The Computing Community Consortium

Dr. Erwin Gianchandani
Director, Computing Community Consortium
Computing Research Association

NIH Biomedical Information Science & Technology Initiative (BISTI)
April 7, 2011
Overview

- The Computing Research Association
- What is the CCC?
- Possible synergistic directions?
The Computing Research Association
Over 220 department/lab members
Core activities

Policy

Information

Human resources

Community
Mission + activities

- Strengthen research and education in the computing fields
- Working to influence policy that impacts computing research
- Encouraging the development of human resources
- Contributing to the cohesiveness of the professional community
- Collect and disseminate information about the importance and state of computing research
Mission + activities

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The Computing Community Consortium
Concerns in the mid-2000s...

- NSF leaders and computing research leaders had similar deep concerns about computing:
  - Failure to articulate and coalesce around exciting research visions in computer science that could galvanize the public, policymakers, researchers, and students
  - Need to groom the future leadership of the field
  - Decrease in student interest
Increased focus by NSF leaders and computing research leaders in academia & industry

A Computing Community Consortium solicitation & proposal

“[NSF] will support the CCC as a community proxy responsible for facilitating the conceptualization and design of promising infrastructure-intensive projects...”

“The purpose of the CCC is to provide a voice for the national computing research community. The CCC will facilitate the development of a bold, multi-themed vision for computing research and education... [communicating] that vision to ... major stakeholders.”
And NSF asked CRA to create it

- 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 CCC -- a broad-based Council

Leadership:
- Ed Lazowska, Chair
- Susan Graham, Vice-Chair
- Erwin Gianchandani, Director
- Andrew Bernat, CRA Executive Director

Terms ending 2014
- Deborah Crawford
- Gregory Hager
- John Mitchell
- Bob Sproull
- Josep Torrellas

Terms ending 2013
- Randy Bryant
- Lance Fortnow
- Hank Korth
- Eric Horvitz
- Beth Mynatt
- Fred Schneider
- Margo Seltzer

Terms ending 2012
- Stephanie Forrest
- Chris Johnson
- Anita Jones
- Frans Kaashoek
- Ran Libeskind-Hadas
- Robin Murphy

Rotated off
- Greg Andrews, 2009
- Bill Feiereisen, 2011
- Dave Kaeli, 2011
- Dick Karp, 2010
- John King, 2011
- Peter Lee, 2009
- Andrew McCallum, 2010
- Karen Sutherland, 2009
- Dave Waltz, 2010

Meets three times a year, including once in DC
Funded at $2M/year for three years

Thursday, April 7, 2011
Communicating about computing...

...to the community, to the public, etc.
Communicating about computing...

Presentations

...to the community, to the public, etc.

The Computing Community Consortium: Stimulating Bigger Thinking

Ed Lazowska
Bill & Melinda Gates Chair in Computer Science & Engineering
University of Washington
Chair, Computing Community Consortium
Tapia Conference Career Workshop
April 2009
http://www.cra.org/ccc/
Communicating about computing...

Presentations

Articles

...to the community, to the public, etc.
Communicating about computing...

- Presentations
- Articles
- CCC Blog

...to the community, to the public, etc.
Communicating about computing...

- Presentations
- Articles
- CCC Blog
- Computing Research “Highlight of the Week”

...to the community, to the public, etc.
### Outreach to Federal agencies

#### “Transition Team” white papers

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<th>Computing Research Initiatives for the 21st Century</th>
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<td>(Oren Eady, Stanford, and Ed Lazowska, University of Washington)</td>
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Sensed and seized an opportunity to influence Federal science policy through the Presidential Transition Team

19 papers produced in late 2008 & early 2009
30 separate authors

Many highly influential:

- **Re-envisioning DARPA** -- Peter Lee, Randy Katz
- **Infrastructure for eScience & eLearning/Unleashing waves of innovation** -- Ed Lazowska, Peter Lee, Chip Elliott, Larry Smarr
- **Security is not a commodity** -- Stefan Savage, Fred Schneider
- **Synthetic biology** -- Drew Endy, Ed Lazowska
- **Big-data computing** -- Randy Bryant, Randy Katz, Ed Lazowska
- **The ocean observatories initiative** -- John Delaney, John Orcutt, Robert Weller
- **Cyber-Physical Systems** -- Janos Sztipanovits, Jack Stankovic
Outreach to Federal agencies

“Transition Team” white papers

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Outreach to Federal agencies

- “Transition Team” white papers
- Library of Congress Symposium
Outreach to Federal agencies

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- "Landmark Contributions by Students in Computer Science"

Landmark Contributions by Students in Computer Science
Version 11: September 15, 2009

There are many reasons for research funding agencies (DARPA, NSF, etc.) to invest in the education of students. Producing the next generation of innovators is the most obvious one. In addition, though, there are an impressive number of instances in our field in which undergraduate and graduate students have made truly game-changing contributions in the course of their studies.

