TALK OUTLINE

1. Big Picture
2. Context, Members, Goals
3. Longitudinal Activities
4. Ongoing Work
5. Discussion
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 - 20 members
- 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

Professional Development
- Early Career Workshops & Participation
- Council Membership
- Leadership w/ Gov’t (LISPI)
CCC: CATALYZING I.T.’S VIRTUOUS CYCLE

Icons modified from Zlatko Najdenovski, Flaticon
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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

• Staffed by CRA
MAJOR STAKEHOLDERS

• Computing Research Community
  – CRA members
  – 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
GOVERNMENT STAKEHOLDERS

Agencies that are particularly 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
- NITRD – entre to interagency working groups

Others that are relevant

- NIST
- HHS/ONC
- IARPA
- DoT
- DHS
Members:

- Mark Hill, University of Wisconsin, Madison (Chair)
- Liz Bradley, University of Colorado Boulder (Vice Chair)
- Nadya Bliss, Arizona State University
- Dan Lopresti, University of Lehigh
- Beth Mynatt, Georgia Tech (Past Chair)
- Ben Zorn, Microsoft Research
- Ann Drobnis, Director
- Andy Bernat, CRA Executive Director
THE CCC COUNCIL

Chair: Mark Hill
Vice Chair: Liz Bradley

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
- Manuela Veloso, Carnegie Mellon
- Ben Zorn, Microsoft Research

Terms ending June 2019
- Sampath Kannan, UPenn
- Maja Matarić, USC
- Elizabeth Mynatt, Georgia Tech
- Nina Mishra, Amazon
- Holly Rushmeier, Yale
- Kevin Fu, Univ. Michigan
CRA STAFF WITH CCC RESPONSIBILITIES

CCC Director: Ann Drobnis
CCC Deputy Director: TBD
Senior Program Associate: Helen Wright
Program Associate: Khari Douglas
CRA Executive Director: Andy Bernat
Additional CRA Staff:
  – Peter Harsha, Director of Government Affairs
  – Sandra Corbett
  – Sabrina Jacob
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.
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ACTIVITIES

Events for the Community
- Visioning Workshops
- Blue Sky Ideas Conference Tracks

Aligning with National Priorities
- Short Reports / White Papers
- Task Forces

Website Features
- CCC Blog (http://cccblog.org)
- Great Innovative Ideas

Leadership Opportunities
- Industry – Academic Collaborations
- Leadership in Science Policy Institute (LiSPI)
VISIONING: PROCESSES

• Periodic RFP for community-initiated activities
• Top-down (agency initiated)
• Bottom-up (open call)
• Sideways (council initiated, joint with other agencies,....)
• Average of seven workshops/year over the last three years
VISIONING ACTIVITIES

- Over 45 visioning activities in 11-year history
- Nine since 1 January 2017
- Research areas include:
  - Smart and Pervasive Health
  - Beyond Moore’s Law
  - Robotic Materials
  - Privacy by Design
  - BRAIN Initiative
  - Fairness
  - Personalized Education
- 13 workshop reports and 20 additional white papers released in past four years
- Over 300 community members annually participate in visioning workshops

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Date</th>
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<tbody>
<tr>
<td>Cyber-Social Learning Systems Workshop 3</td>
<td>January 24-25, 2017</td>
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<tr>
<td>Cyber Security for Manufacturers Workshop</td>
<td>March 14-15, 2017</td>
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<tr>
<td>Sociotechnical Cybersecurity Workshop 2</td>
<td>August 8-9, 2017</td>
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<td>Fair Representations and Fair Interactive Learning</td>
<td>March 18-19, 2018</td>
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<td>Sociotechnical Interventions for Health Disparity Reduction</td>
<td>April 9-10, 2018</td>
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<tr>
<td>Robotic Materials</td>
<td>April 23-24, 2018</td>
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<tr>
<td>Digital Computing Beyond Moore’s Law</td>
<td>May 3-4, 2018</td>
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<tr>
<td>Next Steps in Quantum Computing: Computer Science’s Role</td>
<td>May 22-23, 2018</td>
</tr>
<tr>
<td>Leadership in Embedded Security</td>
<td>August 13, 2018</td>
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AMPLIFICATION

BRAIN Initiative launched in 2013.

