Persistent Storage with Kubernetes in Production

Which solution and why?

Kubecon + CloudNativeCon, Dec 8, 2017

Cheryl Hung, Product Manager

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Cheryl

Product manager, StorageOS

@oicheryl

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Objectives

- Why is state so tricky?
- How should I compare storage?
- What storage should I use with Kubernetes?

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Objectives

- Why is state so tricky?
- How should I compare storage?
- What storage should I use with Kubernetes?

Anti-objective:

- Should I use a database/message queue/key-value store... for my app?

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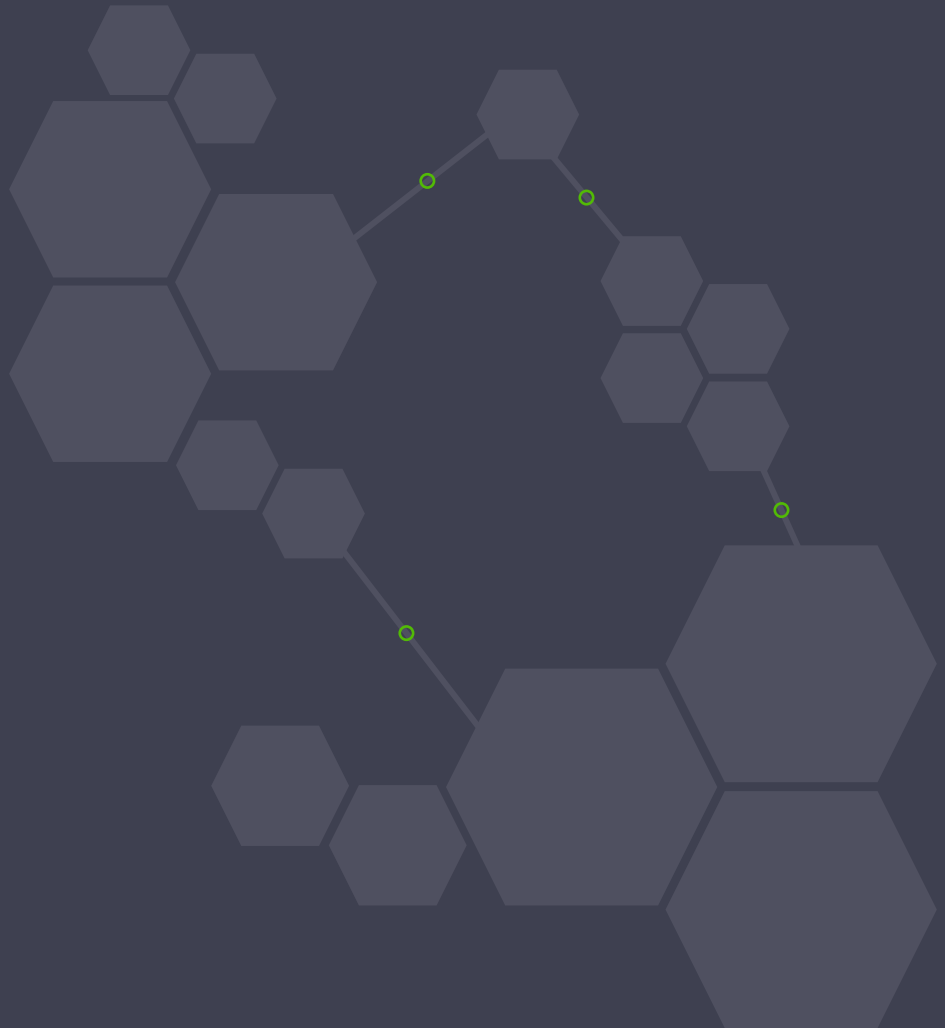
Why is state so tricky?



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Why do I need storage?

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Why do I need storage?

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First challenge: No pet storage

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Second challenge: Data needs to follow

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Third challenge: Humans are fallible

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How should I compare storage?

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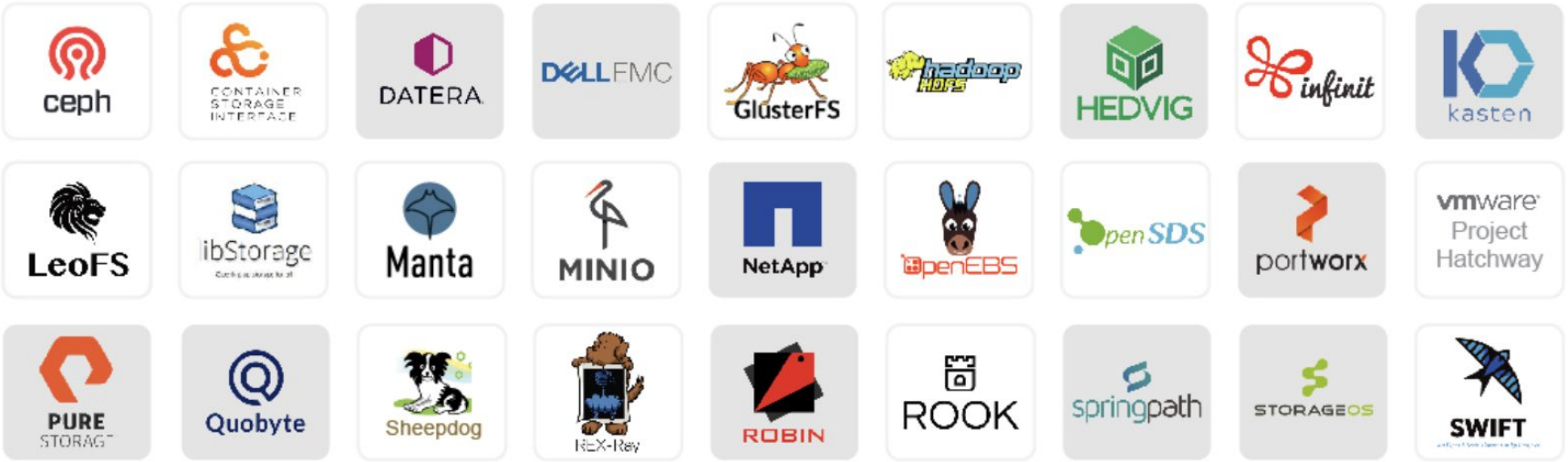
From the CNCF Landscape

