Kubernetes & Shared Responsibility

Understanding one’s scope of responsibility in a Kubernetes cloud service

Why are we here?

Kubernetes is

- Big
- Complex
- New

Overview

- Shared Responsibility Models
- Kubernetes (aka K8)
- Cloud Delivery Model
- Customer Surface Area
- Threat Matrix
- Hardening
- Q&A

Who Am I?

Ken Netzorg

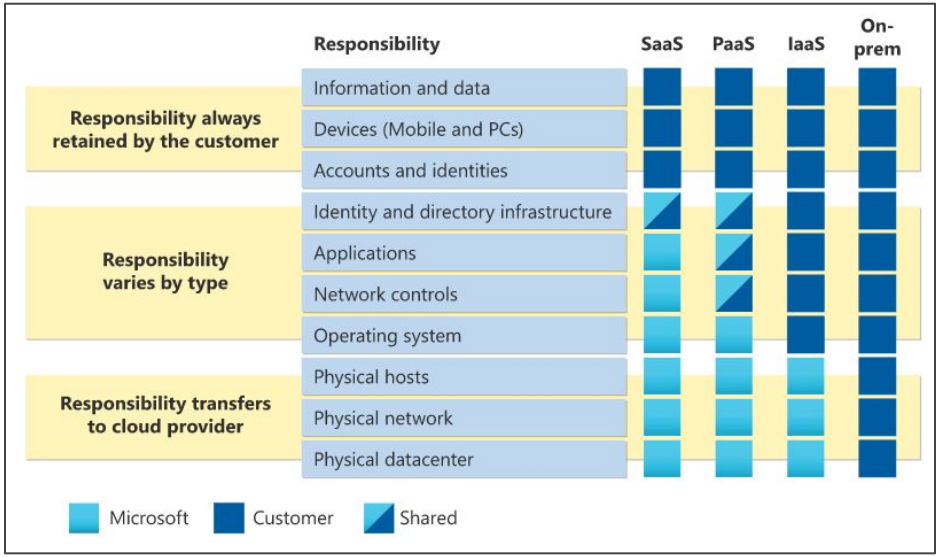
25 Years across various responsibilities ranging from network administration to DBA to C# development.

I like to solve problems, IT related.

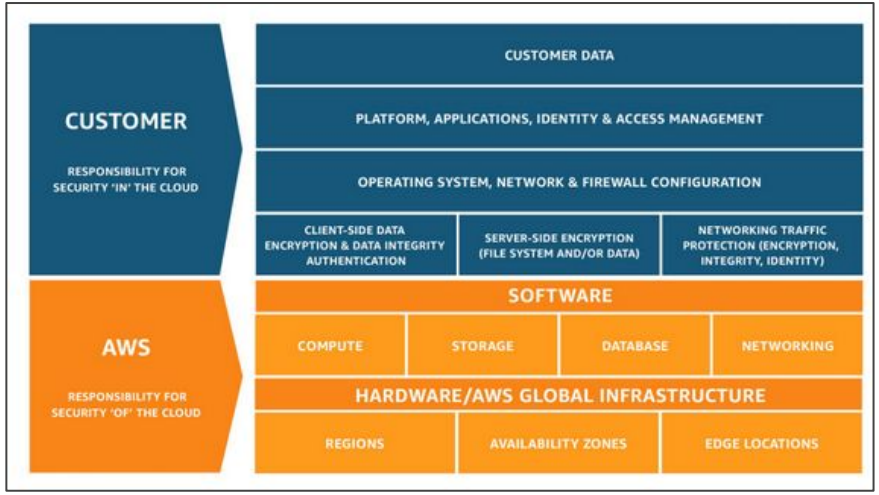
Currently the Director of Technology Operations and Security at DecisivEdge and heavily involved in Azure infrastructure, security, and DevOps.

