Master Kubernetes from Scratch
The Workbook

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Curios Devs Corner

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Table of Contents

Introduction

Welcome to the Kubernetes Workbook! This workbook is designed to help you solidify the key concepts you learned in the **Master Kubernetes from Scratch** book. By taking the quiz and completing the hands-on mini projects, you'll be able to reinforce your understanding of Kubernetes in a practical way.

Before diving into the quiz and projects, ensure you've read the entire book and tried out the exercises. If you're unsure about any topic, don't hesitate to review the corresponding chapters.

Quiz: Kubernetes Fundamentals & Concepts

1. What is the primary purpose of Kubernetes?

a) To manage and orchestrate containerized applications
 b) To replace Docker
 c) To provide cloud hosting services
 d) To create virtual machines

2. Which of the following best describes a Pod in Kubernetes?

a) A single container running in the Kubernetes cluster
 b) A collection of containers running together in a shared environment
 c) A group of Services
 d) A container image that is stored in a container registry

3. How does Kubernetes handle application scaling?

a) It automatically scales the applications based on the CPU usage of nodes
 b) You must manually scale Pods and Deployments
 c) It scales the number of replicas based on the specified requirements in the Deployment
 d) Kubernetes doesn't support scaling

4. What command is used to update the image of a running Deployment?

a) `kubectl update deployment`
 b) `kubectl set image`
 c) `kubectl apply`
 d) `kubectl scale`

5. What does a Kubernetes Service do?

a) It schedules Pods across nodes in the cluster
 b) It manages the storage of application data
 c) It allows communication between Pods and external traffic
 d) It secures the communication between Pods

6. Which of the following is a correct definition of RBAC (Role-Based Access Control) in Kubernetes?

a) A mechanism to control the number of replicas in a Pod
 b) A security feature that manages who can access resources in the cluster

c) A way to automatically scale Pods based on traffic
d) A tool to monitor resource usage

7. What is the default rolling update strategy in Kubernetes?

a) Recreate
 b) Rolling Update with no downtime
 c) Blue-Green deployment
 d) Canary deployments

8. What is a Kubernetes ConfigMap used for?

a) To store sensitive data securely
 b) To store configuration data for Pods and Deployments
 c) To define RBAC rules
 d) To define storage options for Pods

9. Which Kubernetes object is primarily responsible for controlling the lifecycle of Pods?

a) Service
 b) Deployment
 c) StatefulSet
 d) ReplicaSet

10. In the context of a Kubernetes Pod, what is the purpose of the `readinessProbe`?

a) To determine if a container is ready to handle traffic
 b) To verify if a container is functioning properly after a crash
 c) To start a new instance of the container
 d) To scale the Pod based on traffic

11. What is the purpose of a Kubernetes Job?

a) To run a one-time task or batch job
 b) To manage Pods in a StatefulSet
 c) To ensure that Pods are always running
 d) To manage continuous integration pipelines

12. What is a CronJob in Kubernetes?

a) A job that runs at a specific time and interval
 b) A job that runs continuously until manually stopped

c) A job that ensures a specific Pod is running at all times
d) A job for managing databases

13. What is the difference between Ephemeral and Persistent Volumes in Kubernetes?

a) Ephemeral Volumes are permanent, while Persistent Volumes are temporary
 b) Ephemeral Volumes are only available while a Pod is running, while Persistent Volumes retain data across Pod restarts
 c) Persistent Volumes are used only for logs, while Ephemeral Volumes are for application data
 d) There is no difference

14. Which file contains the configuration for accessing a Kubernetes cluster and managing authentication?

a) `/etc/kube/config`
 b) `~/.kube/config`
 c) `kube-config.yaml`
 d) `config.yaml`

15. How does Kubernetes handle authentication and authorization for users and services?

a) Authentication is handled by the Kubernetes API server, while authorization is handled by the kubelet
 b) Authentication and authorization are managed through RBAC rules and service accounts
 c) Kubernetes uses tokens for authorization only
 d) Both authentication and authorization are not required in Kubernetes

Hands-on Mini Projects

1. Deploy a Simple Nginx Application with a Service

Objective: Deploy a simple Nginx application and expose it using a Service.

Instructions:

- Create a Pod for the Nginx container.
- Expose the Nginx Pod via a Service using a ClusterIP.
- Access the Nginx page via the Service IP.

Hint: Review **Pods** and **Services** for a deeper understanding of how Pods and Services work together.

2. Implement a Rolling Update for a Deployment

Objective: Update the image of a Deployment and observe how Kubernetes handles rolling updates.

Instructions:

- Create a Deployment for an application (e.g., nginx).
- Update the Deployment to use a different image version.
- Verify that the new Pods are gradually replacing the old Pods with minimal disruption.

Hint: Refer to **Deployments** for how rolling updates work in Kubernetes.

