

Project Demo

DevOps Pipeline Architecture



1. Assignment Task:











DevOps Take-Home Assignment Demonstration Subtitle: End-to-End CI/CD Pipeline with Kubernetes

2. Project Overview










Tools and languages used

- Node.js for api
- Github Actions for CI
- Docker Containerization & Registry
- Terraform for IAC
- K8s Orchestration using Minikube
- Azure cloud for Infra

3. Repository Structure

 gajapathi Read me 	49130c9 · 1 hour ago	 12 Commits
 .github/workflows	changes	19 hours ago
 app	Generate proper package-lock.json for CI/CD	19 hours ago
 infrastructure	Initial commit: Terraform configuration for devops assignment	20 hours ago
 k8s	Read me	1 hour ago
 .env	Initial commit: Terraform configuration for devops assignment	20 hours ago
 .gitignore	Initial commit: Terraform configuration for devops assignment	20 hours ago
 README.md	Read me	1 hour ago

4.Github Actions CI

<div> <div> <div><> Code</div> <div>Issues</div> <div>Pull requests</div> <div>Actions</div> <div>Projects</div> <div>Wiki</div> <div>Security</div> <div>Insights</div> <div>Settings</div> </div> <div> <div>Actions</div> <div>New workflow</div> <div>All workflows</div> <div>CI/CD Pipeline</div> <div>Management</div> <div>Caches</div> <div>Attestations</div> <div>Runners</div> <div>Usage metrics</div> <div>Performance metrics</div> </div> </div>	<div> <div>All workflows</div> <div>Showing runs from all workflows</div> <div>Filter workflow runs</div> </div> <div> <div>12 workflow runs</div> <div>Event Status Branch Actor</div> <div> <div>  Read me CI/CD Pipeline #12: Commit 49130c9 pushed by gajapathi22 </div> <div>main</div> <div>Today at 6:22 PM</div> <div>54s</div> <div>...</div> </div> <div> <div>  Read me CI/CD Pipeline #11: Commit 8b8e7d8 pushed by gajapathi22 </div> <div>main</div> <div>Today at 6:15 PM</div> <div>56s</div> <div>...</div> </div> <div> <div>  Read me CI/CD Pipeline #10: Commit 7107254 pushed by gajapathi22 </div> <div>main</div> <div>Today at 6:15 PM</div> <div>1m 0s</div> <div>...</div> </div> <div> <div>  Read me CI/CD Pipeline #9: Commit d2eed51 pushed by gajapathi22 </div> <div>main</div> <div>Today at 6:14 PM</div> <div>56s</div> <div>...</div> </div> <div> <div>  rename prometheus CI/CD Pipeline #8: Commit 244d951 pushed by gajapathi22 </div> <div>main</div> <div>Today at 1:13 AM</div> <div>46s</div> <div>...</div> </div> <div> <div>  nodeport manifets CI/CD Pipeline #7: Commit 6039911 pushed by gajapathi22 </div> <div>main</div> <div>Today at 12:27 AM</div> <div>59s</div> <div>...</div> </div> <div> <div>  nodeport manifets CI/CD Pipeline #6: Commit 2273e14 pushed by gajapathi22 </div> <div>main</div> <div>Today at 12:24 AM</div> <div>39s</div> <div>...</div> </div> <div> <div>  name change in k8s CI/CD Pipeline #5: Commit fc41932 pushed by gajapathi22 </div> <div>main</div> <div>Today at 12:10 AM</div> <div>57s</div> <div>...</div> </div> <div> <div>  changes CI/CD Pipeline #4: Commit 533ae79 pushed by gajapathi22 </div> <div>main</div> <div>Today at 12:00 AM</div> <div>46s</div> <div>...</div> </div> </div>
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5.Docker Container Registry

Installation OS / Arch 2

[Learn more about packages](#)

 Install from the command line

```
$ docker pull ghcr.io/gajapathi22/devops-assignment:main-49130c9
```

