Get Started, Part 3: Services

Estimated reading time: 9 minutes

Prerequisites

- Install Docker version 1.13 or higher (https://docs.docker.com/engine/installation/).
- Get Docker Compose (https://docs.docker.com/compose/overview/). On Docker Desktop for Mac (https://docs.docker.com/docker-for-mac/) and Docker Desktop for Windows (https://docs.docker.com/docker-for-windows/) it's pre-installed, so you're good-to-go. On Linux systems you need to install it directly (https://github.com/docker/compose/releases). On pre Windows 10 systems *without Hyper-V*, use Docker Toolbox (https://docs.docker.com/toolbox/overview/).
- Read the orientation in Part 1 (https://docs.docker.com/get-started/).
- Learn how to create containers in Part 2 (https://docs.docker.com/get-started/part2/).
- Make sure you have published the `friendlyhello` image you created by pushing it to a registry (https://docs.docker.com/get-started/part2/#share-your-image). We use that shared image here.
- Be sure your image works as a deployed container. Run this command, slotting in your info for `username`, `repo`, and `tag`: `docker run -p 4000:80 username/repo:tag`, then visit `http://localhost:4000/`.

Introduction

In part 3, we scale our application and enable load-balancing. To do this, we must go one level up in the hierarchy of a distributed application: the **service**.

- Stack
- **Services** (you are here)
- Container (covered in part 2 (https://docs.docker.com/get-started/part2/))

About services

In a distributed application, different pieces of the app are called “services”. For example, if you imagine a video sharing site, it probably includes a service for storing application data in a database, a service for video transcoding in the background after a user uploads something, a service for the front-end, and so on.

Services are really just “containers in production.” A service only runs one image, but it codifies the way that image runs—what ports it should use, how many replicas of the container should run so the service has the capacity it needs, and so on. Scaling a service changes the number of container instances running that piece of software, assigning more computing resources to the service in the process.

Luckily it’s very easy to define, run, and scale services with the Docker platform -- just write a `docker-compose.yml` file.

Your first `docker-compose.yml` file

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

`docker-compose.yml`

Save this file as `docker-compose.yml` wherever you want. Be sure you have pushed the image (https://docs.docker.com/get-started/part2/#share-your-image) you created in Part 2 (https://docs.docker.com/get-started/part2/) to a registry, and update this `.yml` by replacing `username/repo:tag` with your image details.

```
version: "3"
services:
  web:
    # replace username/repo:tag with your name and image details
    image: username/repo:tag
    deploy:
      replicas: 5
      resources:
        limits:
          cpus: "0.1"
          memory: 50M
      restart_policy:
        condition: on-failure
    ports:
      - "4000:80"
    networks:
      - webnet
networks:
  webnet:
```

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

- Pull the image we uploaded in step 2 (https://docs.docker.com/get-started/part2/) from the registry.
- Run 5 instances of that image as a service called `web`, limiting each one to use, at most, 10% of a single core of CPU time (this could also be e.g. “1.5” to mean 1 and half core for each), and 50MB of RAM.
- Immediately restart containers if one fails.
- Map port 4000 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).

Run your new load-balanced app

Before we can use the `docker stack deploy` command we first run:

```
docker swarm init
```

> **Note**: We get into the meaning of that command in part 4 (https://docs.docker.com/get-started/part4/). If you don't run `docker swarm init` you get an error that "this node is not a swarm manager."

Now let's run it. You need to give your app a name. Here, it is set to `getstartedlab` :

```
docker stack deploy -c docker-compose.yml getstartedlab
```

Our single service stack is running 5 container instances of our deployed image on one host. Let's investigate.

Get the service ID for the one service in our application:

```
docker service ls
```

Look for output for the `web` service, prepended with your app name. If you named it the same as shown in this example, the name is `getstartedlab_web` . The service ID is listed as well, along with the number of replicas, image name, and exposed ports.

Alternatively, you can run `docker stack services` , followed by the name of your stack. The following example command lets you view all services associated with the `getstartedlab` stack:

```
docker stack services getstartedlab
ID                  NAME                MODE                REPLICAS            I
bqpve1djnk0x        getstartedlab_web   replicated          5/5                 u
```

