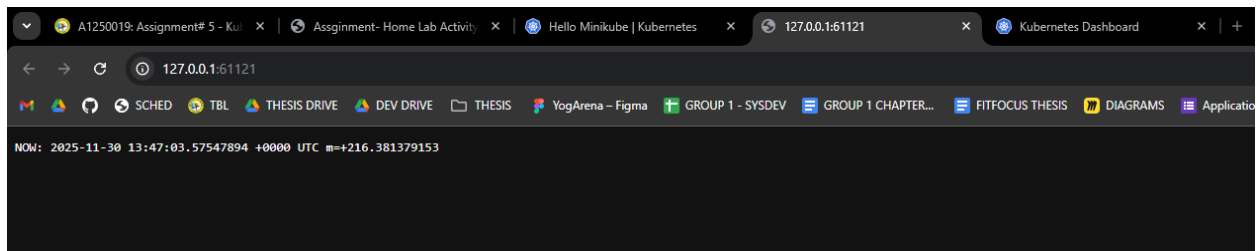


1. Hello Minikube:

App response in browser window:



Commands and outputs:

Minikube start and minikube dashboard

```
C:\Users\marky>minikube start
* minikube v1.37.0 on Microsoft Windows 11 Pro 10.0.26100.7171 Build 26100.7171
* Automatically selected the docker driver
* Using Docker Desktop driver with root privileges
* Starting "minikube" primary control-plane node in "minikube" cluster
* Pulling base image v0.0.48 ...
* Downloading Kubernetes v1.34.0 preload ...
  > preloaded-images-k8s-v18-v1...: 337.07 MiB / 337.07 MiB 100.00% 6.71 Mi
  > gcr.io/k8s-minikube/kicbase...: 488.52 MiB / 488.52 MiB 100.00% 4.45 Mi
* Creating docker container (CPUs=2, Memory=7680MB) ...
! 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 v1.34.0 on Docker 28.4.0 ...
* 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! kubectrl is now configured to use "minikube" cluster and "default" namespace by default

C:\Users\marky>minikube dashboard
* Enabling dashboard ...
  - Using image docker.io/kubernetesui/metrics-scraper:v1.0.8
  - Using image docker.io/kubernetesui/dashboard:v2.7.0
* 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://127.0.0.1:62626/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/ in your default browser..
.
^C
C:\Users\marky>k
'k' is not recognized as an internal or external command,
```


Kubectl create deployment, and get commands:

```
C:\Users\marky>kubectl create deployment hello-node --image=registry.k8s.io/e2e-test-images/agnhost:2.53 -- /agnhost netexec --http-port=8080
deployment.apps/hello-node created

C:\Users\marky>kubectl get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
hello-node 0/1      1             0           7s

C:\Users\marky>kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
hello-node-6c9b5f4b59-7sgpm        1/1     Running   0           17s

C:\Users\marky>kubectl get events
LAST SEEN   TYPE      REASON          OBJECT                                MESSAGE
28s         Normal    Scheduled        pod/hello-node-6c9b5f4b59-7sgpm      Successfully assigned default/hello-node-6c9b5f4b59-7sgpm to minikube
27s         Normal    Pulling          pod/hello-node-6c9b5f4b59-7sgpm      Pulling image "registry.k8s.io/e2e-test-images/agnhost:2.53"
15s         Normal    Pulled           pod/hello-node-6c9b5f4b59-7sgpm      Successfully pulled image "registry.k8s.io/e2e-test-images/agnhost:2.53" in 12.51s (12.51s including waiting). Image size: 139374622 bytes.
14s         Normal    Created          pod/hello-node-6c9b5f4b59-7sgpm      Created container: agnhost
14s         Normal    Started          pod/hello-node-6c9b5f4b59-7sgpm      Started container agnhost
28s         Normal    SuccessfulCreate replicaset/hello-node-6c9b5f4b59-7sgpm Created pod: hello-node-6c9b5f4b59-7sgpm
28s         Normal    ScalingReplicaSet deployment/hello-node-6c9b5f4b59-7sgpm Scaled up replica set hello-node-6c9b5f4b59 from 0 to 1
3m30s       Normal    Starting         node/minikube                        Starting kubelet.
3m29s       Normal    NodeAllocatableEnforced node/minikube                        Updated Node Allocatable limit across pods
3m29s       Normal    NodeHasSufficientMemory node/minikube                        Node minikube status is now: NodeHasSufficientMemory
3m29s       Normal    NodeHasNoDiskPressure node/minikube                        Node minikube status is now: NodeHasNoDiskPressure
3m29s       Normal    NodeHasSufficientPID node/minikube                        Node minikube status is now: NodeHasSufficientPID
3m25s       Normal    RegisteredNode   node/minikube                        Node minikube event: Registered Node minikube in Controlle
3m22s       Normal    Starting         node/minikube
```

