Red Hat
Enterprise Linux

Declarative Kubernetes Clusters with Cluster API

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What we will discuss today

- Tech Review
- What is CAPI?
- Why is CAPI?
- CAPI Anatomy
- Demo
- Getting Involved

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Tech review: Kubernetes

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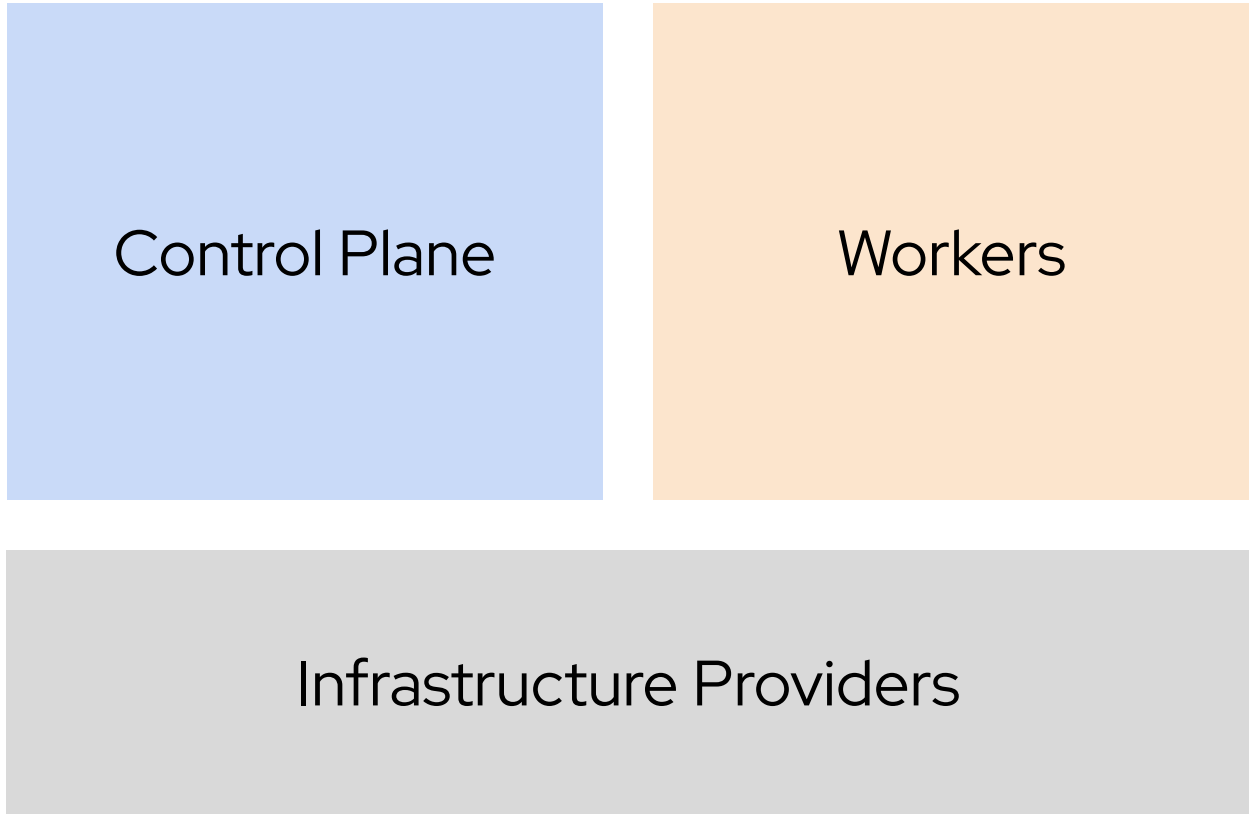

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Control Plane

- kube-apiserver
- etcd
- kube-scheduler
- kube-controller-manager
- cloud-controller-manager

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Workers

- kubelet
- kube-proxy
- container runtime

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Infrastructure Providers

- bare metal
- virtual machines
- networking
- storage
- containers?
- in-memory?!?

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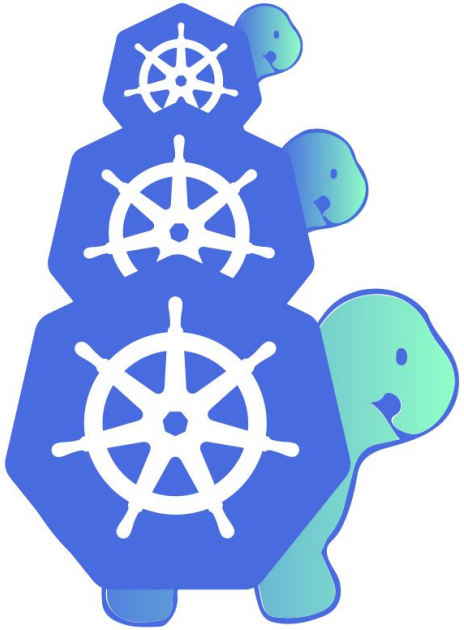
What is CAPI?



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Cluster API is a Kubernetes sub-project focused on providing declarative APIs and tooling to simplify provisioning, upgrading, and operating multiple Kubernetes clusters.

