Revamp of High Energy Physics Laboratory's Computer Systems

Joseph Bostik, Eric Pereira, Ryan Wojtyla

Faculty Advisor: Dr. Marcus Hohlmann, Dept. of Aerospace, Physics and Space Sciences, Florida Institute of Technology

ABSTRACT

Dr. Hohlmann's High Energy Physics (HEP) research group at Florida Tech contributes to micropattern gas detector research with the CMS experiment at CERN and R&D for a future Electron-Ion Collider to be built in the United States. In order to conduct this research, the group makes extensive use of several computer systems. These systems can be split into three main sections: the high throughput computing cluster, the muon tomography station (MTS), and general use machines.

LINUX COMPUTING CLUSTER

BACKGROUND & INITIAL SITUATION

The high throughput computing cluster is primarily used to store data and run calculations. It is also affiliated with the Open Science Grid (OSG), where researchers from across the globe can submit jobs to be run. At the beginning of the project, the cluster had been under severe maintenance for a good deal of time, and its software would soon be outdated. After attempting to help solve its many issues, the OSG support staff finally recommended a full rebuild of the entire system.

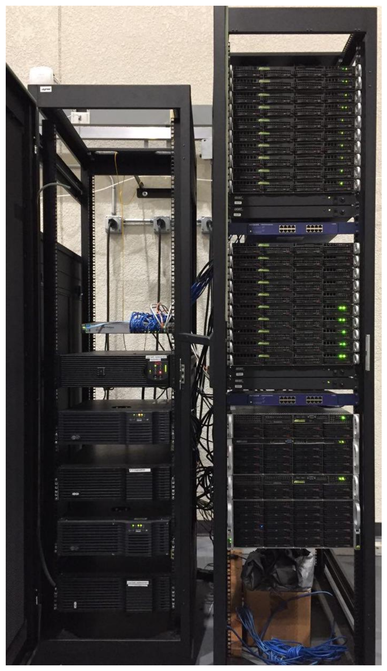

Figure 1: *The group's linux computing computer split up into its two racks. The right cabinet houses the computing hardware, while the left one houses the UPSs.*

Install ROCKS 7 onto the CE.	
Install ROCKS 7 onto the other cluster components.	
Configure HTCondor.	
Integrate cluster with OSG.	
Create a cluster rebuild manual.	

GENERAL PURPOSE MACHINES

BACKGROUND & INITIAL SITUATION

The research group uses general purpose Linux machines to interface with miscellaneous detectors and electronics, process and store data, and run simulations. The researchers using these machines often run into technical trouble and benefit from technical assistance provided both within and without the group. The lab's general purpose machines, while largely usable, had much room for optimization in terms of resource allocation and workflow automation.

LEGEND

Fully Completed	
Partially Completed	
Not Yet Completed	

Reallocate hardware.	
Optimize workflows.	
Develop solutions for long-term maintenance.	
Provide miscellaneous technical support.	

MUON TOMOGRAPHY STATION INTERFACE

BACKGROUND & INITIAL SITUATION

The MTS is an experimental device that makes use of micropattern gas detectors to track the paths of muons in order to image an object placed within it. The computer system for the MTS was running outdated software, had grown unreliable, and had an inefficient and convoluted data-taking workflow.

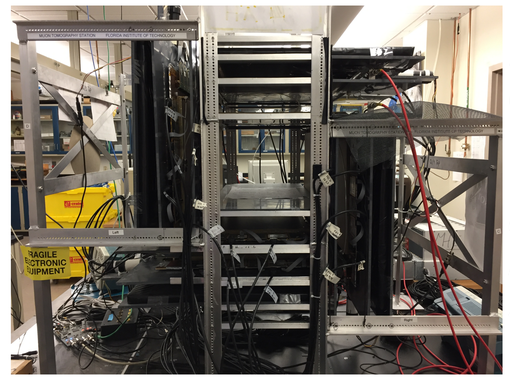

Figure 2: *The group's Muon Tomography Station. The cavity into which objects to be imaged are placed is beset on four sides by three layers of micro pattern gas detectors.*

Install software onto new machine.	
Configure the software to work together.	
Create a user interface for operating the software.	
Integrate the new machine with the MTS.	
Create a manual describing the construction and operation of a new MTS machine.	

ACKNOWLEDGEMENTS

Daniel Campos helped us overcome obstacles encountered with the computing cluster. **James Cicak** from Florida Tech's IT department helped start us off with the computing cluster. **Samantha Wohlstadter** assisted us a great deal with the computing cluster, saving us much valuable time. The **ROCKS User's Guide** (http://central-7-0-x86-64.rocksclusters.org/roll-documentation/base/7.0/) provided us much needed guidance during the ROCKS installation process. MTS researchers **Miguel Gutierrez** and **Tommy Walker** provided us with guidance in designing the new MTS machine.