Kubernetes from Basic to Advanced

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Session #07
Other Workloads

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Session Contents

- DaemonSets
- Jobs & CronJobs
- StatefulSets

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DaemonSets

DaemonSets

- Daemonset is another controller that manages pods like Deployments or ReplicaSets
- DaemonSet ensures that all (or some) Nodes run a copy of a Pod
- As nodes are added to the cluster, Pods are added to them
- As nodes are removed from the cluster, those Pods are garbage collected
- Deleting a DaemonSet will clean up the Pods it created.

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DaemonSets: Typical Uses

- Running a cluster storage daemon on every node
- Running a logs collection daemon on every node
- Running a node monitoring daemon on every node

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Demo | DaemonSets

Jobs & CronJobs

Motivation

- When Kubernetes controller detects a container has failed, it will attempt to restart it based on the container's restartPolicy: Always, Never or OnFailure
- When controlled by a Deployment, containers in Pods are expected to run continuously. Thus, the only restart policy a Deployment supports is Always.
- However, what if you want to run a container that's expected to perform a finite task and then just stop? Just like an Init Container, but without creating any other container afterwards?

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Job

- A Job is a Kubernetes controller that creates and run task-based workload.
- A Job creates one or more Pods and will continue to retry execution of the Pods until a specified number of them successfully terminate.
- As Pods successfully complete, the Job tracks the successful completions. When a specified number of successful completions is reached, the task (i.e., Job) is complete.
- Deleting a Job will clean up the Pods it created.
- Containers defined as part of a Job only support Never and OnFailure restart policies.
- To make changes you need to delete and recreate

Job Types

- Multiple Parallel Jobs: Run multiple jobs (pods) in parallel to make it faster (when possible) to process. This can be set using **`parallelism`** property
- Parallel Jobs with Fixed Completion Count: These jobs occur concurrently but run a set number of times before terminating successfully. By setting **`completions`** to a value greater than one, you trigger the formation of successful pods.
- Non-parallel Jobs: This specifies a job that executes single-handedly or independently. Only one successful pod is started, with additional pods forming in response to any startup failures. Once a pod terminates successfully, that specific job is complete.

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CronJob

- A CronJob is a Kubernetes controller that creates and manages Jobs according to a cron schedule.
- CronJobs are useful for creating periodic and recurring tasks, like running backups or sending emails.
- CronJobs maintain a certain number of successful and failed jobs, so their logs can be examined.
- When a CronJob deletes a Job, that Job's Pods are deleted.
- When a CronJob is deleted, the Jobs it created (and their Pods) are deleted.

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Demo | Jobs & CronJobs

StatefulSets

Motivation

- Using Deployments you need to build your application (or components) on a stateless approach
- Your pods can be deleted and recreated without having a consistency on names and IPs
- Additionally, some solutions to have an associated volume to be always available when running and not depending from a PVC defined on another resource
- For these needs, you should use a StatefulSet

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StatefulSet

- StatefulSet is a pod controller designed to manage stateful applications
- Unlike Deployments, a StatefulSet maintain a sticky identity for each of its Pods
- Pods are created from the same spec but are not interchangeable: each Pod has a persistent identifier that it maintains across rescheduling
- Pods are created in order and are assigned sequential numbers, starting with 0…N-1.

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StatefulSet

- StatefulSets define a Volume Claim Templates, which define parameters to use when dynamically creating PersistentVolumeClaims and PersistentVolumes for each Pod.
- Pod order and persistent volume claims are maintained when Pods are deleted.
- Replacement Pods are linked to the same PVCs.
- Deleting Pods in a StatefulSet (or the StatefulSet itself) will use by default retain reclaim policy
- Can be configured delete reclaim policy when scale down or delete the StatefulSet

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Headless Service

- A "headless" service (**`clusterIP=None`**) is required for StatefulSets.
- The service is referenced by the Pod definition and allows direct access to each without load balancing.
- Creates a DNS entry for each Pod instead of just for the Service.
- Pods is accessed individually through the headless service using DNS and the FQDN address.
  - Fully Qualified domain name: **`{pod}.{service}.{namespace}.svc.cluster.local`**
  - Example: **`mysql.connect("mysql-02.db-service.micro.svc.cluster.local")`**

