



U.S. Department of Energy

---

# Funding the Digital Humanities: A Roundtable

*Presentation to the  
National Endowment for the Humanities*

*Dr. Raymond L. Orbach*  
Under Secretary for Science  
U.S. Department of Energy  
April 13, 2007  
[www.science.doe.gov](http://www.science.doe.gov)



# The Office of Science

---

- The Office of Science is the single largest supporter of basic research in the physical sciences in the U.S..
- In addition, the Office of Science is the Federal Government's largest single funder of materials and chemical sciences, and it supports unique and vital parts of U.S. research in climate change, geophysics, genomics, life sciences, and science education.
- SC's Advanced Scientific Computing Research (ASCR) program supports DOE's mission to provide world-class scientific research capacity using high-performance computing and advanced networks, and through the application of computers capable of trillions of operations per second (terascale computers).



# The Rationale for High- Performance Scientific Computing

---

We have used computers to solve sets of equations, physical laws too complicated to solve analytically. But now, we can simulate systems to discover physical laws for which there are no known predictive equations. This means that we will be able to model physical or social structures with hundreds of thousands, or maybe even millions, of “actors”, interacting with one another in a complex fashion. The speed of our new computational environment allows us to test different inter-actor (or inter-personal) relations to see what macroscopic behaviors can ensue. Thus, we may be able to use simulations to determine the nature of the fundamental “forces” or interactions between “actors.”

This approach to understanding complex systems is to be thought of in the same vein as experiment and analytic theory. In science of the 21st century, simulation and high-end computation are equal partners with theory and experiment.

Scientific leadership, the basis for our economic, physical, and intellectual prosperity depends on this triad, our being first in each component.

**--Dr. Ray Orbach Commencement Address to the  
Rand Graduate School, June 22, 2002  
*Computation for the 21<sup>st</sup> Century: A New Paradigm***



# SC's High-Performance Computing Capability

---

- SC is building world leadership class computer facilities for open research.
- Over the past 30 years, the Department of Energy's (DOE) supercomputing program has played an increasingly important role in scientific research by allowing scientists to create more accurate models of complex processes, simulate problems once thought to be impossible, and to analyze the ever-increasing amount of data created.
- SC will have an installed capability of over a petaflop in 2008.
- We are planning the jump to exascale computing in the next decade – we are only beginning to comprehend the potential of this kind of power.



# The Digital Humanities

---

"He looked into the water and saw that it was made up of a thousand thousand thousand and one different currents, each one a different colour, weaving in and out of one another like a liquid tapestry of breathtaking complexity; and Iff explained that these were the Streams of Story, that each coloured strand represented and contained a single tale. Different parts of the Ocean contained different sorts of stories, and as all the stories that had ever been told and many that were still in the process of being invented could be found here, the Ocean of the Streams of Story was in fact the biggest library in the universe."

Salman Rushdie, *Haroun and the Sea of Stories*  
(London: Granta Books, 1990), p. 71



# Common Ground

## – *petascale to exascale data*

---

- From a sea of stories to an ocean of data, we face some of the same challenges from massive amounts of information.
  - Integration - of isolated datasets in different formats, media, units, languages, etc. – *collaboration is crucial.*
  - Management - because these data are not static.
  - Sharing - across continents and generations.
  - Storage - both local and distributed.
  - Integrity – who has “the original” and how do you know your copy is exact.
  - Utility – navigating the waters and extracting knowledge.



# Prosopography

---

- 'Prosopography is about what the analysis of the sum of data about many individuals can tell us about the different types of connexion between them, and hence about how they operated within and upon the institutions - social, political, legal, economic, intellectual - of their time.'. (Katharine Keats-Rohan, History and Computing 12.1, p. 2)



# Common Ground

## - *computational science*

---

- Over the past decade, computational science has become a third leg supporting basic research.
  - Partnering researchers with applied mathematicians and computer scientists to build robust models of physical and engineered systems.
- With modeling and simulation we can explore where it is too expensive or dangerous.
  - We can understand and predict the effects of aging on materials.
  - We can predict changes in our climate and regional effects.
  - We can investigate supernovae and the heart of stars.





# Our Resources

---

- In Climate and Genomics collaborations we have significant experience and tools for bringing together disparate datasets and research efforts (including social science).
- The Scientific Discovery through Advanced Computing (SciDAC) Program institutionalized collaborations across our programs and disciplines.
  - SciDAC supports Centers and Institutes that are focused on overcoming the technical barriers to computational science.
  - The current portfolio includes: Data Management; Visualization and Distributed Computing, and an Outreach Center.
- ESnet partnership with Internet2 is bringing the next generation networking technologies to academia and the DOE National Laboratories.
- Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program opens the Office of Science high performance computing centers to the best research regardless of affiliation.



# Closing Thoughts

---

- We invite you to participate in our planning for the petascale, the exascale and beyond:
  - Three “town hall meetings” on the proposed Simulation and Modeling at the Exascale for Energy, Ecological Sustainability and Global Security (E<sup>3</sup>SGS) program will be held.
    - Berkeley Lab will host the first meeting on April 17-18,

The planned petascale computer systems and the potential for exascale systems shortly provide an unprecedented opportunity for science; one that will make it possible to use computation not only as an critical tool along with theory and experiment in understanding the behavior of the fundamental components of nature but also for fundamental discovery and exploration of the behavior of complex systems with billions of components, including those involving humans.
    - Oak Ridge National Lab will host a meeting on May 17-18, and
    - Argonne National Lab will host a meeting on May 31 - June 1.
- *“The purpose of computing is insight, not numbers.”*
  - *Richard Wesley Hamming*



---

# Backup



# The Scientific Discovery through Advanced Computing (SciDAC)

---

- SciDAC supports Centers and Institutes that are focused on overcoming the technical barriers to computational science.
- The current portfolio includes:
  - SciDAC Outreach Center – connecting SciDAC to the research community
  - SciDAC Institutes (University Led with educational outreach component)
    - SciDAC Institutes for Ultrascale Visualization
    - Petascale Data Storage Institute
  - Centers for Enabling Technologies
    - Visualization and Analytics Center for Enabling Technologies (VACET)
    - Scientific Data Management
    - Sustaining and Extending the Open Science Grid: Science Innovation on a Petascale Nationwide Facility
    - Enabling Distributed Petascale Science
    - Scaling the Earth System Grid to Petascale Data



---

*Where is the Life we have lost in living?*

*Where is the wisdom we have lost in  
knowledge?*

*Where is the knowledge we have lost in  
information?*

*– T.S. Eliot, The Chorus from The Rock*



---

**“ To explain all nature is too difficult a task for any one man or even for any one age. 'Tis much better to do a little with certainty, & leave the rest for others that come after you, than to explain all things by conjecture without making sure of any thing.”**

- Sir Isaac Newton, Statement from unpublished notes for the Preface to *Opticks* (1704) quoted in *Never at Rest: A Biography of Isaac Newton* (1983) by Richard S. Westfall, p. 643