

QUES 1 : Create a Kubernetes cluster using minikube

SOLN:

What is Minikube?

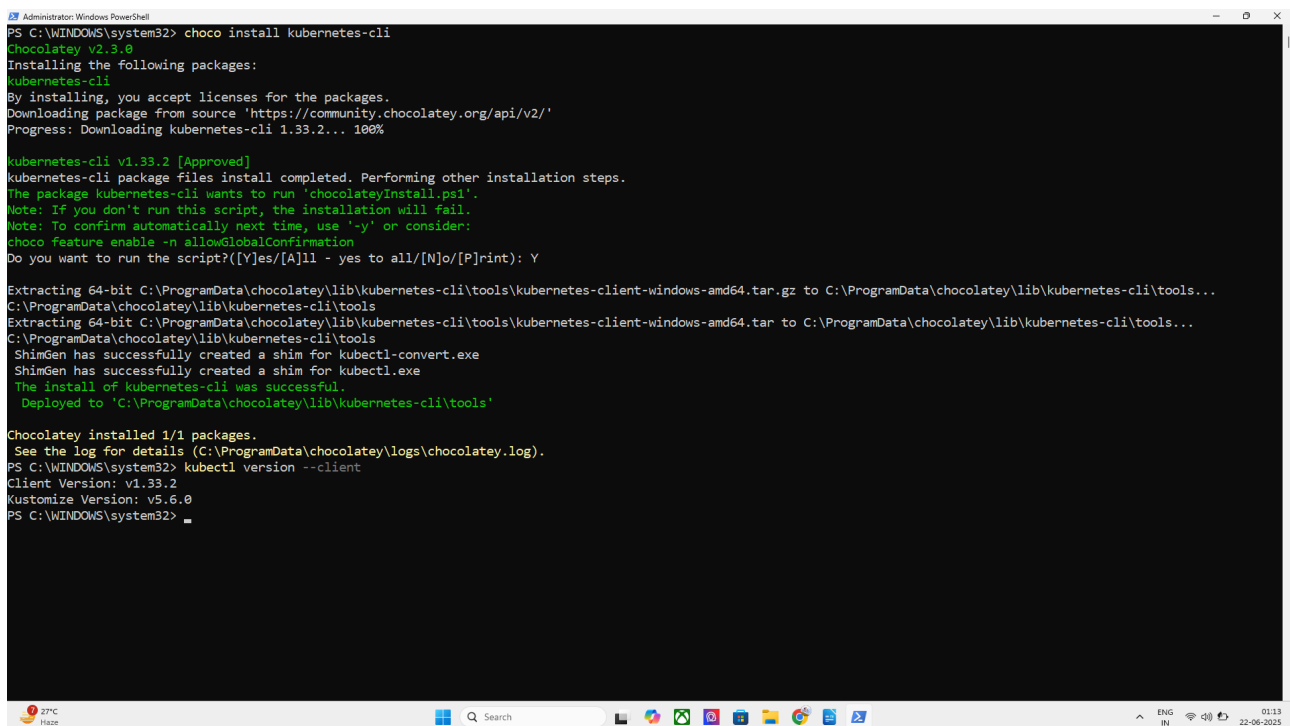
Minikube is a lightweight tool that creates a local Kubernetes cluster on your machine for development and testing purposes. It runs a single-node Kubernetes cluster inside a VM or container.

Install Required Tools

- **Minikube**
- **kubectl (Kubernetes CLI)**
- **Virtualization enabled** (like Hyper-V, VirtualBox, Docker, etc.)

For Windows (Using PowerShell or CMD)

✓ 1. Install kubectl



```
PS C:\WINDOWS\system32> choco install kubernetes-cli
Chocolatey v2.3.0
Installing the following packages:
kubernetes-cli
By installing, you accept licenses for the packages.
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading kubernetes-cli 1.33.2... 100%

kubernetes-cli v1.33.2 [Approved]
kubernetes-cli package files install completed. Performing other installation steps.
The package kubernetes-cli wants to run 'chocolateyinstall.ps1'.
Note: If you don't run this script, the installation will fail.
Note: To confirm automatically next time, use '-y' or consider:
choco feature enable -n allowGlobalConfirmation
Do you want to run the script?([Y]/[A]ll - yes to all/[N]o/[P]rint): Y

Extracting 64-bit C:\ProgramData\chocolatey\lib\kubernetes-cli\tools\kubernetes-client-windows-amd64.tar.gz to C:\ProgramData\chocolatey\lib\kubernetes-cli\tools...
C:\ProgramData\chocolatey\lib\kubernetes-cli\tools
Extracting 64-bit C:\ProgramData\chocolatey\lib\kubernetes-cli\tools\kubernetes-client-windows-amd64.tar to C:\ProgramData\chocolatey\lib\kubernetes-cli\tools...
C:\ProgramData\chocolatey\lib\kubernetes-cli\tools
ShimGen has successfully created a shim for kubectl-convert.exe
ShimGen has successfully created a shim for kubectl.exe
The install of kubernetes-cli was successful.
Deployed to 'C:\ProgramData\chocolatey\lib\kubernetes-cli\tools'

Chocolatey installed 1/1 packages.
See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).
PS C:\WINDOWS\system32> kubectl version --client
Client Version: v1.33.2
Kustomize Version: v5.6.0
PS C:\WINDOWS\system32>
```

COMMAND : choco install kubernetes-cli

You need Chocolatey installed.

