OIL AND GAS
HIGH PERFORMANCE COMPUTING

2015 TECHNICAL PROGRAM

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RICE | K²I
KEN KENNEDY INSTITUTE
for Information Technology

WORKSHOP
MARCH 4-5, 2015

Message from the Chair

On behalf of Rice University and this year's program committee, it is with great enthusiasm that I welcome you to the 8th Annual Rice Oil & Gas High-Performance Computing Workshop.

This year's workshop takes place amid a time of cautious optimism in the oil and gas industry, with a shared hope for a strong and prosperous economy in the months ahead. Once again, the Ken Kennedy Institute for Information Technology at Rice University is proud to bring together academic researchers with experienced professionals from the oil and gas industry and the IT industry to share ideas, network and discuss challenges and trends in high-performance computing and data science.

We are also extremely excited about the opportunities this workshop brings to the community. The OG-HPC Workshop continues to serve as an education and workforce enabler by highlighting the many cutting edge computational science and engineering opportunities in the oil and gas industry, and by offering supplemental fellowships for students pursuing research or degrees in computational mathematics, scientific computing, computer science, and engineering. With proceeds from last year's OG-HPC Workshop, the Ken Kennedy Institute was able to support a record number of graduate enhancement fellowships to Rice students in the 2014-2015 academic year. Thanks to the growing support from our sponsors and partners, we will be awarding additional fellowships this spring to students entering our program. Our students are eager to discuss their research with you at this year's poster session – don't miss it!

This year's program features impressive keynote speakers and more than 36 talks that address the key challenges and topics shaping the oil and gas and IT industries. During breaks between sessions, I encourage you to network and peruse the sponsor exhibit hall where you'll have the opportunity to learn about business-enhancing products and services from more than 25 companies. I am certain this year's conference will make meaningful contributions to the industry dialogue, especially in the areas of large-scale high-performance computing, disruptive technology, and advanced seismic algorithms.

While this event has grown beyond what we expected, the goal of the OG-HPC Workshop continues to be to unite members of the oil and gas industry, the IT industry and academic research. The workshop also serves as a platform for inspiring leaders to share their knowledge, views, and experiences to benefit the oil and gas community and those students seeking to be a part of it. It is extremely rewarding to see the dedication and continued support of Rice University and of so many committee members and volunteers that share in our vision for the OG-HPC Workshop. I sincerely thank our program committee and the many people who contributed their time and expertise to bring you this year's event. It is my great pleasure to serve as the Chair for the 2015 Rice Oil and Gas High Performance Computing Workshop. Together, I invite you to stay engaged during this workshop, embrace the challenges we face as a community, and join me in pursuit of excellence in our future endeavors.

Jan Odegard

Rice Univeristy

Associate Vice President, Office of Information Technology

Executive Director, Ken Kennedy Institute for Information Technology

Program Committee

Henri Calandra, Total
Simanti Das, ExxonMobil
Erik Engquist, Rice University
Keith Gray, BP
Scott Morton, Hess Corporation
Jan Odegard, Rice University
Ernesto Prudencio, Schlumberger
Paul Singer, Statoil
Amik St-Cyr, Shell
Chap Wong, Chevron

The Ken Kennedy Institute for Information Technology (K2I) is dedicated to the advancement of research in the fields of computing and information technology. Our goal is to provide broad support for a strong community of research experimentation that challenges traditional disciplinary limits. We see our most important role as being a catalyst for research collaboration across the conventional boundaries of school, department, center and laboratory. We work to encourage partnerships with industry, government and other universities to help solve real-world problems.

The Institute's power lies in its ability to challenge traditional boundaries, look beyond individual faculty members and departments, and collaborate with industry leaders to solve critical problems that will have a direct societal impact.

For more information on the Ken Kennedy Institute (K2I), visit: **k2i.rice.edu**

OG-HPC Workshop Code of Conduct

The workshop program committee invites all sponsors, volunteers, speakers, attendees, media, exhibitors and other participants to help us realize a safe and positive workshop experience for everyone.

OG-HPC venues are shared with members of the public that are not attendees of the workshop; please be respectful to all patrons of these locations.

Please note that audio-recording and/or videotaping and/or photography of any portion of the OG-HPC Workshop Technical Program material is strictly prohibited without prior consent of the OG-HPC General Chair.