Kubectl config view and log for specific node

```
Command Prompt
C:\Users\marky>kubectl config view
apiVersion: v1
clusters:
- cluster:
    certificate-authority: C:\Users\marky\.minikube\ca.crt
    extensions:
    - extension:
        last-update: Sun, 30 Nov 2025 21:40:12 +08
        provider: minikube.sigs.k8s.io
        version: v1.37.0
        name: cluster_info
    server: https://127.0.0.1:62334
    name: minikube
contexts:
- context:
    cluster: minikube
    extensions:
    - extension:
        last-update: Sun, 30 Nov 2025 21:40:12 +08
        provider: minikube.sigs.k8s.io
        version: v1.37.0
        name: context_info
    namespace: default
    user: minikube
    name: minikube
current-context: minikube
kind: Config
users:
- name: minikube
  user:
    client-certificate: C:\Users\marky\.minikube\profiles\minikube\client.crt
    client-key: C:\Users\marky\.minikube\profiles\minikube\client.key

C:\Users\marky>kubectl logs hello-node-6c9b5f4b59-7sgpm
I1130 13:43:27.234863    1 log.go:245] Started HTTP server on port 8080
I1130 13:43:27.235254    1 log.go:245] Started UDP server on port 8081
```


Kubectl expose deployment for specific node, get services, and get for specific node

```
C:\Users\marky>kubectl expose deployment hello-node --type=LoadBalancer --port=8080
service/hello-node exposed
```

```
C:\Users\marky>kubectl get services
NAME          TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)          AGE
hello-node    LoadBalancer 10.109.217.8   <pending>       8080:32074/TCP   7s
kubernetes    ClusterIP      10.96.0.1     <none>          443/TCP          6m39s
```

```
C:\Users\marky>minikube service hello-node
```

NAMESPACE	NAME	TARGET PORT	URL
default	hello-node	8080	http://192.168.49.2:32074

```
* Starting tunnel for service hello-node./
```

NAMESPACE	NAME	TARGET PORT	URL
default	hello-node		http://127.0.0.1:61121

```
* Starting tunnel for service hello-node.
```




```
* Opening service default/hello-node in default browser...
```

```
! Because you are using a Docker driver on windows, the terminal needs to be open to run it.
```

```
* Stopping tunnel for service hello-node.
```


Minikube addons list

C:\Users\marky>minikube addons list

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)
inaccel	minikube	disabled	3rd party (InAccel [info@inaccel.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 (MetalLB)
metrics-server	minikube	disabled	Kubernetes
nvidia-device-plugin	minikube	disabled	3rd party (NVIDIA)
nvidia-driver-installer	minikube	disabled	3rd party (NVIDIA)
nvidia-gpu-device-plugin	minikube	disabled	3rd party (NVIDIA)
olm	minikube	disabled	3rd party (Operator Framework)
pod-security-policy	minikube	disabled	3rd party (unknown)
portainer	minikube	disabled	3rd party (Portainer.io)
registry	minikube	disabled	minikube
registry-aliases	minikube	disabled	3rd party (unknown)
registry-creds	minikube	disabled	3rd party (UPMC Enterprises)
storage-provisioner	minikube	enabled 	minikube
storage-provisioner-gluster	minikube	disabled	3rd party (Gluster)
storage-provisioner-rancher	minikube	disabled	3rd party (Rancher)
volcano	minikube	disabled	third-party (volcano)
volumesnapshots	minikube	disabled	Kubernetes
yakd	minikube	disabled	3rd party (marcnuri.com)

