The Computing Community Consortium: Stimulating Bigger Thinking

Ed Lazowska, UW and CCC
Susan Graham, UC Berkeley and CCC
Richard Ladner, UW
Randy Bryant, CMU
Chip Elliott, BBN and GENI Project Office

Snowbird

July 2008

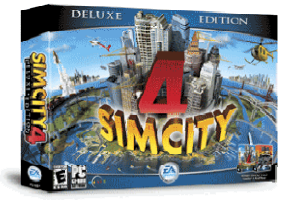
http://www.cra.org/ccc/

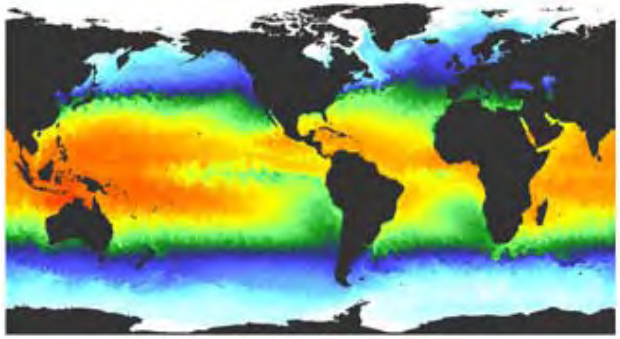
Today …

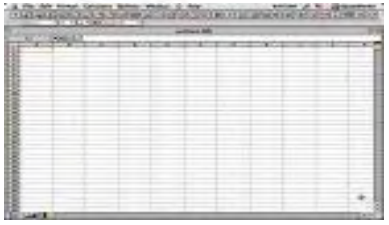
- An overview of the Computing Community Consortium
  - Ed Lazowska, Susan Graham
- Big Data Computing Study Group
  - Randy Bryant
- Visions for Theoretical Computer Science
  - Richard Ladner
- Network Science and Engineering + GENI
  - Ed Lazowska, Chip Elliott

Computing has changed the world

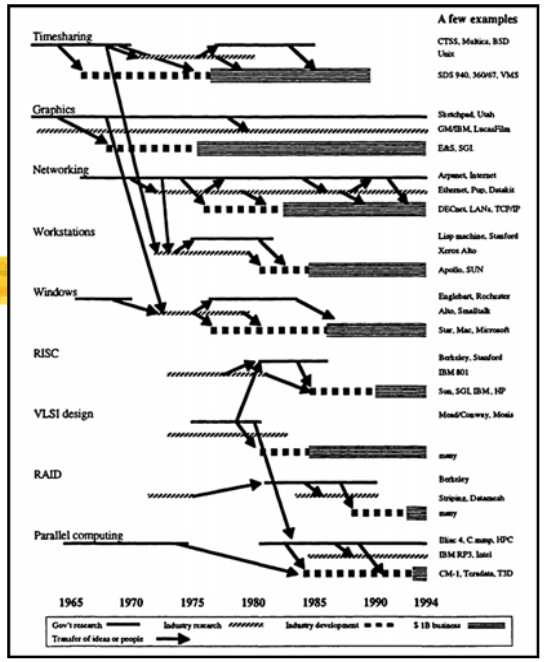
- Advances in computing change the way we live, work, learn, and communicate
- Advances in computing drive advances in nearly all other fields
- Advances in computing power our economy
  - Not just through the growth of the IT industry – through productivity growth across the entire economy



