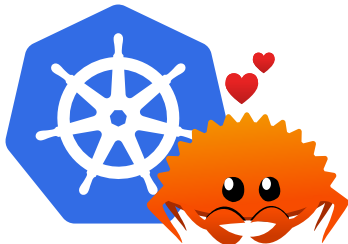# Extend Kubernetes Using Rust:
A *Quick* Introduction to kube-rs

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Rust Talks Luzern, 20.11.2025

Agenda

- Introduction to Kubernetes
- kube-rs
- Demos

What Is Kubernetes?

Kubernetes is a portable, extensible, open source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation.
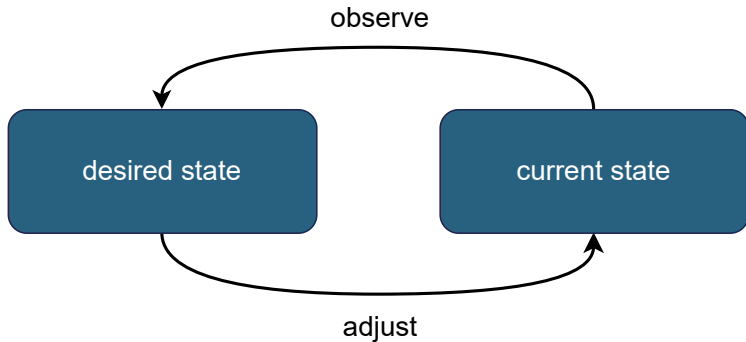
https://kubernetes.io/docs/concepts/overview/

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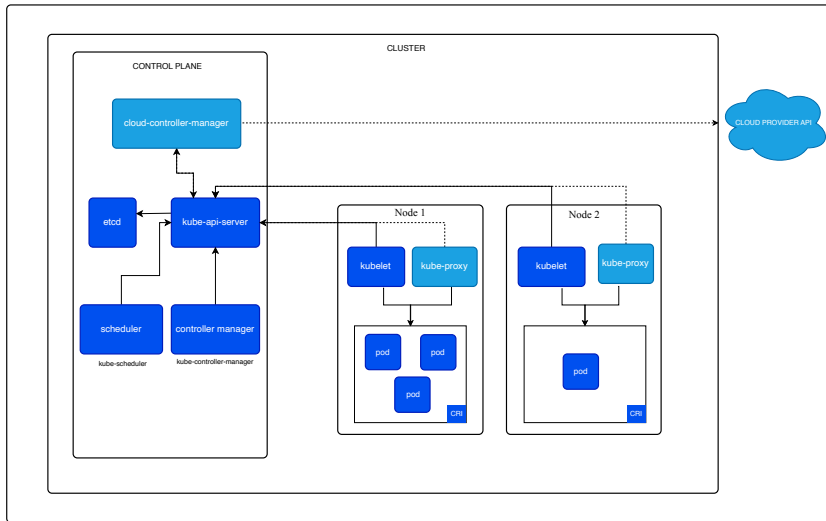
Kubernetes API

- Resources (`Pods`, `Deployments`, `Services`, etc.)
- Custom Resource Definitions (`CRDs`) allow extending the API
- Controllers and Operators

Reconciliation Loop

Example: nginx `Deployment`

```
 1 apiVersion: apps/v1
 2 kind: Deployment
 3 metadata:
 4   name: nginx
 5 spec:
 6   replicas: 1
 7   selector:
 8     matchLabels:
 9       app: nginx
10   template:
11     metadata:
12       labels:
13         app: nginx
14     spec:
15       containers:
16       - image: nginx:latest
17         name: nginx
```

kube-rs

- Rust client for Kubernetes
- Runtime abstraction
- Derive macro for `CRD`s

- First release: April 29, 2019
- CNCF Sandbox: November 16, 2022
- Release 1.0: May 13, 2025
- Current 2.0.1: Sept 12, 2025
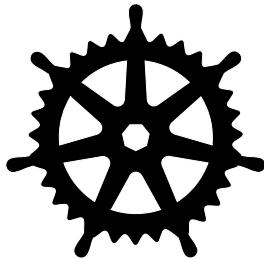
kube-rs

kube-rs: Runtime

- `watcher`: stream of events
- `reflector`: watcher + store
- `controller`: reflector + *n* watchers + `reconciler`
- `reconciler`:
  `async fn reconcile(o: Arc<K>, ctx: Arc<T>) -> Result<Action, Error>`

Demos

1. **CRUD Operations**: Creating and managing `Deployments`
2. **Pod Watcher**: Streaming `Pod` related events in real-time
3. **Pod Reflector**: Maintaining local state cache
4. **Static Website Hosting**: Our first SaaS

Resources

- https://kube.rs
- https://github.com/kube-rs/version-rs
- https://github.com/kube-rs/controller-rs
- https://github.com/kube-rs/kube/issues/584
- https://github.com/olix0r/kubert
- https://ahmet.im/blog/controller-pitfalls/
- https://github.com/linkerd/linkerd2/tree/582f1afa5ebf0f3d227a0260bc611e987fcd261e/policy-controller
- https://youtu.be/rXS-3hFYVjc?si=yXjWGOQQgYnkH5-D
- https://github.com/ioboi/kube-rs-rust-talk