

Session 1: Instruments of Science & Engineering

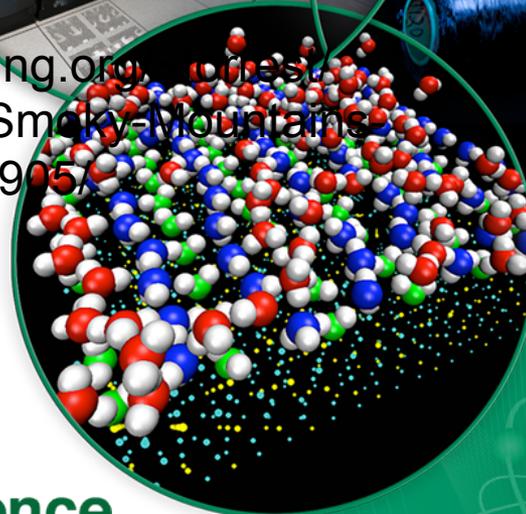
Barney Maccabe

http://www.climatemodeling.org/presentations/Hoffman_Smoky-Mountains-CSE-Conference_20130915/slideshow.html



**Smoky Mountains
Computational Sciences
and Engineering Conference**

Gatlinburg, TN September 4, 2013



Building the instruments

- The architecture of the compute, data, and communication infrastructure needed to support science applications
 - It's about the computer science
 - Science provides the context
- How do we co-locate data and compute in time and space to enable science?
 - Data tends to have natural spatial locality (e.g., the point of observation, the point of integration, or repositories that designed to hold vast amounts of data)
 - How do we decide whether to move the data or to integrate computation where the data resides

The Talks

- Data Management and Analysis in Support of Community Climate Science Dean Williams
LLNL
- Creating an Open Cloud Marketplace Orran Krieger
Boston U.
- Integration of Quantum Computing into High Performance Computing Colin Williams
D-wave
- PyLight, A Common Architecture for Composable Workflows to Facilitate Data Acquisition and Analysis at NSLS-II Dantong Yu
BNL

Data Management and Analysis in Support of Community Climate Science



- Science grids:
 - ... access and analysis of climate modeling, observation, and measurements data through the use of the Earth System Grid Federation (ESGF) and the Ultra-scale Visualization Climate Data Analysis Tools (UV-CDAT).
- **Dean Williams**, Analytics and Informatics Management Systems Lead, LLNL
 - ... three decades ... development of the hardware and software infrastructure that are required for successfully distributing model output which is now a community-wide activity....
 - Currently leading ESGF, UV-CDAT, and Climate 100 Advanced Networking Initiative
 - Prior includes DOE, NSF, NASA, NOAA, and international projects

Creating an Open Cloud Marketplace



- Data in the cloud:
 - Cloud Computing has the potential of impacting all aspects of society... to achieve its potential, the efforts of large community of researchers, innovators, and industry participants is needed. Unfortunately, existing public clouds limit innovation and research in public clouds to the small number of public cloud providers.
- **Orran Krieger**, research Professor of Computer Science, Boston University
 - Founding Director for the Center for Cloud Innovation (CCI)
 - Five years at VMware starting and working on vCloud
 - Lead the Advanced Operating System Research Department at IBM T. J. Watson (K42)
 - PhD and MASc in Electrical Engineering at the University of Toronto (Tornado)

Integration of Quantum Computing into High Performance Computing



- Integrating novel computing technologies:
 - ... D-Wave's approach to quantum computing including its operating principles, system architecture, evidence of quantumness, and report on our latest performance data.... then describe strategies for integrating our quantum processor into mainstream high performance computing systems.
- **Colin Williams**, Director of Business Development & Strategic Partnerships at D-Wave Systems Inc.
 - Explorations in Quantum Computing
 - Edinburgh: developed an AI system for reasoning about the physical world via qualitative and quantitative differential equations.
 - Xerox PARC: links between statistical physics and computer science, invented the theory of computational phase transitions, and applied it to understanding the deep structure of NP-Hard problems.

PyLight, A Common Architecture for Composable Workflows to Facilitate Data Acquisition and Analysis at NSLS-II



- Moving compute to the source:
 - The tremendous volume of data generated from NSLS-II will require a real-time streaming analysis pipeline at the beamline to reduce raw data, perform data transformation and visualization right at the beamline, to assure the data quality control, and to provide feedback for experiment reconfiguration
- Dantong Yu, Computer Science Group Lead, BNL
 - high-speed network performance, network quality of service, cluster/grid computing, information retrieval, data mining, database, and data warehouse
 - ClusterTree: high-dimensional indexing algorithm using the semantics of datasets.