Computer Science: Past, Present, and Future

Ed Lazowska

Bill & Melinda Gates Chair in
Computer Science & Engineering
University of Washington

Chair, Computing Community Consortium

Saul Gorn Memorial Lecture
University of Pennsylvania

April 2010

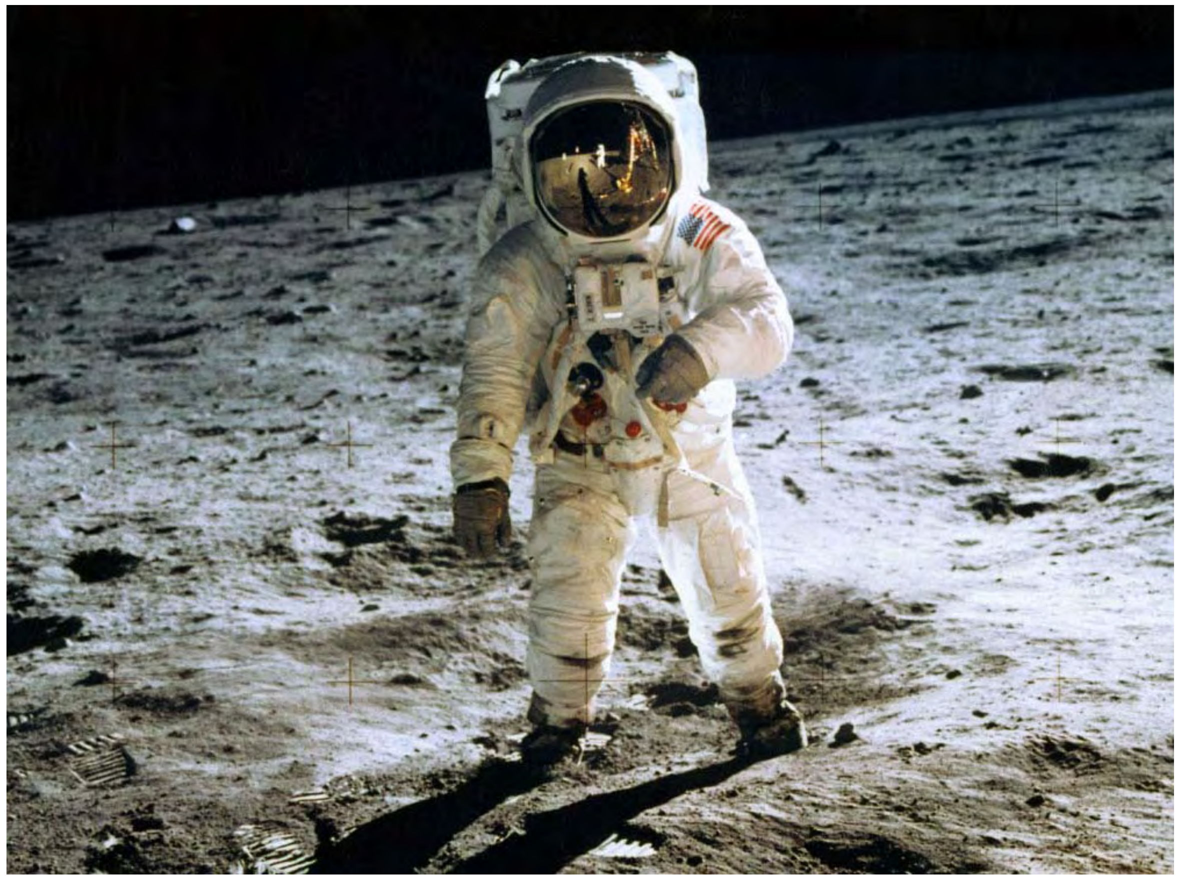
http://lazowska.cs.washington.edu/penn.pdf

Today …

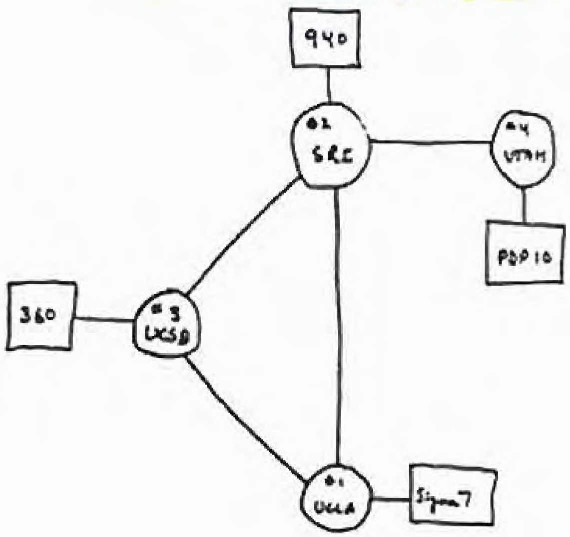
- A quick reminder of what we've accomplished as a field
- The Computing Community Consortium: origins, goals, recent activities
- Some research challenges for our field
- Be a Myth Buster!

Forty years ago …

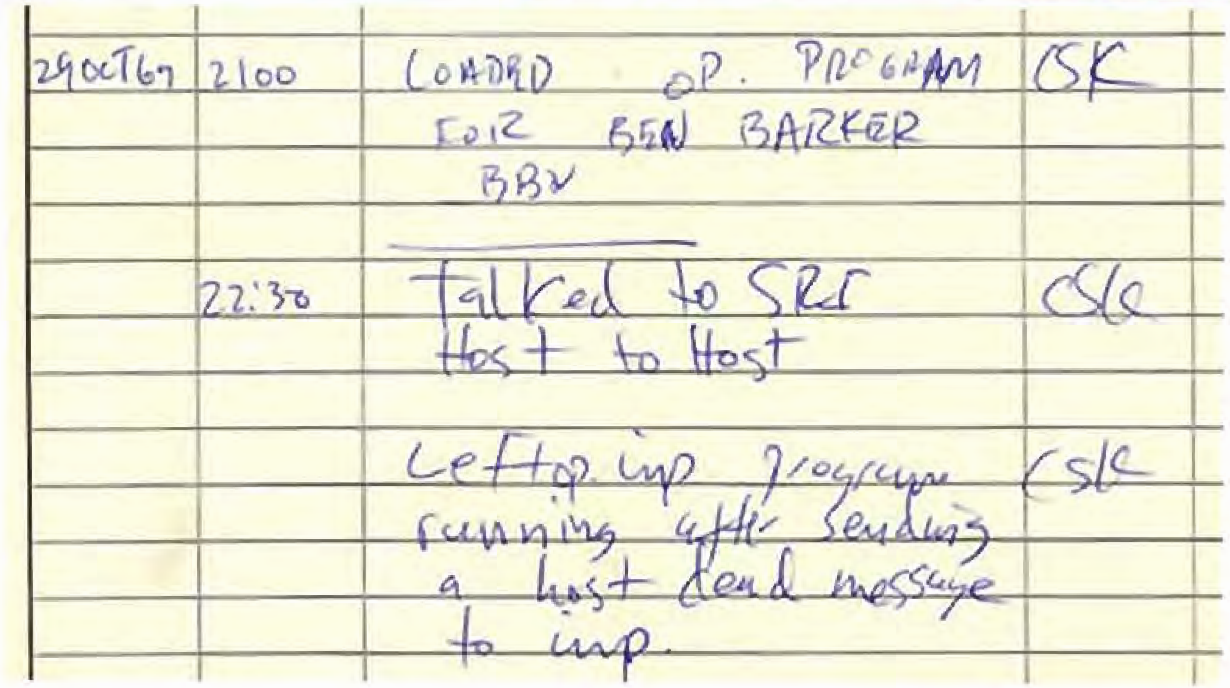

WOODSTOCK
MUSIC & ART FAIR
AN
AQUARIAN
EXPOSITION
WHITE LAKE, N.Y.
WITH
3 DAYS
of PEACE
& MUSIC
AUGUST
15, 16, 17.



[Peter Lee, DARPA, and Pat Lincoln, SRI]



THE ARPA NETWORK
DEC 1969
4 NODES



29OCT69	2100	LOADED OP. PROGRAM FOR BEN BARKER BBN	CSK
	22:30	Talked to SRI Host to Host	CSK
		Left op. imp program running after sending a host dead message to imp.	CSK

With forty years hindsight, which had the greatest impact?

- Unless you're big into Tang and Velcro (or sex and drugs), the answer is clear …

- And so is the reason …

EXPONENTIALS Я US

The past thirty years …

THE COUNT

Internet, Mobile Phones Named Most Important Inventions

By PHYLLIS KORKKI
Published: March 7, 2009

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In response to the shouted-out question, "What are some of the greatest inventions of all time?," nearby office workers in a recent informal survey gave the following answers: the wheel, the engine, the ballpoint pen, diapers and the cheese Danish.

Life Changers

The top innovations of the last 30 years, according to judges at the Wharton School of the University of Pennsylvania.

1. Internet, broadband
2. PC and laptop computers
3. Mobile phones
4. E-mail
5. DNA testing and sequencing
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THE NEW YORK TIMES

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Good, important choices all, but for classic, long-lasting appeal, they still can't beat the wheel. **PHYLLIS KORKKI**

Next Article in Business (22 of 29) »

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Business

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News for Education Professionals
FROM NYTIMES.COM
What's This?

- Colleges Sweat Out Admissions This Year
- Schumer Says Schools and State Will Get Some Stimulus Money This Month
- Districts Pursue School-Closing Plans to Save Money
- Parents Sue Trustees Over Prep School's Shutdown
- Doctoral Candidates Anticipate Hard Times

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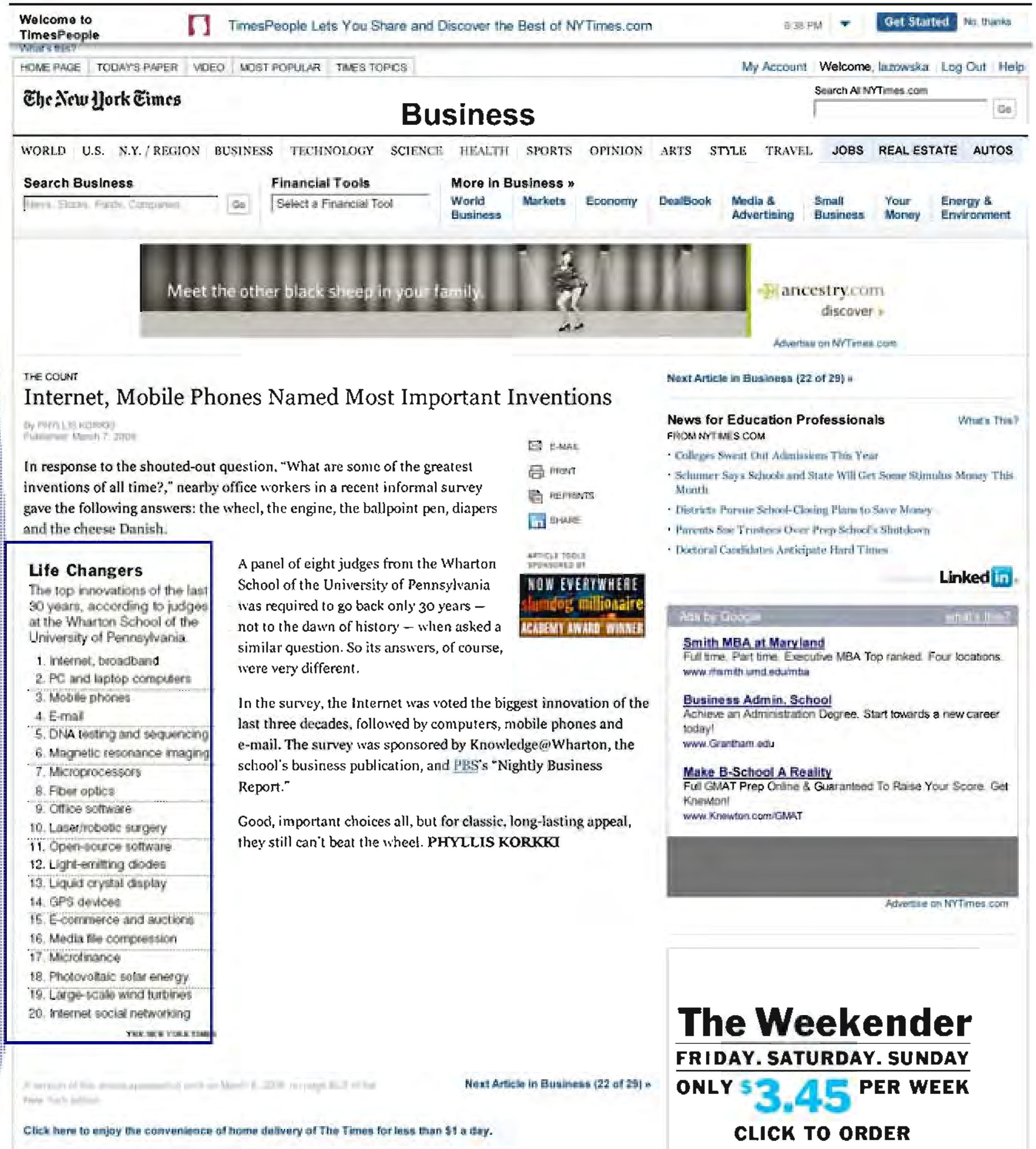
THE NEW YORK TIMES



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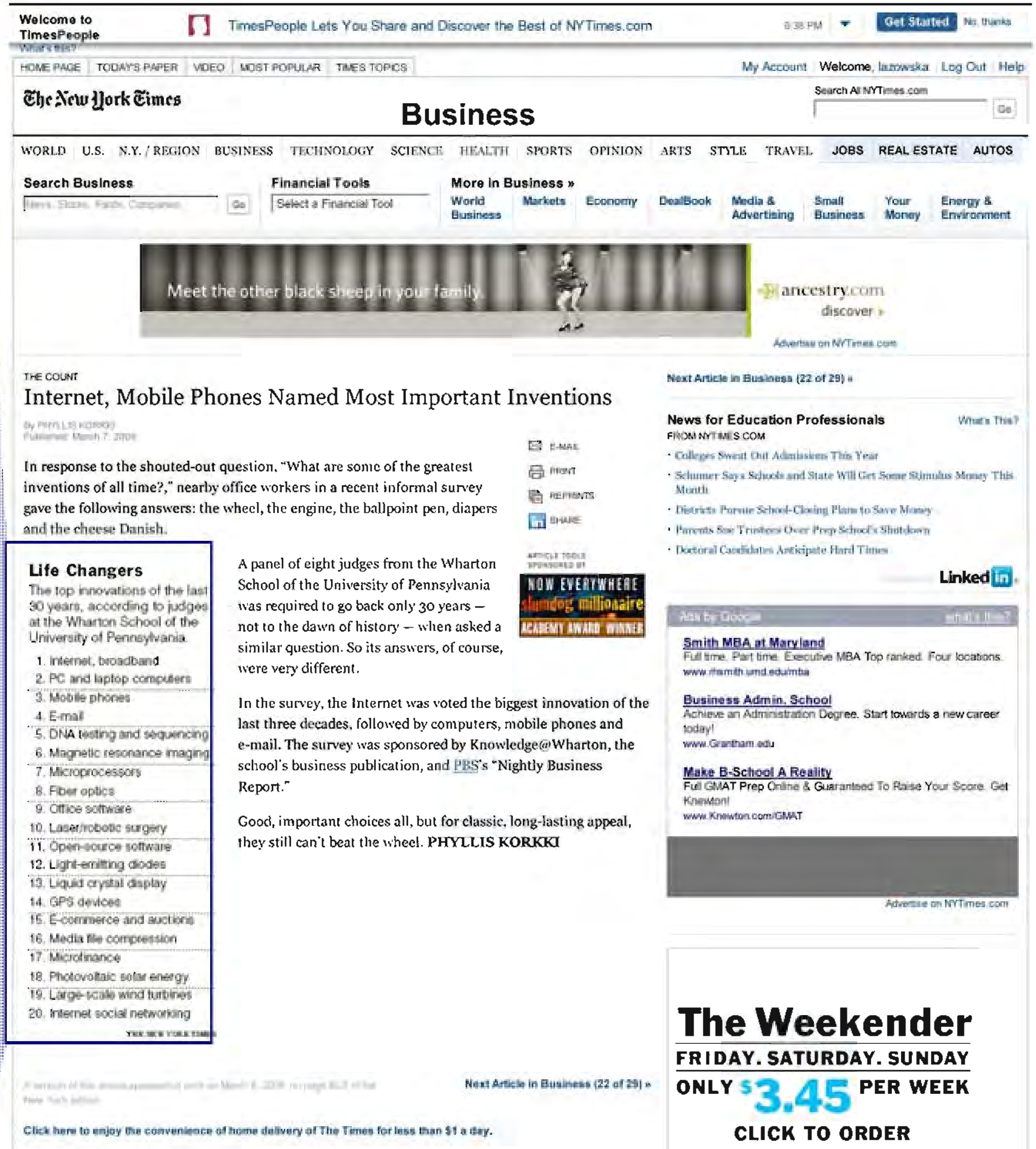

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Landmark contributions by students

- Use of Boolean logic to model digital circuits
  - Claude Shannon, MIT, 1937
- Huffman coding
  - David Huffman, MIT, 1951
- Mathematical foundation of packet communication
  - Len Kleinrock, MIT, 1962
- Interactive computer graphics
  - Ivan Sutherland, MIT, 1963
- Computer vision
  - Larry Roberts, MIT, 1963
- Symbolic mathematics
  - William A. Martin & Joel Moses, MIT, 1967

- The FLEX language and machine
  - Alan Kay, Utah, 1969
- The Boyer-Moore theorem prover
  - Robert S. Boyer and J Strother Moore, Edinburgh, 1971
- Efficient graph planarity testing using depth-first search
  - Bob Tarjan, Stanford, 1972
- Ethernet
  - Bob Metcalfe, Harvard, 1973
- BSD Unix
  - Bill Joy, Berkeley, 1977
- VisiCalc
  - Bob Frankston & Dan Bricklin, MIT, 1979

- Public key cryptography
  - Ralph Merkle, Berkeley & Stanford, 1979
- The SUN workstation
  - Andy Bechtolsheim, Stanford, 1982
- The Connection Machine
  - Danny Hillis, MIT, 1983
- Sphinx (speech recognition)
  - Kai-Fu Lee, Carnegie Mellon, 1988
- Linux
  - Linus Torvalds, Helsinki, 1991
- BDD-based symbolic model checking
  - Ken McMillan, Carnegie Mellon, 1992

- Mosaic
  - Marc Andreessen, Illinois, 1994
- The PCP theorem
  - Sanjeev Arora, Berkeley, 1994
- Google
  - Larry Page & Sergey Brin, Stanford, 1998
- Akamai
  - Danny Lewin, MIT, 1999
- Peer-to-peer file sharing
  - Shawn Fanning, Northeastern, 1999

The most recent ten years …

- Search
- Scalability
- Digital media
- Mobility
- eCommerce
- The Cloud
- Social networking and crowd-sourcing

Xconomy

Business + Technology in the Exponential Economy

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 couldn't fly, travelers had to navigate without benefit of GPS, weather forecasters had no models, banks and merchants couldn't transfer funds electronically, factory automation ceased to function, and the US military lacked technological supremacy

