Kubelab Abstract

This study aims to assess the feasibility and potential advantages of employing container environments as an alternative to traditional computer laboratories. The main inquiry that this contribution seeks to address is: How can containers be of use in the development of computer laboratories?
In order to answer it, this work sets its focus on Kubernetes, a software widely employed for orchestrating large volumes of containers. Within this framework,
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an Operator is built, utilizing custom entries within the Kubernetes API to generate resources that can be readily accessed by both students and teaching staff. A web application is constructed, enabling students to establish connections and effectively manage the state of their container. The prototype manages Authentication to the Kubernetes Cluster via an OpenID-Connect provider. Additionally, it provides lectureres with access to their students' containers and afforded the capability to upload files to a shared space accessible to every student within the class. To simplify the creation of new Kubernetes resources for the Operator, Ansible was employed. This choice aims to make the process of generating classes and students more straightforward by utilizing CSV files. Following that, an examination of viable security mechanisms within the project is carried out. Additionally, the performance of containers is discussed. Concluding this study, an evaluation of the outcomes is presented and potential avenues for further research are outlined. This master's thesis shows that building a container-based laboratory inside Kubernetes is feasible and offers a series of advantages. Nevertheless, some general and security concerns persist and need to be addressed in further research endeavors.