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Day11 容器进阶之Kubernetes 存储管理原理分析

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- 为何需要存储卷？
- 普通存储卷
- 应用中使用普通卷
- 持久化存储卷（PV）
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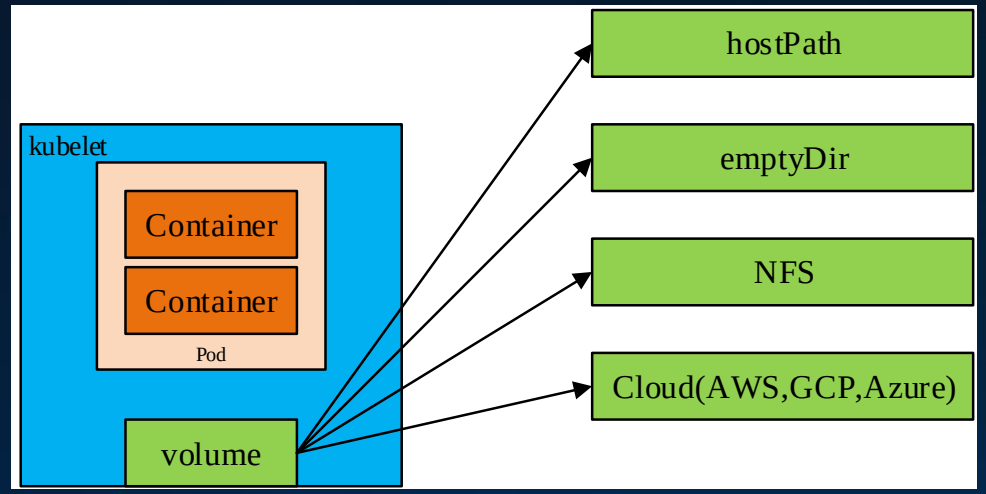
- 应用中使用持久化卷

为何需要存储卷？

容器部署过程中一般有以下三种数据：
- 启动时需要的初始数据，可以是配置文件
- 启动过程中产生的临时数据，该临时数据需要多个容器间共享
- 启动过程中产生的持久化数据

以上三种数据都不希望在容器重启时就消失，存储卷由此而来，它可以根据不同场景提供不同类型的存储能力。



普通存储卷(volume)


```yaml
apiVersion: v1
kind: Pod
metadata:
  name: test-pd
spec:
  containers:
  - image: k8s.gcr.io/test-webserver
    name: test-container
    volumeMounts:
    - mountPath: /test-pd
      name: test-volume
  volumes:
  - name: test-volume
    hostPath:
      # directory location on host
      path: /data
```

存储没有单独资源对象，与Pod的生命周期一起

应用中使用普通卷

创建configmap预制数据卷：
kubectl create –f configmap.yaml
kubectl create –f deployment_cfgmap.yaml

```
apiVersion: v1
data:
  wangbo: hello-world
kind: ConfigMap
metadata:
  name: test
```

```
spec:
      containers:
      - image: nginx:1.0
        imagePullPolicy: IfNotPresent
        name: container-0
        volumeMounts:
        - name: test
          mountPath: /tmp
      volumes:
      - configMap:
          defaultMode: 420
          items:
          - key: wangbo
            path: welcome
          name: test
        name: test
```