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- A day without diagnostic medic
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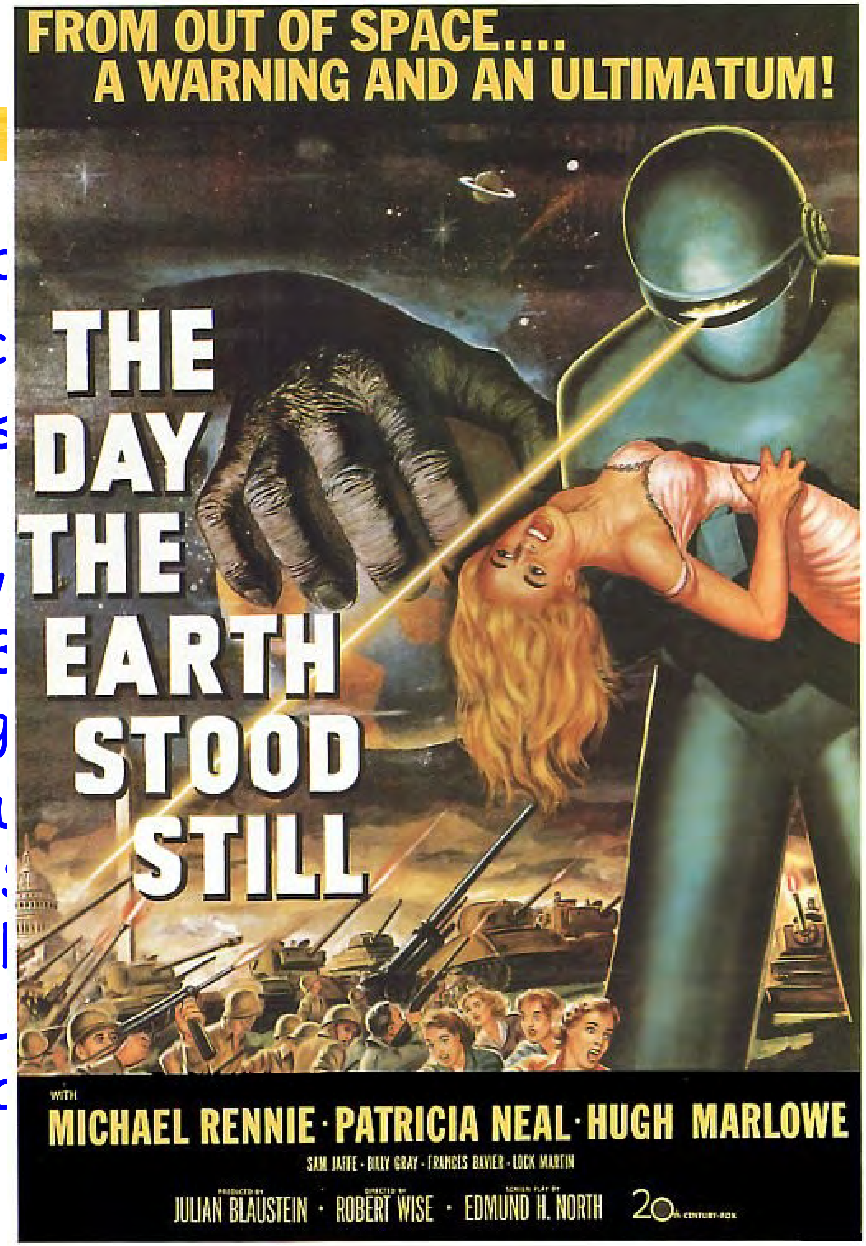
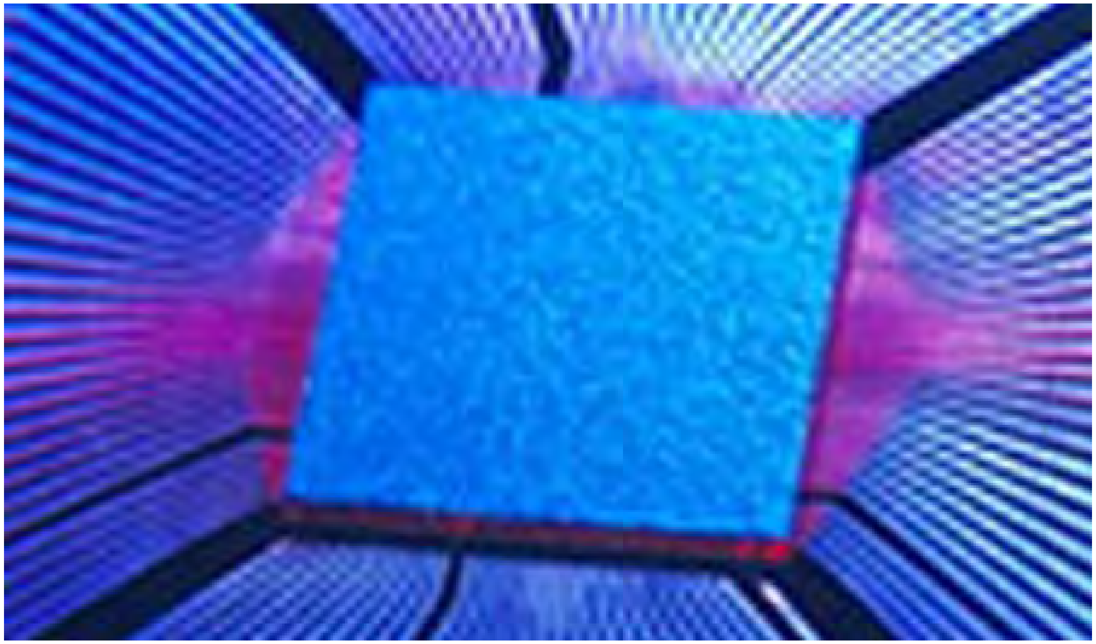


2004: 10,000,000,000,000,000,000 grains of rice

- Ten quintillion: $10*10^{18}$
  - The number of grains of rice harvested in 2004

2004: 10,000,000,000,000,000,000 transistors

- Ten quintillion: $10*10^{18}$
  - The number of grains of rice harvested in 2004
  - The number of transistors fabricated in 2004

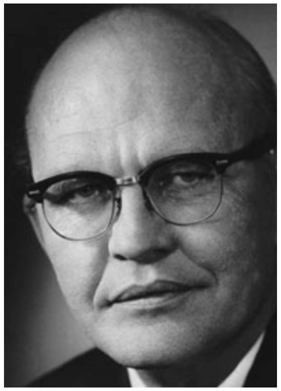
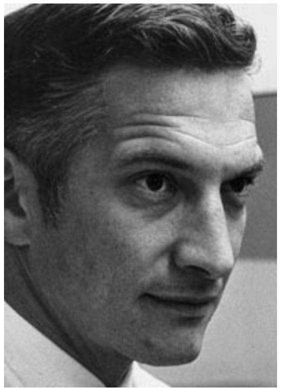
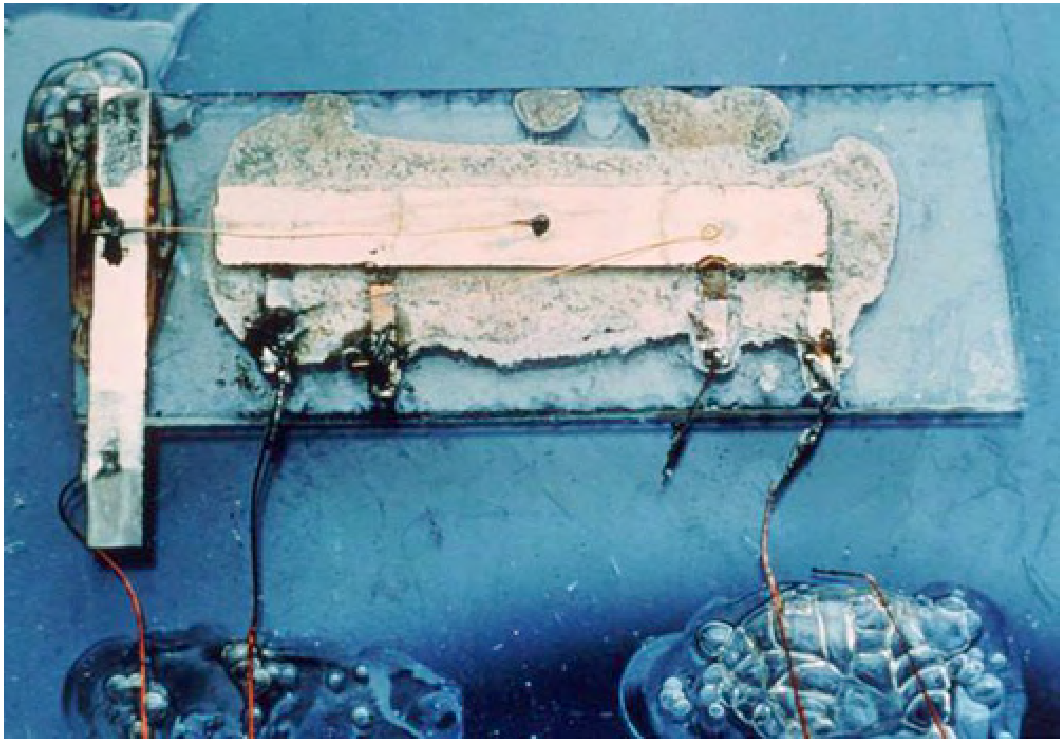


The transistor

- William Shockley, Walter Brattain and John Bardeen, Bell Labs, 1947

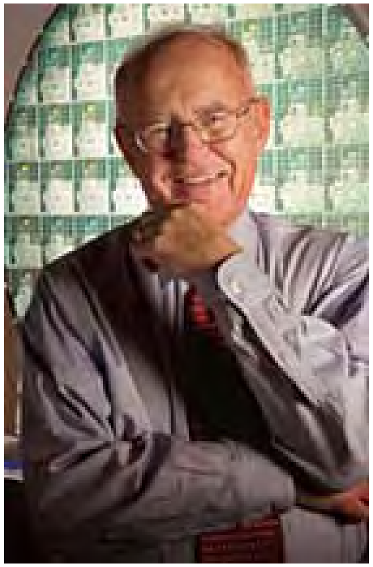
The integrated circuit

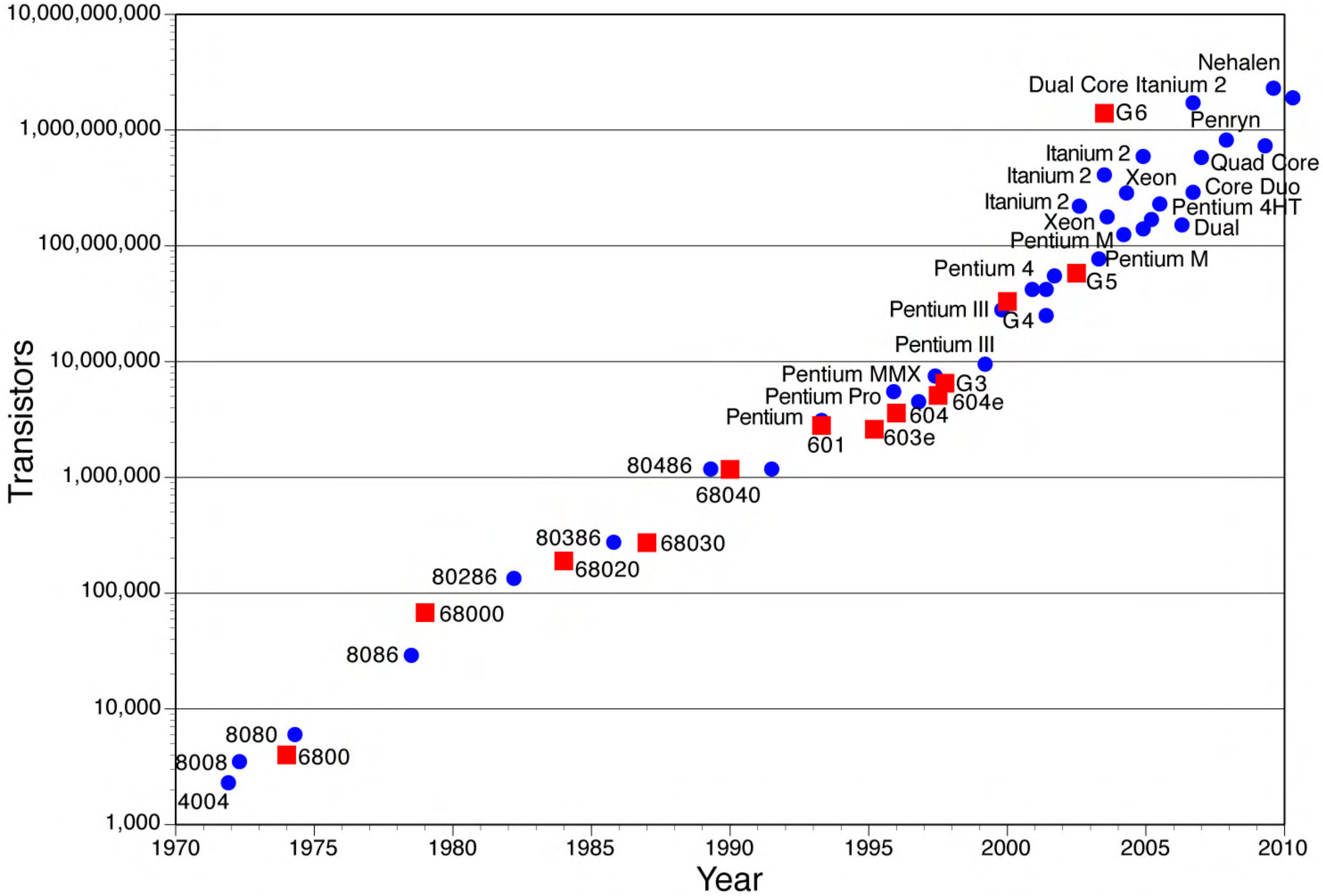
- Jack Kilby, Texas Instruments, and Bob Noyce, Fairchild Semiconductor Corporation, 1958

Exponential progress

- Gordon Moore, 1965

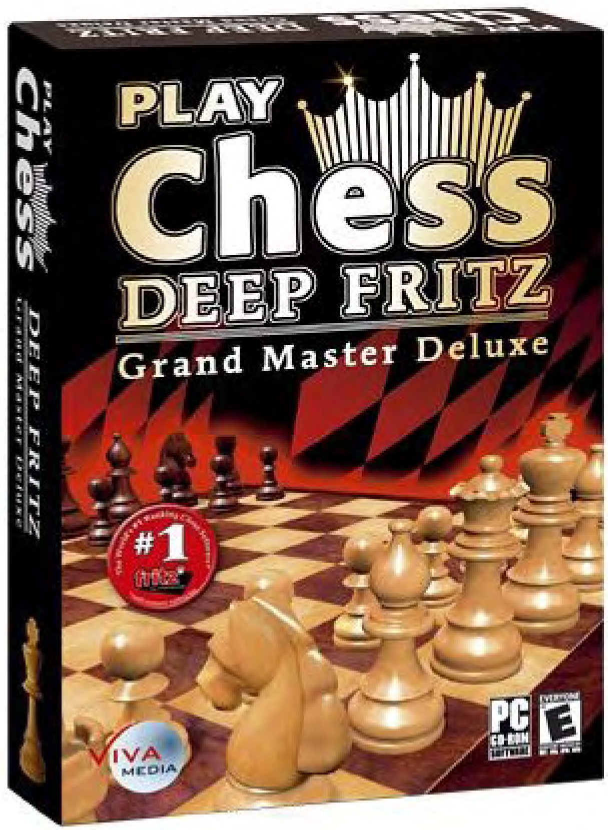





UNIVAC

Software makes equal progress

Deep Blue, 1997



Price: $19.99 & eligible for free shipping with **Amazon Prime**

Deep Fritz, 2002

AlphaServer 1200 product brief

Leadership
"To support our rapid growth, we had to find a highly upgradable and scaleable Internet server. The AlphaServer platform provides the upgrade path we need."

Jeff Bezos
CEO and Founder
Amazon.com

amazon.com

Web commerce back-end, 1997

- Contrast …
  - The cheapest imaginable components
    - Failures occur all the time
    - You couldn't afford to prevent this in hardware
  - Software makes it
    - Fault-Tolerant
    - Highly Available
    - Recoverable
    - Consistent
    - Scalable
    - Predictable
    - Secure

Web commerce back-end, 2007

This sort of progress makes it dicey to predict the future

"I think there is a world market for maybe five computers" – Thomas J. Watson, founder and Chairman of IBM, 1943

"Computers in the future may weigh no more than 1.5 tons" – *Popular Science*, 1949

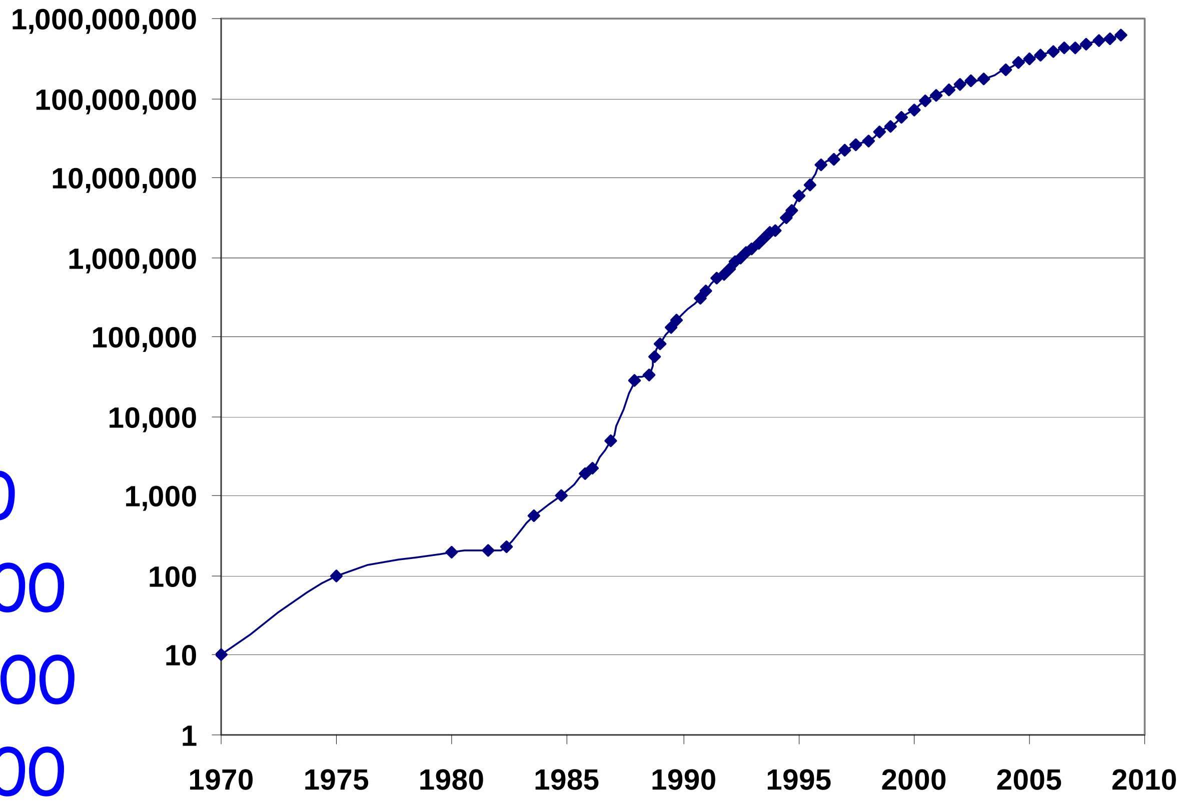
"There is no reason anyone would want a computer in their home" – Ken Olsen, founder and President of Digital Equipment Corporation, 1977

Today: More than 1 billion PCs in use ...

Representing less than 2% of all processors!

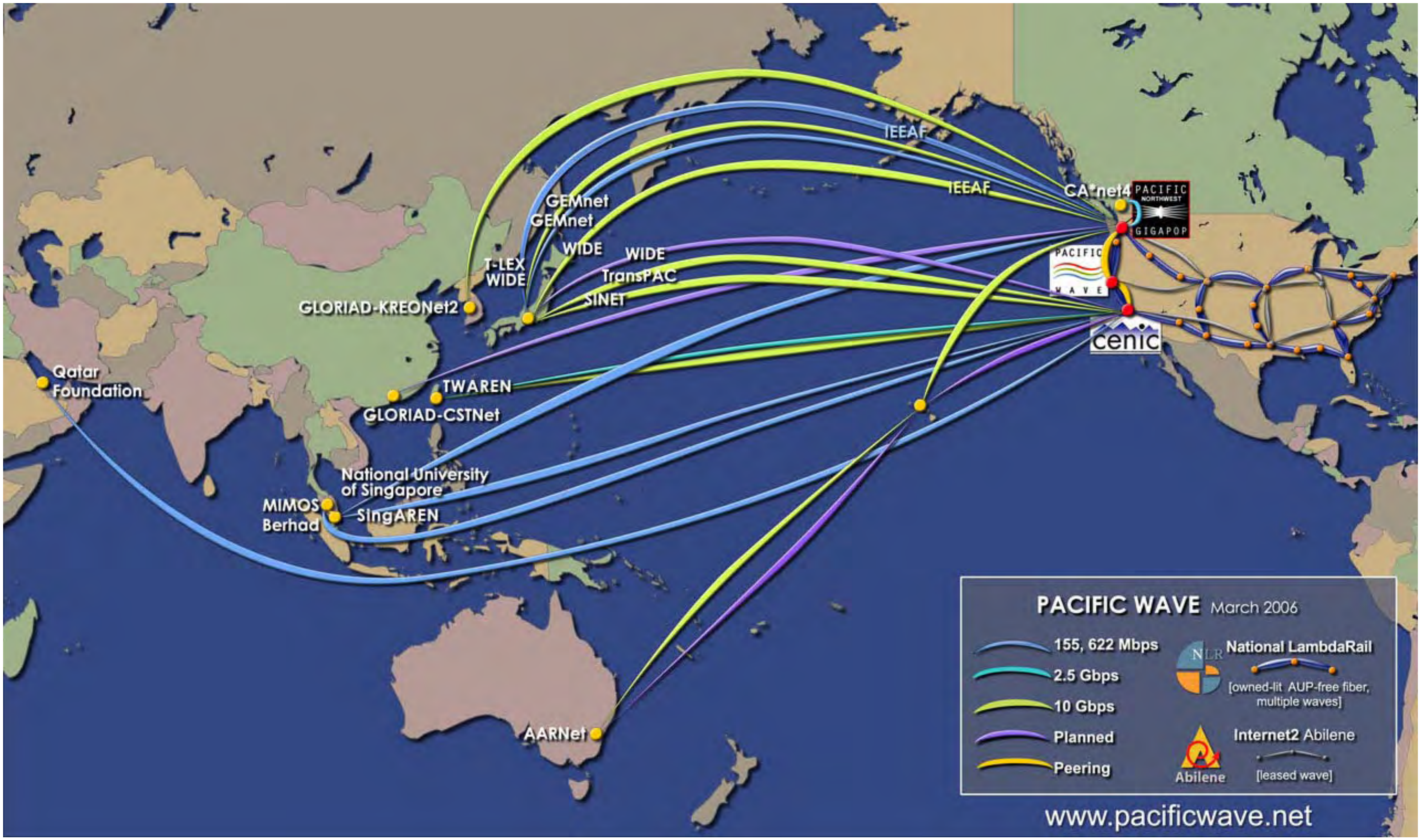
Number of Internet hosts

- 1970: 10
- 1975: 100
- 1980: 200
- 1985: 2,000
- 1990: 350,000
- 1995: 10,000,000
- 2000: 100,000,000
- 2005: 375,000,000
- 2010: 700,000,000

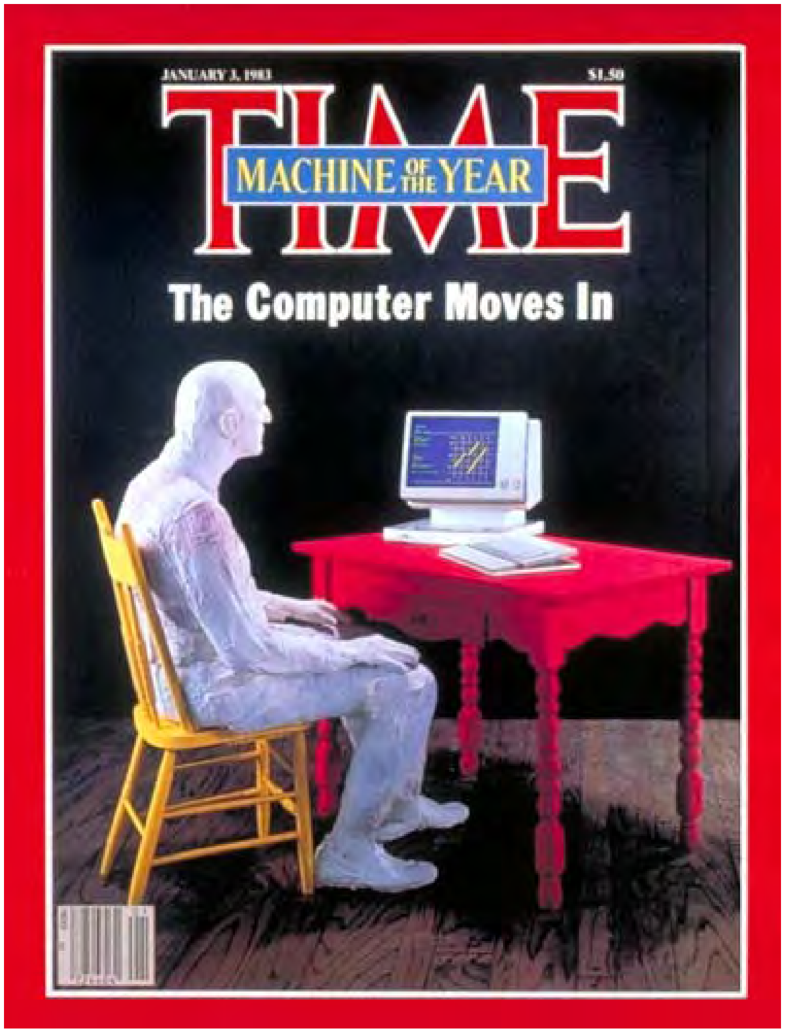


A connected region – then

A connected region - now



The Computer: *Time* Magazine's 1982 "Machine of the Year"



- “In medicine, the computer, which started by keeping records and sending bills, now suggests diagnoses. The process may sound dehumanized, but in one hospital … a survey of patients showed that they found the machine ‘more friendly, polite, relaxing and comprehensible’ than the average physician.’”

