The Computing Community Consortium (CCC)

cat·a·lyst

1. *a substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change.*
2. *a person or thing that precipitates an event.*

July 17, 2019

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Catalyst

AN OVERVIEW OF THE COMPUTING COMMUNITY CONSORTIUM

- Established in 2006 as a standing committee of the Computing Research Association (CRA)
- Funded by NSF under a Cooperative Agreement
  - Third Award began in April 2018
- **Facilitates the development of a bold, multi-themed vision for computing research – and communicates this vision to stakeholders**
- Led by a broad-based Council
- Staff based at CRA

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INFORMAL MISSION

"A catalyst and enabler for the computing research community"

- Bring the community together to contribute to shaping the future of the field
- Provide leadership for the community, encouraging revolutionary, high-impact research
- Encourage the alignment of computing research with pressing national priorities and national challenges (many of which cross disciplines)
- Work with policymakers to facilitate the translation of these important research directions into funded programs
- Give voice to the community, communicating to a broad audience the many ways in which advances in computing will create a brighter future
- Grow new leaders for the computing research community

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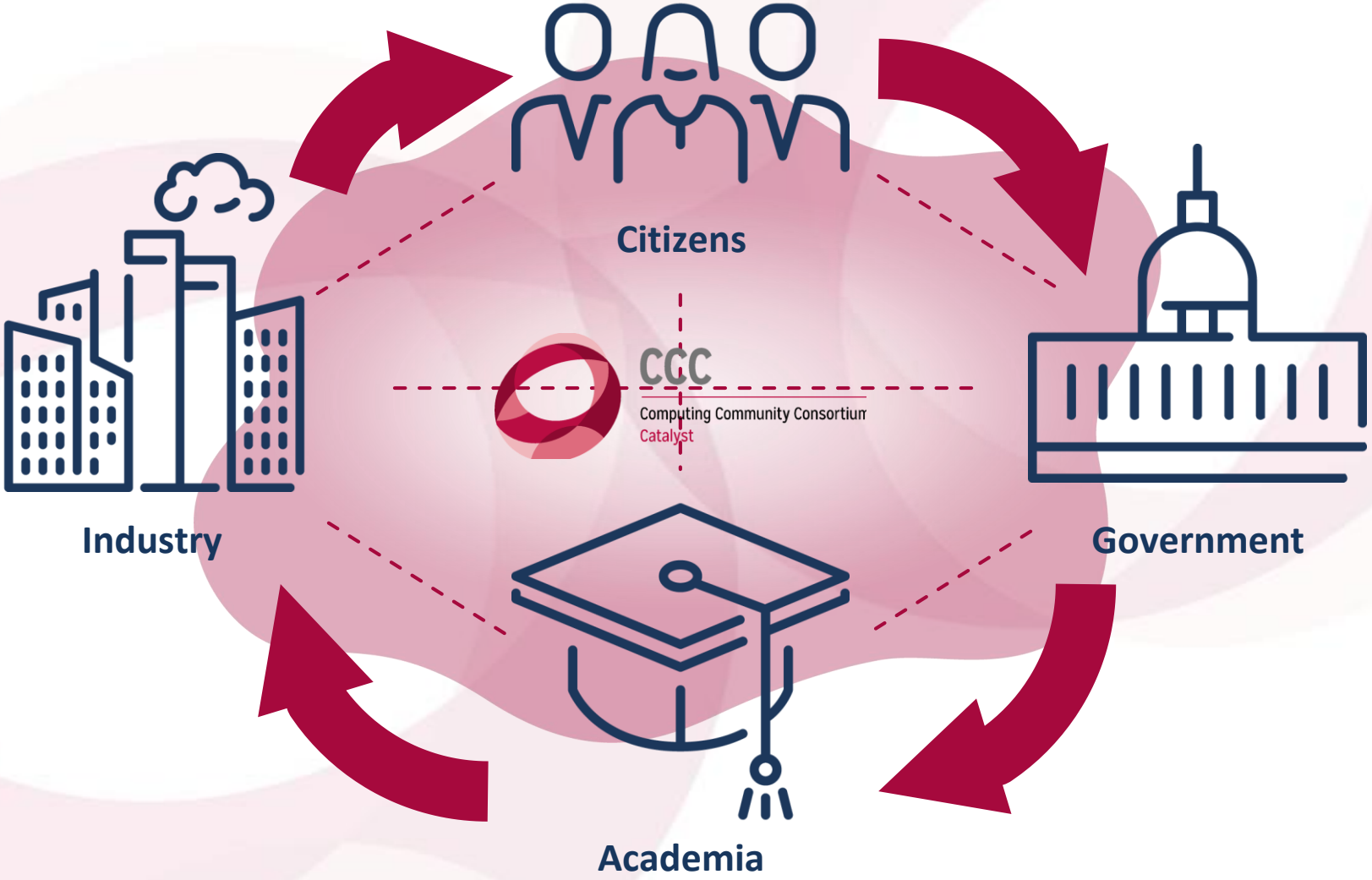
CCC: CATALYZING I.T.'S VIRTUOUS CYCLE



