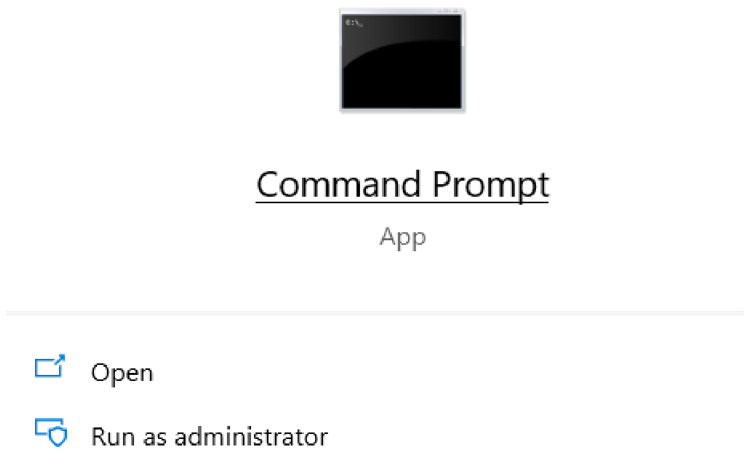
Experiment 06: Working with K3d and Local Persistent Volumes

Note: Refer to the Rancher LAB if you haven't already installed k3d for installation.

Make the local directory that we'll mount into our k3d containers.

For Windows:

Open a command prompt in "Run as administrator" mode



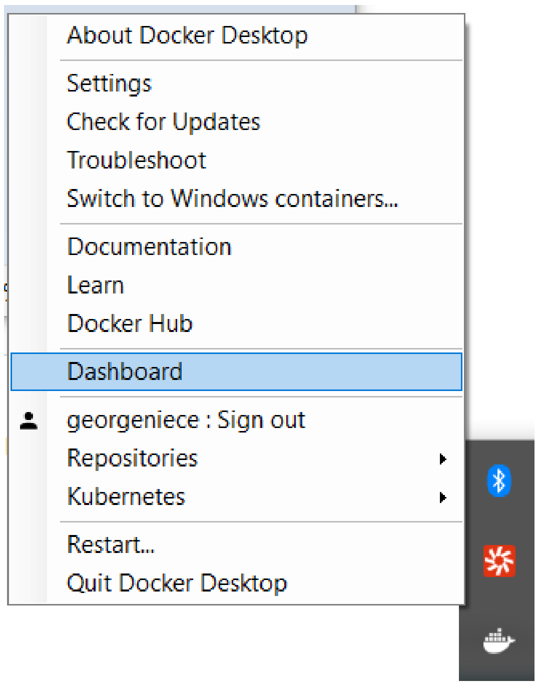
Make the folders that we'll mount into our containers for this experiment

```
mkdir c:\tmp
```

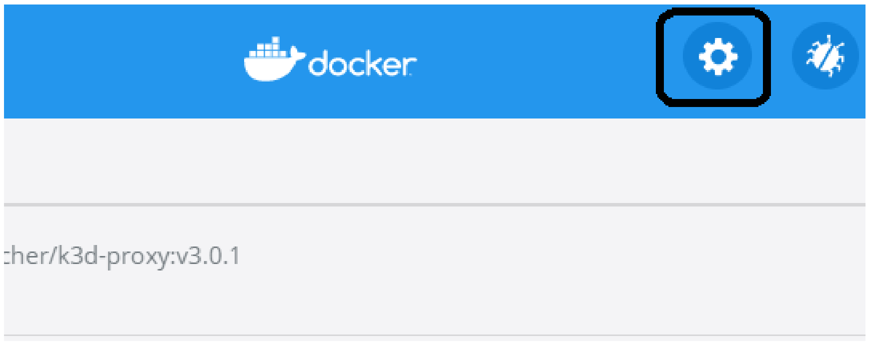
```
mkdir c:\tmp\k3dvol
```

The following step is only required if you're using a version of K3D prior to the WSL2 update. You can verify by opening the Docker for Desktop. If there is a "File Sharing" under resources then you would still need to do the following, but it is recommended to update your Docker Desktop before proceeding.