Speakers

Preparing the Broad Department of Energy, Office of Science User Community for Advanced Manycore Architectures

Katie Antypas

NERSC Services Department Head; NERSC-8 Project Manager, NERSC, Lawrence Berkeley National Laboratory

Katie Antypas is the NERSC Services Department Head, with oversight of the Advanced Technologies, Data and Analytics Services, and User Services Groups. The Services Department works to increase the impact of science research conducted by NERSC users by providing exceptional services and user support, preparing users for the coming advanced manycore HPC architectures, and providing comprehensive services to store, analyze, manage and share data. Katie is also the Project Manager for the NERSC-8 system procurement, a project to deploy NERSC's next generation HPC supercomputer in 2016, named Cori. Katie holds an M.S. degree in Computer Science from the University of Chicago and a B.A. degree in Physics from Wellesley College.

OpenPower Innovation is Redefining High Performance Computing

Bradley McCredie

IBM Fellow, Vice President of IBM Power Systems Development, and President of the OpenPOWER Foundation

Bradley McCredie is an IBM Fellow, Vice President of IBM Power Systems Development, and President of the OpenPOWER Foundation. Bradley is also a member of IBM's Technology Team, a senior executive group that sets IBM's technical strategy. In his current position, he oversees the global development and delivery of IBM Power Systems. His responsibilities span system hardware, software, solutions, and ecosystem development teams, incorporating the latest technology advancements to support clients' changing business needs. Brad holds a B.S., M.S., and Ph.D degree in Electrical and Computer Engineering from the University of Illinois.

Current Trends in Parallel Numerical Computing and Challenges for the Future

Jack Dongarra

American University Distinguished Professor of Computer Science in the Electrical Engineering and Computer Science Department, University of Tennessee

Jack Dongarra holds an appointment at the University of Tennessee, Oak Ridge National Laboratory, and the University of Manchester. Jack specializes in numerical algorithms in linear algebra, parallel computing, use of advanced-computer architectures, programming methodology, and tools for parallel computers. He was awarded the IEEE Sid Fernbach Award in 2004 and in 2008 he was the recipient of the first IEEE Medal of Excellence in Scalable Computing. Jack is also a Fellow of the AAAS, ACM, IEEE, and SIAM and a member of the National Academy of Engineering. Jack holds a B.S. degree in Mathematics from Chicago State University, a M.S. degree in Computer Science from Illinois Institute of Technology, and a Ph.D in Applied Mathematics from the University of New Mexico.

The Green Data Center and Energy Efficient Computing

Steven Hammond

Director of Computational Science Center, National Renewable Energy Laboratory

Steve Hammond is the Director of the Computational Science Center at the National Renewable Energy Laboratory in Golden, CO. Steve leads laboratory efforts in high-performance computing and energyefficient data centers. Prior to joining NREL, Steve spent 10 years at the National Center for Atmospheric Research developing massively parallel climate models. He also worked at the NASA Ames Research Center and at GE's Global R&D Center. Steve holds a Ph.D degree in Computer Science from Rensselaer Polytechnic Institute.

Seismic Imaging and HPC Partnership – Innovation at BP

Eric Green

Vice President, Seismic Imaging, BP

Eric Green is Vice President for Advanced Seismic Imaging at BP and leads a global organization of highly specialized and experienced geophysicists challenged with solving BP's most pressing subsurface imaging challenges. Eric has 33 years of experience in all aspects of the Oil and Gas business from exploration and appraisal, project development, and reservoir management; and brings a passion for technology. BP's seismic imaging geophysicists partner with its Center for High-Performance Computing to deliver industry-leading images to interpreter's desktops through innovation in seismic modeling, acquisition, signal processing, velocity model building, and imaging algorithms. Eric brings a unique perspective on the business case for, and impact of, the linkage between imaging technology and high-performance computing. Eric holds a B.S. degree in Geophysics from the University of Arizona.

Future of High Performance Networking

Anshul Sadana

Senior Vice President, Customer Engineering, Arista

Anshul Sadana has over a decade of experience in engineering management, design & software development in the networking industry. Anshul joined Arista in 2007 and is responsible for product definition and development priorities of Arista's next generation products. He also leads all systems engineering and customer advocacy functions. Anshul holds a M.S. degree in Computer Science from the University of Illinois and an M.B.A. degree from the Wharton School of Business.