Icons modified from Zlatko Najdenovski, Flaticon

COMPUTING COMMUNITY CONSORTIUM

The **mission** of Computing Research Association's Computing Community Consortium (CCC) is to **catalyze** the computing research community and **enable** the pursuit of innovative, high-impact research.

Who

- **Council - 20members**
- **CCC/CRA Staff**
- **Chair, VC, & Director**

Inputs: Bottom-up, Internal, & Top-Down

What:

- **Workshops & Conf. Blue Sky Tracks**
- **Whitepapers & Social Media**
- **Reports Out (esp. to government)**
- **Biannual Symposium to DC'ers**

Human Development

- **Early Career Workshops & Participation**
- **Council Membership**
- **Leadership w/ Gov't (LISPI)**

THE CCC COUNCIL

Chair: Mark Hill
Vice Chair: Liz Bradley

Terms ending June 2022

- Sujata Banerjee, VMware
- Elisa Bertino, Purdue University
- Tom Conte, Georgia Tech
- Maria Gini, University of Minnesota
- Chad Jenkins, University of Michigan
- Melanie Mitchell, Portland State University
- Katie Siek, Indiana University

Terms ending June 2021

- Ian Foster, University of Chicago
- Ronitt Rubinfeld, MIT
- Suresh Venkatasubramanian, Utah
- Daniel P. Lopresti, Lehigh University
- David C. Parkes, Harvard
- Shwetak Patel, Univ. Washington

Terms ending June 2020

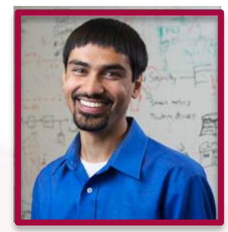
- Nadya Bliss, Arizona State
- Juliana Freire, NYU
- Keith Marzullo, Maryland
- Greg Morrisett, Cornell
- Jennifer Rexford, Princeton
- Ben Zorn, Microsoft Research


















NSF INTERACTIONS

Program Officer: Nina Amla

RELATIONSHIP TO COMPUTING RESEARCH ASSOCIATION (CRA)

NSF cooperative agreement is with CRA

CCC is a standing committee of CRA

- Andy Bernat, CRA Executive Director, is an ex officio member of the CCC Executive Committee
- Mark Hill, the CCC Chair is a member of the CRA Board of Directors
- Ellen Zegura, the CRA chair must consent to CCC Council appointments
- Greg Morrisett, CCC Council member and member of the CRA Board of Directors

CCC staff are based in CRA

MAJOR STAKEHOLDERS

- Computing Research Community
  - CRA
  - CSTB (Computer Science and Telecommunications Board, part of National Research Council)
  - Professional societies
  - Academic units
  - Research labs
- Industry
  - Computing industry, Major users of IT
- Public
- Government
  - See following slides

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GOVERNMENT STAKEHOLDERS

Agencies important to us

- NSF – strong ties with CISE
- NIH – growing ties with folks interested in Health IT
- DARPA – ties come and go
- DoE – ties with ASCR; interest in ARPA-E

Others that are relevant

- NIST
- HHS/ONC
- IARPA
- DoT

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GOVERNMENT STAKEHOLDERS

Networking and Information Technology R&D (NITRD)

- Legislatively mandated coordination among Federal R&D agencies
- National Coordinating Office (NCO) facilitates
  - Interagency working groups
  - Coordinating groups
  - Senior steering groups
  - Community of practice
- Director is Kamie Roberts

