Ivan Danyliuk

https://github.com/idanylyuk/DevOps

Maven™

Java

ANSIBLE

Grafana

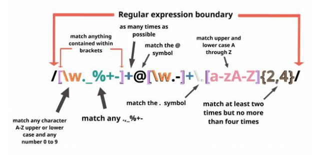
Sensu
by sumo logic

GO

KVM

VM

sonarqube


Regular expression boundary
as many times as possible
match anything contained within brackets
match the @ symbol
match upper and lower case A through Z
/[\w._%+-]+@[\w.-]+\.[a-zA-Z]{2,4}/
match any character A-Z upper or lower case and any number 0 to 9
match any .,_%+-
match the . symbol
match at least two times but no more than four times

docker

HashiCorp
Vagrant

Supervisor

GitHub

aws

Google Cloud

https://github.com/idanylyuk/DevOps

Report plan

Kubernetes

Minikube GeoCitizen Deployment

GKE Geocitizen Deployment

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Kubernetes

https://kubernetes.io

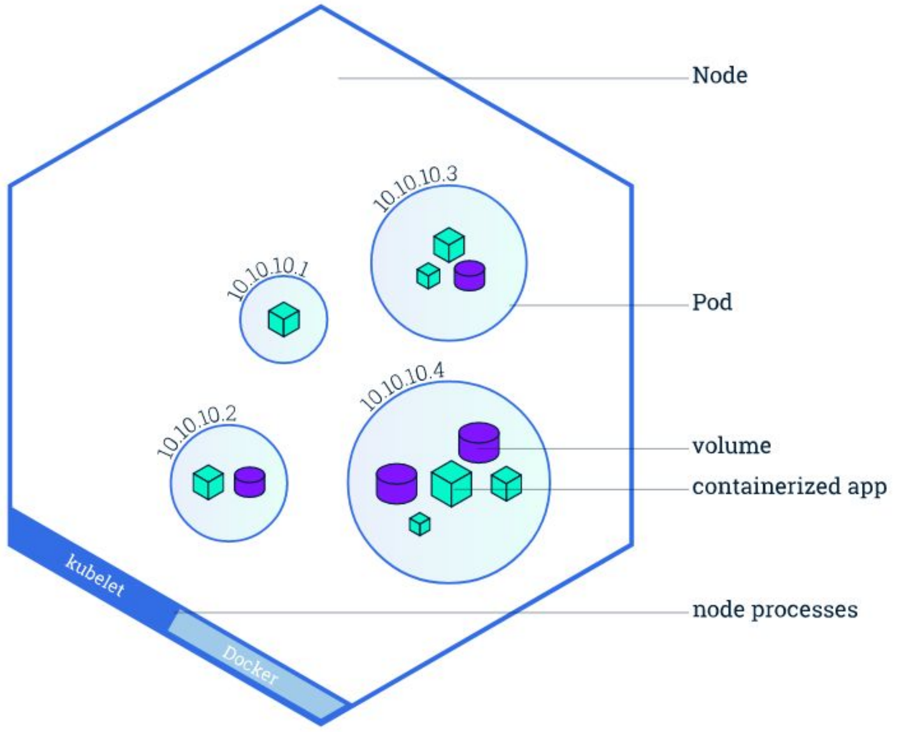
Kubernetes originates from Greek, meaning helmsman or pilot

K8(eight letters between K and s in “Kubernetes” word)s

Google open-sourced the Kubernetes project in 2014

A Kubernetes (K8s) cluster
is a grouping of nodes
that run containerized apps in an
- efficient,
- automated,
- distributed,
- scalable

manner.



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Kubernetes Cluster Architecture

Nodes

Control Plane - Node Communication

Controllers

Cloud Controller Manager

Container Runtime Interface (CRI)

Garbage Collection

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Kubernetes cluster creating tools

Learning Environment

- kind
- minikube
- kubeadm

Production environment

- kubeadm
- kops
- Kubespray

Cloud Solutions

Google Kubernetes Engine (GKE) MCap: $1.5T
Google

Amazon Elastic Container Service for Kubernetes (EKS) MCap: $1.5T
Amazon Web Services

Azure Kubernetes Service (AKS) MCap: $2.1T
Microsoft

https://landscape.cncf.io/card-mode?category=certified-kubernetes-hosted&grouping=category

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minikube

Local Kubernetes

focusing on making it easy to learn and develop Kubernetes

Requirements:

- 2 CPUs or more
- 2GB of free memory
- 20GB of free disk space
- Internet connection
- Container or virtual machine manager, such as: Docker, Hyperkit, Hyper-V, KVM, Parallels, Podman, VirtualBox, or VMware Fusion/Workstation

Simple install / Simple Start

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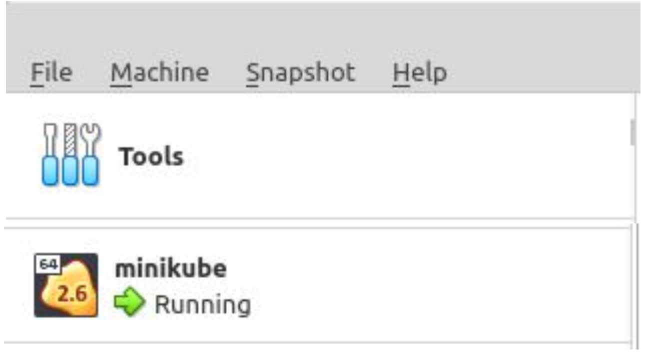
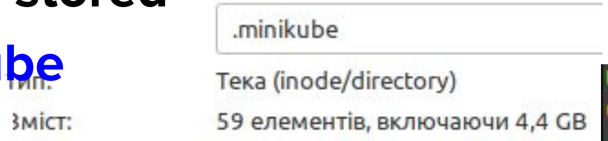
minikube



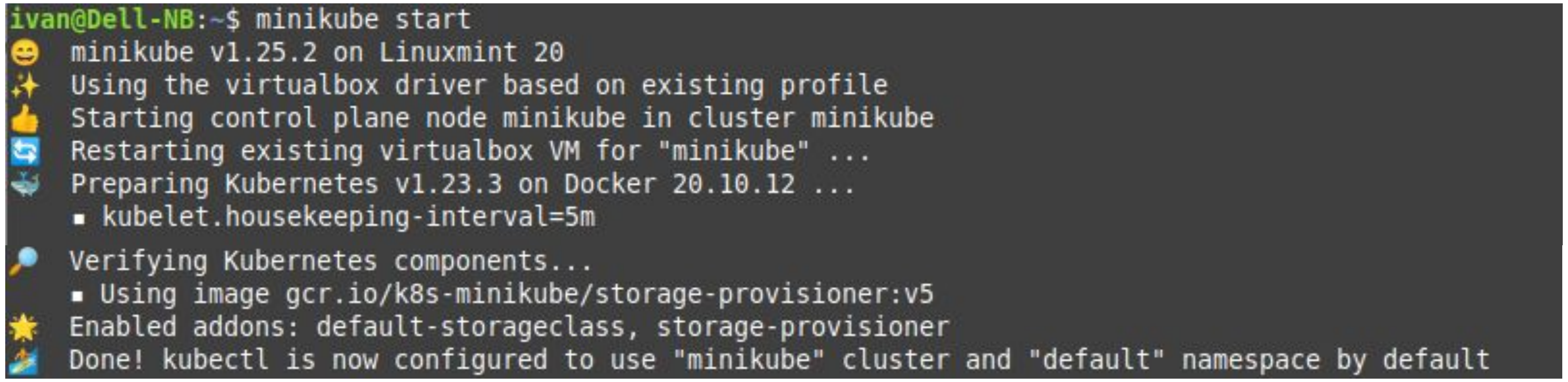
All minikube files are stored in directory **~/.minikube**


.minikube

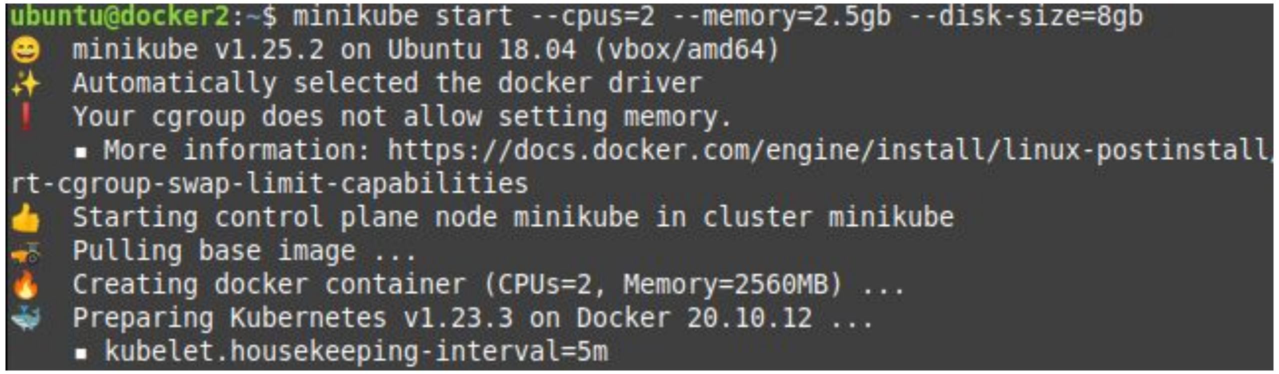
Тип: Тека (inode/directory)

Зміст: 59 елементів, включаючи 4,4 GB

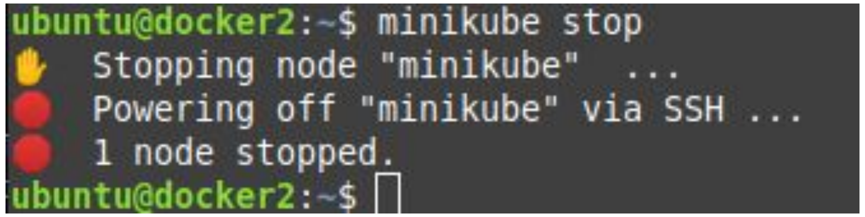
minikube start


```
ivan@Dell-NB:~$ minikube start
😄  minikube v1.25.2 on Linuxmint 20
✨  Using the virtualbox driver based on existing profile
👍  Starting control plane node minikube in cluster minikube
🔄  Restarting existing virtualbox VM for "minikube" ...
🐳  Preparing Kubernetes v1.23.3 on Docker 20.10.12 ...
    ▪ kubelet.housekeeping-interval=5m
🔎  Verifying Kubernetes components...
    ▪ Using image gcr.io/k8s-minikube/storage-provisioner:v5
🌟  Enabled addons: default-storageclass, storage-provisioner
🏄  Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
```

