

turtles: Kubernetes Multi-Cluster Self-service Portal

Degree programme : BSc in Computer Science
Thesis advisor : Prof. Hansjürg Wenger
Expert : Dr. Joachim Wolfgang Kaltz

Kubernetes has become the standard for orchestrating containerized applications in software development and IT infrastructure management. This thesis focuses on developing a self-service portal called „turtles“ using the Cluster API to create temporary, managed Kubernetes clusters, providing a practical sandbox environment for developers and students.

Introduction

In the rapidly evolving landscape of software development and IT infrastructure management, Kubernetes has become the de facto standard for orchestrating containerized applications. Its widespread adoption highlights the need for agile, scalable, and efficient tools that allow developers and students to explore, learn, and innovate within cloud-native ecosystems.

Goals

This thesis presents the development of a self-service portal called „turtles“, leveraging the Cluster API's capabilities to create temporary Kubernetes clusters. These ephemeral clusters provide a sandbox environment for developers and students, offering hands-on experience with Kubernetes in a controlled, resource-efficient manner. The self-service portal integrates seamlessly into existing IT infrastructures, offering user authentication and authorization through OpenID Connect.

Technologies

The „turtles“ platform uses Kubernetes to build a simple, managed Kubernetes platform that is easy to install and operate. These clusters are created using the Cluster API, a project initiated by the Kubernetes Special Interest Group (SIG) Cluster Lifecycle, to provide Kubernetes-style APIs and patterns for automating cluster lifecycle management for platform operators.

Implementation

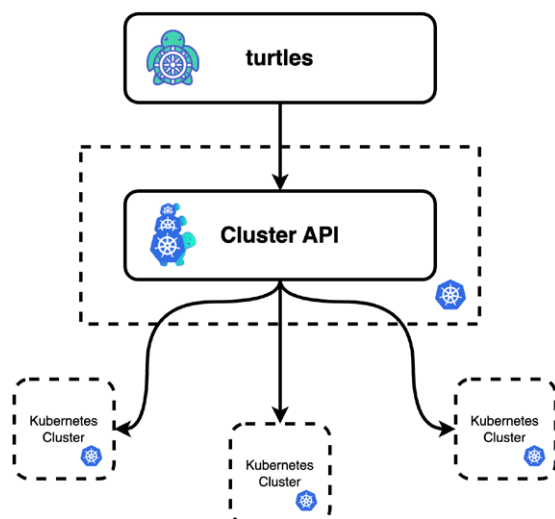
The „turtles“ system comprises two components: a service providing a RESTful API that abstracts the Kubernetes API extension of the Cluster API, and a single-page application for managing created Kubernetes clusters via the browser. The solution supports role-based authorization. Cluster admins have full access to the infrastructure and can administer templates for creating Kubernetes clusters. Admins can manage all Cluster API-managed Kubernetes clusters, while users can only manage their own clusters.

Conclusion

This thesis lays the foundation for a full-fledged managed Kubernetes solution. Using the Cluster API ecosystem, „turtles“ supports creating and operating Kubernetes clusters on hyperscalers such as Microsoft Azure, Amazon Web Services (AWS), and Google Cloud Platform (GCP), as well as on-premise hardware.



Yannik Dällenbach
Digital Business Systems



«turtles» managing Kubernetes clusters with Kubernetes