- "When the citizen of tomorrow wants a new suit, one futurist scenario suggests, his personal computer will take his measurements and pass them on to a robot that will cut his choice of cloth with a laser beam and provide him with a perfectly tailored garment."

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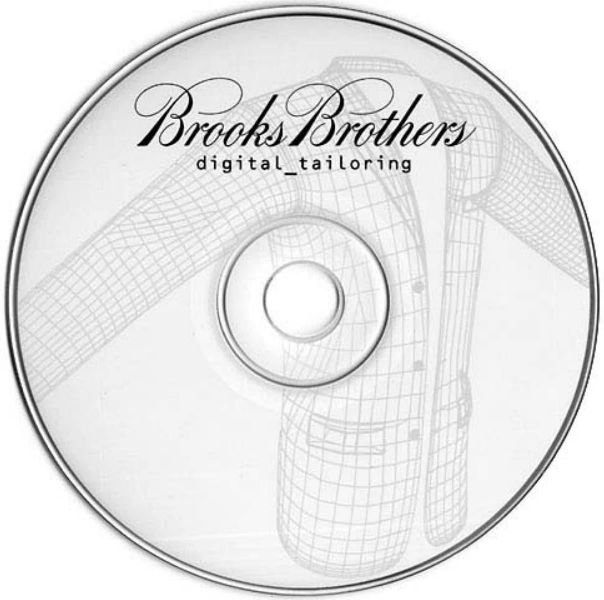

- "In the home, computer enthusiasts delight in imagining machines performing domestic chores."

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vacuum your carpet

iRobot

- “In the home, computer enthusiasts delight in imagining machines performing domestic chores.”

wash your floor

iRobot

- "In the home, computer enthusiasts delight in imagining machines performing domestic chores."

scrub your pool

iRobot

- "In the home, computer enthusiasts delight in imagining machines performing domestic chores."

clean your gutters

- "In the home, computer enthusiasts delight in imagining machines performing domestic chores."

amuse your pet

iRobot

- "In the home, computer enthusiasts delight in imagining machines performing domestic chores."

detonate your IED's

iRobot

The Computing Community Consortium

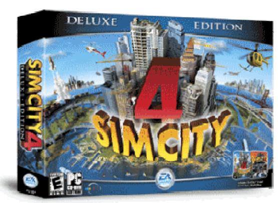
Computing Community Consortium

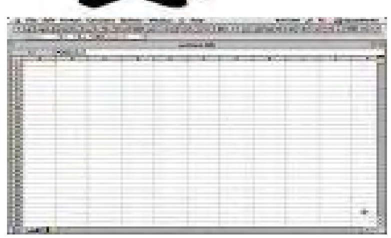
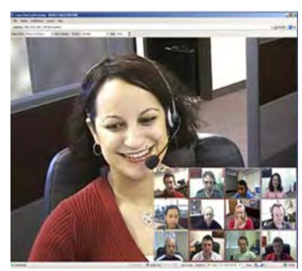
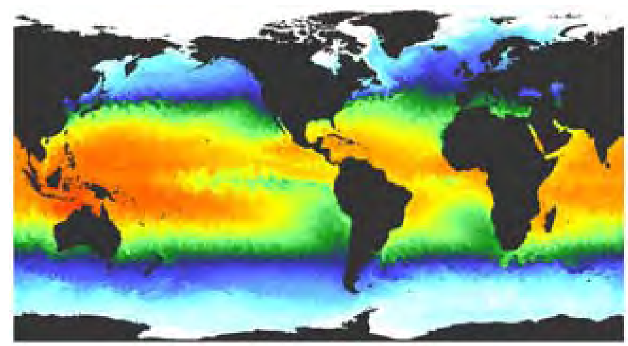
We support the computing research community in creating compelling research visions and the mechanisms to realize these visions.

Computing has changed the world

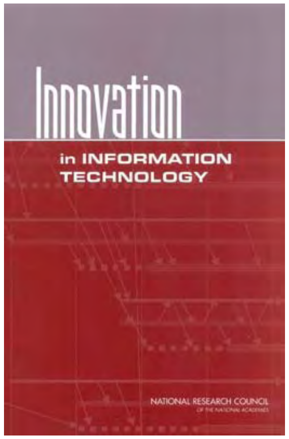
- Advances in computing change the way we live, work, learn, and communicate
- Advances in computing drive advances in nearly all other fields
- Advances in computing power our economy
  - Not just through the growth of the IT industry – through productivity growth across the entire economy

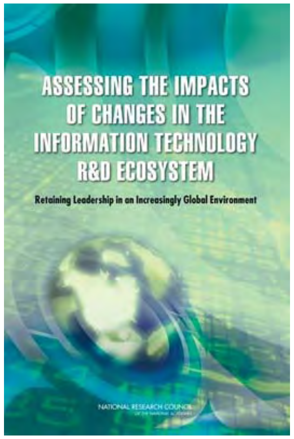


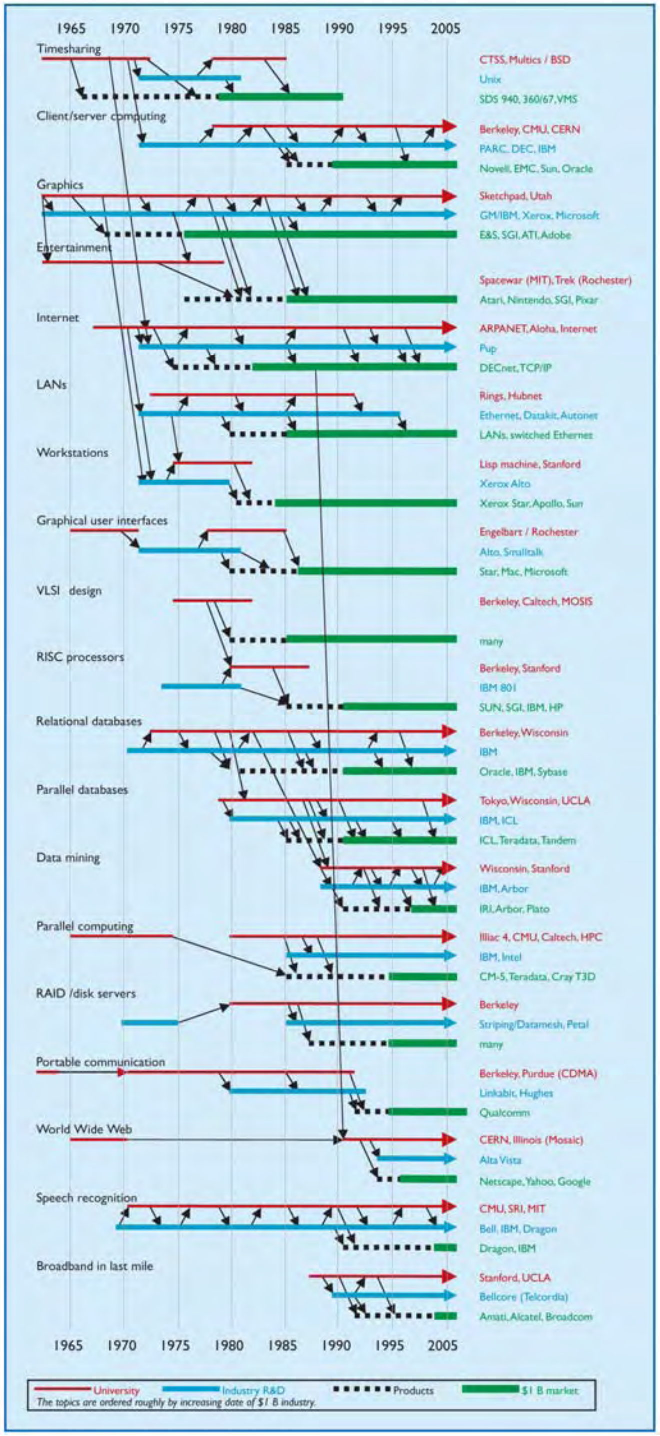


Research has built the foundation

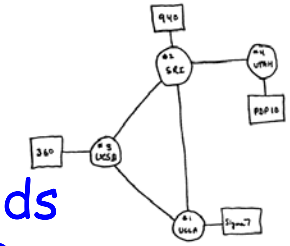
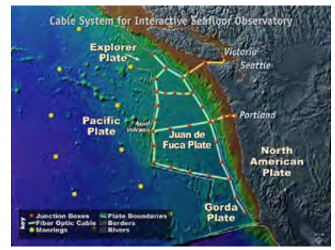


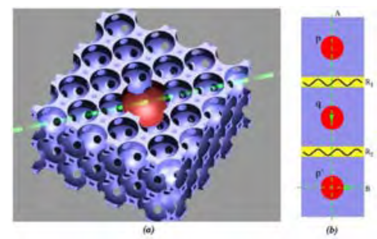




The future is full of opportunity

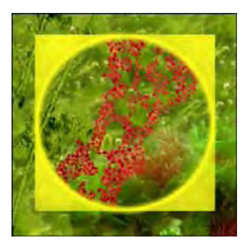
- Creating the future of networking
- Driving advances in all fields of science and engineering
- Revolutionizing transportation
- Personalized education
- The smart grid
- Predictive, preventive, personalized medicine
- Quantum computing
- Empowerment for the developing world
- Personalized health monitoring => quality of life
- Harnessing parallelism
- 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

The CCC Council – broad representation

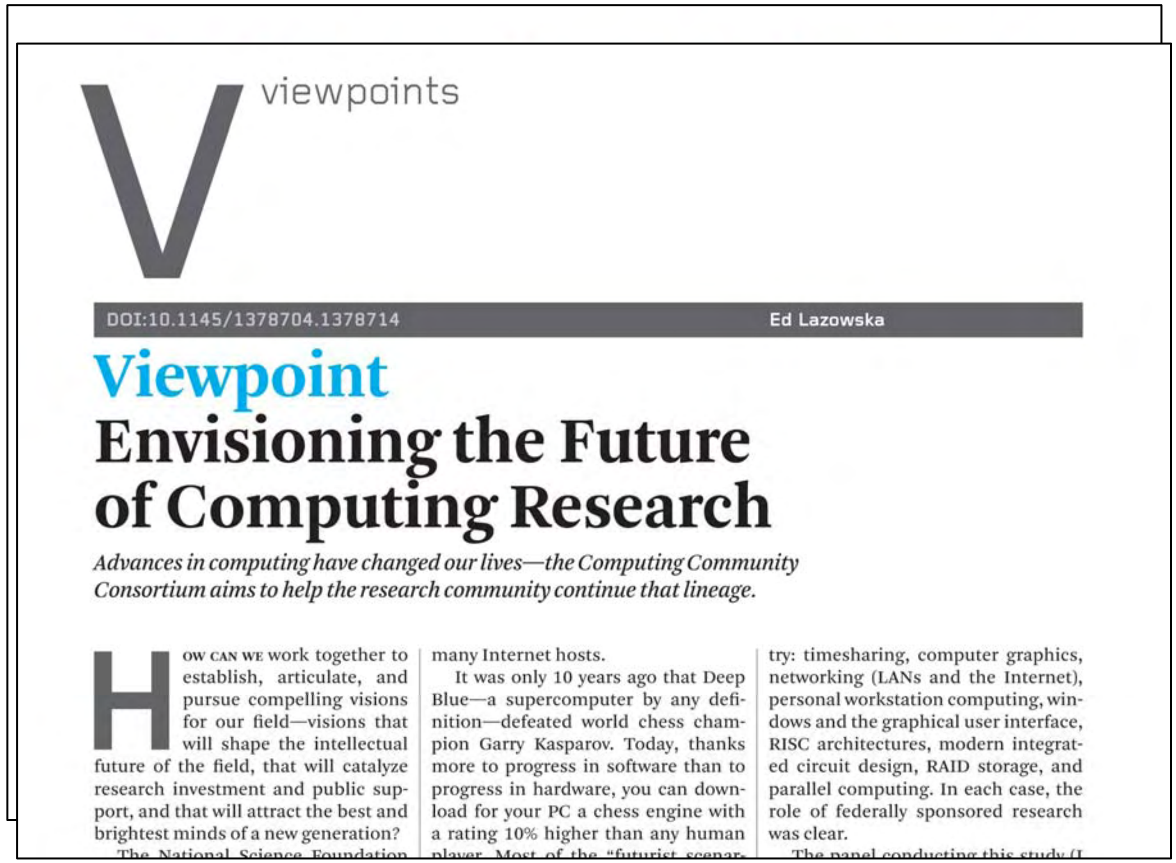
- Chair
  - Ed Lazowska
- Terms ending 2013
  - Randy Bryant
  - Lance Fortnow
  - Hank Korth
  - Eric Horvitz
  - Beth Mynatt
  - Fred Schneider
  - Margo Seltzer
- Terms ending 2012
  - Stephanie Forrest
  - Chris Johnson
  - Anita Jones
  - Frans Kaashoek
  - Ran Libeskind-Hadas
  - Robin Murphy
- Terms ending 2011
  - Bill Feiereisen
  - Susan Graham (v ch)
  - Dave Kaeli
  - John King
  - Bob Sproull
- Ex Officio
  - Andy Bernat
  - Erwin Gianchandani
- Rotated off
  - Dick Karp, 2010
  - Andrew McCallum, 2010
  - Dave Waltz, 2010
  - Greg Andrews, 2009
  - Peter Lee, 2009
  - Karen Sutherland, 2009

Major continuing activities

- Countless talks

Major continuing activities

- Countless talks
- Countless articles



viewpoints

V

DOI:10.1145/1378704.1378714

Ed Lazowska

Viewpoint

Envisioning the Future of Computing Research

Advances in computing have changed our lives—the Computing Community Consortium aims to help the research community continue that lineage.

How can we work together to establish, articulate, and pursue compelling visions for our field—visions that will shape the intellectual future of the field, that will catalyze research investment and public support, and that will attract the best and brightest minds of a new generation?

The National Science Foundation

many Internet hosts.

It was only 10 years ago that Deep Blue—a supercomputer by any definition—defeated world chess champion Garry Kasparov. Today, thanks more to progress in software than to progress in hardware, you can download for your PC a chess engine with a rating 10% higher than any human player. Most of the "futurist scenar-

try: 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, and parallel computing. In each case, the role of federally sponsored research was clear.

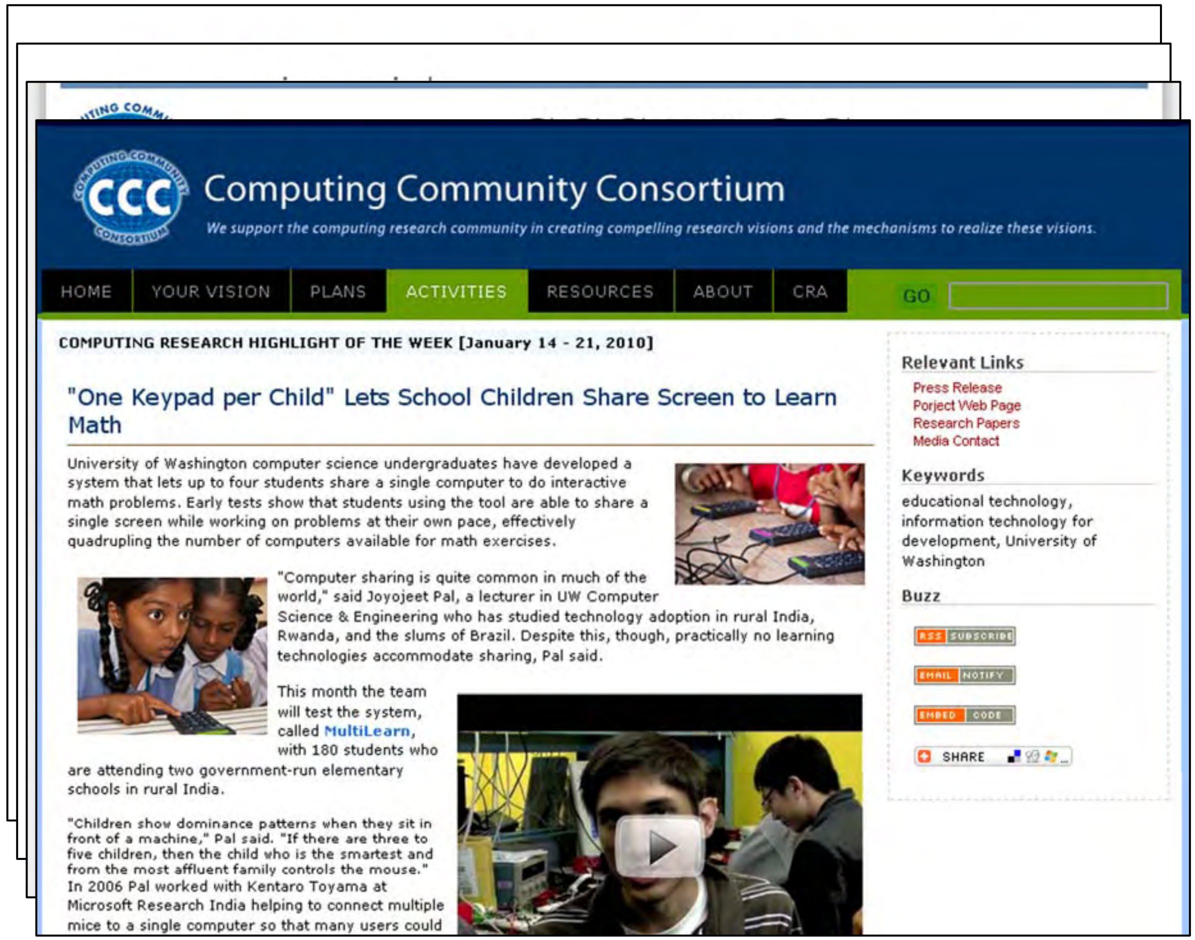
The panel conducting this study (I

Major continuing activities

- Countless talks
- Countless articles
- CCC blog

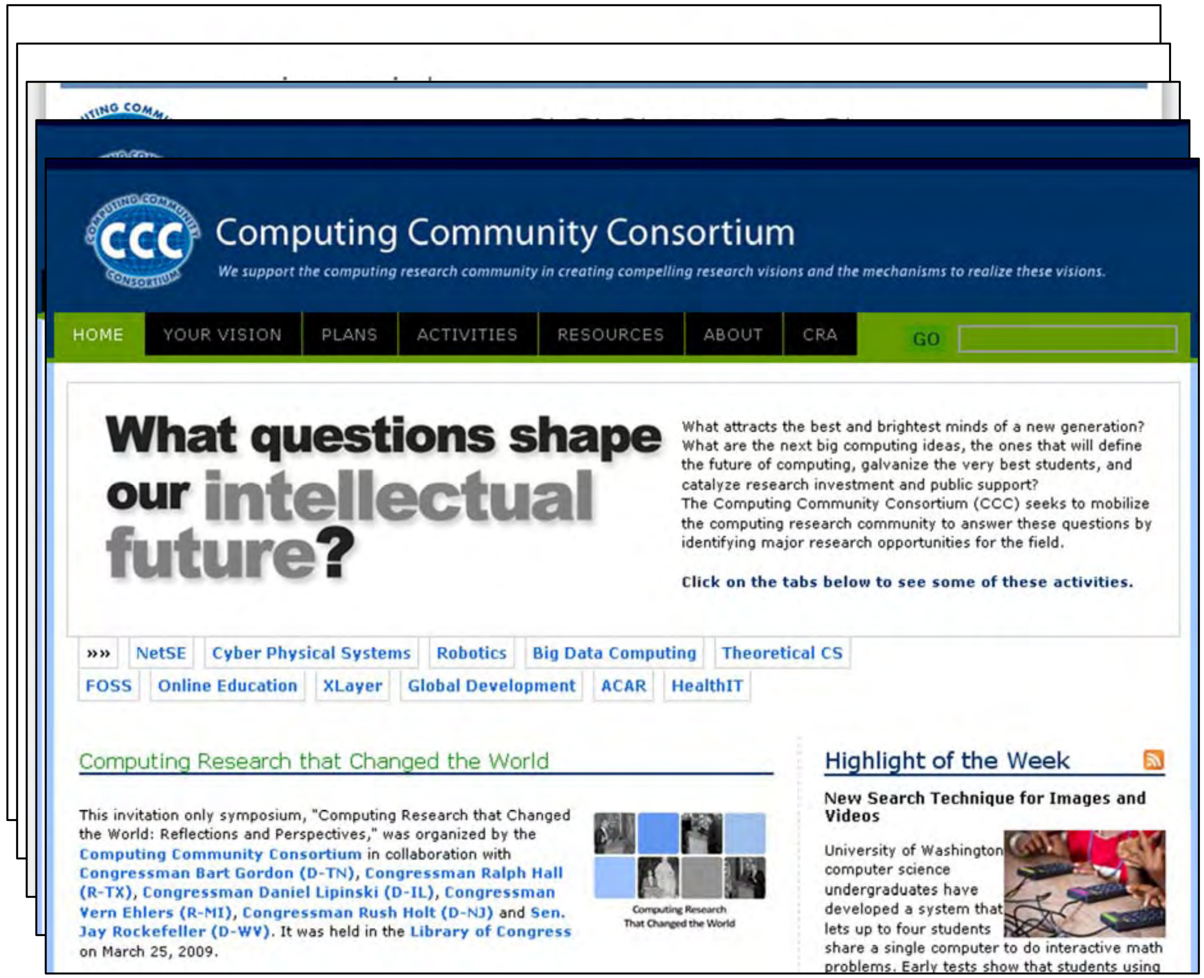
Major continuing activities

- Countless talks
- Countless articles
- CCC blog
- Computing research highlight of the week



