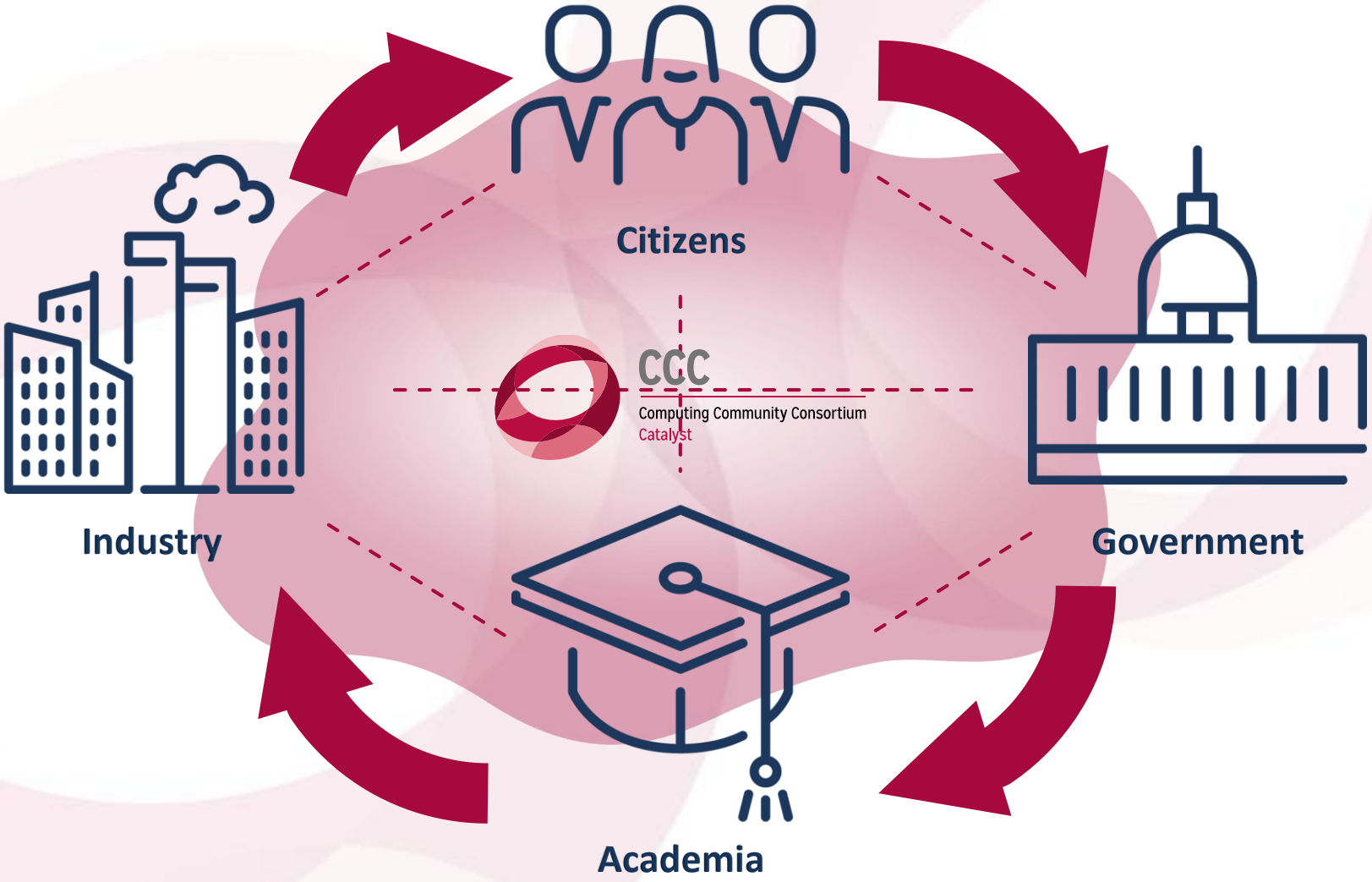
THE COMPUTING COMMUNITY CONSORTIUM (CCC)

Mark D. Hill, U . Wisconsin CS & ECE
CCC Vice Chair 2016-18 & Chair 2018-20
@ ECEDHA, 3/2018

Big Picture: Catalyzing IT's Virtuous Cycle
CCC's Process Backward
Case Study: Computer Architecture
Appendix: Complete Slide Deck

CCC
Computing Community Consortium
Catalyst

CATALYZING IT'S VIRTUOUS CYCLE



Icons modified from Zlatko Najdenovski, Flaticon

COMPUTING RESEARCH
ADDRESSING NATIONAL PRIORITIES AND SOCIETAL NEEDS

Establish a biennial symposium to communicate the role of computing research to address national and societal priorities

- Fall, 2017
  - Intelligent Infrastructure for our Cities and Communities
  - Security and Privacy for Democracy
  - AI and Amplifying Human Abilities
  - Data, Algorithms, and Fairness

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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
- Great Innovative Ideas
  - A way to showcase the exciting new research and ideas generated by the computing community
- Annual Events
  - CCC Symposium
  - CRA Snowbird
  - Leadership in Science Policy Institute (LISPI)
- Special Events
  - Sessions at AAAS Annual Meeting

Computing Research 2016

AI for Social Good 2016

VISIONING PROCESS

Initiated Three Ways

- Bottom-up (Periodic open RFP)
- Sideways (council initiated, joint with other agencies,….)
- Top-down (agency initiated)

Cyber Social Learning Systems

Nanotechnology-inspired Information Processing Systems

Smart Health

Sociotechnical Cybersecurity

Cybersecurity for Manufacturers

CCC TASK FORCES

CCC task forces are organized around national priorities, community needs, and council member interests.