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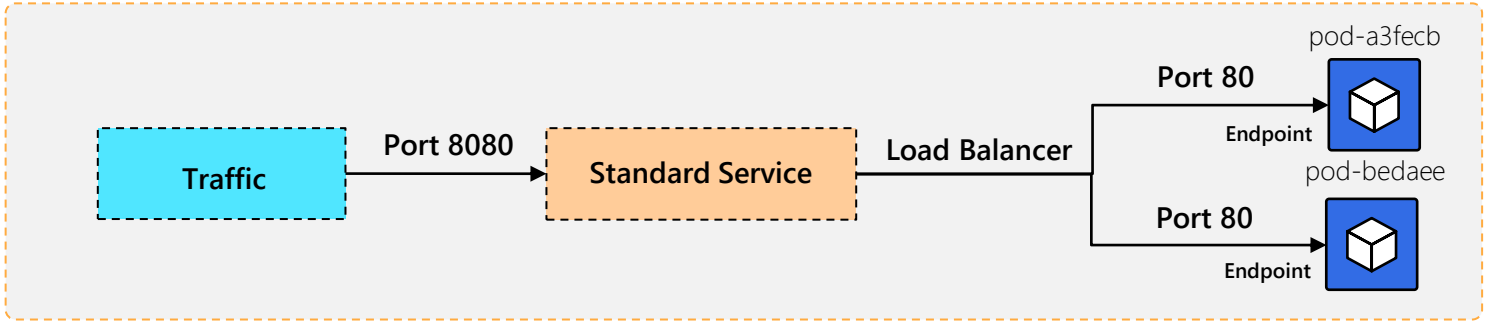
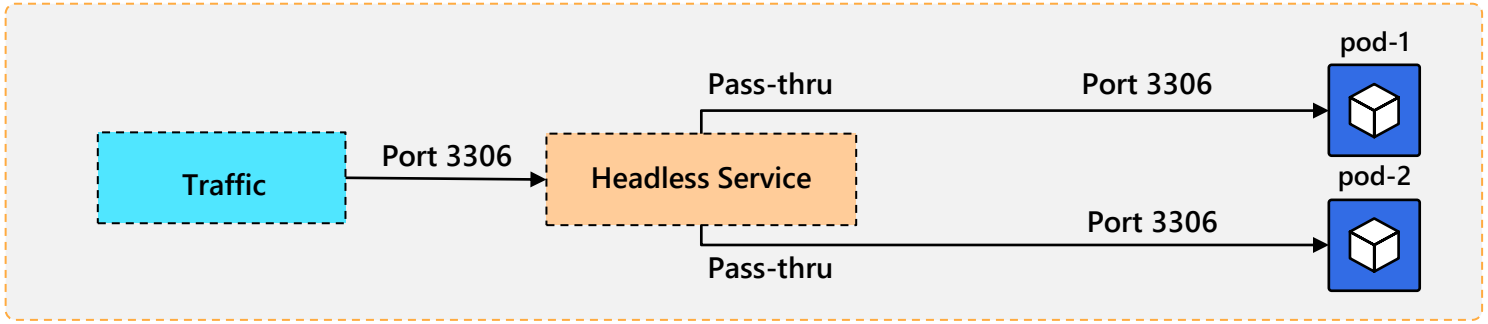
Headless Service

A standard Service load balances traffic across all Pods listed as Endpoints



A Headless Service doesn't have Endpoints. It routes traffic directly to specific Pods



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Why to use?

- Persistent Storage: Stable and unique network identities for pods and stable persistent storage. This is particularly important for stateful applications like databases, caching systems, and message brokers.
- Ordered Deployment and Scaling: Provide a guaranteed ordering for deployment, scaling, and deletion of pods. This helps you avoid potential data loss or corruption that could occur if pods are deleted or recreated in an incorrect order.
- Ordered Rolling Updates: StatefulSets provide an ordered rolling update mechanism, which enables you to update your stateful application one pod at a time, rather than all at once. This helps minimize downtime and reduces the risk of data loss or corruption during an update.

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Demo | StatefulSets

Questions?

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Lab #06: Other workloads

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