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# Cluster API Deep Dive With a Tencent Case Study





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Kubernetes team.

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# Agenda



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- What's Cluster API
- Upgrade as example
- Bootstrapping
- How to deploy
- Demo

# Where we are



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- Cluster Management is a hard job.
- Fragmented tooling and ecosystem.
- Too many tools to choose from.
- Reinventing wheels.



# What's Cluster API?



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## Declarative API

- Cluster
- Machine
- Machine Set + Machine Deployment

## Common Logic

- Machine Lifecycle (incl. Provisioning)
- Machine Upgrade

## Pluggable Architecture

- Infrastructure platform (vSphere, GCP, AWS, etc.)
- Support for various Operating Systems

## Tooling, Services

- Cluster Bootstrapping, Upgrade
- Auto-scaling, Repair, Node Auto-provisioning

# What's Cluster API



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## Cluster Config with Declarative API

# What is configured?



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- **Cluster-level Configuration**

- **Network**

- Machine setup
  - # of machines?
- Platform-specific configuration
  - GCP project, machine type
- Software on those machines
  - Kubelet Version
  - Control Plane

```
apiVersion: "cluster-api.k8s.io/v1alpha1"
kind: Cluster
metadata:
  name: kubecon-demo
spec:
  clusterNetwork:
    services:
      cidrBlocks: ["10.96.0.0/12"]
    pods:
      cidrBlocks: ["192.168.0.0/16"]
    serviceDomain: "cluster.local"
```

# What is configured?



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- Cluster-level Configuration
  - Network
- Machine setup
  - # of machines?
- Platform-specific configuration
  - GCP project, machine type
- Software on those machines
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  - Control Plane

```
apiVersion: "cluster.k8s.io/v1alpha1"
kind: MachineSet
metadata:
  name: my-first-machineset
spec:
  replicas: 3
  template:
    metadata:
      spec:
        ...
    roles:
      - Node
```



# What is configured?



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- Cluster-level Configuration
  - Network
- Machine setup
  - # of machines?
- **Platform-specific configuration**
  - **GCP project, machine type**
- Software on those machines
  - Kubelet Version
  - Control Plane

```
apiVersion: "cluster.k8s.io/v1alpha1"
kind: Machine
metadata:
  name: gce-master-kubecon
spec:
  providerConfig: >
  {
    "project": "gke-kubecon",
    "zone": "us-central1-f",
    "machineType": "n1-standard-2",
    "image": "/path/to/ubuntu-1604-lts"
  }
```

# What is configured?



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- Cluster-level Configuration
  - Network
- Machine setup
  - # of machines?
- Platform-specific configuration
  - GCP project, machine type
- **Software on those machines**
  - **Kubelet Version**
  - **Control Plane**

```
apiVersion: "cluster.k8s.io/v1alpha1"
kind: Machine
metadata:
  name: gce-master-kubecon
spec:
  providerConfig: {
    ...
  }
  versions:
    kubelet: 1.7.4
    controlPlane: 1.7.4
```

# What's Cluster API



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## Tooling, YAML, CRDs, Controllers

# Logical Flow - YAML to Objects

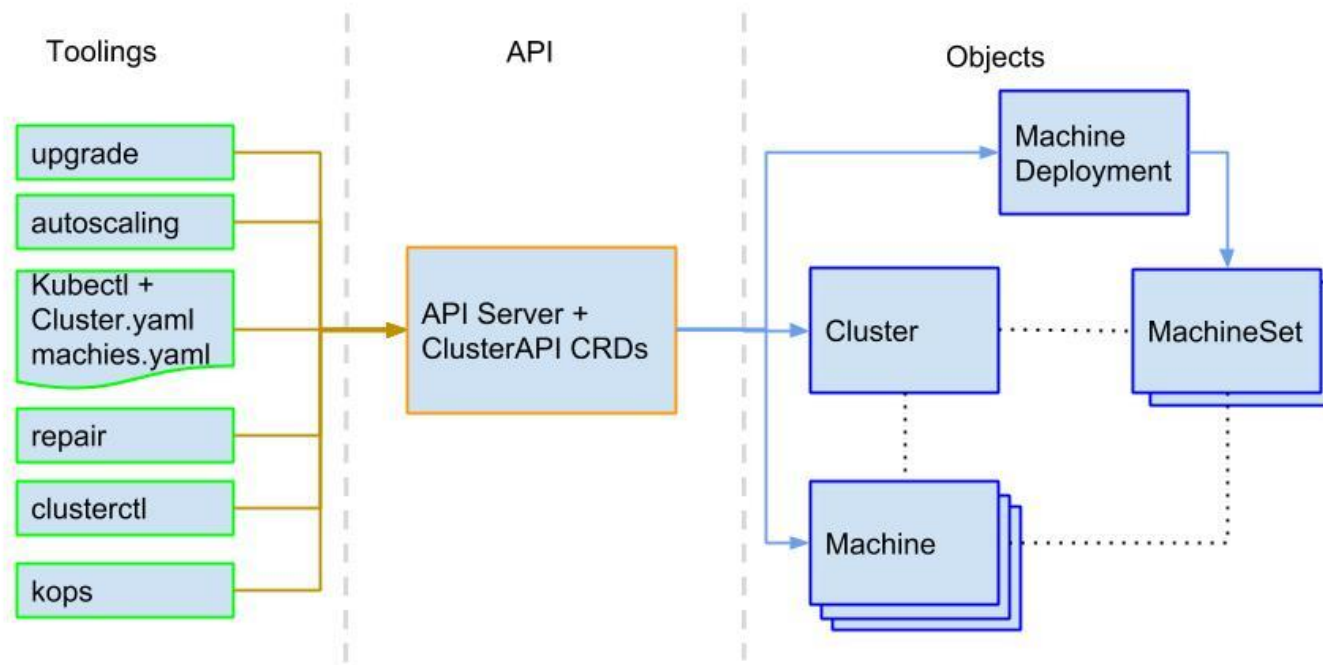


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# Logical Flow - Objects to Machines