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


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).
IMPACT: ARCHITECTURE

Workshop on Advancing Computer Architecture Research (ACAR-I)
Failure is not an Option: Popular Parallel Programming

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

Steering Committee: Chita Das (NSF and Pennsylvania State University), Mark Hill (University of Wisconsin), James L. (Microsoft Research), Margrit Martonosi (Princeton University), Josep M (IBM Research), and Karlle Oldham (Stanford University).

Written by: Josep Torrellas, Mark Oskin, Abhijat Choudhary, Chita Das, Jon Hiller, Samir Ramanan, Krishna Ramalingam, Richard Murphy, Omar Mota, Srinivasan Sumangali, and Dan Tuilson.

Funded by the Computing Research Association’s (CRA) Computing Curricula Coordination (CCC) as a “visioning exercise” meant to promote forward direction in computer research and bring those ideas to a networking program.

Heid on February 21-23, 2010 in San Diego, California.
Contact: torrellas@illinois.edu, skib@cs.washington.edu
Website: http://www.cra.org/ccc/accr.php; http://tacrer.cs.illinois.edu/accr
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 Torrellas (University of Illinois).

Steering Committee: Chita Das (Pennsylvania State University), M. (University of Wisconsin), James L. (Microsoft Research), Margrit Martonosi (Princeton University), Josep M (IBM Research), and Karlle Oldham (Stanford University).

Written By: Mark Oskin, Josep Torrellas, Chita Das, John Gorman, Seth Swartzwelder, Leven Economou, Bill Powers, Daniel Jenner, Mark Martin, Kim, James L. (University of Wisconsin), Omar Mota, and Andrew Putnam.

Funded by the Computing Research Association’s (CRA) Computing Curricula Coordination (CCC) as a “visioning exercise” meant to promote forward direction in computer research and bring those ideas to a networking program.

Contact: oskin@cs.washington.edu, torrellas@illinois.edu
Website: http://www.cra.org/accr.php

21st Century Computer Architecture
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 entertainment. To remember that 20 years ago the first step in information search involved a task force, was the introduction of a new architecture, and was the creation of a new computer architecture. Architects were mostly physical, and 5 years ago... New characters.

Importantly, much evidence suggests that ICT innovation is accelerating with more rapid change than was once thought possible. Applications for both global and local use, software and hardware, are increasing in complexity and number, and software is an individual, sophisticated social netwotk analysis of potential threats and responses. Security, and requirements to reduce the greenhouse effects of ICT are.

Future applications will increasingly require processing on large, heterogeneous, shared computing platforms. This is using distributed co-design, new techniques, and technology.

Two key-enabling technologies are: technology and system requirements. The latter is closely coupled with the former. The former is closely coupled with the technology.

Because most technology and computer architecture innovations were intentional, the main approach is a higher-level implementation. Application and other software developers could reap the benefits of the technology, higher performance that both leads to more compute-intensive applications and higher-level programming abstractions for languages and novel components. Improvements in computer system control and embedded-value creation that could not have been enabled by the field’s now distributed but search very effectively as to be covered by advertising the

Mark Oskin
Washington

Mark Hill
Wisconsin
IMPACT: ARCHITECTURE

Architecture 2030 Workshop @ ISCA 2016

CCC report out: Read the final report here.

Video recordings: Watch the video recordings here.

Luis Ceze
Washington

Tom Wenisch
Michigan

Mark Hill
Wisconsin

2013

2016

2016
Smart and Connected Health (SCH)

PROGRAM SOLICITATION
NSF 13-543

REPLACES DOCUMENT(S):
NSF 12-543

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

Smart Health and Wellbeing (SHW)

CONTACTS
See program guidelines for contact information.

