# KubeNow: A Cloud Agnostic Platform for Microservice-Oriented Applications*

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## Abstract

KubeNow is a platform for rapid and continuous deployment of microservice-based applications over cloud infrastructure. Within the field of software engineering, the microservice-based architecture is a methodology in which complex applications are divided into smaller, more narrow services. These services are independently deployable and compatible with each other like building blocks. These blocks can be combined in multiple ways, according to specific use cases. Microservices are designed around a few concepts: they offer a minimal and complete set of features, they are portable and platform independent, they are accessible through language agnostic APIs and they are encouraged to use standard data formats. These characteristics promote separation of concerns, isolation and interoperability, while coupling nicely with test-driven development. Among many others, some well-known companies that build their software around microservices are: Google, Amazon, PayPal Holdings Inc. and Netflix [11].

Cloud computing is a new technology trend that enables the allocation of virtual infrastructure on demand, giving place to a new business model where organizations can purchase resources with a pay-per-use pricing arrangement [8]. Microservices in cloud environments can help to build scalable and resilient applications, with the goal of maximing resource usage and reducing costs. At the time of writing, Docker and Kubernetes are the most broadly adopted container engine and container orchestration framework [10, 9]. Even though these software tools ease microcroservices operations considerably, their setup and configuration is still complex, tedious and time consuming. When allocating cloud resources on demand this becomes a critical issue, since applications need to be continuously deployed and scaled, possibly over different cloud providers, to minimize infrastructure costs. This new challenging way of provisioning infrastructure was the main motivation for the development of KubeNow.

KubeNow provides the means to rapidly deploy fully configured clusters, automating Docker and Kubernetes configuration, while providing a mechanism for the application layer setup. We designed KubeNow using the Infrastructure as Code (IaC) paradigm, meaning that the virtual resources and the provisioning process are defined as machine-readable language. A natural consequence of this choice is that KubeNow is immutable and repeatable over different cloud providers, being cloud agnostic in this sense. In addition, IaC enables infrastructure version control and collaborative development.

KubeNow has been adopted by the PhenoMeNal H2020 consortium as the platform used to launch on demand Cloud Research Environments (CRE) [6]. The PhenoMeNal CRE allows

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for running reproducible large-scale medical metabolomics analysis. In addition, we are currently developing additional software layers for large-scale analysis on top of KubeNow including: Apache Spark [12], Pachyderm [5] and Slurm [7]. KubeNow supports Amazon Web Services [1], Google Compute Engine [2] and OpenStack [4]. The software is generally applicable and publicly available as open source on GitHub [3].

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