the institute

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IEEE

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BRIEFINGS

REGION NEWS

REGION 1 NORTHEASTERN UNITED STATES

■ **New York** and **North Jersey** sections form joint IEEE Information Theory Society chapter.

REGION 3 SOUTHEASTERN UNITED STATES

■ Student branch formed at **Horry Georgetown Technical College, Conway, S.C.**

■ **East Tennessee Section** forms IEEE Life Member (LM) affinity group.

REGION 4 CENTRAL UNITED STATES

■ **Chicago Section** forms IEEE Computer Society chapter.

■ Student branch at **University of Illinois, Urbana-Champaign,** forms IEEE Photonics Society chapter.

■ **Twin Cities (Minnesota) Section** forms IEEE LM affinity group.

REGION 5 SOUTHWESTERN UNITED STATES

■ Student branch at **John Brown University, Siloam Springs, Ark.,** forms IEEE Aerospace and Electronic Systems Society chapter.

■ Student branch at **University of Denver** forms IEEE Industry Applications Society chapter.

REGION 6 WESTERN UNITED STATES

■ **Foothills (California) Section** forms IEEE Young Professionals (formerly Graduates of the Last Decade) affinity group.

■ **San Fernando Valley (California) Section** forms IEEE Industry Applications Society chapter.

■ Student branches formed at **California State University, Bakersfield,** and **Southern California Institute of Technology, Anaheim.**

REGION 7 CANADA

■ **Hamilton (Ontario) Section** forms joint chapter of IEEE Power Electronics and Power & Energy societies.

■ **Newfoundland-Labrador Section** forms IEEE Women in Engineering (WIE) affinity group.

REGION 8 EUROPE, MIDDLE EAST, AND AFRICA

■ Student branch formed at **Assiut University, Egypt.**

■ Student branch formed at **University of Birmingham, England.**

■ **Germany Section** forms IEEE LM affinity group.

■ Student branch at **University of Cagliari, Italy,** forms IEEE Systems, Man, and Cybernetics Society chapter.

■ **Latvia Section** forms joint chapter of IEEE Industrial Electronics, Industry Applications, and Power Electronics societies.

■ **Poland Section** forms IEEE Communications Society chapter.

■ **Sweden Section** forms IEEE Photonics Society chapter.

■ **Switzerland Section** forms IEEE Industrial Electronics chapter.

■ Student branch at **National Engineering School of Monastir, Tunisia,** forms IEEE Power & Energy Society chapter.

■ **United Arab Emirates Section** forms IEEE Solid-State Circuits Society chapter.

REGION 9 LATIN AMERICA

■ **Argentina Section** forms IEEE Society on Social Implications of Technology chapter.

■ Student branch at **University of Brasília, Brazil,** forms chapters of IEEE Aerospace and Electronic Systems and IEEE Engineering in Medicine and Biology societies.

■ Student branch formed at **Universidade Federal da Paraíba, João Pessoa, Brazil.**

■ **Colombia Section** forms IEEE Antennas and Propagation Society chapter.

■ Student branches in Colombia at **Universidad de la Costa, Atlántico,** and **Universidad de los Andes, Bogotá,** form IEEE Computer Society chapters.

■ Student branch at **Industrial University of Santander, Bucaramanga, Colombia,** forms IEEE Engineering in Medicine and Biology Society chapter.

■ Student branch formed at **Universidad del Caribe, Santo Domingo, Dominican Republic.**

■ Student branch formed at **Universidad San Francisco de Quito, Ecuador.**

REGION 10 ASIA AND PACIFIC

■ Student branch formed at **Deakin University, Melbourne, Australia.**

■ **Harbin (China) Section** forms IEEE Industrial Electronics Society chapter.

■ Student branches in India at **Ambedkar Institute of Technology, BSA College of Engineering and Technology, Indraprastha Institute of Information Technology, LDRP Institute of Technology and Research, Sreenidhi Institute of Science and Technology, Thangavelu Engineering College,** and **Thapar University** form IEEE WIE affinity groups.

■ **Malaysia Section** forms IEEE Computational Intelligence Society chapter.

■ **New Zealand Central Section** forms IEEE Computational Intelligence Society chapter.

■ Student branches formed in Pakistan at **Abasyn University, International Islamic University,** and **University of Lahore.**

■ Student branch at **Beaconhouse National University, Punjab, Pakistan,** forms IEEE WIE affinity group.

SEND US YOUR NEWS *The Institute publishes 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.*

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COVER: GETTY IMAGES; THIS PAGE: ISTOCKPHOTO

CALENDAR

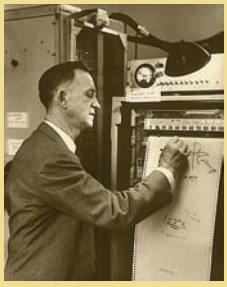
June

8 1920: Edwin Armstrong receives a patent for the **superheterodyne receiver**, a device that would lay the foundation for modern radio receivers.

14 1951: **UNIVAC I**, the first commercial computer in the United States, is put into service by the U.S. Census Bureau, in Blue Bell, Pa.

18–23 IEEE Meeting Series in New Brunswick, N.J.

25 1876: Alexander Graham Bell demonstrates his **telephone** [above] to the public at the Centennial International Exhibition, in Philadelphia.



27 1901: Birth date of **Merle A. Tuve** [above], a geophysicist who helped pioneer the use of radio waves to investigate the ionosphere.

July

1 1941: The **first TV commercial**, an advertisement for the Bulova Watch Co., airs on WNBT (now WNBC) in New York City.

3 1886: Birth date of **John Howard Dellinger**, developer of the radiosonde, a balloon-borne device that transmits meteorological data to weather stations.

13 1977: A lightning strike near New York City triggers a **massive power outage**.

21 1820: Scientist Hans Christian Ørsted publishes his discovery that an **electric current creates a magnetic field**, a vital aspect of electromagnetism.

26 1989: Robert Tappan Morris is the **first person indicted for releasing a computer worm**; it infected MIT, NASA, and several other organizations.

August

3 1811: Birth date of **Elisha Graves Otis** [top], inventor of a mechanism that keeps elevators from falling if their hoisting cables fail.

7 1886: Birth date of **Louis Alan Hazeltine**, inventor of the neutrodyne receiver and 1936 president of the Institute of Radio Engineers, one of IEEE's predecessors.

22–24 IEEE Sections Congress in Amsterdam.

23 IEEE Honors Ceremony at Sections Congress in Amsterdam.

26 1873: Birth date of **Lee de Forest**, inventor of the Audion vacuum tube, the first electronic device that could amplify an electrical signal.

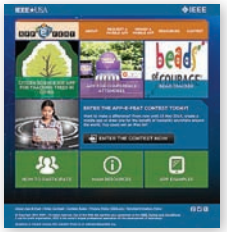
Historical events provided by the IEEE History Center. IEEE events indicated in red.

