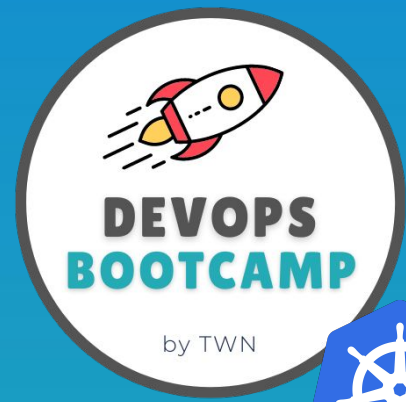


## Module Checklist

# Container Orchestration with Kubernetes

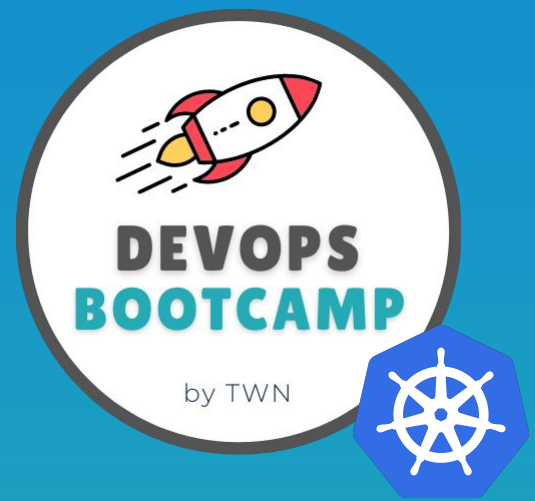
By TechWorld with Nana

# 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
- ★ 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 Git Folder	<a href="https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes">https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes</a>
Demo Project for Private Docker Registry	<a href="https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/js-app">https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/js-app</a>
Online Shop Microservices	<a href="https://github.com/techworld-with-nana/microservices-demo">https://github.com/techworld-with-nana/microservices-demo</a>
Configuration Files & Helm Chart for Microservices Application	<a href="https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/helm-chart-microservices">https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/helm-chart-microservices</a>

# Check your progress... 1/11

## Introduction to Kubernetes

- ☐ Watched video

## Basic Concepts and Main K8s Components

- ☐ Watched videos

### Useful Links:

- Managing K8s Secrets:  
<https://snyk.io/blog/best-practices-for-kubernetes-secrets-management/>

## 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/>

# 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/twn-devops-bootcamp/latest/10-kubernetes/useful-k8s-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/twn-devops-bootcamp/latest/10-kubernetes/yaml-configuration-files>

### 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](https://hub.docker.com/_/mongo)
- Mongo Express Docker Image: [https://hub.docker.com/\\_/mongo-express](https://hub.docker.com/_/mongo-express)
- Project Repo:  
<https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/demo-deploying-application>

## Organizing components with Namespaces

- ☐ Watched videos

### Useful Links:

- Kubectl: <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/twn-devops-bootcamp/latest/10-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>

# 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/twn-devops-bootcamp/latest/10-kubernetes/configmap-and-secret-volume-types>
- 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](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 Artifact 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/twn-devops-bootcamp/latest/10-kubernetes/helm-demo>
- Create a Linode account with \$ credit: search in Google “linode sign up with credit” and in search results, click the link that provides you with some \$ amount of credit on sign-up)
- Mongo Express Docker Image: [https://hub.docker.com/\\_/mongo-express](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/twn-devops-bootcamp/latest/10-kubernetes/deploying-images-from-private-docker-repo>
- Sample NodeJs application Repo:  
<https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/js-app>

## Extending the K8s API with Operators

- ❑ Watched videos

### Useful Links:

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

# Check your progress... 8/11



## 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/techworld-with-nana/microservices-demo>
- Git Repo for Configuration Files for the Microservices App: <https://gitlab.com/twn-devops-bootcamp/latest/10-kubernetes/helm-chart-microservices>
- Redis Docker Image: [https://hub.docker.com/\\_/redis](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/twn-devops-bootcamp/latest/10-kubernetes/helm-chart-microservices>
- 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/](https://helm.sh/docs/chart_template_guide/)
- Built-In Objects: [https://helm.sh/docs/chart\\_template\\_guide/builtin\\_objects/](https://helm.sh/docs/chart_template_guide/builtin_objects/)
- Best practices for creating Charts: [https://helm.sh/docs/chart\\_best\\_practices/](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/>
- Security Best Practices: <https://www.youtube.com/watch?v=oBf5lrmquYI>

## Cheatsheet

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