



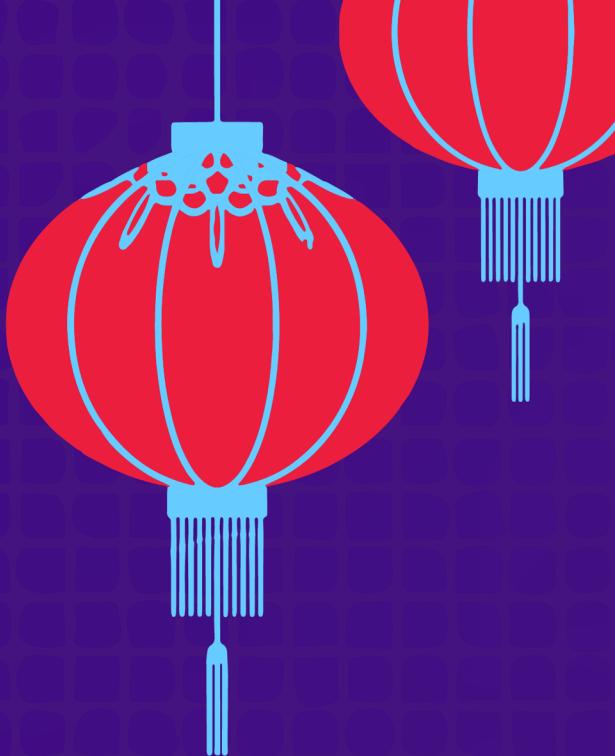
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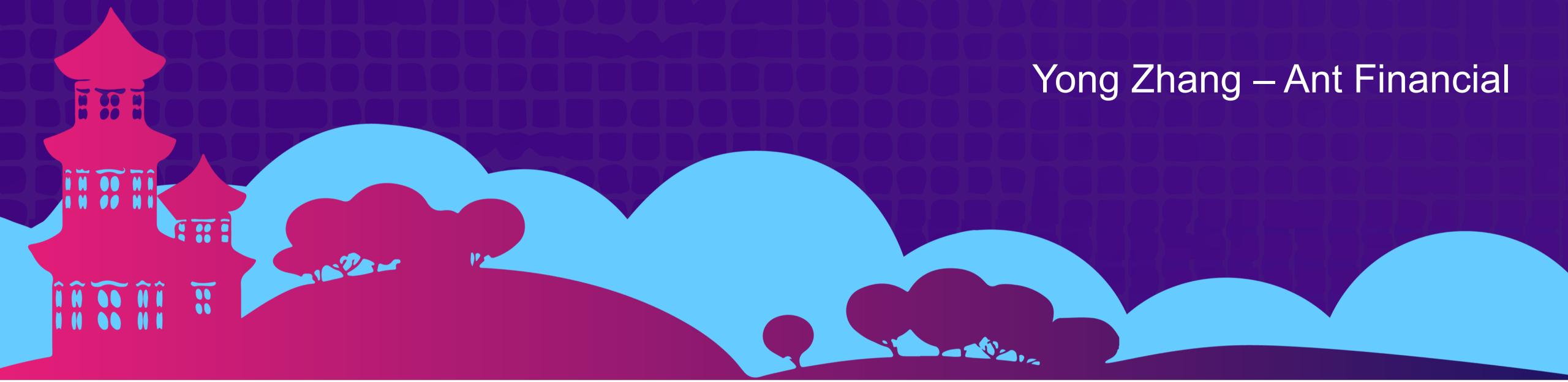
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# Managing Large-Scale Kubernetes Clusters Effectively and Reliably

Yong Zhang – Ant Financial



# About Me



- **Yong Zhang**
  - Ant Financial - Infra & Data
  - PAAS & Automated Cluster Management System



# Agenda

- **Background and Motivation**
- **Design Concept**
- **Cluster Management Operators**
- **Q & A**

# Background: Cluster Scale

- Tens of clusters
  - Tens of thousands of nodes in one cluster
- Hundreds of thousands of pods
  - Tens of thousands of jobs
- Resource cost is huge



# Motivation

- Cluster Life Cycle Management

- Create
- Delete
- Upgrade
- ...