CLOCKWISE FROM TOP: EVERETT COLLECTION/ALAMY; TIME & LIFE PICTURES/GETTY IMAGES; ISTOCKPHOTO; PICTORIAL PRESS/ALAMY

NEWS

Create an App to Help Good Causes

INTERESTED IN using your programming skills to benefit humanity? Then consider signing up for App-E-Feat, an IEEE initiative in which members design mobile apps for nonprofits around the world. Members can sign up for the program by visiting http://www.appefeat.org. They will then be matched with an organization that needs help building an app to further its cause.



App-E-Feat is part of IEEE's commitment to the Clinton Global Initiative. Established in 2005 by former U.S. president Bill Clinton and the Clinton Foundation, CGI each year brings together leaders from a worldwide array of businesses, governments, and nonprofits to come up with solutions to some of the world's most pressing problems, such as poverty, disease, and limited access to education and health care.

IEEE Fellow Karen Panetta proposed the idea for App-E-Feat at CGI's 2013 annual meeting. She is IEEE-USA vice president of communication and public awareness.

"President Clinton's plenary address at last year's CGI meeting addressed the positive impact of mobile apps, especially in the aftermath of natural disasters, such as the massive earthquake that hit Haiti in 2010," Panetta says. "Apps helped rescue workers prioritize their efforts by informing them about the most devastated areas.

"A lot of representatives from nonprofits suggested ways that mobile apps could help their causes, but none were from technology organizations," she says. "So I told them we have thousands of volunteer engineers ready to help further their missions: 'You give us the problems, and we'll give you the engineers to solve them.'" —*Amanda Davis*

Remember to Vote

LOOK FOR YOUR annual election ballot package to arrive in August via first-class mail with a ballot and a postage-paid reply envelope. Members will also receive instructions via e-mail explaining how they can access and return the ballot electronically.

Those eligible to vote include new members as of 30 June and students elevated to member or graduate student member grades on or before that date. Associate members are not eligible.

The member grade requires that you be regularly employed in an IEEE-designated field with a combination of education and work experience totaling at least six years. To apply for transfer to member grade, visit http://www.ieee.org/membership_services/membership/grade_elevation.html.

To be eligible to vote, student members graduating this year between 1 January and 30 June must update their education information online to be elevated to member or graduate student member grade.

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. —*Carrie Loh*

Election Deadlines

15 AUGUST
Date by which IEEE annual election ballots will be mailed to voting members and electronic ballots will be made accessible.

1 OCTOBER
Last day that members' marked ballots can be accepted by IEEE, by noon CDT USA/17:00 UTC.

13 OCTOBER
Election results are announced by the IEEE Tellers Committee.

23–24 NOVEMBER
IEEE Board of Directors acts to accept the report of the Tellers Committee. Annual election results are made official. —*C.L.*

Online

Available 6 June at theinstitute.ieee.org

BOOKS OF INTEREST
E-books cover topics relating to smart cities.

IN MEMORIAM
The Institute pays tribute to three members who recently died.

ELECTION

A Conversation With the Candidates for 2015 President-Elect

Mintzer and Shoop respond to members' questions and concerns

BY MONICA ROZENFELD

ED CARREON PHOTOGRAPHY

THE ANNUAL IEEE election process begins in August—be sure to check your mailbox for your ballot. To help you decide whom to choose for 2015 IEEE president-elect, we interviewed the candidates: IEEE Life Fellow Fred Mintzer [left] and IEEE Fellow Barry Shoop. We asked them questions submitted by members, as well as some of our own. Each candidate shared his vision for the future of the organization and the changes he proposes to make if elected.

First, a bit of background. Mintzer was program director for IBM's Blue Gene Watson supercomputing facility and associate director of the Deep Computing Institute from 2005 until he retired six months ago.

Early in his career, he conducted research on digital signal processing algorithms, applications, and architectures. He led a team at IBM's Watson Research Center that developed technologies to support image database systems that emphasized image quality and security. The work garnered numerous awards.

Mintzer went on to develop new applications for secure printing and new techniques for document watermarking. He became senior manager of IBM's visual technologies department, which developed 3-D graphics and scientific visualization systems. Mintzer has coauthored more than 50 technical papers and holds more than 25 patents.

He was a member of the IEEE Board of Directors and director of IEEE Division IX in 2008 and 2009. He served as vice president of IEEE Technical Activities in 2012, and he was a member of the IEEE Audit, Investment, and Employee Benefits and Compensation committees, among other leadership positions. He received the IEEE Third Millennium Medal in 2000 and the IEEE Signal Processing Society's Meritorious Service Award in 2009.

Shoop, a professor of electrical engineering, is head of the department of electrical engineering and computer science at the U.S. Military Academy at West Point, in New York. He is responsible for a department of 79 faculty and staff members. He joined West Point in 1993 and has served in a number of leadership positions, including director of the Photonics Research Center. While on sabbatical in 2006 and 2007, he served as chief scientist for the U.S. Department of Defense Joint Improvised Explosive Device Defeat Organization, which addresses the IED problem worldwide.

A fellow of the Optical Society of America and the International Society for Optics and Photonics (SPIE), he received OSA's 2008 Robert E. Hopkins Leadership Award and SPIE's 2013 Educator Award. He also received the 2013 IEEE Haraden Pratt Award.

Shoop served on the IEEE Board of Directors from 2006 to 2010. He was 2010 vice president of IEEE Member and Geographic Activities (MGA), IEEE secretary in 2008 and 2009, and Region 1 director in 2006 and 2007. As leader of IEEE's Enterprise Engineering team in 2006 and 2007, he led the transformation of the Regional Activities Board into the MGA Board. He has served on the IEEE Executive, Strategic Planning, New Initiatives, and Audit committees.

Why do you feel you're the best candidate?

MINTZER The needs and expectations of today's engineers are changing. We need to provide more that is of current value to them, such as increased technical community participation and greater involvement in emerging technologies. I have a firmer agenda for creating such value and a record of success in doing so.

IEEE technical communities are where

colleagues work together on a common interest such as a technology, conference, regional meeting, educational activity, standard, or publication. The value of participating in them is high. Attending a conference is an especially effective way of staying technically current because of its interactions. Community discussion of a topic via social media can provide insight beyond any article's text. Many volunteers learn about leadership and interacting in a global business culture through their IEEE community participation. By enabling more and better community interactions, I would add current value.

Emerging technologies include topics such as smart cities [see p. 8], big data, and the Internet of Things. My industrial experience has taught me that these technologies are at the center of tomorrow's jobs. By adding activities and opening new communities in this area, I would add current value.

SHOOP I have been an active IEEE volunteer leader for more than 28 years and bring diverse leadership experience from three other professional societies and a career spanning over 34 years. My IEEE experiences provide me with comprehensive knowledge of the operations of IEEE across the breadth of the institute.

I am a collaborative leader. I listen to people, understand the issues, and have a demonstrated record of bringing diverse groups to consensus. I have led change in IEEE by focusing on the member, developing products for the practitioner, and improving our strategic positioning. I have a vision, a plan, and the experience to lead IEEE to be *the* professional society of choice for technical professionals around the world.


Shoop

Would you consider lowering membership dues, particularly for those who can't afford them?

SHOOP As a community where dues are based on fairness, we have worked hard and continue to develop programs that address this important issue. In 2010, while I was vice president of MGA, we initiated the e-Membership option for members who reside in countries with low per-capita gross domestic product. In 2013 we had more than 27 500 e-Members.

