SAI Docker Workshop

Examples & Exercises



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# Docker Basics

## Setup

Download or clone the exercises repository at <https://github.com/tomverelst/saiworkshop>.

If you do not have Git, you can download the repository as a zip file.

## Running a container

Test that your installation works by running the simple Docker image, [hello-world](https://hub.docker.com/_/hello-world/):

$ docker run hello-world  
Unable to find image 'hello-world:latest' locally  
latest: Pulling from library/hello-world  
ca4f61b1923c: Pull complete  
Digest: sha256:ca0eeb6fb05351dfc8759c20733c91def84cb8007aa89a5bf606bc8b315b9fc7  
Status: Downloaded newer image for hello-world:latest

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

Docker automatically downloads the image from the registry if it cannot find it locally. The container also stopped because the main process (PID 1) stopped.

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## Detached vs foreground

When starting a Docker container, you must first decide if you want to run the container in the background in a “detached” mode or in the default foreground mode:

-d=false: Detached mode: Run container in the background, print new container id

Run the hello-world image again in detached mode:

$ docker run -d hello-world  
abcdef123456abcdef123456

We can stop this container again using its container ID:

$ docker stop abcdef123456abcdef123456

**Foreground mode**

In foreground mode (the default when -d is not specified), docker run can start the process in the container and attach the console to the process’s standard input, output, and standard error. It can even pretend to be a TTY (this is what most command line executables expect) and pass along signals. All of that is configurable:

-a=[] : Attach to `STDIN`, `STDOUT` and/or `STDERR`

-t : Allocate a pseudo-tty

--sig-proxy=true: Proxy all received signals to the process (non-TTY mode only)

-i : Keep STDIN open even if not attached

For interactive processes (like a shell), you must use -i -t together in order to allocate a tty for the container process. -i -t is often written -it:

$ docker run –it alpine /bin/sh

# You are now in a shell inside the container!

## Container identification

The operator can identify a container in three ways:

* **UUID Full** “f78375b1c487e03c9438c729345e54db9d20cfa2ac1fc3494b6eb60872e74778”
* **Partial UUID**   
  e.g. “f78375b1c487”
* **Name**  
  e.g. “generated\_name”

The UUID identifiers come from the Docker daemon. If you do not assign a container name with the --name option, then the daemon generates a random string name for you. Example:

$ docker run --name my-redis -d redis

## Environment variables

Environment variables can be set using the **–e** flag. For example:

$ docker run –e “FOO=BAR” –it alpine /bin/sh  
# echo $FOO  
BAR

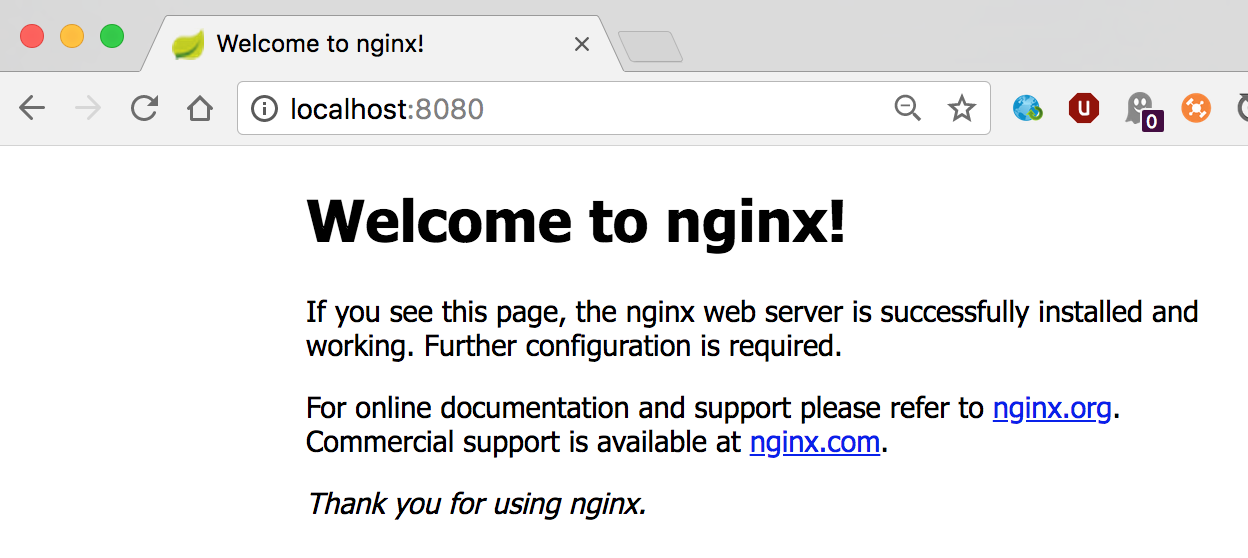
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## Publishing ports