Future Systems and Seismic Computing

Kent Winchell

Director, CTO Office, Cray

Kent Winchell has over 25 years of experience in high performance computing and I/T architecture with strong emphasis on scientific use of computers, high performance storage systems, data analytics, project management, large software projects, customer support, and multi-disciplinary problem solving. Kent holds a B.S. degree in Computer Science from the University of Wyoming and a M.S. degree in Software Engineering from the University of Houston.

RICE

Energy and Environment Initiative

The Rice Energy and Environment Initiative (EEi) is a campus-wide effort that engages the best of Rice's multi-disciplinary research faculty and students in collaboration with industry, government, NGO's, and private citizens to meet energy challenges, to provide accessible, affordable, and more sustainable carbon-based fuels. Campus-wide, transformative research and solutions from natural sciences, engineering, public policy, the social sciences, and the humanities are integrated for this effort.

The EEi aims to transform and assure our future with the help of world-scale talents and research in science and engineering (earth sciences and geology, computational modeling, advanced materials, nanotechnology, and water) as well as policy (James A. Baker Institute for Public Policy) and humanities (Center for Energy and Environmental Research in the Human Sciences).

For more information, visit the Website at: **eei.rice.edu**

Student recipients of the K2I Fellowship Program

The Ken Kennedy Institute for Information Technology (K2I) is pleased to recognize the achievements and research of Rice's graduate students by awarding fellowships to students pursuing research in computational science and engineering, high-performance computing, and data analytics.

Thanks to funding provided by the Rice University Oil & Gas High Performance Computing (OG-HPC) Workshop, and support from the energy industry, more than $400,000 has been awarded by K2I in graduate fellowship support since 2008, making the K2I Fellowship Program one of the largest graduate fellowship programs at Rice University.

We welcome you to become a partner in sponsoring the K2I Fellowship Program at Rice University. For more information, please visit the K2I website at: **www.k2i.rice.edu**

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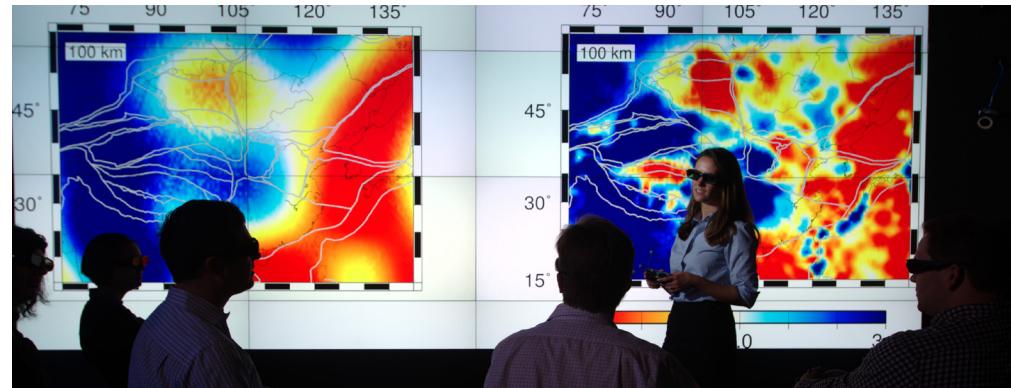
Data Science Summer Institute
### Sponsored by the Ken Kennedy Institute for Information Technology

Society has firmly entered the era of "data" and data-driven discovery and prediction will be in your future. The combination of ubiquitous network connectivity, powerful mobile computing devices, remote sensors and cameras, accurate location data, massive data-center resources, and commercial advertising incentives has spurred an astonishing growth in the collection and availability of data. To prepare you to leverage your data, the Ken Kennedy Institute for Information Technology at Rice University is offering the Data Science Summer Institute to get you up to speed on the skills required to start leveraging the latest data analytics tools.

June 15 –18, 2015

For more information, or to register online, visit: **dssi.rice.edu**

Rice University Visualization Lab

Seismic tomography simulations under Southeast Asia displayed at Rice University's Chevron Visualization Lab, courtesy of Min Chen, Rice University's Earth Science Department. The bright red hues indicate low wave velocity and the blue tones suggest high velocity.

