Cloud Native Storage Orchestration: Rook

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Agenda

- Kubernetes Storage
  - Storage in Kubernetes
  - Kubernetes Volume Plugin
  - Container Storage Interface (CSI)
  - Storage Challenge
- Rook
  - What is Rook?
  - Storage Providers
  - Architecture
  - Operatoro
  - Quickstart

Kubernetes Persistent Storage Objects

Pod

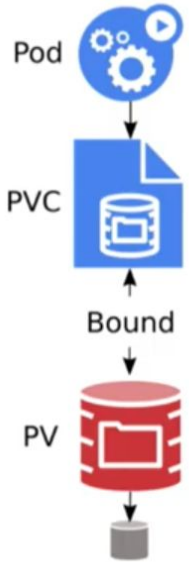
- Mount PersistentVolumeClaim into container

PersistentVolumeClaim (PVC)

- Application request for storage
- Binds to SIngle PV
- Usabe in Pods

PersistentVolume (PV)

- Pointer to physical storage
- Created by “admin” through “pre-provisioning”
- Created by Kubernetes on demand “dynamic-provisioning

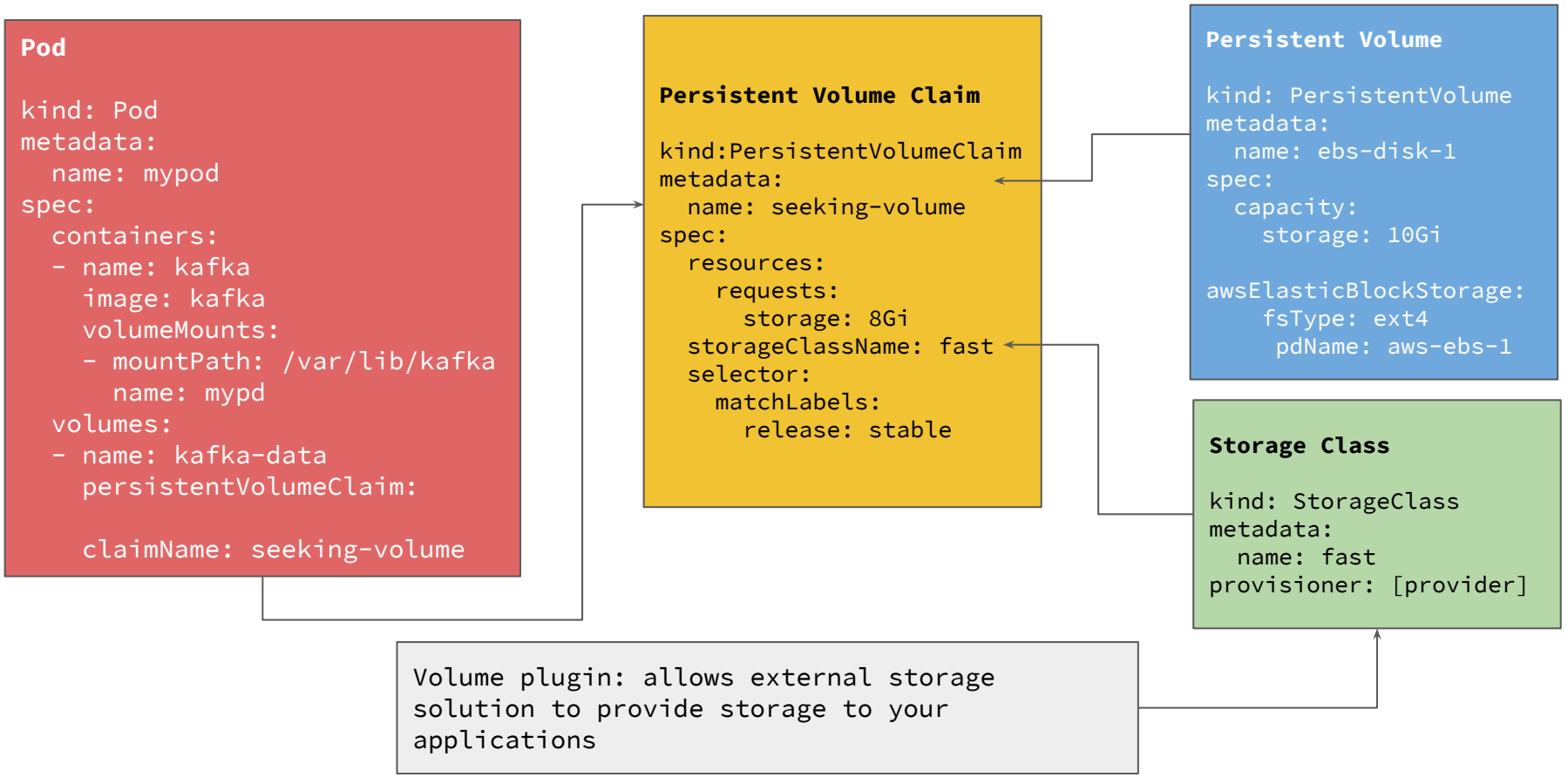


Kubernetes Persistent Storage Objects

StorageClass

- Collection of PersistentVolumes with same characteristics
  - Replicated
- Parameters for dynamic provisioning
- Created by admin