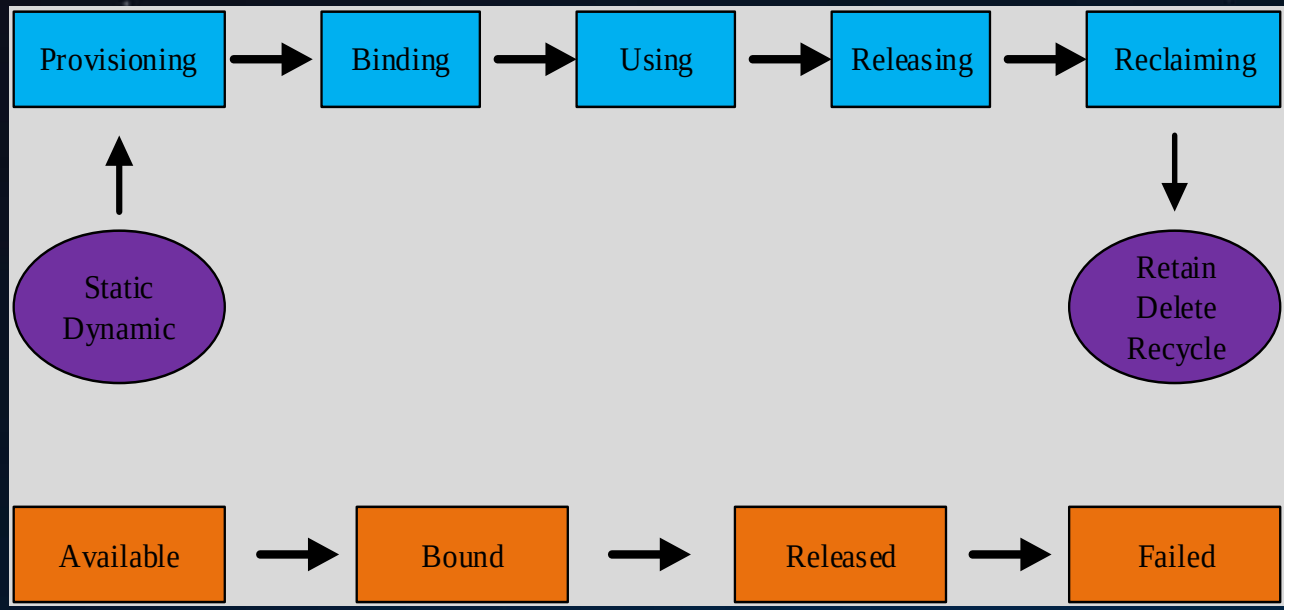
```
[paas@192-168-0-126 ~]$ kubectl exec -it test-6f6d985cc6-r82f9 sh
# cat /tmp/welcome
hello-world#
```

创建emptyDir临时存储数据卷：
kubectl create –f deployment_emptydir.yaml

持久化存储卷(PersistentVolume)

