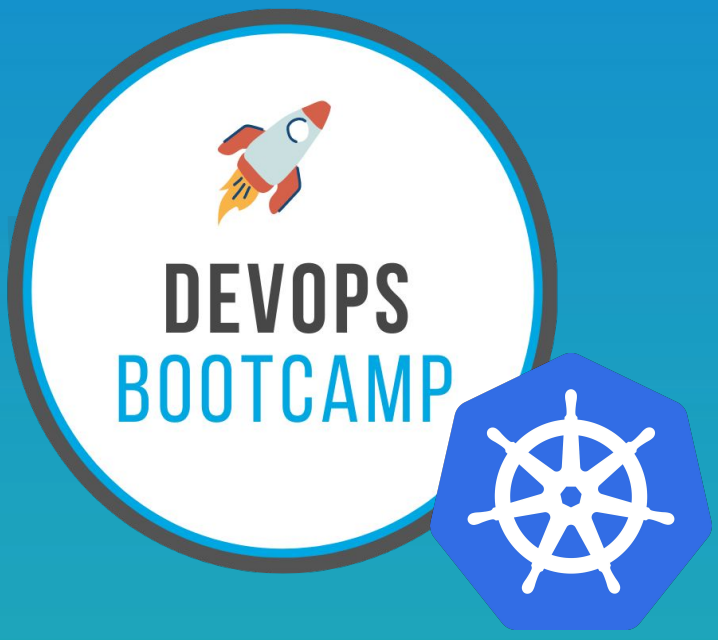
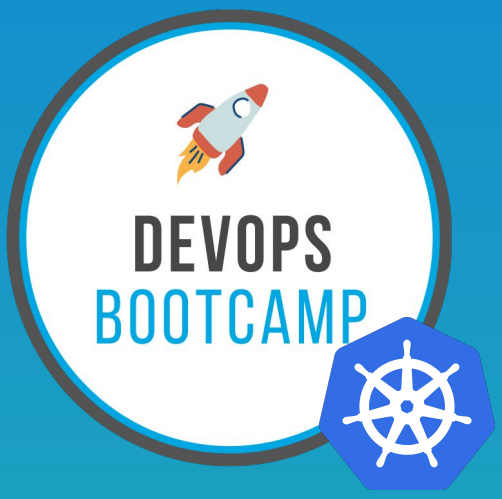


Module Checklist

Container Orchestration with Kubernetes

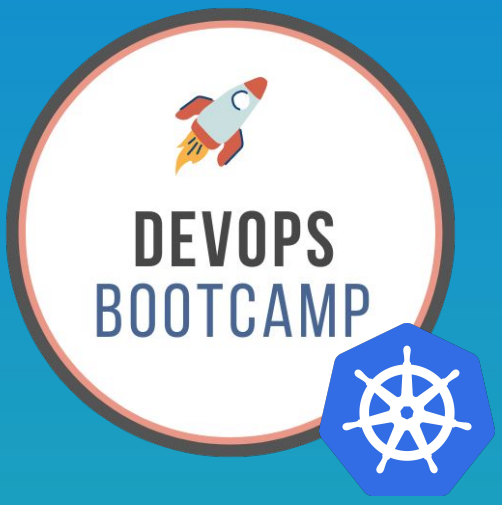
By Techworld with Nana

Video Overview



- ★ Introduction to Kubernetes
- ★ Basic Concepts and Main K8s Components
- ★ Kubernetes Architecture
- ★ Minikube and kubectl - Local Setup
- ★ Kubernetes CLI - Main kubectl commands
- ★ Introduction to YAML Configuration File
- ★ Demo project: Deploying MongoDB and Mongo Express
- ★ Organizing components with Namespaces
- ★ Kubernetes Services
- ★ Kubernetes Ingress
- ★ Persisting Data with Volumes
- ★ ConfigMap & Secret Volume Types
- ★ Deploying stateful Apps with StatefulSet
- ★ Introduction to Managed Kubernetes Services
- ★ Helm - Package Manager of Kubernetes
- ★ Helm Demo: Install a Stateful Application on Kubernetes using Helm
- ★ Demo: Deploy App from Private Docker Registry
- ★ Extending the K8s API with Operators
- ★ Prometheus Operator Demo with Helm: Setup Prometheus Monitoring in K8s
- ★ Secure your cluster - Authorization with RBAC
- ★ Microservices in Kubernetes
- ★ Demo project: Deploy Microservices Application
- ★ Production & Security Best Practices
- ★ Demo project: Create Helm Chart for Microservices
- ★ Demo project: Deploy Microservices with Helmfile