Cloud-Native Storage



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Cloud Storage

	Azure	Google	AWS
Object Storage	Azure Blob Storage	Google Cloud Storage	Amazon Simple Storage Service (S3)
Virtual Machine / Block Storage	Azure Page Blobs / Premium Storage	Persistent Disk	Amazon Elastic Block Storage (EBS)
File Storage	Azure File Storage	⊘	Amazon Elastic File System (EFS)
Long Term Cold Storage	Azure Cool Storage	Google Coldline Storage	Amazon Glacier
Hybrid / Gateway Storage	Azure Storsimple	⊘	AWS Storage Gateway

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Eight Principles of Cloud Native Storage

What is Cloud Native?

Horizontally scalable

No single point of failure

Resilient and self healing

Minimal operator overhead

Decoupled from the underlying platform

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1 Application centric

Storage should be presented to and consumed by applications, not by operating systems or hypervisors

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Eight principles of Cloud Native Storage

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The storage platform should be able to run anywhere. Upgrades and scaling is non-disruptive.

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Storage resources should be declared and composed just like all other resources required by applications and services.

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4 API driven

Storage resources and services should be easy to be provisioned, consumed, moved and managed via an API.

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Eight principles of Cloud Native Storage

Storage services should integrate and inline security features such as encryption and RBAC.

5 Natively secure

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7 Performant

The storage platform should ensure high availability, durability, consistency with a predictable, proven data model.

8 Consistently available

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What storage should I use with Kubernetes?

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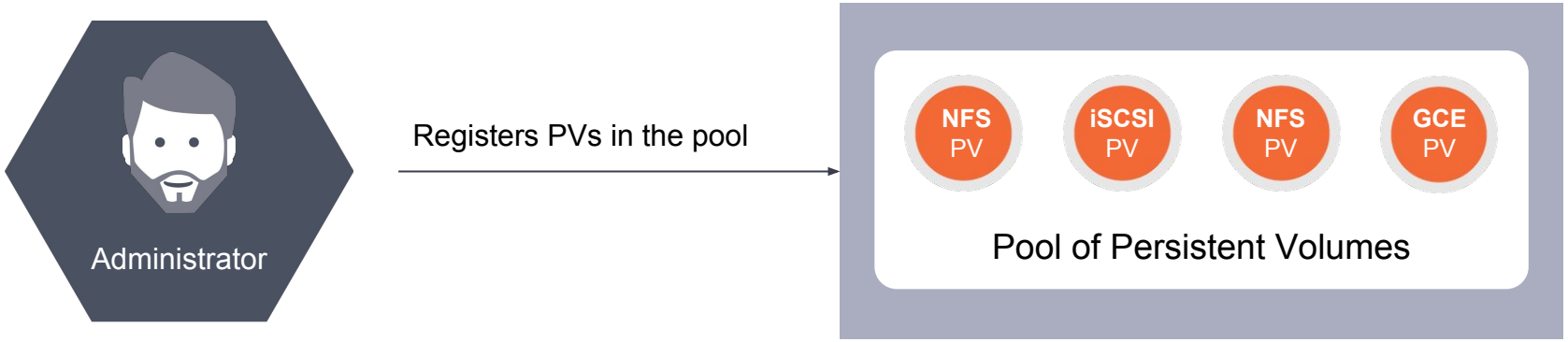
Kubernetes Storage Model: Persistent Volumes and Claims



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Kubernetes Storage Model: Persistent Volumes and Claims