We have special circumstance categories for retired and unemployed members and those with low income, as well as a full discount for those who are permanently disabled. In 2013 we had more than 5700 recent graduates who received discounts in their first year of higher-grade membership. Student members also receive reduced membership dues, with more than 120 000 in this category in 2013.

MINTZER I would love to lower member dues for all. However, at current expense levels, we cannot sustainably do this while continuing to provide the level of service IEEE members expect.

Some IEEE expenses relate to investment. IEEE has been investing heavily in enhanced services to its members and customers, including collaboration tools for its technical communities. Other professional societies are aggressively developing such tools for their communities. We must do so as well or risk losing our communities.

I believe IEEE has an obligation to all members of our profession. IEEE currently provides reduced-rate membership fees for members falling in several categories of special circumstances, including those from developing nations. I support this and favor its expansion where sustainable. In addition, IEEE has opened some of its technical communities to all—free of charge. I support this as well and favor its expansion where sustainable.


Mintzer

How would you improve the IEEE support infrastructure, such as the response time to members' queries?

MINTZER IEEE is a technology-centric organization with a dedicated staff. Our members are top professionals in their fields. They expect us to use leading-edge information technology systems to provide excellent member support.

Social networking is a vital cog in the operation of any modern dynamic technical community. We should harness its power, using the collaboration tools being developed to support technical communities, to be more responsive to members' queries.

SHOOP For a society focused on members, responsiveness to our members' inquiries is essential. With IEEE's wide variety of products, services, benefits, and offerings, navigating the IEEE support infrastructure is often challenging. We have made important strides in customer service, and I will advocate for additional improvements.

As one recent example of an effort to improve responsiveness, in 2012 we deployed IEEE Knowledge Base to provide searchable self-service access to information to improve the response time to common questions. In conjunction with Knowledge Base, we introduced a service called Chat that enables members to communicate with staff at no cost with the option to request a return telephone call from the IEEE Contact Center at the member's convenience. I understand the importance of supporting our members and am committed to this effort.

What are your plans for growing the membership of female engineers?

SHOOP The future of our disciplines, profession, and world is far too important to entrust to any single subset of society. Diversity is our greatest strength and therefore must be a priority. Addressing this will require multiple approaches.

First, I think it is critical that we have female role models in leadership positions—to inspire and serve as mentors. Next, for our profession, IEEE needs to provide modern collaboration and networking tools that provide opportunities for expanded engagement beyond traditional boundaries in a global community. And finally, looking to the future of our profession, we must develop programs that will encourage young women to consider careers in our disciplines.

MINTZER I find technology extremely exciting—and getting even more exciting every year. We are changing the world! I find it disappointing when others do not share that excitement. We need to reach women at a young age and tell them about the technology world's awesome opportunities. I will participate in delivering that message.

Because of the number of young women we need to reach, delivering this message will be a significant challenge. It will require building a large, skilled, and enthusiastic community of IEEE leaders that interacts with future engineers. I believe we have leaders who will welcome this challenge. I will support building that community and will participate in it.

ED CARREON PHOTOGRAPHY(2)

In addition, I will help women in our technical communities find leadership positions. Their leadership can help demonstrate that many exciting opportunities are available.

What new benefits would you offer members who work in the business sector?

MINTZER Industrial members need to stay technically current; knowledge of emerging technologies will help them do so. I recently helped create two related benefits. The IEEE Technical Activities Board (TAB) created online technical communities, open to all members, centered on the emerging technologies managed by the IEEE Future Directions Committee. I would increase the number of these communities. TAB also created an e-magazine, *IEEE Technical Community Spotlight,* which provides all IEEE members with selected articles on emerging technologies and how-to information on participating in related communities. I would enhance this e-magazine.

Talks by speakers who work in industry are especially attractive to industrial members. I would offer more industry-focused meetings such as the Metro Area Workshops and IEEE Industry Days, which feature plenary talks by industry leaders and discussions of the technologies most likely to shape the future.

SHOOP As vice president of MGA, I developed the Metro Area Workshop, which provides professional education and certification to equip members to compete in an increasingly challenging job market. The target audience is practicing engineers and technical professionals who are innovators, have a desire to learn more, or are in career transition or considering a career change. The workshop addresses emerging technologies that are in demand within the local geographic area.

These have been a huge success—well attended, with high satisfaction rates—and have attracted new members. Additionally, using new modalities of information delivery, we have the opportunity to create and deliver *knowledge* rather than just more information. By combining both traditional and application-oriented papers with online interaction, videos, databases, simulation tools, and wikis, we can enrich knowledge content for *all* our members.

What do you see as the future of IEEE? As president, how would you help us get there?

SHOOP I see an IEEE that is valued by our members, our profession, and the public. All our members have access to individualized tools, products, and services that support professional growth and career security. IEEE's brand provides increased recognition and prestige for our profession and influences public policies worldwide.

Engineering, computing, and technology careers are sought after by young people. IEEE is a truly global organization—in every sense. We have successfully developed new modalities of knowledge distribution that create and deliver knowledge by combining traditional papers with online interaction, videos, databases, simulation tools, and wikis, all to enrich knowledge content.

And finally, we have created a structure and culture of innovation, one that proactively identifies new markets and potentially disruptive innovations and encourages diversity, experimentation, risk taking, and collaboration. I believe I can help in getting us to this future by first articulating this vision, bringing together diverse teams of experts, applying a collaborative leadership style to bring these groups to consensus, and, finally, securing the resources necessary to create this future.

MINTZER IEEE will become a dynamic organism of technical communities in its fields of interest. It will quickly organize new communities around emerging technologies and interests. It will share insights more quickly and broadly within its communities. Its publications will be enhanced with interactive discourse—often in multiple languages—for which social networking will be the backbone. That future IEEE will provide better mission fulfillment and better member satisfaction.

As president, I will persistently focus on strengthening our technical communities and will strongly support the development of the information-technology ecosystem needed to support them.

Check out our website in July for a series of video interviews with the candidates: http://institute.ieee.org/2015-candidates-videos

Making Cities Smarter

HALF THE WORLD'S population now lives in cities, and that proportion is expected to climb, according to the United Nations. For many cities, the influx of people is already straining aging infrastructures, including power grids, roadways, and mass transit—as well as government services and office and apartment buildings. To become more efficient and make residents' lives easier, municipalities are turning to technology.

IEEE plans to lend a helping hand through its Smart Cities initiative—launched in January by the IEEE Future Directions Committee, the organization's R&D arm—by working with local communities to implement technologies that can solve local problems.

Cities that already have a plan to manage the transition can receive help from IEEE in a number of ways. They will have access to IEEE experts, workshops to help delineate their goals, conferences on smart cities, assistance with building a repository of lessons learned, and help with developing courses for university students and others.

This issue of *The Institute* highlights the city chosen to be the pilot for the IEEE Smart Cities Initiative: Guadalajara, Mexico [this page]. We also showcase cities that are applying technology to make themselves more livable [p. 10]. And we've profiled the career of IEEE Member Gilles Betis, chair of the Smart Cities initiative [p. 17]. The issue also presents products, standards, and conferences that provide the foundation members need to build the cities of the future.

