Script to Dynamically Generate Docker Compose YAML Files

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Description

This document explains how to write a **Python script** that dynamically generates Docker Compose YAML files. The script allows you to define services, networks, and volumes in a programmatic way, making it easy to manage and scale multi-container applications like **TodoApp**.

Problem Statement

Manually writing Docker Compose files can be time-consuming, especially when managing multiple services and environments. Dynamically generating YAML files through a script ensures consistency, flexibility, and automation in your infrastructure.

Prerequisites

Completion of all previous lab guides (up to Lab Guide-08) is required before proceeding with Lab Guide-09.

Software Required

- **Docker Desktop**: Installed on your Windows machine.
- **Python 3.x**: Installed on your system to run the script.
- **PyYAML Library**: Required for generating YAML files in Python.
- **TodoAPP_MYSQl**: To download the source folder **click here**

Hardware Requirement

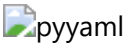
- Minimum of 4 GB RAM
- At least 2 cores in the processor

Implementation Steps

Step-1: Write a Python Script to Generate Docker Compose YAML

First, install the required Python package **PyYAML** to manage YAML files:

```
pip install pyyaml
```

 pyyaml

Next, create a Python script called `generate_compose.py` to dynamically generate a Docker Compose YAML file for your **TodoApp**.

> Note: Make sure to build that the docker image exists

Sample Python Script

```
import yaml

def generate_compose():
    # Define the structure of the Docker Compose file
    compose_content = {
        'version': '3',
        'services': {
            'web': {
                'image': 'my_todoapp',
                'ports': ['8081:8081'],
                'networks': ['todoapp_network'],
            },
            'db': {
                'image': 'mysql:8.0',
                'environment': {
                    'MYSQL_ROOT_PASSWORD': 'rootpassword',
                    'MYSQL_DATABASE': 'todoapp_db',
                    'MYSQL_USER': 'root',
                    'MYSQL_PASSWORD': 'P@ssw0rd'
                },
                'networks': ['todoapp_network'],
                'volumes': ['db_data:/var/lib/mysql']
            }
        },
        'networks': {
            'todoapp_network': {
                'driver': 'bridge'
            }
        },
        'volumes': {
            'db_data': {}
        }
```

```
    }

    # Write the Docker Compose content to a YAML file
    with open('docker-compose.yml', 'w') as compose_file:
        yaml.dump(compose_content, compose_file, default_flow_style=False)

    print("docker-compose.yml generated successfully!")


if __name__ == '__main__':
    generate_compose()
```

Explanation:

- `version`: Defines the version of Docker Compose (3 in this case).
- `services`: Specifies the services (containers) to be deployed (`web` and `db` in this case).
  - `web`: Runs the **TodoApp** on port `8081`.
  - `db`: Runs a MySQL container, providing the environment variables for database setup.
- `networks`: Defines a custom bridge network (`todoapp_network`) to connect the containers.
- `volumes`: Creates a named volume (`db_data`) to persist MySQL data.

Step-2: Customize the Script for Dynamic Generation

You can modify the script to accept **dynamic inputs** such as service names, images, and ports. This allows you to customize the Docker Compose YAML file based on user input or environment variables.

Example of Dynamic Customization:

```
import yaml

def generate_compose(app_name='my_todoapp', app_port=8081, db_name='mysql',
db_port=3306):
    compose_content = {
        'version': '3',
        'services': {
            'web': {
                'image': app_name,
                'ports': [f'{app_port}:{app_port}'],
                'networks': ['todoapp_network'],
            },
            'db': {
                'image': db_name,
                'environment': {
                    'MYSQL_ROOT_PASSWORD':'P@ssw0rd',
                    'MYSQL_DATABASE': 'todoapp_db',
                    'MYSQL_USER': 'root',
                    'MYSQL_PASSWORD': 'P@ssw0rd'
                },
                'networks': ['todoapp_network'],
```

```
                'volumes': ['db_data:/var/lib/mysql'],
                'ports': [f'{db_port}:{db_port}']
            }
        },
        'networks': {
            'todoapp_network': {
                'driver': 'bridge'
            }
        },
        'volumes': {
            'db_data': {}
        }
    }

    with open('docker-compose.yml', 'w') as compose_file:
        yaml.dump(compose_content, compose_file, default_flow_style=False)

    print(f'docker-compose.yml generated with {app_name} and {db_name}!')


if __name__ == '__main__':
    generate_compose(app_name='my_todoapp', app_port=8081, db_name='mysql',
db_port=3306)
```

This version of the script allows you to specify the **application name**, **application port**, **database name**, and **database port** dynamically.

Step-3: Execute the Script to Generate YAML

Once you've written the script, execute it to generate the **docker-compose.yml** file:

```
python generate_compose.py
```

 GenerateCompose

This will generate a **docker-compose.yml** file in the current directory with the structure defined in the script. You can now use this file to manage your multi-container **TodoApp** with Docker Compose.

Sample Output (`docker-compose.yml`):

```
version: '3'
services:
  web:
    image: my_todoapp
    ports:
      - "8081:8081"
    networks:
```

```
      - todoapp_network
  db:
    image: mysql:8.0
    environment:
      MYSQL_ROOT_PASSWORD: P@ssw0rd
      MYSQL_DATABASE: todoapp_db
      MYSQL_USER: root
      MYSQL_PASSWORD: P@ssw0rd
    networks:
      - todoapp_network
    volumes:
      - db_data:/var/lib/mysql
    ports:
      - "3306:3306"

networks:
  todoapp_network:
    driver: bridge

volumes:
  db_data: {}
```

You can now run the following command to launch the application:

```
docker-compose up
```

References

- Docker Compose Documentation: https://docs.docker.com/compose/
- PyYAML Documentation: https://pyyaml.org/