

Workshop on the Role of Information Sciences and Engineering in Sustainability

*Hyatt Regency Washington on Capitol Hill
February 2-3, 2011*

Please send us your comments, notes, etc.:

erwin@cra.org



<http://cra.org/ccc/seesit>



Sustainability

- “meet present needs without compromising the ability of future generations to meet their needs”
 - One of many definitions - we’ll not quibble
- NSF-wide investment area in “Science, Engineering, and Education for Sustainability” (SEES)
 - 5-year initiative: <http://www.nsf.gov/sees>
 - climate change, energy, and other aspects...
 - Computer and Information Science and Engineering (CISE) directorate participates, often in partnership with other directorates
- CISE commissioned the Computing Community Consortium (CCC) to organize this workshop to explore the SEES research portfolio of the CSE community



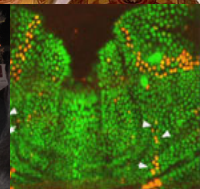
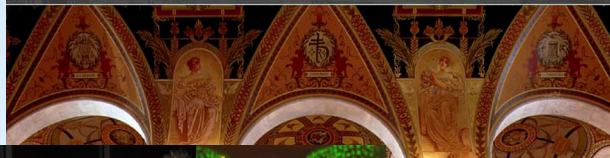
Computing Community Consortium

Focused on empowering the computing research community to pursue more audacious visions

A broad-based standing committee of 20 leading U.S. computer scientists

- Housed within the Computing Research Association (CRA), representing >200 U.S. & Canadian academic departments and industrial research labs
- Chair: Ed Lazowska, U-Washington
- Vice-Chair: Susan Graham, UC-Berkeley
- Director: Erwin Gianchandani, CRA [erwin@cra.org]

Computing Research That Changed The World



This Week's Highlight:
Fruit Fly Suggests New
Solution to Computer
Networking Problem

*LANDMARK CONTRIBUTIONS BY
STUDENTS IN COMPUTER SCIENCE*
*undergraduate and graduate students that
have made truly game-changing contributions
in the course of their studies*



A multitude of activities:

- Community-initiated visioning workshops - bringing researchers together to generate “out-of-the-box” ideas
- White papers for the White House & others - short reports to inform policymakers
- Public relations efforts - Library of Congress symposiums, Research “Highlight of the Week,” CCC Blog
- Nurturing the next generation of leaders - Computing Innovation Fellows, “Landmark Student Contributions”



NSF SEES investment

- DCL: “Achieving a sustainable human future in the face of both gradual and abrupt environmental change is one of the most significant challenges facing humanity.”
- Research portfolio includes several challenges in CISE areas:
 - novel energy production...and intelligent control
 - innovative CSE methods and systems for monitoring, understanding, and optimizing life-cycle energy costs and carbon footprints
 - data analysis, modeling, simulation, visualization and intelligent decision-making facilitated by advanced computation...
 - research to enable a new generation of observational networks
 - development of cyberinfrastructure and instrumentation to enable sustainability science and engineering
 - support of the physical, cyber and human infrastructure necessary

CSE research for sustainability

- Routine application of CSE
 - there will be many, many such applications that address sustainability needs
- Incremental research innovation in areas where work is already underway
 - examples: low-power electronics, data-center energy management, process control for new renewable electricity sources, ...
 - cumulative effect of incremental work can be large
 - forecasts often under-estimate this kind of change
- Research that leads to “radical” approaches
 - transformative or “game changing” developments
 - but don’t violate the laws of physics

Example: incremental

- Hardware/software control of real-time, life-critical equipment such as automobiles
- We do it now: costly, limited applications
- We'll need to do it more: optimizing for performance will lead to more complex software
 - and to interactions with other vehicles, people, infrastructure
- Would like to provide interfaces to open opportunities for innovation, without compromising safety
- ...there might be radical approaches to this problem

Example: radical (retrospect...)

- Human genome sequencing: symbiosis of molecular biology and computer science
- early days (1990-2000) reading fragments and assembling
 - ~600 nucleotides/fragment
 - Meyers, Celera
 - new algorithms developed (but matching not a new problem)
- Next Generation Sequencing (NGS)
 - parallel sequencing, ~100 nucleotides/fragment, headed down
 - still more new assembly algorithms
- Now there's a reference human genome
 - still more new algorithms
- **The problem keeps changing...**

How you can contribute

- Brainstorm new research directions
- Identify important problems facing sustainability that CSE might address
- Interact with other workshop attendees, with different technical backgrounds, to imagine new approaches
- Integrate with the entire group, report
- Send afterthoughts by email to erwin@cra.org

Please try to avoid:

- Extolling your own research area only
- Focusing only on incremental work

Logistics

- Plenary speakers and panels to stimulate thinking
- Breakouts, loosely driven by topics, to discuss ideas
 - Please help us keep the groups small and interactive
- Report back to the entire group
- Final integrative session Friday afternoon
- Organizing committee will draft a report, circulate for further comments

We have tight schedules. Please try to stay on time.