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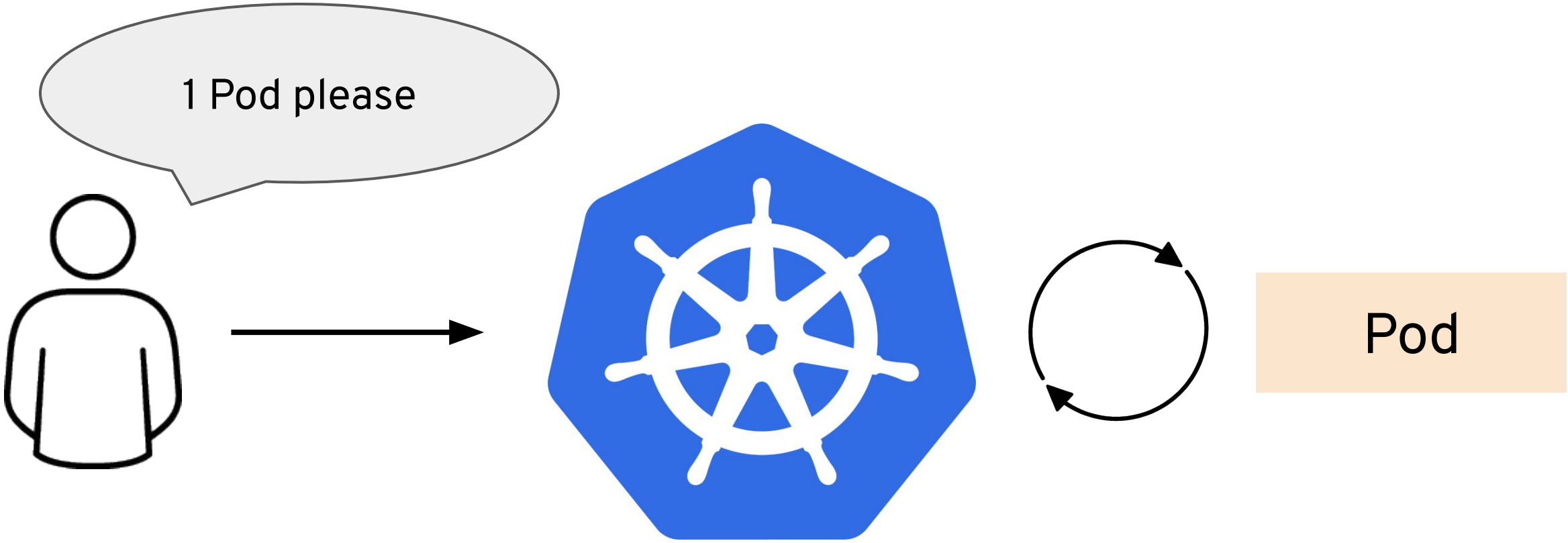

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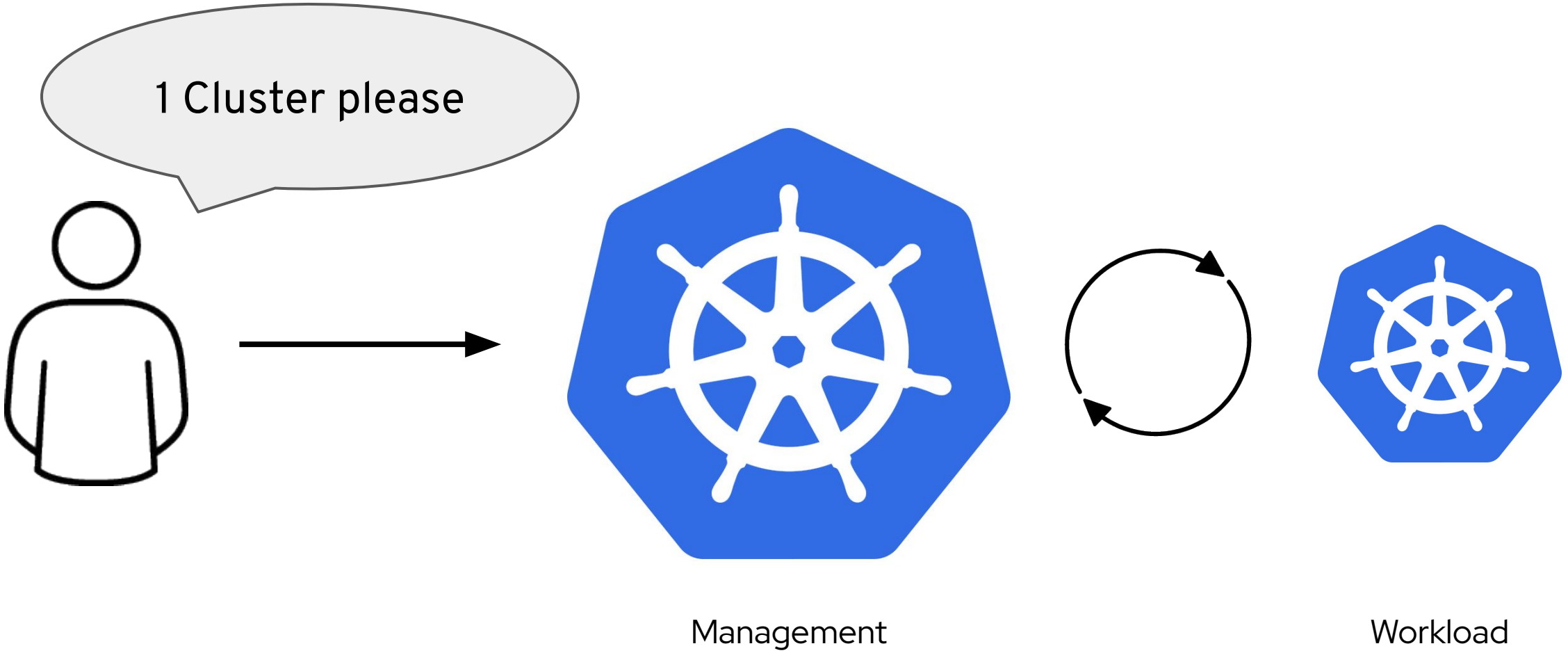