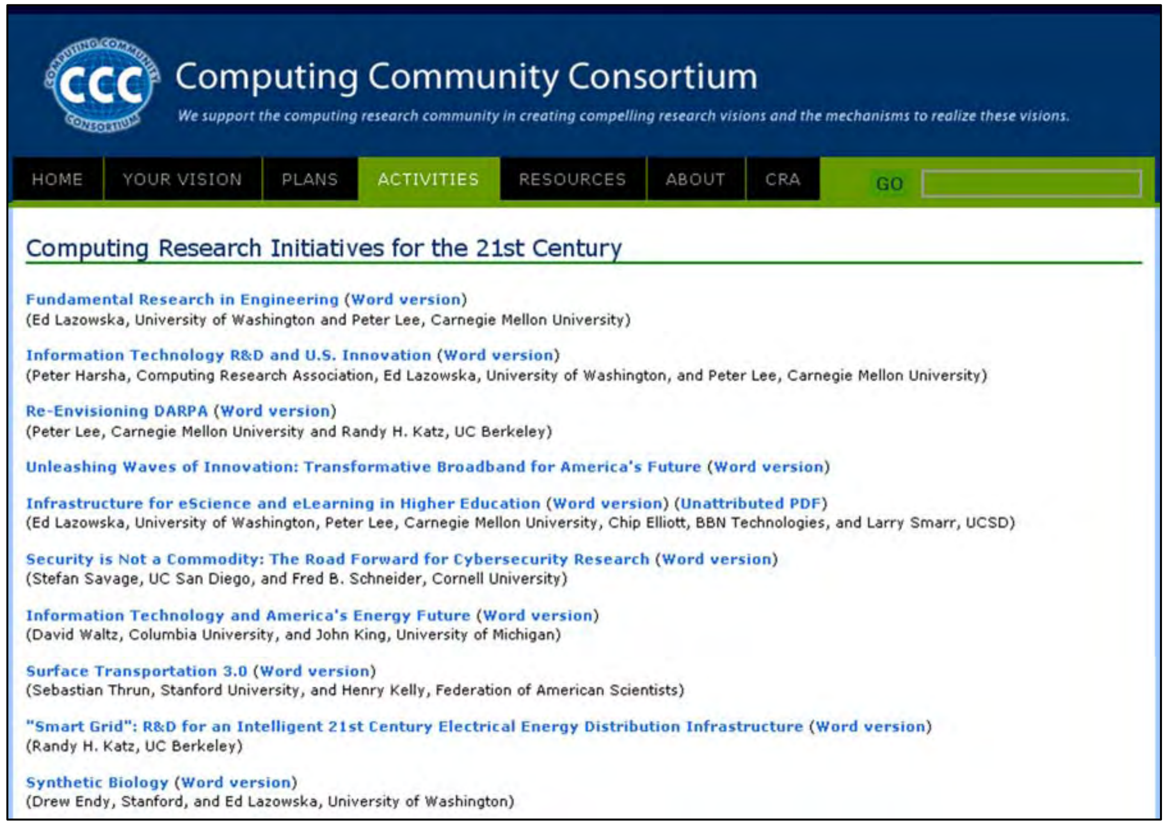
Major continuing activities

- Countless talks
- Countless articles
- CCC blog
- Computing research highlight of the week
- Community visioning exercises



Major special initiatives

- Transition Team white papers



Computing Community Consortium

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

HOME | YOUR VISION | PLANS | ACTIVITIES | RESOURCES | ABOUT | CRA | GO

Computing Research Initiatives for the 21st Century

Fundamental Research in Engineering (**Word version**)
(Ed Lazowska, University of Washington and Peter Lee, Carnegie Mellon University)

Information Technology R&D and U.S. Innovation (**Word version**)
(Peter Harsha, Computing Research Association, Ed Lazowska, University of Washington, and Peter Lee, Carnegie Mellon University)

Re-Envisioning DARPA (**Word version**)
(Peter Lee, Carnegie Mellon University and Randy H. Katz, UC Berkeley)

Unleashing Waves of Innovation: Transformative Broadband for America's Future (**Word version**)

Infrastructure for eScience and eLearning in Higher Education (**Word version**) (**Unattributed PDF**)
(Ed Lazowska, University of Washington, Peter Lee, Carnegie Mellon University, Chip Elliott, BBN Technologies, and Larry Smarr, UCSD)

Security is Not a Commodity: The Road Forward for Cybersecurity Research (**Word version**)
(Stefan Savage, UC San Diego, and Fred B. Schneider, Cornell University)

Information Technology and America's Energy Future (**Word version**)
(David Waltz, Columbia University, and John King, University of Michigan)

Surface Transportation 3.0 (**Word version**)
(Sebastian Thrun, Stanford University, and Henry Kelly, Federation of American Scientists)

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

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

Major special initiatives

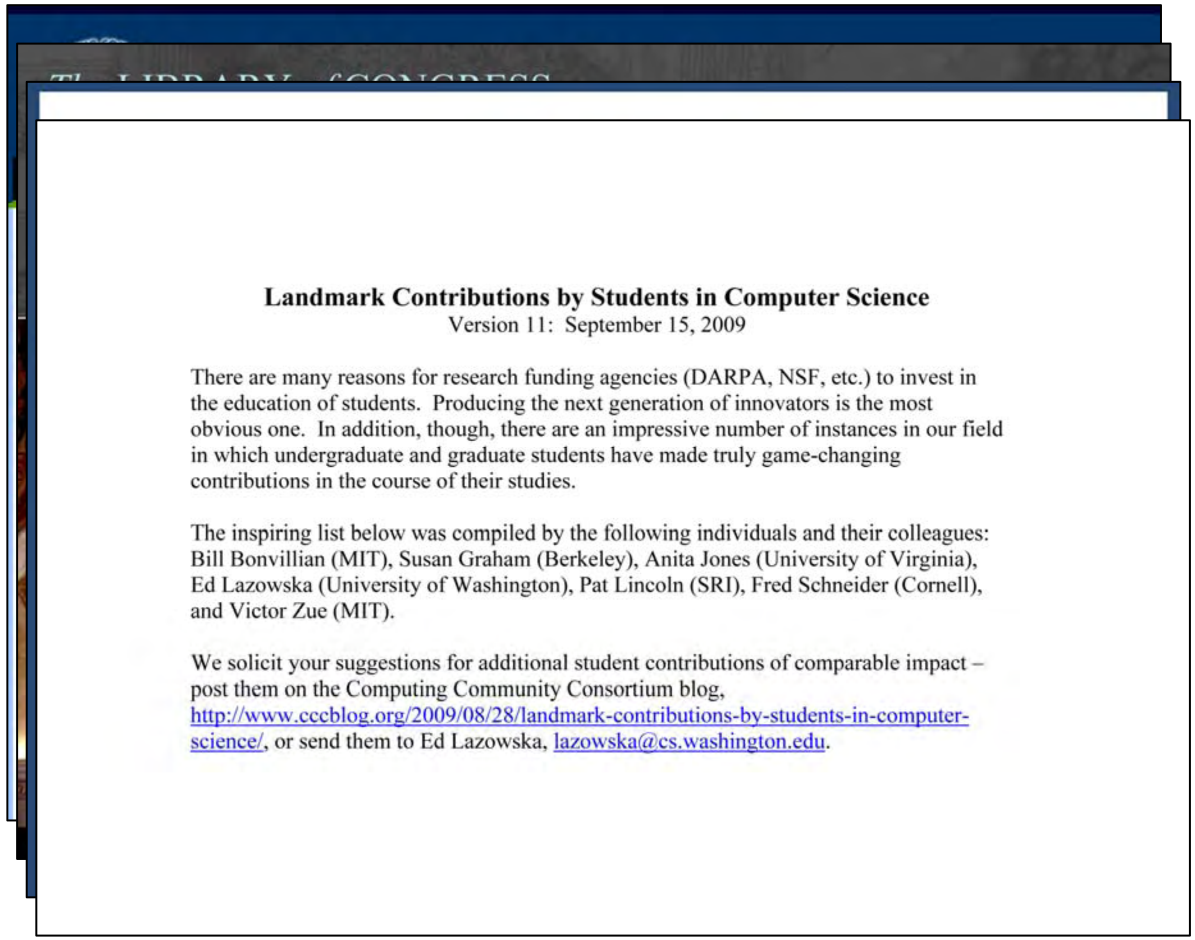
- Transition Team white papers
- Library of Congress Symposium

Major special initiatives

- Transition Team white papers
- Library of Congress Symposium
- Computing Innovation Fellows project
  - 1209 mentors
  - 526 applicants
  - Julia Stoyanovich (Columbia) -> Susan Davidson
  - Andrew McPherson -> Drexel (Youngmoo Kim)
  - Jennifer Wortman Vaughan -> Harvard (Yiling Chen)

Major special initiatives

- Transition Team white papers
- Library of Congress Symposium
- Computing Innovation Fellows project
- Landmark Contributions by Students



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

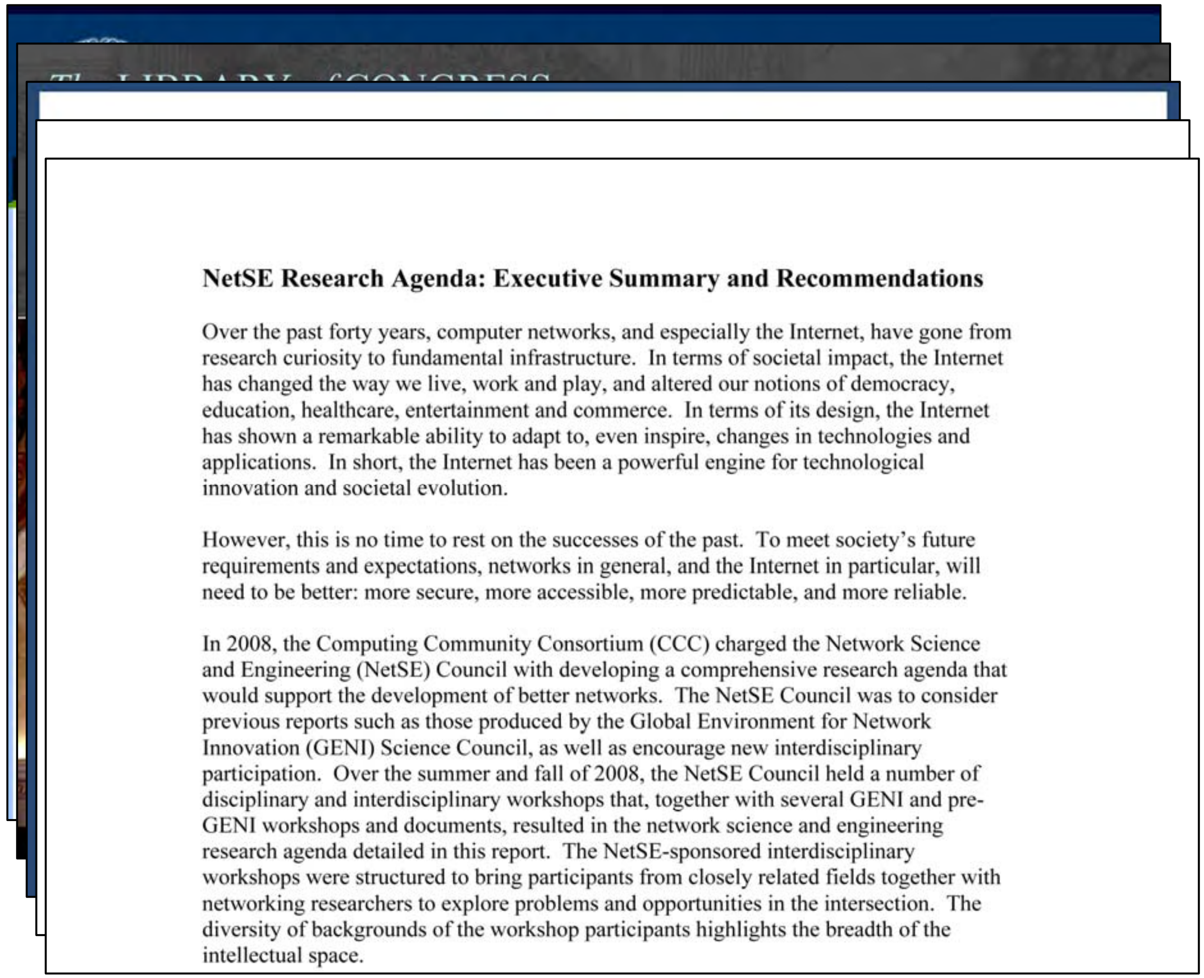
There are many reasons for research funding agencies (DARPA, NSF, etc.) to invest in the education of students. Producing the next generation of innovators is the most obvious one. In addition, though, there are an impressive number of instances in our field in which undergraduate and graduate students 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 Bonvillian (MIT), Susan Graham (Berkeley), Anita Jones (University of Virginia), Ed Lazowska (University of Washington), Pat Lincoln (SRI), Fred Schneider (Cornell), and Victor Zue (MIT).

We solicit your suggestions for additional student contributions of comparable impact – post them on the Computing Community Consortium blog, http://www.cccblog.org/2009/08/28/landmark-contributions-by-students-in-computer-science/, or send them to Ed Lazowska, lazowska@cs.washington.edu.

Major special initiatives

- Transition Team white papers
- Library of Congress Symposium
- Computing Innovation Fellows project
- Landmark Contributions by Students
- NetSE Research Agenda



NetSE Research Agenda: Executive Summary and Recommendations

Over the past forty years, computer networks, and especially the Internet, have gone from research curiosity to fundamental infrastructure. In terms of societal impact, the Internet has changed the way we live, work and play, and altered our notions of democracy, education, healthcare, entertainment and commerce. In terms of its design, the Internet has shown a remarkable ability to adapt to, even inspire, changes in technologies and applications. In short, the Internet has been a powerful engine for technological innovation and societal evolution.

However, this is no time to rest on the successes of the past. To meet society's future requirements and expectations, networks in general, and the Internet in particular, will need to be better: more secure, more accessible, more predictable, and more reliable.

In 2008, the Computing Community Consortium (CCC) charged the Network Science and Engineering (NetSE) Council with developing a comprehensive research agenda that would support the development of better networks. The NetSE Council was to consider previous reports such as those produced by the Global Environment for Network Innovation (GENI) Science Council, as well as encourage new interdisciplinary participation. Over the summer and fall of 2008, the NetSE Council held a number of disciplinary and interdisciplinary workshops that, together with several GENI and pre-GENI workshops and documents, resulted in the network science and engineering research agenda detailed in this report. The NetSE-sponsored interdisciplinary workshops were structured to bring participants from closely related fields together with networking researchers to explore problems and opportunities in the intersection. The diversity of backgrounds of the workshop participants highlights the breadth of the intellectual space.

Major special initiatives

- Transition Team white papers
- Library of Congress Symposium
- Computing Innovation Fellows project
- Landmark Contributions by Students
- NetSE Research Agenda
- Health IT

Current initiatives

- Computing research and health care
- Computing research and sustainability / energy / transportation
- From Data to Knowledge to Action:
  - Enabling Evidence-Based Healthcare
  - Enabling the New Biology
  - Enabling 21st Century Discovery in Science and Engineering
  - Enabling Advanced Intelligence and Decision Making for America's Security
  - Enabling a Revolution in Transportation
  - Enabling a Transformation of American Education
  - Enabling the Smart Grid

The next ten years …

Greatest Engineering Achievements OF THE 20TH CENTURY

• About • Timeline • The Book

Welcome!

How many of the 20th century's greatest engineering achievements will you use today? A car? Computer? Telephone? Explore our list of the top 20 achievements and learn how engineering shaped a century and changed the world.

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials

Greatest Achievements

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11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials

Greatest Achievements

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

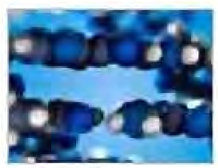

Develop carbon sequestration methods


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

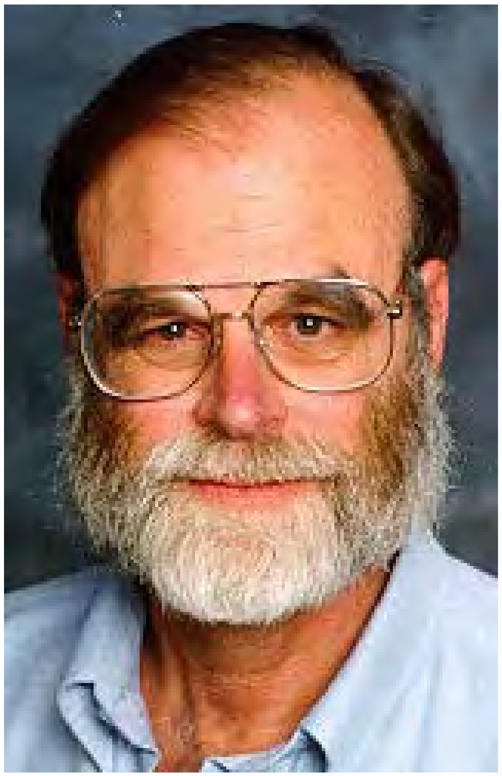

Enhance virtual reality


Advance personalized learning


Engineer the tools of scientific discovery

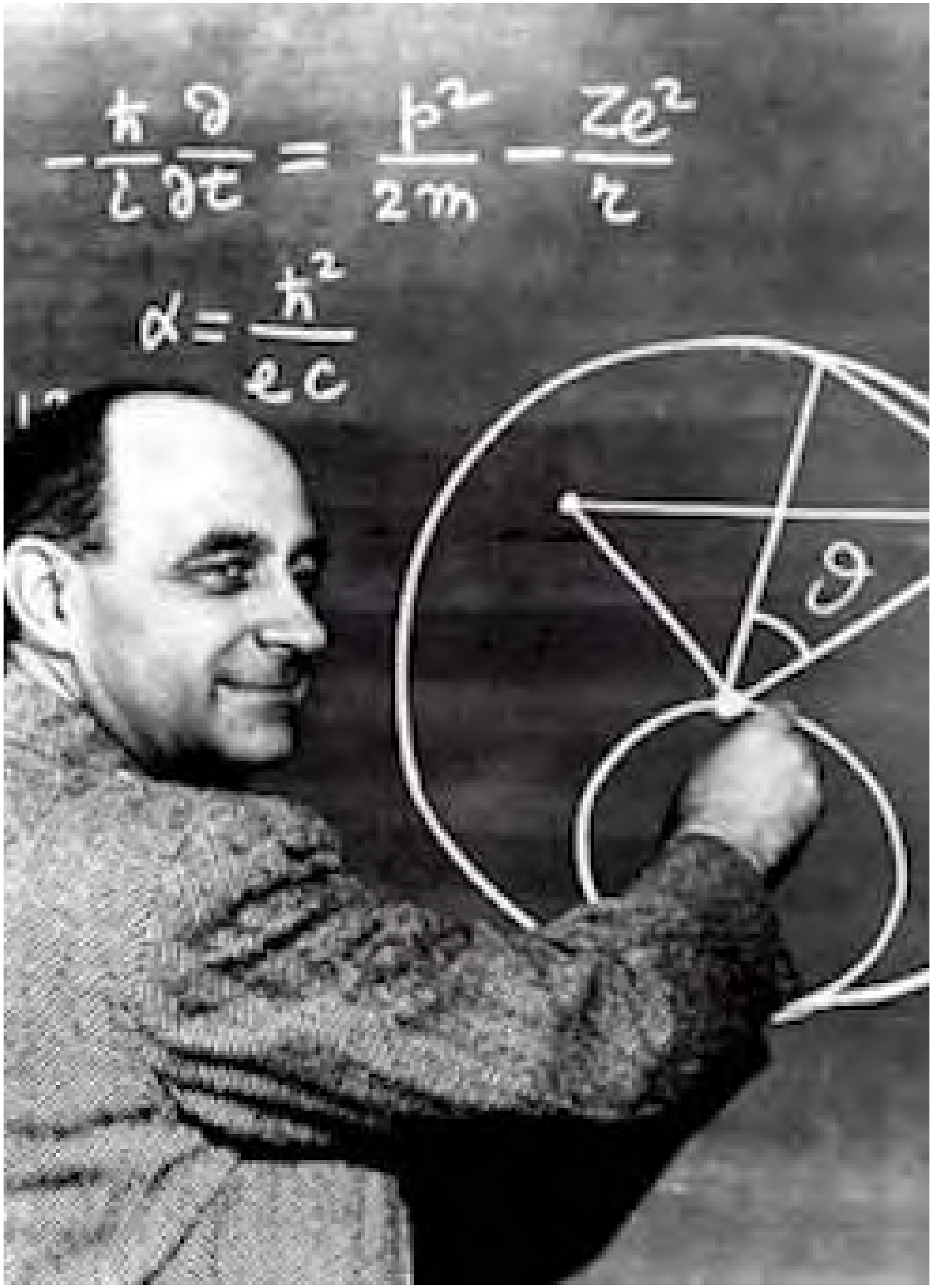

NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES
CHALLENGES
IDEAS
NEXT STEPS
COMMITTEE
GRAND CHALLENGES FOR ENGINEERING
Make solar energy economical
Provide energy from fusion
Develop carbon sequestration methods
Manage the nitrogen cycle
Provide access to clean water
Restore and improve urban 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

eScience: Sensor-driven (data-driven) science and engineering



Jim Gray

Transforming science (again!)