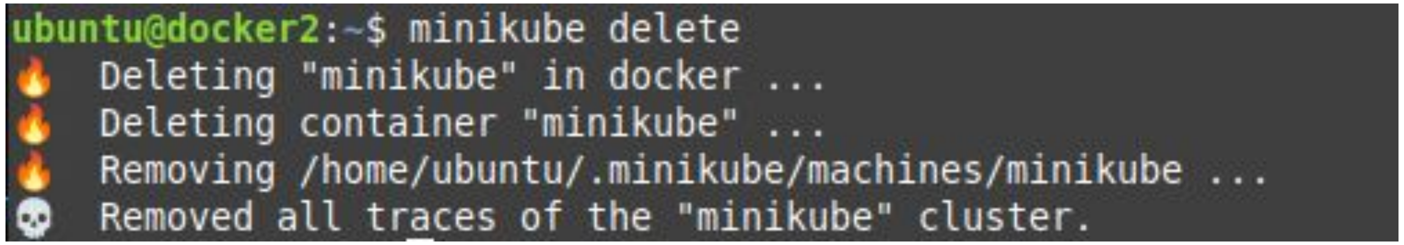
Start with parameters


```
ubuntu@docker2:~$ minikube start --cpus=2 --memory=2.5gb --disk-size=8gb
😄  minikube v1.25.2 on Ubuntu 18.04 (vbox/amd64)
✨  Automatically selected the docker driver
❗  Your cgroup does not allow setting memory.
    ▪ More information: https://docs.docker.com/engine/install/linux-postinstall/#your-kernel-does-not-suppo
rt-cgroup-swap-limit-capabilities
👍  Starting control plane node minikube in cluster minikube
🚜  Pulling base image ...
🔥  Creating docker container (CPUs=2, Memory=2560MB) ...
🐳  Preparing Kubernetes v1.23.3 on Docker 20.10.12 ...
    ▪ kubelet.housekeeping-interval=5m
```

minikube stop


```
ubuntu@docker2:~$ minikube stop
✋  Stopping node "minikube"  ...
🛑  Powering off "minikube" via SSH ...
🛑  1 node stopped.
ubuntu@docker2:~$ 
```

minikube delete


```
ubuntu@docker2:~$ minikube delete
🔥  Deleting "minikube" in docker ...
🔥  Deleting container "minikube" ...
🔥  Removing /home/ubuntu/.minikube/machines/minikube ...
💀  Removed all traces of the "minikube" cluster.
```

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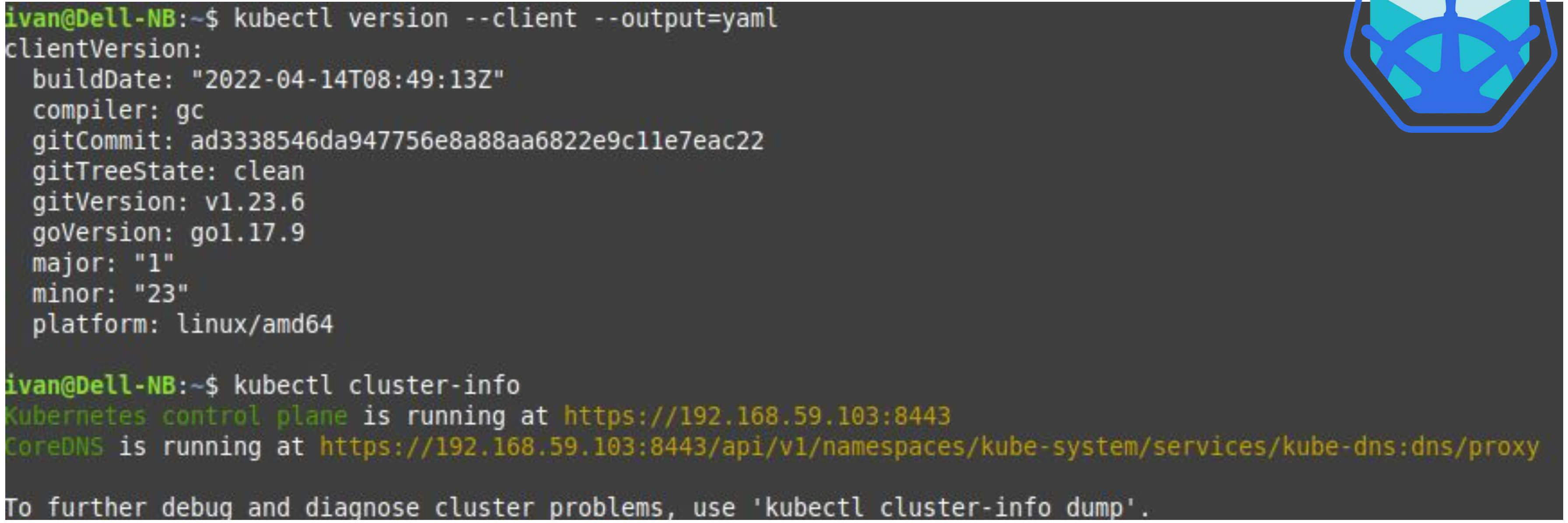
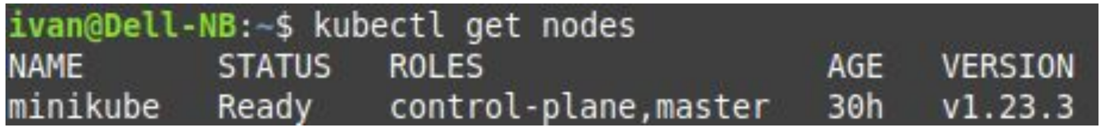
kubectl

interaction with cluster

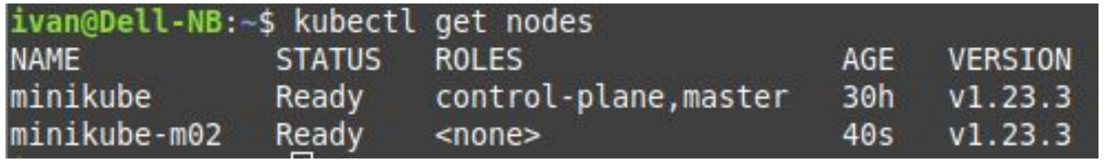


```
ivan@Dell-NB:~$ kubectl version --client --output=yaml
clientVersion:
  buildDate: "2022-04-14T08:49:13Z"
  compiler: gc
  gitCommit: ad3338546da947756e8a88aa6822e9c11e7eac22
  gitTreeState: clean
  gitVersion: v1.23.6
  goVersion: go1.17.9
  major: "1"
  minor: "23"
  platform: linux/amd64

ivan@Dell-NB:~$ kubectl cluster-info
Kubernetes control plane is running at https://192.168.59.103:8443
CoreDNS is running at https://192.168.59.103:8443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
```

kubectl get nodes

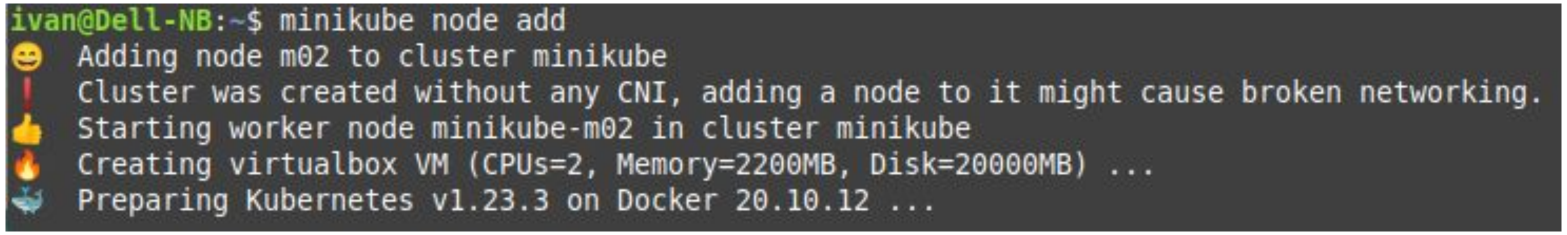


```
ivan@Dell-NB:~$ kubectl get nodes
NAME       STATUS   ROLES                  AGE   VERSION
minikube   Ready    control-plane,master   30h   v1.23.3
```

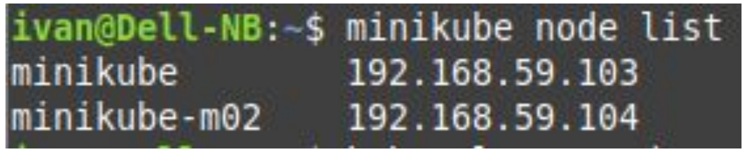


```
ivan@Dell-NB:~$ kubectl get nodes
NAME           STATUS   ROLES                  AGE   VERSION
minikube       Ready    control-plane,master   30h   v1.23.3
minikube-m02   Ready    <none>                 40s   v1.23.3
```

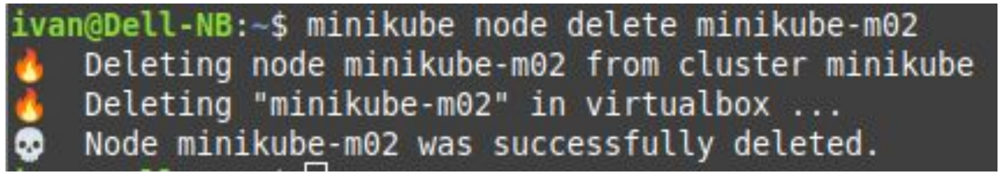
Add new node to cluster



```
ivan@Dell-NB:~$ minikube node add
😄  Adding node m02 to cluster minikube
❗  Cluster was created without any CNI, adding a node to it might cause broken networking.
👍  Starting worker node minikube-m02 in cluster minikube
🔥  Creating virtualbox VM (CPUs=2, Memory=2200MB, Disk=20000MB) ...
🐳  Preparing Kubernetes v1.23.3 on Docker 20.10.12 ...
```



```
ivan@Dell-NB:~$ minikube node list
minikube        192.168.59.103
minikube-m02    192.168.59.104
```



```
ivan@Dell-NB:~$ minikube node delete minikube-m02
🔥  Deleting node minikube-m02 from cluster minikube
🔥  Deleting "minikube-m02" in virtualbox ...
💀  Node minikube-m02 was successfully deleted.
```

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Working with pods

Starts new pod with name app-geo, docker image tomcat:9 and port 8080:

```
    $ kubectl run app-geo --image=tomcat:9 --port=8080
```

Get pods info

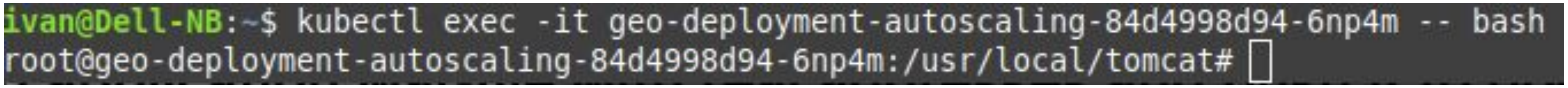
```
    $ kubectl get pods
    $ kubectl describe pods app-geo
```

