THE COMPUTING COMMUNITY CONSORTIUM: CATALYZING AND ENABLING COMPUTING RESEARCH

Gregory Hager
Chair
Johns Hopkins

Beth Mynatt
Vice Chair
Georgia Tech

Ann Drobnis
Director

CCC
Computing Community Consortium
Catalyst

THE COMPUTING COMMUNITY CONSORTIUM

- Established in 2006 as a standing committee of the Computing Research Association
- Funded by NSF under a Cooperative Agreement
  - Second Award began in 2012, recently completed Reverse Site Visit
- Facilitates the development of a bold, multi-themed vision for computing research – and communicates this vision to stakeholders
- Led by a broad-based Council
- Staffed by CRA

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THE CCC COUNCIL








- Terms ending June 2017
  - Lorenzo Alvisi, UT Austin
  - Vasant Honavar, Penn State
  - Jennifer Rexford, Princeton
  - Debra Richardson, UC Irvine
  - Klara Nahrstedt, UIUC
  - Ben Zorn, Microsoft Research
- Terms ending June 2016
  - Randy Bryant, CMU**
  - Limor Fix, formerly Intel
  - Tal Rabin, IBM
  - Daniela Rus, MIT
  - Ross Whitaker, Univ. Utah
- Terms ending June 2015
  - Sue Davidson, Univ. Pennsylvania
  - Joe Evans, Univ. Kansas
  - Ran Libeskind-Hadas, Harvey Mudd College
  - Shashi Shekhar, Univ. Minnesota







** 1 year leave

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THE CCC COUNCIL – EXECUTIVE COMMITTEE

- Greg Hager, Johns Hopkins Univ. (Chair)
- Beth Mynatt, Georgia Tech (Vice Chair)
- Susan Graham, UC Berkeley (Past Chair)
- Bob Sproull, formerly Sun Labs Oracle
- Liz Bradley, University of Colorado, Boulder
- Mark Hill, University of Wisconsin, Madison
- Ann Drobnis, Director
- Andy Bernat, CRA Executive Director

* Executive Committee
** 1 year leave

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OUR MISSION

- Catalyze new ideas and communicate the excitement of computing research
- Align and articulate our contributions to other fields and to national priorities
- Groom future leadership to help shape science policy

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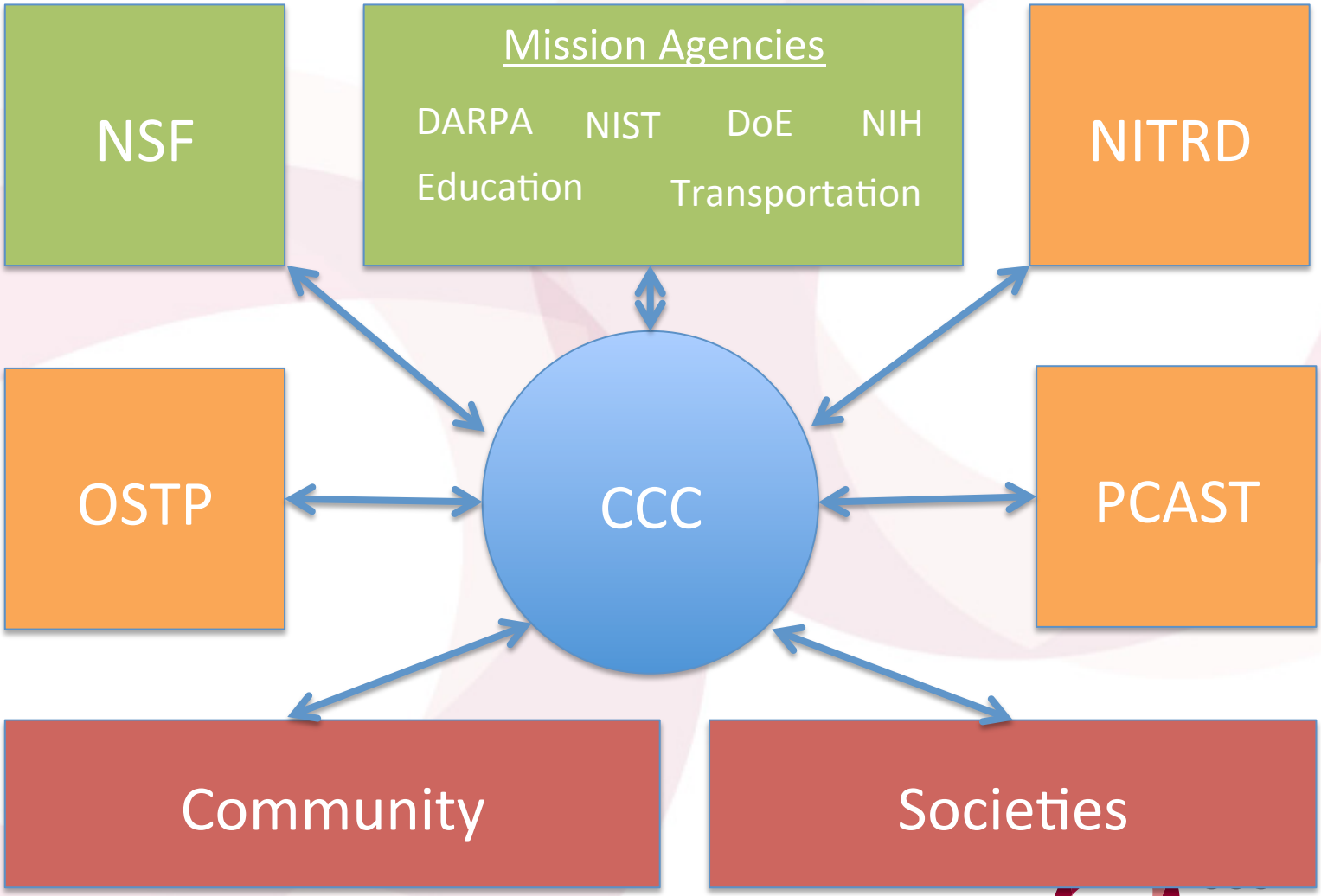
CCC AND ITS STAKEHOLDERS