With 200 inches of projection display (measured diagonally) and a resolution totaling more than 33 million pixels, the Data Analysis and Visualization Cyberinfrastructure (DAVinCI) Visualization Wall located at Rice University allows scientist and students to see the big picture on a grand scale. The Wall is funded in part by Chevron and a grant from the National Science Foundation (NSF) and enables scientist to boost data into three dimensions to probe details in ways that were not possible until now.

Inside the Rice Visualization Laboratory, users can view their data sets in stereoscopic 3D using active shutter glasses and an IR tracking system. The Lab's advanced technology allows users to analyze images of all types, from atoms to galaxies, and helps researchers in earth science, biomedicine, engineering, art, architecture, geology, and other fields gain extraordinarily clear pictures of their data-be it bacteria or bridges.
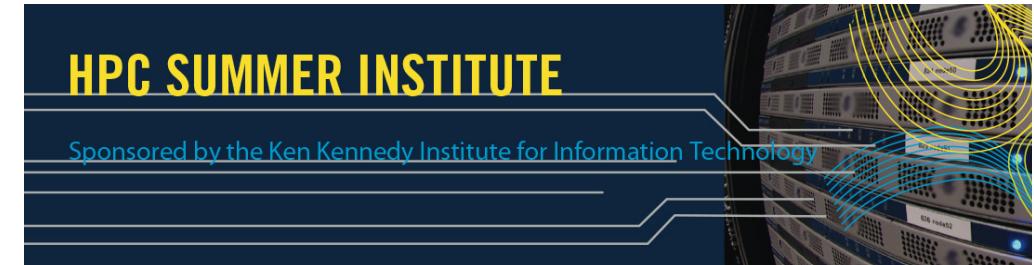
For more information, please visit the Website at: **viz.rice.edu**

Whether you're looking for interns, recent graduates, master's, or Ph.D.s — in every discipline from STEM to the humanities — the Center for Career Development (CCD) is ready to help you identify, contact, and hire the people who can propel your organization's future success.

Our services, resources, and events make it easy to connect with highly qualified candidates. **Get started at ccd.rice.edu.**

RICE
Center for Career Development

HPC SUMMER INSTITUTE
Sponsored by the Ken Kennedy Institute for Information Technology

Make plans now to attend the 2015 HPC Summer Institute, organized by the Ken Kennedy Institute for Information Technology at Rice University. This summer program offers participants, from a wide array of backgrounds, the opportunity to be trained in modern programming techniques and tools used in high-performance computing.

Leading HPC faculty and staff members from Rice University serve as instructors for the HPC Summer Institute. The curriculum covers topics ranging from MPI, OpenMP, Pthreads, Performance analysis (HPCToolkit and Jumpshot), accelerated computing using GPGPU (OpenCL, CUDA and OpenACC), and Parallel i/o. Hands on laboratory sessions supported by the instructors and lab assistants will be offered each day allowing participants to practice what is being taught in the class sessions.

June 1 - 4, 2015

For more information, or to register online, visit: **hpcsi.rice.edu**

TUTORIALS   SECOND FLOOR

8:00 a.m.   Tutorial Registration (BRC 1st floor)

Tutorial Session I

8:30 a.m.   **Introduction to HDF5 for High-Performance Computing Environments**
Quincey Koziol (Director of Core Software and HPC, The HDF Group)

8:30 a.m.   **OCCA: Portability Layer for Many-core Thread Programming**
Tim Warburton (Professor, Computational & Applied Mathematics, Rice University)
David Medina (Computational & Applied Mathematics, Rice University)

10:00 a.m.   **Networking and Break**

Tutorial Session II

10:30 a.m.   **OpenMP Tutorial,**
Barbara Chapman (Professor, Computer Science, University of Houston)

10:30 a.m.   **Performance Analysis of MPI+OpenMP Programs with HPCToolkit**
John Mellor-Crummey (Professor, Computer Science & ECE, Rice University)

12:00 p.m.   **On-site Workshop Registration & Networking**

Welcome (BRC103)

1:00 p.m.   **Opening and Welcome**
Jan E. Odegard (Associate Vice President, Office of Information Technology and Executive Director, Ken Kennedy Institute for Information Technology, Rice University)
Klara Jelinkova (Vice President for IT & Chief Information Officer, Rice University)

