Ch-134.DevOps/Cisco

Demo 4

IT Academy

softserve

Team 2

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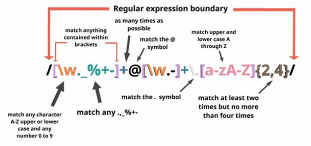
https://github.com/idanylyuk/DevOps

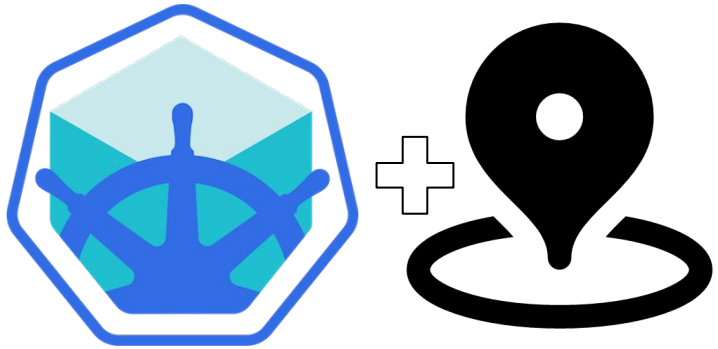


https://github.com/idanylyuk/DevOps

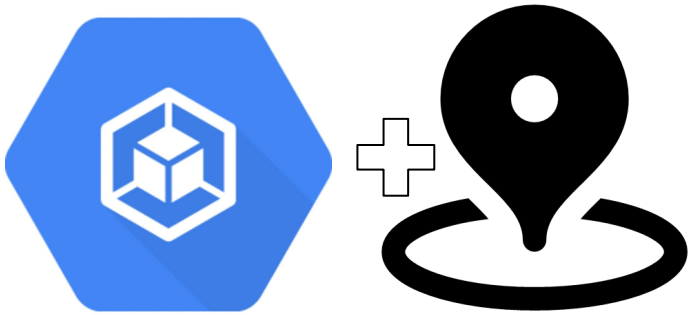
Report plan

Kubernetes

Minikube GeoCitizen Deployment



GKE Geocitizen Deployment



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Kubernetes

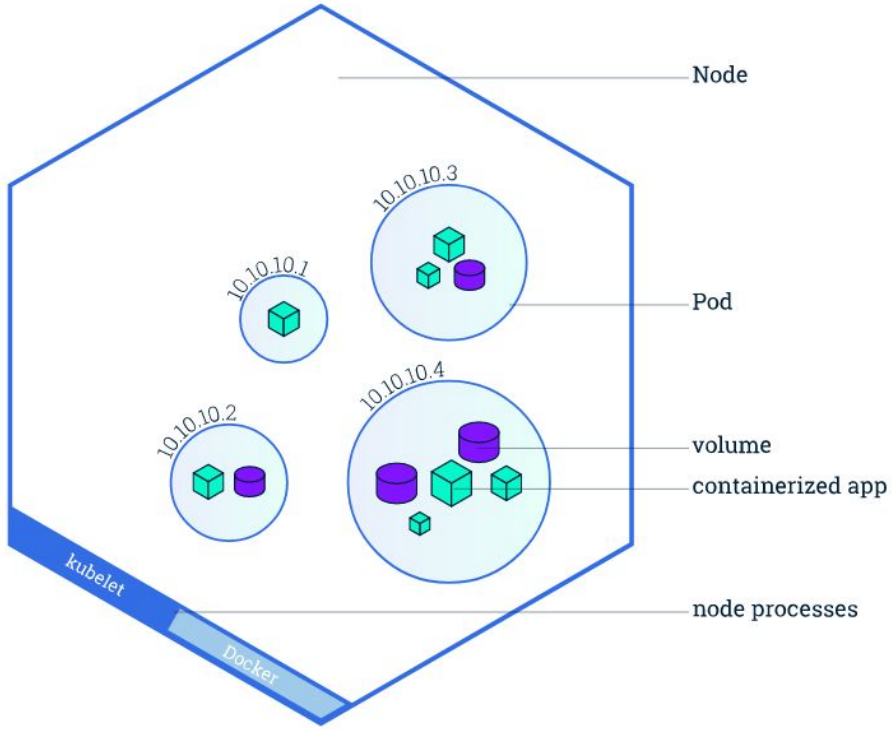
https://kubernetes.io

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

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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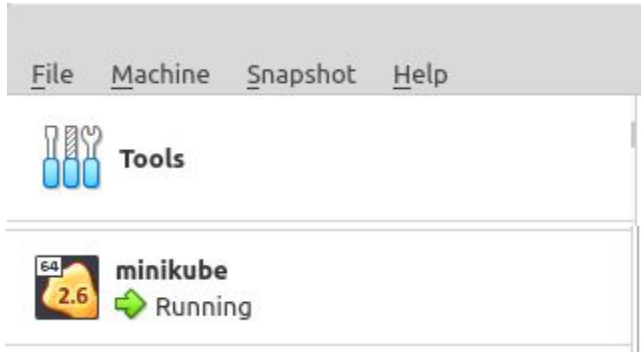
minikube