Ports can be published using the **--publish** flag, or the shorthand flag **-p**

$ docker run -p 8080:80 -d nginx

If you open your browser and go to <http://localhost:8080>, you should see the **nginx** home page:



You can also publish all ports to random ports using the **--publish-all** flag, or the shorthand flag **-P** (capital).

$ docker run -P -d nginx  
8a17b8dd7a2a6a8a708c651078894d7c07108c5b8c0f9996642d478e494a9cda

You can check which random port has been chosen using **docker port**.

$ docker port 8a17b8d 80  
0.0.0.0:32769

In this example, Docker assigned port 32769 to the container. If you go to <http://localhost:32679>, then the nginx homepage will be shown again.

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## Inspecting & debugging a container

Docker offers a few tools which makes debugging easy.

**Viewing logs of a container**

The first tool we have is **docker logs**. With this command, we can view the console output of a container.

First, let’s create a container named **test** that prints the time every second:

$ docker run --name test -d alpine sh -c "while true; do $(echo date); sleep 1; done"afa4b30a270c793b1c1f6ad823fa7e62160a2f2c562c8c046241eb9c765110dc

Then, let’s follow the logs, for 2 seconds:

$ docker logs -f --until=2s test  
Tue 14 Nov 2017 16:40:00 CET  
Tue 14 Nov 2017 16:40:01 CET  
Tue 14 Nov 2017 16:40:02 CET

Use CTRL+C to stop following the logs.

**Inspecting a container**

The second tool we have is **docker inspect**. This command prints all information related to the container in JSON format.

$ docker inspect test

We can also use this tool to extract bits of information from the container, by passing in the **--format** flag, or the shorthand **-f** flag. For example:

$ docker inspect -f ‘{{.Config.Image}}’ test

**Executing commands**

The third tool we have is the **docker exec** command. This command executes commands inside the container. When combined with interactive mode (**-it**), this can be very powerful. Example:

$ docker exec -it test /bin/sh  
# We are now inside the container that was already running!

## Building an image with a Dockerfile

Let’s write our first Dockerfile! Go to the **examples/basic/hello** folder. You will see there are 2 files in this directory:

$ cd examples/basic/hello  
$ ls  
app.py requirements.txt

* 1. app.py
     + A python application
  2. requirements.txt
     + This file contains the dependencies for the application

Create a new Dockerfile in this folder.

$ touch Dockerfile

Copy the following contents to this Dockerfile

# 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

ADD . /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"]

That’s it! You don’t need Python or anything in requirements.txt on your system, nor does building or running this image install them on your system. It doesn’t seem like you’ve really set up an environment with Python and Flask, but you have.

We are ready to build the app. Make sure you are still at the top level of your new directory. Here’s what ls should show:

