

6 Q&A With the
President-Elect
Candidates

8 Why Now Is the
Time for Cloud
Computing to Soar

9 Standards for
Seamless Cloud
Computing

12 New IEEE
Resources
for the Cloud

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Taking On the Cloud

*A look at the work of IEEE and
its members on cloud computing*

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REGION NEWS



REGION 1 NORTHEASTERN UNITED STATES

- Student branch formed at **Central Connecticut State University, New Britain.**

REGION 3 SOUTHEASTERN UNITED STATES

- **Atlanta Section** forms Graduates of the Last Decade affinity group.
- Student branch formed at **Savannah Technical College, Georgia.**
- **Mississippi Section** forms IEEE Power & Energy Society chapter.
- Student branch formed at **University of the West Indies, Mona, Jamaica.**

REGION 4 CENTRAL UNITED STATES

- Student branch at **University of North Dakota, Grand Forks,** forms IEEE Engineering in Medicine and Biology Society chapter.

REGION 5 SOUTHWESTERN UNITED STATES

- **Dallas Section** forms IEEE Instrumentation and Measurement Society chapter.

REGION 6 WESTERN UNITED STATES

- **San Diego Section** forms IEEE Broadcast Technology Society chapter.
- Student branch at **University of Santa Barbara, California,** forms IEEE Photonics Society chapter.

REGION 7 CANADA

- **London (Ontario) Section** forms joint chapter of IEEE Computer and IEEE Systems, Man, and Cybernetics societies.

REGION 8 EUROPE, MIDDLE EAST, AND AFRICA

- **Algeria Section** forms IEEE Power & Energy Society chapter.
- **Egypt Section** forms IEEE Robotics and Automation Society chapter.
- Student branches formed in Egypt at **Misr University for Science and Technology, 6th of October City,** and **Modern Academy for Engineering and Technology, Cairo.**
- Student branch formed at **University of Salento, Lecce, Italy.**
- **Italy Section** forms IEEE Electron Devices Society chapter.

- Student branch at **École Nationale d'Ingénieurs de Tunis** forms Women in Engineering (WIE) affinity group.

- **Serbia and Montenegro Section** forms IEEE Broadcast Technology Society chapter.

- Student branch formed at **Cumhuriyet University, Sivas, Turkey.**

- Student branch at **University of Patras, Greece,** forms chapters of IEEE Computer and IEEE Engineering in Medicine and Biology societies.

- Student branch at **University of Cyprus, Nicosia,** forms IEEE Power & Energy Society chapter.

- Student branch formed at **University of Valencia, Spain.**

- Student branches formed in Palestine at **Birzeit University, West Bank,** and **Palestine Technical College, Deir al-Balah.**

REGION 9 LATIN AMERICA

- **Pontifical Catholic University of Peru, Lima,** forms IEEE Communications Society chapter.
- Student branch at **National Pedagogic University, Bogotá, Colombia,** forms IEEE Education Society chapter.
- **Querétaro (Mexico) Section** forms

IEEE Power & Energy Society chapter.

- Student branch at the **Center for Research and Advanced Studies of the National Polytechnic Institute, Mexico City,** forms IEEE Computer Society chapter.

REGION 10 ASIA AND PACIFIC

- **Madras (India) Section** forms IEEE Robotics and Automation Society chapter.

- **Delhi (India) Section** forms IEEE Geoscience and Remote Sensing Society chapter.

- Student branches in India at **College of Engineering, Cherthala, Maharaja Suralma Institute of Technology, Aurora's Technological and Research Institute, and People's Education Society College of Engineering** form WIE affinity groups.

- Student branch at **Muffakhamjah Jah College of Engineering and Technology, Hyderabad, India,** forms IEEE Power & Energy Society chapter.

- Student branches formed in India at **HKBK College of Engineering, MBES College of Engineering, Gyan Ganga Institute of Technology and Sciences, Indira College of Engineering and Management, Periyar University, CVSR College of Engineering, Annamacharya Institute of Technology and Sciences, LBS Institute of Technology for Women, Hindustan Institute of Technology and Management, RVS College of Engineering and Technology, Nandha College of Technology, GMR Institute of Technology, Gautam Buddha University, Infant Jesus College of Engineering, and Global Institute of Technology.**

- Student branch formed at **Beijing University of Technology.**

- **Chengdu (China) Section** forms joint chapter of IEEE Antennas and Propagation and IEEE Electromagnetic Compatibility societies.

- **Sendai (Japan) Section** forms IEEE Communications Society chapter.

- Student branch at **University of Moratuwa, Sri Lanka,** forms WIE affinity group.

SEND US YOUR NEWS

We publish announcements of new groups once they've been approved by IEEE Member and Geographic Activities. To send us local news, like student branch events and competitions, WIE or preuniversity outreach efforts, or other IEEE group activities, use our form on the Region News page at <http://theinstitute.ieee.org/region-news>.



NEWS

IEEE Partners With UNESCO

IEEE AND UNESCO recently signed a memorandum of understanding that calls for the two organizations to develop engineering education outreach programs for university students and teachers in Africa.

UNESCO, based in Paris, promotes worldwide literacy and education through teacher-training and science programs, with the goals, among others, of eradicating poverty and preserving human rights.

“Everywhere in the world, quality of life and prosperity depend on the application of technology—which means every country needs to have and sustain a strong high-tech workforce,” says IEEE president Gordon Day. “Through this partnership, IEEE and UNESCO will be better able to help countries in Africa and elsewhere achieve that goal.”

UNESCO and IEEE plan to collaborate on several projects, including accreditation programs for universities, faculty training, and programs to encourage women to enter the field of engineering. —Amanda Davis

Members: Get Ready to Vote

LOOK FOR YOUR annual election ballot package to arrive in August via first-class mail. Included with the paper ballot and a postage-

paid reply envelope is information about how to access and return the ballot electronically.

Those eligible to vote include new members as of 30 June and those elevated to member or graduate student member grades on or before that date. Associate members may not vote in the annual election.

Member grade requires that the person be regularly employed in IEEE-designated fields and have a combination of education and work experience of at least six years. To apply for transfer to member grade, visit http://www.ieee.org/membership_services/membership/grade_elevation.html.

Student members graduating between 1 January and 30 June must update their education information in order to be elevated to graduate student member grade or member grade and have the opportunity to vote in the annual election.

To help guarantee you receive the ballot package, confirm your contact information, member preferences, and education information at http://www.ieee.org/go/my_account.



ELECTION DEADLINES

15 AUGUST IEEE annual election ballots are sent to all voting members by this date. Electronic ballots are also accessible.

1 OCTOBER Last day for members' marked ballots to be received by IEEE, by noon CDT USA/17:00 UTC.

10 OCTOBER Last day for ballots to be tallied by the IEEE Tellers Committee.

11-12 NOVEMBER IEEE Board of Directors acts to accept the report of the Tellers Committee. Annual election results are made official. —Carrie Loh

Online

Available 7 June at theinstitute.ieee.org

SOCIETY SPOTLIGHTS

Two IEEE societies take on the cloud.

