// GITOPS - IS THIS SOMETHING FOR ME?

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Agenda

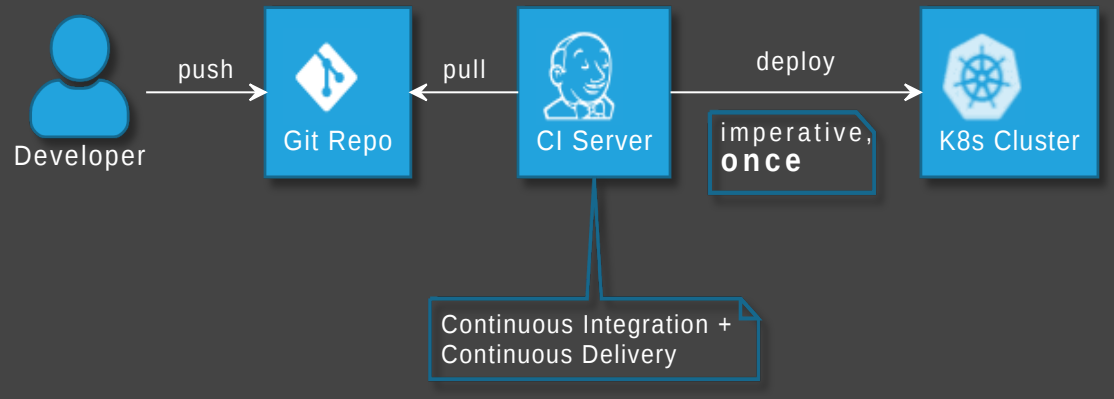
- Basics
- Tools
- Challenges
- Demo

GitOps basics

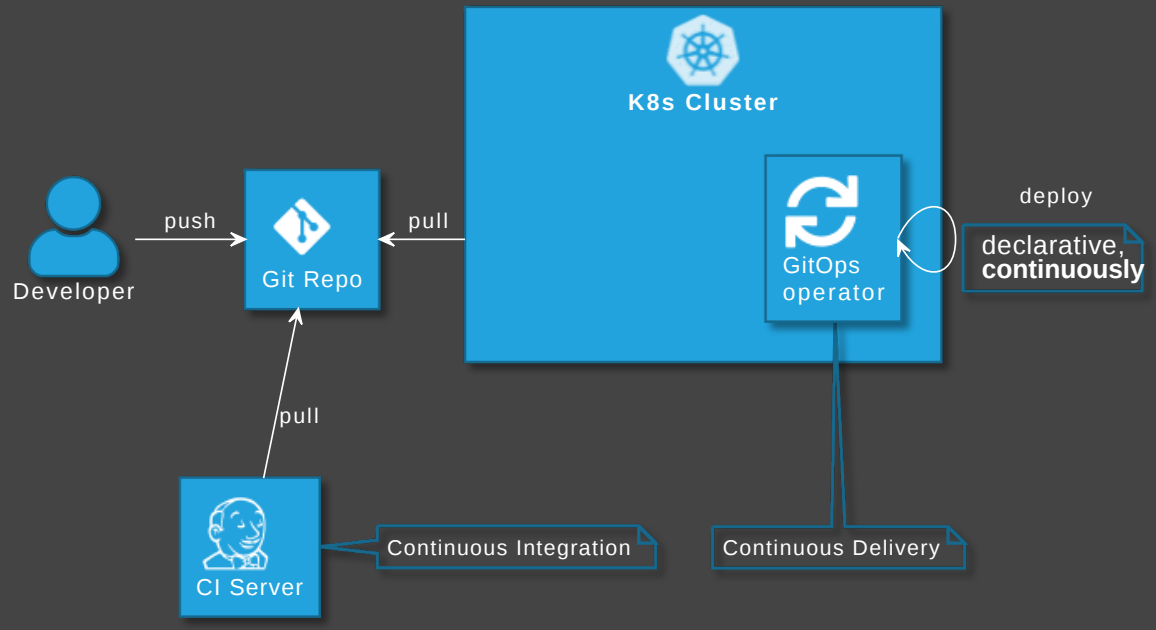
Origin: blog post by Weaveworks, August 2017

> Use developer tooling to drive operations
> 🌐 weave.works/blog/gitops-operations-by-pull-request

"Classic" Continuous Delivery ("CIOps")



GitOps



GitOps Principles

The desired state of a GitOps managed system must be:

1. **Declarative**
2. **Versioned and Immutable**
3. **Pulled Automatically**
4. **Continuously Reconciled**

github.com/open-gitops/documents/blob/main/PRINCIPLES.md

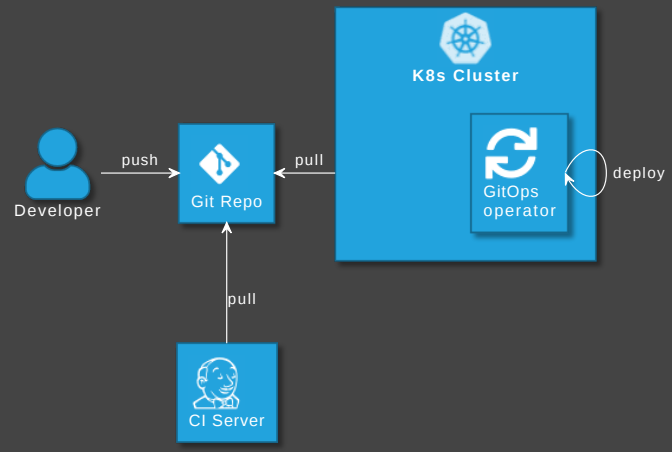
GitOps vs DevOps

- DevOps is about collaboration of formerly separate groups (mindset)
- GitOps focuses on ops (operating model)
- GitOps could be used with or without DevOps and vice versa
- Still, GitOps might be...