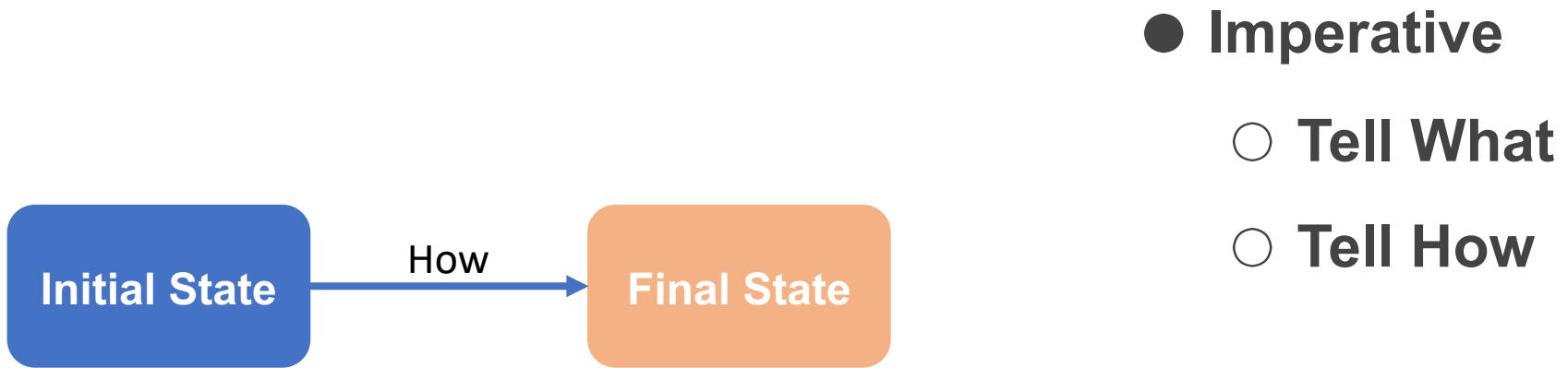
- Fault self-recovery:

