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China 2018

SIG Cluster Lifecycle: Deep Dive

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2018-11-15

Who Are We?

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Our Mission

SIG Cluster Lifecycle's objective is to simplify creation, configuration, upgrade, downgrade, and teardown of Kubernetes clusters and their components.

SIG Cluster Lifecycle Projects

- **kubeadm**
- **cluster-api**
- kops
- kubespray
- minikube
- bootkube
- kubeadm-dind-cluster
- ...

Agenda

- kubeadm
  - Best practices: install and fine-tuning
  - How it works
  - Current status and plans
- Cluster API
- Join and contribute!

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kubeadm Best Practices

Installing kubeadm

Ways of installing kubeadm:

- Supported distributions
  - Container Linux
  - DEBs and RPMs:
    Ubuntu, Debian, Hypriot, RHEL,
    CentOS, Fedora
- There are other distros
  - OpenSuSE, ArchLinux, …

What is actually needed on the node:

- kubeadm
- kubelet
- kubectl
- CNI plugins
- cri-tools

For distros without official support you can use Container Linux section for manually install binaries
https://kubernetes.io/docs/setup/independent/install-kubeadm/

kubeadm: fine-tuning kubelet

- systemd
  - /etc/systemd/system/kubelet.service.d/10-kubeadm.conf
    - **Don’t edit it!**
- Override a instance-specific kubelet flag via environment file
  - **/etc/default/kubelet** or **/etc/sysconfig/kubelet**
    - **KUBELET_EXTRA_ARGS**=”--flag=…”
- ConfigMap in “kube-system” namespace
  - “kubelet-config-1.X”
- kubeadm-managed files
  - /var/lib/kubelet/kubeadm-flags.env
  - /var/lib/kubelet/config.yaml

kubeadm: Offline installation

- Offline and air-gapped detection improved in v1.12
- “Calling home”
  - --kubernetes-version
    - stable, stable-1, stable-1.12, ...
    - latest, latest-1, latest-1.12, ...
    - ci/latest-1.13
  - upgrade plan

```
$ kubeadm config images list
```

- k8s.gcr.io/kube-apiserver
- k8s.gcr.io/kube-controller-manager
- k8s.gcr.io/kube-scheduler
- k8s.gcr.io/kube-proxy
- k8s.gcr.io/pause
- k8s.gcr.io/etcd
- k8s.gcr.io/coredns

```
$ kubeadm config images pull
```