$ ls  
Dockerfile app.py requirements.txt

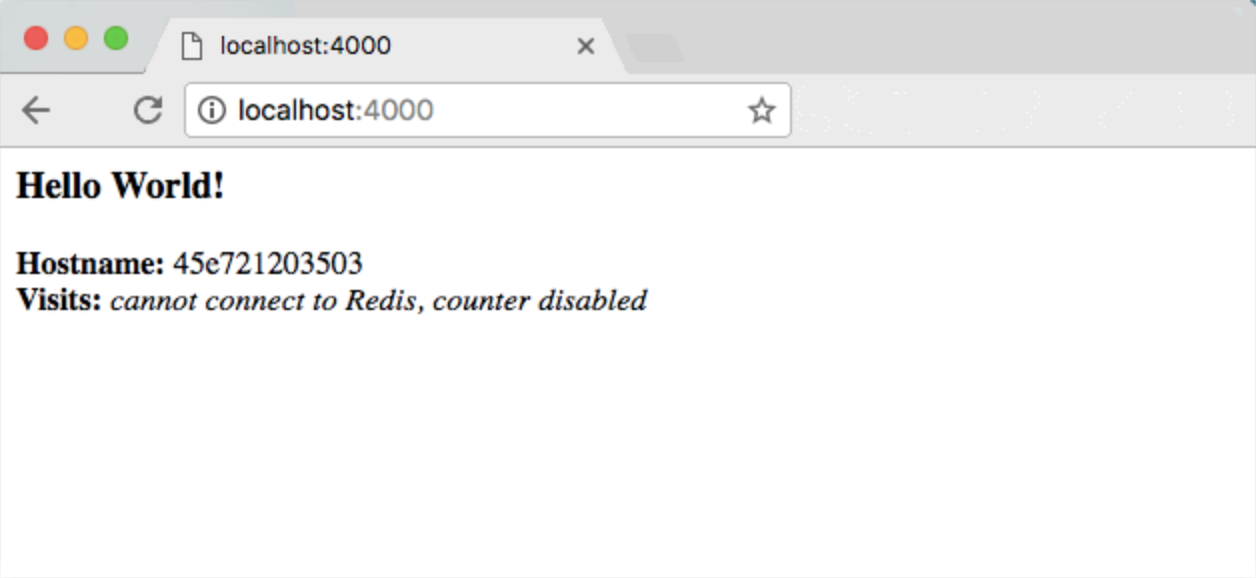
Now run the build command. This creates a Docker image, which we’re going to tag using -t so it has a friendly name.

$ docker build -t friendlyhello .

Run the app, mapping your machine’s port 4000 to the container’s published port 80 using -p:

$ 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>.



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***Note****: If you are using Docker Toolbox on Windows 7, use the Docker Machine IP instead of localhost. For example, http://192.168.99.100:4000/. To find the IP address, use the command docker-machine ip.*

This port remapping of 4000:80 is to demonstrate the difference between what you EXPOSE within the Dockerfile, and what you publish using docker run –p.

You get the long container ID for your app and then are kicked back to your terminal. Your container is running in the background. You can also see the abbreviated container ID with docker container ls (and both work interchangeably when running commands):

$ docker container ls  
CONTAINER ID IMAGE COMMAND CREATED  
1fa4ab2cf395 friendlyhello "python app.py" 28 seconds ago

Notice that CONTAINER ID matches what’s on http://localhost:4000.

Now use docker container stop to end the process, using the CONTAINER ID, like so:

$ docker container stop 1fa4ab2cf395

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## Pushing an image

To demonstrate the portability of what we just created, let’s upload our built image and run it somewhere else. After all, you need to know how to push to registries when you want to deploy containers to production.

A registry is a collection of repositories, and a repository is a collection of images—sort of like a GitHub repository, except the code is already built. An account on a registry can create many repositories. The docker CLI uses Docker’s public registry by default.

**Login with your Docker ID**

If you don’t have a Docker account, sign up for one at [cloud.docker.com](https://cloud.docker.com/). Make note of your username. Or you can use the following account:

**User**: saiworkshop

**Password:** sai123

Log in to the Docker public registry on your local machine.

$ docker login

**Tagging an image**

The notation for associating a local image with a repository on a registry is username/repository:tag. The tag is optional, but recommended, since it is the mechanism that registries use to give Docker images a version. Give the repository and tag meaningful names for the context, such as get-started:part2. This puts the image in the get-started repository and tag it as part2.