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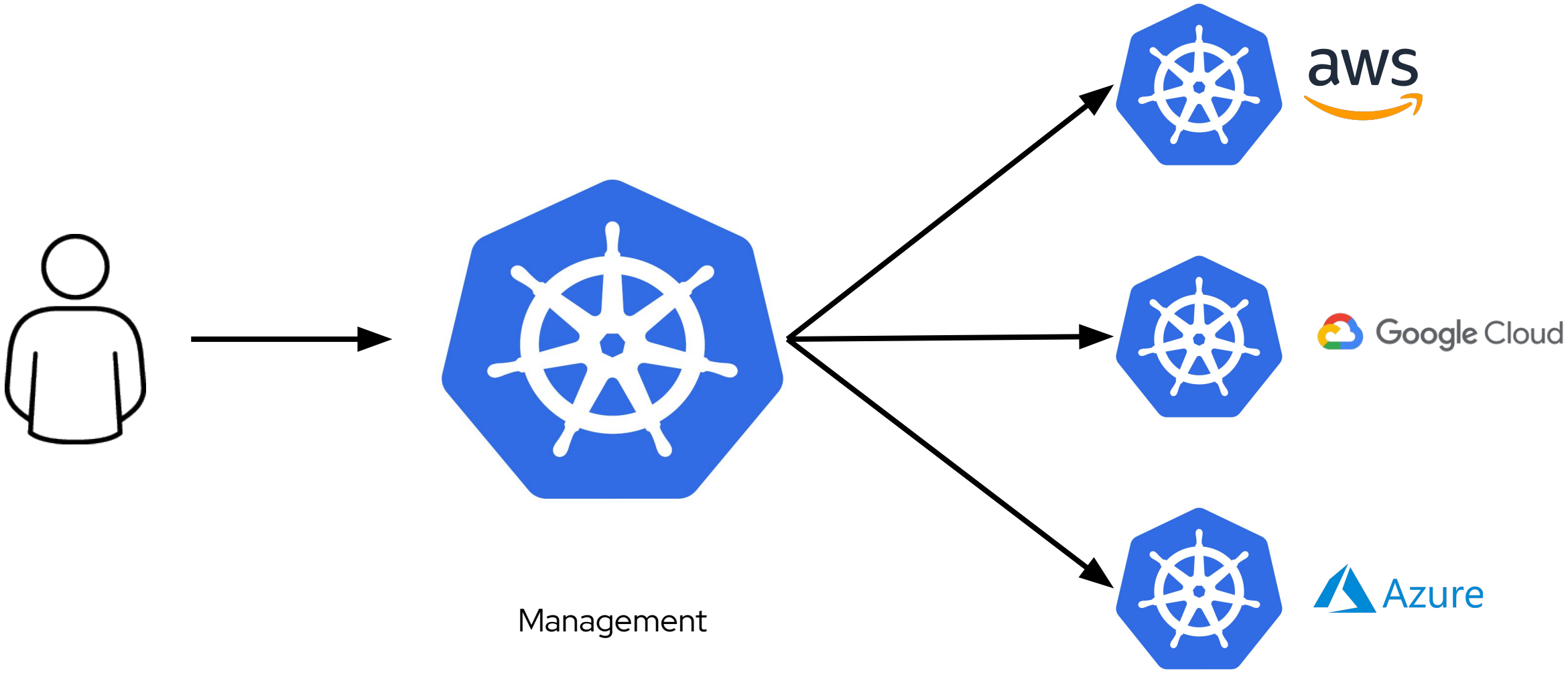

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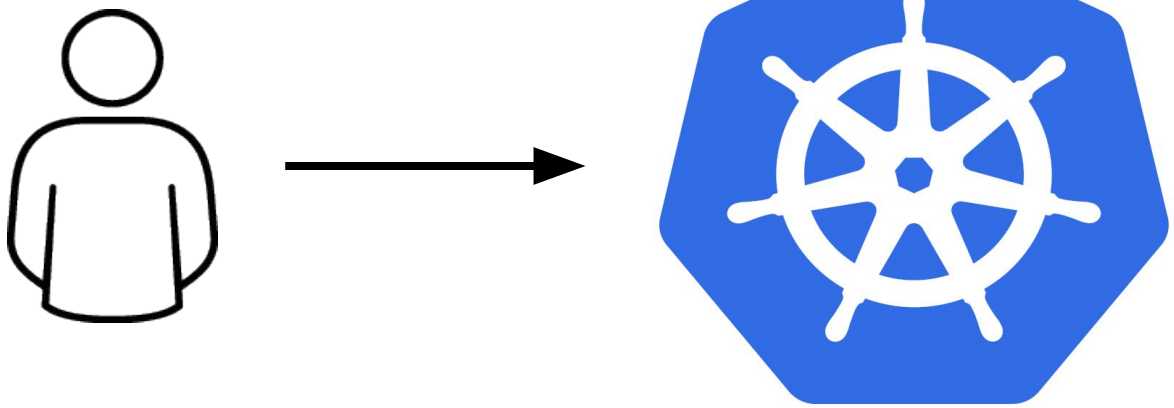
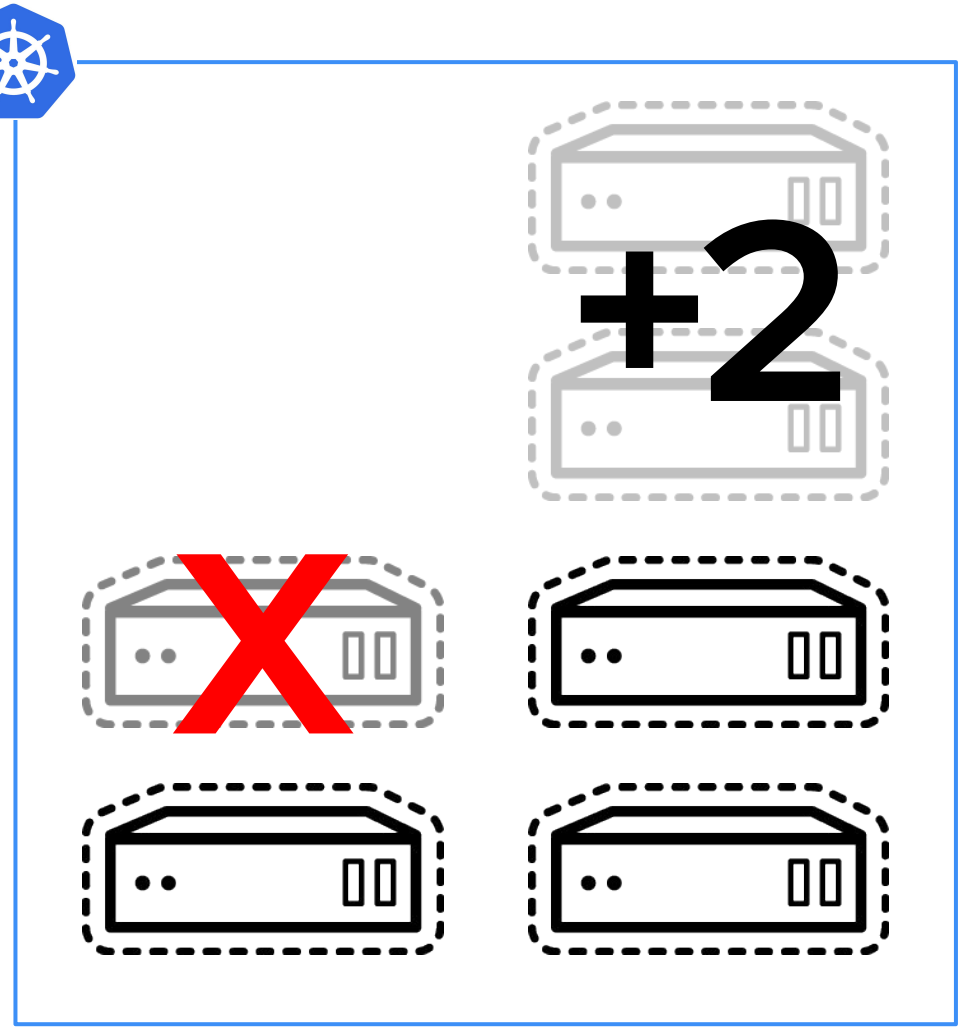


