50TH ANNIVERSARY

# *Computer's* 50th Anniversary

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With maturity comes reflection and enlightenment. In this golden anniversary year, Computer celebrates not only its impressive past, but also the promise of its future.

Welcome to this very special issue, marking *Computer's* 50th anniversary—a special time for celebration and reflection. And what luck it is to be serving as *Computer's* editor in chief as we reach this remarkable milestone. I am truly honored to witness this occasion and to continue to serve the Computer Society's flagship and finest publication.

Computer was 15 when I first started to read it. It was love at first sight—I was fully on board, engaged, and excited to be a reader and a Computer Society member. It was how I learned about what was new and forthcoming in my field. It was also the publication that gave my generation of then-nerdy engineering students a clear professional identity and a sense of professional community. And so today, as we recognize and celebrate the magazine's accomplishments and how well it has served and empowered generations of readers, we owe it our diligent and sincere efforts to continue its
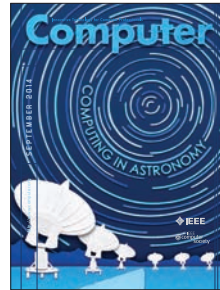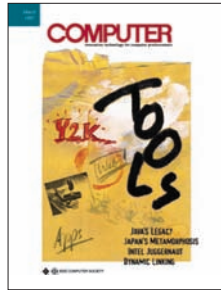
evolution and advancement as the flagship serving the Computer Society and its members.

EDITORIAL BOARD CHANGES

After many years of service and dedication to *Computer*, Kirk Cameron, Brian Gaff, Neville Holmes, Ying-Dar Lin, Theresa-Marie Rhyne, Karl Ricanek, Savitha Srinivasan, Christian Timmerer, and Upkar Varshney are stepping down. Their contributions and incredible support have helped shape *Computer* to be the successful publication that it is. I wish them all the best.

We also welcome six new editorial and advisory board members who will serve in different roles. Elisa Bertino, professor of computer science at Purdue University, will serve as associate editor in chief. Bruce Shriver, who served as the 1992 Computer Society president and also as past editor in chief of *Computer,* will now join our advisory panel. Bob Colwell, who served for many years as associate editor in chief for Perspectives submissions and authored *Computer*'s At Random column, also will join our advisory panel. Our Perspectives articles will now be handled by associate editor in chief George K. Thiruvathukal. Erich Neuhold, professor emeritus at the University of Vienna, will continue the good work of long-time

32 & 16 Years Ago department editor Neville Holmes, and will highlight the content from past issues of *Computer*, although we have expanded the reach in time and rechristened the department 50 & 25 Years Ago.

Christopher Nugent, professor and director of the Computer Science Research Institute at Ulster University, will serve as Digital Health area editor. Scooter Willis, director of computational biology at Avera Cancer Institute and an adjunct professor in the College of Engineering at Florida Atlantic University, will serve as column editor for the Student Design Showcase, which Greg Byrd launched in 2016. Greg, who will serve as the vice president of the Computer Society's Publications Board, will continue to serve as a Computer Architectures area editor. Also, Michael Beigl, chair of Pervasive Computing Systems at the Karlsruhe Institute of Technology, will join Roy Want as an Internet of Things (IoT) area editor.

NEW AREA, COLUMNS, AND DEPARTMENTS

Oleg Sokolsky, research associate professor in the Department of Computer and Information Science at the University of Pennsylvania, will serve as area editor for the newly added Cyber-Physical Systems (CPS) area. Research

and development in CPS addresses how to handle challenging requirements associated with systems that tightly couple computational algorithms with physical components.

Editorial board member and futurist Brian David Johnson starts a new column titled The Future Today, which provides an outlook on technology trajectories, especially for human-centric future applications. Also, veteran columnist and editorial board member David Alan Grier launches a new column, Global Code, which considers the impact of events, actions, and decisions from all over the world on the computing profession.

We are also proud to introduce our new Virtual Roundtable department, which brings panel-style discussions and debates on hot and emerging technical issues to the magazine. We are recruiting content from panels organized by high-impact conferences—interested? Consider proposing a virtual roundtable in *Computer*.

SPECIAL FEATURES

As part of our 50th anniversary celebration, we will publish several special columns and departments throughout the year that reflect the impact and history of the magazine. First, we are proud to feature From the Archives: *Computer*'s Legacy, a column edited
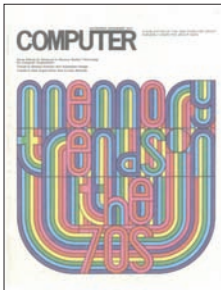
by Ron Vetter, *Computer* EIC Emeritus, which focuses on influential articles appearing on the pages of *Computer* throughout the past 50 years.

In addition, two other special anniversary features are planned for this year. Computing—The Next 50 Years is a monthly department coming from the Computer Society's Technical and Conference Activities Board and Industry Advisory Board. The first installment kicks off with self-driving cars and the impact such technology will have on the way we live in the future. Brian David Johnson's first installment of The Future Today also reflects on this paradigm shift, adding a futurist's depth to the prediction horizon.