Afternoon Plenary (BRC103)
Session Chair: Jan E. Odegard (Rice University)

1:15 p.m.   **Preparing the Broad Department of Energy, Office of Science User Community for Advanced Manycore Architectures**
Katie Antypas (NERSC Services Department Head; NERSC-8 Project Manager, NERSC, Lawrence Berkeley National Laboratory)

2:00 p.m.   **Keynote**
OpenPower Innovation is Redefining High Performance Computing
Bradley McCredie
(IBM Fellow, Vice President of IBM Power Systems Development, and President of the OpenPOWER Foundation)

DISRUPTIVE TECHNOLOGY TRACK (Disruptive Technology Talks, 2 minutes each)   BRC103
Session Chairs: Jan E. Odegard (Rice University) and Chap Wong (Chevron)

2:45 p.m.   **Automata Processing: Massively Parallel Computing Solution**
Dan Skinner (Micron)
HPC Anywhere: Submersion and Directed Flow Cooling Technology for Oil & Gas
Herb Zien (LiquidCool Solutions)
Improving the Design of Subsea Riser Systems
William Calver II (Altair)
Keep Agility, Reduce Cost! HPC and Compute-on-Demand with AWS
Dougal Ballantyne (Amazon Web Services)
RTM Using Hadoop: Is There a Case for Migration?
Ian Lumb (York University & Bright Computing, Inc.)
Predictive Analytics at Work: Oil and Gas Exploration Using Watson and Data Streaming
Currie Boyle (IBM)
REX Neo Architecture: A Path to Exascale
Paul Sebexen (Rex Computing)
The Next Generation of High Performance Fabric
Joseph Yaworski (Intel)

3:15 p.m.   **Networking and Break**

PARALLEL SESSIONS:

3:45 p.m.   **Parallel session A: Coarse-grained Seismic Algorithms**   BRC280 and 282

3:45 p.m.   **Parallel session B: Facilities, Infrastructure & Data I**   BRC103

5:30 p.m.   **Networking Reception**   BRC Event Hall

Parallel Session A: Coarse-grained Seismic Algorithms   BRC280 and 282   A
Session Chairs: Scott Morton (Hess) and Simanti Das (ExxonMobil)

3:45 p.m.   **RTM - Asynchronous Constraint Execution for Scalability and Heterogeneity on Shot Level**
Daniel Grünewald (Fraunhofer ITWM)

4:05 p.m.   **Portable Task-based Programming for Elastodynamics**
Lionel Boillot (INRIA Magique3D team)

4:25 p.m.   **Using Performance Tools to Analyze the Performance of an MPI+OpenMP Reverse Time Migration Code**
Sri Raj Paul (Rice University)

4:45 p.m.   **Using Modeling to Develop Stencil Codes**
Raul de La Cruz (Barcelona Supercomputing Center)

5:05 p.m.   **Democratization of HPC in the Oil & Gas Industry Through Automatic Parallelization with Parallware**
Manuel Arenaz (Appentra Solutions S.L. and University of A Coruña)

Parallel Session B: Facilities, Infrastructure & Data I   BRC103   B
Session Chairs: Keith Gray (BP), Paul Singer (Statoil) and Erik Engquist (Rice University)

3:45 p.m.   **Hosting DLC HPC System and Beyond**
Diego Klahr (Total)

4:05 p.m.   **BP Center for High Performance Computing Facility - Year 1 Review**
Stefan Garrard (BP)

4:25 p.m.   **Move of the Chevron HPC to a New Facility**
Jay Williamson (Chevron)

4:45 p.m.   **SC '15 Student Cluster Challenge Team**
Carlos Rosales-Fernandez (Texas Advanced Computing Center)

5:05 p.m.   **Best Practices in HPC Systems Administration**
Shawn Hall (Numerical Algorithms Group)

OIL AND GAS HIGH PERFORMANCE COMPUTING

2015 TECHNICAL PROGRAM — THURSDAY, MARCH 5

7:30 a.m. On-site Workshop Registration & Networking

Morning Plenary (BRC103)
Session Chair: Jan E. Odegard (Rice University)

8:30 a.m. **Message from Organizers**
Jan E. Odegard
(Associate Vice President, Office of Information Technology and Executive Director,
Ken Kennedy Institute for Information Technology, Rice University)

