Containerization using Docker & Kubernetes

Total Duration: 52 Hours
Delivery: 13 Half-Days (4 hours/day)
Mode: Instructor-led | Conceptual + Demo + Hands-on Practice
Target Audience: Developers, DevOps Engineers, Cloud Engineers

Day 1 – Containerization Fundamentals & Docker Basics
Topics:

- Traditional deployment vs Virtualization vs Containerization
- What is Docker and why it matters
- Docker architecture (Client, Daemon, Images, Containers)
- Installing Docker
- Docker CLI basics

Demo + Hands-on:

- Verify Docker installation
- Pull and run first container (hello-world, nginx)
- Explore container lifecycle (run, stop, remove)

Day 2 – Docker Images & Dockerfile
Topics:

- Docker images vs containers
- Image layers and caching
- Dockerfile fundamentals
- Instructions: FROM, RUN, COPY, CMD, ENTRYPOINT, EXPOSE
- Best practices for writing Dockerfiles

Demo + Hands-on:

- Create a Dockerfile for a sample app
- Build custom Docker image
- Run container from custom image
- Inspect image layers

Day 3 – Container Management & Docker Networking
Topics:

- Container lifecycle management
- Logs, exec, inspect commands
- Docker networking concepts
- Bridge, host, and custom networks
- Port mapping and container communication

Demo + Hands-on:

- Access container logs and shell
- Create custom Docker network
- Connect multiple containers
- Test inter-container communication

Day 4 – Docker Volumes & Docker Compose
Topics:

- Data persistence challenges in containers
- Docker volumes and bind mounts
- Volume lifecycle and use cases
- Introduction to Docker Compose
- docker-compose.yml structure

Demo + Hands-on:

- Create and use Docker volumes
- Persist application data
- Build multi-container application using Docker Compose
- Start/stop services using Compose

Day 5 – Kubernetes Fundamentals & Architecture
Topics:

- Why Kubernetes? Container orchestration challenges
- Kubernetes architecture
  - Master & Worker nodes
  - API Server, Scheduler, Controller Manager
- Kubernetes objects overview
- Introduction to kubectl

Demo + Hands-on:

- Setup local Kubernetes cluster (Minikube / Kind)
- Explore cluster info
- Run first Pod using kubectl

Day 6 – Pods, ReplicaSets & Deployments
Topics:

- Pods and Pod lifecycle
- ReplicaSets and scaling concepts
- Deployments and rolling updates
- Declarative vs imperative approach
- YAML fundamentals

Demo + Hands-on:

- Create Pod using YAML
- Create Deployment
- Scale replicas
- Perform rolling update and rollback

Day 7 – Kubernetes Services & Networking
Topics:

- Kubernetes networking model
- Services: ClusterIP, NodePort, LoadBalancer
- Service discovery and DNS

- Ingress overview (conceptual)

Demo + Hands-on:
- Create ClusterIP and NodePort services
- Access application through service
- Validate service-to-pod communication

Day 8 – Configuration & Storage in Kubernetes
Topics:
- ConfigMaps and Secrets
- Environment variables in Pods
- Volumes in Kubernetes
- Persistent Volumes (PV) and Persistent Volume Claims (PVC)
- RBAC basics
- Secrets best practices
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Demo + Hands-on:
- Create ConfigMap and Secret
- Inject configuration into Pods
- Create PVC and attach storage to Pods

Day 9 – Kubernetes Operations & Troubleshooting
Topics:
- Monitoring Pods and nodes
- Logs, exec, describe commands
- Health checks (Liveness & Readiness probes)
- Resource requests and limits
- Common Kubernetes issues and fixes

Demo + Hands-on:
- Debug failing Pods
- Add probes to deployments
- Simulate failure and recovery

Day 10 – Mini Project & Best Practices
Topics:
- End-to-end application deployment flow
- Docker & Kubernetes best practices
- Common mistakes & troubleshooting
- Design discussions based on learner use cases
- Recap of key concepts
- Q&A and discussion

Missing Topics

Day 11 – CI/CD Integration
Topics:

- CI/CD with Docker & Kubernetes
- Deploy through CI/CD pipelines
- Spring Boot microservices deployment
- Basic pipeline YAML walkthrough

Demo + Hands-on:

- Docker image build & push using CI (Jenkins/GitHub Actions)
- Kubernetes deployment via CI/CD

Day 12 – Helm Fundamentals & Chart Usage
Topics:

- Challenges with raw Kubernetes YAML
- Introduction to Helm and use cases
- Helm architecture (Charts, Releases, Repositories)
- Helm CLI workflow
- Using public Helm charts
- Helm release lifecycle (install, upgrade, rollback)

Demo + Hands-on:

- Install and verify Helm CLI
- Add and manage Helm repositories
- Search and inspect existing charts
- Install NGINX using Helm
- Upgrade, Rollback and Inspect a Helm release

Day 13 – GitOps Fundamentals & Argo CD Setup
Topics:

- CI vs CD vs GitOps
- GitOps principles and benefits
- Introduction to Argo CD
- Argo CD architecture and components
- Declarative deployment model
- Argo CD vs traditional CD tools

Demo + Hands-on:

- Access Argo CD UI and CLI
- Connect Git repository to Argo CD
- Create an Argo CD Application
- Sync application from Git to Kubernetes
- Observe desired vs live state
- Manual sync and auto-sync overview