Delete pod

```
    $ kubectl delete pods app-geo
```

Login to created pod (app-geo)

```
    $ kubectl exec -it geo-deployment-autoscaling-84d4998d94-6np4m -- bash
```



```
ivan@Dell-NB:~$ kubectl exec -it geo-deployment-autoscaling-84d4998d94-6np4m -- bash
root@geo-deployment-autoscaling-84d4998d94-6np4m:/usr/local/tomcat# 
```

View log files of pod

```
$ kubectl logs app-geo
```

Port forwarding

```
$ kubectl port-forward app-geo 8081:8080
```

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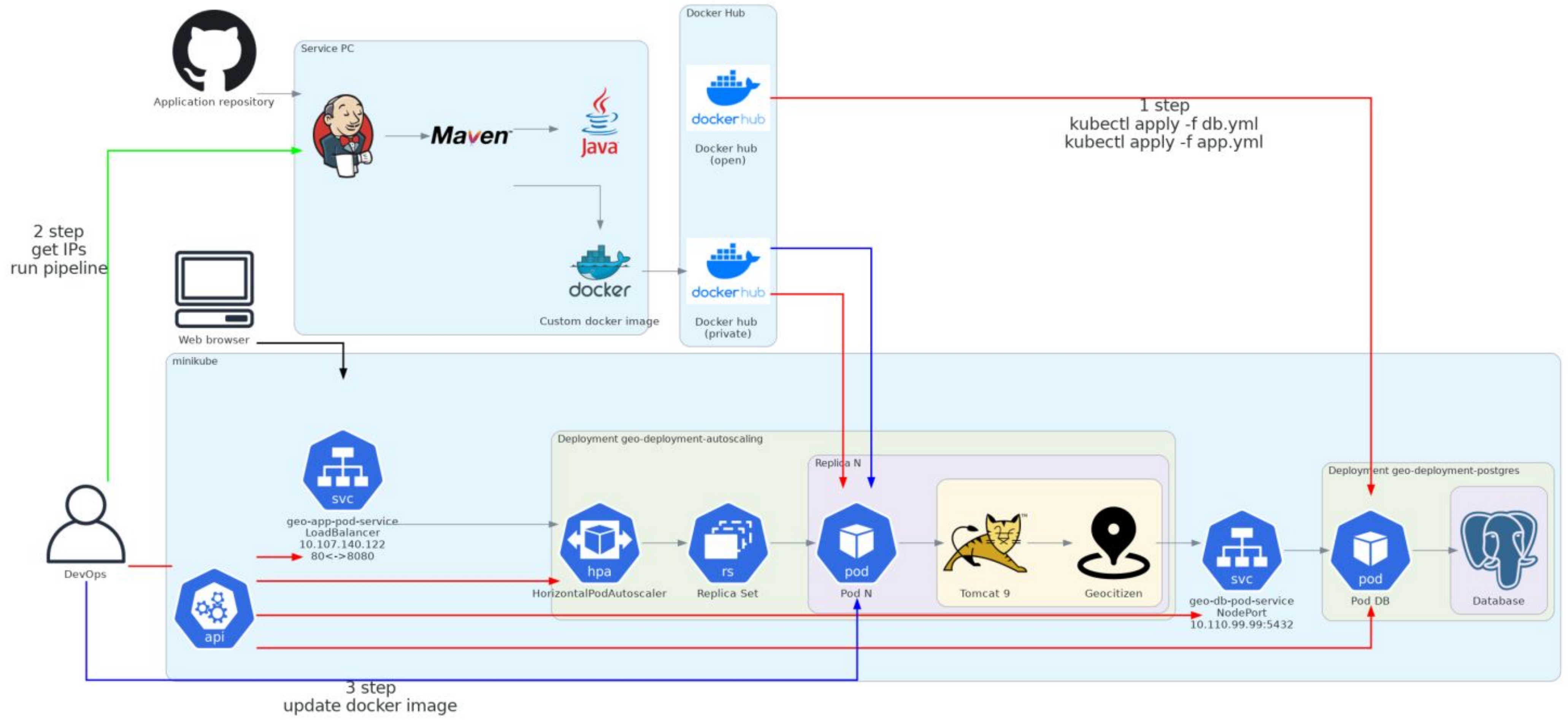
minikube GeoCitizen deployment



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minikube GeoCitizen deployment

1.Build application war-file with fake addresses and push it to docker hub.

```
$ docker login -u <user>
$ docker push xbuyer/data:geo_minikube
```

2.Generate in docker hub access token

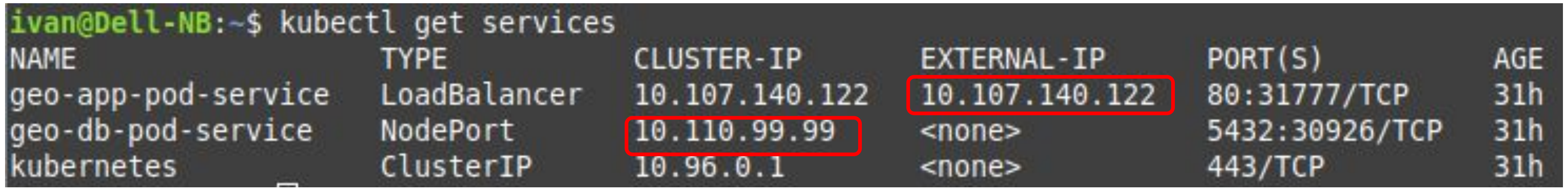
3.Create secret with kubectl

```
$ kubectl create secret docker-registry geosecret
--docker-server='https://index.docker.io/v1/'
--docker-username='-----'
--docker-password='--------------'
--docker-email='--------'
```

4.Create Infrastructure

```
$ kubectl apply -f db.yml
$ kubectl apply -f app.yml
```

5.Get Ip-addresses



```
ivan@Dell-NB:~$ kubectl get services
NAME                  TYPE           CLUSTER-IP       EXTERNAL-IP      PORT(S)          AGE
geo-app-pod-service   LoadBalancer   10.107.140.122   10.107.140.122   80:31777/TCP     31h
geo-db-pod-service    NodePort       10.110.99.99     <none>           5432:30926/TCP   31h
kubernetes            ClusterIP      10.96.0.1        <none>           443/TCP          31h
```

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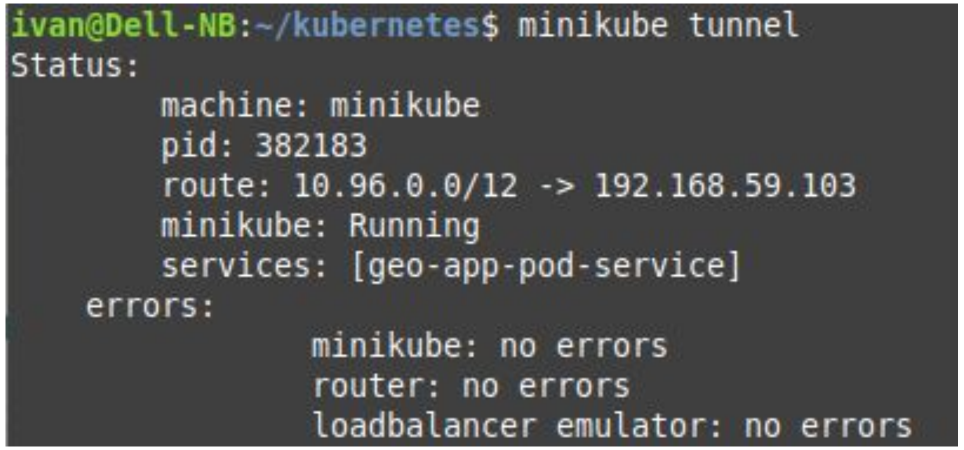
minikube GeoCitizen deployment

6.Run minikube tunnel and leave it working

```
    $ minikube tunnel
```



```
ivan@Dell-NB:~/kubernetes$ minikube tunnel
Status:
        machine: minikube
        pid: 382183
        route: 10.96.0.0/12 -> 192.168.59.103
        minikube: Running
        services: [geo-app-pod-service]
    errors:
                minikube: no errors
                router: no errors
                loadbalancer emulator: no errors
```

7.Rebuild application war-file with real addresses and push it to docker hub with new tag.

```
    $ docker login -u <user>
    $ docker push xbuyer/data:geo_minikube_v2
```

8.Update image for App Load Balancer Pods

```
    $ kubectl set image deployment/geo-deployment-autoscaling \
      app-web=docker.io/xbuyer/data:geo_minikube_v2
```

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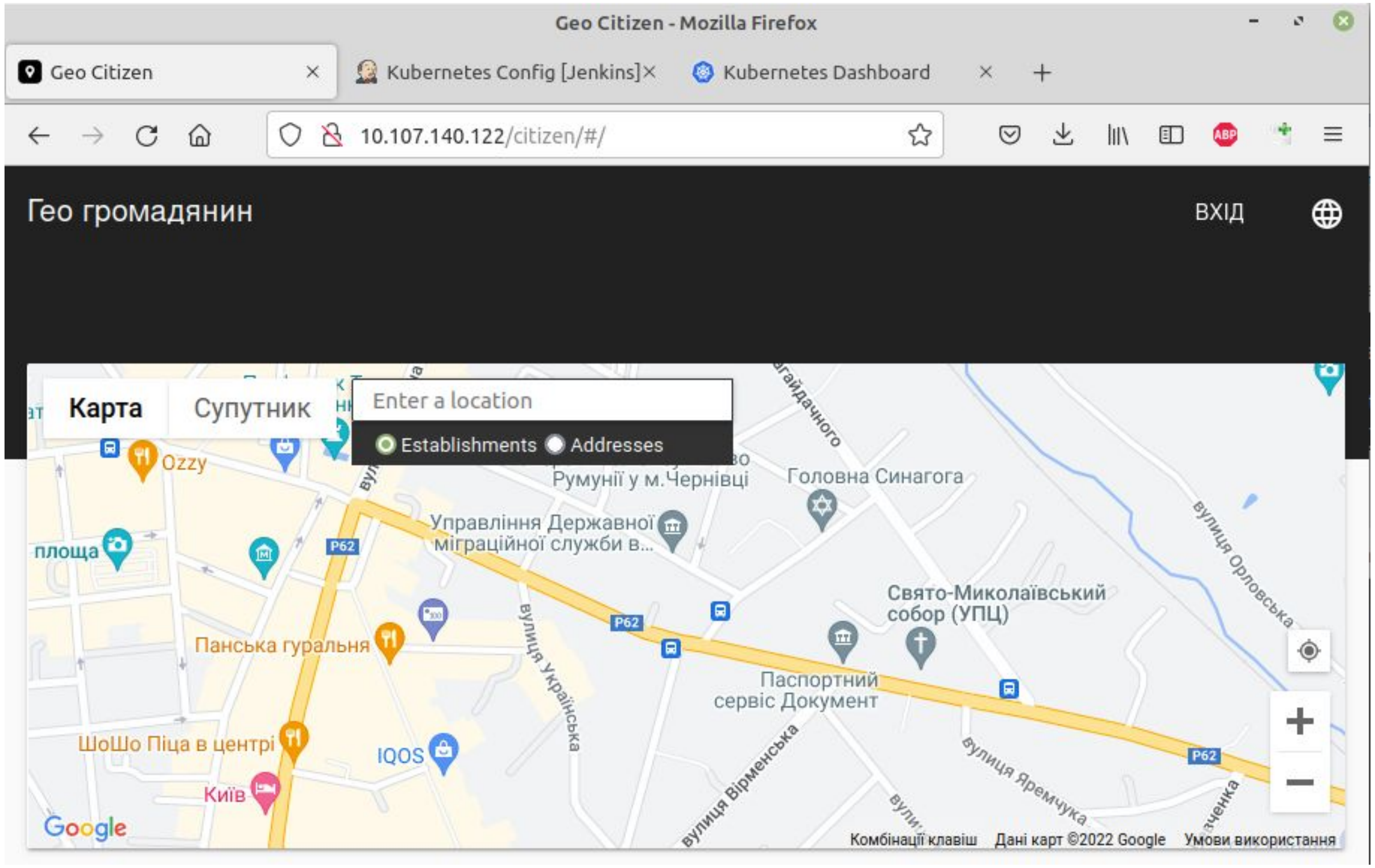
minikube GeoCitizen deployment