The inspiring list below was compiled by the following individuals and their colleagues: Bill Bonvillain (MIT), Susan Graham (Berkeley), Anita Jones (University of Virginia), Ed Lazowska (University of Washington), Pat Lincoln (SRI), Fred Schneider (Cornell), and Victor Zue (MIT).

Leadership development
Leadership development

Computing Innovation Fellows (CIFellows)

Computing Innovation Fellows Project

The 2009 Computing Innovation Fellows have been selected!

View the press release with the names of the 2009 Fellows and their Mentors.

Congratulations to everyone who was selected for a CIFellow award!
Thank you for your interest in CIFellows. The response has been tremendous!
For up-to-the-minute news on the progress of the selection process, check out the forum.

In the light of the response that the CIFellows has received, we have set up a courtesy website where employers can post available positions suitable for new computing PhD's. This site is available at http://cifellows.org/opportunities.

An additional courtesy site has been set up for computing PhD's to post their profiles and availability. This website is available at http://cifellows.org/profiles. We encourage employers and candidates to make use of these complimentary services.

The Computing Community Consortium (CCC) and the Computing Research Association (CRA), with funding from the National Science Foundation, announce a program for new PhD graduates to obtain one-to-two year postdoctoral positions.
CIFellows Project overview

- Established in 2009 with NSF/CISE funding
- Provides recent Ph.D.s in computer science (and allied fields) post-doctoral positions
- Positions span one to two years
- Goal is to retain new Ph.D.s in research & teaching during difficult economic times
- 60 CIFellows funded in 2009
  - 19 are leaving by the end of year I, most with permanent positions, many with tenure-track faculty appointments
  - 41 are continuing for a second year
- Additional 47 CIFellows funded in 2010

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Leadership development

- Computing Innovation Fellows (CIFellows)
- Leadership in Science Policy Institute
Visioning for the future
Visioning for the future

Research visions sessions at conferences...

Call for Visionary Conference Tracks

The Computing Community Consortium (CCC) is sponsoring an initiative to bring special "Challenges and Visions" tracks to leading computer science research conferences. The goal of this initiative is to help conferences reach out beyond the usual research papers that present completed work and to seek out papers that present ideas and visions that can stimulate the research community to pursue new directions.

Conferences may request CCC sponsorship of such tracks along with a CCC grant that provides a prize money for the top 3 papers (first prize $1,000, second prize $750, and third prize $500, to be awarded as travel grants). (See below for details about selecting and awarding these prizes.)

Papers in a "Challenges and Visions" track should be open-minded, possibly "outrageous" or "weird" and present new problems, new application domains, or new methodologies that are likely to stimulate significant new research. The CCC is seeking papers (roughly 4 pages in length) so that the ideas can be referenced after the conference is over.

After the conference, the CCC will post links to the track papers on its Challenges and Visions web page and help disseminate these ideas broadly in the computer science research community.

Requests for CCC sponsorship should include information on the conference and a proposed list of program committee members for the track. We provide below a prototype call for papers and suggestions regarding the review process. Proposals should be sent to Evren Cianchados, the CCC Director, at evren@eecs.org.
...And lots of “visioning activities”

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Open RFP for community-driven visioning
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Open RFP for community-driven visioning

Yahoo!
NSF, ONC, NLM, NIST, AHRQ
Canada GRAND, ACM CHI
Robotics as an example

4 meetings during summer 2008

Roadmap published May 2009

Extensive discussions between visioning activity leaders & agencies

Henrik Christensen
Georgia Tech
Robotics as an example

A Roadmap for US Robotics
From Internet to Robotics
Organized by:
Georgia Institute of Technology
University of Southern California
Johns Hopkins University
University of Pennsylvania
University of California, Berkeley
Rensselaer Polytechnic Institute
University of Massachusetts, Amherst
University of Utah
Carnegie Mellon University
Tech Collaborative
Sponsors:

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503
July 21, 2010

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Peter R. Orszag
Director, Office of Management and Budget
John P. Holdren
Director, Office of Science and Technology Policy

SUBJECT: Science and Technology Priorities for the FY 2012 Budget

Scientific discovery, technological breakthroughs, and innovation are major engines for expanding the frontiers of human knowledge and are indispensable for promoting sustainable economic growth, improving the health of the population, moving toward a clean energy future, addressing global climate change challenges, managing competing demands on the environment, and safeguarding our national security.

This memorandum follows up on OMB Memorandum M-10-19 by outlining the Administration’s science and technology (S&T) priorities for formulating FY 2012 Budget submissions to the Office of Management and Budget (OMB). These priorities for research and development (R&D) investments and other S&T investments build on priorities already reflected in the American Recovery and Reinvestment Act, the FY 2010 and 2011 Budgets, and key Administration policy guidance such as the President’s Strategy for American Innovation. This memorandum also provides program guidance for S&T activities in Executive Departments and Agencies.

