
KubeCon
CloudNativeCon
OPEN SOURCE SUMMIT
China 2019

Managing Kubernetes in Air Gap/Offline Environments

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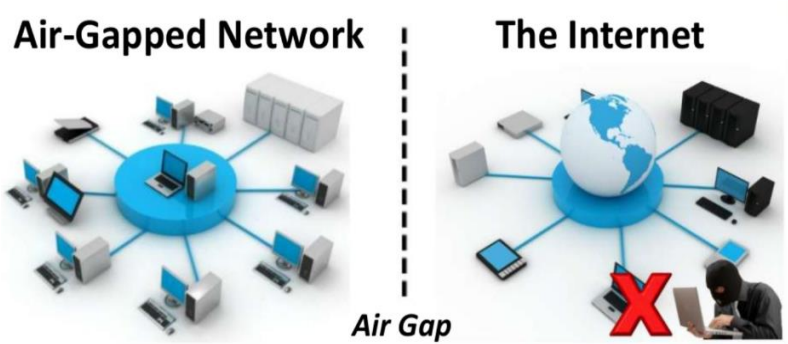
Agenda

- What is an Air Gap/Offline environments
- Kubeadm Air Gap/Offline installer support
- Trusted Cloud Native Registry – Harbor
- Production Ready Kubernetes Cluster –Kubespray
- How to setup kubespray in an Air Gap/Offline environment

What is an Air Gap/Offline environments ?


Air-Gapped Network
The Internet
Air Gap


Offline

Challenging and a quite common requirement

- Government
- Large corporations
- China
- Private cloud user

- User’s privacy guarantee
- Already maintaining own infrastructure and CDN
- Costs and not Public cloud

Kubeadm Air Gap/Offline installer support

Kubeadm images list


```
[root@k8s-dev home]# kubeadm  config images list
k8s.gcr.io/kube-apiserver-amd64:v1.11.10
k8s.gcr.io/kube-controller-manager-amd64:v1.11.10
k8s.gcr.io/kube-scheduler-amd64:v1.11.10
k8s.gcr.io/kube-proxy-amd64:v1.11.10
k8s.gcr.io/pause:3.1
k8s.gcr.io/etcd-amd64:3.2.18
k8s.gcr.io/coredns:1.1.3
```

- Kubeadm configmap kubernetesVersion
- Version must be v1.11.10,v1.12.1,v1.13.3?

kubeadm configmap imageRepository

How to define the version of etcd and image repo ?

https://github.com/kubernetes/kubernetes/pull/71135
Based on feedback from KubeCon China 2018.
Supported v1.13, Thanks @luxas