Certs: CISA/CISSP

Shared Responsibility Models

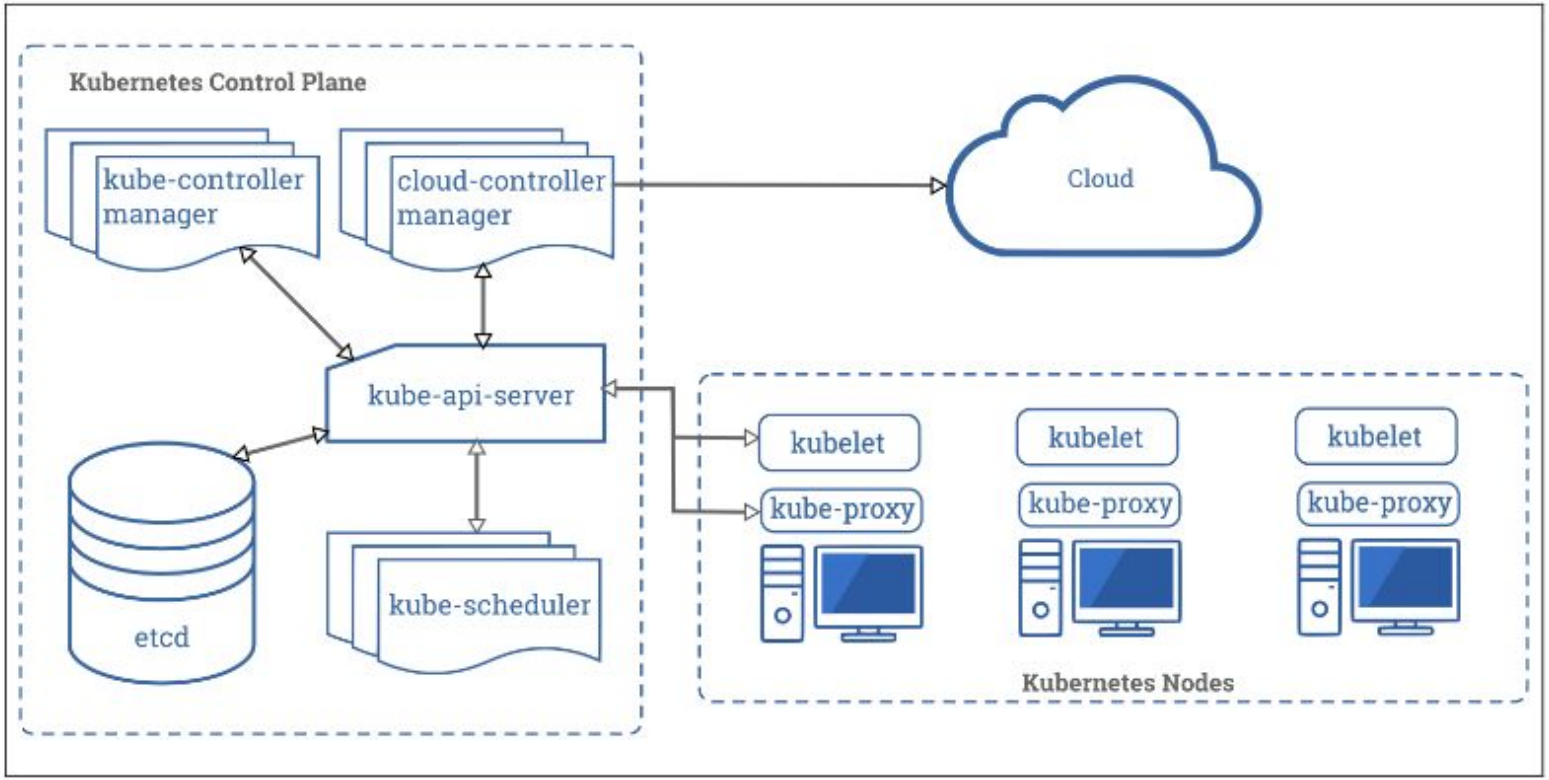


Microsoft - Azure



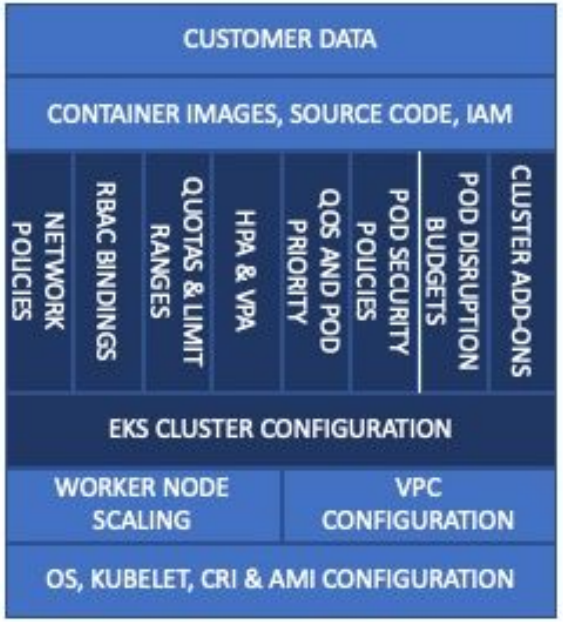
Amazon - AWS

Kubernetes Architecture



Source: NIST Kubernetes Hardening Guide Aug 2021 V1.0

Kubernetes Architecture - Nodes

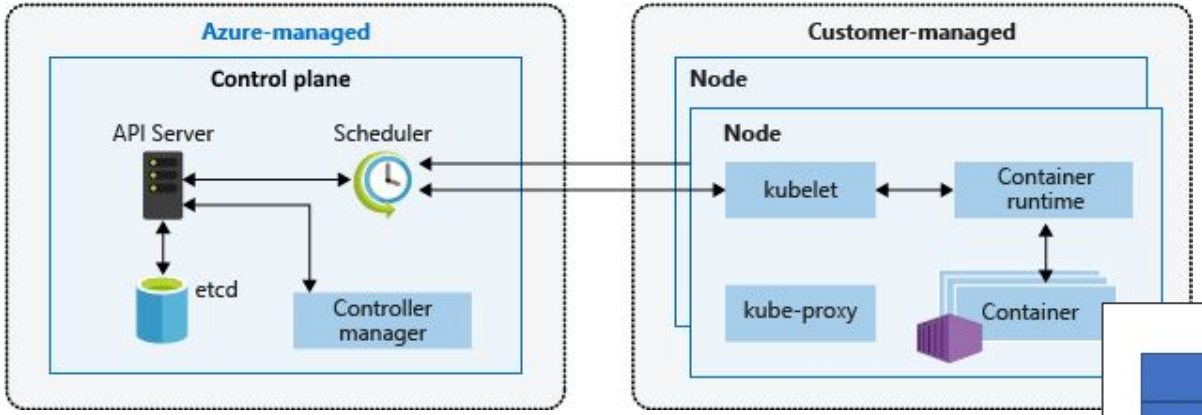


Add-Ons

- Network Policies
- DNS
