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

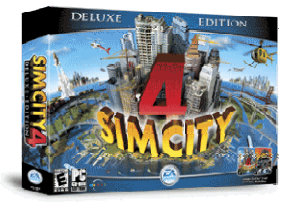
http://www.cra.org/ccc/

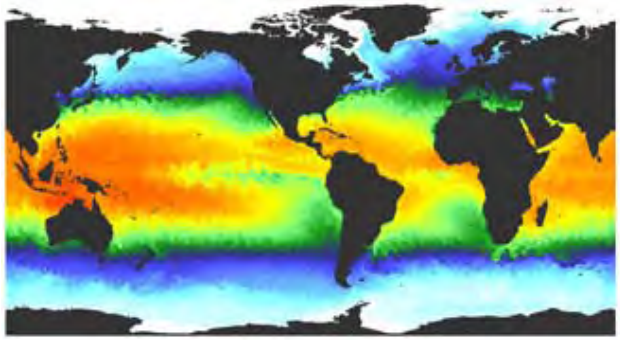
Today …

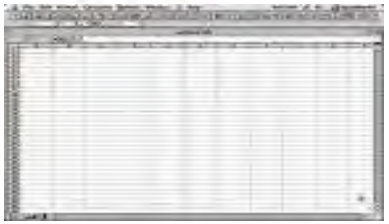
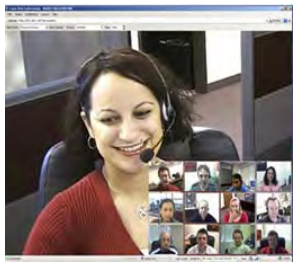
- Origins
- Structure
- Continuing activities
- Recent and current special initiatives
- Become a MythBuster!

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





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Internet, Mobile Phones Named Most Important Inventions

By PHYLLIS KORKKI
Published: March 7, 2009

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2. PC and laptop computers
3. Mobile phones
4. E-mail
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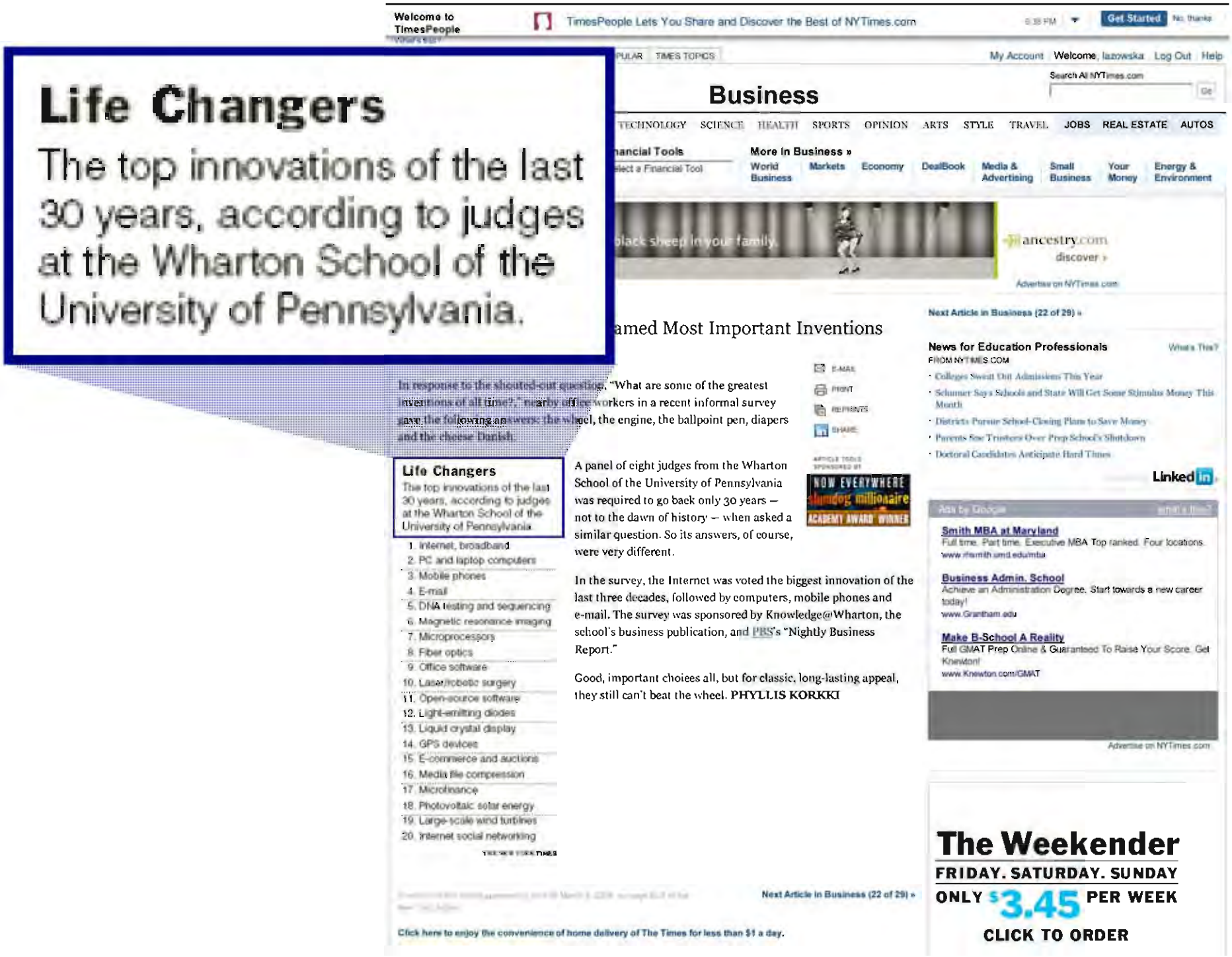
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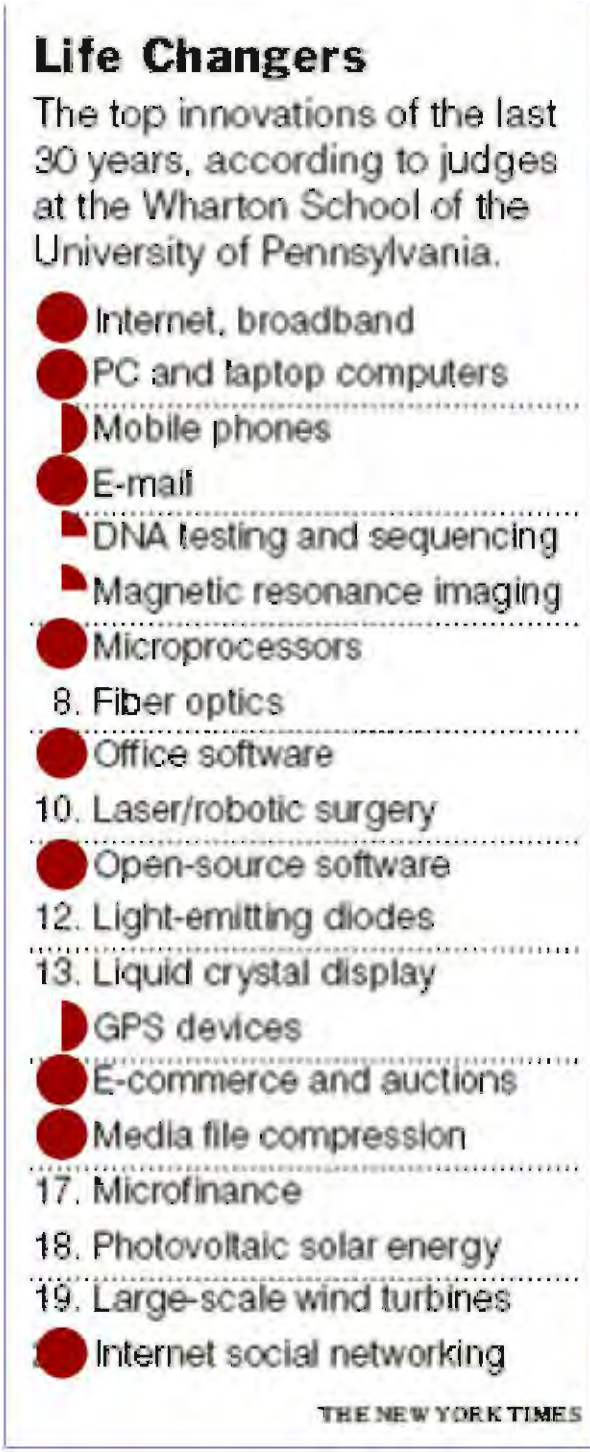

