Deploy Kubernetes...From Kubernetes
An overview of Cluster API

FOSDEM 2024 – Brussels, Belgium
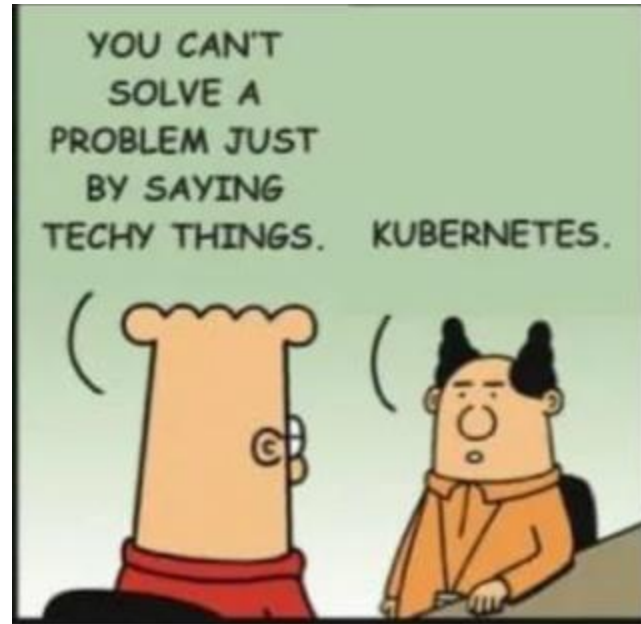
3rd February 2024

Hello ✌️

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Flatcar Maintainer, Microsoft

Context

Deploying Kubernetes

Denis @zwindler

On a dépassé les 100 personnes intéressées (le sondage est pas encore fini)

Je vous dit tout de suite, j'ai été un poil ambitieux avec mon titre "99 façons de déployer Kubernetes"

Mais on est laaaaarges pour "50 nuances de #Kubernetes", faut même que j'en enlève.

Let's go ✏️ ?

