

# LAB 4

```
● akshatsrivastava@Akshats-Air Lab4 % minikube start
🐳 minikube v1.33.1 on Darwin 14.5 (arm64)
🔧 Using the docker driver based on existing profile
👉 Starting "minikube" primary control-plane node in "minikube" cluster
📦 Pulling base image v0.0.44 ...
🔄 Restarting existing docker container for "minikube" ...
🔧 Preparing Kubernetes v1.30.0 on Docker 26.1.1 ...
🔧 Verifying Kubernetes components...
  ▪ Using image docker.io/kubernetes/dashboard:v2.7.0
  ▪ Using image gcr.io/k8s-minikube/storage-provisioner:v5
  ▪ Using image docker.io/kubernetes/metrics-scraper:v1.0.8
💡 Some dashboard features require the metrics-server addon. To enable all features please run:

    minikube addons enable metrics-server

🔧 Enabled addons: default-storageclass, storage-provisioner, dashboard
👉 Done! kubectrl is now configured to use "minikube" cluster and "default" namespace by default
● akshatsrivastava@Akshats-Air Lab4 % kubectrl create -f - <<EOF
apiVersion: v1
kind: PersistentVolume
metadata:
  name: ethereum-pv
spec:
  capacity:
    storage: 50Gi
  accessModes:
    - ReadWriteOnce
  hostPath:
    path: "/mnt/data"
EOF
Error from server (AlreadyExists): error when creating "STDIN": persistentvolumes "ethereum-pv" already exists
● akshatsrivastava@Akshats-Air Lab4 % kubectrl create -f - <<EOF
apiVersion: v1
kind: PersistentVolume
metadata:
  name: ethereum-pv1
spec:
  capacity:
    storage: 50Gi
  accessModes:
    - ReadWriteOnce
  hostPath:
    path: "/mnt/data"
EOF
persistentvolume/ethereum-pv1 created
● akshatsrivastava@Akshats-Air Lab4 % kubectrl create -f - <<EOF
```

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: ethereum-pvc1
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 50Gi
EOF
persistentvolumeclaim/ethereum-pvc1 created
● akshatsrivastava@Akshats-Air Lab4 % kubectrl create -f - <<EOF
apiVersion: apps/v1
kind: StatefulSet
metadata:
  name: ethereum-node1
spec:
  selector:
    matchLabels:
      app: ethereum
  serviceName: "ethereum"
  replicas: 3
  template:
    metadata:
      labels:
        app: ethereum
    spec:
      containers:
        - name: ethereum
          image: ethereum/client-go:latest
          ports:
            - containerPort: 30303
          volumeMounts:
            - name: ethereum-storage
              mountPath: /root/.ethereum
          volumes:
            - name: ethereum-storage
              persistentVolumeClaim:
                claimName: ethereum-pvc
      EOF
statefulset.apps/ethereum-node1 created
● akshatsrivastava@Akshats-Air Lab4 % kubectrl create -f - <<EOF
apiVersion: apps/v1
```

0 0 0

Ln 7, Col 18 (32 selected) Spaces: 2 UTF-8 LF YAML

```

kind: ReplicaSet
metadata:
  name: ethereum-frontend1
spec:
  replicas: 2
  selector:
    matchLabels:
      app: ethereum-frontend
  template:
    metadata:
      labels:
        app: ethereum-frontend
    spec:
      containers:
        - name: frontend
          image: my-frontend-image:latest
          ports:
            - containerPort: 80
EOF

replicaset.apps/ethereum-frontend1 created
akshatsrivastava@Akshats-Air Lab4 % # Service for Ethereum Nodes
kubectl create -f - <<EOF
apiVersion: v1
kind: Service
metadata:
  name: ethereum-service1
spec:
  selector:
    app: ethereum
  ports:
    - protocol: TCP
      port: 30303
      targetPort: 30303
  type: ClusterIP
EOF

kubectl create -f - <<EOF
apiVersion: v1
kind: Service
metadata:
  name: frontend-service1
spec:
  selector:
    app: ethereum-frontend
  ports:

```

0 0 0

Ln 7, Col 18 (32 selected) Spaces: 2 UTF-8 LF YAML