- Service Mesh
- Ingress
- Etc.

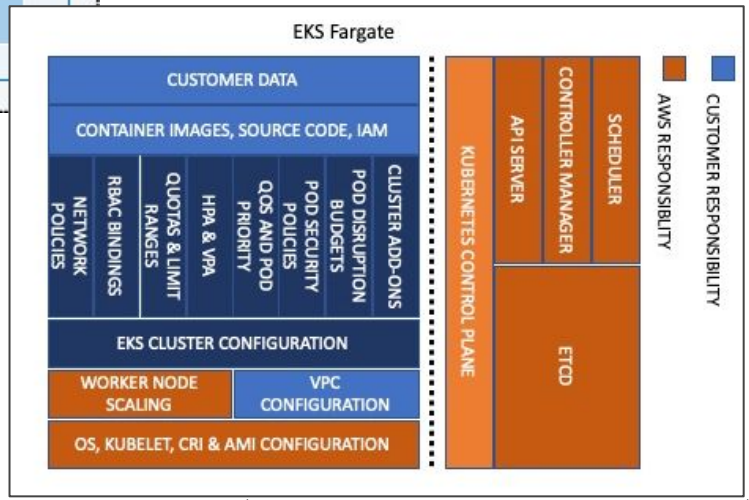
Source: AWS EKS Best Practices Guide (https://aws.github.io/aws-eks-best-practices/security/docs/)

Kubernetes In the Cloud



Microsoft - Azure

Amazon - AWS

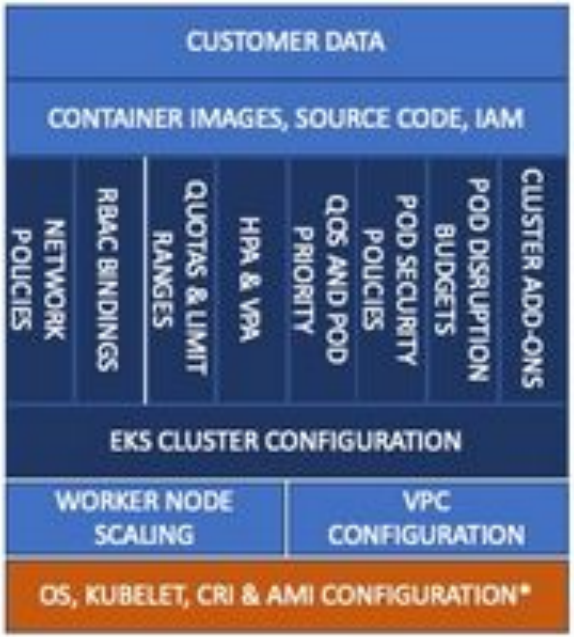


Source: AKS Docs (https://docs.microsoft.com/en-us/azure/aks/concepts-clusters-workloads)

