CI/CD Pipeline Script Using Docker for Build and Deployment

Table of Contents

Description

This document explains how to create a **CI/CD pipeline** script using Docker. The script will automate the process of building, testing, and deploying a Dockerized application like **TodoApp** using common CI/CD tools.

Problem Statement

Manually building and deploying Docker applications can lead to human errors and delays. A well-designed CI/CD pipeline automates these tasks, ensuring that new code changes are automatically built, tested, and deployed in a consistent and reliable way.

Prerequisites

Completion of all previous lab guides (up to Lab Guide-09) is required before proceeding with Lab Guide-10.

Software Required

- **Docker**: To containerize your application.
- **Kubernetes**: A running Kubernetes cluster.
- **kubectl**: To manage your Kubernetes clusters.
- **Git**: Version control system to store and trigger the CI/CD pipeline.
- **CI/CD Tools**:
  - **GitLab CI**, **GitHub Actions**, or **Jenkins** (select based on preference).
  - **A remote Docker registry** (such as Docker Hub or GitLab's built-in registry).
- **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: Kubernetes Deployment with deployment.yaml

This section explains how to create and understand a `deployment.yaml` file for Kubernetes. This file defines your Kubernetes resources like pods and deployments.

Example `deployment.yaml`

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: todoapimysql
spec:
  replicas: 3
  selector:
    matchLabels:
      app: todomysql
  template:
    metadata:
      labels:
        app: todomysql
    spec:
      containers:
      - name: todoapimysql
        image: myusername/todoapimysql:1.0
        env:
        - name: MYSQL_HOST
          value: svcmysql.default.svc.cluster.local
        ports:
        - containerPort: 80




---


apiVersion: v1
kind: Service
metadata:
  name: svctodomysqlapi
spec:
  type: NodePort
  selector:
```

```
    app: todomysql
  ports:
  - port: 9098
    targetPort: 80


---


apiVersion: apps/v1
kind: Deployment
metadata:
  name: mysql
spec:
  replicas: 1
  selector:
    matchLabels:
      app: mysql
  template:
    metadata:
      labels:
        app: mysql
    spec:
      containers:
      - name: mysql
        image: mysql
        env:
        - name: MYSQL_DATABASE
          value: tododb
        - name: MYSQL_ROOT_PASSWORD
          value: P@ssw0rd
        ports:
        - containerPort: 3306


---


apiVersion: v1
kind: Service
metadata:
  name: svcmysql
spec:
  type: ClusterIP
  selector:
    app: mysql
  ports:
  - port: 3306
    targetPort: 3306
```

> Note: Username should be replaced with docker hub username

Breakdown of `deployment.yaml`:

1. **Todo API Deployment** (`todoapimysql`):
   - **apiVersion**: `apps/v1` – Specifies the API version for creating a deployment.
   - **kind**: `Deployment` – Creates a deployment resource that ensures a specified number of pod replicas are running.
   - **metadata**:
     - `name: todoapimysql` – The name of this deployment.
   - **spec**:
     - **replicas**: `3` – This specifies that three replicas (pods) of the Todo API will be running.
     - **selector**:
       - **matchLabels**: `app: todomysql` – Identifies the pods to associate with this deployment using the `app: todomysql` label.
     - **template**: Defines the pod configuration.
       - **metadata**:
         - **labels**: `app: todomysql` – Labels the pod with `app: todomysql`, which must match the selector.
       - **spec**:
         - **containers**: Defines the container configuration.
           - **name**: `todoapimysql` – The name of the container.
           - **image**: `username/todoapimysql:1.0` – The container image to be used (in this case, the `username/todoapimysql` image with tag `1.0`).
           - **env**:
             - **name**: `MYSQL_HOST` – Sets an environment variable in the container to point to the MySQL host (`svcmysql.default.svc.cluster.local`), which is the MySQL service inside the Kubernetes cluster.
           - **ports**:
             - **containerPort**: `80` – The port on which the API container listens.

---

2. **Todo API Service** (`svctodomysqlapi`):
   - **apiVersion**: `v1` – Specifies the API version for creating a service.
   - **kind**: `Service` – Creates a service resource to expose the Todo API deployment.
   - **metadata**:
     - `name: svctodomysqlapi` – The name of this service.
   - **spec**:
     - **type**: `NodePort` – The service will be accessible via a node port (accessible outside the cluster).
     - **selector**:
       - `app: todomysql` – This service is linked to the pods that have the `app: todomysql` label.
     - **ports**:
       - **port**: `9098` – The port exposed by the service.
       - **targetPort**: `80` – The port on the container where traffic is forwarded (matches the Todo API container's `containerPort`).

---

3. **MySQL Deployment** (`mysql`):
    - **apiVersion**: `apps/v1` – Specifies the API version for creating the deployment.
    - **kind**: `Deployment` – Creates a deployment resource for the MySQL database.
    - **metadata**:
        - `name: mysql` – The name of the deployment.
    - **spec**:
        - **replicas**: `1` – This specifies a single MySQL pod replica.
        - **selector**:
            - **matchLabels**: `app: mysql` – Selects pods labeled with `app: mysql`.
        - **template**:
            - **metadata**:
                - **labels**: `app: mysql` – Labels the MySQL pod as `app: mysql`.
            - **spec**:
                - **containers**: Defines the container configuration.
                    - **name**: `mysql` – The name of the MySQL container.
                    - **image**: `mysql` – Specifies the MySQL image to be used.
                    - **env**: Sets the environment variables for the MySQL container.
                        - **MYSQL_DATABASE**: `tododb` – The name of the database to be created.
                        - **MYSQL_ROOT_PASSWORD**: `P@ssw0rd` – The root password for the MySQL database.
                    - **ports**:
                        - **containerPort**: `3306` – The port the MySQL container listens on (standard MySQL port).

---

4. **MySQL Service** (`svcmysql`):
    - **apiVersion**: `v1` – Specifies the API version for creating a service.
    - **kind**: `Service` – Defines a service resource for the MySQL deployment.
    - **metadata**:
        - `name: svcmysql` – The name of the service for MySQL.
    - **spec**:
        - **type**: `ClusterIP` – Makes the MySQL service available only within the cluster.
        - **selector**:
            - `app: mysql` – Targets pods with the `app: mysql` label (the MySQL deployment).
        - **ports**:
            - **port**: `3306` – The port exposed by the service.
            - **targetPort**: `3306` – The port on the MySQL container.

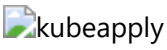
Step-2: Deploy to Kubernetes Cluster

To deploy your application to a Kubernetes cluster using the `deployment.yaml` file:

```
kubectl apply -f deployment.yaml
```

or non-interactively:

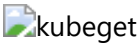
```
kubectl apply -y deployment.yaml
```



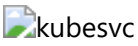
Step-3: Verify Deployment

To verify your application to a Kubernetes cluster using the `deployment.yaml` file:

```
kubectl get pods
```



```
kubectl get svc
```



References

- Docker Documentation: https://docs.docker.com/
- GitLab CI Documentation: https://docs.gitlab.com/ee/ci/
- Docker Hub: https://hub.docker.com/
- Jenkins Documentation: https://www.jenkins.io/doc/