



U.S. Department of Energy's
Office of Science

Multidisciplinary Research in DOE's Office of Science

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06/25/06



Top 10 reasons researchers give for not doing multidisciplinary research:

- Agencies may not support it;
- Your Department Chair (tenure committee,...) doesn't value it;
- You have to talk to people in other departments;
- You have to spend time learning your partners' language;
- You have to talk to people who you don't see at **your** meetings and conferences; and
- Being useful as a partner compromises the integrity of your discipline



Multidisciplinary research is critical to DOE's Office of Science

- Many of the hard problems require multiple disciplines;
- Computational science requires partnerships between scientific disciplines and math and computer science;
- Construction and operation of large scientific facilities requires multiple disciplines;
- Validates and tests results from single disciplines and identifies new areas of research.



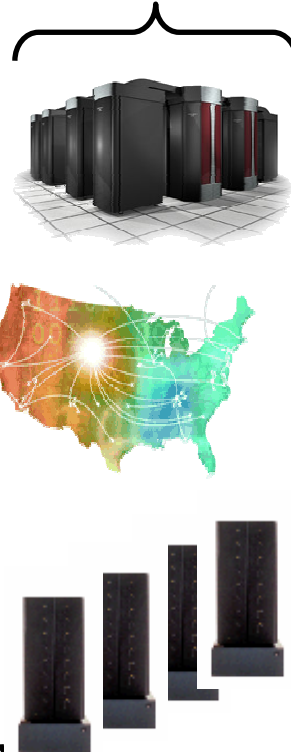
Scientific Discovery Through Advanced Computation (SciDAC) (~\$80M/yr)

Brings the power of tera/petascale computing to science

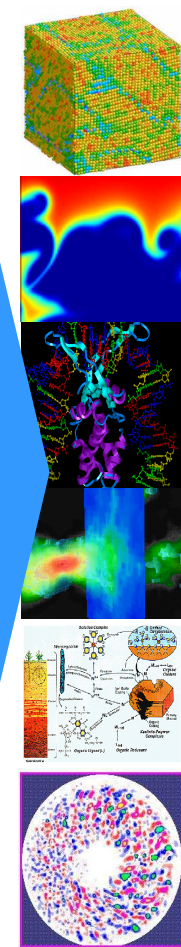
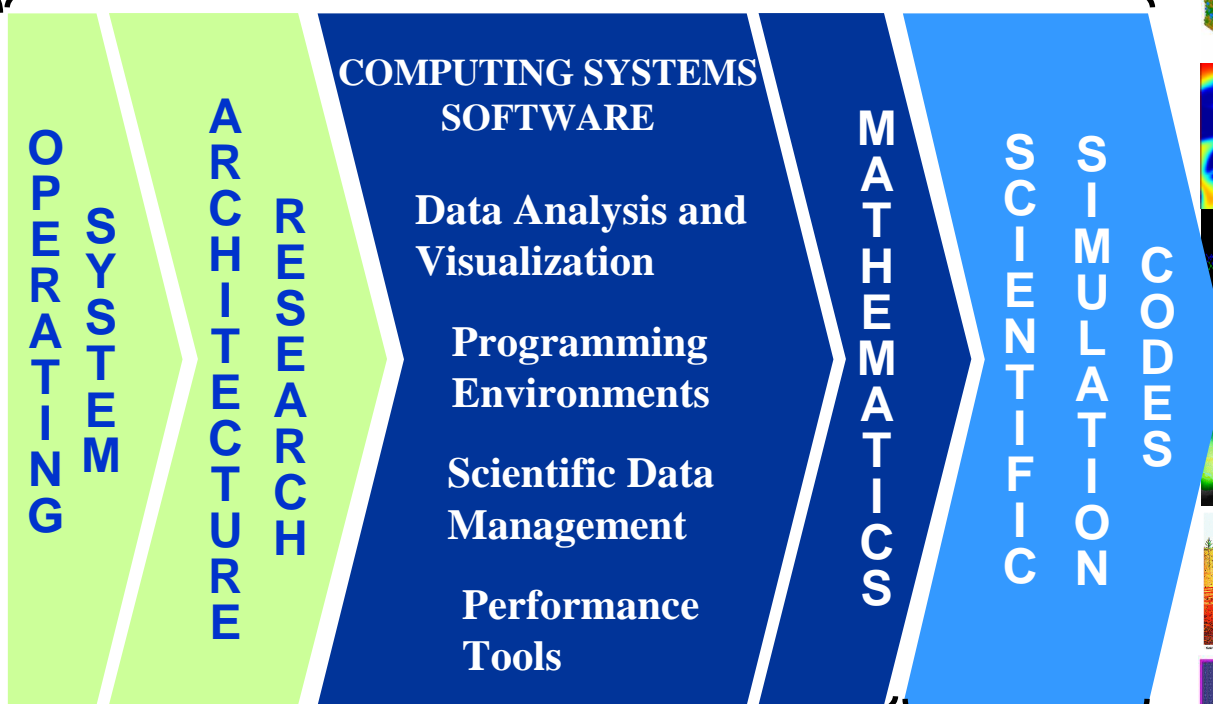
www.scidac.org

Office of Science

Hardware Infrastructure



Software Infrastructure



ASCR

**BES, BER
FES, HENP**

State-of-the-art electronic collaboration tools will facilitate access to these tools to bring simulation to a level of parity with theory and experiment in the scientific enterprise.