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Imagine spending a day without information technology

- A day without the Internet and all that it enables
- A day without diagnostic medical imaging
- A day during which automobiles lacked electronic ignition, antilock brakes, and electronic stability control
- A day without digital media – without wireless telephones, high-definition televisions, MP3 audio, DVD video, computer animation, and videogames
- A day during which aircraft could not fly, travelers had to navigate without benefit of GPS, weather forecasters had no models, banks and merchants could not transfer funds electronically, factory automation ceased to function, and the US military lacked technological supremacy

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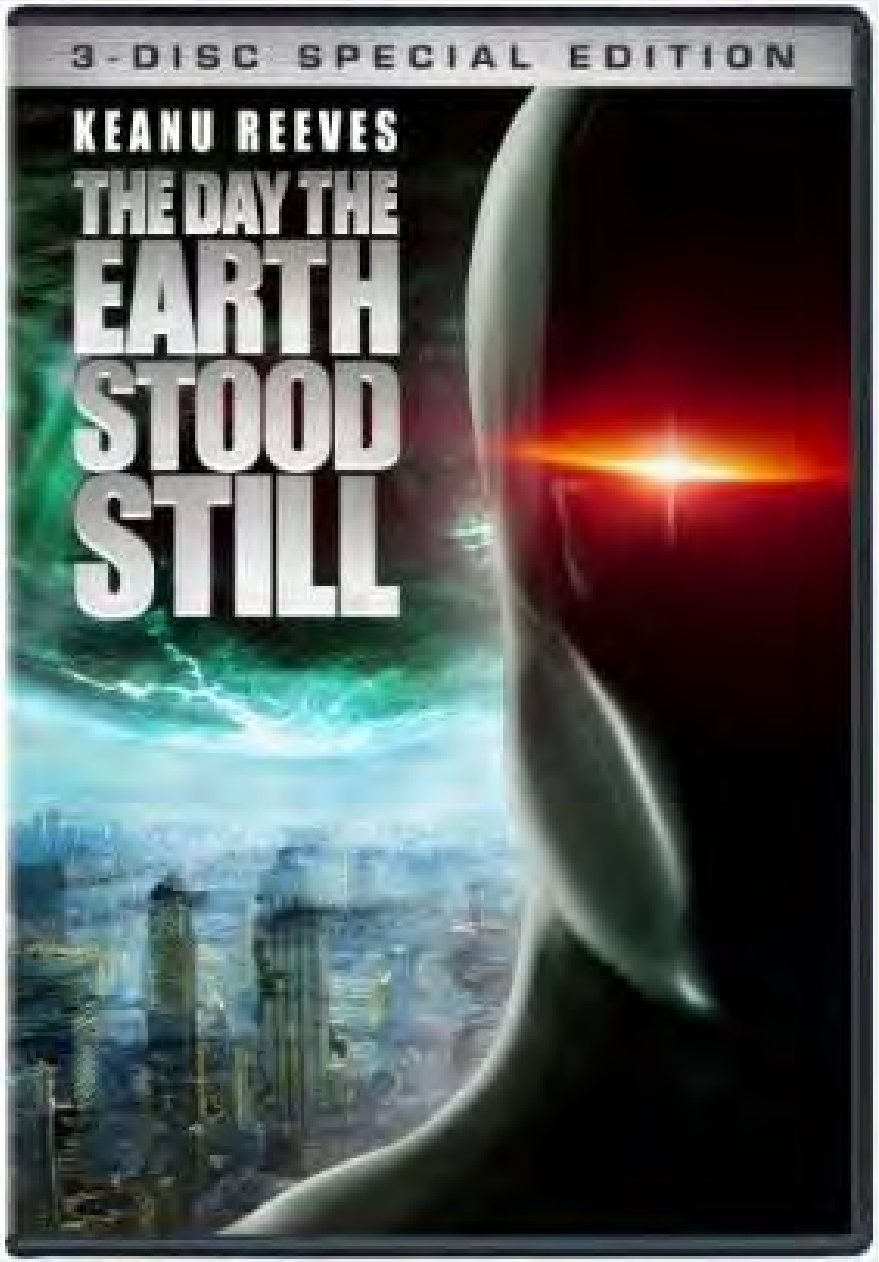
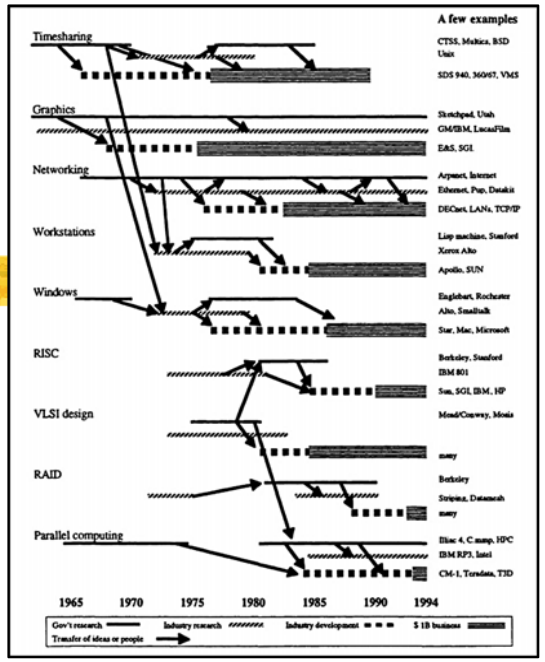
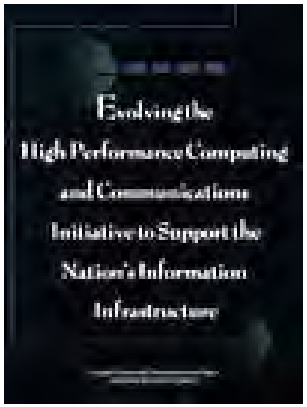