Current topics:

- Artificial Intelligence
- Cybersecurity
- Human Technology Frontier
- Intelligent Infrastructure
- Post Moore’s Law Computing
- Privacy and Fairness

THE CCC COUNCIL

Terms ending June 2020

- Nadya Bliss, Arizona State
- Elizabeth Churchill, Google
- Juliana Freire, NYU
- Keith Marzullo, Maryland
- Greg Morrisett, Cornell
- Jennifer Rexford, Princeton
- Manuela Veloso, Carnegie Mellon
- Ben Zorn, Microsoft Research

Terms ending June 2019

- Kevin Fu, Univ. Michigan
- Sampath Kannan, UPenn
- Maja Mataric, USC
- Nina Mishra, Amazon
- Holly Rushmeier, Yale

Terms ending June 2018

- Liz Bradley, CU Boulder
- Cynthia Dwork, Microsoft Research
- Daniel P. Lopresti, Lehigh University
- Shwetak Patel, Univ. Washington
- Katherine Yelick, UC Berkeley

THE CCC COUNCIL LEADERSHIP & STAFF

←Executive Committee:

- Beth Mynatt, Georgia Tech, (Chair)
- Mark Hill, U of Wisconsin, Madison (Vice Chair)
- Ben Zorn, Microsoft Research
- Jennifer Rexford, Princeton
- Daniel P. Lopresti, Lehigh
- Ann Drobnis, Director
- Andy Bernat, CRA Executive Director

CCC Staff ➔

- Helen Wright
- Khari Douglas

CRA Staff ➔

- Peter Harsha, Dir. of Gov't Affairs
- Sandra Corbett
- Sabrina Jacob

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NURTURING NEXT GENERATION OF LEADERS

