Community Software Analysis Proposal

Trilinos

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Trilinos : An Overview

The Trilinos Project is a community of developers, users and user-developers focused on collaborative creation of algorithms and enabling technologies within an object-oriented software framework for the solution of large-scale, complex multi-physics engineering and scientific problems on new and emerging high-performance computing (HPC) architectures.

It is also a collection of reusable scientific software libraries, known in particular for linear solvers, non-linear solvers, transient solvers, optimization solvers, and uncertainty quantification (UQ) solvers.

Most Trilinos algorithms and software are built upon its abilities to construct and solve sparse problems, using sparse linear solvers. These solvers rely on a collection of data structure classes and functions (kernels) for parallel linear algebra, especially parallel sparse kernels.

Trilinos Linear Solvers

Solvers for large sparse linear systems come in two categories

- Direct Methods - Amesos2
- Iterative Methods - Belos

Trilinos Linear Solvers

Amesos2

Amesos2 offers a common interface to many different sparse matrix factorization codes, and can handle any implementation of sparse matrices and vectors, via an easy-to-extend C++ traits interface.

It can also factor matrices whose entries have arbitrary “Scalar” type, enabling extended-precision and mixed-precision algorithms.

Trilinos Linear Solvers

Belos

Belos includes many different iterative methods for solving large sparse linear systems and least-squares problems. Unlike competing iterative solver libraries, Belos completely decouples the algorithms from the implementations of the underlying linear algebra objects. This lets Belos exploit the latest hardware without changes to the code.

Belos favors algorithms that solve higher-level problems, such as multiple simultaneous linear systems and sequences of related linear systems, faster than standard algorithms. The package also supports extended-precision and mixed-precision algorithms.

Contribution Ideas

- Adding at least one new coverage test suite to either Belos or Amesos2.
- A performance study on the Trilinos linear solvers suite (Amesos2 & Belos).
- Explore an extension of Trilinos for a hybrid-classical Quantum Linear Solver (Too ambitious?)