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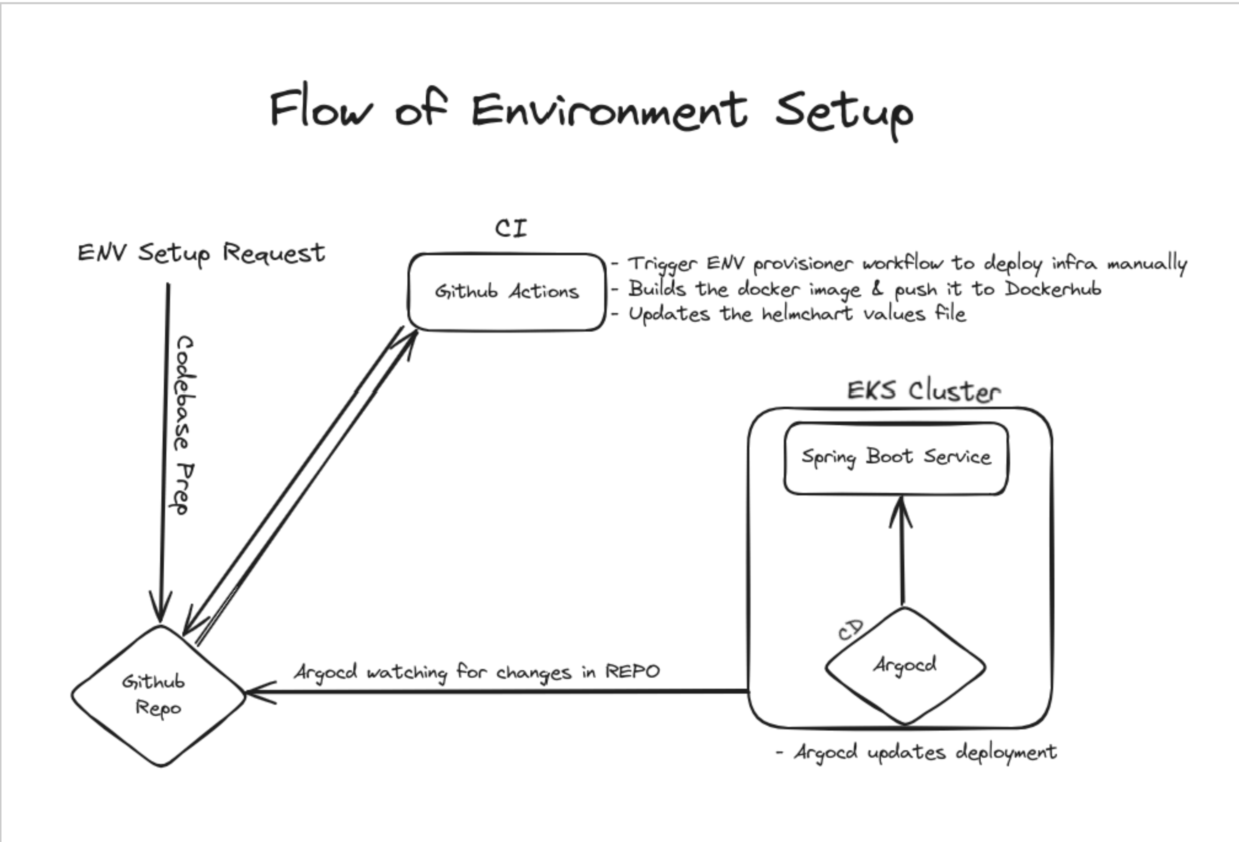
Digitify DevOps Assessment

CI/CD, K8S & AWS EKS

Introduction

This report explains the approach and decisions made throughout the implementation of the assessment, as well as the challenges encountered during the process.

The following flow chart diagram depicts the overall solution.



Web Application Setup

I created a basic Java web application using start.spring.io, incorporating the Spring Web module. I selected the Spring Web module because it includes an embedded Tomcat server, making it straightforward to package the app into an image and serve it with minimal additional effort.

Dockerfile

The Dockerfile builds a containerized Java application using OpenJDK 17, copies the compiled JAR file, and runs it on port 8080, with the image hosted on a public DockerHub repository.

Build & Push Commands:

- **Build**: docker build -t imtiaz1519/digitify-sprint-boot:1.0.0 .
  Builds the Docker image with version 1.0.0.
- **Push**: docker push imtiaz1519/digitify-sprint-boot:1.0.0
  Pushes the built image to DockerHub for public access.

Helmchart

I've developed a Helm chart to deploy the Spring Boot application on an EKS cluster. The chart includes a Deployment, Service, Ingress, Horizontal Pod Autoscaler (HPA), and ServiceAccount. The values file has been customized to provide environment variables, ensuring the application is properly configured and deployed on the EKS cluster.