Kubeadm V1.12 Support

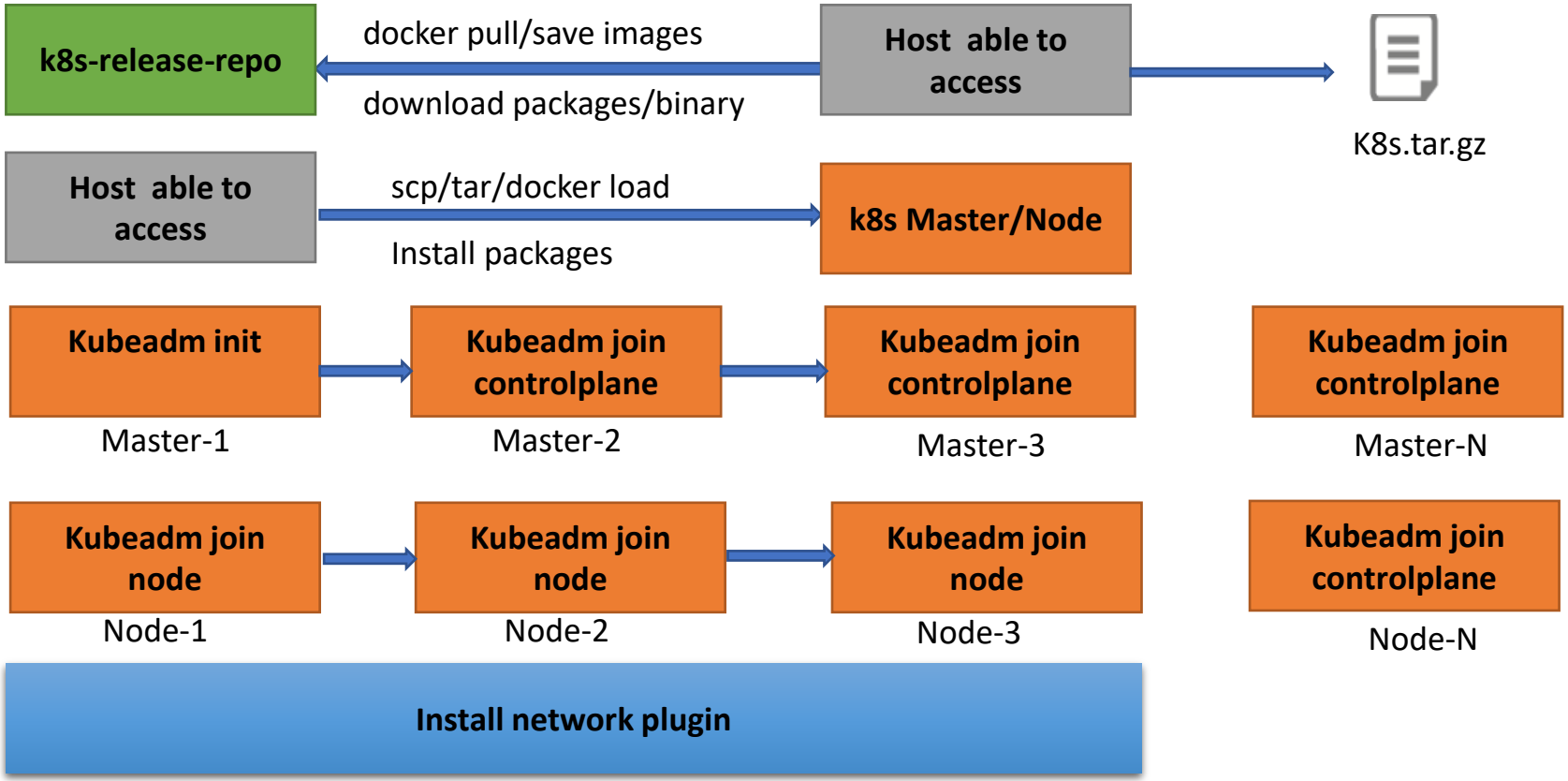
- Kubeadm Issues:

solve the kubeadm offline and air-gapped support issues#1041
https://github.com/kubernetes/kubeadm/issues/1041

- kubernetes PR:

kubeadm: fix offline and air-gapped support #67397
https://github.com/kubernetes/kubernetes/pull/67397