IN MEMORIAM

IEEE honors members who have recently died.

CALENDAR

June

3 1875: Alexander Graham Bell and Thomas A. Watson **transmit speech sounds electrically by wire** for the first time.



11 1915: Birth date of Nicholas Constantine Metropolis, developer of **MANIAC** [left], a computer used to develop the hydrogen bomb.

19 1623: Birth date of **Blaise Pascal**, a philosopher and mathematician who invented the first mechanical calculator, known as the Pascaline.

26 1824: Birth date of **William Thomson** (later Lord Kelvin), developer of the Kelvin scale of absolute temperature.



27-2 July: **IEEE Meeting Series in Boston.**

July

4 1861: Western Union begins construction of a telegraph line between Missouri and California—the final piece of the **first coast-to-coast, high-speed communications link** in the United States.

7 1752: Birth date of Joseph-Marie Jacquard, inventor of the **Jacquard loom**, still used in the textile industry.



12 2001: First appearance of **Code Red**, a Web worm that infects Microsoft Internet Information Servers. A week later, it infiltrates hundreds of thousands of servers, causing billions of U.S. dollars in damage.

18 1968: IEEE Life Fellow Gordon Moore and Robert N. Noyce (left to right) establish **Intel Corp.**, in Mountain View, Calif.



25 1857: Birth date of **Frank Julian Sprague**, developer of the first successful electric streetcar system, operated in Richmond, Va.

31 1909: Birth date of physicist **Jenny Rosenthal Bramley**, who in 1966 became the second woman to be named an IEEE Fellow.

August

6 1926: **Don Juan**, the **first feature-length movie with synchronized sound**, premieres at the Warner Theater in New York City.



12 1960: **Echo-1**, the first telecommunications satellite, is launched.

18 **Region 1 meeting in Newark, N.J.**

20 1911: *The New York Times* sends the **first around-the-world telegram**. The message made the 45 000-kilometer trip in about 16 minutes.

28 1863: Birth date of **André-Eugène Blondel**, inventor of the electromagnetic oscillograph, an instrument used to record alternating-current waveforms.



29 1876: Birth date of **Charles Franklin Kettering**, AIEE Fellow and inventor of the electric cash register and an electric starter for automobiles.

Historical events provided by the IEEE History Center. IEEE events indicated in red.

CLOCKWISE FROM LEFT: DAVID MALAN/GETTY IMAGES; MONDADORI PORTFOLIO/GETTY IMAGES; INTEL: AP PHOTO; BETTMANN/CORBIS/AP PHOTO; INERFOTO/ALAMY; ISTOCKPHOTO; BONNIE NANI



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"IEEE is the umbrella that allows us all to stay current with technology trends."

Dr. Mathukumalli Vidyasagar
Head, Bioengineering Dept.
University of Texas, Dallas



 **IEEE**
Advancing Technology
for Humanity



ELECTION

Q&A: The 2013 President-Elect Candidates

Where de Marca and Durrani stand on important IEEE issues

BY ANIA MONACO

YOU'LL RECEIVE YOUR ballot in August for the annual election. To help you learn more about the candidates for 2013 IEEE president-elect, IEEE Fellows J. Roberto Boisson de Marca and Tariq S. Durrani [shown left to right], *The Institute* interviewed them in February at the IEEE Meeting Series in Phoenix.

De Marca has been a faculty member since 1978 at the Catholic University of Rio de Janeiro, where he has held several leadership positions, including associate academic vice president. He also held visiting appointments at universities and industrial laboratories in Europe, Asia, and North America. Twice he served as scientific consultant with AT&T Bell Laboratories.

De Marca was also scientific director of the Brazilian National Research Council and served on the advisory committee of Finep, the largest Brazilian funding agency for R&D and innovation. He was the founding president of the Brazilian Telecommunications Society and is a member of both the Brazilian National Academy of Sciences and the National Academy of Engineering. He has received several awards, including the IEEE Communications Society's Donald W. McLellan Award, its Harold Sobol Award, and the IEEE Communications Society/Korea Information and Communications Society Globalization Award.

De Marca has served IEEE in several capacities, including vice president of Technical Activities in 2008, president of the Communications Society in 2000 and 2001, Division III director from 2004 to 2005, IEEE secretary in 2006, and chair of the Humanitarian Technology Challenge Committee from 2008 to 2010. He is now chair of the Future Directions Committee.

Durrani is a research professor in the electronic and electrical engineering department at the University of Strathclyde, in Glasgow. He joined the university as a lecturer in 1976, and from 1990 to 1994 he headed its electronic and electrical engineering department. Durrani was also deputy principal of the university from 2000 to 2006.

He is a Fellow of the United Kingdom's Royal Academy of Engineering and the Royal Society of Edinburgh. In 2003, he was awarded the Order of the British Empire by Queen Elizabeth II "for services to electronics research and higher education."

Durrani has held several high-level positions within IEEE. In 2010 and 2011 he was vice president of IEEE Educational

Activities and vice chair of Technical Activities for Region 8 in 2003 and 2004. He served as president of the IEEE Engineering Management Society in 2006 and 2007 and president of the IEEE Signal Processing Society in 1994 and 1995. He was founding chair of the IEEE Periodicals Review Committee in 1998 and 1999.

The following are excerpts of the interviews with the candidates. You can read the complete interviews at <http://theinstitute.ieee.org/briefings/election> and listen to podcasts of the Q&A at <http://theinstitute.ieee.org/multimedia>.

What would be your top two priorities if elected?

DE MARCA: I would like to lead IEEE into the next decade. The first priority is to guarantee that IEEE will have a leadership role in new technologies and in fostering and sustaining global innovation initiatives.

The second priority is to develop benefits and services, including more online networking and learning opportunities, that will allow members to perceive IEEE as essential in their career development and professional success.

DURRANI: I see the role of IEEE as providing members with opportunities to realize their full potential by delivering effective products and services for enhancing their skill bases. In this context, continuing education and development is a key element to support lifelong learning.

The second aspect is greater engagement with industry and encouraging practitioner-driven and practitioner-oriented products and services. I plan to establish a panel of chief executives and chief technology officers to advise IEEE on strategic issues for effective engagement with industry.

All this reflects a strong commitment to ensuring that through its activities, IEEE contributes to the enrichment of lives and advancement of society, leading to progress and transformation for the future.

Why do you feel you are the best candidate?

DURRANI: I have had a wide-ranging and unique leadership experience within IEEE and outside.

This has prepared me to take up the reins and responsibilities at the helm of IEEE. This experience has been gained through intimate working knowledge of most of the IEEE main boards. I've been the president of not one but two keynote IEEE societies: the IEEE Signal Processing Society and the IEEE Engineering Management Society. The IEEE Signal Processing Society has given me technical depth, and the other, management breadth.