To verify:

COMMAND : kubectl version --client

2. Install Minikube

COMMAND : choco install minikube

TO VERIFY : minikube version

```
Administrator: Windows PowerShell

PS C:\WINDOWS\system32> choco install minikube
Chocolatey v2.3.0
Installing the following packages:
minikube
By installing, you accept licenses for the packages.
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading Minikube 1.36.0... 100%

Minikube v1.36.0 [Approved]
Minikube package files install completed. Performing other installation steps.
ShimGen has successfully created a shim for minikube.exe
The install of Minikube was successful.
  Deployed to 'C:\ProgramData\chocolatey\lib\Minikube'

Chocolatey installed 1/1 packages.
See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).
PS C:\WINDOWS\system32> minikube version
minikube version: v1.36.0
commit: f8f52f5de11fc6ad8244afac475e1d0f96841df1-dirty
PS C:\WINDOWS\system32>
```

Start Minikube (After Installation)

COMMAND : minikube start / minikube start --driver=docker

```
Administrator: Windows PowerShell

Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\WINDOWS\system32> minikube delete
! "minikube" profile does not exist, trying anyways.
* Removed all traces of the "minikube" cluster.
PS C:\WINDOWS\system32> minikube start --driver=docker
* minikube v1.36.0 on Microsoft Windows 11 Home Single Language 10.0.26100.4351 Build 26100.4351
* Using the docker driver based on user configuration
* Using Docker Desktop driver with root privileges
* Starting "minikube" primary control-plane node in "minikube" cluster
* Pulling base image v0.0.47 ...
  > gcr.io/k8s-minikube/kicbase...: 502.26 MiB / 502.26 MiB 100.00% 1.90 Mi
* Creating docker container (CPUs=2, Memory=4000MB) ...
! Failing to connect to https://registry.k8s.io/ from inside the minikube container
* To pull new external images, you may need to configure a proxy: https://minikube.sigs.k8s.io/docs/reference/networking/proxy/
* Preparing Kubernetes v1.33.1 on Docker 28.1.1 ...
  - Generating certificates and keys ...
  - Booting up control plane ...
  - Configuring RBAC rules ...
* Configuring bridge CNI (Container Networking Interface) ...
* Verifying Kubernetes components...
  - Using image gcr.io/k8s-minikube/storage-provisioner:v5
* Enabled addons: storage-provisioner, default-storageclass
* Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
PS C:\WINDOWS\system32>
```

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME          STATUS    ROLES          AGE      VERSION
minikube      Ready    control-plane   2m54s    v1.33.1
PS C:\WINDOWS\system32>
```

COMMAND TO GET NODES : `kubectl get nodes`

AND ALSO MINIKUBE IS A SINGLE NODE ARCHITECTURE

TO GET ALL THE PODS THAT ARE RUNNING IN NODE:

COMMAND USED : `kubectl get pods -A`

```
PS C:\WINDOWS\system32> kubectl get pods -A
NAMESPACE      NAME                                READY   STATUS
RESTARTS      AGE
kube-system    coredns-674b8bbfcf-wjdh4          1/1     Running
0             4m23s
kube-system    etcd-minikube                     1/1     Running
0             4m35s
kube-system    kube-apiserver-minikube           1/1     Running
0             4m35s
kube-system    kube-controller-manager-minikube  1/1     Running
0             4m34s
kube-system    kube-proxy-svg6l                  1/1     Running
0             4m24s
kube-system    kube-scheduler-minikube           1/1     Running
0             4m34s
kube-system    storage-provisioner               1/1     Running
0             4m16s
PS C:\WINDOWS\system32>
```

TO CHECK STATUS :

command used :

`minikube status`

