Kubernetes CAPI For Apache CloudStack - A story of cross community collaboration

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About Me

- First Of My Name
- First Born
- Rugby
- CloudStack Committer
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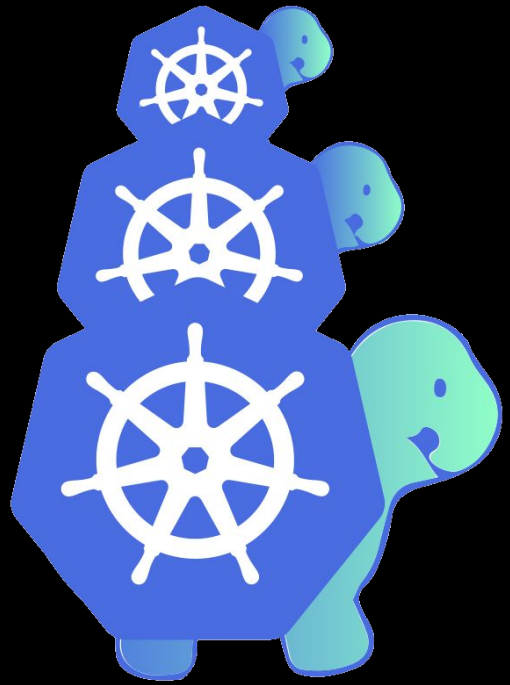
Run-Down

- What is CAPI ?
- Why we need it ?
- How does it work ?
- How we did it !
- Demo
- Q&A



What is CAPI ?

- Kubernetes Cluster API
- Standardize, Declarative
- Defining Kubernetes Clusters
- Kubernetes-style APIs and patterns
- Way too many!! (100+ distro / installers)
- Consistency
- Simplify Kubernetes management
- Everywhere !!

What is CAPI ?

```yaml
apiVersion: cluster.x-k8s.io/v1alpha4
kind: Cluster
metadata:
  name: acs-cluster
spec:
  clusterNetwork:
    pods:
      cidrBlocks: ["192.168.0.0/16"]
    serviceDomain: "cluster.local"
  infrastructureRef:
    apiVersion: infrastructure.cluster.x-k8s.io/v1alpha4
    kind: CloudStackCluster
    name: acs-cluster
  controlPlaneRef:
    kind: KubeadmControlPlane
    apiVersion: controlplane.cluster.x-k8s.io/v1alpha4
    name: acs-cluster-control-plane
```

```yaml
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha4
kind: CloudStackCluster
metadata:
  name: acs-cluster
spec:
  zone: ref-trl-2220-k-M7-david-jumani
  network: acs-cluster-network
  controlPlaneEndpoint:
    host: 10.0.57.23
    port: 7443
```

What is CAPI ?

```yaml
apiVersion: cluster.x-k8s.io/v1alpha4
kind: MachineDeployment
metadata:
  name: acs-cluster-md-0
spec:
  clusterName: acs-cluster
  replicas: 1
  selector:
    matchLabels:
  template:
    spec:
      clusterName: acs-cluster
      version: v1.20.10
      bootstrap:
        configRef:
          name: acs-cluster-md-0
          apiVersion: bootstrap.cluster.x-k8s.io/v1alpha4
          kind: KubeadmConfigTemplate
      infrastructureRef:
        name: "acs-cluster-md-0"
        apiVersion: infrastructure.cluster.x-k8s.io/v1alpha4
        kind: CloudStackMachineTemplate
```

```yaml
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha4
kind: CloudStackMachineTemplate
metadata:
  name: acs-cluster-md-0
spec:
  template:
    spec:
      offering: kube
      template: rhel-8-kube-v1.20.10-kvm
      sshkey: mine
```

