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ParFlow Performance Tracking & ParFlowIO

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ParFlow Performance Tracking & ParFlowIO

Abstract
ParFlow is a hydrology model that simulates groundwater flow. It runs on many of the fastest supercomputers in the world and has produced hundreds of papers. Our two research projects support the development and use of ParFlow. ParFlow Performance Tracking Framework is a React web frontend to display ParFlow performance data using a Flask API and MongoDB database for storing and querying data. The website serves as an easy way for performance data to be displayed to those running ParFlow. ParFlowIO is a C++11 library with a Python3 interface for reading and writing ParFlow binary files. It allows hydrologists to read and manipulate the data produced by their ParFlow runs.

This student presentation is available at ScholarWorks: https://scholarworks.boisestate.edu/rcd_2021/6
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3. ParFlow Performance Testing

Parflow Performance Testing is an initiative to easily display performance data to those running ParFlow. This project uses a combination of a ReactJS frontend with a Flask API to issue queries to the MongoDB database. This interface will serve as an easily accessible way to monitor ParFlow runs on Verde at Princeton.

3.1 Problem Statement
- Hydrologists want to easily view their run results and compare them to others
- ParFlow developers want to see the progression of runtime improvement with new releases
- This data is immense and not easily comparable

4. ParFlowIO

ParFlowIO is a C++11 library with a Python3 interface for reading and writing ParFlow binary files. ParFlowIO allows hydrologists to easily work with ParFlow data using standard data processing tools through a Python interface.

4.1 Problem Statement
- Hydrologists want to easily operate on ParFlow results
- ParFlow outputs its results as a ParFlow Binary File (.pfb)
- This file is difficult to read and write
- Existing IO tools are written in C/C++
- These existing tools aren’t suitable for quick analysis

4.2 Solution
- ParFlowIO is composed of two parts:
  - A C++11 library containing the majority of the code
  - A Python3 interface to most of the C++ functions
- The Python3 interface allows hydrologists to easily manipulate their ParFlow results.

5. Technologies Used

5.1 ParFlow Performance Testing
- ReactJS
- Flask
- MongoDB

5.2 ParFlowIO
- C++11
- Python3
- SWIG

6. Future Development

6.1 ParFlow Performance Testing
- Web app to view all runs on Princeton’s Verde server and the ability to queue identical runs for re-testing.

6.2 ParFlowIO
- Future development will be handled by Princeton
- Existing tools will be ported to use ParFlowIO

7. Acknowledgements