Translate post

https://twitter.com/zwindler/status/1745456748956409899/

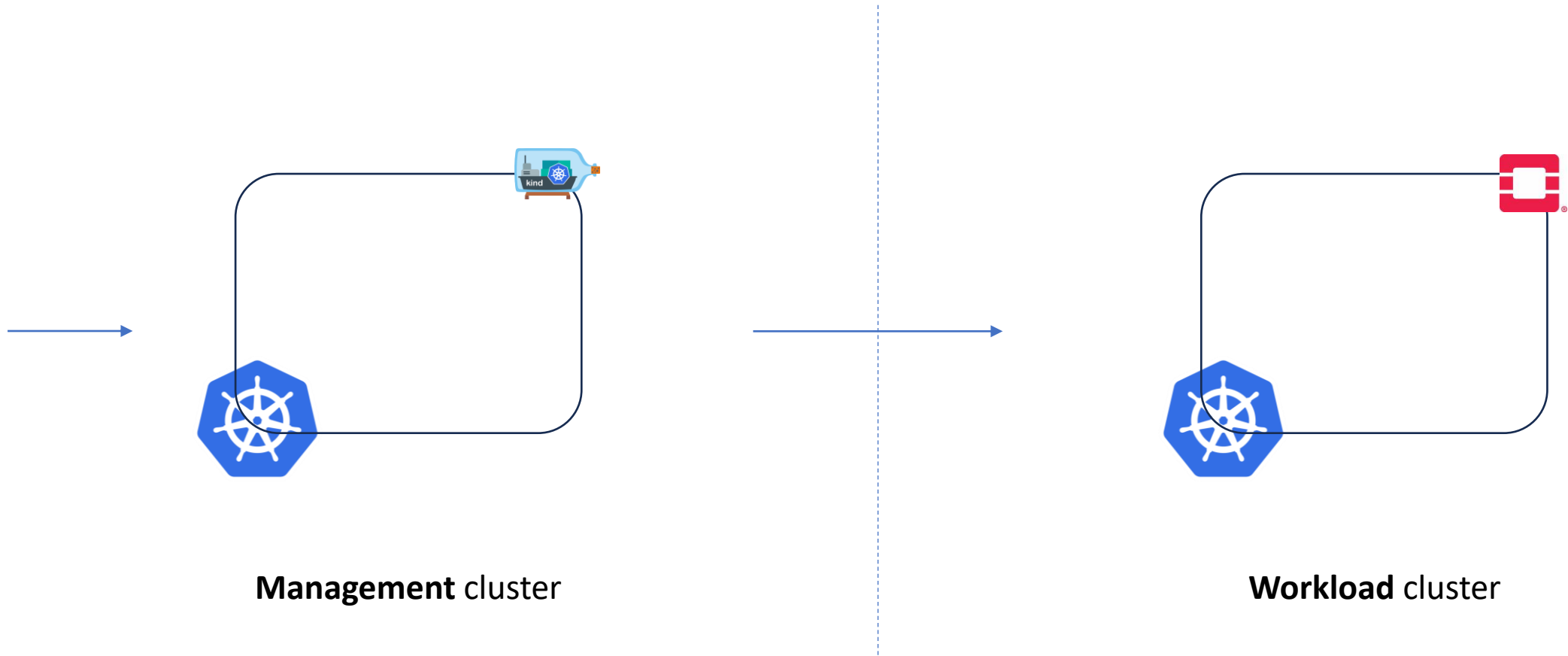| Nom	Url	Articles perso existant	Type
Canonical microk8s	https://microk8s.io/		Desktop
Canonical microk8s w/ WSL2	https://microk8s.io/	https://blog.zwindler.fr/2020/06/01/installer-microk8s-dans-w	Desktop
crc (openshift 4 on a desktop)	https://github.com/crc-org/crc		Desktop
Desktop-Kubernetes	https://github.com/aceeric/desktop-kubernetes		Desktop
Docker desktop	https://www.docker.com/products/docker-desktop/		Desktop
kind (Kubernetes in docker)	https://kind.sigs.k8s.io/		Desktop
Minikube	https://kubernetes.io/fr/docs/tasks/tools/install-minikube/		Desktop
Minikube Windows w/ hyperV	https://kubernetes.io/fr/docs/tasks/tools/install-minikube/	https://blog.zwindler.fr/2018/10/02/minikube-sur-hyper-v-pa	Desktop
minikube Windows w/ virtualbox	https://kubernetes.io/fr/docs/tasks/tools/install-minikube/		Desktop
minishift (openshift 3 on a desktop)	https://github.com/minishift/minishift		Desktop
Podman desktop	https://podman-desktop.io/		Desktop
Rancher Desktop	https://rancherdesktop.io/		Desktop
Rancher k3d	https://github.com/k3d-io/k3d		Desktop
Ansible (alvista)	ansible-collection-kubernetes		IaC
Azure aks-engine (deprecated)	https://github.com/Azure/aks-engine		IaC
Kubernetes ClusterAPI	https://cluster-api.sigs.k8s.io/		IaC
Kubespray	https://github.com/kubernetes-sigs/kubespray	https://blog.zwindler.fr/2017/12/05/installer-kubernetes-kube	IaC
Pulumi	https://www.pulumi.com/kubernetes/		IaC
Puppet	https://forge.puppet.com/modules/puppetlabs/kubernetes/readme		IaC
Vagrant-kubernetes (alvistack)	https://github.com/alvistack/vagrant-kubernetes		IaC
vcluster (Virtual Kubernetes Clusters)	https://www.vcluster.com/docs/what-are-virtual-clusters		IaC
Alibaba Cloud Container Service for Kubernetes (ACK)	https://www.alibabacloud.com/fr/product/kubernetes		Managed
AWS EKS	https://aws.amazon.com/fr/eks/	https://www.ibm.com/cloud/container-service/	Managed
Azure AKS	https://azure.microsoft.com/fr-fr/products/kubernetes-serv	https://blog.zwindler.fr/2018/12/18/jai-teste-pour-vous-aks-l	Managed
Civo	https://www.civo.com/	https://blog.zwindler.fr/2021/07/16/civo-du-kubernetes-man	Managed
Digital Ocean DOKS	https://www.digitalocean.com/products/kubernetes/		Managed
Exoscale SKS	https://community.exoscale.com/documentation/sks/over	https://blog.zwindler.fr/2021/05/03/test-de-sks-le-kubernete	Managed
Google Cloud Platform GKE	https://cloud.google.com/kubernetes-engine?hl=fr		Managed
Gridscale Managed Kubernetes (GSK)	https://gridscale.io/en/products/kubernetes/		Managed
IBM Cloud (IKS)	https://www.ibm.com/cloud/container-service/		Managed
IONOS Kubernetes Service	https://cloud.ionos.com/managed/kubernetes		Managed
Karpenter (AWS)	https://karpenter.sh/		Managed
Kops (AWS)	https://github.com/kubernetes/kops		Managed
