

---

Martin Schulz  
**Addressing Performance Challenges on Modern Node Architectures**

PO Box 808  
L-561  
Livermore  
CA 94551  
USA  
`schulzm@llnl.gov`

Modern HPC systems feature complex node architectures with a large number of cores, deep memory hierarchies, non-uniform memory access (NUMA) properties and hyper threading; and future systems will only grow in complexity. When porting solver libraries to such systems, understanding the impact of data access patterns is key to extracting good performance as well as energy efficiency. In this talk I will present a set of tools, which can help developers extract memory access patterns at runtime, annotate it with the necessary context to allow root cause analysis and visualize the results in an intuitive way.

Mitos is a sampling tool that can transparently capture memory accesses at runtime with minimal overhead at runtime; Caliper is an annotation library that can be used to add information about a codes structure, such as key data structures or phases, in a composable and reusable manner; and MemAxes is a visualization tool that maps memory access information, combined with structural information, back to hardware topologies, key data structures, or even the underlying matrices or simulation domains. Combined these tools provide the necessary insight into an applications or a librarys memory access behavior to optimize data communication for complex node architectures.