Using Docker Compose

Docker Compose [https://docs.docker.com/compose/] is a tool that was developed to help define and share multi-container applications. With Compose, we can create a YAML file to define the services and with a single command, can spin everything up or tear it all down.

The *big* advantage of using Compose is you can define your application stack in a file, keep it at the root of your project repo (it's now version controlled), and easily enable someone else to contribute to your project. Someone would only need to clone your repo and start the compose app. In fact, you might see quite a few projects on GitHub/GitLab doing exactly this now.

So, how do we get started?

Installing Docker Compose

If you installed Docker Desktop/Toolbox for either Windows or Mac, you already have Docker Compose! Play-with-Docker instances already have Docker Compose installed as well. If you are on a Linux machine, you will need to install Docker Compose using the instructions here [https://docs.docker.com/compose/install/].

After installation, you should be able to run the following and see version information.

```
docker-compose version
```

Creating our Compose File

1. At the root of the app project, create a file named `docker-compose.yml` .

2. In the compose file, we'll start off by defining the schema version. In most cases, it's best to use the latest supported version. You can look at the Compose file reference [https://docs.docker.com/compose/compose-file/] for the current schema versions and the compatibility matrix.

```
version: "3.8"
```

3. Next, we'll define the list of services (or containers) we want to run as part of our application.

```
version: "3.8"

services:
```

And now, we'll start migrating a service at a time into the compose file.

Defining the App Service

To remember, this was the command we were using to define our app container.

```
docker run -dp 3000:3000 \
  -w /app -v "$(pwd):/app" \
  --network todo-app \
  -e MYSQL_HOST=mysql \
  -e MYSQL_USER=root \
  -e MYSQL_PASSWORD=secret \
  -e MYSQL_DB=todos \
  node:12-alpine \
  sh -c "yarn install && yarn run dev"
```

If you are using PowerShell then use this command.

```
docker run -dp 3000:3000 `
  -w /app -v "$(pwd):/app" `
  --network todo-app `
  -e MYSQL_HOST=mysql `
  -e MYSQL_USER=root `
  -e MYSQL_PASSWORD=secret `
  -e MYSQL_DB=todos `
  node:12-alpine `
  sh -c "yarn install && yarn run dev"
```

1. First, let's define the service entry and the image for the container. We can pick any name for the service. The name will automatically become a network alias, which will be useful when defining our MySQL service.

```
version: "3.8"

services:
  app:
    image: node:12-alpine
```

2. Typically, you will see the command close to the `image` definition, although there is no requirement on ordering. So, let's go ahead and move that into our file.

```
version: "3.8"

services:
  app:
    image: node:12-alpine
    command: sh -c "yarn install && yarn run dev"
```

3. Let's migrate the `-p 3000:3000` part of the command by defining the `ports` for the service. We will use the short syntax [https://docs.docker.com/compose/compose-file/compose-file-v3/#short-syntax-1] here, but there is also a more verbose long syntax [https://docs.docker.com/compose/compose-file/compose-file-v3/#long-syntax-1] available as well.

```
version: "3.8"

services:
  app:
    image: node:12-alpine
    command: sh -c "yarn install && yarn run dev"
    ports:
      - 3000:3000
```

4. Next, we'll migrate both the working directory (`-w /app`) and the volume mapping (`-v "$(pwd):/app"`) by using the `working_dir` and `volumes` definitions. Volumes also has a short [https://docs.docker.com/compose/compose-file/compose-file-v3/#short-

syntax-3] and long [https://docs.docker.com/compose/compose-file/compose-file-v3/#long-syntax-3] syntax.