9.Use application



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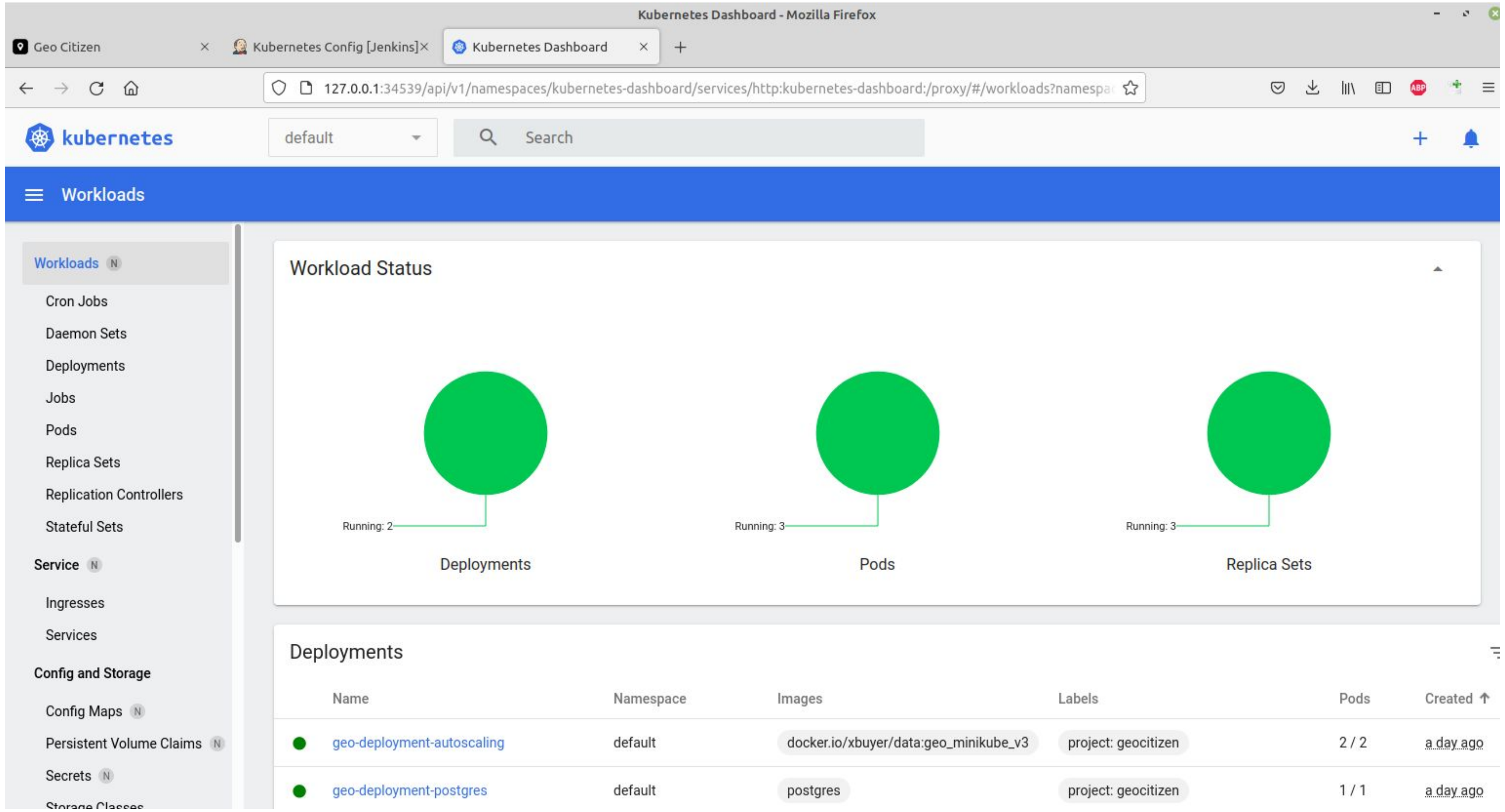
minikube GeoCitizen deployment

10.Dashboard with created infrastructure

```
$ minikube dashboard
```



Kubernetes Dashboard - Mozilla Firefox

Geo Citizen | Kubernetes Config [Jenkins] | Kubernetes Dashboard

127.0.0.1:34539/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/workloads?namespa

kubernetes | default | Search

Workloads

Workloads N
- Cron Jobs
- Daemon Sets
- Deployments
- Jobs
- Pods
- Replica Sets
- Replication Controllers
- Stateful Sets

Service N
- Ingresses
- Services

Config and Storage
- Config Maps N
- Persistent Volume Claims N
- Secrets N
- Storage Classes

Workload Status

Deployments: Running: 2
Pods: Running: 3
Replica Sets: Running: 3

Deployments

	Name	Namespace	Images	Labels	Pods	Created
●	geo-deployment-autoscaling	default	docker.io/xbuyer/data:geo_minikube_v3	project: geocitizen	2 / 2	a day ago
●	geo-deployment-postgres	default	postgres	project: geocitizen	1 / 1	a day ago

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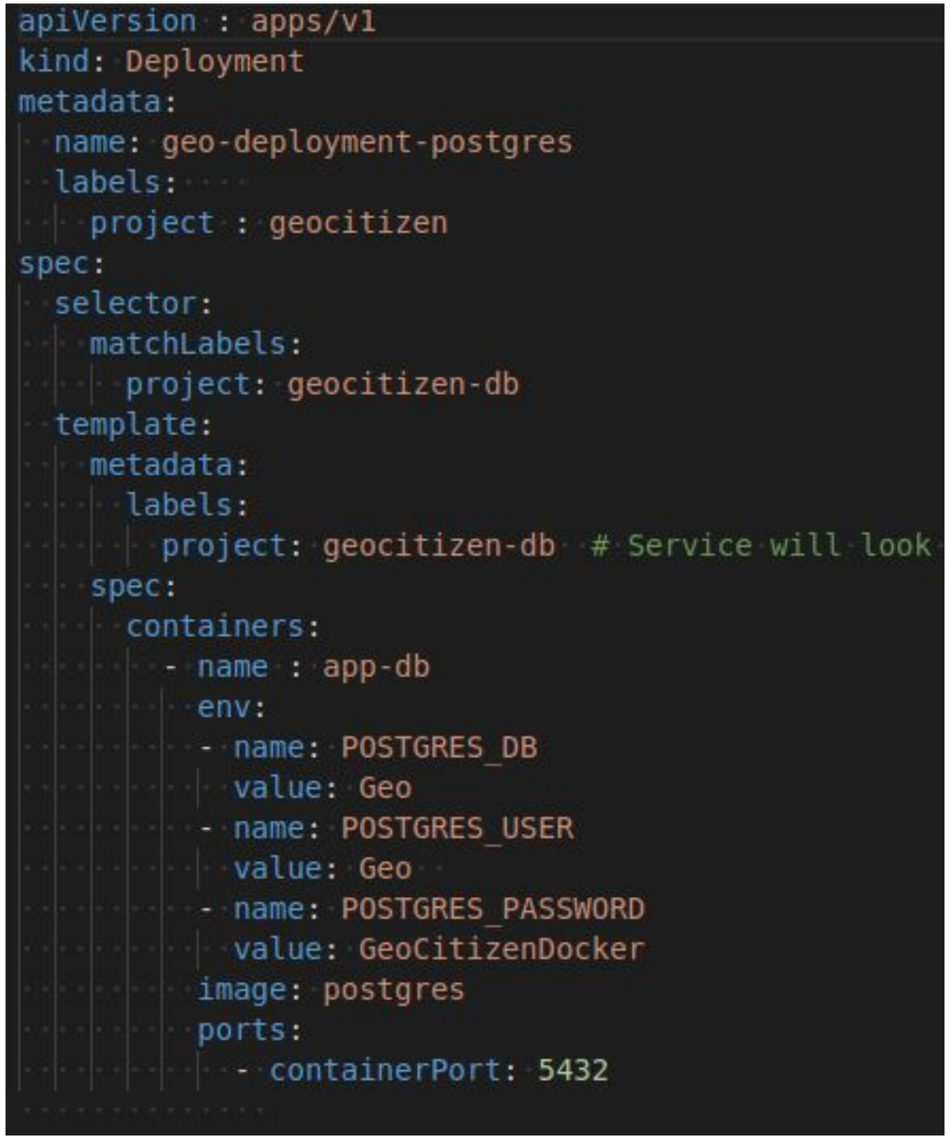
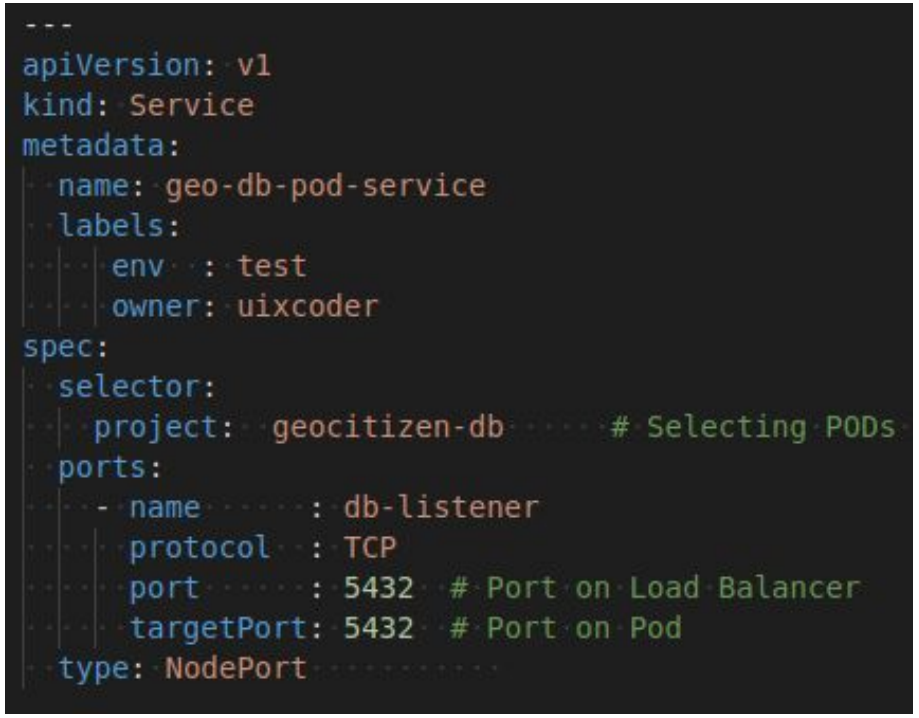
db.yml



```yaml
apiVersion : apps/v1
kind: Deployment
metadata:
  name: geo-deployment-postgres
  labels:
    project : geocitizen
spec:
  selector:
    matchLabels:
      project: geocitizen-db
  template:
    metadata:
      labels:
        project: geocitizen-db  # Service will look
    spec:
      containers:
        - name : app-db
          env:
          - name: POSTGRES_DB
            value: Geo
          - name: POSTGRES_USER
            value: Geo
          - name: POSTGRES_PASSWORD
            value: GeoCitizenDocker
          image: postgres
          ports:
            - containerPort: 5432
```



```yaml
---
apiVersion: v1
kind: Service
metadata:
  name: geo-db-pod-service
  labels:
     env  : test
     owner: uixcoder
spec:
  selector:
    project:  geocitizen-db     # Selecting PODs
  ports:
    - name      : db-listener
      protocol  : TCP
      port      : 5432  # Port on Load Balancer
      targetPort: 5432  # Port on Pod
  type: NodePort
```