Research has built the foundation

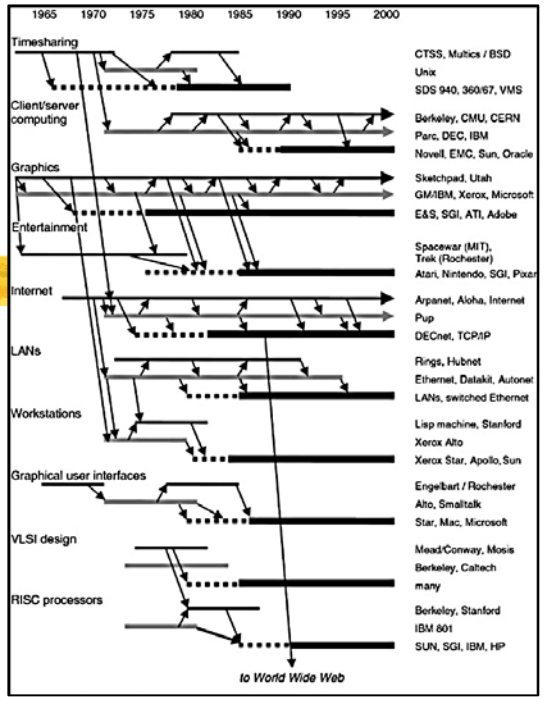


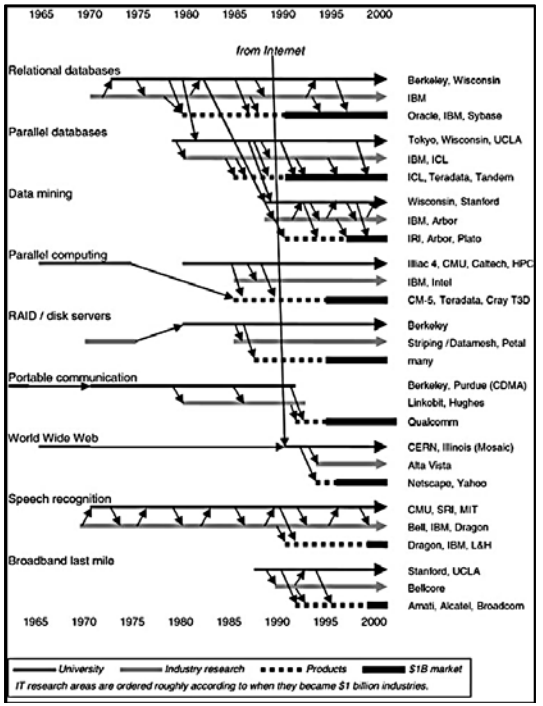
- Timesharing
- Computer graphics
- Networking (LANs and the Internet)
- Personal workstation computing
- Windows and the graphical user interface
- RISC architectures
- Modern integrated circuit design
- RAID storage
- Parallel computing



Much of the impact is recent

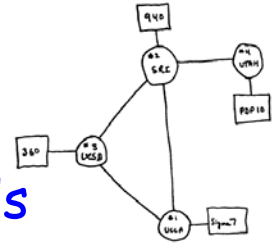
- Entertainment technology
- Data mining
- Portable communication
- The World Wide Web
- Speech recognition
- Broadband last mile

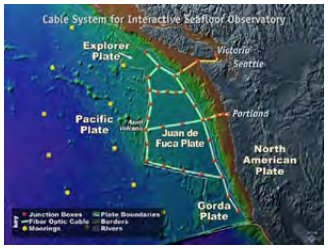


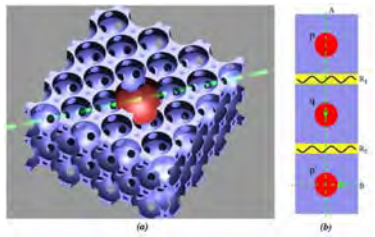


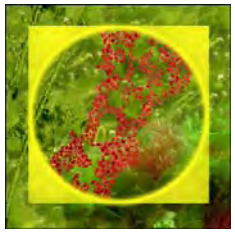
The future is full of opportunity

- Creating the future of networking
- Driving advances in all fields of science and engineering
- Revolutionizing transportation
- Personalized education
- The Smart Grid
- Predictive, preventive, personalized medicine
- Quantum computing
- Empowerment of the developing world
- Personalized health monitoring => quality of life
- Neurobotics
- Synthetic biology









