

Kokkos Programming Model and Library

Quote: “Sandia's Center for Computing Research (CCR) solves the performance portability barrier for high performance computing (HPC) across heterogeneous many-core architectures by developing and deploying the Kokkos programming model and library.” – Carter Edwards

Team Members: Carter Edwards (PI), Christian Trott, Daniel Sunderland, Mark Hoemmen, Simon Hammond

No Processing hours

No movie

Add LDRD icon

High performance computing is in the midst of a many-core revolution driven by rapidly evolving microchips with diverse and heterogeneous architectures, increasing concurrency (thread count), and decreasing memory per thread. Our HPC applications face a major challenge to effectively use these microchips with a single code base that is *performance portable* across these evolving architectures.

Kokkos was developed to enable on-chip concurrency *and* manage architecture-dependent constraints on memory access patterns. The goal is to maximize the amount of application code that is portable across diverse architectures and still obtain the same (or nearly) performance as a variant of that code written specifically for that architecture. The Kokkos team has ongoing R&D co-design collaborations with Sandia's and vendors' microchip and system engineers to rapidly incorporate evolving computer architecture features into Kokkos. The team is also providing leadership for DOE laboratories' participation on the ISO/C++ language standard committee to subsuming Kokkos features into a future standard.

The Center for Computing Research Advanced Architecture Test Bed program has been critical to the success of Kokkos. This program fields leading industry vendors' first-of-a-kind prototype computing architectures for early application porting and performance analysis across DOE's Sandia National Laboratories, Lawrence Livermore National Laboratory, and Los Alamos National Laboratory tri-lab complex. Test beds included hardware and software environment prototypes for the forthcoming Advanced Simulation and Computing (ASC) Trinity and Sierra platforms.

Application and domain library projects are adopting Kokkos to enable performance portability through the ongoing HPC many-core revolution. Within the DOE laboratories, these include Trillinos, Zoltan, LAMMPS, Albany, ASCR MultiphysicsMHD, FASTMath SciDAC, Empress, SHIFT, and others. Outside of DOE, the US Army Research Laboratory, Swiss Supercomputing Center, Helmholtz-Zentrum Dresden-Rossendorf German research laboratory, University of Utah, and

King Abdullah University of Science and Technology have expressed interest in adopting Kokkos for new projects.

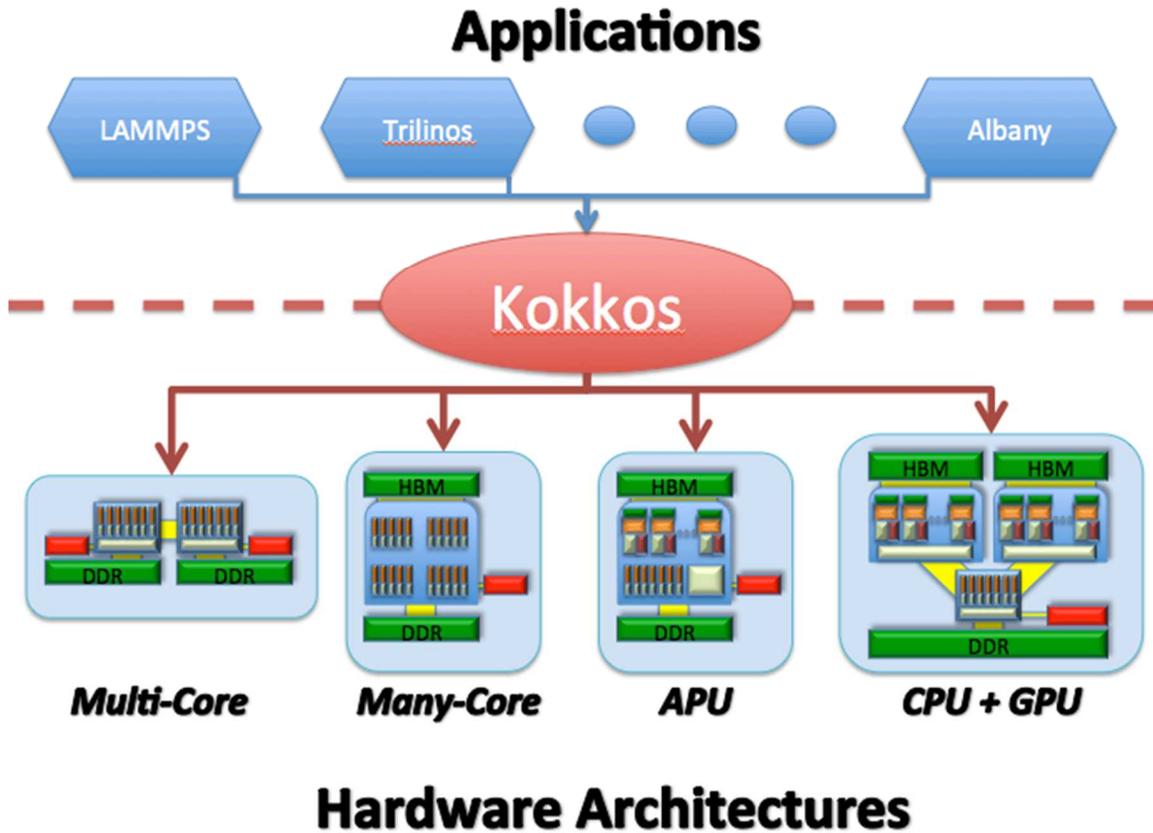


Figure 1 Kokkos enables high performance computing (HPC) applications to achieve performance portability across heterogeneous many-core architectures.