Center for Scalable Application Development Software:
Center Overview

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SciDAC Program

• Portfolio of coordinated research to exploit the capabilities of emerging petascale platforms for computational science

• Research projects respond to
  – extraordinary difficulties of realizing sustained peak performance for scientific applications that require petascale computation
  – need for collaborative software environments that combine distributed resources and expertise to address complex questions

SciDAC-2 Mission

• Develop comprehensive scientific computing software infrastructure to enable petascale science
• Develop new generation of data management and knowledge discovery tools for large data sets
Goals

• Conduct research leading to the design and construction of software tools and systems to help applications scale to the petascale
  – focus on DOE Leadership Class Facilities and parallel systems composed of multicore processors
  – promote application-driven software systems research
  – promote research collaborations with DOE labs and centers, NSF (Teragrid), and industry (systems and software vendors)

• Catalyze activities within the CS community that will lead to visionary new ideas for application development support software
  – work with system vendors, application developers and library designers
  – promote community vision building through summer workshops

• Foster development of new tools by the CS community through support of common software infrastructure and standards
Scalable Application Development Software?

Software that helps applications scale in three different dimensions

• Scale from simple high-productivity languages on a laptop to efficient applications on high-end, single-processor workstations

• Scale from small numbers of processors to full machines consisting of thousands of processors with minimal loss of efficiency

• Scale from a single abstract program representation to tuned implementations for many different high-end machines and heterogeneous processors with minimal programming effort
A Refined Vision

• Provide open source software systems, tools, and components that address a spectrum of needs
  – directly usable by application experts
  – support development of enabling technologies by the CS community
• Target architectures of critical interest to DOE
  – Cray XT
  – Blue Gene/P
  – multicore processors in general
• Engage DOE application teams and vendors
• Engage the research community in SciDAC challenges
Vertical integration across the petascale software stack

- System software for leadership computing platforms
- Communication libraries
- Math libraries
- Open source compilers
- Performance tool infrastructure
- Performance tools
- Application engagement: analysis and tuning
Community Engagement

CScADS Summer Workshop Series

• Goals
  – identify challenges and open problems for leadership computing
  – brainstorm on promising approaches
  – foster collaborations between computer and application scientists
  – engage the broader community of enabling technology researchers

• Workshops to engage SciDAC and INCITE application teams
  – Leadership class machines, petascale applications, and performance
  – Scientific data analysis and visualization for petascale computing

• Workshops to foster development of enabling technologies
  – Autotuning for petascale systems
  – Performance tools for petascale computing
  – Libraries and algorithms for petascale applications

2009 Workshops at Granlibakken
Metrics for Success

• How well are the Summer Institute workshops functioning as a mechanism for two-way exchange of information?
  – as a way of familiarizing consumers with new developments
  – as a driver for change in the research and development plans

• How effectively is the research adapting to the needs of the community while keeping quality at the highest possible level?

• How effectively is the research effort directly interacting with application teams to understand their problems and using solution strategies to influence future directions?

• How effectively is the infrastructure development effort supporting the entire HPC software research community, both within and outside the center?

• How effective is the center at spinning out intermediate results as prototype tools and software for end users and at influencing commercial software products?
Charge Questions

- Scientific and/or technical merit of the project
- Appropriateness of the proposed methods or approach
- Performance under existing award
- Competency of the investigators personnel
- Adequacy of the project resources
- Reasonableness and appropriateness of the budget and work plan
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<th>Time</th>
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<td>9:00 - 9:10</td>
<td>Introduction</td>
<td>John Mellor-Crummey</td>
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<td>9:10 - 9:30</td>
<td>System software</td>
<td>Pete Beckman</td>
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<td>9:30 - 10:10</td>
<td>Libraries and compilers</td>
<td>Kathy Yelick</td>
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<td>Break</td>
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<td>10:20 - 11:10</td>
<td>Performance tools</td>
<td>Bart Miller, John Mellor-Crummey, Rusty Lusk</td>
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<td>11:10 - 11:40</td>
<td>Application engagement</td>
<td>Rusty Lusk, Gabriel Marin</td>
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<td>11:40 - 12:00</td>
<td>Summary and plans</td>
<td>John Mellor-Crummey</td>
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