Installing and Configuring Kubernetes

Kien Bui
DevOps & Platform Engineer

Course Overview

Introduction

Exploring Kubernetes Architecture

Installing and Configuring Kubernetes

Working with Your Kubernetes Cluster

Overview

Installation Considerations

Installation Overview

Getting Kubernetes

Installing a Cluster with `kubeadm`

Creating a Cluster in the Cloud

Installation Considerations

Where to install?

- Cloud
  - IaaS - Virtual Machines
  - PaaS - Managed Service
- On-Premises
  - Bare Metal
  - Virtual Machines

Which oneshould you choose?

Installation Considerations (con't)

Cluster Networking

Scalability

High Availability

Disaster Recovery

Installation Methods

Desktop

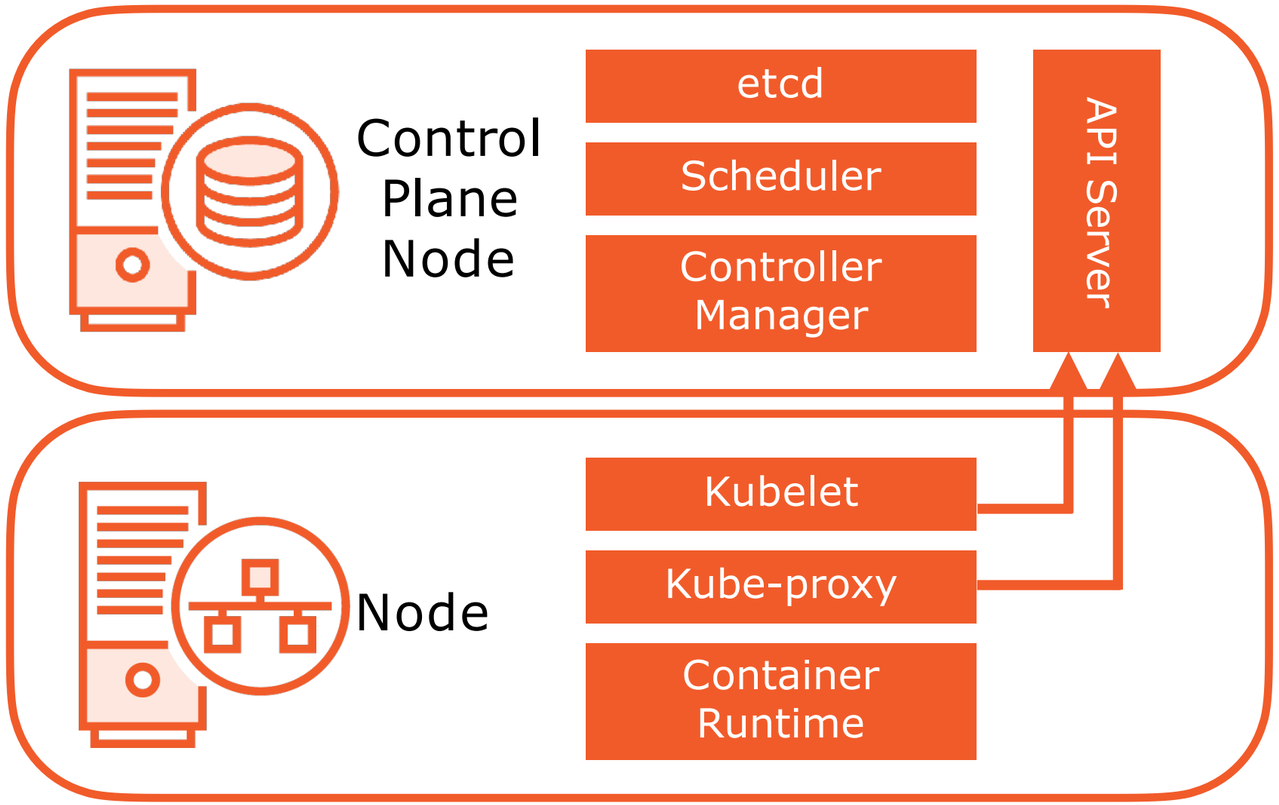
kubeadm

Cloud Scenarios

Installation Requirements

System Requirements	Container Runtime	
Linux - Ubuntu/RHEL	Container Runtime Interface (CRI)	Connectivity between all Nodes
2 CPUs	containerd	Unique hostname
2GB RAM	Docker (Deprecated 1.20)	Unique MAC address
Swap Disabled	CRI-O	

