KPLABS Course

Certified Kubernetes Administrator 2022

Workloads & Scheduling

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Module 1: Labels & Selector

1.1 Labels

Labels are key/value pairs that are attached to objects, such as pods

1.2 Selectors

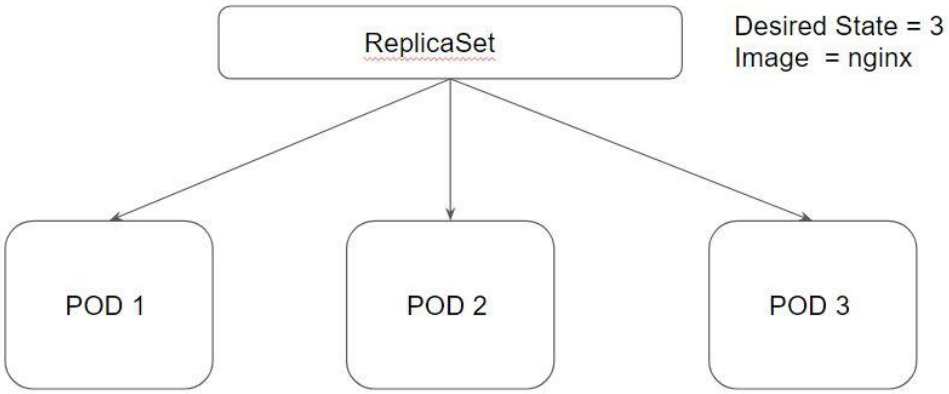
Selectors allow us to filter objects based on labels.

Example:

Show me all the objects which have a label where env: prod

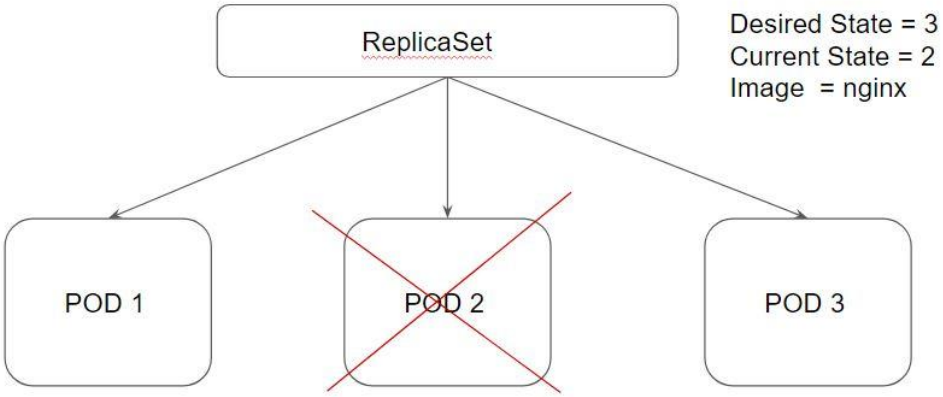
Module 2: ReplicaSets

A ReplicaSet purpose is to maintain a stable set of replica Pods running at any given time.



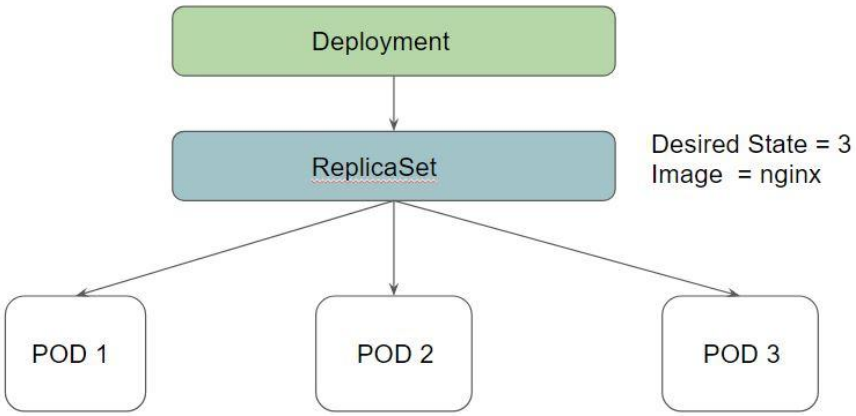
Desired State - The state of pods which is desired.

