

Project Name

Introducing Virtualization via OpenStack "Cloud" System to SUNY Orange Applied Technologies Students

Principal Investigator Christopher Rigby

Campus Orange County Community College

Year of Project 2013

Tier Tier Two

Project Team

- Cartmell Warrington, SUNY Orange

Overview Summary

"Creation of modules and open stack virtual servers to provide students with experiential learning of security configurations and administration of database systems."

Outcomes Summary

Virtualization lab environments described in a [PPT report](#).

Project Abstract

SUNY Orange seeks support for augmenting the study of virtualization by students majoring in Networking and Cyber Security in the Applied Technologies Department. The goal is to expose students to a more extensive range of technologies and give them relevant, applicable experience in a wider set of technology platforms. This will impact students by exposing them to cutting-edge technology, preparing them for real-world employment, and broadening their portfolios to help propel them to success in industry. As such, the proposal is to implement a small OpenStack "cloud" system.

Such a program would benefit students as follows:

- Provide a wider exposure to multiple operating systems and software in an environment that replicates industry conditions.
- Broaden each student's skill set via exposure to a wider spectrum of virtualized hardware and software, and introduce them to virtualization tools whose mastery will be attractive to employers.
- Provide a virtual "sandbox" for network security/intrusion detection "simulations" and modeling.

SUNY Orange's virtualization proposal aligns with IITG goals as it will integrate innovative uses of instructional technology to improve student engagement and learning, and SUNY Orange's Networking and Cyber Security students will be afforded hands-on experience with a cutting edge technology. Justification to provide this unique training for students in virtualization and cloud technologies is evidenced by recent articles decrying the lack of suitable training outlets in higher education for virtualization and cloud systems. The few classes offered tend to be survey courses for Computer Science students at the graduate level. The appended Bibliography supports these observations.

This proposal builds on a pilot project initiated by the PIs, which provided sufficient evidence of increased student engagement and learning by integrating virtualization in a limited number of Applied Technologies labs to warrant scaling up the project. This IITG proposal is to expand the virtualization pilot, with plans for sharing resources and discoveries within the SUNY system.

The PIs' pilot testing phase strategically introduced virtualization in existing laboratory sessions, and is currently taking place as a small-scale experiment conducted in 4 courses. SUNY Orange's Applied Technology Dept. is experiencing success in multiple courses utilizing Linux on external flash drives and exposing students to limited virtualization. As an example, a RAID laboratory session allows instructors to allocate virtual hard drives and install both a RAID 5 array (on Ubuntu Linux) and a RAID 1 mirror (on Windows 7) Other Operating System laboratory sessions have covered such topics as memory management, process management, iSCSI, SaMBa and NFS shares, among others. Similarly, the Network Security laboratories have included such topics as SQL Injection. Although there is student learning success with this method, it is very costly for the students who pay approximately \$100 for an external hard-drive per course. This is even more overwhelming when combined with the purchase of an expensive text book. With the proposed cloud environment, these hard drives would no longer be necessary.

PROGRAM REQUEST TO SUNY IITG Grant

This grant request involves the installation of a "cloud" virtualization environment-- an OpenStack virtualization environment that will allow students to use the tools increasingly prevalent in industry, namely Eucalyptus (Amazon EC2/S3 and OpenStack), nova (OpenStack), HybridFox (both Amazon and OpenStack), and the boto scripting environment (Amazon and OpenStack). This environment will:

1. Allow us to train students on "cloud" virtualization technologies, exposing them to technology that they would not otherwise see until they enter the industry, therefore improving preparation for the growing number of jobs in this area.
2. Allow students to more heavily use virtual images in laboratory sessions and maximizing faculty engagement with students. For example, current labs require an inordinate amount of setup time as instructors attempt to mirror real-life environments with very little "payload" in terms of deliverable exercises for the laboratory assignment. For example, to create an environment in which faculty can illustrate an actual SQL Injection, they must first install and configure the requisite software – the PostgreSQL database, the Apache web server configured with PHP. This consumes much of the laboratory session, which interferes with time that faculty and students could spend exploring the principles of SQL Injection. With IITG funding, the PIs could prepare an image with software preinstalled and running on the OpenStack cloud. Students will then spend more time working on the actual laboratory assignments, and with the added benefit of being spared the purchase of an expensive external drive. A further benefit would be "any-time, any-where" access for the students via the Internet. Sustainability of virtualization equipment will be transferred from the instructors to the SUNY Orange IT department, and will be added to the technology replacement cycle.

Looking ahead, this project allows for scaling up and sharing resources. With additional equipment, the PIs could initially create virtual servers for other projects at SUNY Orange – for example, most Computer Science students enter industry lacking any experience in version control or code repositories. With the proposed environment, a code repository system (for example, git) could be installed to introduce students to the rudiments of code versioning. Computer Science students could store code for all their labs, available to them from any location. OpenStack access could be expanded beyond SUNY Orange, initially to our partners in the Hudson Valley Educational Consortium (HVEC). HVEC currently supports Applied Technologies students from SUNY Orange, Rockland, Sullivan and Ulster in Cyber Security.

Replication and Sharing

Proposed as a pilot project, this initial grant investment will set up a small system. However, it could be easily expanded, with additional funding, to purchase computational resources. The program could thus be easily scaled to support multiple courses. Furthermore, since the laboratory assignments developed would be modular, and the technology easily replicated, the program could also be shared with our HVEC partners with whom we already share the Cyber Security Program. Sharing will also be pursued with the wider SUNY system using such conduits such as the SUNY Learning Commons.

Reports and Resources

- [Project outcomes report](#)
- [2014 CIT presentation](#)
- [Outline of project scope and materials](#)
- [Mid-project report](#)

Discipline Specific Pedagogy

- STEM

Instructional Design

- Student Learning Support

Instructional Technologies

- Open Educational Resources (OER)