

## Fortran Testing and Refactoring Infrastructure

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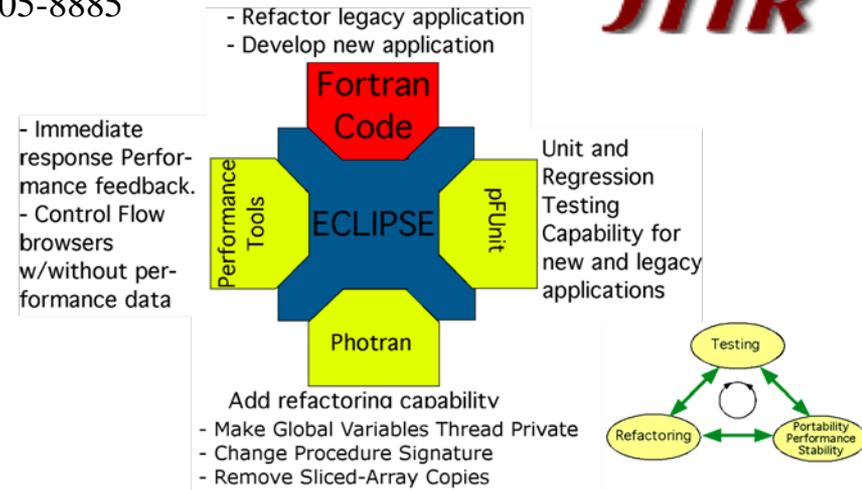
### Identification and Significance of Innovation

#### Identification:

- Unit and regression testing are proven methods to develop robust, portable and extensible codes.
- Refactoring legacy codes is a difficult problem that requires modern tools used often for C++ and Java but have not been readily adopted by the Fortran community.
- Testing, refactoring and performance are used in concert to develop stable and usable codes.
- Fortran testing and refactoring within an Integrated Developer Environment (IDE) will additionally enhance code development.

#### Significance:

- Providing a IDE-based testing and refactoring infrastructure usable can greatly increase developer efficiency and code robustness.
- The combination of testing and refactoring with immediate performance feedback increases productivity and code efficiency, especially important for legacy code optimization and code-combining framework projects.



**Innovation allows Fortran developers to accurately test and refactor codes (multi-processor performance emphasis)**

### Technical Objectives

- Design a portable and extensible testing toolsuite for Fortran that supports generating tests for legacy codes.
- Integrate pFUnit into the Eclipse environment and combine it with Photran and PTP to form a complete-cycle tool.
- Design and Implement a set of feature rich refactorings for Fortran with focus on parallelization.
- Use the resulting tools with GISS-ModelE and NCAR-CESM/CAM in order to improve testing functionality and overall utilization.

### Work Plan

- Task 1: Engineer Thread-Safe Refactorings
- Task 2: Engineer Performance-Related Refactorings
- Task 3: Create Unit Testing Tools for Multi-Core Development
- Task 4: Integrate pFUnit into Eclipse User Interface
- Task 5: Integrate Performance Testing Features
- Task 6: Assimilate Parts into the FTRI Application
- Task 7: Create a Command-Line Version of FTRI
- Task 8: Exercise FTRI on Climate Models

### NASA Applications

- NASA MAP and HEC provide support to and use many Fortran applications (modelE, GEOS-4 and 5).
- The Fortran applications must be continually tested and refactored as new algorithms and ideas are implemented; as computer architectures advance, there is a greater emphasis on speeding up application performance.

### Non-NASA Applications

- Fortran developers outside of NASA have many similar concerns and many Fortran codes are in use for computational fluid dynamics, climate and weather modeling (CESM/CAM, WRF), combustion and geophysics.
- Providing a more complete (testing, refactoring, performance) integrated development environment will be highly advantageous to the Fortran community.

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