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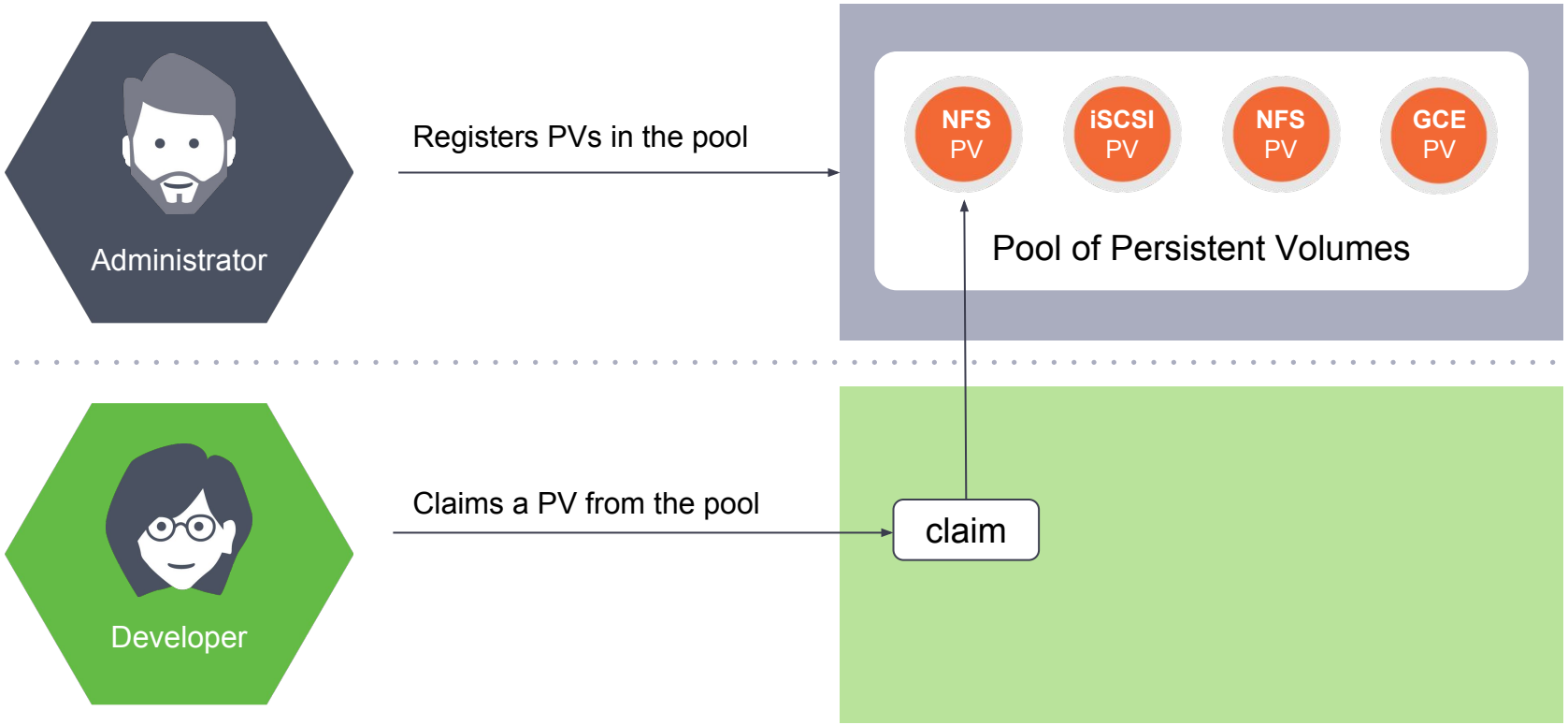

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Kubernetes Storage Model: Persistent Volumes and Claims

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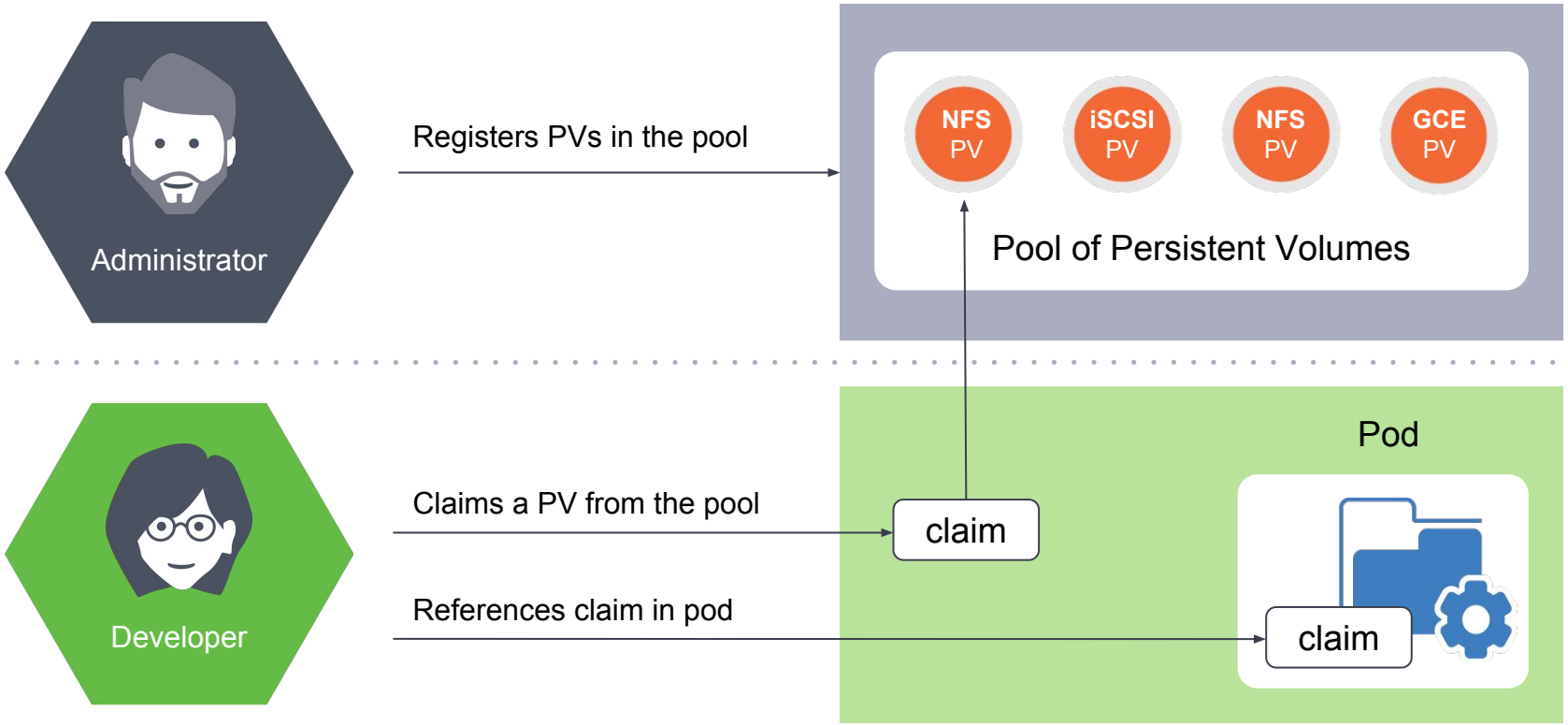