Current State - The actual state of pods that are running.



Module 3: Deployments

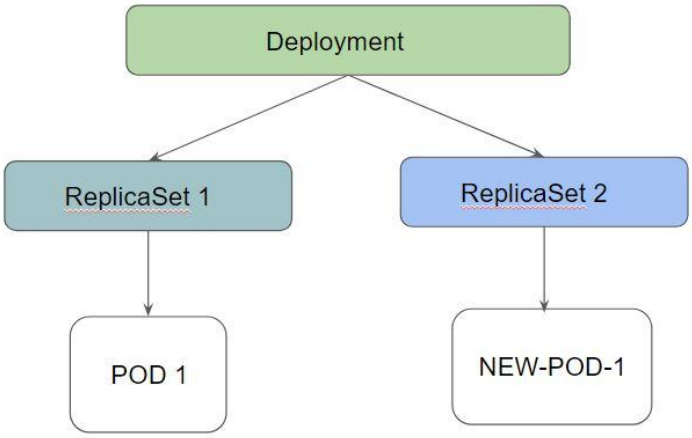
Deployments provide replication functionality with the help of ReplicaSets, along with various additional capabilities like rolling out of changes, rollback changes if required.



3.1 Benefits of Deployment - Rollout Changes

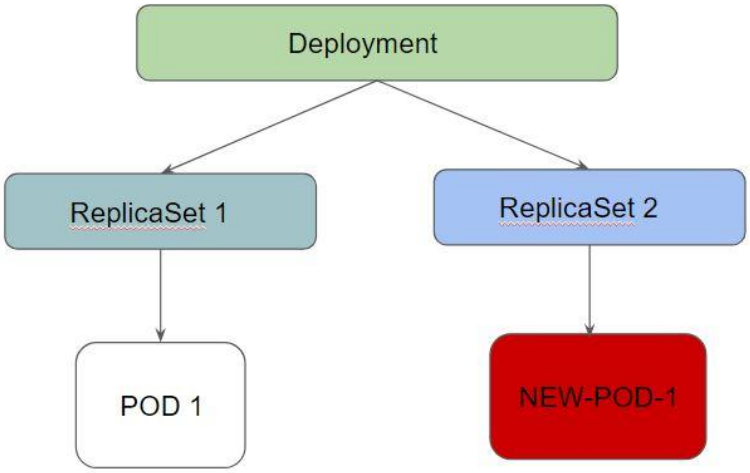
We can easily roll out new updates to our application using deployments.

Deployments will perform an update in a rollout manner to ensure that your app is not down.



3.2 Benefits of Deployment - Rollback Changes

Sometimes, you may want to rollback a Deployment; for example, when the Deployment is not stable, such as crash looping



Deployment ensures that only a certain number of Pods are down while they are being updated.

By default, it ensures that at least 25% of the desired number of Pods are up (25% max unavailable)

Deployments keep the history of revision which had been made.

Module 4: Important Pointer - Deployments

1. You should know how to set a new image to deployment as part of rolling update.
2. You should know the importance of --record instruction.
3. You should know how to rollback a deployment.
4. You should be able to scale the deployment

Command	Command
kubectl set image deployment nginx-deployment nginx=nginx:1.91 --record	Set Image
kubectl scale deployment nginx-deployment --replicas 10	Scale Deployment
kubectl rollout undo deployment nginx-deployment	Rollout Undo

Module 5: Generating Deployment Manifests via CLI

Till now, we have been referencing the documentation to get the manifests for objects like Pods.

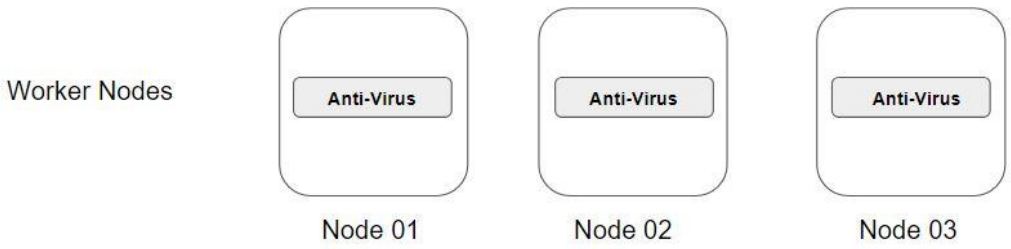
This can be a tedious process and can consume time.

```
C:\Users\Zeal Vora>kubectl run nginx --image=nginx --dry-run=client -o yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    run: nginx
  name: nginx
spec:
  containers:
  - image: nginx
    name: nginx
```

Module 6: Daemonsets

A DaemonSet can ensure that all Nodes run a copy of a Pod.