Recent tagged image versions

latest main-49130c9 main

Published about 2 hours ago · Digest 

 0

main-8b9e7d8

Published about 2 hours ago · Digest 

 0

main-71072f4

Published about 2 hours ago · Digest 

 0

main-d2eed51

Published about 2 hours ago · Digest 

 0

main-244df51

Published about 19 hours ago · Digest 

 0

6. Infrastructure as Code

```

gajapathi@ATPL-GAJAPATHI:~/Desktop/projects/devops-assignment/infrastructure$ terraform plan
random_id.suffix: Refreshing state... [id=wEVhow]
module.vm.tls_private_key.ssh: Refreshing state... [id=7e7acb687a98986718bdc87c275b42c7b9c59bb2]
module.vm.local_file.private_key: Refreshing state... [id=8b8c95db326ab91a61aaa576c41448d2d94cf8d6]
azurerm_resource_group.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3]
module.network.azure_rm_public_ip.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/publicIPAddresses/pip-devops-c04561a3]
module.network.azure_rm_virtual_network.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/virtualNetworks/vnet-devops-c04561a3]
module.network.azure_rm_network_security_group.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/networkSecurityGroups/nsg-devops-c04561a3]
module.network.azure_rm_subnet.internal: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/virtualNetworks/vnet-devops-c04561a3/subnets/subnet-internal]
module.network.azure_rm_subnet_network_security_group_association.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/virtualNetworks/vnet-devops-c04561a3/subnets/subnet-internal]
module.vm.azure_rm_network_interface.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/networkInterfaces/nic-vm-devops-c04561a3]
module.vm.azure_rm_linux_virtual_machine.main: Refreshing state... [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/virtualMachines/vm-devops-c04561a3]
module.vm.data.azure_rm_public_ip.main: Reading...
module.vm.time_sleep.wait_for_vm: Refreshing state... [id=2025-09-20T17:28:45Z]
module.vm.data.azure_rm_public_ip.main: Read complete after 1s [id=/subscriptions/4b87cf63-7451-4163-ae72-654051745ebe/resourceGroups/rg-devops-c04561a3/providers/Microsoft.Network/publicIPAddresses/pip-devops-c04561a3]
module.vm.null_resource.vm_provisioning: Refreshing state... [id=5400323124235854894]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
-/+ destroy and then create replacement

Terraform will perform the following actions:

# module.vm.null_resource.vm_provisioning is tainted, so must be replaced
-/+ resource "null_resource" "vm_provisioning" {
  id      = "5400323124235854894" -> (known after apply)
  triggers = {
    script_hash = "896d8e575ff04281152dc94ac9aa62cc" -> "d727b4a7c918844c6a8166f76fe40cc2"
  }
}

Plan: 1 to add, 0 to change, 1 to destroy.

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these actions if you run "terraform apply" now.
gajapathi@ATPL-GAJAPATHI:~/Desktop/projects/devops-assignment/infrastructure$

```

7.Kubernetes Cluster

```

Last login: Sun Sep 21 12:35:34 2025 from 103.242.196.64
azureuser@vm-devops-c04561a3:~$ ls
devops-assignment  get-docker.sh  kubectl
azureuser@vm-devops-c04561a3:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
devops-app-5c56467bc5-g6flv        1/1     Running   0           19h
devops-app-5c56467bc5-mqnb8        1/1     Running   0           19h
azureuser@vm-devops-c04561a3:~$ kubectl get services
NAME            TYPE          CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
devops-app-public  NodePort      10.108.55.119    <none>            80:30080/TCP      19h
devops-app-service ClusterIP      10.103.33.237    <none>            80/TCP            19h
kubernetes       ClusterIP      10.96.0.1        <none>            443/TCP           20h
azureuser@vm-devops-c04561a3:~$ kubectl get ingress
NAME            CLASS    HOSTS    ADDRESS    PORTS    AGE
devops-app-ingress <none>   *        192.168.49.2  80       19h
azureuser@vm-devops-c04561a3:~$ miinkube status
miinkube: command not found
azureuser@vm-devops-c04561a3:~$ miinikube status
miinikube: command not found
azureuser@vm-devops-c04561a3:~$ minikube status
minikube
type: Control Plane
host: Running
kubelet: Running
apiserver: Running
kubeconfig: Configured
azureuser@vm-devops-c04561a3:~$