Theory

Experiment

Observation

Theory

Experiment

Observation


Theory
Experiment
Observation
[John Delaney, University of Washington]

Theory
Experiment
Observation
Computational Science

Theory

Experiment

Observation

Computational Science

eScience

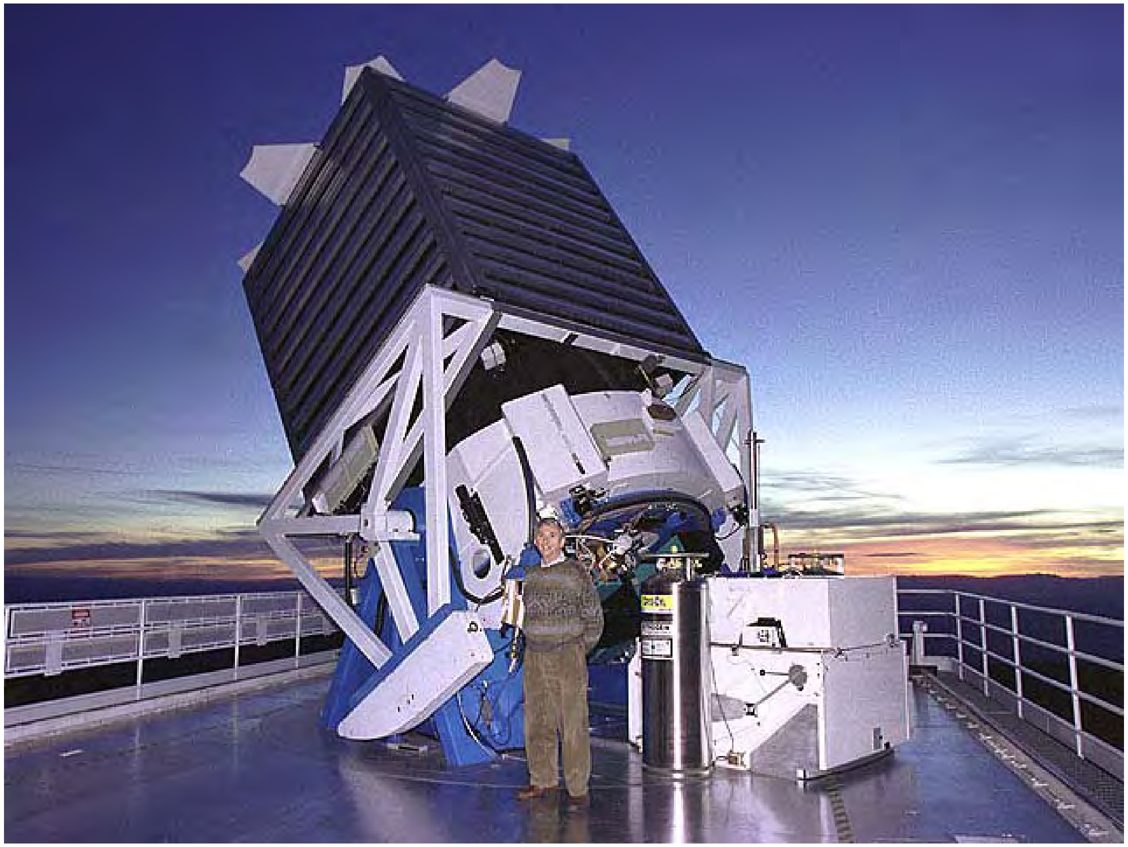
SLOAN DIGITAL SKY SURVEY

eScience is driven by *data* more than by cycles

- Massive volumes of data from sensors and networks of sensors

Apache Point telescope, SDSS

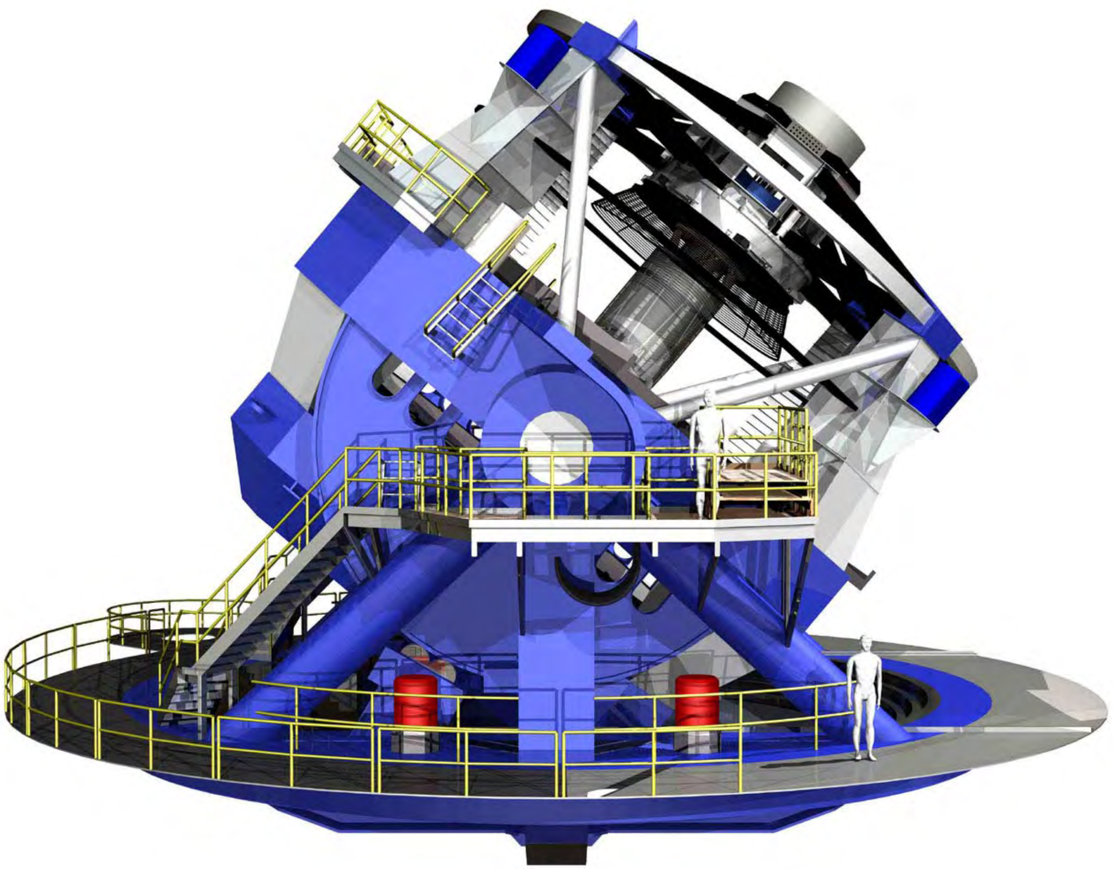
80TB of raw image data (80,000,000,000,000 bytes) over a 7 year period



Large Synoptic Survey Telescope (LSST)

40TB/day (an SDSS every two days), 100+PB in its 10-year lifetime

400mbps sustained data rate between Chile and NCSA



Large Hadron Collider

700MB of data per second, 60TB/day, 20PB/year

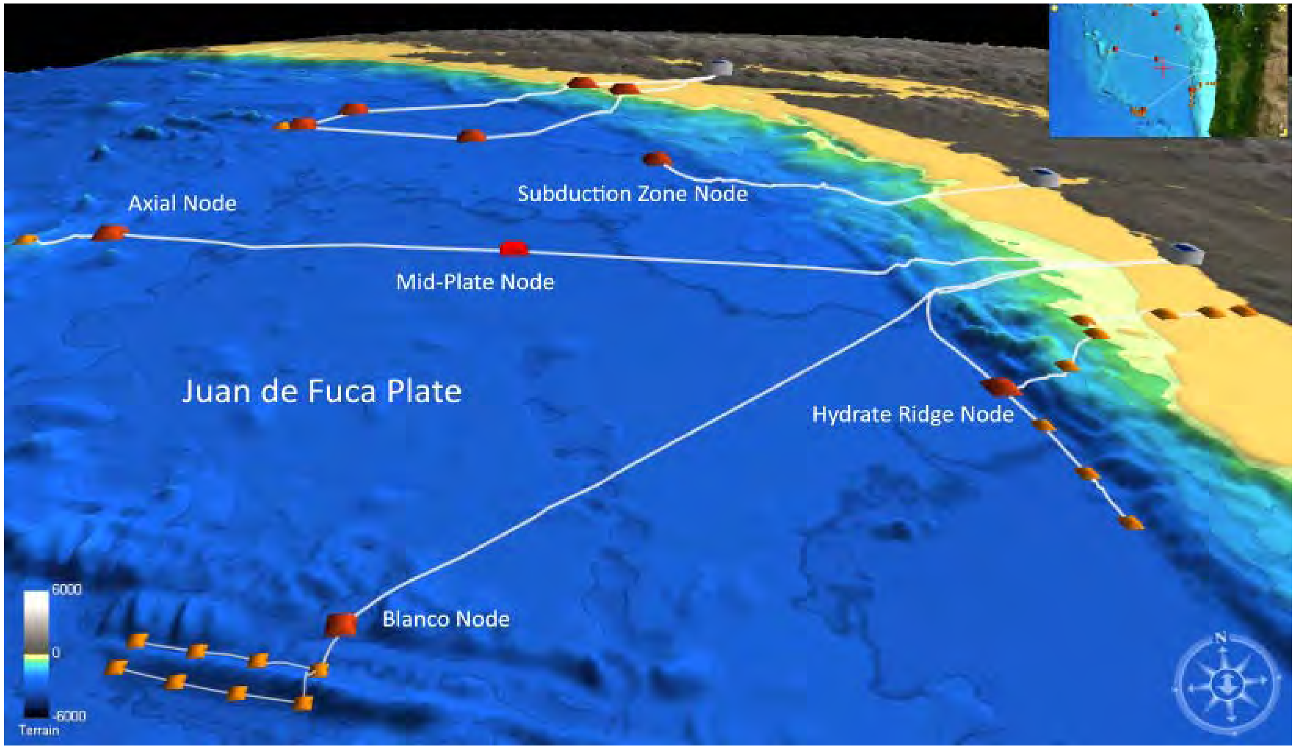
Illumina HiSeq 2000 Sequencer

~1TB/day

Major labs have 25-100 of these machines

Regional Scale Nodes of the NSF Ocean Observatories Initiative

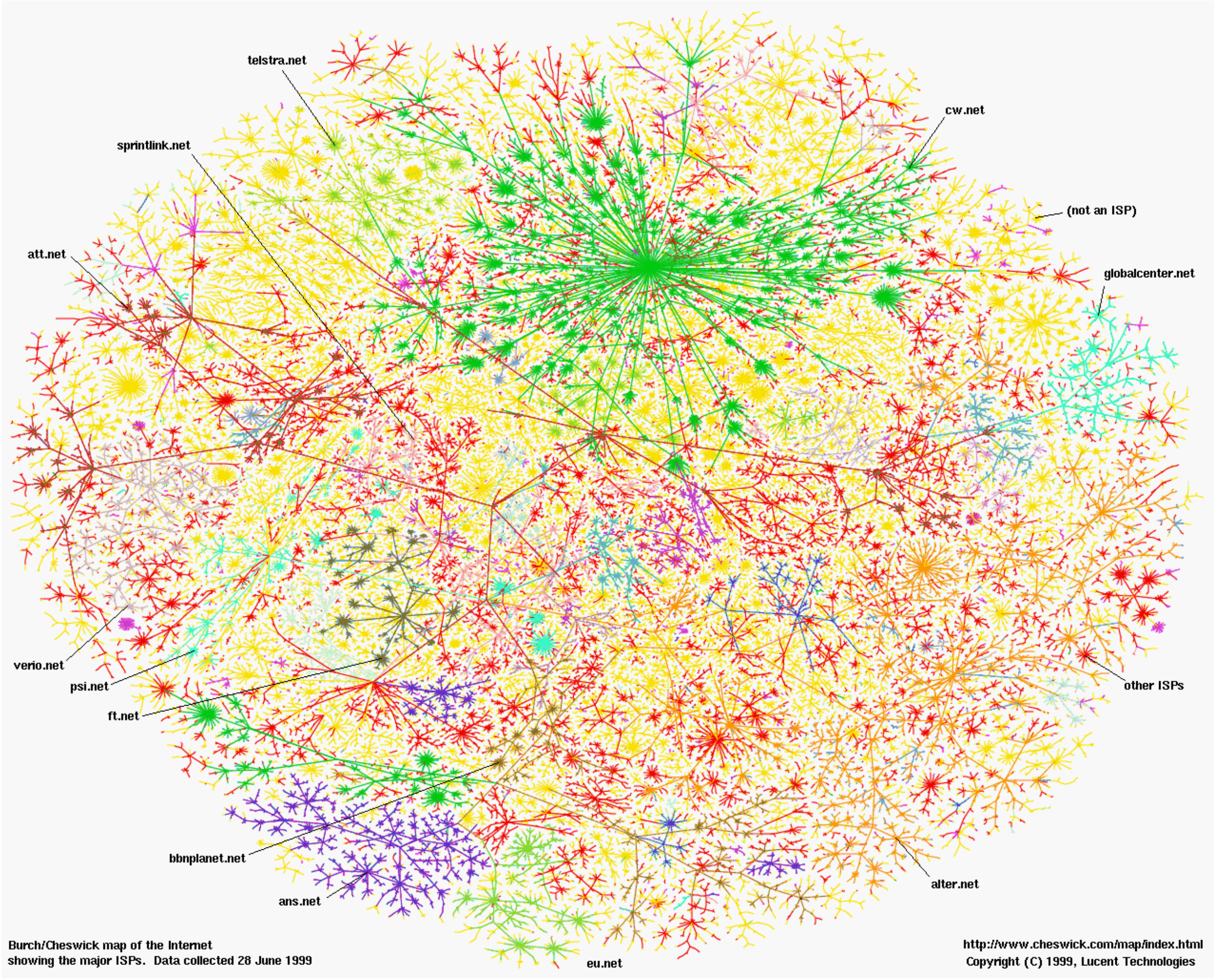
1000 km of fiber optic cable on the seafloor, connecting thousands of chemical, physical, and biological sensors



The Web

20+ billion web pages x 20KB = 400+TB

One computer can read 30-35 MB/sec from disk => 4 months just to read the web



Point-of-sale terminals

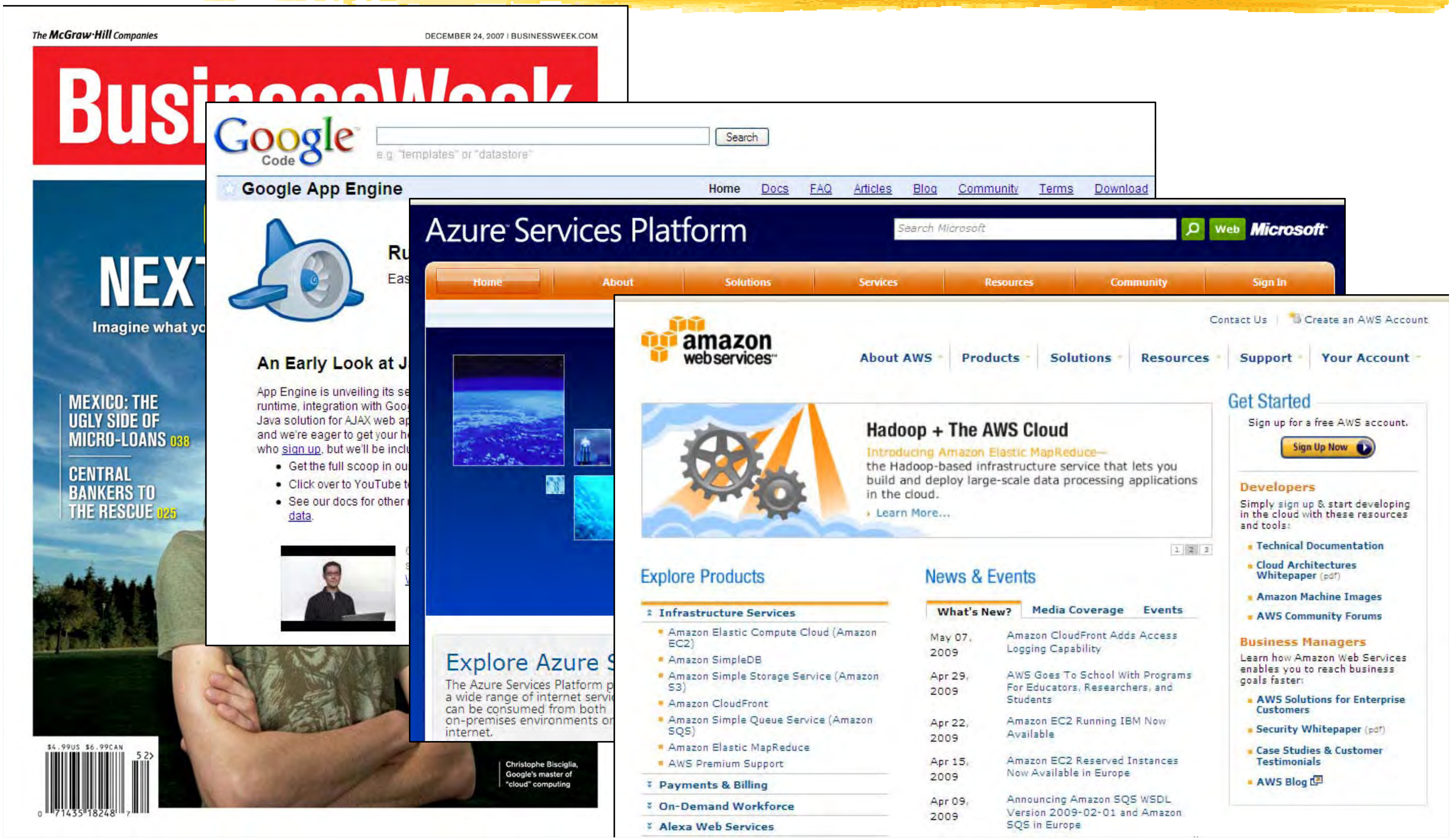
eScience is about the *analysis* of data

- The automated or semi-automated extraction of knowledge from massive volumes of data
  - There's simply too much of it to look at
- It's not just a matter of volume
  - Volume
  - Rate
  - Complexity / dimensionality