SYNOPSIS
Information and communications technologies are poised to transform our access to and participation in our own health and well-being. The complexity of this challenge is being shaped by concomitant transformations to the fundamental nature of what it means to be healthy. Having good health increasingly means managing our long-term care rather than sporadic treatment of acute conditions; it places greater emphasis on the management of wellness rather than healing illness; it acknowledges the role of home, family, and community as significant contributors to individual health and wellbeing as well as the changing demographics of an increasingly aging population; and it recognizes the technical feasibility of diagnosis, treatment, and care based on an individual’s genetic makeup and lifestyle. The substrate of 21st century healthcare will be computing and networking concepts and technologies whose transformative potential is tempered by unresolved core challenges in designing and optimizing them for applicability in this domain.

The goal of the Smart Health and Wellbeing program is to seek improvements in safe, effective, efficient, equitable, and patient-centered health and wellness services through innovations in computer and information science and engineering. Doing so requires leveraging the scientific methods and knowledge bases of a broad range of computing and communication research perspectives.

Some illustrative examples are described here. Protecting patient privacy while providing legitimate anytime, anywhere access to health services will require new security and cryptographic solutions. Personalized medicine will require advances in information retrieval, data mining, and decision support software systems. Continuous monitoring and real-time, customized feedback on health and behavior will rely on remote and networked sensors and actuators, mobile platforms, novel interactive displays, and advances in computing and networking infrastructure.

Data collected by sensors, at clinics, and labs need to be anonymized and aggregated for community-wide health awareness and maintenance. Such data, especially collected over populations, can lead to inferences about best practices and cost savings in providing health services. Virtual worlds, robotics, image, and natural language understanding can facilitate better and more efficient delivery of health services. Software-controlled and interoperable medical devices are necessary for providing safe critical care. Healthcare systems and applications must be usable, to preclude or minimize failures due to human error; and they have to be useful, by matching the mental model of users, from provider to patient, so people make appropriate decisions and choices.

These examples are meant to convey the breadth of computing areas that are relevant to Smart Health and Wellbeing.
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
**BLUE SKY**

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

- 17 different tracks at ten different conferences in the last four years
- On average, 13 papers submitted per track at a conference
- Winners are asked to submit Great Innovative Ideas
METHODS OF COMMUNICATING: CURRENT

- Workshop Reports
- White Papers
  - CCC works with the community to produce timely white papers that inform policymakers about pressing issues and national priorities
- CCC Blog
  - Provides a continuous stream of information about advances in computing research
  - Opportunities for community to get involved
- Great Innovative Ideas
  - A way to showcase the exciting new research and ideas generated by the computing community
- Special Events
  - CCC Symposium
  - CRA Snowbird
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
INDUSTRY – ACADEMIC COLLABORATIONS

With NSF Big Data Regional Innovation Hubs

- **Northeast**: Young Innovator Internships, Knowledge Exchange Lecture Series, Data Science Best Practices Workshop

- **South**: Data Start Internships, PEPI Early Career Exchange Visits

- **Midwest**: Early Career Big Data Summit, Data Quality and Informal Data-An Oxymoron Workshop, Travel Grants

- **West**: Collaboratory Faire, Workshop on Data Hackathon Best Practices, Tools of the Data Journalism Trade Workshop
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CCC WORKING GROUPS & TASK FORCES

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

Task forces, which include Council members and others from the community, meet on a regular basis and report at every Council meeting.

These provide a key mechanism to enable parallelism and expand CCC’s reach

• Pioneered a few years ago
• Includes some non-CCC members
• Five task forces in 2017-18 ➔ six task forces + two working groups in 2018-19
• Expect smaller task forces to increase participant engagement
ARTIFICIAL INTELLIGENCE ROADMAP
WORKING GROUP

Chairs: Yolanda Gil and Bart Selman

Yolanda Gil
University of Southern California

Bart Selman
Cornell University

Context:
• NSF & others encouraged on tight timetable
• Like Robotics Roadmap, but industry all over ML

Current Members:

Liz Bradley
University of Colorado, Boulder

Maja Matarić
University of Southern California

Nina Mishra
Amazon

David Parkes
Harvard University

Recent Activities:
• WS #1-Integrated Intelligence
  Marie desJardins (Simmons) & Ken Forbus (Northwestern University)

