



kubernetes

Kubernetes Vagrant CI / CD

GitHub Project Repo: [kubernetesVagrant](#)

Sample of Work of fully automate build, deploy, validate containers locally. Deploy on a k8s cluster and validations.

October 3, 2021

Outline I

Introduction

Container Runtime Interface(s)

Kubernetes

CI / CD

Project smooth CI / CD

How to accomplish requirements

The correct tool of choice

Implementation

CI / CD Flow Build / Deploy / Test

CI / CD Flow Kubernetes

Outline II

Implementation

CI / CD Flow Build / Deploy / Test

CI / CD Flow Kubernetes

Architecture

Minimal Kubernetes Components

My view of Kubernetes Minimal Core Components

Demo

Demo CI / CD

Summary

Key points repetition

Bibliography

High level description

- ▶ **VM Vs Container.**
- ▶ What is a Pod (pea pod)?
- ▶ Container Runtime Interface(s) (CRI).
- ▶ Docker Vs Podman.
- ▶ What is actually k8s?

Virtual Machine Vs Container

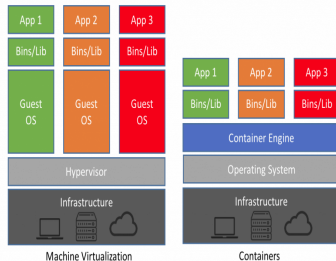


Figure 1: k8s Overview

High level description

- ▶ VM Vs Container.
- ▶ What is a Pod (pea pod)?
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 - ▶ Docker
 - ▶ Podman
 - ▶ CRI-O
- ▶ Docker Vs Podman.
- ▶ What is actually k8s?

Container inside Pod

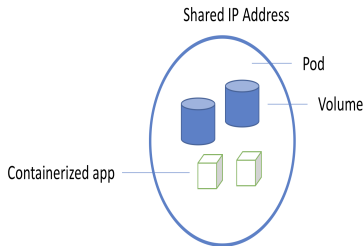


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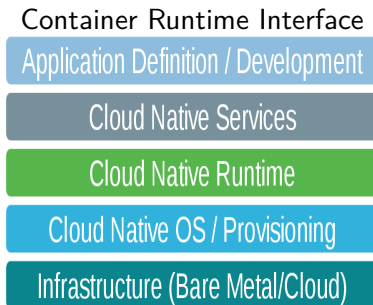


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Most known (insecure) socket

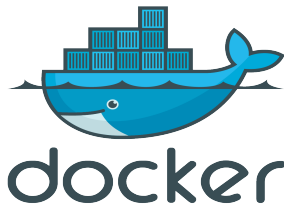


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podman



buildah

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Lightest fastest socket



**CRI-O: OCI-based
Kubernetes Runtime**

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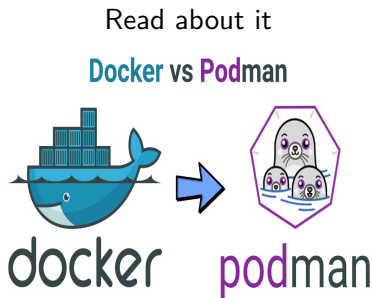


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Is a puzzle of elements

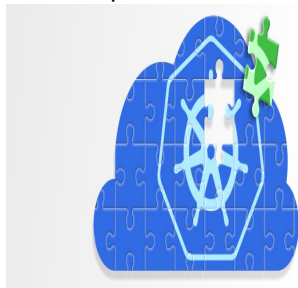


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Problems / Desires / Solutions on CI / CD

Assessment Requirements

- ▶ CI / CD (Locally / Remotely).
- ▶ Everything As a Code
- ▶ Validation Locally!!!
- ▶ OS / Infra. dependencies.

Justification of Requirements

- ▶ Works on my PC, why not on Cloud?
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- ▶ Test (automatically).
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- ▶ Launch a **k8s cluster locally** and run all tests locally!
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Ansible

Possible Questions

- ▶ **Why Ansible?**
- ▶ Are there any benefits of this tool?
- ▶ Ansible works on ssh how it will work locally?
- ▶ How it can interact with Containers, k8s, Cloud, tests?