存储系统与应用系统区分开，单独资源对象，它不直接和Pod发生关系，通过另一个资源对象PersistentVolumeClaim来绑定关联

PV生命周期

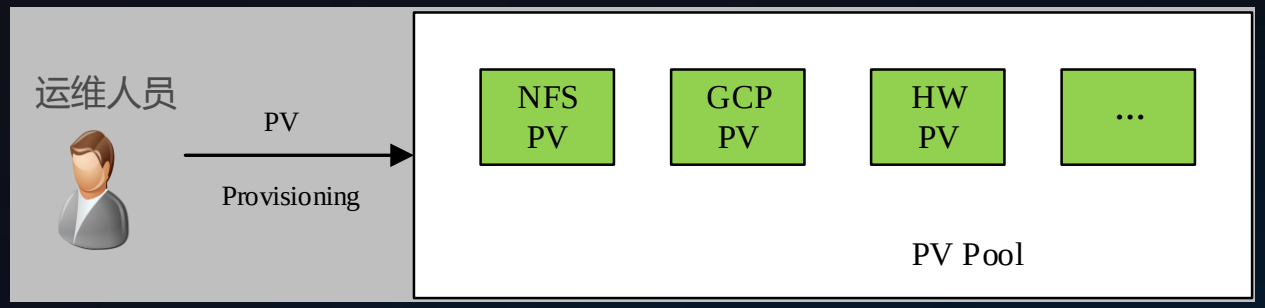


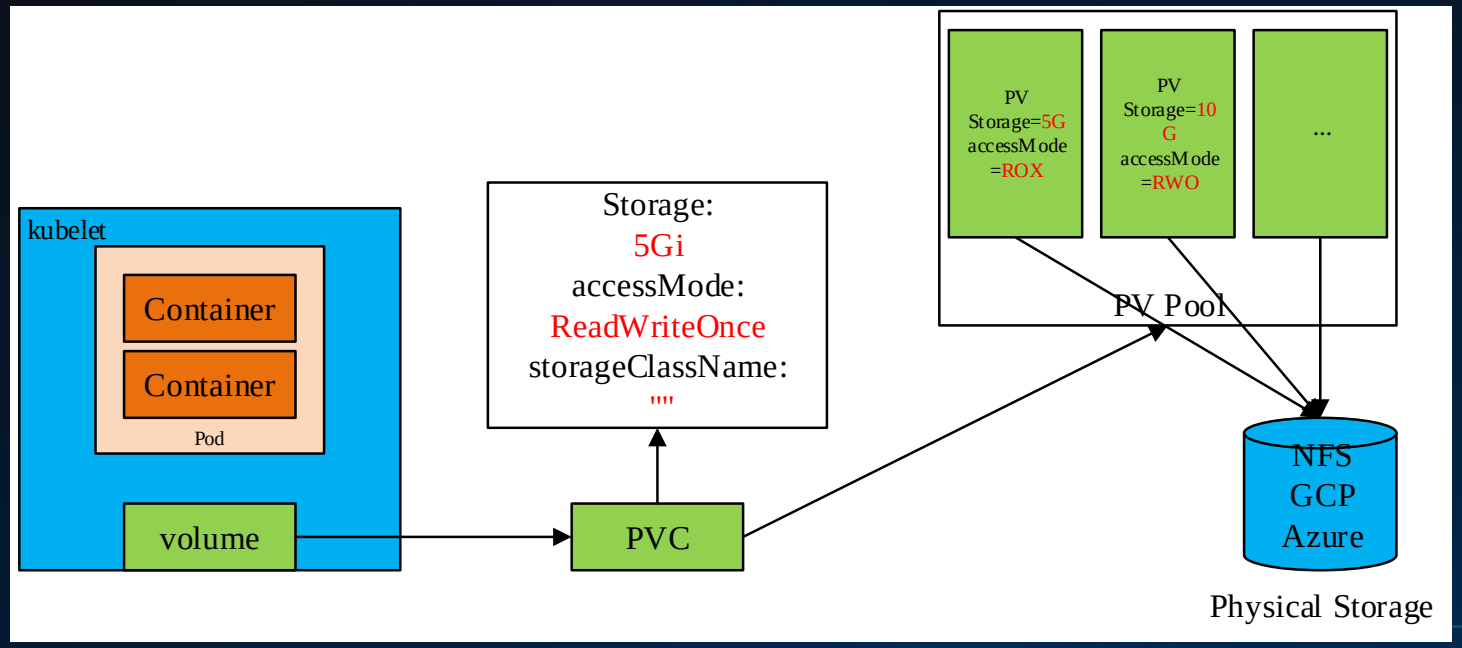

```yaml
apiVersion: v1
kind: PersistentVolume
metadata:
  name: pv0003
spec:
  capacity:
    storage: 5Gi
  volumeMode: Filesystem
  accessModes:
  - ReadWriteOnce
  persistentVolumeReclaimPolicy: Recycle
  storageClassName: slow
  mountOptions:
  - hard
  - nfsvers=4.1
  nfs:
    path: /tmp
    server: 172.17.0.2
```

持久化存储卷(PersistentVolume)

Provisioning：PV的预制创建有两种模式：静态模式和动态模式

静态模式：除创建PVC外，还需手动创建PV



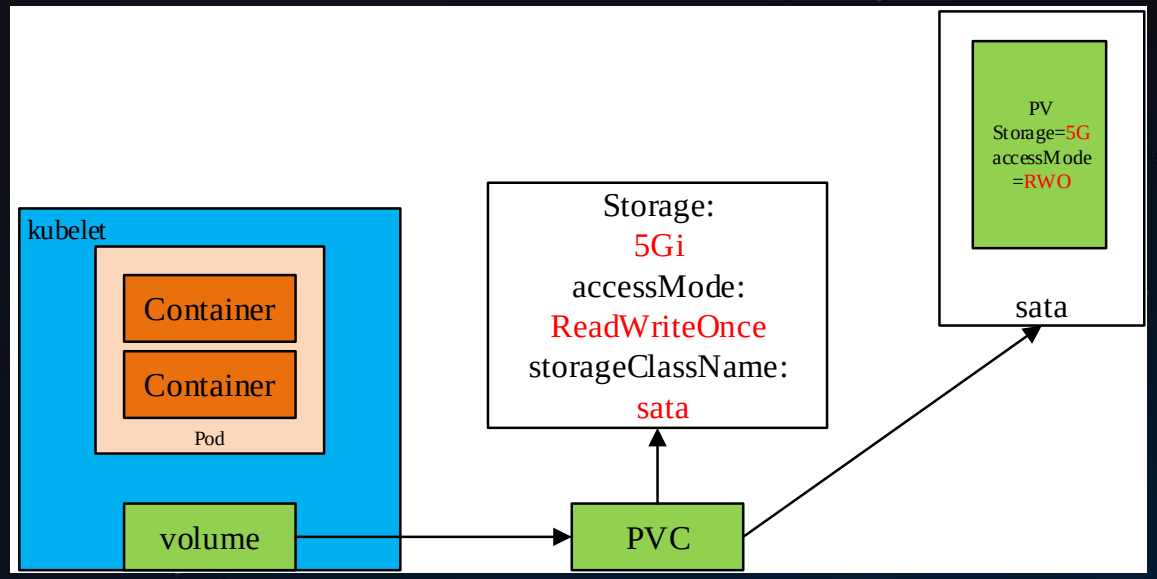



```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mongodb-pv-claim
  labels:
    app: mongodb
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 5Gi

---
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: rsvp-db
spec:
  replicas: 1
  template:
    metadata:
      labels:
        appdb: rsvpdb
    spec:
      containers:
      - name: rsvpd-db
        image: mongo:3.3
        ports:
        - containerPort: 27017
        volumeMounts:
        - name : mongodb-persistent-storage
          mountPath : /data/db
      volumes:
      - name: mongodb-persistent-storage
        persistentVolumeClaim:
          claimName: mongodb-pv-claim
```