Kubeadm Air Gap/Offline install



Kubeadm Air Gap/Offline install

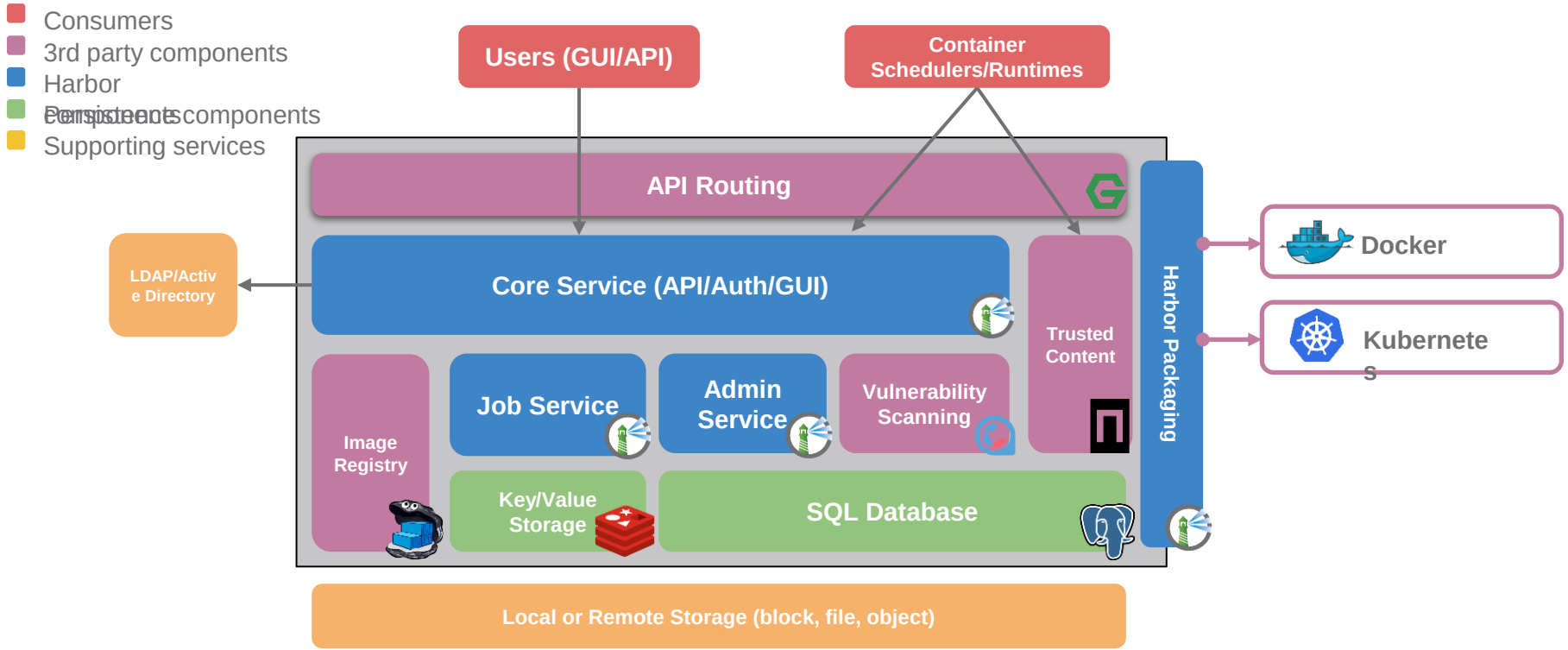
Images Registry

Kubeadm + Ansible

Trusted Cloud Native Registry – Harbor

Harbor is a trusted cloud native registry that stores, signs, and scans content. The mission is to provide cloud native environments the ability to confidently manage and serve container images.

