Persistent Storage with Kubernetes in Production

Which solution and why?

Kubernetes London, 30 Nov 2017

Cheryl Hung, Product Manager

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Cheryl

Product manager at StorageOS

@oicheryl

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Objectives

- Why is state tricky in Kubernetes?
- How do I evaluate storage?
- What storage options are there for Kubernetes?

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Objectives

- Why is state tricky in Kubernetes?
- How do I evaluate storage?
- What storage options are there for Kubernetes?

Anti-objective:

- Should I use a database, message queue, NoSQL… for my app?

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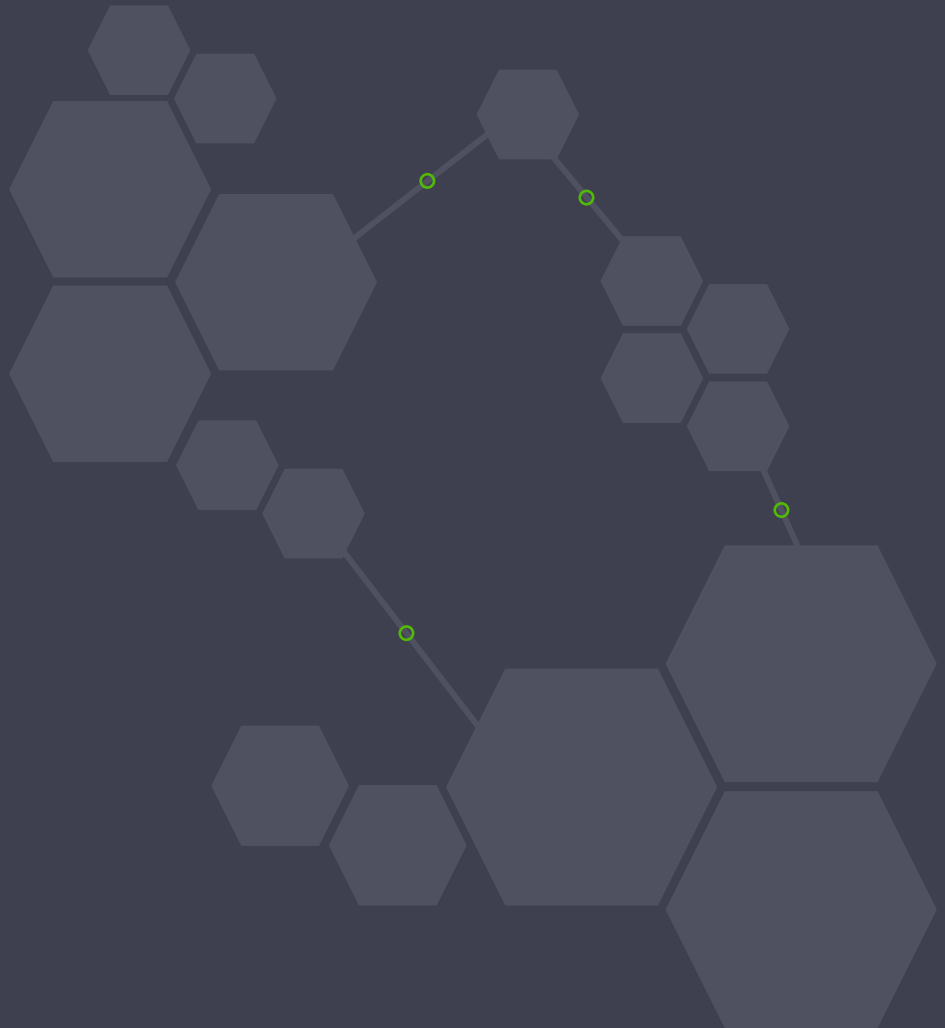
Why is state so tricky?



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Why do I need storage?

Why do I need storage?

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Problem 1: No pet storage

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Problem 2: Data needs to follow

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Problem 3: Gravity can be a problem

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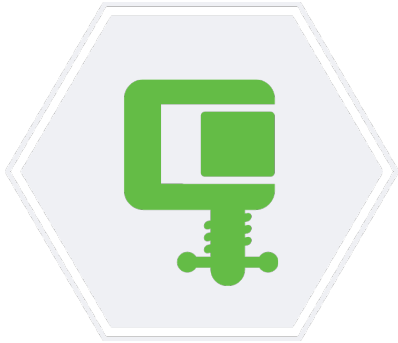
Problem 4: Storage isn't just storage

App Binaries

App data



Config

Backup

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Kubernetes Storage Model: Persistent Volumes and Claims

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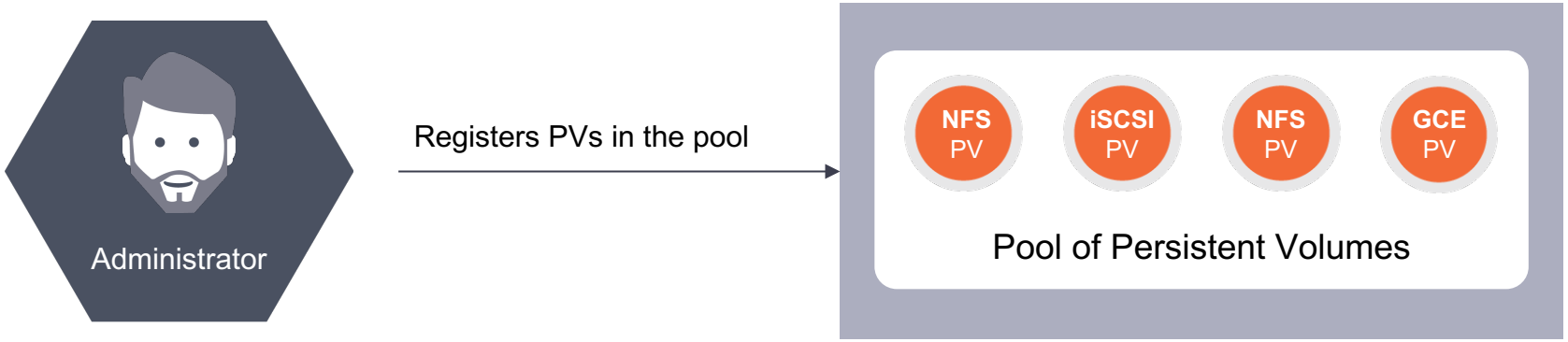
Kubernetes Storage Model: Persistent Volumes and Claims



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Kubernetes Storage Model: Persistent Volumes and Claims

