Managing Kubernetes Deployments with Helm and Flux

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https://indico.cern.ch/event/915708/

About

Computing Engineer in the CERN cloud team

Focusing on containers, kubernetes and networking

Accelerators and ML

Previous work in storage and the WLCG (worldwide LHC computing grid)

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Outline

Basic Helm Usage

Flux and GitOps

SOPS and Handling of Configuration Secrets

Multi-Cluster Deployments

Principles

Declarative infrastructure and applications

Git as a single source of truth

- Versioning, easy rollback, reviews
- Authentication and Authorization

Automated Delivery


HELM

What is Helm

The Kubernetes package manager

A **Chart** manages the deployment and configuration of an application

- Reusable, shareable units
- Includes all required manifests, plus any required libraries for lifecycle
- Can be published in **Repositories**

Separate **values** definitions for instance configuration

Alternative: Kustomize

Demo

GitOps

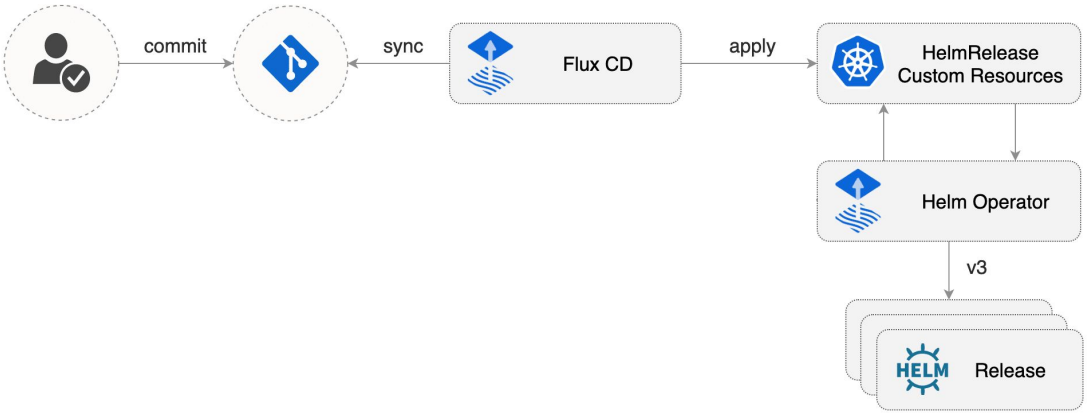
“ Git as a single source of truth for declarative infrastructure and applications ”

