

Lab 6 Report

Course: Cloud_Computing

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GitHub Repo: yangzheng.github.io — Repository for personal website project using GitHub Pages

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1. Objectives

Install and run a local single-node Kubernetes cluster using Minikube.

Deploy, explore, expose, scale, and update an application using `kubectl`.

Document the steps with screenshots and explanations.

2. Environment & Prerequisites

Operating System: windows11

Minikube Version: minikube version: v1.37.0

Kubectl Version:

Client Version: v1.34.0

Kustomize Version: v5.7.1

Server Version: v1.34.0

Driver: docker

Hardware: ≥ 2 CPUs, ≥ 2 GB RAM, ≥ 20 GB disk space

3. Lab Steps & Observations

For each section below, include your **commands**, **screenshots**, **observations**, and **notes**.

3.1 Start Minikube Cluster

Commands:

```
minikube start  
Minikube dashboard  
kubectl version  
kubectl get nodes
```

Screenshots:

```
PS C:\Windows\system32> minikube start  
* Microsoft Windows 10 Home China 10.0.22631.5624 Build 22631.5624 上的 minikube v1.37.0  
* 根据现有的配置文件使用 docker 驱动程序  
* 在集群中 "minikube" 启动节点 "minikube" primary control-plane  
* 正在拉取基础镜像 v0.0.48 ...  
* 正在更新运行中的 docker "minikube" container ...-  
! 从 Minikube 的 container 内部连接到 https://registry.cn-hangzhou.aliyuncs.com/google_containers/ 失败  
* 要获取新的外部镜像, 可能需要配置代理: https://minikube.sigs.k8s.io/docs/reference/networking/proxy/  
* 正在 Docker 28.4.0 中准备 Kubernetes v1.34.0.../  
* 正在验证 Kubernetes 组件...  
- 正在使用镜像 registry.cn-hangzhou.aliyuncs.com/google_containers/storage-provisioner:v5  
* 启用插件: storage-provisioner, default-storageclass  
  
! C:\Program Files\Docker\Docker\resources\bin\kubectl.exe 的版本为 1.32.2, 可能与 Kubernetes 1.34.0 不兼容。  
- 想要使用 kubectl v1.34.0 吗? 尝试使用 'minikube kubectl -- get pods -A' 命令  
* 完成! kubectl 现在已配置, 默认使用"minikube"集群和"default"命名空间
```

The screenshot shows the Kubernetes Dashboard interface. The title bar says "Hello Minikube | Kubernetes" and "Kubernetes Dashboard". The main content area is titled "Workloads" and contains a message: "There is nothing to display here". Below this message, there is a note in Chinese: "你可以部署一个容器化应用,选择其他命名空间,或者阅读 Dashboard 说明 了解更多。" On the left side, there is a sidebar with various navigation options: Cron Jobs, Daemon Sets, Deployments, Jobs, Pods, Replica Sets, Replication Controllers, Stateful Sets, Services, Ingresses, Ingress Classes, Config Maps, Persistent Volume Claims, Secrets, Storage Classes, Cluster Role Bindings, and Cluster Roles.

Observations:

Cluster started successfully

Dashboard started successfully

3.2 Deploy Application

Commands:

```
kubectl create deployment hello-minikube
--image=kicbase/echo-server:1.0
kubectl get deployments
kubectl get pods
```

Screenshots:

The screenshot shows a Windows command prompt window. The user runs the command "kubectl create deployment hello-node --image=registry.k8s.io/e2e-test-images/agnhost:2.53 -- /agnhost netexec --http-port=8080". The response shows the deployment was created successfully. Then, the user runs "kubectl get pods" to list the pods, which shows one pod named "hello-node-6c9b5f4b59-jfgbg" in the "Running" status with 1/1 readiness.

NAME	READY	STATUS	RESTARTS	AGE
hello-node-6c9b5f4b59-jfgbg	1/1	Running	0	60s

Observations:

Deployment created and pod(s) are running.

3.3 Explore Resources

Commands:

```
kubectl get pods  
kubectl describe pod <pod-name>  
kubectl logs <pod-name>
```

Screenshot:

The screenshot shows a Windows command prompt window with several commands run:

- `PS C:\Windows\system32> kubectl get pods` - Shows a table of pods:

NAME	READY	STATUS	RESTARTS	AGE
hello-node-6c9b5f4b59-jfgbg	1/1	Running	0	60s
- `PS C:\Windows\system32> kubectl expose deployment hello-node --type=LoadBalancer --port=8080` - Shows the service has been exposed.
- `PS C:\Windows\system32> minikube addons list` - Shows a table of available addons:

ADDON NAME	PROFILE	STATUS	MAINTAINER
ambassador	minikube	disabled	3rd party (Ambassador)
amd-gpu-device-plugin	minikube	disabled	3rd party (AMD)
auto-pause	minikube	disabled	minikube
cloud-spanner	minikube	disabled	Google
csi-hostpath-driver	minikube	disabled	Kubernetes
dashboard	minikube	enabled	Kubernetes
default-storageclass	minikube	enabled	Kubernetes
efk	minikube	disabled	3rd party (Elastic)
freshpod	minikube	disabled	Google
gcp-auth	minikube	disabled	Google
gvisor	minikube	disabled	minikube
headlamp	minikube	disabled	3rd party (kinvolk.io)
inacel	minikube	disabled	3rd party (InAccel [info@inacel.com])
ingress	minikube	disabled	Kubernetes
ingress-dns	minikube	disabled	minikube
inspektor-gadget	minikube	disabled	3rd party (inspektor-gadget.io)
istio	minikube	disabled	3rd party (Istio)
istio-provisioner	minikube	disabled	3rd party (Istio)
kong	minikube	disabled	3rd party (Kong HQ)
kubeflow	minikube	disabled	3rd party
kubetail	minikube	disabled	3rd party (kubetail.com)
kubevirt	minikube	disabled	3rd party (KubeVirt)
logviewer	minikube	disabled	3rd party (unknown)
metallb	minikube	disabled	3rd party (MetallLB)
- `PS C:\Windows\system32> kubectl get deployments` - Shows a table of deployments:

NAME	READY	UP-TO-DATE	AVAILABLE	AGE
kubernetes-bootcamp	1/1	1	1	45s

```
PS C:\Windows\system32> curl http://localhost:8001/version

StatusCode      : 200
StatusDescription: OK
Content         : {
                    "major": "1",
                    "minor": "34",
                    "emulationMajor": "1",
                    "emulationMinor": "34",
                    "minCompatibilityMajor": "1",
                    "minCompatibilityMinor": "33",
                    "gitVersion": "v1.34.0",
                    "gitCommit": "f28b4c..."
}
RawContent      : HTTP/1.1 200 OK
                  Audit-Id: b36a02ef-309b-4a28-8fc6-a58e9ff43dc1
                  X-Kubernetes-Pf-Flowschema-Uid: 6fd9e072-ec3d-474a-9d98-84708d4ca98c
                  X-Kubernetes-Pf-Prioritylevel-Uid: 21280c6c-95e6-4470-8813-04e6cc...
Forms          : {}
Headers         : {[Audit-Id, b36a02ef-309b-4a28-8fc6-a58e9ff43dc1], [X-Kubernetes-Pf-Flowschema-Uid, 6fd9e072-ec3d-474a-9d98-84708d4ca98c], [X-Kubernetes-Pf-Prioritylevel-Uid, 21280c6c-95e6-4470-8813-04e6cc65b989], [Content-Length, 379]...}
Images          : {}
InputFields     : {}
Links           : {}
ParsedHtml      : mshtml.HTMLDocumentClass
RawContentLength: 379
```

Observations:

Pod details and logs retrieved successfully.

Notes: Add findings or unexpected log behavior.

3.4 Expose Service

Commands:

```
kubectl expose deployment hello-minikube --type=NodePort --port=8080  
kubectl get services  
minikube service hello-minikube --url
```

Screenshot:

The screenshot shows a Windows command-line interface (cmd) window with several commands run in sequence:

- `PS C:\Windows\system32> kubectl get services`: Shows a table of services. One entry for 'kubernetes' is highlighted, showing it's a ClusterIP service with EXTERNAL-IP <none> and PORT(S) 443/TCP.
- `PS C:\Windows\system32> minikube service kubernetes-bootcamp --url`: Prints the URL `http://127.0.0.1:51311`.
- `PS C:\Windows\system32> kubectl expose deployment/kubernetes-bootcamp --type="NodePort" --port 8080`: Exposes the deployment 'kubernetes-bootcamp' on port 8080.
- `PS C:\Windows\system32> kubectl describe deployment`: Prints detailed information about the deployment 'kubernetes-bootcamp'. It includes fields like Name, Namespace, CreationTimestamp, Labels (app=kubernetes-bootcamp), Annotations (deployment.kubernetes.io/revision: 1), Selector (app=kubernetes-bootcamp), Replicas (1 desired | 1 updated | 1 total | 1 available | 0 unavailable), and StrategyType (RollingUpdate).
- `PS C:\Windows\system32> kubectl get pods -l app=kubernetes-bootcamp`: Shows a table of pods. One entry for 'kubernetes-bootcamp-658f6cbd58-z7wsd' is highlighted, showing it's READY 1/1, STATUS Running, and AGE 23m.
- `PS C:\Windows\system32> $POD_NAME = kubectl get pods -o go-template --template "{{range .items}}{{.metadata.name}}{{end}}"`: A PowerShell command to capture the name of the pod into a variable \$POD_NAME.
- `>> Write-Host "Name of the Pod: $POD_NAME"`: Prints the value of \$POD_NAME.
- `>> error: error parsing template {{range .items}}{{.metadata.name}}{{}}`: An error message from the previous command.
- `Name of the Pod:`: The final output of the command, showing the pod name.

Observations:

Service exposed successfully.

Accessible via NodePort URL.

Notes: Record NodePort number or accessibility issues.