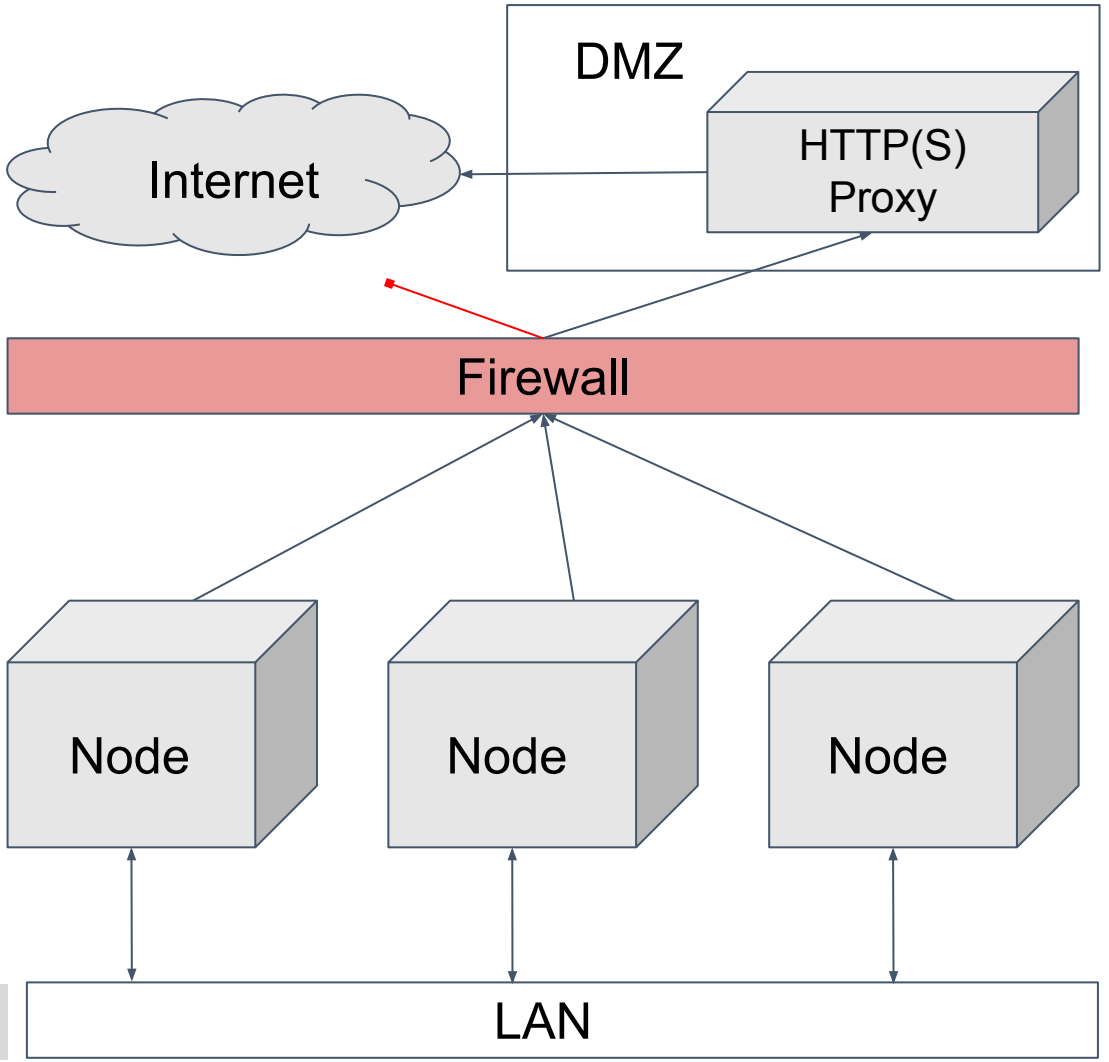
https://dl.k8s.io/release/${RELEASE}/bin/linux/amd64

```
$ gsutil ls -l gs://kubernetes-release/release/v1.12.2/bin/linux/amd64/
```

kubeadm: Network and Proxies

- Proxy for CRI
  - HTTP_PROXY
  - HTTPS_PROXY
  - NO_PROXY
    - Attention: local registries

- Proxy for kubeadm
  - HTTP_PROXY
  - HTTPS_PROXY
  - NO_PROXY
    - Node IPs range
    - Service IPs range
    - POD IPs range
    - Cluster domains




```
NO_PROXY=tld.com,192.168.0.0/16,10.0.0.0/8,cluster.local
```

kubeadm: Using own certificates

- Directory with all your custom certificates (--cert-dir)
  - etcd serving: **etcd/ca.key** and **etcd/ca.crt**
  - Cluster CA: **ca.key** and **ca.crt**
  - API Server serving: **apiserver.key** and **apiserver.crt**
  - ServiceAccount signing key: **sa.pub** and **sa.key**
  - API Server Kubelet client: **apiserver-kubelet-client.key** and **apiserver-kubelet-client.crt**
  - Frontend Proxy -- for API Aggregation
    - CA: **front-proxy-ca.key** and **front-proxy-ca.crt**
    - Client: **front-proxy-client.key** and **front-proxy-client.crt**

kubeadm: Using ComponentConfig

- Why use a config file for configuring kubeadm?
  - Tired of long complicated flags
  - Wants more advanced features, including more customized parameters
  - The API spec in v1.12 is unstable, *but there's always an upgrade path*
  - The API spec is graduated to v1beta1 in v1.13
- Supported Kinds in config file
  - InitConfiguration: kubeadm init master-local runtime config
  - ClusterConfiguration: cluster-wide settings, wide range of parameters
  - KubeletConfiguration: cluster-wide kubelet options
  - JoinConfiguration: kubeadm join node-local runtime config
- Saved to ConfigMaps for future upgrading
  - "**kubeadm-config**" and "**kubelet-config-1.x**" in "**kube-system"**

kubeadm: InitConfiguration


```
kubeadm config print-default --api-objects InitConfiguration
```