Management



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Beyond the basics

- Control plane management
- Machine health checking
- Cluster autoscaling
- Bootstrapping
- Spot instance usage
- 8 cloud providers

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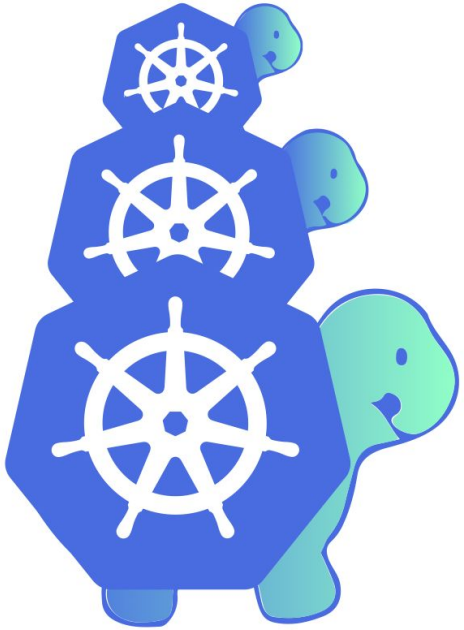
Why do we need CAPI?



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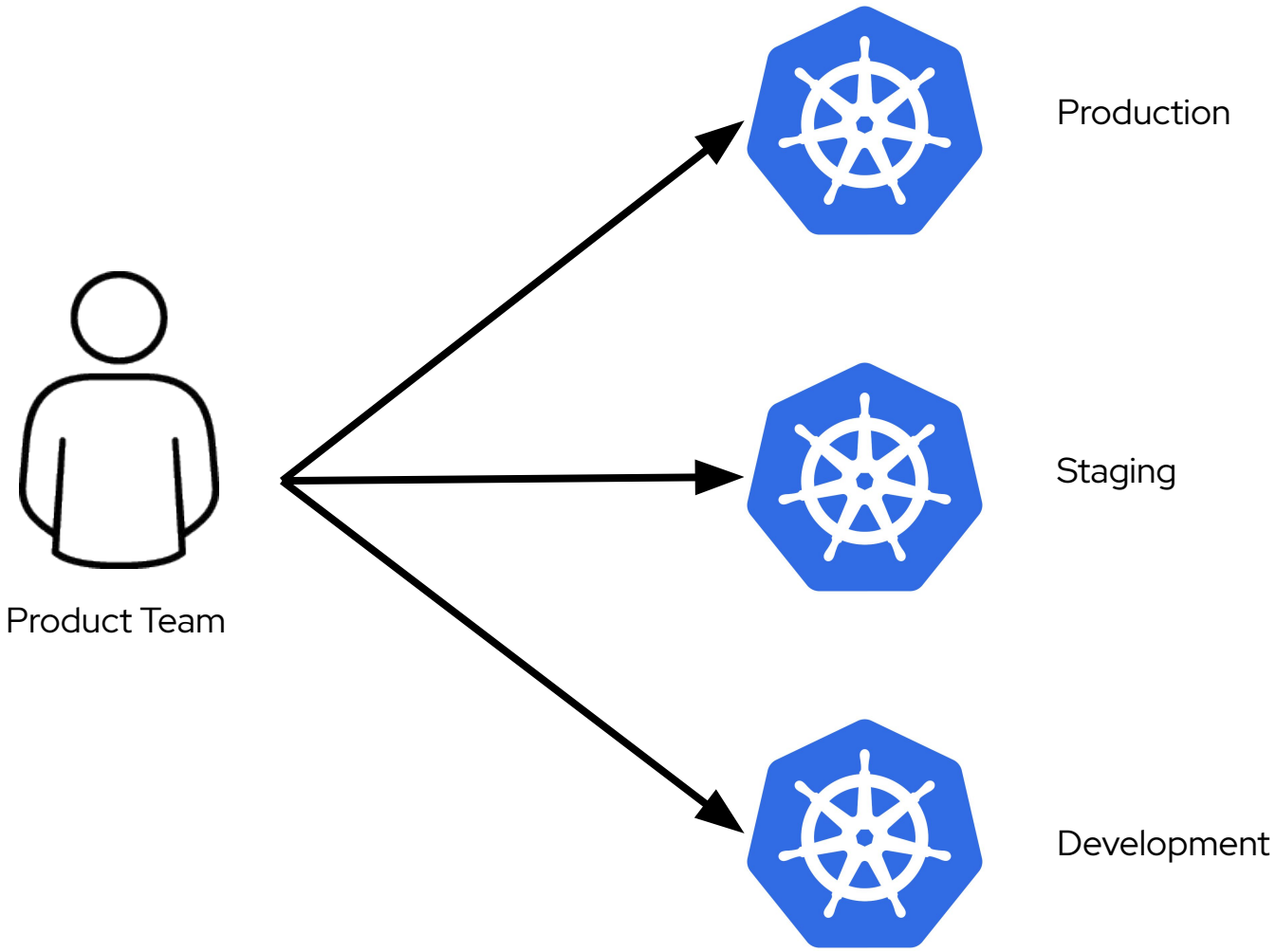
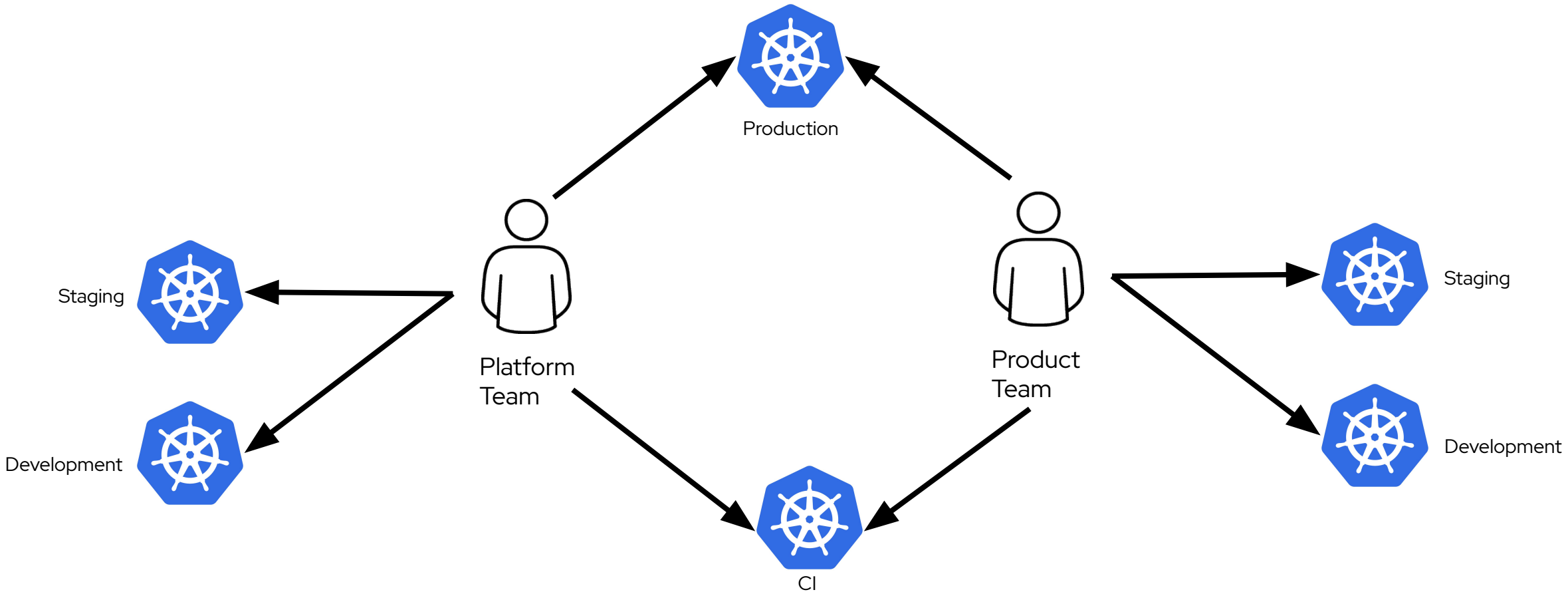
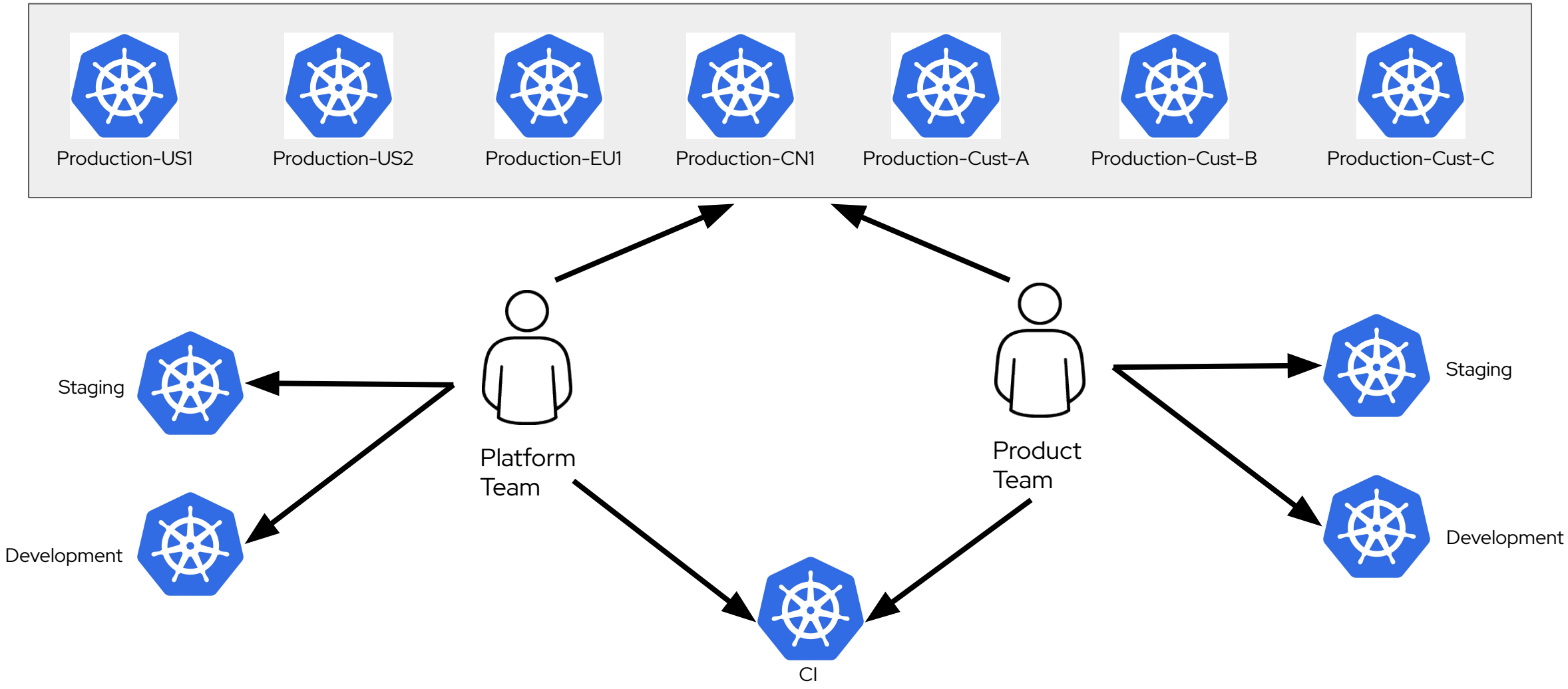

