The ADAPT Framework for Enhancing Parallel-Distributed Computing Execution

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Parallel-distributed computing using message passing paradigms are the universal computing model of choice in science and engineering, especially for high-performance applications. With the increasing maturation of grids and especially clouds, the number of available platforms for scientific computing is ever-enlarging. Users no longer need to have on-premise clusters or high-end supercomputers; grids and clouds can be accessed as needed, on demand. However, the usability of such cyber-infrastructure platforms for efficiently executing legacy science and engineering applications is a challenge. These applications are often able to utilize resources that span local and campus facilities, those accessed via virtual organizations, and on-demand Cloud offerings. But in order to do so, they often need target-specific adjustments, porting and reconciliations -- which pose considerable logistical obstacles to effectively and flexibly using the best resource in a given instance. This talk will describe the proposed design of the ADAPT framework that investigates novel approaches to enhance the executability of applications on varied computational back-ends. In particular, we discuss a Hemodynamics application that uses Finite Element Methods to numerically solve partial differential equations in the modeling of blood flow through arteries. We compare and contrast the execution of this application on a local on-premise parallel machine, a remote grid system, and the Amazon AWS Cloud platform on which a cluster was simulated. The process of deploying this application on multiple platforms, and the resulting differences in performance and speedup, will be discussed in detail. Several preliminary findings concerning feasibility of using emerging platforms for parallel and distributed computing, and issues with cross platform porting will be discussed.

Vaidy Sunderam, PhD, is Samuel Candler Dobbs Professor of Computer Science and Chair of Mathematics and Computer Science at Emory University. His research interests are in parallel and distributed processing systems and infrastructures for collaborative computing. His prior and current research efforts have focused on system architectures and implementations for heterogeneous metacomputing, including the Parallel Virtual Machine system and several other frameworks including IceT, CCF, Harness, and Unibus. His work is supported by the US National Science Foundation.