Possible Answers

- ▶ **Written in Python 2/3. Developed and maintained by RedHat.**
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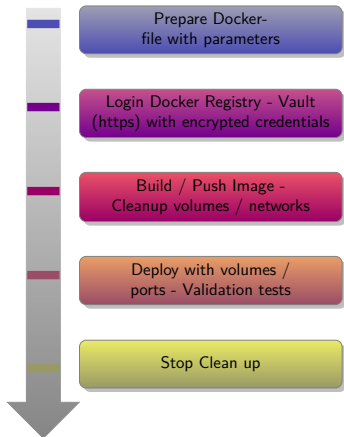
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Local Procedure



► Dockerfile (template).

► Vault ([https](https://vaultproject.io/)).

► Any socket.

► Build / Push Image - Cleanup volumes / networks.

► Deploy with volumes / ports - Validation tests.

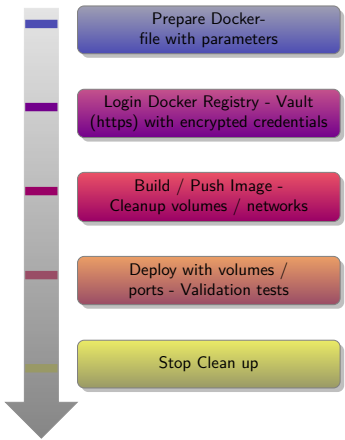
► Stop, Clean up.

► Deployment (volume).

► Validation (tests).

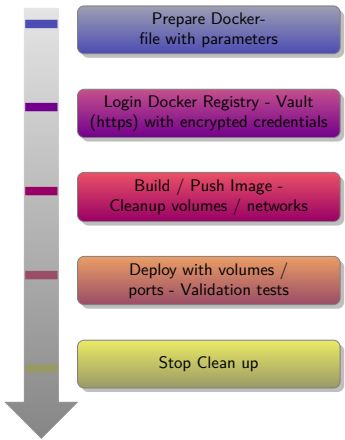
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Local Procedure



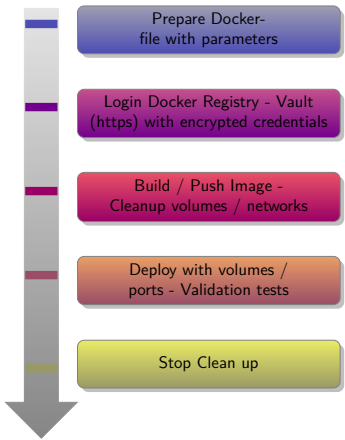
- ▶ Dockerfile (template).
- ▶ Vault (<https>).
- ▶ Any socket.
 - ▶ Azzure Registry.
 - ▶ Dockerfile
 - ▶ Push Image
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 - ▶ Dockerfile
 - ▶ Dockerfile
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Local Procedure



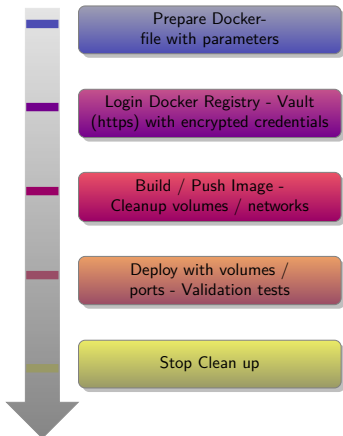
- ▶ Dockerfile (template).
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- ▶ **Any socket.**
 - ▶ Azzure Registry.
 - ▶ Build Dockerfile.
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 - ▶ Logout Azzure.
 - ▶ Prune everything.
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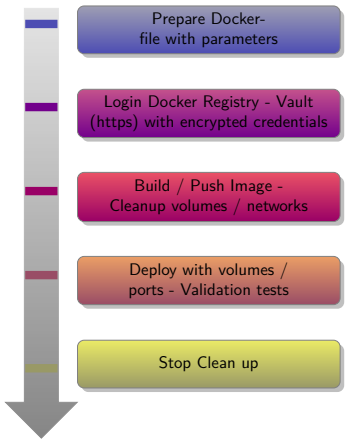
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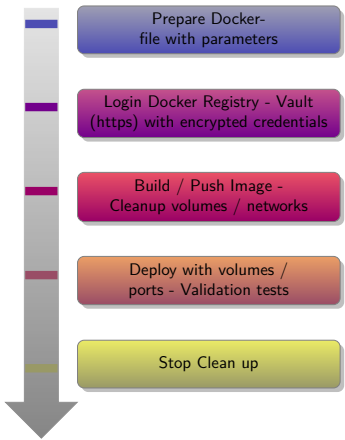
- ▶ Dockerfile (template).
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 - ▶ Azure Registry.
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Local Procedure