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PCAST NITRD REPORT

2010

- 1/3 of the PCAST NITRD Working Group members were CCC Council Members
- The report drew extensively on CCC White Papers
- An excellent roadmap for the field

2013

- ¼ Contributing Members were CCC Council Members
- An excellent review of progress from 2010 report
- The challenge now: Continuing to translate it into action

2015

- 1/3 Contributing Members were CCC Council Members
- An update to the 2013 report, including recommendations for Federal Agencies
- The challenge now: restructuring NITRD

CCC GOALS AND ACTIVITIES

GOALS FOR CCC

1. **Bring the computing research community together to envision audacious research challenges**, and to articulate concrete pathways to enable pursuit of these challenges.
2. **Communicate** these challenges and opportunities to the broader national community.
3. **Facilitate investment** in these research challenges **by key stakeholders**.
4. **Inculcate** values of **leadership** and service by the computing research community.
5. **Inform and influence early career researchers** to engage in these community-led research challenges.

CCC ACTIVITIES

- Envisioning Future Computing Research
- Engaging and Aligning with National and Computing Research Priorities
- Communicating Future Computing Research
- Cultivating Computing Leadership and Community Capacity to Engage and Respond to National Priorities

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ENVISIONING FUTURE COMPUTING RESEARCH

"The Computing Community Consortium (CCC) solicits proposals that will galvanize the community to define visions and agendas for exciting frontiers of computing research."

- Create a new community of researchers.
- Inform a new funding initiative.
- Help an extant community define a new trajectory.

Goals for next phase

- Increase our outreach and participation
- Increase the participation of industry leadership and early career researchers at Visioning Workshops

VISIONING PROCESSES

- Periodic RFP for Community Initiated Activities
- Average of 8 workshops per year in the last 3 years
- Top-down (agency initiated)
- Bottom-up (open call)
- Sideways (council initiated, joint with other agencies,….)

Robotic Materials

Digital Computing Beyond Moore's Law

Sociotechnical Interventions for Health Disparity Reduction

Sociotechnical Cybersecurity

Cybersecurity for Manufacturers

VISIONING ACTIVITIES

- Over 55 visioning activities in 10-year history
- Average of 8 activities per year in the last 3 years
- Research areas include:
  - AI
  - Post Quantum Cryptography
  - Health
  - Privacy by Design
  - BRAIN Initiative
  - Fairness
  - Misinformation
  - Thermodynamic Computing
- 20 workshop reports released in past 5 years
- 36 white papers released in past 5 years

Early Career Researcher Symposium	August 1-2. 2018
Leadership in Embedded Security Workshop	August 12-13, 2018
Artificial Intelligence Roadmap Workshop 1- Integrated Intelligence	November 14-15, 2018
Thermodynamic Computing	January 3-5, 2019
Artificial Intelligence Roadmap Workshop 3- Self Aware Learning	January 17-18, 2019
Identifying Research Challenges in Post Quantum Cryptography Migration and Cryptographic Agility	January 31-February 1, 2019
Code 8.7: Using Computational Science and AI to End Modern Slavery	February 19-20, 2019
Misinformation Roundtable	March 26 2019
Economics and Fairness	May 22-23, 2019

SUCCESSFUL VISIONING ACTIVITIES

- **Engage the community and relevant stakeholders**
- **Facilitate broad thinking with compelling examples**
- Create new avenues for (interdisciplinary) collaboration
- Prepare and energize the community for future opportunities
- Rapidly capture and synthesize ideas from the community.
- Present ideas and engage possible funders and stakeholders
- Articulate needs and barriers to research impact

BLUE SKY

Goal - Help conferences reach out beyond the usual research papers. Papers are open-ended and possibly “outrageous” or “wacky.”