```
PS C:\WINDOWS\system32> minikube status
minikube
type: Control Plane
host: Running
kubelet: Running
apiserver: Running
kubeconfig: Configured
PS C:\WINDOWS\system32>
```

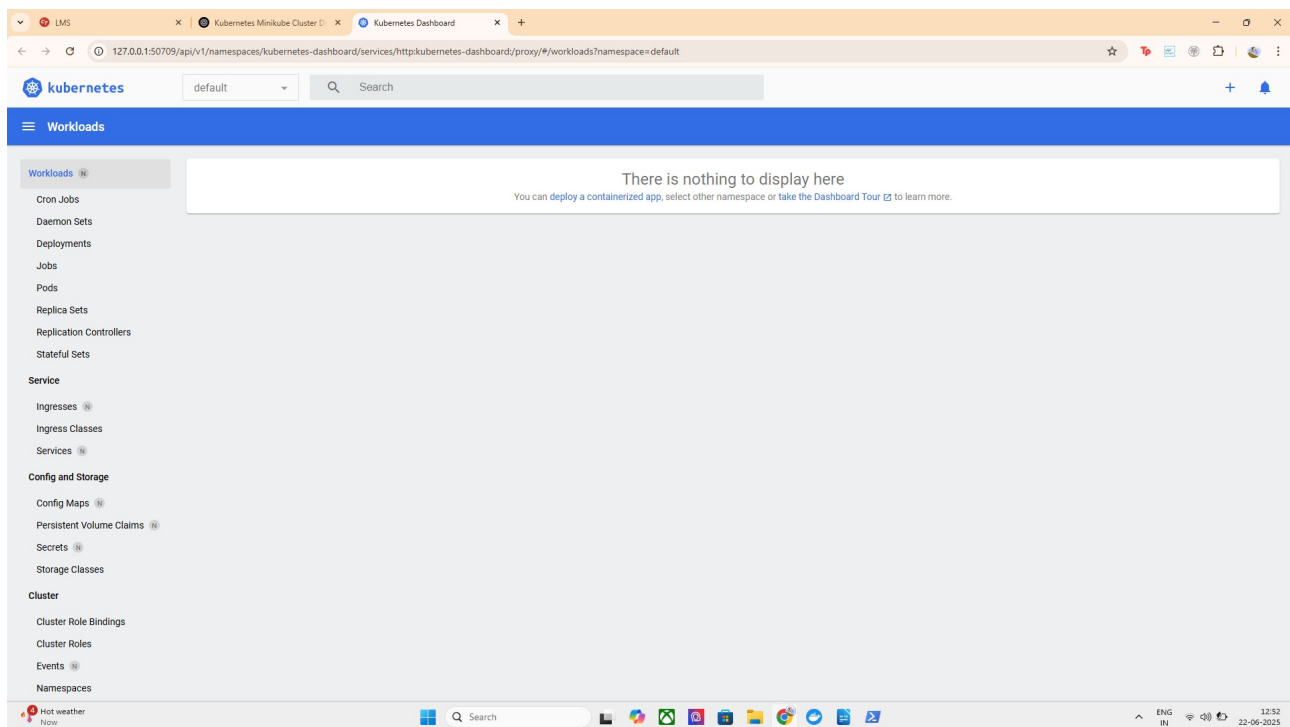
TO OPEN THE DASHBOARD WE USE : minikube dashboard

```
Administrator: Windows PowerShell
kubeconfig: Configured

PS C:\WINDOWS\system32> minikube dashboard
* Enabling dashboard ...
  - Using image docker.io/kubernetesui/dashboard:v2.7.0
  - Using image docker.io/kubernetesui/metrics-scraper:v1.0.8
* Some dashboard features require the metrics-server addon. To enable all features please run:

    minikube addons enable metrics-server

* Verifying dashboard health ...
* Launching proxy ...
* Verifying proxy health ...
* Opening http://127.0.0.1:50709/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/ in your default browser...
PS C:\WINDOWS\system32>
```



FOR NOW THERE IS NO DEPLOYMENT HENCE DASHBOARD IS EMPTY SO LETS US CREATE A DEPLOYMENT

Lets Deploy a Sample Nginx Application First :

command used : `kubectl create deployment my-nginx --image=nginx`

This creates a deployment named `my-nginx` using the official Nginx container image.

- Kubernetes will automatically create a pod running Nginx.

```
Administrator: Windows PowerShell

nginx
deployment.apps/my-nginx created
PS C:\WINDOWS\system32>
```

TO GET YOUR DEPLOYMENTS : kubectl get deployments

```
PS C:\WINDOWS\system32> kubectl get deployments
NAME          READY    UP-TO-DATE    AVAILABLE    AGE
my-nginx      1/1      1             1            95s
PS C:\WINDOWS\system32>
```

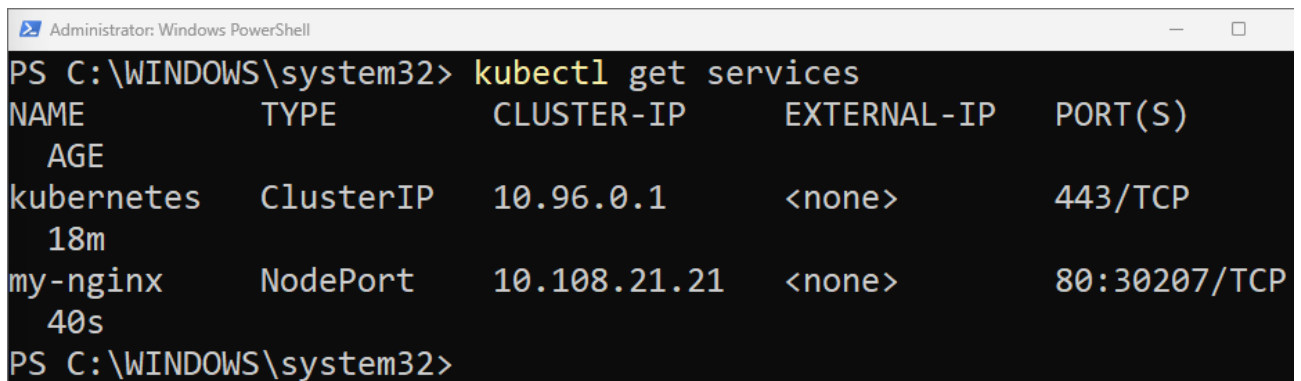
Now Lets Expose the Nginx Deployment

command used : kubectl expose deployment my-nginx --type=NodePort --port=80

```
PS C:\WINDOWS\system32> kubectl expose deployment my-nginx --type=NodePort --port=80
service/my-nginx exposed
PS C:\WINDOWS\system32>
```

Exposes the Nginx deployment so it can be accessed outside the cluster via a NodePort service.

Command used : kubectl get services