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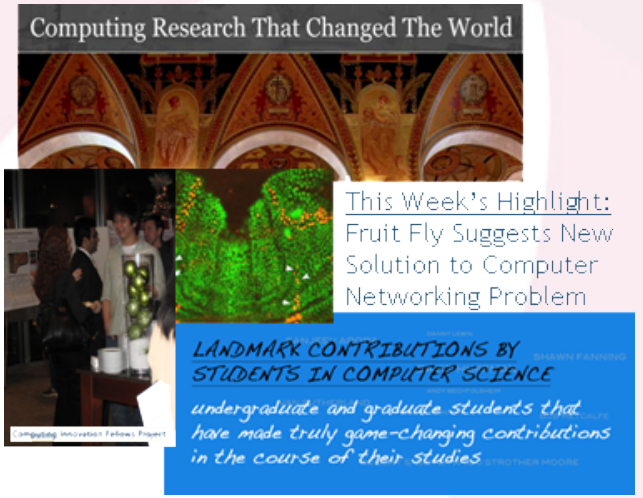
HOW DO WE DO IT?

- **Community-initiated visioning:**
  - Workshops to discuss “out-of-the-box” ideas
  - Blue Sky Ideas tracks at conferences
- **Outreach to White House, funding agencies:**
  - Outputs of visioning activities
  - Short reports to inform policy makers
  - Task Forces – Health IT, Sustainability IT, Data Analytics



- **Communicating CS Research:**
  - CCC Blog [http://cccblog.org/]
  - Computing Research in Action Video Series
  - Research “Highlight of the Week”
  - “The Impact of NITRD” symposium
- **Nurturing the next generation of leaders:**
  - Computing Innovation Fellows Project
  - Leadership in Science Policy Institute

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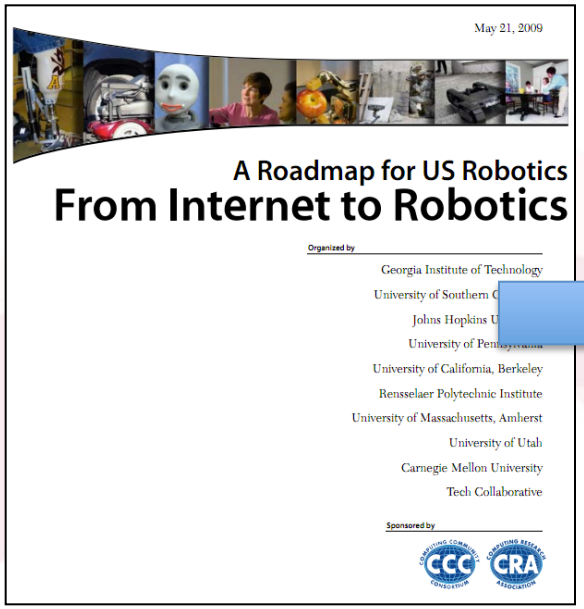
CATALYZING AND ENABLING: ROBOTICS

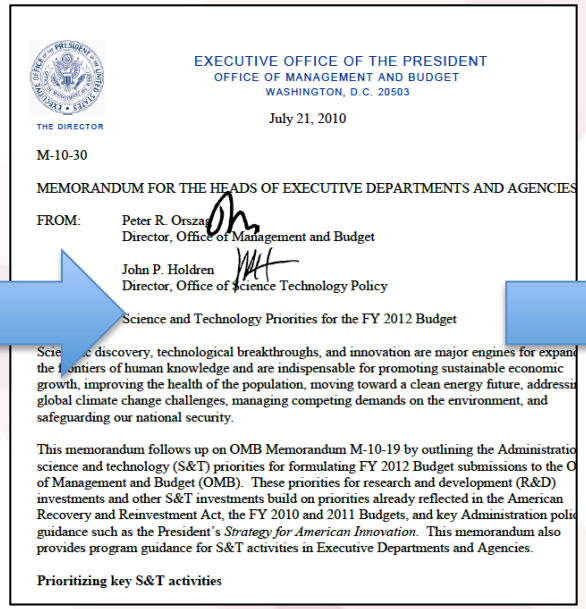

May 21, 2009

A Roadmap for US Robotics
From Internet to Robotics

Organized by

Georgia Institute of Technology
University of Southern C
Johns Hopkins U
University of Pennsylvania
University of California, Berkeley
Rensselaer Polytechnic Institute
University of Massachusetts, Amherst
University of Utah
Carnegie Mellon University
Tech Collaborative

Sponsored by


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

THE DIRECTOR

July 21, 2010

M-10-30

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 Technology Policy

Science and Technology Priorities for the FY 2012 Budget

Scie discovery, technological breakthroughs, and innovation are major engines for expand 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, addressi 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 Administratio science and technology (S&T) priorities for formulating FY 2012 Budget submissions to the O 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 poli 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


Office of Science and Technology Po

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Developing the Next Generation of Robots

Posted by Tom Kalil and Sridhar Kota on June 24, 2011 at 10:14 AM EDT

E- Tweet Share +

ch at Carnegie Mellon University, President Obama is launching the Advance esearch initiative that will promote a renaissance of American manufacturing.

One ex ting element of the President's Advanced Manufacturing Partnership is the National R Robots are working for us every day, in countless ways. At home, at work, and on the battlefie increasingly lifting the burdens of tasks that are dull, dirty, or dangerous.

But they could do even more, and that's what the National Robotics Initiative is all about. So t (the National Science Foundation, the National Institutes of Health, NASA, and the United Sta Agriculture) are issuing a joint solicitation that will provide up to $70 million in research fundin generation robotics.