Upcoming Activities:
• WS #2- Interaction
  Kathy McKeown (Columbia University) & Dan Weld (University of Washington)
• WS #3- Learning and Robotics
  Fei Fei Li (Stanford) & Tom Dietterich (Oregon State)
INDUSTRY WORKING GROUP:  
TRANSPORTATION / AUTONOMOUS VEHICLES

Chair: Ben Zorn

Current Members:

Shwetak Patel
University of Washington

Ben Zorn
Microsoft Research

Jennifer Rexford
Princeton University

Greg Morrisett
Cornell University

Context:
• University/industry interaction is crucial, CCC round-table in 2015
• Questions: Is this interaction changing? If so, how?
• Approach: Consider one vertical closely this year – Autonomous Vehicles / Transportation
• Learn & move forward next year

Recent Activities:
• Ongoing discussions with academics, industry (nuTonomy), DoT FHWA

Upcoming Activities:
• Preparing preliminary white paper
• Possible workshop in Spring
White Papers:
• Safety, Security, and Privacy Threats Posed by Accelerating Trends in IoT
• System Computing Challenges in the IoT

Recent Activities:
• Sociotechnical Cybersecurity workshop series (2016-2017)
• Leadership in Embedded Security Workshop (2018)

Upcoming Activities:
• Developing partnerships for UN workshops and followup on application of AI to fight against human trafficking (CCC, UNU Delta 8.7, Alan Turning Institute, Tech Against Trafficking)
HEALTH AND HUMAN COMPUTER INTERACTION TASK FORCE

**Chair:** Maja Matarić and Shwetak Patel

**Recent Activities:**
- Response to NITRD draft Federal Health Information Technology Research and Development Strategic Framework

**Upcoming Activities:**
- Working on content creation for training (future of work)
- Developing potential workshops such as opioid abuse and eldercare

**White Papers:**
- *Information Technology Research Challenges for Healthcare: From Discovery to Delivery*
- *Trans-NIH/Interagency Workshop on the Use and Development of Assistive Technology for the Aging Population and People with Chronic Disabilities*

**Current Members:**

- **Maja Matarić**
  University of Southern California
- **Shwetak Patel**
  University of Washington
- **Keith Marzullo**
  University of Maryland
- **Beth Mynatt**
  Georgia Tech
- **Holly Rushmeier**
  Yale
- **Nina Mishra**
  Amazon
- **Maja Matarić**
  University of Southern California
- **Shwetak Patel**
  University of Washington
INFORMATION INTEGRITY AND PROVENANCE
TASK FORCE

**Chairs:** Nadya Bliss and Juliana Freire

Nadya Bliss  
Arizona State University

Juliana Freire  
New York University

**Recent Activities:**
- New Task Force!

**Upcoming Activities:**
- Charting the research agenda for this area

**Current Members:**

Beth Mynatt  
Georgia Institute of Technology

Greg Morrisett  
Cornell University

Keith Marzullo  
University of Maryland
Recent Activities:
• *Intelligent Infrastructure white paper series (2017)*

Upcoming Activities:
• Collaboration with the NIST GCTC Meeting at the end of October, 2018
• Likely joint workshop between CCC and NIST GCTC Public Safety SuperCluster in Spring
• Companion CCC whitepaper to NIST GCTC Public Safety Blueprint for 2019
FAIRNESS AND ACCOUNTABILITY TASK FORCE

**Chairs:** Liz Bradley and Sampath Kannan

**Recent Activities:**
- March 2018 workshop on Fairness; draft report in preparation for CACM

**Upcoming Activities:**
- Planning a workshop on Economics and Fairness
- Support of and input to the AI Roadmapping working group

**White Papers:**
- Big Data, Data Science, and Civil Rights
- Privacy-Preserving Data Analysis for the Federal Statistical Agencies
- Towards a Privacy Research Roadmap for the Computing Community