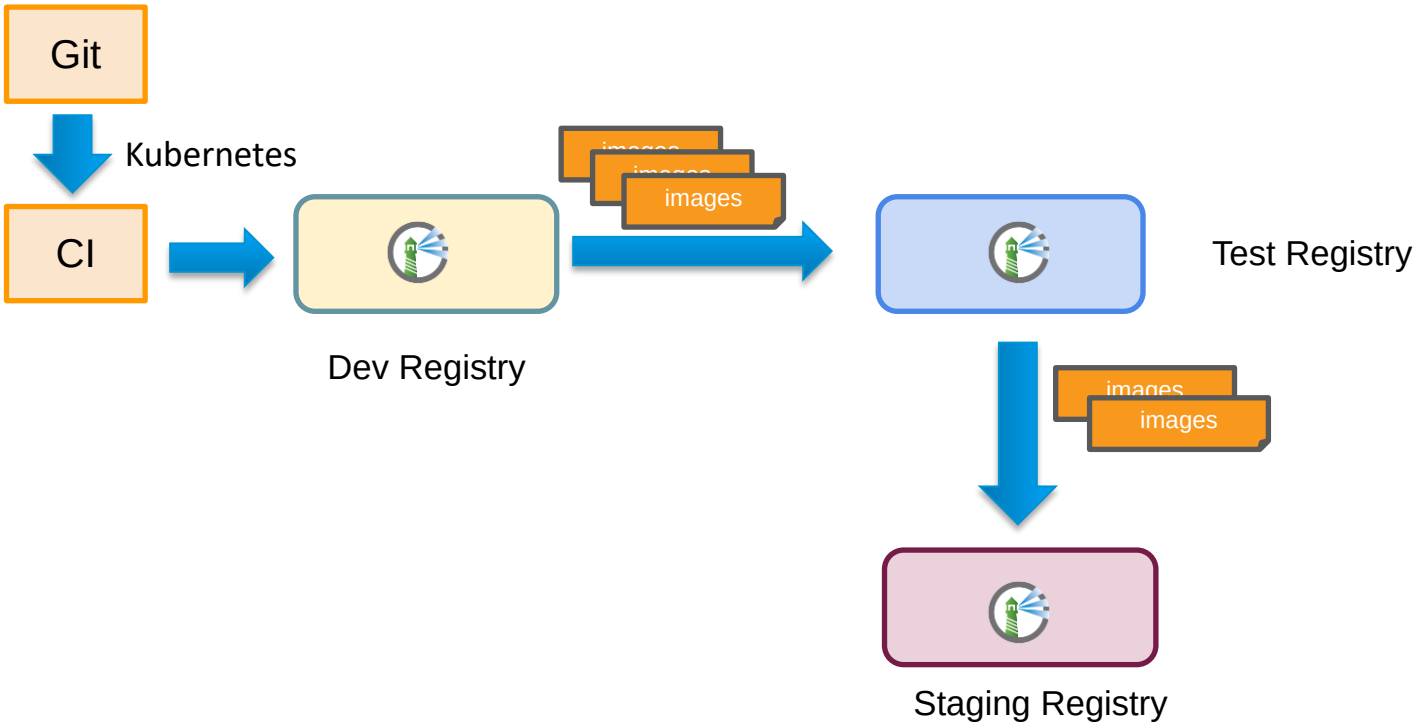
Harbor Architecture



Typical Use Cases

- Image consistency through software lifecyle
- Shipping images in “binary” format
- Image replication unlocks interesting deployment architectures
- Auth{Z,N}
- Vulnerability scanning
- Image signing
- Helm chart management

Shipping “Binaries”



Production Ready Kubernetes Cluster –Kubespray

Kubespray is a sig-cluster-lifecyle’s project to create, configure and manage kubernetes clusters. It provides optional,additive functionality on top of core kubernetes.

Kubespray at a glance

- Cluster lifecycle manager
- Flexible and composable
- Production ready
- Ansible based
- One package-based component: Docker,Cri-o etc…
- Multi-arch
- Community driven since 2015
- Base of kubeadm since 2018
- Just bring your own machine
- Certified Kubernetes Installer(CNCF)

Deployment workflow

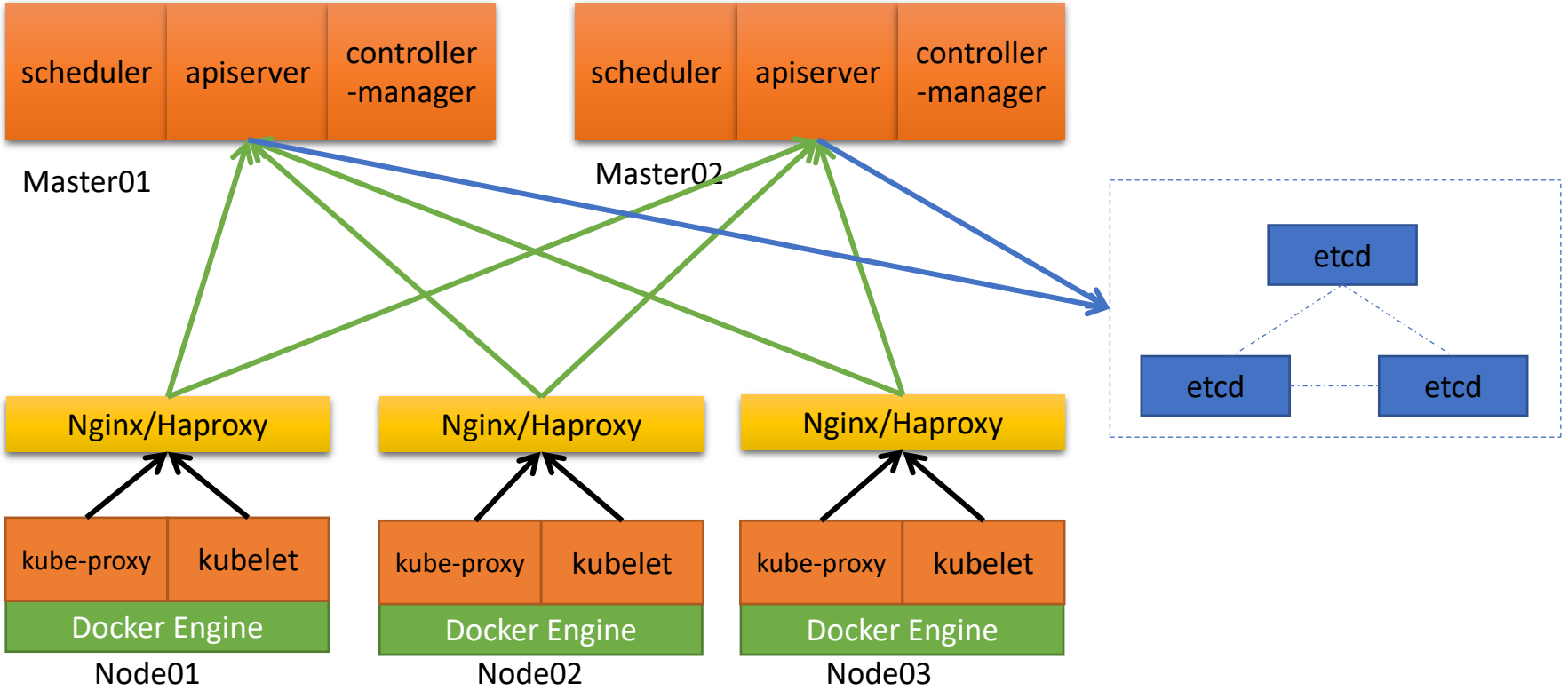
- Bootstrap OS
- Preinstall step
- Install Docker
- Install etcd
- Install Kubernetes Master
- Install Kubernetes Minion
- Configure network plugin
- Addons

