

# NIAC Breakout Session: Science of Computing

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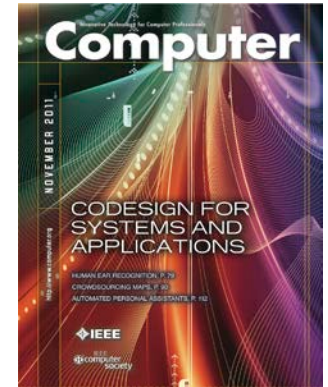
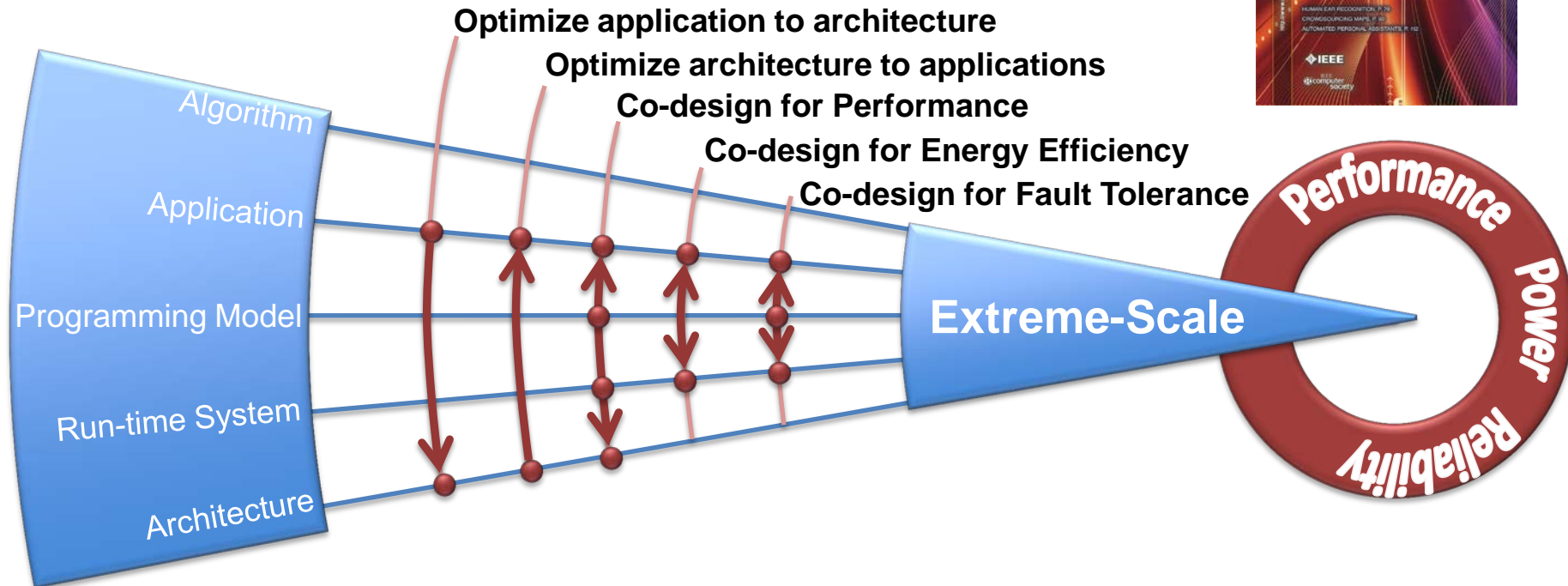
# Science of Computing

- UW-PNNL Synergy
- Discuss interaction and synergies between PNNL, UW, and other strategic partners on leading edge computing research
- --Collaboration on education on high performance /scientific computing to complement the science / data science growth.
- --Discuss with UW on future computing infrastructure for research
- --Potential proposal opportunities -- June 9th, NSF big data call. Other DOE ?
- --Integrate parallel, scalable computing ideas into engineering and science curricula.
- --Potential joint online course development

# Science of Computing

- Integrative, strategic concept for computing research
- Also relates to the methods and techniques of understanding and teaching computing
- Computational science
- Complements Data science