Production
Staging
Development
Product Team


Production
Staging
Development
Platform
Team
Product
Team
Staging
Development
CI

Why do we need CAPI?



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How does CAPI help?

- Centralises Management
- Automated Provisioning
- Automated Remediation
- Automated Upgrades (for workers)

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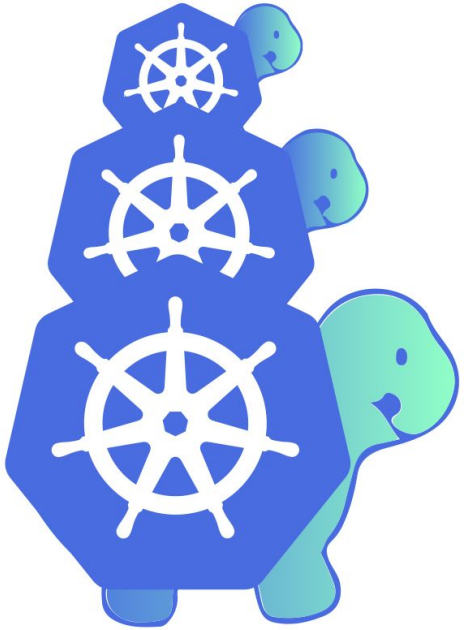
CAPI Anatomy



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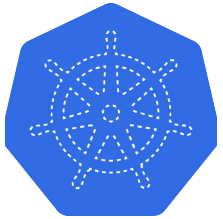
Core CAPI resources

Optional subheading

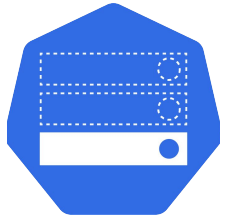


Cluster

Acts as a parent for other resources.

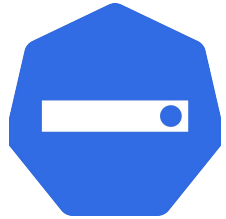
MachineDeployment

Creates MachineSets and updates them as needed.



MachineSet

Ensures the desired number of Machines.



Machine

Creates a virtual Machine.