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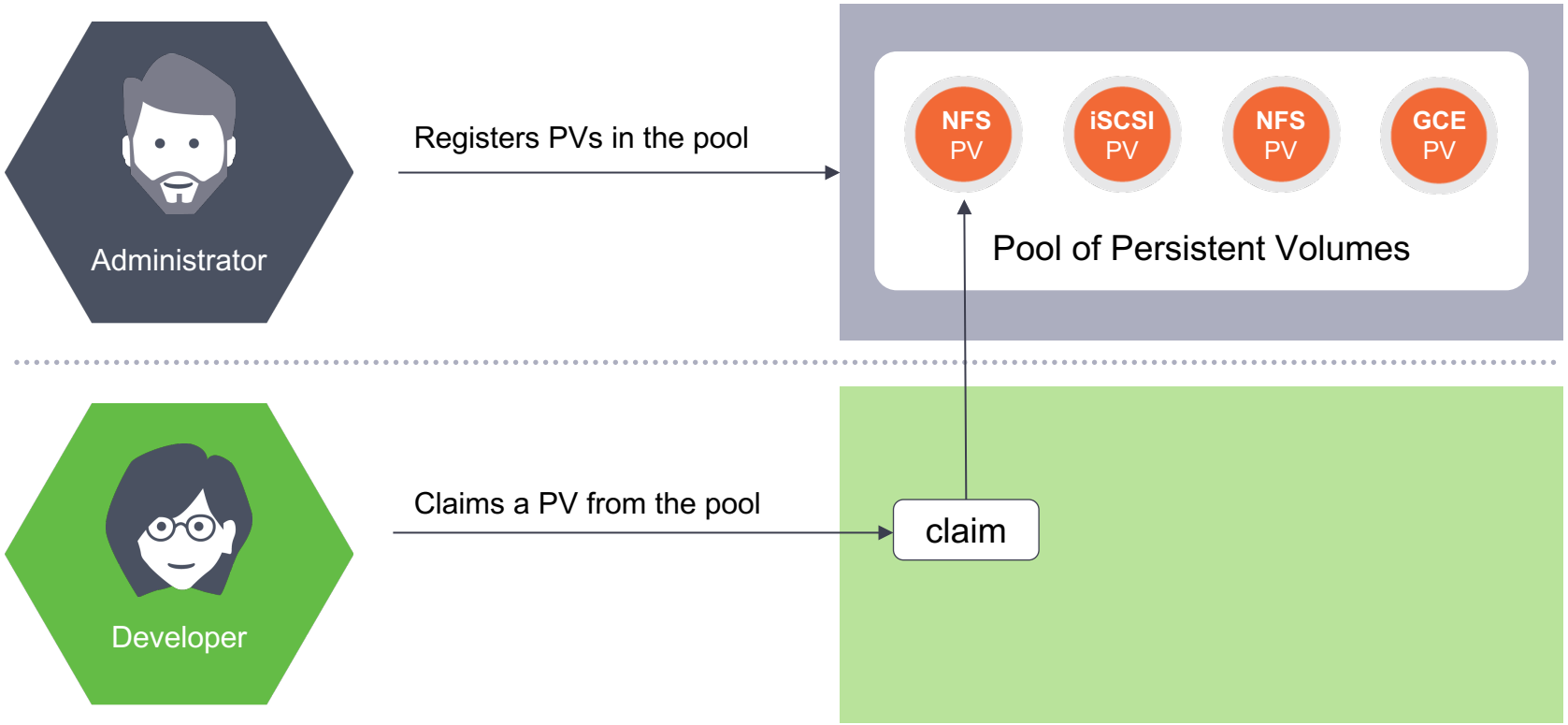

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Kubernetes Storage Model: Persistent Volumes and Claims

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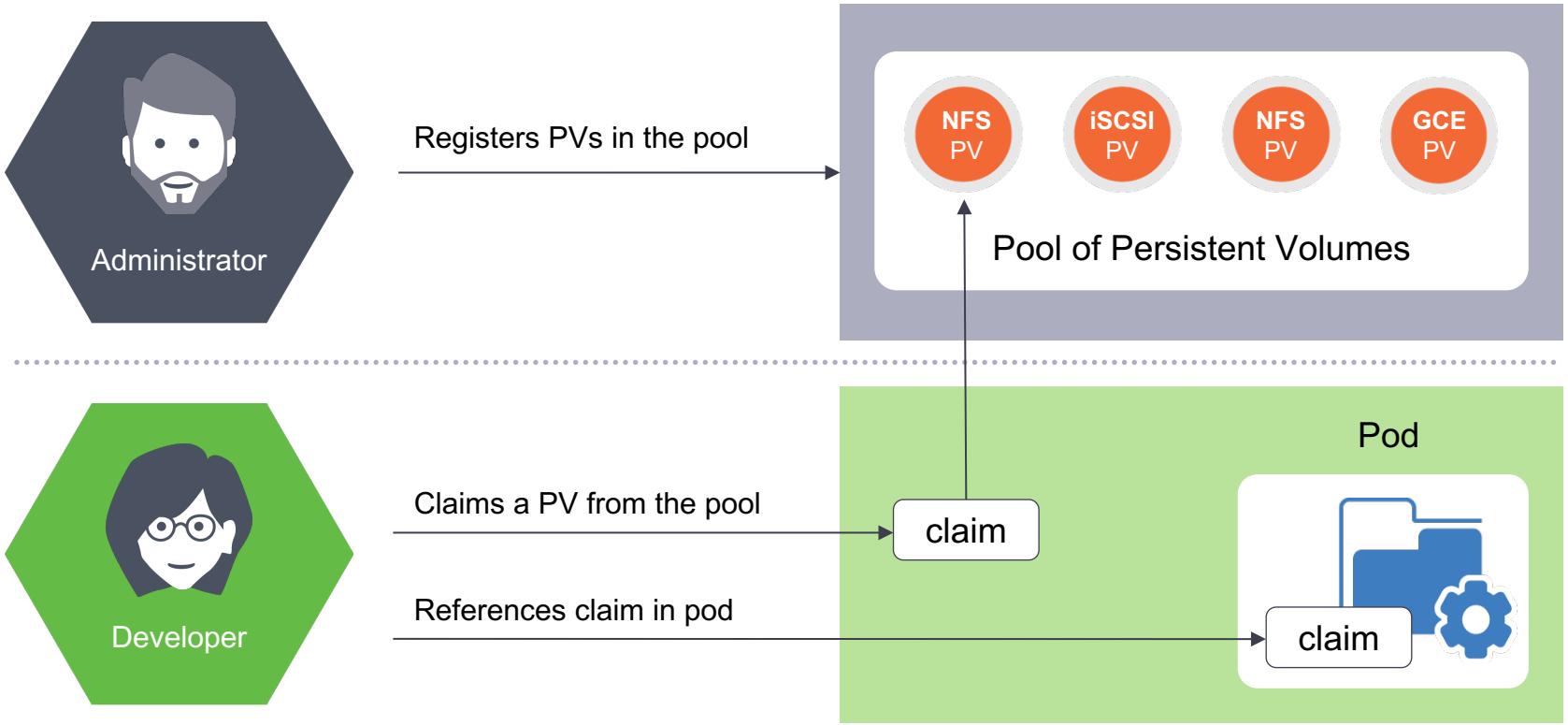