➔ **Inviting Future Leaders to CCC Workshops!** ➔

Industry – Academic Collaborations

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

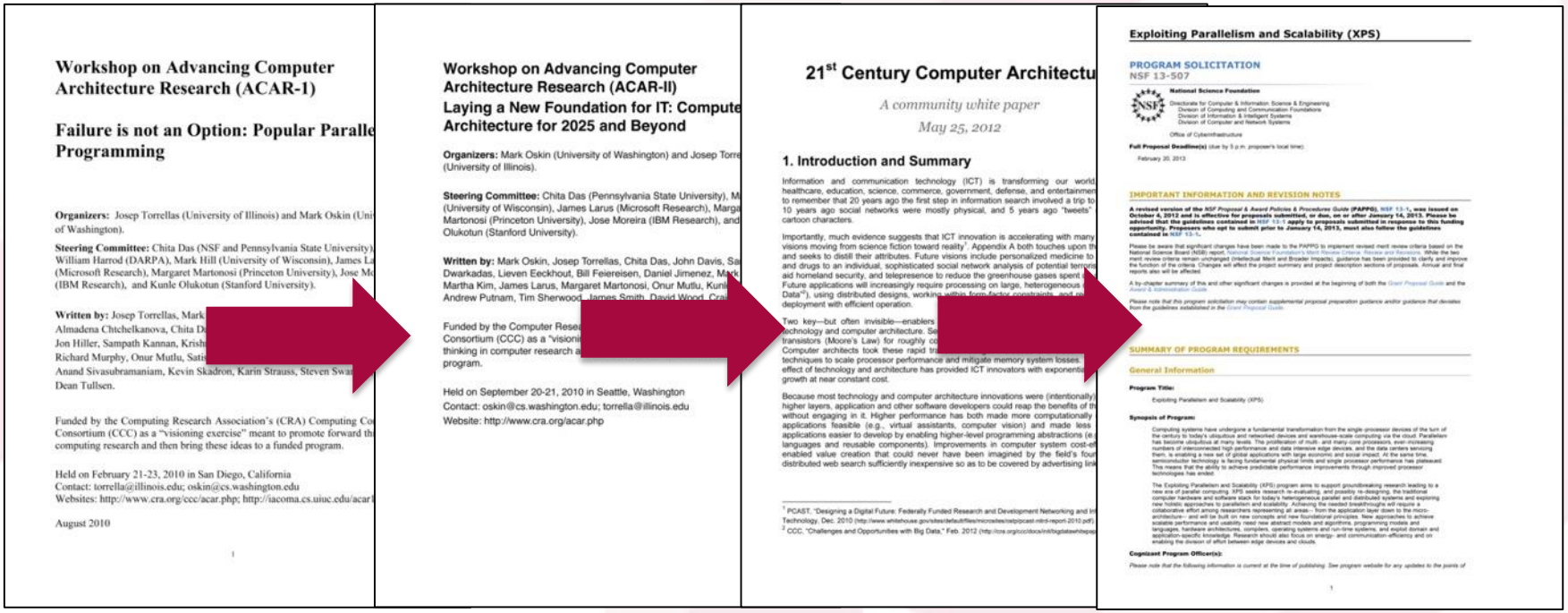
Leadership in Science Policy Institute

- 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

E.g., Computing Innovation Fellows Project (Symposium 8/2018)

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

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 M (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

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, Cris

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

2010

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

2012

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 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

2013

Josep Torrellas
UIUC

Mark Oskin
Washington

Mark Hill
Wisconsin

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Computing Community Consortium
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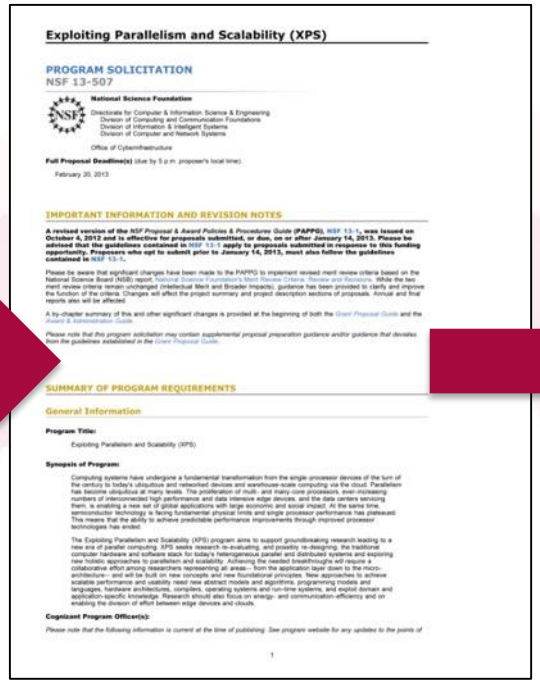
IMPACT: ARCHITECTURE



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
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1

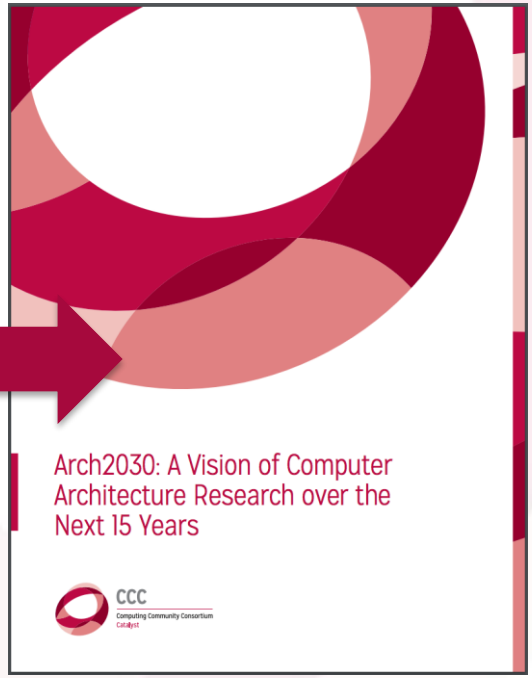
2013

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: ARCHITECTURE

- 2017-18 Post-Moore's Law Task Force
  - Tom Conte (GaTech & IEEE Rebooting Computing), CCC's Hill & Yelick
- Selected Whitepapers
  - Challenges to Keeping the Computer Industry Centered in the US, 2016
  - Democratizing Design for Future Computing Platforms, 2017
- Selected Blog Posts
  - Store your (Big) Data in the Code of Life?, 2016
  - A Primer on the Meltdown & Spectre Hardware Security Design Flaws and their Important Implications, 2018
- Workshops
  - Post Moore's Law Digital Computing, 5/2018
  - Next Steps in Quantum Computing, 5/2018
  - Thermodynamic Computing, Fall 2018

APPENDIX: COMPLETE SLIDE DECK

- Rapidly expanding world of computing
- CCC Overview, est. 2006 thru NSF Cooperative Agreement
- Major Stakeholders
- Executive Committee, Council, & CCC/CRA Staff
- Goals, Desired Outcomes, Activities
- Visioning Process, Recent Activities, & Blue Sky
- Task Forces
- Symposium Addressing National Priorities & Societal Needs
- Communicating
- Nurturing next generation of leaders
- Engaging with Industry
- Amplification, e.g., OSTP
- Examples: Architecture, Health IT, Aging in Place

COMPUTING COMMUNITY CONSORTIUM

Our **mission** is to **catalyze** the computing research community and **enable** the pursuit of innovative, high-impact research.

