2020 CSLabs Extension Project

Feasibility Report

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# Summary

The purpose of this report is to outline the CSLabs 2020 Capstone project and discuss the project’s feasibility. Team Cosmic Alpha (TCA) has obtained a proposal from the Computer Security Group (CSG) at Indiana University Southeast (IUS) and met with the product stakeholders on 22 Sep. 2020 to discuss the proposal. TCA and CSG have exchanged ideas, and both parties have agreed to move forward and explore a solution.

# Product Introduction

The CSLabs 2020 Capstone project is proposed as an extension of the previous year’s Capstone projects. CSLabs is a virtual learning environment for IUS students to practice computer security and other aspects of computer science using virtual machines (VM). A functional CSLabs will serve the CSG’s mission of providing “…technical education and hands on experience…” to its members and educating “…the public about security awareness”.

# Technical Feasibility

Since the proposed project is a continuation of past projects, which have already demonstrated successful concepts, TCA is relatively confident that the proposed product will perform to the required specification as long as the stakeholders have realistic expectations.

The software portion of CSLabs consists of two parts: the web-facing frontend and the application server backend. The frontend should satisfy the requirements of three user categories interfacing with the backend if the actions to be performed by the users are practical. The three categories described in the proposal are: administrator, creator, and regular user. The backend should also satisfy the requirements of creating, servicing, and storing both the user data and VM(s) contingent upon the infrastructure availability and reliability.

# Social Feasibility

The proposed system is designed to expose the students and the faculty members of IUS to a cloud based lab environment using modules. The initial phase will limit the membership to individuals affiliated with IUS. At a later time, there may be plans to make CSLabs available to other institutions and the public. Because not all users will have the same amount of technical knowledge or operate in the same computing environment, a learning curved is expected as the users’ transition from an on-premise application experience, such as VMware or Virtual Box, to a cloud based Software-as-a-Service (SaaS) through web browsers. The next few paragraphs will discuss the social feasibility for the regular users, the creators, and the administrators. Once all parties concerned can collaborate and perform to the standards expected by the stakeholders, CSLabs will remain socially feasible.

Compared to a decentralized on premise learning environment for individual students, CSLabs will be centrally managed and universal to all regular users. Regular users may lose some technical competencies by setting up and running VMs locally themselves, but as a tradeoff, they can effectively explore a computer science topic with clear goals already defined and focus on the learning aspect instead of spending time on setup.

The creators are usually content designers in CSLabs that create and publish learning modules. They are normally faculty members, but knowledgeable CSG members may also work in that capacity. It is unknown at this point how creators will work to create learning modules, but they are expected to learn some parts of CSLabs and acquire new skills in order to fulfill their teaching objectives.

The voluntary nature of CSG and the affiliation with IUS will ensure a healthy flow of students participating in all phases of CSLabs’ development cycle. This can lead to new talent acquisition at the expense of project discontinuity as the CSG members will eventually graduate and move on to different priorities in life. CSG must have proper governance and a chain of succession well established for the long term support of CSLabs. Nevertheless, all participating CSG members will gain valuable job skills during the process of learning, testing, and administrating CSLabs.

# Economic Feasibility

CSG is currently responsible for the underlining infrastructure of CSLabs. This includes network connectivity, domain hosting, the CSG web portal maintenance, Promox cluster and associated hypervisor administration, and hardware maintenance of the server(s). TCA is not familiar with the exact man-hours and budget required to maintain the infrastructure for CSLabs. TCA can only assume that the fix and the variable expenses to sustain CSLabs are within the constraint of CSG and economically feasible.

CSG will also undertake the responsibilities of identifying and publishing project requirements, reviewing and approving commits to the repository, and ultimately testing and deploying the CSLabs releases. The man-hours required for these tasks will be substantial, and the workload may be concentrated in bursts instead of evenly spaced. It is uncertain at this moment if the CSG has enough man power to handles all the tasks, although the CSG leadership appears to be very technically competent and enthusiastic about the CSG mission.

TCA is expected to make significant development progress to the existing CSLabs environment in two semesters. It is the TCA understanding that Unit Testing is outside of the scope of the proposed project. TCA will focus on creating the required features on the frontend and documentation at this point. TCA has tentatively proposed to dedicate 12 man-hours each week to the project for approximately six months. This equals to 288 man-hours divided among three project members to tackle 23 proposed requirements, although the exact number of the requirements has not been finalized. TCA collectively agrees that the current labor budget is economically feasible.