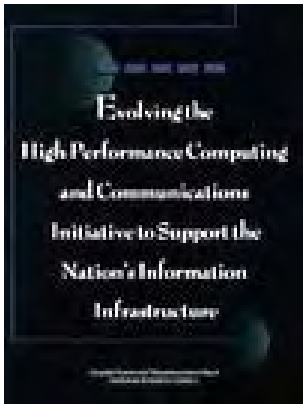




Research has built the foundation

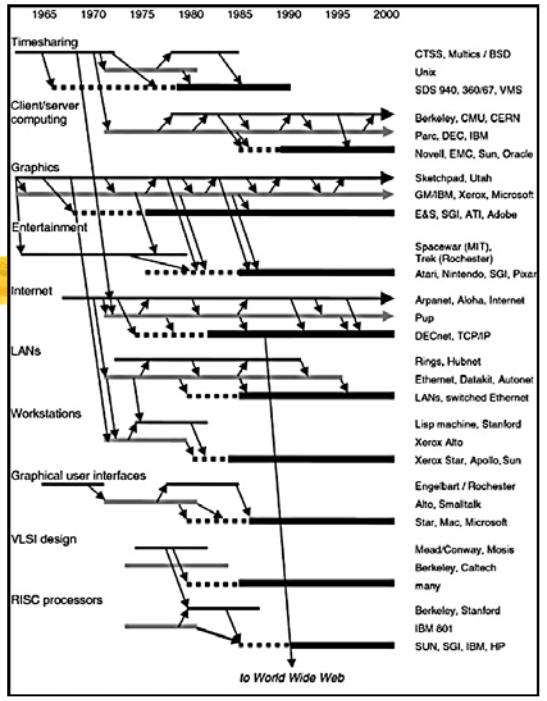


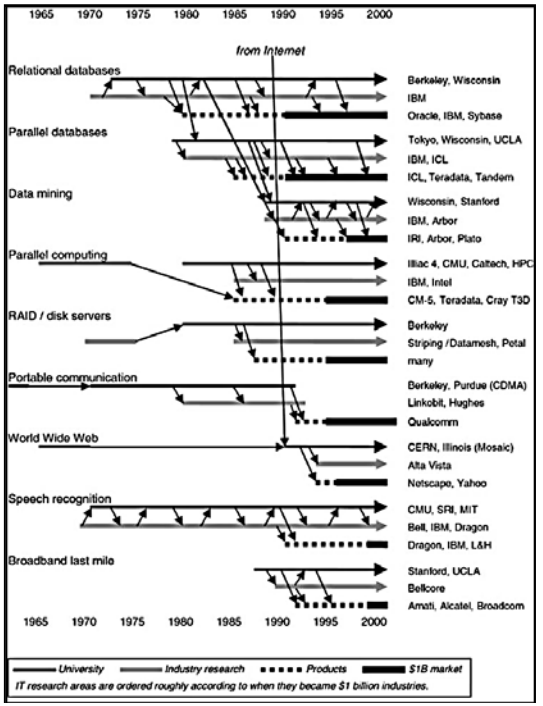
- Timesharing
- Computer graphics
- Networking (LANs and the Internet)
- Personal workstation computing
- Windows and the graphical user interface
- RISC architectures
- Modern integrated circuit design
- RAID storage
- Parallel computing



Much of the impact is recent

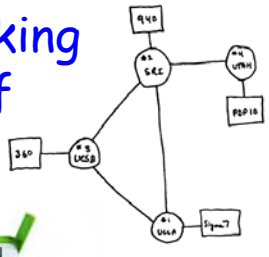
- Entertainment technology
- Data mining
- Portable communication
- The World Wide Web
- Speech recognition
- Broadband last mile

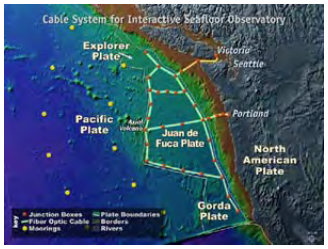


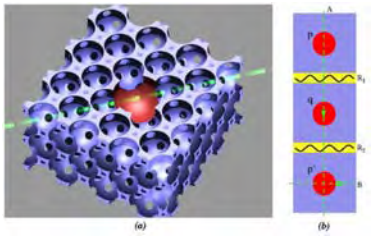


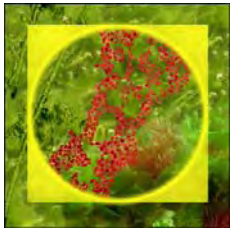
The future is full of opportunity

- Creating the future of networking
- Driving advances in all fields of science and engineering
- Wreckless driving
- Personalized education
- Predictive, preventive, personalized medicine
- Quantum computing
- Empowerment for the developing world
- Personalized health monitoring => quality of life
- Harnessing parallelism: many-core and DISC
- Neurobotics
- Synthetic biology
- The algorithmic lens: Cyber-enabled Discovery and Innovation









NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES

GRAND CHALLENGES FOR ENGINEERING

Make solar energy economical

Provide energy from fusion

Develop carbon sequestration methods

Manage the nitrogen cycle

Provide access to clean water

Restore and improve urban infrastructure

Advance health informatics

Engineer better medicines

Reverse-engineer the brain

Prevent nuclear terror

Secure cyberspace

Enhance virtual reality

Advance personalized learning

Engineer the tools of scientific discovery

NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES

CHALLENGES | IDEAS | NEXT STEPS | COMMITTEE

GRAND CHALLENGES FOR ENGINEERING


Make solar energy economical


Provide energy from fusion


Develop carbon sequestration methods


Manage the nitrogen cycle


Provide access to clean water


Restore and improve urban infrastructure


Advance health informatics


Engineer better medicines


Reverse-engineer the brain


Prevent nuclear terror


Secure cyberspace


Enhance virtual reality


Advance personalized learning


Engineer the tools of scientific discovery

Predominant CS component

Significant CS component

We must work together to establish, articulate, and pursue visions for the field

- The challenges that will shape the intellectual future of the field
- The challenges that will catalyze research investment and public support
- The challenges that will attract the best and brightest minds of a new generation

To this end, NSF asked CRA to create the Computing Community Consortium

- To *catalyze the computing research community* to consider such questions
  - To envision long-range, more audacious research challenges
  - To build momentum around such visions
  - To state them in compelling ways
  - To move them towards funded initiatives
  - To ensure "science oversight" of large-scale initiatives
- *A "cooperative agreement" with NSF*
  - Close coordination

The structure

- CCC is all of us!
  - This process *must* succeed, and it *can't* succeed without broad community engagement
- There is a CCC Council to guide the effort
  - The Council *stimulates* and *facilitates* – it doesn't "own"
  - Inaugural Council appointed through an open process led by Randy Bryant
- The Council is led by a Chair
  - Ed Lazowska, University of Washington
    - Susan Graham, UC Berkeley, serves as Vice Chair
  - 50% effort – not titular
- The CCC is staffed by CRA
  - Andy Bernat serves as Executive Director

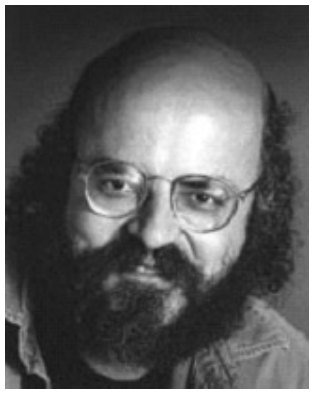
- Those involved in shaping CRA's response to NSF's original challenge
  - Andy Bernat
  - Randy Bryant
  - Susan Graham
  - Anita Jones
  - Dick Karp
  - Ken Kennedy
  - Ed Lazowska
  - Peter Lee
  - Dan Reed
  - Wim Sweldens
  - Jeff Vitter
- Inaugural CCC Council
  - Greg Andrews
  - Bill Feiereisen
  - Susan Graham (v ch)
  - Anita Jones
  - Dave Kaeli
  - Dick Karp
  - John King
  - Ed Lazowska (ch)
  - Peter Lee
  - Andrew McCallum
  - Beth Mynatt
  - Fred Schneider
  - Bob Sproull
  - Karen Sutherland
  - David Tennenhouse
  - Dave Waltz

Activities to date

- Definition and execution of a bootstrapping procedure for the CCC
  - It took time, because community ownership was essential

- Five plenary talks at the Federated Computing Research Conference (June 2007) to introduce CCC to the computing research community
  - Embracing and amplifying efforts that are already underway




- Countless additional talks

- Articles in CRN, CACM (forthcoming), …

COMPUTING RESEARCH NEWS

A Publication of the Computing Research Association

January 2008 Vol. 20/No. 1

The Computing Community Consortium: Who, What, When, Where, Why, and How

Ed Lazowska

Computing Research News interviews Ed Lazowska, Bill & Melinda Gates Chair of Computer Science & Engineering at the University of Washington, and Chair of the Computing Community Consortium. Short articles on the CCC in its formative stages appeared in the November 2006 and May 2007 issues of CRN.