THE COMPUTING COMMUNITY CONSORTIUM (CCC)

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Computing Community Consortium
Catalyst

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.

Promote Audacious Thinking:

- Community Initiated Visioning Workshops
- Blue Sky Ideas tracks at conferences

Communicate to the Community:

- CCC Blog - http://cccblog.org/
- Great Innovative Ideas
- White Papers and Workshop Reports
- Social Media (@compcomcon)
- Council member presentations

Facilitate Investment:

- Outputs of visioning activities
- Task Forces – AI, Cybersecurity, Post Moore's, etc.
- Engage with federal agencies and industry

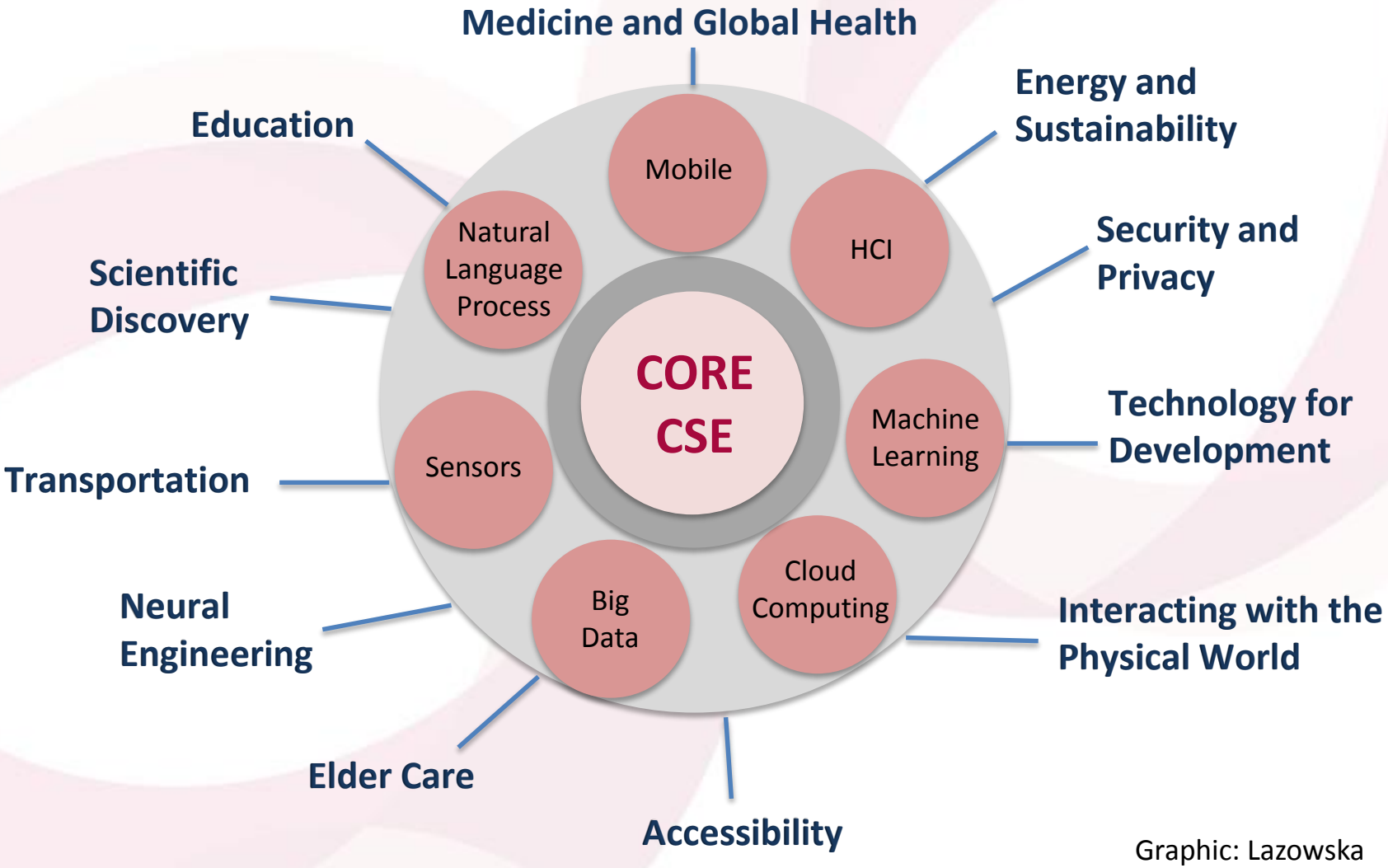
Inculcate Leadership and Service:

- Engage with CCC Alumni and Sister Organizations
- Biennial Symposia series

Influence Early Career Researchers:

- Industry – Academic Collaborations
- Leadership in Science Policy Institute
- Postdoc Best Practices

THE RAPIDLY EXPANDING WORLD OF COMPUTING



Graphic: Lazowska

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
- 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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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
- NIH
- DARPA
- DoE
- NIST
- HHS/ONC

