



A Time of Change

Tom Conte, IEEE Computer Society 2015 President

As aspects of computing undergo massive transformation, the Computer Society and the profession itself are at a special inflection point. The Society is adapting to these changes to remain valuable and useful to you, its members.

Since the days of John von Neumann and Alan Turing, the computing field has followed a set of design choices that led to exponential performance scaling, in which single-processor performance doubled every 18 months. Many people mistakenly refer to this as Moore's law—after Intel founder and Silicon Valley pioneer Gordon Moore. But Moore instead predicted a doubling in the number of transistors per unit area every two years (now 18 months). In 2004, however, Moore's law and exponential computer-performance scaling parted ways due to thermal constraints. Although we continued to produce more transistors during the past decade, 11 nanometers is only marginally better than 14 nm, which is only marginally better than 22 nm.

In response, the computing field shifted to thread-level parallelism, and the multicore era began. But parallelism and multicore computing likewise failed to return us to exponential computer-performance scaling. The reason was simple: not everything can be parallelized. Now, 10 years into the multicore era, even Moore's law is reaching its limits: the doubling of transistors per unit area is slowing down as well and is projected to end at 7 nm circa 2020.

Meanwhile, the need for faster computers hasn't slowed. In fact, with advances in machine learning, the demand is greater than ever. We need to rethink the

fundamental decisions we made along the way to consider whether—had we gone down a different path, taken a right turn instead of a left—we would still be experiencing exponential performance scaling.

In 2013, IEEE started the Rebooting Computing initiative (<http://rebootingcomputing.ieee.org>), which I co-chaired with Elie Track, 2014 president of the IEEE Council on Superconductivity. We gathered a team of experts, held three summits, and explored interesting possibilities for an effective way forward toward renewed exponential scaling. None of these will be easy; each of these possibilities requires a fundamental shift in the computer industry and thus necessitates a significant investment from government and industrial channels. But we have no choice: we must explore these alternatives. Returning computing to its historic exponential performance scaling trends is critical to ensure the continuation of computing's benefits to society.

THE COMPUTER SOCIETY MUST ALSO CHANGE

As computing is itself at an inflection point, so too is the CS. Many of our activities are either in the process of or about to begin rapidly changing. The way we communicate, publish, educate our members, and so on are all in flux. The CS must update its structure to position itself for this change, or it will cease to be a society that serves its members.



My immediate predecessor, Past-President Dejan Milojević, undertook an aggressive agenda to revitalize the Society, and I will continue his initiatives. Specifically, I will focus on advancing the strategic directions identified in the CS's three-year plan, including taking the lead in next-generation conferences and publications, supporting and delivering high-quality professional education to our members, listening to all of our constituent communities, and in general providing value to you, our members.

NEXT-GENERATION CONFERENCES AND PUBLICATIONS

We still think of articles in terms of 8½" × 11" pages, even though all of our content—including *Computer*—is read on electronic devices by the vast majority of our members. But the digital publishing revolution has come to the CS, and we must think in terms of free-flow content (like Kindle e-books). The transformation doesn't stop at format though; the content itself can no longer be static.

When I discuss this shift with undergraduate students, their reactions reveal more than a little disbelief. "How could you not see this coming?" they ask. These future members no longer turn pages. They think printed books are as quaint as my Walkman-obsessed generation regarded the transistor radio. Today they disseminate ideas online, and even reputations are based on social media principles. Take, for example, stackoverflow.com: good, technically sound answers can contribute to one's professional standing in much the same way as patents and peer-reviewed publications.

Change is never easy, and this is quite a shift in thinking for many of us. What will it mean for your peers to review your "paper"? Will people need to physically be at a conference, or will

virtual attendance be a welcome middle ground between traveling and just reading the proceedings? What will it mean to disagree with an aspect of a published article? Could the author have a chance to address errors directly? Will each paper become a living document, with versions and revision histories (think: an *IEEE Transactions on Computers* github)?

I'm proud of the huge step the CS has taken in embracing next-generation magazines and journals, and I'm ex-

disciplines such as computer engineering, computer science, information technology, information systems, systems engineering, and software engineering. Our educational offerings should be of high value to our members.