High Availability

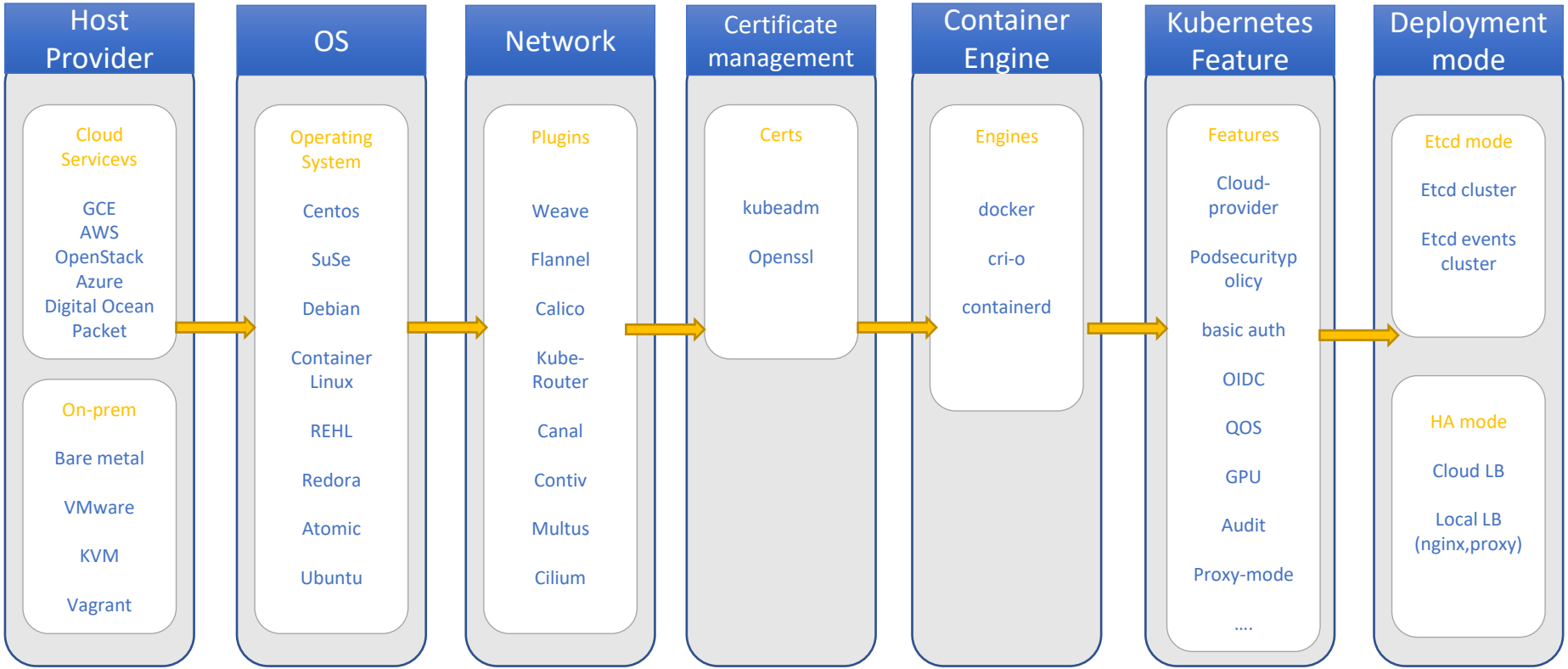
- Etcd
  - Native support for all clients to connect to all ETCD instances

