Performance Optimized Methods for Heterogeneous Architectures

S&T Campaign: Computational Sciences

Computing Sciences

Research Objective

- Develop a novel, portable software package to automatically tune commonly used kernels to enable benchmarking of arbitrary compute platforms.
- Discover new methods that allow developers to make a more informed selection of architecture-specific optimization techniques.
- Identify processor architecture improvements that can better address algorithmic bottlenecks.
- Drive computing resource acquisitions based on intended application.

Challenges

- Widely divergent processing core types.
- Lack of performance portability across heterogeneous computing platforms.
- Projection of known optimizations on one core type fails on another.
- New and emerging hardware require architecture specific optimization techniques and software rewrite.

ARL Facilities and Capabilities Available to Support Collaborative Research

- Leverage state-of-the-art hybrid computing systems at ARL.
  - 48 IBM dx360M4 nodes, each with one Intel Phi 5110P and 16 dx360M4 nodes each with one NVIDIA Kepler K20M GPU.
- Extensive expertise in accelerator programming.
- A first-of-its-kind heterogeneous benchmarking suite.
- A portable and extendable benchmarking suite to address processing cores used in fixed and mobile heterogeneous computing assets.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expertise is novel architectures
- Expertise in optimization algorithms
- Expertise in hardware/software optimization techniques
  - E.g Compiler optimization techniques, kernel parameter optimization techniques, etc.

Results of auto-tuning methodologies compared to OpenCL SHOC and architecture specific implementation.