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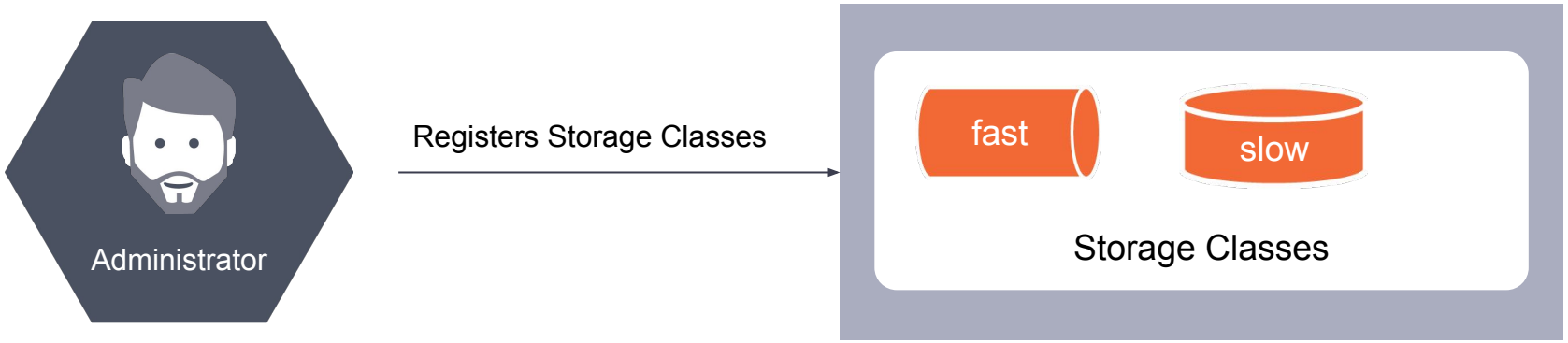
Dynamic provisioning with Storage Classes



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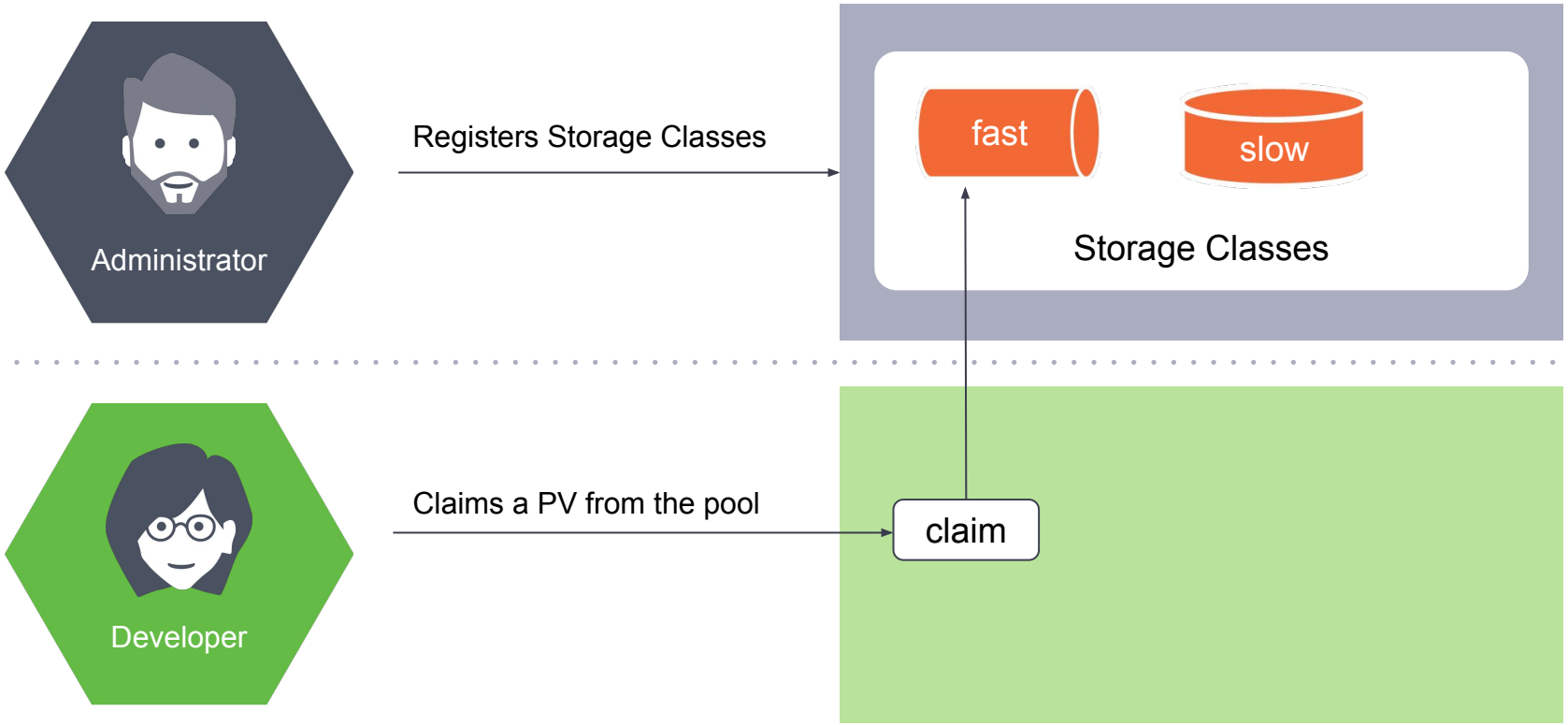
Dynamic provisioning with Storage Classes