Market Research

In the course of conducting market research for CSLabs, it has been hard to find a niche market for CSLabs as a commercial solution. The market for online/distance learning are saturated with solutions from many large and small providers. Vendors such as Microsoft, Oracle, Udemy (www.udemy.com/), and Pluralsight (www.pluralsight.com) all have various solutions suitable for general purpose or specialized trainings that are recognized by the computer industry. A simple search on Google for cloud computing labs has hundreds of results, and some websites have very detailed feature comparison and product rankings. CSLabs may be free or cost very little, however, it has neither a large library of content offering nor the scalability to compete with existing solution providers on the commercial market.

In the open source community, many established learning solutions exist for individual students. Solutions such as Metasploit and OWASP's Software Assurance Maturity Model (OpenSAMM) have feature rich and customizable VMs packaged and ready to distribute to the end users to experiment with. With the advance of broadband internet and inexpensive home computing power, it is no longer cost prohibitive to run a few fully featured VMs locally. Although there is a certain amount learning curve and productivity overhead to obtain, install, and run custom VMs, the end users can quickly start the learning process with a little help from the online open source community. In TCA’s opinion, the open source community has many useful products and best practices that can be incorporated into CSLabs. In return, CSLabs can provide feedback to the open source community based upon the user experience and lessons learned.

In TCA’s opinion, CSLabs can exist as a custom academic solution with unique content that can encourage structured learning and targeted learning paths. Because CSLabs and its associated learning modules very likely have their roots in the curriculum of the IUS Computer Science department, the standard users will be likely to archive desired outcomes whether it is academically or competing in collegian events. Although the IUS Computer Science department has been using various open source content to teach computer security, such as Metasploit and OpenSAMM, neither is specifically designed with IUS Computer Science department’s curriculum in mind. Furthermore, CSLabs content will very likely be designed by IUS faculty members and students for the purposes of learning. It is logical to assume that the content created will be valuable to the IUS Computer Science department and the greater IU Computer Science community.

# Alternative Solution

TCA has conducted research regarding alternative solutions to CSLabs and has found at least three alternative solutions. They are Qwiklabs (www.qwiklabs.com), CloudAcademy (www.cloudacademy.com), and ACloudGuru (www.acloud.guru). All three of these services offer cloud based lab learning environments with various cost structures. The cost varies from $1 per lab session to subscription of unlimited access for $500 per year. A typical cloud lab offers dynamically generated Windows or Linux VM that end users can access securely through either Remote Desktop Connection or SSH. The end users have a great deal of freedom to explore and experiment desired computer skills without the fear of ruining their own system. While CSLabs cannot compete with these solutions, it may be beneficial to learn from and replicate their success stories.

# Project Risks

It has been mentioned in a previous section that CSLabs may be exposed to risk of discontinuity due to the changing CSG membership and knowledge retention. In addition, the public facing nature of the CSLabs project will certainly face cyber security challenges and risks. Data security and service level agreement (SLA) may ultimately determine the feasibility of the CSLabs project as a user data beach can be disastrous and shut down the project completely.

The CSLabs project may also face unexpected risks contingent upon actions of many external factors, such as the IU University Information Technology Services (UITS), any corporate sponsors, the school of Natural Science, regulatory agencies that governs user privacy and data retention rules.

# Recommendation

TCA is generally optimistic towards the feasibility of the CSLabs 2020 proposal. TCA members are eager to learn but are slightly reserved with the list of requirements presented without precise specifications outlined. TCA would appreciate your feedback on this report, Dr. Finkbine. Your comments and suggestions to the analysis and the subject will help the group succeed in planning and executing the project. Thank you!

Key Personnel and Contribution Breakdown

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| Position | Name | Contribution |
| Project leader | Lu, Yiliang | Conduct primary and secondary research; draft and edit reports; coordinate events and meetings; establish a liaison with external parties and advisors. |
| Full Stack Developer | Bello, Junet | Create and manage backlogs; project feasibility consulting; primary developer for the CSLabs backend; alternate project POC |
| Full Stack Developer | Martin, Cooper | Primary developer for the CSLabs web-app frontend; alternate event coordinator; unit testing |