The need for high-quality, just-in-time, practitioner-focused education is great. Much like the revolution in publishing, this revolution will require experimentation. For example, at Georgia Tech we're offering an

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cited about what it means for us as a Society. I was the vice president of publications when our volunteer leaders decided to move our magazines to a primarily digital format. We weighed such factors as the changing behavior of our readership, the potential for enriching our content, and the ability to reach new communities. As the CS blazes a trail, we find ourselves one of the leaders in STEM publishing. But this is only the first step. We have much more to do!

So that the infrastructure for the new ways of conferencing and publishing is in place for our members, we need to anticipate the future and set things in motion now. We are our members. If you have an idea, tell the CS leadership—let's go try it out!

SUPPORT AND DELIVER HIGH-QUALITY PROFESSIONAL EDUCATION

The CS engages in educational activities to prepare members for their pre-professional and professional careers as practitioners engaged in

online master's in computer science degree program. This program isn't for everyone, so traditional in-person and workshop-based delivery will continue. However, tomorrow's workforce will expect the option to get their continuing education online. Many of you are leaders in the online higher education revolution. As with publishing, if you have new ideas, let the CS leadership know and we'll try them out!

REACHING OUT TO SERVE AND LISTEN TO EVERYONE

The CS leadership determined a number of years ago that the Society was becoming very research/academic focused. We made a concerted effort to better address our practitioner members' needs, beginning certification programs and establishing an Industrial Advisory Board. It worked: our professional practitioner members now look to the CS as a source for information, lifelong learning, and career guidance.

Some in the research community wonder, I think rightly, if the pendulum might have swung too far in the

PRESIDENT'S MESSAGE

other direction. One of my goals is to strengthen and empower the community of research engineers and scientists. To that end, I have asked Harold Javid of Microsoft Research to establish a Research Advisory Board to serve as a counterweight and give voice to this community. Similarly, I have asked vice president of Technical & Conference Activities Phillip Laplante to consider ways to restructure the Society so that our technical communities have a larger leadership role.

Another population that we've taken for granted is our computer engineering members. These are performance-oriented computer professionals, often with computer engineering degrees from accredited programs around the world. As electrical engineers who specialize in computing, there's no more natural home for them than the CS. I will seek to engage this community, starting with the student population, and welcome them to contribute actively to the Society.

Let's get started! This is a special time in the history of both computing and the CS. The CS leadership needs your help to "get it right." You are the CS. If you want to be involved in plotting the future of this Society, please—I want to hear from you. Let's be the revolutionaries. Let's reboot!

I had the privilege of being the President-Elect during the term of 2014 President Dejan Milošević. Dejan has done many things to strengthen the CS and position us for success in the future. At the same time, I'll have the pleasure of serving with 2015 President-Elect Roger Fujii, who

is an accomplished engineer and industry executive. Your Society is in good hands. ■



Selected CS articles and columns are also available for free at <http://ComputingNow.computer.org>.

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Circulation: *Computer* (ISSN 0018-9162) is published monthly by the IEEE Computer Society. IEEE Headquarters, Three Park Avenue, 17th Floor, New York, NY 10016-5997; IEEE Computer Society Publications Office, 10662 Los Vaqueros Circle, Los Alamitos, CA 90720; voice +1 714 821 8380; fax +1 714 821 4010; IEEE Computer Society Headquarters, 2001 L Street NW, Suite 700, Washington, DC 20036. IEEE Computer Society membership includes a subscription to *Computer* magazine.

Postmaster: Send undelivered copies and address changes to *Computer*, IEEE Membership Processing Dept., 445 Hoes Lane, Piscataway, NJ 08855. Periodicals Postage Paid at New York, New York, and at additional mailing offices. Canadian GST #125634188. Canada Post Corporation (Canadian distribution) publications mail agreement number 40013885. Return undeliverable Canadian addresses to PO Box 122, Niagara Falls, ON L2E 6S8 Canada. Printed in USA.

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