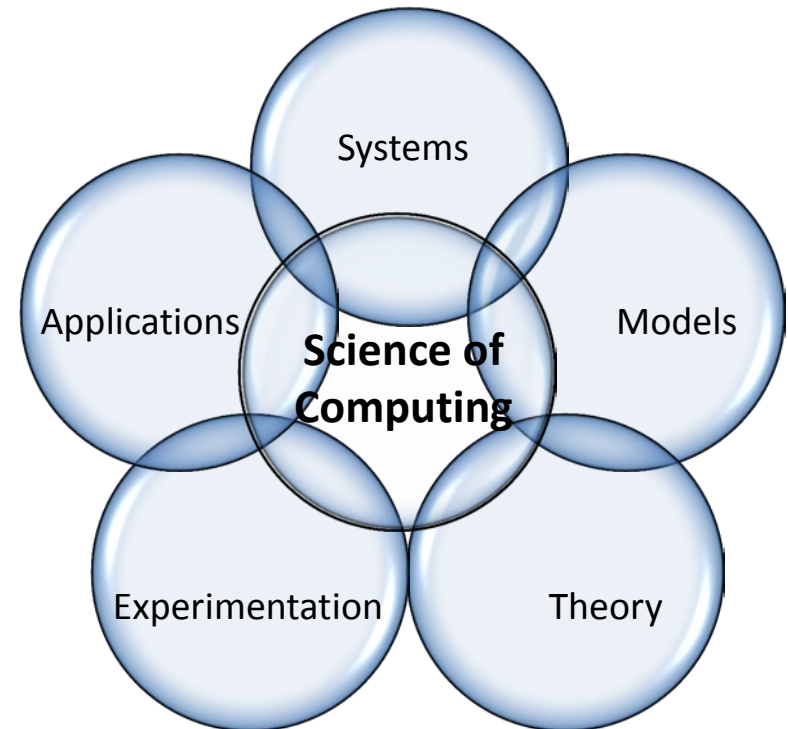
# Throughout the Software Stack and Down to the Hardware



“Co-design for Exascale systems: Performance, Power, Reliability,”  
Kerbyson, Vishnu, Barker, Hoisie, IEEE Computer, Nov. 2011.

## Science of Computing – Research Drivers

- Evolution and innovations on the path to exascale levels of computation
- Performance modeling in the design space through to model-driven optimizations in runtime systems
- Overcoming faults in normal system operation through fault tolerance and resilience throughout the software stack
- Power-aware computing to optimize for energy consumption during system and application runtime
- Encompasses a broad spectrum of computing scales, and “flavors” of computing (e.g., data-intensive)



## Science of Computing – Approach

- Co-design
  - Modeling needs be applied to negotiate tradeoffs at all the boundaries of the hardware/software stack
- Performance, Power, and Reliability
  - Coherent approach to cover all future system constraints
  - Convergence of concerns – applicable to computing at all scales
- Vertical integration through quantitative tools
  - Execution Models
    - Intelligent and informed decision within runtime software
  - Runtime Systems
    - Exploit system and application understanding from modeling to effectively utilize extreme scale systems
- Lifecycle Coverage
  - Software and hardware
  - From design space exploration to analysis of early implementation to deployment and to runtime optimizations.

# Major Organizing Questions/Challenges

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Major Question/Challenge	Who Should be Engaged?
<p>Teaming/collaboration:                      Proposal: website database, update telecons                      Teaming/bonding: Summer institute                      Curriculum: weekly seminars with instructors from both sides                      SW carpentry: gpu, hadoop, numpy                      Proposal teaming and writing process: tracks, administrative                      Classes specialized for national Lab needs                      Industry speakers                      Industry involvement in NIAC                      Spectrum of computing solutions: from HPC to clouds                      Discussion about computing skills, including programming                      Teaming for research groups between domain and CS scientists</p>	<p>Relevant experts</p>

# Implementation Strategy

- Outline your implementation strategy (what is needed, from whom, and how you will get it)

What	Who	How