DeepGreen

Final Presentation

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Problem Statement

- What is the benefit of using Submer's fully immersive cooling method?
- Why or how is it better than traditional air cooling methods?

Answering these questions will give Submer concrete data on how their product performs compared to traditional cooling methods. If the results are positive, they could then go on to use this data to advertise the effectiveness of their product.

Main Project Goals

- Two main objectives:
  - Research air-based cooling vs. immersion cooling
  - Provide an experiment report with quantitative data comparing immersion cooling technology with air cooling

Technical Challenges

Software Challenges

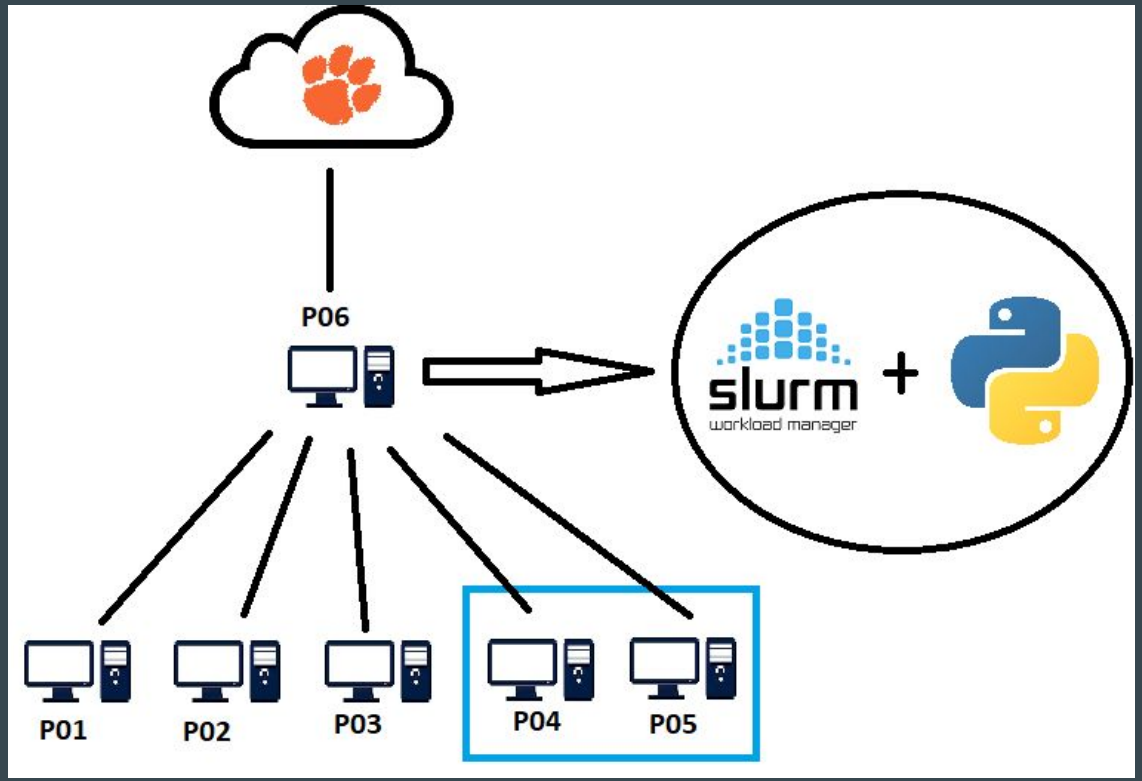
- Securing remote access to the computers
- Configuring and physically installing the cluster nodes
- Setting up a testing environment
- Creating scripts to automate testing

Research Challenges

- Designing a methodology
- Utilizing servers with different specifications
- Knowing what metrics we wanted to gather
- How to collect system information
- Limitations of the hardware

Solution Overview

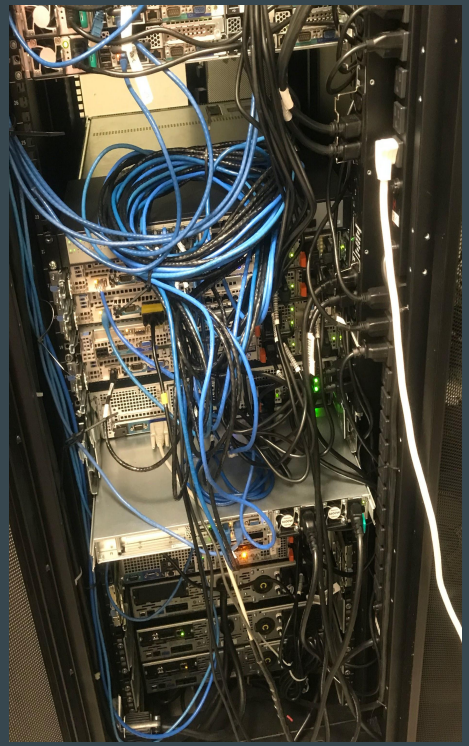
- Create Test Plan
- Find way to record metrics
- Hook up all the computers to a single cluster accessed through a head node
- Connect the head node to Clemson's network
- Install benchmarks
- Install Slurm to assign tasks to computers in the cluster
- Create scripts to run on test computers using slurm



