Docker & Kubernetes (60 hours)

Docker: Containerization Training

Module 1: Introduction to Containers

- What is a container?

- Virtual Machines vs Containers

- Benefits of Docker

- Docker architecture: client, daemon, images, containers, registries

Module 2: Installing and Running Docker

- Install Docker on Linux/Windows

- Docker CLI and GUI (Docker Desktop)

- Docker Hub and Image Pulling

- `docker run`, `docker ps`, `docker exec`, `docker stop`

Module 3: Docker Images

- Dockerfile: Creating custom images

- `docker build`, `docker tag`, `docker push`

- Layers and caching

- Base images and best practices

Module 4: Volumes and Data Management

- Persistent storage

- Bind mounts vs named volumes

- Volume lifecycle

- Backing up and restoring data

Module 5: Networking in Docker

- Bridge, Host, and Overlay networks

- Exposing ports and service discovery

- Docker DNS

- Multi-container communication

Module 6: Docker Compose

- YAML syntax for Compose

- Defining multi-container apps

- Environment variables and `.env` files

- Orchestrating services with `docker-compose up`

Module 7: Docker Security

- Least-privilege containers

- Image scanning (Trivy)

- Docker Content Trust

- Secrets management in Docker

Module 8: Real-world Docker Projects

- Hosting WordPress + MySQL using Compose

- Flask + Redis containerized

- Dockerizing a Node.js or Python app

Kubernetes (K8s): Container Orchestration

Module 1: Kubernetes Introduction

- Need for orchestration

- Kubernetes vs Docker Swarm

- Kubernetes architecture: Master vs Worker Nodes

- Components: API Server, Scheduler, Controller, etcd, kubelet, kube-proxy

Module 2: Setting Up Kubernetes

- Install Minikube / Kubeadm / Kind

- kubectl configuration and usage

- Cluster info and basic commands

Module 3: Pods, ReplicaSets, and Deployments

- Pod lifecycle and YAML definition

- ReplicaSets and self-healing

- Deployments for rolling updates and rollbacks

- Labels and selectors

Module 4: Services and Networking

- ClusterIP, NodePort, LoadBalancer

- DNS and service discovery

- Ingress controllers and routing

- Port-forwarding and external access

Module 5: ConfigMaps and Secrets

- Decouple config from containers

- Mounting configs and environment variables

- Creating and using Secrets securely

Module 6: Storage in Kubernetes

- Volumes and PersistentVolumes (PV)

- PersistentVolumeClaims (PVC)

- Storage classes and dynamic provisioning

- Access modes: RWO, ROX, RWX

Module 7: Helm Package Manager

- What is Helm?

- Helm charts and repositories

- Installing applications via Helm

- Customizing values

Module 8: Monitoring and Logging

- Installing Prometheus + Grafana

- Visualizing pod metrics

- Basic logging with `kubectl logs`

- Centralized logging (EFK stack)

Module 9: Kubernetes Security Basics

- RBAC and ServiceAccounts

- NetworkPolicies (Calico intro)

- Resource quotas and limits

- Image scanning with Trivy

Module 10: CI/CD with Kubernetes

- Deploying from Jenkins/GitHub Actions

- Blue-Green and Canary deployments

- GitOps basics (ArgoCD preview)