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
- Launched in 2007
  - Chair appointed in March
  - Inaugural Council appointed in June

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"
  - Chosen through an open process under CRA auspices (Randy Bryant chaired first search, Eric Grimson chaired second)
- 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

The CCC Council

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  - Ed Lazowska
- Terms expire 2012
  - Stephanie Forrest
  - Chris Johnson
  - Anita Jones
  - M. Frans Kaashoek
  - Ran Lebeskind-Hadas
  - Robin Murphy

- Rotated off
  - Greg Andrews
  - Karen Sutherland
- Terms expire 2011
  - Bill Feiereisen
  - Susan Graham (v ch)
  - Dave Kaeli
  - John King
  - Peter Lee
  - Bob Sproull
- Terms expire 2010
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  - Andrew McCallum
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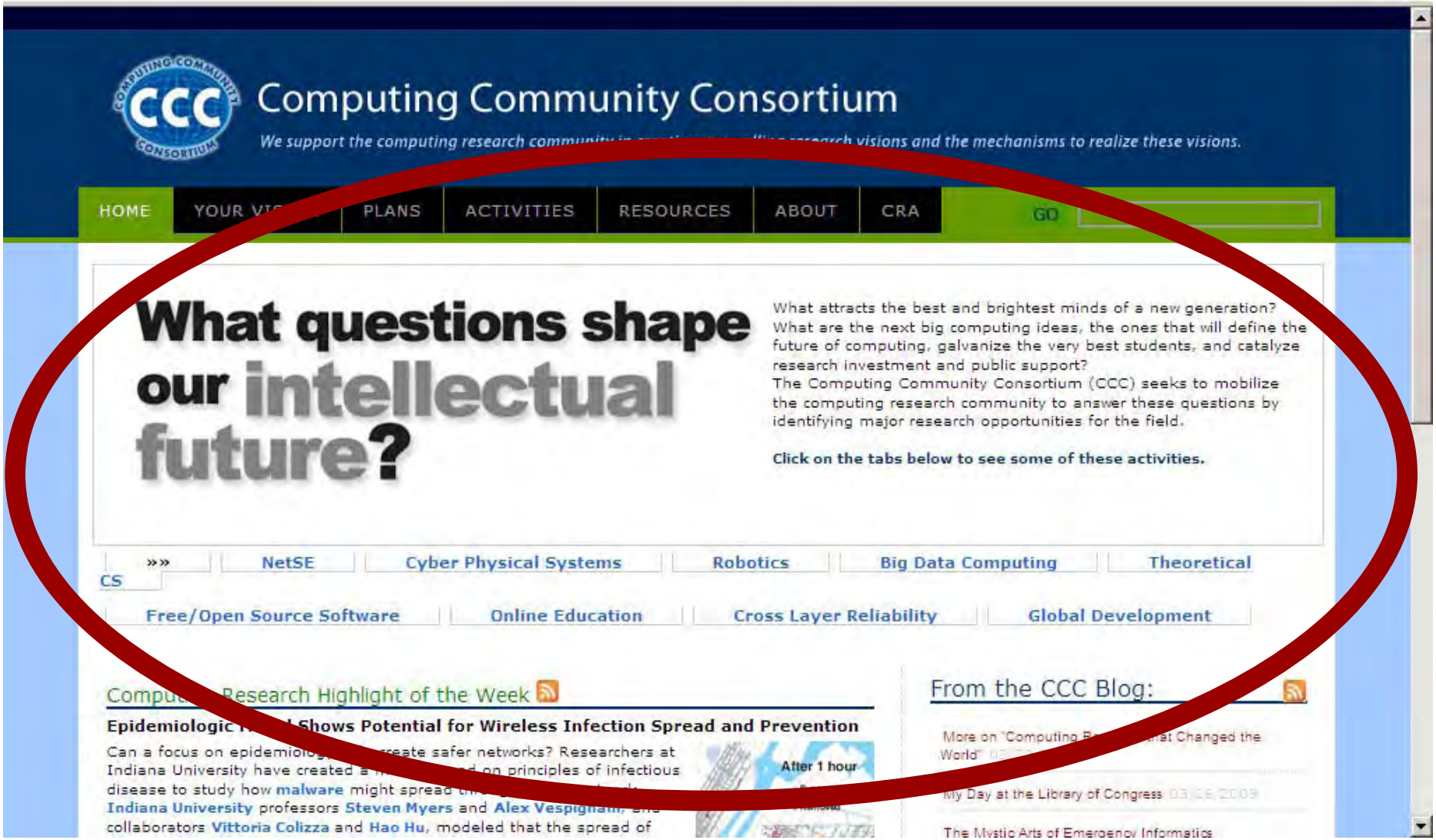

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More on "Computing Research that Changed the World"

Filed Under policy, resources, workshop reports (Edit Post)

Susan Graham provided a great overview in a post a few days ago of the Computing Community Consortium's March 25th day-long Library of Congress symposium, "Computing Research that Changed the World: Reflections and Perspectives." I thought I'd provide a few additional details — as well as a reminder that all materials (slides, videos, a summary booklet, etc.) will be available on the CCC website in the very near future.

Inspiration for the program came from a large number of responses from the computing research community to two November CCC blog posts — this was *your* symposium!

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We support the computing research community in creating compelling r… …and the mechanisms to realize these visions.

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COMPUTING RESEARCH HIGHLIGHT OF THE WEEK [Feb 26 - Mar 6, 2009]

Epidemiologic Model Shows Potential for Wireless Infection Spread and Prevention

Can a focus on epidemiology help create safer networks? Researchers at Indiana University have created a model based on principles of infectious disease to study how **malware** might spread through a WiFi network. **Indiana University** professors **Steven Myers** and **Alex Vespignani**, and collaborators **Vittoria Colizza** and **Hao Hu**, modeled that the spread of malware on common WiFi networks much as an epidemiologist would model the spread of disease in a population and determined that large "epidemics" of malware can be effectively halted by bringing encryption rates on networks to a given threshold value.