The focus of this initiative is on developing robots that work with or beside people to extend o capabilities, taking advantage of the different strengths of humans and robots. In addition to i technology needed for next-generation robotics, the initiative will support applications such a

4 meetings during summer 2008

Roadmap published May 2009

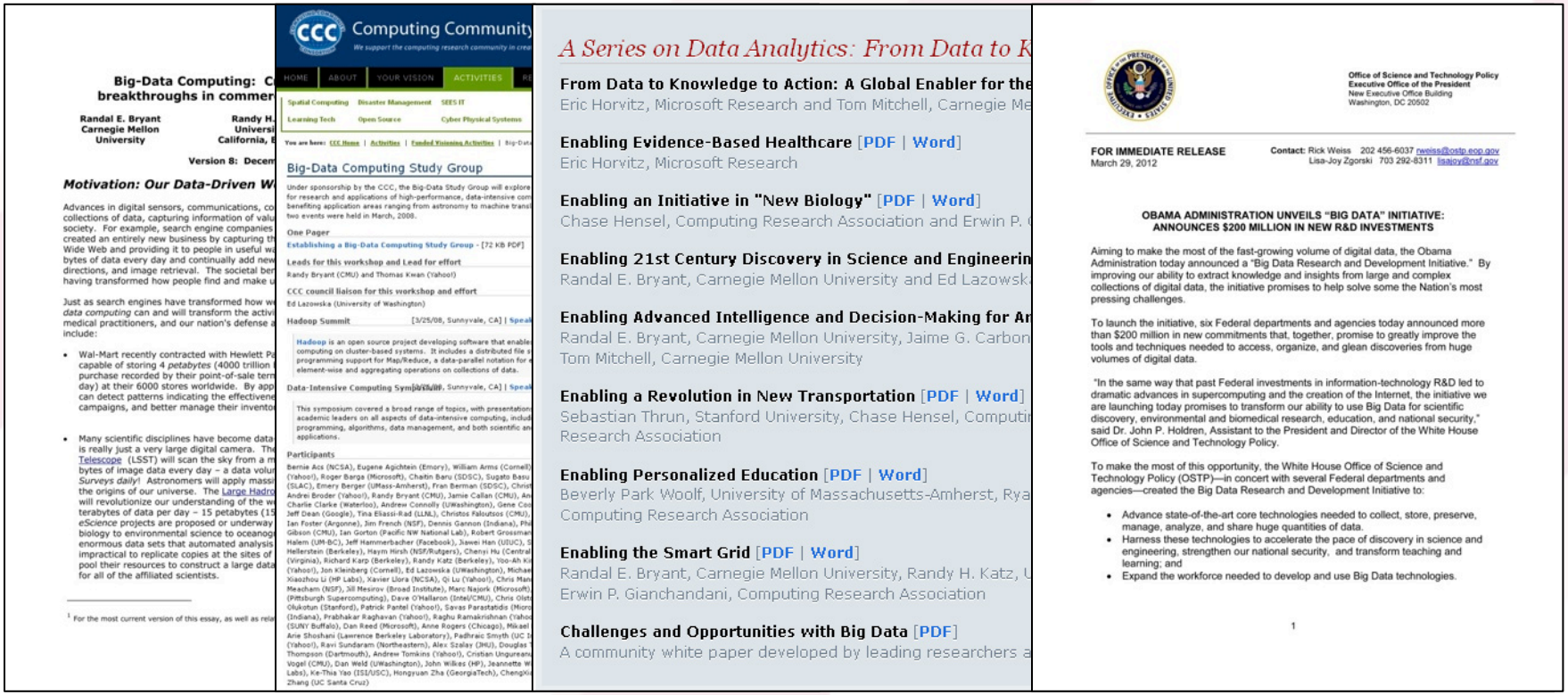
Extensive discussions between visioning leaders & agencies

OSTP issues directive to all agencies in summer 2010 to include robotics in FY 12 budgets

National Robotics Initiative announced in summer 2011

Henrik Chistensen
Georgia Tech

CATALYZING AND ENABLING: BIG DATA



Big-Data Computing: C
breakthroughs in commer

Randal E. Bryant
Carnegie Mellon University

Randy H.
Universi
California,

Version 8: Decem

Motivation: Our Data-Driven W

Advances in digital sensors, communications, co
collections of data, capturing information of valu
society. For example, search engine companies
created an entirely new business by capturing th
Wide Web and providing it to people in useful w
bytes of data every day and continually add new
directions, and image retrieval. The societal ben
having transformed how people find and make u

Just as search engines have transformed how w
data computing can and will transform the activ
medical practitioners, and our nation's defense
include:

- Wal-Mart recently contracted with Hewlett P
capable of storing 4 *petabytes* (4000 trillion
purchase recorded by their point-of-sale term
day) at their 6000 stores worldwide. By app
can detect patterns indicating the effectiveness
campaigns, and better manage their inventor

- Many scientific disciplines have become data-
is really just a very large digital camera. The
Telescope (LSST) will scan the sky from a m
bytes of image data every day – a data volu
Surveys daily! Astronomers will apply massi
the origins of our universe. The Large Hadro
will revolutionize our understanding of the w
terabytes of data per day - 15 petabytes (15
eScience projects are proposed or underway
biology to environmental science to oceanog
enormous data sets that automated analysis
impractical to replicate copies at the sites of
pool their resources to construct a large data
for all of the affiliated scientists.

[1] For the most current version of this essay, as well as rela

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We support the computing research community in creat

HOME | ABOUT | YOUR VISION | ACTIVITIES | RE

Spatial Computing | Disaster Management | SEES IT
Learning Tech | Open Source | Cyber Physical Systems

You are here: CCC Home | Activities | Funded Visioning Activities | Big-Data

Big-Data Computing Study Group

Under sponsorship by the CCC, the Big-Data Study Group will explore
for research and applications of high-performance, data-intensive com
benefiting application areas ranging from astronomy to machine transl
two events were held in March, 2008.

One Pager

Establishing a Big-Data Computing Study Group - [72 KB PDF]

Leads for this workshop and Lead for effort

Randy Bryant (CMU) and Thomas Kwan (Yahoo!)

