

Placement Empowerment Program

Cloud Computing and DevOps Centre

Set Up Docker Compose for Multi-Container Applications Create a docker-compose.yml file to define and run a multi-container application (e.g., a web server and database).

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Objective

The goal of this Proof of Concept (PoC) is to demonstrate how to create and use a docker-compose.yml file to define and run a multi-container application. This example will set up an Nginx web server and a MySQL database using Docker Compose.

What is Docker Compose?

Docker Compose is a tool for defining and running multi-container Docker applications. With Compose, you use a YAML file to configure application services, networks, and volumes, then start everything with a single command.

Prerequisites

Before proceeding, ensure the following prerequisites are met:

- **Docker Installed:** [Get Docker](#)
 - **Docker Compose Installed:** [Install Docker Compose](#)
 - Basic knowledge of **Docker**, **Containers**, and **YAML Syntax**
-

Step-by-Step Guide

Step 1: Verify Docker and Docker Compose Installation

Check if Docker is installed:

```
docker --version
```

Check if Docker Compose is installed:

```
docker-compose --version
```

```
C:\Users\gopin>docker-compose --version  
Docker Compose version v2.32.4-desktop.1
```

If any of these are missing, install them using the links in the prerequisites.

Step 2: Create a Project Directory

Open a terminal and create a directory for your project:

```
mkdir multi-container-app && cd multi-container-app
```

```
C:\Users\gopin>mkdir multi-container-app && cd multi-container-app
C:\Users\gopin\multi-container-app>
```

Inside this directory, create a docker-compose.yml file:

touch docker-compose.yml

Step 3: Define Services in docker-compose.yml

Open the file in a text editor and add the following content:

```
version: '3.8'

services:
  web:
    image: nginx
    ports:
      - "8080:80"
    depends_on:
      - db

  db:
    image: mysql:5.7
    environment:
      MYSQL_ROOT_PASSWORD: rootpassword
      MYSQL_DATABASE: mydatabase
      MYSQL_USER: user
      MYSQL_PASSWORD: password
```

Explanation of the YAML Configuration:

- version: '3.8' → Specifies the Docker Compose version.
- services: → Defines the containers in this application.
- web: → Nginx service:
 - Uses the official Nginx image.
 - Maps container port 80 to local port 8080.
 - Depends on the database service (db).
- db: → MySQL service:

- Uses MySQL version 5.7.
- Sets up environment variables for root password, database, user, and user password.

Step 4: Start the Application

Run the following command to start the services:

docker-compose up -d

```
C:\Users\gopin\multi-container-app>docker-compose up -d
time="2025-02-23T19:34:16+05:30" level=warning msg="C:\\Users\\gopin\\multi-container-app\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
✔db [f9f83a1c24c] 46.88MB / 137.9MB Pulling
✔db [f9f83a1c24c] Download complete
✔1c56c3d4ce74 Download complete
✔20e4dca4c69 Downloading [=====] 28.97MB/59.5MB 13.6s
✔43d85e938198 Downloading [=====] 11.53MB/56.29MB 13.6s
✔df9add85569b Download complete
✔db Pulled
✔db [f9f83a1c24c] Download complete 18.6s
✔1c56c3d4ce74 Download complete 0.4s
✔20e4dca4c69 Download complete 2.9s
✔43d85e938198 Download complete 25.9s
✔df9add85569b Download complete 37.4s
✔e9f83a1c24c Download complete 2.2s
✔964b2d298fba Download complete 1.6s
✔ffc89e9fd88 Download complete 1.9s
✔ae71319d5779 Download complete 2.2s
✔68c3898c2015 Download complete 21.4s
✔90986bb8de6e Download complete 2.8s
✔web Pulled
✔web [f9f83a1c24c] Download complete 3.1s
[+] Running 1/3
✔Network multi-container-app_default Created 0.4s
✔Container multi-container-app-db-1 Started 0.7s
✔Container multi-container-app-web-1 Started 1.9s
C:\Users\gopin\multi-container-app>
```

This command will:

- Pull the required Docker images (if not available locally).
- Create and start the containers in the background (detached mode -d).

Step 5: Verify the Running Containers

To check running containers:

docker ps

To view the logs for the services:

docker-compose logs

```
C:\Users\gopin\multi-container-app>docker-compose logs
time="2025-02-23T19:35:58+05:30" level=warning msg="C:\\Users\\gopin\\multi-container-app\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
db-1 | 2025-02-23 14:05:12+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 5.7.44-1.el7 started.
db-1 | 2025-02-23 14:05:12+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
db-1 | 2025-02-23 14:05:12+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 5.7.44-1.el7 started.
db-1 | 2025-02-23 14:05:12+00:00 [Note] [Entrypoint]: Initializing database files
db-1 | 2025-02-23T14:05:12.764767Z 0 [Warning] TIMESTAMP with implicit DEFAULT value is deprecated. Please use --explicit_defaults_for_timestamp server option (see documentation for more details).
db-1 | 2025-02-23T14:05:13.391446Z 0 [Warning] InnoDB: New log files created, LSN=45799
db-1 | 2025-02-23T14:05:13.486650Z 0 [Warning] InnoDB: Creating foreign key constraint system tables.
db-1 | 2025-02-23T14:05:13.512734Z 0 [Warning] No existing UUID has been found, so we assume that this is the first time that this server has been started. Generating a new UUID: 337dae4e-f1ef-11ef-83b2-0242ac120902.
db-1 | 2025-02-23T14:05:13.518566Z 0 [Warning] Gtid table is not ready to be used. Table 'mysql.gtid_executed' cannot be opened.
web-1 | /docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
web-1 | /docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
web-1 | /docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
web-1 | 10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
web-1 | 10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
web-1 | /docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
web-1 | /docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
web-1 | /docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
web-1 | /docker-entrypoint.sh: Configuration complete; ready for start up
web-1 | 2025/02/23 14:05:12 [notice] 1#1: using the "epoll" event method
web-1 | 2025/02/23 14:05:12 [notice] 1#1: nginx/1.27.4
web-1 | 2025/02/23 14:05:12 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-10)
web-1 | 2025/02/23 14:05:12 [notice] 1#1: OS: Linux 5.15.107.0-microsoft-standard-WSL2
web-1 | 2025/02/23 14:05:12 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker processes
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 29
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 30
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 31
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 32
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 33
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 34
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 35
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 36
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 37
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 38
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 39
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 40
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 41
web-1 | 2025/02/23 14:05:12 [notice] 1#1: start worker process 42
db-1 | 2025-02-23T14:05:13.518566Z 0 [Warning] Gtid table is not ready to be used. Table 'mysql.gtid_executed' cannot be opened.
```

To check a specific service log (e.g., MySQL):

docker-compose logs db

Step 6: Stop and Remove Containers

To stop the application:

docker-compose down

```
C:\Users\gopin\multi-container-app>docker-compose down
time="2025-02-23T19:36:21+05:30" level=warning msg="C:\\Users\\gopin\\multi-container-app\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
[+] Running 3/3
✔ Container multi-container-app-web-1   Removed          1.1s
✔ Container multi-container-app-db-1    Removed          2.2s
✔ Network multi-container-app_default   Removed          0.9s
```

This command will:

- Stop all running containers.
- Remove the containers and networks created by Docker Compose.

Conclusion

By following these steps, you have successfully set up a multi-container application using Docker Compose. This setup can be extended to include more services like Redis, Node.js, or PostgreSQL.

References

- [Docker Compose Documentation](#)
- [Docker Hub Nginx](#)

- [Docker Hub MySQL](#)