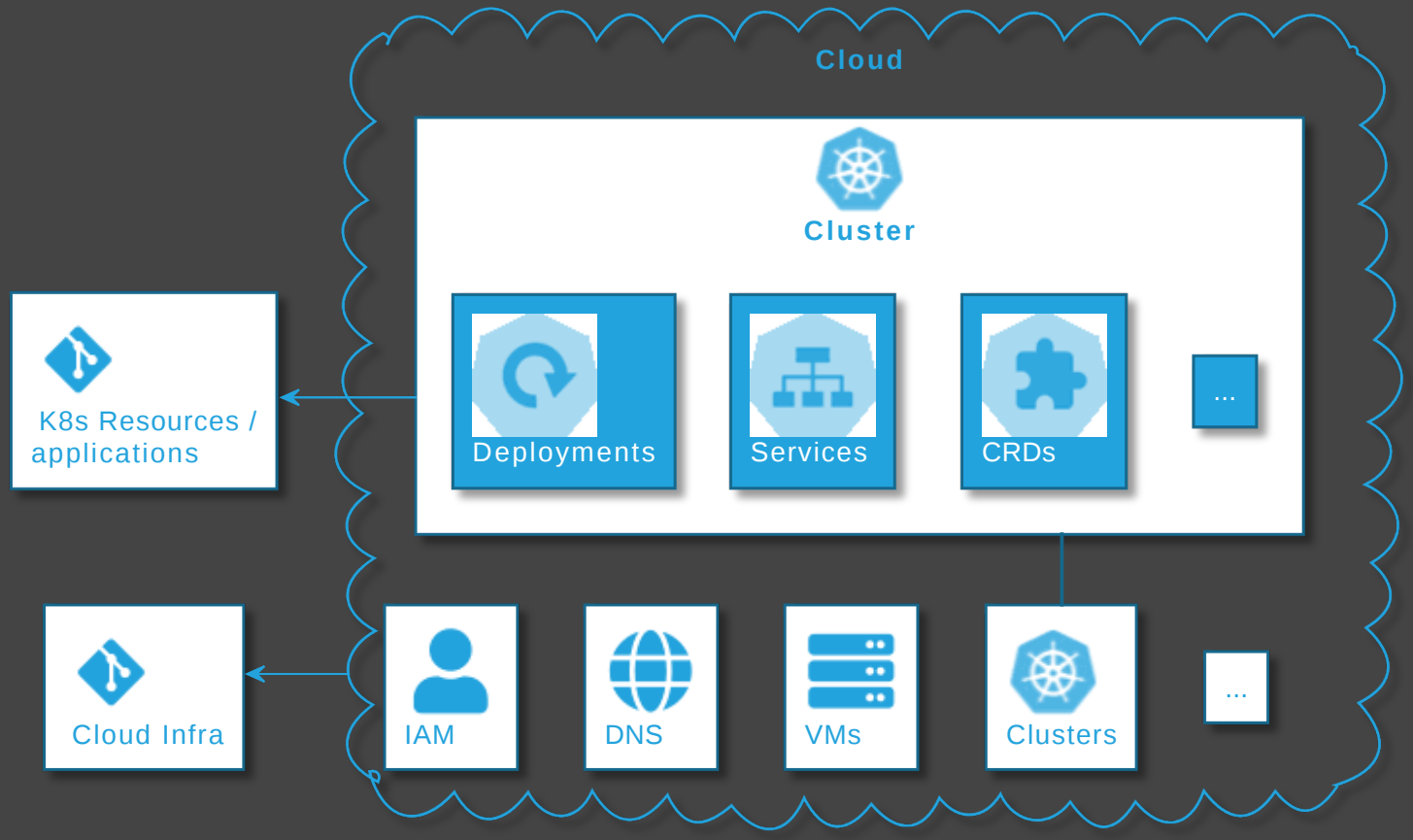
> The right way to do DevOps
>
> 🗣️ Alexis Richardson

Advantages of GitOps

- No access to cluster from outside
  (might also solve firewall/zone issues)
- No credentials on CI server
  (neither cluster access nor for apps)
- Forces declarative description
- IaC is auditable
- Scalability - one repo many applications
- Self-healing



What can GitOps be used for?



GitOps tools

GitOps tool categories

- GitOps operators/controllers
- Supplementary GitOps tools
- Tools for operating cloud infra

GitOps operators/controllers

Supplementary GitOps tools

- Secrets
  - KMS, e.g. aws …
  - + K8s Integration
    - Operator
    - Container Storage Interface (CSI) driver
    - Side car (injector)
    - Helm/Kustomize plugin
    - GitOps Operator: native support or plugin
- Backup / **restore**
- Deployment Strategies - Progressive Delivery