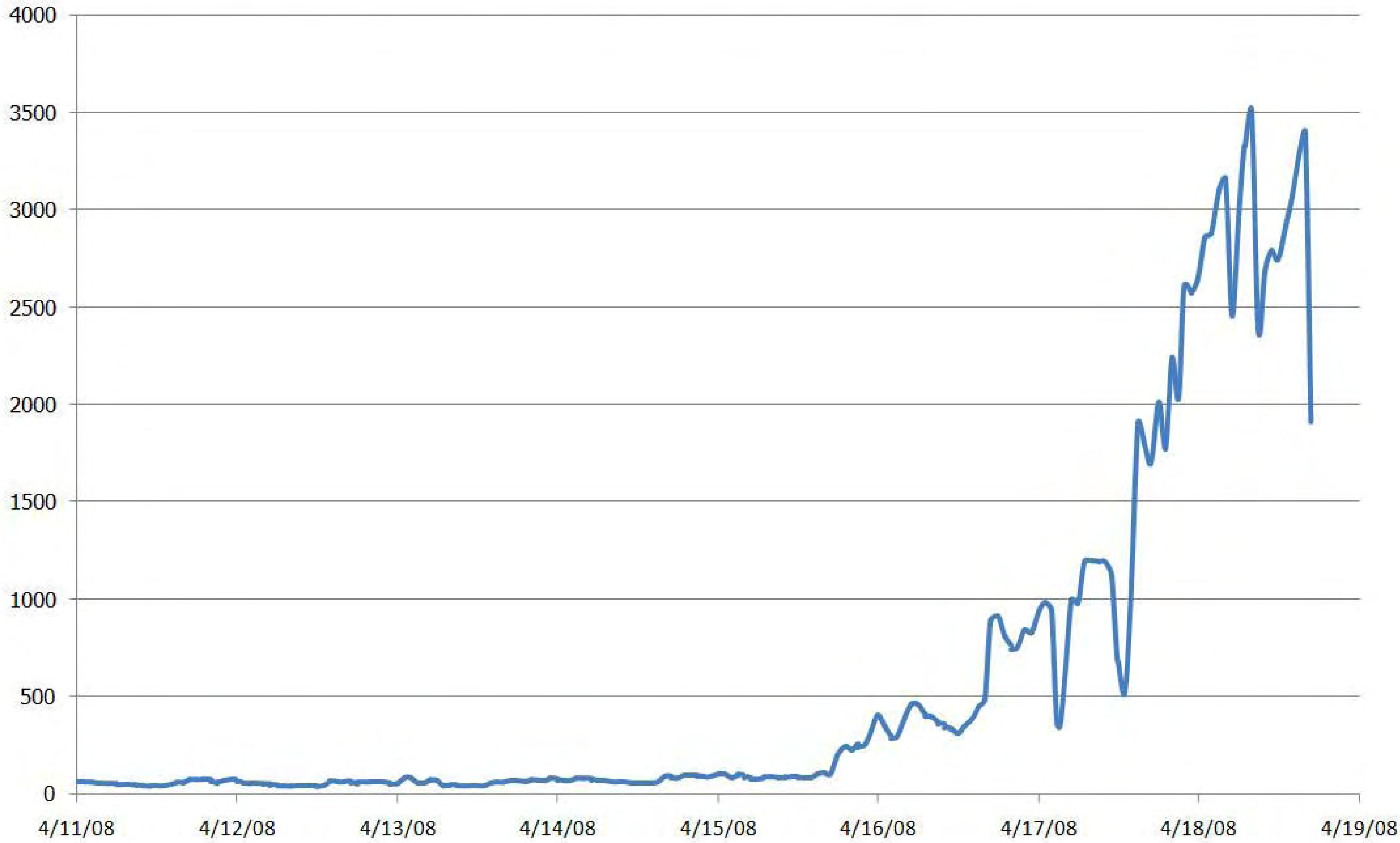
eScience utilizes a spectrum of computer science techniques and technologies

- Sensors and sensor networks
- Backbone networks
- Databases
- Data mining
- Machine learning
- Data visualization
- Cluster computing at enormous scale

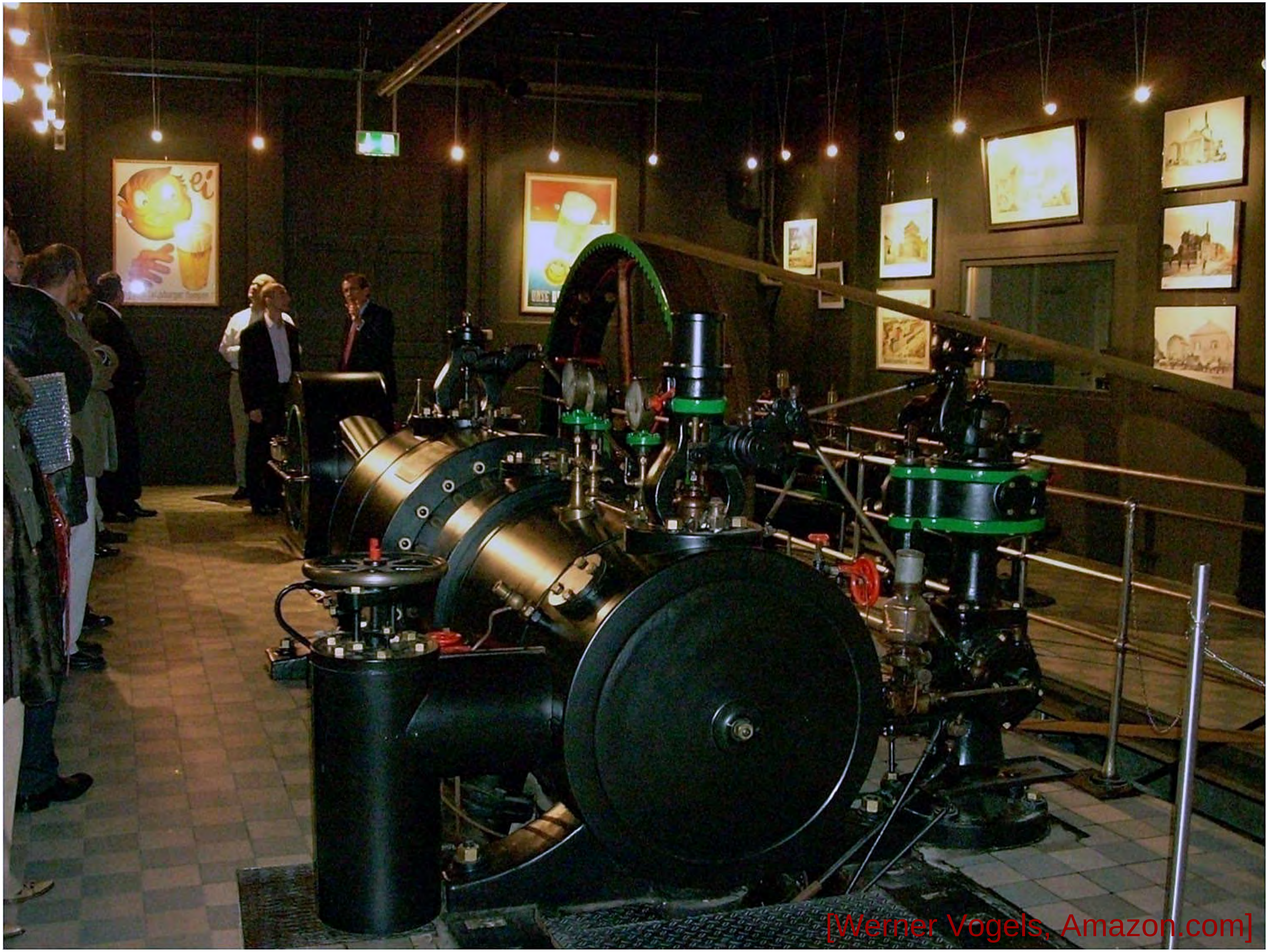
eScience is married to the cloud: Scalable computing and storage for everyone



Animoto: EC2 Instance Usage



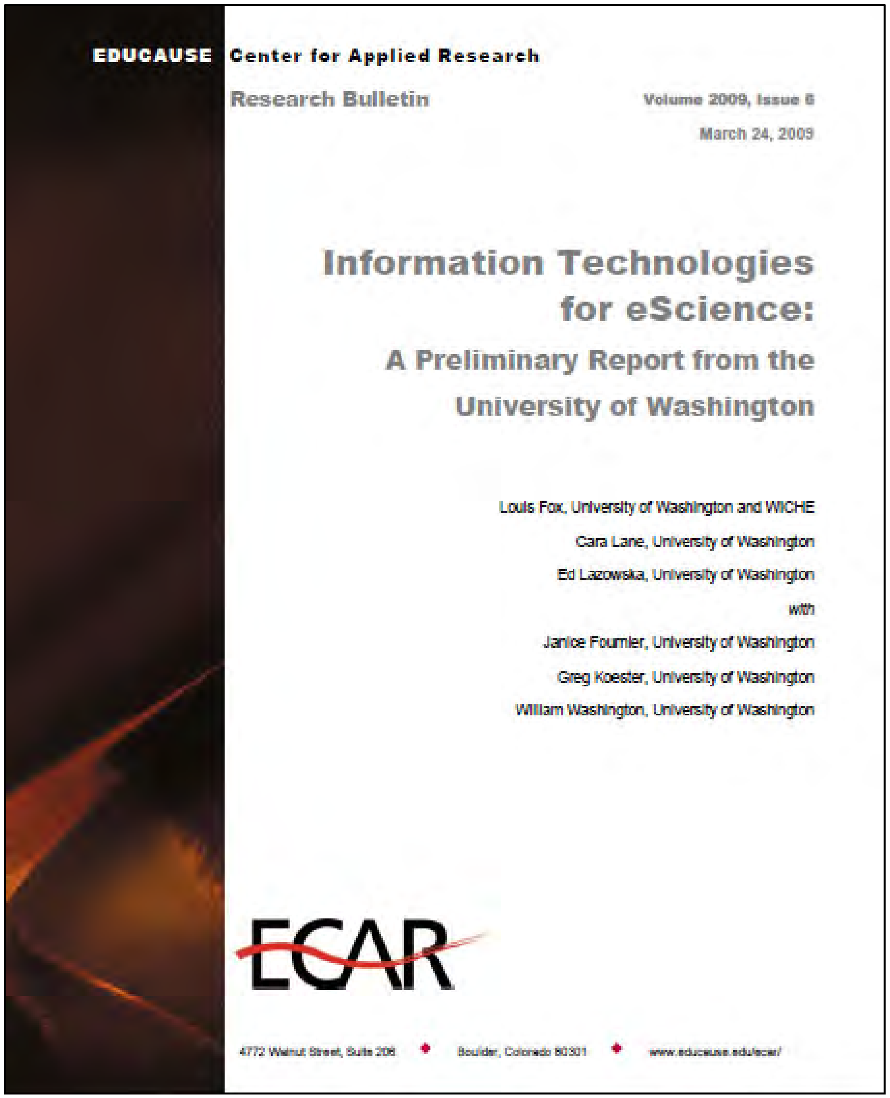
[Werner Vogels, Amazon.com]


[Werner Vogels, Amazon.com]

eScience will be pervasive

- Simulation-oriented computational science has been transformational, but it has been a niche
  - As an institution (e.g., a university), you didn't need to excel in order to be competitive
- eScience capabilities must be broadly available in any institution
  - If not, the institution will simply cease to be competitive

Top scientists across all fields grasp the implications of the looming data tsunami


EDUCAUSE Center for Applied Research

Research Bulletin

Volume 2009, Issue 6

March 24, 2009

Information Technologies for eScience:

A Preliminary Report from the University of Washington

Louis Fox, University of Washington and WICHE

Cara Lane, University of Washington

Ed Lazowska, University of Washington

with

Janice Fournier, University of Washington

Greg Koester, University of Washington

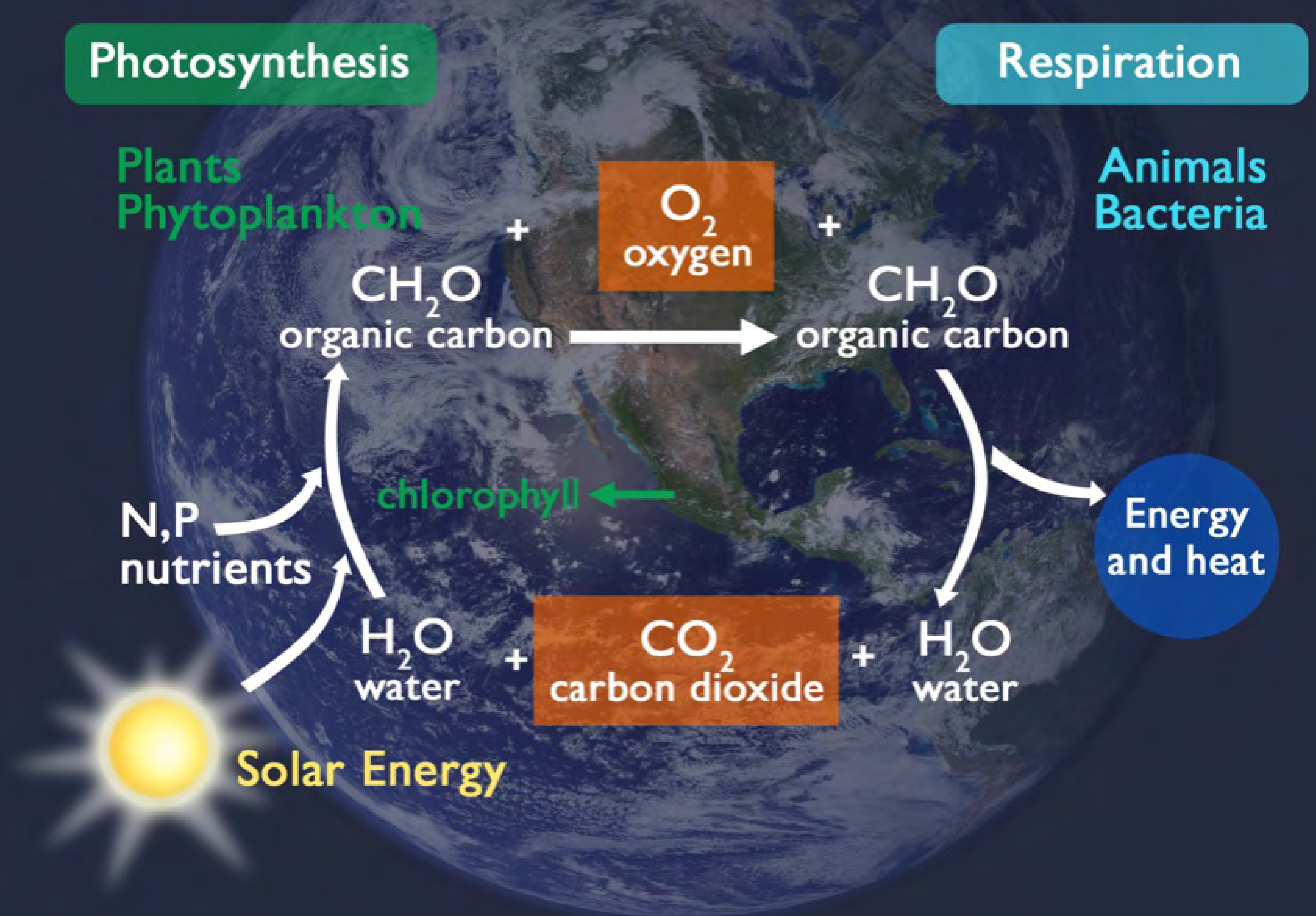
William Washington, University of Washington

ECAR

4772 Walnut Street, Suite 206 ♦ Boulder, Colorado 80301 ♦ www.educause.edu/ecar/

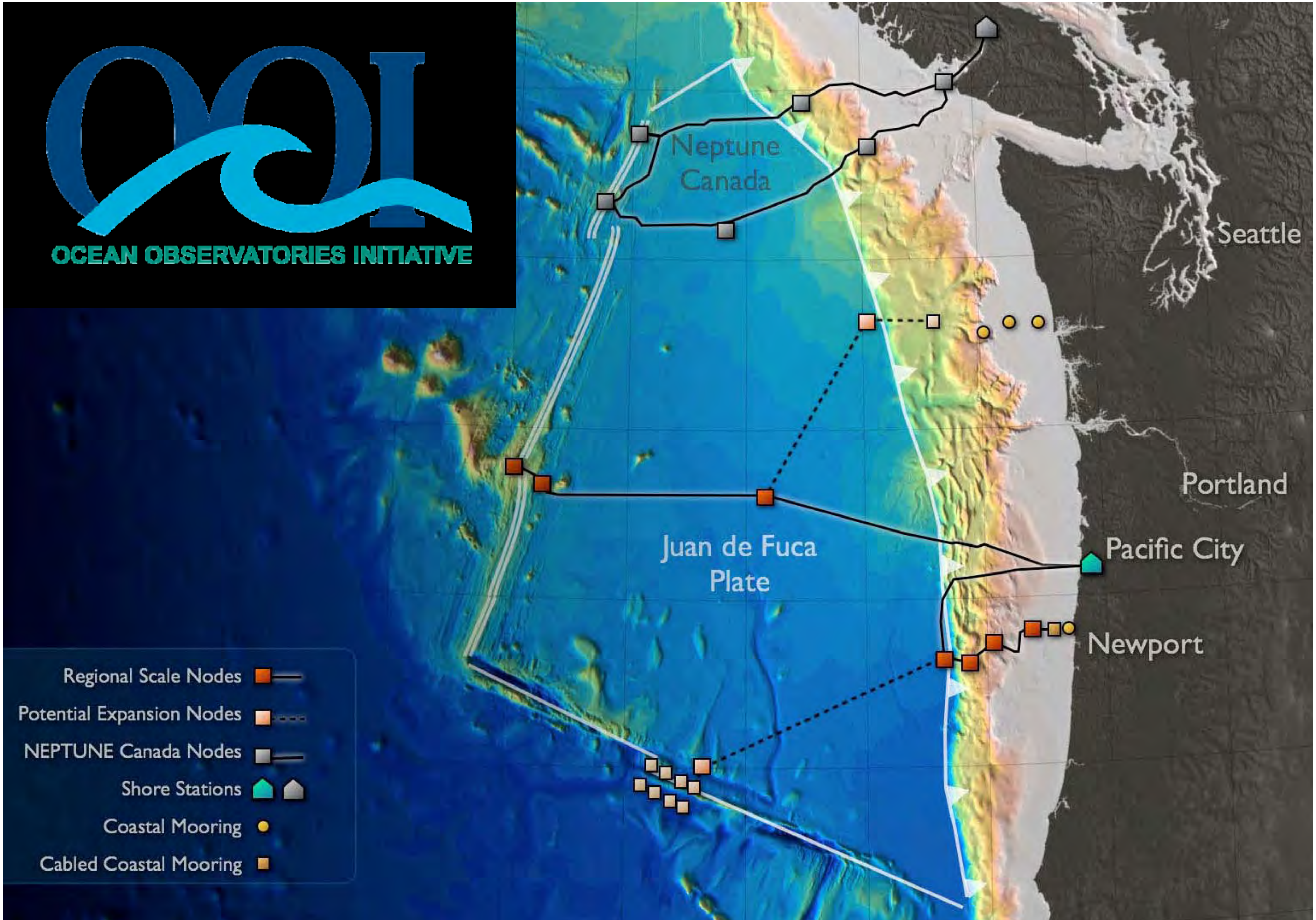
- Survey of 125 top investigators
  - "Data, data, data"
- Flat files and Excel are the most common data management tools
  - Great for Microsoft … lousy for science!
- Typical science workflow:
  - 2 years ago: 1/2 day/week
  - Now: 1 FTE
  - In 2 years: 10 FTE
- Need tools, tools, tools!