```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> kubectl get services
NAME          TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)
AGE
kubernetes    ClusterIP     10.96.0.1     <none>         443/TCP
18m
my-nginx      NodePort      10.108.21.21  <none>         80:30207/TCP
40s
PS C:\WINDOWS\system32>
```

Access the App via Minikube Service

command used : minikube service my-nginx

Service running successfully:

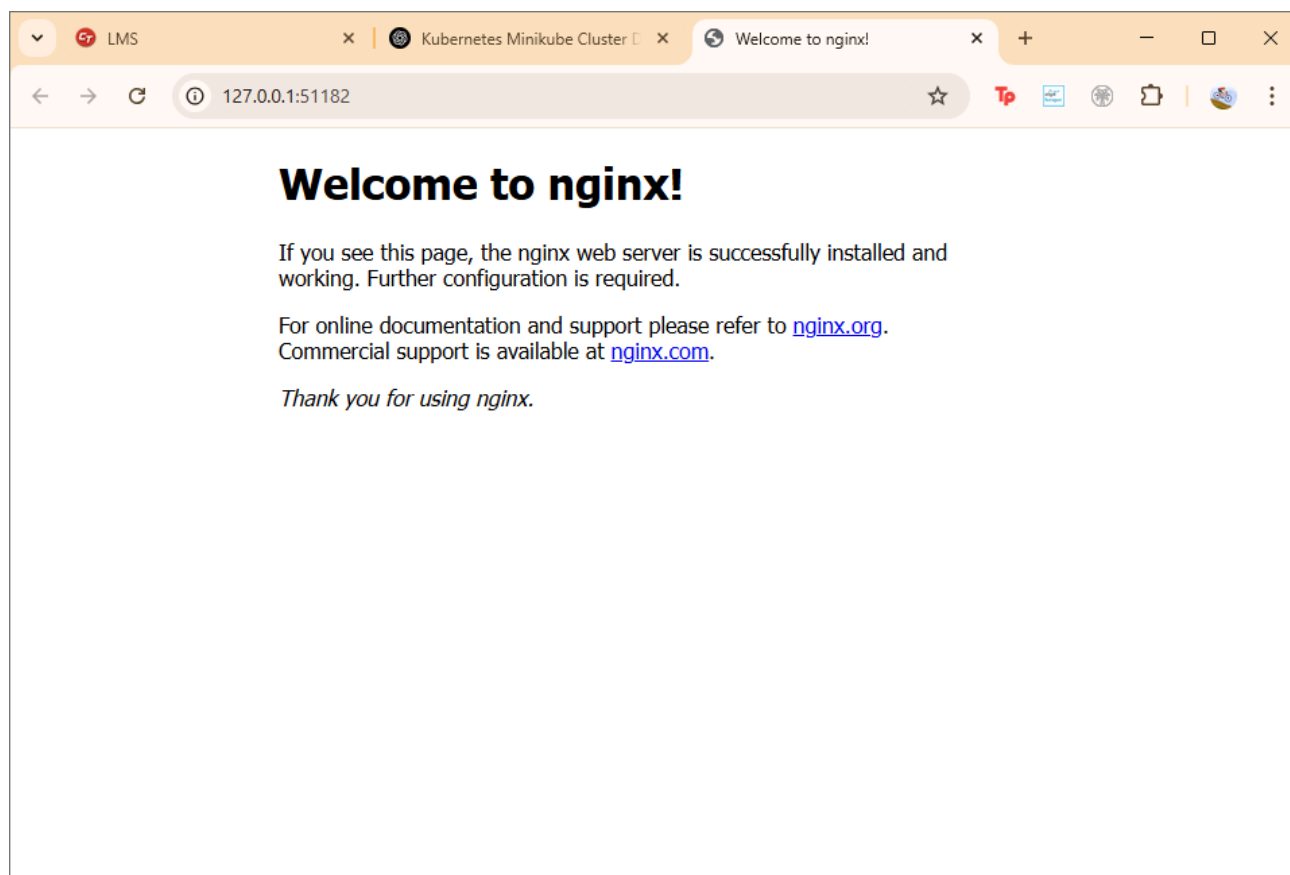
```
PS C:\WINDOWS\system32> minikube service my-nginx
```

| NAMESPACE | NAME | TARGET PORT | URL |
|-----------|----------|-------------|---------------------------|
| default | my-nginx | 80 | http://192.168.49.2:30207 |

```
* Starting tunnel for service my-nginx.
```

| NAMESPACE | NAME | TARGET PORT | URL |
|-----------|----------|-------------|------------------------|
| default | my-nginx | | http://127.0.0.1:51182 |

```
* Opening service default/my-nginx in default browser...
! Because you are using a Docker driver on windows, the terminal ne
eds to be open to run it.
```



7. View Cluster Resources : kubectl get all

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> kubectl get all
NAME                                     READY   STATUS    RESTARTS   AGE
pod/my-nginx-5b584c864b-fqkg8          1/1     Running   0           12m

NAME                                     TYPE          CLUSTER-IP   EXTERNAL-IP   PORT(S)          AGE
service/kubernetes                     ClusterIP      10.96.0.1    <none>         443/TCP           26m
service/my-nginx                       NodePort       10.108.21.21 <none>         80:30207/TCP      9m16s

NAME                                     READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/my-nginx                1/1     1             1           12m

NAME                                     DESIRED   CURRENT   READY   AGE
replicaset.apps/my-nginx-5b584c864b     1         1         1       12m
PS C:\WINDOWS\system32>
```