- …

➡️ GitOps ❤️ operators

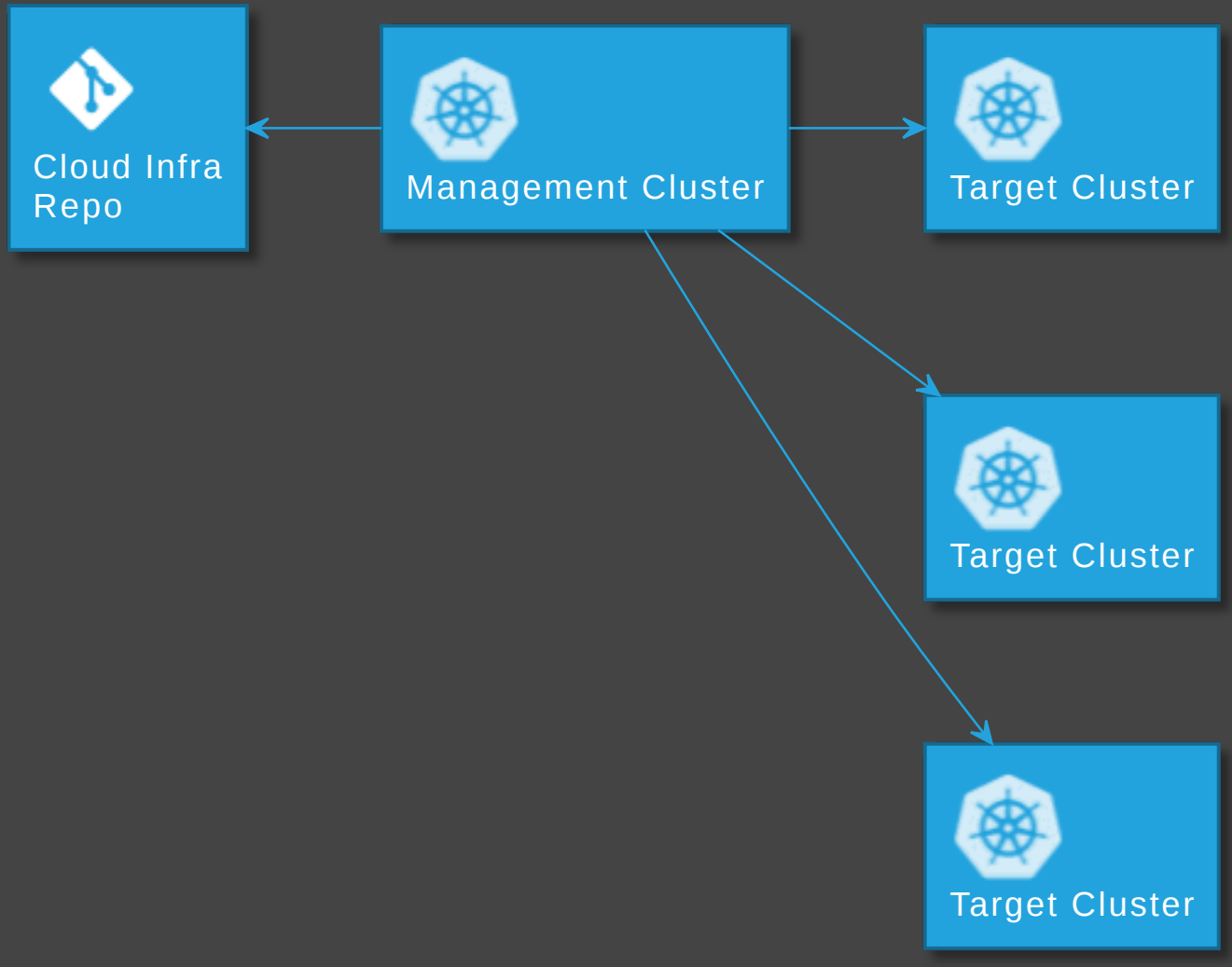
+

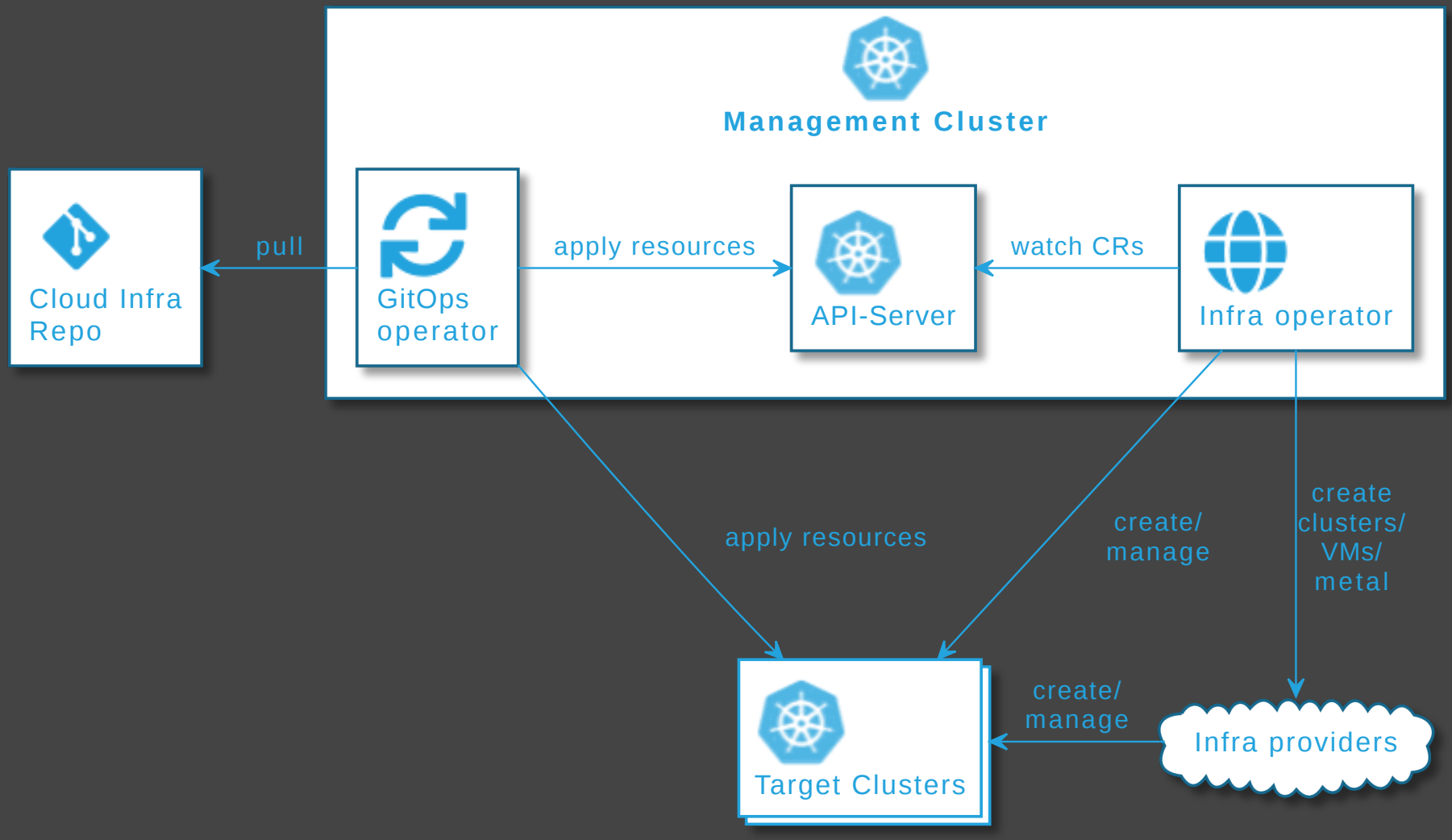
Infra Operator

=

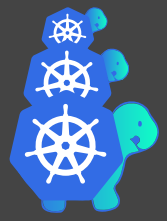
Operate cloud infra with GitOps

Operate Kubernetes with Kubernetes




Management Cluster
Cloud Infra Repo
pull
GitOps operator
apply resources
API-Server
watch CRs
Infra operator
apply resources
create/ manage
create clusters/ VMs/ metal
Target Clusters
create/ manage
Infra providers