Minikube addons enable metrics-server and get pod and service

```
C:\Users\marky>minikube addons enable metrics-server
* metrics-server is an addon maintained by Kubernetes. For any concerns contact minikube on GitHub.
You can view the list of minikube maintainers at: https://github.com/kubernetes/minikube/blob/master/0
- Using image registry.k8s.io/metrics-server/metrics-server:v0.8.0
* The 'metrics-server' addon is enabled

C:\Users\marky>kubectl get pod,svc -n kube-system
NAME                                READY   STATUS             RESTARTS   AGE
pod/coredns-66bc5c9577-m8psb        1/1     Running            0           7m38s
pod/etcd-minikube                   1/1     Running            0           7m43s
pod/kube-apiserver-minikube         1/1     Running            0           7m43s
pod/kube-controller-manager-minikube 1/1     Running            0           7m43s
pod/kube-proxy-znv9k                1/1     Running            0           7m38s
pod/kube-scheduler-minikube         1/1     Running            0           7m43s
pod/metrics-server-85b7d694d7-4h5jl 0/1     ContainerCreating  0           6s
pod/storage-provisioner              1/1     Running            1 (7m16s ago) 7m41s

NAME                                TYPE               CLUSTER-IP    EXTERNAL-IP    PORT(S)                                     AGE
service/kube-dns                    ClusterIP          10.96.0.10    <none>         53/UDP,53/TCP,9153/TCP                   7m45s
service/metrics-server              ClusterIP          10.107.78.36  <none>         443/TCP                                   6s

C:\Users\marky>kubectl top pods
```

Kubectl top pods

```
C:\Users\marky>kubectl top pods
NAME                                CPU(cores)   MEMORY(bytes)
hello-node-6c9b5f4b59-7sgpm        1m           6Mi
```

Minikube addons disable metrics-server

```
C:\Users\marky>minikube addons disable metrics-server
* "The 'metrics-server' addon is disabled"
```

kubectl delete service hello-node

kubectl delete deployment hello-node

```
C:\Users\marky>kubectl delete service hello-node
service "hello-node" deleted from default namespace

C:\Users\marky>kubectl delete deployment hello-node
deployment.apps "hello-node" deleted from default namespace
```


Minikube stop

```
C:\Users\marky>minikube stop
* Stopping node "minikube" ...
* Powering off "minikube" via SSH ...
* 1 node stopped.
```

2. Get a Shell to a Running Container

Commands and outputs:

kubectl apply -f <https://k8s.io/examples/application/shell-demo.yaml>

```
C:\Users\marky>kubectl apply -f https://k8s.io/examples/application/shell-demo.yaml
pod/shell-demo created

C:\Users\marky>kubectl get pod shell-demo
NAME          READY   STATUS             RESTARTS   AGE
shell-demo    0/1     ContainerCreating   0           5s

C:\Users\marky>kubectl exec --stdin --tty shell-demo -- /bin/bash
error: Internal error occurred: unable to upgrade connection: container not found ("nginx")

C:\Users\marky>kubectl exec --stdin --tty shell-demo -- /bin/bash
root@minikube:/# ls /
bash: ls: command not found
root@minikube:/# ls
bash: ls: command not found
root@minikube:/# ls
bin  dev                docker-entrypoint.sh  home  lib64  mnt  proc  run  srv  tmp  var
boot  docker-entrypoint.d  etc                  lib   media  opt  root  sbin sys  usr
root@minikube:/# cat /proc/mounts
overlay / overlay rw,relatime,lowerdir=/var/lib/docker/overlay2/l/VCFPWB6C3GZUOWQL03JIHG32CT:/var/lib/docker/overlay2/l/ILTMLBQRGKJ7NQ0Q6C5FFZIQKY:/var/lib/docker/overlay2/l/QEYFWJE4XYIL7SN227DBE56IX0:/var/lib/docker/overlay2/l/BZJ5GNJI4YCP5XNMXB8M6LWTNZZ:/var/lib/docker/overlay2/l/S5GIJRLGDMMM5WWYWGGOYCTGER:/var/lib/docker/overlay2/l/YZKMMVH4T5GFDCELM7URB434M6:/var/lib/docker/overlay2/l/CKUQIVUL3VVA6GWEY3IOJYHZUU:/var/lib/docker/overlay2/l/DWS5YGY57BU5DW3MDTOUV6JZQ0,upperdir=/var/lib/docker/overlay2/ec40fca6b86f57419d2ce3389107d24a0dcb6a5ce7162fef999419eb8c2b13e7/diff,workdir=/var/lib/docker/overlay2/ec40fca6b86f57419d2ce3389107d24a0dcb6a5ce7162fef999419eb8c2b13e7/work 0 0
proc /proc proc rw,nosuid,nodev,noexec,relatime 0 0
tmpfs /dev tmpfs rw,nosuid,size=65536k,mode=755 0 0
```