Check Logs of Running Pod :

kubectl get pods

kubectl logs <pod-name>

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME                                     READY   STATUS    RESTARTS   AGE
my-nginx-5b584c864b-fqkg8              1/1     Running   0           14m
PS C:\WINDOWS\system32> kubectl logs my-nginx-5b584c864b-fqkg8
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2025/06/22 07:27:18 [notice] 1#1: using the "epoll" event method
2025/06/22 07:27:18 [notice] 1#1: nginx/1.27.5
2025/06/22 07:27:18 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2025/06/22 07:27:18 [notice] 1#1: OS: Linux 6.6.87.1-microsoft-standard-WSL2
2025/06/22 07:27:18 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/06/22 07:27:18 [notice] 1#1: start worker processes
2025/06/22 07:27:18 [notice] 1#1: start worker process 30
2025/06/22 07:27:18 [notice] 1#1: start worker process 31
2025/06/22 07:27:18 [notice] 1#1: start worker process 32
2025/06/22 07:27:18 [notice] 1#1: start worker process 33
2025/06/22 07:27:18 [notice] 1#1: start worker process 34
2025/06/22 07:27:18 [notice] 1#1: start worker process 35
2025/06/22 07:27:18 [notice] 1#1: start worker process 36
2025/06/22 07:27:18 [notice] 1#1: start worker process 37
2025/06/22 07:27:18 [notice] 1#1: start worker process 38
2025/06/22 07:27:18 [notice] 1#1: start worker process 39
2025/06/22 07:27:18 [notice] 1#1: start worker process 40
2025/06/22 07:27:18 [notice] 1#1: start worker process 41
2025/06/22 07:27:18 [notice] 1#1: start worker process 42
2025/06/22 07:27:18 [notice] 1#1: start worker process 43
```

Lets open the dashboard again : Open the Kubernetes Dashboard

Now you can see deployments are ready

Kubernetes Dashboard - Workloads

Workload Status

Running: 1

Deployments

Running: 1

Pods

Running: 1

Replica Sets

Deployments

| Name | Images | Labels | Pods | Created |
|----------|--------|---------------|-------|----------------|
| my-nginx | nginx | app: my-nginx | 1 / 1 | 16 minutes ago |

Pods

| Name | Images | Labels | Node | Status | Restarts | CPU Usage (cores) | Memory Usage (bytes) | Created |
|---------------------------|--------|--|----------|---------|----------|-------------------|----------------------|----------------|
| my-nginx-5b584c864b-fqkg8 | nginx | app: my-nginx pod-template-hash: 5b584c864b | minikube | Running | 0 | - | - | 16 minutes ago |

Replica Sets

Kubernetes Dashboard - Service > Services

Services

| Name | Labels | Type | Cluster IP | Internal Endpoints | External Endpoints | Created |
|------------|--|-----------|--------------|--|--------------------|----------------|