8:45 a.m. **Keynote**
Current Trends in Parallel Numerical Computing and Challenges for the Future
Jack Dongarra
(American University Distinguished Professor of Computer Science in the Electrical Engineering and
Computer Science Department, University of Tennessee)

9:30 a.m. **Keynote**
The Green Data Center and Energy Efficient Computing
Steven Hammond
(Director of Computational Science Center, National Renewable Energy Laboratory)

10:15 a.m. Networking & Break

10:45 a.m. Parallel session C: Facilities, Infrastructure & Data II — BRC103
10:45 a.m. Parallel session D: Fine-grained Seismic Algorithms — BRC282 and 284
10:45 a.m. Parallel session E: Reservoir/Production — BRC280

12:30 p.m. Networking & Lunch Break

Afternoon Plenary (BRC103)
Session Chair: Keith Gray (BP)

1:30 p.m. **Future of High Performance Networking**
Anshul Sadana (Senior Vice President of Customer Engineering, Arista)

2:00 p.m. **Future Systems and Seismic Computing**
Kent Winchell (Director, CTO Office, Cray)

2:30 p.m. **Keynote**
Seismic Imaging and HPC Partnership – Innovation at BP
Eric Green (Vice President, Advanced Seismic Imaging, BP)

3:15 p.m. Poster Session, Networking and Closing Reception — BRC Event Hall

OIL AND GAS
HIGH PERFORMANCE COMPUTING

Parallel Session C: Facilities, Infrastructure & Data II — BRC103 — C
Session Chairs: Keith Gray (BP), **Paul Singer** (Statoil) and **Erik Engquist** (Rice University)

10:45 a.m. **Petascale Data Management at ExxonMobil**
Alan Wild (ExxonMobil)

11:05 a.m. **HDF5 - Where We're At and Where We're Going**
Quincey Koziol (The HDF Group)

11:25 a.m. **Performance and TCO of a Submersion Cooled Data Center: Two Case Studies from Medium to Large Scale, Oil and Gas Exploration Data Center Installations**
Christiaan Best (Green Revolution Cooling)

11:45 a.m. **Large-Data Software Defined Visualization on CPUs**
Gregory S. Johnson (Intel)

12:05 p.m. **Pixel pipelines: An Update on Current Trends in Visualization Infrastructure**
Erik Engquist (Rice University)

Parallel Session D: Fine-grained Seismic Algorithms — BRC282 and 284 — D
Session Chairs: Scott Morton (Hess) and **Simanti Das** (ExxonMobil)

10:45 a.m. **OKL: A Unified Kernel Language for Parallel Architectures**
David Medina (Rice University)

11:05 a.m. **Revisiting Kirchhoff Migration on GPUs**
Rajesh Gandham (Rice University)

11:25 a.m. **RiDG: A Portable High-Performance Simulation Tool for Seismic Imaging**
Axel Modave (Rice University)

11:45 a.m. **Performance Comparison Between HDG and Nodal DG Methods for Elastic Waves Simulation in Harmonic Domain**
Marie Bonnasse-Gahot (INRIA Bordeaux-Sud-Ouest)

12:05 p.m. **Towards an Explicit RTM Stencil Computation Framework on KALRAY TURBOCARD2**
Yann Kalemkarian (Kalray Inc.)

Parallel Session E: Reservoir/Production — BRC280 — E
Session Chairs: Amik St-Cyr (Shell) and **Ernesto Prudercio** (Schlumberger)

10:45 a.m. **Vectorization of Equation of State Calculations in Compositional Reservoir Simulation**
Shaji Chempath (ExxonMobil)

11:05 a.m. **High-performance Parallel Preconditioning for Large-scale Reservoir Simulation Through Multiscale, Architecture-aware Techniques**
Jason Sewall (Intel)

11:25 a.m. **Heterogeneous HPC Framework for Agile Formation Evaluation and Well Placement Workflows in High-Angle and Horizontal Wells**
Valery Polyakov (Schlumberger)

11:45 a.m. **Strongly Scalable High Order Algorithm for Miscible Flooding on Massively Parallel Architecture**
Jizhou Li (Rice University)

12:05 p.m. **Rapid Simulation of Hydraulic Fracturing Using a Planar 3D Model**
Bjoern Nordmoen (Schlumberger)