Linode Kubernetes Engine (LKE)	https://www.linode.com/docs/kubernetes/		Managed
Oracle Cloud Infrastructure Container Engine for Kubernetes (OKE)	https://www.oracle.com/fr/cloud/cloud-native/container-engine-kubernetes/		Managed
OVH Cloud MKS	https://www.ovhcloud.com/fr/public-cloud/kubernetes/	https://blog.zwindler.fr/2019/07/09/jai-teste-pour-vous-loffre	Managed
Redhat Openshift cloud	https://www.redhat.com/fr/technologies/cloud-computing/openshift/openshift-cloud-services		Managed
Scaleway Kapsule	https://www.scaleway.com/en/kubernetes-kapsule/		Managed
SysEleven	https://www.syseleven.de/en/		Managed
Vultr	https://www.vultr.com/kubernetes/		Managed
Kubermatic KubeOne	https://www.kubermatic.com/products/kubermatic-kubeone/		Management platform
Kubermatic Kubernetes Platform	https://github.com/kubermatic/kubermatic		Management platform
Rancher	https://ranchermanager.docs.rancher.com/		Management platform
Tanzu	https://docs.vmware.com/en/VMware-Tanzu-Application-Platform/index.html		Management platform
Play with k8s	https://labs.play-with-k8s.com/		Other
A la main, via des containers	https://github.com/kubernetes/registry.k8s.io		Selfhosted
A la main, via les binaires	https://github.com/kubernetes/kubernetes	https://github.com/zwindler/demystifions-kubernetes	Selfhosted
Canonical Juju	https://juju.is/		Selfhosted
k3sup	https://github.com/alexellis/k3sup		Selfhosted
k8e	https://github.com/xiaods/k8e		Selfhosted
K8S The Easy way	https://github.com/darxkies/k8s-tew		Selfhosted
kubeadm w/ CLI	https://kubernetes.io/fr/docs/setup/production-environmen	https://blog.zwindler.fr/2017/06/07/installer-cluster-kubernet	Selfhosted
kubeadm w/ ClusterConfiguration	https://kubernetes.io/fr/docs/setup/production-environmen	https://blog.zwindler.fr/2023/12/17/kubeadmcfg-introduction	Selfhosted
Kubernetes the hard way	https://github.com/kelseyhightower/kubernetes-the-hard-way		Selfhosted
Kubernetes the hard way w/ Terraform	https://github.com/aidanSoles/kubernetes-the-hard-way-terraform		Selfhosted
Kurl	https://github.com/replicatedhq/kurl		Selfhosted
Mirantis k0s	https://k0sproject.io/		Selfhosted
OKD (open source openshift)	https://okd.io/#what-is-okd		Selfhosted
OpenNebula OneKE	https://docs.opennebula.io/6.8/marketplace/appliances/oneke.html		Selfhosted
Rancher elemental (ex k3os)	https://elemental.docs.rancher.com/	https://blog.zwindler.fr/2020/12/08/k3os-le-reboot-de-ranche	Selfhosted
Rancher harvester	https://harvesterhci.io/	https://blog.zwindler.fr/2023/01/24/test-rancher-labs-harves	Selfhosted
Rancher k3s w/ cli	https://k3s.io/	https://blog.zwindler.fr/2023/09/01/k3s-et-cilium-rapide-et-fa	Selfhosted
Rancher k3s w/ config files	https://k3s.io/		Selfhosted
Rancher RKE2	https://docs.rke2.io/	https://blog.zwindler.fr/2020/11/30/kubernetes-avec-ranche	Selfhosted
Talos Linux	https://www.talos.dev/v1.6/introduction/quickstart/		Selfhosted
typhoon	https://github.com/poseidon/typhoon		Selfhosted