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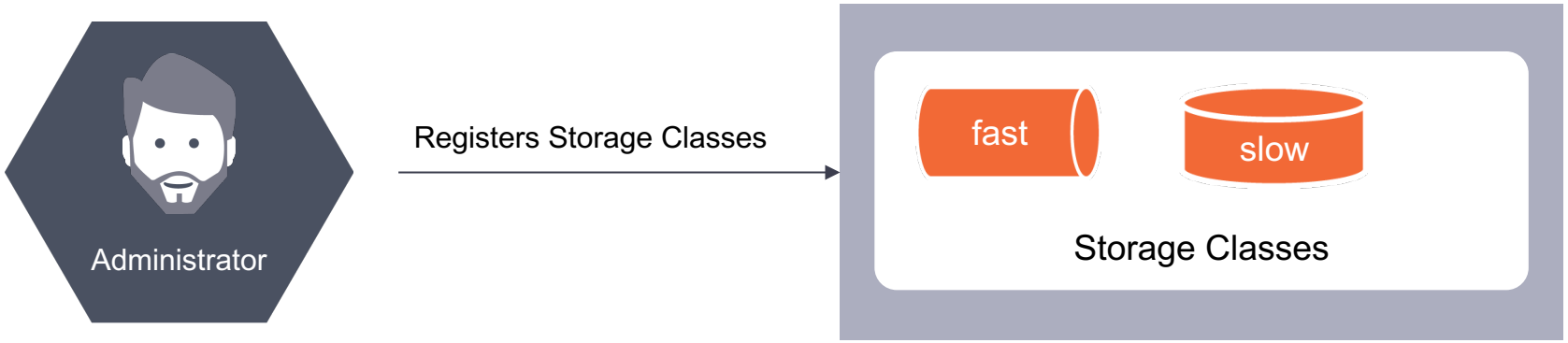
Dynamic provisioning with Storage Classes



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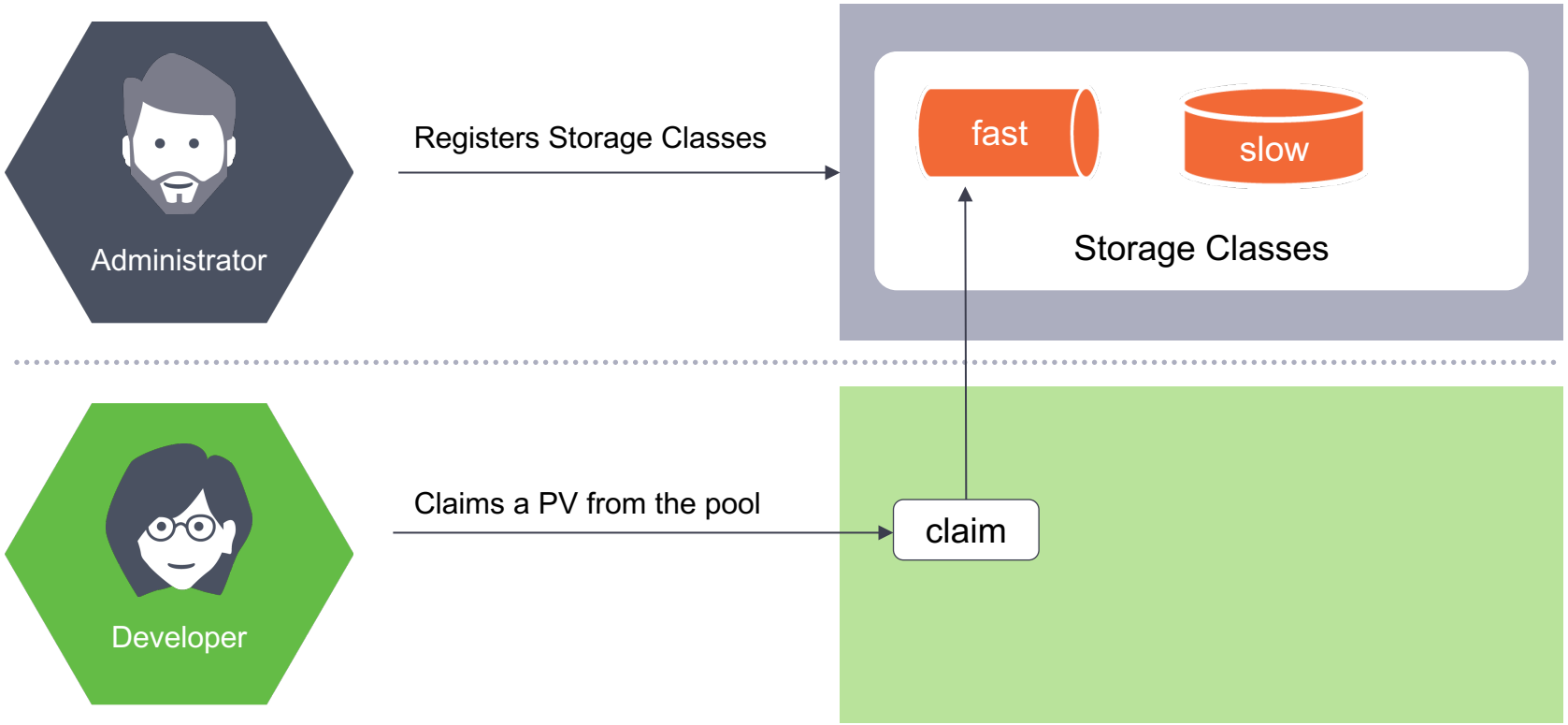

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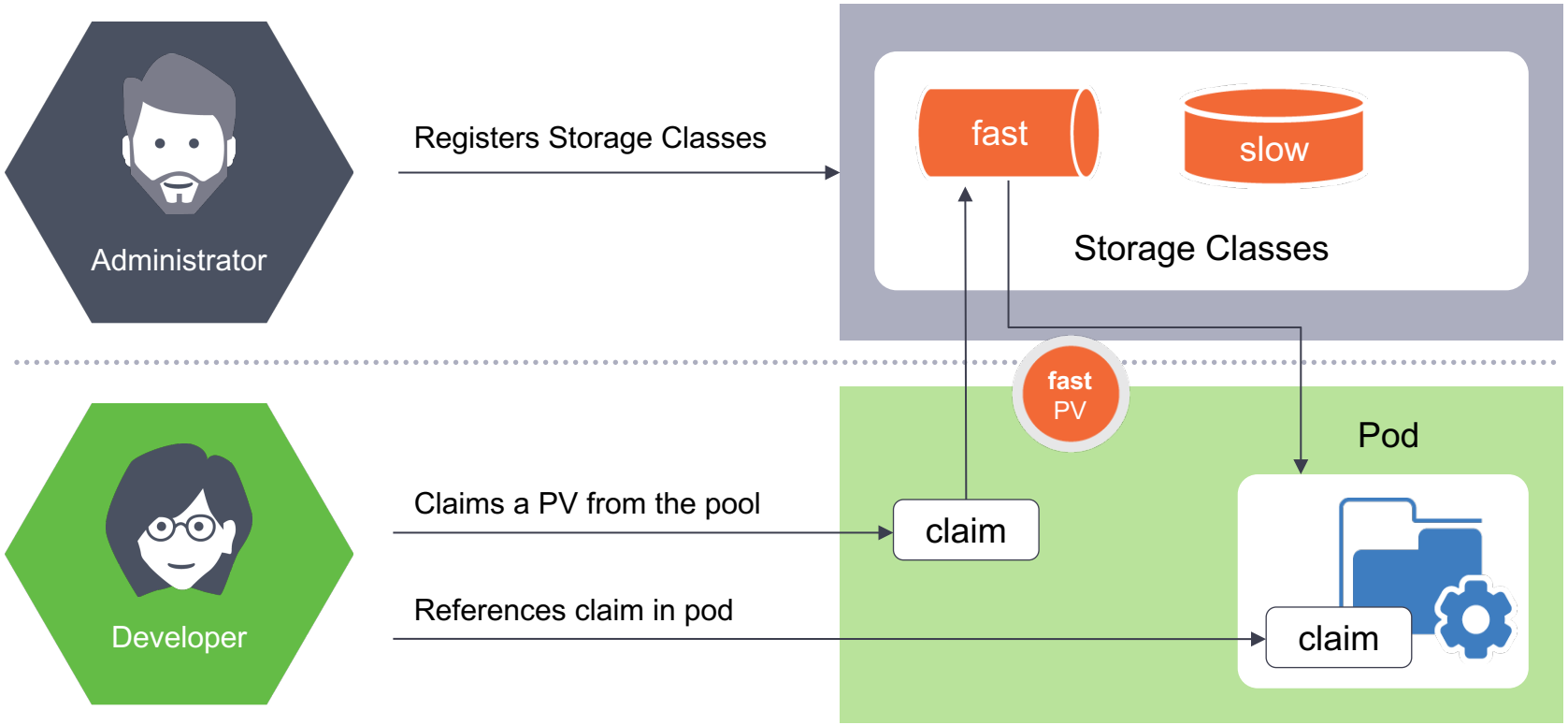
Dynamic provisioning with StorageClass