- Subject of quota per namespace

Storage in Kubernetes



Kubernetes Volume Plugin

A Kubernetes Volume plugin extends the Kubernetes volume interface to support a block and/or file storage system.

Kubernetes Volume Plugin (Con’t)

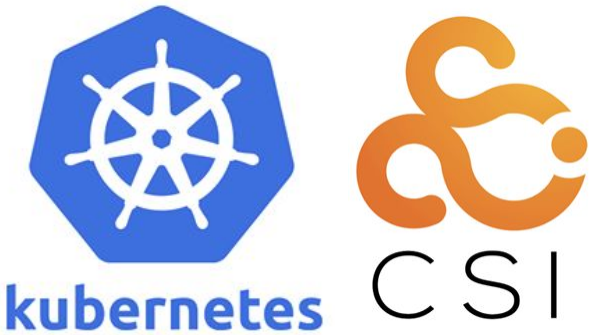
In-tree vs. Out-of-Tree Volume Plugins

- There are three methods to implement a volume plugin:
  - In-tree volume plugin [deprecated, SIG Storage no longer accepting in-tree volume plugin]
  - Out-of-tree FlexVolume driver [deprecated]
  - Out-of-tree CSI driver, which is a recommended approach since it overcome limitation from FlexVolume

Container Storage Interface (CSI)

Standardized mechanism for Container Orchestration Systems (COs), including Kubernetes, to expose arbitrary storage systems to containerized workloads.

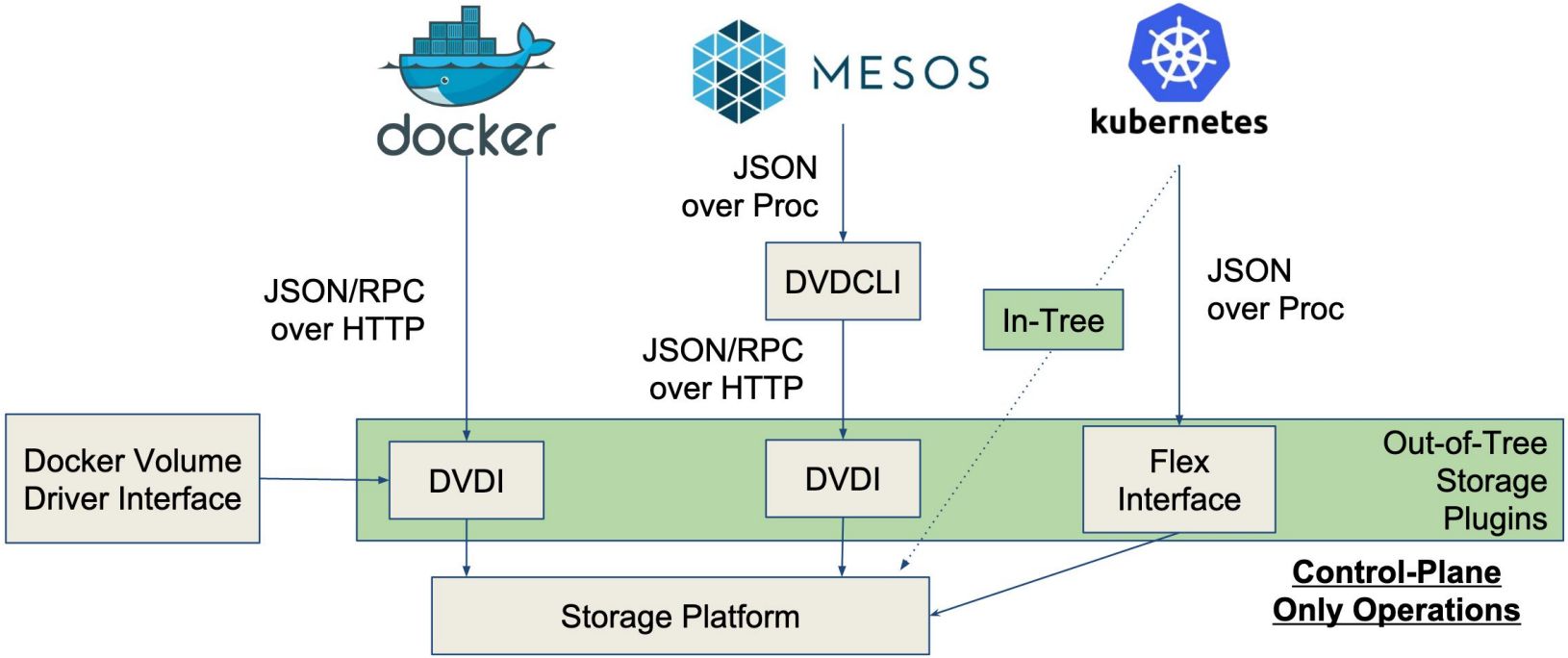
- Introduced in Kubernetes 1.9 as alpha
- Promoted to beta with Kubernetes 1.10, and GA in Kubernetes 1.13.