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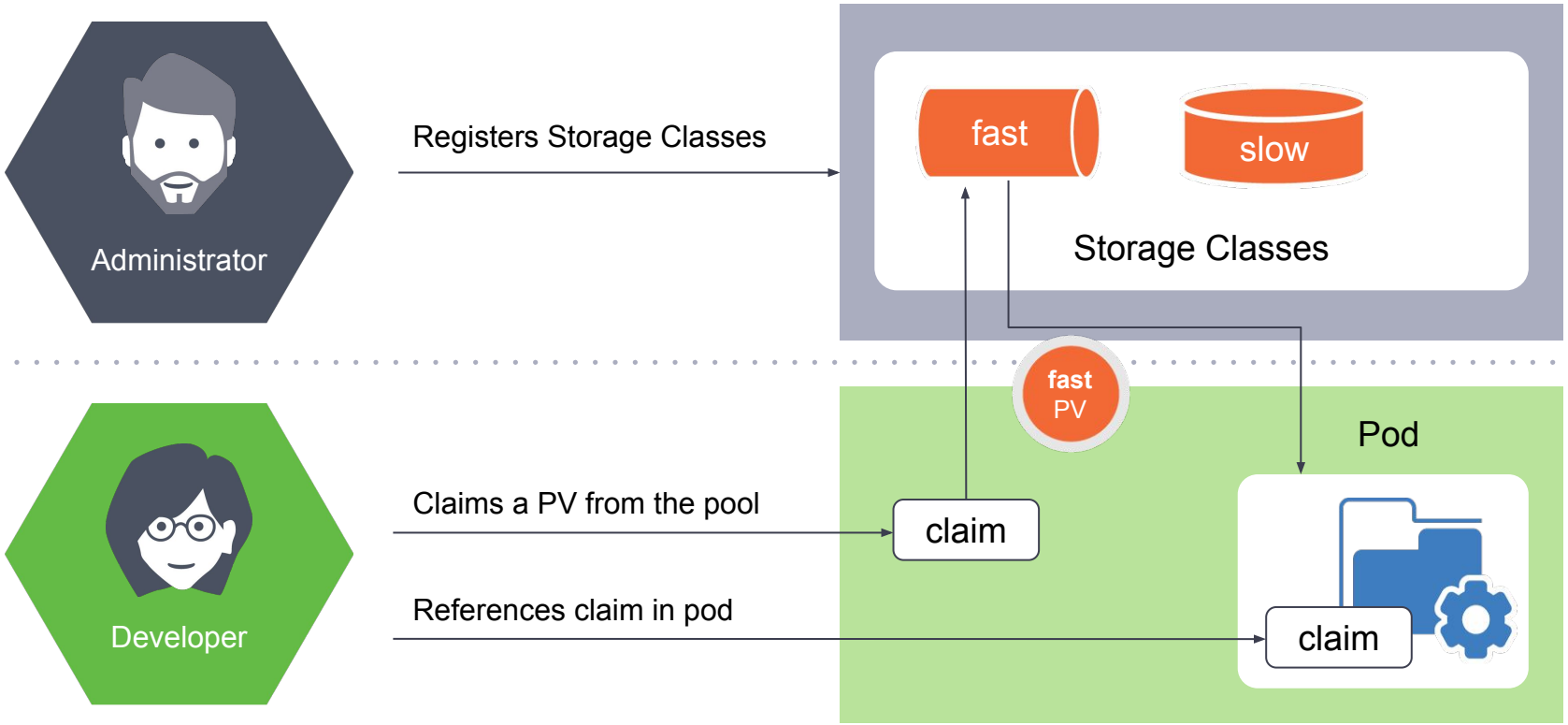
Dynamic provisioning with Storage Classes



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Meet Jane

- A DevOps engineer at a media company
- Migrating client Wordpress websites into Kubernetes
- Wants to follow the cloud native principles

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Proliferating plugins

Volume Plugin	Internal Provisioner	Config Example
AWSElasticBlockStore	✓	AWS
AzureFile	✓	Azure File
AzureDisk	✓	Azure Disk
CephFS	-	-
Cinder	✓	OpenStack Cinder
FC	-	-
FlexVolume	-	-
Flocker	✓	-
GCEPersistentDisk	✓	GCE
Glusterfs	✓	Glusterfs
iSCSI	-	-
PhotonPersistentDisk	✓	-
Quobyte	✓	Quobyte
NFS	-	-
RBD	✓	Ceph RBD
VsphereVolume	✓	vSphere
PortworxVolume	✓	Portworx Volume
ScaleIO	✓	ScaleIO
StorageOS	✓	StorageOS

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Key information

1. What is my **use case**?
2. What are my **performance requirements**?
3. How should developers **access** storage?
4. Where is the storage **deployed and managed**?