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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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Meet Jane

- A DevOps engineer in a bank
- She wants to migrate a Postgres database to containers

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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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2. Platform agnostic

The storage platform should be able to run anywhere.

Upgrades and scaling is non-disruptive.

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3. Declarative and composable

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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5. Natively secure

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

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6. Agile

The platform should be able to move application data between locations, dynamically resize volumes for growth, take point in time copies of data for data retention or to facilitate rapid recovery of data.

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7. Performant

The storage platform should be able to offer deterministic performance in complex distributed environments.

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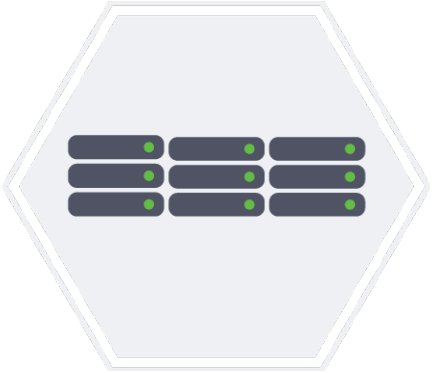
Block vs file vs object



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

File Storage
Data stored as ‘files’ in hierarchically nested ‘folders’ – ideal for active documents

Object Storage
Data stored as ‘objects’ in scalable ‘buckets’ – ideal for unstructured big data, analytics and archiving

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8. Consistently available

The storage platform should manage data distribution with a predictable, proven data model to ensure high availability, durability, consistency of application data.

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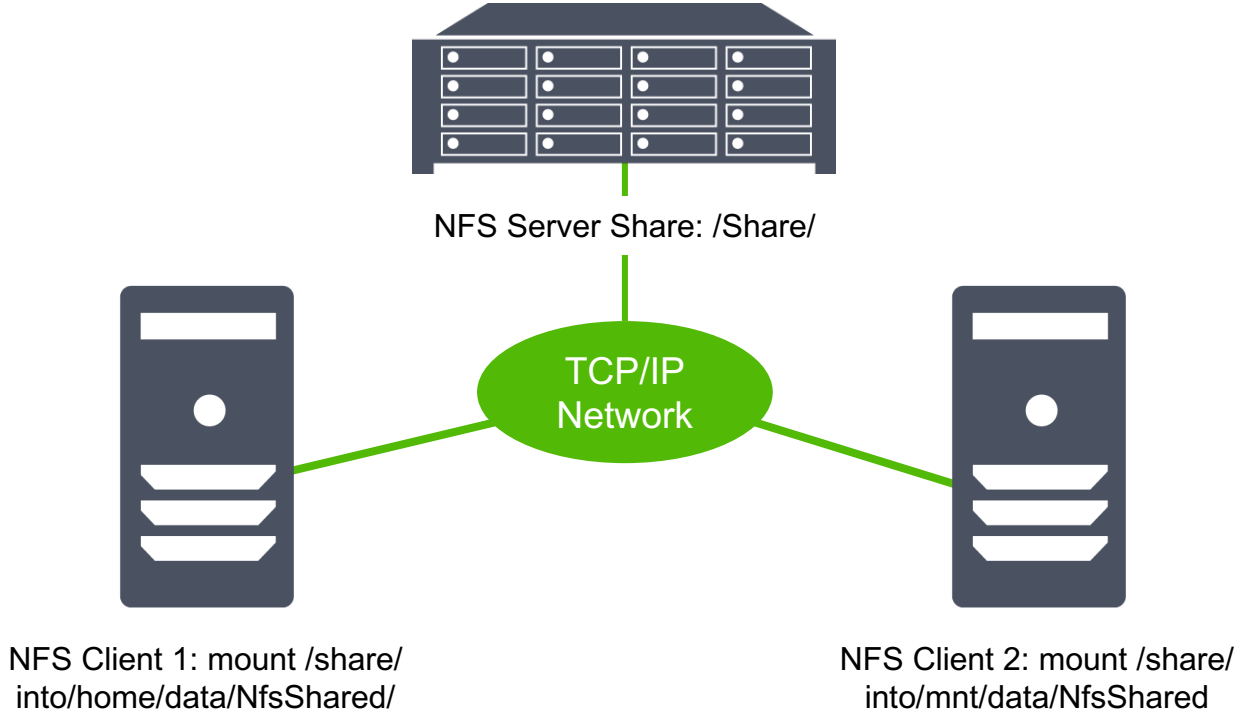
Storage Landscape

Centralized file system



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Centralized file system

Single point of failure
Hard to scale horizontally
No Docker/Kubernetes integration

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Proprietary storage array

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Proprietary storage array

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Deterministic performance
Vendor lock in
No thin provisioning
Hard to scale horizontally
Expensive and long lead times