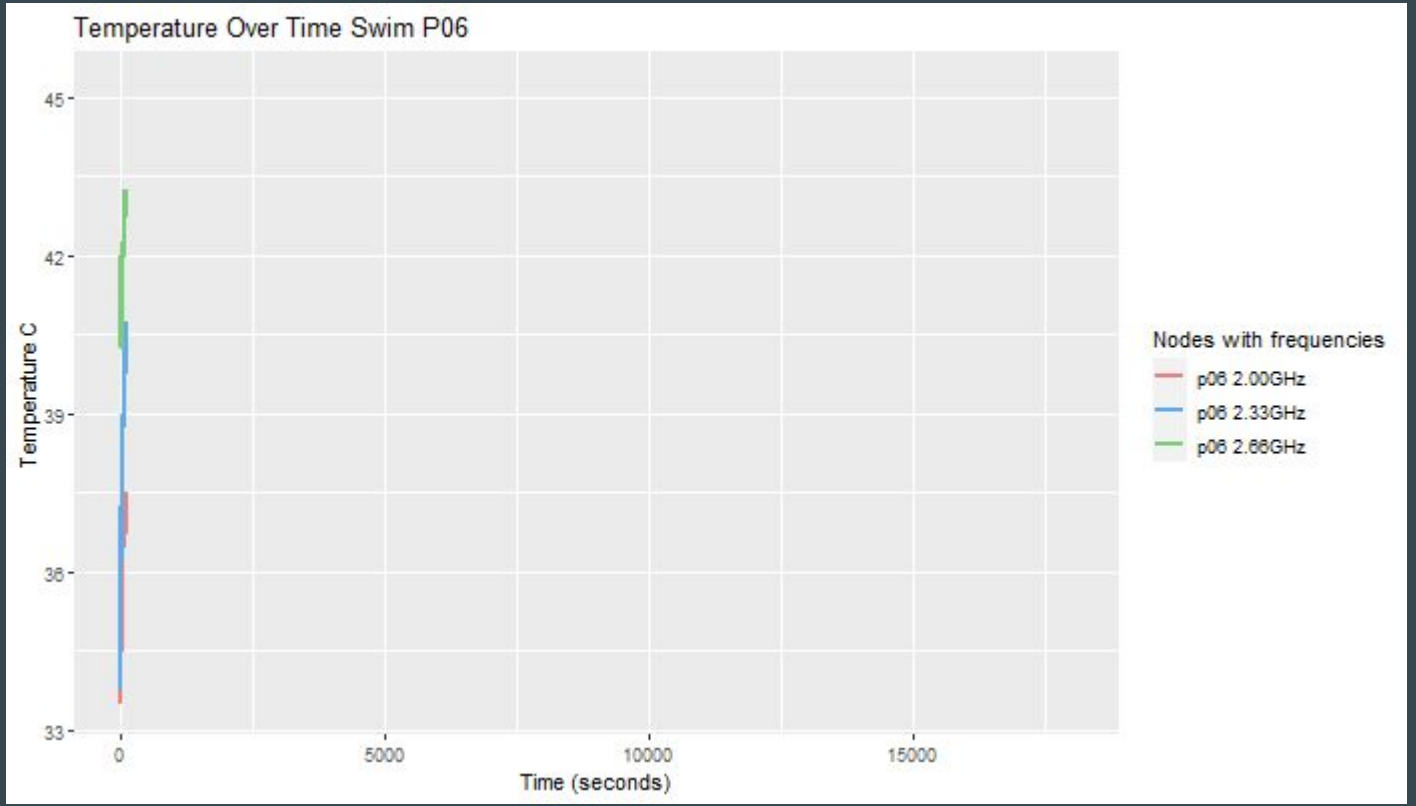
What We Achieved

- Setup air cooled environment
  - Servers are accessible through ssh anywhere
- Narrowed focus of testing
  - Multiple fixed frequencies vs performance and/or temperature
- Gathered crucial test results
  - At each fixed frequencies
  - With an array of tests
- Visualized data
  - Graphs plotting the usefulness of homebrewed tools
  - Animated over time to signify what data is collected
- Hands on experience with the Submer pod
  - Successfully submerged one server into pod
- Collectively formatted paper with all procedures and methodologies employed