I've also been regional director of the IEEE Communications Society. I served on the Technical Activities Board for eight years, the Publication Services and Products Board for six years, and several years on the Awards Board and IEEE medal committees. I've been vice chair for Technical Activities for Region 8, and most recently I was vice president of the IEEE Educational Activities Board.

I have grassroots experience working with chapters, sections, and my region—Region 8. Having traveled extensively around the world, I have a clear understanding of the needs and motivations of IEEE members. I've negotiated for and helped establish two IEEE medals: the Jack Kilby Medal in Signal Processing and the James Clerk Maxwell Medal, with the Royal Society of Edinburgh, for the recognition of leaders in their subject areas. I've been a member of the IEEE Conferences Committee and a general or executive chair of some of the flagship IEEE conferences.

Just taking into account the positions I've held within IEEE, I've gained a deep understanding of the workings of IEEE. In addition to all this activity, in my professional life I've been deputy principal—the second-highest position—at the University of Strathclyde in Glasgow, one of Europe's leading technical universities. This has given me experience in leadership, strategic management, and resource planning and delivery. I've held high offices in other professional organizations and learned societies, including vice president of one of the oldest and most distinguished, the national academy of Scotland: the Royal Society of Edinburgh. And I'm a Fellow of several organizations.

I work closely with industry and government at the highest levels. I've held some eight directorships in public, private, national, and international organizations, ranging from small and medium enterprises

to large corporations. I spent quite some time in the United States and currently hold visiting appointments at two prestigious universities: Princeton and the University of Southern California. I have worked in Europe for most of my career and have advised governments and professional organizations in the Asia-Pacific region.

DE MARCA: There are several reasons. I have had a very diverse and successful experience as an IEEE volunteer and, similarly, a diverse professional career where I held positions in academia, industry, and government.

In IEEE, I served four years on the Board of Directors and participated in the activities of four major boards, as well as the Awards Board. I also led the initial development of IEEE's Humanitarian Technology Challenge program. I have unique experience in fostering activity in new technologies, both inside IEEE as chair of the Future Directions Committee and in my country, Brazil, where I held government leadership roles in this area.

In every volunteer position I held, including president of IEEE's second-largest society [the IEEE Communications Society] and as vice president of IEEE Technical Activities, I made things happen; I made concrete contributions for the good of IEEE.

Finally, in life, I have cherished acquiring international experience in diverse cultural sensitivity. I have lived for periods of time in six IEEE regions, and therefore I have a unique world view of IEEE.

What new benefits do you think IEEE should offer members?

DE MARCA: One of the top five recommendations of the 2011 IEEE Sections Congress was that there should be recognition of a member's longtime association with IEEE. And I would extend that to significant volunteer work. This recognition should be in tangible benefits that reward loyalty and dedication to the organization. I will seek to implement programs that could offer, for example, discounts and access to information and registration for career-enhancing webinars and other IEEE products.

IEEE must also focus on developing educational programs, and that goes back to my priority, too. It should allow members to stay

current and involved with their careers and also be perceived as having value by their employers. These programs, to be successful, must be developed in partnership with industry. I'll use my extensive contacts with global industry leaders to help implement these new programs. However, it's also true that if IEEE wants to be relevant to industry, it must continue to be the authoritative source of information presented in a way that's suitable for the different audiences it must reach.

DURRANI: I think in these turbulent times, there is a compelling need for IEEE to support career development of its members. The increased and integrated provision of continuing education and professional development, skills development, and related opportunities is a key benefit that should be enhanced. The IEEE Educational Activities Board has a major role to play through the provision and extension of e-learning. So that's one benefit.

Another aspect is mass customization of technological information: offering members information products constructed from the whole range of IEEE publications, customized to their needs and suited to their requirements. This is an additional model for publications, one that is customer-needs driven and user-focused.

I feel a very important benefit for a global organization is to encourage multilingual versions of our journals, serving members worldwide and opening new markets for IEEE products.

And a further benefit is to look toward driving affordable member rates worldwide through new membership models and progressive benefits, such as providing career support for GOLD [Graduates of the Last Decade] members through a virtual network of mentors.

Another interesting and important aspect is to encourage innovation and entrepreneurship within the IEEE by establishing an innovations academy to support the IEEE global talent pipeline that turns innovative products into entrepreneurship. ■

Find out which technical areas the candidates want IEEE to focus on and how IEEE can expand its global reach at <http://theinstitute.ieee.org/briefings/election>.



TECH TOPIC

A View Inside the Cloud

Why the time is right for cloud computing to soar

BY ANIA MONACO

IT'S HARD TO watch television, read a magazine, or visit a website these days without coming across ads for services “in the cloud.”

Great for storing documents and for accessing your music, photos, and videos from anywhere on any device, cloud computing services are becoming increasingly popular.

Recognizing that, the IEEE New Initiatives Committee has given US \$500 000 this year to the IEEE Cloud Computing Initiative. Launched in April 2011, the initiative involves work in standards, publica-

tions, continuing education, conferences, and other areas. [Read about the products and services under development in “Coming Soon: New Cloud Computing Services,” p. 12.]

Should your company be using cloud services? What’s been holding your executives back? And what can you expect in the future? To answer such questions, *The Institute* interviewed two IEEE senior members who are experts in the field: Alexander Pasik, IEEE chief information officer, and Thomas Coughlin, president of the data storage con-

sulting group Coughlin Associates, of Atascadero, Calif., and vice president of operations and planning for the IEEE Consumer Electronics Society.

CLOUD ABCs

Coughlin thinks of cloud computing as “sort of an outsourcing of technology assets.”

“An Internet-connected machine and remote digital storage are used to provide a variety of capabilities for business and personal applications,” he says.

There are three types of cloud computing: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).

With IaaS, clients have access to virtual servers in the service provider’s data center. “You can use those servers any way you want,” Pasik says. Users install their own software, and they’re responsible for maintaining it. “The benefit here is that you get flexibility and scalability,” Pasik says. “For example, if I typically need 3 or 4 servers to run my systems but need 50 during the holiday season, I don’t have to buy more servers. I just rent those additional servers on the cloud system.”

Amazon’s Elastic Compute Cloud, better known as EC2, is an IaaS—users can rent virtual servers on which they run their own applications.

PaaS includes all the features of IaaS, but clients use the provider’s computing platform, which typically includes an operating system, developer tools, database, and Web server. Users can develop and run their software in the cloud without the cost and complexity of buying and managing the underlying hardware.

“With PaaS you get better economies of scale,” Pasik says. “The trade-off is that platform providers lock down the service so that you can’t use your own tools.” An example of a PaaS is the Google App Engine, with which users develop and host Web applications using Google’s development tools.

With SaaS, cloud providers install and operate application software such as Salesforce, an online sales management tool that users can access.