They accounted for different types of security commonly used in WiFi networks, such as encrypted and password-protected systems, and then divided the routers into three classes: susceptible (routers not infected with malware), infectious (routers transmitting the malware), and recovered (routers immune to the malware). They found that within two weeks, the malware had reached thousands of routers in the model. Finally they showed that, even densely populated areas, by bringing encryption rates to a given threshold value, large epidemics can be effectively halted, unlike in wired networks.

"This project is an excellent example of true interdisciplinary collaboration," said Professor Myers. "The interdisciplinary approach of the School of Informatics makes such projects plausible – researchers from the cyber security group working with researchers from the complex systems group on a project that has generated such significant findings. The School's interdisciplinary approach has really been beneficial."

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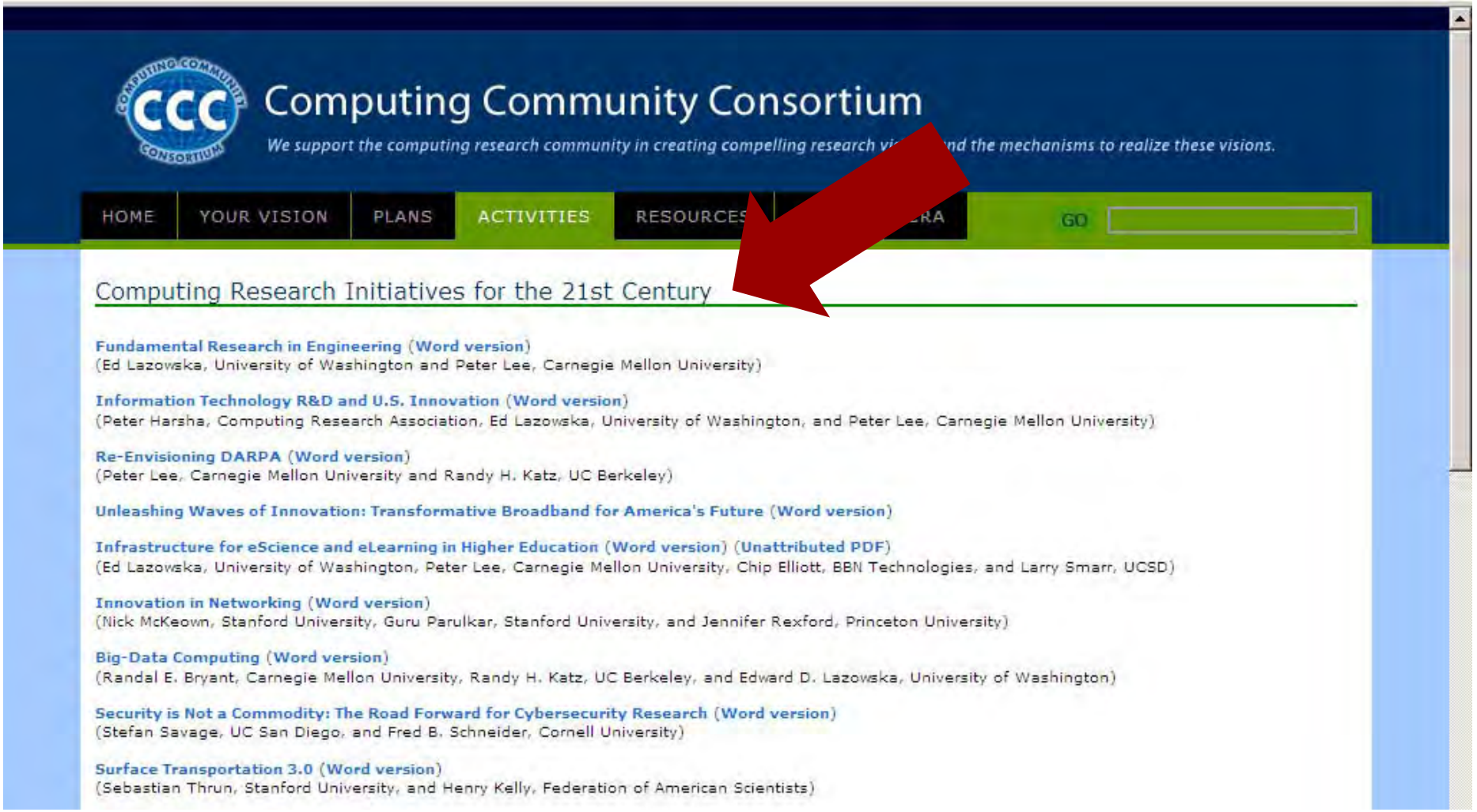
Recent and current special initiatives



Robotics (Word version)
(Rodney Brooks, MIT)

The Ocean Observatories Initiative (Word version)
(John Delaney, University of Washington, John Orcutt, Scripps Institute of Oceanography, and Robert Weller, Woods Hole Oceanographic Institution)

Quality of Life Technology (Word version)
(Howard Wactlar, Carnegie Mellon University, and Takeo Kanade, Carnegie Mellon University)

P4 Medicine (Word version)
(Leroy Hood, Institute for Systems Biology, and David Galas, Battelle Memorial Institute)

"Smart Grid": R&D for an Intelligent 21st Century Electrical Energy Distribution Infrastructure (Word version)
(Randy H. Katz, UC Berkeley)

Quantum Computing (Word version)
(Scott Aaronson, MIT, and Dave Bacon, University of Washington)

Synthetic Biology (Word version)
(Drew Endy, Stanford, and Ed Lazowska, University of Washington)

Computer Architecture (Word version)
(David Patterson, UC Berkeley)

Cyber-Physical Systems: A National Priority for Federal Investment in Infrastructure and Competitiveness (Word version)
(Janos Sztipanovits, Vanderbilt University, and John Stankovic, University of Virginia)

Post your comments on the **Computing Community Consortium blog**!

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Unleashing Waves of Innovation

Transformative Broadband for America's Future

Version 15: March 22, 2009[1]

Executive Summary

A forward-thinking National Broadband Strategy should focus on the transformative power of advanced networks to unleash new waves of innovation, jobs, economic growth, and national competitiveness – and to create new tools to deliver health care, education, and a low carbon economy. ARRA broadband decisions should target high-impact investments with those criteria in mind. They should seek to rebuild U.S. global leadership in networking – and the economic innovations that networking can create. Broadband investments should "pull from the future."