Prioritizing key S&T activities

4 meetings during summer 2008
Roadmap published May 2009
Extensive discussions between visioning activity leaders & agencies

OSTP issues directive to all agencies to include robotics in FY 12 budgets

Henrik Christensen
Georgia Tech
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OSTP issues directive to all agencies to include robotics in FY 12 budgets

Agencies begin rolling out robotics initiatives, beginning with RTD2

Henrik Christensen
Georgia Tech

A Roadmap for US Robotics
From Internet to Robotics

May 21, 2009

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Prioritizing key S&T activities

OSTP issues directive to all agencies to include robotics in FY 12 budgets

Roadmap published May 2009

4 meetings during summer 2008

Extensive discussions between visioning activity leaders & agencies

RTD2: Research for Robotics

Posted by Tom Kelli and Sridhar Kota on September 15, 2010 at 09:00 PM EDT

In July, the heads of the Office of Management and Budget and OSTP identified robotics as one of the Administration’s S&T priorities for the President’s FY 2012 budget.

Robotics is an important technology because of its potential to advance national needs such as homeland security, defense, medicine, healthcare, space exploration, environment monitoring and remediation, automation, advanced manufacturing, logistics, warehousing, and agriculture. Robotics is also nearing a tipping point in terms of its usefulness and versatility as technologies such as software, chips, and computer vision drive to improve.

OSTP has been working with Federal agencies and the research community to identify concrete steps that the Administration can take to promote U.S. leadership in robotics.

As part of this effort, five agencies teamed up to issue a joint solicitation for small business research for Robotics Technology Development and Deployment (RTD2). Small businesses can apply for research funding for a wide range of topics, including robot-assisted remanufacturing, robotics for drug discovery, and robots that can disarm explosive devices.

Expect to see more to come in the months ahead from a newly energized and collaborative Federal robotics community!

Tom Kelli is Deputy Director for Policy in the White House Office of Science and Technology Policy
Sridhar Kota is Assistant Director for Advanced Manufacturing in the White House Office of Science and Technology Policy
Robotics as an example

4 meetings during summer 2008
Roadmap published May 2009
Extensive discussions between visioning activity leaders & agencies

Trying to replicate success with learning technologies, through discussions with ED and NSF leaders
Following ARRA, NSF asked CCC to organize workshop

Computer scientists, systems engineers, social scientists, care practitioners

Produced a report summarizing key research questions and directions

From data to knowledge to action -- enabling evidence-based healthcare

Empowering people -- providers and consumers -- improves healthcare quality

Computer-based augmentation of human learning, reasoning, decision-making, and physical motion significantly enhances human capabilities

Healthcare is a complex, large-scale, adaptive distributed evolving system

The Importance of Collaborative Government Investment
NSF/CISE recently asked CCC to run a workshop on sustainability

Computer scientists, systems engineers, social scientists, sustainability scientists

Produced a report summarizing key research questions and directions

Defining sustainability
Routine uses of CISE for sustainability
CISE research to further sustainability
  “Big data”
Modeling & simulation
Optimization
Intelligent systems
Cyber-physical systems
Human-centered & social computing
Privacy & security
Systems engineering & systems integration
Green IT
The power of applied problems
Collaboration & interdisciplinary research
Education & workforce development
The importance of collaborative Federal investment
Data analytics

Overview
eScience
Healthcare
Energy
Education technology
New Transportation
Intelligence
New Biology
Robotics & emergency response
Systems biology: As the NAS report stated, “improved measurement technologies and mathematical and computational tools have led to the emergence of a new approach to [address] biological questions termed ‘systems biology’ [that] strives to [integrate heterogeneous experimental data sets] and achieve predictive modeling [of biological systems].” Rather than pursuing the decades-old reductionist approach, interrogating individual components and reactions underlying a given system, systems biology attempts to integrate various biological structures and create predictive models representing systems-level functions and behaviors.

For example, in 2007, systems biologists published a genome-scale reconstruction of the human metabolic network. This reconstruction catalogs all known gene, protein, and reaction relationships underlying human metabolism—the vital cellular process that is attributed to many human diseases—in a highly quantitative, structured, and chemically consistent manner. In other words, the reconstruction assimilates all existing experimental knowledge about the system, and enables a quantitative analysis of the “flows” through the network—much like a map of a highway system overlaid with quantitative data about traffic volumes. Nearly 1,500 genes spanning 2,000 proteins and 3,300 reactions were incorporated from nearly 1,600 different papers. The resultant model represents the set of all hypotheses about the network that have been reported in the literature to date and, in turn, can be used to predict which genes are essential or inessential, and which ones are involved in mechanisms of chronic diseases like cancer and arthritis. Ultimately, such a model enables us to better understand the manifestation of human diseases and identify ideal drug targets to combat these illnesses.

