

SDC Vending Machine

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INTRODUCTION

Figure 1.
Official logo for the Mitchell C. Hill SDC.



The Mitchell C. Hill Student Data Center (SDC) Vending Machine is a project focused on automating production tasks and enhancing compliance and security through building tested scripts that reduce the potential for human error. The vending machine allows the SDC's clients to easily deploy services in real time. This platform deploys pre-built environments at the click of a button. These environments range from simple websites, to Capture-the-Flag (CTF) competitions popular amongst middle to high school students, Collegiate Cyber Defense Competition (CCDC) practice environments, and a learning platform for a digital forensics course offered to an aerospace company. The vending machine removes roadblocks in deploying and provides a productive, efficient, cost-effective, and secure environment.

ISSUES

- Lack of resources
- Increasing demand for training in cyber infrastructure
- Popularity of cyber competitions and research activities among students



Figure 2. Cal Poly Pomona's Collegiate Cyber Defense Competition (CCDC) 2015 Team.

- Inability of students to put concepts learned in the classroom to practice
- The need for a sustainable set of resources that allow cyber research and competition resources to be reused and built upon over time.

PURPOSE

Administer Services

As SDC services become better known within Cal Poly Pomona and its partners, demand for services steadily increases. This demand includes supporting curriculum (graduate and undergrad) and research projects both in and beyond the classroom. In addition, the SDC hosts CTF competitions and other learning environments for middle and high school students including conferences and the first California high school cyber cup competition. The goal of the SDC Vending Machine is to make creating a cybersecurity game as easy as purchasing a bottle of soda.

Increase Efficiency and Productivity

The SDC Vending Machine is also aiming for overall increase in productivity. If systems can be easily and reliably created and shut down then computing hardware can be shared among many uses as opposed to being dedicated to one. Students who have struggled in the past to attain servers and systems to complete projects will be able to build systems within the shared virtual infrastructure allowing the platform to enable both faculty-led and student-led learning.

Hands-On Experience

Not only does the SDC Vending Machine provide help for individual students, it will also serve student clubs and allow students to pursue greater challenges. There are a number of student clubs just within the Computer Information Systems (CIS) program including:

1. Students With an Interest in the Future of Technology – cyber infrastructure
2. Management Information Systems Student Association – business professionalism and data analytics
3. Forensics and Security Technology – digital forensics
4. Application Development Club – applications development and mobile systems

CIS clubs are known for weekly workshops covering different topics in information technology. The vending machine will allow clubs to provide more workshops with increased quality. There are many more clubs across the university that will also benefit.



Figure 3. SWIFT teaching an Intro to Linux workshop.

METHODS

Chef

Chef is used to automate the configuration of nodes deployed via python scripts. Chef bootstraps each of the nodes in order to manage them via an SSH or WinRM connection. It also allows the loading of configuration profiles known as cookbooks to quickly configure systems to a baseline requirement.

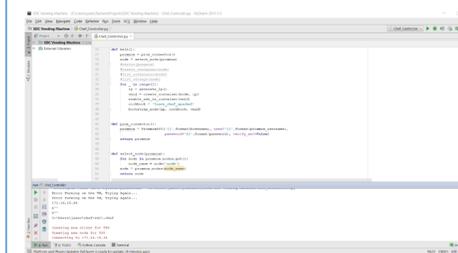
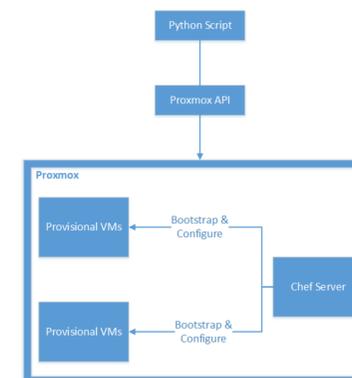


Figure 4. Creating a virtual instance using a Chef script.

Figure 5. SDC Vending Machine controller.



Networking

The SDC Vending Machine makes use of Software-Defined Networking (SDN) with Open vSwitch which virtualizes the networking layer. Networks are segmented, increasing security and enabling a large number of VMs to run on one physical node. Open vSwitch is controlled by OpenFlow, a standard SDN protocol that automates deployments and updates within the network. OpenDaylight, an SDN controller will be implemented for programmatically managing OpenFlow capable switches.

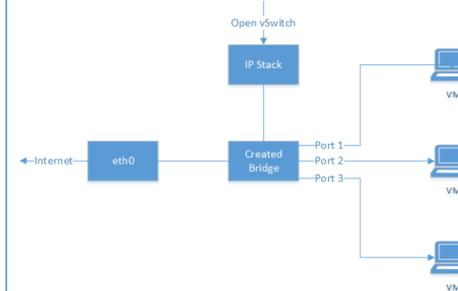


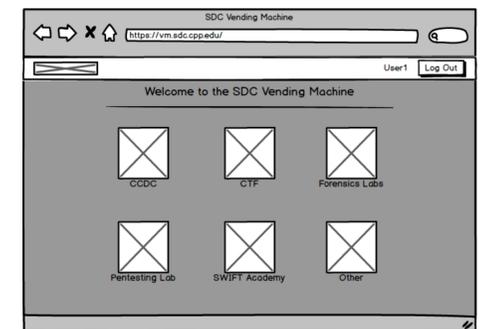
Figure 6. Open vSwitch.

METHODS (CONT'D.)

Web Development

Django, a free and open-source framework based on Python was used for developing the web front-end. It is mostly developed and simply needs to be configured to fit system needs. Python was determined to be the best choice for the web front end due to its large footprint and ease of execution. This makes Django the ideal tool for creating the web interface of the SDC Vending Machine

Figure 7. A mockup of the final web GUI.



IMPACT

There are many benefits for students and external organizations, but what about the creators?

The SDC Vending Machine project started as a SWIFT club research project and evolved into a CIS 499 course – Special Topics for Upper Division Students. The group of students that continued this project, led by Juan Ortega, all went through the same struggles as listed in the Issues section. Along with countless hours of research and implementation also came practical knowledge that cannot simply be taught in class. Those that work on the SDC Vending Machine gain valuable insight in working with a team, making design decisions, and implementing the design which includes the development of technical skills.

FUTURE PLANS

- Gather a larger team of students to work together and conduct research
- Revise and improve the Chef scripts to ensure the system fulfills its intended use and is free of errors
- Go through continuous trial and error of configuration to find the best solutions, especially with networking
- Create various mockups of the web interface to have the most efficient and clean website to be offered to clients