



CS 470 Module Two Assignment Two Guide

Introduction

This lesson will complete your work with containers by introducing Docker Compose to allow orchestrating multiple containers as a logical unit. You will bring up the entire stack in three containers working together to serve a full stack application.

Summary Steps

- Create a shared network:
 - o `docker network create --driver bridge lafs-net`
- Create a Docker Compose script for the backend containers:
 - o Create `docker-compose.yml` file in top-level `lafs-api` directory.
 - o `docker-compose up`
 - o Edit `lafs-api/server/datasources.development.js` to add default local values.
 - o `docker-compose up`
 - o `http://localhost:3000/explorer` to verify and add data
 - o Use Mongo shell or Robo 3T to verify the data stored in the Mongo container.
- Create a Docker Compose script for the frontend container:
 - o Create `docker-compose.yml` file in top-level `lafs-web` directory.
 - o Edit `lafs-web/src/environments/environment.ts` to use `localhost:3000`.
 - o `docker-compose up`
 - o `http://localhost:4200` to verify and add data
 - o Use Mongo shell or Robo 3T to verify the data stored in the Mongo container.

Detailed Steps

Docker Network

As you discovered in the previous assignment, every container is isolated. There are three common ways for the application(s) in the container to interact with resources outside of the container:

1. Use port mapping to allow network traffic from the host computer into the container.
2. Use Docker networking to build a virtual network between containers.
3. Use Docker volume management to mount storage volumes into the container.

You have already practiced using port mapping in the previous assignment. Volume management will not be covered in this exercise. You will build a bridge network for the containers to communicate with each other.

Create a new bridge network using the Docker [network](#) commands:

```
> docker network create --driver bridge lafs-net
> docker network list
```

```
> docker network create --driver bridge lafs-net
7a8db2af9ac5b178e29aede2ec8ee22c028805b77d99720512ec850a4d953ea0

> docker network list
NETWORK ID          NAME                DRIVER              SCOPE
b4ff8b47f38d        bridge             bridge              local
f194fde17772        host               host               local
7a8db2af9ac5        lafs-net           bridge              local
aa240e13d171        none              null               local
>
```

Note: The network list command will show the Docker networks including the new one just created.

You have created a virtual network within Docker and given it the name of “lafs-net”, which you can now refer to in your containers.

Backend

Docker Compose uses a [YAML](#) file to define the services, network, and storage volumes that an application will use. Like the Python programming language, YAML files rely on indentation to group values together. A single compose file can configure one or more containers. For the backend application you will define two services – one for Node JS and the other for MongoDB.

Refer to the documentation for compose and study the proposed file below:

```
docker-compose.yml

version: '3.7'
services:
# REST API running on Node JS container
app:
  container_name: lafs-api
  restart: always
  build: .
  ports:
    - '3000:3000'
# link this container to the Mongo DB container
links:
  - mongo
# pass in environment variables for database host and name
environment:
  - DB_HOST=mongo
  - DB_NAME=lafs-db
# Mongo DB storage container
mongo:
  container_name: lafs-db
  image: 'mongo:4'
  ports:
    - '27017:27017'
# Attach the external network to these containers
networks:
```



default:
external:
name: lafs-net

Create a “docker-compose.yml” file in the top of the project directory and input the above information.

To ensure that the REST API application will default to running against a local Mongo DB instance, update the **server/datasources.development.js** file to specify default values if not overridden by environment values:

```
module.exports = {  
  mongodb: {  
    connector: 'mongodb',  
    hostname: process.env.DB_HOST || 'localhost',  
    port: process.env.DB_PORT || 27017,  
    user: process.env.DB_USER || '',  
    password: process.env.DB_PASSWORD || '',  
    database: process.env.DB_NAME || 'lafs',  
    url: process.env.DB_URL  
  }  
};
```

Edit the file by adding the values shown highlighted above.

Now issue the Docker Compose command in your PowerShell window to bring up both containers:

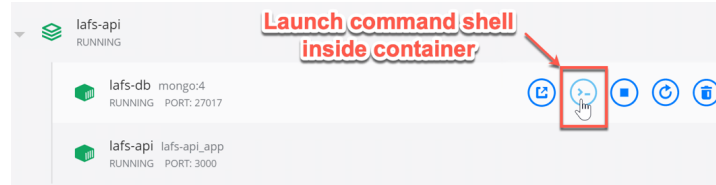
```
> docker-compose up
```

```
> docker-compose up  
Building app  
Step 1/7 : FROM node:10  
----> a02c9f46f94a  
Step 2/7 : WORKDIR /usr/src/lafs  
----> Using cache  
----> 8683f9c11a89  
Step 3/7 : COPY package*.json ./  
----> 8683f9c11a89  
Successfully built lafs-api  
Successfully tagged lafs-api_app:latest  
WARNING: Image for service app was built because it did not already  
exist. To rebuild this image you need to run: docker-compose up --build .  
Creating lafs-db ... done  
Creating lafs-api ... done  
Attaching to lafs-db, lafs-api  
lafs-db | 2020-05-08T02:41:41.641+0000 I CONTROL [main] Automatically  
lafs-db | ify --sslDisabledProtocols 'none'  
lafs-db | 2020-05-08T02:41:41.647+0000 W ASIO [main] No Tra  
lafs-db | 2020-05-08T02:41:41.648+0000 I CONTROL [initandlisten]
```

Note: Two containers started and attached to the virtual network.

First, open a command shell inside the Mongo container and see the status of the database after initial startup:

1. On the Docker Dashboard app, hover the mouse over the Mongo container entry and click the Shell/CLI icon:



2. Now input the follow commands:

```
> mongo
> show dbs
```

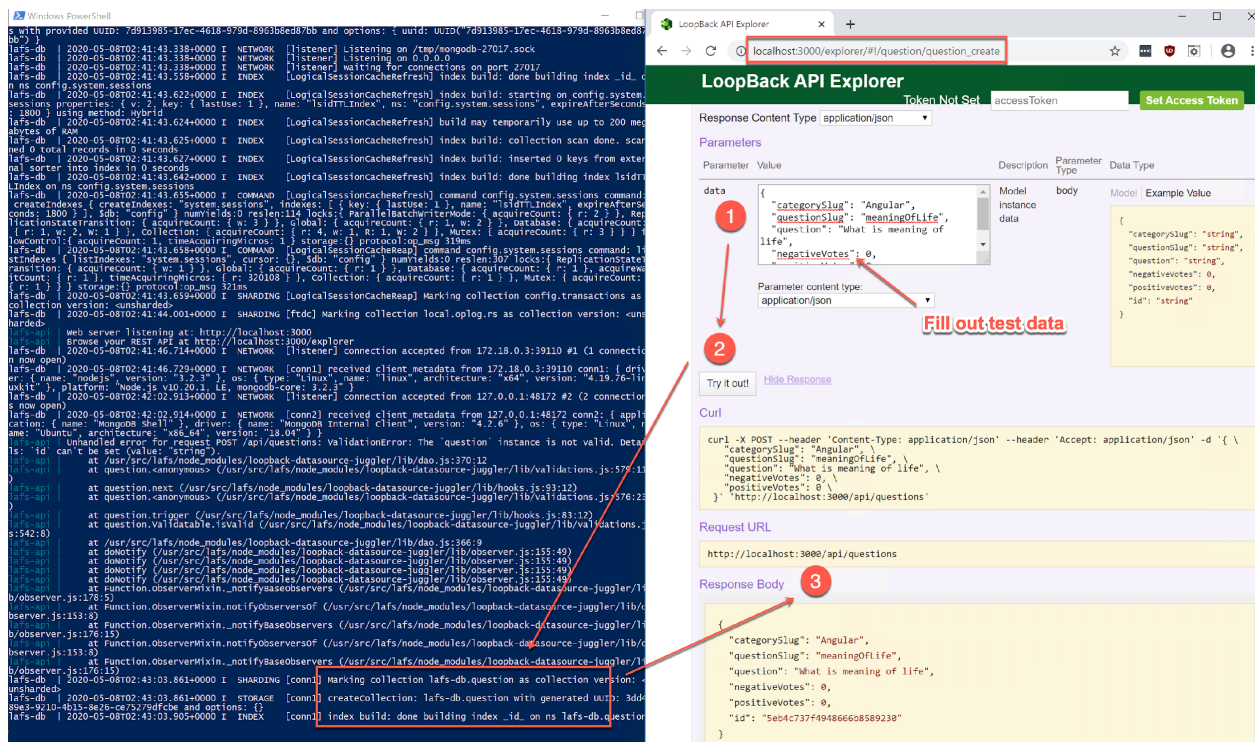
```
docker exec -it 44668e532c72c41068b5238a6d8b078e1c6b8a4a64d596f80f0277828bfb42:
# mongo
MongoDB shell version v4.2.6
connecting to: mongodb://127.0.0.1:27017/?compressors=disabled&gssapiEnabled=false
Implicit session: session { "id" : UUID("9fc163f0-9a73-44dd-8956-d33f11e7f1e7") }
MongoDB server version: 4.2.6
Welcome to the MongoDB shell.
For interactive help, type "help".

> show dbs
admin    0.000GB
config  0.000GB
local    0.000GB
```

Default databases

To test these containers, open a web browser and navigate to the LoopBack Explorer test page:

```
> http://localhost:3000/explorer
```



The screenshot displays a MongoDB console window on the left and a LoopBack API Explorer on the right. The console window shows the execution of various database commands, including creating a collection, inserting data, and building an index. The LoopBack API Explorer shows the 'question_create' endpoint with a JSON body. Red arrows and numbers 1, 2, and 3 highlight the data input, the 'Try it out!' button, and the response body respectively. A red box highlights the URL 'localhost:3000/explorer/#/question/question_create'.

