*How does this project contribute to the overall Vision of Columbus State University?*

Columbus State University’s vision prioritizes student success and academic excellence. By tasking students with the design, implementation, and maintenance of a private cloud for real-life usage by peers, this project will provide both career-relevant experience and daily utility for computer science students. Senior-level students who work on the cloud will gain invaluable experience with requirement analysis, collaboration, stakeholder communication, and production procedures. Younger students will have the chance to work with industry-standard cloud computing technology over the courses of their studies. The project will provide a significant new way for students to engage with computer science.

*What does this project need to accomplish?*

Successful execution of the project is defined by the establishment of a functional private cloud from bare metal, local servers. The cloud should be fully accessible by students over the campus LAN and the Internet. Students will be able to access virtual computing services on-demand, simplifying their development process. The cloud must be highly maintainable and extensible, allowing future senior students to continue and expand upon our efforts. Clear documentation on the system will be necessary for future project continuation.

*What are the benefits?*

Undergraduate and graduate computer science students will be able to experiment with programming and system administration on ephemeral virtual machines, allowing for quick, low-risk access to unfamiliar operating systems and environments. As a private, on-premises cloud platform, the project will be faster and less expensive than offerings from public cloud providers. Large datasets, which are a vital component in industry trends like big data and AI, can be stored locally for reduced costs and increased computational accuracy. The hands-on experience gained from the use of these machines will strengthen students’ overall understanding of IT infrastructure containing networking, hardware, and software components. Senior students who work directly on the cloud servers will gain further experience with real hardware that would otherwise have prohibitively high barriers to entries.

*Please list the deliverables.*

The primary deliverable will be an OpenStack-based cloud infrastructure, fully deployed and accessible by students through a web-based dashboard and a command line interface, which can provide on-demand virtual machines.

A dashboard for maintainers and faculty will provide administrative access and system monitoring.

Documentation for users will be created to explain the basics necessary to utilize the system’s capabilities.

Documentation for maintainers will enable the project to continue and expand.

*How is data being made secure for this project?*

A variety of security measures will be conducted. The physical servers will operate from a locked room. Further physical security can be achieved with the lockable server front bezels, and a lockable server rack. The servers’ storage disks are encrypted with LUKS (Linux Unified Key Setup). Access to the cloud will be managed with OpenStack Keystone, an implementation of OpenStack’s token-based authentication API. The cloud will be connected through a private VLAN with configurable access control lists. Usernames and passwords for the servers will be stored and managed with BitWarden, an open-source, encrypted password manager.

*Does the project need BC/DR plans in case of a disaster?*

Yes, some plans must be created for continuation and recovery in disasters. In the case of power outages, documentation on server startup will be necessary. Similarly, plans for network connection and reconnection are vital for continued availability. Evaluations should be conducted on the cloud’s resilience and critical systems in order to prioritize future maintenance and upgrades.

*Identify any risks or obstacles that may cause the project to fail.*

A short list of serious risks threaten the project’s success. The necessity of departmental support for the project characterizes immediate risks. Sufficient network access to connect the cloud servers to each other and the Internet has not been granted, halting progress towards a full deployment. Funding for future maintenance and upgrades may become necessary, requiring assistance from the Computer Science department, in potential events of hardware failures or obsolescence. Prominent among long-term obstacles is the ongoing transfer of knowledge between student maintenance teams; continual effort will be required on behalf of the Computer Science faculty to ensure successful preservation of existing documentation. Outages and ensuing disaster recovery are long-term risks which can be largely mitigated through documentation.

*List what the project will and will not address.*

The project will address the provision of cloud computing resources for experiential learning. To preserve resource availability, it will not provide long-term server hosting, virtual machines, cloud storage, or high-performance computing.

* Networking resources for scalable website platforms

4.8 KWh/day / server. 144 KWh/month/server. ~432 KWh

Assuming the servers idle at 200W, the cloud computing setup will consume approximately 430 KWh per month.

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| --- |
| **Project Start (estimated):** January 10th |
| **Project Finish (estimated):** May 5th |
| **Project Cost**  **(estimated):**  Equipment   * Front Bezel with key 710 $ 40 (renewed) * Front Bezel with key 710 $ 40 (renewed) * Front Bezel with key 730 $ 49 (renewed) * Rack Rail 710 $ 97.35/$129 (renewed) * Rack Rail 710 $ 97.35/$129 (renewed) * Rack Rail 730 $ |
| **Funding Source:** For Dr. Zhou |

What I’ve learned so far:

Private Server Setup

Installation of dev stack, OpenStack, Kubernetes, and Kolla Ansible

Updating a private server in the Lifecycle Controller

Server Rack Setup

Structuring OpenStack system

Multi-node – connect all three servers together

Document with pictures of server creation