```

  ports:
    - protocol: TCP
      port: 80
      targetPort: 80
  type: LoadBalancer
EOF

zsh: command not found: #
service/ethereum-service1 created
service/frontend-service1 created
akshatsrivastava@Akshats-Air Lab4 % kubectl create -f - <<EOF
apiVersion: autoscaling/v2beta1
kind: HorizontalPodAutoscaler
metadata:
  name: frontend-hpa1
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: ReplicaSet
    name: ethereum-frontend
  minReplicas: 2
  maxReplicas: 10
  metrics:
    - type: Resource
      resource:
        name: cpu
        targetAverageUtilization: 50
EOF

error: resource mapping not found for name: "frontend-hpa1" namespace: "" from "STDIN": no matches for kind "HorizontalPodAutoscaler" in version "autoscaling/v2beta1"
ensure CRDs are installed first
akshatsrivastava@Akshats-Air Lab4 % kubectl create -f - <<EOF
apiVersion: autoscaling/v2beta1
kind: HorizontalPodAutoscaler
metadata:
  name: frontend-hpa
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: ReplicaSet
    name: ethereum-frontend
  minReplicas: 2
  maxReplicas: 10
  metrics:
    - type: Resource

```

0 0 0

Ln 7, Col 18 (32 selected) Spaces: 2 UTF-8 LF YAML