- hardware failure
- component service exception

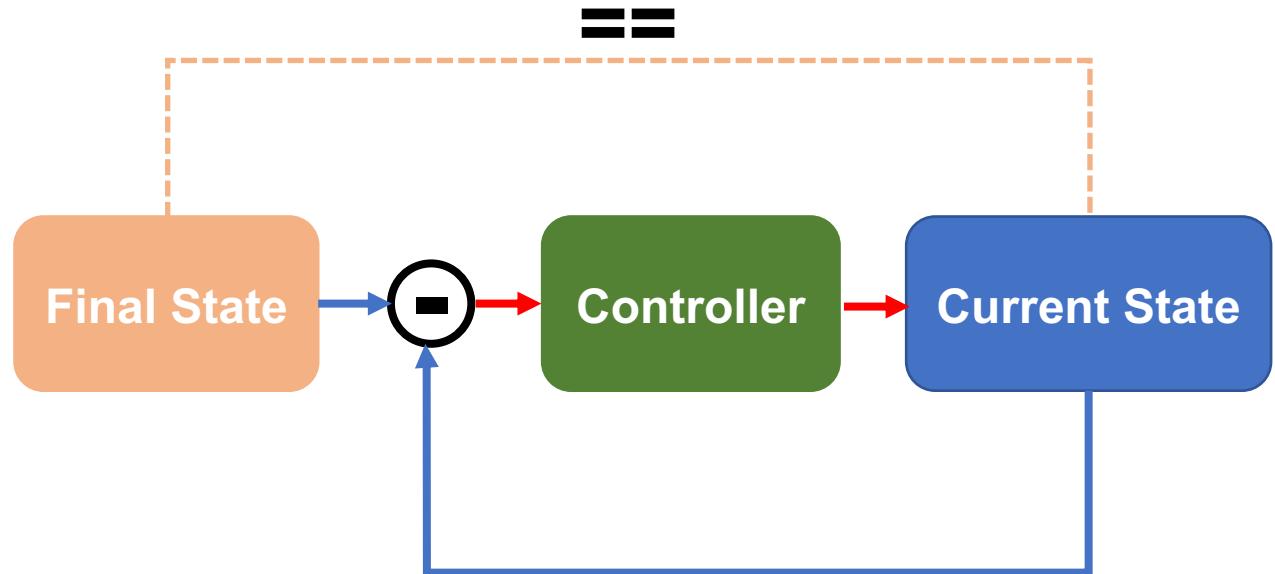
- Change Controllable



# Design Concept: Imperative

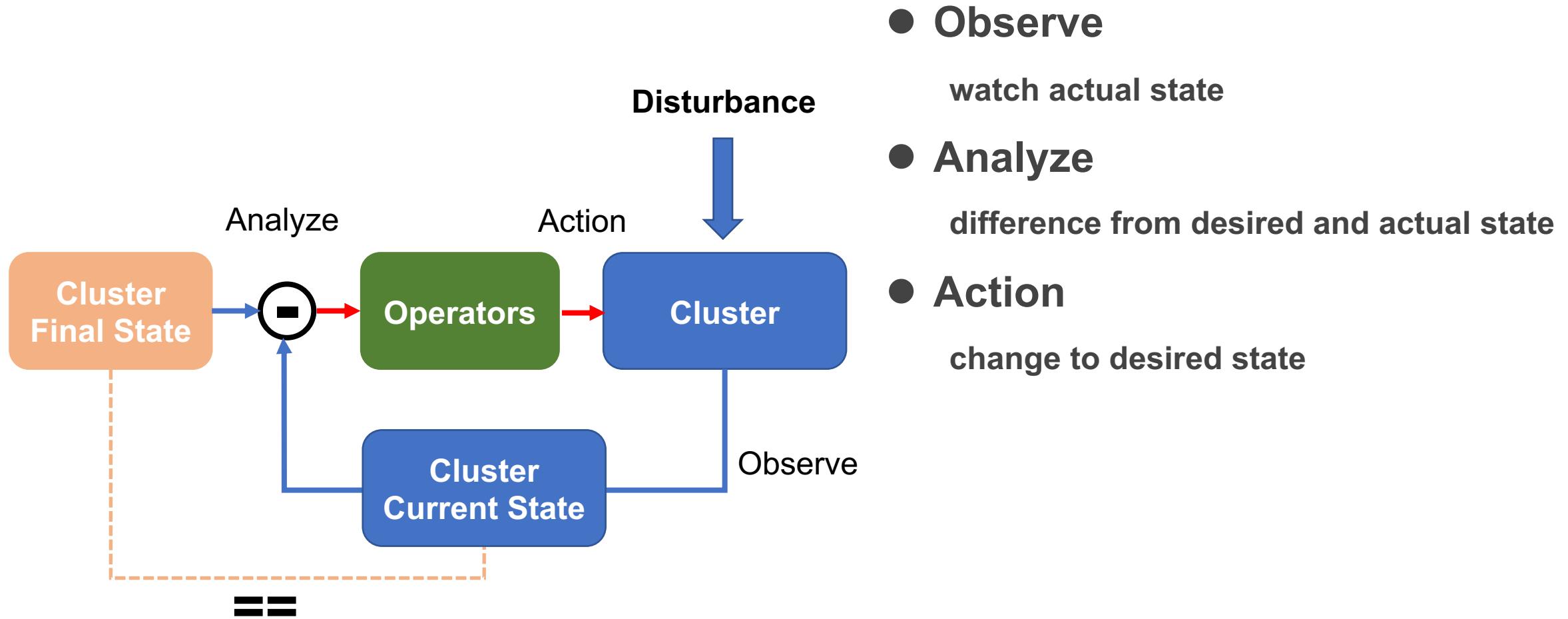


# Design Concept: Declarative

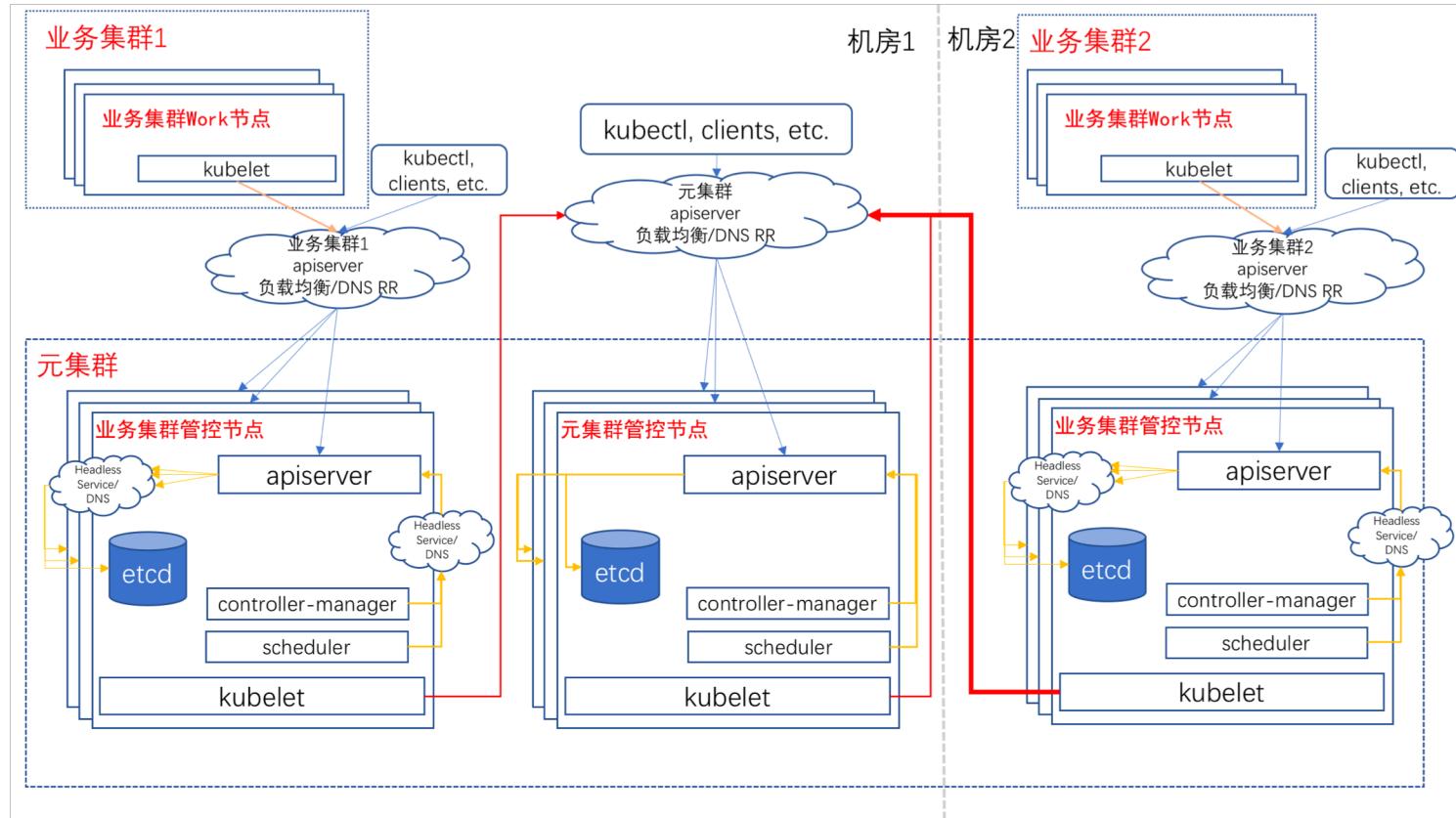


- **Declarative**
  - Tell What