“You have the least flexibility with SaaS, because you are just using the provider’s software, but you get dramatically better economies of scale,” Pasik says. Users don’t have to worry about manag-

ing the infrastructure or platform on which the application runs—the cloud provider handles that.

WHY NOW?

Although cloud computing generates lots of excitement these days, it’s not a new idea, Pasik notes.

“People have been able to use someone else’s software on their systems for a long time,” he says, citing the decades-old payroll and human resources systems provided by ADP.

What has made cloud computing so popular now is a combination of technological advances and a change in mindset.

“The adoption of Web browsers as a standard user interface and increased Internet bandwidth have really made the dramatic rise possible,” Pasik says. “You don’t need to install anything on anyone’s computer to work with the cloud, because a Web browser is already in place.”

Several other advances have fueled cloud computing’s widespread adoption. “These include object storage, which refers to metadata for stored content; deduplication, in which multiple copies of a piece of data can be aggregated as one copy; and the evolution of enterprise storage tiering [a process where data that is most often accessed or that requires fast response is kept on the storage system with the fastest throughput], such as flash memory as well as hard-disk drives and magnetic tape,” Coughlin says.

FEAR NO MORE

Businesses have also become more open to the technology. “Until recently, there’s been a hesitancy to adopt cloud computing,” Pasik says.

What has been holding executives back? For starters, fear.

“It wasn’t really a matter of anyone doing an analysis and finding that your data is safer in your own data center than in a cloud data center,” he says. “It was more of a gut fear—a feeling that ‘if it’s in my building, I have control.’”

Would-be users have come to realize that cloud leaders such as Google invest a lot more in the security of their data centers than do small- or medium-size companies. When it comes to security, the giants simply have more money to spend.

If businesses are still concerned with data protection, Coughlin points out, they can always choose a private cloud: an infrastructure operated solely for a single organization. “That way,” he says, “access

can be restricted to whatever level is required by the business, and encryption helps create even greater security.”

A perceived lack of privacy is another reason some companies have been reluctant to put their data in the cloud. They don’t want anyone—including the cloud provider—to have access to their data.

“Those fears have been systematically dealt with through improved security technology and contracts that give clients more privacy protection,” Pasik explains.

Another hurdle is what Pasik calls “empire protection.” Many CIOs felt that by going to the cloud they would relinquish control of their domain. “They didn’t want to let go,” he explains. “Maybe they didn’t want to reduce the size of their operations—which, of course, goes against their fiduciary responsibility. But with time, CIOs have

realized cloud computing is in the best interest of their company.”

But for businesses with a lot of money invested in their own infrastructure, the biggest obstacle to cloud adoption is fear of change. “The thinking is, ‘If you have a fabulous data center that works well, why change?’” Pasik says. “It’s important for such businesses to look carefully to see where they can leverage their existing data solutions with ones in the cloud.”

Other concerns remain, including reliability and performance.

“A road warrior may not be able to access cloud-based content and applications when needed or at the performance level required,” Coughlin notes. “Local backup of important content on a regular basis can help reduce this problem. Also, some may want to keep valuable content on their devices to make sure they can access it anytime.”

LOOKING FORWARD

What can we expect of cloud computing in the next few years? Coughlin envisions widespread use of applications for e-wallets, which allow people to make purchases by swiping their smartphone across a reader. He also says to look for devices that automatically aggregate, generate, and store the location, time, and other metadata from user-generated content such as photos, audio, and video.

“The device will capture precisely where and when the photo or video was taken and the format it was taken in, for quick and easy access,” he says. Coughlin notes that such automated metadata will be more prevalent as still larger storage capabilities become available in the cloud.

For Pasik, an important trend to watch for is cloud insurance. “Right now, if an organization wants to buy an insurance policy to protect it against the financial implications of a data attack, it can only do so for its own data center,” he explains. “There aren’t really any options for

insuring cloud data. Availability of such insurance would further fuel adoption of cloud computing.”

Pasik predicts we’ll see more services that offer a consistent user experience across all of a company’s cloud offerings. For example, Google recently revamped its core apps, like e-mail, calendar, and contacts, to have a similar design. “A consistent look makes the user feel more comfortable with the systems,” he says.

Whatever the future brings, one thing’s for sure, Pasik and Coughlin believe: All businesses should be thinking about the cloud. “If you don’t become educated about cloud computing and the potential it has for expanding your business and lowering operating costs, you will be at a significant competitive disadvantage,” says Coughlin.

Pasik puts it more bluntly: “If a business isn’t looking into the cloud, it is spending way more on IT than it has to.”

Read more in this issue to learn what IEEE is doing in cloud computing, including products and services, standards, and conferences. ■

STANDARDS

Standards for Seamless Cloud Computing

BY KATHY KOWALENKO

A MORE COMPANIES, government agencies, and consumers adopt cloud technologies, they’re encountering turbulence along the way. The problems include multiple file formats, applications that fail to operate with each other, and the inability to move data from one cloud-service vendor to another. To help clear the way, IEEE Standards Association working groups have been focusing for the past year on writing a cloud portability road map and producing an interoperability standard. The IEEE

Cloud Computing Initiative is leading both efforts. More than 45 people are involved in the working groups.

The Institute first reported on the groups in “Bringing Standards to the Burgeoning Cloud” [July 2011]. In this special-topic issue, we want to update our readers on their progress.

As more services become available, users at some point probably will want to transfer their data from one provider to another, but there is no standard to seamlessly do that. The IEEE P2301 Draft Guide for Cloud Portability and Interoperability Profiles is being

designed to provide an intuitive road map for application portability, management, and interoperability interfaces, as well as for file formats and operating conventions. When completed—probably in 2014—the standard will help vendors, service providers, and consumers involved with every aspect of procuring, developing, building, and using cloud computing.

Further along is the IEEE P2302 Draft Standard for Intercloud Interoperability and Federation. Nowadays, people want the same kinds of global roaming, portability, and interoperability capabilities for storage and computing that they have with voice mail and text messaging. They also want to store their documents, photos, and apps and access them from anywhere using their smartphones, tablets, or laptops.

To that end, IEEE P2302 is defining the topology, protocols, functionality, and governance required for cloud-to-cloud interoperability. In its title, “intercloud” refers to an interconnected mesh of clouds that depend on open standards for their operation. “Federation” allows users to move their data across internal and external clouds and access services running on other

clouds according to the business and application requirements.

The IEEE P2302 working group is also focusing on building a system among cloud product and service providers that would be transparent to users. The group plans to address transparent interoperability and federation in much the same way that standards do for the global telephony system and the Internet.

What the standard won’t do is address intracloud operation, because that is specific to the cloud’s implementation. Nor will it address proprietary hybrid-cloud implementations.

The standard is expected to roll out next year. A draft is available to working group members at <http://standards.ieee.org/develop/project/2302.html>. ■



QUESTION OF THE MONTH

Are You in the Cloud Yet?