Environments



Data Visualization



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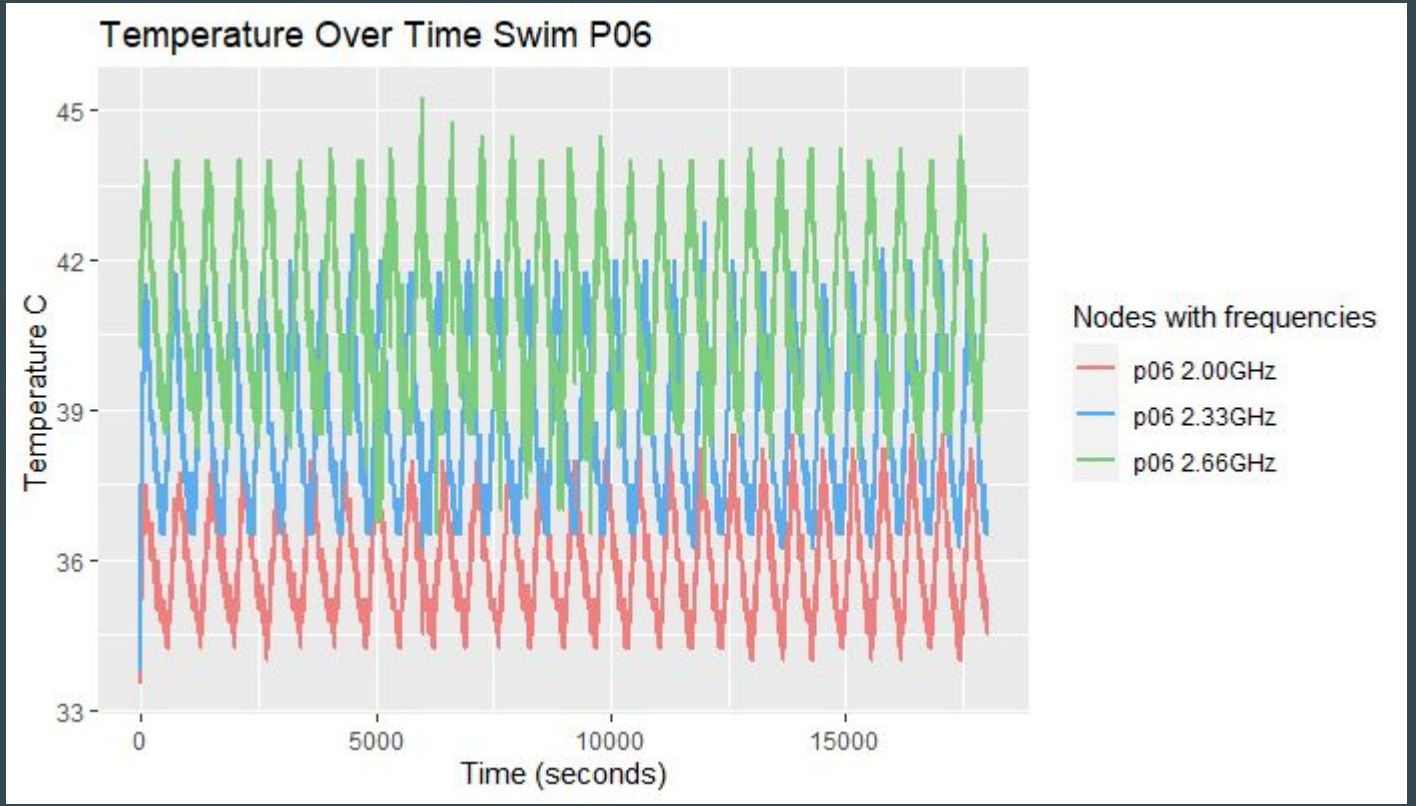

Future Development

We have now laid the foundation for future work comparing novel immersion cooling with traditional air cooling

- Test servers with Submer pod
- Near-threshold computing
- Benchmarking other components like GPUs, FPGAs, Network Adapters
- New metrics: mean time to failure or more robust power monitoring

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Clemson Creative Inquiry course DeepGreen