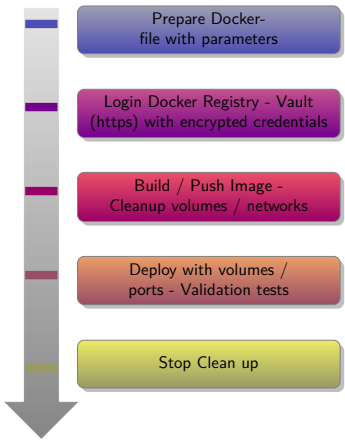
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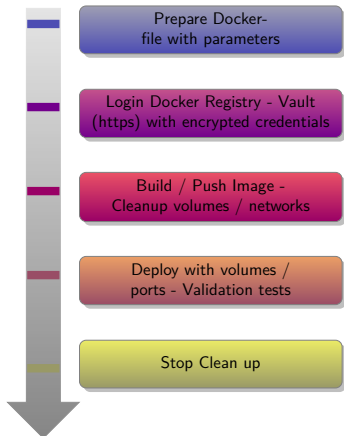
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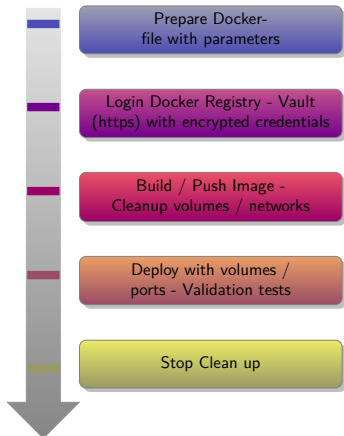
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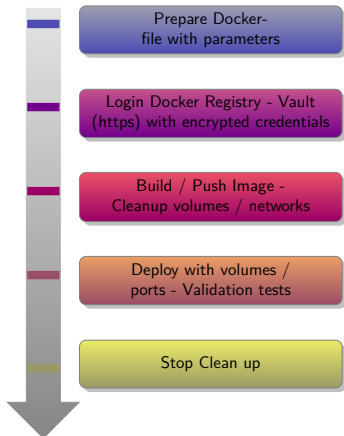
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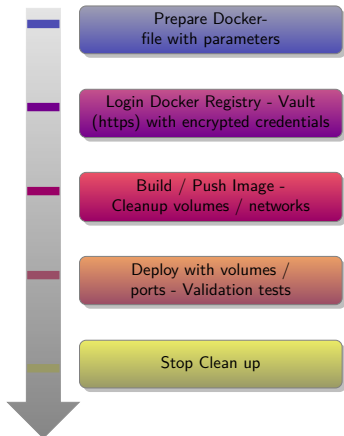
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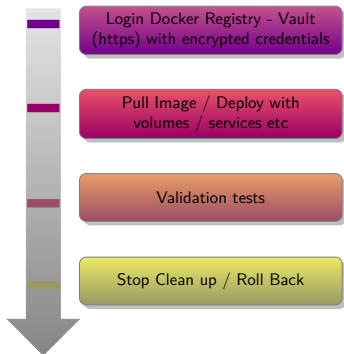
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Local k8s Deployment Procedure



