XSCI

eXtreme Scale Computing Initiative

Initiative Leadership

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Upcoming Events

November 13-19
Supercomputing 2010,
New Orleans, Louisiana

Pacific Northwest
NATIONAL LABORATORY

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Leadership Notes

The XSCI concluded FY 2010 with a very successful Annual Review Committee meeting in July. We are ready for an exciting new year of scalability and research, and to begin three new project areas in addition to the seven already existing. I would like to thank the entire team for all their hard work the last two years, and it's a pleasure to continue that work this year.

November is 2010's Supercomputing meeting in New Orleans. We are looking forward to the collaboration opportunities SC10 brings to the initiative. XSCI will be announcing a Post Doctoral Research Fellowship position in tribute to Dr. Jaroslav Nieplocha. The initiative is also hiring four additional post docs. If you know anyone who may be interested, please refer them to *http://jobs.pnl.gov* keyword "300179" to apply.

Finally, I am happy to announce that Darren Kerbyson has joined the team as the Initiative Chief Scientist. Darren is a PNNL Laboratory Fellow and an internationally recognized computer scientist with more than 25 years of experience in the development and analysis of high-performance computing systems and applications. His current work is focused on the exploration of both performance and power of future systems. We have also gained Kevin Barker, a research scientist specializing in the area of performance and power modeling and analysis for advanced large-scale parallel systems. I invite you to check out our new website look at *http://xsci.pnl.gov*.

New Projects

- Integrating Power and Performance Modeling for Exascale Systems led by **Kevin Barker**
- Mapping Molecular Dynamics Algorithmic Parallelism to Heterogeneous Architectures led by **T.P. Straatsma**
- Extending the Global Arrays Programming Model on Hybrid Architectures led by **Daniel Chavarria**

Kevin Barker

T.P. Straatsma

Daniel Chavarria

Meet the Team

T.P. Straatsma, Molecular Dynamics
Abhinav Vishnu, Scalable Fault Tolerance
Steven Yabusaki, Subsurface
Manoj Krishnan, Data Decomposition
Karol Kowalski, Molecular Modeling
Oreste Villa, Architecture Exploration
Daniel Chavarria, Performance Optimizations
Sriram Krishnamoorthy, Performance Diagnostics
Kevin Barker, Power and Performance Modeling

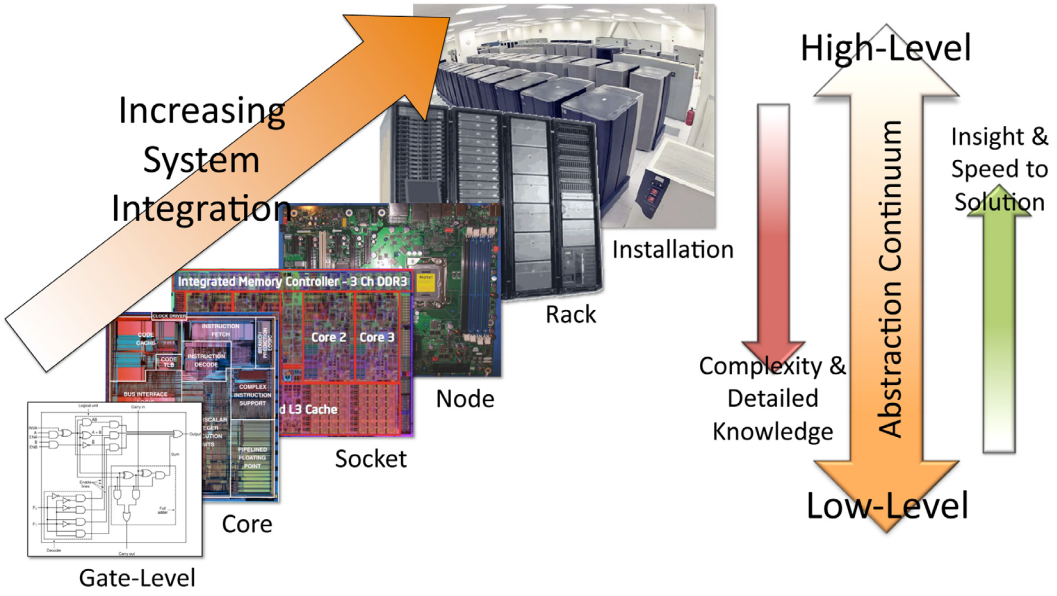
Feature of the Quarter

Integrating Power and Performance Modeling for Exascale Systems

This project will focus on the development of a power-modeling technique and its integration with existing performance-modeling capabilities. The aim is to develop a unified methodology that will allow for rapid exploration of the exascale system design space. Therefore, two primary outcomes are expected. The first is the development of a power-modeling capability equivalent to already proven performance-modeling methods. Benchmarks and measurement tools will be developed that will allow for the characterization of existing computing platforms. The power-modeling tools will be quasi-analytical in nature; that is, the resulting power models will be static representations of application behavior parameterized by empirical or estimated system characteristics. The second outcome is the integration of power and performance-modeling techniques into a single unified methodology.

Integrating Power and Performance Modeling for Exascale Systems

Initial Question: At what level of abstraction should the parallel system be modeled? Accuracy, time-to-solution, and appropriateness must be considered, especially as low-level detail may not be available for systems in the design stage.



Our modeling methods must be able to adapt as more refined information becomes available during system design. In this way, the confidence in the model and error will improve over time.

Modeling Methodology: Total system power is modeled as a composition of component power models. Predictions must be validated against measurements wherever possible.

Some Open Issues:

1. Determining appropriate level of abstraction
2. Integration with Performance-Modeling methods to enable quantitative architectural exploration
3. Obtaining Validation and Model Input data from existing systems.

The XSCI is a quarterly publication covering research being conducted in PNNL's eXtreme Scale Computing Initiative. For more information, contact the initiative leads or visit our web page at *http://xsci.pnl.gov*.

Operational Team

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Steve Minnick, Finance

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Website

http://xsci.pnl.gov

PNNL-SA-75948