**Current Members:**
- Liz Bradley
  University of Colorado, Boulder
- Sampath Kannan
  University of Pennsylvania
- Ronitt Rubinfeld
  MIT
- Suresh Venkatasubramanian
  University of Utah
- David Parkes
  Harvard University
- Liz Bradley
  University of Colorado, Boulder
- Sampath Kannan
  University of Pennsylvania
- Ronitt Rubinfeld
  MIT
- Suresh Venkatasubramanian
  University of Utah
- David Parkes
  Harvard University
SYSTEMS AND ARCHITECTURE TASK FORCE

**Chairs:** Mark Hill and Jen Rexford

- **Mark Hill**
  University of Wisconsin, Madison

- **Jennifer Rexford**
  Princeton University

**Current Members:**

- **Tom Conte**
  Georgia Tech

- **Juliana Freire**
  New York University

- **Ian Foster**
  Argonne National Lab

**Recent Activities:**

- Two workshops (*Next Steps in Quantum Computing: Computer Science’s Role and Digital Computing Beyond Moore’s Law*) completed in Spring 2018

**Upcoming Activities:**

- Thermodynamic Computing Workshop: January, 2019
- Deploying Post-Quantum Crypto systems Workshop
- Talking about four possible new areas for a workshop (such as self driving systems or distributed databases)

**White Papers:**

- *The Opportunities and Challenges for Next Generation Computing*
- *Challenges to Keeping the Computing Industry Centered in the US*
CCC Visioning Workshop:
Next Steps in Quantum Computing:
Computer Science’s Role

Prof. Margaret Martonosi
Dept. of Computer Science
Princeton University

Dr. Martin Roetteler
Microsoft Research
Workshop Intro

Who?

• 55 participants
• QC researchers + CS researchers curious about QC + other
• Math, Physics, Computer hardware and software, Algorithms, ...
• Academia, Industry, govt agencies, ...

Overall Goal:

• Envisioning the research future of QC, with particular focus on Computer Science role
QC: Current State

- Grover's Algorithm (Database search)
- Shor's Factoring Algorithm (Crypto)
- Quantum Sim, QChem, QAOA
- Gap!

- Noisy Intermediate-Scale Quantum (NISQ)
  - Preskill, Jan 2018
  - 10-1000 qubits
- Large enough to support interesting experiments
- Too small for known algorithms with exponential speedup
- Too small for ECC
- Current: 10-50 qubits at 1% error per gate

Year: 1995, 2005, 2015, 2025

NISQ
Approach

- 4 topic areas: Algorithms, Technologies, Toolchains/Programming, Architecture
- For each topic area: 2 broad vision talks + group discussion + breakout + report-back
- For each breakout:
  - What do you think are the current major breakthroughs that didn’t get mentioned during those talks?
  - What do you think has to happen in these areas for quantum computing to become viable in N years (10 or 20)?
  - How can computer scientists play a role?
Opportunity vs. Hype: Positivity about the technology opportunities, balanced with a desire to avoid excessive hype.
Takeaways

- **(Efficient) Abstraction**: Must mitigate systems complexity while still allowing information flow algorithms $\leftrightarrow$ devices

\[ a + b \]
**Takeaways**

- **Roadmap**: Great sense of value in collaborating on a technology maturation roadmap, much like Moore’s Law articulated a scaling vision for semiconductors.
  - -> Note: This is not about **exponential** scaling. But rather about a plan for how to value qubit counts, vs. precision, vs. coherence interval, etc.
HOW CAN YOU GET INVOLVED?

• Reach out to the CCC with your ideas!
  – Email Ann (adrobnis@cra.org)
  – Come to a CCC visioning workshop
    (See upcoming events: https://cra.org/ccc/events/)
  – Come to a CCC council meeting

• Tell your community about CCC!
  – RFP posted at the beginning of each year, please share
  – Have a colleague who you would recommend for a visioning workshop? Let Ann know!
  – Read and share our blog (http://www.cccblog.org)
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.

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- Chair, VC, & Director
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**What:**
- Workshops & Conf. Blue Sky Tracks
- Whitepapers & Social Media
- Reports Out (esp. to government)
- Biannual Symposium in DC

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