Tools for operating cloud infra




See also

☁ cloudogu.com/blog/gitops-tools (iX 4/2021)

- General tool comparison,
- tips on criteria for tool selection,
- comparison of ArgoCD and Flux

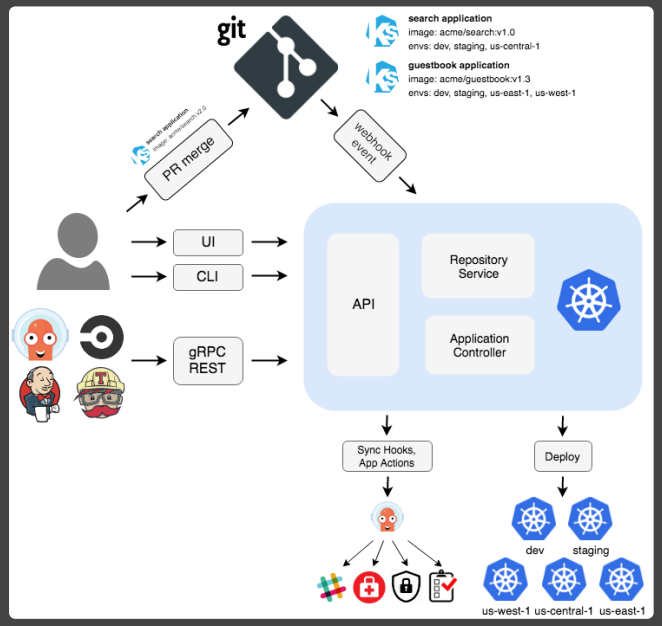
Challenges with GitOps

Downsides

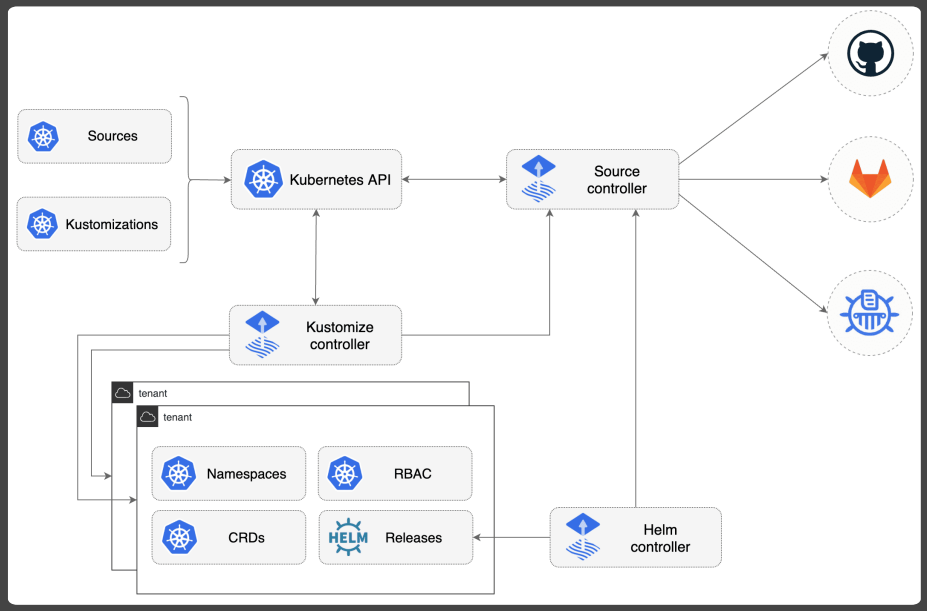
- More infra necessary
- Steep Learning curve

GitOps infra

- GitOps Operator comprises several applications;
- Cause ops efforts: maintenance, alerts



argo-cd.readthedocs.io/en/stable/assets/argocd_architecture.png



fluxcd.io/img/diagrams/gitops-toolkit.png

Learning curve

- New concepts and tools for developers and platform teams
- Adapt deployment process
- Migrate applications
- Adapt error handling and alerting
  - avoid failing late and silently
  - accustom to new notification mechanism
  - still, reason might be difficult to pinpoint

Day two questions

- How to realize local dev env?
- How to delete resources?
- How to structure repos and folders?
- How to realize staging?
- Role of CI server?
- ...

Local development

- Option 1: Deploy GitOps operator and Git server on local cluster ➡️ complicated
- Option 2: Just carry on without GitOps.

How to delete resources?

- `garbage collection` (Flux) / `resource pruning` (ArgoCD) disabled by default
- 💡 Enable from beginning ➡️ avoid manual interaction
- Unfortunately, still often unreliable / too defensive (?) 😒

Repo and folder structure

- No standard for structures (intentionally) ➡️ Conway's law
- Repo patterns: Monorepo vs Polyrepo (per app, team, stage) 🏗️
- Within repo: folder/~~branch~~ structure for stage, team, app
- More options:
  - Topology: GitOps controller (s) ↔️ Cluster(s) / Namespaces
  - GitOps controller-specific config

🤯 GitOps Chasm

Infra

- repos
- folders
- branches
- clusters
- namespaces
- controller instances
- controller-specific config