Video Overview



Demo Projects	
Kubernetes Demo	https://gitlab.com/nanuchi/bootcamp-kubernetes
Demo Project for Private Docker Registry	https://gitlab.com/nanuchi/developing-with-docker
Online Shop Microservices	https://github.com/nanuchi/microservices-demo
Configuration Files & Helm Chart for Microservices Application	https://gitlab.com/nanuchi/online-shop-microservices-deployment

Check your progress... 1/11

Introduction to Kubernetes

- ❏ Watched video

Basic Concepts and Main K8s Components

- ❏ Watched videos

Useful Links:

- Managing K8s Secrets: https://blog.aquasec.com/managing-kubernetes-secrets

Kubernetes Architecture

- ❏ Watched videos

Minikube and Kubectl - Local Setup

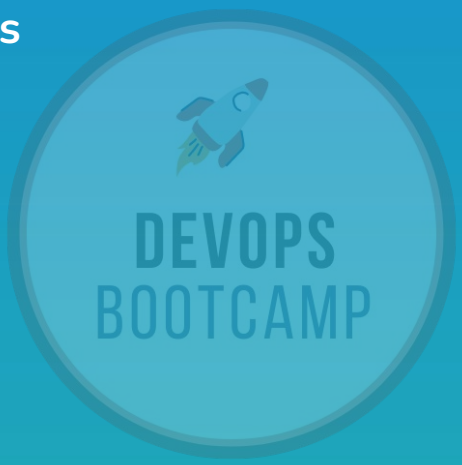
- ❏ Watched videos
- ❏ **Demo executed:**
  - ❏ Installed and setup Minikube
  - ❏ Installed Kubectl

Useful Links:

- Installation guide for Minikube (Mac, Linux and Windows): https://minikube.sigs.k8s.io/docs/start/
- Installation guide for Kubectl: https://kubernetes.io/docs/tasks/tools/install-kubectl/

Check your progress... 2/11

Kubernetes CLI - Main kubectl commands



- ❑ Watched video
- ❑ **Demo executed:**
  - ❑ Created nginx Deployment
  - ❑ Edited Deployment
  - ❑ Created mongodb Deployment
  - ❑ Inspected logs of a Pod
  - ❑ Got shell of a running container - kubectl exec
  - ❑ Deleted deployment
  - ❑ Applied configuration file

Useful Links:

- Example commands repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/basic-kubectl-commands

YAML Configuration File

- ❑ Watched videos

Useful Links:

- Configuration File: https://kubernetes.io/docs/tasks/manage-kubernetes-objects/declarative-config/
- Example files repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/kubernetes-configuration-file-explained

Best practices:

- Store Configuration Files with your application code or own Git Repository just for the configuration files

Check your progress... 3/11

Demo project: Deploying MongoDB and Mongo Express

- ❑ Watched videos
- ❑ **Prerequisite:**
  - ❑ Minikube cluster running
- ❑ **Demo executed - Deploying MongoDB and MongoExpress:**
  - ❑ Created MongoDB Deployment
  - ❑ Created Secret for Mongo Credentials
  - ❑ Created MongoDB Internal Service
  - ❑ Created MongoExpress Deployment
  - ❑ Created ConfigMap for DB Server URL
  - ❑ Created Mongo Express External Service

Useful Links:

- MongoDB Docker Image: https://hub.docker.com/_/mongo
- Mongo Express Docker Image: https://hub.docker.com/_/mongo-express
- Project Repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/demo-kubernetes-components

Organizing components with Namespaces

- ❑ Watched videos

Useful Links:

- Kubectx: https://github.com/ahmetb/kubectx#installation

Check your progress... 4/11

Kubernetes Services

❏ Watched video

Useful Links:

- Service: https://kubernetes.io/docs/concepts/services-networking/service/

Best Practice:

- Do NOT use NodePort Service Type for external connections. Use Ingress or Load Balancer instead.

