

Kubernetes Security and CI/CD

Duration: 10 days (8hrs/day)

Prerequisites:

- Basic knowledge of Linux Server Administration.
- Basic knowledge of Containers

Course Objective: This comprehensive DevOps Tools course, covering implementation of container orchestration and managing containerized application with CI/CD pipeline and security best practices, is designed to equip learners with the skills needed to successfully to implement DevOps practices securely.

Kubernetes and DevOps Tools Version: Latest

Lab Requirement: Koenig-DC and AWS EKS

Module 1 – Kubernetes Recap

[16 - hours]

Overview of Container Orchestration

Introduction to Kubernetes

Understanding Kubernetes Architecture

Lab: Installation of Kubernetes 1-Master and 2-Nodes Cluster

Lab: Choose a Network Solution and Configure

Lab: Verify Installation with Kubectl command

Understanding Pods, Labels & Selectors

Lab: Deploying Applications as a Pod

Lab: Managing Labels & Selector

Understanding Replica Set

Lab: Deploying Replica Set

Understanding Services – ClusterIP, NodePort & LoadBalancer

Lab: Creating & Managing Service

Understanding Daemon Sets

Lab: Deploying Applications as Daemon Sets

Overview of Deployment

Deployment Strategies – Blue/Green & Canary



Lab: Deploying Applications as Deployment Lab: Implementing Deployment Strategies on Deployments Understanding Volume Management in K8s Types of Volumes Provisioning Persistent Volumes Persistent Volume Claim Lab: Using PV & PVC to attach Persistent Volume to a Pod as HostPath **Understanding Kubernetes Authentication** Lab: Creating Service Accounts Understanding Role, ClusterRole, RoleBinding& ClusterRoleBinding Lab: Managing Roles and Role Binding Lab: Managing Cluster Role and Cluster Role Binding Understand Basics of Kubernetes Networking **Understand CNI overview Understand Pod Networking Concepts** Understanding DNS of K8s Understanding Ingress Lab: Configure and Manage Ingress Rule **Understanding Namespace & Use-Cases** Lab: Creating Namespace & Deploying K8s resources in Different Namespaces Metal Load Balancer Lab: Deploying Metal Load Balancer

Module 2 – Kubernetes Extras

Introduction to StatefulSet Use cases of StatefulSet Manage StatefulSet Storage in StatefulSet Lab: Deploying and Managing Stateful Sets [12 - hours]



Lab: Creating Persistent Storage in Stateful Sets Headless Service Lab: Headless Service Introduction to Readiness and Liveness Probe Implement Readiness and Liveness in Pod Lab: Creating Liveness and Readiness Probe for Pod Kubernetes Autoscaling using VPA, HPA, CA and Karpenter Lab: Implementing VPA in EKS cluster Lab: Implementing HPA in EKS cluster Lab: Implementing cluster node autoscaling using Karpenter Understanding Kubernetes package manager – Helm Lab: Deploying application using Helm

Module 3 - Cluster Hardening

[10 - hours]

[10 - hours]

Use CIS Benchmark to Review the Security Configuration of Kubernetes Components Lab: Perform Security Benchmark checks using CIS-CAT Lite and Kube-Bench Tool Pod to Pod Communica1on Public Key Infrastructure (PKI) – Certificate Authority (CA) Lab: Find Certificates Lab: Implementing Network Policies on Pods Lab: Create User and assign RBAC (Role Based Access Control) Lab: Disable Automount Service Account Token and Anonymous Access Lab: Node Restriction Admission Controller

Module 4 - Minimize Microservice Vulnerabilities

Managing Secrets

Lab: Managing Secrets



Lab: Encrypt Secrets in ETCD

Setup Appropriate OS Level Security Domains using PSP, OPA, Security Contexts

- Lab: Implementing Security Context in Pods and Containers
- Lab: Creating privileged containers using security context
- Lab: Disable Privilege Escalation
- **Pod Security Policy**
- **Container Runtime Sandboxes**
- Open Container Initiative
- Kata Containers Sandbox
- Lab: Contact the Linux Kernel of worker node From Inside a Container
- Lab: Implemen1ng Gvisor on pods
- Lab: Custom Security Policies using OPA Gatekeeper

Module 5 - Supply Chain Security

Container Image creation using Dockerfile

Lab: Creating container image using Dockerfile

Minimize Base Image Footprint Use Static Analysis of User Workloads (e.g. Kubernetes Resources and Docker Files)

- Lab: Static Analysis with Kubesec
- Lab: Static Analysis with OPA Conftest
- Lab: Checking Image Vulnerabilities with Trivy
- Secure Supply Chain
- Lab: Whitelist Some Registries Using OPA
- ImagePolicyWebhook
- Lab: ImagePolicyWebhook

Module 6 – CI/CD with Jenkins, GitLab and ArgoCD

[10 - hours]

What is CI/CD

Introduction to Jenkins

[10 - hours]



Lab: Jenkins Installation Jenkins Management Lab: Run Jobs on Remote Machines Introduction to Jenkins Pipeline Lab: Building Jenkins Pipeline Introduction to Gitlab Gitlab Architecture and Runner Lab: Installing and Configuring Gitlab Runner Lab: Building a CI-CD Pipeline Using Gitlab Introduction JFrog Artifactory Lab: Deploying artifacts with JFrog What and why of ArgoCD ArgoCD Architecture Lab: Installing and configuring ArgoCD Lab: Deploying Java application on Kubernetes using ArgoCD

Module 7 – Service mesh tool – Istio

[06 - hours]

What and why of service mesh
Service mesh architecture
Admission controller
Sidecar containers
Lab: Istio installation and configuration
Lab: Configure traffic management, virtual services, mutual TLS [mTLS] and Observability
Service mesh vs Ingress

Module 8 – Logging and Monitoring

[04 - hours]

Understand how to Monitor Application and Cluster Components Lab: Understand how to Read Application & Cluster Component Logs Lab: Deploying Prometheus & Grafana to Monitor K8s Cluster



Lab: Monitoring k8s with Zabbix

Module 9 – Managing multi Kubernetes cluster with Rancher [02 - hours]

Rancher overview

Lab: Importing Kubernetes cluster to Rancher

Exploring available external authentication to Rancher