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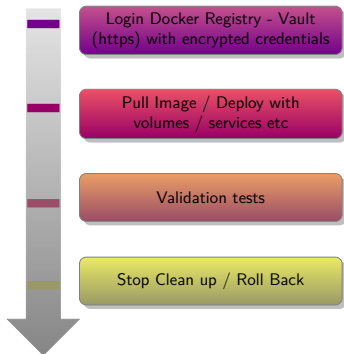
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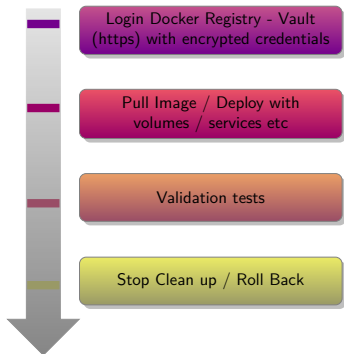
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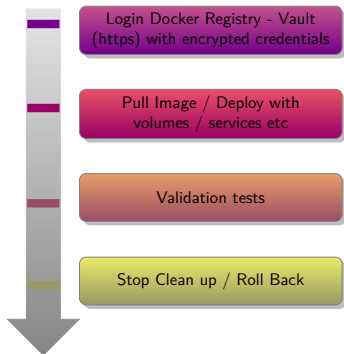
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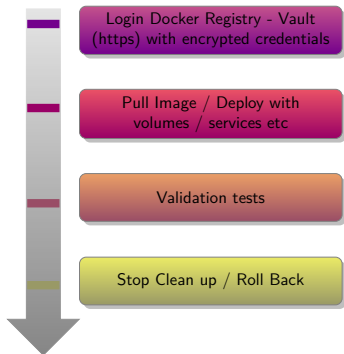
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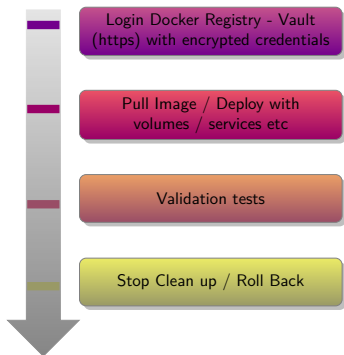
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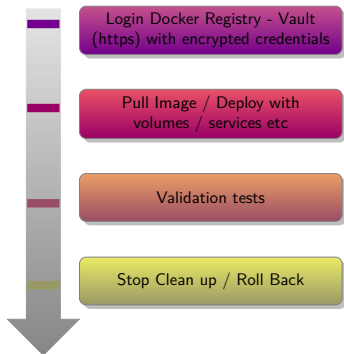
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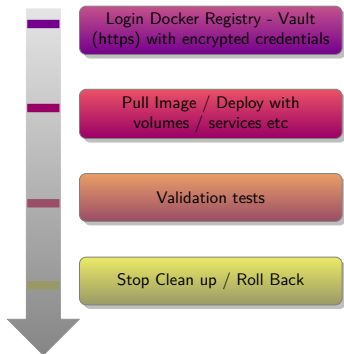
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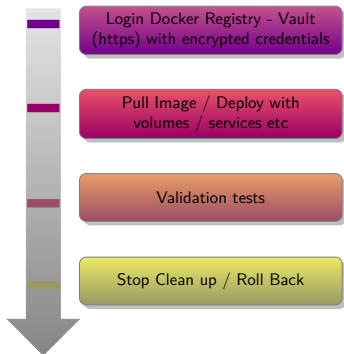
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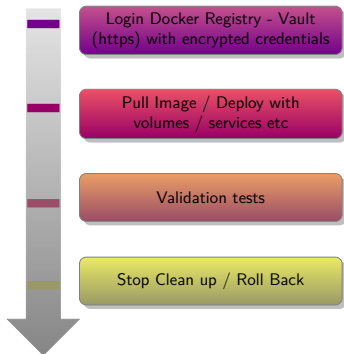
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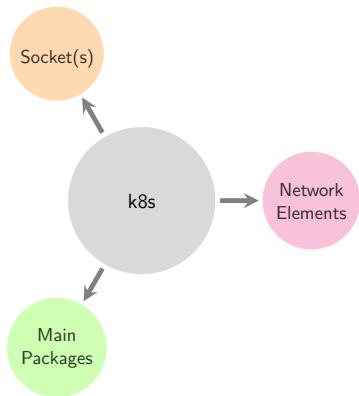
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- ▶ Validation (tests).
 - ▶ Raise error (if).
 - ▶ **Stop, Cleanup.**
 - ▶ Roll back.