↔️

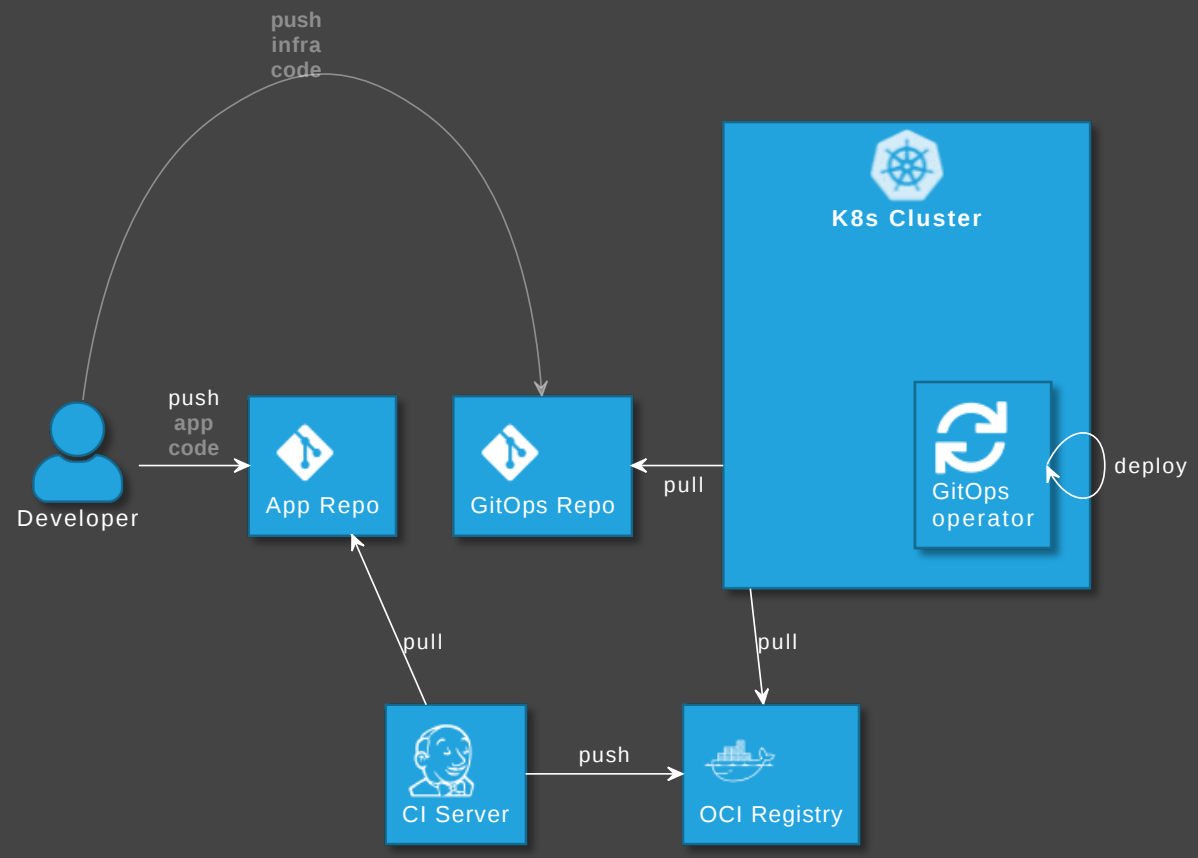
Mapping?

🤔

🌍 Real-world

- company/departments
- teams
- projects
- applications
- microservices
- stages/environments
- customers
- tenants
- etc.

App vs GitOps repo



GitOps tools: Put infra in separate repo! See

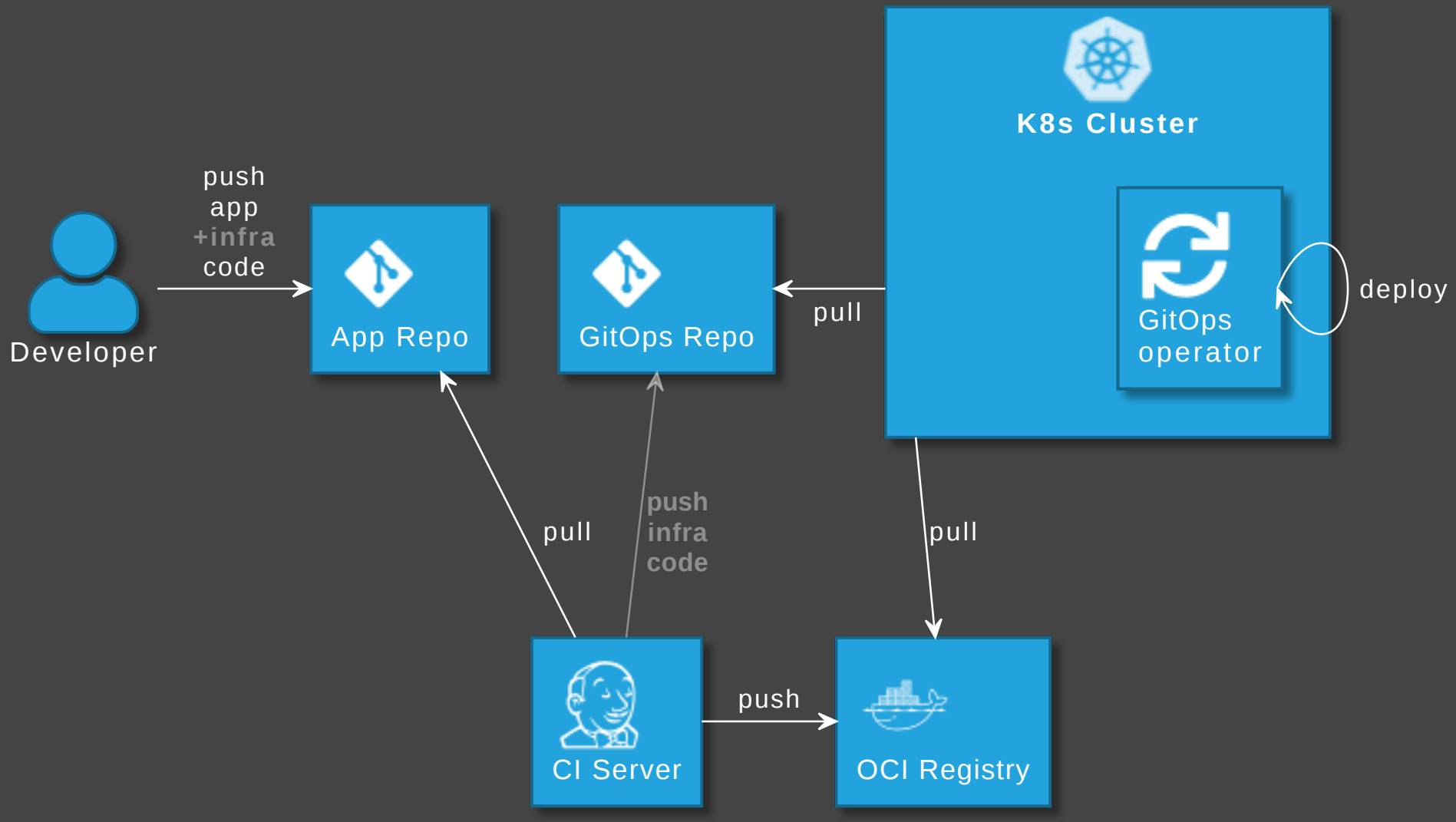
argo-cd.readthedocs.io/en/release-2.5/user-guide/best_practices