As nodes are added to the cluster, Pods are added to them.

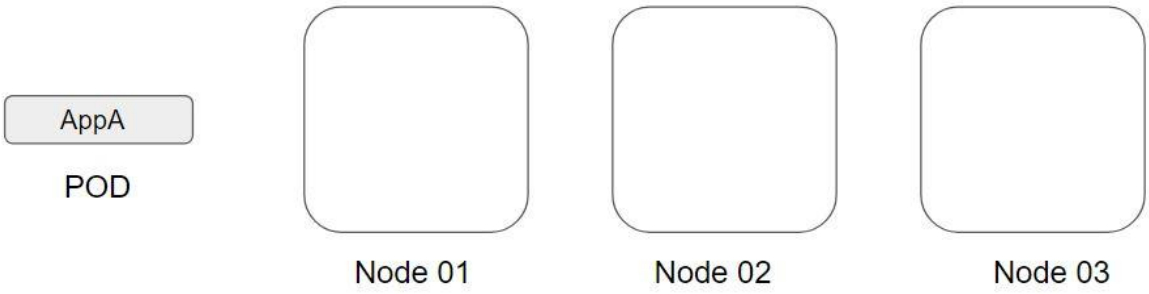


Module 7: NodeSelector

nodeSelector allows us to add a constraint about running a pod in a specific worker node.

Use-Case:

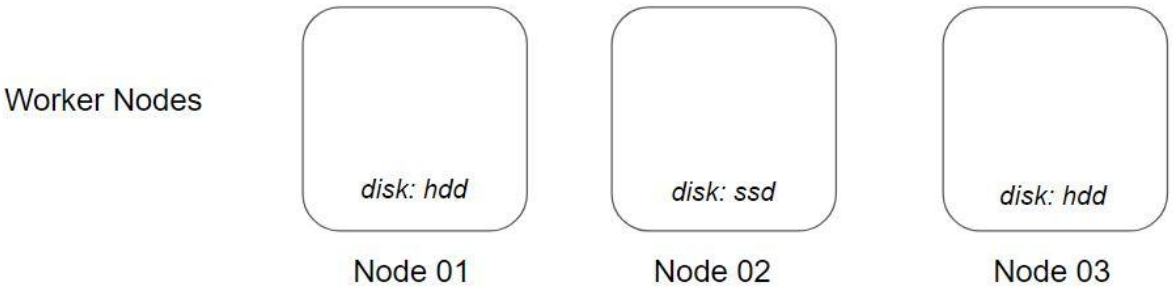
- AppA requires a faster disk in order to be able to run effectively.
- Run AppA in nodes which has SSD.



Step 1: Adding a Label to the Node

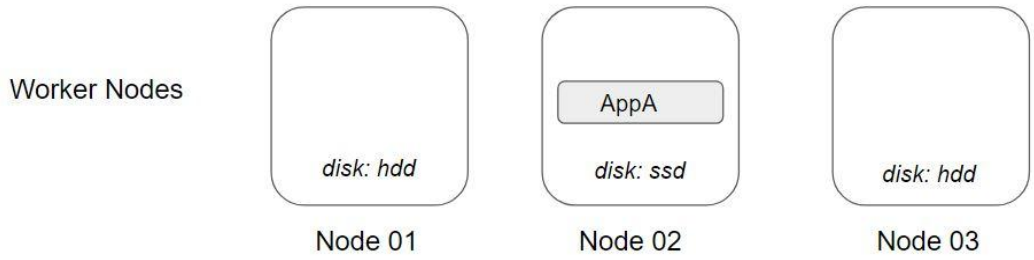
Step 1: Add a Label to your nodes depending on their disk types.

- disk: hdd
- disk:ssd



Step 2: Using nodeSelector Configuration

Create a nodeSelector configuration to run pods only on nodes which has a label of disk=ssd



Module 8: Node Affinity

For multiple reasons, there can be a need to run a pod on a specific worker node.