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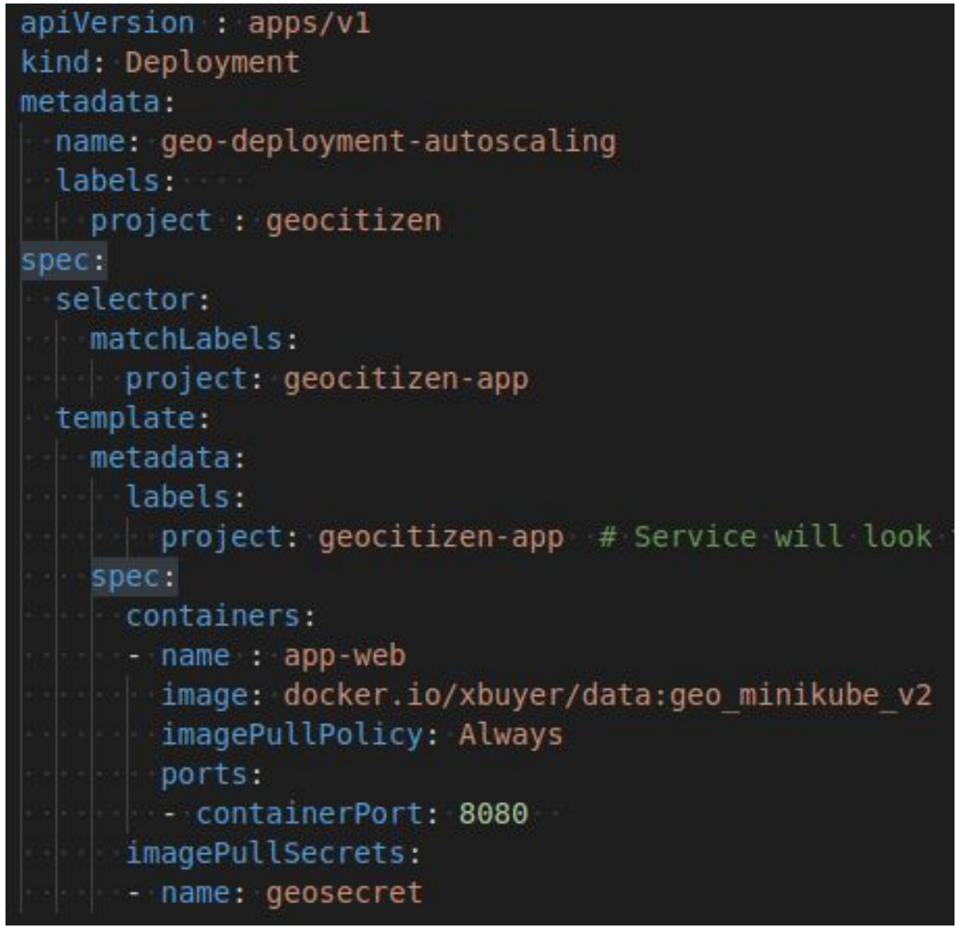
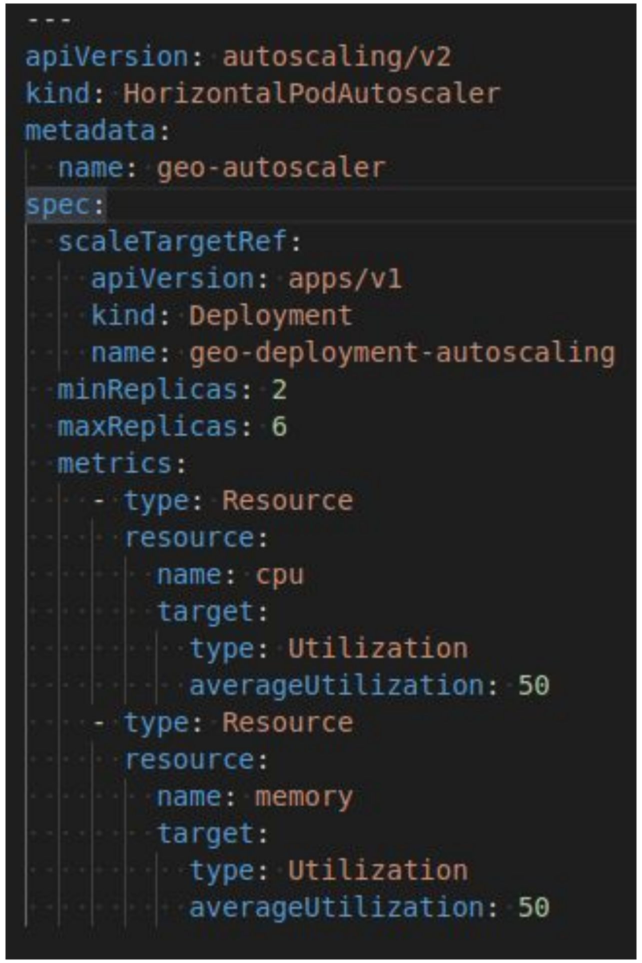
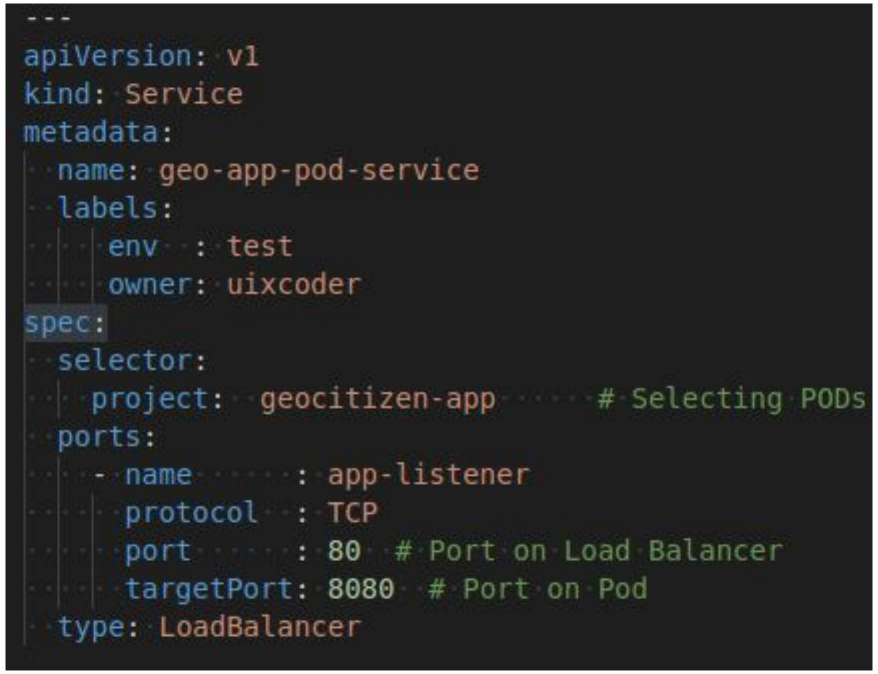
app.yml



```yaml
apiVersion : apps/v1
kind: Deployment
metadata:
  name: geo-deployment-autoscaling
  labels:
    project : geocitizen
spec:
  selector:
    matchLabels:
      project: geocitizen-app
  template:
    metadata:
      labels:
        project: geocitizen-app  # Service will look
    spec:
      containers:
      - name : app-web
        image: docker.io/xbuyer/data:geo_minikube_v2
        imagePullPolicy: Always
        ports:
        - containerPort: 8080
      imagePullSecrets:
      - name: geosecret
```



```yaml
---
apiVersion: autoscaling/v2
kind: HorizontalPodAutoscaler
metadata:
  name: geo-autoscaler
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: geo-deployment-autoscaling
  minReplicas: 2
  maxReplicas: 6
  metrics:
    - type: Resource
      resource:
        name: cpu
        target:
          type: Utilization
          averageUtilization: 50
    - type: Resource
      resource:
        name: memory
        target:
          type: Utilization
          averageUtilization: 50
```



```yaml
---
apiVersion: v1
kind: Service
metadata:
  name: geo-app-pod-service
  labels:
     env  : test
     owner: uixcoder
spec:
  selector:
    project:  geocitizen-app      # Selecting PODs
  ports:
    - name      : app-listener
      protocol  : TCP
      port      : 80  # Port on Load Balancer
      targetPort: 8080  # Port on Pod
  type: LoadBalancer
```