And to help you decide whom to choose for 2015 IEEE president-elect, read our interview with the candidates, IEEE Life Fellow Fred Mintzer and IEEE Fellow Barry Shoop [p. 5].

Smart Cities

TECH TOPIC

Guadalajara: Smart City of the Near Future

IEEE will work to make Mexico's Silicon Valley more efficient BY KATHY PRETZ

MEXICO'S second-most-populous city is a high-tech powerhouse. Guadalajara, capital of the state of Jalisco, is home to more than 100 software companies and manufacturers, including Foxconn, Intel, Jabil, Oracle, SCI Systems, and Tata. Known as the country's Silicon Valley, the city is dotted with more than 20 corporate campuses. And the area's talent pool is young: The average age is 24.

Guadalajara also has a strong education element: More than 20 universities offer engineering and IT courses. According to the American Chamber of Commerce Mexico, more than 7000 students graduated with degrees in engineering in 2012, the most recent figure available.

With so much high-tech talent, it's no wonder Mexico's leaders selected Guadalajara as the site for the Ciudad Creativa Digital, a smart-city development project. The CCD is expected to advance the country's leadership position in media by using technology to create a socially integrated urban environment that can attract those working in advertising, gaming, movies, television, and related fields. Housing, recreational areas, educational and cultural institutions, retail stores, restaurants, and hotels are part of the project.

Guadalajara began the development efforts in October in a 40-hectare area downtown it calls the Digital Hub. Eventually, the CCD is expected to expand beyond the downtown and cover some 380 hectares.

To be considered a smart city, a municipality must do such things as retrofit buildings to make them more energy efficient; update aging power grids, public transportation systems, and roads; integrate related but separate government services and departments; and use social media to communicate with residents. Guadalajara plans to use information and communication technologies to improve its infrastructure and develop more efficient ways to provide services to its citizens and businesses.

Overhauling a city's infrastructure and services requires a lot of technology: telecommunica-

An architectual rendering of the buildings that will make up the the Ciudad Creativa Digital (CCD) site, in Guadalajara, Mexico.

tions, wireless networks, a smart grid, sensors, facial-recognition systems, renewable energy sources, integrated transportation, crowdsourcing, and data aggregation—the list goes on and on. Who better to understand how to put it all together and make it work than members of IEEE?

"Designing successful and sustainable smart cities requires careful planning of energy, water, transportation, and communications facilities and for the citizens' public health and safety," says Gilles Betis, chair of the IEEE Smart Cities Initiative [see p. 17]. The initiative is a global, multidisciplinary effort through which IEEE seeks to help municipalities address the huge demands on land, resources, and services associated with population growth.

Along with access to IEEE experts, municipalities receive help with a number of activities, including workshops to develop white papers describing what the city would like to accomplish, an international conference on smart cities, and access to members of the IEEE Distinguished Lecturers program. IEEE also plans to help build a repository to serve as a source of lessons learned and to develop massive open online courses and support postgraduate students working on smart cities–related disciplines.

"IEEE has cultivated a powerful and talented brain trust that can assist municipalities in addressing the essential services that must be managed in unison while providing a clean and safe environment for residents to live, work, and play," Betis says.

THE CHALLENGE

Because of its CCD master plan, Guadalajara was chosen as the pilot for the IEEE Smart Cities Initiative.

"We selected Guadalajara as our first city because it has a well-defined plan in the CCD and welcomed support from IEEE," says IEEE Senior Member Roberto Saracco, chair of IEEE's Future Directions Committee, which oversees the initiative.

"IEEE has established cooperation with the International Telecommunication Union and other organizations, recognizing the need for a multidisciplinary and multiperspective approach," Saracco says. "We are going to provide CCD with support in introducing new technologies and, more important, team it up with professors and students at local universities.

"Local IEEE chapters will follow the city's day-by-day progress. Guadalajara can create a ripple effect for other cities with similar goals," he continues.

CARLO RATTI ASSOCIATI & TEAM FOR GUADALAJARA CCD A.C. (3)

BUILDING BLOCKS

The team working on the CCD plan includes engineers from MIT as well as IEEE members from the Guadalajara Section and engineering students from the city's universities. The group has proposed several plans for orchestrating the transition. These include developing network architectures for communication systems, putting up efficient new buildings and retrofitting old ones, and developing tools to make the data being generated available to residents. One such tool, for example, could be an app to check whether buses are on time.

The city's strengths and weaknesses must be identified, as well as trends about how services are being used. Trends could include a spike in crime, the use of electricity, and calls to government offices during certain times of the day.

The team realizes it can't realistically improve every aspect of the city, so it is focusing on eight areas: public transportation and parking, waste collection, safety and security, telecommunications, the economy, the environment, government operations, and how involved citizens want to be in improving their communities.

Top: One of the many courtyards that will make up Ciudad Creativa Digital (CCD). Bottom: An artistic rendering of the site. The CCD's Digital Hub will surround Parque Morelos, a park located in the city's historic downtown area.

For the telecommunications infrastructure, engineers will need to combine legacy networks with new communication architectures, which include sensor and mobile networks. The goal is to configure the networks to be compatible at the very least with the ones being used by law enforcement, hospitals, highway authorities, and weather forecasters.

The CCD plan calls for an optical network using fiber-to-the-home technology. FTTH involves installing optical fiber from a telephone switch in the street directly to the subscriber's home or business. That enables faster connection speeds and greater carrying capacity—ideal for the large audio, data, and video files handled by the digital media industry. The network is also being designed to incorporate such features as big-data analysis, cloud computing, the Internet of Things, machine-to-machine communication, and wireless sensor networks.

The data generated will provide a treasure trove of information about matters like traffic patterns, energy consumption, and public transit, according to organizers, but the data must be turned into something that residents and businesses can use.

To that end, the team plans to build what it calls an urban operating system (UOS): a big-data platform to help analyze how the city operates and to help it find better ways to make use of its resources.

The UOS is expected to provide a comprehensive set of digital services for supporting business processes and managing data. The catalog of services provided by the UOS includes intelligent streetlights to reduce energy usage and increase citizens' security by means of optimizing the lights' intensity, an app that locates parking spaces via mobile devices or public displays, and an education platform that will make a wide variety of courses accessible to residents.

If the smart-city transition proves successful, the CCD will be replicated across the country and Latin America, according to the team.

"IEEE can provide city leaders unbiased help with accessing the technology and becoming aware of the options that exist. Even more important, IEEE members can help leverage their experience to the benefit of others," Saracco says. "It is something we have to do, because IEEE is about the well-being of the world, with technology as a tool, not an end."

Smart Cities TECH TOPIC

An Urban Reality: Smart Cities

Many are already more livable BY KATHY PRETZ

MUNICIPALITIES large and small are finding ways to use technology to make life easier for their residents and visitors. Among the cities striving to make themselves smarter are Barcelona; Da Nang, Vietnam; Edmonton, Alta., Canada; Fort Lauderdale, Fla.; and Rio de Janeiro.