Cluster Network Ports



Component	Ports (tcp)	Used By
API	6443	All
etcd	2379-2380	API/etcd
Scheduler	10251	Self
Controller Manager	10252	Self
Kubelet	10250	Control Plane

Kubelet	10250	Control Plane
NodePort	30000-32767	All

Getting Kubernetes

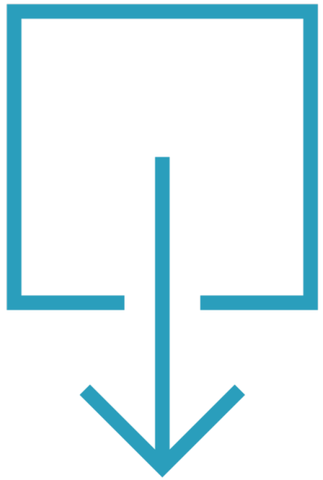
Maintained on GitHub

https://github.com/kubernetes/kubernetes

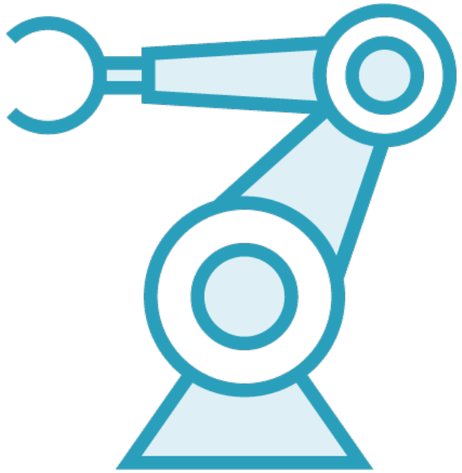
Linux Distribution Repositories

yum and apt

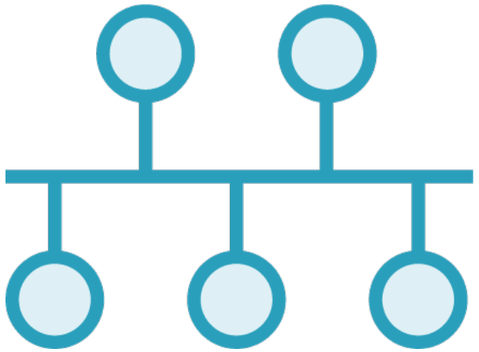
Building Your Cluster



Install and Configure Packages



Create Your Cluster



Configure Pod Networking

Join Nodes to Your Cluster

Required Packages

containerd

kubelet

kubeadm

kubectl

Install on all Nodes in your cluster

Getting and Installing Kubernetes on Ubuntu VMs

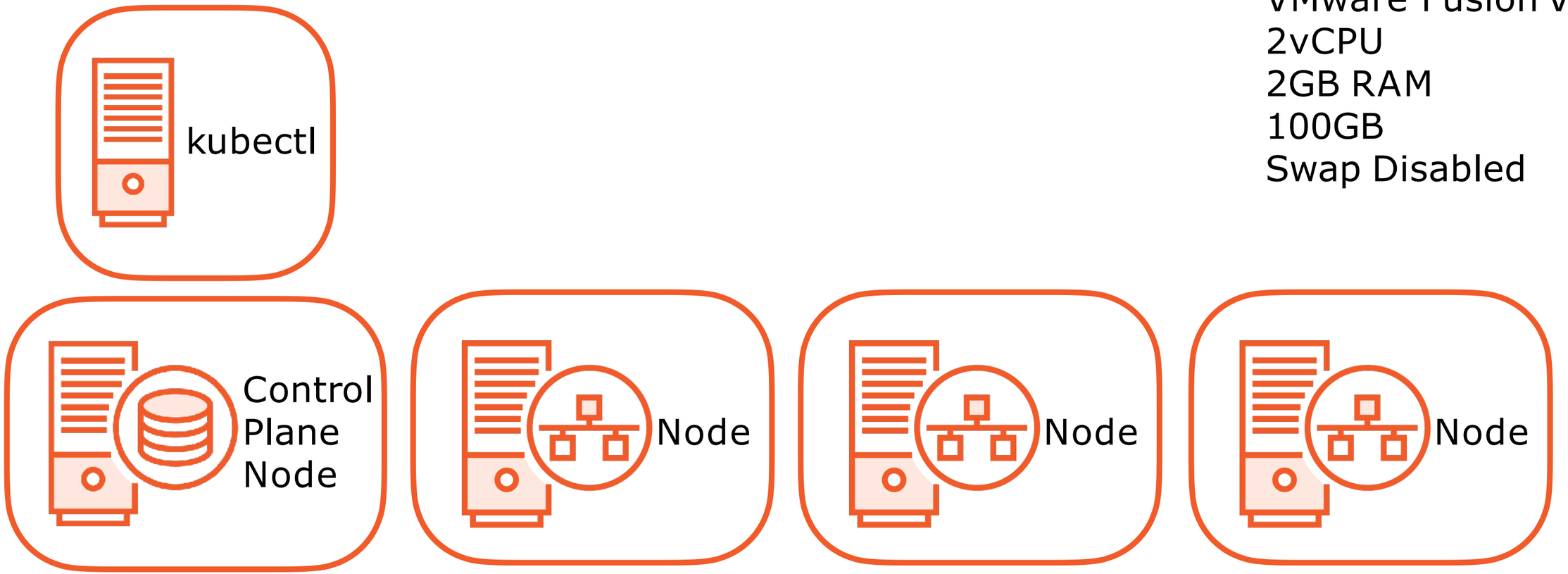
```
sudo apt-get install -y containerd

curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -

cat <<EOF >/etc/apt/sources.list.d/kubernetes.list
deb https://apt.kubernetes.io/ kubernetes-xenial main
EOF

apt-get update
apt-get install -y kubelet kubeadm kubectl
apt-mark hold kubelet kubeadm kubectl containerd
```