Cluster API

Cluster API is a Kubernetes sub-project focused on providing declarative APIs and tooling to simplify provisioning, upgrading, and operating multiple Kubernetes clusters.

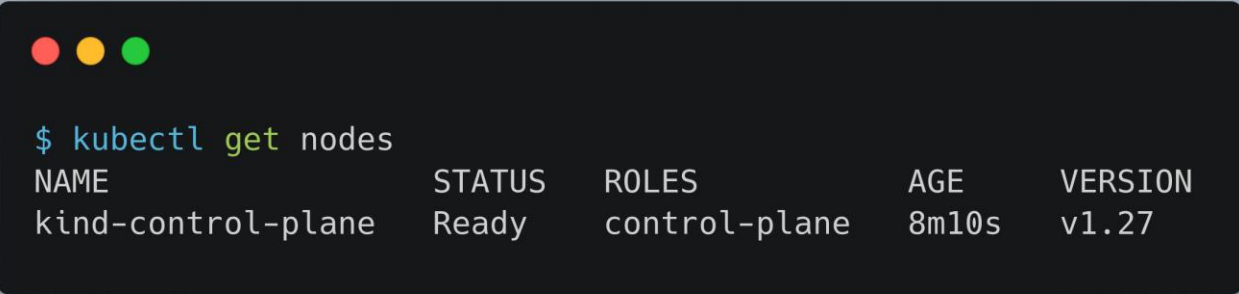*[...] the Cluster API project uses Kubernetes-style APIs and patterns to automate cluster lifecycle management for platform operators*

https://cluster-api.sigs.k8s.io/

Deploy Kubernetes... From Kubernetes

Management cluster

Workload cluster
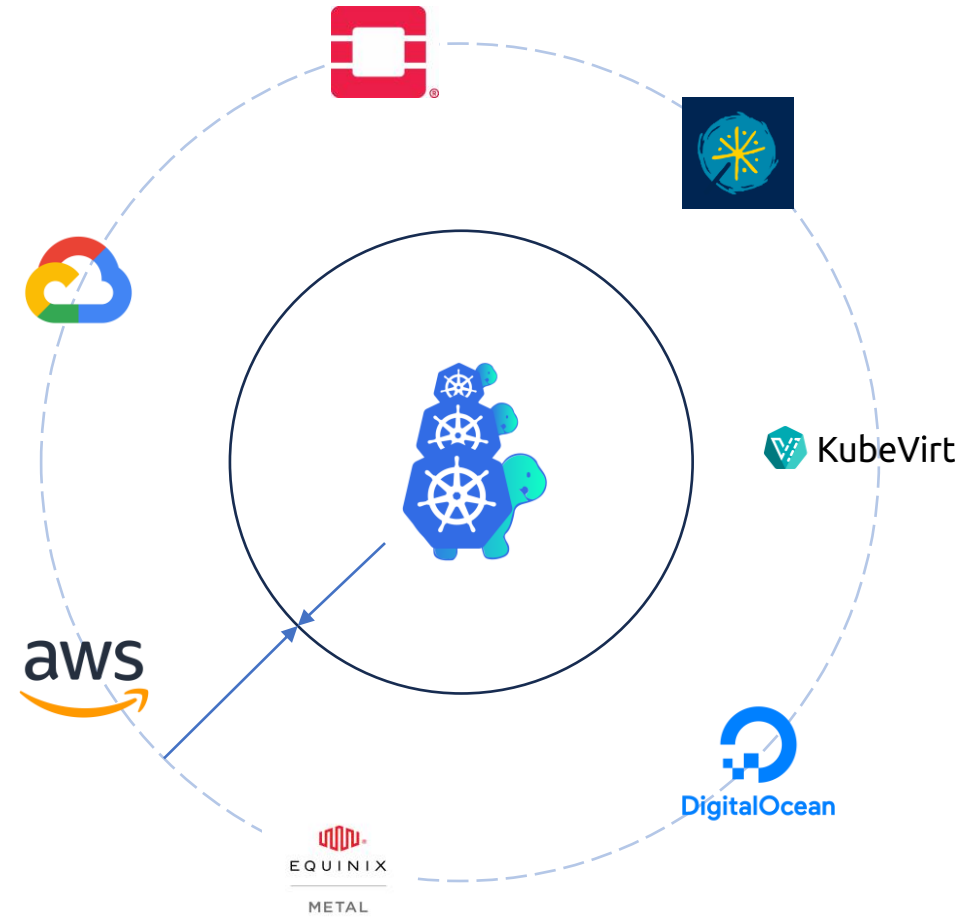
Example - init


```
$ kubectl get nodes
NAME                 STATUS    ROLES           AGE      VERSION
kind-control-plane   Ready     control-plane   8m10s    v1.27
```