3.5 Scale Application

Commands:

```
kubectl scale deployment hello-minikube --replicas=3  
kubectl get pods
```

Screenshot:

```
PS C:\Windows\system32> kubectl get rs  
NAME          DESIRED   CURRENT   READY   AGE  
kubernetes-bootcamp-658f6cbd58   1         1         1      27m  
  
PS C:\Windows\system32> kubectl scale deployments/kubernetes-bootcamp --replicas=4  
deployment.apps/kubernetes-bootcamp scaled  
  
PS C:\Windows\system32> kubectl get deployments  
NAME          READY   UP-TO-DATE   AVAILABLE   AGE  
kubernetes-bootcamp   4/4       4           4          32m  
  
PS C:\Windows\system32> kubectl get pods -o wide  
NAME          READY   STATUS    RESTARTS   AGE   IP           NODE   NOMINATED NODE   READINESS GATES  
kubernetes-bootcamp-658f6cbd58-7qfv4   1/1     Running   0          78s   10.244.0.15   minikube   <none>   <none>  
kubernetes-bootcamp-658f6cbd58-ncwnc   1/1     Running   0          78s   10.244.0.13   minikube   <none>   <none>  
kubernetes-bootcamp-658f6cbd58-sbxwd   1/1     Running   0          78s   10.244.0.14   minikube   <none>   <none>  
kubernetes-bootcamp-658f6cbd58-z7wsd   1/1     Running   0          33m   10.244.0.12   minikube   <none>   <none>  
  
PS C:\Windows\system32> kubectl scale deployments/kubernetes-bootcamp --replicas=2  
deployment.apps/kubernetes-bootcamp scaled  
PS C:\Windows\system32> kubectl get deployments  
NAME          READY   UP-TO-DATE   AVAILABLE   AGE  
kubernetes-bootcamp   2/2     2           2          35m  
PS C:\Windows\system32> kubectl get pods -o wide  
NAME          READY   STATUS    RESTARTS   AGE   IP           NODE   NOMINATED NODE   READINESS GATES  
kubernetes-bootcamp-658f6cbd58-7qfv4   1/1     Running   0          3m25s  10.244.0.15   minikube   <none>  
kubernetes-bootcamp-658f6cbd58-ncwnc   1/1     Terminating   0          3m25s  10.244.0.13   minikube   <none>  
kubernetes-bootcamp-658f6cbd58-sbxwd   1/1     Terminating   0          3m25s  10.244.0.14   minikube   <none>  
kubernetes-bootcamp-658f6cbd58-z7wsd   1/1     Running   0          35m   10.244.0.12   minikube   <none>
```

Observations:

Deployment scaled up to 4 pods and then scaled down to 2 pods.

Notes: Mention any differences in load balancing or startup times.

3.6 Update Application

Commands:

```
kubectl set image deployment/hello-minikube  
hello-minikube=kicbase/echo-server:2.0  
kubectl rollout status deployment/hello-minikube  
kubectl get pods
```

Screenshot:

The screenshot shows a Windows command-line interface (cmd) window with several lines of text output from Kubernetes commands. The first line shows the deployment image being updated. The second line shows the rollout status as successful. The third line is a warning message about a node being unexecable. The fourth line is a detailed log of events for the deployment, showing various status changes and errors related to image pulling. The fifth line shows the deployment being rolled back.

```
PS C:\Windows\system32> kubectl set image deployments/kubernetes-bootcamp kubernetes-bootcamp=docker.io/jocatalin/kubernetes-bootcamp:v2  
deployment.apps/kubernetes-bootcamp image updated  
PS C:\Windows\system32> kubectl rollout status deployments/kubernetes-bootcamp  
deployment "kubernetes-bootcamp" successfully rolled out  
node.kubernetes.io/unexecable:ROLXecuteOpExists for 500s  
Events:  
Type Reason Age From Message  
Normal Scheduled <invalid> default-scheduler Successfully assigned default/kubernetes-bootcamp-p-677ff875c4-remxm to minikube  
Normal BackOff 4s (x2 over <invalid>) kubelet Back-off pulling image "gcr.io/google-samples/kubernetes-bootcamp:v10"  
Warning Failed 4s (x2 over <invalid>) kubelet Error: ImagePullBackOff  
Normal Pulling <invalid> (x2 over <invalid>) kubelet Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v10"  
Warning Failed <invalid> (x2 over <invalid>) kubelet Failed to pull image "gcr.io/google-samples/kubernetes-bootcamp:v10": Error from daemon: manifest for gcr.io/google-samples/kubernetes-bootcamp:v10 not found: manifest unknown: Failed to fetch "v10"  
Warning Failed <invalid> (x2 over <invalid>) kubelet Error: ErrImagePull  
PS C:\Windows\system32> kubectl rollout undo deployments/kubernetes-bootcamp  
deployment.apps/kubernetes-bootcamp rolled back
```

Observations:

Deployment updated or rolled back successfully.

Notes: Record whether the update was smooth or required rollback.

4. Summary & Lessons Learned

What went well: *Smooth deployment, quick Minikube startup.*

Challenges: *Driver or network issues.*

Key Takeaways:

Kubernetes resource hierarchy and relationships.

How deployments manage pods and rollouts.

How scaling and updates maintain app availability.