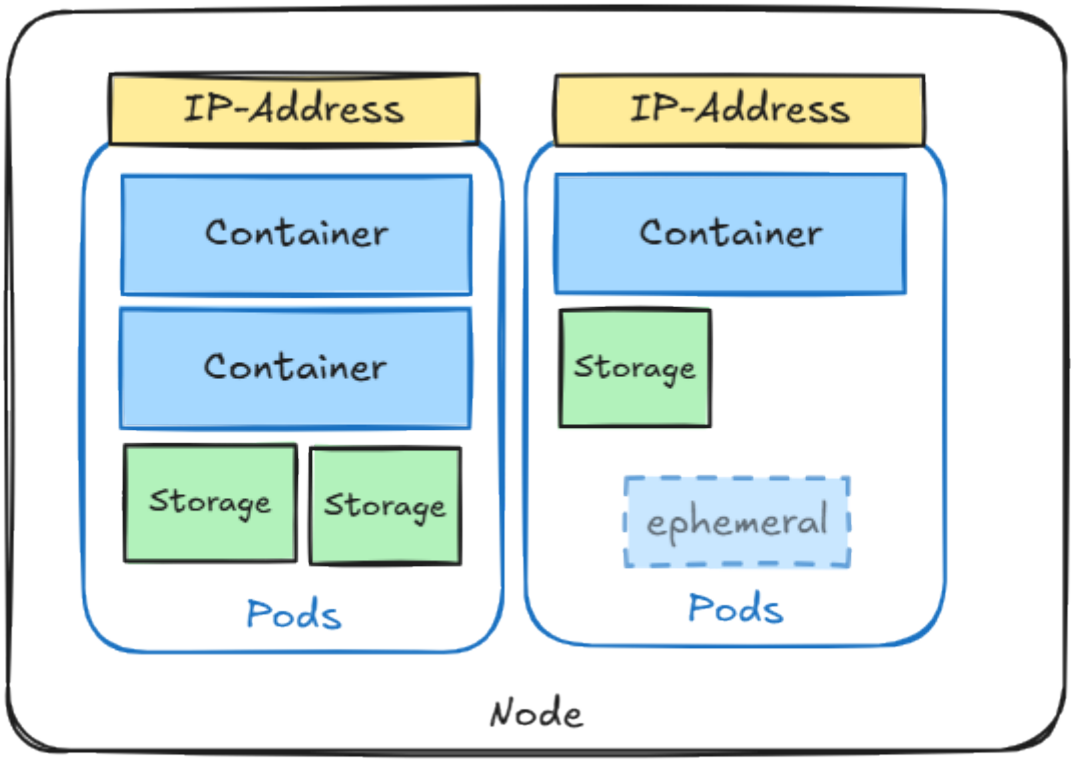
Pod

Useful Links:

- Kubernetes Official Documentation
- Viewing Pods and Nodes

Architecture:



Detailed Description:

A Pod is the smallest deployable unit in Kubernetes and serves as the basic building block for running applications in the cluster. Each Pod encapsulates one or more containers, which share the same resources such as storage, networking, and compute. Containers within a Pod are tightly coupled, meaning they always run together on the same node and

share the same network namespace, allowing them to communicate with each other using `localhost`.

Typically, a Pod has a single container, but it can host sidecar containers that assist the main application container with additional tasks like logging, monitoring, or proxying requests. Pods are ephemeral by nature, designed to be replaceable and scaled according to workload demands through higher-level Kubernetes abstractions like Deployments or StatefulSets.

Key characteristics of Pods include:

- **Shared Networking:** All containers in a Pod share the same IP address and port space.
- **Shared Storage:** Volumes attached to a Pod are shared among all its containers.
- **Lifecycle Management:** Pods are managed by controllers like Deployments, ReplicaSets, and DaemonSets to ensure desired state is maintained.

`Init containers` in Kubernetes run before the main app container starts in a pod.

- Prepare the environment (e.g., set up files or check conditions)
- Run once and finish before the main app starts
- Are useful for tasks that your main app doesn't handle well or should not have access to

`Sidecar containers` run alongside the app container in a pod to enhance its functionality without modifying the main app. They can share resources and help with tasks like logging, monitoring, or proxying.

`Ephemeral containers` are temporary containers that you can add to an existing Pod to troubleshoot or inspect it. Unlike regular containers, they are not part of the initial setup and cannot be restarted. They’re useful when you need to debug or run commands in a Pod that’s already running.