CCC council liaison for this workshop and effort

Ed Lazowska (University of Washington)

Hadoop Summit [3/25/08, Sunnyvale, CA] | Speak

Hadoop is an open source project developing software that enables
computing on cluster-based systems. It includes a distributed file s
programming support for Map/Reduce, a data-parallel notation for
element-wise and aggregating operations on collections of data.

Data-Intensive Computing Symposium [3/26/08, Sunnyvale, CA] | Speak

This symposium covered a broad range of topics, with presentation
academic leaders on all aspects of data-intensive computing, includ
programming, algorithms, data management, and both scientific an
applications.

Participants

Bernie Acs (NCSA), Eugene Agichtein (Emory), William Arms (Cornell)
(Yahoo!), Roger Barga (Microsoft), Chaitin Baru (SDSC), Sugato Basu
(SLAC), Emery Berger (UMass-Amherst), Fran Berman (SDSC), Christ
Andrei Broder (Yahoo!), Randy Bryant (CMU), Jamie Callan (CMU), An
Charlie Clarke (Waterloo), Andrew Connolly (UWashington), Gene Coo
Jeff Dean (Google), Tina Eliassi-Rad (LLNL), Christos Faloutsos (CMU),
Ian Foster (Argonne), Jim French (NSF), Dennis Gannon (Indiana), Phi
Gibson (CMU), Ian Gorton (Pacific NW National Lab), Robert Grossman
Halem (UM-BC), Jeff Hammerbacher (Facebook), Jiawei Han (UIUC), S
Hellerstein (Berkeley), Haym Hirsh (NSF/Rutgers), Chenyi Hu (Central
(Virginia), Richard Karp (Berkeley), Randy Katz (Berkeley), Yoo-Ah Ki
(Yahoo!), Jon Kleinberg (Cornell), Ed Lazowska (UWashington), Michae
Xiaozhou Li (HP Labs), Xavier Llora (NCSA), Qi Lu (Yahoo!), Chris Man
Meacham (NSF), Jill Mesirov (Broad Institute), Marc Najork (Microsoft),
(Pittsburgh Supercomputing), Dave O'Hallaron (Intel/CMU), Chris Olst
Olukotun (Stanford), Patrick Pantel (Yahoo!), Savas Parastatidis (Micro
(Indiana), Prabhakar Raghavan (Yahoo!), Raghu Ramakrishnan (Yahoo
(SUNY Buffalo), Dan Reed (Microsoft), Anne Rogers (Chicago), Mikael
Arie Shoshani (Lawrence Berkeley Laboratory), Padhraic Smyth (UC I
(Yahoo!), Ravi Sundaram (Northeastern), Alex Szalay (JHU), Douglas T
Thompson (Dartmouth), Andrew Tomkins (Yahoo!), Cristian Ungureanu
Vogel (CMU), Dan Weld (UWashington), John Wilkes (HP), Jeannette W
Labs), Ke-Thia Yao (ISI/USC), Hongyuan Zha (GeorgiaTech), ChengXi
Zhang (UC Santa Cruz)

A Series on Data Analytics: From Data to K

From Data to Knowledge to Action: A Global Enabler for the
Eric Horvitz, Microsoft Research and Tom Mitchell, Carnegie Me

Enabling Evidence-Based Healthcare [PDF | Word]
Eric Horvitz, Microsoft Research

Enabling an Initiative in "New Biology" [PDF | Word]
Chase Hensel, Computing Research Association and Erwin P.

Enabling 21st Century Discovery in Science and Engineerin
Randal E. Bryant, Carnegie Mellon University and Ed Lazowsk

Enabling Advanced Intelligence and Decision-Making for Ar
Randal E. Bryant, Carnegie Mellon University, Jaime G. Carbon
Tom Mitchell, Carnegie Mellon University

Enabling a Revolution in New Transportation [PDF | Word]
Sebastian Thrun, Stanford University, Chase Hensel, Computi
Research Association

Enabling Personalized Education [PDF | Word]
Beverly Park Woolf, University of Massachusetts-Amherst, Rya
Computing Research Association

Enabling the Smart Grid [PDF | Word]
Randal E. Bryant, Carnegie Mellon University, Randy H. Katz, U
Erwin P. Gianchandani, Computing Research Association

Challenges and Opportunities with Big Data [PDF]
A community white paper developed by leading researchers a

Office of Science and Technology Policy
Executive Office of the President
New Executive Office Building
Washington, DC 20502

FOR IMMEDIATE RELEASE
March 29, 2012

Contact: Rick Weiss 202 456-6037 rweiss@ostp.eop.gov
Lisa-Joy Zgorski 703 292-8311 lisajoy@nsf.gov

**OBAMA ADMINISTRATION UNVEILS "BIG DATA" INITIATIVE:
ANNOUNCES $200 MILLION IN NEW R&D INVESTMENTS**

Aiming to make the most of the fast-growing volume of digital data, the Obama Administration today announced a "Big Data Research and Development Initiative." By improving our ability to extract knowledge and insights from large and complex collections of digital data, the initiative promises to help solve some the Nation's most pressing challenges.

To launch the initiative, six Federal departments and agencies today announced more than $200 million in new commitments that, together, promise to greatly improve the tools and techniques needed to access, organize, and glean discoveries from huge volumes of digital data.

"In the same way that past Federal investments in information-technology R&D led to dramatic advances in supercomputing and the creation of the Internet, the initiative we are launching today promises to transform our ability to use Big Data for scientific discovery, environmental and biomedical research, education, and national security," said Dr. John P. Holdren, Assistant to the President and Director of the White House Office of Science and Technology Policy.

To make the most of this opportunity, the White House Office of Science and Technology Policy (OSTP)—in concert with several Federal departments and agencies—created the Big Data Research and Development Initiative to:

- Advance state-of-the-art core technologies needed to collect, store, preserve, manage, analyze, and share huge quantities of data.
- Harness these technologies to accelerate the pace of discovery in science and engineering, strengthen our national security, and transform teaching and learning; and
- Expand the workforce needed to develop and use Big Data technologies.