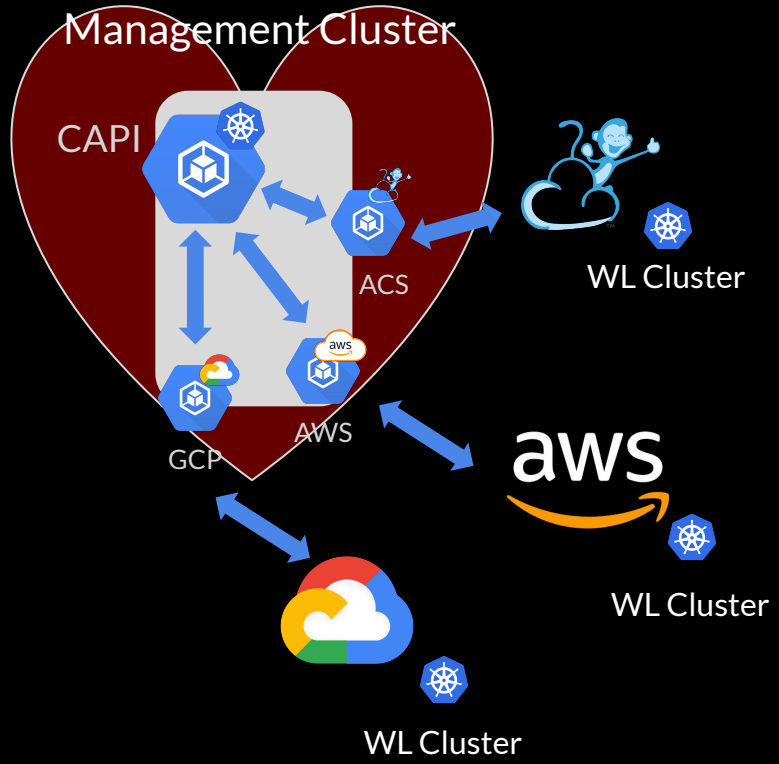
Why we need CAPI ?

- Everyone is a provider !!!
- Standardize Operations
- Unified Cluster Management
- Across Infra (private / public / technologies)
- Define common operations - CSUD
- Default implementation
- Simplify Lifecycle management
- Under one hood

PROVIDERS EVERYWHERE !!

How does CAPI work ?

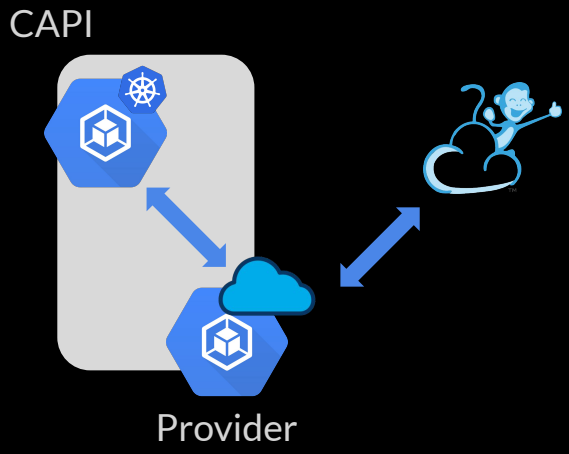
- Kubernetes Manages Kubernetes
- Management Cluster
  - Anywhere - local, cloud, CKS
- Workload Cluster - Infra specific
  - Target, End user
- Custom Resource Definitions
  - Infra specific - CloudStack Cluster, AWS Cluster, GCP Cluster
- Interacts with the provider



How does CAPI work ?