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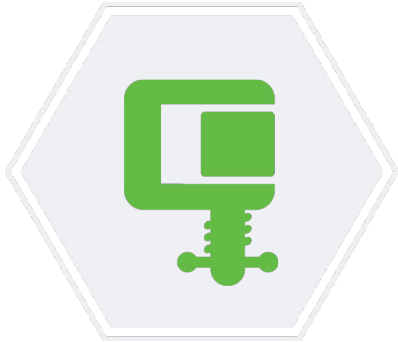
1. What is my use case?

App Binaries
Ephemeral

App data
Dedicated, performant, highly available



Config
Shared persistent

Backup
Cost efficient, cloud backup

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2. What are my performance requirements?

- High performance
- Low latency
- Throughput
- High availability / replication
- Shared to multiple instances

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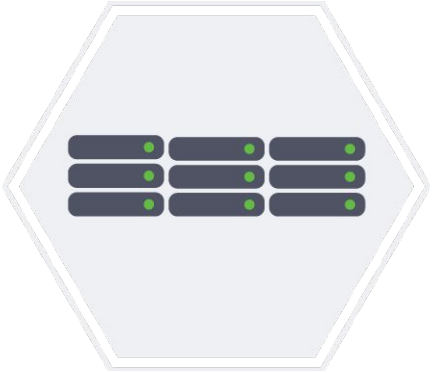
3. How should developers access storage?



Block Storage
Fixed-size ‘blocks’ in a rigid arrangement – ideal for enterprise databases

File Storage
‘Files’ in hierarchically nested ‘folders’ – ideal for active documents

Object Storage
‘Objects’ in scalable ‘buckets’ – ideal for unstructured big data, analytics and archiving

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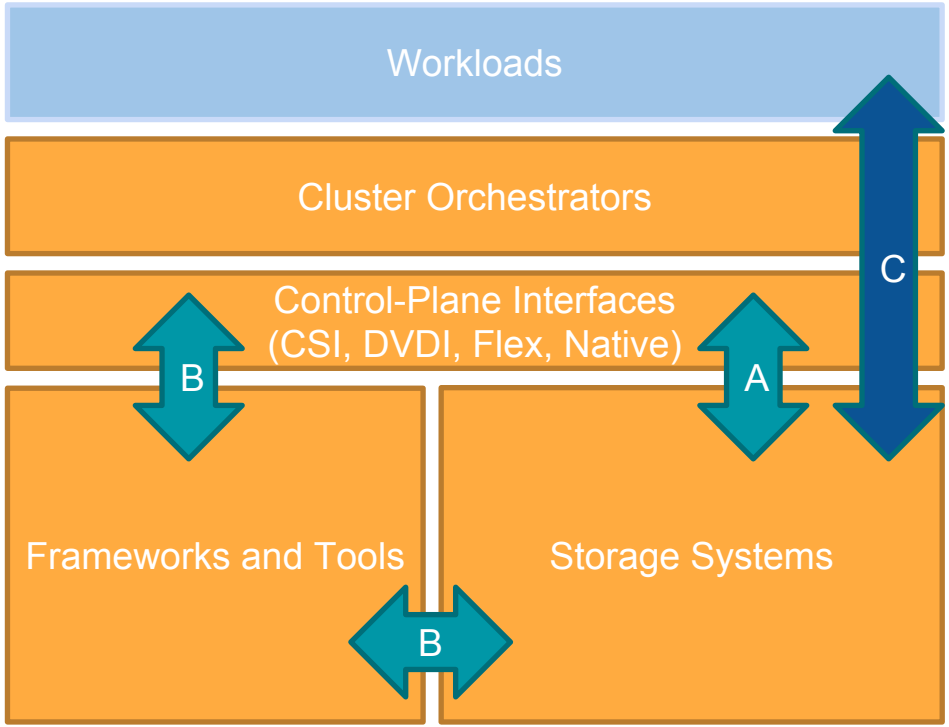
4. Where is the storage deployed and managed?



- CO supports one or more **Interfaces** to interact with the Storage System
- Storage System can **(A)** support control-plane interface API directly and interact directly with the CO or can **(B)** interact with the CO via an **API framework layer** or other **Tools**.
- Storage system must support the ability to provision and consume (C) volumes through a standard interface to be considered **Interoperable**
- Workloads interact (C) with storage systems over various data-plane methods

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Jane’s storage requirements

- Configuration data
- Postgres database for application data
- Shared media store for uploads
- Backup and archival

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Database location and credentials

1. **Use case?** Config
2. **Performance requirements?** Shared across instances.
3. **Access?** Kubernetes provides Secrets for sensitive data such as passwords, and ConfigMap for arbitrary config. Both can be accessed by the application through environment variables
4. **Deployed and managed?** Tight integration with Kubernetes

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User media files

1. **Use case?** Shared media
2. **Performance requirements?** Large blobs of data, shared
3. **Access?** Shared filesystem
4. **Deployed and managed**?

Cloud: Object store, if the app can support it, or managed NFS

On prem: Distributed FS (but please not NFS!)