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2008 2008 2010 2012

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CCC 2025 VISIONING ACTIVITIES

Interacting With the Computers All Around Us

When disruptive technology transformations change our interaction assumptions: how will these change interactions of people to computing, machine to machine, & people to people?

May 2014

The New Making Renaissance: Programmable Matter and Things

When the decentralization of creation and mass delivery of software is achieved for many other constructive arts: 3D printing, synthetic biology, printable electronics, end-user programming, manufacturing, robotics, design, health, CAD/CAM, & intellectual property

June 2014

2025 Roundtable

Interactive discussion of computing research visions stemming from the 2025 workshops as well as recent CCC visioning workshops in Distributed Systems, Aging, Brain and Uncertainty.

January 2015

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INTELLIGENT ASSISTANTS

In 2025 we expect computing to dramatically improve the way it assists humans in three fundamental dimensions:

Cognitive, Physical, Social

A vast variety of Networked Intelligent Assistants will be created

NIAs will help humans to overcome challenges in education, health, elder-care, population growth, work, sustainability, and more

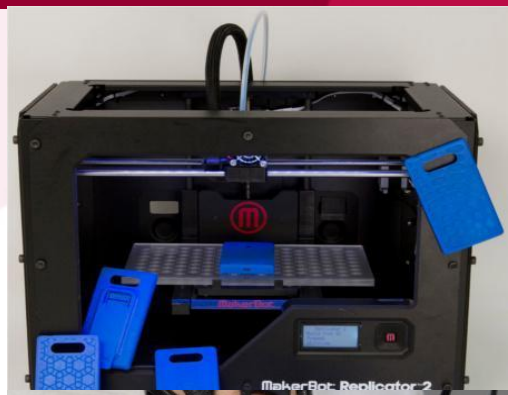
PROGRAMMABLE MATTER

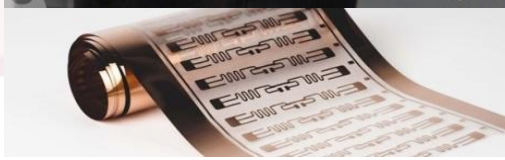
This new renaissance, underpinned by "maker movement", may change the way that most items are designed, manufactured, and delivered.

Confluence of 3 major trends:

- Cheap and fast creation of matter in new forms (e.g., 3D printing)
- On-demand electronics
- Programmable intelligence in every object

The creativity & change unleashed could change how society operates: return to craftsmanship with precision and the ability to mass customize/produce.

