CRA-W
Taking Action to Achieve Diversity in Computing Research

DILMA DA SILVA

Dilma Da Silva is a principal engineer and manager at Qualcomm Research in Santa Clara, California, where she leads in the area of mobile cloud computing. She previously worked at IBM Research in New York and at University of Sao Paulo in Brazil. She received her PhD from Georgia Tech in 1997. She has published more than 80 technical papers and filed 14 patents. Dilma is an ACM Distinguished Scientist, an ACM Distinguished Speaker, a member of the board of CRA-W and CDC, co-founder of Latinas in Computing, and treasurer for ACM SIGOPS. More information is available at www.dilmamds.com.

Presented by

WIAC
USENIX WOMEN IN
ADVANCED COMPUTING

I've been a member of the Computing Research Association's Committee on the Status of Women in Computing Research (CRA-W) for six years. Over that time, I've seen the impact that the CRA-W programs have had on the women and minorities who have participated. In this short article, I'll introduce CRA-W's goals, share some evidence of CRA-W's impact, and describe upcoming opportunities for participation.

One aspect that has kept me very active at CRA-W is the action-oriented approach that the organization takes to pursue the mission of increasing the success and number of women participating in computer science and engineering research and education at all levels. The board operates with very few meetings or open-ended discussions; instead, we pursue our goals by having each board member implement a program. Our programs aim to develop research, communication, and career strategy skills, as well as create a sense of community for women in computing research. It is the experience of many of us that such skills help women to earn advanced degrees in computing and achieve success in research careers in academia or industry. The committee is made up of prominent and dedicated women who have progressed well in their careers and are now willing to devote time and energy to design, implement, and secure the necessary funding for initiatives that advance diversity in computing research.

CRA-W programs expose women to knowledge that illustrates the rewards of a research career and the various paths people take to get where they want to be. The programs showcase the value of a PhD and provide guidance on getting to graduate school and making the best out of the experience. Our programs help participants develop self-efficacy through increased skills, knowledge, and confidence. The programs have been designed to connect participants to the research community and to each other to build a network for success. From 1992 to 2013, CRA-W programs have directly impacted more than 7,700 women and minorities.

Many members of the USENIX community have been involved in CRA-W programs, and I believe there are many opportunities to join forces to continue to advance our fields. All USENIX communities can gain a lot by including participation from all groups in society so that a diverse group of people continues to pursue innovation and contribute to advancing our society. But much needs to be done before we get there: Women and minority groups (e.g., Native Americans, African Americans, and Hispanics) are severely underrepresented in all areas of computing. There is increasing demand for talent in all areas of computer science: the Occupational Outlook Handbook (2012-2013) forecasts 22% growth in computer occupations between 2012 and 2022, including 15% growth in computer and information research scientists [1]. In the areas covered by USENIX members, the situation is even more promising, but we still lack the diversity in our professional communities that one would expect based on the general population makeup.

There is strong evidence that diversity can impact business in significant ways:

◆ A 2007 NCWIT study shows that IT patents issued to mixed gender teams are cited 26% to 42% more than similar IT patents by all men or all women teams [6].

◆ Herring found that companies with reported highest levels of racial diversity had 15 times more sales revenues than those with lower diversity [7].
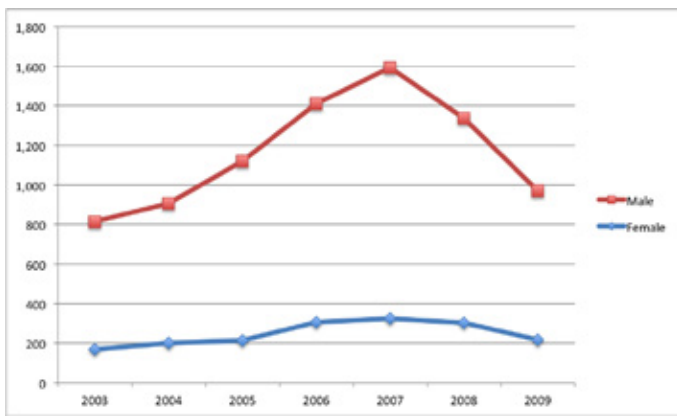
Figure 1: Computer science doctoral degrees granted

- In the mid-1990s, IBM expanded its minority markets by promoting diversity in its own workforce [8].
- A study from 2008 finds that having multi-cultural experience enhances creativity [9].

