

## InstantLab - Cloud Computing with OpenStack

Software experiments are a burden in university lectures and the achilles heel of massive open online courses: Constant software updates and complex software requirements make it difficult to reproduce the required environment. In addition, current developments in hard- and software such as parallel computing, accelerator hardware and virtualization exceed the capabilities of end-user devices.

### Moving it into the Cloud: InstantLab

To remedy these issues, we have created InstantLab - a self-service web platform that allows students to access provided software experiments through their web-browser. Experiments are pre-packed software containers (VM images) that contain all relevant tools, data and instructions for an exercise assignment. These experiments are executed and hosted either on the public cloud resources or in the university data center. Students can either use a remote-desktop screen in their web browser to operate the virtual machines and complete their assignments. Over time, InstantLab has matured into a modular and extensible architecture that is in continuous service and already has been used to some extent in the undergraduate OS courses.

### Making it smarter: The masters project

To truly scale to serve large audiences and be used for complex experiments, InstantLab still has a lot to learn. At the same time, InstantLab should make of new features emerging in the cutting edge cloud technology.

- **Smart admission control:** Cloud resources may be vast, but certainly not free. InstantLab should be reward a earnest students with access to all experiment resources of a course. At the same time, abuse of resources should be detected and prevented.
- **Smart feedback & grading:** To learn effectively, students need feedback on their work. Manual advice and grading are not manageable in settings with thousands of users. By monitoring student activity on the platform and during software experiments (virtual machine introspection), valuable information can be obtained.
- **Smart content:** Online courses are dependent on high-quality content. InstantLab is going to be used for making historic OS available, where manual work is required. For bulk creation, modern tools (Ansible, Puppet, Chef, etc.) should be employed to automated setup of experiments.
- **New Cloud Technologies:** New cloud platforms and releases enable new features (bare-metal deployments, software-defined networking, cluster setups) that should be used by InstantLab.
- **Smart Balancing and offloading:** InstantLab should be able to recognize the requirements of experiments and automatically move the experiment to the best-suited platform.
- **Smart Frontends:** InstantLab is prepared to provide dedicated frontends for different purposes. Modern web-technology should be used to create a clear and functional interfaces for InstantLab — enabling in-browser remote desktop connections. Open-ID technology is used identify and authenticate users.

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