Management cluster deployed with Kind

Under the hood

Example - generate


```
$ clusterctl generate cluster capi-quickstart \
  --flavor flatcar \
  --kubernetes-version v1.29.1 \
  --control-plane-machine-count=1 \
  --worker-machine-count=3 > capi-quickstart.yaml
```

Workload cluster configuration generated

Example - deploy


```
$ kubectl apply -f ./capi-quickstart.yaml
secret/capi-quickstart-cloud-config unchanged
kubeadmconfigtemplate.bootstrap.cluster.x-k8s.io/capi-quickstart-md-0 created
cluster.cluster.x-k8s.io/capi-quickstart created
machinedeployment.cluster.x-k8s.io/capi-quickstart-md-0 created
kubeadmcontrolplane.controlplane.cluster.x-k8s.io/capi-quickstart-control-plane created
openstackcluster.infrastructure.cluster.x-k8s.io/capi-quickstart created
openstackmachinetemplate.infrastructure.cluster.x-k8s.io/capi-quickstart-control-plane unchanged
openstackmachinetemplate.infrastructure.cluster.x-k8s.io/capi-quickstart-md-0 created
```

Workload cluster deployed

Example – provider side

FLAT CAR

Security Groups

Displaying 6 items

	Name	Security Group ID	Description
☐	default	6233d7f3-607b-410b-beb9-c0d51c292558	Default security group
☐	k8s-cluster-default-capi-quickstart-secgroup-controlplane		
☐	k8s-cluster-default-capi-quickstart-secgroup-worker		