kubectl get pod shell-demo

```
C:\Users\marky>kubectl get pod shell-demo
NAME          READY   STATUS             RESTARTS   AGE
shell-demo    0/1     ContainerCreating   0           5s
```


kubectl exec --stdin --tty shell-demo -- /bin/bash (and other commands)

```
C:\Users\marky>kubectl exec --stdin --tty shell-demo -- /bin/bash
root@minikube:/# ls /
bash: ls: command not found
root@minikube:/# ls
bash: ls: command not found
root@minikube:/# ls
bin      dev      docker-entrypoint.sh  home  lib64  mnt  proc  run  srv  tmp  var
boot     docker-entrypoint.d  etc      lib   media  opt  root  sbin sys  usr
root@minikube:/# cat /proc/mounts
overlay / overlay rw,relatime,lowerdir=/var/lib/docker/overlay2/L/VCFPW6C3GZUOWQL03JIHG32CT:/var/lib/docker/overlay2/L/ILTMLBQRGKJ7N0Q06C5FFZIQKY:/var/lib/docker/overlay2/L/QEYFWJE4XYIL7SN227DBE56IX0:/var/lib/docker/overlay2/L/BZJ5GNJI4YCP5XNMXB6LW1TNZZ:/var/lib/docker/overlay2/L/S5GIJRLGDM5MM5WVWGG0YCTGER:/var/lib/docker/overlay2/L/YZKMMVH4T5GFDCELM7URB434M6:/var/lib/docker/overlay2/L/CKUQIVUL3VVA6GWEY3IOJYHZUU:/var/lib/docker/overlay2/L/DWS5YGY57BU5DW3MDTOUV6JZQ0,upperdir=/var/lib/docker/overlay2/ec40fca6b86f57419d2ce3389107d24a0dcb6a5ce7162fef999419eb8c2b13e7/diff,workdir=/var/lib/docker/overlay2/ec40fca6b86f57419d2ce3389107d24a0dcb6a5ce7162fef999419eb8c2b13e7/work 0 0
proc /proc proc rw,nosuid,nodev,noexec,relatime 0 0
tmpfs /dev tmpfs rw,nosuid,size=65536k,mode=755 0 0
devpts /dev/pts devpts rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=666 0 0
sysfs /sys sysfs ro,nosuid,nodev,noexec,relatime 0 0
cgroup /sys/fs/cgroup cgroup2 ro,nosuid,nodev,noexec,relatime 0 0
mqueue /dev/mqueue mqueue rw,nosuid,nodev,noexec,relatime 0 0
shm /dev/shm tmpfs rw,nosuid,nodev,noexec,relatime,size=65536k 0 0
/dev/sde /dev/termination-log ext4 rw,relatime 0 0
/dev/sde /etc/resolv.conf ext4 rw,relatime 0 0
/dev/sde /etc/hostname ext4 rw,relatime 0 0
/dev/sde /etc/hosts ext4 rw,relatime 0 0
/dev/sde /usr/share/nginx/html ext4 rw,relatime 0 0
tmpfs /run/secrets/kubernetes.io/serviceaccount tmpfs ro,relatime,size=15302876k,noswap 0 0
proc /proc/bus proc ro,nosuid,nodev,noexec,relatime 0 0
```