- 18 different tracks at 12 different conferences in last 5 years
- On average, 13 papers submitted per track at a conference
- Winners are asked to submit Great Innovative Ideas

Past CCC Chair Gregory Hager with AAAI-16 Blue Sky award winner Francesca Rossi

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ENGAGING AND ALIGNING WITH NATIONAL AND COMPUTING RESEARCH PRIORITIES

- Agility to respond to requests and ideas.
- Outreach pulls together visioning with stakeholder needs and timely opportunities

- Increase scale and capacity through CCC Task Forces
- Increase engagement with industry, sister organizations and other relevant stakeholders (philanthropy)

CURRENT CCC TASK FORCES

CCC task forces are organized around national priorities, community needs, and council member interests. Our current* set of topics are:

- **Artificial Intelligence Working Group**
- **Industry Working Group**
- **Cybersecurity and Cybercrime**
- **Health and Computing**
- **Systems and Architecture**
- **FADE (Fairness, Accountability, Disinformation, and Explainability)**
- **Future of the Research Enterprise**

Goal is for CCC to be **engaged in ongoing activities** around these topics, to **identify needs and opportunities** in the topic area, and to **identify actions** (generating white papers, convening a workshop, publicizing information, etc.) that have the possibility of "moving the needle" for these topics.

Annual process to determine topics, membership and priorities. Informed by major stakeholders (NSF, OSTP, PCAST, NITRD, workshops and council members).

COMPUTING RESEARCH

ADDRESSING NATIONAL PRIORITIES AND SOCIETAL NEEDS

- Held first National Symposium to **Highlight the Impact of Computing Research** in 2016. Held second one in October 2017.
- Established a biennial Symposium to communicate the role of computing research to address national and societal priorities
- Bring in **early career researchers to connect** them with and invigorate the community

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COMMUNICATING

- **Workshop Reports**
- **White Papers**
  - CCC works with community to produce timely white papers that inform policymakers and the broader community on national priorities
- **CCC Blog**
  - Provides a continuous stream of information on advances in computing research
  - Opportunities for community to get involved
  - Forum for community discussion
- **Catalyzing Computing Podcast**
  - Highlighting Researchers in the Community
- Website
  - Collection of Resources
- Great Innovative Ideas
  - A way to showcase the exciting new research and ideas generated by the computing community
- Annual events
  - CCC Symposium
  - CRA Snowbird
- Special Events
  - Early Career Researcher Symposium

Biannual Computing Research Symposium

BiWeekly Podcast

NURTURING NEXT GENERATION OF LEADERS

Grow leadership and community capacity to engage in and respond to national science policy needs and identify new directions for computing research.

Leadership in Science Policy Institute

- **Educates and trains computing researchers on how science policy in the U.S. is formulated and how to advocate for computing research**
- **Co-sponsored by CRA's Government Affairs Committee**

Industry – Academic Collaborations

- CCC collaborated with Big Data Regional Hubs
- Activities to enhance the research of early career faculty

Postdoc Best Practices

- Program to study institutional support structures for postdocs
- 3 programs: University of Washington, NY ASCENT, Arizona

Computing Innovation Fellows (CIFellows) Project

- Rapidly created the CI Fellows program to preserve human capital when faculty positions became scarce with the financial crisis

Visioning Activities

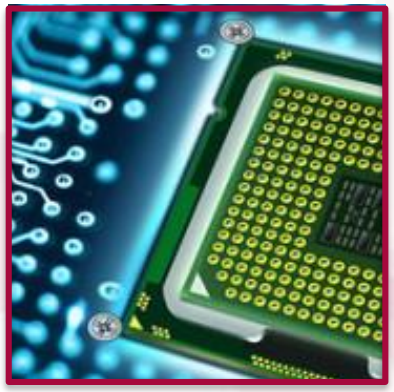
- Cultivate leaders for the community through leadership / involvement in visioning activities

IMPACT

AMPLIFICATION

BRAIN Initiative launched in 2013.

CCC co-hosted the Brain Workshop with NSF in 2014.



CCC co-hosted the SA+TS workshop with SRC and NSF in 2013.

Produced Research Needs for Trustworthy, and Reliable Semiconductors Report in 2015.