Finally, Reflections from Our Editors, edited by David Alan Grier, brings us the many untold stories and perspectives about what it takes to put a magazine like *Computer* out each and every month. David will interview our past EICs and give us a sense of where we have been and how we developed and evolved into what we are today.

IN THIS ISSUE

In addition to kicking off our anniversary year, this January issue is, as usual, our Outlook issue. We look into computing's future through two articles that examine the state of the art as well as emerging research on how to make computing and computers scalable again. The issue also examines design innovation in the area of human–computer interaction in the two other feature articles, which show how new predictive user interface design principles and ubiquitous human-activity–sensing technologies are advancing intelligent interactive systems capabilities.

In "Rebooting Computing: The Road Ahead," Thomas M. Conte, Erik P. DeBenedictis, Paolo A. Gargini, and Elie Track report on ongoing developments in the IEEE Rebooting Computing Initiative (RCI). Not only is Moore's law coming to an end and the limits of device physics are upon us, but we are also developing applications that rely upon technologies such as machine learning and big data analytics that have growing demands for higher, never-before-attained computational powers. It has been a year since the authors' widely circulated *Computer* special issue on the topic (December 2015), and this update covers RCI's progress. The authors also warn that, in addition to the potential semiconductor changes, the way we structure computing system software (including operating systems) will also have to change to adapt to potential solutions as they are developed. The article also covers the recent launch of the IEEE International Roadmap for Devices and Systems, a strategic partnership with the semiconductor industry aimed at identifying the technologies and solutions needed to enable a more scalable future for computing.

In "The Emergence of Edge Computing," Mahadev Satyanarayanan broadens the scope of *the future of computing* question so that it encompasses computer systems—that is, the powerful servers in the cloud, the mobile computers such as smartphones and connected cars, as well as the many things that make up the IoT. The article highlights the promise of so-called *edge computing* as an architectural evolution enabling high performance and scalable design of cloud-based mobile systems (and applications) or IoT clouds in which device services are hosted in the cloud. For instance, by using edge computers to temporarily host some of the cloud resources one or two hops away from mobile applications, responsiveness of cloud services would be significantly improved. The article also demonstrates other important roles and benefits of edge computing, including masking temporary cloud outages, which would provide for higher system availability, and effective enforcement of customizable privacy policies in smart spaces.

Moving on to human–computer
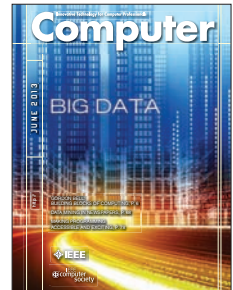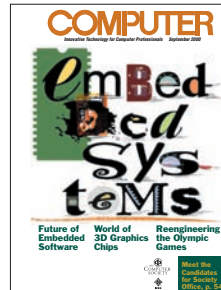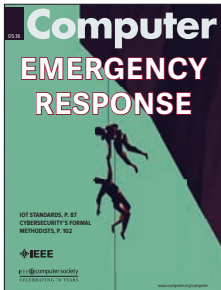
ABOUT THE AUTHOR

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interactions, in "User Interface Design with Combinatorial Optimization," Antti Oulasvirta reviews progress and challenges in an often-attempted UI design approach in which predictive models of human perception and experience are used to better enable optimization-based designs of various interfaces. These include GUIs, webpages, and input methods. The idea of designing through a tool that uses optimization algorithms to provide design-time cues to the designer is intriguing. The article describes how this approach is gaining momentum and possibly bringing the field closer to a state in which UIs can be designed by expert UI designers using such tools, leading to a faster development cycle and higher design quality, or even, for simple interfaces, by novices, potentially eliminating the need for a specialized designer.

The final Outlook article presents a breakthrough in human activity sensing using nothing more than the ubiquitous Wi-Fi signals we encounter almost everywhere. In "Toward Centimeter-Scale Human Activity Sensing with Wi-Fi Signals," Daqing Zhang, Hao Wang, and Dan Wu present the application of the Fresnel zone signal-propagation model to achieve highly accurate human activity sensing, all in real time. Fresnel zones can model RF signal impact with objects capturing the signal continuation paths past the impact. The ability to accurately sense human activities using only "air" (to exaggerate just a little) and no other encumbering sensors or transceivers is transformative. It enables us to detect, for example, if an elderly person has fallen and is immobilized, as well as gestures, vital signs, and, of course, a driver on the verge of falling asleep at the wheel.

I hope you enjoy these Outlook articles, as well as the new columns and departments our great volunteers are bringing you throughout the year. I also invite you to celebrate, with all of us at the Computer Society, the 50th anniversary of *Computer*.

Perhaps the best expression of celebration is to contribute to the magazine. Send us your best work—be it a Research Feature, a Perspectives article, or a Computing Practices paper. Or, if you feel strongly about an emerging issue and want to share your view on the debate, feel free to contact one of our column editors or propose a Virtual Roundtable discussion.

Similarly, if you are working within a community of researchers on an emerging area of technology and feel strongly that *Computer* should cover it, drop me a line and propose a special issue. Guidelines for submitting special issue proposals can be found under "Write for Us" on the magazine's website (www.computer.org /computer-magazine). **C**