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

THE CCC COUNCIL – EXECUTIVE COMMITTEE

Members:

- Beth Mynatt, Georgia Tech (Chair)
- Mark Hill, University of Wisconsin, Madison (Vice Chair)
- Ben Zorn, Microsoft Research
- Jennifer Rexford, Princeton
- Daniel P. Lopresti, Lehigh
- Ann Drobnis, Director
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- Cynthia Dwork, Microsoft Research
- Daniel P. Lopresti, Lehigh University
- Shwetak Patel, Univ. Washington
- Katherine Yelick, UC Berkeley

CRA STAFF

CCC Director: Ann Drobnis

- 100% CCC, responsible for day-to-day management of the Organization

Senior Program Associate: Helen Wright

- 100% CCC, responsible for promoting the CCC mission through the website, blog, and social media

Program Associate: Khari Douglas

- 100% CCC, responsible for supporting CCC special programs, workshops, and communications

CRA Executive Director: Andy Bernat

- 10% CCC, responsible for general oversight

Other CRA Staff:

- Peter Harsha, Director of Government Affairs
- Sandra Corbett
- Sabrina Jacob

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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.

DESIRED OUTCOMES

1. **Create broad awareness of the role computing research will play in future science and technology advances** within federal agencies, philanthropic organizations, and industry through concrete examples and products.

2. **Facilitate broad engagement of the computing research community** in identifying and articulating new directions for computing research, in shaping priorities for those new directions, and in responding to existing opportunities in the computing research ecosystem.

3. **Create high-impact tangible resources** that inform stakeholders as to the current and potential impact of computing research.

4. **Sustain the CCC** as a widely accepted catalyst and voice for the computing research community.

5. **Grow leadership and community capacity** to engage in and respond to national science policy needs.

ACTIVITIES

Envisioning Future Computing Research

- Workshops
- Blue Sky Ideas Conference Tracks
- Computing Research Symposia: Addressing National Priorities and Societal Needs

Engaging and Aligning with National and Computing Research Priorities

- Outputs of Visioning Activities
- Short Reports / White Papers
- Task Forces

Communicating Future Computing Research

- CCC Blog (http://cccblog.org)
- Great Innovative Ideas
- Computing Research Symposia
  - Fall 2017

Cultivating Computing Leadership and Community Capacity

- Postdoc Best Practices
- Industry – Academic Collaborations
- Computing Innovation Fellows (CIFellows) Project
- Leadership in Science Policy Institute (LiSPI)

VISIONING PROCESSES

- Periodic RFP for Community Initiated Activities
- ~6 workshops per year in the last 3 years
- Top-down (agency initiated)
- Bottom-up (open call)
- Sideways (council initiated, joint with other agencies,….)

Cyber Social Learning Systems

Nanotechnology-inspired Information Processing Systems

Smart Health

Sociotechnical Cybersecurity

Cybersecurity for Manufacturers

VISIONING ACTIVITIES

- Over 45 visioning activities in 11-year history
- Average of 6 activities per year in the last 4 years
- Research areas include:
  - Smart and Pervasive Health
  - Nanotechnology-inspired Information Processing Systems
  - Cyber Social Learning Systems
  - Privacy by Design
  - BRAIN Initiative
  - Inclusive Access
  - Personalized Education
- 13 workshop reports released in past 4 years
- 20 white papers released in past 4 years

Workshop	Date
Quantum Computing	May 22-23, 2018
Digital Computing Beyond Moore's Law	May 3-4, 2018
Robotic Materials	April 23-24, 2018
Sociotechnical Interventions for Health Disparity Reductions	April 9-10, 2018
Fair Representation and Fair Interactive Learning	March 18-19, 2018
Sociotechnical Cybersecurity Workshop 2	August 8-9, 2017
AAAI Symposium on AI for Social Good	March 27-29, 2017
Cyber Security for Manufacturers	March 14-15, 2017
Cyber-Social Learning Systems Workshop 3	January 24-25, 2017
Sociotechnical Cybersecurity Workshop 1	December 12-13, 2016
Discovery and innovation in Smart and Pervasive Health	December 5-6, 2016

BLUE SKY

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

- 8 different tracks at 6 different conferences in last 4 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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CCC TASK FORCES

CCC task forces are organized around national priorities, community needs, and council member interests.

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).