Computing Research News: Begin by describing the Computing Community Consortium. What is its role?

Ed Lazowska: The National Science Foundation created the Computing Community Consortium with the goal of stimulating the computing research community to imagine, articulate, and pursue more audacious research visions—visions that will capture the imagination and change the world. The CCC is funded through an NSF award to the Computing Research Association; the CCC's Council operates as a committee of CRA.

CRN: Who is on the CCC Council? How were they chosen?

EL: The CCC Council comprises a Chair and 15 members on staggered 3-year terms. Members of the Council are listed on the CCC website: http://www.cra.org/ccc/. The Council was chosen through an open process led by Randy Bryant, Dean of the School of Computer Science at Carnegie Mellon University. I chair the Council (this selection, too, involved an open process led by Randy), and Susan Graham from UC Berkeley serves as Vice Chair.

CRN: What's the role of the Council?

EL: The Council serves as a facilitator. It is *the computing research community as a whole* that must imagine, articulate, and pursue more audacious research visions. The Council helps the process in various ways.

CRN: How?

EL: We're in the early stages—the Council was appointed six months ago, after an open process that engaged the entire computing research community. Here are some examples:

- The CCC sponsored a set of five plenary talks at the Federated Computing Research Conference in June—talks by Christos Papadimitriou, Bob Colwell, Randy Bryant, Scott Shenker and me that described specific research visions for the field. See http://www.cra.org/ccc/fcrc/.
- The CCC is providing support for "visioning workshops" organized by members of the computing research community. Sponsorship can be obtained through a lightweight proposal process; the first awards have already been made, and we were excited by the level of participation. See http://www.cra.org/ccc/rfp/.
- We will coordinate closely with funding agencies so we can help to transition visionary ideas into funded programs.

"Our field has accomplished so much, and there is so much more to do. The opportunities are extraordinary."

- We are preparing an inspirational website and booklet describing a wide range of research visions for the field. We are also initiating a blog where the entire research community can participate in real time.

CRN: How does the CCC relate to CRA and to NSF?

EL: CRA and CCC both are concerned with the health of the computing research community—CRA in a broad-based way, and CCC with a narrower focus on research visions. One way to view the relationship is that NSF, by funding the CCC through CRA, has provided CRA and the computing research community with the means to dramatically expand our efforts in this particular area. The

The CCC
Continued on Page 5

- Definition and execution of an RFP process to support visioning by the computing research community
  - Quarterly deadlines, but a rolling process
  - Five efforts launched thus far:
    - "Big Data Computing Study Group"
    - "Cyber-Physical Systems"
    - "Visions for Theoretical Computer Science"
    - "From Internet to Robotics: The Next Transformative Technology"
    - "Network Science and Engineering"

- Definition and execution of an RFP process to support visioning by the computing research community
  - Quarterly deadlines, but a rolling process
  - Five efforts launched thus far:
    - "Big Data Computing Study Group"
    - "Cyber-Physical Systems"
    - "Visions for Theoretical Computer Science"
    - "From Internet to Robotics: The Next Transformative Technology"
    - "Network Science and Engineering"

- *Big Data Computing Study Group*
  - Topic:
    - "The Big Data Computing Study Group will undertake efforts to explore and enable opportunities on the research and application of high-performance computing over very large data sets."
  - Leadership:
    - Randy Bryant, CMU
    - Thomas Kwan, Yahoo! Research
  - Initial activities:
    - Hadoop Summit, March 25, Sunnyvale CA
    - Data-Intensive Scalable Computing Symposium, March 26, Sunnyvale CA