A proven track record of innovating in networking and its applications, of deploying and continually upgrading advanced networks, and of extending those networks to the unserved and underserved across our nation, lies not with telephone or cable companies, nor with most state governments, but with our nation's colleges and universities and the state, regional and national research and education networks that this community has built, in many instances forged through partnerships with telecommunications providers and state agencies to achieve these goals. A National Broadband Strategy should begin with America's colleges and universities and the state, regional and national research and education networks that connect them and extend to

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Congressman Rush Holt (D-NJ)
Senator Jay Rockefeller (D-WV)
March 25, 2009

Agenda

- Game-changing advances of the recent past
- Advances that are on the horizon, and what will be needed to achieve them
- Lessons that can further increase the already remarkable effectiveness of the IT R&D ecosystem
- Synthesis (and some demonstrations)

Session 1: The Internet and the World Wide Web 9:00 - 10:20

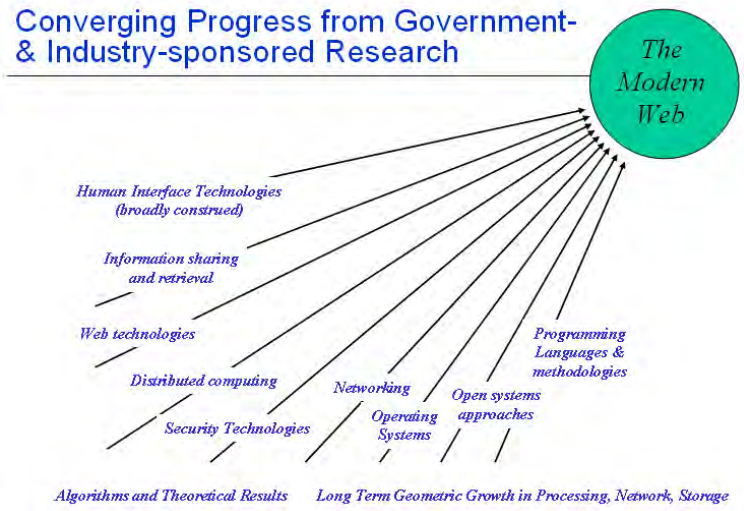
Why We're Able to Google
Alfred Spector (Google)

The Magic of the "Cloud": Supercomputers for Everybody, Everywhere
Eric Brewer (University of California, Berkeley)

Human Computation
Luis von Ahn (Carnegie Mellon University)

Discussion by the speakers of future challenges and synergies

Why We're Able to Google™



Dr. Alfred Z. Spector
VP, Research and Special Initiatives
Google, Inc.

Internet and the World Web Panel, March 25, 2009

Computing Research that Changed the World

The Magic of the Cloud:

Supercomputers for Everyone, Everywhere

Prof. Eric A. Brewer

UC Berkeley

Human Computation

Luis von Ahn

Carnegie Mellon University

Session 2: Evolving Foundations

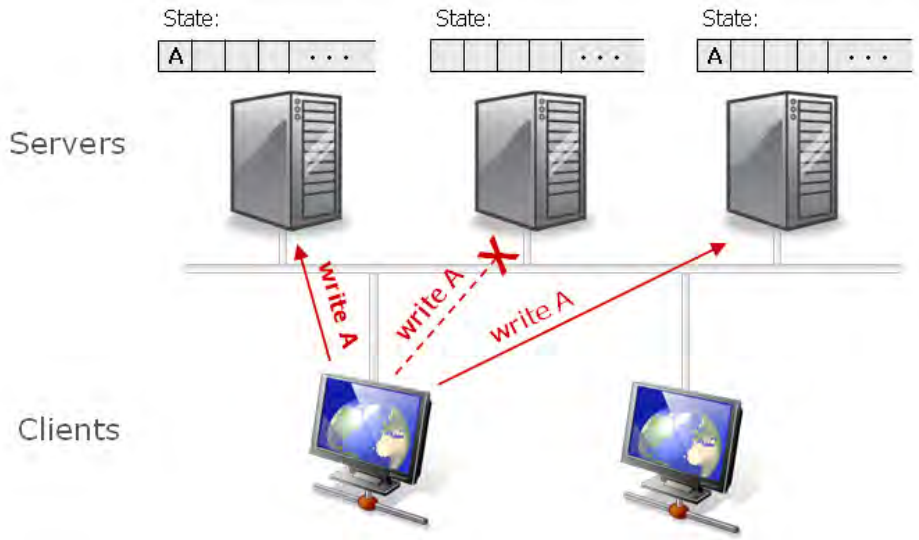
10:40 - 12:00

Security of Online Information
Barbara Liskov (Massachusetts Institute of Technology)

Learning to Improve Our Lives
Daphne Koller (Stanford University)

Global Information Networks
Jon Kleinberg (Cornell University)

Discussion by the speakers of future challenges and synergies

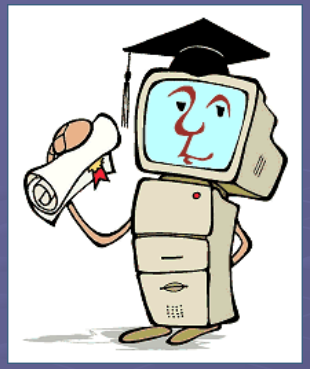


Security of Online Information

Barbara Liskov

MIT CSAIL

March 2009



Learning

to improve our lives

Daphne Koller
Stanford University

Global Information Networks

Jon Kleinberg

Cornell University

Crandall-Backstrom-Huttenlocher-Kleinberg (2009)

Session 3: The Transformation of the Sciences via Computation 1:00 - 2:20

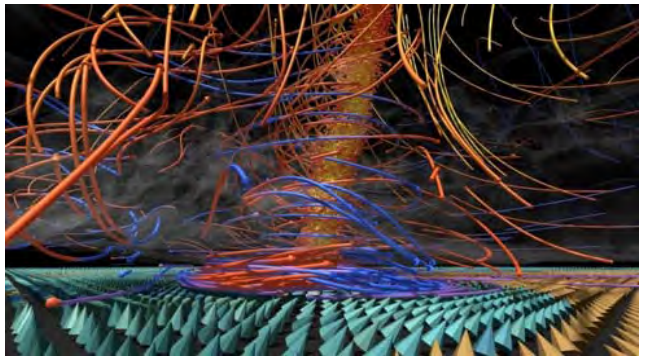
Supercomputers and Supernetworks are Transforming Research
Larry Smarr (University of California, San Diego)