- Apiserver
  - External LB (Cloud LB,F5)
  - Local LB (nginx,proxy),static pod in kubernetes cluster

Local LB (default)



User options



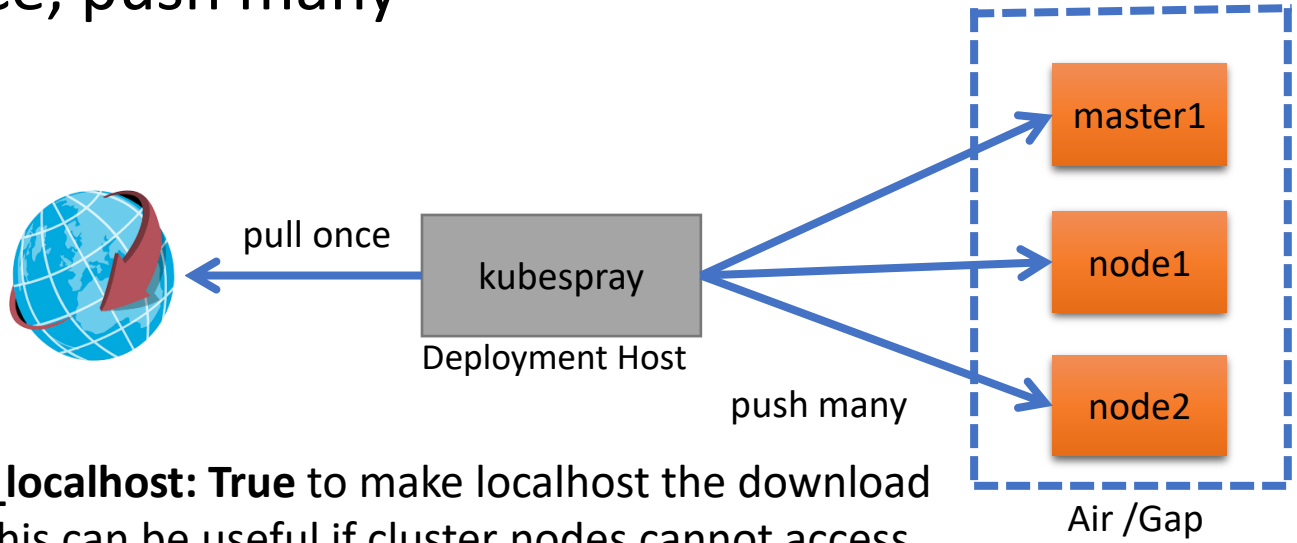
Offline options

- Binaries
  - **foo_download_url**
- Images
  - When using docker， **docker_insecure_registries** and **docker_registry_mirrors**
- System packages
  - When container_manager=docker, **docker_foo_repo_base_url,** docker_foo_repo_gpgkey, **dockerproject_bar_repo_base_url** and dockerproject_bar_repo_gpgkey (where foo is the distribution and baris system package manager)
  - When container_manager=crio, **crio_rhel_repo_base_url**
- Helm charts
  - When using Helm, **helm_stable_repo_url**

https://kubespray_downloads.md#offline-environment

Air /Gap options

pull once, push many



download_localhost: True to make localhost the download delegate. This can be useful if cluster nodes cannot access external addresses. Download container images and binaries only once and then push them to the cluster nodes.

