it.
- Containers are isolated from each other, but can share libraries where possible.
- Containers are created with Linux, but share a *kernel* with almost any type of OS.

A kernel is the central part of the OS.



Docker Timeline and Popularity

Docker was made open source in 2013 by Solomon Hykes at dotCloud.

Main contributors in 2016: Docker team, Cisco, Google, Huawei, IBM, Microsoft.

Has been downloaded more than 13 billion times as of 2017.

Main reasons for popularity:

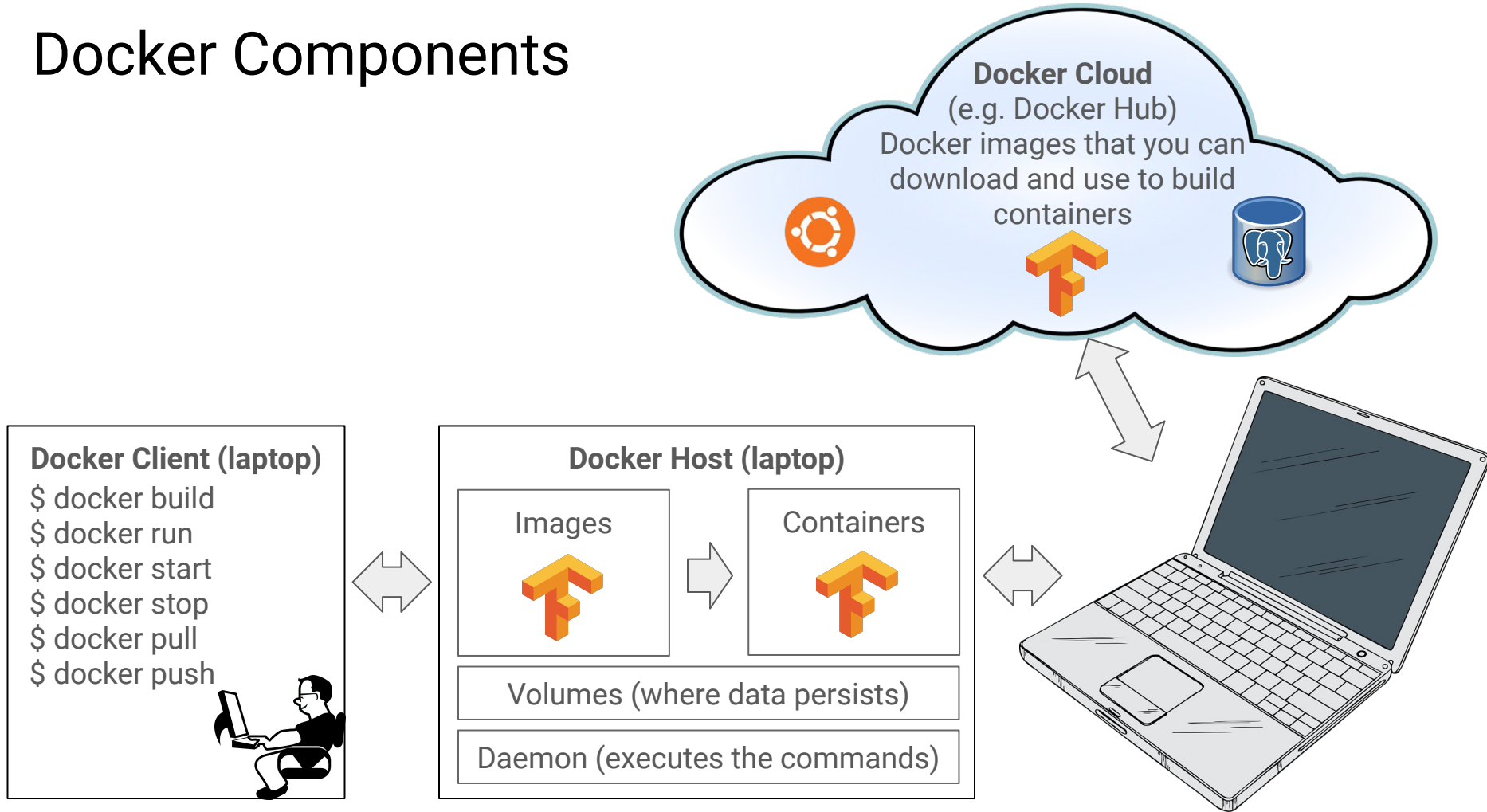
Ease of use: Build and test it on your laptop and it will run anywhere.

Speed: Containers are sandboxed environments running on the kernel that take up fewer resources and are faster to start-up than virtual machines.

Docker Hub: the free app-store for Docker images

Modularity and Scalability: An application can be divided into multiple containers but those containers can communicate.

Docker Components



Breakout - Install Docker

- For us, Docker is a relatively simple way to make an application that you know will work the same for someone else (as long as they have Docker, too.)
- The CE (Community Edition) is free.
- [Install Docker Ubuntu Linux](#)
 - are you tired of typing `sudo` all time? Do [this](#).
- [Install Docker Mac](#)
- Install [Docker Toolbox](#) for Windows and older versions for Mac
- After installation, can you get information on your installation?
 - `$ docker info`
 - For Mac you may want to [allocate more memory to Docker](#) (4 GB instead of 2)
- After installation, can you run Docker's hello-world container?
 - `$ docker run hello-world`

Making a Docker container from scratch

- Docker containers contain running applications.
 - All dependencies are taken care of inside the container.
- You are going to want to make containers for your applications.
 - A Flask app, for example.
- A Docker *container* is made by running a Docker *image*.
 - `$ docker run <image>`
- You can get existing Docker images from [Docker Hub](#).
- You can make your own Docker *image* by building from a *Dockerfile*.
 - `$ docker build -t <name_of_image> <path_Dockerfile_and_sup_files>`
- A *Dockerfile* is a text-file that defines the environment inside the container.
 - Can pull from parent images, specify programs to install, define environment variables, expose ports, run commands.