OIL AND GAS
HIGH PERFORMANCE COMPUTING
EVENT MAP

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BioScience Research Collaborative

SECOND FLOOR

RESTROOM
RESTROOM
STAIRS

BR285
BR287
STAIRS

BR280
PARALLEL
SESSIONS A & E

BR282 **BR284**
PARALLEL
SESSIONS A & D
BR286

CAFE AREA

OUTSIDE STAIR ACCESS TO FIRST FLOOR

STAIRS

TRAVIS STREET

BRC103
PARALLEL SESSIONS
B & C

STUDENT POSTERS (DAYTIME)

PARKING →

LIVE BROADCAST
BRC106

ELEVATORS

SPEAKER CHECK-IN

NAME TAGS

EMERGENCY
ASSEMBLY
POINT

OUTSIDE STAIR ACCESS TO SECOND FLOOR

OUTDOOR EVENT TENT

STREAMING VIDEO

ON-SITE REGISTRATION

STAIRS

◄ **MAIN ENTRANCE**

RESTROOM
PARKING GARAGE ELEVATORS
RESTROOM

EVENT HALL
(SEE EVENT HALL LEGEND)
STREAMING VIDEO

FIRST FLOOR

DRYDEN STREET

UNIVERSITY BOULEVARD

MAIN STREET

Event Hall and Sponsor Exhibits

BREEZEWAY

MAIN ENTRANCE

OUTDOOR EVENT AREA

COOKIES

6 5 4 3 2 1

7 8 9 10 11

K

FOOD
FOOD

J

INTEL

COFFEE BAR

RICE   13 12

A B

CDW

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STREAMING VIDEO

I   H G   HP   IBM   SGI

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9 NetApp
10 OmniBond
11 Dell
12 Altair
13 Society of High Performance Computing Professionals

SILVER
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B Cray
C Seagate
D Amazon
E DDN
F Penguin Computing
G Dot Hill
H Fortinet
I Mellanox
J Panasas
K Micron

STREAMING VIDEO
Christie

Student Posters

A High Performance JPEG-XR Image Compression Library
Lai Wei, Rice University

A Meshless Approach to Modeling Fluid-Filled Fracture Propagation in a Porous Medium
Javier Villarreal, Rice University

A Spark-based Seismic Data Analytics Cloud
Yuzhong Yan, Prairie View A&M University

Accelerating Extended Least Squares Migration with an Approximate Inverse to the Extended Born Modeling Operator
Jie Hou, Rice University

Adaptive Hierarchical Sparse-grid Integration for Uncertainty Quantification
Timur Takhtaganov, Rice University

Adding Vectors and Matrix Support to SimSQL, an Analytic Relational Database System
Shangyu Luo, Rice University

Analysis of Separation Mechanisms in Molecular Transport Through Channels
Shaghayegh Agah, Rice University

Bottom-up Insight into the Morphology, Spectroscopy, and Photophysics of Thiophene Based Polymers
Ryan Haws, Rice University

Calculation of Solubility Parameters of Crude Oil Systems as a Function of Pressure, Temperature and Composition Using Experiments, Thermodynamic Modeling and Molecular Simulations
Mohan Boggara, Rice University

Communication Avoiding Algorithms: Analysis and Code Generation for Parallel Systems
Karthik Murthy, Rice University

Computational Science Undergraduate Research Experiences (CSURE) in National Institute for Computational Sciences (NICS)
Kwai Wong, University of Tennessee

Depth-oriented Extended Full Waveform Inversion with an Unknown Source Function
Lei Fu, Rice University