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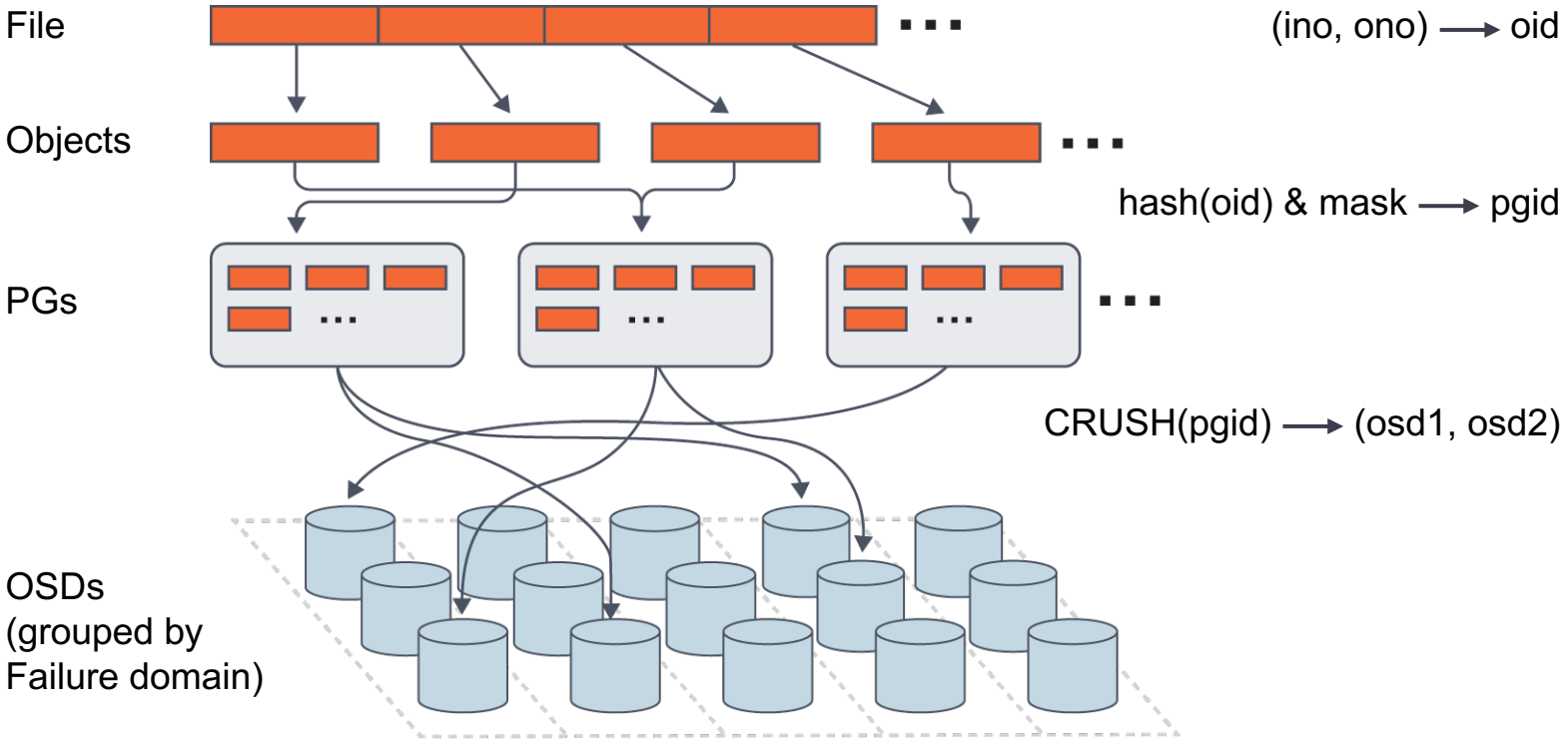
Distributed storage



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Horizontally scalable
Hardware agnostic
Write amplification
Failures are expensive
Complicated to set up

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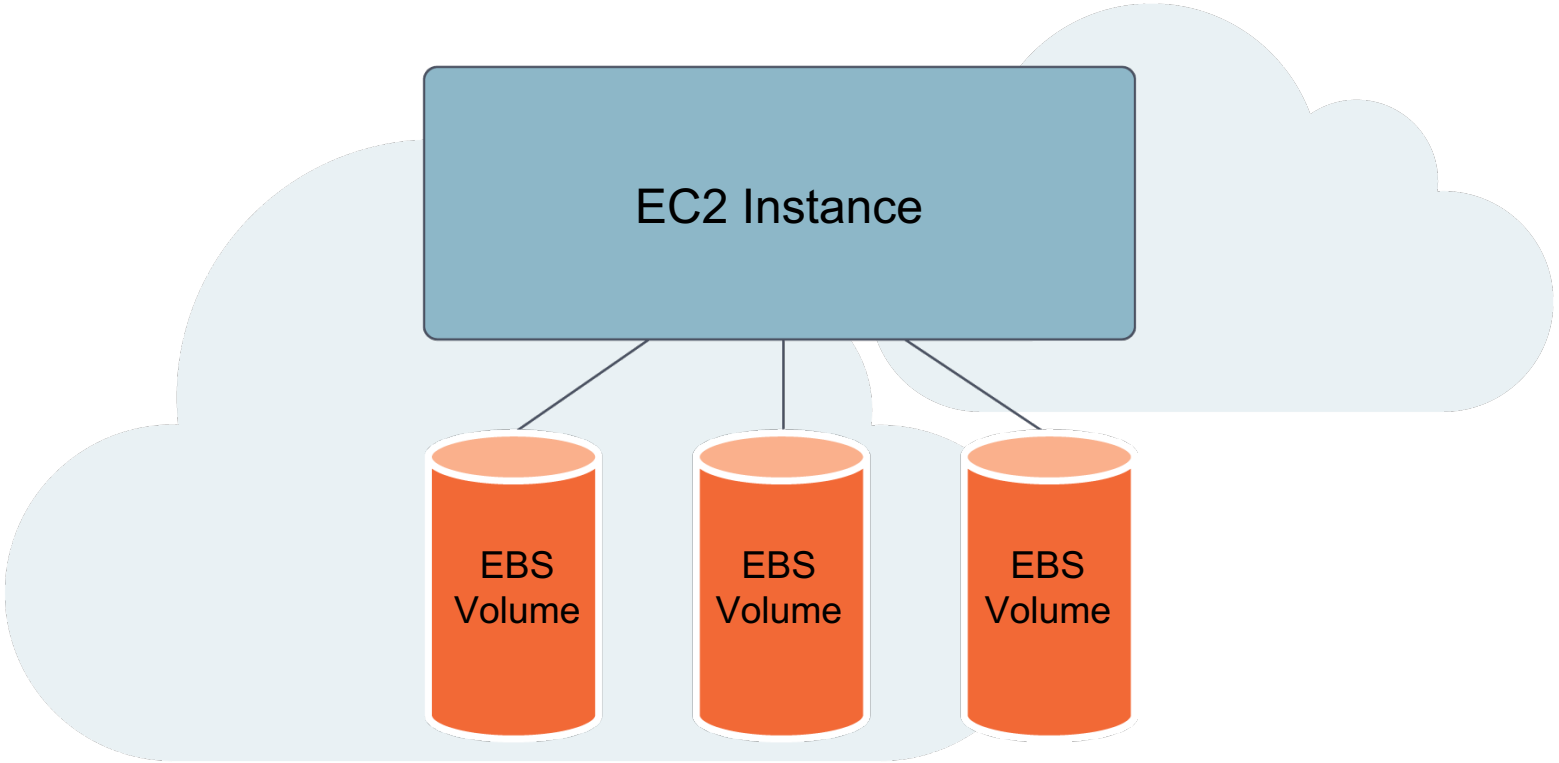
Public cloud SAN