Lessons Learned

- Must have a shared goal...something that cannot be accomplished alone;
- Must benefit all partners;
- Program managers/funders need to serve as neutral referees (at least in the beginning);
and
- Exchange of hostages works as well today as it did 1,000 years ago.
- Do not underestimate the lessons of Machiavelli and Sun Tzu



Closing Thoughts

- Multidisciplinary research is here and will become increasingly important in the 21st century;
- Computer science and applied mathematics are key to many multidisciplinary projects;
- Multidisciplinary projects identify new problems in computer science;
- Multidisciplinary projects are great training for students.



Workshops and Reports

www.sc.doe.gov/ascr/



- High Performance Network Planning Workshop, August 2002
 - <http://www.doecollaboratory.org/meetings/hpnpw/>
- Blueprint for Future Science Middleware and Grid Research and Infrastructure, August 2002
 - <http://www.nsf-middleware.org/MAGIC/default.htm>
- DOE Science Network Meeting, June 2003
 - <http://gate.hep.anl.gov/may/ScienceNetworkingWorkshop/>
- DOE Science Computing Conference, June 2003
 - <http://www.doe-sci-comp.info>
- Science Case for Large Scale Simulation, June 2003
 - www.pnl.gov/scales/
- Workshop on the Road Map for the Revitalization of High End Computing
 - <http://www.cra.org/Activities/workshops/nitrd/>
- Cyberinfrastructure Report
 - <http://www.cise.nsf.gov/evnt/reports/toc.htm>
- ASCR Strategic Planning Workshop
 - <http://www.fp-mcs.anl.gov/ascr-july03spw>
- ASCR Strategic Plan, July 2003
 - <http://www.sc.doe.gov/ascr/ASCRstrategicplan073004final.pdf>
- HECRTF Plan, May, 2004
 - http://www.sc.doe.gov/ascr/20040510_hecrtf.pdf
- The Office of Science Data-Management Challenge, Report from the DOE Office of Science Data-Management Workshops, November, 2004
 - <http://www.sc.doe.gov/ascr/Final-report-v26.pdf>
- Multiscale Mathematics Workshops:
 - May, 2004 – Washington, DC
 - <http://www-fp.mcs.anl.gov/multiscale-workshop/>
 - July, 2004 – Denver, CO
 - http://www.math.colostate.edu/~estep/doe_multiscale/DOE_Multiscale_2.html
 - September, 2004 – Portland, OR
 - <http://multiscalemath.pnl.gov>





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Integrated Software Infrastructure Centers in SciDAC 1 (just completed)

- **Applied Mathematics ISICs**
 - [An Algorithmic and Software Framework for Applied PDEs](#)
 - [Terascale Optimal PDE Solvers \(TOPS\)](#)
 - [Terascale Simulation Tools and Technologies \(TSTT\)](#)
- **Computer Science ISICs**
 - [Center for Component Technology for Terascale Simulation Software](#)
 - [High-End Computer System Performance: Science and Engineering](#)
 - [Scalable Systems Software](#)
 - [Scientific Data Management Enabling Technology Center](#)
- **Middleware Projects**
 - [Middleware Technology to Support Science Portals](#)
 - [A High-Performance Data Grid Toolkit: Enabling Technology for Wide Area Data-Intensive Applications](#)
- **National Collaboratory Projects**
 - [DOE Science Grid: Enabling and Deploying the SciDAC Collaboratory Software Environment](#)
 - [A National Collaboratory to Advance the Science of High-Temperature Plasma Physics for Magnetic Fusion](#)
 - [Particle Physics Data Grid Collaborative Pilot](#)
 - [Earth System Grid II: Turning Climate Datasets into Community Resources](#)
 - [Security and Policy for Group Collaboration](#)
- **Network Projects**
 - [INCITE: Edge-Based Traffic Processing and Service Inference for High-Performance Networks](#)
 - [Optimizing Performance and Enhancing Functionality of Distributed Applications Using Logistical Networking](#)
 - [Bandwidth Estimation: Measurement Methodologies and Application](#)



ASCR Program Overview

Research

Research to enable...

...simulation of complex systems

...distributed teams, remote access to facilities

**BES,
BER, FES,
HEP, NP**

- Applied Mathematics
- Computer Science

- Network Environment
- Scientific Applications
- Genomes to Life

- Nanoscience
- Materials
- Chemistry
- Combustion
- Accelerator
- High energy Physics
- Nuclear physics
- Fusion
- Climate
- Astrophysics
- Biology



- Nanoscience
- Grid enabling research
- Integrated Software Infrastructure Centers

(Mathematicians, computer scientists, application scientists, and software engineers)

High Performance Computing and Network Facilities for Science

National Energy Research Scientific Computing Center (NERSC)

Leadership Computing Facility (LCF)

Research and Evaluation Prototypes

Energy Sciences Network (ESnet)