Regardless of size, cities are becoming too crowded, and the lure of technology is appealing. A little more than half of the world's population now resides in cities, according to the World Health Organization, and that proportion is expected to grow. The WHO predicts that 60 percent of the world's population will live in cities by 2030, and 70 percent by 2050.

Because each city has its own challenges, there's no one-size-fits-all solution. Some cities overhaul their transportation systems or coordinate their services in ways not done before, while others look for ways to reduce traffic congestion, monitor water supplies, and fight crime.

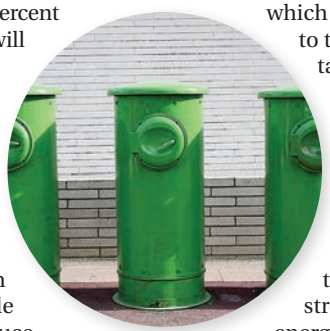
The technologies being applied can be as complex as advanced data and analytical tools, cloud-based services, and integrated data, voice, and wireless systems. Or they can be as relatively simple as making use of mobile devices, LEDs, and solar panels.

The cities below received grants from IBM's Smarter Cities Challenge, the company's largest philanthropic initiative. IBM works closely with city leaders and issues recommendations on how to make cities more efficient.

BARCELONA

Spain's second-largest municipality is an acknowledged leader in the smart-city movement, and for good reason. It has introduced a host of services.

Barcelona collects garbage via a pneumatic waste management system, so its residents no longer have to see or smell overflowing trash bins. The covered containers [below] have portholes with chutes connected to a subterranean vacuum network. Some bins are color coded for recycling glass, paper, or plastic.



Sensors in the portholes indicate when the trash needs to be emptied, and they can help ensure that only one kind of waste material is traveling through the pipe at a time. The waste is moved through the underground pipeline by air pressure created by large industrial fans. The pipelines converge in a central processing facility, which directs the waste to the proper container. From there it is trucked to a landfill, composting plant, or other final destination.

The city has also installed thousands of LED streetlights to save energy. And at night, they're not always on. The lights are activated only when a sensor detects movement. Other sensors collect information about the environment, such as humidity, temperature, noise, and air pollution.

To make life easier for commuters, Barcelona revamped its bus service. Like some other major cities, it relies on an orthogonal network with horizontal, vertical, and a few diagonal lines so that passengers need only one transfer to travel between any two points in the city. What's different is that the buses are natural gas–electric hybrids, and solar panels on bus shelters activate a screen that shows arrival times.

DA NANG

Vietnam's fourth-largest city [below] has one of the highest population growth rates in the country. It's challenging to keep its drinking water clean and its traffic moving.

During water treatment, samples used to be manually collected and analyzed. But the city's water utility has automated the process by

installing sensors throughout the system to measure salinity, pH, and chlorine levels in real time. The utility's workers receive alerts and notifications when readings stray from norms or when analysis indicates that water quality has changed.

Da Nang is reducing traffic congestion by installing a traffic-control center that uses big-data techniques and predictive analyses to better coordinate city responses to accidents and bad weather.

With its system, Da Nang's transportation department also has real-time information on its buses, including their location, speed, and predicted journey times. From a website, travelers can find timetables and learn about estimated arrival times and changes to bus routes.

EDMONTON

Parks department workers are armed with tablet computers [above] to keep track of conditions in what is the largest expanse of urban parkland in North America. The rugged tablets are loaded with geographic information, which workers use to capture, report, analyze, and share data on the condition of playground equipment, picnic areas, park benches, and other amenities. The information is then used to prioritize maintenance projects for Edmonton's more than 450 parks.

FORT LAUDERDALE

This city has a low crime rate, and its leaders want to keep it that way. So law enforcement keeps tabs on things using a variety of big-data sources, including emergency-response call records, crime statistics, and event information. Working with up-to-the-minute information and advanced predictive models, the police department hopes to gain a deeper insight into factors contributing to crime and predict when and where it should deploy its officers.

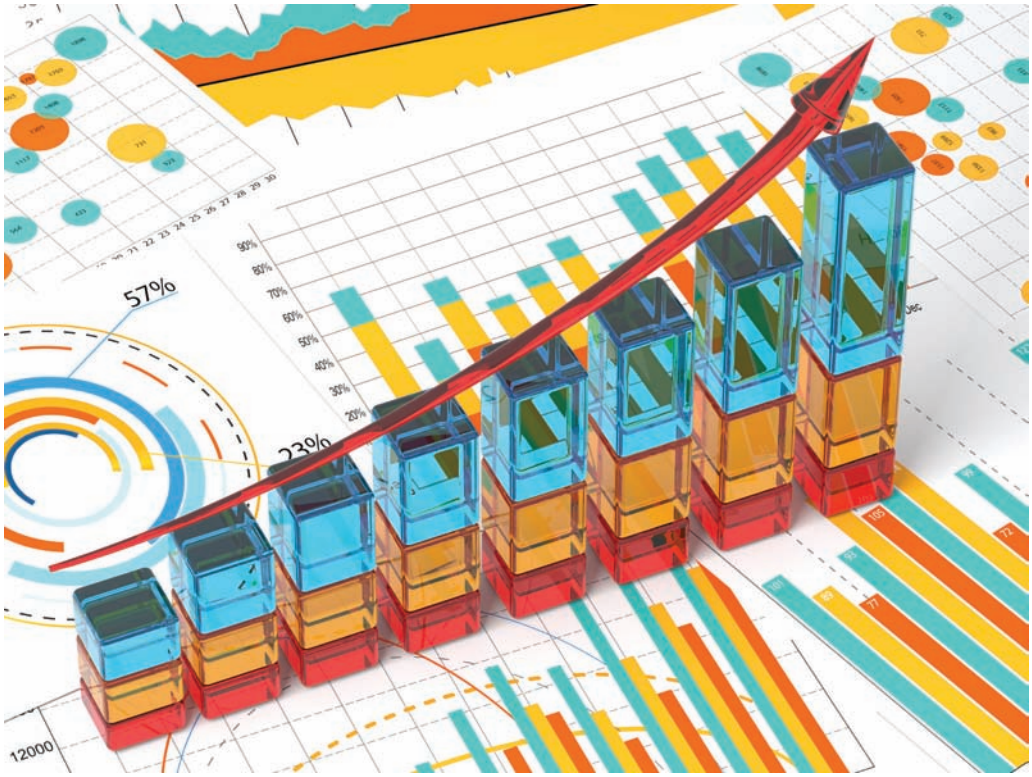
RIO DE JANEIRO

Open for nearly a year, the Rio Operations Center [below] has integrated the information systems and processes of 30 city agencies. The center, which provides an overview of how the city is functioning, uses analytical models to predict emergency situations and coordinate the city's reaction to them. Officials from across the city collaborate daily to manage the movement of public transportation as well as monitor the use of electric power and water.

The center employs a high-resolution weather-forecasting and hydrological-modeling system that can predict heavy rains up to 48 hours in advance. Forecasts are based on a unified mathematical model of Rio that pulls data from the city's river basin, topographic surveys, the municipality's historical rainfall logs, and radar feeds. Along with predicting rainfall, the system can anticipate flash floods and mudslides, and the city has begun to evaluate the effects of weather on traffic and on the supply of electric power.