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Public cloud SAN

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Horizontally scalable

Consistent and performant

Attach/detach times on physical block devices is slow

Expensive, vendor lock in

Compliance

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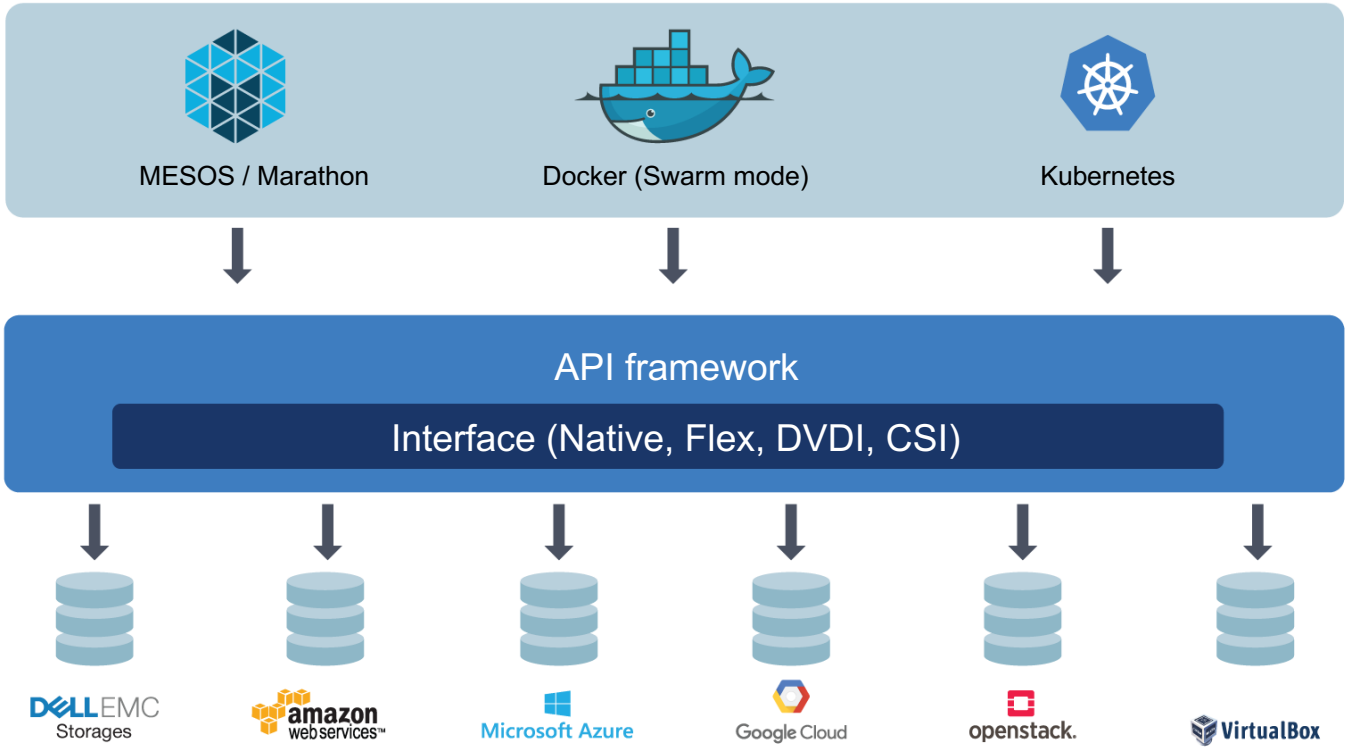
API framework



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Docker/Kubernetes integration

No guarantees for performance, replication, failover, scalability

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Orchestrated storage (StorageOS)

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

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Platform agnostic

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Orchestrated storage (StorageOS)

Platform agnostic

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

Docker/K8s integration

High availability

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KEEP CALM IT IS DEMO TIME

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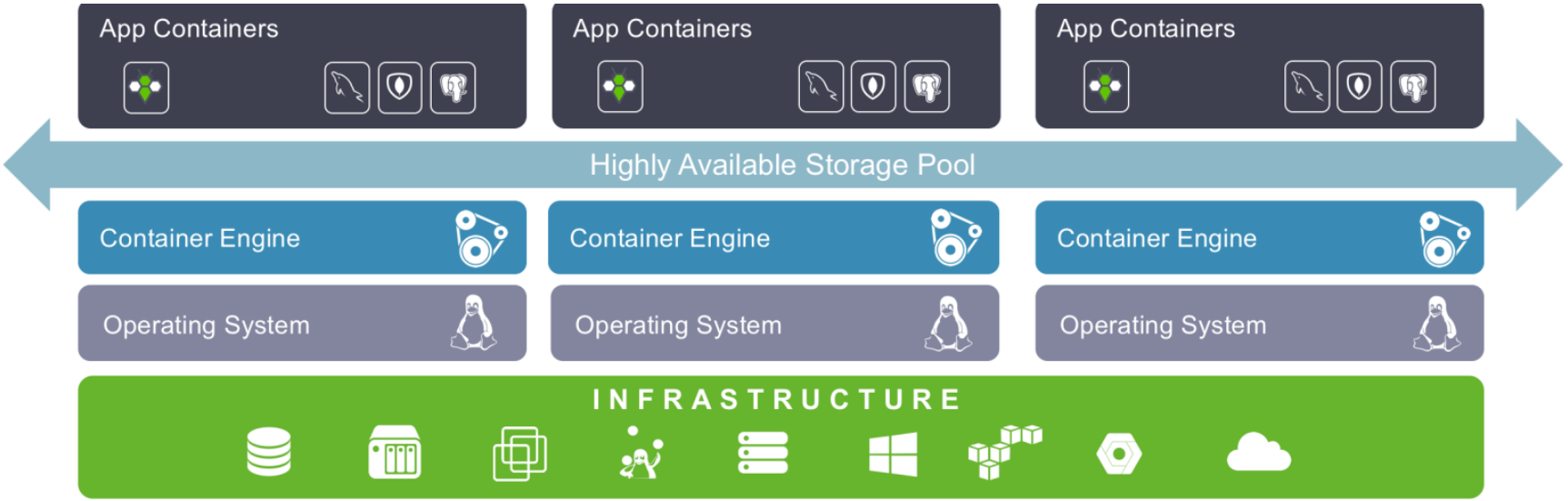
Orchestrated storage (StorageOS)



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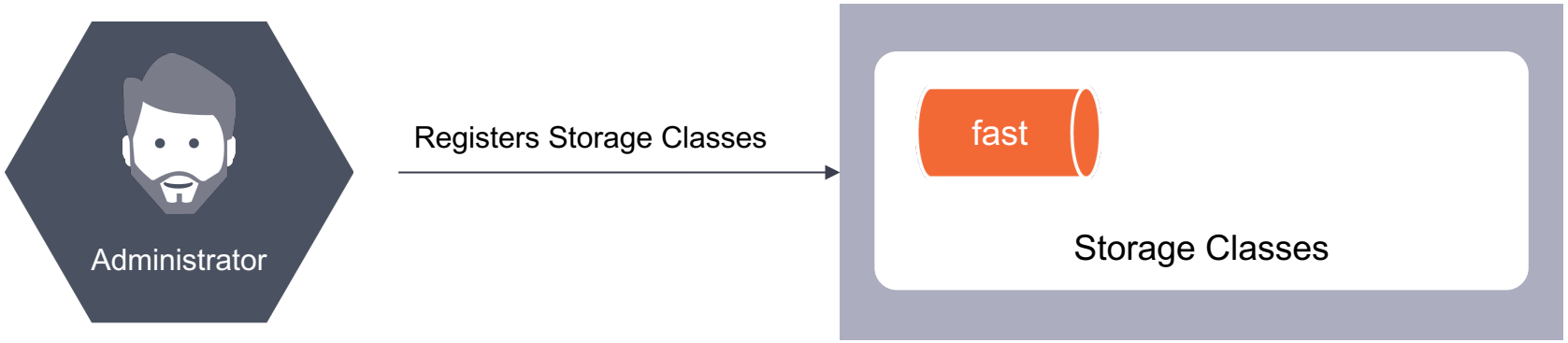
Create the fast StorageClass