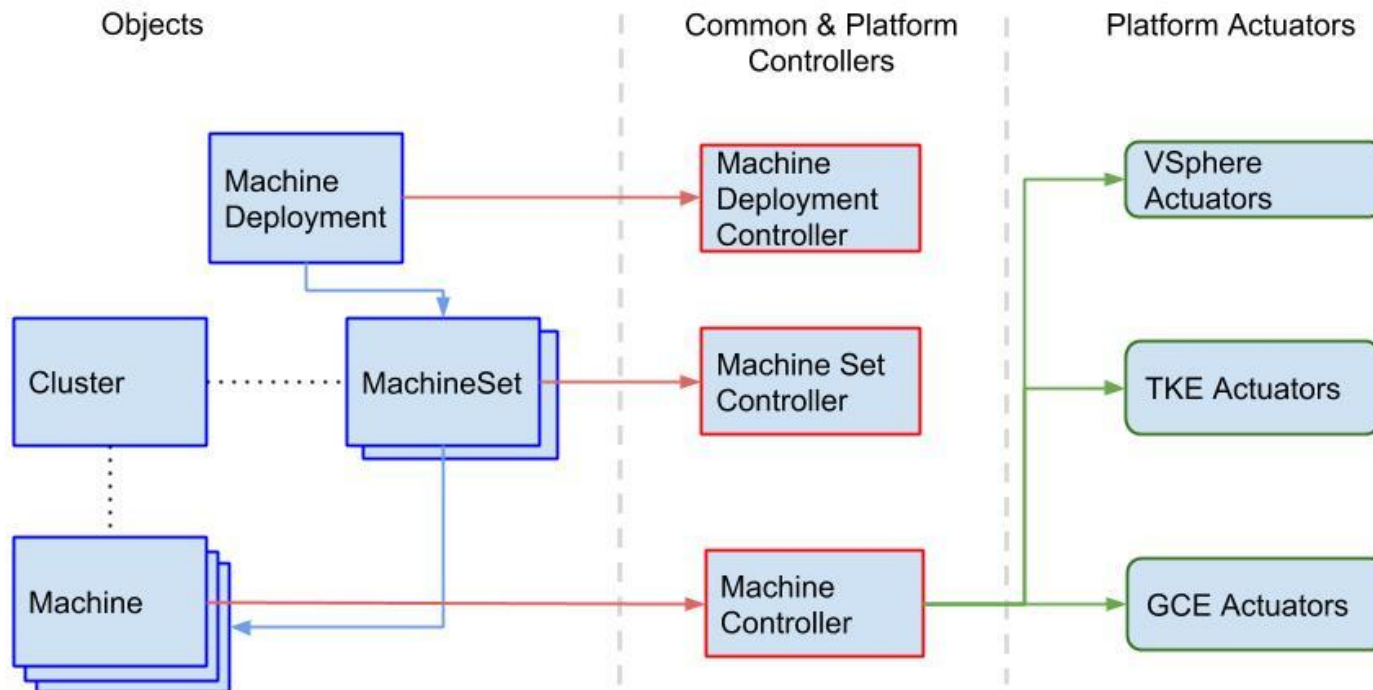


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# Case Study: Upgrade



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How do we upgrade K8s  
Cluster using Cluster API?



# Upgrade



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## **MachineDeployment**

- **replicas: 3**
- **nodes: MyNodes**
- **maxSurge: 1**
- **maxUnavailable: 0**
- **version: v1.8.3**

# Upgrade



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## MachineDeployment

- replicas: 3
- nodes: MyNodes
- maxSurge: 1
- maxUnavailable: 0
- **version: v1.9.3**

# Upgrade



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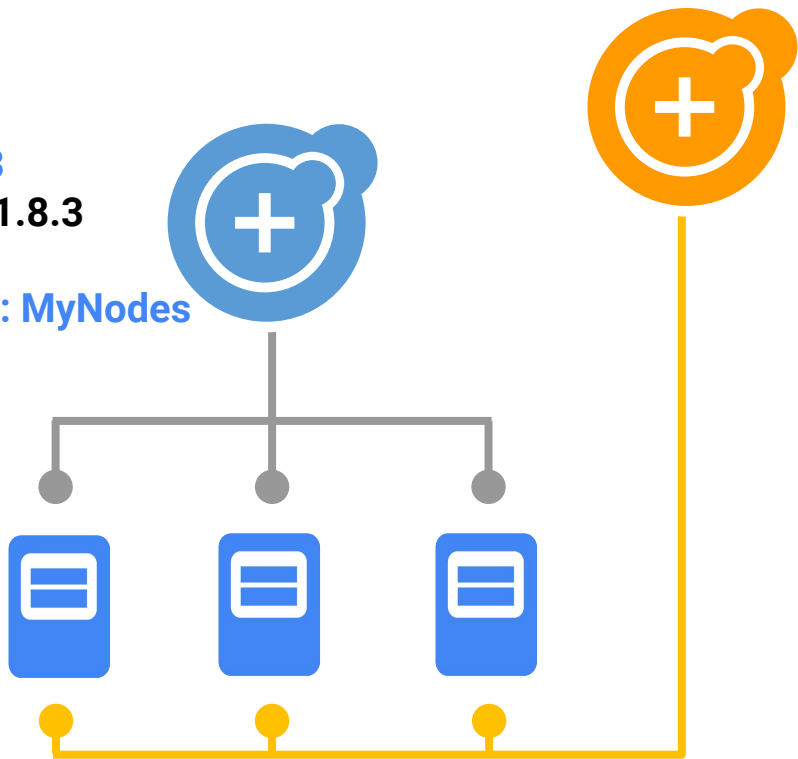