In short, there is evidence showing that a diverse group of contributors can lead to better results. My work in the CRA-W is motivated by much more than any "let's do the right thing" attitude; like many people I know, I want to help build a future for computing in which the IT industry continues to improve society through significant technological contributions and economic impact.

In research careers requiring graduate degrees, women and minorities continue to be a small fraction of computing PhD recipients (see Figure 1). We are failing to capitalize on the creativity of a large part of our society, and CRA-W works to change this picture so that we achieve a diverse technical community. Studies indicate that a diverse leadership drives students and workforce diversity [2–5], so we have many CRA-W programs that focus on exposing students to a diverse group of role models and mentors from academia and industry. We also have programs to guide junior women researchers towards successful careers.

In CRA-W, we value systematic evaluation of our programs. We founded CERP (CRA Center for Evaluating the Research Pipeline) and perform quantitative comparisons of a nationwide sample of undergraduates, graduate students, and faculty to our program participants. Our evaluation results show that our undergraduate participants are almost four times more likely than nonparticipants to enroll in a PhD program, and our graduate participants are more likely to publish, be first author, and collaborate—all indicators of success in the research community [10].

In upcoming issues of *;login:,* I will be presenting detailed information on several CRA-W programs and discussing opportunities for CRA-W and USENIX members to collaborate towards a stronger research community. USENIX itself began its Women in Advanced Computing (WiAC) initiative in 2012 and is partnering with CRA-W to bring this content to the USENIX community via *;login:,* as well as exploring other paths of partnership.

For the list of CRA-W programs and events, please visit www.cra-w.org. An upcoming event of particular interest to *;login:* readers is USENIX's Diversity '14, a discipline-specific mentoring workshop for the system software community co-located with OSDI '14.

References

[1] Bureau of Labor Statistics, Occupational Outlook Handbook, 2012-13 Edition, Computer and Information Research Scientists, 2012: http://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm, accessed May 1st, 2014.

[2] H. Astin and L. Sax, "Developing Scientific Talent in Undergraduate Women," in C. S. Davis, A. Ginorio, C. Hollenshead, B. Lazarus, and P. Rayman, eds, *The Equity Equation: Fostering the Advancement of Women in the Sciences, Mathematics, and Engineering* (Jossey-Bass, 1996).

[3] G. Hackett, D. Esposito, and M. S. O' Halloran, "The Relationship of Role Model Influences to the Career Salience and Educational and Career Plans of College Women," *Journal of Vocational Behavior,* vol. 35, no.2 (October 1989), pp. 164–180.

[4] M. A. Mason, M. Goulden, and K. Frasch, "Why Graduate Students Reject the Fast Track," *Academe,* vol. 95, no. 1 (January-February 2009): https://www.law.berkeley.edu/files/Grad_Students_Fast_Track_Article.mamason.pdf, accessed May 9, 2012.

[5] B. W. Packard and E. D. Wong, "Future Images and Women's Career Decisions in Science," in *Proceedings of the Annual Meeting of the American Educational Research Association,* Montreal, Canada, April 1999.

[6] C. Ashcraft and A. Breitzman, "Who Invents IT? An Analysis of Women's Participation in Information Technology Patenting," technical report, National Center for Women and Information Technology, March 2007.

[7] C. Herring, "Does Diversity Pay? Race, Gender and the Business Case for Diversity," *American Sociological Review,* vol. 74, no. 2 (2009), pp. 208–224.

[8] D. A. Thomas, "Diversity as Strategy," *Harvard Business Review* (September 2004).

[9] A. K. Leung, W. Maddux, A. D. Galinsky, and C-Y. Chiu, "Multicultural Experience Enhances Creativity: The When and How," *American Psychologist,* vol. 63, no. 3 (2008), pp. 169–181.

[10] E. Bizot, K. Hines, I. Pufahl, T. McKlin, and S. Engelman, "The Data Buddies Project: CRA-W/CDC Project on Measuring Outcomes for Students in Computing: Report on Spring 2011 Surveys," technical report, Computing Research Association, Washington, DC, 2012: http://cra.org/cerp/wp-content/uploads/2011/11/Data-Buddies-Report-CRA-Report-Final.pdf, accessed May 1, 2014.