It is present at ***helmcharts/digitify-app*** in the root directory of the repository.

```
[imtiaz@alam digitify-devops-assessment]$ tree helm-charts/digitify-app/
helm-charts/digitify-app/
├── Chart.yaml
├── templates
│   ├── deployment.yaml
│   ├── _helpers.tpl
│   ├── hpa.yaml
│   ├── ingress.yaml
│   ├── NOTES.txt
│   ├── serviceaccount.yaml
│   └── service.yaml
└── values.yaml

1 directory, 9 files
[imtiaz@alam digitify-devops-assessment]$
```

Bash Script

Created a bash script that deploys the helm chart into any EKS cluster

Terraform

Pre-requisites

NOTE: *Before running these terraform scripts, one must have enough knowledge of* ***AWS, Terraform,*** *and* ***Kubernetes****.*

1. **S3 bucket**

   Create an S3 bucket with the name digitify-terraform-state-bucket. This bucket will be used as a terraform remote state backend, and it is a one-time effort.
2. **Dynamodb table**

   Note: This will beb used for terraform **State Locking.** Create a table digitify-dynamodb-terraform-state-lock. You can create a separate table for other environments.
3. **AWS IAM User**

   We need to create an IAM user for terraform that have service specific permissions to provision infrastructure resources.
4. **AWS User Profile:**

   Update your aws config (~/.aws/config) and credentials (~/.aws/credentials) files on your machine to add a profile with named devops.

Resource Naming Convention

<business-unit>-<env>-<resource-name>-<optional-identifier>

1. **Business Unit:** The name of *company/business-unit/team/org* that is creating a resource
2. **ENV:** The name of the environment e.g: dev, qa, stage, prod, test

3. **Resource Name:** The name of the actual resource being created e.g.: eks cluster, bastion host, postgres instance, redshift cluster.
4. **Optional Identifier:** Any additional name that describes the additional details for which resource is being created e.g. for testing, a resource is in multi-az, standalone, internal for the team, shared b/w environments, etc.

Terraform Directory Structure

I've implemented a modular approach to designing the infrastructure. The **`modules`** directory houses all the core modules like `argocd`, `eks`, `bastion`, and `vpc`, each encapsulating its respective infrastructure logic. These modules are then utilized in the **`env`** directory, which contains environment-specific folders such as `dev`. Each environment folder, like `dev`, calls these core modules for that particular environment.

This approach simplifies the infrastructure code and provides the advantage of managing state files for each component separately, ensuring modularity and easier management.

```
~/personalProjects/di/digitify-devops-assessment  git develop ?1  tree terraform
terraform
├── envs
│   └── dev
│       ├── argocd
│       │   ├── backend.tf
│       │   ├── main.tf
│       │   ├── manifests
│       │   │   ├── applicationset-dev.yaml
│       │   │   ├── argocd-install.yaml
│       │   │   ├── argocd-ns.yaml
│       │   │   ├── developer-full-access.yaml
│       │   │   └── github-secret.yaml
│       │   ├── provider.tf
│       │   └── remote.tf
│       ├── bastion
│       │   ├── backend.tf
│       │   ├── main.tf
│       │   ├── outputs.tf
│       │   ├── provider.tf
│       │   └── remote.tf
│       ├── eks
│       │   ├── backend.tf
│       │   ├── main.tf
│       │   ├── outputs.tf
│       │   ├── provider.tf
│       │   └── remote.tf
│       └── vpc
│           ├── backend.tf
│           ├── main.tf
│           ├── outputs.tf
│           └── provider.tf
├── modules
│   ├── argocd
│   │   ├── main.tf
│   │   ├── outputs.tf
│   │   ├── provider.tf
│   │   ├── README.md
│   │   └── variables.tf
│   ├── bastion
│   │   ├── main.tf
│   │   ├── outputs.tf
│   │   └── variables.tf
│   ├── eks
│   │   ├── main.tf
│   │   ├── outputs.tf
│   │   └── variables.tf
│   └── vpc
│       ├── main.tf
│       ├── outputs.tf
│       ├── README.md
│       └── variables.tf
└── README.md
```

CI/CD

CI via GitHub Actions

I've implemented **GitHub Actions** as the CI solution, with several workflow files:

1. **main-workflow.yaml**: Monitors pushes to the `dev` or `main` branches and invokes `changes.yaml` to determine which directories have been modified.

2. **changes.yaml**: Identifies folder changes and returns the result to `main-workflow.yaml`.
3. **reusable.yaml**: Accepts parameters, builds the Docker image, pushes it to DockerHub, and updates the Helm chart. Once the Helm chart is updated, it pushes the changes back to the GitHub repository. The `main-workflow.yaml` workflow triggers this file.

To provision or de-provision an environment, the **.github/workflows** directory contains two additional files:

1. **env-provisioner.yaml**: This workflow is triggered manually to set up the environment infrastructure. It calls the `vpc`, `bastion`, `eks`, and `argocd` modules to provision the environment's infrastructure.
2. **env-destroyer.yaml**: This workflow is responsible for tearing down the environment. It calls the modules in reverse order to destroy the infrastructure.

CD via Argocd

We chose to implement GitOps for our continuous deployment and delivery processes, using ArgoCD. This tool is deployed within our EKS cluster and monitors changes in our Helm charts. Whenever a Helm chart is updated, ArgoCD detects the changes, pulls them, and redeploys them to the EKS cluster.