echo 'Hello shell demo' > /usr/share/nginx/html/index.html

apt-get update

apt-get install curl

curl http://localhost/

exit

```
root@minikube:/# echo 'Hello shell demo' > /usr/share/nginx/html/index.html
root@minikube:/# apt-get update
apt-get install curl
curl http://localhost/
Get:1 http://deb.debian.org/debian trixie InRelease [140 kB]
Get:2 http://deb.debian.org/debian trixie-updates InRelease [47.3 kB]
Get:3 http://deb.debian.org/debian-security trixie-security InRelease [43.4 kB]
Get:4 http://deb.debian.org/debian trixie/main amd64 Packages [9670 kB]
Get:5 http://deb.debian.org/debian trixie-updates/main amd64 Packages [5412 B]
Get:6 http://deb.debian.org/debian-security trixie-security/main amd64 Packages [75.6 kB]
Fetched 9982 kB in 3s (3579 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
curl is already the newest version (8.14.1-2+deb13u2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Hello shell demo
root@minikube:/# exit
exit
```


kubectl exec shell-demo -- env

```
C:\Users\marky>kubectl exec shell-demo -- env
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
HOSTNAME=minikube
KUBERNETES_SERVICE_HOST=10.96.0.1
KUBERNETES_SERVICE_PORT=443
KUBERNETES_SERVICE_PORT_HTTPS=443
KUBERNETES_PORT=tcp://10.96.0.1:443
KUBERNETES_PORT_443_TCP=tcp://10.96.0.1:443
KUBERNETES_PORT_443_TCP_PROTO=tcp
KUBERNETES_PORT_443_TCP_PORT=443
KUBERNETES_PORT_443_TCP_ADDR=10.96.0.1
NGINX_VERSION=1.29.3
NJS_VERSION=0.9.4
NJS_RELEASE=1~trixie
PKG_RELEASE=1~trixie
DYNPKG_RELEASE=1~trixie
HOME=/root

C:\Users\marky>kubectl exec shell-demo -- ps aux
OCI runtime exec failed: exec failed: unable to start container process: exec: "ps": executable file not found in $PATH:
unknown
command terminated with exit code 127

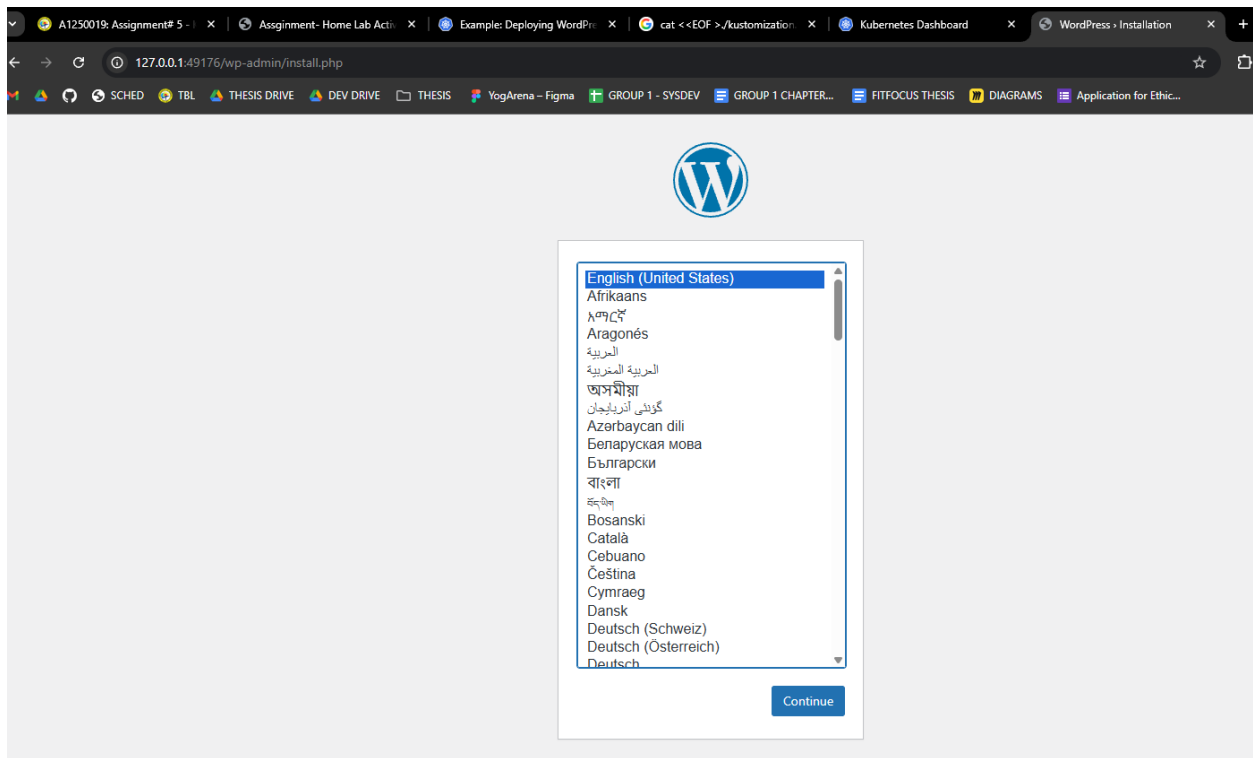
C:\Users\marky>kubectl exec shell-demo -- ls /
bin
boot
dev
docker-entrypoint.d
docker-entrypoint.sh
etc
```