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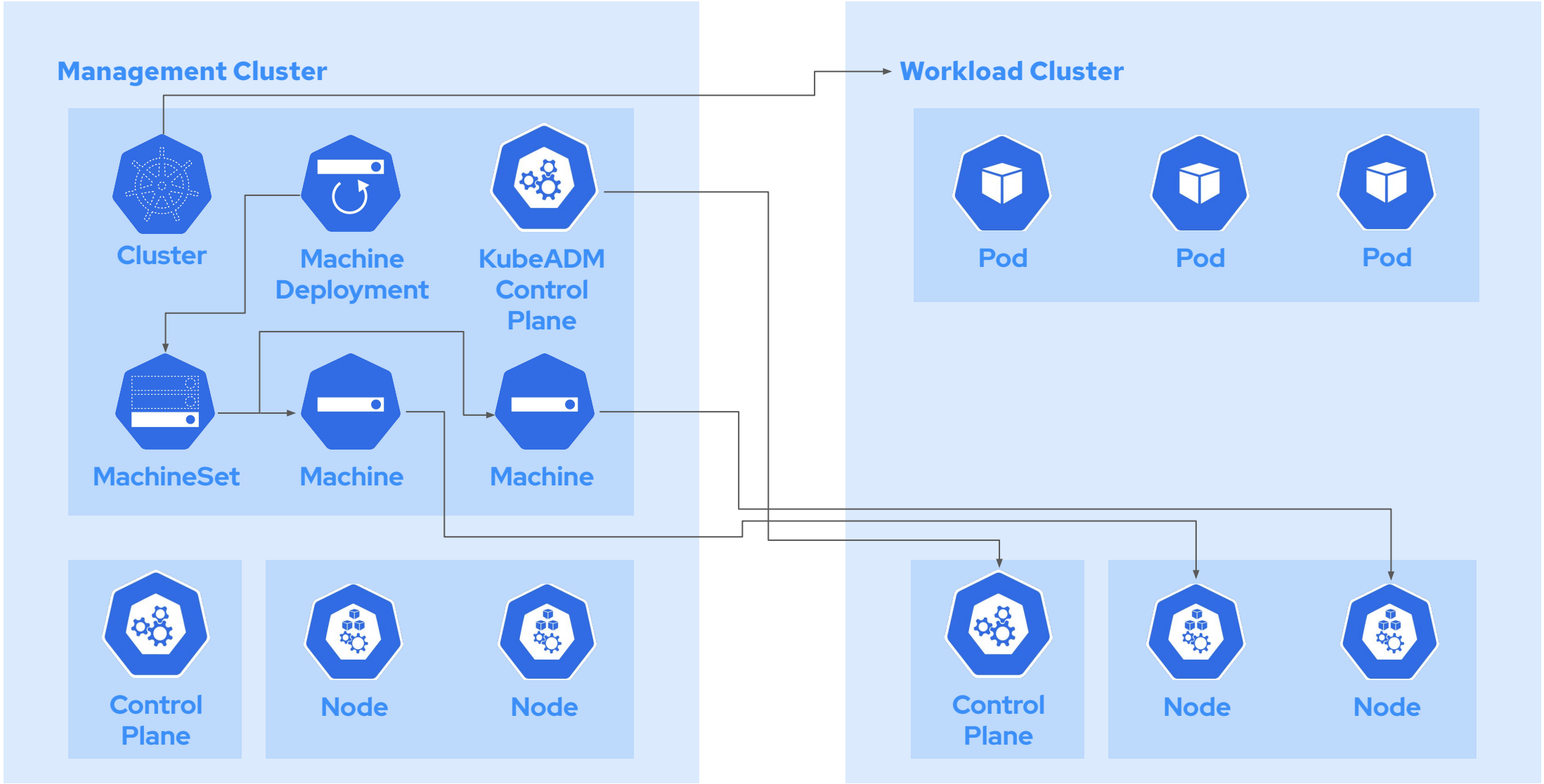
Management Cluster
Cluster
Machine Deployment
KubeADM Control Plane
MachineSet
Machine
Machine
Control Plane
Node
Node
Workload Cluster
Pod
Pod
Pod
Control Plane
Node
Node

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CAPI Controllers

Cluster API Controllers

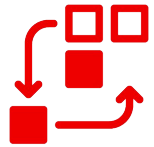
Set of controllers responsible for core Cluster API responsibilities.

Provider Controllers

Responsible for interacting with cloud providers to manage VM instances and supporting services.

Bootstrap Provider

Responsible for providing configuration for VMs to enable them to join the cluster.



Control Plane Controller

Responsible for creating and managing a control-plane, eg configuring etcd.

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```yaml
apiVersion: cluster.x-k8s.io/v1alpha3
kind: Cluster
metadata:
  name: capi-demo-1
spec:
  clusterNetwork:
    pods:
      cidrBlocks:
      - 192.168.0.0/16
  controlPlaneRef:
    apiVersion: controlplane.cluster.x-k8s.io/v1alpha3
    kind: KubeadmControlPlane
    name: capi-demo-1-control-plane
  infrastructureRef:
    apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
    kind: AWSCluster
    name: capi-demo-1
```

Cluster

Red Hat

```yaml
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
kind: AWSCluster
metadata:
  name: capi-demo-1
spec:
  region: us-east-1
  sshKeyName: capi-demo-ssh-key
```

InfrastructureCluster

Red Hat

```
apiVersion: controlplane.cluster.x-k8s.io/v1alpha3
kind: KubeadmControlPlane
metadata:
  name: capi-demo-1-control-plane
spec:
  infrastructureTemplate:
    apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
    kind: AWSMachineTemplate
    name: capi-demo-1-control-plane
  kubeadmConfigSpec:
    clusterConfiguration:
      ...
    initConfiguration:
      ...
    joinConfiguration:
      ...
  replicas: 3
  version: 1.18.2
```

ControlPlane

Red Hat

```yaml
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
kind: AWSMachineTemplate
metadata:
  name: capi-demo-1-control-plane
spec:
  template:
    spec:
      iamInstanceProfile: control-plane.cluster-api-provider-aws.sigs.k8s.io
      instanceType: t3.large
      sshKeyName: capi-demo-ssh-key
```

MachineTemplate

Red Hat

```yaml
apiVersion: cluster.x-k8s.io/v1alpha3
kind: MachineDeployment
metadata:
  name: capi-demo-1-md-0
spec:
  clusterName: capi-demo-1
  replicas: 0
  template:
    spec:
      bootstrap:
        configRef:
          apiVersion: bootstrap.cluster.x-k8s.io/v1alpha3
          kind: KubeadmConfigTemplate
          name: capi-demo-1-md-0
      clusterName: capi-demo-1
      infrastructureRef:
        apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
        kind: AWSMachineTemplate
        name: capi-demo-1-md-0
      version: 1.18.2
```

MachineDeployment

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```
apiVersion: bootstrap.cluster.x-k8s.io/v1alpha3
kind: KubeadmConfigTemplate
metadata:
  name: capi-demo-1-md-0
spec:
  template:
    spec:
      joinConfiguration:
        nodeRegistration:
          kubeletExtraArgs:
            cloud-provider: aws
          name: '{{ ds.meta_data.local_hostname }}'
```