Now, put it all together to tag the image. Run docker tag image with your username, repository, and tag names so that the image uploads to your desired destination. The syntax of the command is:

For example:

$ docker tag friendlyhello saiworkshop/hello:1.0

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**Viewing a list of images**

Run [docker image ls](https://docs.docker.com/engine/reference/commandline/image_ls/) to see your newly tagged image.

$ docker image ls  
REPOSITORY TAG IMAGE ID CREATED SIZE  
friendlyhello latest d9e555c53008 3 minutes ago 195MB  
saiworkshop/hello 1.0 d9e555c53008 3 minutes ago 195MB  
python 2.7-slim 1c7128a655f6 5 days ago 183MB

**Publishing an image**

Upload your tagged image to the repository:

$ docker push saiworkshop/hello:1.0

Docker will upload each layer of the image one by one.

**Removing an image**

You can remove the image you pushed (if you want to), using the **docker image rm** command.

$ docker image rm saiworkshop/hello:1.0

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## Command recap

Here is a list of all commands we have encountered so far, and some extra:

docker build -t friendlyhello . # Create image using this directory's Dockerfile

docker run -p 4000:80 friendlyhello # Run "friendlyname" mapping port 4000 to 80

docker run -d -p 4000:80 friendlyhello # Same thing, but in detached mode

docker container ls # List all running containers

docker container ls -a # List all containers, even those not running

docker container stop <hash> # Gracefully stop the specified container

docker container kill <hash> # Force shutdown of the specified container

docker container rm <hash> # Remove specified container from this machine

docker container rm $(docker container ls -a -q) # Remove all containers

docker container exec <hash> # Execute a command in a container

docker image ls -a # List all images on this machine

docker image rm <image id> # Remove specified image from this machine

docker image rm $(docker image ls -a -q) # Remove all images from this machine

docker login # Log in this CLI session using your Docker credentials

docker tag <image> username/repository:tag # Tag <image> for upload to registry

docker push username/repository:tag # Upload tagged image to registry

docker run username/repository:tag # Run image from a registry

docker container logs <hash> # View logs of a container

docker container inspect <hash> # Inspect the details of a container

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## Exercise: Dockerize the FakeCoin Server

In this exercise, we will Dockerize the FakeCoin server application. You can find the application in the **fakecoin/server** folder.

You can build the application beforehand using the following command:

$ docker run -v $(pwd):/usr/src/app --workdir=/usr/src/app maven:3.5.3-jdk-8-alpine mvn clean package

**Note:** If you are working on Windows, replace **$(pwd)** with the full path of the directory.

The current directory will be mounted in the container, and Maven will compile the application, run all tests, and build an artifact. The application will be built as a jar file at **target/fakecoin-1.0.jar**.

Create a Dockerfile that:

* Starts from the **maven:3.5.3-jdk-8-alpine** base image
* Copies the **target/fakecoin-1.0.jar to /usr/src/app/fakecoin-1.0.jar**
* Exposes port **8080**
* Runs the following command to run the application:
  + **java -jar /usr/src/app/target/fakecoin-1.0.jar**

Our artifact was built, but our artifact was built in a separate Docker container. Let’s move the build of our application to our Dockerfile as well:

Update the Dockerfile so that it:

* Starts from the **maven:3.5.3-jdk-8-alpine** base image
* Sets the working directory to **/usr/src/app**
* Copies the **pom.xml** file to **/usr/src/app/pom.xml**
* Copies **src/** to **/usr/src/app/src/**
* Runs the following command to build the application:
  + **mvn clean package**
* Runs the following command to run the application:
  + **java -jar target/fakecoin-1.0.jar**

Try to build and run this image.

$ docker build -t fakecoin-server .  
$ docker run -p 8080:8080 fakecoin-server

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## Exercise: Dockerize the FakeCoin UI

In this exercise, we will Dockerize the FakeCoin UI application. You can find the application in the **fakecoin/ui** folder.

Create a Dockerfile that:

* Starts from the **node:6.0.0** base image
* Sets the working directory to **/usr/src/app**
* Copies the whole root project folder to **/usr/src/app**
* Runs the following command to download our dependencies:
  + **npm install**
* Exposes port **3000**
* Runs the following command to run the application:
  + **npm start**

Try to build and run this image.