Source: AWS EKS Best Practices Guide (https://aws.github.io/aws-eks-best-practices/security/docs/)

Customer Surface Area

- Application Security
  - Secure Coding
  - Patching
  - etc
- Access Management
- Transport Security
  - Encrypted
  - Segmented
- Backups/Redundancy
  - Alternate data locations
- Secret Management
- Patching



Kubernetes Threat Matrix (updated)

Initial Access	Execution	Persistence	Privilege Escalation	Defense Evasion	Credential Access	Discovery	Lateral Movement	Collection	Impact
Using Cloud credentials	Exec into container	Backdoor container	Privileged container	Clear container logs	List K8S secrets	Access the K8S API server	Access cloud resources	Images from a private registry	Data Destruction
Compromised images in registry	bash/cmd inside container	Writable hostPath mount	Cluster-admin binding	Delete K8S events	Mount service principal	Access Kubelet API	Container service account		Resource Hijacking
Kubeconfig file	New container	Kubernetes CronJob	hostPath mount	Pod / container name similarity	Access container service account	Network mapping	Cluster internal networking		Denial of service
Application vulnerability	Application exploit (RCE)	Malicious admission controller	Access cloud resources	Connect from Proxy server	Applications credentials in configuration files	Access Kubernetes dashboard	Applications credentials in configuration files		
Exposed Dashboard	SSH server running inside container				Access managed identity credential	Instance Metadata API	Writable volume mounts on the host		
Exposed sensitive interfaces	Sidecar injection				Malicious admission controller		Access Kubernetes dashboard		
							Access tiller endpoint		
							CoreDNS poisoning		
							ARP poisoning and IP spoofing		

= New technique

= Deprecated technique

Source: Microsoft Security Blog (https://www.microsoft.com/security/blog/2021/03/23/secure-containerized-environments-with-updated-threat-matrix-for-kubernetes/)

Hardening Help

Sources are available, all is not lost

- NIST - Kubernetes Hardening Guidance (total platform)
- CIS - Total platform and specific provider guides
- Azure - “Day 2” Topics
- Amazon - EKS Best Practices
- Azure AKS Baseline Cluster (Azure centric/full solution concept)

Links to these documents will be in the final slide

Hardening Help - NIST

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NIST main TOC

Hardening Help - CIS (Azure)

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CIS partial TOC

Hardening Help - AWS EKS

EKS Best Practices Guides

aws/aws-eks-best-practices

EKS Best Practices Guides

Guides
- Introduction

Security
- Home
- Identity and Access Management
- Pod Security
- Multi-tenancy
- Detective Controls
- Network Security
- Data Encryption and Secrets Management
- Runtime Security
- Infrastructure Security
- Regulatory Compliance
- Incident Response and Forensics
- Image Security

Cluster Autoscaling

Reliability

Windows Containers (beta)

Introduction

Welcome to the EKS Best Practices Guides. The primary goal of this project is to offer a set of best practices for day 2 operations for Amazon EKS. We elected to publish this guidance to GitHub so we could interate quickly, provide timely and effective recommendations for variety of concerns, and easily incorporate suggestions from the broader community.

We currently have published guides for the following topics:

- Best Practices for Security
- Best Practices for Reliability
- Best Practices for Cluster Autoscaling

In the future we will be publishing best practices guidance for performance, cost optimization, and operational excellence.

Contributing

We encourage you to contribute to these guides. If you have implemented a practice that has proven to be effective, please share it with us by opening an issue or a pull request. Similarly, if you discover an error or flaw in the guidance we've already published, please submit a PR to correct it.

Table of contents

Contributing

EKS Best Practices Intro

Conclusion

- Kubernetes is complex
- Leveraging a cloud service provider eases the burden
- Understanding where the provider stops and you start is critical
- Help is readily available if you know where to look

Q & A

Contact

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Copy of the slides will be posted to my github: zorg-the-blue

https://github.com/zorg-the-blue/talks

Document Source Links

NIST - Kubernetes Hardening Guidance (total platform)
https://media.defense.gov/2021/Aug/03/2002820425/-1/-1/1/CTR_KUBERNETES%20HARDENING%20GUIDANCE.PDF

CIS - Total platform and specific provider guides/checklists [*Requires registration*]
https://www.cisecurity.org/benchmark/kubernetes

Azure - “Day 2” Topics
https://docs.microsoft.com/en-us/azure/architecture/operator-guides/aks/day-2-operations-guide

Amazon - EKS Best Practices
https://aws.github.io/aws-eks-best-practices/

Azure AKS Baseline Cluster (Azure centric/full solution concept)
https://github.com/mspnp/aks-secure-baseline