One advantage of Docker Compose volume definitions is we can use relative paths from the current directory.

```
version: "3.8"

services:
  app:
    image: node:12-alpine
    command: sh -c "yarn install && yarn run dev"
    ports:
      - 3000:3000
    working_dir: /app
    volumes:
      - ./:/app
```

5. Finally, we need to migrate the environment variable definitions using the `environment` key.

```
version: "3.8"

services:
  app:
    image: node:12-alpine
    command: sh -c "yarn install && yarn run dev"
    ports:
      - 3000:3000
    working_dir: /app
    volumes:
      - ./:/app
    environment:
      MYSQL_HOST: mysql
      MYSQL_USER: root
      MYSQL_PASSWORD: secret
      MYSQL_DB: todos
```

Defining the MySQL Service

Now, it's time to define the MySQL service. The command that we used for that container was the following:

```
docker run -d \
  --network todo-app --network-alias mysql \
  -v todo-mysql-data:/var/lib/mysql \
  -e MYSQL_ROOT_PASSWORD=secret \
  -e MYSQL_DATABASE=todos \
  mysql:5.7
```

If you are using PowerShell then use this command.

```
docker run -d `
  --network todo-app --network-alias mysql `
  -v todo-mysql-data:/var/lib/mysql `
  -e MYSQL_ROOT_PASSWORD=secret `
  -e MYSQL_DATABASE=todos `
  mysql:5.7
```

1. We will first define the new service and name it `mysql` so it automatically gets the network alias. We'll go ahead and specify the image to use as well.

   ```
   version: "3.8"

   services:
     app:
       # The app service definition
     mysql:
       image: mysql:5.7
   ```

2. Next, we'll define the volume mapping. When we ran the container with `docker run`, the named volume was created automatically. However, that doesn't happen when running with Compose. We need to define the volume in the top-level `volumes:` section and then specify the mountpoint in the service config. By simply providing only the volume name, the default options are used. There are many more options available [https://docs.docker.com/compose/compose-file/compose-file-v3/#volume-configuration-reference] though.

   ```
   version: "3.8"

   services:
     app:
       # The app service definition
   ```

```
  mysql:
    image: mysql:5.7
    volumes:
      - todo-mysql-data:/var/lib/mysql

volumes:
  todo-mysql-data:
```

3. Finally, we only need to specify the environment variables.

```
version: "3.8"

services:
  app:
    # The app service definition
  mysql:
    image: mysql:5.7
    volumes:
      - todo-mysql-data:/var/lib/mysql
    environment:
      MYSQL_ROOT_PASSWORD: secret
      MYSQL_DATABASE: todos

volumes:
  todo-mysql-data:
```

At this point, our complete `docker-compose.yml` should look like this:

```
version: "3.8"

services:
  app:
    image: node:12-alpine
    command: sh -c "yarn install && yarn run dev"
    ports:
      - 3000:3000
    working_dir: /app
    volumes:
      - ./:/app
    environment:
      MYSQL_HOST: mysql
      MYSQL_USER: root
      MYSQL_PASSWORD: secret
      MYSQL_DB: todos

  mysql:
    image: mysql:5.7
```

```
    volumes:
      - todo-mysql-data:/var/lib/mysql
    environment:
      MYSQL_ROOT_PASSWORD: secret
      MYSQL_DATABASE: todos

volumes:
  todo-mysql-data:
```

Running our Application Stack

Now that we have our `docker-compose.yml` file, we can start it up!

1. Make sure no other copies of the app/db are running first (`docker ps` and `docker rm -f <ids>`).
2. Start up the application stack using the `docker-compose up` command. We'll add the `-d` flag to run everything in the background.

   ```
   docker-compose up -d
   ```

   When we run this, we should see output like this:

   ```
   Creating network "app_default" with the default driver
   Creating volume "app_todo-mysql-data" with default driver
   Creating app_app_1   ... done
   Creating app_mysql_1 ... done
   ```

   You'll notice that the volume was created as well as a network! By default, Docker Compose automatically creates a network specifically for the application stack (which is why we didn't define one in the compose file).
3. Let's look at the logs using the `docker-compose logs -f` command. You'll see the logs from each of the services interleaved into a single stream. This is incredibly useful when you want to watch for timing-related issues. The `-f` flag "follows" the log, so will give you live output as it's generated.