  - Not How

# Design Concept: Self-recovery



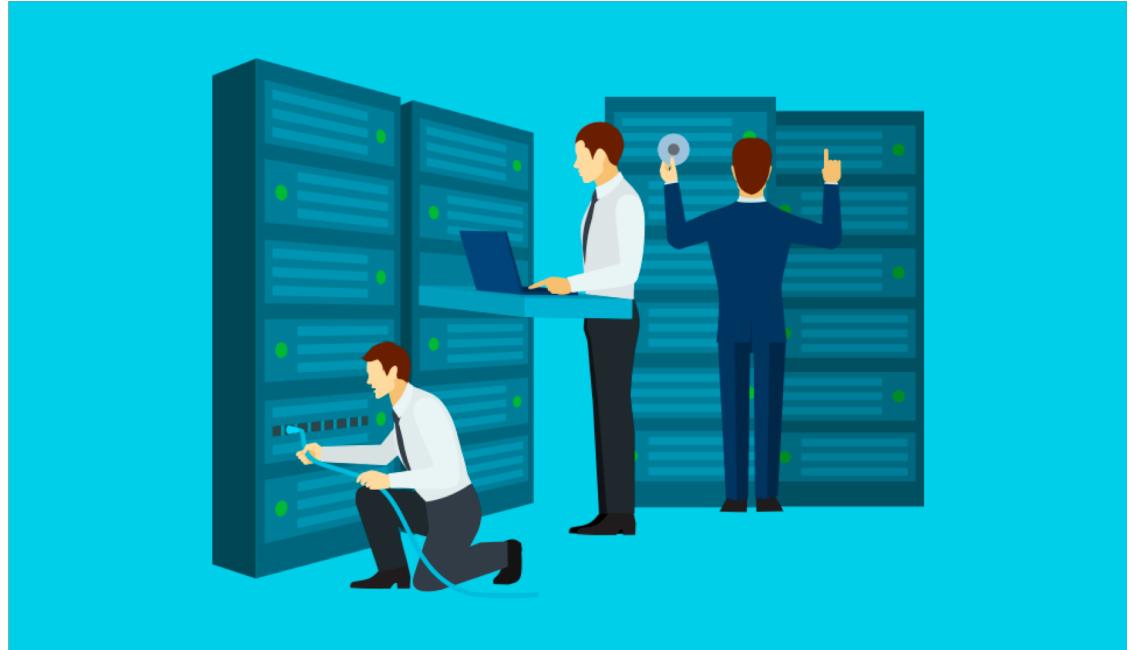
# Cluster-Operator



- Cluster CRD
- ClusterPackageVersion
- Cluster-Operator

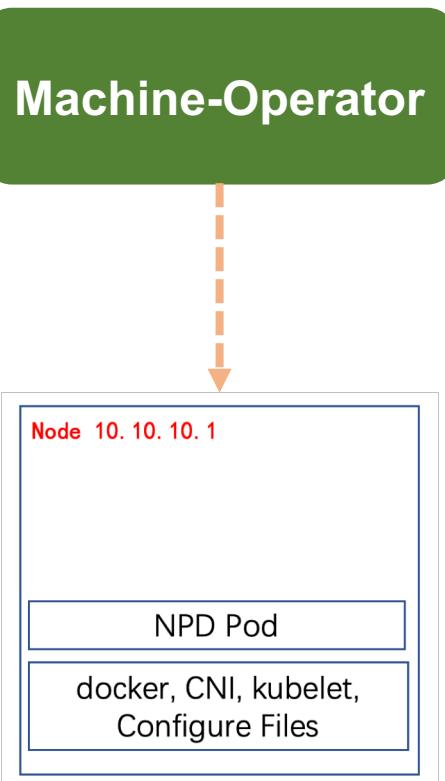
# Machine-Operator

- Node Configuration and Kernel Patch Management