Our current set of topics are:

- Artificial Intelligence
- Cybersecurity
- Human Technology Frontier
- Intelligent Infrastructure
- Post Moore's Law Computing
- Privacy and Fairness

COMPUTING RESEARCH
ADDRESSING NATIONAL PRIORITIES AND SOCIETAL NEEDS

Establish a biennial symposium to communicate the role of computing research to address national and societal priorities

- Spring, 2016
  - Computational Methods for Sustainable Development
  - Computing Enhancing Our Lives
  - Personal Control of Digital Data
  - Partnerships for the Future
- Fall, 2017
  - Intelligent Infrastructure for our Cities and Communities
  - Security and Privacy for Democracy
  - AI and Amplifying Human Abilities
  - Data, Algorithms, and Fairness

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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
- Great Innovative Ideas
  - A way to showcase the exciting new research and ideas generated by the computing community
- Annual events
  - CCC Symposium
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  - Leadership in Science Policy Institute (LISPI)
- Special Events
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Computing Research 2016

AI for Social Good 2016

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

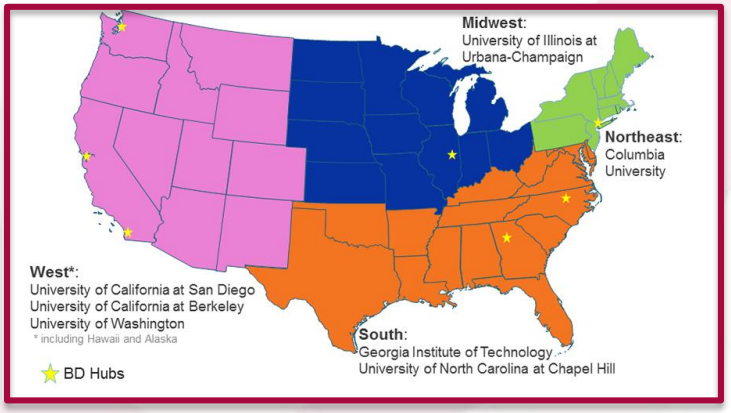
Computing Innovation Fellows (CIFellows) Project

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

ENGAGING WITH INDUSTRY

- Working with industry leaders in planning CCC workshops
- Hosting CCC activities at industry events
- Cultivating and working with federal-industry partnerships
- Engaging non profits and industry consortia
- Taking a broad view on computing industry
- Ensuring industry participation at CCC events

Platforms for Advanced Wireless Research (PAWR)

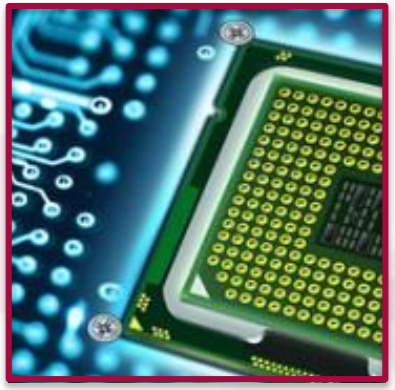


Partnership on AI
to benefit people and society

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.

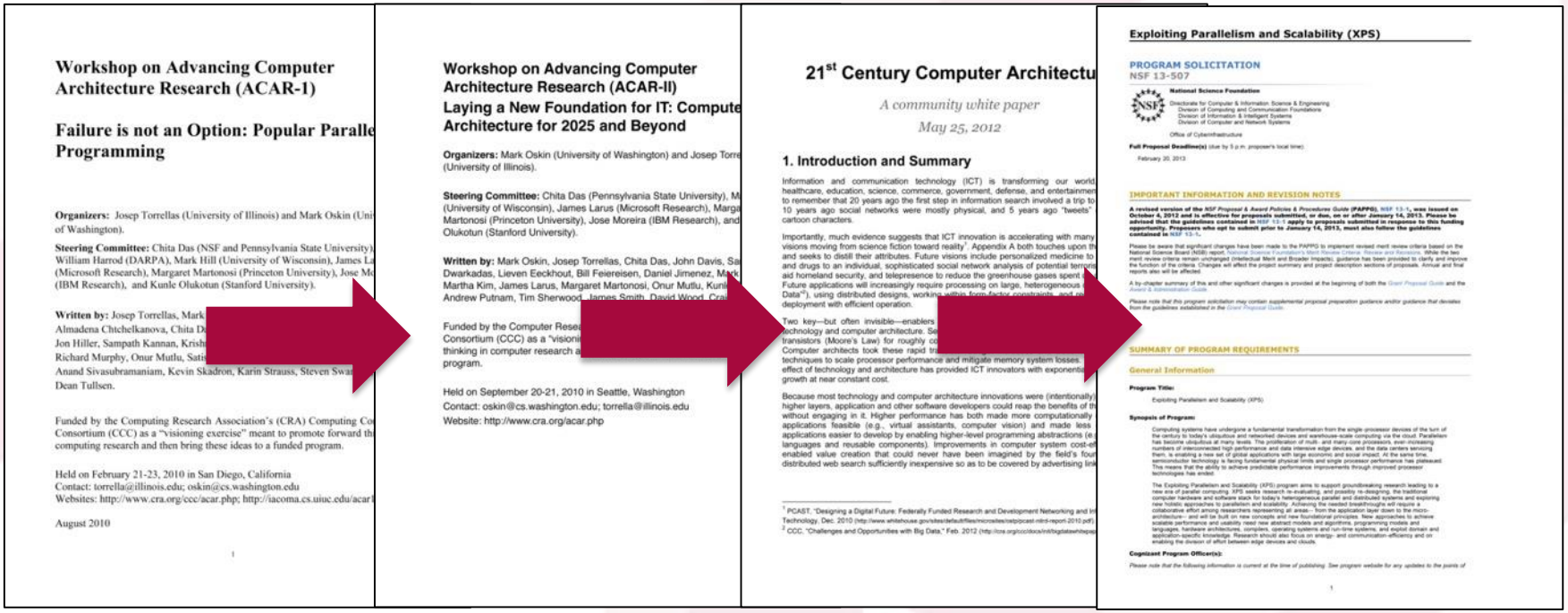
NSCI announced in July 2015.