Umbrella / Meta Charts

Single deployment unit for complex applications

Wrap all dependencies

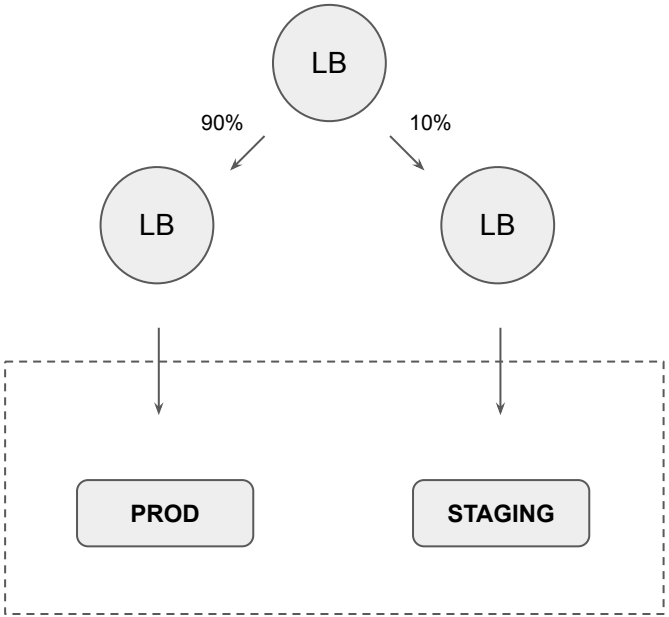
Add any additional custom manifests

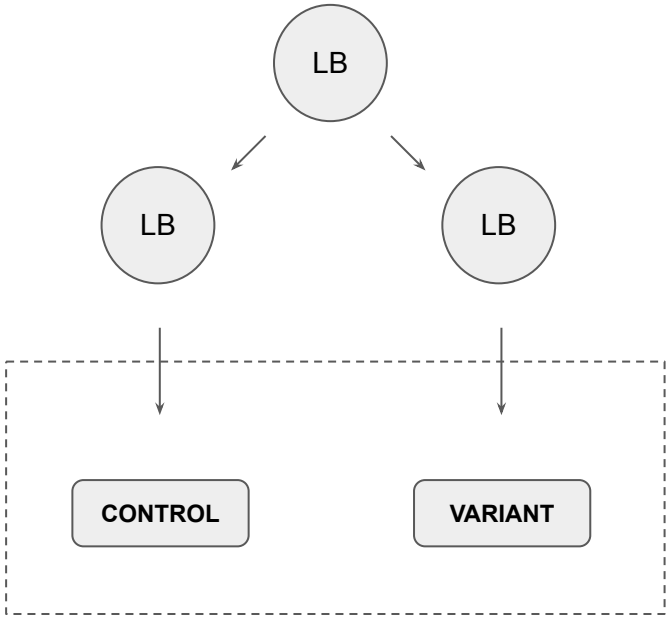


HelmRelease: A Kubernetes custom resource

Flux: Syncs the git repo with the local HelmRelease definitions

Helm Operator: Monitors HelmRelease resources in the cluster and applies them





Rollout

A/B Testing

Demo

https://gitlab.cern.ch/helm/releases/gitops-getting-started

Handling Sensitive Data

SOPS

Mozilla editor for encrypted files

Supports YAML, JSON, ENV, INI and BINARY

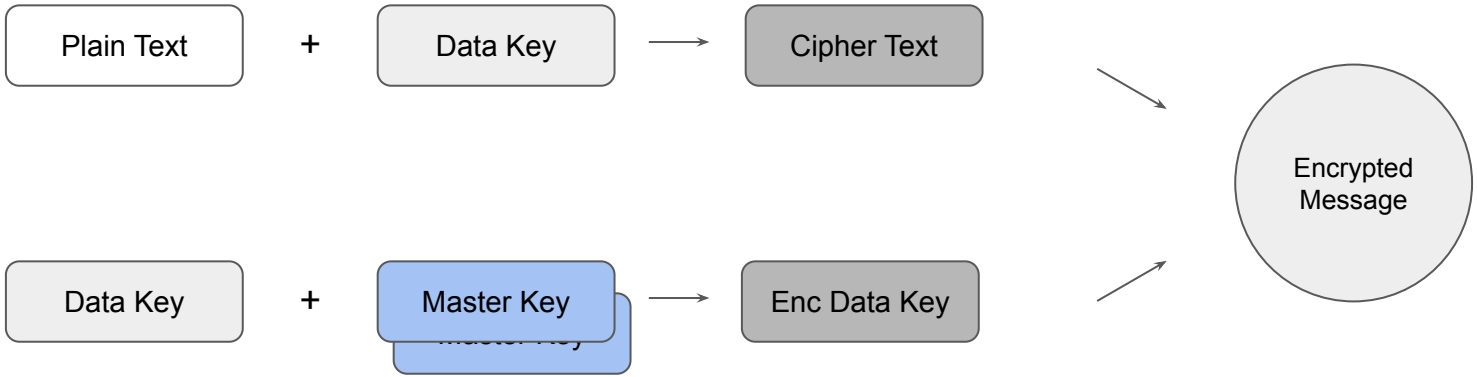
Supports AWS KMS, GCP KMS, Azure KeyVault, PGP

- HashiCorp Vault under review
- OpenStack Barbican added and pushed recently
  - https://github.com/mozilla/sops/pull/683