There can be multiple reasons, node hardware being the common one.

Node affinity is a set of rules used by the scheduler to determine where a pod can be placed

In Kubernetes terms, it is referred to as nodeSelector, and nodeAffinity/podAffinity fields under PodSpec.

In Kubernetes, we can achieve nodeAffinity with the help of:

- nodeSelector
- nodeAffinity (more flexibility)

Node affinity is conceptually similar to nodeSelector – it allows you to constrain which nodes your pod is eligible to be scheduled on, based on labels on the node.

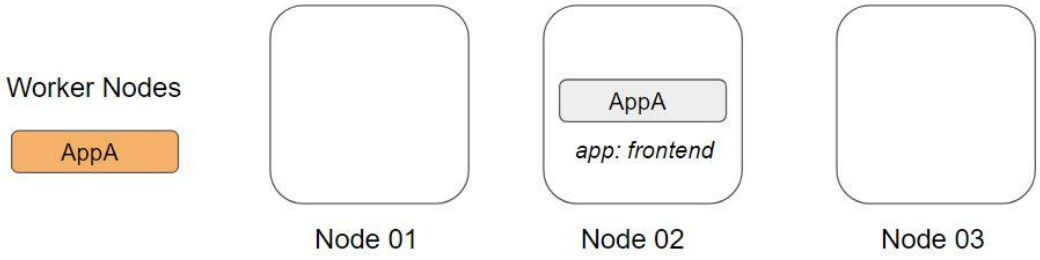
Sr	Types	Description
1	requiredDuringSchedulingIgnoredDuringExecution	Hard Preference
2	preferredDuringSchedulingIgnoredDuringExecution	Soft Preference

Module 9: Pod Affinity and Pod Anti-Affinity

First Question: Where should I be running this pod?

With Node Affinity, the question became: Should I be running my pod in this node?

The considerations are still about the node. No outside information is considered apart from node.



Step 1: Pod Selector

The first thing to figure out: “What other POD are we referring to”

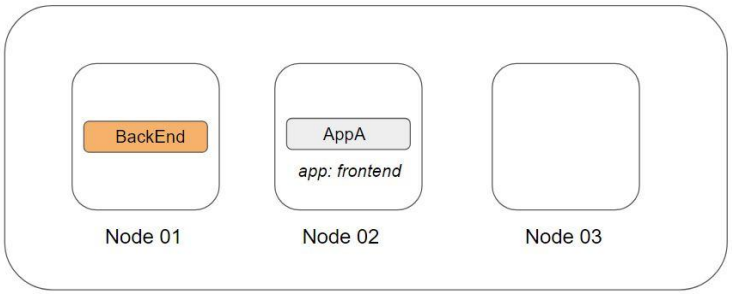
In this case, we are referring to other POD as AppA which has a label of app:frontend

Answer: I want BackEnd Pod to be running in the same place as AppA Pod.

Step 2: Topology

Topology refers to “what does the same place mean”?

It can mean the same place if we look at the zone or region level (same AZ / same region)
It can mean a different place if we look at the host level.



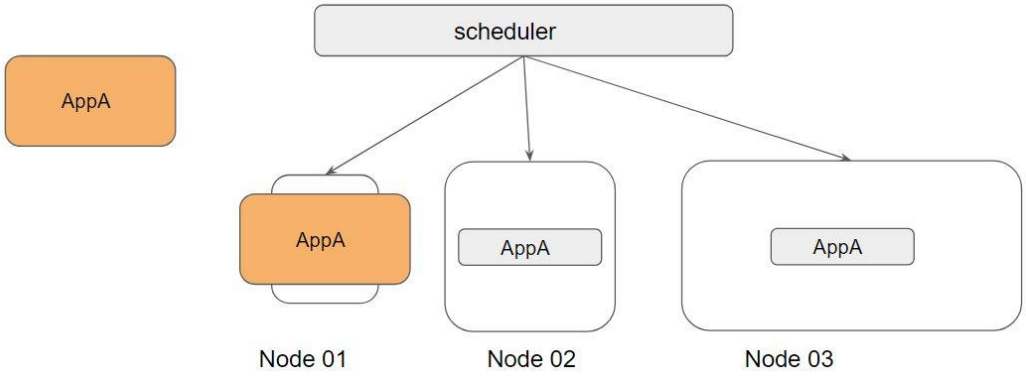
Step 3: Yes/No

Should I run my pod in the same place as the other POD? (Yes or No)

Yes: Pod Affinity
No: Pod Anti-Affinity

Module 10: Resource Requests and Limits

If you schedule a large application in a node which has limited resources, then it will soon lead to OOM or others and will lead to downtime.



