Achieving and maintaining performance and performance portability within the Albany multi-physics code: perspectives and tools (abstract: 1500 chars max)

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The focus of this talk is the Albany multi-physics finite element code, a software framework created using the Agile Components code development strategy. This strategy enables the rapid development of parallel efficient multi-physics tools by requiring that: (1) application codes be built primarily from modular pieces (independently developed libraries, e.g., Trilinos), abstract class hierarchies, and template-based generic classes, and (2) projects both leverage and contribute to a comprehensive set of software components. Specifically, I will discuss our experience with and perspectives on evaluating, improving and maintaining performance and performance-portability within Albany. For performance portability, Albany relies primarily on the Kokkos library and programming model, which enables the same code to run correctly and efficiently, with reasonable scalability, across a variety of computer architectures including the most current generation of GPUs. I will present some key performance-portability developments for the land ice modeling application implemented within Albany and known as Albany Land Ice (ALI), covering topics including both finite element assembly and linear solvers. I will also discuss some recently-developed tools that have helped us maintain performance of Albany across a variety of platforms, namely automatic parameter tuning and automated performance testing/analysis.