Computational biology: Whereas systems biology takes an integrative, systems-based approach, computational biology applies data mining, machine learning, graphics/visualization, and related computational techniques to specific biological questions. For instance, clustering algorithms have been applied to gene expression data to associate genes with similar functions. High-throughput gene expression assays are enabling us to measure the expression levels of thousands of genes simultaneously, across different conditions and over time. These assays result in incredibly large data sets: the expression of each gene requires multiple “probes,” meaning that there are often 20 or more data elements per gene, and a routine experiment involving human cells measures 54,000 human gene transcripts concurrently. By clustering these data, we are able to make sense of the data and gain insight into gene function; genes that respond similarly to different stimuli are more likely to have related functions. Likewise, “compendium analyses” are used to study the mechanisms underlying drug function, by comparing the gene expression profiles of unknown drugs with databases of profiles of known drugs. Drugs with similar mechanisms are likely to have correlative gene expression footprints.
Nearly 2500 years ago, Hippocrates kicked off a revolution in healthcare by calling for the careful collection and recording of evidence about patients and their illnesses. This call—which first introduced the goal of sharing data among physicians to provide the best care possible for patients—established a foundation for the evolution of modern healthcare. Although 25 centuries have passed since Hippocrates’ call, we have not yet attained the dream of true evidence-based healthcare. Large quantities of data about wellness and illness continue to be dropped on the floor, rather than collected and harnessed to optimize the provision of care. We are simply not yet doing the best that we can.

We now stand at the brink of a potential revolution in data-centric healthcare, enabled by advances in computer science. Such a revolution promises to enhance the quality of healthcare while cutting costs, and, more generally, enabling physicians to do the very best that is possible with realistically bounded healthcare resources. Doing the best that can be done with available resources aligns with the core promise that all physicians make when they solemnly raise their hand and recite the Hippocratic Oath upon receipt of their medical degree.

Enabling this vision of true evidence-based healthcare will require critical investments for translating key methods and insights into working systems, as well as for advances in core computer science research and engineering to address key conceptual bottlenecks and opportunities.

Collecting and analyzing data collected on health and illness promises to enhance the quality and efficacy of healthcare, and to enhance the quality and longevity of life. The collection and analysis of data can provide new insights about wellness and illness that can be operationalized. Data-centric methods allow us to transform data into predictive models. Predictive models can be used to generate forecasts with well-characterized accuracies about the future—or diagnoses about states of a patient that we cannot inspect directly. Such forecasts or diagnoses can be harnessed within procedures that generate recommendations for actions in the world, and decisions about when it is best to collect more information about a situation before acting, considering the costs and time delays associated with collecting more information to enhance a decision.

The pipeline of data to prediction to action can be used to automate or provide decision support for accurate triage and diagnosis, to generate well-calibrated predictions about health outcomes,
**The value of the CCC**

How necessary is it to have within the U.S. computing research community an organization designated to perform one or more of the following activities?

- Small, nimble organization
- Unique components to the mission
- Provides a “leadership voice” for the community

<table>
<thead>
<tr>
<th>Activity</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
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<tbody>
<tr>
<td>Bring the community together to discuss, prioritize, and envision future research needs</td>
<td>238</td>
<td>261</td>
<td>145</td>
<td>31</td>
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<td>Communicate these priorities and needs to the broader national community</td>
<td>353</td>
<td>217</td>
<td>91</td>
<td>13</td>
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<td>Develop visions and thinking for computing research that will galvanize the public, policymakers, researchers, and/or students</td>
<td>353</td>
<td>209</td>
<td>96</td>
<td>17</td>
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<tr>
<td>Turn the priorities and visions developed within the community into funded research programs and/or instruments</td>
<td>325</td>
<td>234</td>
<td>97</td>
<td>18</td>
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<tr>
<td>Generate excitement within and about computing research that attracts students of both genders and all ethnic groups into computing research careers</td>
<td>387</td>
<td>192</td>
<td>81</td>
<td>15</td>
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<tr>
<td>Serve as a widely accepted catalyst and voice for the computing research community</td>
<td>201</td>
<td>271</td>
<td>166</td>
<td>36</td>
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<tr>
<td>Inculcate values of leadership and service in the computing research community by example, induction, and mentoring</td>
<td>182</td>
<td>263</td>
<td>201</td>
<td>26</td>
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--SRI International

Thursday, April 7, 2011
Synergistic steps forward?

Number of places where computing can help with NIH mission and activities
- Modeling & simulation
- Robotics and cyber-physical systems
- "Big data"/data analytics

Ways to get more computer scientists involved?
- Workshops that bring CS folks together with domain scientists?
- Getting the word out about NIH RFPs relevant for computer scientists?
Questions?

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