Ingress

❏ Watched video

Useful Links:

- Project repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/kubernetes-ingress
- List of Ingress Controllers you can choose from: https://kubernetes.io/docs/concepts/services-networking/ingress-controllers/
- Ingress Controller Bare Metal: https://kubernetes.github.io/ingress-nginx/deploy/baremetal/

Persisting Data with Volumes

❏ Watched video

Useful Links:

- Volume Types: https://kubernetes.io/docs/concepts/storage/volumes/#volume-types
- Project demo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/kubernetes-volumes

Check your progress... 5/11

ConfigMap & Secret Volume Types

- ❑ Watched video
- ❑ **Demo executed:**
  - ❑ Created Mosquitto Deployment without any volumes
  - ❑ Created ConfigMap component to overwrite mosquitto.conf file
  - ❑ Created Secret component to add passwords file
  - ❑ Adjusted Mosquitto Deployment to include volumes

Useful Links:

- Project demo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/configmap-and-secret-volumes
- ConfigMap Volume Type: https://kubernetes.io/docs/concepts/storage/volumes/#configmap
- Secret Volume Type: https://kubernetes.io/docs/concepts/storage/volumes/#secret
- Mosquitto Public Docker Image: https://hub.docker.com/_/eclipse-mosquitto

Deploying Stateful Apps with StatefulSet

- ❑ Watched videos

Introduction to Managed Kubernetes Services

- ❑ Watched videos

Helm - Package Manager of Kubernetes

- ❑ Watched videos

Useful Links:

- Install Helm: https://helm.sh/docs/intro/install/
- Helm Hub: https://artifacthub.io/

Check your progress... 6/11

Helm Demo: Install a Stateful Application on K8s using Helm

- ❑ Watched video
- ❑ **Demo executed:**
  - ❑ Created K8s cluster on Linode Kubernetes Engine
  - ❑ Deployed replicated MongoDB (StatefulSet using Helm Chart) and configured Data Persistence with Linode Block Storage
  - ❑ Deployed MongoExpress (Deployment and Service)
  - ❑ Deployed NGINX Ingress Controller as Loadbalancer (using Helm Chart)
  - ❑ Configured Ingress rule

Useful Links:

- Project Repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/linode-kubernetes-engine-demo
- Create a Linode account ($100 - 60day credit with this link: https://bit.ly/31p4GW2)
- Mongo Express Docker Image: https://hub.docker.com/_/mongo-express

Check your progress... 7/11

Demo: Deploy App from Private Docker Registry

- ❏ Watched videos
- ❏ **Demo executed:**
  - ❏ Logged in to AWS Container Repository | docker login and create docker config.json file
  - ❏ Created Secret component
  - ❏ Configured Deployment for demo app
- ❏ **Pre-Requisites:**
  - ❏ Setup a Private Docker Repository (e.g. AWS Elastic Container Registry)
  - ❏ Have a demo application (see provided one)

Useful Links:

- K8s Project Repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/pull-images-from-private-reporsitory-in-k8s
- Sample NodeJs application Repo: https://gitlab.com/nanuchi/developing-with-docker

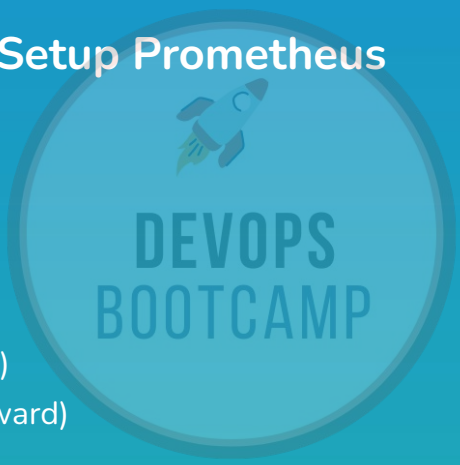
Extending the K8s API with Operators

- ❏ Watched videos

Useful Links:

- Find Operators: https://operatorhub.io/

Check your progress... 8/11



Prometheus Operator Demo with Helm: Setup Prometheus Monitoring on Kubernetes

- ❏ Watched videos
- ❏ **Demo executed:**
  - ❏ Installed Prometheus Operator Helm Chart
  - ❏ Accessed Grafana UI (configured port-forward)
  - ❏ Accessed Prometheus UI (configured port-forward)

Useful Links:

- Prometheus Monitoring - What it is and how it works: https://youtu.be/h4Sl21AKiDg
- Project Repo: https://gitlab.com/nanuchi/bootcamp-kubernetes/-/tree/master/setup-prometheus-operator

Secure your Cluster - Authorization with RBAC

- ❏ Watched videos

Useful Links:

- Site dedicated to good practices and tooling around Kubernetes RBAC: https://rbac.dev/
- Authenticating: https://kubernetes.io/docs/reference/access-authn-authz/authentication/
- 3 Realistic Approaches to K8s RBAC: https://thenewstack.io/three-realistic-approaches-to-kubernetes-rbac/

Check your progress... 9/11

Microservices in Kubernetes (Part 1)