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## MachineSet

- replicas: 3
- version: v1.8.3
- selector:
  - nodes: MyNodes



# Upgrade



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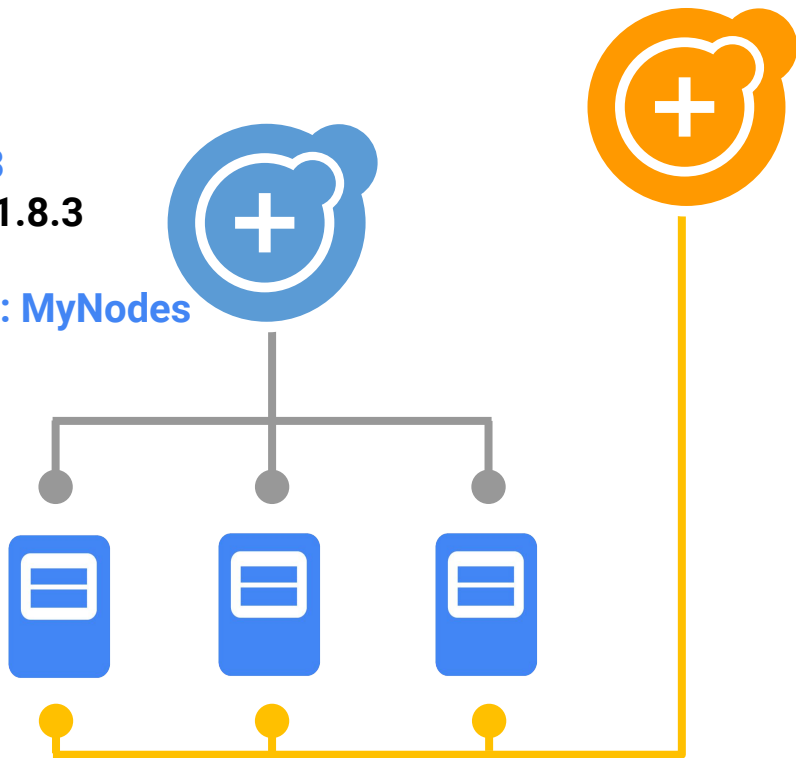


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## MachineSet

- replicas: 3
- version: v1.8.3
- selector:
  - nodes: MyNodes



## MachineSet

- replicas: 0
- version: v1.9.3
- selector:
  - nodes: MyNodes



# Upgrade



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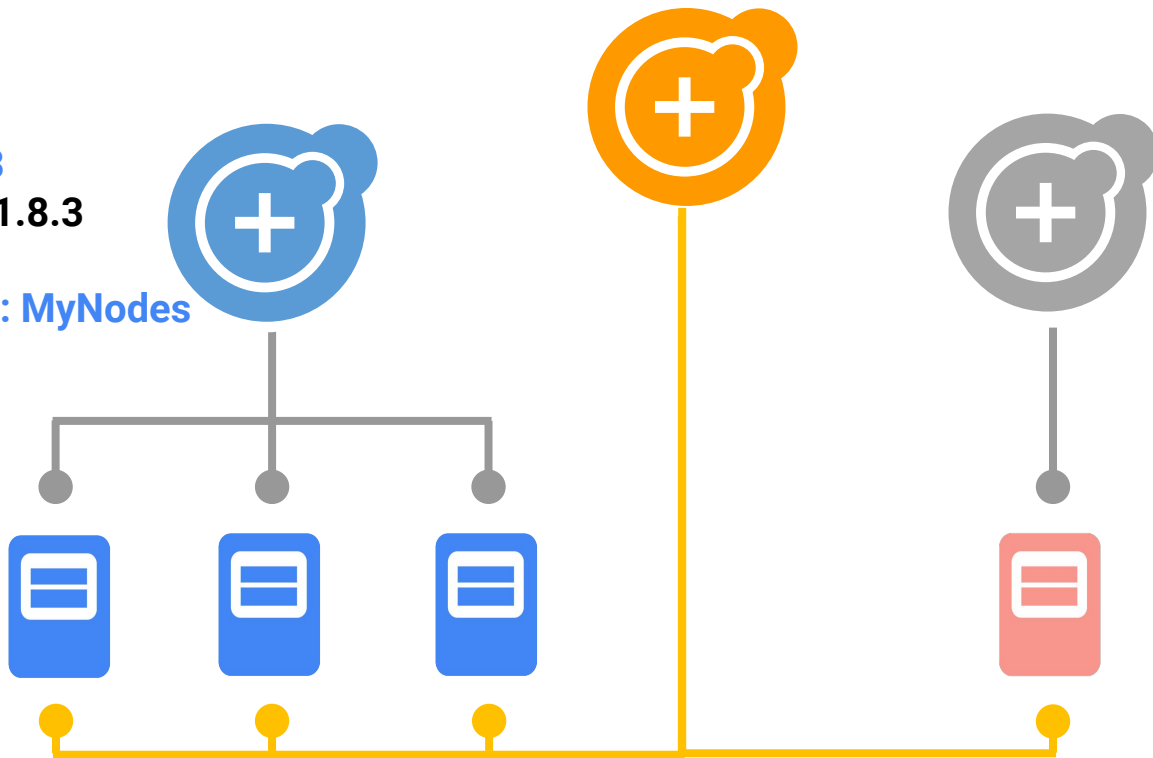


