Cloud Contraptions
TRAINING & CONSULTING

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Mastering Docker and Kubernetes

Class Duration

35 hours of live training delivered over 5 days.

Student Prerequisites

- Familiarity with basic Linux commands
- No prior Docker or Kubernetes experience required

Target Audience

Developers and administrators who want to deploy applications with Docker and Kubernetes. The managed Kubernetes module runs on Amazon EKS or Azure Kubernetes Service (AKS), chosen to match the client's platform. Teams that want a shorter path can take Docker for Programmers and Kubernetes Essentials for Programmers separately.

Description

This course introduces developers and administrators to Docker and Kubernetes for deploying applications on-premises and in the cloud. It starts with Docker architecture, images, storage, networking, and multi-container applications with Docker Compose. Students then create Kubernetes deployments, configuration, storage, and services. Traffic management uses the Gateway API, since the community ingress-nginx controller is retired. After Helm, the course ends with a managed Kubernetes module on Amazon EKS or Azure AKS.

Learning Outcomes

- Explain Docker and Kubernetes architecture and install the tools for each.
- Build, run, and manage images and containers with the Docker CLI.
- Run multi-container applications with Docker Compose.
- Convert Compose applications to Kubernetes.
- Create Kubernetes resources with commands and YAML files.
- Scale, update, and roll back Deployments.
- Configure applications with ConfigMaps and Secrets.

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- Persist data with Persistent Volumes and StorageClasses.
- Expose applications with Services and the Gateway API.
- Install and manage applications with Helm.
- Store images in Amazon ECR or Azure Container Registry.
- Deploy, secure, and scale applications on Amazon EKS or Azure AKS.

Training Materials

Comprehensive courseware is distributed online at the start of class. All students receive a downloadable MP4 recording of the training.

Software Requirements

- Modern web browser (Chrome, Firefox, Safari, Edge)
- For the EKS module: an AWS account with permission to create resources (ECR, EKS, IAM roles) and the AWS CLI v2
- For the AKS module: an Azure subscription with permission to create resources (ACR, AKS, managed identities) and the Azure CLI
- SSH client for connecting to an Ubuntu virtual machine
- Visual Studio Code with the Container Tools extension
- Docker Engine, kubectl, Minikube, and Helm (installation is covered in class)

Training Topics

Introduction to Docker

- What is Docker?
- Containers and their benefits
- Docker architecture
  - The `docker` CLI client
  - Daemon and client-daemon communication
  - Images, registries, and the Docker Engine
- Installation
  - Creating and connecting to an Ubuntu virtual machine
  - Testing and updating the installation
  - Configuring Visual Studio Code for Docker

Containers and Images

- Container operations
  - Listing containers

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  - Start, stop, pause, and unpause
  - Removing containers
- Images
  - Docker Hub
  - Dockerfiles
  - Multi-stage builds and minimal base images
  - Creating, tagging, and running images
  - Removing images

Docker Storage and Networking

- Volume mounts
- Bind mounts
- tmpfs mounts
- Default and user-defined bridge networks
- Host networks

Multi-Container Applications with Docker Compose

- What is Docker Compose?
- The Compose file and the Compose Specification
  - Defining services, networks, and volumes
  - Merging multiple Compose files
- Creating, starting, and stopping services
- Listing and removing services
- Converting Compose apps with Compose Bridge
- Converting Compose apps with Kompose

Introduction to Kubernetes

- What is Kubernetes?
- Clusters, nodes, and Pods
- The control plane
- Tools, installation, and basic commands
  - Minikube
  - kubectl
  - Headlamp
- Creating a simple “Hello World” deployment

Kubernetes Deployments

- Architecture details

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  - Pods and nodes
  - Objects and resources
  - Workloads and ReplicaSets
- Deployments
  - Creating from the command line
  - Creating from a YAML file
  - Updating and rolling back
  - Scaling
  - Pausing and resuming

Configuration and Storage

- ConfigMaps and Secrets
- Environment variables and mounted configuration
- Persistent Volumes and Persistent Volume Claims
- StorageClasses and dynamic provisioning

Kubernetes Networking: Services

- The Kubernetes networking model
- Selectors, labels, and endpoints
- ClusterIP and NodePort Services
- LoadBalancer and ExternalName Services
- Creating services from the CLI and from YAML
- Exposing services inside and outside the cluster
- Local port forwarding

Kubernetes Networking: Gateway API

- Gateway API vs. NodePort and LoadBalancer Services
- GatewayClass, Gateway, and HTTPRoute
- Installing a Gateway API implementation
- Path-based fanout
- Host-based routing
- TLS termination and HTTP-to-HTTPS redirects
- Weighted traffic splitting for canary releases
- Ingress as a frozen API
- The retired ingress-nginx controller
- Migrating from Ingress

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Helm

- What is Helm?
- Installation and architecture
- Charts
  - Searching Artifact Hub and chart repositories
  - Adding and installing charts
  - Setting default values
- Creating and upgrading releases
- Rolling back and uninstalling releases

Managed Kubernetes on Amazon EKS (AWS option)

- Amazon Elastic Container Registry (ECR)
  - Private and public repositories
  - Authenticating with the AWS CLI and IAM
  - Pushing, pulling, and viewing images
- Creating an EKS cluster
- Managed node groups
- EKS Auto Mode
- Workload identity with EKS Pod Identity
- AWS Load Balancer Controller with Gateway API
- Running and scaling applications on EKS
- Updating applications on EKS
- Where Amazon ECS and AWS Fargate fit

Managed Kubernetes on Azure AKS (Azure option)

- Azure Container Registry (ACR)
  - Creating a registry and logging in
  - Pushing and viewing images
  - Attaching ACR to AKS
- Creating an AKS cluster
- Node pools and networking options
- Workload identity with Microsoft Entra Workload ID
- Application routing add-on with Gateway API
- Application Gateway for Containers
- Running and scaling applications on AKS
- Updating applications on AKS
- Where Azure Container Apps and Azure Container Instances fit

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