Kubernetes Volumes

Containers are ephemeral. It means, any container generated data gets stored into its own filesystem and will be deleted automatically if the container is deleted or restarted.

Kubernetes volumes provide a way for containers to access external disk storage or share storage among containers.

Types of Persistent Volumes

PersistentVolume types are implemented as plugins. Kubernetes currently supports the following

plugins:emptyDir: Used for mounting temporary empty directory from worker node Disk/RAM

awsElasticBlockStore: Used for mounting AWS EBS volume into the pod

azureDisk: Used for mounting Microsoft Azure data disk into the pod

azureFile: Used for mounting Microsoft Azure File volume into the pod

gcePersistentDisk: Used for mounting Google PD into the pod

hostPath: Used for mounting Worker node filesystem into the pod

nfs: Used for mounting existing NFS (Network file system) into the pod

configMap/secret: Used for mounting these values into the pod

persistentVolumeClaim: Used for mounting dynamically provisioned storage into the pod

Kubernetes Volume emptyDir:

* Persists data during lifetime of pod

* Persists data during container crashes in a pod

* Intially emptyDir

* Exists till the pod die

* Non-persistent

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: my-jenkins
spec:
  selector:
    matchLabels:
      run: my-jenkins
  replicas: 2
  template:
    metadata:
      labels:
        run: my-jenkins
```

```yaml
    spec:
      containers:
      - name: my-jenkins
        image: jenkins/jenkins:lts

        ports:
        - containerPort: 8080
        volumeMounts:
        - mountPath: /var/jenkins/data_jenkins
          name: jenkins-volume
      volumes:
      - name: jenkins-volume
        emptyDir: {}
```

To check the pod status

```
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-4c95v   1/1     Running   0          2m30s
my-jenkins-65757db454-wfcb2   1/1     Running   0          2m50s
ubuntu@master:~$
```

Verification

```
    Environment:    <none>
    Mounts:
      /var/jenkins/data_jenkins from jenkins-volume (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-mlq8k (ro)
Conditions:
  Type              Status
  Initialized       True
  Ready             True
  ContainersReady   True
  PodScheduled      True
Volumes:
  jenkins-volume:
    Type:       EmptyDir (a temporary directory that shares a pod's lifetime)
    Medium:
    SizeLimit:  <unset>
  kube-api-access-mlq8k:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
```

Go to inside the pod and create a file

```
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-4c95v   1/1     Running   0          2m30s
my-jenkins-65757db454-wfcb2   1/1     Running   0          2m50s
ubuntu@master:~$ kubectl exec -it my-jenkins-65757db454-4c95v /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
jenkins@my-jenkins-65757db454-4c95v:/$ pwd
/
jenkins@my-jenkins-65757db454-4c95v:/$ cd /var/jenkins/data_jenkins
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ ls -lrt
total 0
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ echo "hello Ashok" >Ashok.txt
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ ls -lrt
total 4
-rw-r--r-- 1 jenkins jenkins 12 Dec 15 17:19 Ashok.txt
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$
```

Finally Terminate the pod and check file exits or not for new running pod level

```
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-4c95v   1/1     Running   0          2m30s
my-jenkins-65757db454-wfcb2   1/1     Running   0          2m50s
ubuntu@master:~$ kubectl exec -it my-jenkins-65757db454-4c95v /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
jenkins@my-jenkins-65757db454-4c95v:/$ pwd
/
jenkins@my-jenkins-65757db454-4c95v:/$ cd /var/jenkins/data_jenkins
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ ls -lrt
total 0
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ echo "hello Ashok" >Ashok.txt
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ ls -lrt
total 4
-rw-r--r-- 1 jenkins jenkins 12 Dec 15 17:19 Ashok.txt
jenkins@my-jenkins-65757db454-4c95v:/var/jenkins/data_jenkins$ exit
exit
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-4c95v   1/1     Running   0          6m25s
my-jenkins-65757db454-wfcb2   1/1     Running   0          6m45s
ubuntu@master:~$ kubectl delete po my-jenkins-65757db454-4c95v
pod "my-jenkins-65757db454-4c95v" deleted

ubuntu@master:~$
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-v6krj   1/1     Running   0          5s
my-jenkins-65757db454-wfcb2   1/1     Running   0          7m2s
ubuntu@master:~$ kubectl exec -it my-jenkins-65757db454-v6krj /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
jenkins@my-jenkins-65757db454-v6krj:/$ cd /var/jenkins/data_jenkins
jenkins@my-jenkins-65757db454-v6krj:/var/jenkins/data_jenkins$ ls -lrt
total 0
jenkins@my-jenkins-65757db454-v6krj:/var/jenkins/data_jenkins$
```

Kubernetes Volume hostPath:

Kubernetes host Path volume helps us to persist volume contents even after pod deleted from the worker node.

K8 hostPath volume mounts a file or directory from the worker node file system into the pod.

A pod running on the same worker node can only mount to the file/directory of that node.

Hostpath pv.yaml

```yaml
kind: PersistentVolume
apiVersion: v1
metadata:
  name: pv-volume
  labels:
    type: local
spec:
  storageClassName: manual
```

```
  capacity:
    storage: 10Gi
  accessModes:
    - ReadWriteOnce
  hostPath:
    path: "/scratch/data"
```

Host path PVC.yaml file

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: pv-claim
spec:
  storageClassName: manual
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 3Gi
```