- Usage
  - “kubeadm init --config …”
- Why
  - Custom API endpoint address
  - Specify init bootstrap tokens
  - Pass custom kubelet flags
  - Set node name/taints

```
apiVersion: kubeadm.k8s.io/v1beta1
kind: InitConfiguration
localAPIEndpoint:
  advertiseAddress: "10.100.0.1"
  bindPort: 6443
nodeRegistration:
  criSocket: "/var/run/crio/crio.sock"
  kubeletExtraArgs:
    cgroupDriver: "cgroupfs"
bootstrapTokens:
    ...
```

kubeadm: ClusterConfiguration


```
kubeadm config print-default --api-objects ClusterConfiguration
```

- Usage
  - “kubeadm init --config …”
- Why
  - Fine tune cluster defaults
  - Custom args and volume mounts to control plane components

```
apiVersion: kubeadm.k8s.io/v1beta1
kind: ClusterConfiguration
kubernetesVersion: "v1.12.2"
imageRepository: registry.example.com
networking:
  serviceSubnet: "10.96.0.0/12"
  dnsDomain: "cluster.local"
etcd:
  ...
apiServer:
  extraArgs:
    ...
  extraVolumes:
    ...
```

Kubeadm: KubeletConfiguration


```
kubeadm config print-default --api-objects KubeletConfiguration
```

- Usage
  - “kubeadm init --config …”
- Why
  - Fine tuning kubelet parameters

```
apiVersion: kubelet.config.k8s.io/v1beta1
kind: KubeletConfiguration
cpuManagerPolicy: static
failSwapOn: false
maxPods: 110
resolvConf: /etc/my-cluster-resolv.conf
```

Kubeadm: JoinConfiguration


```
kubeadm config print-default --api-objects JoinConfiguration
```

- Usage
  - “kubeadm join --config …”
- Why
  - Customize discovery options
  - Pass custom kubelet flags
  - Set node name/taints

```
apiVersion: kubeadm.k8s.io/v1beta1
kind: JoinConfiguration
nodeRegistration:
  criSocket: /var/run/crio/crio.sock
  name: k8s-node2.example.com
  kubeletExtraArgs:
      cgroupDriver: "cgroupfs"
discovery:
  bootstrapToken:
    apiServerEndpoint: kube-apiserver:6443
    token: abcdef.0123456789abcdef
```

Kubeadm: KubeProxyConfiguration


```
kubeadm config print-default --api-objects KubeProxyConfiguration
```

- Usage
  - “kubeadm init --config …”
- Why
  - Fine tuning kubeproxy parameters

```
apiVersion: kubeadm.k8s.io/v1beta1
kind: KubeProxyConfiguration
iptables:
  masqueradeAll: false
  masqueradeBit: 14
  syncPeriod: 30s
ipvs:
  syncPeriod: 30s
```

kubeadm: Managing “addons”

- Installed and configured by kubeadm
  - DNS
    - CoreDNS has already been marked as default starting from 1.12
    - kube-dns can be used via feature-gate
  - kube-proxy - deployed as a DaemonSet
- Anything that isn’t required for meeting the Conformance criteria is outside of kubeadm scope
  - Dashboard
  - CNI plugins
- Future: Cluster Bundles…