If cloud computing is not exploding, then how do you describe a technology expected to generate 14 million jobs globally by 2015, according to a recent study by market researcher IDC? That number reflects myriad cloud services involving music, video, photo, and document storage offered by Amazon, Google, and many others. And then there are the business services, such as data analysis, like those Hewlett-Packard announced in March. Cloud computing fans say they like being able to access their content from any Internet-connected device and never running out of storage. But some hesitate to get into the cloud because of security and accessibility issues.

Are you using a cloud computing service? Why or why not? Will cloud computing take over as the main form of data storage?

Respond to this question by commenting online at <http://theinstitute.ieee.org/opinions/question>. A selection of responses will appear in the September issue of The Institute and may be edited for space. Suggestions for questions can be sent to institute@ieee.org.

RESPONSES TO MARCH'S QUESTION

Are Printed Textbooks Disappearing?

A recent PC World article reported that an increasing number of preuniversity schools are using iPads in the classroom. Teachers interviewed said the tablet computers are particularly helpful for students with special needs. Some teachers use iPads to introduce or enrich textbooks' content. And Apple recently launched a section of its e-book app store specifically for textbooks. The article quotes college students saying they've stopped using printed books: They buy e-textbooks instead and save money.

Will tablet computers completely replace printed textbooks in the classroom?

The following responses were selected from comments that appear at <http://theinstitute.ieee.org/opinions/question/are-printed-textbooks-disappearing>.

WORTH HOLDING ON TO

I think tablets will replace printed textbooks as long as e-books cost less and students can access the books even after the semester is over.

However, I still think there's a magical feeling that comes from holding a real book in my hands. This is especially true for books that cover advanced topics. Some are classics, and I prefer to have a hard copy on my bookshelf.

D.M.

DON'T DEPEND ON A BATTERY

I still have textbooks from my days as an undergraduate 35 years ago. They are heavy and bulky, but at least they don't depend on a battery. Some textbooks become obsolete, but many of my advanced textbooks still hold a lot of relevant information. Maybe in the future we'll be able to buy either the e-book or the "deluxe version," which would come with a hard copy as well as an e-book. I don't think hardcover textbooks will ever completely go away.

K. L. Reed

CUTS COSTS IN HALF

I hope e-books will replace textbooks. I feel guilty every time I assign a new textbook for one of

my classes because the prices are well above their actual value. My university is now assigning the new edition of a popular textbook. There are no used books available yet, so students will pay around US \$230 at the bookstore. However, they can buy the online edition with lifetime access for half that amount.

Bill E.

TAKE A LOAD OFF

When I was younger and carried my textbooks, I had to go everywhere with a 6- to 7-kilogram load. It was not only tiring but also annoying because we hardly ever had to read the entire book.

I'd prefer to use a tablet computer that can store hundreds of e-books. It would also be cheaper than buying numerous textbooks. My only worry is that students may get distracted playing games or talking to each other online, but teachers will have to find ways to prevent that.

Angel Arturo

NEED IMPROVEMENT

To gain popularity, e-books will have to become more authoritative, accessible, and affordable. Wikipedia has developed a way to make content free to everyone, but it also has had issues with accuracy and its long-term financing. Electronic literature will eventually replace printed books, but to make it happen we have significant challenges to overcome.

Tom Craver

PRINT WILL CARRY ON

Tablet computers may become popular, but printed textbooks will be hard to eliminate. Students with poor eyesight may find reading e-books challenging. Perhaps novels and one-time reads will be assigned electronically, but textbooks are dense with information. Future generations may be more accepting of tablets, but it is a little dangerous to be completely dependent on technology.

Nathan

PEOPLE WILL ADAPT

I believe e-readers will replace printed books. It may not happen soon, but change seems likely. People who have been reading printed books for years seem to adapt easily to e-readers. Since the next generation will be using e-readers from childhood, it will have no problem using them for school.

Huma

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PRESIDENT'S COLUMN

Make Yourself Indispensable!

WHEN I WAS a senior at the University of Illinois, an alumnus returned to campus to give a talk about his work. While he was being introduced, he walked to the blackboard and wrote two words—"initiative" and "tenacity"—in the upper left corner. He didn't mention them during his talk, and no one asked about them in the Q&A session that followed. But as he left the stage, he pointed to the board and said, "By the way, if you don't remember me or anything else I've said today [unfortunately, I don't], try to remember and apply those two words. If you do, you'll have a successful career."

A few years later, I joined the National Bureau of Standards, in Boulder, Colo., as a postdoctoral fellow. It didn't take long to figure out that NBS was a great place to work and Boulder was a great place to live. One day, while talking to my boss, I asked about the chances of a permanent position. He responded, "Make yourself indispensable!" and abruptly ended the conversation.

A few weeks later, he invited me to join the highest-profile project in his group, a project that would eventually have a major impact on fundamental metrology, and a team that included a future Nobel Prize winner. Whether he thought my skills would be useful, or was giving me a chance to learn some new things, or wanted to see what I could do, I'll never know. I'd like to think it was all three.

I've always been grateful for those three gifts: good advice, an impossible challenge, and an exceptional opportunity. The collective message to a young engineer was that I should accept responsibility for my career. If I wanted to advance, I should find ways to become more valuable to

my employer. When an opportunity to contribute and grow was offered, I should grab it.

Much has changed in the working world over the past few decades, and that message is even more important now than when it was delivered to me years ago.

Today's graduates should not expect to do the same work for 40 years. Workforce experts tell us that they will probably change jobs 8 to 10 times. Technology is progressing at an accelerating rate. Those who fail to keep their skills fresh will find job transitions difficult and will need to learn how to navigate successfully through periods of midcareer unemployment and the challenges of reentering the workforce.

Today, engineering labor is often treated like a commodity, to be purchased as needed. By choice or necessity, consulting and contracting are becoming more common career paths. This is not necessarily a bad thing—supporting a broad clientele is common in other professions, including law and medicine. However, it increases the need for career-long skills development, not only in technology but also in aspects of business, customer relations, marketing, accounting, intellectual property, and other nontechnical areas.

The former CEO of a large international technology company was recently quoted as saying, "You need to have the advanced skills that the future requires. You need to move to the

future from a skills perspective." But then he added, "We do a lot of retraining every year, and we still find ourselves in the situation where people can't move up the skill ladder. So we have to replace them with current skills."

He may be correct that some members of our profession have not moved up the skill ladder, but I reject the idea that they can't. Engineers may lose the currency of their knowledge, but they don't lose their talents or their basic understanding of physical principles. Technologists of all ages must commit to a lifelong expansion of their skills.

Help with that is one of the greatest benefits of belonging to a professional society. A professional society is about knowledge, nurturing its creation and—through its dissemination—helping technologists thrive, and helping innovators innovate. It's also about the nontechnical



Technologists of all ages must commit to a lifelong expansion of their skills

aspects of being a professional—about building nontechnical skills through education and gaining experience as a volunteer. It's a source of advice and information about career management. And all of that happens through a supportive community of peers and friends.