```

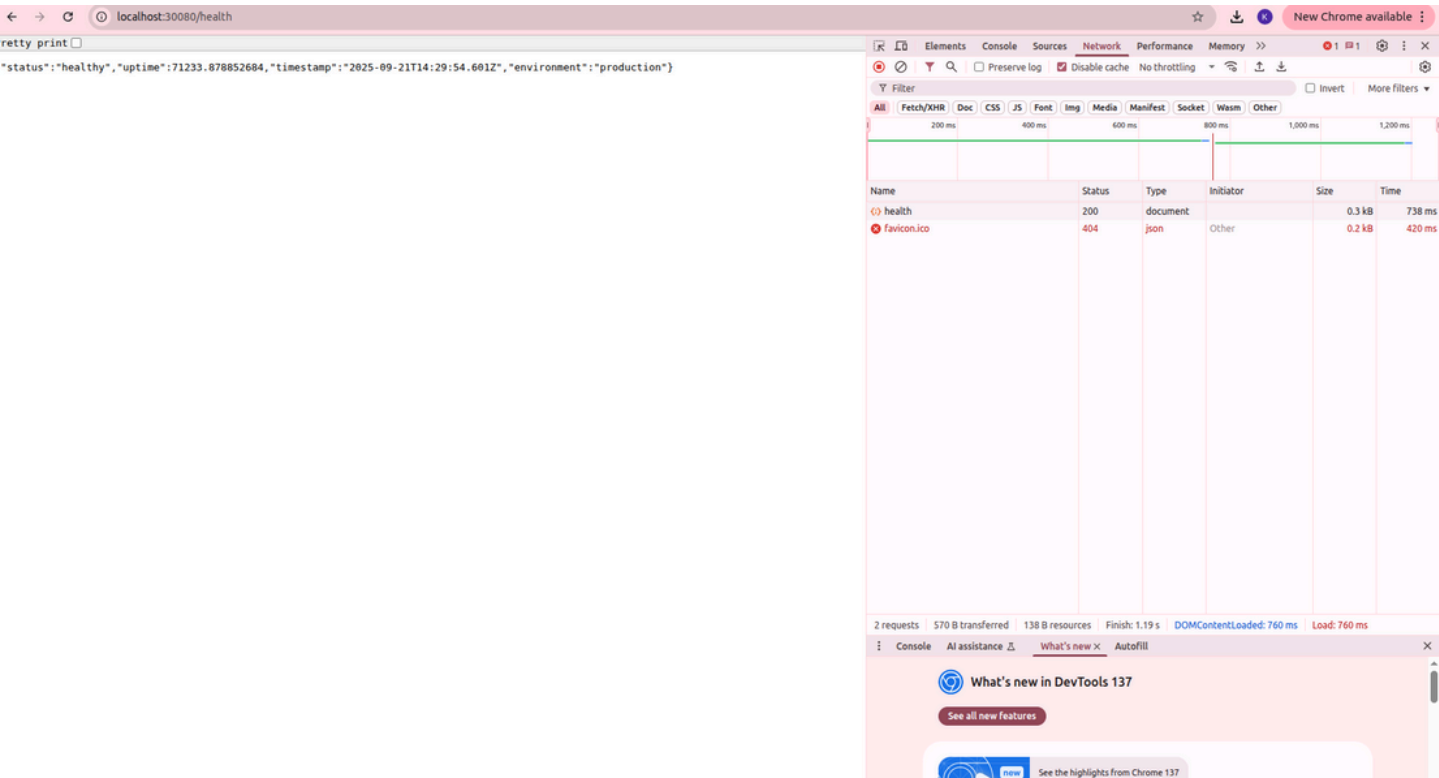
8.SSH Tunnel for App, Grafana, Prometheus

```

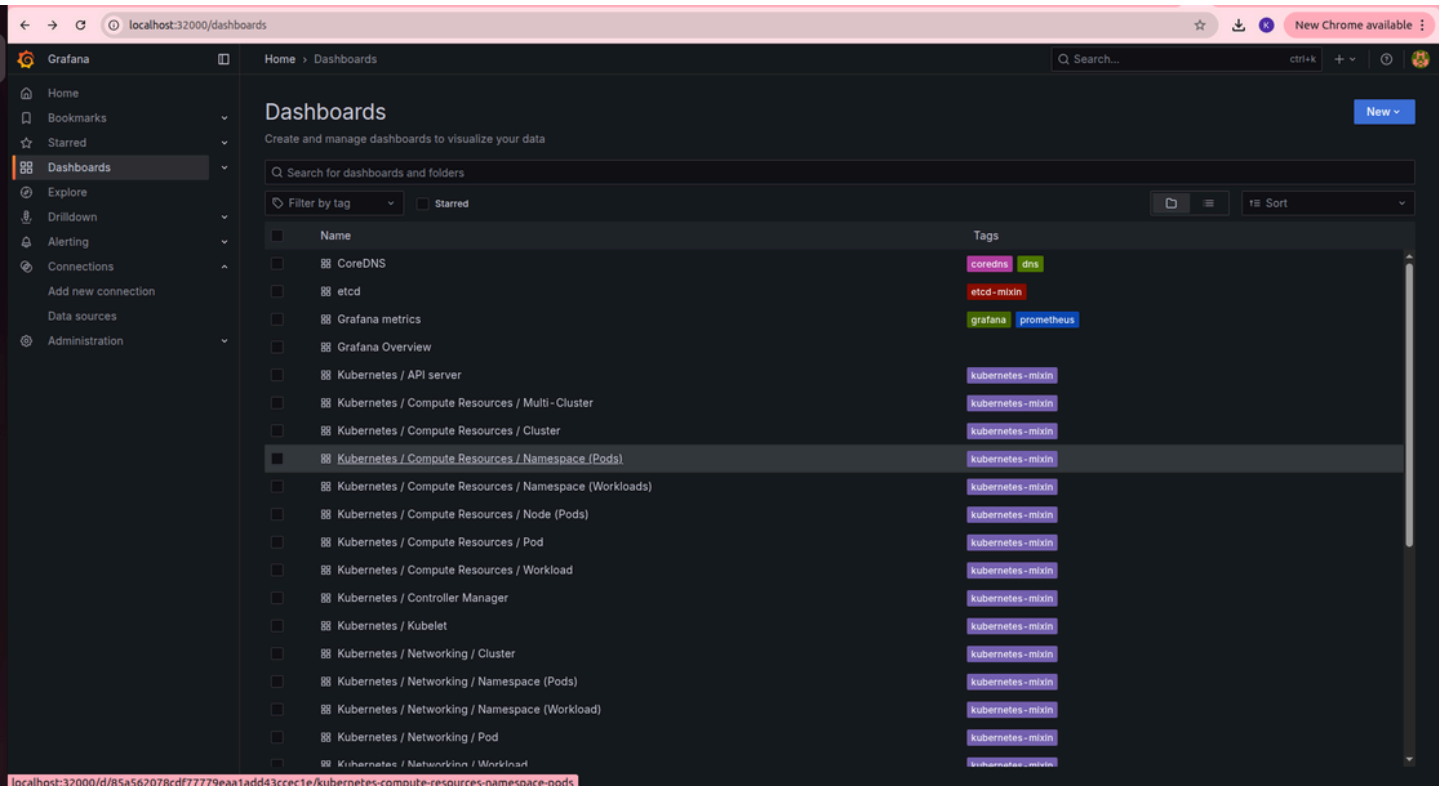
gajapathi@ATPL-GAJAPATHI:~$ ps aux | grep ssh
gajapath+ 4693  0.0  0.0   7980  5032 ?        Ss   17:57   0:00 /usr/bin/ssh-agent -D -a /run/user/1000/keyring/.ssh
gajapath+ 14450  0.0  0.0   1844   848 pts/4    Ss+  19:56   0:00 ssh -L infrastructure/devops-vm-key.pem azureuser@74.235.227.110
gajapath+ 14906  0.0  0.0   17052  8448 pts/0    Ss+  19:59   0:00 ssh -L /home/gajapathi/Desktop/projects/devops-assignment/infrastructure/devops-vm-key.pem -L 30080:192.168.49.2:80 azureuser@74.235.227.110
gajapath+ 14913  0.0  0.0   17052  8448 pts/1    Ss+  19:59   0:00 ssh -L /home/gajapathi/Desktop/projects/devops-assignment/infrastructure/devops-vm-key.pem -L 32000:192.168.49.2:32000 azureuser@74.235.227.110
gajapath+ 14914  0.0  0.0   17052  8192 pts/2    Ss+  19:59   0:00 ssh -L /home/gajapathi/Desktop/projects/devops-assignment/infrastructure/devops-vm-key.pem -L 9090:localhost:9090 azureuser@74.235.227.110
gajapath+ 15165  0.0  0.0   9212  2432 pts/3    R+   20:00   0:00 grep --color=auto ssh
gajapathi@ATPL-GAJAPATHI:~$