```
kubectl create -f - <<EOF
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: ethereum-rolebinding1
subjects:
- kind: User
  name: ethereum-user
  apiGroup: rbac.authorization.k8s.io
zsh: command not found: #
role.rbac.authorization.k8s.io/ethereum-role1 created
rolebinding.rbac.authorization.k8s.io/ethereum-rolebinding1 created
akshatsrivastava@Akshats-Air Lab4 % minikube dashboard
👉 Verifying dashboard health ...
🚀 Launching proxy ...
👉 Verifying proxy health ...
🔗 Opening http://127.0.0.1:49707/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/ in your default browser...
```

# Minikube Dashboard

127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/persistentvolumeclaim?namespace=default

New TabGmailYouTubeMapsPopcorn Time - W...ChatGPT

kubernetesdefaultSearch

Config And Storage > Persistent Volume Claims

Replication Controllers

Stateful Sets

Service

Ingresses

Ingress Classes

Services

Config and Storage

Config Maps

Persistent Volume Claims

Secrets

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events

Namespaces

Network Policies

Nodes

Persistent Volume Claims

Name	Labels	Status	Volume	Capacity	Access Modes	Storage Class	Created
ethereum-pvc	-	Bound	pvc-115a8867-b1ac-4fc2-8ae5-de946c9ec275	50Gi	ReadWriteOnce	standard	8 minutes ago
ethereum-storage-ethereum-node-2	app: ethereum	Bound	pvc-31490acb-e847-4998-8d5d-3f519efee0fa	50Gi	ReadWriteOnce	standard	9 minutes ago
ethereum-storage-ethereum-node-1	app: ethereum	Bound	pvc-97929e1b-fc7d-4fdc-bd33-e2eef2de6f7b	50Gi	ReadWriteOnce	standard	9 minutes ago
ethereum-storage-ethereum-node-0	app: ethereum	Bound	pvc-2fe4b3bc-4f01-4739-a901-da4d225d4d8f	50Gi	ReadWriteOnce	standard	9 minutes ago
mongodb-data-mongodb-stateful-set-1	app: mongodb	Bound	pvc-544914bf-32d1-492e-8c77-6e11644da146	1Gi	ReadWriteOnce	standard	2 hours ago
mongodb-data-mongodb-stateful-set-0	app: mongodb	Bound	pvc-f5359282-4574-4eff-a42d-17bd8858ce73	1Gi	ReadWriteOnce	standard	2 hours ago

127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/replicationcontroller?namespace=default

127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/persistentvolume?namespace=default

New TabGmailYouTubeMapsPopcorn Time - W...ChatGPT

kubernetesdefaultSearch

Cluster > Persistent Volumes

Config Maps

Persistent Volume Claims

Secrets

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events

Namespaces

Network Policies

Nodes

Persistent Volumes

Role Bindings

Roles

Service Accounts

Custom Resource Definitions

Settings

About


Persistent Volumes

Name	Capacity	Access Modes	Reclaim Policy	Status	Claim	Storage Class	Reason	Created
ethereum-pv	storage: 50 Gi	ReadWriteOnce	Retain	Available	-	-	-	11 minutes ago
pvc-115a8867-b1ac-4fc2-8ae5-de946c9ec275	storage: 50 Gi	ReadWriteOnce	Delete	Bound	default/ethereum-pvc	standard	-	11 minutes ago
pvc-31490acb-e847-4998-8d5d-3f519efee0fa	storage: 50 Gi	ReadWriteOnce	Delete	Bound	default/ethereum-storage-ethereum-node-2	standard	-	11 minutes ago