All minikube files are stored in directory ~/.minikube

minikube 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/
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
```

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:~$ 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
```

```
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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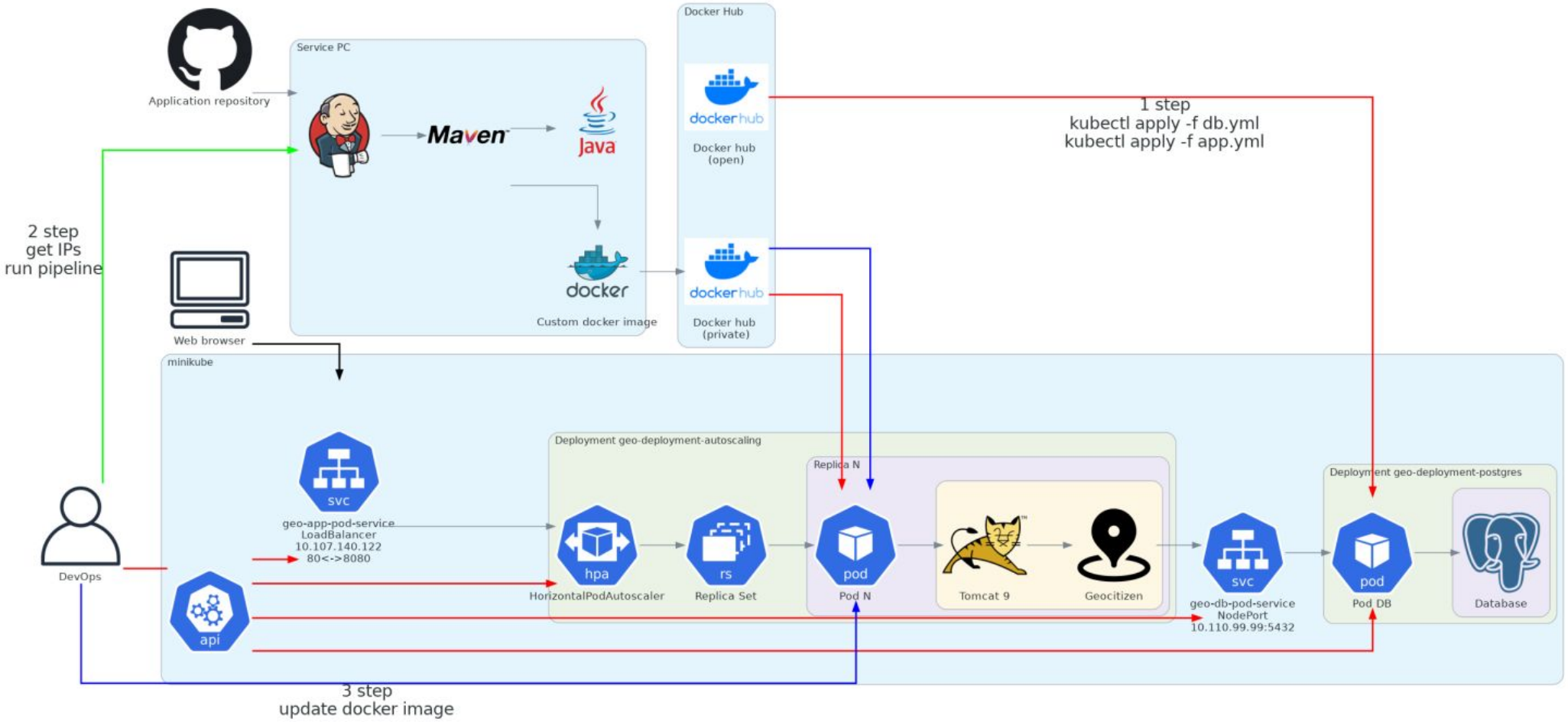
minikube GeoCitizen deployment



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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