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Database and website backup

1. **Use case?** Backup and archival
2. **Performance requirements?** Durability, cost, snapshots
3. **Access?** Object store
4. **Deployed and managed?**

Cloud: Managed object store or long term cold storage

On prem: object store, NAS

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Postgres for application data

1. **Use case?** Transactional database
2. **Performance requirements?** HA, low latency, deterministic performance
3. **Access?** Database connector
4. **Deployed and managed?**

Cloud: Cloud volumes (watch out for attach/detach times, compliance) or managed db (limited offerings)

On prem: Software defined storage (maximise configurability)

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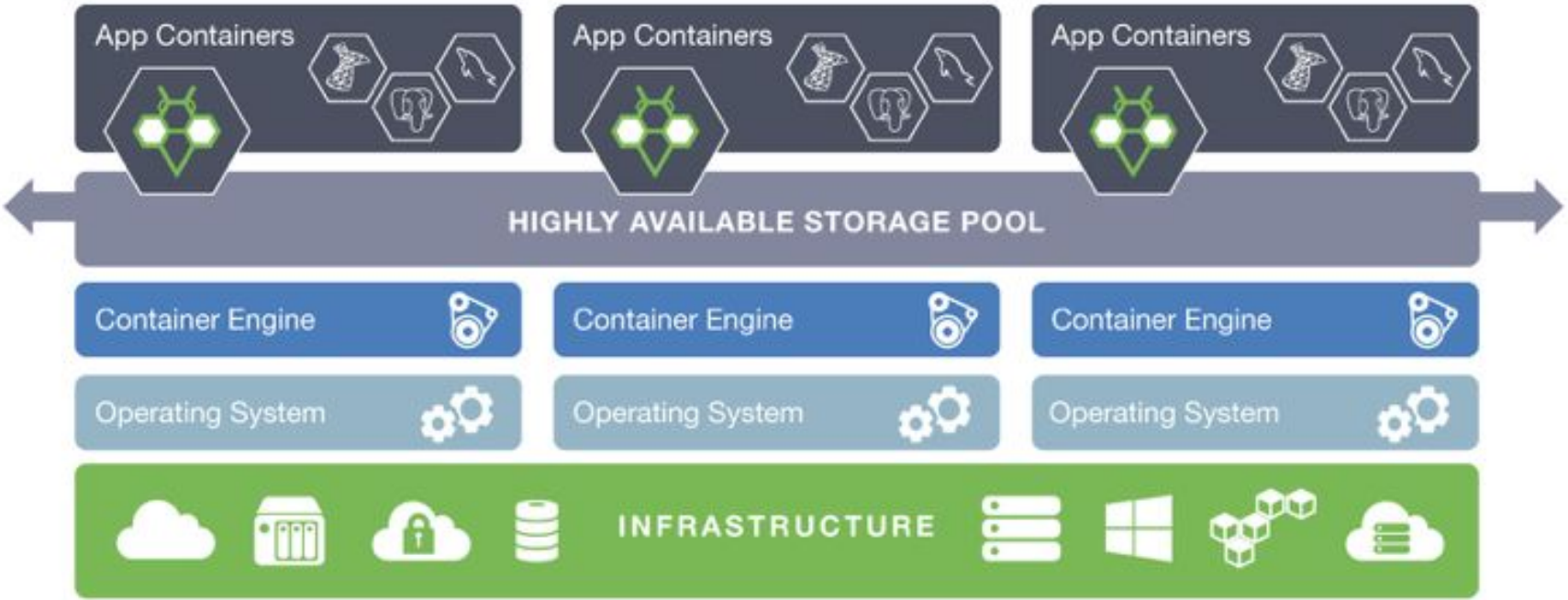
Software-defined storage



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KEEP
CALM
IT IS
DEMO
TIME

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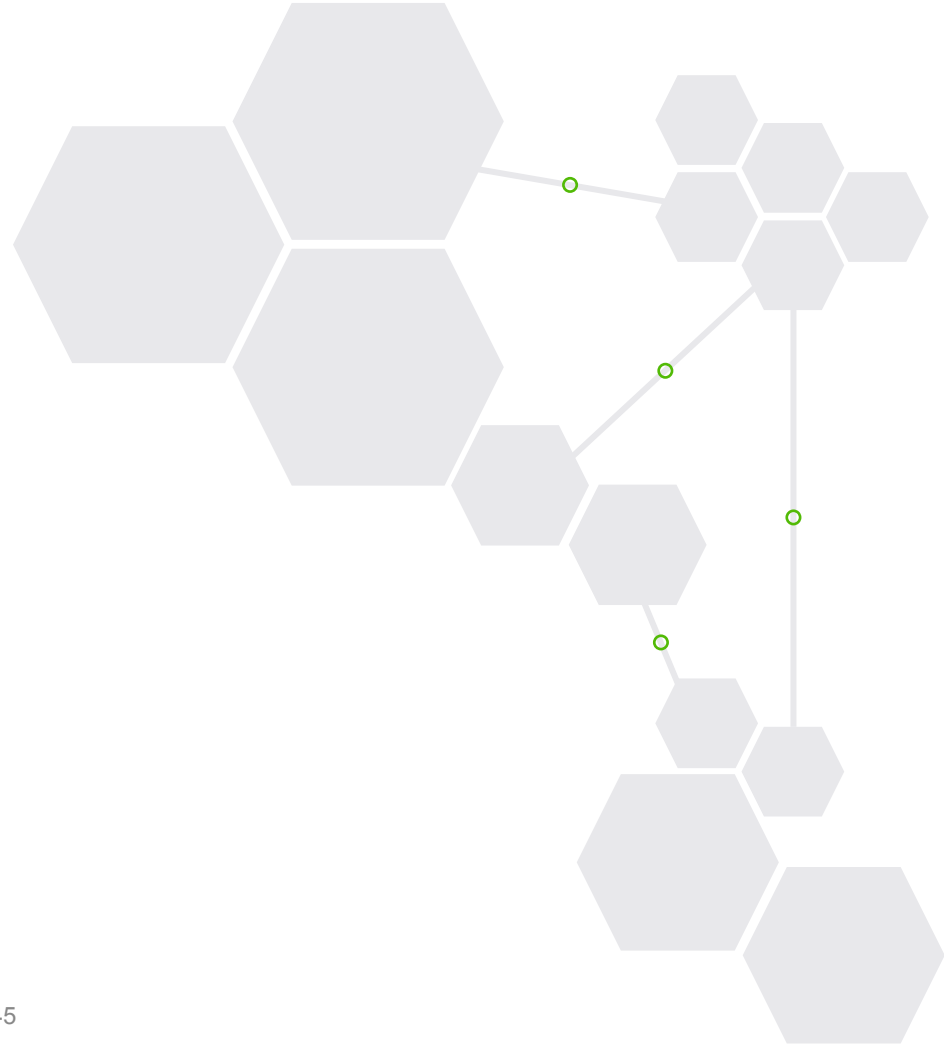
To Recap…