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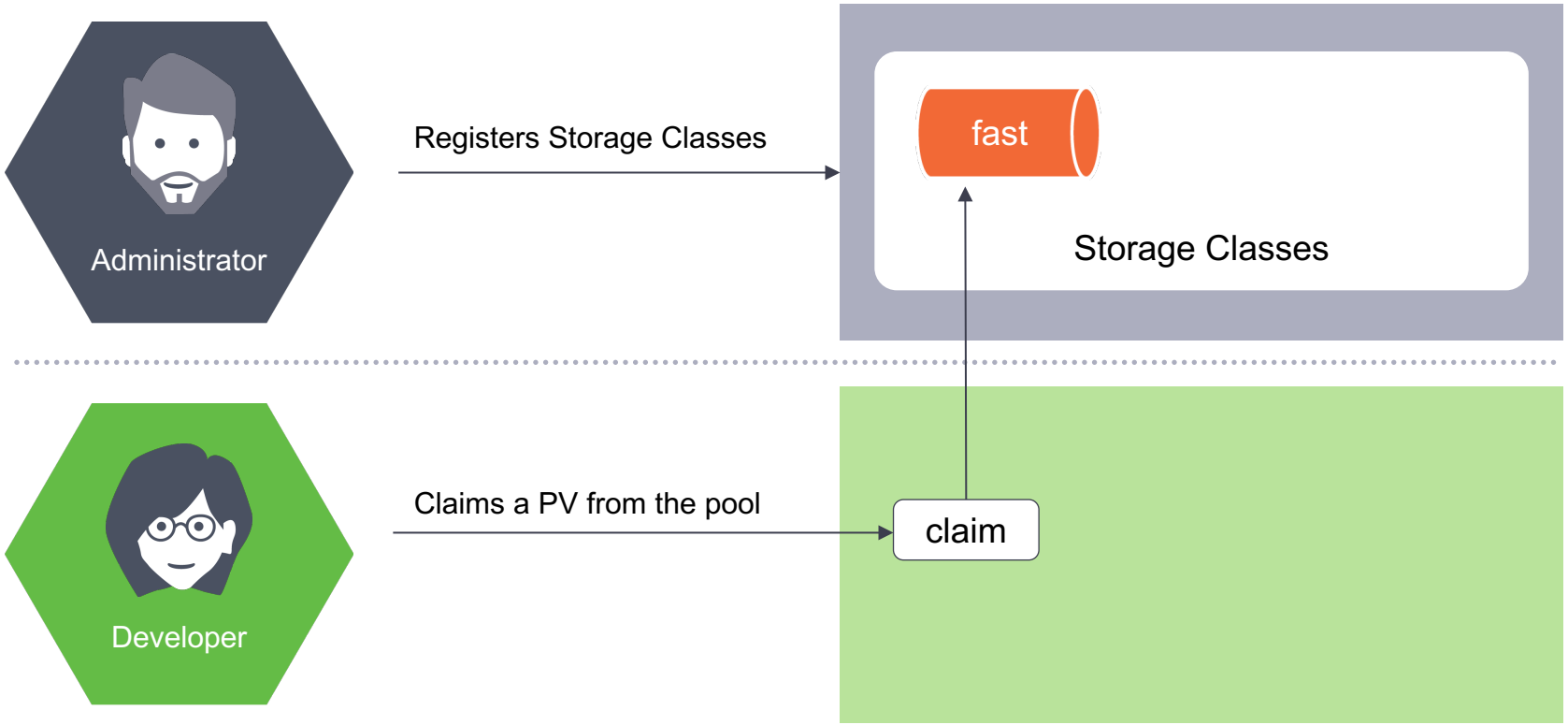
Claim a persistent volume



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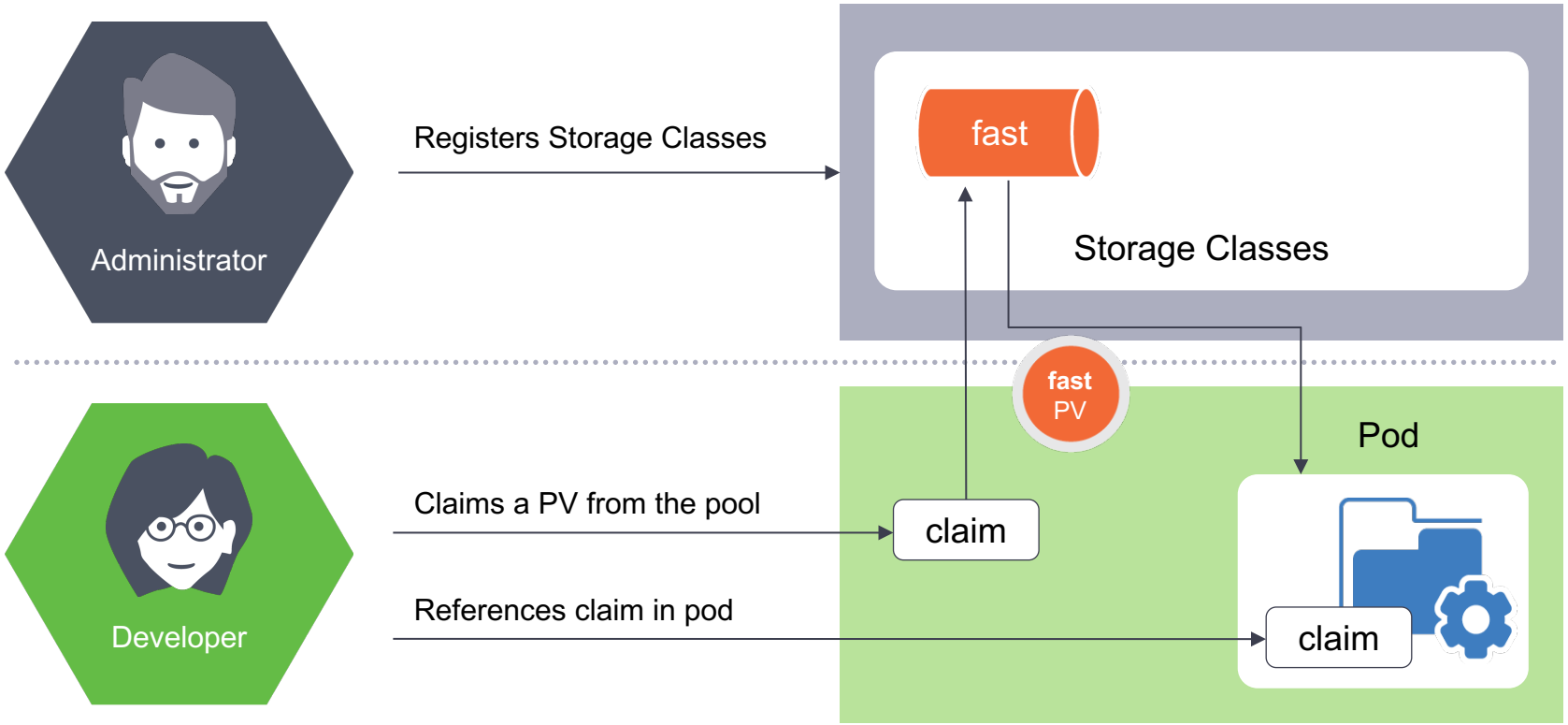