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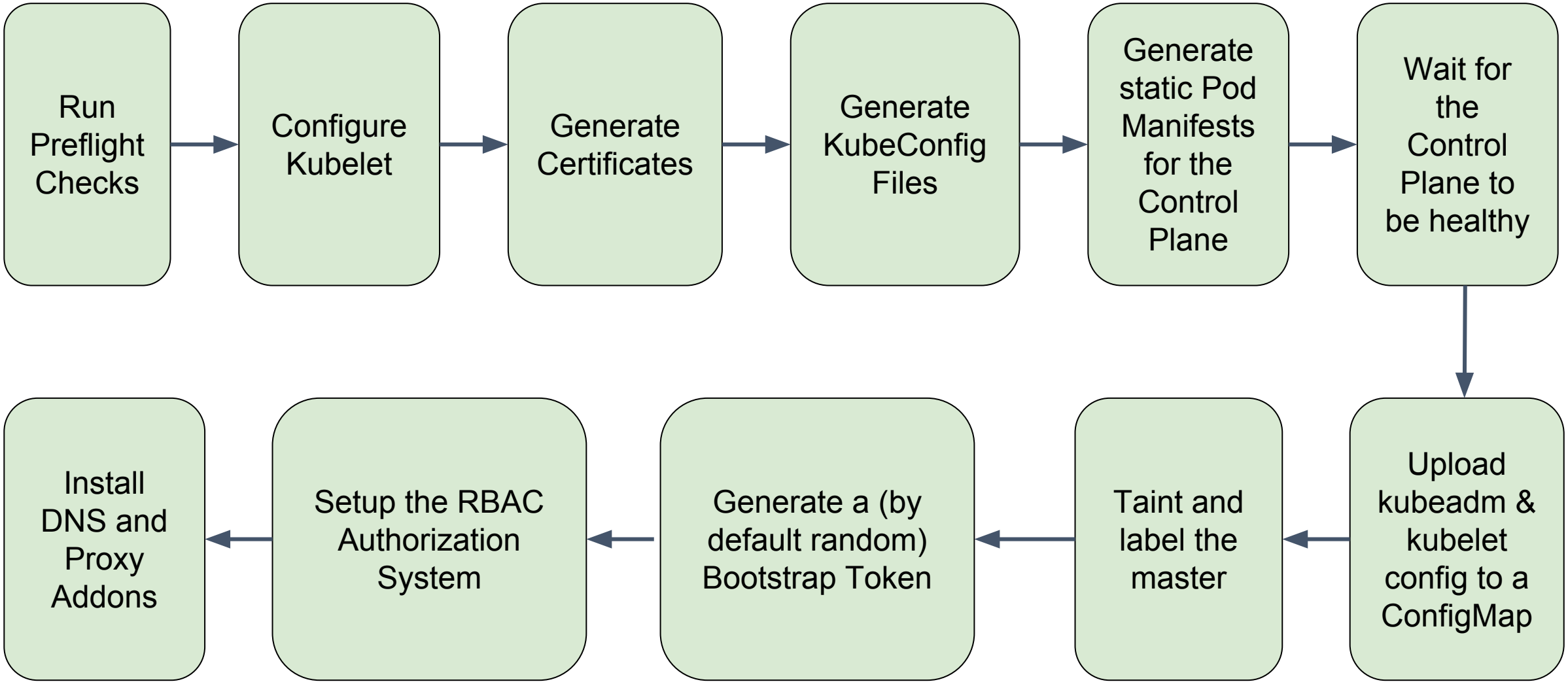
kubeadm
Under the hood