Residents can access daily information from the center's Facebook and Twitter feeds to get updates on weather and traffic as well as recommendations for alternate routes during crowded special events. That is likely to come in handy this month, as the city welcomes World Cup fans to matches, concerts, and festivals.

CLOCKWISE FROM TOP: ROB WHITWORTH/GETTY IMAGES; MARIO TAMA/GETTY IMAGES; INTERGRAPH; XAVIER SUBIAS/GETTY IMAGES



ISTOCKPHOTO

BUSINESS

Evaluating the Quality of Research

IEEE issues guidelines for assessing the impact of research articles BY KATHY PRETZ

EVALUATING the impact of scientific research is a notoriously difficult problem with no standard solution. Nevertheless, making such evaluations has become increasingly important, as more universities and research administrators, research agencies, funding and government organizations and, ultimately, taxpayers want to assess the results of public and private research.

The pressure is on to find a way to measure the value of a researcher's published work. But this has led to oversimplified and ultimately incorrect methods.

"Technically incorrect use of bibliometric indicators has caused great concern in the scholarly community," says Gianluca Setti, vice president of IEEE Publication Services and Products.

As an example, some employers are using a single bibliometric indicator of a journal—the Thomson Reuters Impact Factor (IF)—as a gauge for evaluating each individual paper published in the journal and of the researchers who authored it. Setti points out that the IF was not designed for that purpose. In fact, it was introduced to help librarians decide whether to renew journal subscriptions.

Thanks to the "scientific recognition" attached to a citation, the IF is indeed a legitimate proxy for the relative importance of a journal within its field: the more citations, the higher the IF and the more "important" that journal is.

Currently, the IF of individual publications is being misused, Setti says, when it alone is employed to assess the performance of a researcher not only for salary increases but also for decisions on hiring, promotion, and tenure. In medicine, biology, and other areas, the situation is even worse, according to Setti, because of the practice of computing a single indicator to rank individual performance by totaling (or averaging) the IFs of the publications produced by a scientist in a given period. Doing so has no significance from a bibliometric point of view, he says.

Setti points to several problems with using the IF as a gold standard for assessing the quality of research.

First, the IF of a scholarly journal is a measure reflecting the *average* number of citations to articles it contains. Yet the number of citations is not evenly distributed but skewed: In each journal, only a few articles receive an appreciable number of citations, while most articles are cited only a few times, if at all, Setti notes.

As a consequence, use of basic statistics is sufficient to understand that an average measure like the IF, upon which the reputation of a journal is based, is not at all related to the quality (for example, number of citations) of a specific article.

Second, the IF possesses several weak points in the area of bibliometrics that have been criticized by the the scientific community. As a result, improved indicators have been introduced.

INDICATORS

■ The Eigenfactor score, developed by Jevin West and Carl Bergstrom at the University of Washington, in Seattle, computes the ranking of a scientific journal based on an algorithm similar to the one used by Google to rank Web pages as a result of a search. Journals are rated according to the number of citations their articles attract, with citations from highly ranked journals weighted to make a larger contribution to the Eigenfactor. Citations by authors to their own articles are excluded. Furthermore, unlike the IF, the Eigenfactor measures the performance of the journal as a whole; as such, it tends to be larger for journals publishing a substantial number of papers.

■ The Article Influence Score is computed by normalizing the Eigenfactor to the number of papers published in a specific journal to obtain a measure of the average impact of an individual article.

■ The Scimago Journal Ranking is similar to the Article Influence Score but with the partial inclusion of self-citations, to better evaluate—the thinking goes—the impact of journals that are the sole reference of a small scientific community.

CONCERNS

One of the scientific community's main bibliometric concerns is that a journal's impact is multidimensional and cannot be captured by any single bibliometric indicator. For instance, the Article Influence Score and the IF are jointly necessary.

Another problem is that the misuse of a single indicator to evaluate the impact of research has led to manipulation, mainly by artificially inflating the number of self-citations. Although citing oneself is legitimate in cases of previous relevant work in the same area or when a scientist is part of a large research group, recently the number of self-citations for some journals has increased dramatically, according to Setti. In

some cases, this has led Thomson Reuters to exclude some publications from its Journal Citation Reports.

DISTORTED VIEW

Over the years, the IF has become the single most widely used factor measuring an article's impact. And therein lies the problem.

"The IF can simply not be used for this purpose," Setti says. "And what is worse, its use leads to many unintended consequences, including the manipulation of the indicator." A better measure for the impact of an individual research article is simply the actual number of citations it has received, he says. Yet he believes reducing impact evaluation to that simple number is also inappropriate.

That's because citation practices can vary widely across disciplines and subdisciplines. What's more, the number of authors contributing to a specific field can be vastly different. And the count can include citations to poor work or even to incorrect results.

In short, Setti says, even if bibliometrics and citation analysis can be used as an additional source of information, nothing can replace human judgment through a fair peer-review process in assessing the impact of a research article or of a scientist.

RECOMMENDATIONS

The IEEE Board of Directors in September issued a statement on the correct use of bibliometric indicators. The statement includes the following guidelines for assessing the quality of research papers in the engineering, computer science, and information technology areas.

- The use of multiple complementary bibliometric indicators is of fundamental importance to offer a comprehensive and balanced view of each scholarly journal. Accordingly, IEEE has adopted the Eigenfactor and the Article Influence Score in addition to the Impact Factor for assessing its publications. IEEE also welcomes the adoption of other complementary measures at the article level, such as the number of citations from different sources and the so-called altmetrics, once these have been validated and recognized by the scientific community. Altmetrics cover other aspects of the impact of a work, such as article views, downloads, or mentions by news outlets or social media.
- A journal-based metric such as the Impact Factor does not capture the quality of individual papers and must not be used alone to gauge single-article quality or to evaluate individual scientists. In fact, it cannot be assumed that any single article published in a high-impact journal, as determined by any particular journal metric, will be highly cited.
- While bibliometrics may be employed as a source of additional information for quality assessment within a specific area of research, the primary means for assessing either the scientific quality of a research project or of an individual scientist should be peer review.

IEEE also condemns any practice aimed at influencing the number of citations of a specific journal with the sole purpose of artificially influencing the corresponding indices.

For more information and the full text of the IEEE statement, see http://www.ieee.org/publications_standards/publications/rights/bibliometrics_statement.html.

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Smart Cities

PRESIDENT'S COLUMN

Smarter Cities… and Wiser Ones?

WE ARE ALREADY seeing remarkable work in the creation of smart cities, as the pages of this issue of *The Institute* attest. Likewise, IEEE's newly inaugurated Smart Cities technical community is already seeing robust growth, attracting technologists from a diverse array of pursuits.

That diversity is going to be critical to the successful development of smart cities. Today's global cities are multilayered, complex, and delicately balanced. Their lifeblood is interdependent systems within systems; the proper functioning of those structures determines their citizens' quality of life.