| my-nginx | app: my-nginx | NodePort | 10.108.21.21 | my-nginx:80 TCP my-nginx:30207 TCP | - | 13 minutes ago |
| kubernetes | component: apiserver provider: kubernetes | ClusterIP | 10.96.0.1 | kubernetes:443 TCP kubernetes:0 TCP | - | 31 minutes ago |

| Name | Reason | Message | Source | Object | Count | First Seen | Last Seen |
|--|-----------------------|--|-----------------------|--------------------------------|-------|----------------|----------------|
| my-nginx-5b584c864b-fqkg8.184b4cb92724e397 | Started | Started container nginx | kubelet minikube | Pod/my-nginx-5b584c864b-fqkg8 | 1 | 17 minutes ago | 17 minutes ago |
| my-nginx-5b584c864b-fqkg8.184b4cb91d091f7d | Created | Created container: nginx | kubelet minikube | Pod/my-nginx-5b584c864b-fqkg8 | 1 | 17 minutes ago | 17 minutes ago |
| my-nginx-5b584c864b-fqkg8.184b4cb9117156f3 | Pulled | Successfully pulled image "nginx" in 46.316s (46.316s including waiting). Image size: 192461947 bytes. | kubelet minikube | Pod/my-nginx-5b584c864b-fqkg8 | 1 | 17 minutes ago | 17 minutes ago |
| my-nginx-5b584c864b-fqkg8.184b4cae491af7b2 | Pulling | Pulling image "nginx" | kubelet minikube | Pod/my-nginx-5b584c864b-fqkg8 | 1 | 17 minutes ago | 17 minutes ago |
| my-nginx.184b4cae2078b93a | ScalingReplicaSet | Scaled up replica set my-nginx-5b584c864b from 0 to 1 | deployment-controller | Deployment/my-nginx | 1 | 18 minutes ago | 18 minutes ago |
| my-nginx-5b584c864b.184b4cae22f4a606 | SuccessfulCreate | Created pod: my-nginx-5b584c864b-fqkg8 | replicaset-controller | ReplicaSet/my-nginx-5b584c864b | 1 | 18 minutes ago | 18 minutes ago |
| my-nginx-5b584c864b-fqkg8.184b4cae23fc790c | Scheduled | Successfully assigned default/my-nginx-5b584c864b-fqkg8 to minikube | default-scheduler | Pod/my-nginx-5b584c864b-fqkg8 | 1 | 18 minutes ago | 18 minutes ago |
| minikube.184b4becd964d204e | RegisteredNode | Node minikube event: Registered Node minikube in Controller | node-controller | Node/minikube | 1 | 31 minutes ago | 31 minutes ago |
| minikube.184b4becd14fb28e | NodeHasSufficientPID | Node minikube status is now: NodeHasSufficientPID | kubelet minikube | Node/minikube | 1 | 31 minutes ago | 31 minutes ago |
| minikube.184b4becd14f3601 | NodeHasNoDiskPressure | Node minikube status is now: NodeHasNoDiskPressure | kubelet minikube | Node/minikube | 1 | 31 minutes ago | 31 minutes ago |

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Stop or Delete Cluster :

minikube stop
minikube delete

Stops the cluster
Deletes the Minikube VM and cleans up resources

LETS GET SOME MORE INSIGHTS

BY DEPLOYING SOME

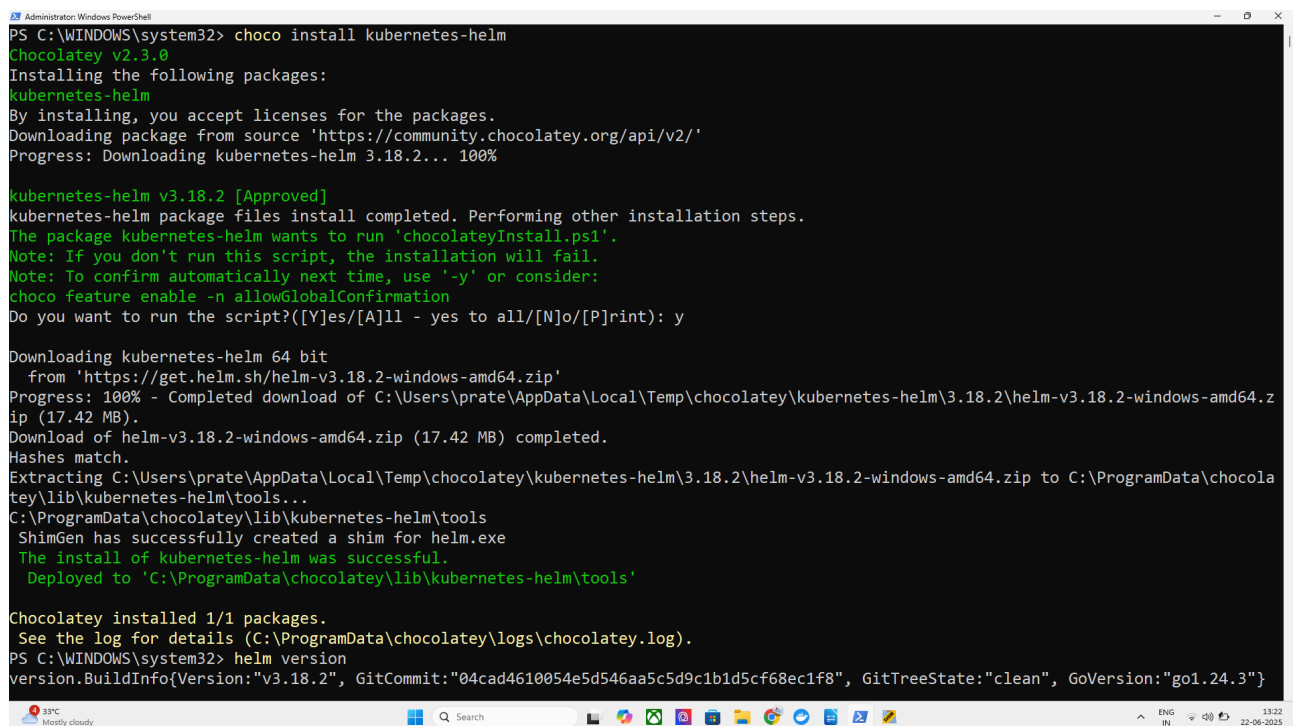
1. Helm Chart

Step 1: Install Helm

For Windows (Using Chocolatey):