Requests and Limits are two ways in which we can control the amount of resource that can be assigned to a pod (resource like CPU and Memory)

Requests: Guaranteed to get.
Limits: Makes sure that the container does not take node resources above a specific value.

Kubernetes Scheduler decides the ideal node to run the pod depending on the requests and limits.

If your POD requires 8GB of RAM, however, there are no nodes within your cluster which has 8GB RAM, then your pod will never get scheduled.

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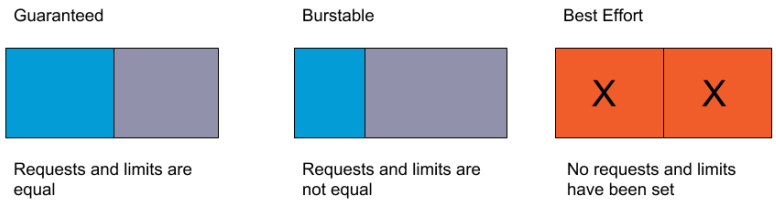


Module 11: Static Pods

You can directly inform the kubelet that it needs to run a specific pod.

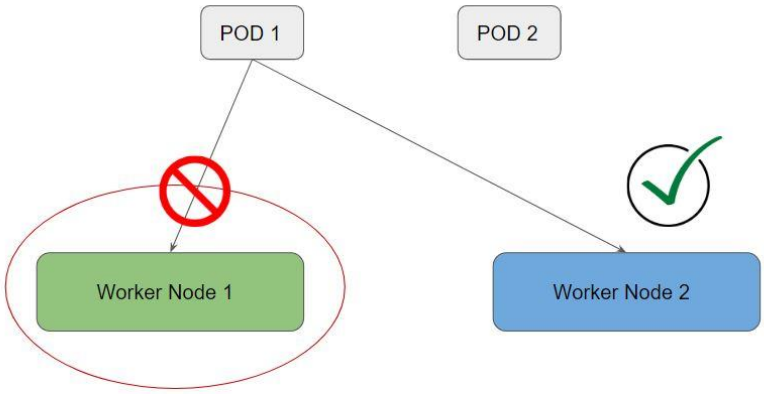
There are multiple ways in which you can tell kubelet to run a pod.

Pod created directly without schedulers are also referred to as Static Pods.

Module 12: Taints and Toleration

12.1 Understanding Taints:

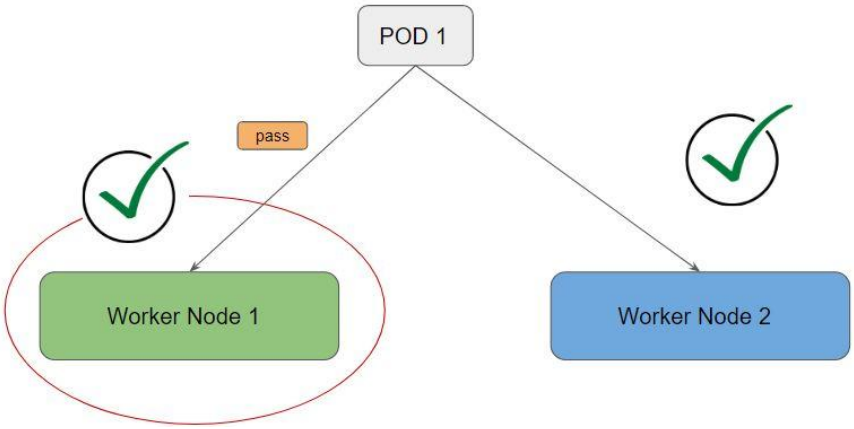
Taints are used to repel the pods from a specific node



12.2 Understanding Toleration:

In order to enter the taint worker node, you need a special pass.

This pass is called toleration.