3. Configure a Pod with Readiness and Liveness Probes

Objective: Add readiness and liveness probes to a Pod.

Instructions:

- Deploy a Pod with an Nginx container.
- Add both a readiness probe and a liveness probe to the Pod configuration.
- Verify the probes are working by checking the Pod's status.

Hint: See **Container Probes** for more on probes.

4. Secure a Multi-Container Pod Using RBAC

Objective: Implement Role-Based Access Control (RBAC) to secure a multi-container application.

Instructions:

- Create two containers in the same Pod (e.g., one for a database, another for a web app).
- Set up an RBAC policy that restricts access to the database container.
- Test the RBAC policy to ensure the web app can access the database but other Pods cannot.

Hint: Check **Security Context** for securing containerized environments using RBAC.

5. Use a ConfigMap for Application Configuration

Objective: Create and use a ConfigMap for storing configuration data.

Instructions:

- Create a ConfigMap with a configuration value (e.g., Nginx configuration).
- Reference the ConfigMap in your Pod's configuration.
- Test the application to ensure it's using the correct configuration from the ConfigMap.

Hint: Review **ConfigMaps and Secrets** to learn how to manage application configuration.

Quiz Answers

1. What is the main purpose of Kubernetes?

Answer: a) To manage and orchestrate containerized applications
 Explanation: Kubernetes is designed for managing, automating, and orchestrating containerized applications at scale.

2. What is a Pod in Kubernetes?

Answer: b) A collection of containers running together in a shared environment
 Explanation: A Pod is the smallest deployable unit in Kubernetes that can run one or more containers.

3. What does the `kubectl scale` command do in the context of Kubernetes?

Answer: c) It scales the number of replicas based on the specified requirements in the Deployment
 Explanation: Kubernetes can scale Pods automatically based on the defined number of replicas.

4. Which of the following commands can be used to update a Deployment in Kubernetes?

Answer: b) `kubectl set image`
 Explanation: This command updates the image of a running Deployment, triggering a rolling update of the Pods.

5. What is the main purpose of a Kubernetes Service?

Answer: c) It allows communication between Pods and external traffic
 Explanation: A Kubernetes Service acts as an abstraction that exposes Pods to the external network or other Pods within the cluster.

6. Which of the following is a correct definition of RBAC (Role-Based Access Control) in Kubernetes?

Answer: b) A security feature that manages who can access resources in the cluster
 Explanation: RBAC allows you to define roles and permissions, controlling who has access to which Kubernetes resources.

7. What is the default rolling update strategy in Kubernetes?

Answer: b) Rolling Update with no downtime
 Explanation: Kubernetes uses a rolling update strategy by default to replace old Pods with new ones gradually, ensuring there is no downtime during the process.

8. What is a Kubernetes ConfigMap used for?

Answer: b) To store configuration data for Pods and Deployments
 Explanation: ConfigMaps are used to store non-sensitive configuration data, which can then be accessed by Pods and Deployments in the cluster.

9. Which Kubernetes object is primarily responsible for controlling the lifecycle of Pods?

Answer: b) Deployment
 Explanation: A Deployment manages the lifecycle of Pods, ensuring the desired state of the application is maintained.

10. In the context of a Kubernetes Pod, what is the purpose of the `readinessProbe`?

Answer: a) To determine if a container is ready to handle traffic
 Explanation: The readinessProbe checks whether the container is ready to handle requests. If the probe fails, the container is not marked as ready to serve traffic.

11. What is the purpose of a Kubernetes Job?

Answer: a) To run a one-time task or batch job
 Explanation: Jobs are designed for running short-lived, one-time tasks (such as batch processing) that are completed once the task succeeds or fails.

12. What is a CronJob in Kubernetes?

Answer: a) A job that runs at a specific time and interval
 Explanation: CronJobs allow you to run tasks at specified intervals, similar to cron jobs in Linux.

13. What is the difference between Ephemeral and Persistent Volumes in Kubernetes?

Answer: b) Ephemeral Volumes are only available while a Pod is running, while Persistent Volumes retain data across Pod restarts
 Explanation: Ephemeral volumes are temporary and only exist as long as the Pod is running. Persistent Volumes, on the other hand, are independent of Pods and retain data across restarts and rescheduling.

14. Which Kubernetes file contains the configuration for accessing a Kubernetes cluster and managing authentication?

Answer: b) `~/.kube/config`
 Explanation: The `~/.kube/config` file contains the configuration needed for accessing a Kubernetes cluster, including authentication and cluster details.

15. How does Kubernetes handle authentication and authorization for users and services?

Answer: b) Authentication and authorization are managed through RBAC rules and service accounts
 Explanation: Kubernetes uses service accounts, RBAC (Role-Based Access Control), and other mechanisms to handle authentication (who you are) and authorization (what you can do) for users and services.