That is what IEEE has done for me and is doing for more than 415 000 members all around the globe, helping us "move up the skill ladder," a bit closer to the elusive goal of becoming indispensable.

Gordon W. Day
IEEE President and CEO



PRODUCTS AND SERVICES

Coming Soon: New Cloud Computing Services

Resources from IEEE are in the works

BY KATHY KOWALENKO

THE IEEE Cloud Computing Initiative, launched in April 2011, has picked up momentum since it received additional funding in January from the IEEE New Initiatives Committee. Several products and services in the works for months are about to be introduced, including a website, conferences, continuing education courses, publications, standards, and a platform for testing cloud computing applications. The initiative is the first broad-based collaborative project for the cloud to be introduced by a global professional association.

WEBSITE

A Web portal to all things related to IEEE cloud computing launches this month. The portal includes news about the cloud computing initiative's progress, articles from the IEEE Xplore digital library, conferences sponsored by IEEE and other organizations, standards, educational materials, and interviews with experts.

CONFERENCES

Two conferences organized by the IEEE Computer Society have already been scheduled: IEEE Cloud 2012, being held from 24 to 29 June in

Honolulu, and IEEE CloudCom 2012, taking place from 3 to 6 December in Taipei, Taiwan. Other IEEE conferences will include a session or two covering the field [see "Conferences: June–December," p. 13].

An IEEE Cloud Congress will be held every year or two, bringing together thought leaders, users, vendors, and interest groups, according to Kathy Grise, senior program director with the IEEE Future Directions group, in Piscataway, N.J., which oversees the Cloud Computing Initiative.

Congresses are under way in Asian, European, and Latin American cities. One congress is scheduled to be held in Shenzhen, China, from 8 to 11 November, and another in Porto Alegre, Brazil, from 26 to 27 December.

An annual IEEE Cloud World Forum is in the works for high-level innovators.

CONTINUING EDUCATION

To get members up to speed in the field, IEEE is developing several e-learning courses. Given by experts, the courses offer professional development hours and continuing education units. Some

courses will charge a nominal fee, while others will be free.

PUBLICATIONS

Few publications regularly offer articles about cloud computing, so IEEE plans to launch new publications on the topic. An online-only quarterly journal and a magazine are to debut next year. Also, *Cloud Computing Letters*, designed for rapid dissemination of original, cutting-edge ideas and significant contributions, is to be available in 2014. How frequently the magazine and *Letters* will be published are yet to be determined.

IEEE is also exploring a publishing business to take advantage of the vast amount of data being accumulated in such fields of research as astronomy, meteorology, genomics, biology, social media, and finance. The raw research data usually is not stored in a central location and so is inaccessible to other researchers.

Small data sets present no dissemination problem. Data files of less than, say, 100 gigabytes could be published as a digital-only paper and stored in the IEEE Xplore digital library. But larger data sets may be stored only in the cloud. Publishing the data and providing access to it requires a complicated infrastructure, which is where IEEE comes in. Certain aspects of traditional publishing, such as standard formats, methods for downloading and securing data, an editorial process, and a glossary are required, and IEEE is setting up the infrastructure for them.

STANDARDS AND TEST BED

Another area IEEE plans to explore involves developing environments for creating and testing protocols for the IEEE P2302 Draft Standard for Intercloud Interoperability and Federation [see "Standards for Seamless Cloud Computing," p. 9]. To that end, IEEE wants to partner with governments, universities, and research institutions around the world that already have cloud computing resources. The goal is to create a well-connected, standards-based platform. The test bed could also be used to experiment with other IEEE cloud computing products and services, such as education modules, conferences, and publications. ■

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CONFERENCES: JUNE-DECEMBER

Several IEEE conferences deal with cloud computing



IEEE International Conference on Cloud Computing

HONOLULU; 24-29 JUNE

TOPICS: Cloud computing for business, cloud computing architecture, virtualization of hardware and software resources, programming models and systems, design tools for cloud computing, energy efficiency, cloud monitoring and maintenance, and security and privacy.

SPONSOR: IEEE Computer Society

VISIT: <http://www.thecloudcomputing.org/2012>

IEEE International Conference on Web Services

HONOLULU; 24-29 JUNE

TOPICS: Held in conjunction with the International Conference on Cloud Computing, this meeting covers cloud computing for Web-based services, service-oriented computer architecture, software validation and testing, and Internet security.

SPONSOR: IEEE Computer Society

VISIT: <http://conferences.computer.org/licws/2012>

IEEE Computer Software and Applications Conference

IZMIR, TURKEY; 16-20 JULY

TOPICS: Cloud computing, software design and maintenance, security, software architecture and design, real-time and embedded systems, mobile and pervasive computing, Web services and systems, and educational software.

SPONSOR: IEEE Computer Society

VISIT: <http://www.compsac.org>

IEEE/IPSJ International Symposium on Applications and the Internet

IZMIR, TURKEY; 16-20 JULY

TOPICS: Colocated with the IEEE Computer Software and Applications Conference and cosponsored with the Information Processing Society of Japan (IPSJ), this event covers cloud computing, social networking, Web 2.0, open application programming interfaces, and other Internet technologies and applications.

SPONSOR: IEEE Computer Society

VISIT: <http://www.saintconference.org>

IEEE International Workshop on the Maintenance and Evolution of Service-Oriented and Cloud-Based Systems

RIVA DEL GARDA, ITALY;

24 SEPTEMBER

TOPICS: Tools and methods that support service-oriented and cloud computing environments, as well as data migration to cloud computing services.

SPONSOR: IEEE Computer Society

VISIT: http://www.ieee.org/conferences_events/conferences/conferencedetails/index.html?Conf_ID=20615

IEEE International Symposium on Web Systems Evolution

RIVA DEL GARDA, ITALY;

27-28 SEPTEMBER

TOPICS: Analysis and testing of Web systems, data migration to Web 2.0 and the cloud, security and privacy in Web systems, and multilingual Web systems.

SPONSOR: IEEE Computer Society

VISIT: <http://www.websiteevolution.org/2012>

IEEE International Conference on Cloud Computing Technology and Science

TAIPEI, TAIWAN; 3-6 DECEMBER

TOPICS: Cloud computing infrastructure, networking technology, cloud system design, security in the cloud, cloud computing workflow management, resource monitoring, cloud computing usability and reliability, and middleware.

SPONSOR: IEEE Computer Society

VISIT: <http://2012.cloudcom.org>

BOOKS OF INTEREST

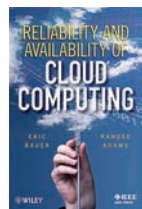
Topics include cloud computing, biology, and data mining

BY ANIA MONACO

Here's a selection of books published by Wiley-IEEE Press. IEEE members receive a 15 percent discount by using promo code 18493 when ordering from <http://www.wiley.com>.