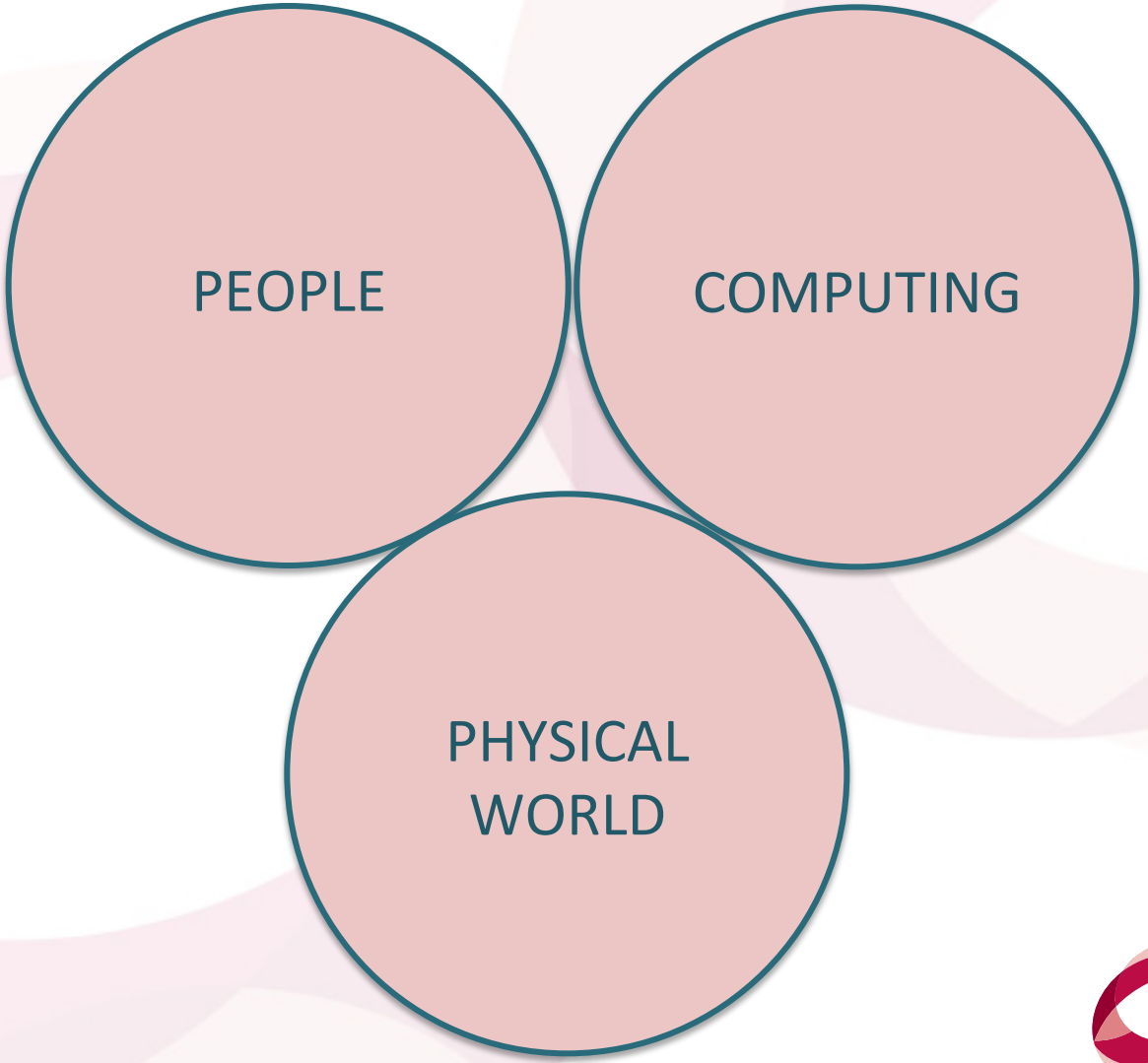




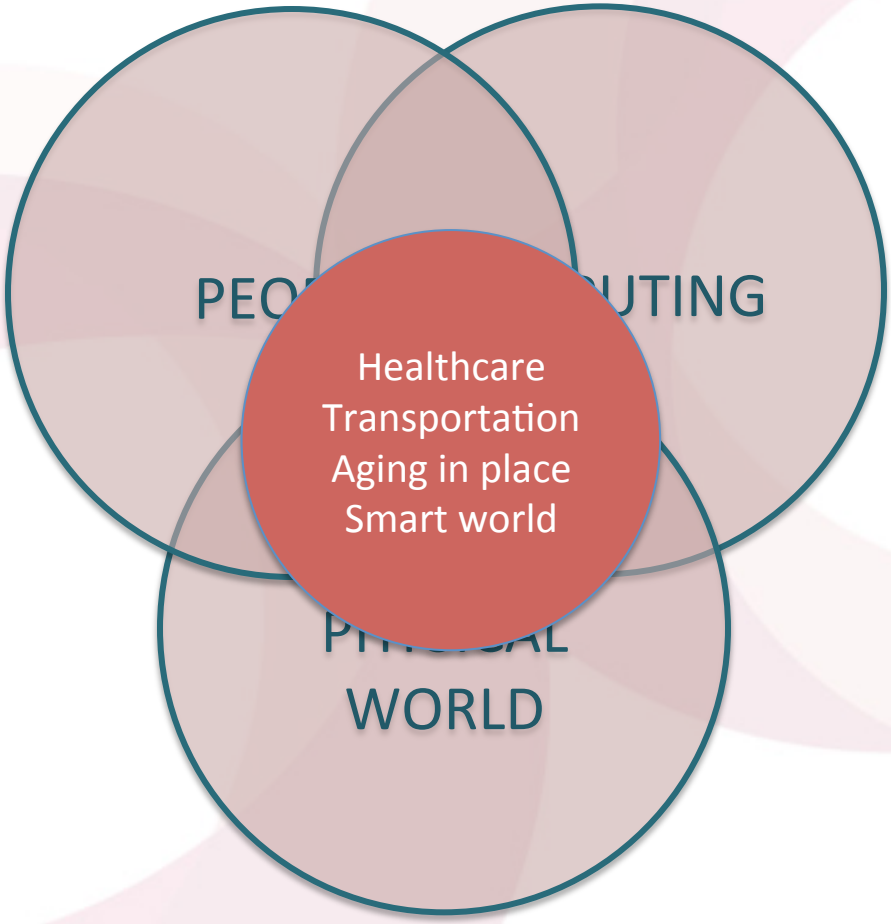
PERSONALIZED X

- "Wide" data analytics to create personalized models that support our needs, X = healthcare, X = education, X = transportation, X = social, X = home management, ….
- Eg. X = healthcare: Smart home technologies to enable comprehensive home health monitoring (e.g. aging population)
- Fundamental challenges in sensor fusion, data uncertainty, distributed systems, HCI, collaborative computing, and privacy and security

2025 IN 1 SLIDE



2025 IN 1 SLIDE



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SOME CURRENT ACTIVITIES RELATED TO ROBOTICS

- Computing in the Physical World
  - Broad working paper framing the area
  - Autonomous physical systems white papers
  - RSS Blue Sky Tracks

- Computing and People
  - Human Computation Workshop
  - Theoretical Foundations of Social Computing
  - Computer-Aided Personalized Design
  - Aging in Place

- Broader Related Themes
  - Privacy by Design Workshop Series
  - Privacy Roadmap White Paper
  - Uncertainty in Computation
  - University/Industry interaction

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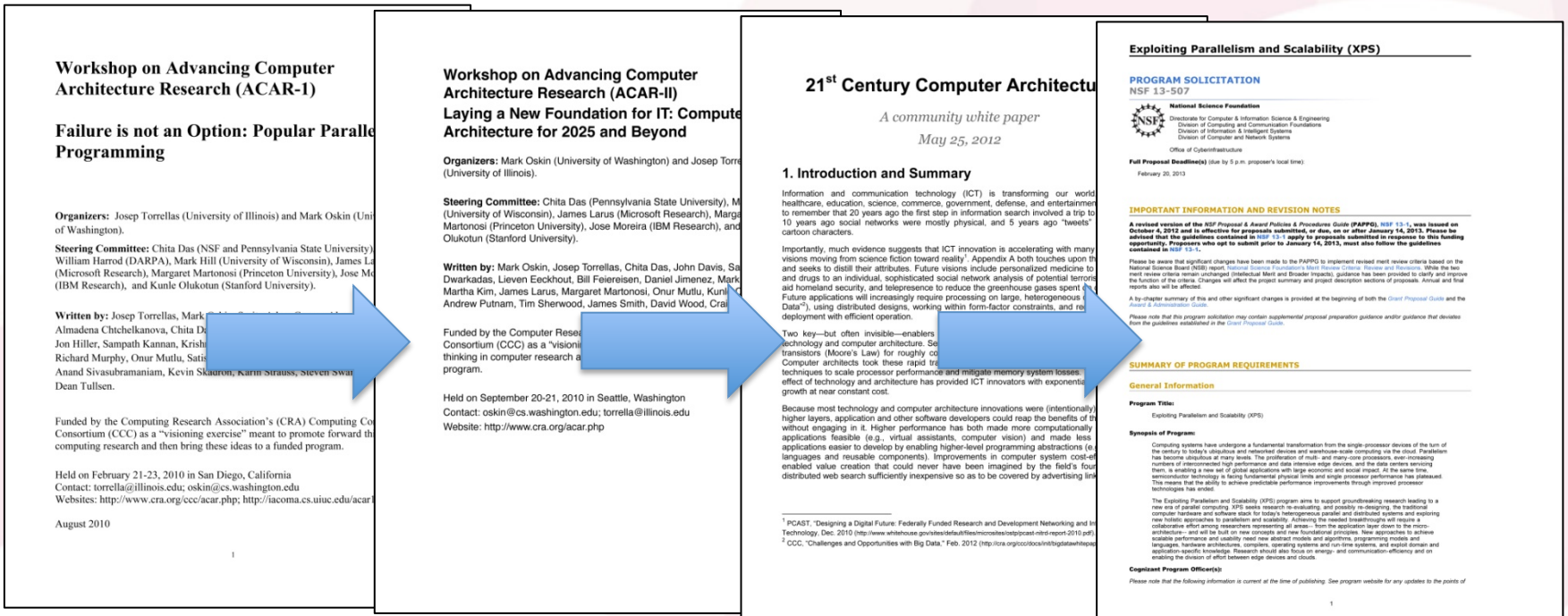
CATALYZING AND ENABLING: ARCHITECTURE