Supported natively by Flux

SOPS

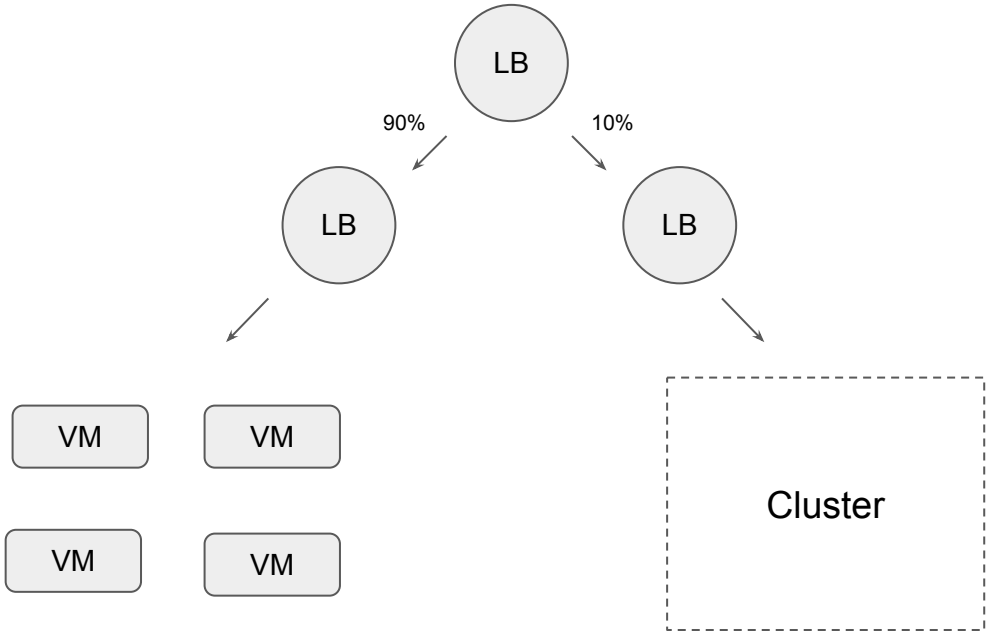
Possible to use multiple Master Keys, even from different providers