Cyber-Physical Systems

- Topic:
  - "The integration of physical systems and processes with networked computing has led to the emergence of a new generation of engineered systems: Cyber-Physical Systems (CPS). Such systems use computations and communication deeply embedded in and interacting with physical processes to add new capabilities to physical systems. CPS range from miniscule (pace makers) to large-scale (the national power-grid). This effort will identify the science and technology challenges facing CPS."
- Leadership:
  - Bruce Krogh, CMU
  - Jack Stankovic, University of Virginia
  - 12 others
- Initial activities:
  - Multiple preliminary workshops
  - Cyber-Physical Systems Summit, April 24-25, St. Louis MO

- *Visions for Theoretical Computer Science*
  - Topic:
    - "The purpose of the visioning workshop will be to identify and distill broad research themes within TCS that have potential for major impact in the future … The workshop will aim to produce compelling "nuggets" that can quickly convey the importance of a research direction to a layperson [and] could be used by the CCC or anyone else making the case for a sustained investment in long-term, foundational computing research."
  - Leadership:
    - Richard Ladner, Washington
    - Bernard Chazelle, Anna Karlin, Dick Lipton, Salil Vadhan
  - Initial activities:
    - Workshop prior to STOC, May 17, Seattle WA

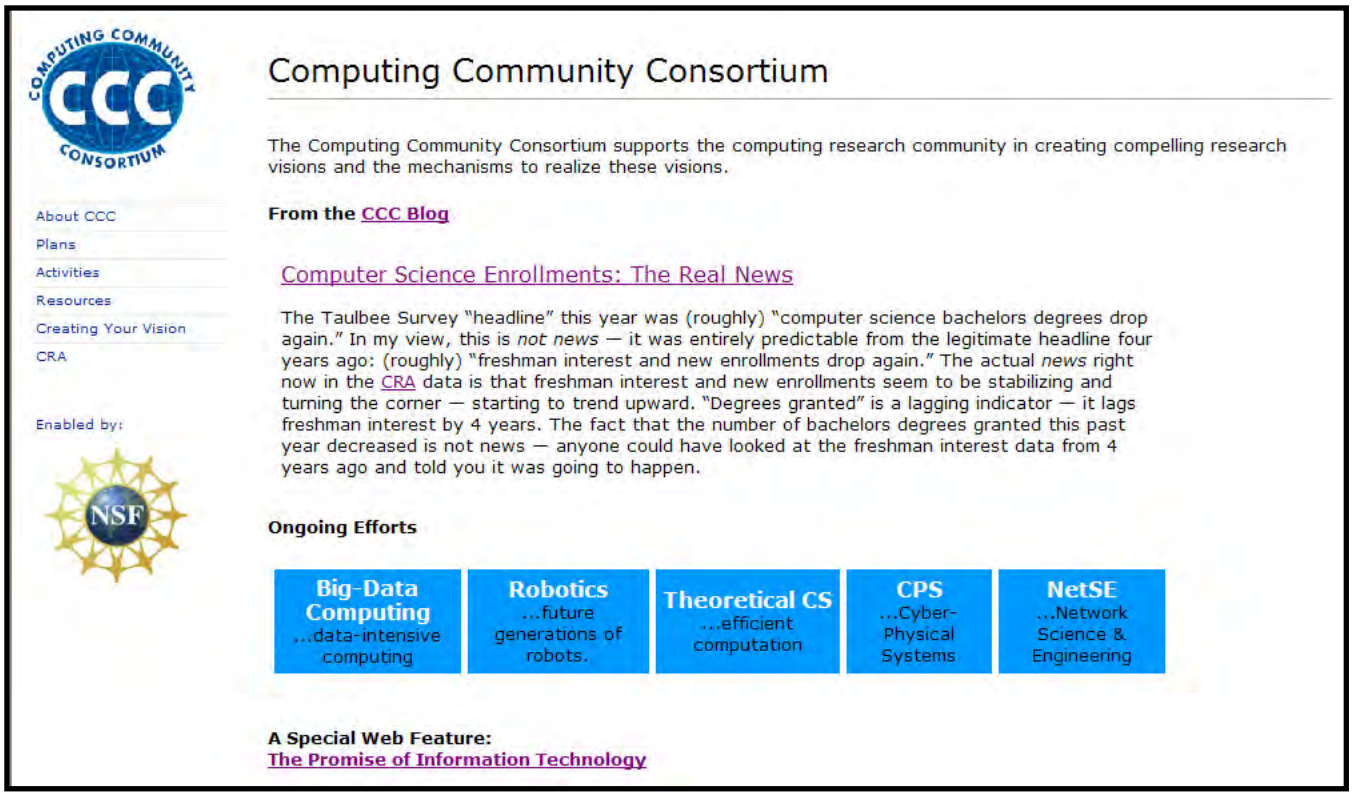
- *From Internet to Robotics: The Next Transformative Technology*
  - Topic:
    - "This study will generate a roadmap of applications for robotics across users, producers and researchers. The objective is to provide a comprehensive view of use of robotics, the main obstacles to deployment, and the key competencies required to facilitate the transformation."
  - Leadership:
    - Henrik Christensen, Georgia Tech, and 10 others
  - Initial activities:
    - Workshop on manufacturing robotics, June 17, Arlington
    - Workshop on medical/healthcare robotics, June 18-19, Arlington
    - Workshop on emerging technologies and trends in robotics, August 14-15, Snowbird
    - Workshop on domestic and professional service robotics, August 7-8, San Francisco