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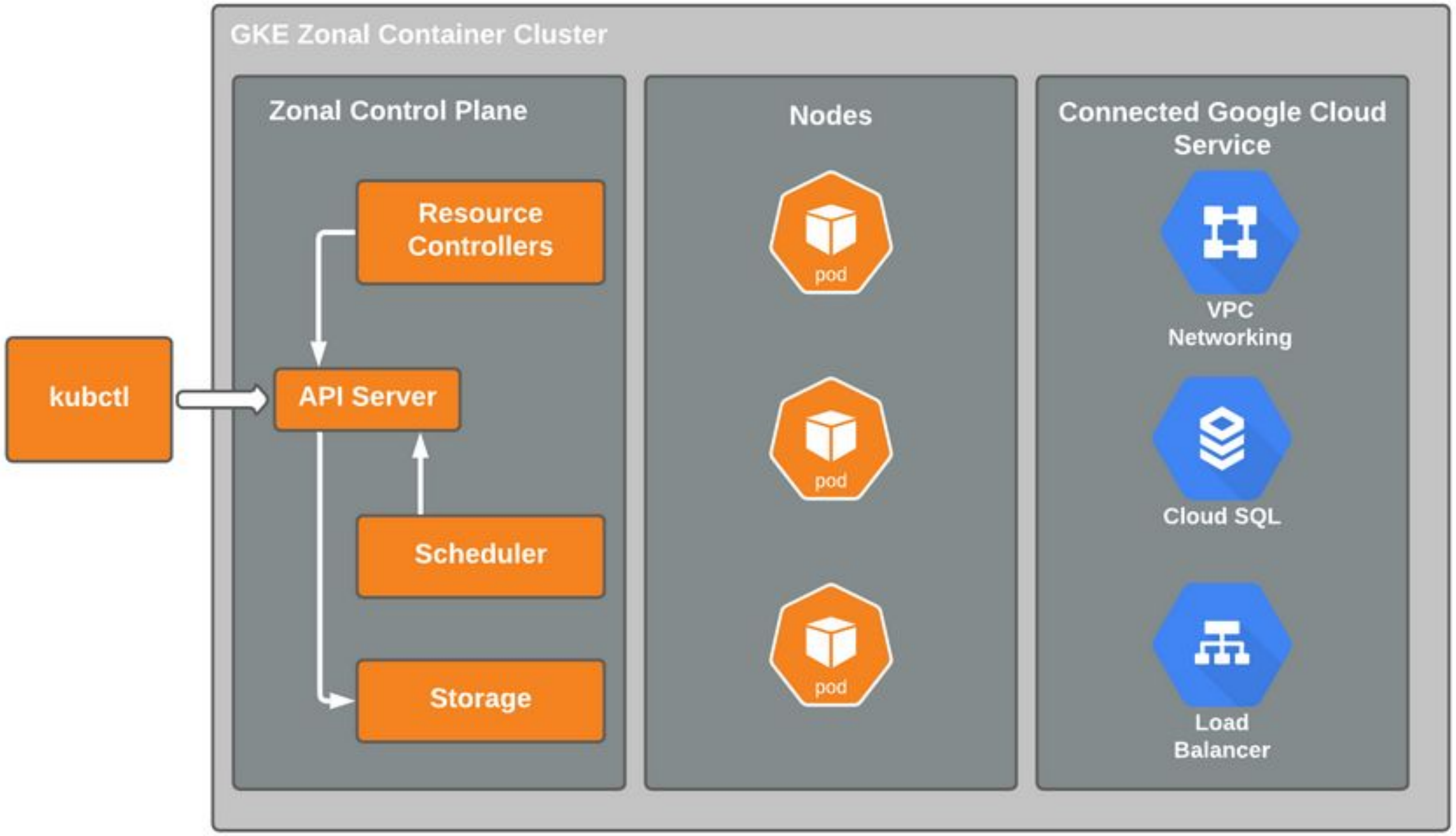
Kubernetes on GCP (GKE)



Google Kubernetes Engine (GKE)

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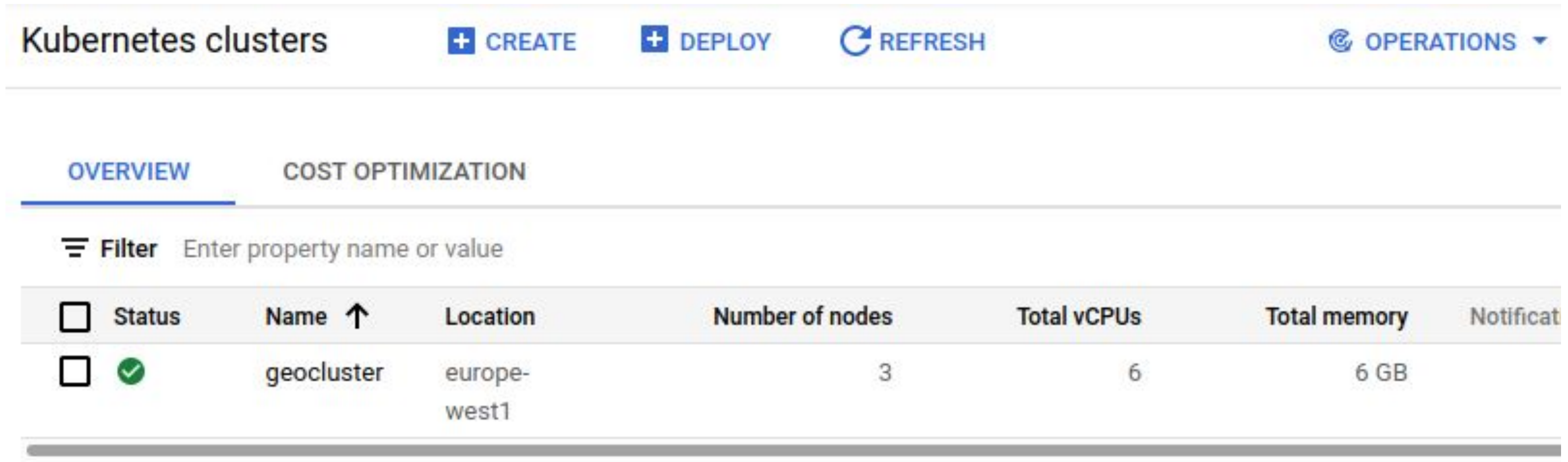
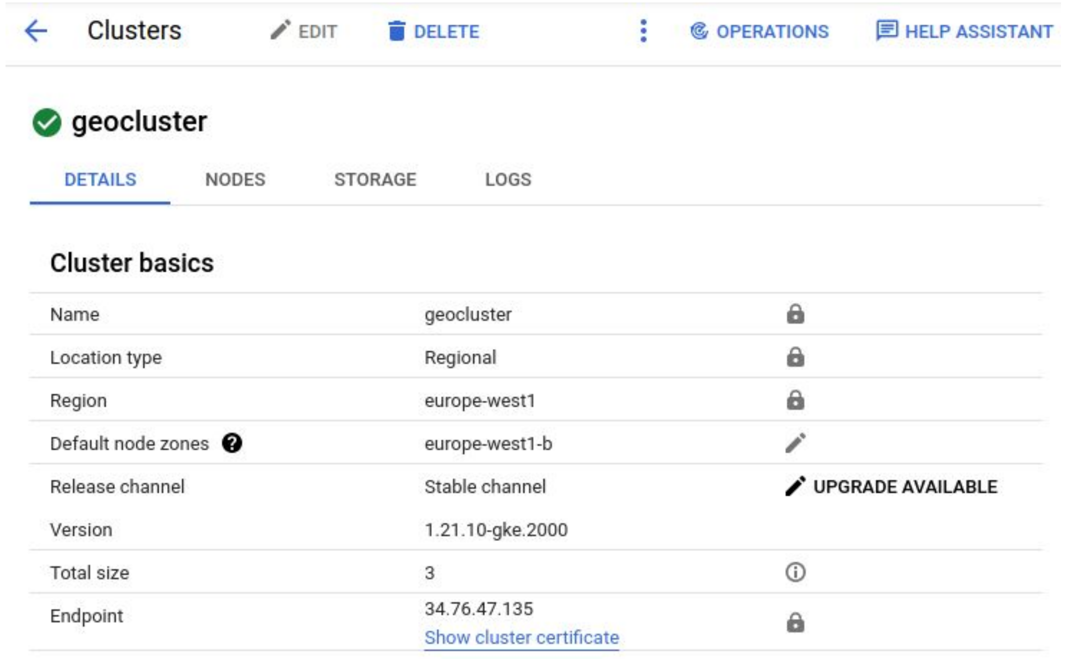
GKE start

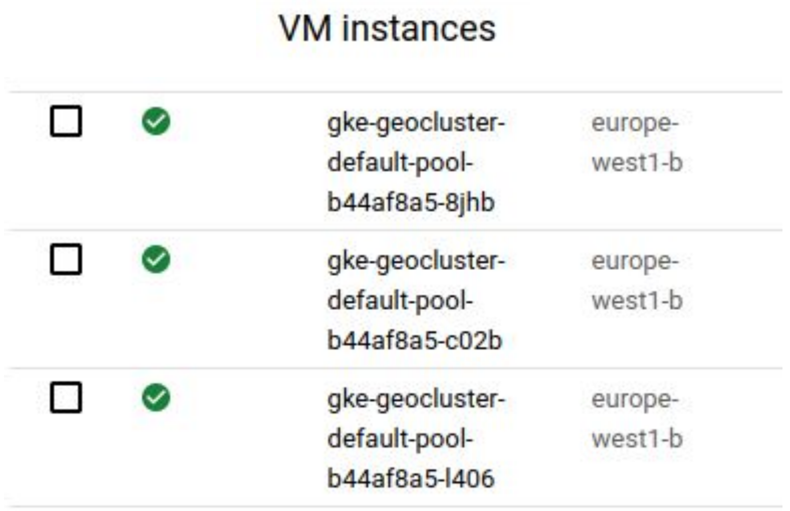


Status	Name ↑	Location	Number of nodes	Total vCPUs	Total memory	Notificat
✓	geocluster	europe-west1	3	6	6 GB	



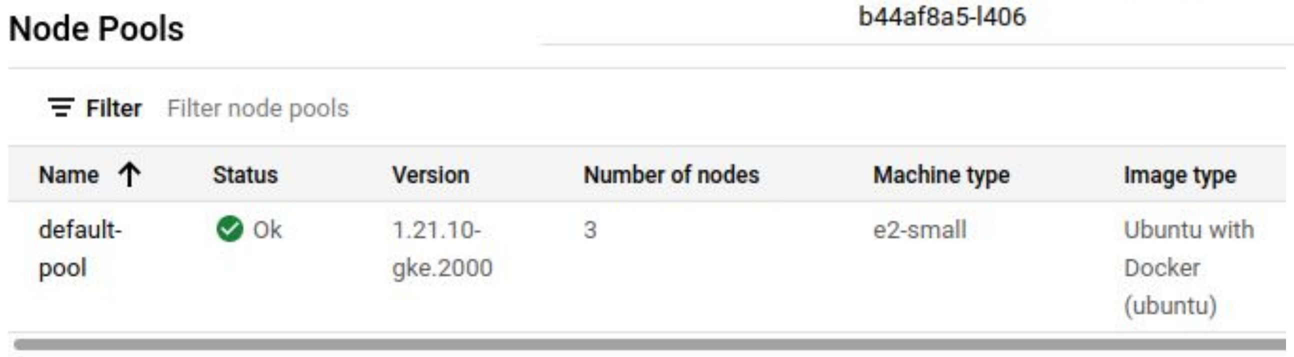
Cluster basics

Name	geocluster	
Location type	Regional	
Region	europe-west1	
Default node zones	europe-west1-b	
Release channel	Stable channel	UPGRADE AVAILABLE
Version	1.21.10-gke.2000	
Total size	3	
Endpoint	34.76.47.135 Show cluster certificate	