Evaluating storage

1 Application centric

2 Platform agnostic

3 Declarative/ composable

4 API driven

5 Natively secure

6 Agile

7 Performant

8 Consistently available

1. Use case?
2. Performance requirements?
3. Access?
4. Deployed and managed?

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CSI launched as alpha in Kubernetes 1.9

Objective is to define an industry standard “Container Storage Interface” (CSI) that will enable storage vendors to develop a plugin once and have it work across a number of container orchestration systems.

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StorageOS resources

Browser-based demo

- demo.storageos.cloud

Kubernetes quickstart

- storageos.com/kubernetes

We’re hiring! London and NYC roles

- storageos.com/careers

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Thanks

Slides at oicheryl.com

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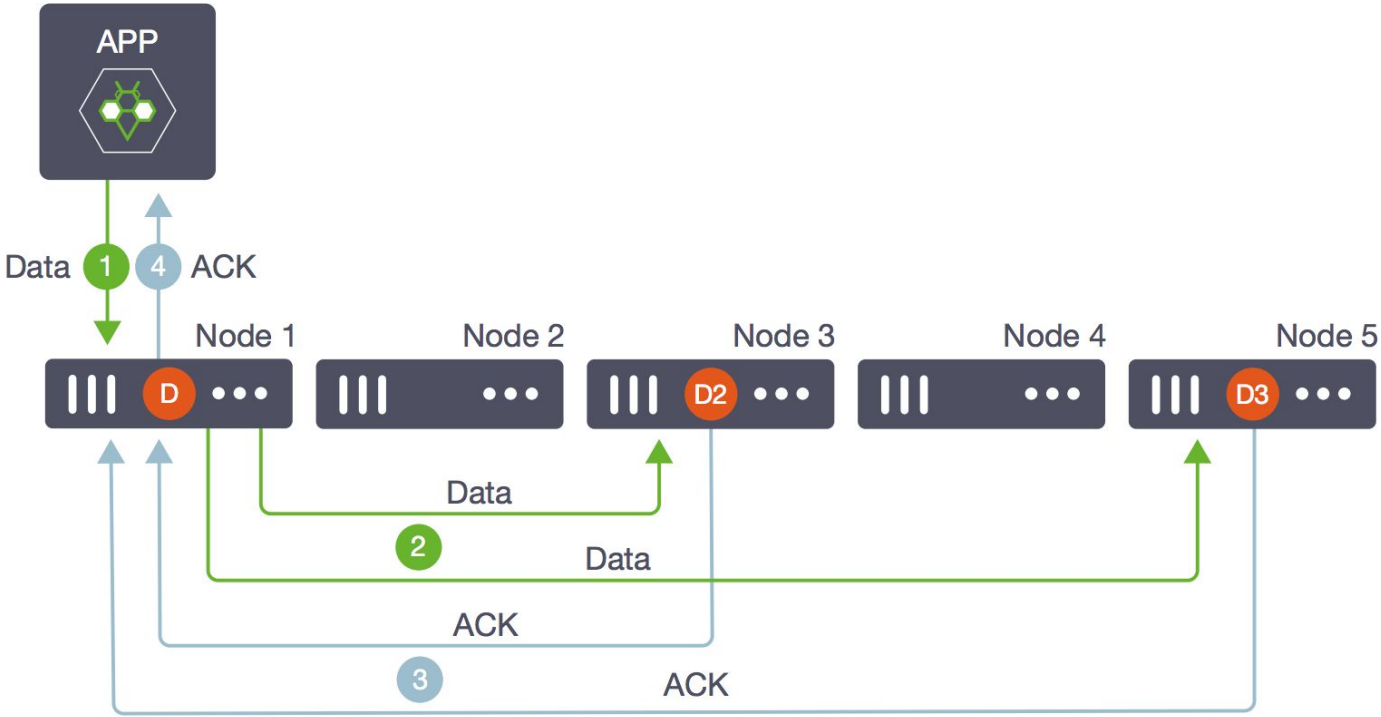
High availability with StorageOS



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Orchestrated Storage Platform (StorageOS)

A software-defined, scale-out storage platform for running enterprise containerized applications in production

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Orchestrated storage (StorageOS)

Platform agnostic

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Horizontally scalable

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High availability

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