```

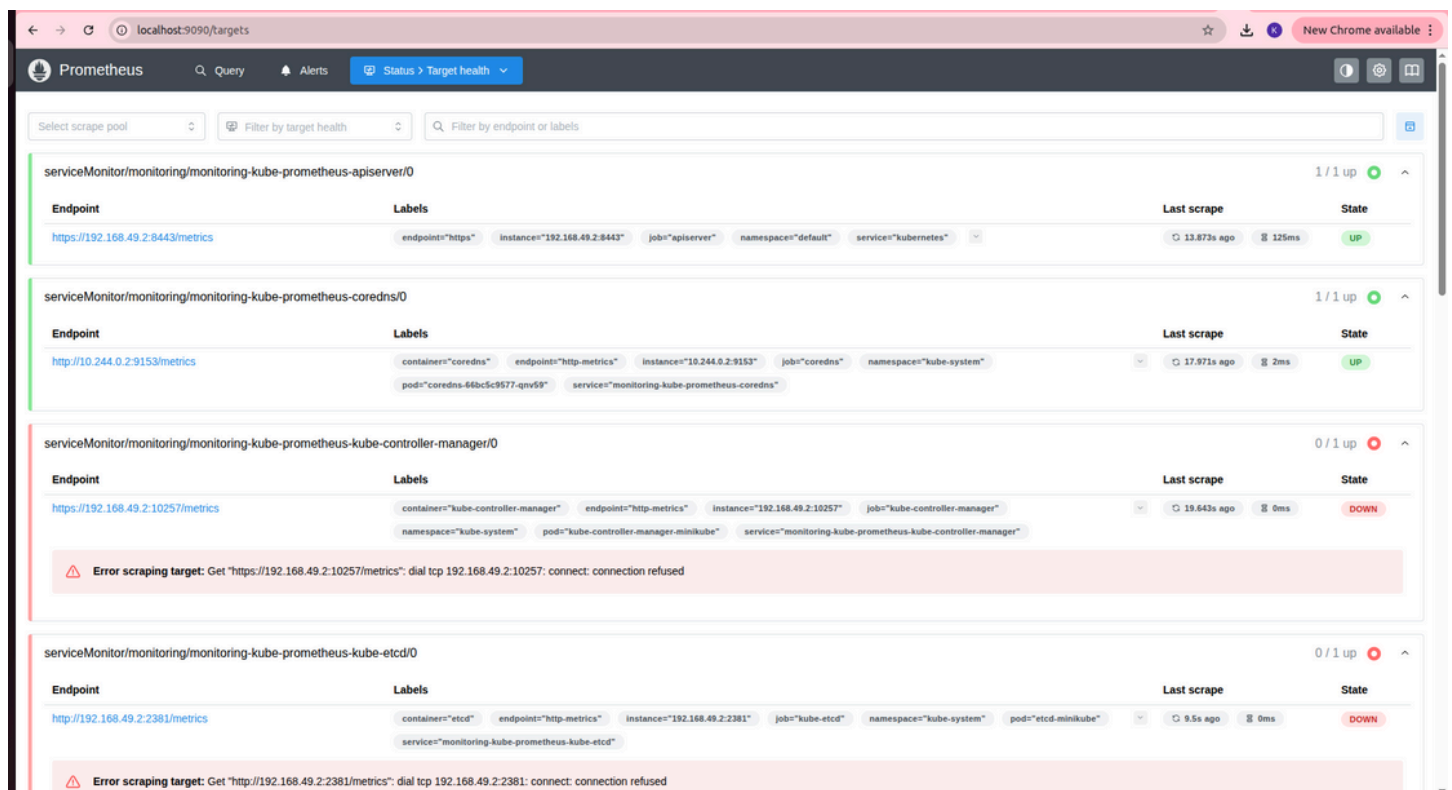
9.Application Running



10.Grafana Dashboard



11.Prometheus Dashboard



12. Access Endpoints

Application: `ssh -L 30080:192.168.49.2:80` → `http://localhost:30080`

Grafana: `ssh -L 32000:192.168.49.2:32000` → `http://localhost:32000`

Prometheus: `ssh -L 9090:localhost:9090` → `http://localhost:9090`

13. Challenges & Solutions

- **Azure subscription activation**

Switched to manual tool installation, resolved subscription issues

- **Minikube network isolation**

Implemented SSH tunneling for local access

- **External service exposure**

Created NodePort services with proper port configuration