To test the REST API running in the container, do the following:

1. Input a test question into the text box labeled “Data” using information like this:


```
{
  "categorySlug": "angular",
  "questionSlug": "what-is-the-meaning-of-life",
  "question": "What is the meaning of life?",
  "negativeVotes": 0,
  "positiveVotes": 0
}
```
2. Click the **Try it out!** button.
3. An HTTP request will be sent to the REST endpoint. You can see in the console window that it was received and processed.
4. A successful response is returned with the “id” value populated by Mongo.

Now go back to the Mongo command shell and see what has been stored using the following commands:

- > show dbs
- > use lafs_db
- > show collections
- > db.getCollection('question').find({})

```

> show dbs
admin    0.000GB
config  0.000GB
lafs-db  0.000GB
local    0.000GB
> use lafs-db
switched to db lafs-db
> show collections
question
> db.getCollection('question').find({})
{ "_id" : ObjectId("5eb4c737f4948666b8589230"), "categorySlug" : "Angular", "questionSlug" : "meaningOfLife", "question" : "What is meaning of life", "negativeVotes" : 0, "positiveVotes" : 0 }
>

```

Annotations in the image:

- New database**: points to `lafs-db` in the `show dbs` output.
- question collection**: points to `question` in the `show collections` output.
- question stored**: points to the document in the `find` output.

Running a browser on your computer, you tested sending a question to the REST API endpoint running in one container. That Node JS code in turn connected to the second container running Mongo DB, where the question was finally stored.

Frontend Development

Because the frontend Angular site is a separate code repository, it is a separate directory on your computer. Therefore, a separate docker-compose YML file needs to be created there to load it into a container. By specifying the same external virtual network, you will communicate with the other two containers and you will see previously entered questions and answers shown on the frontend web application.

docker-compose.yml

```

version: '3.7'
services:
  # Angular frontend application
  app:
    container_name: lafs-web
    restart: always
    build: .
    ports:
      - '4200:4200'
    command: >
      bash -c "npm install && ng serve --host 0.0.0.0 --port 4200"
  # Attach the external network to these containers
  networks:
    default:
      external:
        name: lafs-net

```

The Angular tutorial code is written to run against a Heroku cloud instance, so you will need to change the `api_url` value in `src/environments/environment.ts`.

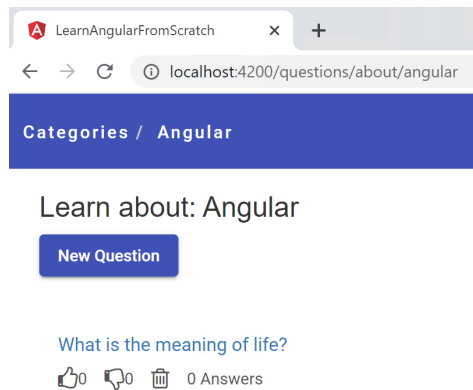
```

export const environment = {
  production: false,
  api_url: 'http://localhost:3000'
};

```



Start the container as you did for the backend application, open a browser and navigate to <http://localhost:4200>, choose the Angular category, and you will see the following:



You now have three Docker containers, each of them isolated from the others yet communicating together. Use the [Docker ps](#) command to see all the container instances running and their configured state:

```
> docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
d096d411de4c	lafs-web_app	"docker-entrypoint.s..."	2 hours ago	Up 2 hours	0.0.0.0:4200->4200/tcp	lafs-web
c2e95ae05b83	lafs-api_app	"docker-entrypoint.s..."	11 hours ago	Up 11 hours	0.0.0.0:3000->3000/tcp	lafs-api
44668e532c72	mongo:4	"docker-entrypoint.s..."	11 hours ago	Up 11 hours	0.0.0.0:27017->27017/tcp	lafs-db
e1d5ffe938fb	mongo	"docker-entrypoint.s..."	4 days ago	Exited (0) 2 days ago		mongodb

These container images can be deployed to a server in a data center or to a cloud provider and will run there exactly as you have configured them on your computer!