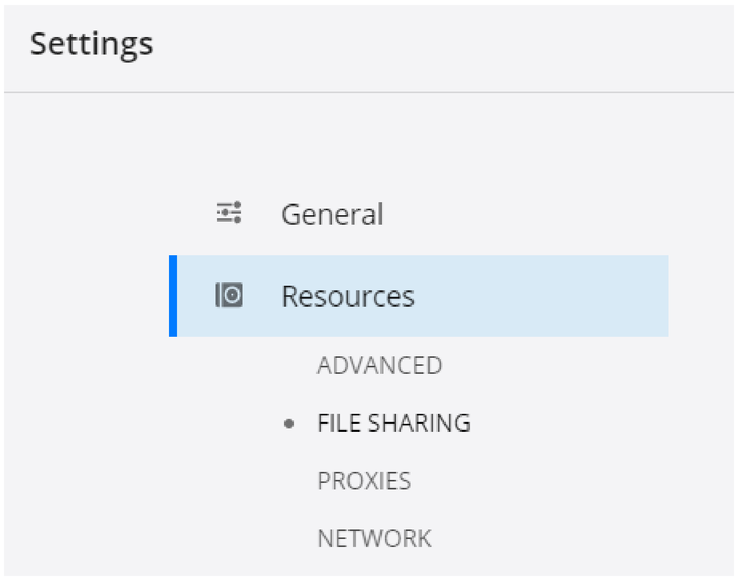
Open Docker for Desktop



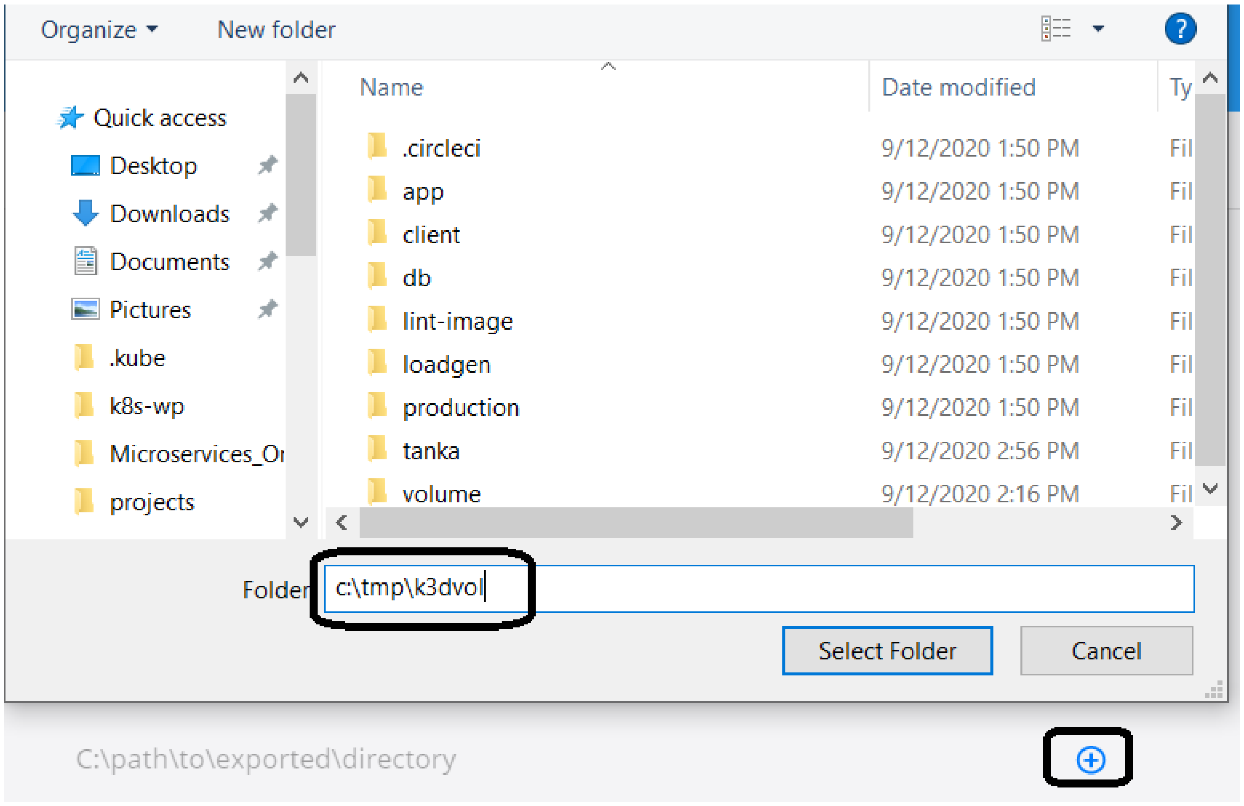
Select the settings icon



Under settings we'll expand the **Resources** and select **FILE SHARING**. From this Settings pane we can select folders that we want to expose as mount points within our Docker containers.



