PROTEAS: PROgramming Toolchain for Emerging Architectures and Systems

http://ft.ornl.gov/research/proteas

PI: Jeffrey Vetter; ORNL (vetter@ornl.gov)

Partner sites: Univ. of Oregon (Allen D. Malony), LANL (Kei Davis), ANL (Hal Finkel)

EXASCALE COMPUTING PROJECT

Description and Scope

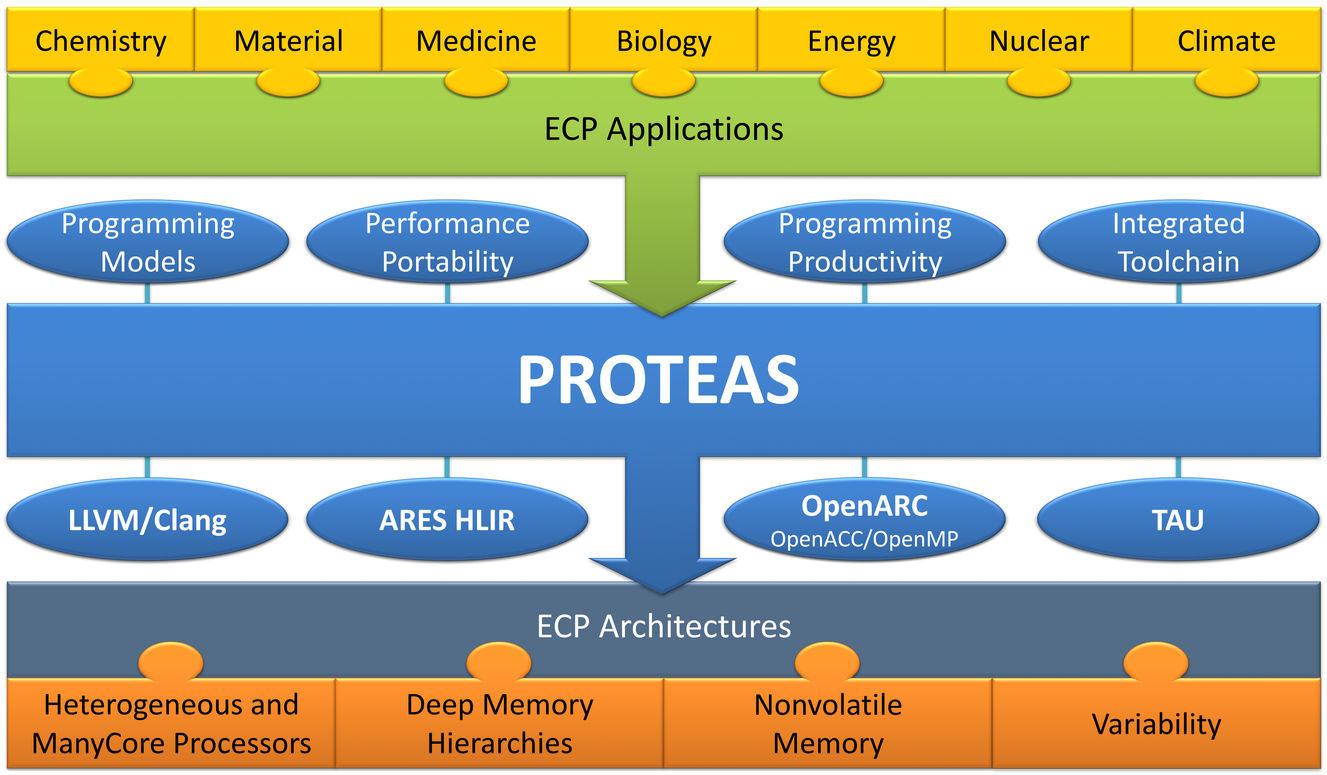
Project Description:

- Provide productive and performance-portable programming solutions.
- Enable automatic performance analysis and performance-driven optimization.
- Provide a flexible, integrated programming toolchain.
- Using established software including LLVM/Clang, ARES HLIR, OpenARC, TAU, and others.