Right now, in Barcelona, Guadalajara, London, Rio de Janeiro, Singapore, and elsewhere, members of IEEE are actively engaged in making established cities smarter. And in Masdar City, United Arab Emirates, and Songdo, South Korea, members of our IEEE community are working to create smart cities as well. But just as no two cities are alike, neither are any two smart cities. Each one faces unique challenges and objectives [see "An Urban Reality: Smart Cities," p. 10].

In Masdar and Songdo we are already seeing innovative approaches to the age-old problems of transportation, energy generation, waste removal, building construction, and the interfaces between people and technology.

In places like Guadalajara's Ciudad Creativa Digital [p. 8], IEEE members are leading efforts to make technology an immersive and pervasive part of the urban landscape. They are fostering collaboration between the public and private sectors on scales unheard of a few decades ago. Efforts such as those in Guadalajara are becoming the norm of urban planning, rather than the anomaly. In fact, collaboration with local and global organizations in different aspects (technical and geopolitical) will be a hallmark of IEEE's smart-cities activities.

My own home city of Rio de Janeiro worked with a leading IT solutions provider to build a cutting-edge "control room" that monitors the city's infrastructure, with inputs received from across the breadth of Rio's extensive urban web of interrelated systems. Traffic, air quality, and water and sewage flow are but a few of the many elements of daily life constantly monitored by this state-of-the-art system.

Such efforts—be they in Guadalajara, Masdar, Rio de Janeiro, or Songdo—are making the cities smarter. But are they making them wiser?

MORE THAN TECHNOLOGY

For smart cities to become wise, more than just technology is needed. Steve Jobs, in a 1994 interview in *Rolling Stone* magazine, perhaps said it best: "Technology is nothing. What's important is that you have faith in people, that they're basically good and smart, and if you give them tools, they'll do wonderful things with them."

It is critical to keep that in mind in any discussion of smart cities. Technology is the tool that governments and societies will employ to transform and improve economies, energy generation and distribution, governance, the environment, and, above all else, our daily lives. But technology is just that: a tool. How the tool is wielded will be paramount in achieving success.

Today, the pace of progress is measured by the month and year, rather than the year and decade. In the future, it may be measured by the day and month. That is where wisdom must come into play.

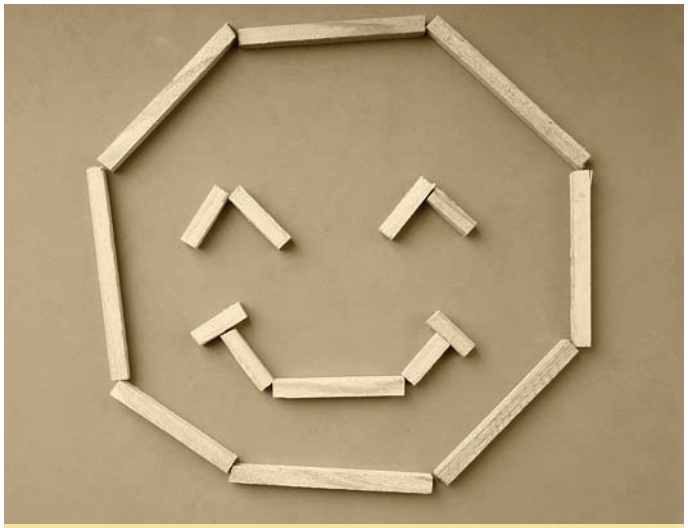
As we create smart cities, or develop our established urban centers into smart cities, our vision as technologists must focus on them as evolving, organic constructs. Thus, our investment in tomorrow's smart cities must be sustained over an extraordinarily long time. The work IEEE technologists do today to build these smarter cities must prove sustainable for many more years of evolution, growth, and development. We are not only building a smart city for today, we are also initiating a path for generations to come. Therefore, we must also educate the next generations to become builders of smarter cities.

I believe our global IEEE community is more than up to that task. As the 20th century began, members of our predecessor societies, AIEE and IRE, were changing the way the world lived, worked, and communicated. And now, in the opening decades of the 21st century, we find IEEE members doing the same.

Involve yourself in IEEE's smart-cities efforts. Take part in our technical communities and share your expertise. Smart cities will be only as intelligent as the thinking and vision that goes into creating them. Ours is a wise community; let us use that wisdom in the service of our global future.

Please share your views on smart cities with me at president@ieee.org or visit the IEEE Smart Cities Web portal at http://smartcities.ieee.org to contribute to IEEE's ongoing efforts.

J. Roberto Boisson de Marca
IEEE President and CEO



Smart Cities

QUESTION OF THE MONTH

Can You Build Happiness?

WITH MORE OF THE WORLD'S population moving into cities, according to the United Nations, urban planners are looking not only at improving municipal infrastructures but also at how to make residents, as the planners see it, happier. One idea involves placing interactive maps around a neighborhood to help pedestrians and cyclists decide which route to take based on scenery or lack of noise. Another is to sync mobile phones with parking meters and public transportation to help make paying more convenient.

But some believe more will have to be done than simply applying new technology. In a letter that went viral—"What Starbucks Gets That Architects Don't," originally published on Medium.com—Christine Outram explains that she quit her job as an architect because her former colleagues, she believes, focus too much on what they want people to do, not how people feel.

Outram founded the City Innovations Group, a self-described global network of experts who help to build smart cities. In one example she cites, Starbucks introduced round tables in its cafes after surveying customers—not because the tables looked better but because they made people feel better about sitting alone. Outram encourages city planners to talk to people and tap into the power of the Internet to learn what might make residents happy in their communities. It could simply be more bike lanes and parks, rather than new technology.

Is it possible to build a city around the idea of happiness, and are smart technologies one way to achieve that?

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.*

RESPONSES TO MARCH'S QUESTION

Will the IoT Crush IT?

As the Internet of Things becomes a reality, the enormous amount of data collected from billions of devices could overwhelm information technology companies. In a blog post on Wired.com, Mahesh Kumar, chief marketing officer at the data services company BDNA, of Mountain View, Calif., notes that many IT organizations already have trouble organizing and analyzing their existing data. Rather than worry about the number of things to be connected, Kumar warns, the concern should be about the amount and complexity of data those devices will produce.

"IT decision-support systems that are stretched to their limits today may come crashing down as the future arrives," he says. One solution he proposes is that IT companies form partnerships to share resources and knowledge.

What should IT companies be doing to keep up with the expected avalanche of data?

The following responses were selected from comments that appear at http://theinstitute.ieee.org/IoT_question.

LEAVE IT TO THE LOCALS

Perhaps big-data companies need to learn a lesson in subsidiarity—that is, rather than having a central organization collect all the data, have smaller local units handle the sorting and analyzing. After all, you don't need to know the temperature of every single tree in a forest, but you should respond if someone locally reports that one is on fire.

—Les

DECENTRALIZING DATA

Companies should use a distributed architecture, where most of the data is analyzed by the end user's device [rather than a central server], and greatly reduce centralized networking.

And to lighten the load, people should be able to sell their personal data rather than having it collected from their devices for free.

—Bill

LOSING THE BIG PICTURE

I don't agree that we should cut down on centralized networking. To get real insight, we need to get the big picture by orchestrating many different sources toward finding causality and making sense of the data.