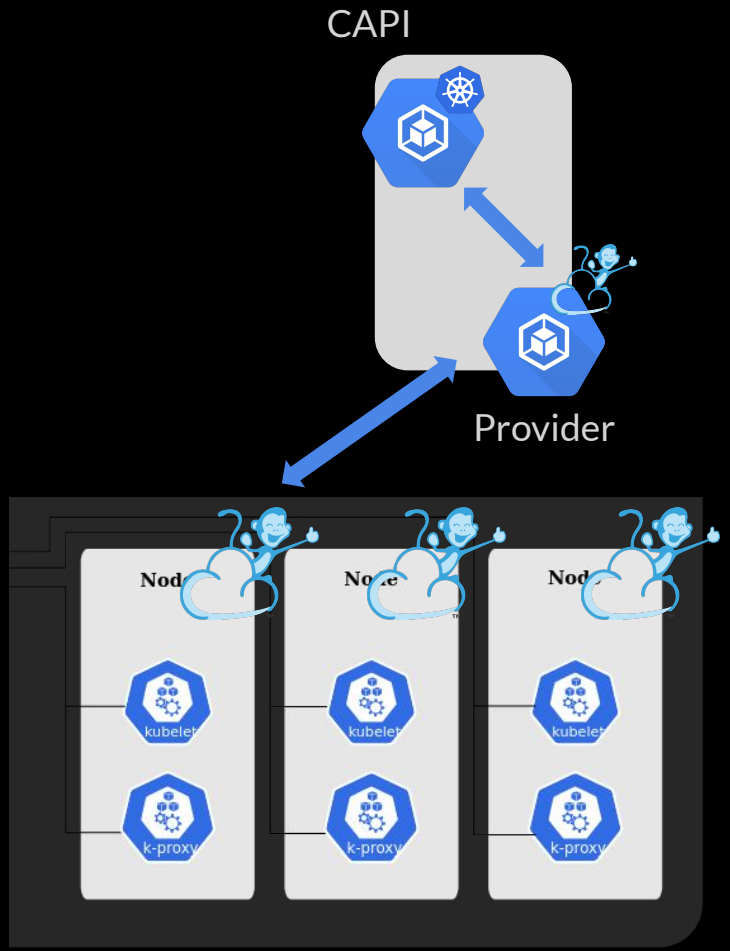
Components :

- CAPI Controller
  - Orchestrator
- Control Plane Provider (kubeadm)
  - Alive? Kubeconfig
- Bootstrap Provider (kubeadm)
  - Bootstrap - userdata, etc
- Infrastructure Provider



How does CAPC work ?

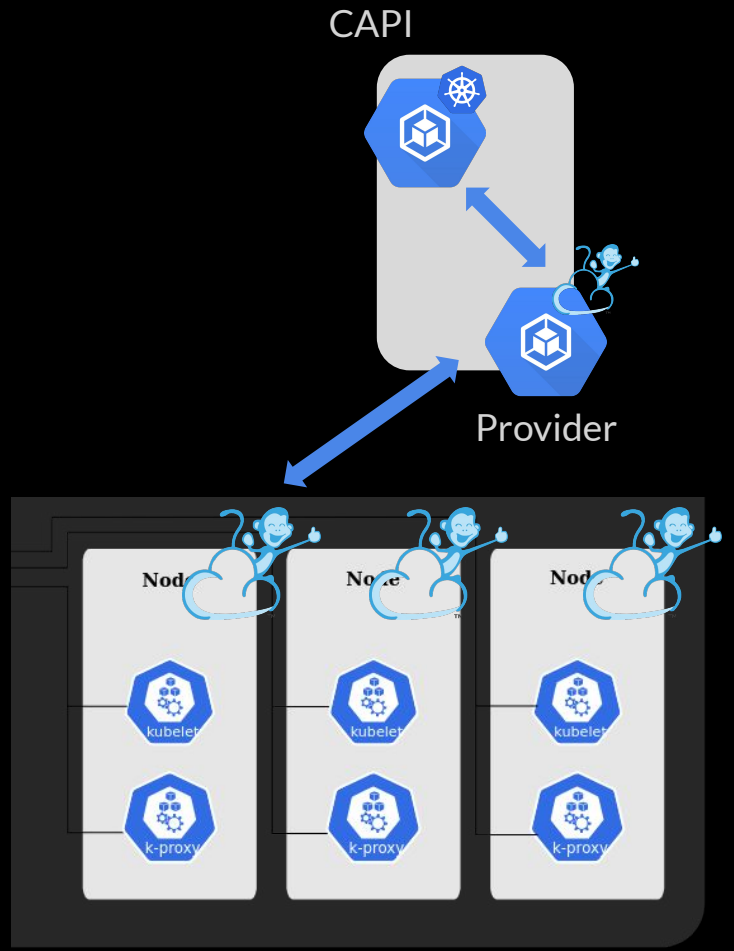
- clusterctl - tool
- Infrastructure (acs, aws, gcp)
- Network Resources
  - Public IP
  - FW / LB Rules
- Deploys VMs
- Bootstrap via userdata
- Cleanup