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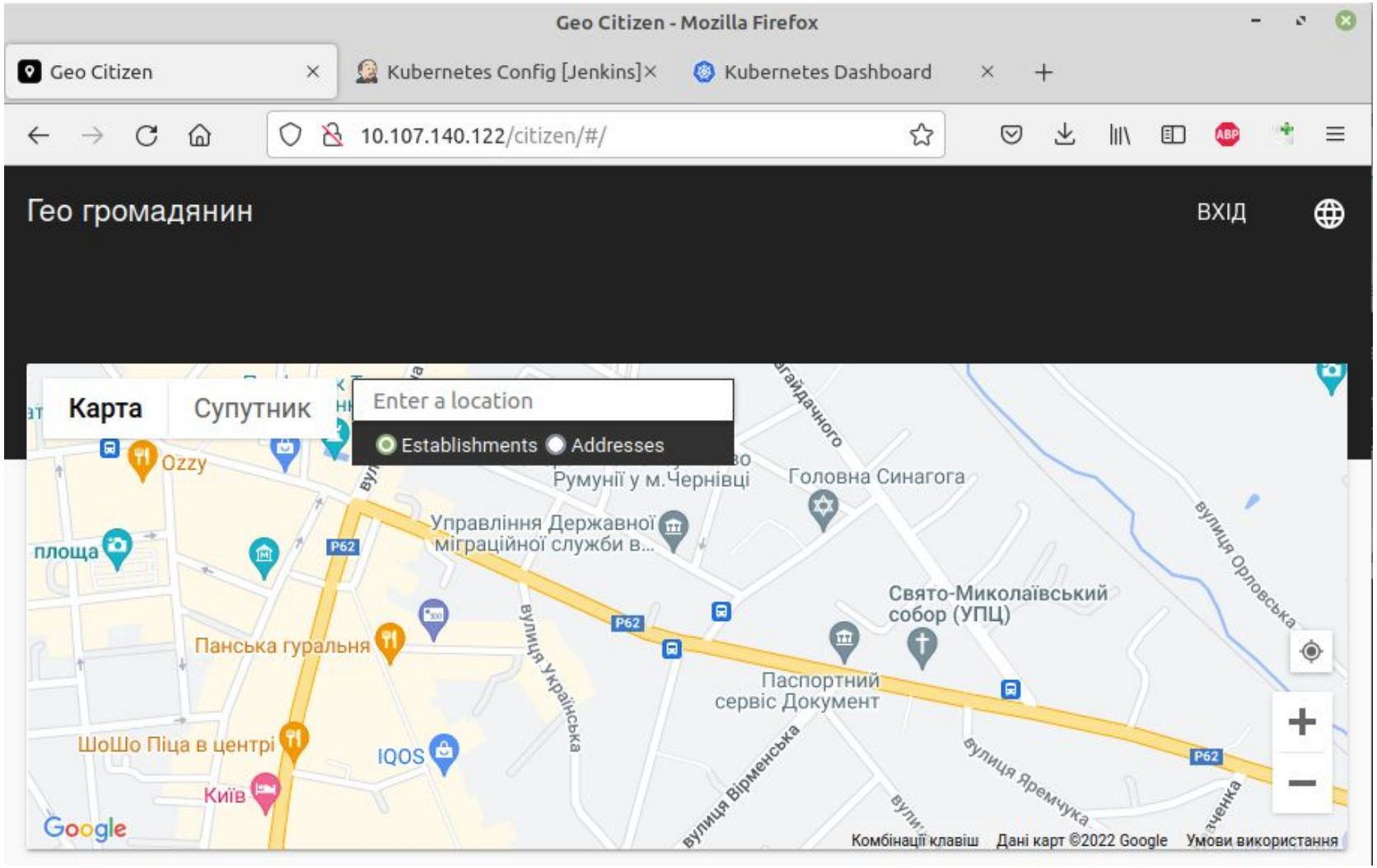
minikube GeoCitizen deployment

9.Use application



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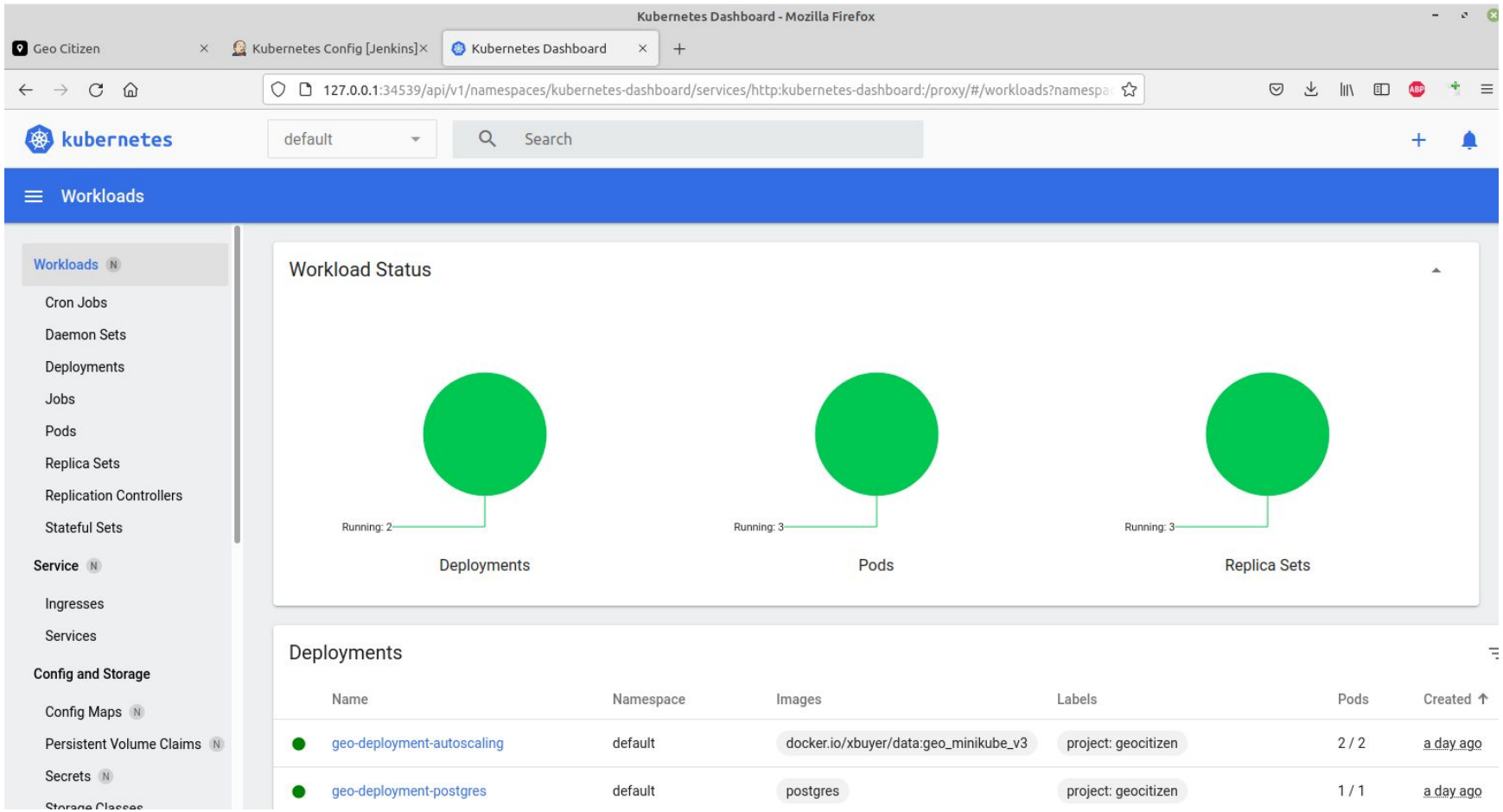
minikube GeoCitizen deployment

10.Dashboard with created infrastructure