Command Reference Guide:

```
# Query running pods
kubectl get pods


# Query detailed informatoin about pods
kubectl get pods -o wide


# Create single pod
```

```
kubectl run nginx --image=nginx

# Run image / pass environment and command
kubectl run --image=ubuntu ubuntu --env="KEY=VALUE" -- sleep infinity

# Get yaml configuration for the resource
kubectl run nginx --image=nginx --dry-run=client -o yaml | tee nginx.yaml

# Get specific information of any yaml section
kubectl explain pod.spec.restartPolicy

# Create pod resource from yaml configuration file
kubectl create -f nginx.yaml

# Apply pod resource from yaml configuration
kubectl apply -f nginx.yaml

# Delete pod resource wihtout waiting for graceful shutdown of application (--now)
kubectl delete pod/nginx pod/ubuntu --now

# Get full resource description using descripe
kubectl describe pod/nginx

# Get logs for a specific container in the pod
kubectl logs pod/nginx -c nginx

# If a pod fails use -p to get previouse logs for a specific container in the pod
kubectl logs pod/nginx -c nginx -p

# Get shell from running container
kubectl exec --stdin --tty nginx -- /bin/bash
kubectl exec --stdin --tty nginx -c container1 -- /bin/bash # get access to specific container

# Combine pod creation
kubectl run nginx --image=nginx --dry-run=client -o yaml | tee nginx.yaml
kubectl run ubuntu --image=ubuntu --dry-run=client -o yaml | tee ubuntu.yaml
{ cat nginx.yaml; echo "---"; cat ubuntu.yaml; } | tee multi_pods.yaml
kubectl apply -f multi_pods.yaml
```

fail-pod-deploy.yaml:

```
apiVersion: v1
kind: Pod
metadata:
name: blocked-pod
spec:
restartPolicy: Never
initContainers:
- name: init-fail
  image: busybox
  command: ["sh", "-c", "exit 1"]
containers:
- name: app-container
  image: nginx
```

success-on-retry-pod-deploy.yaml:

```
apiVersion: v1
kind: Pod
metadata:
name: blocked-pod
spec:
restartPolicy: Always
initContainers:
- name: init-fail
  image: busybox
  command: ["sh", "-c", "if [ ! -f /data/ready ]; then touch /data/ready; sleep 10; exit 1; else exit 0; fi"]
  volumeMounts:
  - name: shared-data
    mountPath: /data
containers:
- name: app-container
  image: nginx
  volumeMounts:
  - name: shared-data
    mountPath: /data
```

```
volumes:
- name: shared-data
  emptyDir: {}
```

sidecar-pod-deploy.yaml:

```
apiVersion: apps/v1
kind: Deployment
metadata:
name: myapp
labels:
  app: myapp
spec:
replicas: 1
selector:
  matchLabels:
    app: myapp
template:
  metadata:
    labels:
      app: myapp
  spec:
    containers:
      - name: myapp
        image: alpine:latest
        command: ['sh', '-c', 'while true; do echo "$(date) logging $(($RANDOM))" >> /opt/logs.txt; sleep 5;
done']
        volumeMounts:
          - name: data
            mountPath: /opt
      - name: logshipper
        image: alpine:latest
        command: ['sh', '-c', 'tail -F /opt/logs.txt']
        volumeMounts:
          - name: data
            mountPath: /opt
```

```
  volumes:
    - name: data
      emptyDir: {}
```

```
# Create init container that will fail. App container will not start
kubectl apply -f fail-pod-deploy.yaml && watch kubectl describe  -f blocked.yaml

# Create init container that will succed on second try.
kubectl apply -f success-on-retry-pod-deploy.yaml && watch kubectl describe  -f blocked.yaml

# Run app container along with sidecar helper container
kubectl apply -f sidecar-pod-deploy.yaml && watch kubectl logs $(kubectl get pods -l app=myapp -o
jsonpath='{.items[0].metadata.name}') --all-containers=true

# Run ephemeral container (If you only need to inspect and debug the running Pod)
kubectl run ephemeral-demo --image=busybox --restart=Never -- sleep 100000
kubectl debug -it ephemeral-demo --image=busybox:1.28 --target=ephemeral-demo
kubectl describe pod ephemeral-demo

# Copy and Add a New Container (If you need to change the environment or add more debugging tools)
kubectl run myapp --image=busybox:1.28 --restart=Never -- sleep 1d
kubectl debug myapp -it --image=ubuntu --share-processes --copy-to=myapp-debug
kubectl get pods
```

Revision #14
Created 22 November 2024 19:25:21 by Admin
Updated 30 November 2024 17:04:33 by Admin