$ docker build -t fakecoin-ui .  
$ docker run -p 3000:3000 fakecoin-ui

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## Exercise: Dependency-first Dockerfile FakeCoin Server

In this exercise, we will Dockerize the FakeCoin server application using a dependency-first Dockerfile. You can find the application in the **fakecoin/server** folder.

Update the Dockerfile or create a separate one that:

* Starts from the **maven:3.5.3-jdk-8-alpine** base image
* Sets the working directory to **/usr/src/app**
* Copies the **pom.xml** file to **/usr/src/app/pom.xml**
* Runs the following command to download all dependencies:
  + **mvn dependency:go-offline**
* Copies **src/** to **/usr/src/app/src/**
* Runs the following command to build the application:
  + **mvn clean package**
* Exposes port **8080**
* Runs the following command to run the application:
  + **java -jar target/fakecoin-1.0.jar**

Try to build and run this image.

$ docker build -t fakecoin-server .  
$ docker run -p 8080:8080 fakecoin-server

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## Exercise: Dependency-first Dockerfile FakeCoin UI

In this exercise, we will Dockerize the FakeCoin UI application, using a dependency-first Dockerfile. You can find the application in the **fakecoin/ui** folder.

Create a Dockerfile that:

* Starts from the **node:6.0.0** base image
* Sets the working directory to **/usr/src/app**
* Copies the **package.json** and **package-lock.json**
* Runs the following command to download our dependencies:
  + **npm install**
* Copies the **bin/** folder
* Copies the **server.js**
* Copies the **routes/** folder
* Copies the **public/** folder
* Exposes port **3000**
* Runs the following command to run the application:
  + **npm start**

Try to build and run this image.

$ docker build -t fakecoin-ui .  
$ docker run -p 3000:3000 fakecoin-ui

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## Example: Multi-Stage Dockerfile

Our current images currently include all build steps and build tools. This results in a much larger image than needed. With Docker, it is possible to create multi-stage Dockerfiles.

In a multi-stage Dockerfile, you define different steps by starting from different base images using the FROM keyword.

# Create a step named builder  
FROM alpine as builder  
RUN echo “Hello” >> “world.txt”

# Create our final step  
FROM alpine

# Copy the file from the previous step  
COPY --from=builder world.txt hello.txt  
CMD [“cat”, “hello.txt”]

## Exercise: Multi-Stage Dockerfile FakeCoin Server

In this exercise, we will Dockerize the FakeCoin server application using a Multi-Stage Dockerfile. You can find the application in the **fakecoin/server** folder.

Update the Dockerfile or create a separate one that:

* Has a first step named **builder** that starts from the **maven:3.5.3-jdk-8-alpine** base image
* Sets the working directory to **/usr/src/app**
* Copies the **pom.xml** file to **/usr/src/app/pom.xml**
* Runs the following command to download all dependencies:
  + **mvn dependency:go-offline**
* Copies **src/** to **/usr/src/app/src/**
* Runs the following command to build the application:
  + **mvn clean package**
* Has a second step that starts from the **java:openjdk-8u111-jre** base image.
* Copies the **/usr/src/app/target/fakecoin-1.0.jar** from the first step to **/usr/src/app/app.jar**
* Runs the following command to run the application:
  + **java -jar target/app.jar**

Try to build and run this image.

$ docker build -t fakecoin-server .  
$ docker run -p 8080:8080 fakecoin-server

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## Exercises: Volumes

Create a volume named “**rabbit-data**”

Start a **rabbitmq** container that:

* Uses the image **rabbitmq:3.7.4-management**
* Publishes port **15672**
* Mounts the volume **rabbit-data** to **/var/lib/rabbitmq**

## Exercises: FakeCoin Network

In this exercises we will create a network and attach our FakeCoinapplications which we built in our earlier exercises.

Create a bridge network named “**fakenet**”.