Disadvantages

- Separated maintenance & versioning of app and infra code
- Review spans across multiple repos
- Local dev more difficult
- Static code analysis for IaC code not possible

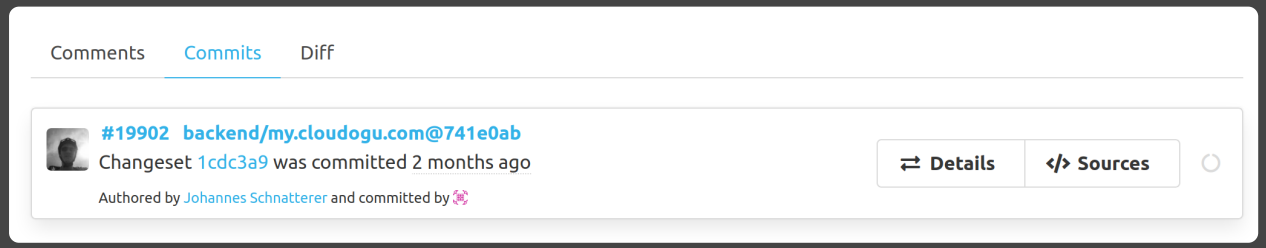
How to avoid those?

Using CI-Server with GitOps part 1



Advantages

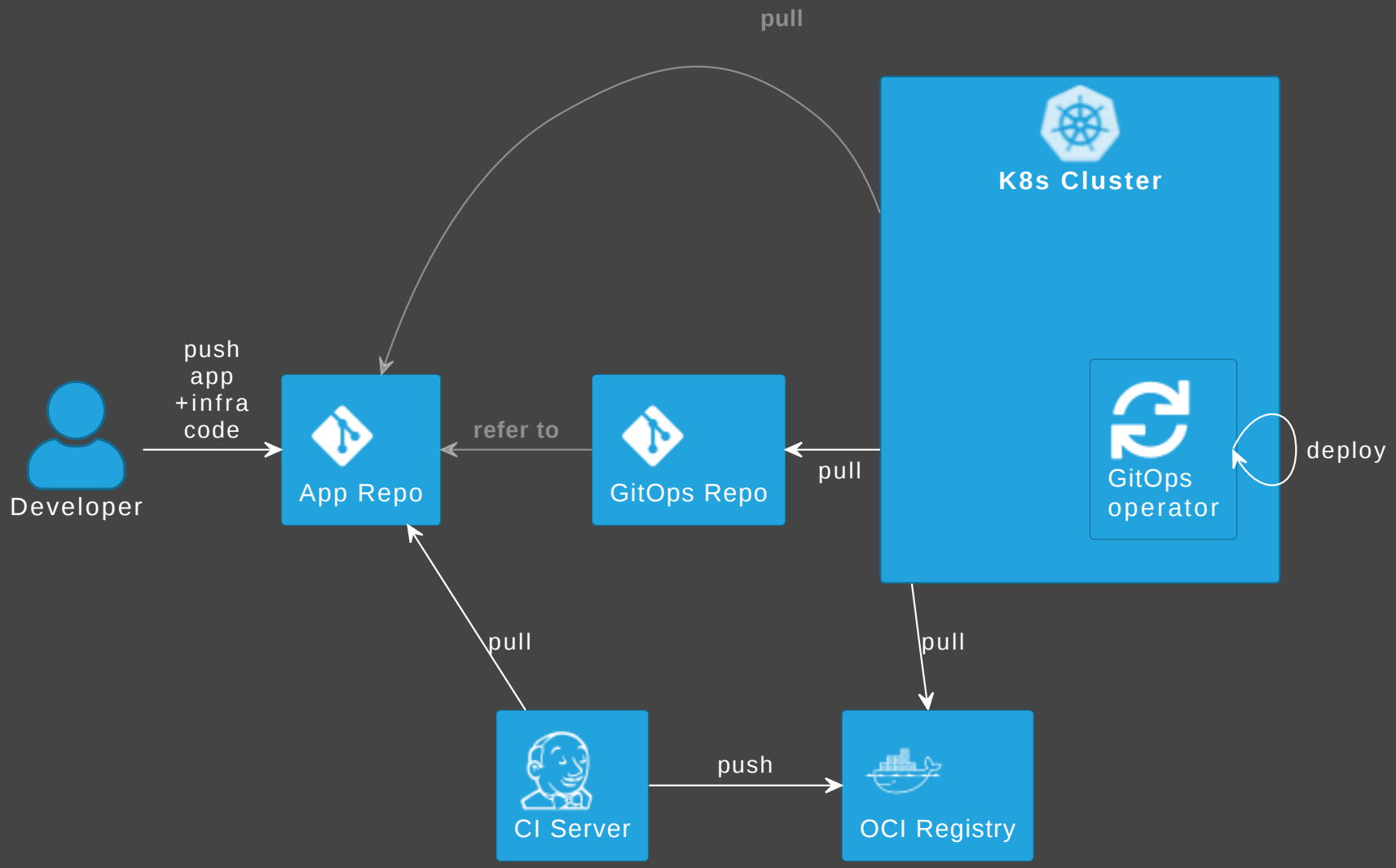
- Single repo for development: higher efficiency
- Shift left: static code analysis + policy check on CI server, e.g. yamlint, kubeval, helm lint, conftest
- Automated staging (e.g. PR creation, namespaces)
- Simplify review by adding info to PRs