- Docker / Kubelet Install、Uninstall、Upgrade
- Node Final-state Management
- Node Fault Self-recovery



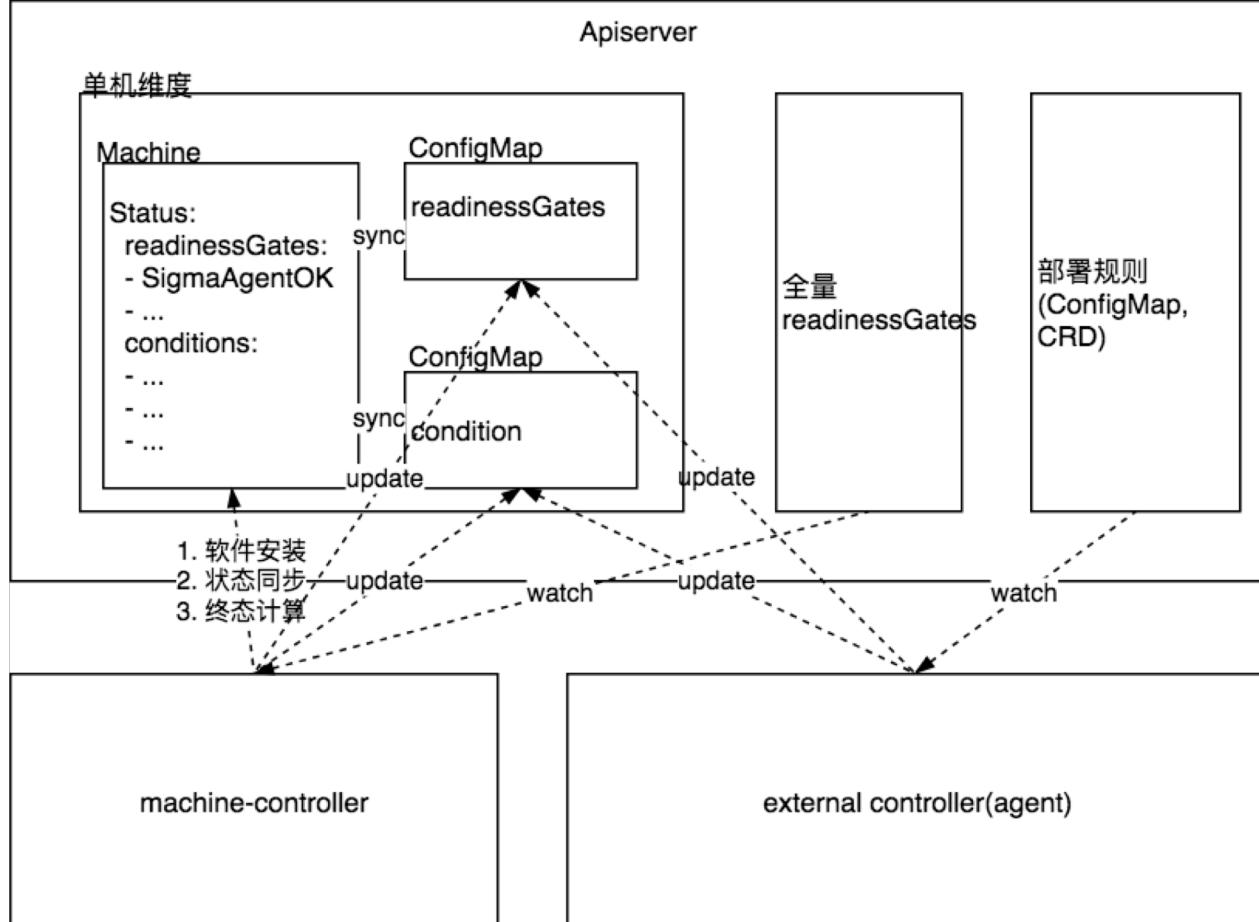
# Machine-Operator

```
kind: Machine
spec:
  idc: xxx
  ip: 10.10.10.1
  versions:
    pouch: 1.0
    kubelet: 1.1
status:
  phase: Running
  readinessGates:
    - conditionType: PouchOK
    - conditionType: OSOK
  versions:
    pouch: 1.0
    kubelet: 1.0
```



```
kind: MachinePackageVersion
metadata:
  name: pouch-1.0
spec:
  packageName: pouch
  config:
    rpm: http://pouch-1.0.rpm
  configMaps:
    - name: pouch-config
      value: v1
```