   If you don't already, you'll see output that looks like this...

   ```
   mysql_1  | 2019-10-03T03:07:16.083639Z 0 [Note] mysqld: ready
   for connections.
   mysql_1  | Version: '5.7.27'  socket:
   ```

```
'/var/run/mysqld/mysqld.sock'  port: 3306  MySQL Community
Server (GPL)
app_1    | Connected to mysql db at host mysql
app_1    | Listening on port 3000
```

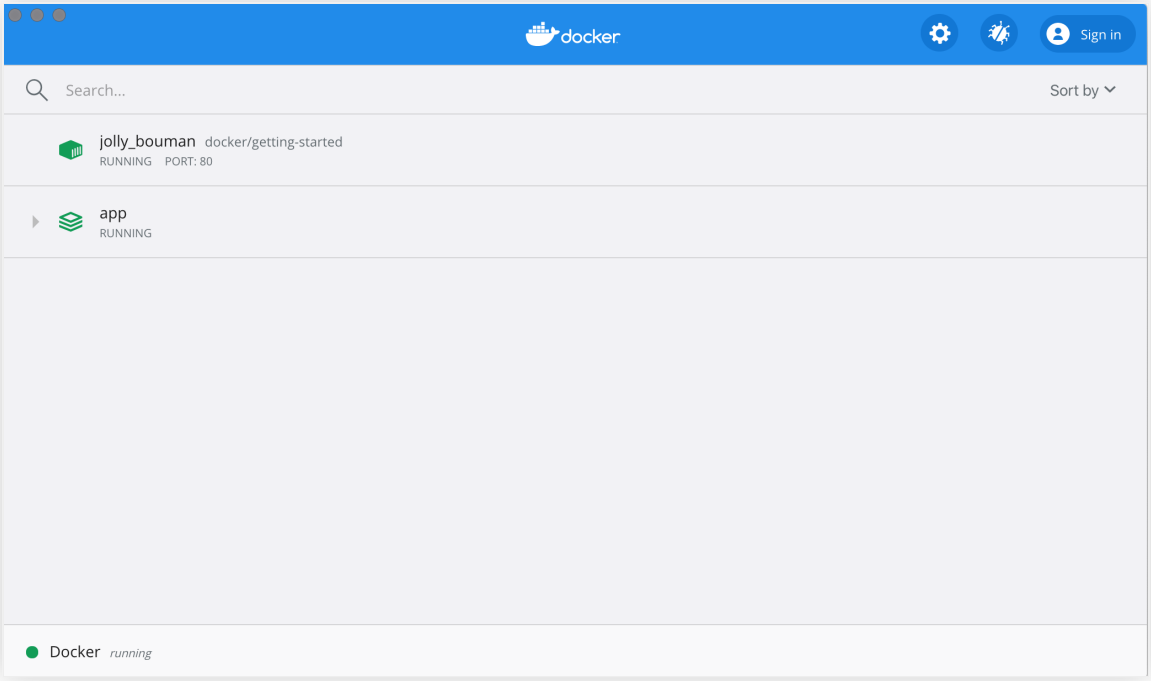
The service name is displayed at the beginning of the line (often colored) to help distinguish messages. If you want to view the logs for a specific service, you can add the service name to the end of the logs command (for example, `docker-compose logs -f app`).

> **Pro tip - Waiting for the DB before starting the app**
>
> When the app is starting up, it actually sits and waits for MySQL to be up and ready before trying to connect to it. Docker doesn't have any built-in support to wait for another container to be fully up, running, and ready before starting another container. For Node-based projects, you can use the wait-port [https://github.com/dwmkerr/wait-port] dependency. Similar projects exist for other languages/frameworks.