Module 13: Components of Taints and Tolerations

A taint allows a node to refuse pod to be scheduled unless that pod has matching toleration.

We can apply toleration to a pod within the PodSpec

Parameter	Description
key	A key is any string upto 253 characters.
value	The value is any string, up to 63 characters.
effect	• NoSchedule • PreferNoSchedule • NoExecute
operator	• Equal • Exist

```
kubectl taint nodes kubadm-worker-01 key=value:NoSchedule
```

The following table shows the effects:

Effects	Description
NoSchedule	New pods that do not match the taint are not scheduled onto that node. Existing pods on the node remain.
PreferNoSchedule	New pods that do not match the taint might be scheduled onto that node, but the scheduler tries not to. Existing pods on the node remain.
NoExecute	New pods that do not match the taint cannot be scheduled onto that node. Existing pods on the node that do not have a matching toleration are removed.

The following are the two primary operators.

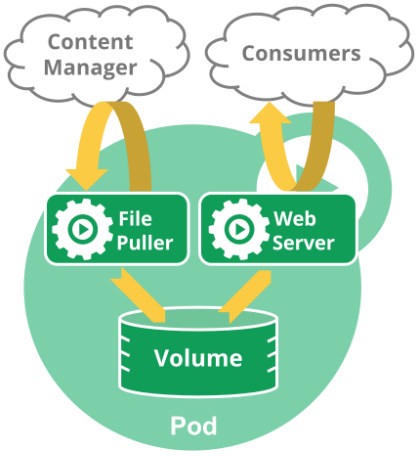
Operator	Description
Equal	The key/value/effect parameters must match. This is the default.
Exists	The key/effect parameters must match. You must leave a blank value parameter, which matches any.

Module 14: Multi-Container POD Patterns

14.1 Overview of Sidecar Pattern

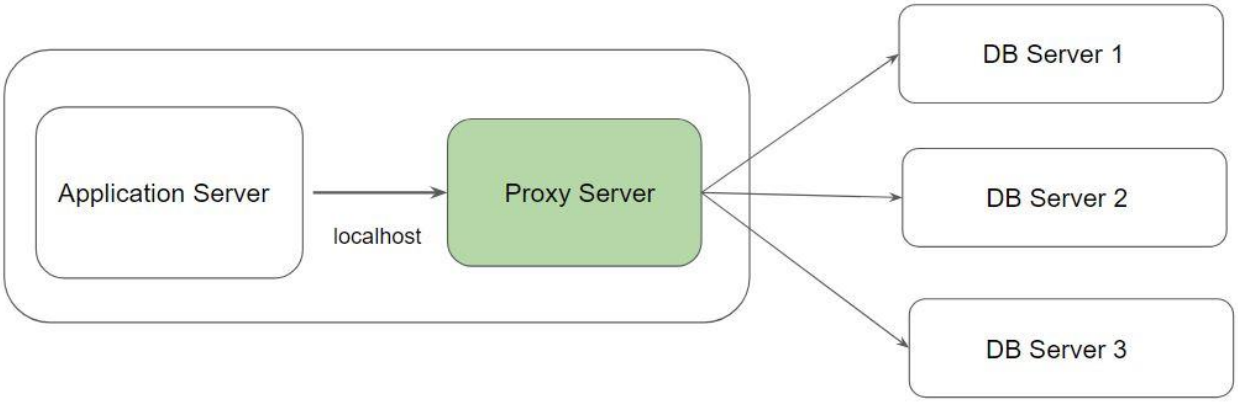
Sidecar pattern is nothing but running multiple containers as part of a pod in a single node.

In the diagram below we see that there is a web-server container which servers files from volumes and a separate sidecar container “file puller” which fetches and updates those files.