Start a **rabbitmq** container that:

* Uses image **rabbitmq:3.7.4-management**
* Is attached to the **fakenet** network
* Named **rabbitmq** (important for DNS resolution!)
* Publishes ports **15672**
* Mounts the volume **rabbit-data** to **/var/lib/rabbitmq**

Start a **fakecoin-server** container that:

* Is attached to the **fakenet** network
* Publishes port **8080**
* Sets the environment variable **SPRING\_RABBIT\_HOST** to **rabbitmq** (optional)

Start a **fakecoin-ui** container that:

* Is attached to the **fakenet** network
* Publishes port 3000
* Sets the environment variable **RABBIT\_URL** to **amqp://rabbitmq**
* Sets the environment variable **FAKECOIN\_HOST** to **fakecoin-server**

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# Docker Compose

## Example: Our hello app

A docker-compose.yml file is a YAML file that defines how Docker containers should behave in production.

In this example, we will scale and load balance one of our first apps.

version: "3"

services:

web:

# replace saiworkshop/hello:1.0 with your name and image details

image: saiworkshop/hello:1.0

deploy:

replicas: 5

resources:

limits:

cpus: "0.1"

memory: 50M

restart\_policy:

condition: on-failure

ports:

- "80:80"

networks:

- webnet

networks:

webnet:

This docker-compose.yml file tells Docker to do the following:

* Pull the image we created in one of the first examples
* Run 5 instances of that image as a service called web, limiting each one to use, at most, 10% of the CPU (across all cores), and 50MB of RAM.
* Immediately restart containers if one fails.
* Map port 80 on the host to web’s port 80.
* Instruct web’s containers to share port 80 via a load-balanced network called webnet. (Internally, the containers themselves publish to web’s port 80 at an ephemeral port.)
* Define the webnet network with the default settings (which is a load-balanced overlay network).

## Example: Voting App & scaling services

Go to the folder **examples/docker-compose/voting-app**.

Start the application. You should have 5 containers being started.

$ docker-compose up -d

After the applications have started, scale the **worker** service to **3** replicas.

$ docker-compose scale worker=3

Stop the applications.

$ docker-compose down

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## Exercise: FakeCoin docker-compose.yml

In this exercise, we will write a docker-compose file for our FakeCoin application.

Go to the **fakecoin** folder and create a **docker-compose.yml** file.

Add a bridge network named “**fakenet**”.

Add a volume named “**rabbit-data**”.

Add a **rabbitmq** service that:

* Uses image **rabbitmq:3.7.4-management**
* Is attached to the **fakenet** network
* Named **rabbitmq** (important for DNS resolution!)
* Publishes ports **15672**
* Mounts the volume **rabbit-data** to **/var/lib/rabbitmq**

Add a **fakecoin-server** service that:

* Is attached to the **fakenet** network
* Publishes port **8080**
* Sets the environment variable **SPRING\_RABBIT\_HOST** to **rabbitmq** (optional)
* Depends on the **rabbitmq** server

Add a **fakecoin-ui** service that:

* Is attached to the **fakenet** network
* Publishes port **3000**
* Sets the environment variable **RABBIT\_URL** to **amqp://rabbitmq**
* Sets the environment variable **FAKECOIN\_HOST** to **fakecoin-server**
* Depends on the **rabbitmq** and **fakecoin-server** services

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# Docker Swarm

## Creating a swarm with Docker Machine

First, let’s create two nodes with Docker Machine.

Create a node named **manager**.

$ docker-machine create -d virtualbox manager

Create a node named **worker**.

$ docker-machine create -d virtualbox worker

Connect to the **manager** node using **docker-machine ssh**

$ docker-machine ssh manager

Initiate the manager node as a Swarm manager

docker@manager:~$ docker swarm init --advertise-addr 192.168.99.100  
Swarm initialized: current node (pjn381c98lbt8o2gr1roi0j0n) is now a manager.  
To add a worker to this swarm, run the following command:  
  
 docker swarm join --token SWMTKN-1-1ocbfx7hpqai4yd1c2fefbngzg1nszgbtlrhim4zoyl5wsj8za-f4rg94f82hhdz1oxzgi4a5sro 192.168.99.100:2377

To add a manager to this swarm, run 'docker swarm join-token manager' and follow the instructions.

docker@manager:~$ exit

Copy the command and **exit**.