Storage Challenges

- Reliance of external storage
  - Not Portable
  - Requires service to be accessible
  - Deployment burden to solutions
  - Make sure it’s deployed and running
- Reliance on Cloud Provider
  - Vendor lock-in
    - Using provider managed services
- Who’s managing the storage?

Storage Interopability



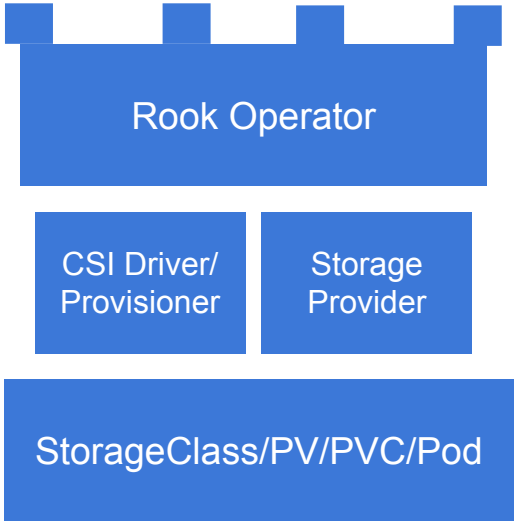
What is Rook?

- Storage Operators for Kubernetes
- Extends Kubernetes with custom types of operators and custom resource definitions (CRD)
- Automated management:
  - Deployment
  - Configuration
  - Upgrading
- Framework for storage providers
  - storage resource normalization
  - operators pattern
  - common policies, specs, logics
  - build/ci/testing

Storage Providers (as of 1.3)

Architecture

- Orchestration
  - The operator owns the **management** of the storage provider
- Storage Provisioning
  - CSI driver **connects** client pods to the storage
- Data layer: Storage Provider
  - Block/File/Object storage or databases



Rook Operator

- Deploy and manage storage platform
  - Automate human actions
- Define desired state for storage resource
  - Storage Cluster, Filesystem, Object Store, etc.
- Watch out for reconciliation loops:
  - Watches changes in desired state
  - Watches changes in cluster
  - Applies changes to cluster to create desired state
- The Operators leverages the full power of K8S
  - Services, ReplicaSets, DaemonSets, Secrets, …
- Manage storage systems at scale
  - Stateful upgrades
  - Health and monitoring tasks
- Not on the data path – can be offline for minutes

Rook Quickstart

References

1. https://github.com/kubernetes/community/blob/master/sig-storage/volume-plugin-faq.md
2. https://kubernetes-csi.github.io/docs/developing.html
3. Rook Project Intro, Travis Nielsen
4. https://platform9.com/blog/kubernetes-storage-dynamic-volumes-and-the-container-storage-interface/
5. Demo: https://www.youtube.com/watch?v=QfeN_1KQJKQ
6. Quickstart Guide: https://github.com/giovanism/rook-demo/tree/gke-version

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fin. *(this font is good)*