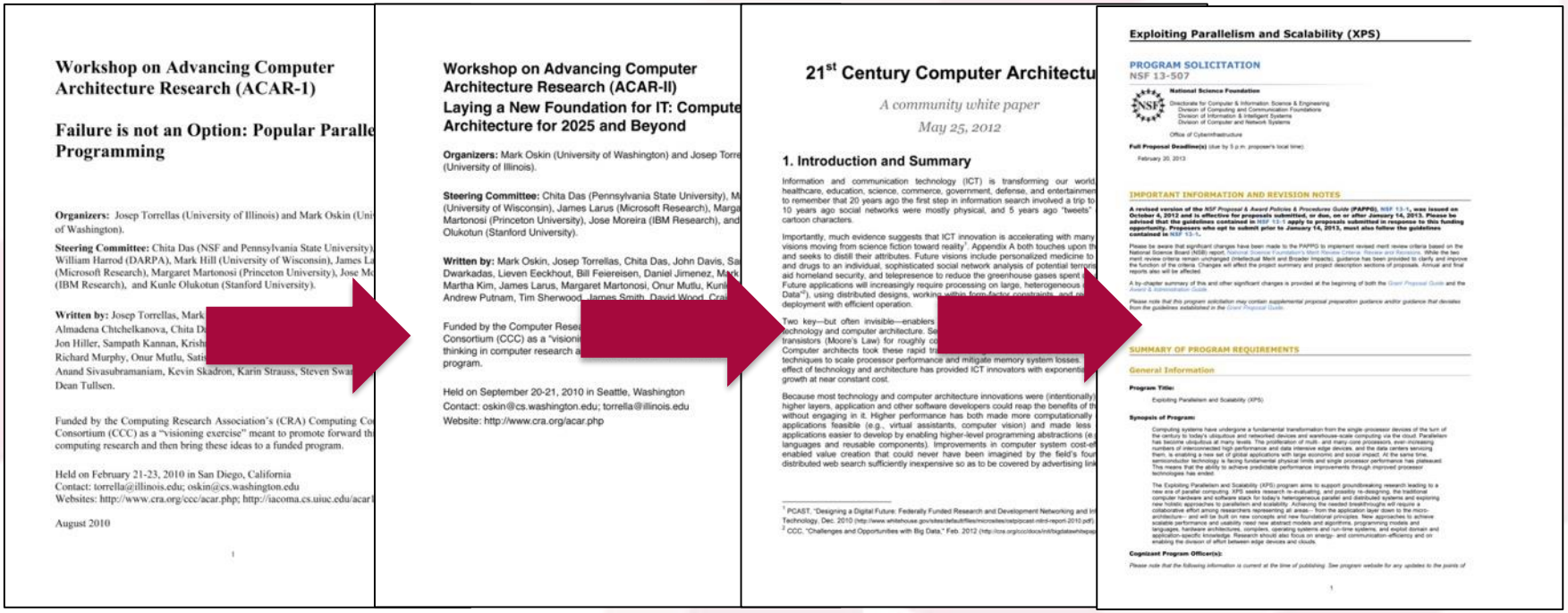
NSCI announced in July 2015.

CCC produced a series of blog posts on the topic, featuring one from Doug Burger, and the Systems and Architecture task force frequently overlaps with this topic.

Smart and Connected Health Program in NSF and NIH.

CCC has hosted several workshops on related topics, including: Aging in Place (2014), Inclusive Access (2015), and Smart and Pervasive Health (2016) and produced related reports and white papers.

IMPACT: 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 Di 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

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, Kuni 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 terroris 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 tr techniques to scale processor performance and mitigate memory system losses. effect of technology and architecture has provided ICT innovators with exponenti 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. 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 link

[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 duo, 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 Revision. 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

2010 2010 2012 2013

Josep Torrellas
UIUC

Mark Oskin
Washington

Mark Hill
Wisconsin

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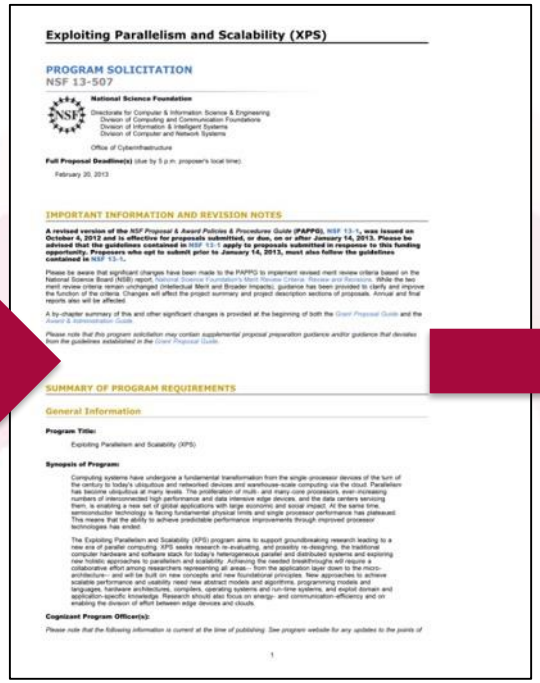
IMPACT: ARCHITECTURE