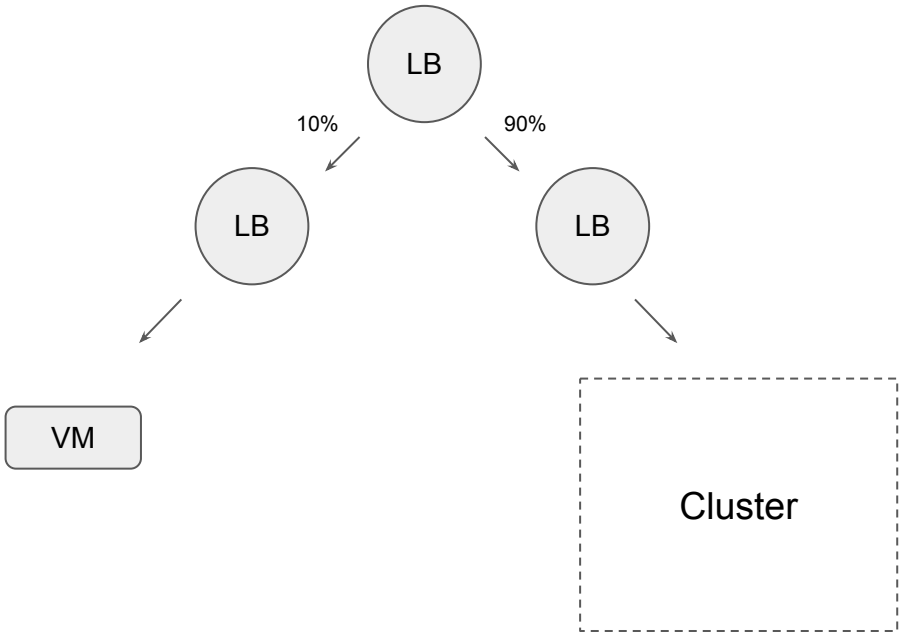
Demo

Multi Cluster Deployments

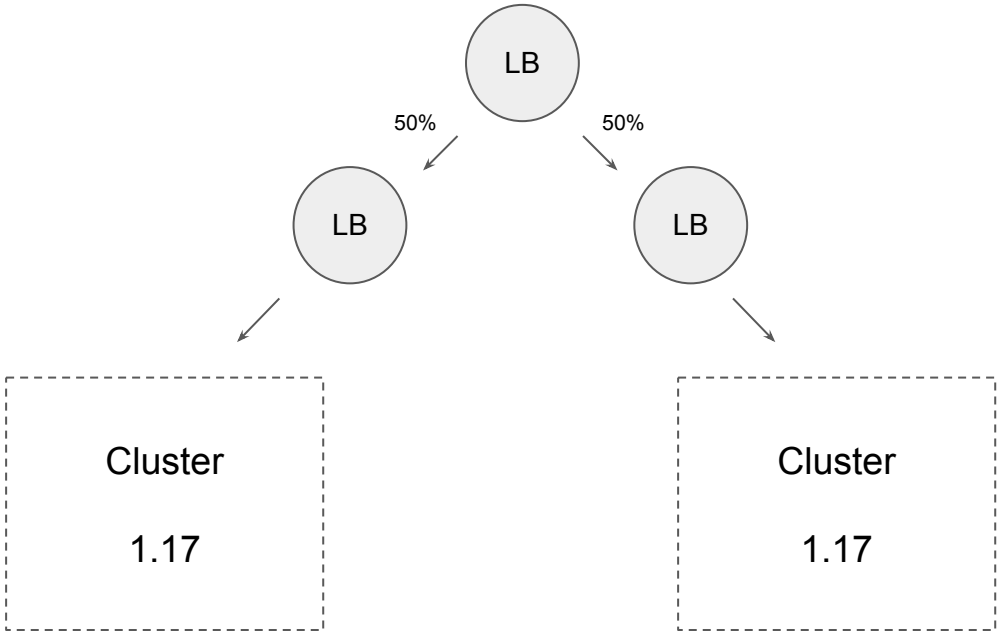
Use Case: Gradual Move to Kubernetes



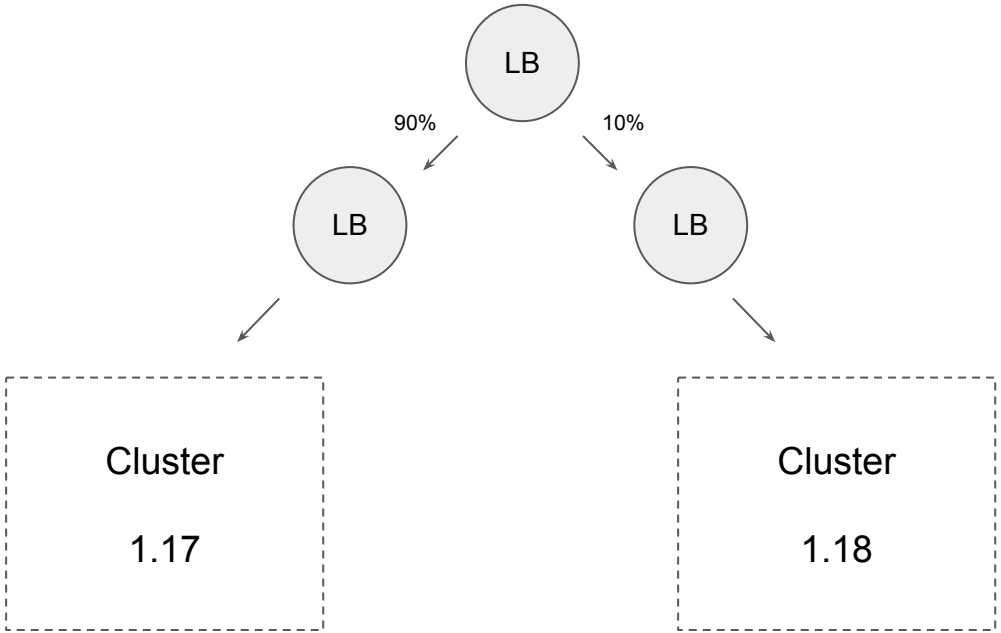
Use Case: Gradual Move to Kubernetes



Use Case: Reduce Blast Radius



Use Case: Safer Cluster Upgrades



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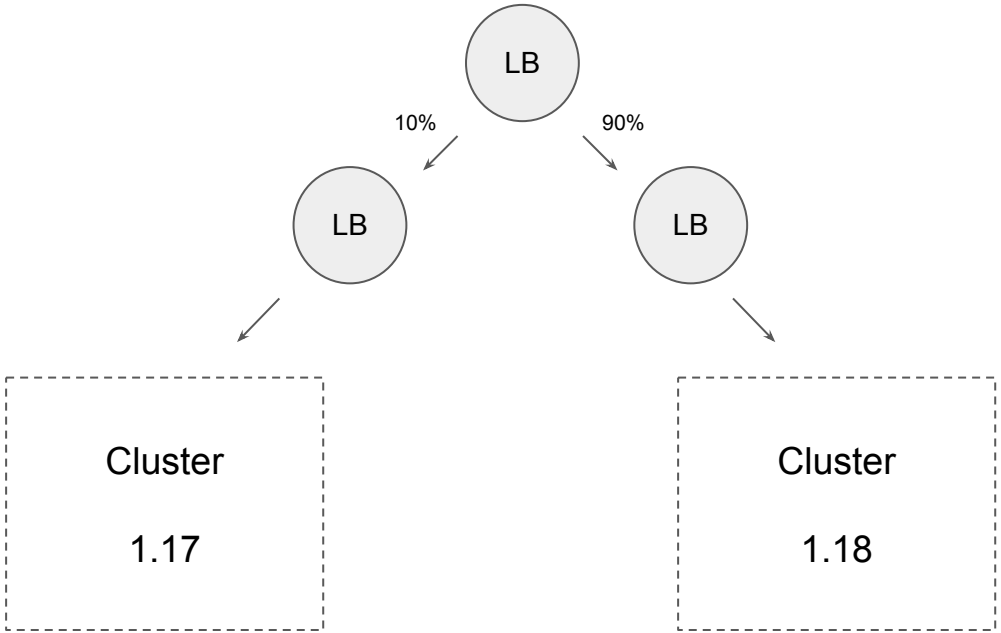

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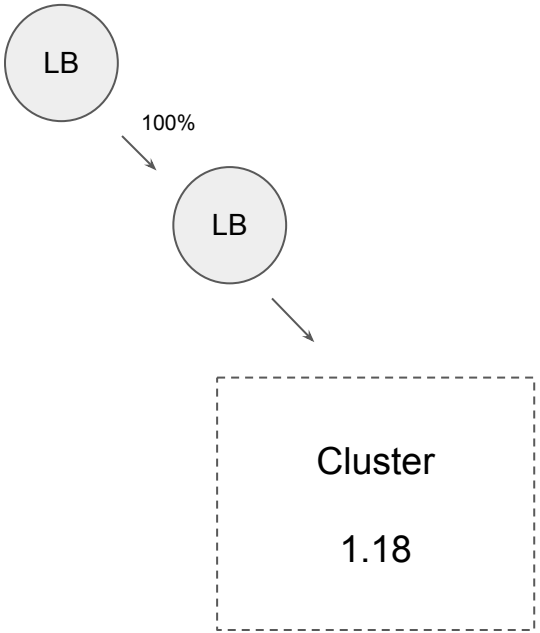

Prometheus

Flux exposes a set of metrics

https://docs.fluxcd.io/en/1.19.0/references/monitoring/

Same for the Helm Operator

https://docs.fluxcd.io/projects/helm-operator/en/stable/references/monitoring/

Other Topics

Automation of Docker Image Updates

Canary releases with Istio / Service Mesh

To be covered in a future webinar...

Improvements

Multiple repositories per Flux instance

Define weights directly in the serviceType: LoadBalancer

Integrate with HashiCorp Vault

Questions?