VM instances

☐	✓	gke-geocluster-default-pool-b44af8a5-8jhb	europe-west1-b
☐	✓	gke-geocluster-default-pool-b44af8a5-c02b	europe-west1-b
☐	✓	gke-geocluster-default-pool-b44af8a5-l406	europe-west1-b



Node Pools

Name ↑	Status	Version	Number of nodes	Machine type	Image type
default-pool	✓ Ok	1.21.10-gke.2000	3	e2-small	Ubuntu with Docker (ubuntu)

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GKE start

Install the gcloud CLI

Install kubectl and configure cluster access

```
    $ gcloud init --console-only
```

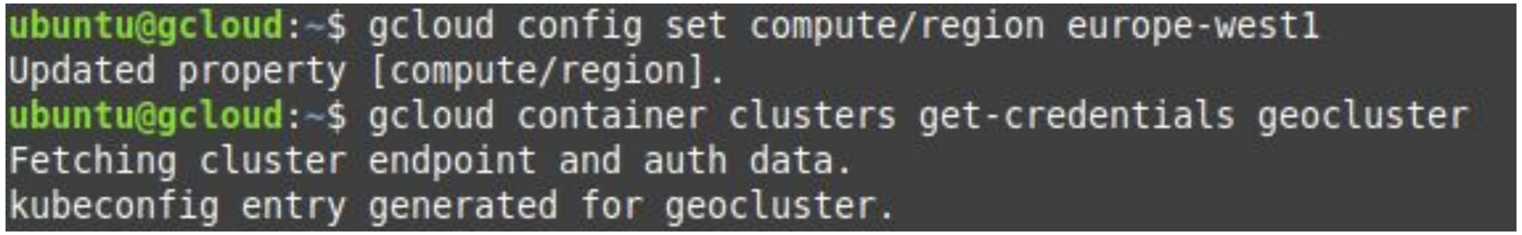
Follow the instructions to authorize the gcloud CLI

!!! Do not set zone. Only region later by command

```
    $ gcloud config set compute/region ....
```

Install required plugins and connect to previously created cluster

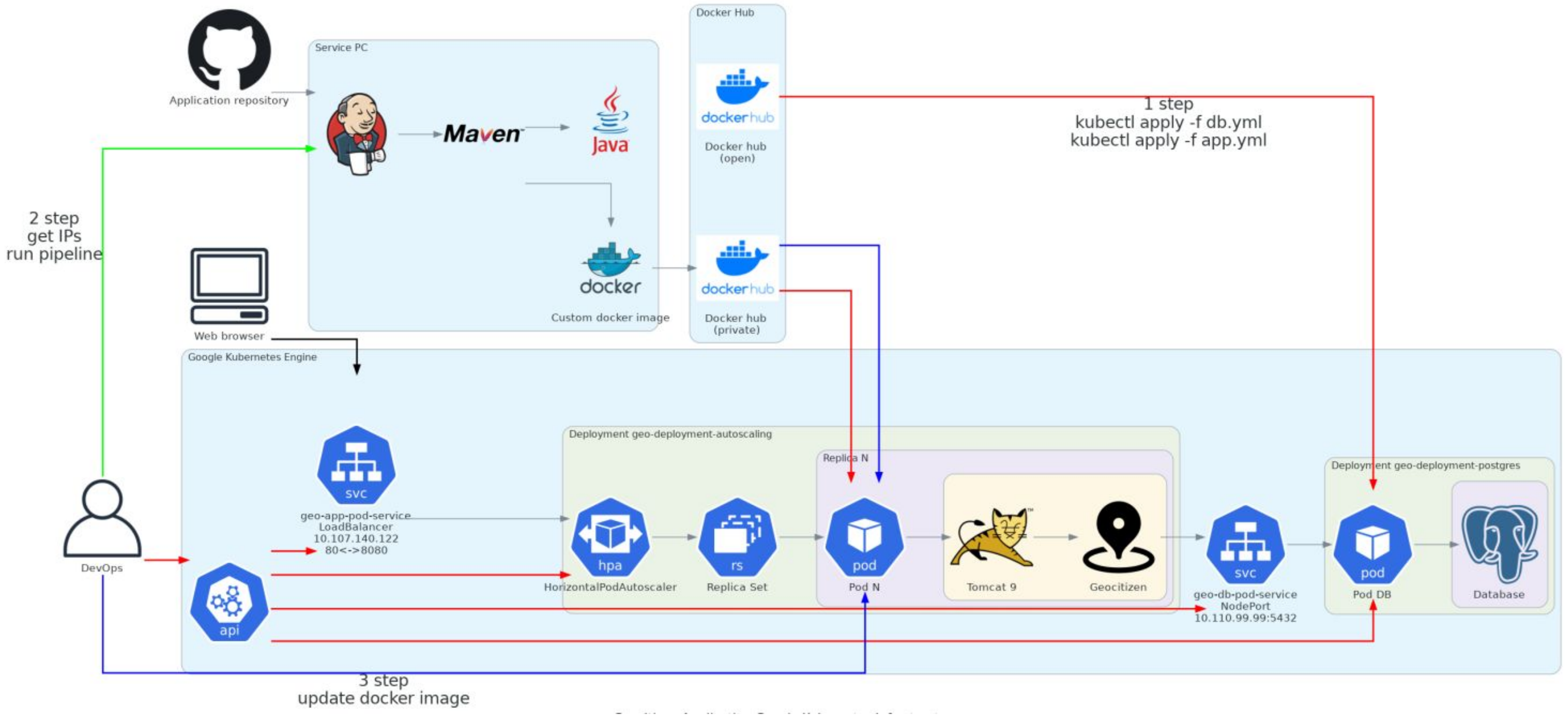
```
    $ sudo apt-get install google-cloud-sdk-gke-gcloud-auth-plugin
    $ gcloud container clusters get-credentials CLUSTER_NAME
```



```
ubuntu@gcloud:~$ gcloud config set compute/region europe-west1
Updated property [compute/region].
ubuntu@gcloud:~$ gcloud container clusters get-credentials geocluster
Fetching cluster endpoint and auth data.
kubeconfig entry generated for geocluster.
```

Ivan Danyliuk

GKE GeoCitizen deployment



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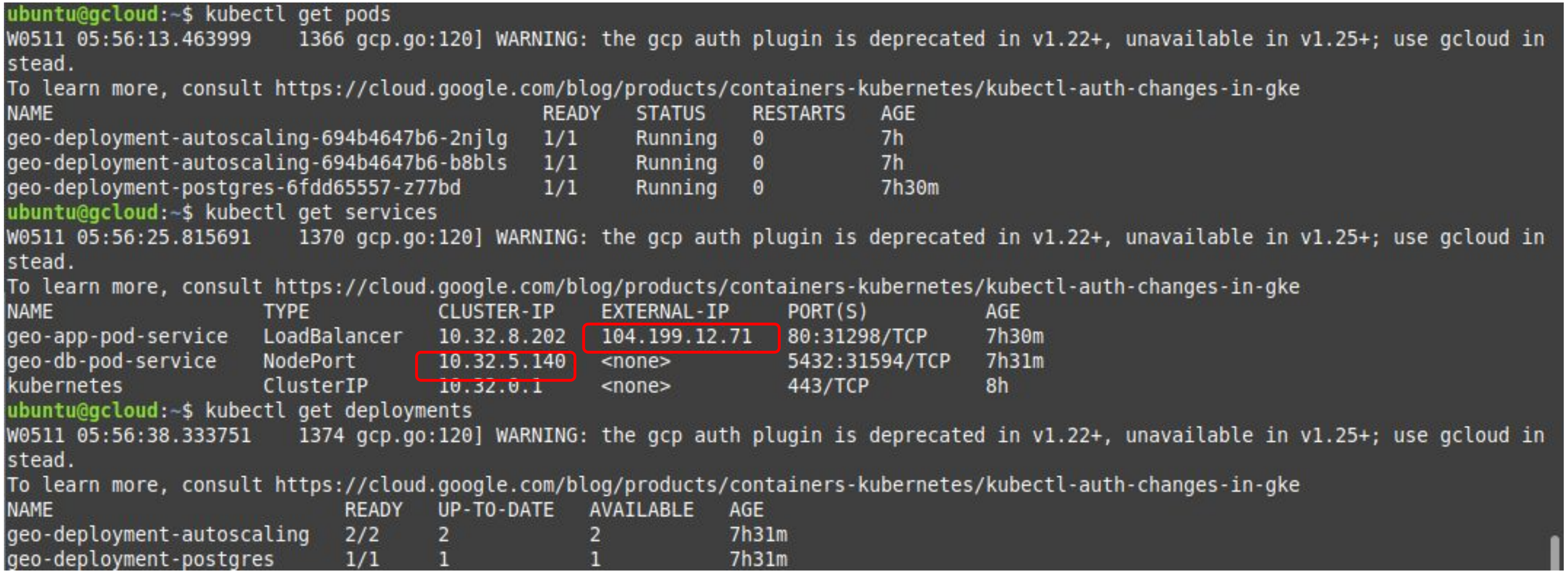
Create Infrastructure as for minikube and get IP addresses



```
ubuntu@gcloud:~$ kubectl get pods
W0511 05:56:13.463999    1366 gcp.go:120] WARNING: the gcp auth plugin is deprecated in v1.22+, unavailable in v1.25+; use gcloud in
stead.
To learn more, consult https://cloud.google.com/blog/products/containers-kubernetes/kubectl-auth-changes-in-gke
NAME                                        READY   STATUS    RESTARTS   AGE
geo-deployment-autoscaling-694b4647b6-2njlg   1/1     Running   0          7h
geo-deployment-autoscaling-694b4647b6-b8bls   1/1     Running   0          7h
geo-deployment-postgres-6fdd65557-z77bd       1/1     Running   0          7h30m
ubuntu@gcloud:~$ kubectl get services
W0511 05:56:25.815691    1370 gcp.go:120] WARNING: the gcp auth plugin is deprecated in v1.22+, unavailable in v1.25+; use gcloud in
stead.
To learn more, consult https://cloud.google.com/blog/products/containers-kubernetes/kubectl-auth-changes-in-gke
NAME                 TYPE           CLUSTER-IP    EXTERNAL-IP     PORT(S)          AGE
geo-app-pod-service  LoadBalancer   10.32.8.202   104.199.12.71   80:31298/TCP     7h30m
geo-db-pod-service   NodePort       10.32.5.140   <none>          5432:31594/TCP   7h31m
kubernetes           ClusterIP      10.32.0.1     <none>          443/TCP          8h
ubuntu@gcloud:~$ kubectl get deployments
W0511 05:56:38.333751    1374 gcp.go:120] WARNING: the gcp auth plugin is deprecated in v1.22+, unavailable in v1.25+; use gcloud in
stead.
To learn more, consult https://cloud.google.com/blog/products/containers-kubernetes/kubectl-auth-changes-in-gke
NAME                         READY   UP-TO-DATE   AVAILABLE   AGE
geo-deployment-autoscaling   2/2     2            2           7h31m
geo-deployment-postgres      1/1     1            1           7h31m
```

