



U.S. ARMY
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Computational Science for Application
Domains

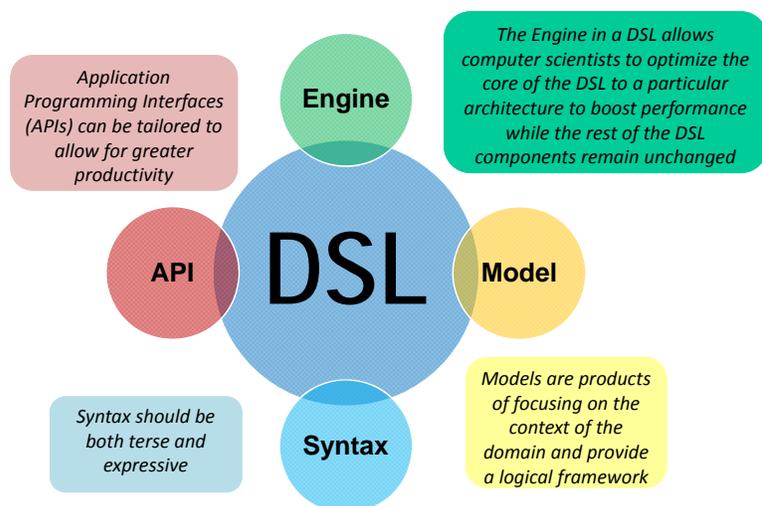


S&T Campaign: Computational Sciences Computing Sciences

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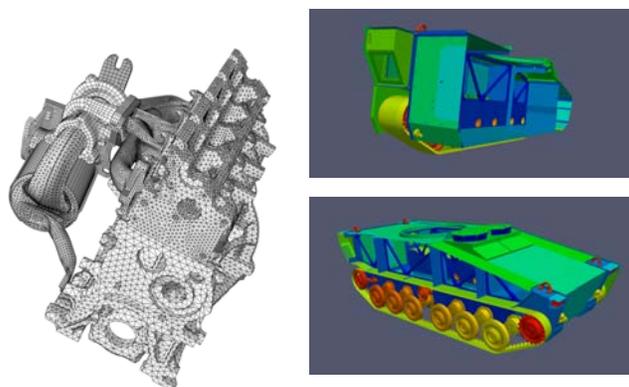
Research Objective

- Develop novel methods to facilitate High Performance Computing algorithm development
- Discover innovative ways to speed software delivery and ensure efficient execution on heterogeneous emerging systems using Domain Specific Languages (DSLs)



ARL Facilities and Capabilities Available to Support Collaborative Research

- Joint research being conducted with the Army High Performance Computing Research Center (AHPCRC) with Stanford University
- Primary initial targets are Finite Element Mesh (FEM)-based codes (LisztFEM)
- New DSL Engine developments for complex heterogeneous architectures
- ARL facilities include large-scale heterogeneous systems and small-scale emerging binary processor testbeds



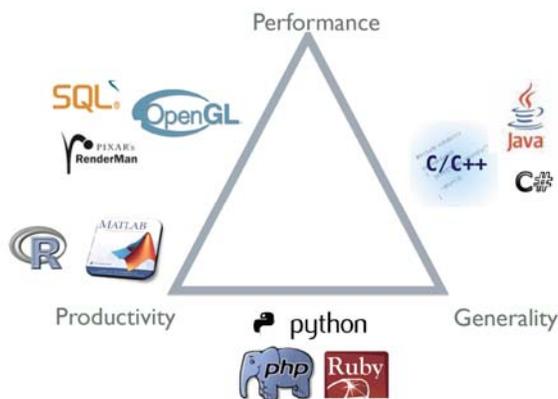
Domain Specific Languages can target numerous possible domains. Finite Element Mesh (FEM)-based codes are a good preliminary candidate

Challenges

- Determining an appropriate balance to the four components of a DSL
- Efficient mapping to complex heterogeneous architectures
- Achieving scalability to emerging memory-hierarchy dependent processors

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expanded sets of applications to facilitate greater understanding of cross-cutting impacts in syntax, model, engine, and API DSL components.
- Compiler expertise is needed for additional components (such as power-aware computing) to be factored into engine developments
- Evolving trends toward exascale computing need to be addressed at this critical stage



DSLs can be designed to allow for a balance of productivity, generality, and performance