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## MachineSet

- replicas: 3
- version: v1.8.3
- selector:
  - nodes: MyNodes



## MachineSet

- replicas: 1
- version: v1.9.3
- selector:
  - nodes: MyNodes

# Upgrade



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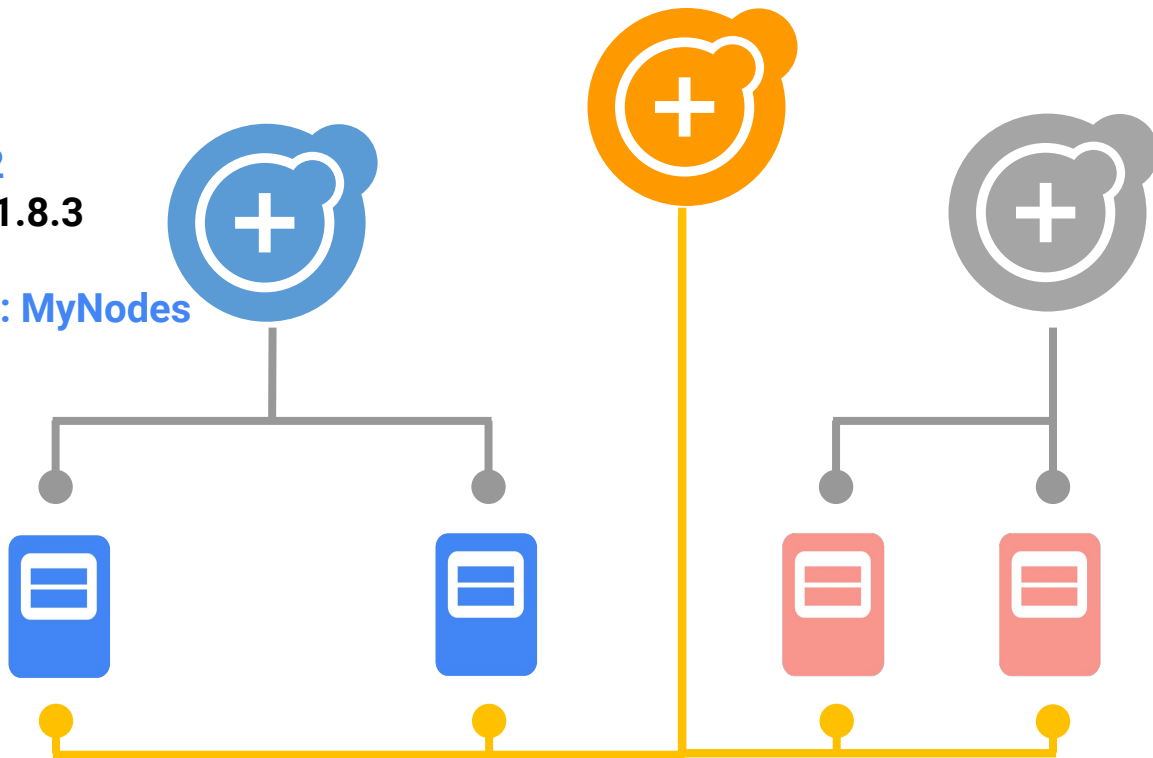


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## MachineSet

- replicas: 2
- version: v1.8.3
- selector:
  - nodes: MyNodes



## MachineSet

- replicas: 2
- version: v1.9.3
- selector:
  - nodes: MyNodes



# Upgrade



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## MachineSet

- replicas: 1
- version: v1.8.3
- selector:
  - nodes: MyNodes



## MachineSet

- replicas: 3
- version: v1.9.3
- selector:
  - nodes: MyNodes

# Upgrade



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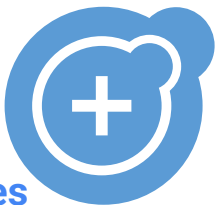


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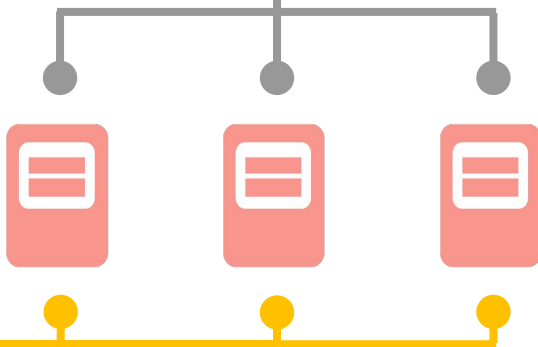
## MachineSet

- replicas: 0
- version: v1.8.3
- selector:
  - nodes: MyNodes



## MachineSet

- replicas: 3
- version: v1.9.3
- selector:
  - nodes: MyNodes





How to get cluster api  
components up and running?

# Bootstrapping - 10 km view

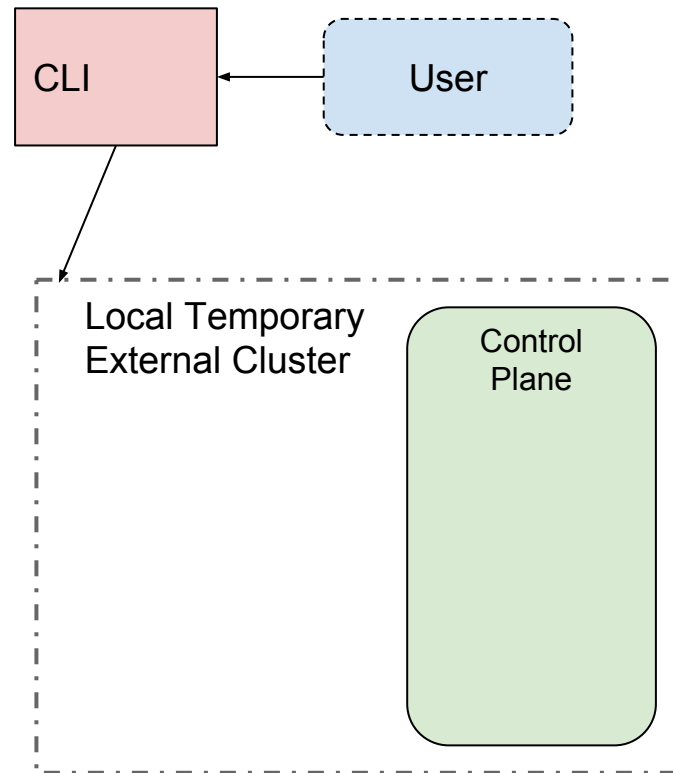


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# Bootstrapping - 10 km view

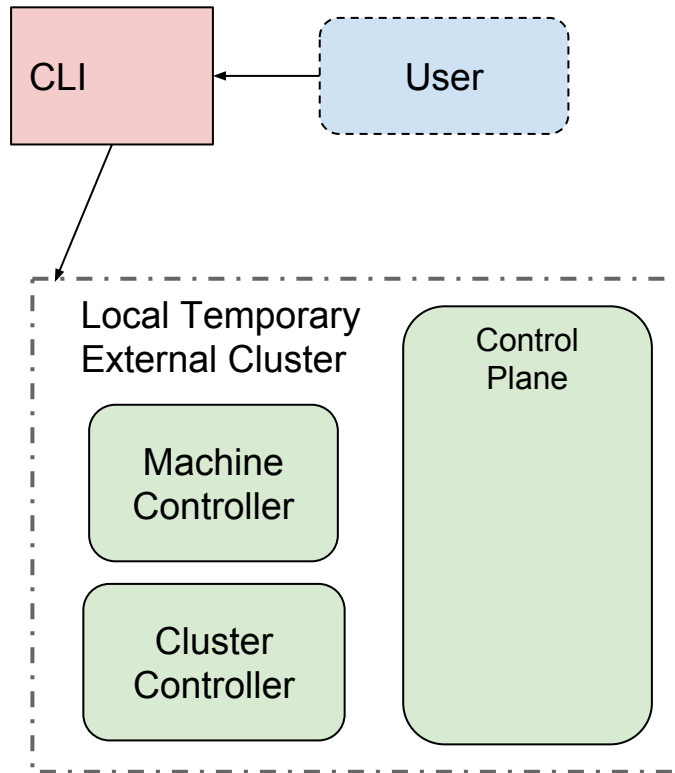


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# Bootstrapping - 10 km view