```
$ minikube dashboard
```



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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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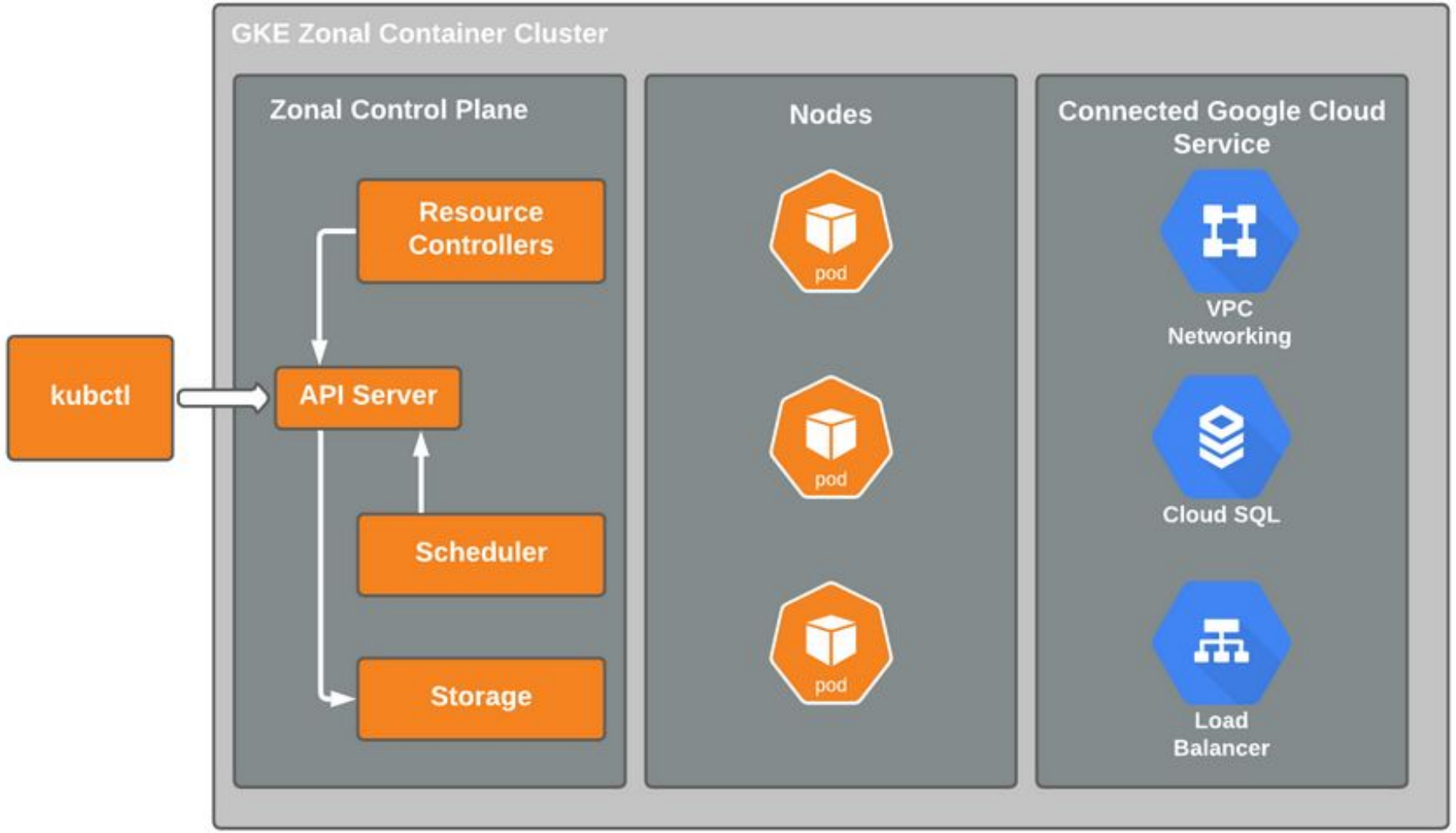
Kubernetes on GCP (GKE)



Google Kubernetes Engine (GKE)

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GKE start

Kubernetes clusters CREATE DEPLOY REFRESH OPERATIONS

OVERVIEW COST OPTIMIZATION

Filter Enter property name or value

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

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

Clusters EDIT DELETE OPERATIONS HELP ASSISTANT

geocluster

DETAILS NODES STORAGE LOGS

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	🔒

Node Pools

Filter Filter 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.
```