https://air_gap_kubespray_download

Community

Stars

6400+

Forks

2600+

Commits

4400+

Contributors

450+

Join us

Slack

#kubespray
#kubespray-dev

Github

http://kubespray.io
http://github.com/kubernetes-sigs/kubespray

WeChat

Kubespray China

How to setup kubespray in an Air Gap/Offline environment

Air Gap/Offline: High Availability Install

- Harbor
  - Harbor offline installer
  - Collect Images and Publish Images Or CI pipeline
- Kubespray
  - Install requirements.txt
  - Modify the roles/download images registry
  - Install kubernetes cluster and add private registry(harbor) options, etc…

Lifecycle of cluster operations

- cluster.yml
  - Install or reconfigure a cluster
- upgrade-cluster.yml
  - Graceful rolling upgrade to a new version
  - Backup， etcd snapshots taken during upgrade
- scale.yml
  - Add a node to an existing cluster
- remove-node.yml
  - Remove a particular node from a cluster
- reset.yml
  - Uninstall an entire cluster

New cluster

ansible-playbook -i inventory/sample/cluster1.ini cluster.yml -e kube_version=v1.12.3 -e **docker_insecure_registries=[‘**mirror.registry.io’,’172.19.16.11’**]**

cluster1.ini

```
[all]
kube-master01 ansible_host=10.32.7.143  ip=10.32.7.143
kube-node01    ansible_host=10.32.7.135  ip=10.32.7.135

[kube-master]
kube-master01

[etcd]
kube-master01

[kube-node]
kube-node01

[k8s-cluster:children]
kube-master
kube-node
```

Scale node

ansible-playbook -i inventory/sample/cluster1.ini scale.yml -e kube_version=v1.12.5 -e **docker_insecure_registries=[‘**mirror.registry.io’,’172.19.16.11’**]**

cluster1.ini

```
[all]
kube-master01 ansible_host=10.32.7.143  ip=10.32.7.143
kube-node01   ansible_host=10.32.7.135  ip=10.32.7.135
kube-node02   ansible_host=10.32.7.136  ip=10.32.7.136

[kube-master]
kube-master01

[etcd]
kube-master01

[kube-node]
kube-node01
Kube-node02

[k8s-cluster:children]
kube-master
kube-node
```

Scale master

ansible-playbook -i inventory/sample/cluster1.ini cluster.yml -e kube_version=v1.12.5 -e **docker_insecure_registries=[‘**mirror.registry.io’,’172.19.16.11’**] -–skip-tags=node,network,apps**

cluster1.ini

```
[all]
kube-master01 ansible_host=10.32.7.143  ip=10.32.7.143
kube-master02 ansible_host=10.32.7.144  ip=10.32.7.144
Kube-master03 ansible_host=10.32.7.145  ip=10.32.7.145
kube-node01    ansible_host=10.32.7.135  ip=10.32.7.135
[kube-master]
kube-master01
Kube-master02
Kube-master03
[etcd]
kube-master01
Kube-master02
Kube-master03
[kube-node]
kube-node01
[k8s-cluster:children]
kube-master
kube-node
```

Upgrade cluster

ansible-playbook -i inventory/sample/cluster1.ini upgrade-cluster.yml -e kube_version=v1.13.3 -e **docker_insecure_registries=[**‘mirror.registry.io’,’172.19.16.11’**]**

Other operations:

- Upgrade docker:
  --tags=docker
- Upgrade etcd:
- --tags=etcd
- Upgrade Kubernetes master components:
  --tags=master
- Upgrade kubelet:
  --tags=node --skip-tags=k8s-gen-certs,k8s-gen-tokens
- Upgrade network plugins:
  --tags=network
- Upgrade l add-ons:
  --tags=apps

Remove node and Uninstall cluster

- Remove nodes

  ansible-playbook -i inventory/sample/cluster1.ini remove-node.yml –e "node=kube-node02“

- Uninstall cluster

  ansible-playbook -i inventory/sample/cluster1.ini reset.yml

Thanks

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Q&A