Reliability and Availability of Cloud Computing

BY ERIC BAUER AND RANDEE ADAMS
(AUGUST 2012, US \$79.95, 300 PP.)

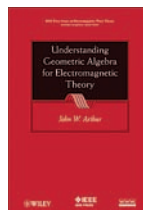


Aimed at Internet security specialists and IT architects; developers; and program, product, and quality managers responsible for cloud applications. Topics

include reliability, meeting customer expectations, and service availability. The book also covers how to choose the right design for your application and how best to employ virtualization and cloud computing.

Understanding Geometric Algebra for Electromagnetic Theory

BY JOHN W. ARTHUR
(SEPTEMBER 2011, \$125, 320 PP.)



Geared to those with basic knowledge of electromagnetic theory—mostly scientists and engineers as well as postgraduate students and senior undergraduates who want to broaden their knowledge of the subject.

Data Mining: Concepts, Models, Methods, and Algorithms, Second Edition

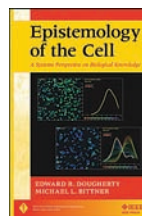
BY MEHMED KANTARDZIC
(AUGUST 2011, \$110, 552 PP.)



Covers techniques for analyzing enormous quantities of raw data in high-dimensional data spaces. Readers learn to analyze large data sets through explanations of concepts, models, and techniques developed in recent years.

Epistemology of the Cell: A Systems Perspective on Biological Knowledge

BY EDWARD R. DOUGHERTY AND MICHAEL L. BITTNER
(AUGUST 2011, \$110, 216 PP.)



Biomedical engineers need a systematic knowledge of the cell if they're to perform effective data handling, which this textbook addresses. It deals with issues such as how biology is studied and how biological knowledge is

translated into medical applications and discusses the history of our understanding of scientific knowledge, the scientific method, and the manner in which scientific knowledge is represented in mathematics.

Mobile Robots: Navigation, Control, and Remote Sensing

BY GERALD COOK
(JUNE 2011, \$99.95, 324 PP.)



Explores a variety of models and methods. Included are the use of Lyapunov stability theory for nonlinear control design, the derivation of optimal control strategies via Pontryagin's maximum principle, and the derivation of a local coordinate system—which is fundamental to steering vehicles along new paths. Also covered are GPS, inertial navigation systems, and coordinate rotations and transformations.

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I invite you to join me, along with all of my Marsh U.S. Consumer Colleagues, as we celebrate the first 50 years of our relationship with IEEE. And here's to at least another 50 more.

Terry Bernier
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PROFILE

Steve Diamond: Seeding the Cloud

Getting IEEE more involved in cloud computing

BY SUSAN KARLIN

THE LAST FEW years have seen the cloud computing marketplace explode like a high-tech Wild West—exciting, fast-growing, chaotic, and full of opportunity. That's because cloud computing offers the promise of ubiquitous, scalable, on-demand computing resources provided as a service for everything from mobile devices to supercomputers.

In 2010, IEEE sponsored two cloud computing-specific conferences—IEEE CLOUD and IEEE CloudCom—but as yet had no cloud-specific standards projects, dedicated publications, or educational activities.

Enter IEEE Senior Member and IEEE Computer Society past president Steve Diamond and a team he began putting together two years ago. Diamond, general manager of the Industry Standards Office at EMC Corp., a global IT company headquartered in Hopkinton, Mass., says he realized that cloud computing could mirror the development—and transformational impact—of the Internet.

He was convinced IEEE was uniquely positioned to play a major role in accelerating and shaping that future. So he and his team of experienced colleagues, with the support of the IEEE Future Directions Committee and seed funding

from the IEEE New Initiatives Committee, developed the IEEE Cloud Computing Initiative (CCI), which he now chairs.

“Much as we saw with the development of the Internet, cloud computing will impact the entire information and communications ecosystem, from embedded controllers, smartphones, tablets, laptops, and personal computers to enterprise data centers and supercomputers,” he says.

“The smartphone is the fastest-growing consumer technology in history, having reached 50 percent penetration of U.S. households in just 7 years. It took the home computer nearly 20 years to do the same thing,” he adds. “Cloud computing will give smartphone users effectively infinite computing resources at their mobile beck and call. The implications of this transition are huge.”

MANY ROLES

As CCI chair, Diamond leads a team of IEEE volunteers and staff guiding the six interdependent CCI tracks: conferences; education; publications; standards; test bed; and Web portal, marketing, and public relations. [Read more about these in “Coming Soon: New Cloud Computing Services,” p. 12.]

Diamond says the CCI team understood how the breadth and depth of expertise across IEEE could be applied to help accelerate the development of cloud computing.

“We knew that IEEE could not only have an important role in the development of cloud standards but could also—by using its global resources and partnerships—contribute significantly to cloud computing research and development, education, conferences, and publications,” he says.

Diamond also chairs the IEEE Cloud Computing Standards Committee, which oversees working groups developing IEEE cloud standards. Two working groups are already under way: IEEE P2301 Draft Guide for Cloud Portability and Interoperability Profiles, a guide to the cloud standards landscape, and IEEE P2302 Draft Standard for Intercloud Interoperability and Federation, which focuses on standards for cloud-to-cloud interfaces. [See “Standards for Seamless Cloud Computing,” p. 9.]

Diamond is also chairing the cloud standards panels at the IEEE

CLOUD 2012 conference in June, in Honolulu, and IEEE CloudCom 2012 in December, in Taipei.

“There are dozens of specification and standards development organizations and industry associations already working on standards in the cloud space, although there are few completed cloud standards or specifications to date—it's still very early,” says Diamond.

“A key challenge for participants in cloud standards is choosing those standards and specification efforts and organizations in which to invest.”

CLOUD CLOUD

Diamond draws his expertise from 30 years of senior management, marketing, business development, and engineering in semiconductors, software, systems, and standards. Prior to his job at EMC, he was director of product management for intercloud computing at Cisco Systems, in San Jose, Calif., and vice president of marketing at Equator Technologies, a VLIW signal processor semiconductor company later sold to Pixelworks, headquartered in San Jose. Before that, he did mergers and acquisitions at National Semiconductor, in Santa Clara, Calif., and ran SPARC architecture marketing at Sun Microsystems, in Palo Alto, Calif.

Along the way, he's authored numerous technical publications on cloud computing, memory and microprocessor technology, signal processing, and computer graphics. Diamond was the 2003 president of the IEEE Computer Society and served on the IEEE Board of Directors from 2005 to 2006 and again from 2009 to 2010.

Diamond's first high-tech job was in biomedical research at the University of California San Francisco Medical Center's Langley Porter Neuropsychiatric Institute, where he built minicomputer-based expert systems for EEG signal analysis. That led to an interest in using microprocessors for portable real-time biomedical signal analysis. Diamond then joined Inter-sil, a pioneer in low-power CMOS microprocessors, which led him into industry standards and ultimately to spearheading the IEEE Cloud Computing Initiative.