pvc-97929e1b-fc7d-4fdc-bd33-e2eef2de6f7b	storage: 50 Gi	ReadWriteOnce	Delete	Bound	default/ethereum-storage-ethereum-node-1	standard	-	11 minutes ago
pvc-2fe4b3bc-4f01-4739-a901-da4d225d4d8f	storage: 50 Gi	ReadWriteOnce	Delete	Bound	default/ethereum-storage-ethereum-node-0	standard	-	11 minutes ago
pvc-544914bf-32d1-492e-8c77-6e11644da146	storage: 1 Gi	ReadWriteOnce	Delete	Bound	default/mongodb-data-mongodb-stateful-set-1	standard	-	2 hours ago
pvc-f5359282-4574-4eff-a42d-17bd8858ce73	storage: 1 Gi	ReadWriteOnce	Delete	Bound	default/mongodb-data-mongodb-stateful-set-0	standard	-	2 hours ago

127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/persistentvolume/pvc-31490acb-e847-4998-8d5d-3f519efee0fa?namespace=default

← → ↺ 127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/role/default/ethereum-role?namespace=default ☆ 🏠 🌐 🔄 📄 ⋮

New Tab Gmail YouTube Maps 🍿 Popcorn Time - W... ChatGPT

 **kubernetes**

default ▾ 🔍 Search

+ 🔔

Cluster > Roles > ethereum-role

Persistent Volume Claims <sup>N</sup>

Secrets <sup>N</sup>

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events <sup>N</sup>

Namespaces

Network Policies <sup>N</sup>

Nodes

Persistent Volumes

Role Bindings <sup>N</sup>

**Roles <sup>N</sup>**

Service Accounts <sup>N</sup>

Custom Resource Definitions

Settings

About

Metadata

Name	Namespace	Created	Age	UID
ethereum-role	default	Jun 1, 2024	7 minutes ago	2632fe20-545c-4091-9fea-e6effd054281

Annotations


[kubectl.kubernetes.io/last-applied-configuration](#)

Rules

Resources	Non-resource URL	Resource Names	Verbs	API Groups
pods, services, persistentvolumeclaims	-	-	get, list, watch, create, update, patch, delete	

← → ↺ 127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/rolebinding/default/ethereum-rolebinding?names... ☆ 🏠 🌐 🔄 📄 ⋮

New Tab Gmail YouTube Maps 🍿 Popcorn Time - W... ChatGPT

 **kubernetes**

default ▾ 🔍 Search

+ 🔔

Cluster > Role Bindings > ethereum-rolebinding

Services <sup>N</sup>

Config and Storage

Config Maps <sup>N</sup>

Persistent Volume Claims <sup>N</sup>

Secrets <sup>N</sup>

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events <sup>N</sup>

Namespaces

Network Policies <sup>N</sup>

Nodes

Persistent Volumes

**Role Bindings <sup>N</sup>**

Roles <sup>N</sup>

Service Accounts <sup>N</sup>

Custom Resource Definitions

Settings

Metadata

Name	Namespace	Created	Age	UID
ethereum-rolebinding	default	Jun 1, 2024	7 minutes ago	0b1da7f8-f35b-4b17-af8d-9a40027b990e

Annotations

[kubectl.kubernetes.io/last-applied-configuration](#)

Resource information

Role Reference

[ethereum-role](#)

Subjects

Name	Namespace	Kind	API Group
<a href="#">ethereum-sa</a>	default	ServiceAccount	

← → ↻ 127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/serviceaccount/default/ethereum-sa?namespace=... ☆ 🏠 🌐 📄 📌 ⋮

New Tab Gmail YouTube Maps Popcorn Time - W... ChatGPT

**kubernetes** default 🔍 Search + 🔔

Cluster > Service Accounts > **ethereum-sa** ✎ 🗑️

Persistent Volume Claims <sup>N</sup>