kubectl exec -i -t my-pod --container main-app -- /bin/bash

```
C:\Users\marky>kubectl exec -i -t shell-demo --container nginx -- /bin/bash
root@minikube:/# |
```


3. Deploying Wordpress and MySQL with PersistentVolumes:

Browser output:



Commands and outputs:

kubectl apply -k ./

```
C:\Users\marky\Downloads>kubectl apply -k /.
secret/mysql-pass-d248m7h6cd created
service/wordpress created
Warning: spec.SessionAffinity is ignored for headless services
service/wordpress-mysql created
persistentvolumeclaim/mysql-pv-claim created
persistentvolumeclaim/wp-pv-claim created
deployment.apps/wordpress created
deployment.apps/wordpress-mysql created
```

kubectl get secrets

```
C:\Users\marky\Downloads>kubectl get secrets
NAME                                TYPE      DATA   AGE
mysql-pass-d248m7h6cd              Opaque    1        20s
```


kubectl get pvc

```
C:\Users\marky\Downloads>kubectl get pvc
```

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	VOLUMEATTRIBUTESCLASS	AGE
mysql-pv-claim	Bound	pvc-e4257e89-8ea1-4835-8122-fafe42bd177e	20Gi	RWO	standard	<unset>	26s
wp-pv-claim	Bound	pvc-e49a7a23-149d-4140-8943-ad13b6bcbfdd	20Gi	RWO	standard	<unset>	26s

kubectl get pods

```
C:\Users\marky\Downloads>kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
shell-demo	1/1	Running	0	28m
wordpress-7bfc756f84-pjfch	1/1	Running	0	3m30s
wordpress-mysql-7b5745f8dd-p9q9p	1/1	Running	0	3m30s

kubectl get services wordpress

```
C:\Users\marky\Downloads>kubectl get services wordpress
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
wordpress	LoadBalancer	10.96.175.15	<pending>	80:32437/TCP	119s

minikube service wordpress --url

```
C:\Users\marky\Downloads>minikube service wordpress --url
http://127.0.0.1:49176
! Because you are using a Docker driver on windows, the terminal needs to be open to run it.
```

kubectl delete -k /.

```
C:\Users\marky\Downloads>kubectl delete -k /.
secret "mysql-pass-d248m7h6cd" deleted from default namespace
service "wordpress" deleted from default namespace
service "wordpress-mysql" deleted from default namespace
persistentvolumeclaim "mysql-pv-claim" deleted from default namespace
persistentvolumeclaim "wp-pv-claim" deleted from default namespace
deployment.apps "wordpress" deleted from default namespace
deployment.apps "wordpress-mysql" deleted from default namespace
```