“Cloud computing is undergoing a rapid evolution, but the major directions are already clear,” he says. “The Cloud Computing Initiative is excited to be leading IEEE's efforts in this new computing megatrend.” ■



PART-TIME PASSIONS

Bringing Nature Into Focus

IEEE members pursue their passion for taking photos—of nature's beauty and its fury

BY SUSAN KARLIN

Virginia Hetrick

JOB

Retired university associate dean

HOMETOWN

Los Angeles

IEEE MEMBER Virginia Hetrick visited her first national park at the age of 3 and took her first picture at 7. Her passion combines those two lifelong loves.

Most of Hetrick's photography captures foliage and landscapes. She has visited 358 of the 397 national parks in the United States, as well as others in Brazil, Canada, England, and France. She is now close to visiting the remaining 39 U.S. national parks, including those in its territories, camera at the ready. She hopes to get to them

all by the end of next year.

With her Sony Alpha 700 digital single-lens-reflex camera in hand, she has captured a whopping 128 800 photos.

"Photography gets my head out of computers—except when I have to upload the pictures," Hetrick says with a laugh. She is a former associate dean for computer information systems, as well as game and simulation programming, at DeVry University's Southern California campus.

She spends some three months a year visiting and shooting parks, turning her favorite photos into calendars and Christmas cards for friends. She occasionally enters her best images in contests, and she has won prizes.

Her favorite subjects are wildflowers, like the beavertail cactus flower shown in the top left photo. She also likes shooting mountains, beaches and, lately, some other

subjects including 18th-century wood-burning stove doors.

"My favorite park is probably Olympic in Washington State, because that's where I grew up, where I picked up most of my outdoor skills, and where my parents first met," she says. "I used to go climbing and hiking in the mountains as a Girl Scout. I only took pictures in black and white, but wildflowers were special. If I found a really beautiful bunch, my mother would take a color slide."

Hetrick's picture taking ramped up in 2006, a year before she retired, when she bought her Sony and switched from film to digital.

"Digital photography wasn't a mystery," she says. "My work involved designing and using satellite image-processing labs, so I knew about things like adjusting for color." She prefers to shoot RAW images—which allows the most control in editing because it contains every detail captured by the camera.

Hartono

JOB

President of a consulting firm

HOMETOWN

Kuala Lumpur, Malaysia

WHAT STARTED AS a curiosity for Senior Member Hartono became a hobby, then a profession. Now it's affecting international building codes.

Hartono—who like most Malaysians goes by a single name—has spent the past 22 years snapping pictures of buildings around his town that have been damaged by lightning, such as the building in the photo below. He also publishes scientific papers on mitigating lightning's effects on structures.

He's in the right part of the world for his interest. Kuala Lumpur has about 200 days of thunderstorms each year. There's so much lightning damage around the city that he goes out daily, shooting with his digital Sony Cybershot DSC-H1 to augment his research, conference papers, and presentations.

Most of the time there are no burn marks, but concrete blocks can get chipped at the corners. The size of the chip varies with the magnitude of the lightning current. "It takes a trained eye to know that it's the result of lightning," Hartono says. "As far as I know," he says, "I'm the only one in the world taking photos of lightning-damaged buildings on a large scale."

He recently joined a working group of experts at CIGRE, the Paris-based international organization for improving electric power



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EXPERT NEWS
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systems, to study lightning strikes and develop a new way to make tall buildings less prone to such damage.

Hartono bought his first camera, a Nikon FM SLR, in 1977 while an undergraduate at Loughborough University, in Leicestershire, England, to snap campus scenery. A few years later, he began photographing lightning damage to electronic equipment as an electrical engineer doing maintenance work for the Telecommunications Department of Malaysia (now Telekom Malaysia). In the late 1980s, he saw a photo of a lightning-struck building in a telecommunications magazine. Shortly after, he began taking similar photos. His passion ultimately led him to start Lightning Research, in Kuala Lumpur, to advise architects, engi-

neers, and companies on ameliorating lightning damage.

Over time, Hartono's pictures revealed that most lightning rods should be placed in roof corners, which have triple the chance of being hit.

"Place a lightning rod correctly, and there's no damage," he says. "Place them randomly on the roof, and damage will occur." His rod-placement suggestions have been included in international lightning protection standards.

Hartono came close to being struck once, running from one tall building to another during a particularly violent thunderstorm. "Objects on the ground can emit streamers—electricity jumping points," he says. "I could feel my skin tingling. Now I don't go out during thunderstorms any more." ■

ACHIEVEMENTS

Lubomyr Romankiw and David A. Thompson

IEEE LIFE FELLOWS



These Life Fellows were inducted into the U.S.

National Inventors Hall of Fame, in Alexandria, Va. They were honored for contributions to the development of the thin-film magnetic head, which dramatically increased the capacity of magnetic disk storage devices as well as reducing their size and cost.

Romankiw [left] is an IBM Fellow at the IBM Thomas J. Watson Research Center, in Yorktown Heights, N.Y., where he works on solar power technology.

Thompson [right] retired as director of IBM's Advanced Magnetic Recording Laboratory, in San Jose, Calif.

The two worked together in 1978 at the Watson Research Center when they were granted a U.S. patent for the thin-film inductive transducer. The invention was a component of the first thin-film magnetic head—a device that reads and writes bits of data on a magnetic disk or tape. IBM began selling disk drives with the thin-film heads in 1979, and electronics manufacturers around the world soon followed suit. The technology is now used to store data on MP3 players, smartphones, and other portable digital devices.

George H. Heilmeier

LIFE FELLOW



George H. Heilmeier is one of four recipients of this year's annual Charles Stark Draper Prize, given by the U.S. National Academy of Engineering. The prize

is awarded to engineers whose accomplishments have benefited society. Heilmeier, the only one of the four who is an IEEE member, was honored for his contributions to the development of the first LCD. The award comes with a US \$500 000 honorarium.

Heilmeier is chairman emeritus of Science Applications International, a company based in McLean, Va., that develops technology for applications in national defense, public health, environmental monitoring, and cybersecurity. He is a member of the U.S. National Security Agency Scientific Advisory Board.

While working as a researcher during the 1960s at RCA Laboratories, in Princeton, N.J., he discovered several electro-optic effects in liquid crystals. One was the dynamic scattering effect, which causes a strong dispersal of light when voltage is applied to a liquid crystal mixture. That discovery eventually led to the first LCD displays in watches and calculators.

Heilmeier received the 1997 IEEE Medal of Honor for his discovery and initial development of electro-optic effects in liquid crystals. He is a member of the IEEE Communications, Computer, and Electron Devices societies.

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2014 IEEE Technical Field Awards

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IEEE Koji Kobayashi Computers and Communications Award

For outstanding contributions to the integration of computers and communications.

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IEEE William E. Newell Power Electronics Award

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For outstanding contributions to solid-state circuits.

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