# Node Final-state Management



- **ReadinessGates**
  - **Node Schedulable Conditions**
- **External controller**
  - **DaemonSet**
  - .....
- **Condition ConfigMap**
  - **External Conditions**

# Fault Self-recovery

## Hardware

- Power
- Disk
- Memory
- Motherboard
- .....



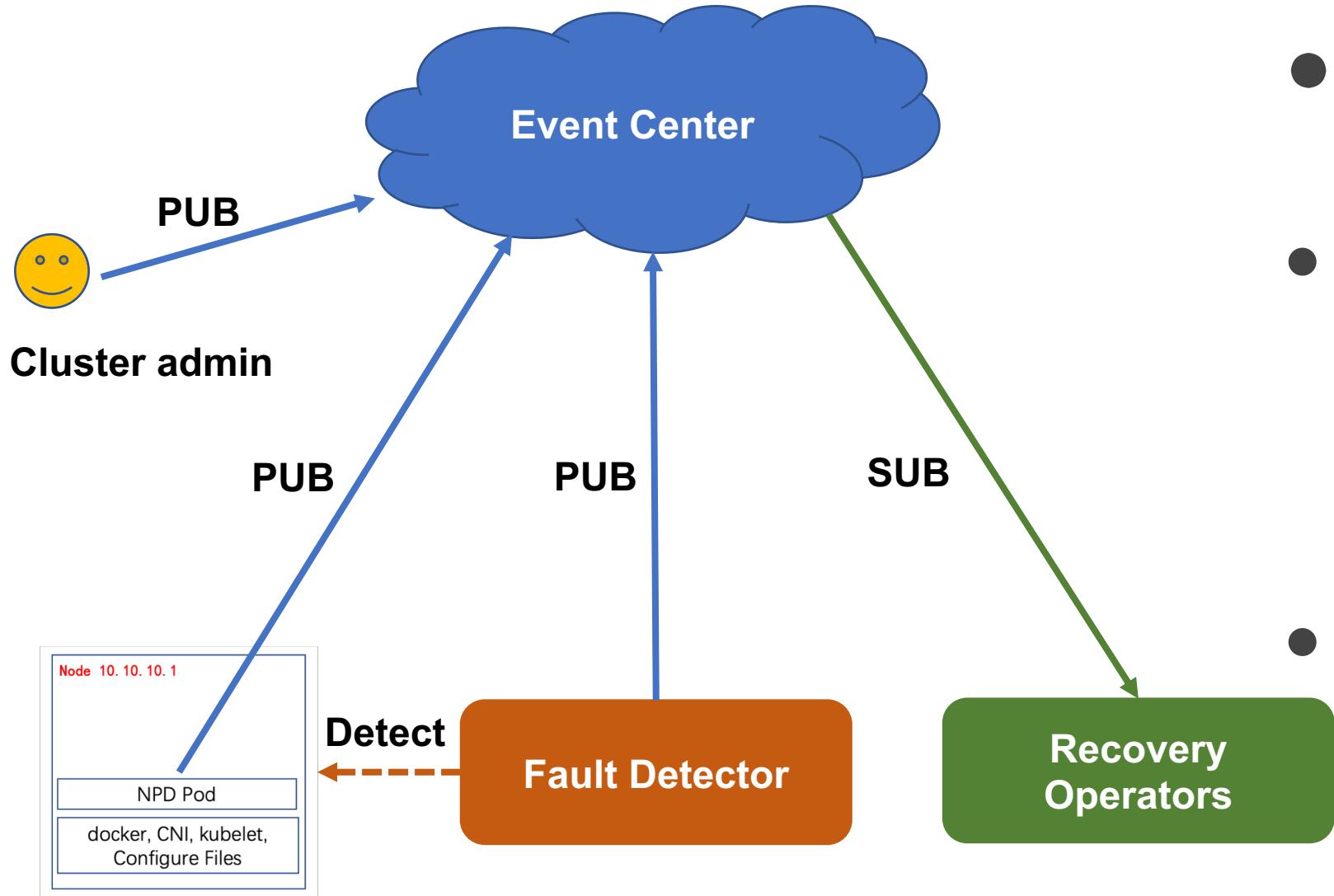
## Resource

- Load
- Memory Pressure
- Disk Pressure

## Component

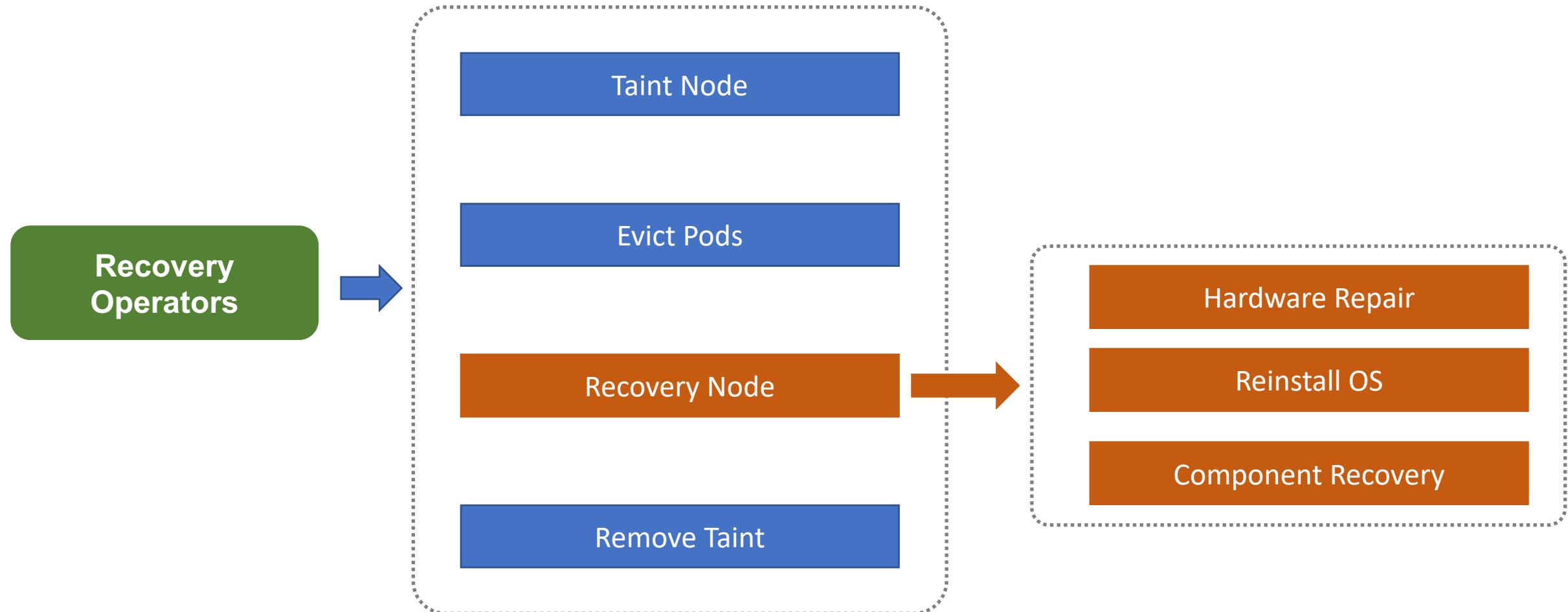