CCC produced a series of blog posts on the topic, featuring one from Doug Burger, and the Convergence of Data and Computing 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, Crai

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 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 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 in 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

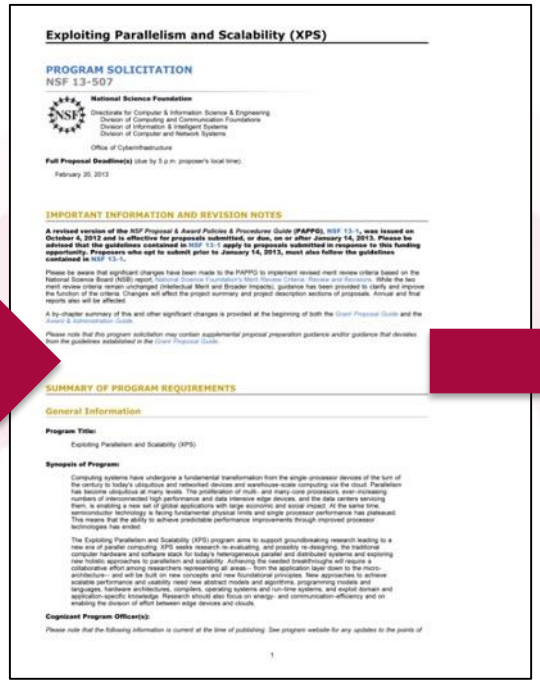
Josep Torrellas
UIUC

Mark Oskin
Washington

Mark Hill
Wisconsin

CCC
Computing Community Consortium
Catalyst

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
Division of Computer and Network Systems

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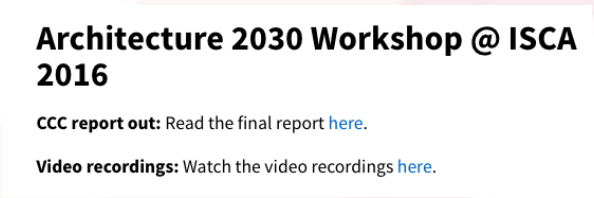
Cognizant Program Officer(s):

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

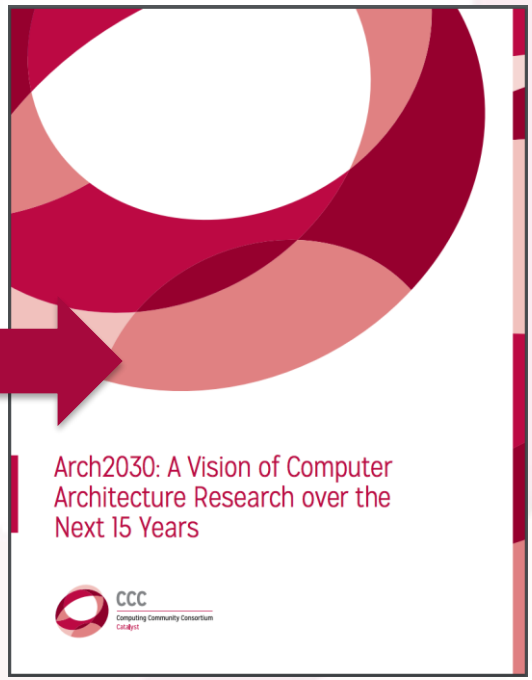


Architecture 2030 Workshop @ ISCA 2016

CCC report out: Read the final report here.

Video recordings: Watch the video recordings here.

2016



2016

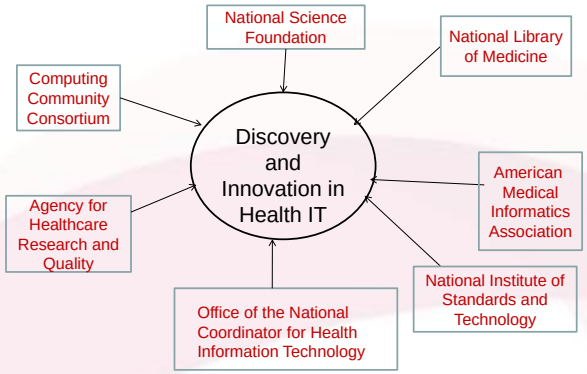
Luis Ceze
Washington

Tom Wenisch
Michigan

Mark Hill
Wisconsin

IMPACT: HEALTH IT

October 2009 Workshop



National Science Foundation
WHERE DISCOVERIES BEGIN

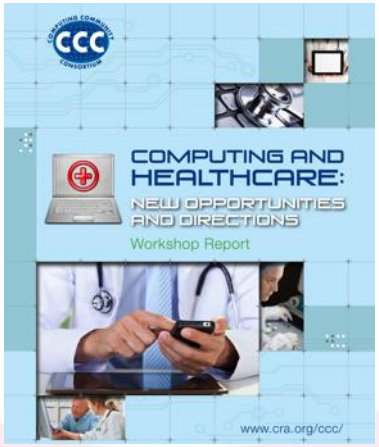
Directorate for Computer & Information Science & Engineering