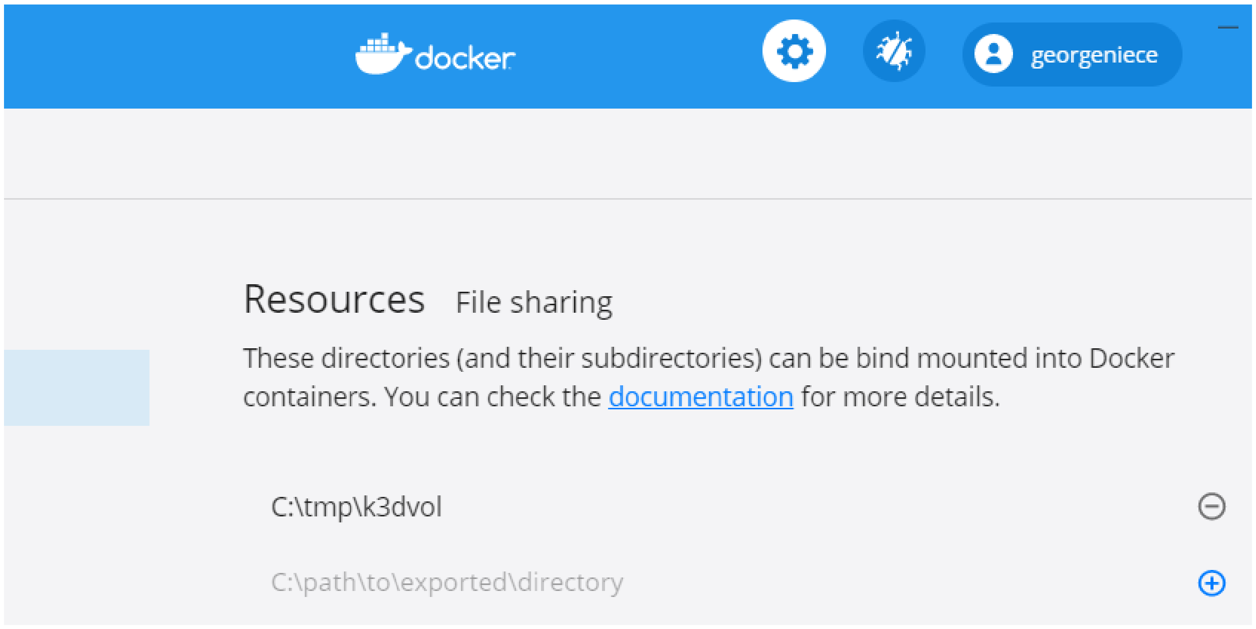
Select the + next to c:\path\to\exported\directory



Folder: c:\tmp\k3dvol

Enter the folder that we created to be bind mounted into our Docker containers. For this experiment that should be **c:\tmp\k3dvol**, then select **Select Folder**

Close, or minimize, the Docker for Desktop dashboard, noting that our new folder is now available in Docker to be mounted for this experiment.



Resources File sharing

These directories (and their subdirectories) can be bind mounted into Docker containers. You can check the documentation for more details.

C:\tmp\k3dvol

C:\path\to\exported\directory

Create the cluster for this experiment, using the volume option to mount our local folder into each node in the cluster. For this cluster we'll expose port 80 against the load balancer and set our agents to 1. Servers option defaults to 1 when not specified.

For Windows:

```
 k3d cluster create "k3d-cluster" --volume /c/tmp/k3dvol:/tmp/k3dvol --port "80:80@loadbalancer" --agents 2
```

For MacOS:

```
k3d cluster create "k3d-cluster" --volume /tmp/k3dvol:/tmp/k3dvol --port "80:80@loadbalancer" --agents 2
```

```
[33mWARN[0m[0000] Failed to stat file/directory/named volume that you're trying to mount:
'/c/tmp/k3dvol' in '/c/tmp/k3dvol:/tmp/k3dvol' -> Please make sure it exists
[33mWARN[0m[0000] No node filter specified
[36mINFO[0m[0000] Created network 'k3d-k3d-cluster'
[36mINFO[0m[0000] Created volume 'k3d-k3d-cluster-images'
[36mINFO[0m[0001] Creating node 'k3d-k3d-cluster-server-0'
[36mINFO[0m[0001] Creating node 'k3d-k3d-cluster-agent-0'
[36mINFO[0m[0001] Creating node 'k3d-k3d-cluster-agent-1'
[36mINFO[0m[0002] Creating LoadBalancer 'k3d-k3d-cluster-serverlb'
[36mINFO[0m[0008] Cluster 'k3d-cluster' created successfully!
[36mINFO[0m[0008] You can now use it like this:
kubectl cluster-info
```