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
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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

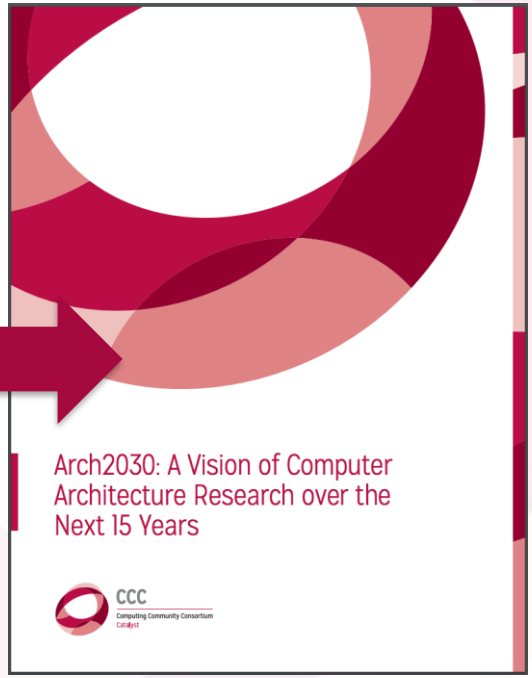
2013

Architecture 2030 Workshop @ ISCA 2016

CCC report out: Read the final report here.

Video recordings: Watch the video recordings here.

2016



2016

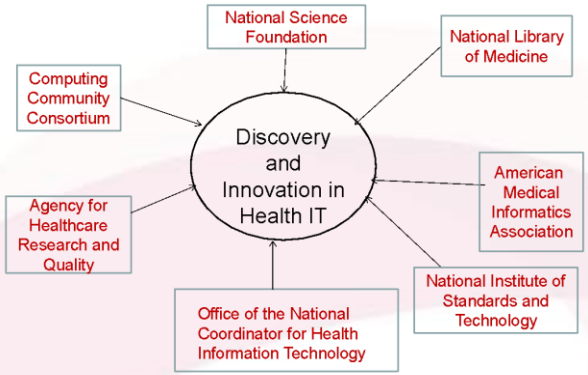
Luis Ceze
Washington

Tom Wenisch
Michigan

Mark Hill
Wisconsin

IMPACT: HEALTH IT

October 2009 Workshop



National Science Foundation
WHERE DISCOVERIES BEGIN

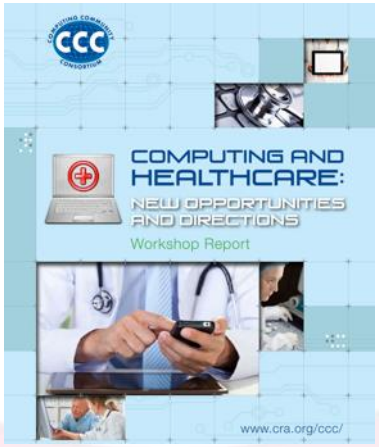
Directorate for Computer & Information Science & Engineering

SMART HEALTH AND WELLBEING (SHW)

CONTACTS

See program guidelines for contact information.

SYNOPSIS



Smart and Connected Health (SCH)