How does CAPC work ?

Requirements :

- Management Cluster
- Custom Provider
- Creds
- Templates with k8s baked in
- Resource Ready (Network, IP, etc)



How we did it ?

How it started ?

- Curiosity
- Weekend project
- Prototype
- Every Project Manager’s Dream
  - Lean / Agile

IT’S A NICE SERVICE YOU GOT THERE

IT WOULD BE GREAT IF

SOMEBODY PROVIDED IT

How we did it ?

The Fun Part !

- Kubernetes SIG
  - Weekly Meeting
  - Proposal
  - Pitch idea
- Building Support

How we did it ?

The Fun Part !

- Integration with wider k8s
  - CAPI
  - Image builder
- Requirements
  - Kubernetes SIG Member
  - PRs / Issues

How we did it ?

Home Stretch

- Donate Repo
- Github Integrations
- Prow Jobs
- Container registry
- Docs

How we did it ?

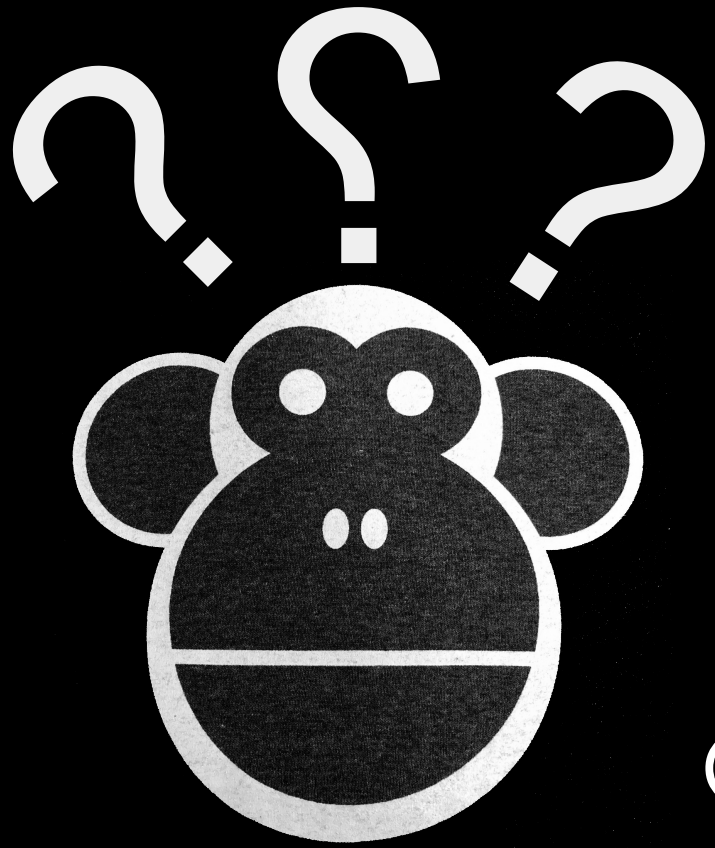
How it’s going !