Set our **KUBECONFIG_FILE** environment variable to the file we'll load our k8s configuration for kubectl usages

set KUBECONFIG_FILE=.\.kube\k3d-cluster

Put our cluster configuration for k3d-cluster into our file

k3d kubeconfig get k3d-cluster > %KUBECONFIG_FILE%

type %KUBECONFIG_FILE%

```
---
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data:
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUJWekNCL3FBREFnRUNBZ0VBTUFvR
0NDcUdTTTQ5QkFNQ01DTXhJVEFmQmdOVkJBTU1HR3N6Y3kxelpYSjIKWlhJdFkyRkFNVF
U1T1RZM01qUTRPVEFlRncweU1EQTVNRGt4TnpJNE1EbGFGdzB6TURBNU1EY3hOekk0TU
RsYQpNQ014SVRBZkJnTlZCQU1NR0dzemN5MXpaWEoyWlhJdFkyRkFNVFU1T1RZM01qUT
RPVEJaTUJNR0J5cUdTTTQ5CkFnRUdDQ3FHU000OUF3RUhBMElBQkdmRm53RUtycFVtbV
h3ckVFUFdaYSsxZWdYQWhPV2ZUZEorZU94UWo4U3kKUDgzSTJQbDYrTUQ4OUNMTlRTb
E1Ebk5pM3FvS1N0ZHdGZFRhOFRHQUxTS2pJekFoTUE0R0ExVWREd0VCL3dRRQpBd0lDc
ERBUEJnTlZIUk1CQWY4RUJUQURBUUgvTUFvR0NDcUdTTTQ5QkFNQ0EwZ0FNRVVDSUF
VOGpaQ0RORkhMCkpDVkdOd2I2UXhxS0xPekp1NUtYV2JNdGZ0VVB4Ymc4QWlFQXNkQXF
JRm90R2JPcVk4OUxudU45eStrTU44M1AKU1pPWWRGMEIyNUV2dXgwPQotLS0tLUVORCB
DRVJUSUZJQ0FURS0tLS0tCg==
    server: https://0.0.0.0:6550
  name: k3d-k3d-cluster
contexts:
- context:
    cluster: k3d-k3d-cluster
    user: admin@k3d-k3d-cluster
  name: k3d-k3d-cluster
current-context: k3d-k3d-cluster
kind: Config
preferences: {}
users:
- name: admin@k3d-k3d-cluster
  user:
    password: dd79f910ebe64a30855bcd38b7425b98
    username: admin
```

set KUBECONFIG=%KUBECONFIG_FILE%

List our clusters to view the

k3d cluster list k3d-cluster

```
NAME          SERVERS   AGENTS   LOADBALANCER
k3d-cluster   1/1       2/2      true
```

kubectl cluster-info

```
Kubernetes master is running at https://0.0.0.0:51472
CoreDNS is running at https://0.0.0.0:51472/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy
Metrics-server is running at https://0.0.0.0:51472/api/v1/namespaces/kube-system/services/https:metrics-server:/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
```

kubectl cluster-info

```
Unable to connect to the server: dial tcp [::1]:8080: connectex: No connection could be made because the target machine actively refused it.
```

Troubleshooting Note: If you have an error similar to above when executing **kubectl**, ensure you correctly set the **KUBECONFIG** in previous steps in this experiment.

Review the enhanced listing for the cluster-info

kubectl cluster-info dump

View the information for the exposed traefik loadbalancer IP/hostname

kubectl get svc traefik --namespace kube-system -w

```
NAME      TYPE           CLUSTER-IP     EXTERNAL-IP   PORT(S)                      AGE

traefik   LoadBalancer   10.43.245.42   172.18.0.2    80:32162/TCP,443:31433/TCP   42m
```

kubectl describe svc traefik --namespace kube-system | grep Ingress

```
LoadBalancer Ingress:     172.18.0.2
```

Open an editor and paste the following yaml file that will create a **busybox** with a simple ping, as well as exposing our local **c:\tmp\k3dvol** as a mount on **/data** within our container. Alternatively, you can wget the file from the labs folder as

$ **wget** **https://github.com/GeorgeNiece/DevOpsForMicroservicesWithKubernetes-3day/tree/master/labs/app.yaml**

View or edit the file to paste the contents and review the yaml file we're using for this experiment

notepad app.yaml

or

vim app.yaml

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: task-pv-volume
  labels:
    type: local
spec:
  storageClassName: manual
  capacity:
    storage: 1Gi
  accessModes:
    - ReadWriteOnce
  hostPath:
    path: "/tmp/k3dvol"
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: task-pv-claim
spec:
  storageClassName: manual
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: echo
spec:
  selector:
    matchLabels:
      app: echo
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: echo
    spec:
      volumes:
        - name: task-pv-storage
          persistentVolumeClaim:
            claimName: task-pv-claim
```