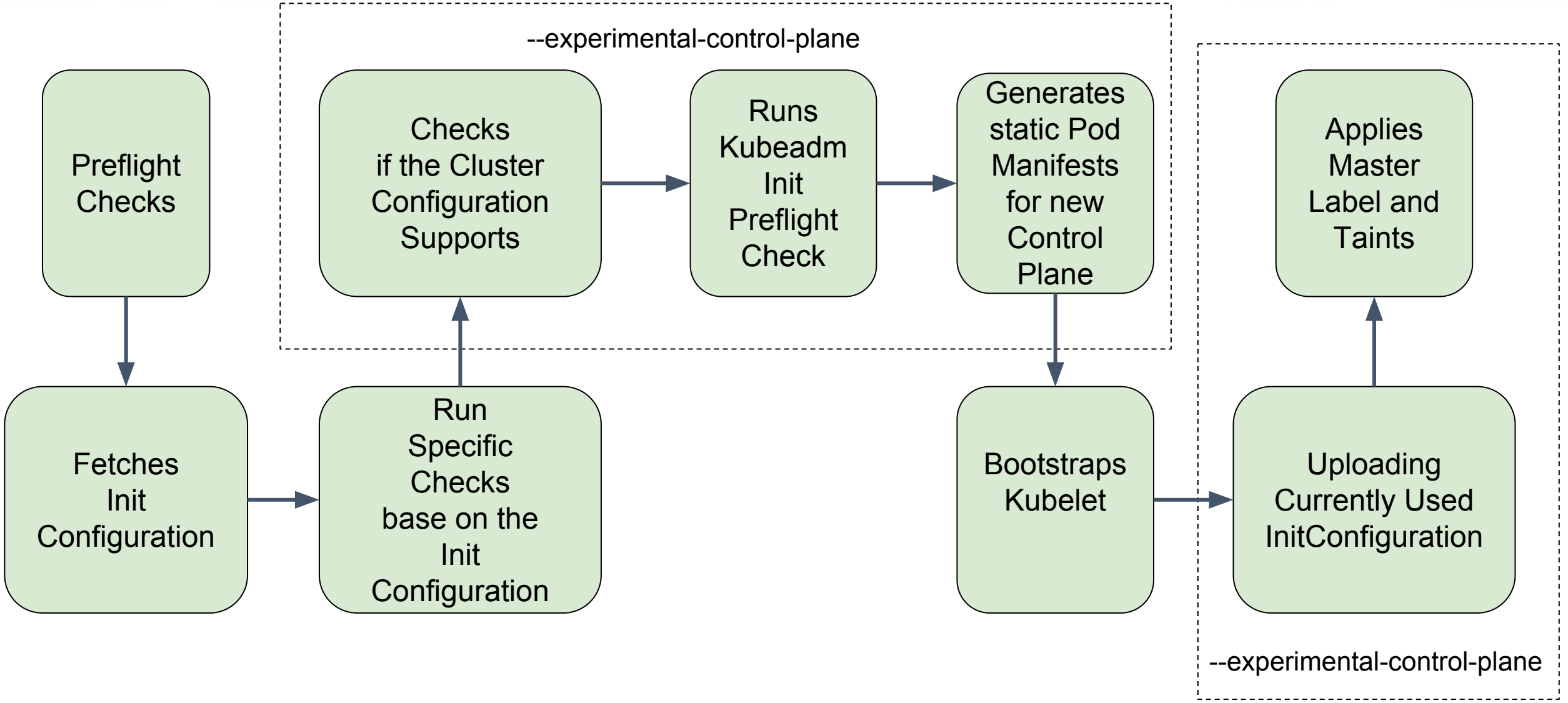
kubeadm: Atomic work “phases”

preflight	Run pre-flight checks
kubelet	Commands related to handling the kubelet.
certs	Generates certificates for a Kubernetes cluster
kubeconfig	Generates all kubeconfig files for the control plane and the admin kubeconfig file
controlplane	Generates all static Pod manifest files necessary to establish the control plane
kubeconfig	Generates all kubeconfig files for the control plane and the admin kubeconfig file
upload-config	Uploads the currently used configuration for kubeadm to a ConfigMap
mark-master	Mark a node as master
bootstrap-token	Manage kubeadm-specific bootstrap token functions
addon	Installs required addons for passing Conformance tests