```
choco install kubernetes-helm
```

```
helm version or helm --version
```



```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> choco install kubernetes-helm
Chocolatey v2.3.0
Installing the following packages:
kubernetes-helm
By installing, you accept licenses for the packages.
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading kubernetes-helm 3.18.2... 100%

kubernetes-helm v3.18.2 [Approved]
kubernetes-helm package files install completed. Performing other installation steps.
The package kubernetes-helm wants to run 'chocolateyInstall.ps1'.
Note: If you don't run this script, the installation will fail.
Note: To confirm automatically next time, use '-y' or consider:
choco feature enable -n allowGlobalConfirmation
Do you want to run the script?([Y]es/[A]ll - yes to all/[N]o/[P]rint): y

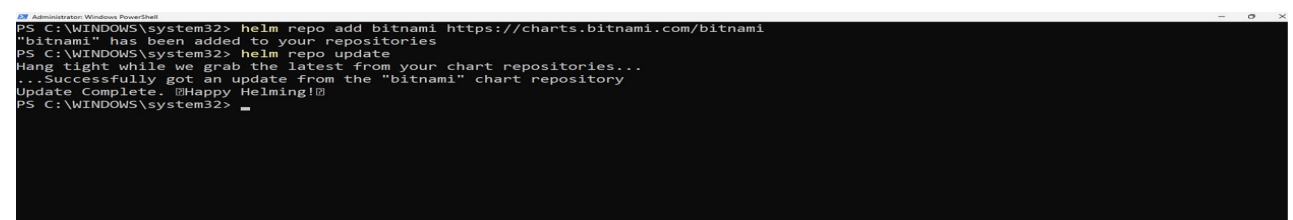
Downloading kubernetes-helm 64 bit
  from 'https://get.helm.sh/helm-v3.18.2-windows-amd64.zip'
Progress: 100% - Completed download of C:\Users\prate\AppData\Local\Temp\chocolatey\kubernetes-helm\3.18.2\helm-v3.18.2-windows-amd64.zip (17.42 MB).
Download of helm-v3.18.2-windows-amd64.zip (17.42 MB) completed.
Hashes match.
Extracting C:\Users\prate\AppData\Local\Temp\chocolatey\kubernetes-helm\3.18.2\helm-v3.18.2-windows-amd64.zip to C:\ProgramData\chocolatey\lib\kubernetes-helm\tools...
C:\ProgramData\chocolatey\lib\kubernetes-helm\tools
ShimGen has successfully created a shim for helm.exe
The install of kubernetes-helm was successful.
  Deployed to 'C:\ProgramData\chocolatey\lib\kubernetes-helm\tools'

Chocolatey installed 1/1 packages.
See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).
PS C:\WINDOWS\system32> helm version
version.BuildInfo{Version:"v3.18.2", GitCommit:"04cad4610054e5d546aa5c5d9c1b1d5cf68ec1f8", GitTreeState:"clean", GoVersion:"go1.24.3"}
```

Step 2: Add Bitnami Helm Repository

```
helm repo add bitnami https://charts.bitnami.com/bitnami
```

```
helm repo update
```



```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> helm repo add bitnami https://charts.bitnami.com/bitnami
"bitnami" has been added to your repositories
PS C:\WINDOWS\system32> helm repo update
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "bitnami" chart repository
Update Complete. 🎉Happy Helming!🎉
PS C:\WINDOWS\system32>
```

Step 3: Install NGINX via Helm

`helm install my-release bitnami/nginx`

Step 4: Verify Deployment

`kubectl get all`

New nginx pod and service formed

```
PS C:\WINDOWS\system32> kubectl get all
NAME                                READY    STATUS    RESTARTS   AGE
pod/my-nginx-5b584c864b-fqkg8      1/1      Running   0           31m
pod/my-release-nginx-7c98b6c94b-wc5nh 0/1      Init:0/1   0           63s

NAME                                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)              AGE
service/kubernetes                  ClusterIP           10.96.0.1       <none>            443/TCP               44m
service/my-nginx                    NodePort            10.108.21.21    <none>            80:30207/TCP          27m
service/my-release-nginx             LoadBalancer        10.103.224.252  <pending>         80:31736/TCP,443:30850/TCP 63s

NAME                                READY    UP-TO-DATE    AVAILABLE    AGE
deployment.apps/my-nginx             1/1      1              1            31m
deployment.apps/my-release-nginx     0/1      1              0            63s