```
   containers:
   - image: busybox
     name: echo
     volumeMounts:
       - mountPath: "/data"
         name: task-pv-storage
     command: ["ping", "127.0.0.1"]
```

kubectl apply -f app.yaml

```
persistentvolume/task-pv-volume created
persistentvolumeclaim/task-pv-claim created
deployment.apps/echo created
```

kubectl get pv

```
NAME           CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS   CLAIM
STORAGECLASS   REASON   AGE
task-pv-volume   1Gi        RWO            Retain           Bound    default/task-pv-claim   manual
38s
```

View our Persistent Volume Claim

kubectl get pvc

```
NAME           STATUS   VOLUME           CAPACITY   ACCESS MODES   STORAGECLASS
AGE
task-pv-claim   Bound    task-pv-volume   1Gi        RWO            manual         73s
```

View our active pod
kubectl get pods

```
NAME                    READY   STATUS    RESTARTS   AGE
echo-859c44dcc6- pfc7m 1/1     Running   0          118s
```

Exec a shell into the container
kubectl exec -it echo-859c44dcc6-pfc7m -- sh

Note: In the deprecated syntax we could have left off the double hyphen before the sh command, but with the pace of change in Kubernetes, and tools like k3d/kind, better to try to stay as current as possible

```
$ echo $(hostname)

$ echo $(hostname) > /data/hostname.txt

$ cat /data/hostname.txt

$ exit
```

kubectl get nodes -o wide

```
NAME                    STATUS   ROLES    AGE   VERSION       INTERNAL-IP   EXTERNAL-IP
OS-IMAGE   KERNEL-VERSION    CONTAINER-RUNTIME
k3d-k3d-cluster-agent-0   Ready   <none>   53m   v1.18.6+k3s1   172.18.0.3   <none>
Unknown   4.19.76-linuxkit   containerd://1.3.3-k3s2
k3d-k3d-cluster-agent-1   Ready   <none>   53m   v1.18.6+k3s1   172.18.0.4   <none>
Unknown   4.19.76-linuxkit   containerd://1.3.3-k3s2
k3d-k3d-cluster-server-0   Ready   master   53m   v1.18.6+k3s1   172.18.0.2   <none>
Unknown   4.19.76-linuxkit   containerd://1.3.3-k3s2
```

Delete our identified pod, that we'd exec'd into and created our **hostname.txt file**

kubectl delete pod/echo-859c44dcc6-pfc7m

```
pod "echo-859c44dcc6-pfc7m" deleted
```

type c:\tmp\k3dvol\hostname.txt

```
echo-859c44dcc6-pfc7m
```

This is Kubernetes, and we're using a configuration requiring that pod for our application, so not surpringly, we'll do another get pods with kubectl and see a new pod created

kubectl get pods -o wide

```
NAME                   READY   STATUS    RESTARTS   AGE   IP          NODE
NOMINATED NODE   READINESS GATES

echo-859c44dcc6-7mnnr   1/1     Running   0          98m   10.42.2.4   k3d-k3d-cluster-server-0
<none>          <none>
```

Exec a sh into our new pod, but this time we'll leave off the double hyphen to see the deprecation warning.

kubectl exec -it echo-859c44dcc6-7mnnr   sh

```
/ # cat /data/hostname.txt
echo-859c44dcc6-pfc7m
/ # echo $(hostname)
echo-859c44dcc6-7mnnr
/ #  exit
```

Delete our cluster for this experiment

k3d cluster delete k3d-cluster

```
[36mINFO[0m[0000] Deleting cluster 'k3d-cluster'
[36mINFO[0m[0000] Deleted k3d-k3d-cluster-serverlb
[36mINFO[0m[0000] Deleted k3d-k3d-cluster-agent-1
[36mINFO[0m[0000] Deleted k3d-k3d-cluster-agent-0
[36mINFO[0m[0000] Deleted k3d-k3d-cluster-server-0
[36mINFO[0m[0000] Deleting cluster network
'f7f0376fbd55c7f4709ad960ad86c6501ed0a05a19a6d9757914370875a76600'
[36mINFO[0m[0001] Deleting image volume 'k3d-k3d-cluster-images'
[36mINFO[0m[0001] Removing cluster details from default kubeconfig...
[36mINFO[0m[0001] Removing standalone kubeconfig file (if there is one)...
[36mINFO[0m[0001] Successfully deleted cluster k3d-cluster!
```

k3d cluster list

```
NAME      SERVERS   AGENTS   LOADBALANCER
```