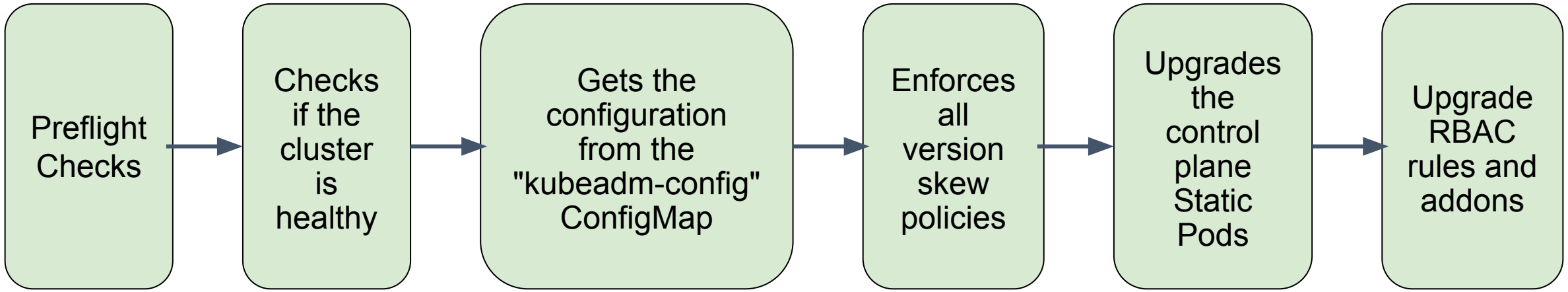
kubeadm init



kubeadm join



kubeadm upgrade: Control Plane



kubeadm upgrade: Node

- Currently kubeadm only supports upgrading the kubelet ***configuration***, **NOT** the kubelet itself.
  - Manually upgrade the kubelet package using your package manager (e.g. apt, yum)

- Kubeadm will download ConfigMap "*kubelet-config-1.x*" in the "*kube-system*" namespace for global cluster kubelet settings
  - Will be stored as "/var/lib/kubelet/config.yaml"
  - Require kubelet version v1.11+

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kubeadm Status and Roadmap

kubeadm 1.12 Changelog

- Config / ComponentConfig
- Experimental: join master
- Improved CRI support
- Improved offline / air-gapped support
- Deprecating of SelfHosting, HA

kubeadm 1.13 Roadmap

- kubeadm is graduated to GA/stable!!!
- Promote the config file from v1alpha3 to v1beta1
- Phases graduated to beta
  - addon, bootstrap-token, certs, control-plane, etcd, kubeconfig, kubelet-start, mark-control-plane, preflight, upload-config

- Bug fixes

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Cluster API

What is the Cluster API?