Connect to the **worker** node using **docker-machine ssh**

$ docker-machine ssh worker

Initiate the node as a Swarm worker node and join the Swarm cluster.

docker@worker:~$ docker swarm join --token SWMTKN-1-1ocbfx7hpqai4yd1c2fefbngzg1n

szgbtlrhim4zoyl5wsj8za-f4rg94f82hhdz1oxzgi4a5sro 192.168.99.100:2377

This node joined a swarm as a worker.  
docker@worker:~$ exit

You have now set up a Docker Swarm cluster with 2 nodes!

## Swarm Management

Now that we have set up our Swarm, let’s inspect it.

Configure your Docker client to connect to the Swarm manager:

$ docker-machine env manager  
export DOCKER\_TLS\_VERIFY="1"  
export DOCKER\_HOST="tcp://192.168.99.100:2376"  
export DOCKER\_CERT\_PATH="/Users/tomverelst/.docker/machine/machines/manager"  
export DOCKER\_MACHINE\_NAME="manager"

# Run this command to configure your shell:   
# eval $(docker-machine env manager)

$ eval $(docker-machine env manager)

As you can see, **docker-machine env** prints a script that configures your Docker client for a certain Docker host. To configure your client, you must evaluate the script.

Normally Docker Machine will auto-detect your shell. If this is not the case on Windows, you can pass in the **--shell** flag.

$ docker-machine.exe env --shell powershell dev  
$Env:DOCKER\_TLS\_VERIFY = "1"  
$Env:DOCKER\_HOST = "tcp://192.168.99.101:2376"  
$Env:DOCKER\_CERT\_PATH = "C:\Users\captain\.docker\machine\machines\dev"  
$Env:DOCKER\_MACHINE\_NAME = "dev"  
# Run this command to configure your shell:  
# docker-machine.exe env --shell=powershell dev | Invoke-Expression

We can view and manage our nodes using **docker node**.

$ docker node ls  
ID HOSTNAME STATUS AVAILABILITY MANAGER STATUS  
pjn381c98lbt8o2gr1roi0j0n \* manager Ready Active Leader  
u1k3p501ijayiq9tdog6yftl0 worker Ready Active

## Creating and scaling a service

Now that our Swarm cluster is set up, we can start creating services. We can create services using the **docker service create** command. Let’s use the **hello** image we created earlier.

$ docker service create --publish 80 \  
 -e NAME=Swarm \  
 --name hello \  
 saiworkshop/hello:1.0

3i12z8llcvuy0c3rlrb5j0ny3  
overall progress: 1 out of 1 tasks   
1/1: running   
verify: Service converged

We can view our service using **docker service ls**

$ docker service ls  
ID NAME MODE REPLICAS IMAGE PORTS

3i12z8llcvuy hello replicated 1/1 saiworkshop/hello:1.0 \*:30000->80/tcp

The service currently only has 1 replica. Let’s scale this up to 3.

$ docker service scale hello=3  
hello scaled to 3  
overall progress: 1 out of 3 tasks   
1/3: preparing   
2/3: preparing   
3/3: running

If we check out our services again, we will see it is scaled to 3 instances

$ docker service ls  
ID NAME MODE REPLICAS IMAGE PORTS

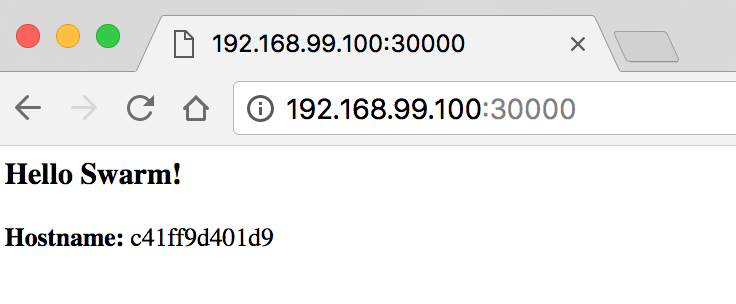
3i12z8llcvuy hello replicated 3/3 saiworkshop/hello:1.0 \*:30000->80/tcp

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Since our Swarm is not running on localhost, we must connect using the IP. You can get the IP of a node by using **docker-machine ip** **<name>**.