Disadvantages

- Complexity in CI pipelines
  - ➡️ Recommendation: Use a plugin or library, e.g.
  - cloudogu/gitops-build-lib 
- Redundant code

Alternative: Refer to app repo

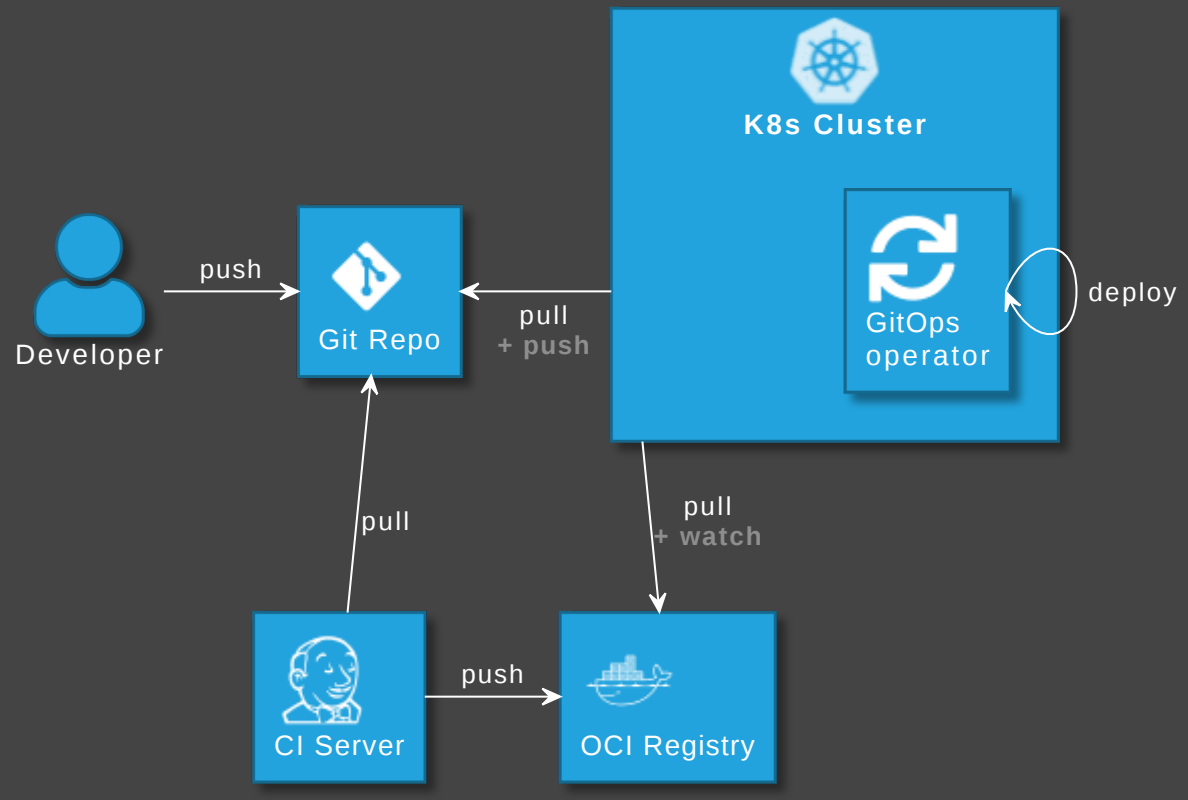


Stage promotion

How to update bump version in GitOps repo and promote through stages?

- **Manual**: Push to short-lived branches, create PRs manually
- **Image Updater**: Operator pushes branches, create PRs manually
- **CI Server**: Build job pushes branches, creates PRs
- **Renovate Bot**: Bot watches registry pushes branches, create PRs