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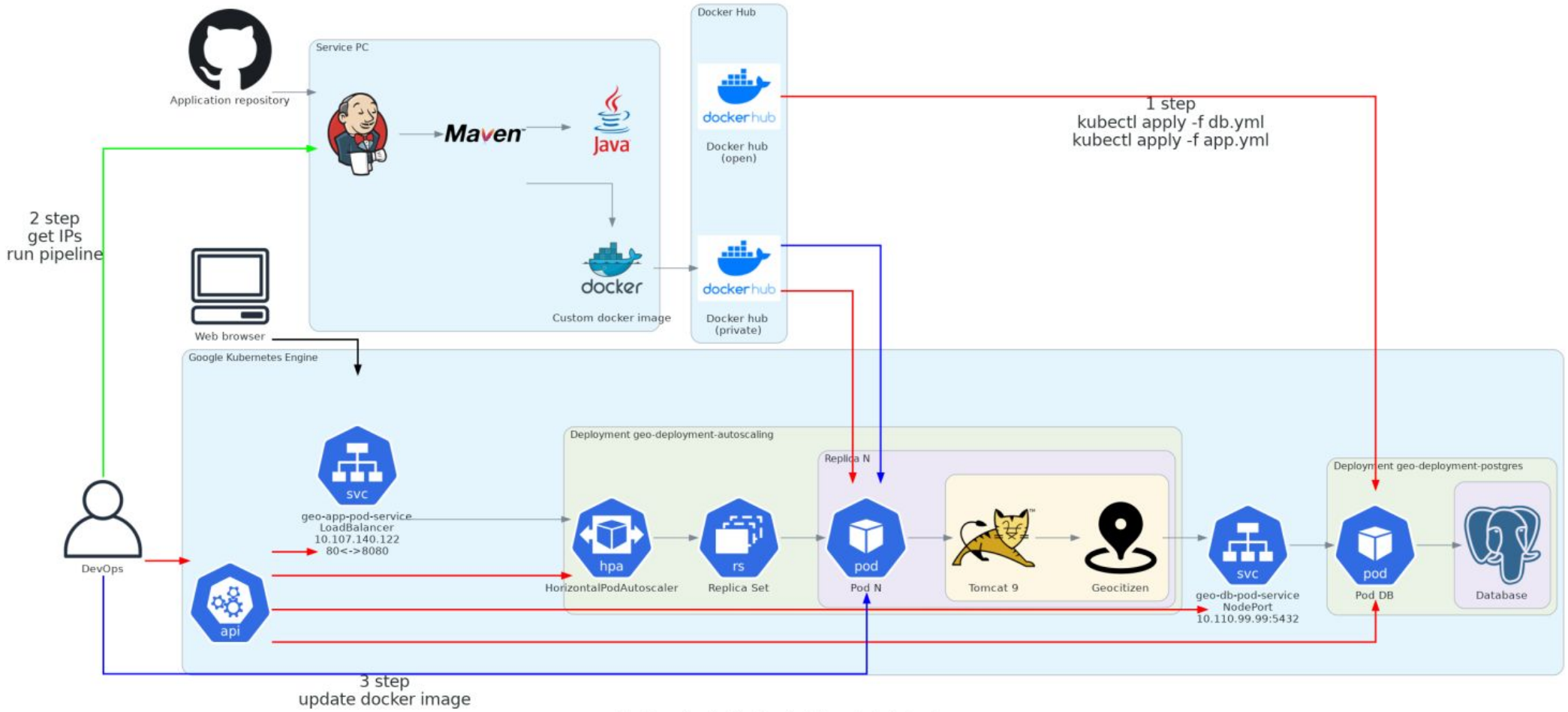
GKE GeoCitizen deployment