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High availability with StorageOS

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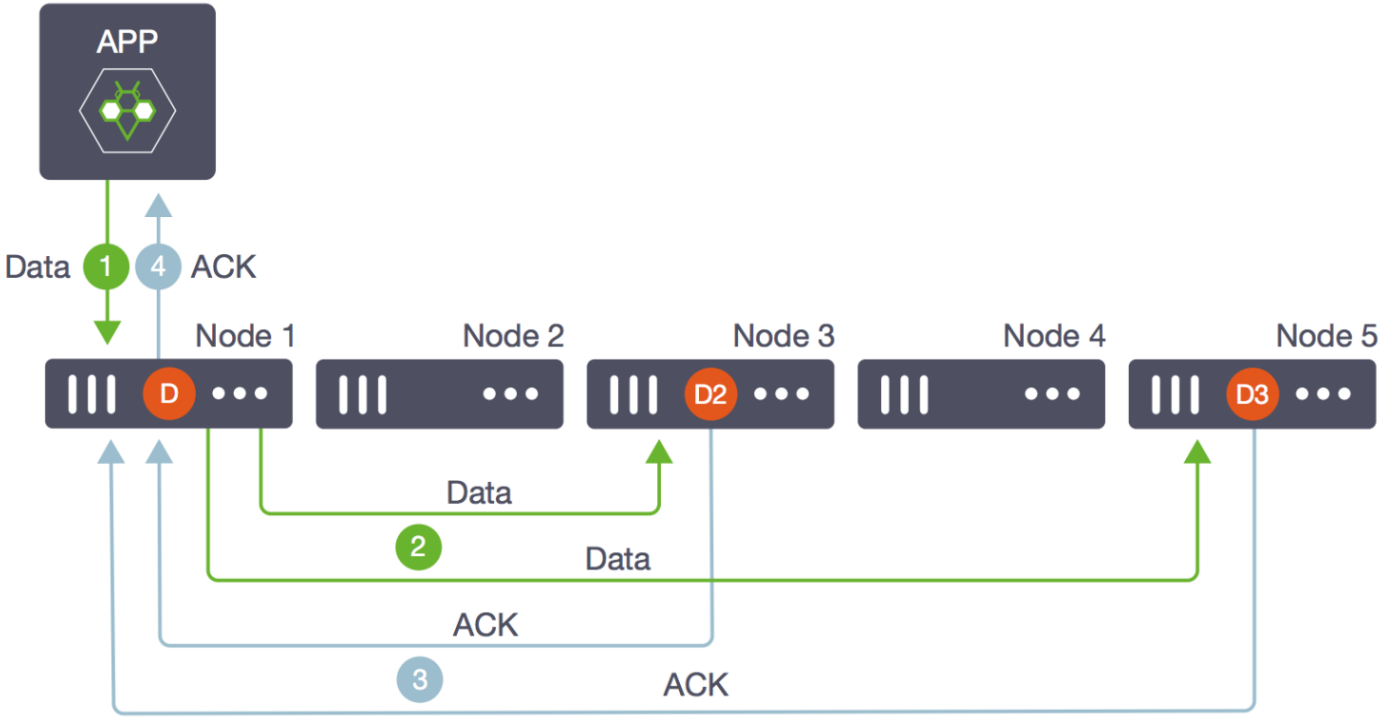

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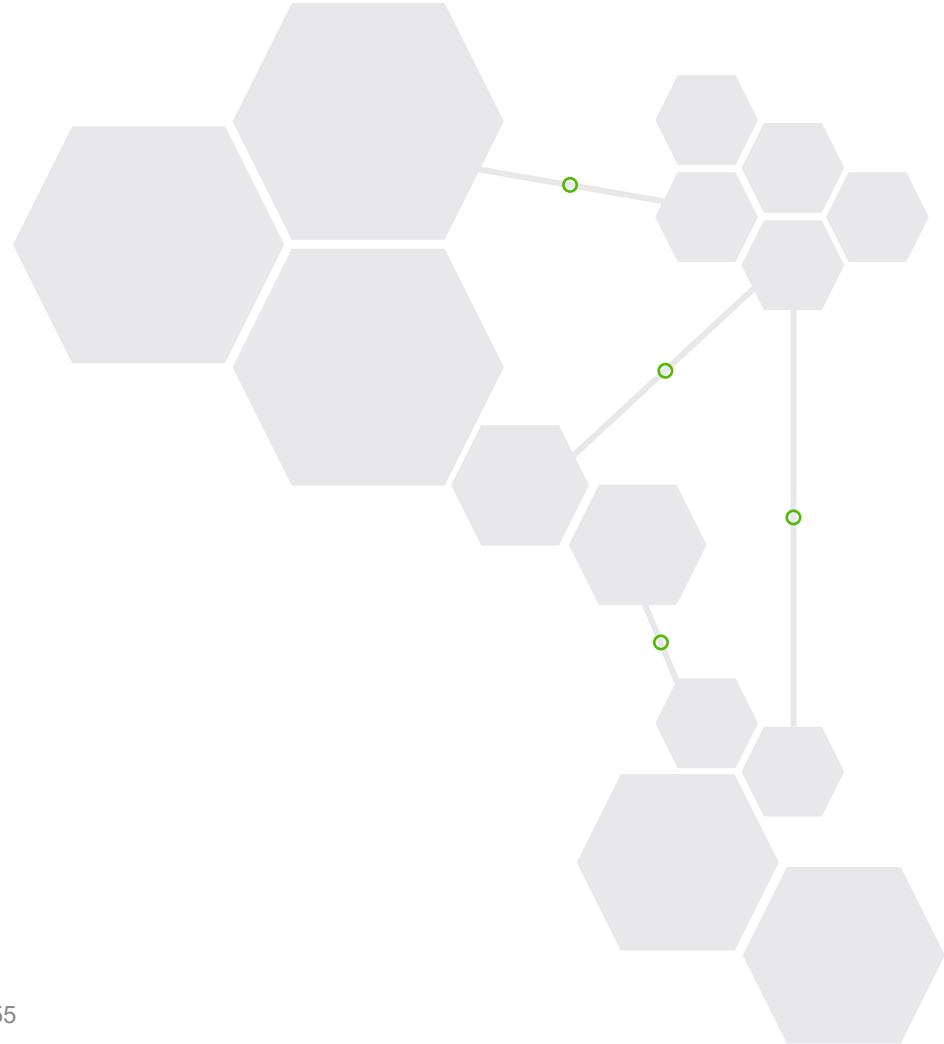
Horizontally scalable
Consistent and performant
Platform agnostic
Synchronous replication
Volume is limited to the size of one node

To Recap…



Storage is tricky…

but you can evaluate options using the eight principles of cloud native storage:

1. Application centric	5. Natively secure
2. Platform agnostic	6. Agile
3. Declarative and composable	7. Performant
4. API driven	8. Consistently available

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K8S Storage SIG / CNCF Storage WG

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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Quickstart

- storageos.com/kubernetes

Slack channel

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Cloud Native London, Tue 12 Dec

Speakers from UK Gov Digital Service, Bitnami, RealKinetic

meetup.com/Cloud-Native-London

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Questions

Slides at oicheryl.com

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