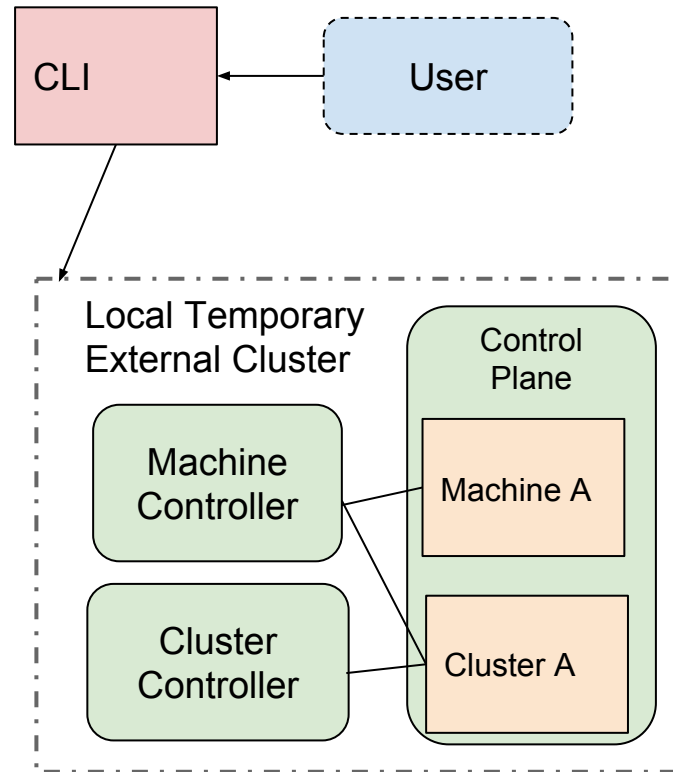


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# Bootstrapping - 10 km view

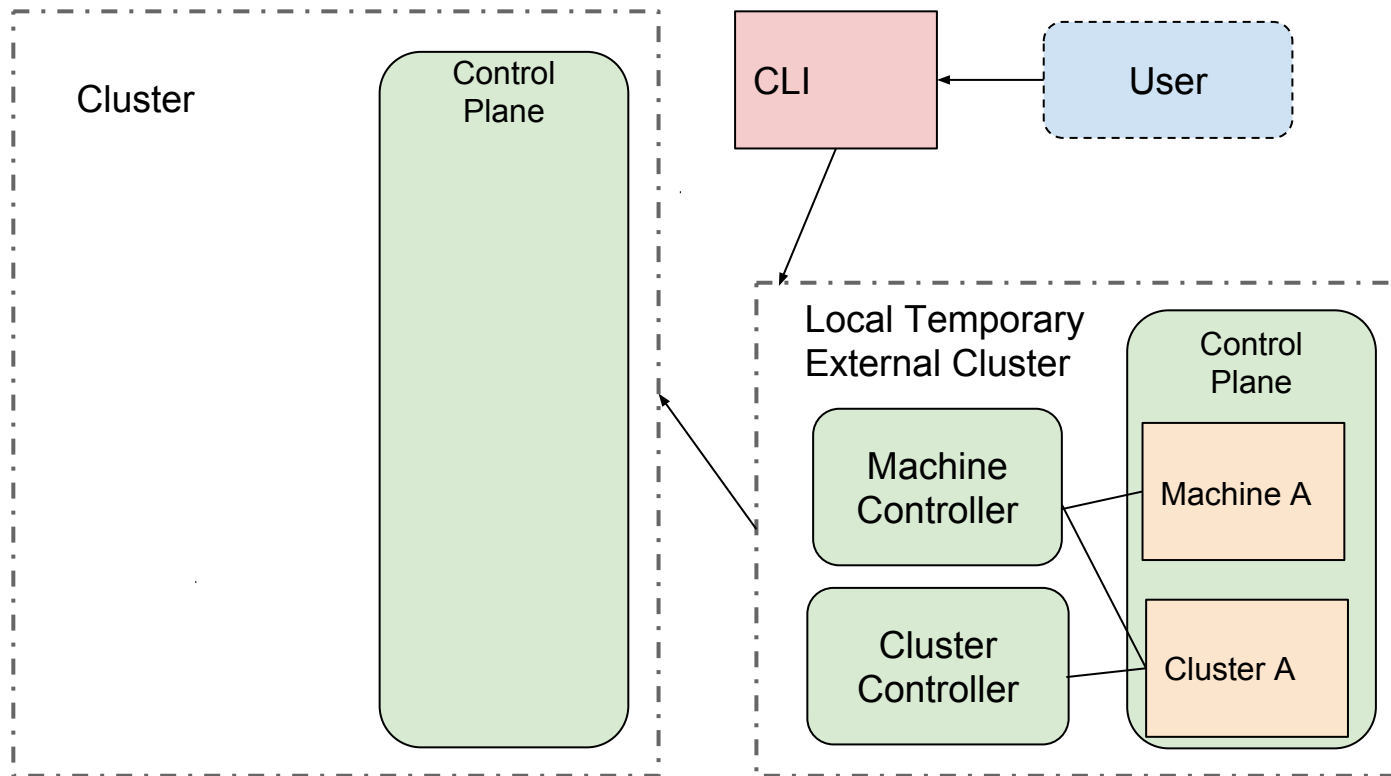


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# Bootstrapping - 10 km view