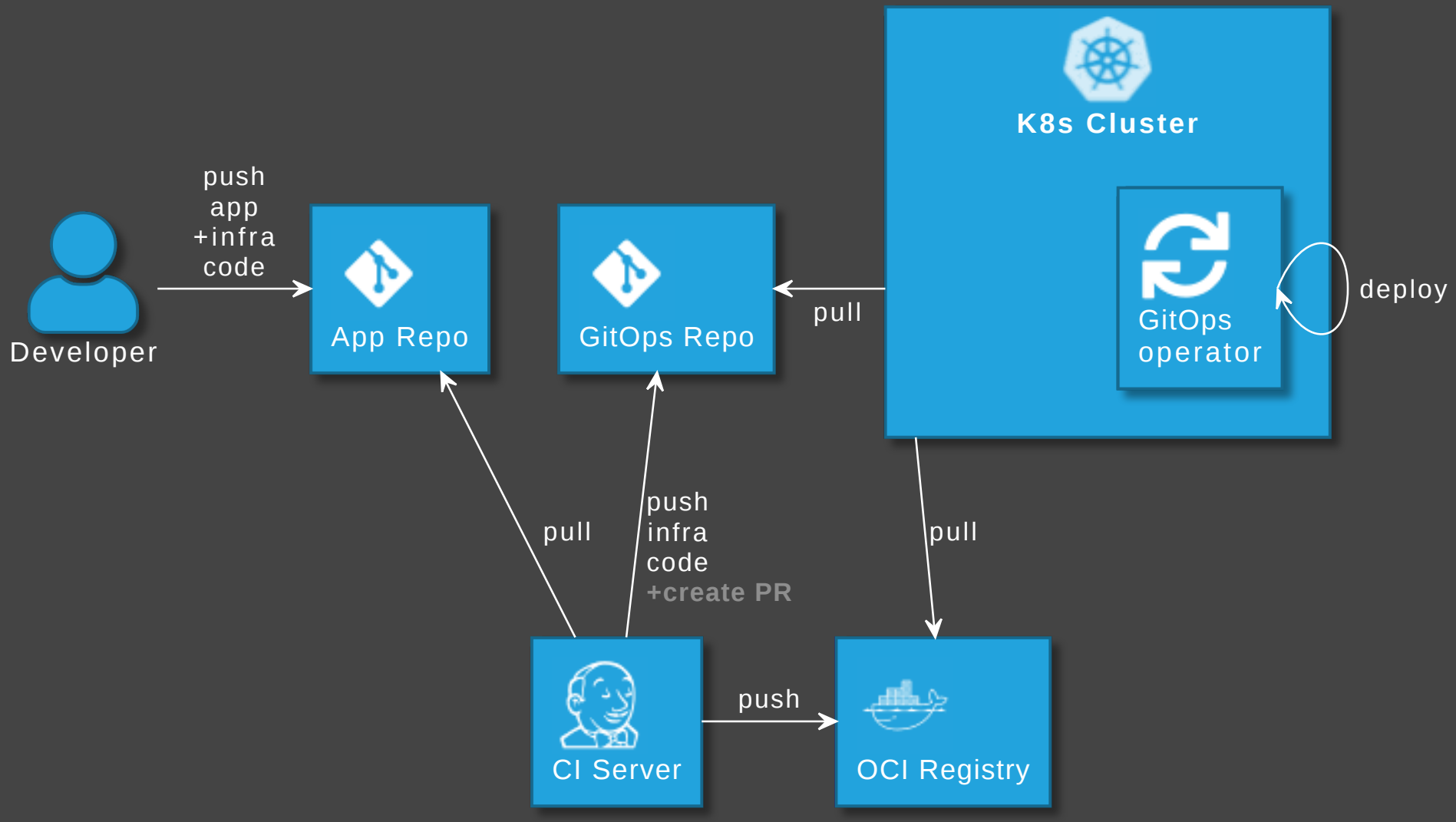
Image updater



GitOps operator can update image version in Git

- github.com/argoproj-labs/argocd-image-updater
- fluxcd.io/docs/guides/image-update

Using CI-Server with GitOps part 2



Stage promotion using renovate bot

 github.com/renovatebot/renovate

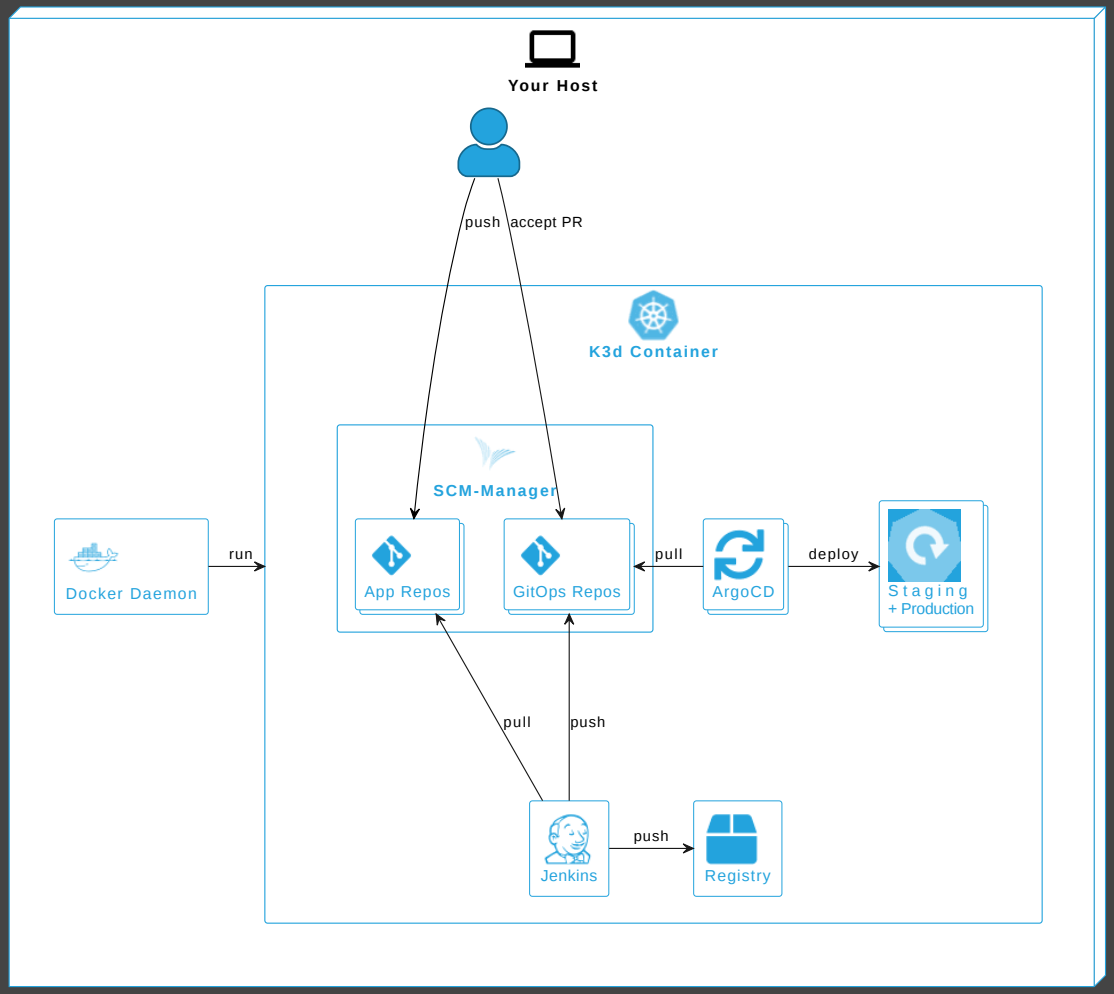
As example: Our approach

- Repo pattern: `Trunk-based monorepo, folder per stage, app`

```
├── production
│   └── application
│       └── deployment.yaml
└── staging
    └── application
        └── deployment.yaml
```

- Promotion between stages:
  - commit to staging folder only (💡 protect `production`),
  - create short lived branches and pull requests for prod
- TODO Duplication is tedious, but can be automized
- TODO CI

Demo



cloudogu/gitops-playground

Johannes Schnatterer, Cloudogu GmbH

cloudogu.com/en/gitops

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Slides