Local k8s Deployment Procedure



- ▶ Vault (https).
- ▶ Any socket.
 - ▶ Azzure Registry.
 - ▶ Pull Image.
- ▶ Deployment (volume).
- ▶ Logout Azzure.
- ▶ Validation (tests).
 - ▶ Raise error (if).
 - ▶ Stop, Cleanup.
 - ▶ Roll back.

Kubernetes Minimal Core Components



► Socket:

- Containerd (Docker)
- CRI-O

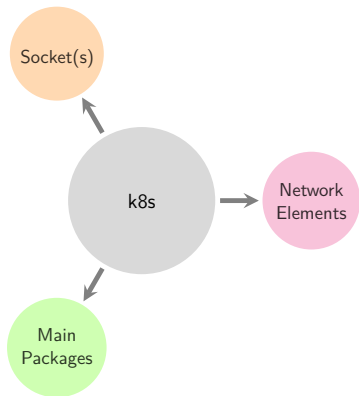
► Main Packages:

- kubelet
- kubectl
- kubeadm

► Network Elements

- Calico [1]
- WeaveNet [2]
- Cilium [3]

Kubernetes Minimal Core Components



► Socket:

► Containerd (Docker)

► CRI-O

► Main Packages:

► kubelet

► kubectl

► kubeadm

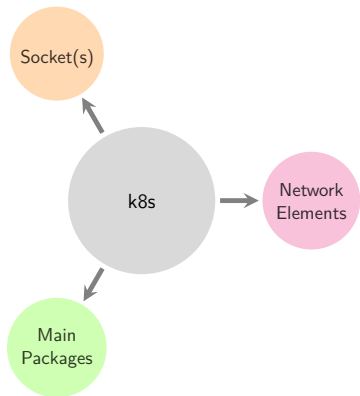
► Network Elements

► Calico [1]

► WeaveNet [2]

► Cilium [3]

Kubernetes Minimal Core Components



- ▶ Socket:
 - ▶ Containerd (Docker)
 - ▶ CRI-O

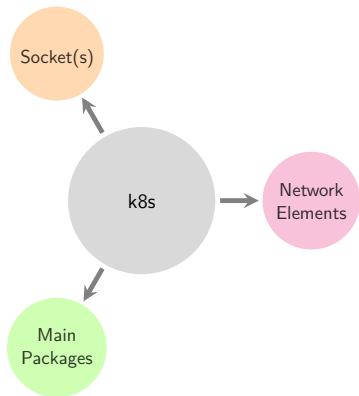
▶ Main Packages:

- ▶ kubeadm
- ▶ kublet
- ▶ kubectl

▶ Network Elements

- ▶ Calico [1]
- ▶ WeaveNet [2]
- ▶ Flannel [3]

Kubernetes Minimal Core Components



- ▶ Socket:
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 - ▶ CRI-O

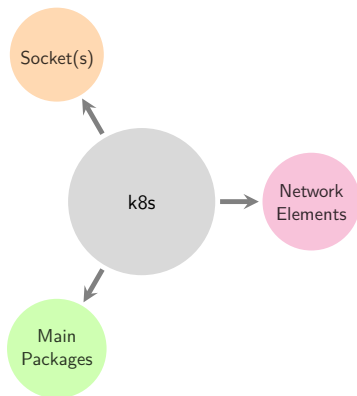
▶ Main Packages:

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- ▶ kubectl

▶ Network Elements

- ▶ Calico [1]
- ▶ WeaveNet [2]
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Kubernetes Minimal Core Components

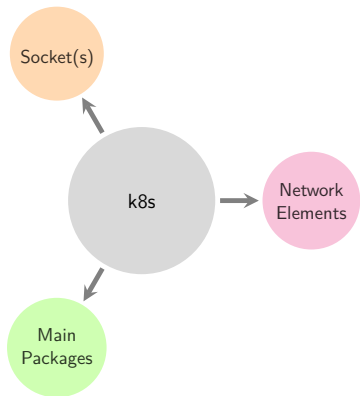


- ▶ Socket:
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- ▶ Main Packages:
 - ▶ **kubeadm**
 - ▶ kubelet
 - ▶ kubectl