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GKE GeoCitizen deployment

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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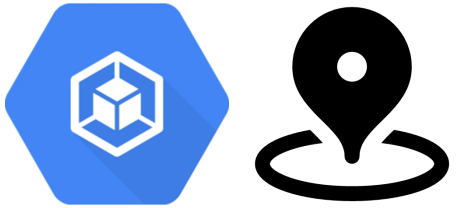
app.yml for GKE



```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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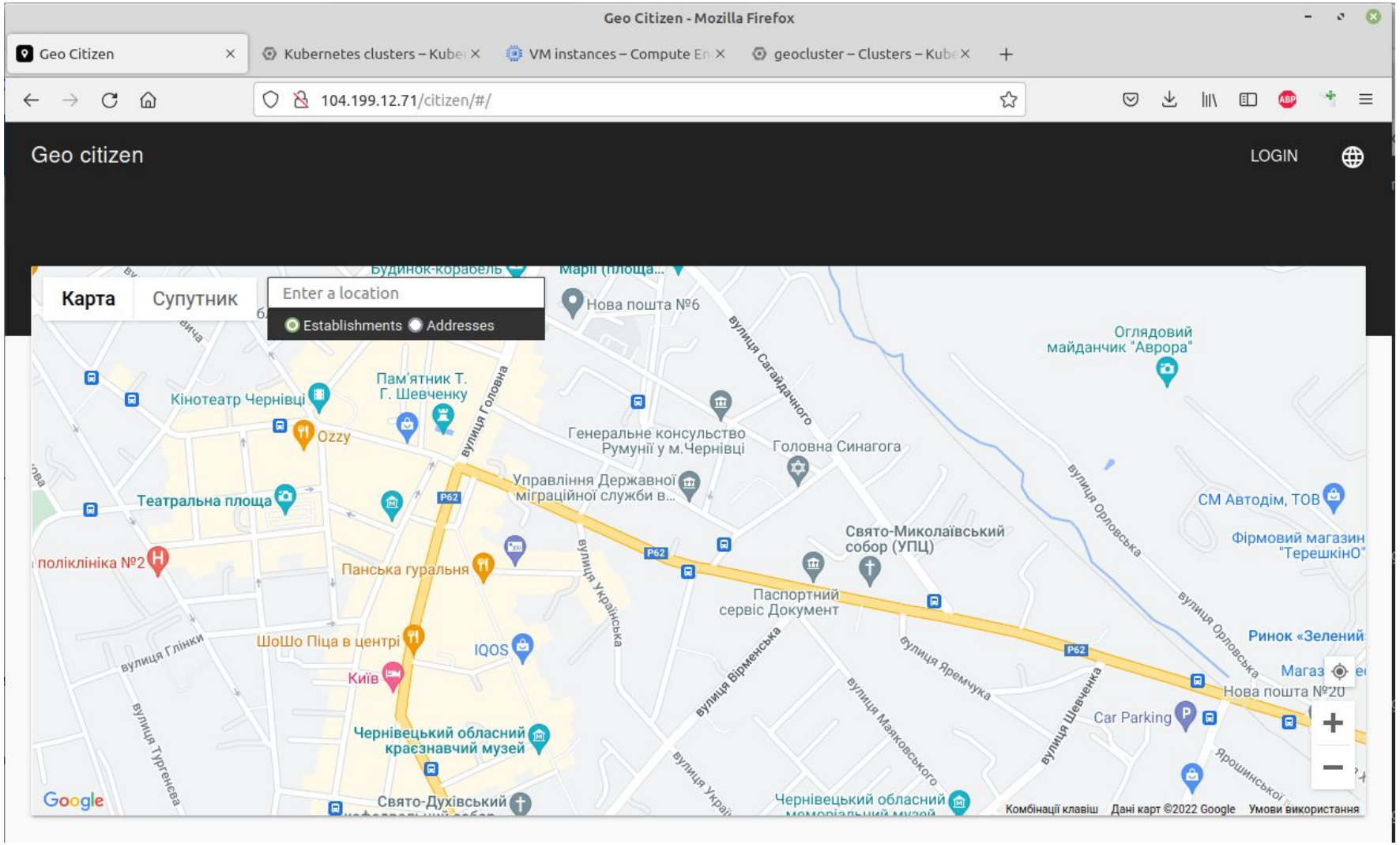
GKE GeoCitizen deployment



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