- *Network Science and Engineering (NetSE)*
  - Topic:
    - Our evolving networks are extraordinarily complex. Is there a science for understanding the complexity of our networks such that we can engineer them to have predictable behavior? We must develop a compelling and broad-based research agenda for the science and engineering of our evolving, complex networks.
  - Leadership:
    - Ellen Zegura, Georgia Tech, chair of NetSE Council
      - 19 members
    - Chip Elliott, BBN, director of GENI Project Office
  - Initial activities:
    - Workshops going back several years, and continuing
    - GENI Engineering Conferences, ongoing
    - Research workshops and meetings, Summer/Fall 2008
    - Delivery of V1.0 NetSE research plan, December 2008

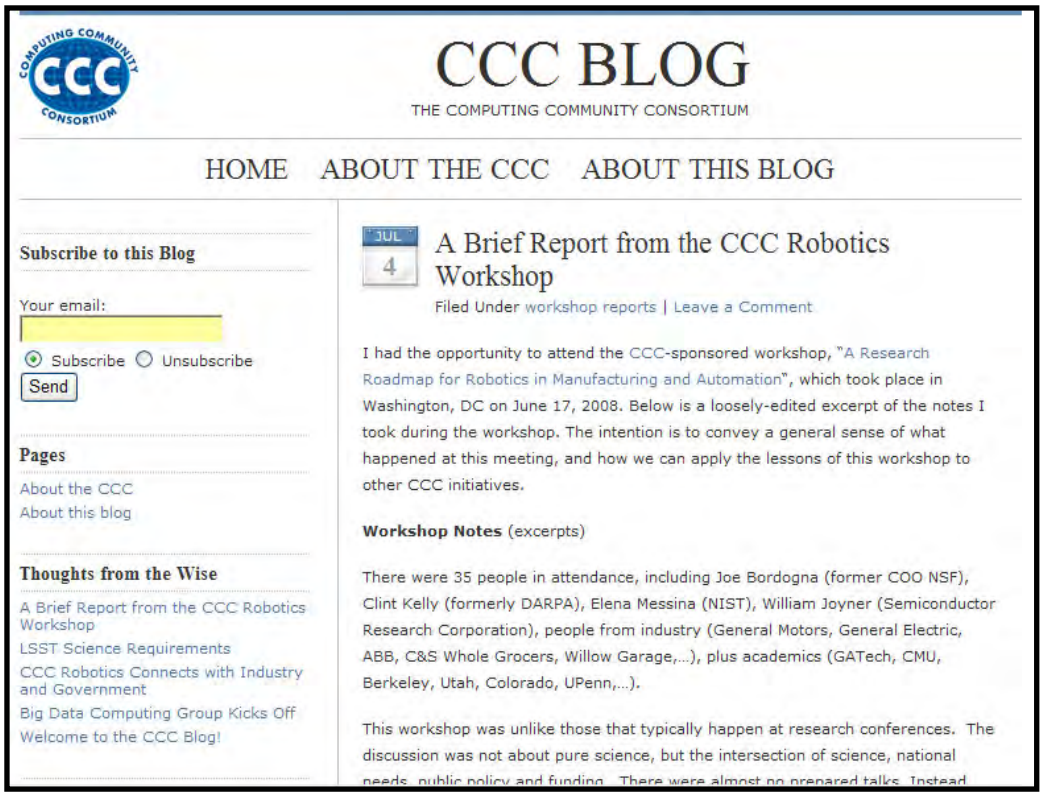
- In the pipeline:
  - Approved after review and resubmission:
    - One Teacher per Student: Global Resources for Online Education (GROE)
      - Beverly Park Woolf, University of Massachusetts, and 14 others
  - Reviewed and recently resubmitted; awaiting re-review:
    - Envisioning National and International Research on the Multidisciplinary Empirical Science of Free/Open Source Software (FOSS)
      - Walt Scacchi, UC Irvine, and others
    - Cyber Security with Apotropaic Language Technology: The marriage of Internet security and human language technology (CSALT)
      - Jordan Cohen and 5 others from SRI and ICSI