▶ Network Elements

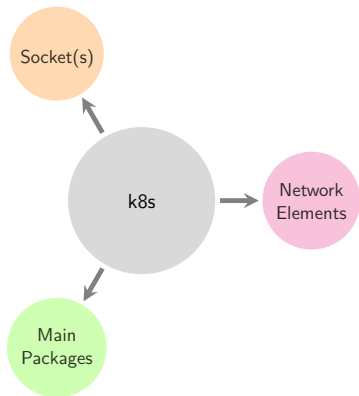
- ▶ Calico [1]
- ▶ Weave [2]
- ▶ Flannel [3]

Kubernetes Minimal Core Components



- ▶ Socket:
 - ▶ Containerd (Docker)
 - ▶ CRI-O
- ▶ Main Packages:
 - ▶ kubeadm
 - ▶ **kubelet**
 - ▶ kubectl
- ▶ Network Elements

Kubernetes Minimal Core Components

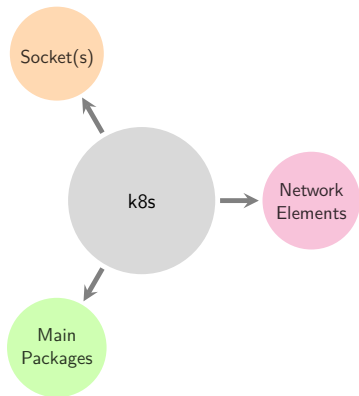


- ▶ Socket:
 - ▶ Containerd (Docker)
 - ▶ CRI-O
- ▶ Main Packages:
 - ▶ kubeadm
 - ▶ kubelet
 - ▶ **kubectrl**

▶ Network Elements

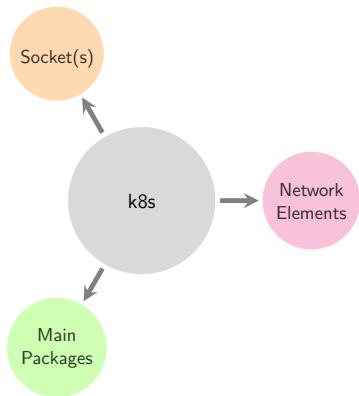
- ▶ Calico [1]
- ▶ Weave [2]
- ▶ Flannel [3]

Kubernetes Minimal Core Components



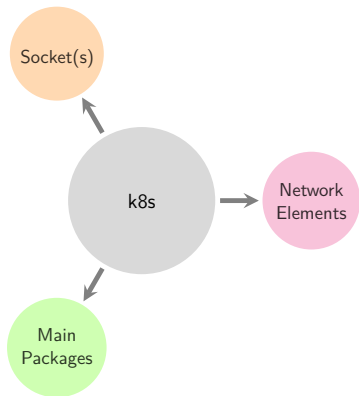
- ▶ Socket:
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 - ▶ WeaveNet [1]
 - ▶ Cilium [1]

Kubernetes Minimal Core Components



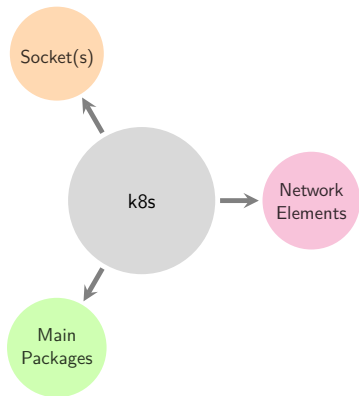
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Kubernetes Minimal Core Components



- ▶ Socket:
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Kubernetes Minimal Core Components



- ▶ Socket:
 - ▶ Containerd (Docker)
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- ▶ Main Packages:
 - ▶ kubeadm
 - ▶ kubelet
 - ▶ kubectrl
- ▶ Network Elements
 - ▶ Calico [1]
 - ▶ WeaveNet [1]
 - ▶ Cilium [1]

Local Auto Deployment

► Previous Elements

► Ingress Controller:

► NGINX [3]

► HAProxy [4]

► Metrics (HPA)

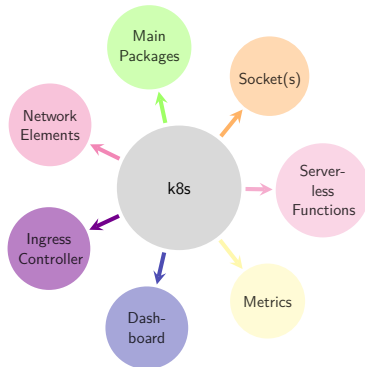
► Dashboard

► <https://kubernetes.io/docs/tasks/debug-application-cluster/kubectl-1.10/#kubectl-explain-logs>