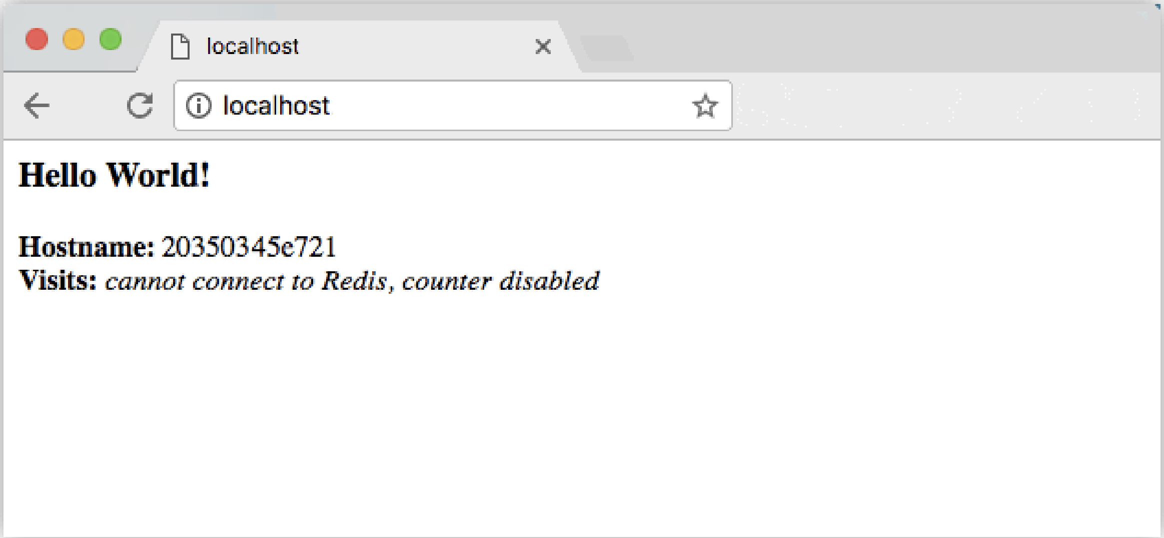
A single container running in a service is called a **task**. Tasks are given unique IDs that numerically increment, up to the number of `replicas` you defined in `docker-compose.yml` . List the tasks for your service:

```
docker service ps getstartedlab_web
```

Tasks also show up if you just list all the containers on your system, though that is not filtered by service:

```
docker container ls -q
```

You can run `curl -4 http://localhost:4000` several times in a row, or go to that URL in your browser and hit refresh a few times.



Hello World!

Hostname: 20350345e721
Visits: *cannot connect to Redis, counter disabled*

Either way, the container ID changes, demonstrating the load-balancing; with each request, one of the 5 tasks is chosen, in a round-robin fashion, to respond. The container IDs match your output from the previous command (`docker container ls -q`).

To view all tasks of a stack, you can run `docker stack ps` followed by your app name, as shown in the following example:

```
docker stack ps getstartedlab
ID                  NAME                  IMAGE               NODE
uwiaw67sc0eh        getstartedlab_web.1   username/repo:tag   docker-desktop
sk50xbhmcae7        getstartedlab_web.2   username/repo:tag   docker-desktop
c4uuw5i6h02j        getstartedlab_web.3   username/repo:tag   docker-desktop
0dyb70ixu25s        getstartedlab_web.4   username/repo:tag   docker-desktop
aocrb88ap8b0        getstartedlab_web.5   username/repo:tag   docker-desktop
```

Running Windows 10?

Windows 10 PowerShell should already have `curl` available, but if not you can grab a Linux terminal emulator like Git BASH (https://git-for-windows.github.io/), or download wget for Windows (http://gnuwin32.sourceforge.net/packages/wget.htm) which is very similar.

> ✔ **Slow response times?**
>
> Depending on your environment's networking configuration, it may take up to 30 seconds for the containers to respond to HTTP requests. This is not indicative of Docker or swarm performance, but rather an unmet Redis dependency that we address later in the tutorial. For now, the visitor counter isn't working for the same reason; we haven't yet added a service to persist data.

Scale the app

You can scale the app by changing the `replicas` value in `docker-compose.yml`, saving the change, and re-running the `docker stack deploy` command:

```
docker stack deploy -c docker-compose.yml getstartedlab
```

Docker performs an in-place update, no need to tear the stack down first or kill any containers.

Now, re-run `docker container ls -q` to see the deployed instances reconfigured. If you scaled up the replicas, more tasks, and hence, more containers, are started.

Take down the app and the swarm

- Take the app down with `docker stack rm`:

  ```
  docker stack rm getstartedlab
  ```