Life on Planet Earth



[John Delaney, University of Washington]


[John Delaney, University of Washington]



[John Delaney, University of Washington]

Human computation, and the wisdom of crowds

Luis von Ahn

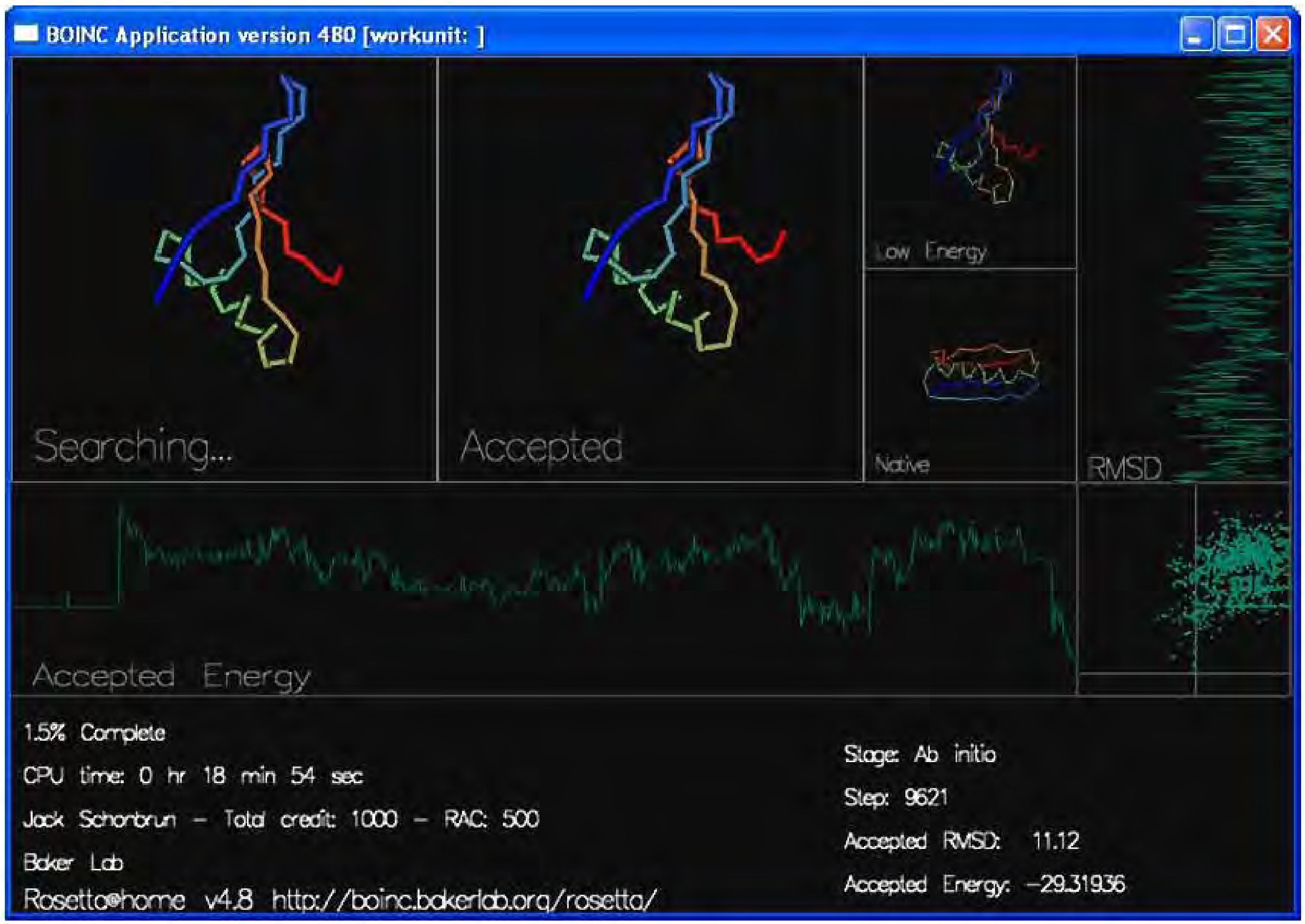
Hours per year, world-wide, spent playing computer solitaire: 9 billion

Hours spent building the Panama Canal: 20 million (less than a day of solitaire)

David Baker

Rosetta@home

Protein Folding, Design, and Docking



fold it BETA
02:59:51 GMT
Solve Puzzles for Science
BLOG GROUPS PLAYERS PUZZLES RECIPES FORUM WIKI FEEDBACK ABOUT
Click to learn how you contribute to science by playing Foldit.
GET STARTED: DOWNLOAD
Win Beta
Mac Beta
Linux Beta
Win XP/Vista
Intel OS X 10.4 or later
Linux
RECOMMEND FOLDIT
Send
USER LOGIN
Username: *
Password: *
Log in
Create new account
Request new password
Sign in using Facebook
Connect with Facebook
What's New
Small Update
We've posted a small update today, here's what's in it:
Some stability fixes, particularly with crashes when canceling recipes.
Improvements to scoring of sequence alignment. The scores of your existing alignments will change in the Sequence Alignment Tool due to this, but it won't affect your actual scores for the puzzles.

foldit BETA

20:46:49 GMT

Solve Puzzles for Science

BLOG GROUPS PLAYERS PUZZLE

BootsMcGraw

Global Soloist Rank: #6

Global Soloist Score: 3784

Cases

Profile

Name: BootsMcGraw

Location: Dallas, Texas USA

Started Folding: 12/06/08

About me: An educated redneck here, from Dallas, Texas.

When I was in grad school in 1985 at the State University of New York at Buffalo, my master's thesis was to construct and present a computer program that predicted the secondary structures (helix, sheet, loop) of proteins based on their amino acid sequences. Tertiary structure (i.e. folding) prediction was a pie-in-the-sky fantasy.

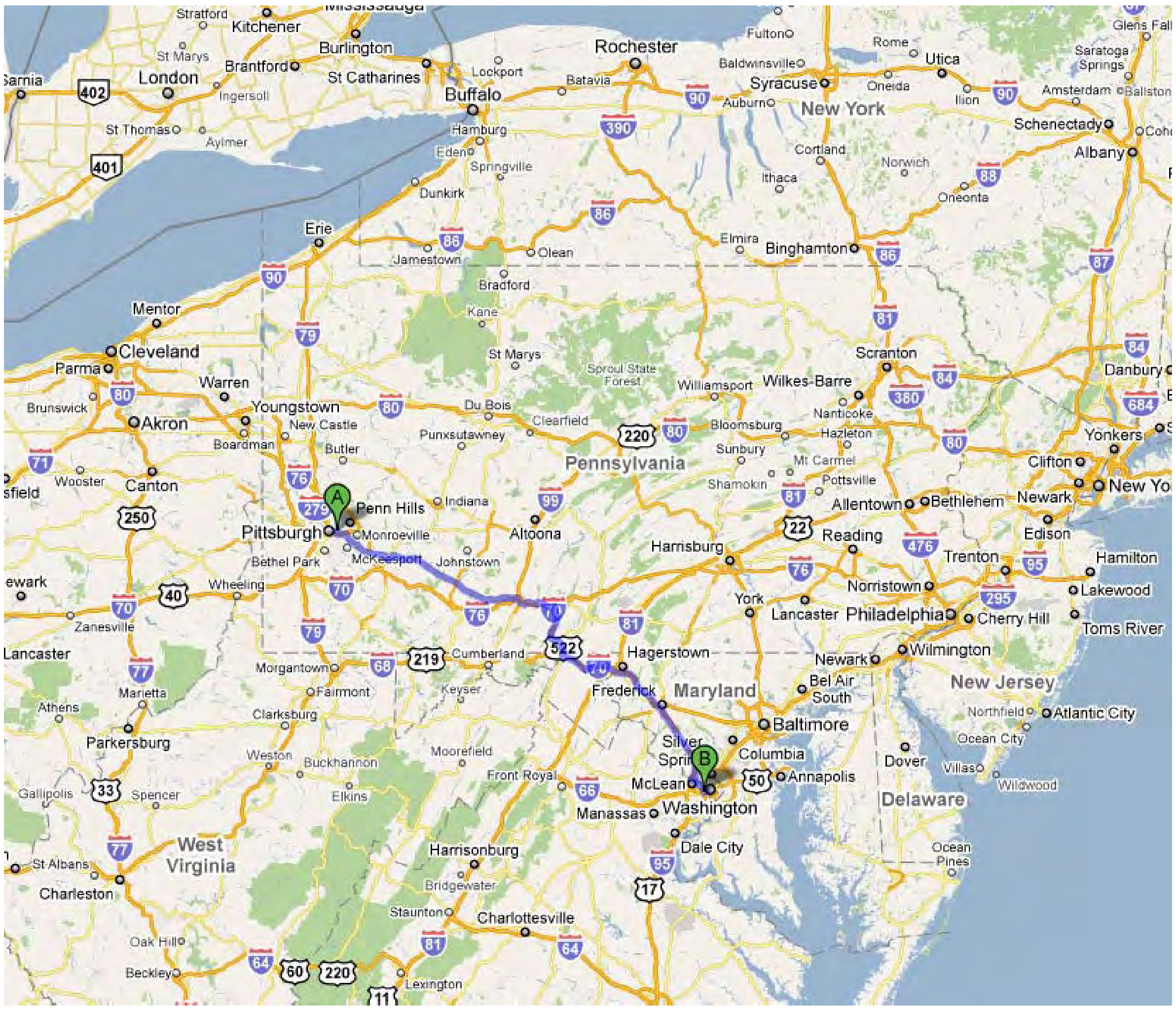
Imagine my delight, a quarter century later, to find out that not only are people determining tertiary structures of proteins, but they've made a *game* of it.

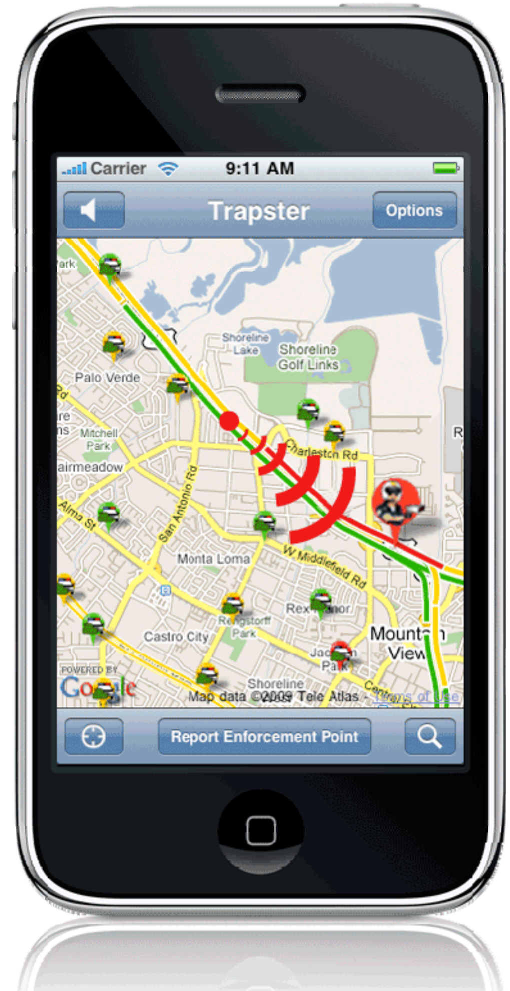
Hobbies: Licensed Massage Therapist; also a photographer, videographer, and webmaster. I have studied health and nutrition for over twenty years. Ask me my opinions about the subject.

Group: Contenders

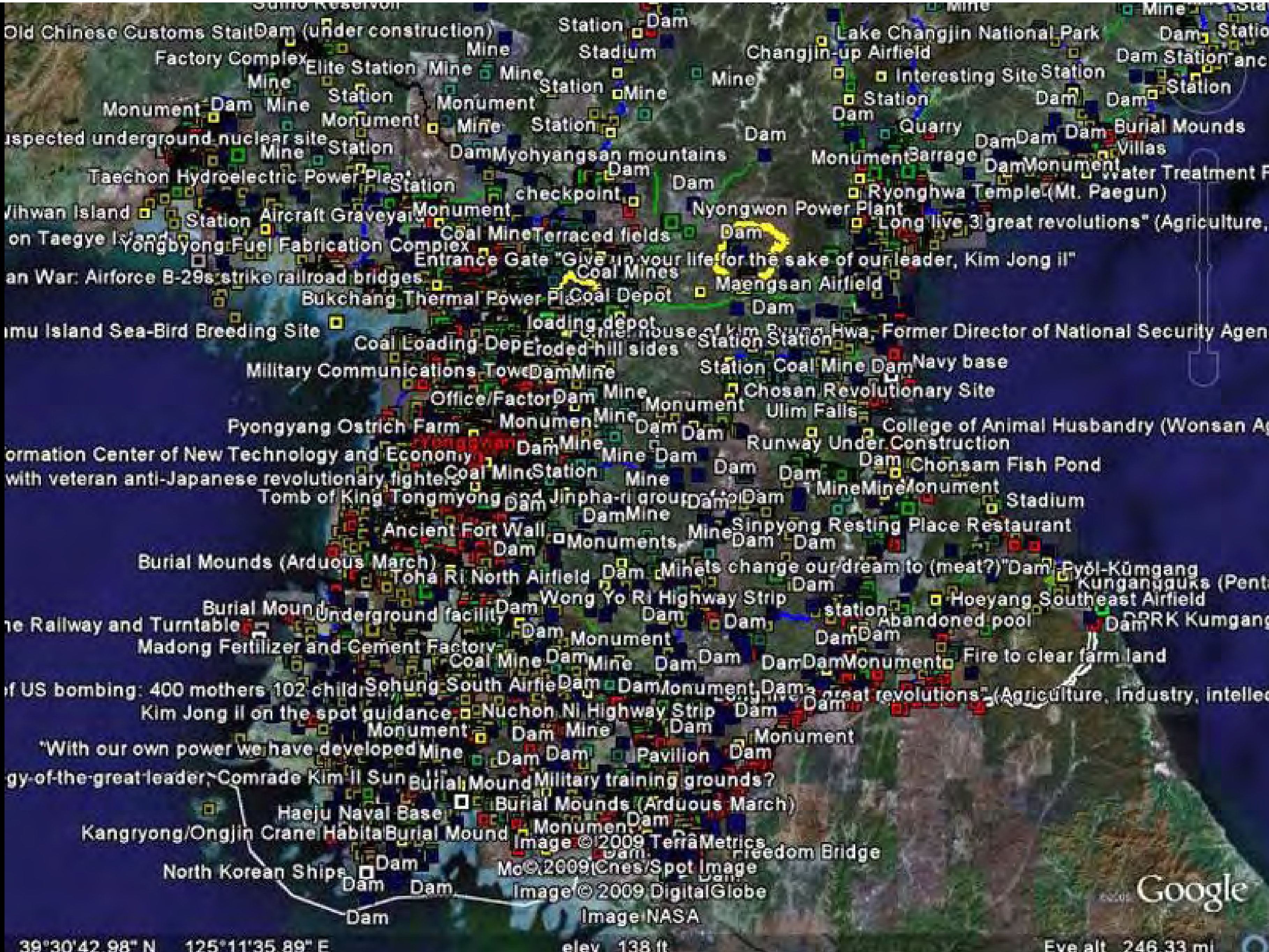
Regina Dugan

Peter Lee





[Peter Lee, DARPA]



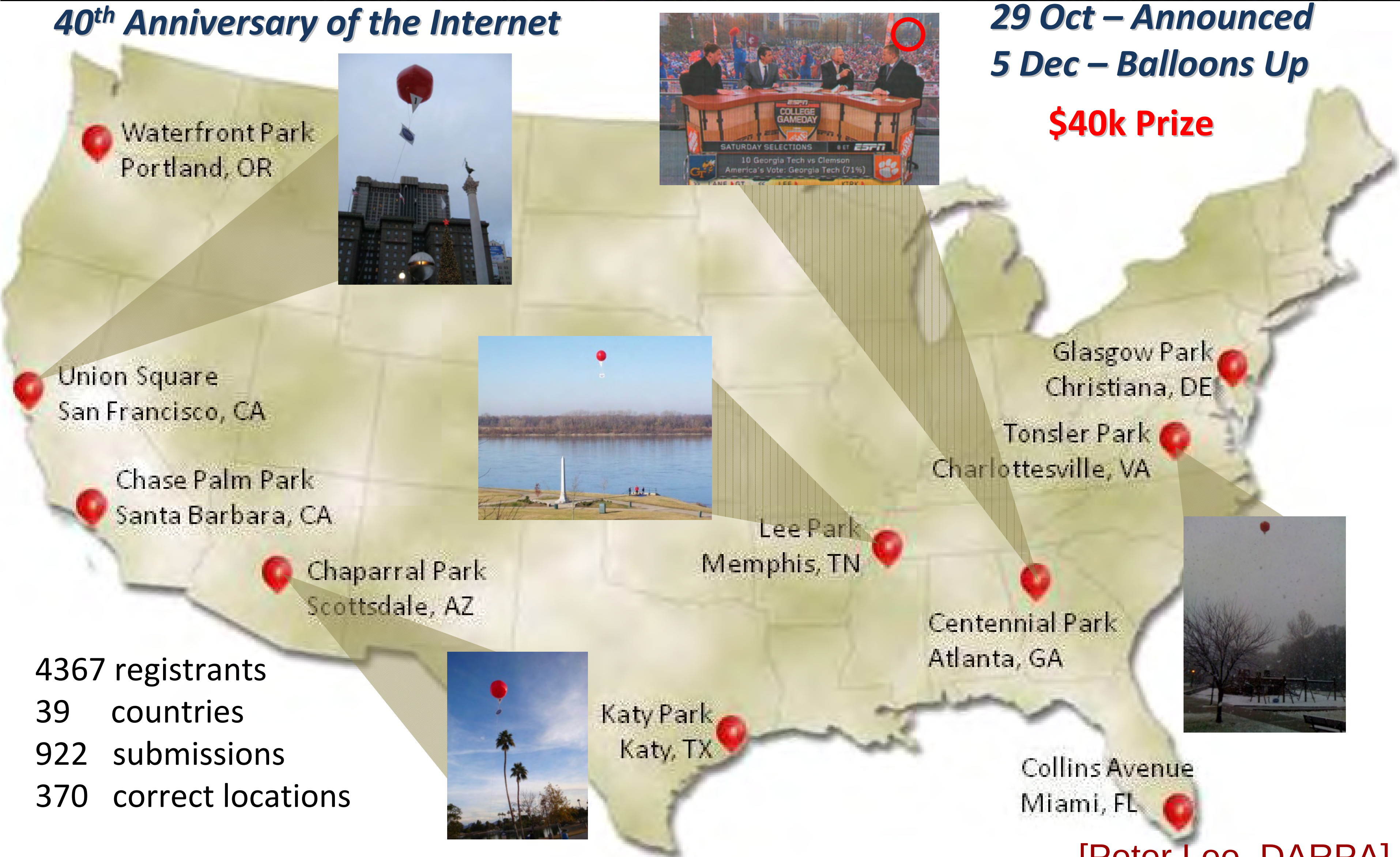
[Peter Lee, DARPA]

DARPA NETWORK CHALLENGE

40th Anniversary of the Internet

29 Oct – Announced
5 Dec – Balloons Up

$40k Prize



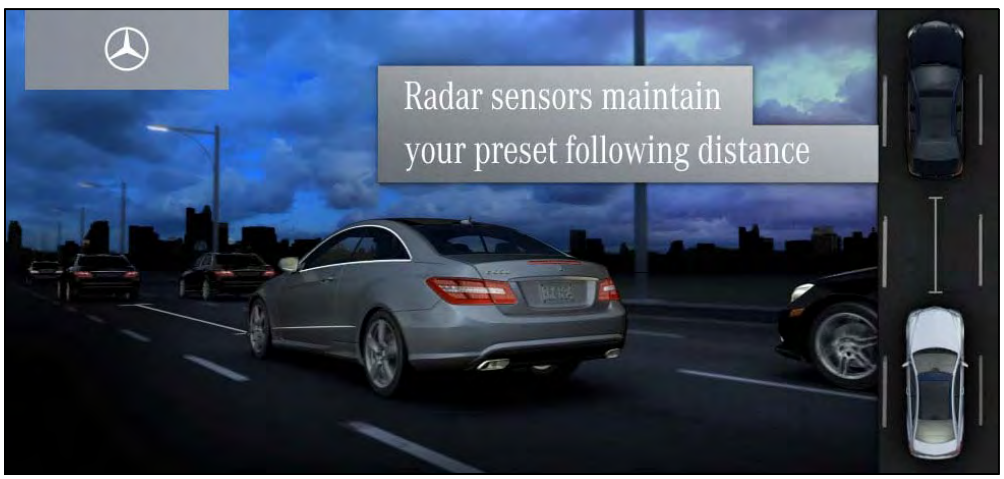
4367 registrants
39 countries
922 submissions
370 correct locations

[Peter Lee, DARPA]

Revolutionizing transportation

Lane departure warning

Self-parking



Adaptive cruise control

- In 2004, in just the United States:
  - 6,181,000 police-reported traffic accidents
    - 42,636 people killed
    - 2,788,000 people injured
    - 4,281,000 had property damage only
  - ~ $250 billion (that's *one quarter of a trillion dollars* …) in *annual* economic cost
    - 100 times greater than even an extravagant estimate of the nation's annual investment in computing research
  - 

ENDNOTES

1 Availability of E 350 BlueTEC and 4MATIC models is delayed. See dealer for details.

2 DISTRONIC PLUS adaptive cruise control is no substitute for active driving involvement. It does not react to stationary objects, nor recognize or predict the curvature and lane layout of the road or the movement of vehicles ahead. It is the driver's responsibility at all times to be attentive to traffic and road conditions, and to provide the steering, braking and other driving inputs necessary to retain control of the vehicle. Drivers are cautioned not to wait for the DISTRONIC Proximity Warning System before braking, as that may not afford sufficient time and distance to brake safely. After braking the car for stopped traffic ahead, system resumes automatically only if traffic pauses for less than 3 seconds.

3 Driving while drowsy or distracted is dangerous and should be avoided. ATTENTION ASSIST may be insufficient to alert a fatigued or distracted driver of lane drift and cannot be relied on to avoid an accident or serious injury.

4 PRE-SAFE® closes the side windows and sunroof when the system's sensors detect side movement that suggests a possible accident.