► Serveless Functions, Functions as a Service (FaaS)

► Operatin System:

► <https://kubernetes.io/docs/tasks/debug-application-cluster/kubectl-1.10/#kubectl-explain-logs>



Local Auto Deployment

▶ Previous Elements

▶ Ingress Controller:

- ▶ NGINX [3]
- ▶ HaProxy [3]

▶ Metrics (HPA)

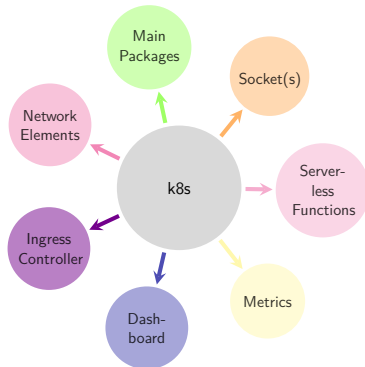
▶ Dashboard

Horizontal Pod Autoscaler

▶ Serveless Functions, Functions as a Service (FaaS)

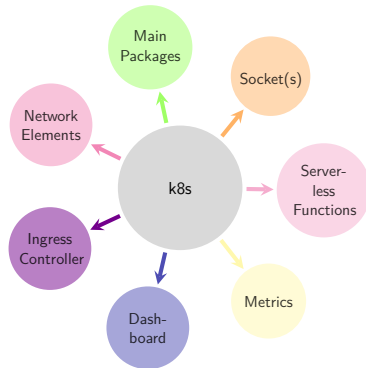
▶ Operatin System:

OpenShift



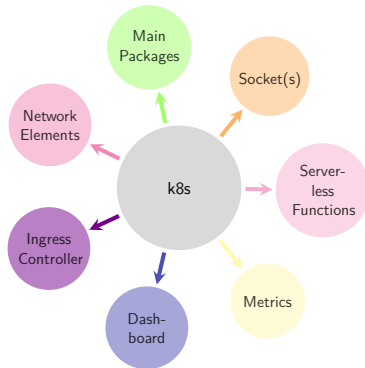
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
- ▶ Network Elements
- ▶ Main Packages
- ▶ Socket(s)
- ▶ Serverless Functions
- ▶ Metrics
- ▶ Ingress Controller
- ▶ Dashboard
- ▶ Metrics
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:



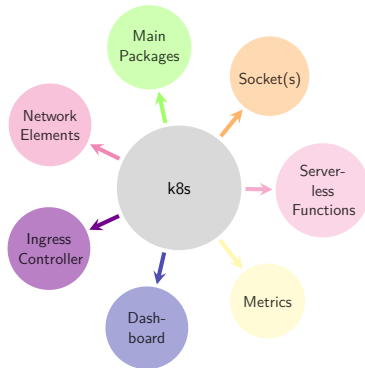
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
- ▶ Network Elements
- ▶ Main Packages
- ▶ Socket(s)
- ▶ Serverless Functions
- ▶ Metrics
- ▶ Ingress Controller
- ▶ Dashboard
- ▶ Metrics
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:



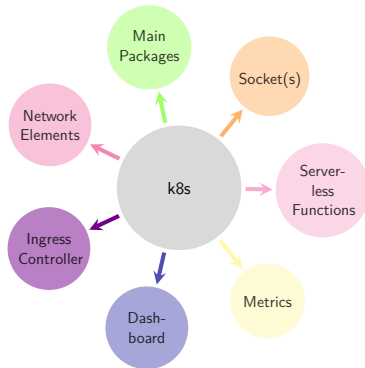
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ **Metrics (HPA)**
- ▶ Dashboard
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:



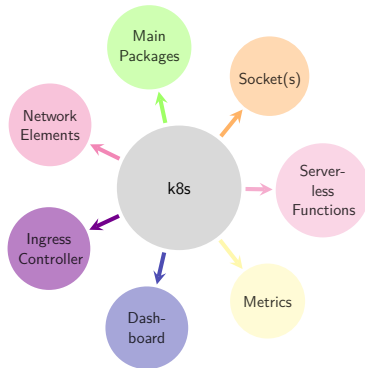
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ **Dashboard**
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:



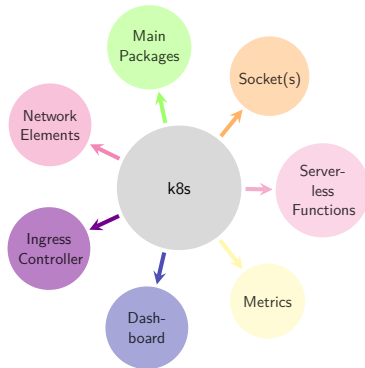
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:



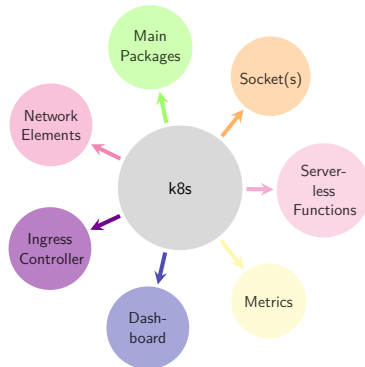
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operating System:
 - ▶ Ubuntu



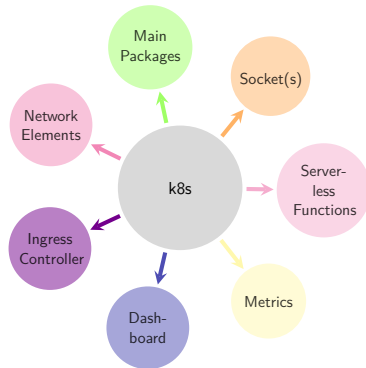
Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ **Operating System:**
 - ▶ Ubuntu



Local Auto Deployment

- ▶ Previous Elements
- ▶ Ingress Controller:
 - ▶ NGINX [3]
 - ▶ HaProxy [3]
- ▶ Metrics (HPA)
- ▶ Dashboard
 - ▶ Self Signed CA
- ▶ Serveless Functions, Functions as a Service (FaaS)
- ▶ Operatin System:
 - ▶ **Ubuntu**



Coming up: Demo

Summary

- ▶ In section “Introduction” page “2” Container Run Time Interfaces.
- ▶ In section “CI / CD” page “3” Problems / Desires / Solutions on CI / CD.
- ▶ In section “Implementation” page “4” CI / CD Flow Build / Deploy / Test.

Future Notes

- ▶ Summary on CI / CD Build / Deploy / Validation and Release.
- ▶ Summary on CI / CD and Kubernetes page and on Kubernetes on CI / CD.
- ▶ Summary on “Future” Page Future plans on CI / CD.

Summary

- ▶ In section “Introduction” page “2” Container Run Time Interfaces.
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- ▶ In section “CI / CD” page “3” Problems / Desires / Solutions on CI / CD.
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Future Work

- ✱ Demo on CI / CD build / deploy / validation and error handling cases.

▶ *CI / CD and Kubernetes* by *Athanasios Garyfalos*

Summary

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Future Notes

- ▶ Demo on CI / CD build / deploy / validation and error handling cases.
- ▶ Both the CI / CD and Kubernetes project are provided as open source contribution. The Presentation was written in *VSX*.

Summary

- ▶ In section “Introduction” page “2” Container Run Time Interfaces.
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- ▶ In section “Implementation” page “4” CI / CD Flow Build / Deploy / Test.

Extra Notes

- ▶ Demo on CI / CD build / deploy / validation and error handling cases.
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Summary

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Extra Notes

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- ▶ Both the CI / CD and Kubernetes project are provided as open source contribution. The Presentation was written in **L^AT_EX**

Coming up: Q & A

References I



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GNU Operating System

available at <https://www.gnu.org/licenses/lgpl.html>.



Author: K. Community

Container Runtimes

available at <https://kubernetes.io/docs/setup/production-environment/container-runtimes/>.



Author: K. Community

Cluster Networking

available at <https://kubernetes.io/docs/concepts/cluster-administration/networking/>.