$ docker-machine ip manager  
192.168.99.100

Now go to the website at <http://192.168.99.100:30000> (replace the IP and port by the IP of the node and the port of the service in your cluster).



Try refreshing the page. You will see that the hostname will change. This is because Docker Swarm will automatically load balance requests between the different replicas.

Remove the service.

$ docker-machine service rm hello  
hello

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## Exercise: FakeCoin Bundle

In this exercise, we are going to create a bundle for the FakeCoin application.

Build and push the FakeCoin applications to a repository on the Docker Hub. Feel free to use your own, or the **saiworkshop** repository. Try to use an unique name, so there are no conflicts with the other attendants.

Create or copy the existing docker-compose.yml file. Edit this file so that:

* The **fakecoin-server** service uses your image that is pushed to the Docker Hub.
* The **fakecoin-ui** service uses your image that is pushed to the Docker Hub.

Create a .dab file using **docker-compose bundle**. You need to make sure you also have all images pulled. You can use **docker-compose pull <service>** to pull images of specific services in the docker-compose.yml file.

## Exercise: Deploying the FakeCoin services

In this exercise, we will first use our docker-compose.yml file to deploy our services.

Deploy the services using **docker stack deploy** using the docker-compose.yml file

$ docker stack deploy --compose-file docker-compose.yml fakecoin  
Creating network fakecoin\_fakenet  
Creating service fakecoin\_fakecoin-server  
Creating service fakecoin\_fakecoin-ui  
Creating service fakecoin\_rabbitmq

We can view and manage our stacks using **docker stack**

$ docker stack ls  
NAME SERVICES  
fakecoin 3

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## Exercise: Deploying the FakeCoin stack (Optional)

In this exercise, we will first use our fakecoin.dab file to deploy our services.

Bundles are an **experimental** feature, and require the Docker agent to run with expiremental mode on. You can check if the Docker agent is running in experimental mode using the following command.

$ docker version -f '{{.Server.Experimental}}'  
true/false

If the feature is on, you can try to deploy the services using **docker stack deploy -f docker-compose.yml**

$ docker stack deploy --bundle-file fakecoin.dab fakecoin

## Updating a service

When running services in production, it is important that you can update these services to newer versions or to have other settings. We can use the **docker service update** command for this.

In this example, we will update our **fakecoin-ui** service to 3 replicas.

$ docker service update --replicas 3 --with-registry-auth fakecoin\_fakecoin-ui  
fakecoin\_fakecoin-ui  
overall progress: 1 out of 3 tasks   
1/3: running [==================================================>]   
2/3: preparing [=================================> ]   
3/3: preparing [=================================> ]

To make sure our worker nodes have access to the registry, we pass in the **--with-registry-auth** flag. Docker Swarm will pass on the authentication details to each node, so it can pull the images if necessary.

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## Applying rolling updates to a service

When updating a service to a newer version of an image, it is possible to use rolling updates to avoid downtime.

First, let’s create a new version of our **fakecoin-ui** application.

$ docker image tag saiworkshop/fakecoin-ui saiworkshop/fakecoin-ui:2.0  
$ docker push saiworkshop/fakecoin-ui:2.0

Then, let’s update our service using a rolling update.

$ docker service update \  
 --image tomverelst/fakecoin-ui:2.0 \  
 --update-parallelism 1 \  
 --update-delay 10s \  
 fakecoin\_fakecoin-ui

fakecoin\_fakecoin-ui  
overall progress: 3 out of 3 tasks   
1/3: running [==================================================>]   
2/3: running [==================================================>]   
3/3: running [==================================================>]   
verify: Service converged

The **--update-parallism** flag defines how many tasks are updated at once. In this case, only 1 task will be updated each time.

The **--update-delay** flag defines how much time there is between each updates. In this case, there is a delay of 10 seconds between the updates.

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