But there's more at stake than safety …

- Energy and the environment
  - Highway transportation uses 22% of all US energy
- Efficiency and productivity
  - Traffic congestion in the US is responsible for 3.6 billion vehicle hours of delay annually
- Equity
  - The elderly, and low-income individuals forced to the exurbs, are disadvantaged
- The economic and environmental costs of manufacturing automobiles

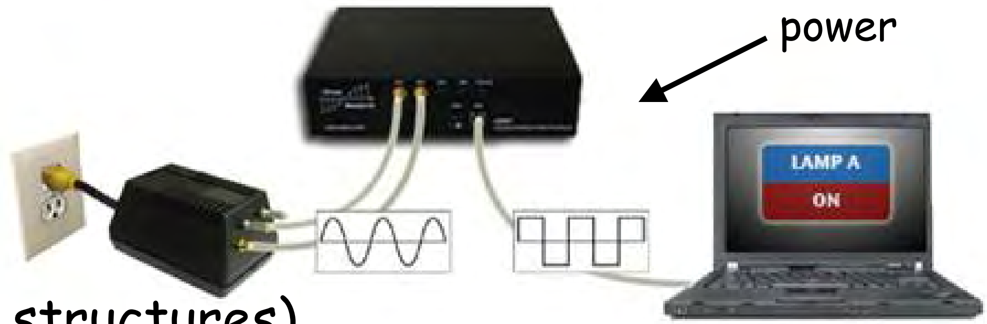
And computing research is central to the solutions

- Real-time sensor information for transit location
- Personalized, real-time information for choosing travel options
- Zipcar on steroids
- Routing around congestion, for transit and personal vehicles
- Greater vehicle density through semi-automated control

Transportation is one dimension of energy

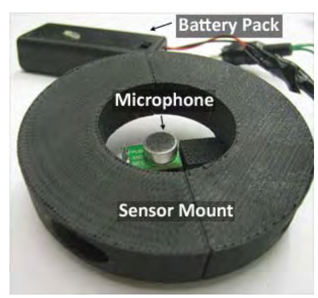
- The smart grid
  - Engineering
  - Control
  - Conservation (intelligent structures)
- IT as a substitute for energy-intensive goods and services
- IT as a tool for discovering and designing new energy sources
- Improved energy efficiency in computation

power



water

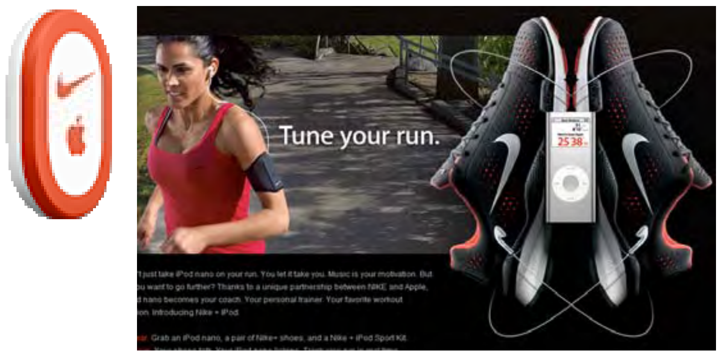
gas



[Shwetak Patel, UW]

Health: Personalized health monitoring

Omron pedometer



Nike + iPod

Bodymedia multi-function

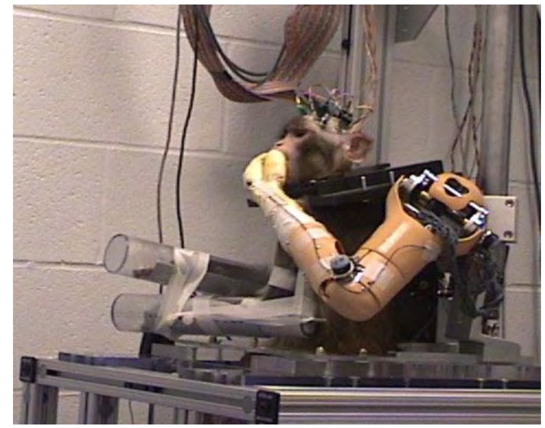
Biozoom: body fat, hydration, blood oxygen, etc.

Glucowatch: measuring body chemistry

Health: Evidence-based medicine

- Machine learning for clinical care
- Predictive models
- Cognitive assistance for physicians

Health: Neurobotics



[Yoky Matsuoka and Raj Rao, UW]

Health: P4 medicine

INSTITUTE FOR
Systems
Biology

ICTD: Empowering the developing world

*3 billion people in the **rural developing world***
need the same <u>information</u> we do

- ✔ <u>Business</u>: new opportunities
- ✔ <u>Finance</u>: capital to invest
- ✔ <u>Government</u>: services & programs
- ✔ <u>Health</u>: informed, consistent care
- ✔ <u>Education</u>: personal advancement




[Tapan Parikh, UW and UC Berkeley]

3 billion people in the rural ***developing world***
have different <u>limitations</u> and <u>capabilities</u>

- ✗ <u>Money</u>: to buy technology
- ✗ <u>Education</u>: to use technology
- ✗ <u>Infrastructure</u>: power, connectivity
- ✔ <u>Time</u>: lots of available labor
- ✔ <u>Community</u>: lots of relations




[Tapan Parikh, UW and UC Berkeley]

CAM: Managing Information from the Grassroots

Information systems are key to scaling microfinance

- *Transaction processing*
- *Monitor members and groups*
- *Analyse performance and impact*
- *Offer more services*
- *Link to formal institutions*

Can we design a UI to document member-level SHG transactions?

- *Accurate and efficient*
- *Accessible to a variety of users*

[Tapan Parikh, UW and UC Berkeley]

[Tapan Parikh, UW and UC Berkeley]

open-data-kit

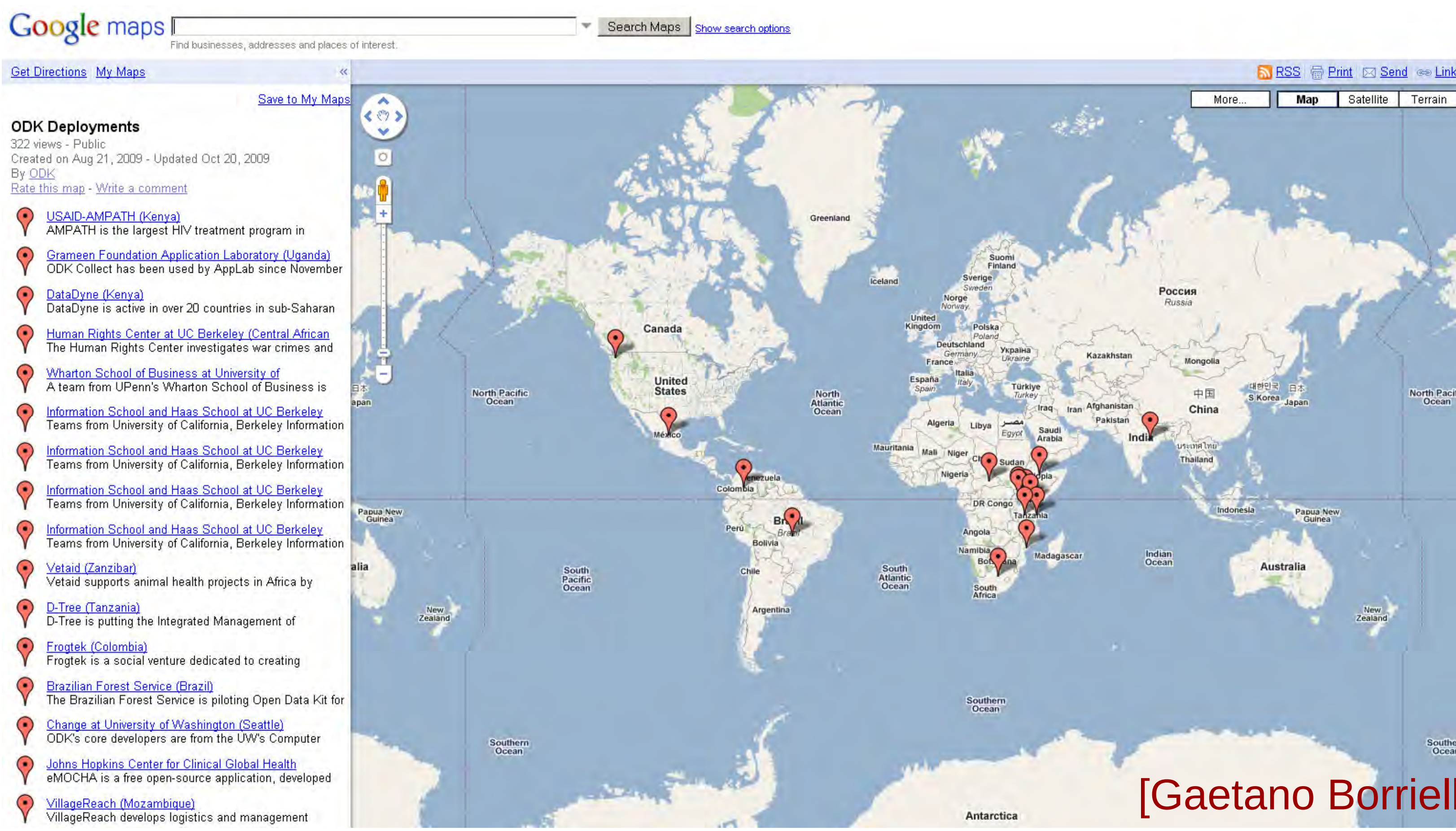
Open Data Kit is a suite of tools to help organizations collect, aggregate and visualize their data.

Project Home | **Downloads** | **Wiki** | **Issues** | **Source**

Summary | Updates | People

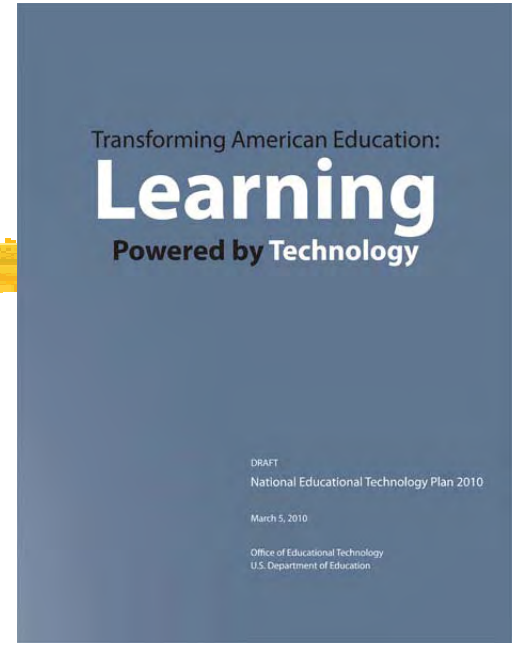
Welcome to ODK

Open Data Kit (ODK) is a suite of tools to help organizations collect, aggregate and visualize their data. Our goals are to make open-source and standards-based tools which are easy to try, easy to use, easy to modify and easy to scale. To this end, we are proud members of the OpenMobile Consortium, the OpenRosa Consortium, and active participants in the JavaRosa project.



[Gaetano Borriello, UW]

Personalized education


Transforming American Education:

Learning

Powered by Technology

DRAFT

National Educational Technology Plan 2010

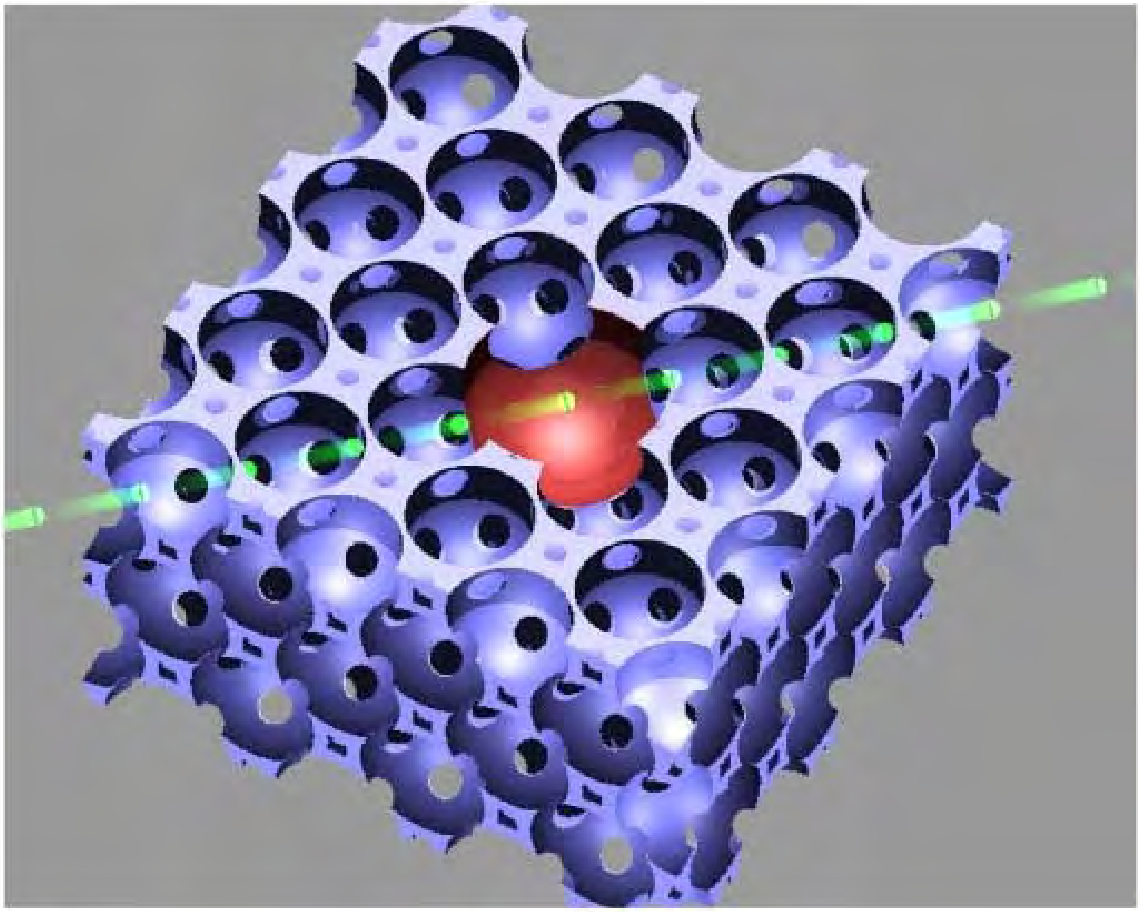
March 5, 2010

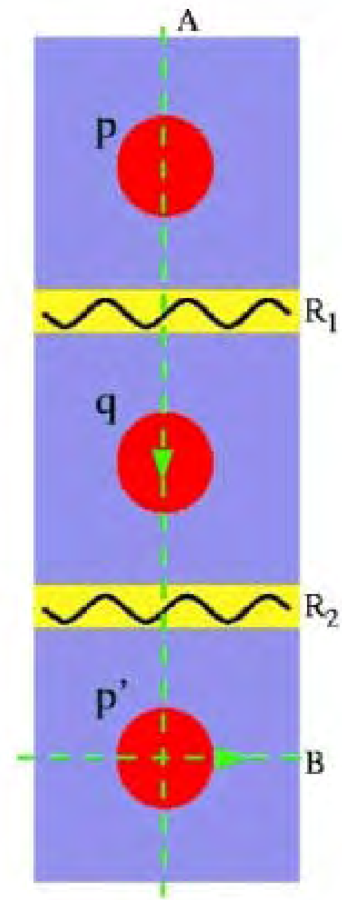
Office of Educational Technology
U.S. Department of Education

Security and privacy

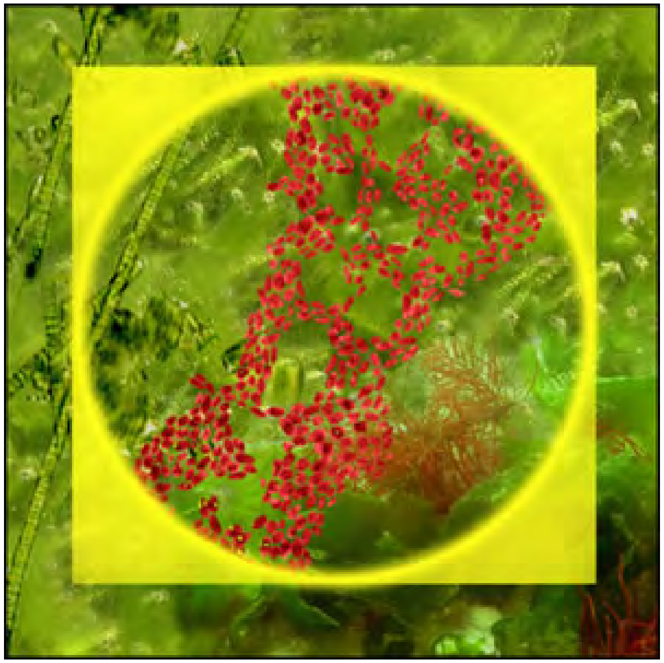
[Yoshi Kohno, UW]

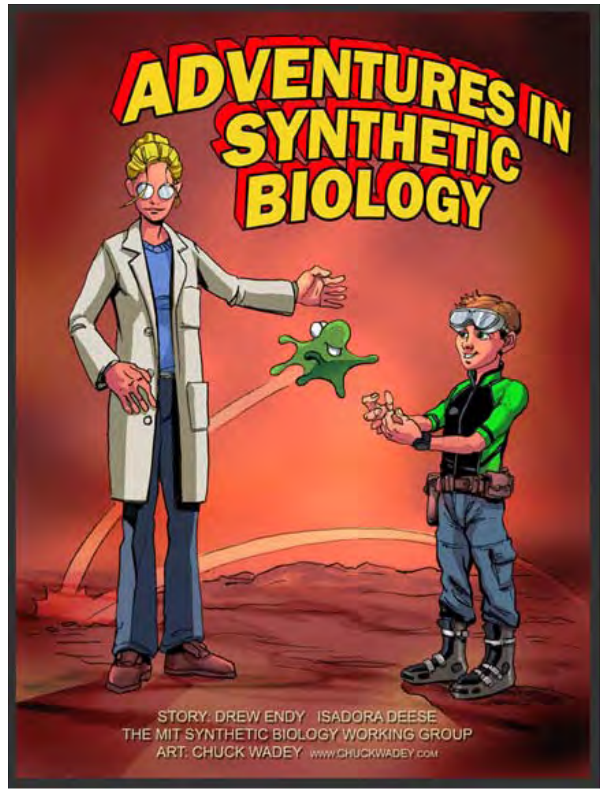
Quantum computing

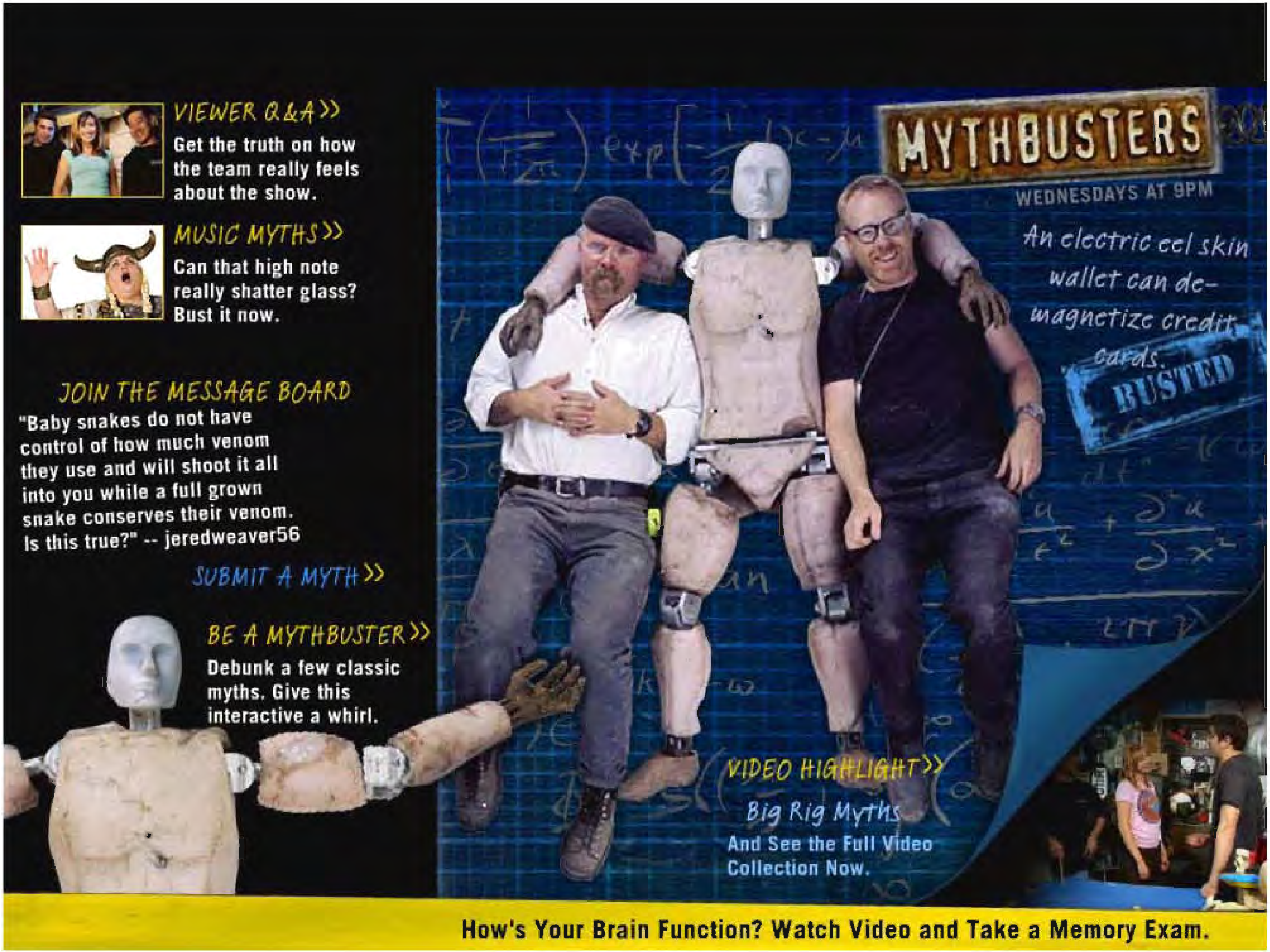




Synthetic biology / molecular engineering






VIEWER Q&A >>
Get the truth on how the team really feels about the show.
MUSIC MYTHS >>
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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
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Debunk a few classic myths. Give this interactive a whirl.
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BUSTED
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Big Rig Myths
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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

We put the “smarts” in …

- Smart homes
- Smart cars
- Smart bodies
- Smart robots
- Smart science (confronting the data tsunami)
- Smart crowds and human-computer systems
- Smart interaction (virtual and augmented reality)

Xconomy
Business + Technology in the Exponential Economy

Is this a great time, or what?!?!

http://lazowska.cs.washington.edu/penn.pdf
http://www.cra.org/ccc/
http://www.cs.washington.edu/WhyCSE/