PROGRAM SOLICITATION
NSF 13-543

REPLACES DOCUMENT(S):
NSF 12-512

National Science Foundation

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

Directorate for Engineering

Directorate for Social, Behavioral & Economic Sciences

National Institutes of Health

October 2012 Workshop

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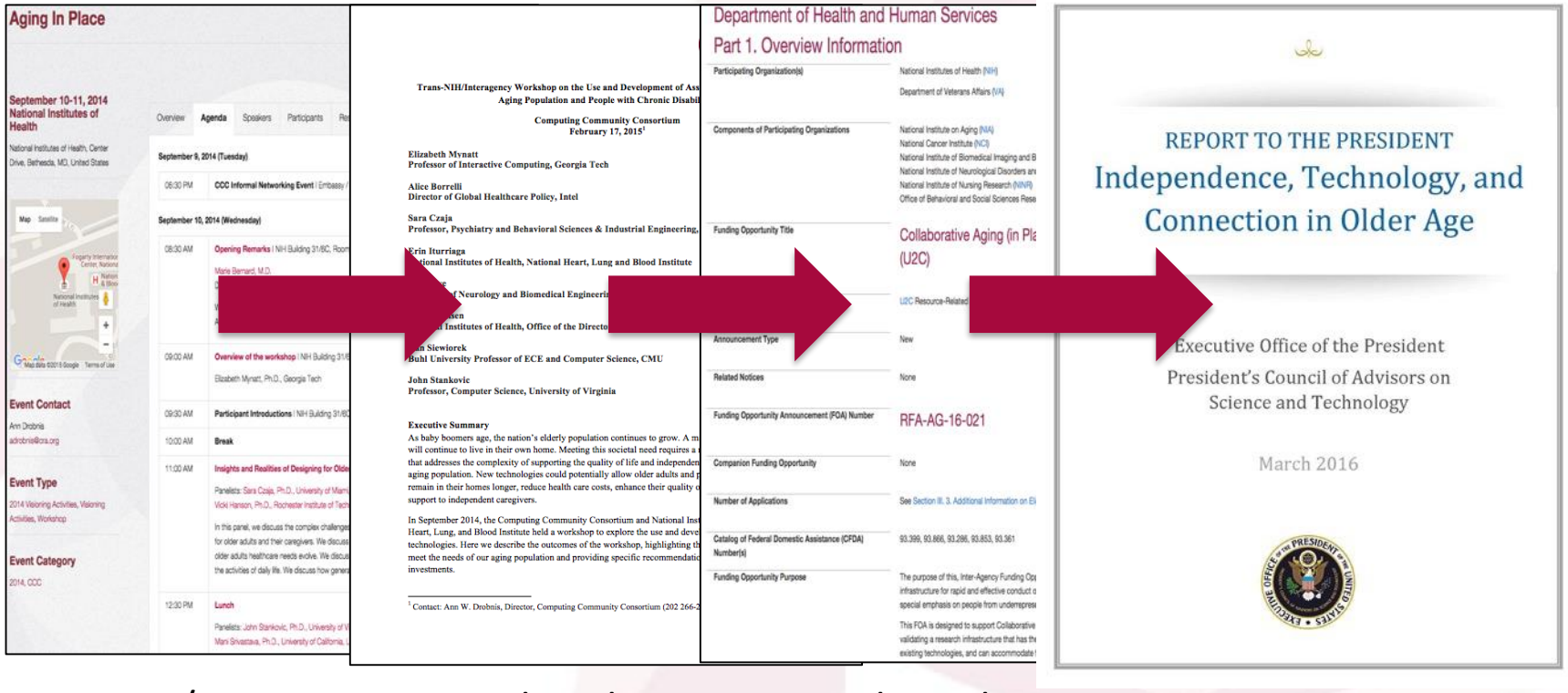
IMPACT: AGING IN PLACE



Joint NIH/CCC Meeting September 2014

Produced Workshop Report February 2015

NIH released new RFP informed by AIP Workshop October 2015

PCAST Report March 2016

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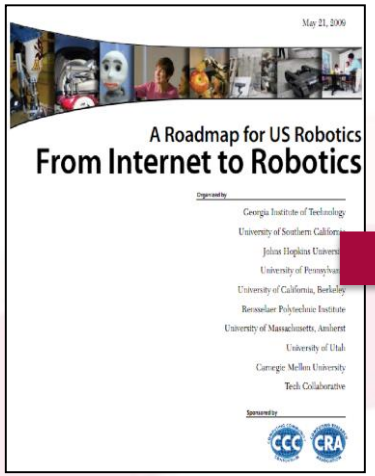
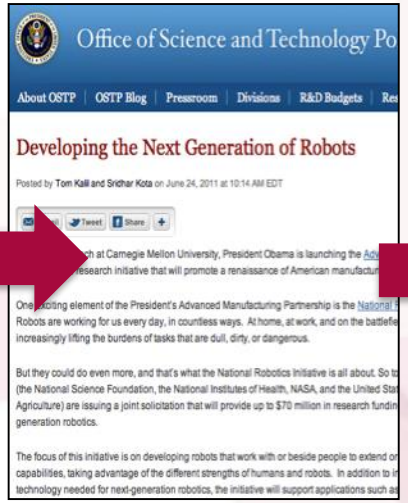
IMPACT: ROBOTICS