Secrets <sup>N</sup>

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events <sup>N</sup>

Namespaces

Network Policies <sup>N</sup>

Nodes

Persistent Volumes

Role Bindings <sup>N</sup>

Roles <sup>N</sup>

Service Accounts <sup>N</sup>

Custom Resource Definitions

Settings

About

### Metadata

Name	Namespace	Created	Age	UID
ethereum-sa	default	Jun 1, 2024	8 minutes ago	ee542165-de3b-4ca1-ab34-23ede20b312c

Annotations

kubecti.kubernetes.io/last-applied-configuration

### Secrets

There is nothing to display here

No resources found.

### Image Pull Secrets

There is nothing to display here

No resources found.

← → ↻ 127.0.0.1:53147/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/statefulset/default/ethereum-node?namespace=... ☆ 🏠 🌐 📄 📌 ⋮

New Tab Gmail YouTube Maps Popcorn Time - W... ChatGPT

**kubernetes** default 🔍 Search + 🔔

Workloads > Stateful Sets > **ethereum-node** ☰ ⋮ ✎ 🗑️

Persistent Volume Claims <sup>N</sup>

Secrets <sup>N</sup>

Storage Classes

Cluster

Cluster Role Bindings

Cluster Roles

Events <sup>N</sup>

Namespaces

Network Policies <sup>N</sup>

Nodes

Persistent Volumes

Role Bindings <sup>N</sup>

Roles <sup>N</sup>

Service Accounts <sup>N</sup>

Custom Resource Definitions

Settings

About

### Metadata

Name	Namespace	Created	Age	UID
ethereum-node	default	Jun 1, 2024	14 minutes ago	35c25a2d-173b-4593-802c-5744878ff5c6

Annotations

kubecti.kubernetes.io/last-applied-configuration

### Resource information

Images

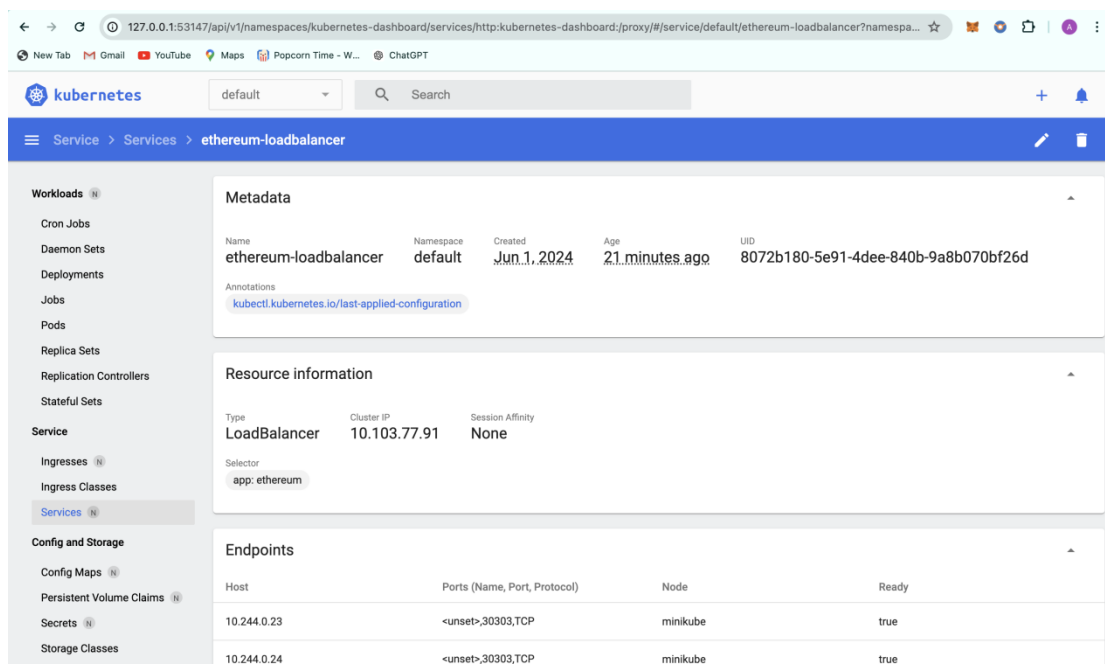
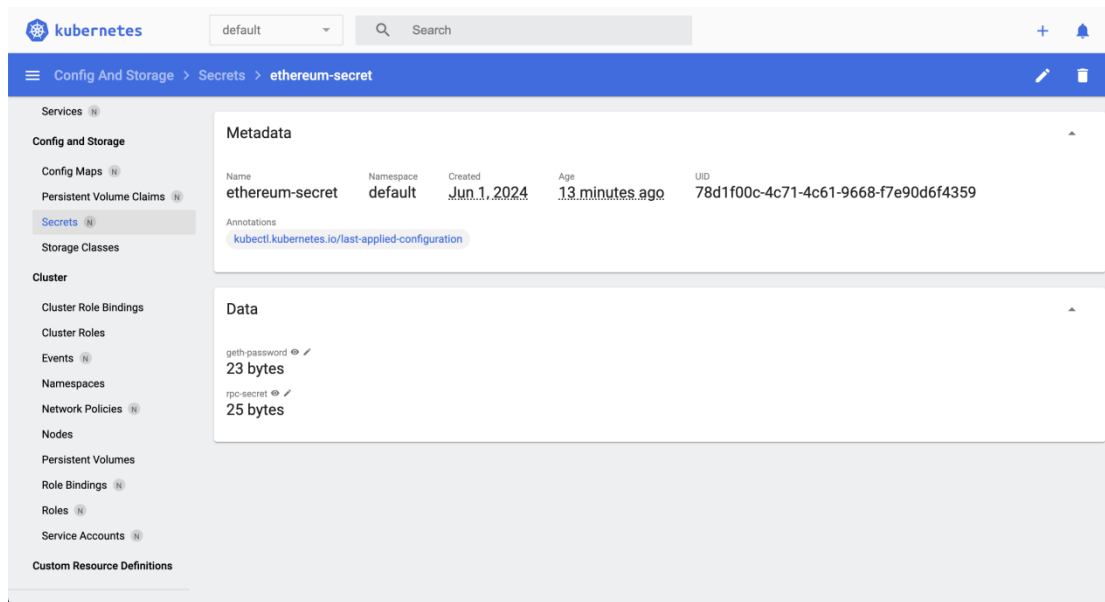
ethereum/client-go:latest

### Pods status

Running	Desired
3	3

### Pods

Name	Image	Label	Node	Status	Restart	Pod IP	IP Address	Memory Usage	Created
------	-------	-------	------	--------	---------	--------	------------	--------------	---------



## Design Rationals

- Ethereum nodes need persistent storage to maintain the blockchain state, making StatefulSets the appropriate choice. ReplicaSets can be used for auxiliary services if needed.

- Persistent storage is critical for maintaining blockchain data integrity. Using PV and PVC with StatefulSets ensures that each Ethereum node retains its data even if the pod is rescheduled.
- HPA ensures that the application can handle varying loads by scaling the number of pods. This is particularly useful for handling high transaction volumes. Cluster Autoscaler complements this by ensuring sufficient node capacity.
- Using a LoadBalancer service ensures efficient distribution of traffic among Ethereum nodes, improving availability and performance. The Ingress Controller facilitates managing access to different services under a single IP.
- Managing secrets securely is crucial for the security of the Ethereum network. Kubernetes Secrets allow for encrypted storage and controlled access.
- RBAC and Service Accounts enhance security by ensuring that each component and user has the necessary permissions without over-provisioning access.