Making a Docker container from scratch (1/3)

A text *Dockerfile* defines what's in your container:

```
# Use an official Python runtime as a parent image
FROM python:2.7-slim

# Set the working directory to /app
WORKDIR /app

# Copy the current directory contents into the container at /app
COPY . /app

# Install any needed packages specified in requirements.txt
RUN pip install --trusted-host pypi.python.org -r requirements.txt

# Make port 80 available to the world outside this container
EXPOSE 80

# Define environment variable
ENV NAME World

# Run app.py when the container launches
CMD ["python", "app.py"]
```

Sidebar

[What is a port \(in computers\)?](#)

[Port assignments](#)

[What port should you use?](#)

[Source: Docker Docs, Getting Started](#)

Making a Docker container from scratch (2/3)

Put the *Dockerfile* and other files/directories required by your application in the same directory and then build them into a *Docker Image* using the *Docker Client*:

```
$ ls
Dockerfile          app.py              requirements.txt
```

```
$ docker build --tag=friendlyhello .
```

View the *Docker Image* “friendlyhello” that you’ve created:

```
$ docker image ls
```

REPOSITORY	TAG	IMAGE ID
friendlyhello	latest	326387cea398

Making a Docker container from scratch (3/3)

Use the *Docker Client* and your *Docker Image* to build your container. The `-p` flag maps the laptop's port 4000 to the container's port 80.

```
$ docker run -p 4000:80 friendlyhello
```

You should see a message that Python is serving your app at <http://0.0.0.0:80>.

But that message is coming from inside the container, which doesn't know you mapped port 80 of that container to 4000, making the correct URL <http://localhost:4000>

Docker command reference

Basic Docker commands

Command	Description
<code>docker</code>	Show available docker commands
<code>docker COMMAND --help</code>	Gets help on COMMAND
<code>docker info</code>	View details about your Docker installation
<code>docker login</code>	Logs in to Docker Hub so you can pull your own images
<code>docker build</code>	Use to make an image from a Dockerfile
<code>docker run <image></code>	Pull (if needed) and start a container from an image
<code>docker image ls</code>	Show local images
<code>docker volume ls</code>	Show local volumes
<code>docker start <name id></code>	Start a pre-existing container
<code>docker logs <id></code>	Return log of container (get token for notebook after starting)
<code>docker stop <name id></code>	Stop a container
<code>docker container ls</code>	Show running containers
<code>docker container ls -a</code>	Show running and stopped containers
<code>docker container rm <name id></code>	Removes a container

Breakout: Dockerfile -> Docker Image -> Docker Container

`Dockerfile`, `app.py` and `requirements.txt` have been given to you in an `app` directory. Go through the three steps described previously to create a Docker Image, and then build (and run) a container!

Questions:

- What do you type to get syntax help on a particular Docker command?
- What would you type at the command line to list your Docker Images?
- What would you type at the command line to list your Docker Containers?
- How do you show currently running containers?
- How do you show stopped containers?
- How do you stop a container?
- How do you delete a container?
- How do you build a new container and specify its name?

Docker Hub

[Docker Hub](#) is a service provided by Docker for finding and sharing container images with your team. It provides the following major features:

- [Repositories](#): Push and pull container images.
- [Teams & Organizations](#): Manage access to private repositories of container images.
- [Official Images](#): Pull and use high-quality container images provided by Docker.
- [And look at all the other images that are available.](#)

Like Github, you can have your own images on DockerHub.. Sign up (for free) on Docker Hub and push your image. See [here](#).

Docker Volumes

- Docker volumes are the preferred way of persisting data needed and created by containers.
- Containers by themselves have a writable layer (you can store data in a container without using a volume), but a volume is better because:
 - it doesn't increase the size of the container using it
 - the volume exists outside of the lifecycle of the container
 - the volume can be shared with other containers
- You can create a volume when a container is made.
- You can move data back and forth between the host file system and the docker container (my_data in my_container).

```
docker cp /tmp/my_data/. my_container:/my_data
```

[More on Docker volumes](#)

Detail syntax mounting a volume to a container

Make a tensorflow container named *tf_container* and a volume called *tf_volume*.

```
$ docker run -it \  
    --name tf_container \  
    --mount source=tf_volume,target=/notebooks \  
    -p 8888:8888 \  
    gcr.io/tensorflow/tensorflow:latest-py3
```


Detail syntax mounting a volume to a container

Make a tensorflow container named *tf_container* and a volume called *tf_volume*.

```
$ docker run -it \
```

in an interactive terminal session

```
--name tf_container \
```

name the container

```
--mount source=tf_volume,target=/notebooks \
```

```
-p 8888:8888 \
```

client port:container port

```
gcr.io/tensorflow/tensorflow:latest-py3
```

Docker image:tag



puts data in the container /notebooks directory into Docker volume tf_container

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<code>docker container ls</code>	Show running containers
<code>docker container ls -a</code>	Show running and stopped containers
<code>docker container rm <name id></code>	Removes a container

References

- [Docker Documentation](#)
- [Docker on Github](#)
- [Docker Hub](#)
- [Solomon Hykes talk at Twitter, 2 Oct. 2013](#)
- [Preethi Kasireddy - Beginner friendly Docker concepts](#)
- [Dockerfile reference](#)
- [Dockerfile best practices](#)

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