- v0.4.4 official release !
- v1.0.0 Coming soon !
- ~ 80% Test Coverage
- Image builder support
  - EL 7 / 8
  - Suse
  - Ubuntu 20 / 22

Learnings

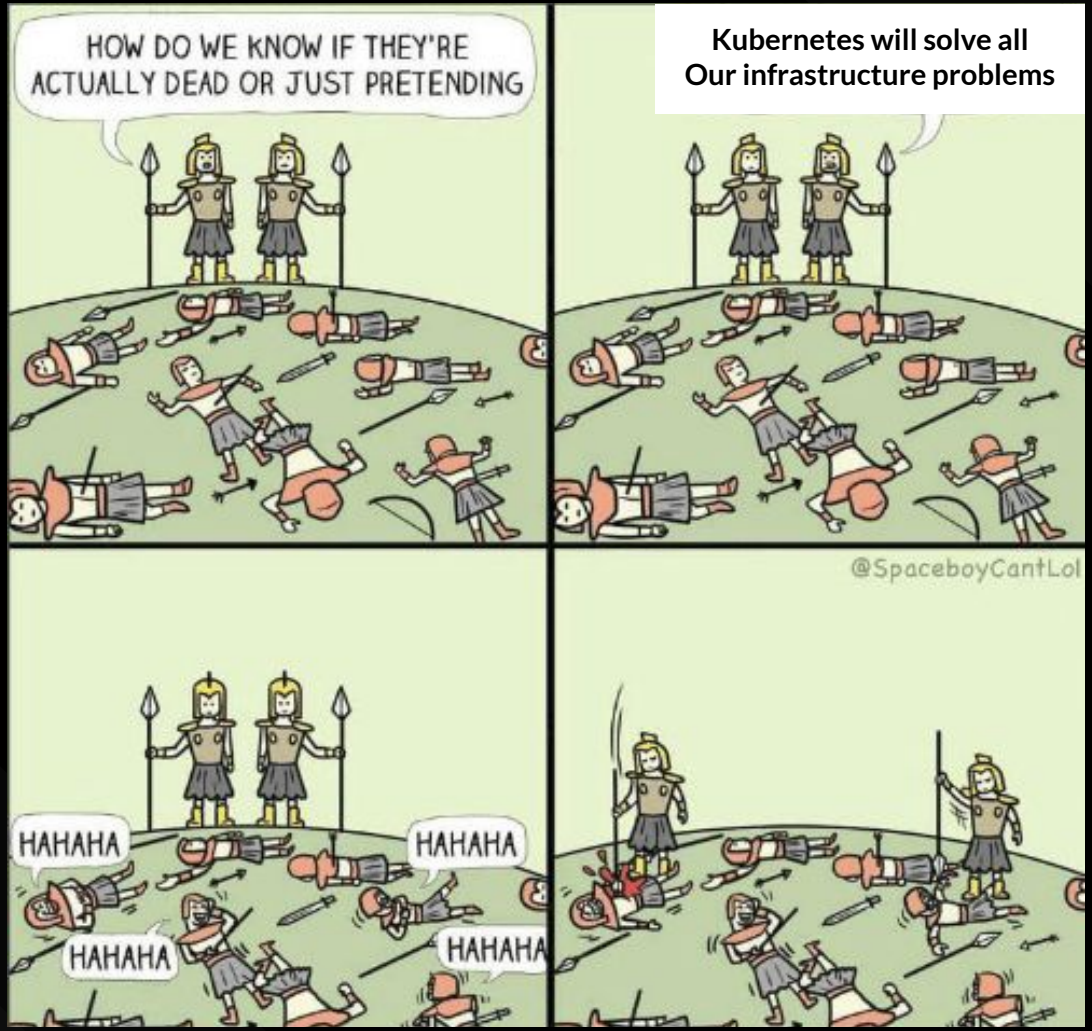
- Be Curious
  - Satisfaction brought it back
- Ask
  - Everyone wants to be a hero
- Do your research
  - Avoid Surprises
- Hope for the best !
  - Community > Code
  - Win - Win - Win

Demo Time !



Questions ?

Thank You !

davidjumani

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