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
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
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]

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”
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
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...

http://cra.org/ccc/seesit
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.*