- Take down the swarm.

  ```
  docker swarm leave --force
  ```

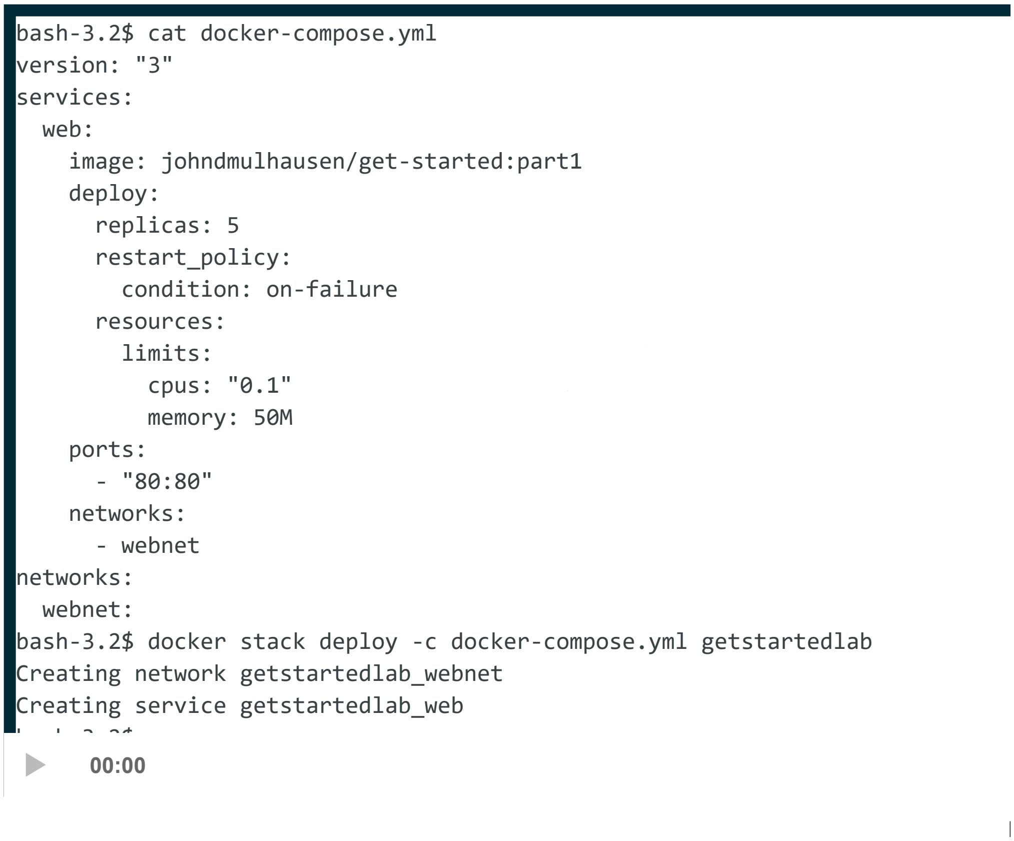
It's as easy as that to stand up and scale your app with Docker. You've taken a huge step towards learning how to run containers in production. Up next, you learn how to run this app as a bonafide swarm on a cluster of Docker machines.

> **Note**: Compose files like this are used to define applications with Docker, and can be uploaded to cloud providers using Docker Cloud (https://docs.docker.com/docker-cloud/), or on any hardware or cloud provider you choose with Docker Enterprise Edition (https://www.docker.com/enterprise-edition).

On to “Part 4” >> (https://docs.docker.com/get-started/part4/)

Recap and cheat sheet (optional)

Here’s a terminal recording of what was covered on this page (https://asciinema.org/a/b5gai4rnflh7r0kie01fx6lip):



```
bash-3.2$ cat docker-compose.yml
version: "3"
services:
  web:
    image: johndmulhausen/get-started:part1
    deploy:
      replicas: 5
      restart_policy:
        condition: on-failure
      resources:
        limits:
          cpus: "0.1"
          memory: 50M
    ports:
      - "80:80"
    networks:
      - webnet
networks:
  webnet:
bash-3.2$ docker stack deploy -c docker-compose.yml getstartedlab
Creating network getstartedlab_webnet
Creating service getstartedlab_web
```

To recap, while typing `docker run` is simple enough, the true implementation of a container in production is running it as a service. Services codify a container’s behavior in a Compose file, and this file can be used to scale, limit, and redeploy our app. Changes to the service can be applied in place, as it runs, using the same command that launched the service: `docker stack deploy` .

Some commands to explore at this stage:

```
docker stack ls                                            # List stacks or apps
docker stack deploy -c <composefile> <appname>  # Run the specified Compose file
docker service ls                 # List running services associated with an app
docker service ps <service>                  # List tasks associated with an app
docker inspect <task or container>                   # Inspect task or container
docker container ls -q                                      # List container IDs
docker stack rm <appname>                             # Tear down an application
docker swarm leave --force      # Take down a single node swarm from the manager
```

services (https://docs.docker.com/glossary/?term=services), replicas (https://docs.docker.com/glossary/?term=replicas), scale (https://docs.docker.com/glossary/?term=scale), ports (https://docs.docker.com/glossary/?term=ports), compose (https://docs.docker.com/glossary/?term=compose), compose file (https://docs.docker.com/glossary/?term=compose%20file), stack (https://docs.docker.com/glossary/?term=stack), networking (https://docs.docker.com/glossary/?term=networking)