4 meetings during summer 2008

Roadmap published May 2009

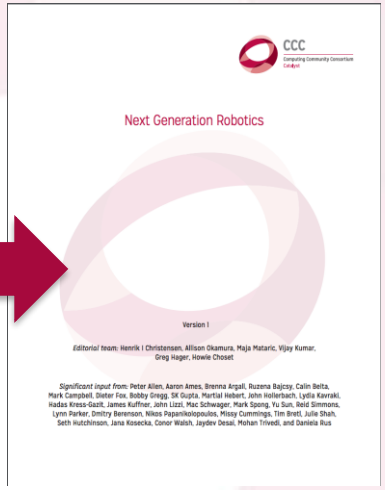
Extensive discussions between visioning leaders & agencies



National Robotics Initiative announced in summer 2011

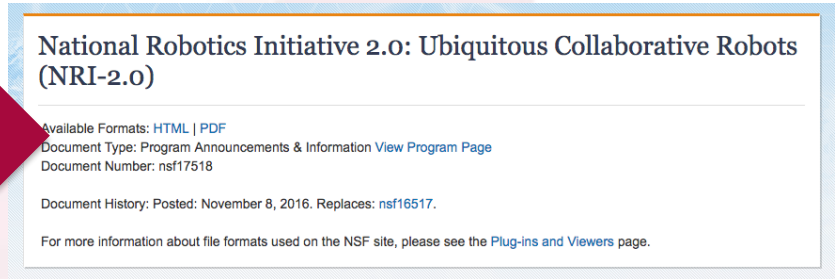
2 meetings in Spring, 2016

Report and Congressional Briefing in June, 2016



Next Generation Robotics published June, 2016

Henrik Chistensen



NRI 2.0 announced November 2016

CCC
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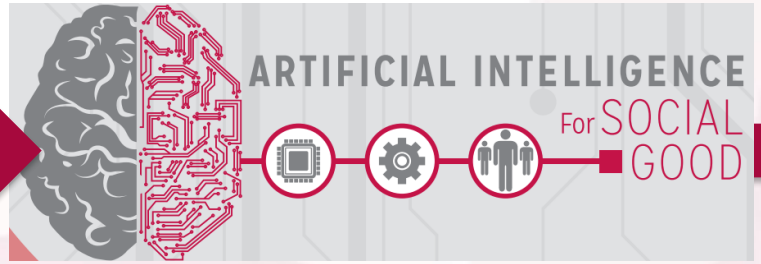
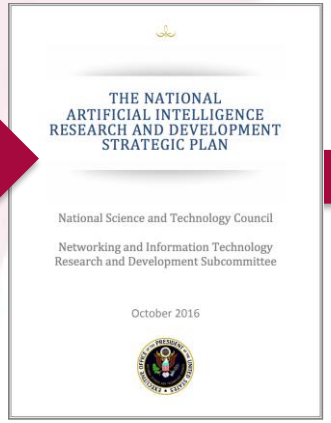
IMPACT: ARTIFICIAL INTELLIGENCE

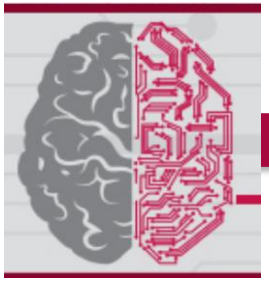
White House announces interest in AI, asks CCC to lead 1 of 4 workshops
Winter, 2016



Symposium for 400 people
June, 2016



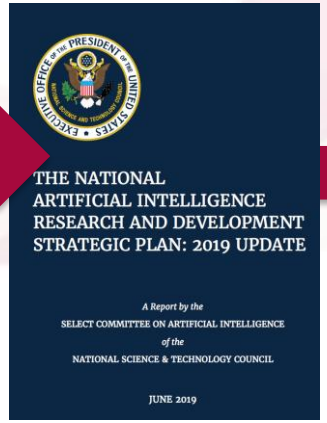
Report Released
Spring, 2017



CCC launches AI Roadmap with 3 Community Workshops
Fall, 2018

Several DC Meetings

Draft Report Released, Soliciting Community Input



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THANK YOU!

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