Computing and Visualizing the Future of Medicine
Chris Johnson (University of Utah)

Zooming In On Life
Gene Myers (Howard Hughes Medical Institute)

Discussion by the speakers of future challenges and synergies

Supercomputers and Supernetworks are Transforming Research



Dr. Larry Smarr

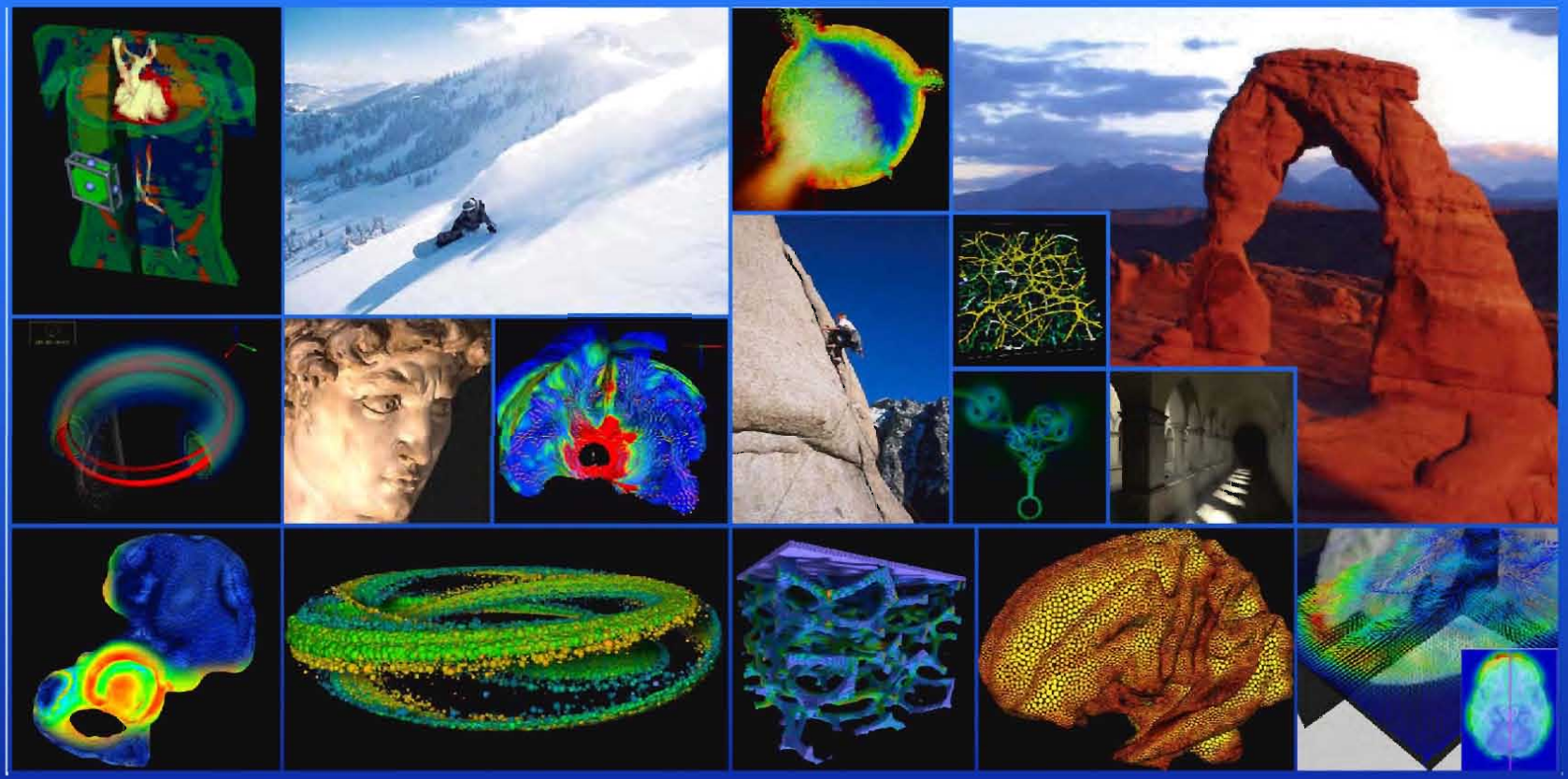
Director, California Institute for Telecommunications and Information Technology

Harry E. Gruber Professor,

Dept. of Computer Science and Engineering

Jacobs School of Engineering, UCSD

Computing and Visualizing the Future of Biomedicine



Chris Johnson

Scientific Computing and Imaging Institute

University of Utah

HHMI
janelia farm
research campus
Zooming in On Life
Gene Myers
Group Leader
HHMI Janelia Farm Research Campus

Session 4: Computing Everywhere! 2:30 - 3:50

Sensing Everywhere!
Deborah Estrin (University of California, Los Angeles)

Pixels Everywhere!
Pat Hanrahan (Stanford University)

Robotics Everywhere!
Rodney Brooks (Massachusetts Institute of Technology and Heartland Robotics)

Discussion by the speakers of future challenges and synergies

Sensing Everywhere!
from ecosystems to human systems

Professor Deborah Estrin

NSF Science and Technology Center for Embedded Networked Sensing (CENS)

UCLA Computer Science Department

destrin@cens.ucla.edu

… in collaboration with faculty, students and staff at CENS

We gratefully acknowledge the support of our sponsors, including the National Science Foundation, Nokia, Intel Corporation, Cisco Systems Inc., Sun Inc., Google, Microsoft Research, UC Micro, Crossbow Inc., T-mobile, Conservation International, and the participating campuses.

http://urban.cens.ucla.edu

Pixels Everywhere

Media Tech and How it Changed the World

Pat Hanrahan

Department of Computer Science

Stanford University

Robots Everywhere!

Rodney Brooks

Massachusetts Institute of Technology

iRobot Corporation

Heartland Robotics

Evaluation Session: Moving Forward 4:00 - 5:00

Discussion by the speakers and the audience of what factors made these achievements possible and what factors will accelerate future advances.

