Unidata Community Equipment Grant

Proposal Title: A JupyterHub Server to Enhance the Use of Python in Meteorology Coursework at Valparaiso University

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Section B: Project Summary

We propose to purchase a new server to support a JupyterHub server to allow for an increase in the use of Python within our meteorology curriculum. The proposed system will be an integral part of the continually adapting computing systems within the Department of Geography and Meteorology to meet the needs of our students' educations to be successful within the field. Additionally, we hope to demonstrate that implementation of this type of server at a smaller university is both possible and beneficial to the educational and research mission of atmospheric science programs. We would offer back to the community both information and assistance to allow more programs to achieve similar goals.

Section C: Project Description

The Department of Geography and Meteorology at Valparaiso University has grown tremendously over the past 30 years. Since the addition of a Bachelor of Science in Meteorology in 1991, we have maintained greater than 100 meteorology majors and 30 geography majors since the early 2000s. In light of the COVID-19 pandemic forcing a quick pivot to remote learning, the meteorology program benefited by a JupyterHub through Unidata's Jetstream computing allocation. The use of JupyterHub was an excellent resource for classes during the Spring 2020, Fall 2020, and Spring 2021 semesters. An added benefit has been the convenience for students to access the resource from their own devices at any time. However, a difficulty has been that the resource is not integrated with our existing computing resources including student home directories and data resources.

Contributions to Education

This proposal seeks funding for a new server to host a Valpo JupyterHub server in order to tie our existing departmental computing system to this expanded resource. Specifically, this resource will expand student flexibility for work on class assignments and projects. In addition, with the JupyterHub easily accessible from a web browser faculty will have more opportunities to incorporate Python in departmental course offerings in traditional classroom. This server would enable the department to alleviate increased scheduling difficulties as more classes increasingly vie for the weather center computer lab for their courses and research work.

The use of Python has been increasing across the atmospheric sciences in many different settings, making it vitally important to incorporate its use throughout our meteorology curriculum in as many contexts as possible. Our program has long been a leader in teaching Python related coursework. We have contributed a number of Python related educational materials to the broader community through Unidata curated GitHub repositories, as well as personal faculty repositories. We look to continue this strong tradition by documenting the benefits of adding a JupyterHub instance to the suite of computing tools that will ensure success of atmospheric science programs everywhere. This grant would allow for the purchase of the necessary equipment to meet these goals.

Contributions to Research

In addition to using this server for classroom activities, the server would allow expanded use of Python activities in undergraduate research. Faculty have ongoing projects studying lake effect snow and the extratropical transition of tropical cyclones, our student researchers would benefit from being able to utilize the JupyterHub environment to complete their work. With the ease of using this system, we hope this would allow us to expand the number of students and faculty working on projects.

Relationship to existing department computing facilities

The Valpo JupyterHub server would complement our 20-workstation weather center computing lab, which utilizes a main server hosting student and faculty home directories and serves data from the LDM. In addition, the department has a server dedicated to numerical weather prediction running twice daily regional WRF simulations for localized forecasts. The 20-workstation computer lab will be updated this summer to replace 10-year-old system originally bought using a NOAA grant. Finally, the plan is to also ramp up a THREDDS instance from our main server resources to be able to host a limited amount of data for using in conjunction with the JupyterHub server and hosting our radar data in an accessible format for others beyond our institution to access.

System management support

Valparaiso University provides system management support through two channels. The Office of Information Technology (IT) at Valparaiso University supports the community needs of the entire campus community by maintaining servers, upgrading PCs, and answering technological questions. IT has closely worked with the department by planning for computer technology upgrades, periodic maintenance of existing hardware, and is primarily responsible for our facility's classroom technologies. It is a robust and strong partnership that has been developed and sustained for more than a decade. In addition to IT, the Department of Geography and Meteorology has a staff meteorologist whose job duties include the maintenance of departmental computing resources and works in consultation with the University IT personnel. Finally, various faculty members with expertise in Linux computing assist the staff meteorologist and University IT personnel in installing and maintaining departmental computer resources.

Requested Equipment

In order to design a system that would meet the needs of the department and our students, Julien Chastang (Unidata) and Kevin Tyle (University at Albany) were consulted to help craft server specifications. After these consultations we used the information from the littlest JupyterHub documentation page for estimating the memory, disk space, and CPU needs, which is based primarily on the number of users. Estimating that we would have 25 concurrent users leads to a server with > 100 GB of RAM (allowing for 4 GB per user), 25 CPUs would be required to give each user a single CPU to run. Disk space is

less of a concern, since we would integrate with our home directory server which has ample storage space for user directories. The high amount of RAM per user is used after consultation with Kevin Tyle who suggested additional RAM over minimum requirements, as analysis of large datasets can quickly take up available RAM.

Section D: Project Budget and justification

In consultation with Julien Chastang (Unidata) and Kevin Tyle (University at Albany), we propose purchasing a Dell 7920 Rack Data Science Workstation with 26 cores and 128 GB of memory. The estimated total cost of the system is $13,804.71 (estimate attached). Faculty and staff time for implementation is covered at no cost.

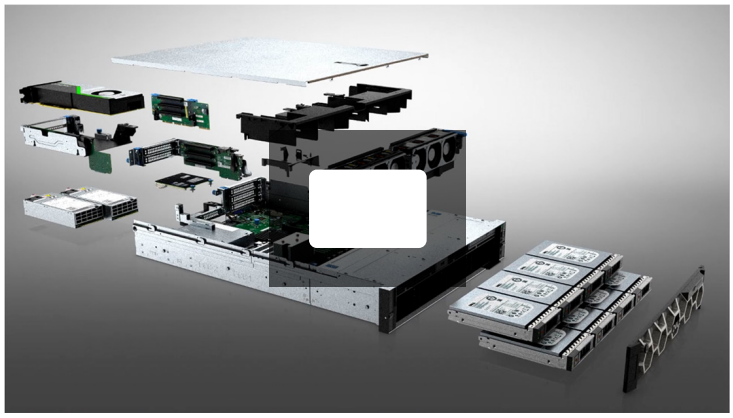
Dell 7920 Rack Data Science Workstation

- Dual Intel Xeon Gold 6230R 2.1GHz, (4.0GHz Turbo, 26C,10.4GT/s 2UPI,35.75MBCache,HT(150W) DDR4-2933)
- 512GB SDD storage
- 128GB memory
- NVIDIA Quadro RTX6000, 24GB, 4DP, VirtualLink (7920R)

Section E: Project milestones

If this proposal is funded we will promptly order and install the proposed server system. Assuming an early summer purchase and delivery, the server system should be on-line and ready for use in fall semester 2021 courses. After the first semester of use, the documentation for set up and operation would be pulled together and lessons learned shared with Unidata and the broader community. Course materials used through this system will additionally be curated via GitHub and made available to the broader geoscience community as example coursework for a variety meteorology courses.

Precision 7920 Rack Data Science Workstation



- Dual Intel Xeon Gold 6230R 2.1GHz, (4.0GHz Turbo, 26C,10.4GT/s 2UPI,35.75MBCache,HT(150W) DDR4-2933)
- Ubuntu Linux 18.04
- NVIDIA Quadro RTX6000, 24GB, 4DP, VirtualLink (7920R)
- 128GB 8x16GB DDR4 2933MHz RDIMM ECC Memory
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