Workshop on Advancing Computer Architecture Research (ACAR-1)

Failure is not an Option: Popular Paralle Programming

Organizers: Josep Torrellas (University of Illinois) and Mark Oskin (Uni of Washington).

Steering Committee: Chita Das (NSF and Pennsylvania State University) William Harrod (DARPA), Mark Hill (University of Wisconsin), James La (Microsoft Research), Margaret Martonosi (Princeton University), Jose Mo (IBM Research), and Kunle Olukotun (Stanford University).

Written by: Josep Torrellas, Mark Almadena Chtchelkanova, Chita D Jon Hiller, Sampath Kannan, Krish Richard Murphy, Onur Mutlu, Sati Anand Sivasubramaniam, Kevin Skadron, Karin Strauss, Steven Swa Dean Tullsen.

Funded by the Computing Research Association's (CRA) Computing Co Consortium (CCC) as a "visioning exercise" meant to promote forward th computing research and then bring these ideas to a funded program.

Held on February 21-23, 2010 in San Diego, California
Contact: torrella@illinois.edu; oskin@cs.washington.edu
Websites: http://www.cra.org/ccc/acar.php; http://iacoma.cs.uiuc.edu/acar

August 2010

1

Workshop on Advancing Computer Architecture Research (ACAR-II)
Laying a New Foundation for IT: Compute Architecture for 2025 and Beyond

Organizers: Mark Oskin (University of Washington) and Josep Torre (University of Illinois).

Steering Committee: Chita Das (Pennsylvania State University), M (University of Wisconsin), James Larus (Microsoft Research), Marga Martonosi (Princeton University), Jose Moreira (IBM Research), and Olukotun (Stanford University).

Written by: Mark Oskin, Josep Torrellas, Chita Das, John Davis, Sa Dwarkadas, Lieven Eeckhout, Bill Feiereisen, Daniel Jimenez, Mark Martha Kim, James Larus, Margaret Martonosi, Onur Mutlu, Kunl Andrew Putnam, Tim Sherwood, James Smith, David Wood, Cra

Funded by the Computer Rese Consortium (CCC) as a "visioni thinking in computer research a program.

Held on September 20-21, 2010 in Seattle, Washington
Contact: oskin@cs.washington.edu; torrella@illinois.edu
Website: http://www.cra.org/acar.php

21st Century Computer Architectu

A community white paper
May 25, 2012

1. Introduction and Summary

Information and communication technology (ICT) is transforming our world healthcare, education, science, commerce, government, defense, and entertainmen to remember that 20 years ago the first step in information search involved a trip to 10 years ago social networks were mostly physical, and 5 years ago "tweets" cartoon characters.

Importantly, much evidence suggests that ICT innovation is accelerating with many visions moving from science fiction toward reality[1]. Appendix A both touches upon th and seeks to distill their attributes. Future visions include personalized medicine to and drugs to an individual, sophisticated social network analysis of potential terrorist aid homeland security, and telepresence to reduce the greenhouse gases spent Future applications will increasingly require processing on large, heterogeneous Data"[2]), using distributed designs, working within form-factor constraints, and re deployment with efficient operation.

Two key—but often invisible—enablers Technology and computer architecture. Se transistors (Moore's Law) for roughly co Computer architects took these rapid tra techniques to scale processor performance and mitigate memory system losses. effect of technology and architecture has provided ICT innovators with exponentia growth at near constant cost.

Because most technology and computer architecture innovations were (intentionally) higher layers, application and other software developers could reap the benefits of th without engaging in it. Higher performance has both made more computationally applications feasible (e.g., virtual assistants, computer vision) and made less applications easier to develop by enabling higher-level programming abstractions (e.g languages and reusable components). Improvements in computer system cost-ef enabled value creation that could never have been imagined by the field's four distributed web search sufficiently inexpensive so as to be covered by advertising lin

[1] PCAST, "Designing a Digital Future: Federally Funded Research and Development Networking and In Technology, Dec. 2010 (http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-nitrd-report-2010.pdf).
[2] CCC, "Challenges and Opportunities with Big Data," Feb. 2012 (http://cra.org/ccc/docs/init/bigdatawhitepap

Exploiting Parallelism and Scalability (XPS)

PROGRAM SOLICITATION
NSF 13-507

National Science Foundation

Directorate for Computer & Information Science & Engineering
Division of Computing and Communication Foundations
Division of Information & Intelligent Systems
Division of Computer and Network Systems

Office of Cyberinfrastructure

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

February 20, 2013

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 13-1, was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that the guidelines contained in NSF 13-1 apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 14, 2013, must also follow the guidelines contained in NSF 13-1.