持久化存储卷(PersistentVolume)

动态模式：只需创建PVC，系统根据PVC自动创建PV



支持的自动创建存储类型

```yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  annotations:
    storageclass.beta.kubernetes.io/is-default-class: "false"
  labels: kubernetes.io/cluster-service: "true"
  name: sata
parameters:
  kubernetes.io/description: ""
  kubernetes.io/hw:passthrough: "false"
  kubernetes.io/storagetype: BS
  kubernetes.io/volumetype: SATA
  kubernetes.io/zone: az1.dc1
provisioner: flexvolume-huawei.com/fuxivol
reclaimPolicy: Delete
```

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mongodb-pv-claim
  labels:
    app: mongodb
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 5Gi
  storageClassName: sata
---
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: rsvp-db
spec:
  replicas: 1
  template:
    metadata:
      labels:
        appdb: rsvpdb
    spec:
      containers:
      - name: rsvpd-db
        image: mongo:3.3
        ports:
        - containerPort: 27017
        volumeMounts:
        - name : mongodb-persistent-storage
          mountPath : /data/db
      volumes:
      - name: mongodb-persistent-storage
        persistentVolumeClaim:
          claimName: mongodb-pv-claim
```

持久化存储卷申明(PersistentVolumeClaim)

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用户真正关心自己想要的

存储访问模式，此能力依赖
存储厂商能力

存储大小

存储类型，适配
不同场景

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mongodb-pv-claim
  labels:
    app: mongodb
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 5Gi
  storageClassName: sata
```

应用中使用持久化卷

可以先查看集群支持的storageclass：
Kubectl get storageclass

```
[paas@192-168-0-13 ~]$ kubectl get storageclass
NAME              PROVISIONER                      AGE
nfs-ro            flexvolume-huawei.com/fuxinfs    6d
nfs-rw            flexvolume-huawei.com/fuxinfs    6d
obs-glacier       flexvolume-huawei.com/fuxiobs    6d
obs-standard      flexvolume-huawei.com/fuxiobs    6d
obs-standard-ia   flexvolume-huawei.com/fuxiobs    6d
sas               flexvolume-huawei.com/fuxivol    6d
sata              flexvolume-huawei.com/fuxivol    6d
ssd               flexvolume-huawei.com/fuxivol    6d
```

创建pvc，定义需要的访问模式，存储大小及存储类型：
Kubectl create –f pvc.yaml

创建deployment，绑定该pvc：
Kubectl create –f deployment_pvc.yaml

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  annotations:
    volume.beta.kubernetes.io/storage-class: sata
    volume.beta.kubernetes.io/storage-provisioner:
flexvolume-huawei.com/fuxivol
  labels:
    failure-domain.beta.kubernetes.io/region:
southchina
    failure-domain.beta.kubernetes.io/zone: kvmxen.dc1
  name: test
spec:
  accessModes:
  - ReadWriteMany
  resources:
    requests:
      storage: 10Gi
```

```yaml
   spec:
      containers:
      - image: nginx:latest
        imagePullPolicy: IfNotPresent
        name: container-0
        volumeMounts:
        - name: test
          mountPath: /tmp
      volumes:
      - persistentVolumeClaim:
          claimName: test
        name: test
```