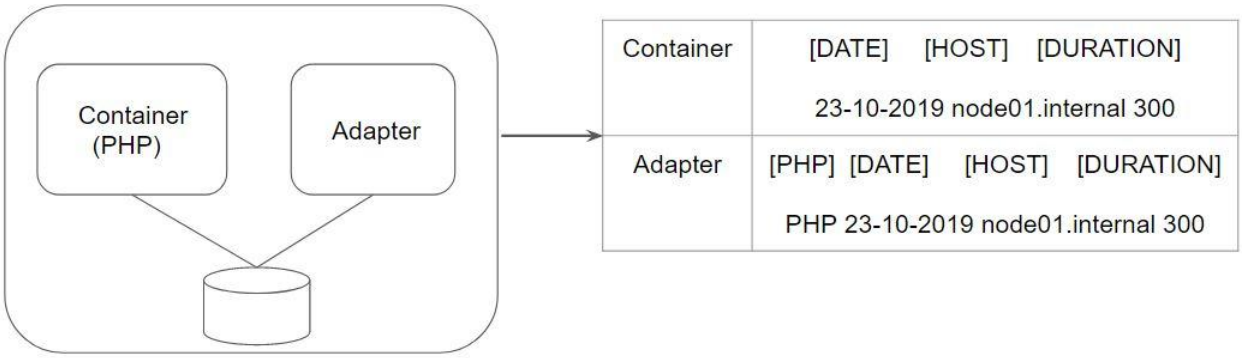
14.2 Ambassador Pattern

Ambassador Pattern is a type of sidecar pattern where the second container is primarily used to proxy the requests.



14.3 Sidecar Container - Adapter Pattern

Adapter Pattern is generally used to transform the application output to standardize / normalize it for aggregation.



Module 15: Adapter Pattern

15.1 Overview of Adapter Pattern

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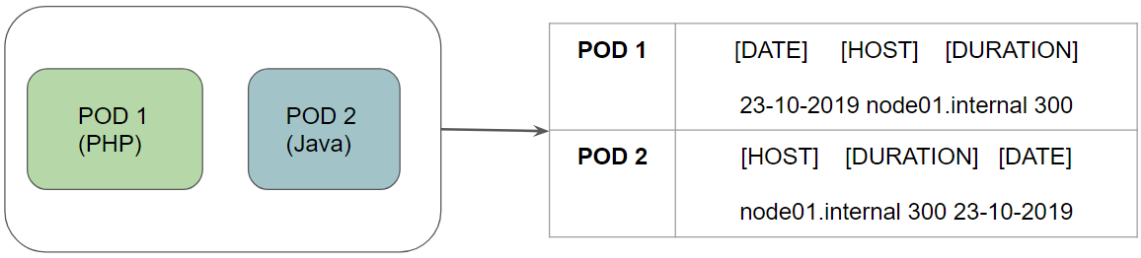


15.2 Standardizing Log Format

Within your logging application, you want to have a common standard format.

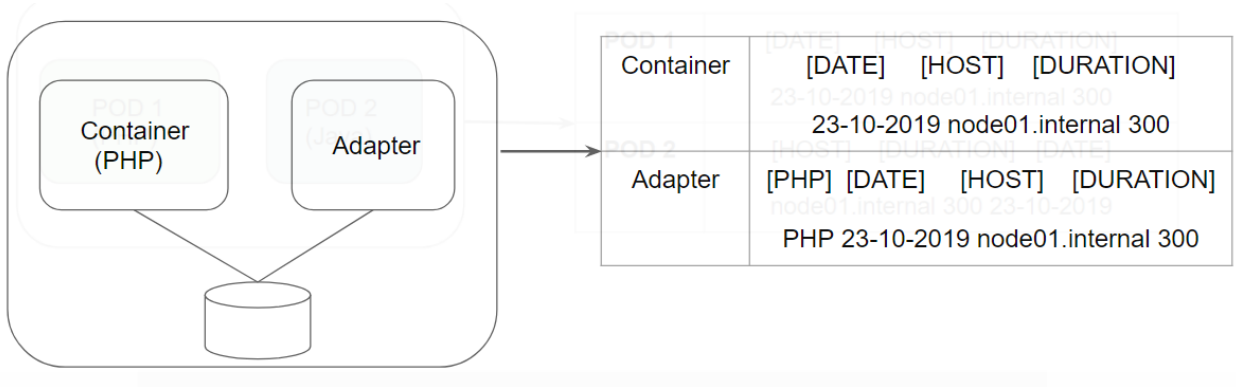
[PHP|JAVA] [DATE] [HOST] [DURATION]

PHP 23-10-2019 node01.internal 300

15.3 Transforming Logs

With Adapter Container, you can transform your logs to standardize it.

Since containers in PODS can share volumes, adapter containers can easily access App logs.



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