- ❑ Watched videos

Useful Links:

- Learn more about Istio Service Mesh: https://youtu.be/16fgzklcF7Y

Demo Project: Deploy Microservices Application (Part 2)

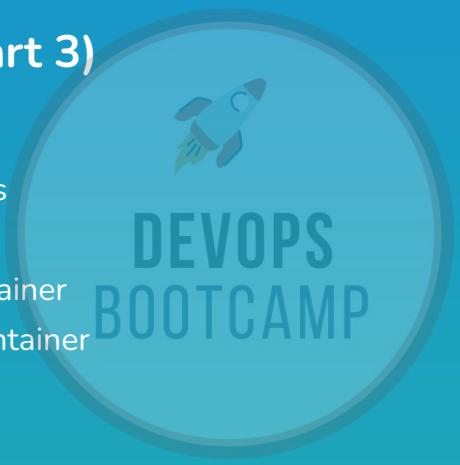
- ❑ Watched videos
- ❑ **Demo executed:**
  - ❑ Created YAML file with 11 Deployment and corresponding Service manifests
  - ❑ Note: All Services' Components are Internal Services, except the Frontend Service, which needs to be accessed from browser
  - ❑ Created a K8s cluster with 3 Worker Nodes on Linode (or any other cloud platform)
  - ❑ Connected to the cluster
  - ❑ Created a Namespace and deployed all the micro services into it
  - ❑ Accessed Online Shop with Browser

Useful Links:

- Microservices Git Repo: https://github.com/nanuchi/microservices-demo
- Git Repo for Configuration Files for the Microservices App: https://gitlab.com/nanuchi/online-shop-microservices-deployment
- Redis Docker Image: https://hub.docker.com/_/redis
- Volume Type emptyDir: https://kubernetes.io/docs/concepts/storage/volumes/#emptydir
- Ephemeral Volumes: https://kubernetes.io/docs/concepts/storage/ephemeral-volumes/

Check your progress... 10/11

Production & Security Best Practices (Part 3)



- ❏ Watched videos
- ❏ Demo executed - Improved Microservices Config Files
  - ❏ BP 1: Added version to each container image
  - ❏ BP 2: Configured Liveness Probe for each container
  - ❏ BP 3: Configured Readiness Probe for each container
  - ❏ BP 4: Configured Resource Requests
  - ❏ BP 5: Configured Resource Limits
  - ❏ BP 6: Don't use NodePort Service Type
  - ❏ BP 7: Configure more than 1 Replica for each Deployment

Useful Links:

- Git Repo for Best Practices Configuration Files for the Microservices App: https://gitlab.com/nanuchi/online-shop-microservices-deployment
- Configure Liveness, Readiness Probes: https://kubernetes.io/docs/tasks/configure-pod-container/configure-liveness-readiness-startup-probes/
- Resource Requests & Limits: https://cloud.google.com/blog/products/containers-kubernetes/kubernetes-best-practices-resource-requests-and-limits

Check your progress... 11/11

Create Helm Chart for Microservices (Part 4)

- ❏ Watched videos
- ❏ Demo executed
  - ❏ Created “microservices” Helm Chart
  - ❏ Created values.yaml files for each microservice
  - ❏ Created “redis” Helm Chart and values file for it

Useful Links:

- Git Repo - Helm Charts: https://gitlab.com/nanuchi/online-shop-microservices-deployment
- Helm Chart Developer Guide: https://helm.sh/docs/chart_template_guide/
- Built-In Objects: https://helm.sh/docs/chart_template_guide/builtin_objects/
- Best practices for creating Charts: https://helm.sh/docs/chart_best_practices/

Deploy Microservices with Helmfile (Part 5)

- ❏ Watched videos
- ❏ Demo executed
  - ❏ Deployed Microservices Application with “helm install”
  - ❏ Created Helmfile
  - ❏ Installed Helmfile
  - ❏ Deployed Helm Charts with Helmfile

Useful Links:

- Git Repo - Helmfile: https://gitlab.com/nanuchi/online-shop-microservices-deployment
- Official Helmfile Repo: https://github.com/roboll/helmfile

More Resources...

More Best practices

- Configuration Best Practices: https://kubernetes.io/docs/concepts/configuration/overview/
- 9 Security Best Practices: https://www.cncf.io/blog/2019/01/14/9-kubernetes-security-best-practices-everyone-must-follow/

Cheatsheet

- K8s CLI Cheat Sheet: https://kubernetes.io/docs/reference/kubectl/cheatsheet/