Curriculum in the Cloud: Using OpenStack to Transform Computer Science Education

Friday, 23 March 2018 09:30 (30 minutes)

We explore the question of relying on OpenStack as critical infrastructure for the instructional requirements of the ABET-accredited Bachelor of Computer Science program in the Computer Science department at the University of Kentucky.

The Computer Science department (established in 1966) has seen its instructional capabilities change dramatically over the past fifty years of computing, from time-shared access to mainframe computers in the 1970s to the personal computer labs of the 1980s to the now ubiquitous use of portable and mobile computing.

In some ways OpenStack harks back to the centralized main frames of the 1970s but with many evolved user conveniences. Key among these are the access through portable and widely distributed computing platforms connected to the OpenStack cloud services through broadband network infrastructure, and the evolution of the OpenStack "Big Tent" project model to provide a wide array of self provisioned capabilities to users.

At last the OpenStack architecture promises real advances for instructional programs and the institutions responsible for running them, offering freedom from the dedicated space and hardwired computer lab environments of the past, and leveraging all the convenience of mobile and personal computing with the power of large scale virtualized compute, storage, and networking resources.

But perhaps even more important is the tailored experience that the OpenStack transformation promises for the student: a virtual machine with resources and software allocated specifically to their course load and their place in the timeline of a curriculum designed for progressive instruction and learning.

We will discuss the issues in moving to an instructional program that is fully dependent on OpenStack for teaching a computer science curriculum, including provisioning requirements and goals, and monitoring issues and solutions that lead to improved scaling and tuning. We share our experiences integrating with the broader institutional authentication requirements and tailoring environments at per-student granularity for almost 1000 students.

Finally, we will discuss the practical issues of roll-out, proprietary environments, and the continuous onboarding of new faculty, researchers, and students.

Summary

We explore adopting OpenStack for instruction with the goal of making reliance on instructional computer lab space and equipment a thing of the past. The self service cloud architecture presents unique infrastructure decisions to provide every student with their own virtual machines for course labs, projects, and research. We discuss the issues in moving to an instructional program that is fully dependent on OpenStack for teaching curriculum.

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