Deployment yaml file

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: my-nginx
spec:
  selector:
    matchLabels:
      run: pv-nginx
  template:
    metadata:
      labels:
        run: pv-nginx
    spec:
      volumes:
        - name: pv-storage
          persistentVolumeClaim:
           claimName: pv-claim
      containers:
        - name: pv-container
          image: nginx
          ports:
            - containerPort: 80
              name: "http-server"
```

```
          volumeMounts:
            - mountPath: "/usr/share/nginx/html"
              name: pv-storage
```

```
ubuntu@master:~$ vi hostpathdep.yaml
ubuntu@master:~$ vi pv.yaml
ubuntu@master:~$ vi pvc.yaml
ubuntu@master:~$ kubectl apply -f pv.yaml
persistentvolume/pv-volume created
ubuntu@master:~$ kubectl apply -f pvc.yaml
persistentvolumeclaim/pv-claim created
ubuntu@master:~$ kubectl apply -f hostpathdep.yaml
deployment.apps/my-nginx created
ubuntu@master:~$ kubectl get po
NAME                          READY   STATUS    RESTARTS   AGE
my-jenkins-65757db454-v6krj   1/1     Running   0          23m
my-jenkins-65757db454-wfcb2   1/1     Running   0          30m
my-nginx-749f56d864-7zlx4     1/1     Running   0          8s
ubuntu@master:~$ ls -lrt
```

```
    Mounts:
      /usr/share/nginx/html from pv-storage (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-xj6n4 (ro)
Conditions:
  Type              Status
  Initialized       True
  Ready             True
  ContainersReady   True
  PodScheduled      True
Volumes:
  pv-storage:
    Type:       PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same namespace)
    ClaimName:  pv-claim
    ReadOnly:   false
  kube-api-access-xj6n4:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
```

```
ubuntu@master:~$ kubectl get po -o wide
NAME                          READY   STATUS    RESTARTS   AGE     IP          NODE     NOMINATED NODE   READINESS GA
my-jenkins-65757db454-v6krj   1/1     Running   0          26m     10.44.0.4   worker   <none>           <none>
my-jenkins-65757db454-wfcb2   1/1     Running   0          33m     10.44.0.7   worker   <none>           <none>
my-nginx-749f56d864-7zlx4     1/1     Running   0          2m43s   10.44.0.5   worker   <none>           <none>
ubuntu@master:~$ kubectl exec my-nginx-749f56d864-7zlx4 /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAN
ubuntu@master:~$ kubectl exec -it my-nginx-749f56d864-7zlx4 /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAN
root@my-nginx-749f56d864-7zlx4:/# cd /usr/share/nginx/html
root@my-nginx-749f56d864-7zlx4:/usr/share/nginx/html# ls -lrt
total 0
root@my-nginx-749f56d864-7zlx4:/usr/share/nginx/html# echo "Hello Ashok" >Ashok.txt
root@my-nginx-749f56d864-7zlx4:/usr/share/nginx/html# ls -lrt
total 4
-rw-r--r-- 1 root root 12 Dec 15 17:48 Ashok.txt
root@my-nginx-749f56d864-7zlx4:/usr/share/nginx/html# cat Ashok.txt
Hello Ashok
root@my-nginx-749f56d864-7zlx4:/usr/share/nginx/html#
```

Finally delete the pod and check the file exit or not

```
ubuntu@master:~$ kubectl get po -o wide
NAME                          READY   STATUS    RESTARTS   AGE     IP          NODE     NOMINATED NODE   READINESS GATES
my-jenkins-65757db454-v6krj   1/1     Running   0          29m     10.44.0.4   worker   <none>           <none>
my-jenkins-65757db454-wfcb2   1/1     Running   0          35m     10.44.0.7   worker   <none>           <none>
my-nginx-749f56d864-7zlx4     1/1     Running   0          5m22s   10.44.0.5   worker   <none>           <none>
ubuntu@master:~$ kubectl delete po my-nginx-749f56d864-7zlx4
pod "my-nginx-749f56d864-7zlx4" deleted

ubuntu@master:~$
ubuntu@master:~$ kubectl get po -o wide
NAME                          READY   STATUS    RESTARTS   AGE   IP          NODE     NOMINATED NODE   READINESS GATES
my-jenkins-65757db454-v6krj   1/1     Running   0          29m   10.44.0.4   worker   <none>           <none>
my-jenkins-65757db454-wfcb2   1/1     Running   0          36m   10.44.0.7   worker   <none>           <none>
my-nginx-749f56d864-h7q6t     1/1     Running   0          7s    10.44.0.5   worker   <none>           <none>
ubuntu@master:~$ kubectl exec -it my-nginx-749f56d864-h7q6t /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
root@my-nginx-749f56d864-h7q6t:/# cd /usr/share/nginx/html
root@my-nginx-749f56d864-h7q6t:/usr/share/nginx/html# ls -lrt
total 4
-rw-r--r-- 1 root root 12 Dec 15 17:48 Ashok.txt
root@my-nginx-749f56d864-h7q6t:/usr/share/nginx/html# cat Ashok.txt
Hello Ashok
root@my-nginx-749f56d864-h7q6t:/usr/share/nginx/html#
```