BootstrapConfigTemplate

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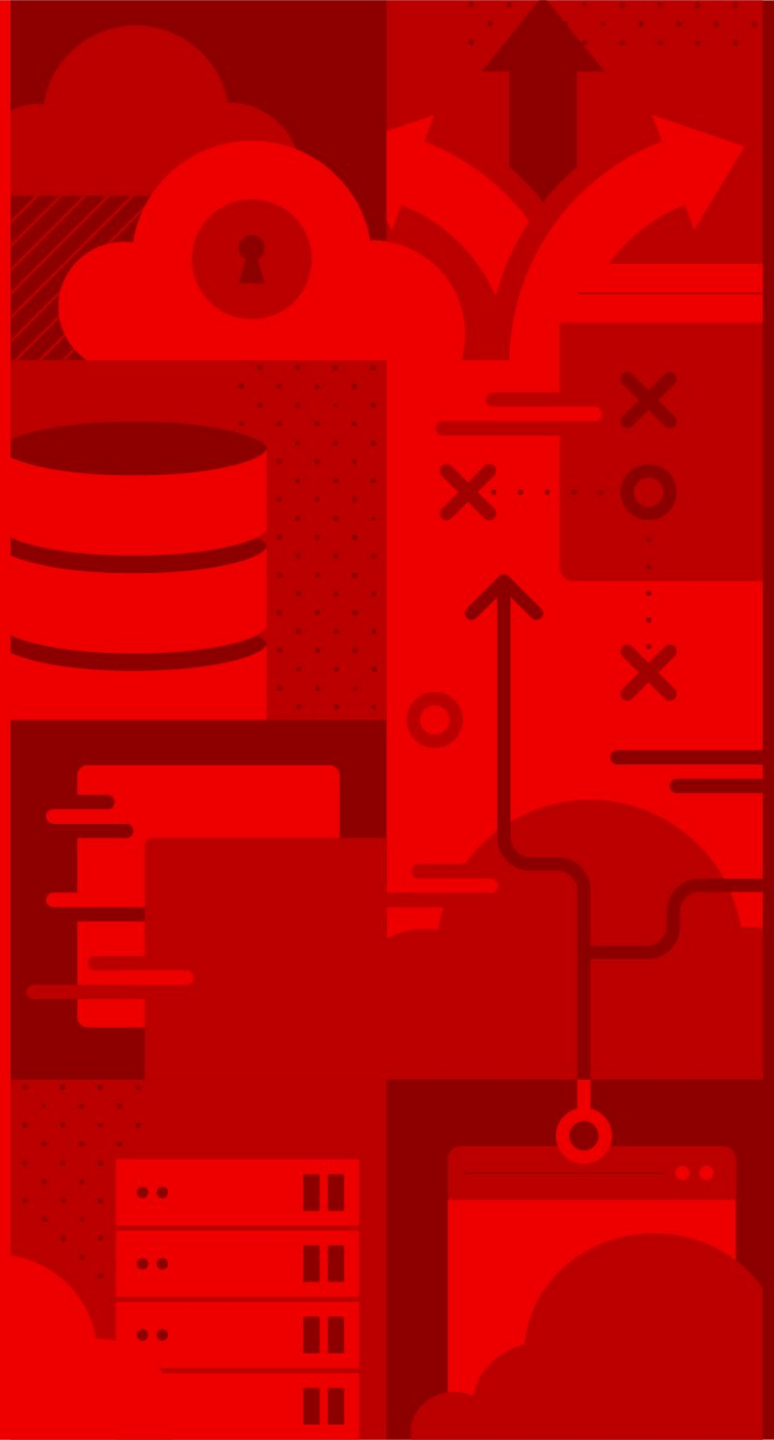

CAPI In Action (Demo)

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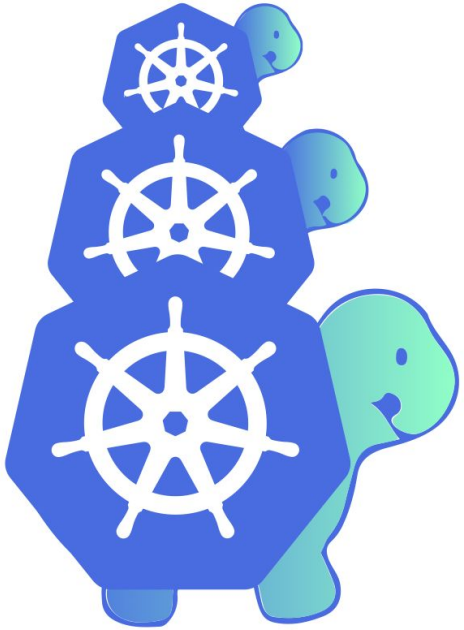
How to get involved?



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Read the book, try it out!

https://cluster-api.sigs.k8s.io/

see the Quick Start section to launch your own clusters, with or without a cloud provider.

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Discuss your issues!

#cluster-api

kubernetes.slack.com

see the Cluster API book for links to the group mailing list

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Attend a meeting!

Wednesdays @ 17:00 UTC

https://zoom.us/j/861487554

see the Cluster API book for recordings, notes, and updated information

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Propose a change!

on github

kubernetes-sigs/cluster-api*

https://github.com/kubernetes-sigs/cluster-api

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CAPI Roadmap

- Beta API version
- Increased testing
- CLI tooling improvements (clusterctl)
- Kubernetes API refactoring
- Bootstrap failure detection
- Pluggable load balancers

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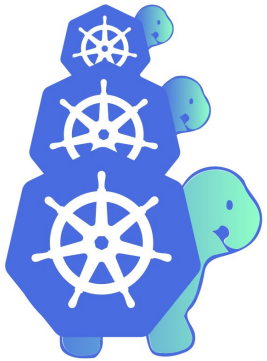
Thank You

Cluster API Book
https://cluster-api.sigs.k8s.io



Cluster API Project
https://github.com/kubernetes-sigs/cluster-api

Stay in touch

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