Do this on allnodes

Lab Environment

Hostnames set
Host file on each

Ubuntu 18.04
VMware Fusion VMs
2vCPU
2GB RAM
100GB
Swap Disabled



c1-cp1
172.16.94.10
c1-master1

c1-node1
172.16.94.11

c1-node2
172.16.94.12

c1-node3
172.16.94.13

Demo

Install Packages

- containerd
- kubelet
- kubeadm
- kubectl

systemd Units

Process is customizable

...strapping a Cluster with kubeadm

`kubeadm init`

Pre-flight checks

Creates a Certificate Authority

Generates kubeconfig files

Generates Static Pod Manifests

Wait for the Control Plane Pods to Start

Taints the Control Plane Node

Generates a Bootstrap Token

Starts Add-On components: DNS and kube-proxy

Certificate Authority

Self signed Certificate Authority (CA)

Can be part of an external PKI

Securing cluster communications

API Server

Authentication of users and cluster components

`/etc/kubernetes/pki`

Distributed to each Node

https://kubernetes.io/docs/reference/setup-tools/kubeadm/kubeadm-init/

kubeadm Created kubeconfig Files

Used to define how to connect to your Cluster

- Client certificates
- Cluster API Server network location

`/etc/kubernetes`

- `admin.conf` (kubernetes-admin)
- `kubelet.conf`
- `controller-manager.conf`
- `scheduler.conf`

