

2015 ECI Programming Models and Environments Workshop

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Science

Workshop Goals and Objectives

- This is the first of a series of PME workshops
- This first PM/E workshop: opportunity for application developers to understand and consider the research efforts that we have made in programming models and environments, providing their input on requirements for future PM/E(s).
- Input from this workshop combined with input from subsequent workshops (next one will include vendors), we will create an overarching plan for the ECI.
- The final DOE vision for PM/E(s): a common understanding of forward-looking PM/E research, grounded in requirements of application teams targeting exascale architectures.



Workshop Goals and Objectives

- **Objectives:**

1. Discuss, determine, and propose the required characteristics or properties of future programming models
2. Review the application requirements for ECI PM/E(s)
3. Identify the key capabilities and elements of future programming environments
4. Determine the research questions that need to be addressed
5. Propose the methods for evaluating PM/E(s) research results



Agenda Change for Today

- 12:00pm – 1:00pm Lunch
- 1:00pm – 1:20pm ASCR Programming Environments Summit Report
Summary, Armando Solar-Lezama, MIT
- 1:20pm – 3:00pm Parallel Session III: Characteristics of PM/PE(s) (set 1)
Chair: Dave Richards, LLNL
Parallel Session IV: Characteristics of PM/PE(s)(set 2)
Chair: John Shalf, LBNL
- 3:00pm – 3:15pm Coffee Break
- 3:15pm – 4:30pm Continue Parallel Session III: Characteristics of
PM/PE(s) (set 1) Chair: Mary Hall, University of Utah
Continue Parallel Session IV: Characteristics of PM/PE(s)
(set 2) Chair: Kathy Yelick, LBNL



Parallel Sessions

- **First set of PM/E(s) Sessions: Focus on Programming Models.**
 - Discuss programming model abstractions and their semantics.
 - Parallelism
 - Global name space(s)
 - Locality/distribution/memory hierarchy
 - Synchronization
 - Introspection
 - Resilience
 - Communication
 - Time/space/energy management
 - Map these abstractions to the application requirements from Session I
 - Identify dependencies that Programming Models have on other parts of the software stack.
 - Characterize role of runtime and compiler support



Parallel Sessions

- **Second set of PM/E(s) Sessions: Focus on Programming Environments.**
 - Identify elements of the programming environment (e.g., debuggers, performance analysis, storage + viz, ...) and how are they integrated
 - Discuss issues of performance portability across systems of different type, scales, and generations
 - Discuss the role of performance models and productivity models to motivate approaches, challenges and opportunities
 - Discuss debugging strategies for correctness and performance
 - Understand the needs for storage abstractions in future programming models and environments
 - Discuss interoperability and composability issues
 - Determine requirements and interconnections of programming environments with the rest of the system stack
- **The two sets of PM/E(s) will be combined into one report summary for PM(s), PE(s), and their interrelationship.**



Parallel Sessions

- **Research Questions for Programming Models:**
 - Discuss the key research questions in programming models that must be answered by the research community including semantic constructs, interoperability with runtime systems, and/or consideration of forming standards.
- **Research Questions for Programming Environments:**
 - What are the key research questions in programming environments that must be answered by the research community before widespread development and adoption? Is there an order and preferred method for pursuing these?