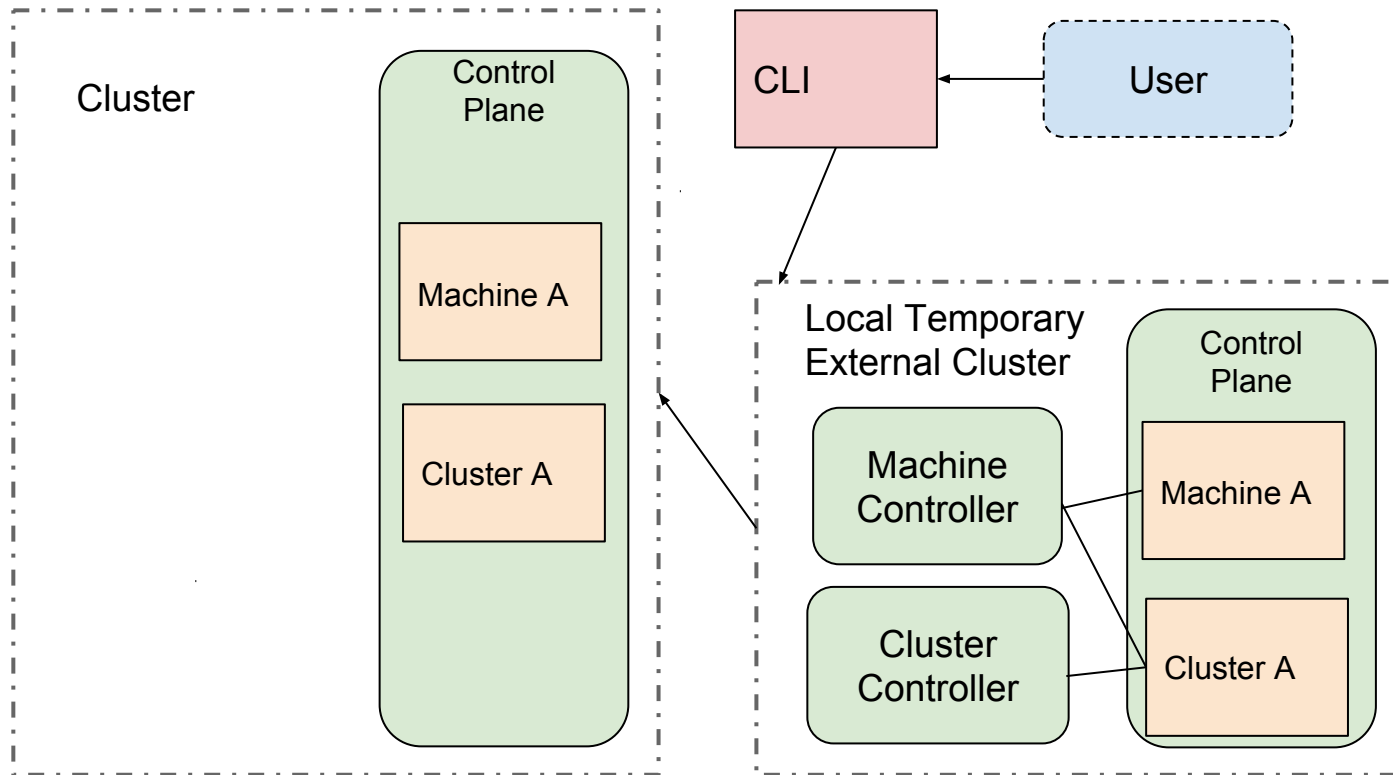


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# Bootstrapping - 10 km view

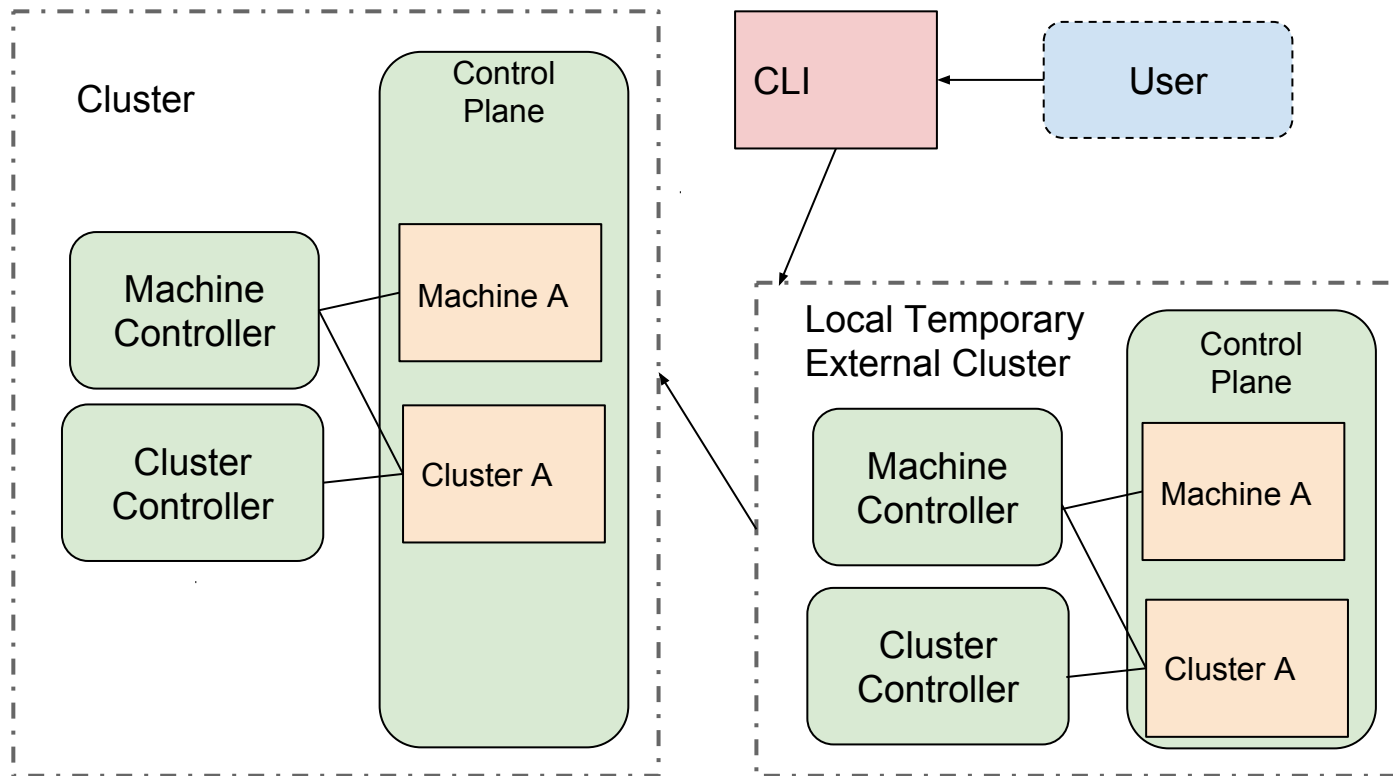


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# Bootstrapping - 10 km view