- Component Crash
- Configuration Error

# Fault Self-recovery

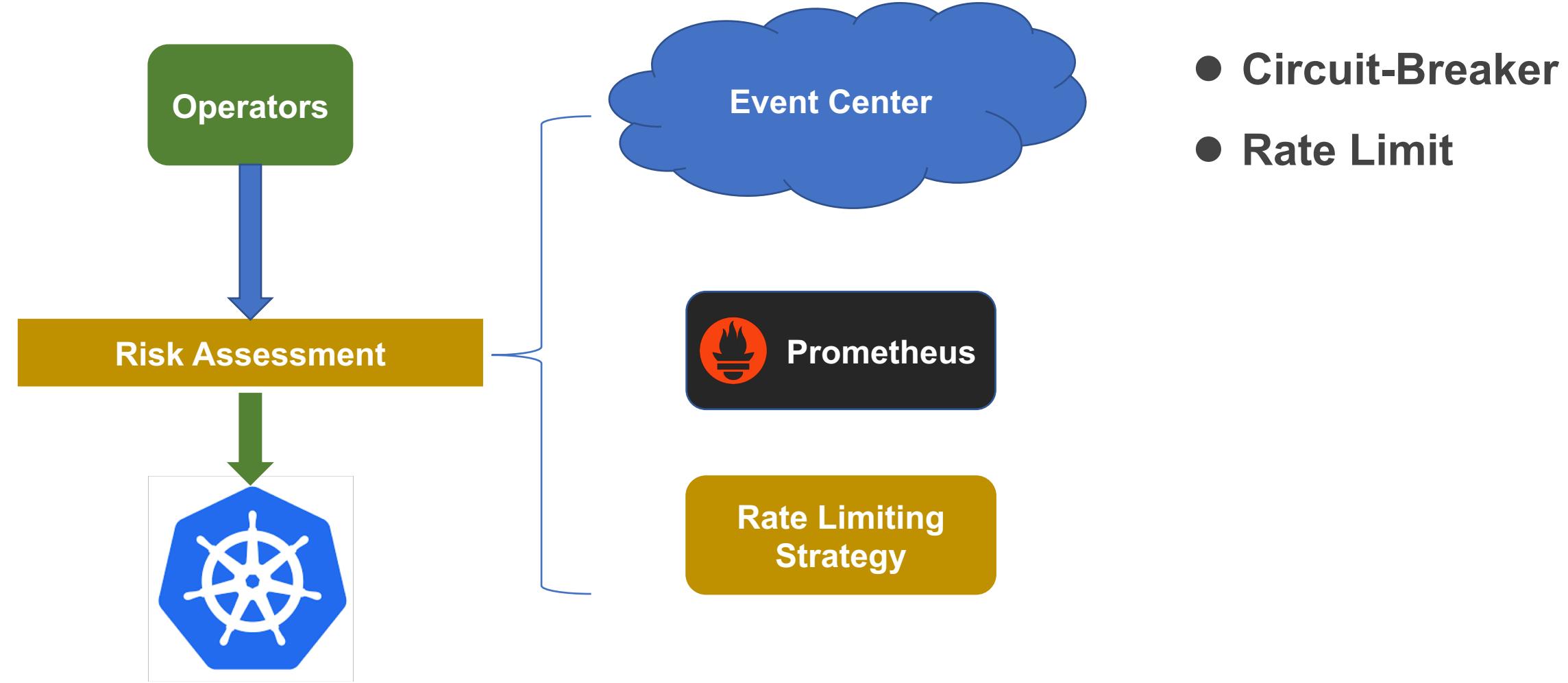


- **Event Center**
  - Publish & Subscribe Event
- **Fault Detection**
  - Cluster admin
  - NPD
  - Fault Detector
- **Fault Recovery**
  - Recovery Operators

# Fault Self-recovery



# Risk Prevention



# Q & A



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# Thanks !



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