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

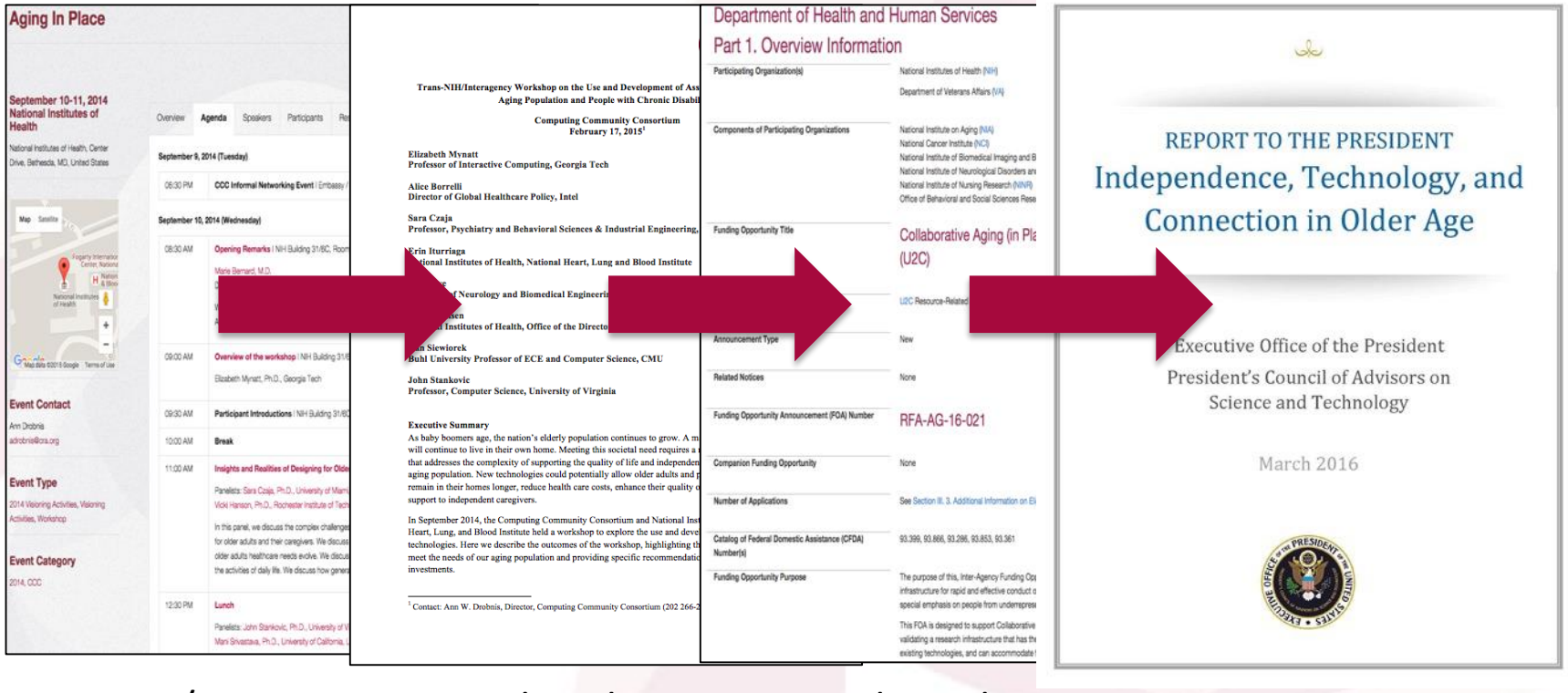
Directorate for Social, Behavioral & Economic Sciences

National Institutes of Health

October 2012 Workshop

CCC
Computing Community Consortium
Catalyst

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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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.

Promote Audacious Thinking:

- Community Initiated Visioning Workshops
- Blue Sky Ideas tracks at conferences

Communicate to the Community:

- CCC Blog - http://cccblog.org/
- Great Innovative Ideas
- White Papers and Workshop Reports
- Social Media (@compcomcon)
- Council member presentations

Facilitate Investment:

- Outputs of visioning activities
- Task Forces – AI, Cybersecurity, Post Moore's, etc.
- Engage with federal agencies and industry

Inculcate Leadership and Service:

- Engage with CCC Alumni and Sister Organizations
- Biennial Symposia series

Influence Early Career Researchers:

- Industry – Academic Collaborations
- Leadership in Science Policy Institute
- Postdoc Best Practices