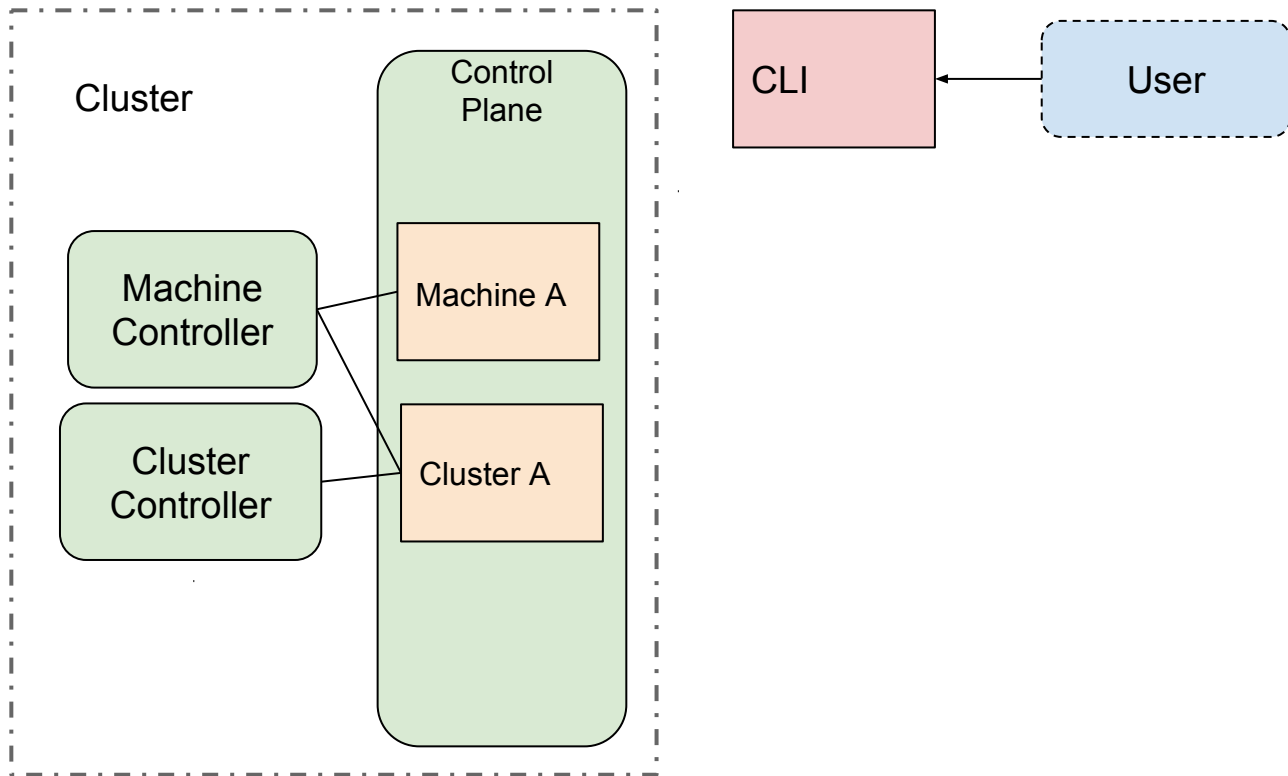


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# Deploy



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## In Cluster or not?