Moderators: Susan Graham (University of California, Berkeley) and Peter Lee (Carnegie Mellon University)

Walk to Madison Hall, James Madison Building, Library of Congress	5:00 - 5:30
Closing Session	5:30

The NSF Computing Innovation Scholars Program

By the Computing Community Consortium

Final Version of March 26, 2009

Executive Summary

We propose a program of *NSF Computing Innovation Scholars* to enable new computing PhDs to obtain one-to-two year positions at academic institutions and industrial research organizations. This program will forestall a permanent loss of research talent likely to occur if new PhDs are forced to seek employment outside of the field due to the sharp cuts brought about by the recent budget crisis. It will also allow new PhDs to develop experience to make them more effective researchers and/or teachers. In two years, increasing enrollments in both undergraduate and graduate computer science programs may create pent-up demand for hiring at university computer science and related departments. As the economy improves and budget adjustments are made, these departments will try to satisfy this demand for additional faculty. We can hope, and perhaps even expect, that this "bump" will match the "bulge" created by this program.

The Computing Research Association, through its Computing Community Consortium, will implement the program and oversee its management. Together CRA and CCC will track its broader impacts and disseminate its outcomes to the community.

CCC: 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)
- Better public appreciation of the potential of the field
- Attraction of a new generation of students
- More robust support for computing research
- Greater impact!

VIEWER Q&A >>

Get the truth on how the team really feels about the show.

MUSIC MYTHS >>

Can that high note really shatter glass? Bust it now.

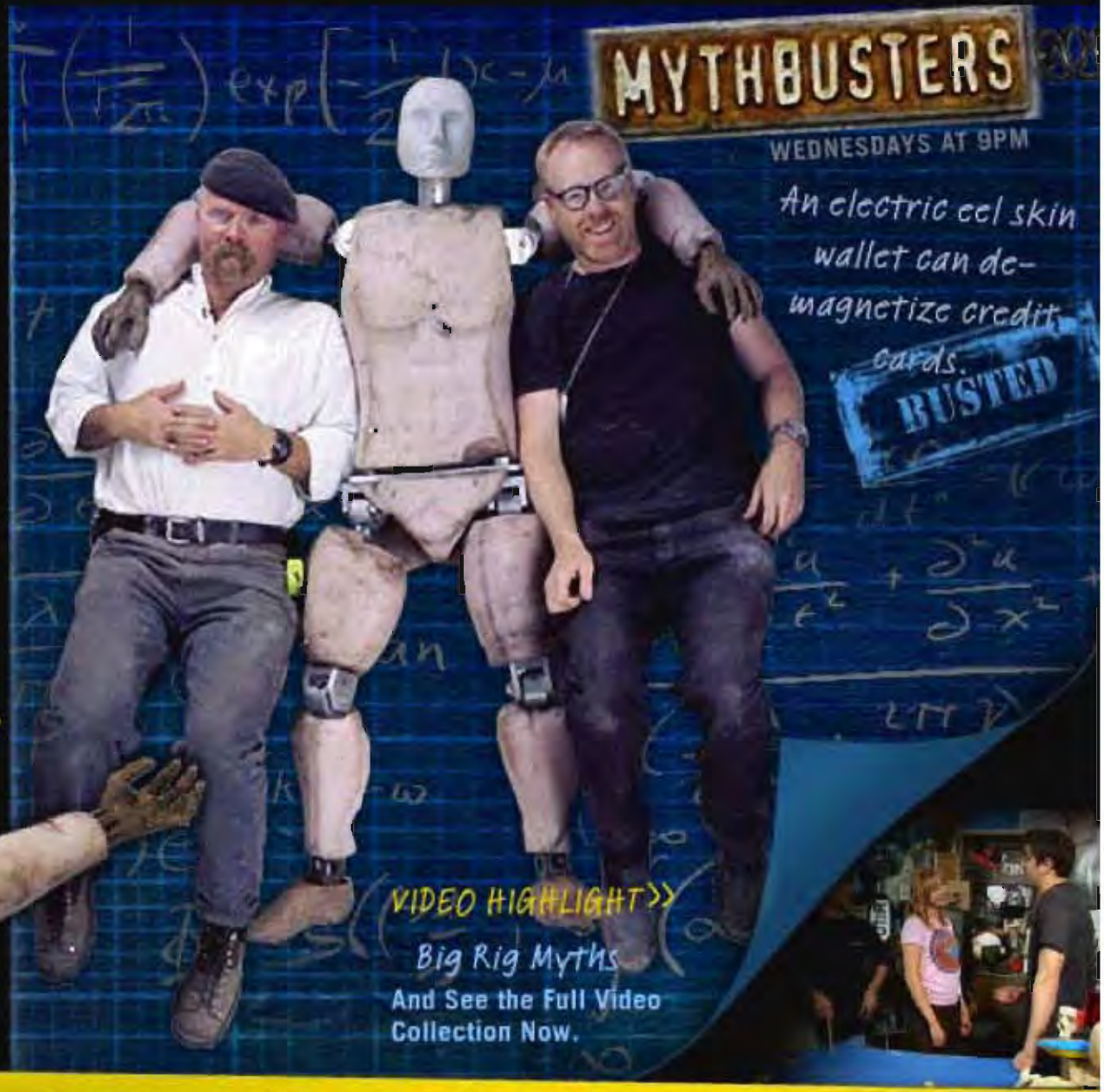
JOIN THE MESSAGE BOARD

"Baby snakes do not have control of how much venom they use and will shoot it all into you while a full grown snake conserves their venom. Is this true?" -- jeredweaver56

SUBMIT A MYTH >>

BE A MYTHBUSTER >>

Debunk a few classic myths. Give this interactive a whirl.



How's Your Brain Function? Watch Video and Take a Memory Exam.

Dispel these myths!

- You need to have programmed in high school to pursue computer science in college
- A computer science degree leads only to a career as a programmer
- Programming is a solitary activity
- Employment continues to be in a trough
- Eventually, all the programming jobs will be overseas
- Student interest in computer science continues to be in a trough, and is lower than in most other STEM fields
- Computer science lacks opportunities for making a positive impact on society
- There's nothing intellectually challenging in computer science
- There have been no recent breakthroughs in computer science
- Computer science lacks compelling research visions

Computing Community Consortium
We support the computing research community in creating compelling research visions and the mechanisms to realize these visions.

NSF

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