Rebuild application war-file with real addresses and push it to docker hub with new tag, update image for App Load Balancer Pods

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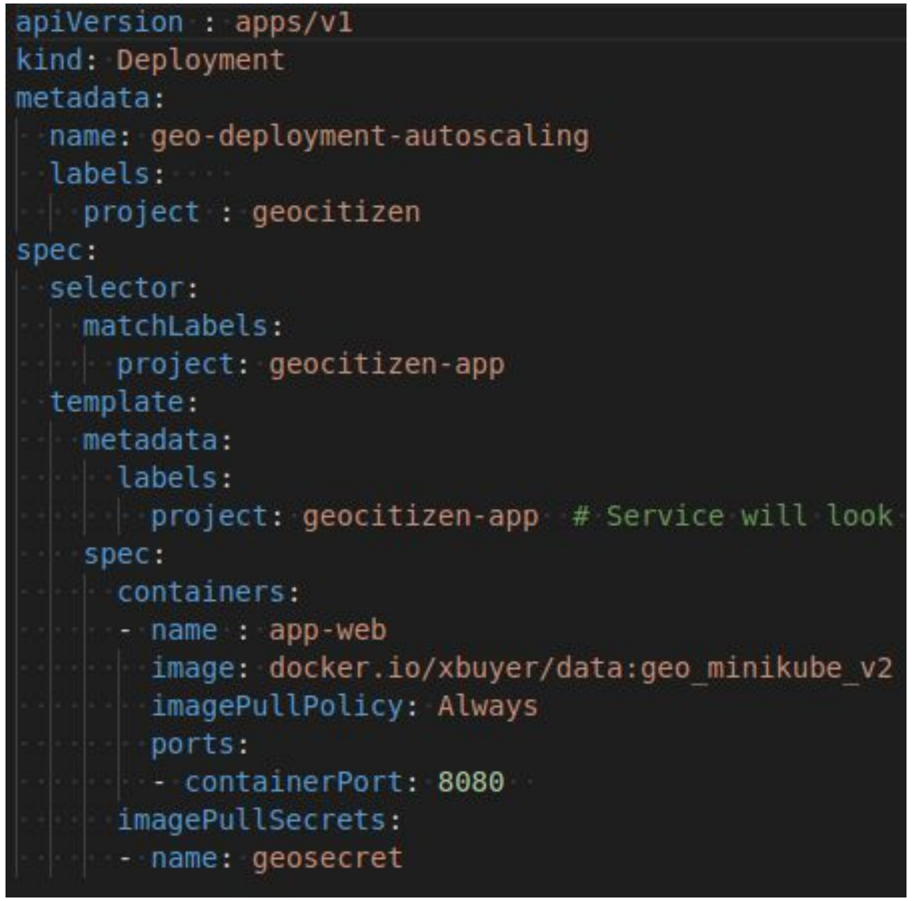
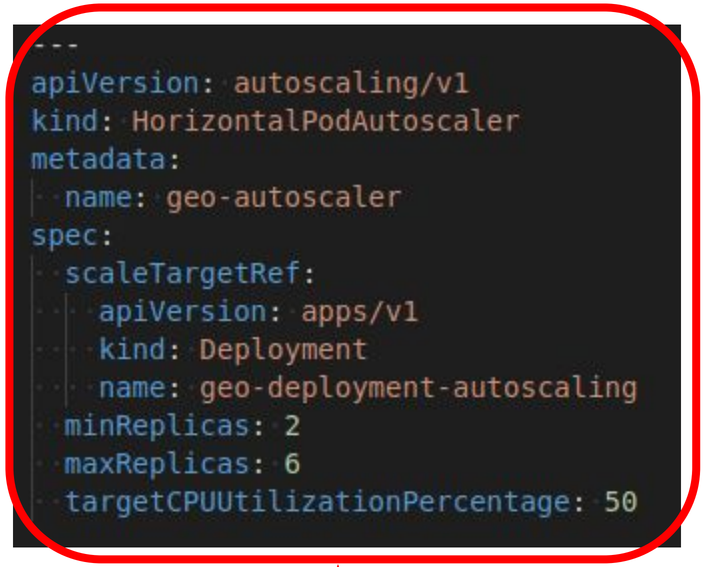
app.yml for GKE

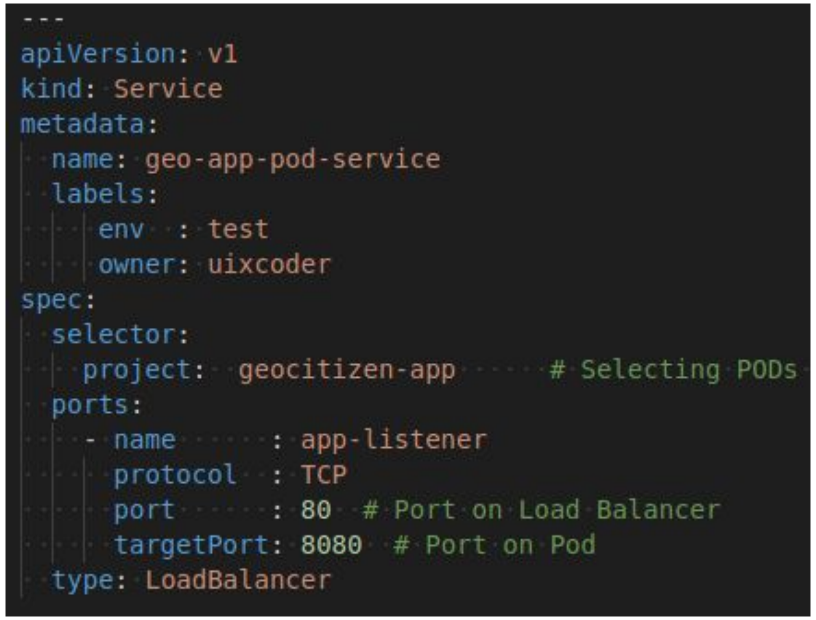


```yaml
apiVersion : apps/v1
kind: Deployment
metadata:
  name: geo-deployment-autoscaling
  labels:
    project : geocitizen
spec:
  selector:
    matchLabels:
      project: geocitizen-app
  template:
    metadata:
      labels:
        project: geocitizen-app  # Service will look
    spec:
      containers:
      - name : app-web
        image: docker.io/xbuyer/data:geo_minikube_v2
        imagePullPolicy: Always
        ports:
        - containerPort: 8080
      imagePullSecrets:
      - name: geosecret
```



```yaml
---
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: geo-autoscaler
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: geo-deployment-autoscaling
  minReplicas: 2
  maxReplicas: 6
  targetCPUUtilizationPercentage: 50
```

Modified for GKE



```yaml
---
apiVersion: v1
kind: Service
metadata:
  name: geo-app-pod-service
  labels:
     env  : test
     owner: uixcoder
spec:
  selector:
    project:  geocitizen-app      # Selecting PODs
  ports:
    - name      : app-listener
      protocol  : TCP
      port      : 80  # Port on Load Balancer
      targetPort: 8080  # Port on Pod
  type: LoadBalancer
```

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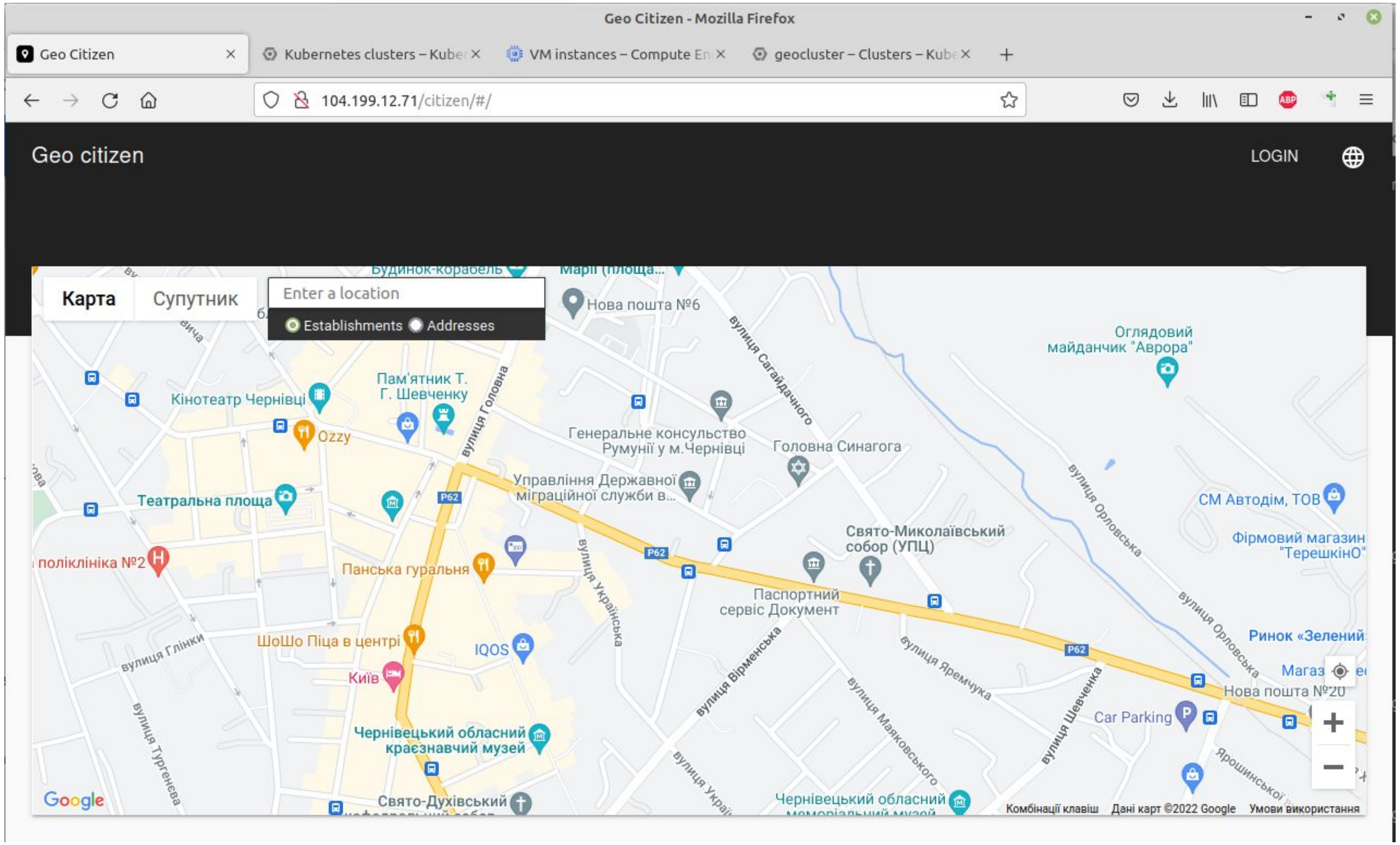

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