# Deploy - In Cluster

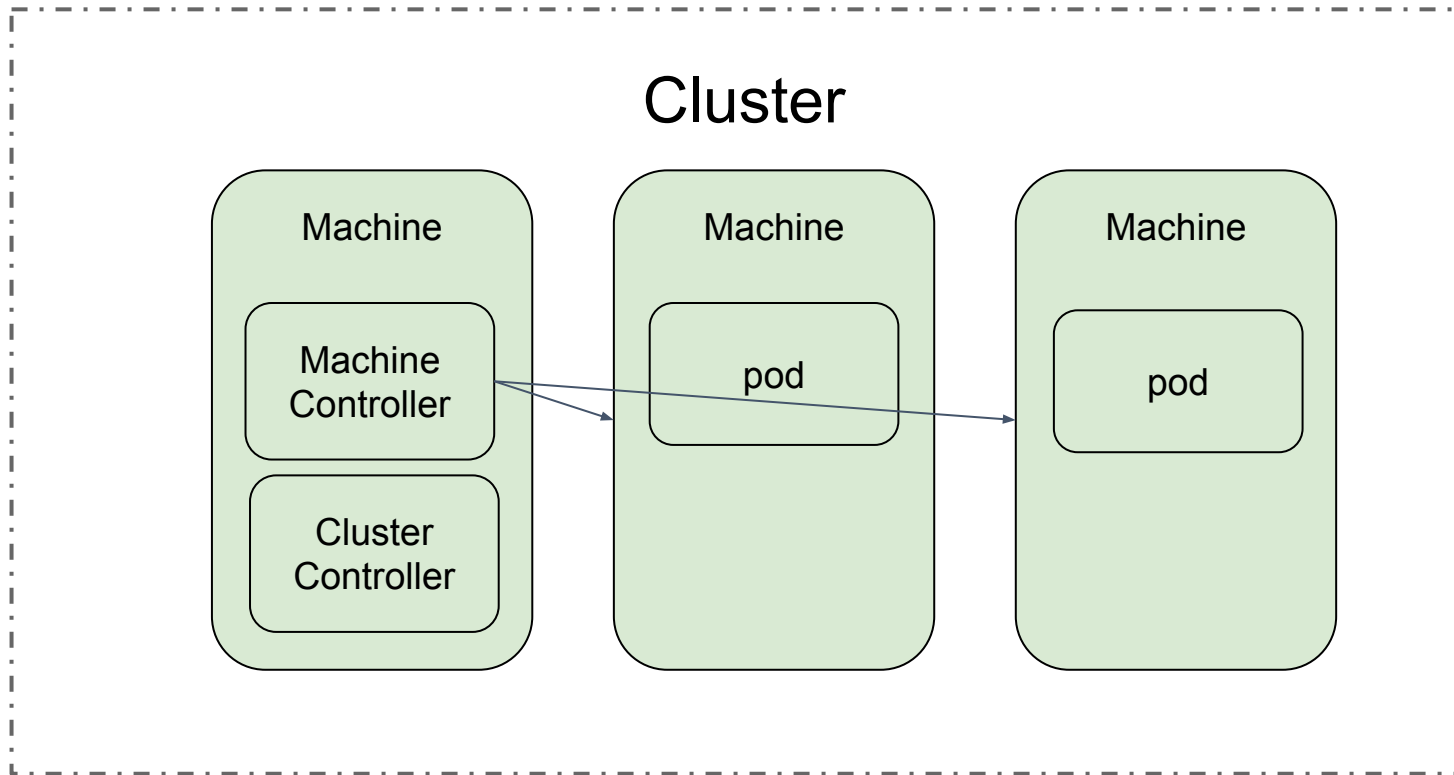


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# Deploy - Out of Cluster

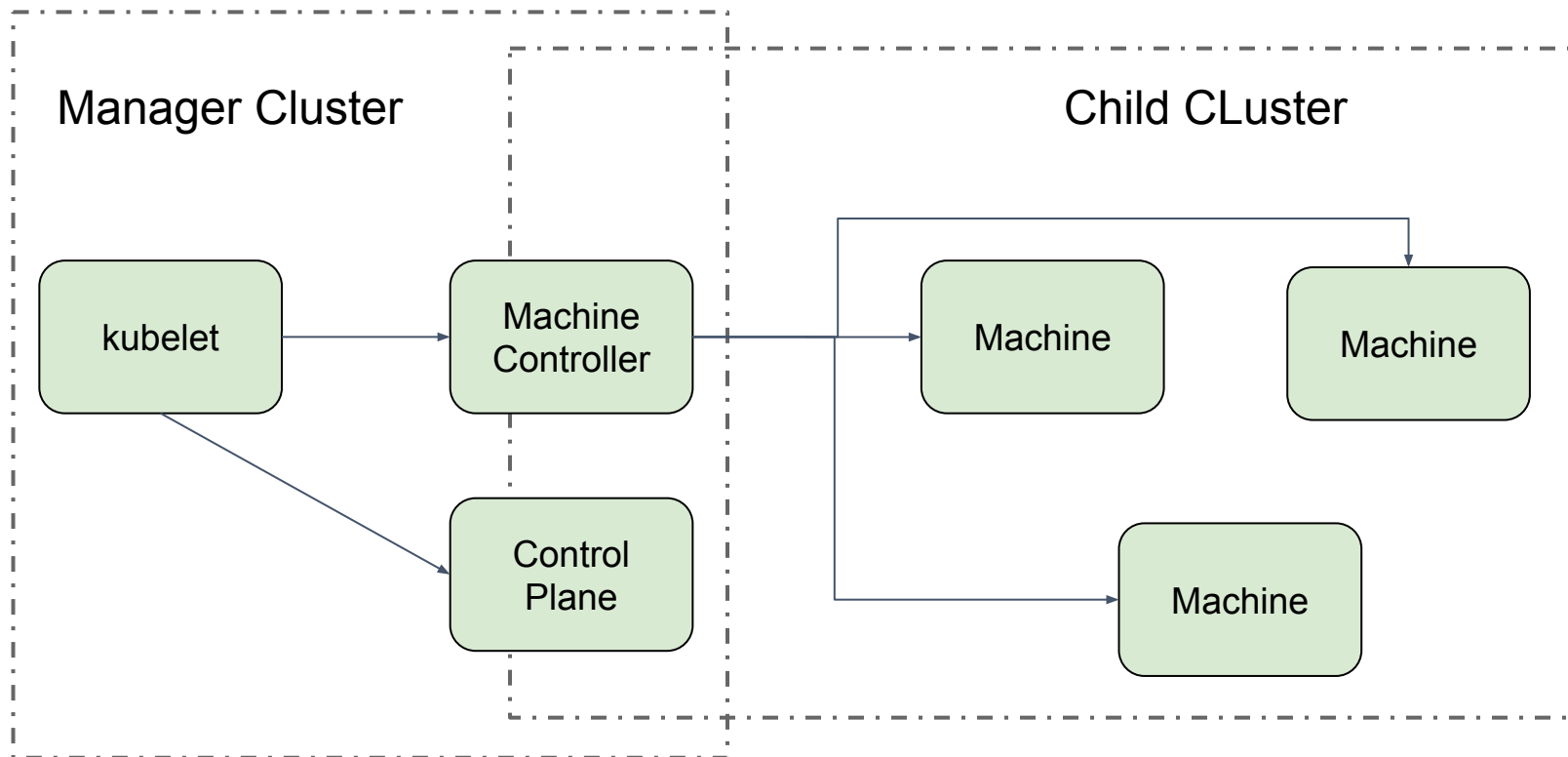


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# Provider Support



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- AWS
- Azure
- DigitalOcean
- GCP
- OpenStack
- Tencent Cloud
- VSphere
- ...



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# DEMO on TKE

# More Information

- <https://github.com/kubernetes-sigs/cluster-api>
- Joining Kubernetes-sig-cluster-lifecycle
- Weekly meeting on Wed @ 10:00 PT
- Office Hours: Weekly on Wed @ 06:00 AM and Tues @ 12:00 PT
- Slack: #cluster-api



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# Question?