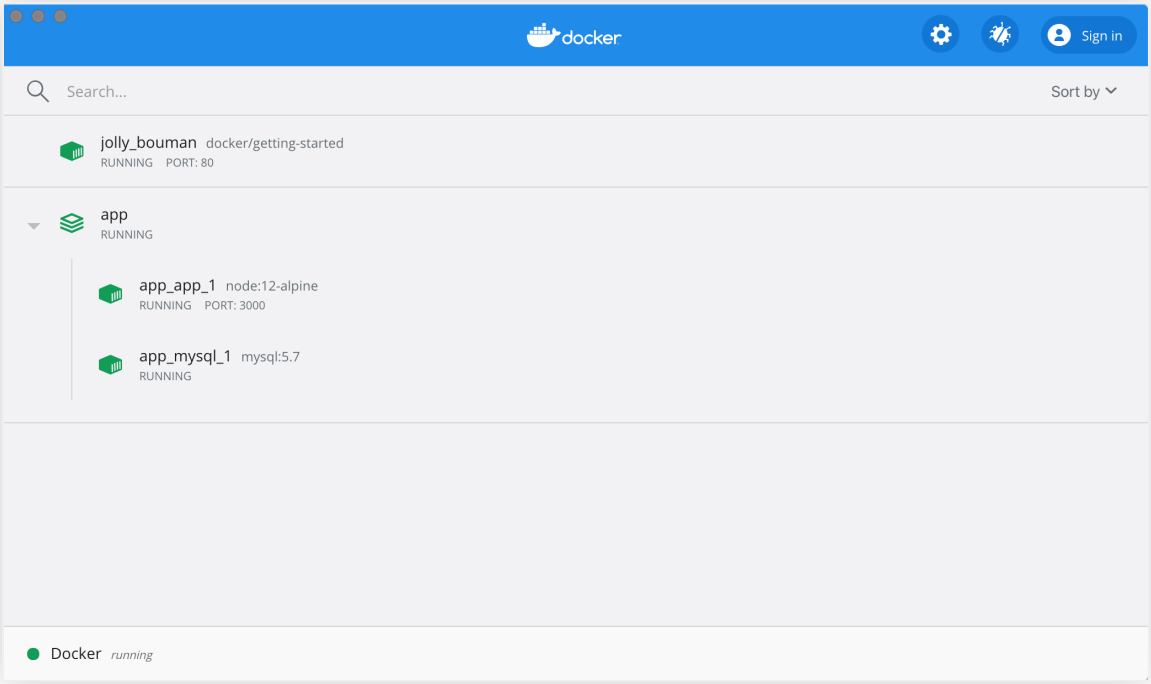
4. At this point, you should be able to open your app and see it running. And hey! We're down to a single command!

Seeing our App Stack in Docker Dashboard

If we look at the Docker Dashboard, we'll see that there is a group named **app**. This is the "project name" from Docker Compose and used to group the containers together. By default, the project name is simply the name of the directory that the `docker-compose.yml` was located in.



If you twirl down the app, you will see the two containers we defined in the compose file. The names are also a little more descriptive, as they follow the pattern of `<project-name>_<service-name>_<replica-number>`. So, it's very easy to quickly see what container is our app and which container is the mysql database.



Tearing it All Down

When you're ready to tear it all down, simply run `docker-compose down` or hit the trash can on the Docker Dashboard for the entire app. The containers will stop and the network will be removed.

> **Removing Volumes**
>
> By default, named volumes in your compose file are NOT removed when running `docker-compose down`. If you want to remove the volumes, you will need to add the `--volumes` flag.
>
> The Docker Dashboard does *not* remove volumes when you delete the app stack.

Once torn down, you can switch to another project, run `docker-compose up` and be ready to contribute to that project! It really doesn't get much simpler than that!

Recap

In this section, we learned about Docker Compose and how it helps us dramatically simplify the defining and sharing of multi-service applications. We created a Compose file by translating the commands we were using into the appropriate compose format.

At this point, we're starting to wrap up the tutorial. However, there are a few best practices about image building we want to cover, as there is a big issue with the Dockerfile we've been using. So, let's take a look!