Declarative Kubernetes Clusters with Cluster API

Joel Speed
Senior Software Engineer

Michael McCune
Principal Software Engineer
Introductions

Joel Speed
Senior Software Engineer
@JoelASpeed

Michael McCune
Principal Software Engineer
@elmiko@mastodon.technology
What we will discuss today:

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

Infrastructure Providers

Control Plane

Workers
Control Plane

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

- kubelet
- kube-proxy
- container runtime
Infrastructure Providers

- bare metal
- virtual machines
- networking
- storage
- containers?
- in-memory?!
What is CAPI?
Cluster API is a Kubernetes sub-project focused on providing declarative APIs and tooling to simplify provisioning, upgrading, and operating multiple Kubernetes clusters.
What is CAPI?

1 Pod please

Pod
What is CAPI?

1 Cluster please

Management

Workload
What is CAPI?
What is CAPI?

Management
Beyond the basics

- Control plane management
- Machine health checking
- Cluster autoscaling
- Bootstrapping
- Spot instance usage
- 8 cloud providers
Why do we need CAPI?
Why do we need CAPI?

Product Team

Production

Staging

Development
Why do we need CAPI?
Why do we need CAPI?
How does CAPI help?

▸ Centralises Management
▸ Automated Provisioning
▸ Automated Remediation
▸ Automated Upgrades (for workers)
CAPI Anatomy
Core CAPI resources

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.

Optional subheading
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, e.g., configuring etcd.
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
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha3
class: AWSCluster
metadata:
  name: capi-demo-1
spec:
  region: us-east-1
  sshKey: capi-demo-ssh-key
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
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
CAPI Anatomy

```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
```
```yaml
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 }}'
```

CAPI In Action (Demo)
How to get involved?
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.
Discuss your issues!

#cluster-api

kubernetes.slack.com

see the Cluster API book for links to the group mailing list
Attend a meeting!

**Wednesdays @ 17:00 UTC**

https://zoom.us/j/861487554

see the Cluster API book for recordings, notes, and updated information
Propose a change!

on github

kubernetes-sigs/cluster-api*

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

CAPI Roadmap

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

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

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

Stay in touch

Joel Speed
@JoelASpeed

Michael McCune
@elmiko@mastodon.technology