Declarative API

Cluster
Machine
Machine Set + Machine Deployment

Common Logic

Machine Lifecycle (including Provisioning)
Machine Upgrade

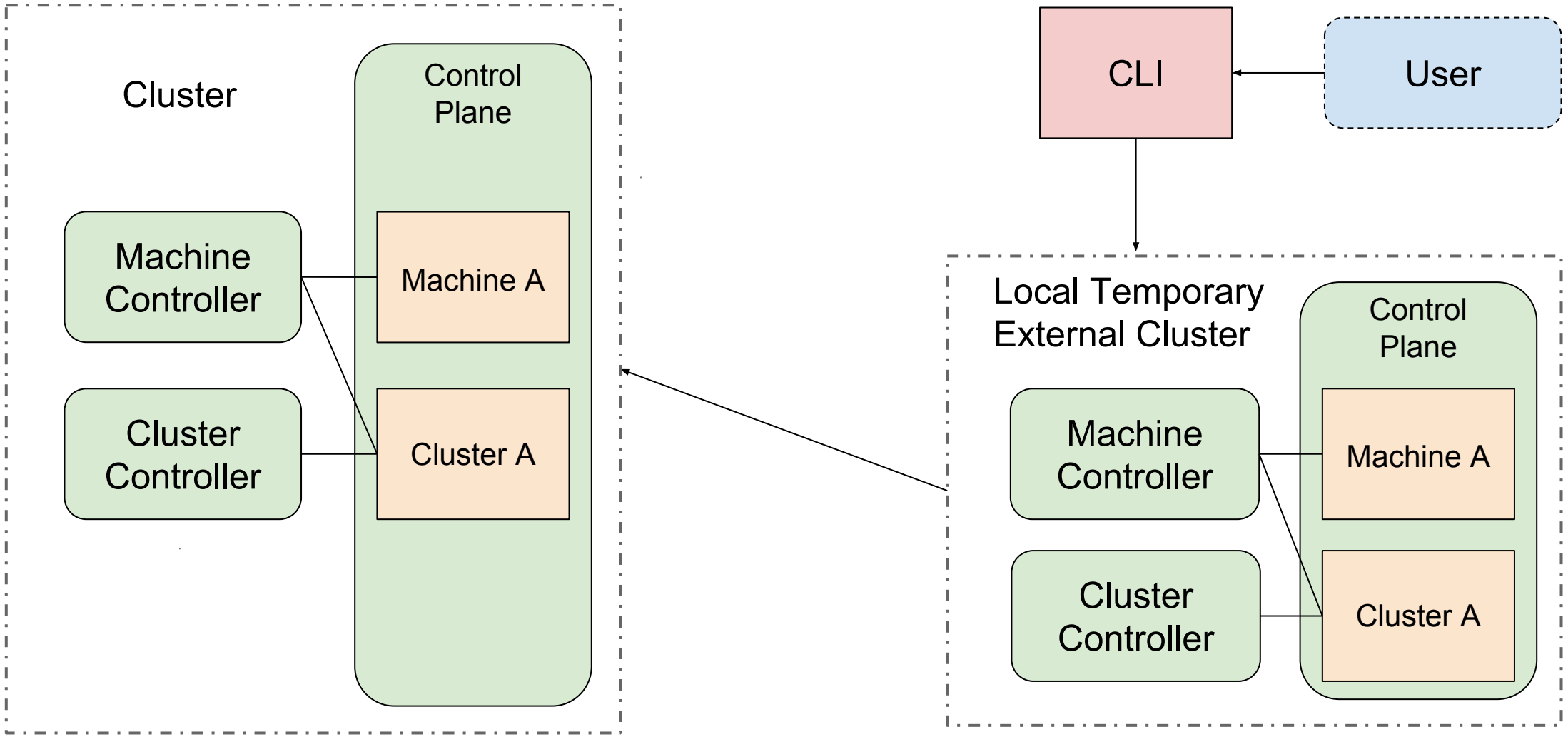
Pluggable Architecture

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

Tooling, Services

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

Bootstrapping - 10 km view



Cluster API: Status

- Actively developed providers
  - AWS: https://github.com/kubernetes-sigs/cluster-api-provider-aws
    - v1.0.0-alpha.3
  - DigitalOcean: https://github.com/kubernetes-sigs/cluster-api-provider-digitalocean
    - v0.2.0
  - AWS/Openshift: https://github.com/openshift/cluster-operator
  - Azure: https://github.com/platform9/azure-provider
  - GCE, https://github.com/kubernetes-sigs/cluster-api-provider-gcp
  - OpenStack: https://github.com/kubernetes-sigs/cluster-api-provider-openstack
  - vSphere: https://github.com/kubernetes-sigs/cluster-api-provider-vsphere

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SIG Cluster Lifecycle
Join us and get involved!

How can you contribute to our SIG

- Contributing to SIG Cluster Lifecycle documentation
- We’re working on growing the contributor/reviewers pool; scaling the SIG
- We have “Office Hours” for our projects: weekly for kubeadm, bi-weekly for kops and kubespray…
- Cluster API office hours weekly for both US West Coast and EMEA
- Full list of SIG meetings and links to minutes and recordings can be found on SIG page
- Attend our Zoom meetings / be around on Slack
- Look for **“good first issue”, “help wanted”** and **“sig/cluster-lifecycle”** labeled issues in our repositories

What now?

- Follow the SIG Cluster Lifecycle YouTube playlist
- Check out the meeting notes for our bi-weekly SIG meetings
- Join #sig-cluster-lifecycle, #kubeadm, #cluster-api, #kops-dev, #kops-users, #kubespray, #minikube, …
- Prep for and take the Certified Kubernetes Administrator exam
- Check out the kubeadm setup guide, reference doc and design doc
- Read how you can get involved and improve kubeadm!

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Thank You!

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