- Recently submitted and awaiting review:
  - Predictable Systems from Unpredictable Components
    - Nicholas P. Carter, Intel; Andre DeHon, Penn; Heather M. Quinn, LANL
  - Information and Communication Technologies for Development (ICTD): A New Grand Challenge for Computer Science Research
    - Tapan S. Parikh, UC Berkeley, and 9 others

- Creation of a website:
  http://www.cra.org/ccc/



- Creation of a research visions blog: http://www.cccblog.org/



CCC BLOG

THE COMPUTING COMMUNITY CONSORTIUM

HOME ABOUT THE CCC ABOUT THIS BLOG

Subscribe to this Blog

Your email:

Subscribe Unsubscribe

Send

Pages

About the CCC

About this blog

Thoughts from the Wise

A Brief Report from the CCC Robotics Workshop

LSST Science Requirements

CCC Robotics Connects with Industry and Government

Big Data Computing Group Kicks Off

Welcome to the CCC Blog!

JUL 4

A Brief Report from the CCC Robotics Workshop

Filed Under workshop reports | Leave a Comment

I had the opportunity to attend the CCC-sponsored workshop, "A Research Roadmap for Robotics in Manufacturing and Automation", which took place in Washington, DC on June 17, 2008. Below is a loosely-edited excerpt of the notes I took during the workshop. The intention is to convey a general sense of what happened at this meeting, and how we can apply the lessons of this workshop to other CCC initiatives.

Workshop Notes (excerpts)

There were 35 people in attendance, including Joe Bordogna (former COO NSF), Clint Kelly (formerly DARPA), Elena Messina (NIST), William Joyner (Semiconductor Research Corporation), people from industry (General Motors, General Electric, ABB, C&S Whole Grocers, Willow Garage,...), plus academics (GATech, CMU, Berkeley, Utah, Colorado, UPenn,...).

This workshop was unlike those that typically happen at research conferences. The discussion was not about pure science, but the intersection of science, national needs, public policy and funding. There were almost no prepared talks. Instead

- Other activities
  - Web repository for research press releases
    - One-stop shopping for descriptions of exciting research
      highlights@cra.org
  - CISE celebratory symposium
    - Planning is actively ongoing
  - CISE nuggets
    - A mining exercise
  - Prior Grand Challenge Efforts
    - Another mining exercise
  - Undergraduate institutions
    - Karen Sutherland is driving

- Enhanced communications
  - CRA has selected Xenophon Strategies to work on communicating the research message and Gimga Group for design issues
- CRA can help you work with your institutional legislative affairs people and with your federal delegation
  - http://www.cra.org/govaffairs/advocacy/
  - Join the Computing Research Advocacy Network!

The desired outcomes

- Broad community engagement in establishing more audacious and inspiring research visions for our field
  - Some may require significant research infrastructure (e.g., NetSE); some will be new programs (e.g., CDI)
- Increased support for computing research
- Broader appreciation of the contributions and potential of the field
- Attraction of a new generation of students
- Greater impact!