Filter 🔍

Project / Network / Networks / k8s-clusterapi-cluster-defaul…

k8s-clusterapi-cluster-default-capi-quickstart

Overview   Subnets   Ports

Subnets

Displaying 1 item

	Name
☐	k8s-clusterapi-cluster-default-capi-quickstart

Displaying 1 item

Instances

Displaying 4 items

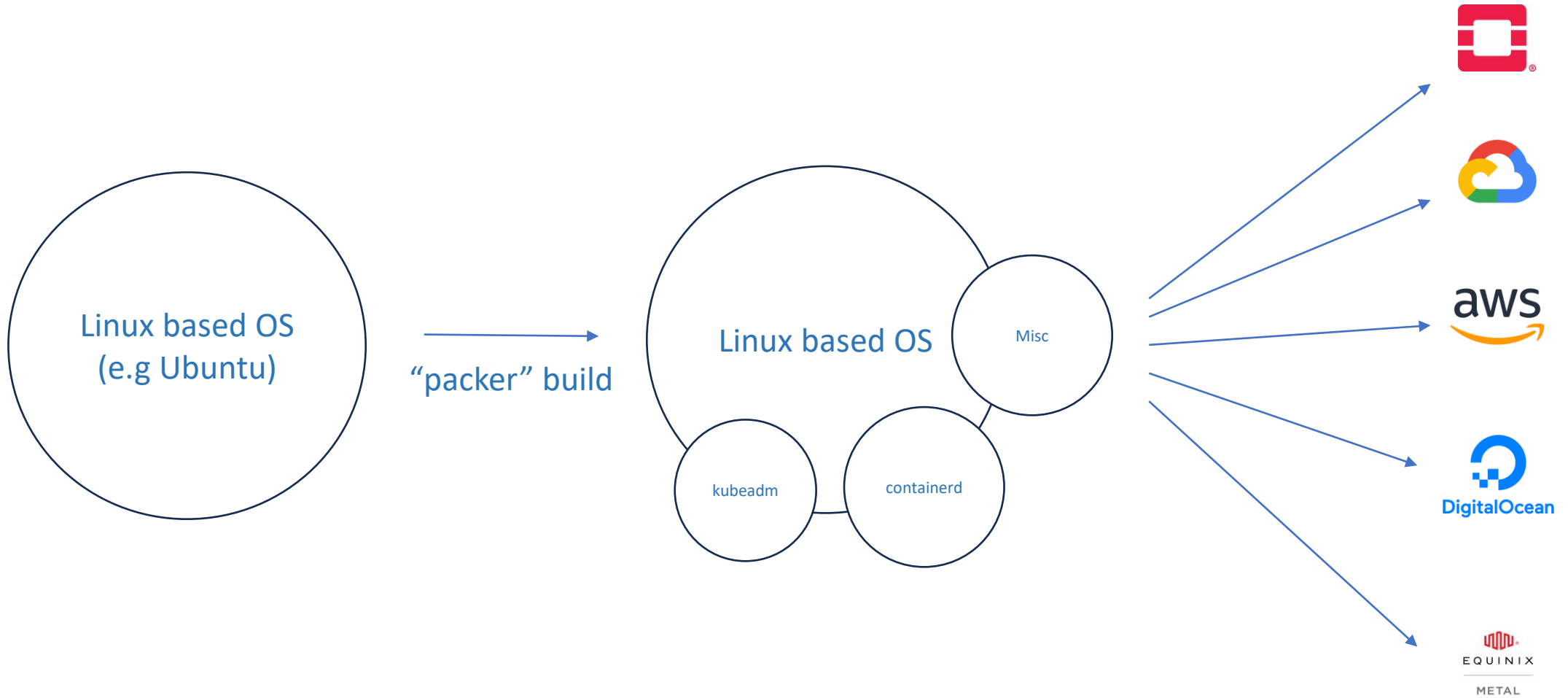|	Instance Name	Image Name	IP Address
☐	capi-quickstart-md-0-z4l6h	flatcar-stable-builder	10.6.0.3
☐	capi-quickstart-md-0-f66jd	flatcar-stable-builder	10.6.0.132
☐	capi-quickstart-md-0-8p7v2	flatcar-stable-builder	10.6.0.204
☐	capi-quickstart-control-plane-z2kf6	flatcar-stable-builder	10.6.0.176, 172.24.4.254