Distributive Interoperable Executive Library (DIEL) for Multi-disciplinary System-Wide Scientific Simulations
Kwai Wong, University of Tennessee
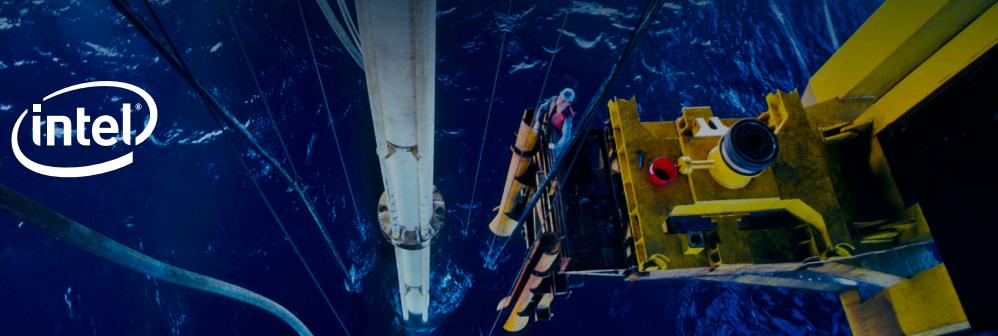
Efficient Implementation of Cactus Stack in Work-stealing Runtimes
Chaoran Yang, Rice University
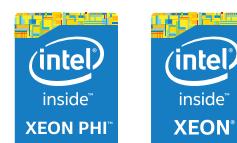
Estimation of Relative Permeabilities in Porous Media Flow
Caleb Magruder, Rice University

Student Posters

Extending FWI into the Plane Wave DomainPapia
Nandi-Dimitrova, Rice University

Fast Step Transition and State Identification (STaSI) for Discrete Single-Molecule Data Analysis
Bo Shuang, Rice University

Graphene-like Sheets Acting as Selective Sieves or Impermeable Membranes
Gustavo Brunetto, Rice University

Graphyne Membranes Functionalization: A Fully Atomistic Molecular Dynamics Investigation
Pedro Autreto, State University of Campinas/Rice University

High Surface Area Activated Asphalt for CO2 Capture
Almaz Jalilov, Rice University

Hybrid Agent-based-simulation framework for Understanding Self-organization in Bacteria
Rajesh Balagam, Rice University

Macro-Dataflow Programming for Mapping on Heterogeneous Architectures
Alina Sbirlea, Rice University

Mixing of Passive Scalars Advected by in Compressible Enstrophy-constrained Flows
Xiaoqian Xu, Rice University

Model Order Reduction in Porous Media Flow Optimizations
Mohammadreza Ghasemi, Texas A&M University

Model-Based Information Acquisition and Retrieval via Compressive Sensing
Yun Li, Rice University

NIR and MIR Charge Transfer Plasmons in Wire-Bridged Antennas
Yue Zhang, Rice University

OCCA Accelerated Lattice Boltzmann Method in Core Sample Analysis
Zheng Wang, Rice University

On Magneto-Optical Magnetic Flux Leakage Sensing
David Trevino-Garcia, Rice University

Optimal Control of Miscible Displacement Equations Using Discontinuous Galerkin Methods
Brianna Lynn, Rice University

Performance Analysis and Configuration Selection for Applications in the Cloud
Ruiqi Liu, Rice University

Performance Characterization of Applications Across Different Programming Models Using Similarity Analysis
Md Abdullah Shahneous Bari, University of Houston

Portable Programming Models for Heterogeneous Platforms
Deepak Majeti, Rice University

Providing Vectors and Matrices Support to SimSQL, an Analytic Relational Database System
Shangyu Luo, Rice University

Student Posters

Scalable Data Mining Using the STAPL C++ library
    Robert Metzger, Texas A&M University

Speeding Up Big Data Jobs Through Better Traffic Flow Management in File Systems
    Simbarashe Dzinamarira, Rice University

Speeding Up Your Data Center with Optical Circuit Switching
    Xin Huang, Rice University

Strongly Scalable High Order Algorithm for Miscible Flooding on Massively Parallel Architecture
    Jizhou Li, Rice University

Unraveling the Sinuous Grain Boundaries in Graphene
    Yang Yang, Rice University

Upper Cambrian Microbial Reefs, Mason, Texas: The Making of Virtual Outcrops Using Photogrammetry
    Pankaj Khanna, Rice University

Variable Projection Method for Extended Born Waveform Inversion with Shot Coordinate Model Extension
    Yin Huang, Rice University

Wall Thickness Measurement System Based on Magnetic Flux Leakage for External Robotic Inspection of Oil and Gas Pipelines
    Issam Ben Moallem, Rice University

Well Rate Optimization of Oil Reservoirs
    Xiaodi Deng, Rice University

Notes
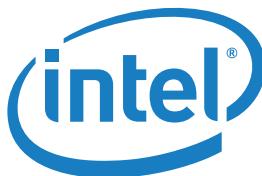
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