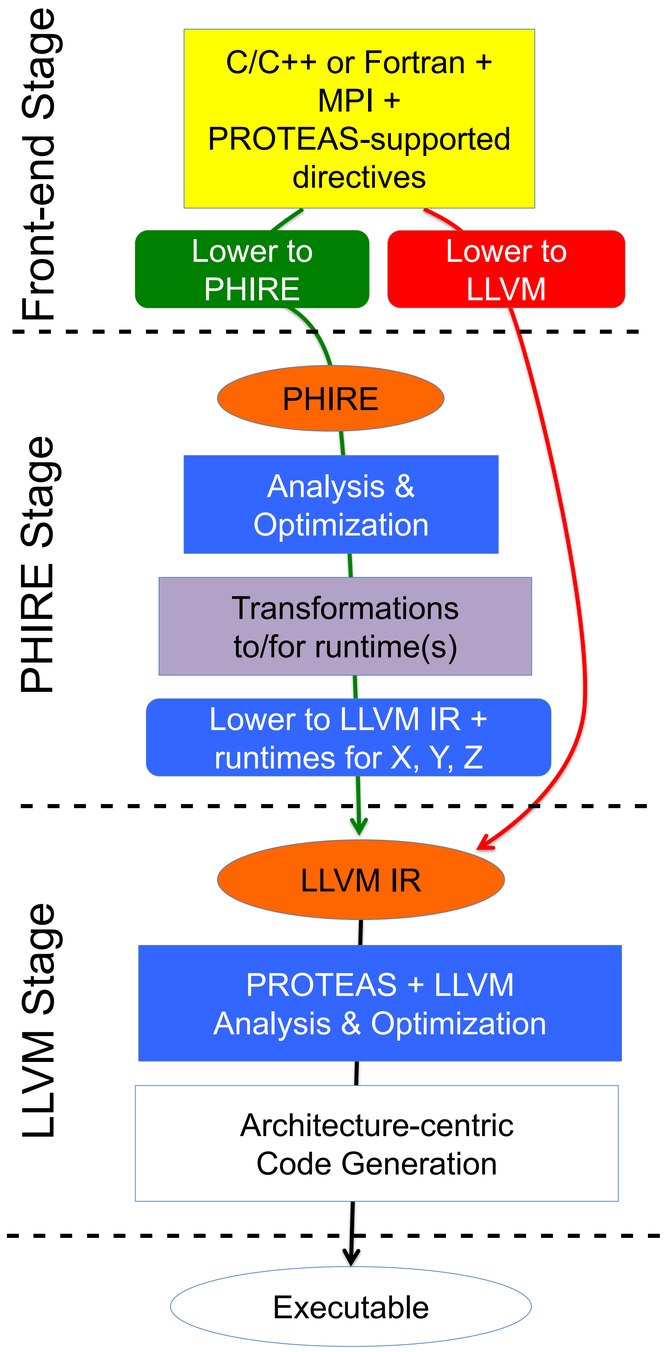
ECP Scope

- Refine our toolchain and solutions through engagement with ECP applications teams.
- Champion our successful solutions in future procurements, community standards, and open-source software stacks.

PROTEAS Overview



PROTEAS Compiler Toolchain



Maturity Level and Accessibility

Maturity Indicators and Metrics

- *LLVM: production; 10y; widely used; http://llvm.org*
- *TAU: production; 20y; widely used; http://tau.uoregon.edu*
- *OpenARC: prototype; 8y; in use at dozens of organizations; http://ft.ornl.gov/research/openarc*
- *ARES High-level Intermediate Representation (HLIR): prototype, 2y; https://github.com/losalamos/ares, BSD 3-Clause License*
- *NVL-C: prototype, 2y, http://ft.ornl.gov/research/nvl-c*

First Year Development Plan

- Develop a scalable framework for distributed heterogeneous systems.
- Extend OpenACC/OpenMP data clauses/runtime API.
- Develop programming interface to manage NVM storage.
- Initial design and implementation of PHIRE intermediate representation.
- Initial lowering to specified runtime TBD API (e.g., Legion, Kokkos, CUDA).
- Demonstrate key optimizations built on PHIRE.
- Support compile-based instrumentation for LLVM and C++ compilers in TAU on IBM Power 8 Linux and Intel Xeon Phi platform.