OpenStack resources automatically created
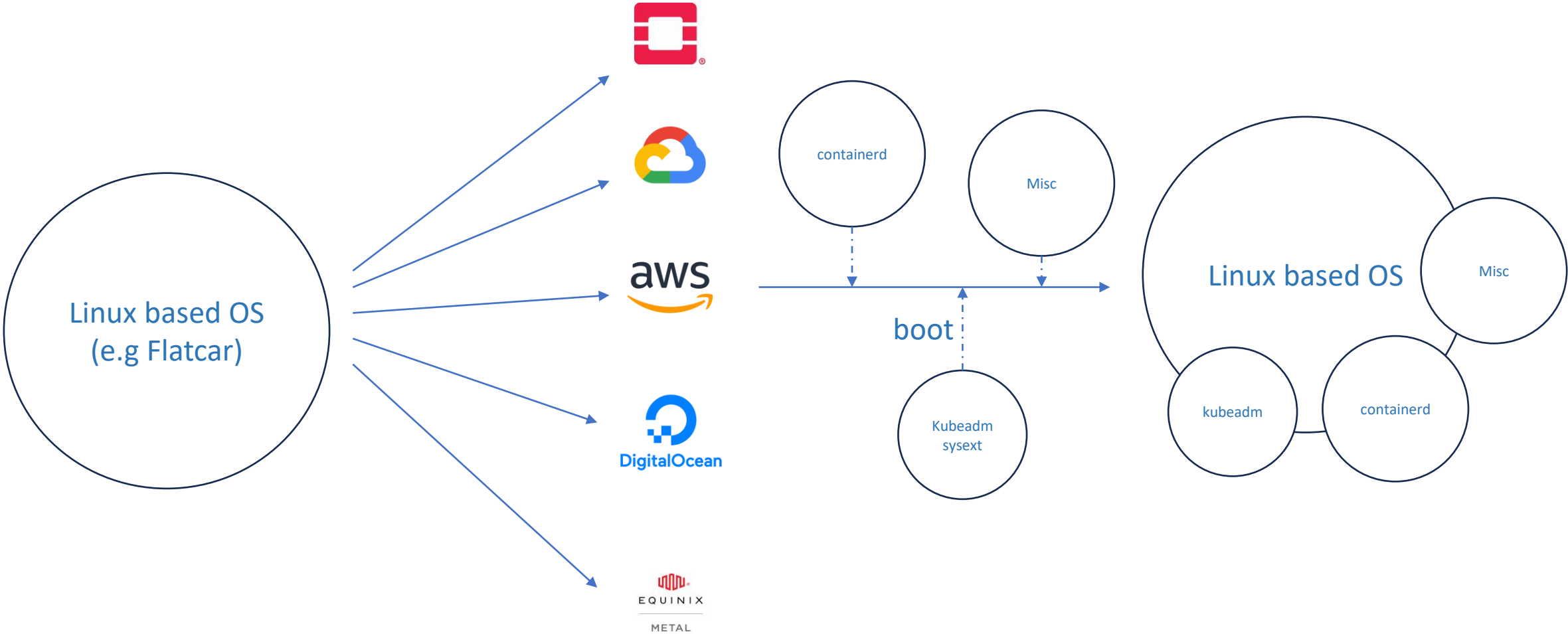
What powers my nodes?


```
$ kubectl --kubeconfig=./${CLUSTER_NAME}.kubeconfig get nodes -o yaml | yq ".items[0].status.nodeInfo"
architecture: amd64
bootID: 0e56c6e7-9843-4355-b2b9-7feb5e33eb54
containerRuntimeVersion: containerd://1.7.10
kernelVersion: 5.15.142-flatcar
kubeProxyVersion: v1.28.5
kubeletVersion: v1.28.5
machineID: 77e94e85ca224205ac2ce7a4b106ffa6
operatingSystem: linux
osImage: Flatcar Container Linux by Kinvolk 3602.2.3 (Oklo)
systemUUID: 77e94e85-ca22-4205-ac2c-e7a4b106ffa6
```

Workload cluster node inspection

What powers my nodes?

Linux based OS (e.g Ubuntu) → "packer" build → Linux based OS (kubeadm, containerd, Misc)

An alternative to the image-builder?

An alternative to the image-builder?


```
$ clusterctl generate cluster capi-quickstart \
  --flavor flatcar-sysext \
  --kubernetes-version v1.29.1 \
  --control-plane-machine-count=1 \
  --worker-machine-count=3 > capi-quickstart.yaml
```

Workload cluster config generation using flatcar-sysext flavor

Node side

SSH on one node

Resources

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

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

- Flatcar: https://www.flatcar.org/docs/latest/container-runtimes/getting-started-with-kubernetes/

- Systemd Sysext: https://www.freedesktop.org/software/systemd/man/latest/systemd-sysext.html

TODO: ADD QR CODE POINTING THE SLIDES DOWNLOADING

Thank you

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