Static Pod Manifests

Manifest describes a configuration

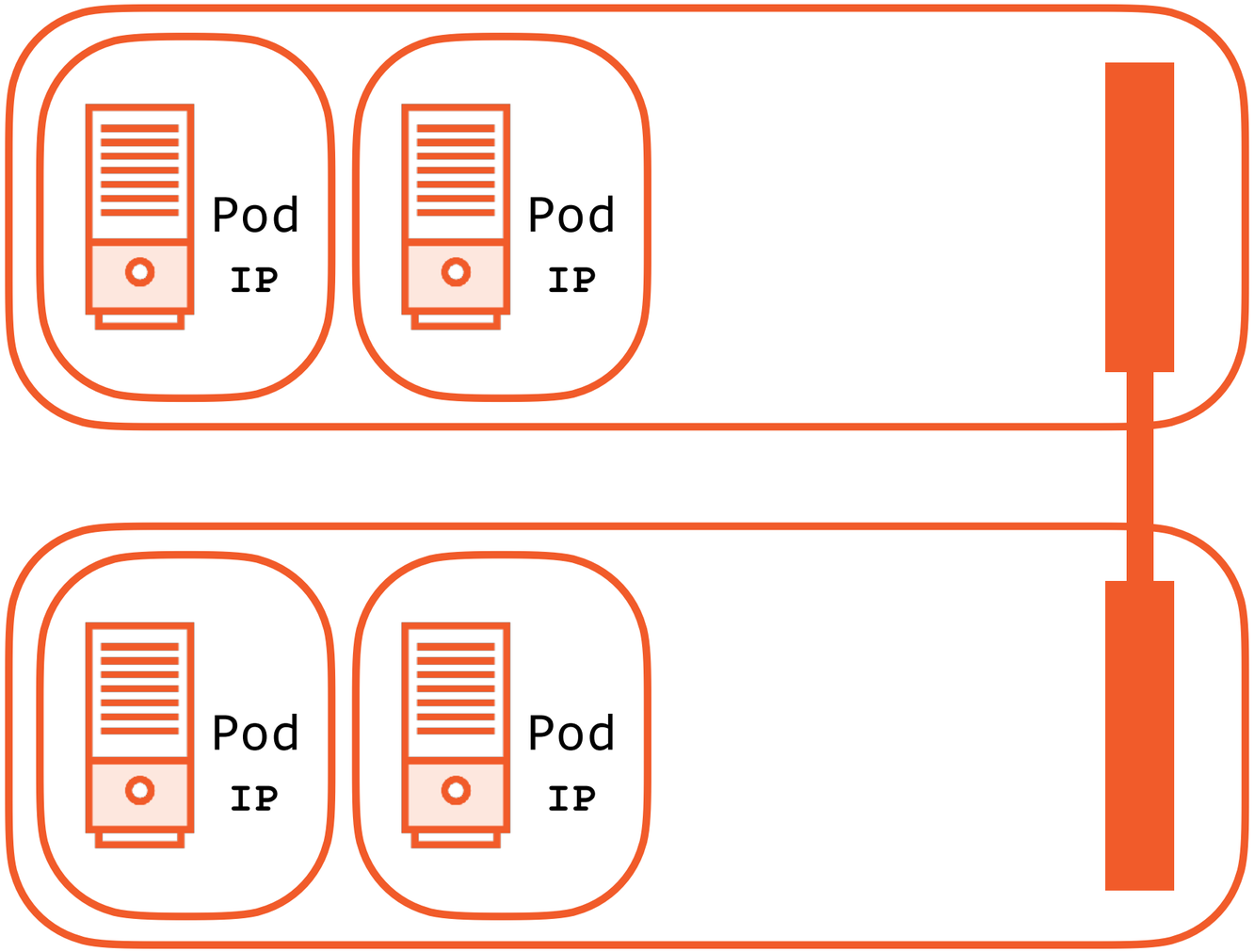
`/etc/kubernetes/manifests`

- etcd
- API Server
- Controller Manager
- Scheduler

Watched by the kubelet started automatically when the system starts and over time

Enable the startup of the cluster…without the cluster

Pod Networking



Single, un NATed IP address per Pod

Direct routing

- Configure infrastructure to support IP reachability between Pods and Nodes

Overlay networking

- Flannel - Layer 3 virtual network
- Calico - L3 and policy based traffic management
- Weave Net - multi-host network

https://kubernetes.io/docs/concepts/cluster-administration/networking/

Creating a Control Plane Node

```
wget https://docs.projectcalico.org/manifests/calico.yaml

kubeadm config print init-defaults | tee ClusterConfiguration.yaml

sudo kubeadm init \
  --config=ClusterConfiguration.yaml \
  --cri-socket /run/containerd/containerd.sock

mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config

kubectl apply -f calico.yaml
```

Adding a Node to a Cluster

Install Packages

`kubeadm join`

Download Cluster Information

Node submits a CSR

CA Signs the CSR automatically

Configures `kubelet.conf`

```
kubeadm join 172.16.94.10:6443 \
  --token i0pr88.pbid2af0071xhuo1 \
  --discovery-token-ca-cert-hash \
  sha256:9a56f13bbae1f77e3a01fecc2bf8c59e6977d9c71c2d3482b988fa47767353d7
```

Adding a Node to a Cluster

Demo

Creating a Cluster

Creating a Pod Network

systemd Units…again!

Static Pod manifests

Joining Nodes to a Cluster

Managed Cloud Deployment Scenarios

Elastic Kubernetes Service (EKS)

https://aws.amazon.com/getting-started/projects/deploy-kubernetes-app-amazon-eks/

Google Kubernetes Engine (GKE)

https://cloud.google.com/kubernetes-engine/docs/how-to/

Azure Kubernetes Services (AKS)

https://docs.microsoft.com/en-us/azure/aks/kubernetes-walkthrough

Demo

Creating a Managed Service Cluster

- Azure Kubernetes Services (AKS)

Summary

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What's Next!

Working With Your Cluster