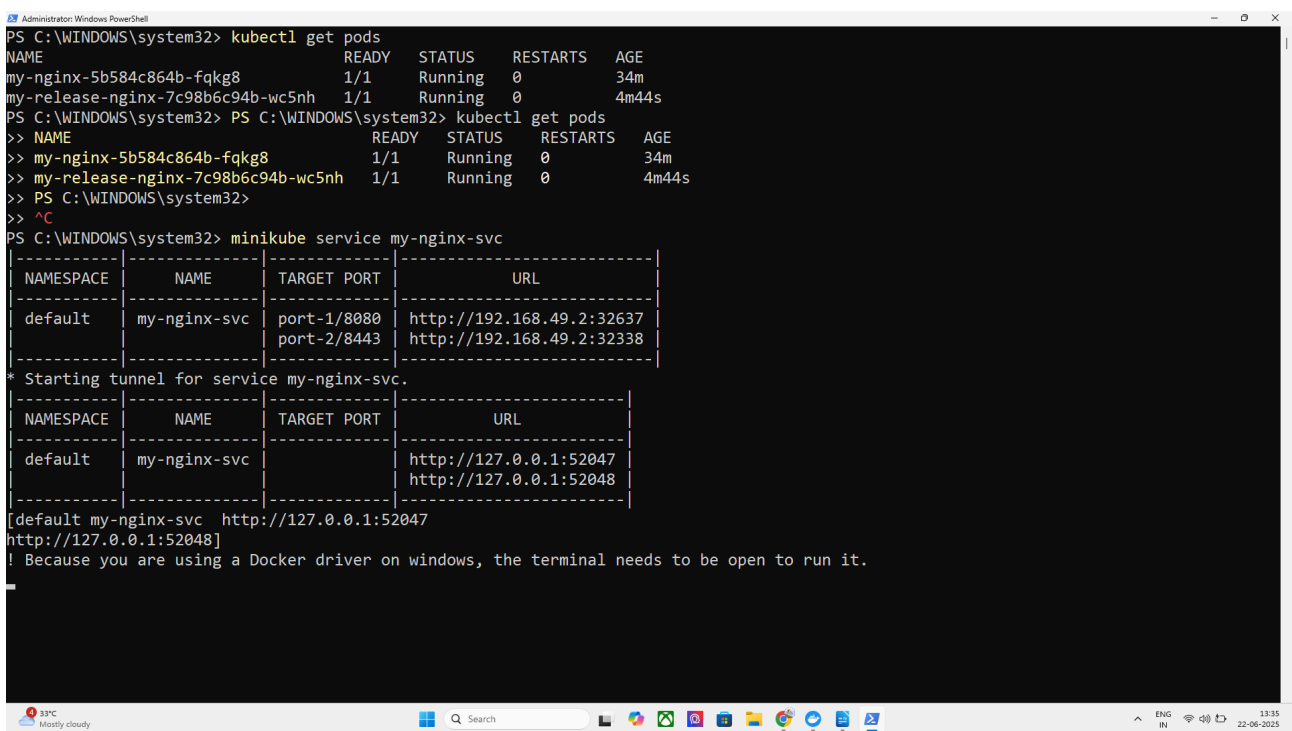
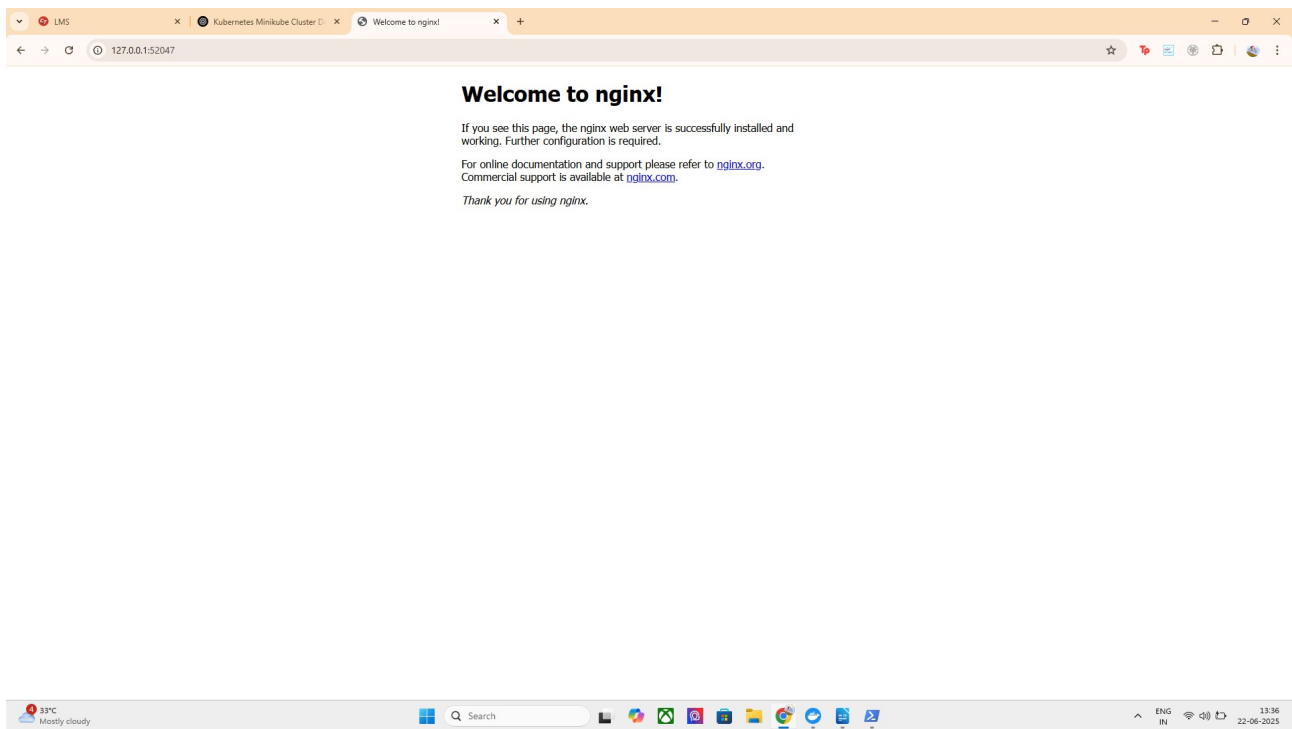
NAME                                DESIRED    CURRENT    READY    AGE
replicaset.apps/my-nginx-5b584c864b 1           1          1        31m
replicaset.apps/my-release-nginx-7c98b6c94b 1           1          0        63s
PS C:\WINDOWS\system32>
```

Step 5: Access the App

`kubectl get svc`

`minikube service my-nginx-svc`

successfully accessed on local host : <http://127.0.0.1:52047>



NOW THERE ARE 2 DEPLOYMENTS ONE WITH **HELM CHART**

What is a Helm Chart?

A **Helm Chart** is a collection of:

- Kubernetes YAML files
- Templates

- Predefined configurations

That together **automate the deployment** of a complete application

Why It's Powerful

Instead of writing multiple YAML files (for Deployment, Service, ConfigMap, PVC, etc.), you:

- Run **one command**
- Helm installs the app with **best practices**
- You can customize it later with `--set` or `values.yaml`

Example: What Happens When You Run This?

```
helm install my-release bitnami/nginx
```

You are telling Helm:

- Fetch the **NGINX chart** from Bitnami's repo
- Install it in your cluster
- Use default settings unless overridden
- Name the release `my-release`