Please be aware that significant changes have been made to the PAPPG to implement revised merit review criteria based on the National Science Board (NSB) report, National Science Foundation's Merit Review Criteria: Review and Revisions. While the two merit review criteria remain unchanged (Intellectual Merit and Broader Impacts), guidance has been provided to clarify and improve the function of the criteria. Changes will affect the project summary and project description sections of proposals. Annual and final reports also will be affected.

A by-chapter summary of this and other significant changes is provided at the beginning of both the *Grant Proposal Guide* and the *Award & Administration Guide*.

Please note that this program solicitation may contain supplemental proposal preparation guidance and/or guidance that deviates from the guidelines established in the Grant Proposal Guide.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Exploiting Parallelism and Scalability (XPS)

Synopsis of Program:

Computing systems have undergone a fundamental transformation from the single-processor devices of the turn of the century to today's ubiquitous and networked devices and warehouse-scale computing via the cloud. Parallelism has become ubiquitous at many levels. The proliferation of multi- and many-core processors, ever-increasing numbers of interconnected high-performance and data intensive edge devices, and the data centers servicing them, is enabling a new set of global applications with large economic and social impact. At the same time, semiconductor technology is facing fundamental physical limits and single processor performance has plateaued. This means that the ability to achieve predictable performance improvements through improved processor technologies has ended.

The Exploiting Parallelism and Scalability (XPS) program aims to support groundbreaking research leading to a new era of parallel computing. XPS seeks research re-evaluating, and possibly re-designing, the traditional computer hardware and software stack for today's heterogeneous parallel and distributed systems and exploring new holistic approaches to parallelism and scalability. Achieving the needed breakthroughs will require a collaborative effort among researchers representing all areas - from the application layer down to the micro-architecture-- and will be built on new concepts and new foundational principles. New approaches to achieve scalable performance and usability need new abstract models and algorithms, programming models and languages, hardware architectures, compilers, operating systems and run-time systems, and exploit domain and application-specific knowledge. Research should also focus on energy- and communication-efficiency and on enabling the division of effort between edge devices and clouds.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of

1

2010 2010 2012 2013

Josep Torrellas
UIUC

Mark Oskin
Washington

Mark Hill
Wisconsin

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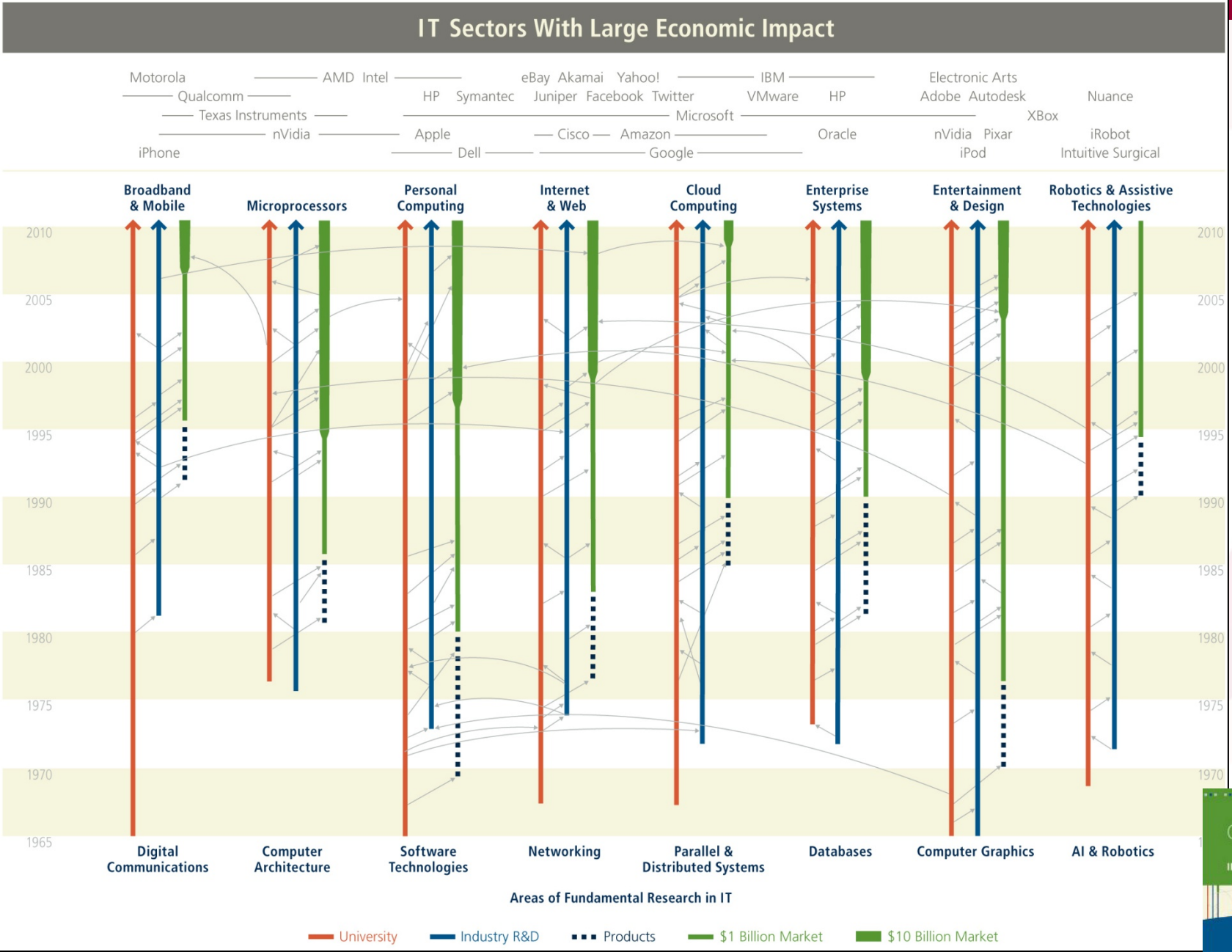

CCC: CATALYZING AND ENABLING COMPUTING RESEARCH

Gregory D. Hager
CCC Chair
Johns Hopkins University

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