IT companies need data-reduction techniques such as aggregation, sampling, and model building. To analyze the results, they could use visualization techniques or combined approaches, like visual analytics.

—Rob

IEEE QUICK GUIDE

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Smart Cities

CONFERENCES: SEPTEMBER–DECEMBER

Upcoming IEEE events cover topics related to smart cities

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IEEE International Symposium on Wireless Vehicular Communications

VANCOUVER, B.C., CANADA; 14–15 SEPTEMBER

TOPICS: Sensor networks for smart cities, citywide vehicle networks, vehicle-to-vehicle and vehicle-to-infrastructure communications, connected vehicles, antenna design, radio resource management, embedded wireless vehicular communications, electromagnetic compatibility, and networking protocols.

SPONSOR: IEEE Vehicular Technology Society
VISIT: http://www.ieeevtc.org/wivec2014

IEEE International Workshop on Intelligent Energy Systems

SAN DIEGO; 8 OCTOBER

TOPICS: New developments in technology for smart cities, power and energy systems for the smart grid, standards for intelligent distributed energy systems, electric vehicles, and advanced information and communications technology.
SPONSORS: IEEE Industrial Electronics and IEEE Systems, Man, and Cybernetics societies
VISIT: http://www.iwies2014.org

IEEE Power & Energy Society Innovative Smart Grid Technologies Conference Europe

ISTANBUL; 12–15 OCTOBER

TOPICS: Smart-metering infrastructure, smart-grid technologies for transmission and distribution systems, energy storage and conversion technologies, smart-grid communications and information technologies, network integration of distributed-energy resources, and applications for microgrids.
SPONSOR: IEEE Power & Energy Society
VISIT: http://www.ieee-isgt-eu.org

eChallenges e-2014 Conference

BELFAST, NORTHERN IRELAND; 29–31 OCTOBER

TOPICS: Smart cities, smart grid, cloud computing, cybersecurity and identity management, mobile applications, technology-enhanced learning, digital libraries, electronic health records and medical devices, and social implications of technology.
SPONSORS: IEEE Computer Society and IEEE Society on Social Implications of Technology
VISIT: https://www.echallenges.org/e2014

IEEE International Conference on Smart Grid Communications

VENICE; 3–6 NOVEMBER

TOPICS: Technology and networks, cybersecurity and privacy, control and operation of the smart grid, microgrids, intelligent energy distribution, data management, and smart-grid analytics.
SPONSORS: IEEE Communications and Power & Energy societies
VISIT: http://sgc2014.ieee-smartgrid-comm.org

IEEE Symposium Series on Computational Intelligence

ORLANDO, FLA.; 9–12 DECEMBER

TOPICS: Smart-grid applications, intelligent vehicle and transportation systems, big data, adaptive dynamic programming, cognitive algorithms, biometrics, cybersecurity and identity management, and communications systems and networks.
SPONSOR: IEEE Computational Intelligence Society
VISIT: http://www.ieee-ssci.org

Smart Cities

PRODUCTS AND SERVICES

A Smart Foundation for Smart Cities

Resources to help design people-friendly towns

BY KATHY PRETZ

THE RECENT LAUNCH of the IEEE Smart Cities Initiative gives IEEE members the opportunity to help build a new urban landscape. Perhaps the best place to go for information is the initiative's website.

WEB PORTAL

At http://smartcities.ieee.org, you can find news about the latest IEEE smart-city activities, articles from IEEE publications and elsewhere, information about conferences and events, videos, and useful links.

There you can also learn how IEEE is collaborating with cities that already have a plan to become smarter. IEEE experts stand ready to discuss the technology the cities need and to offer advice on dealing with privacy and other societal issues. They are also working with local universities on developing courses and workshops, conferences, and other events needed to train engineering students and others to sustain their new urban landscape.

Smartening up a city's aging power grid to handle increasing loads is key. The IEEE Smart Grid portal (http://smartgrid.ieee.org) already has several articles and documents that discuss what's needed, including "The Relationship Between Smart Grids and Smart Cities" by Ken Geisle, vice president of strategy for Siemens Smart Grid, in Minneapolis.

PUBLICATIONS

Several IEEE publications have covered various aspects of building a smart city. The June 2013 issue of *IEEE Communications Magazine* was devoted to the topic. Several articles focused on information and communications technologies for smart-city business models, while other articles discussed ways to protect citizens' privacy, the power of crowd-sourced data, and big-data mining approaches.

IEEE Internet Computing devoted its November/December issue to smart cities. It looked at cutting-edge research, including managing and interpreting information from social media, citywide sensing for traffic control, and driver behavior based on information coming from the Internet.

You also might want to check the IEEE Xplore Digital Library for articles from other publications including *China Communications, IEEE Computer, IEEE Network,* and *IEEE Vehicular Technology Magazine.*

VIDEOS

IEEE.tv has several videos on smart cities. Two are from the IEEE Future Directions Committee, the organization's R&D arm, which oversees the Smart Cities initiative. In one, Roberto Saracco, chair of the committee, discusses what makes a city smart. Other videos include presentations given at an IEEE France Section meeting (in French).

ARE YOU A JOINER?

If you're involved in R&D, planning, or implementation of applications for more intelligent cities, consider joining IEEE's Smart Cities Technical Community, found on the Smart Cities portal. Joining is free, and members receive announcements of upcoming conferences, links to news articles, and other information to keep them abreast of developments in the field.

Smart Cities

STANDARDS

Advancing Smart Cities

Covering applications to build more-intelligent communities BY MONICA ROZENFELD

THE IEEE STANDARDS Association has introduced a number of standards to help improve connectivity and communications in urban areas.

IEEE 1686-2013

APPROVED DECEMBER 2013

"IEEE Standard for Intelligent Electronic Devices Cyber Security Capabilities" describes the functions and features for intelligent electronic devices—including security access, configuration, and data retrieval—needed to accommodate critical infrastructure protection programs.

IEEE 802.15.4k-2013

APPROVED JUNE 2013

"IEEE Standard for Local and Metropolitan Area Networks—Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)—Amendment 5: Physical Layer Specifications for Low Energy, Critical Infrastructure Monitoring Networks" covers the physical layers of the open-systems interconnected model that supports critical infrastructure-monitoring applications.

IEEE 1901-2010

APPROVED SEPTEMBER 2010

"IEEE Standard for Broadband Over Power Line Networks: Medium Access Control and Physical Layer Specifications" covers communications below 100 megahertz over electric power lines for LANs in buildings, smart energy and transportation applications, and data distribution. The standard defines mechanisms for interoperability to ensure the desired bandwidth and quality of service as well as privacy.

The following standards are under development.

IEEE P2302

"IEEE Standard for Intercloud Interoperability and Federation" defines the functions, governance, and topology—including the gateways that mediate data exchange between clouds—for cloud-to-cloud compatibility.

IEEE P802.15.4q

"IEEE Standard for Local and Metropolitan Area Networks—Part 15:4: Low-Rate Wireless Personal Area Networks (LR-WPANs)—Amendment for an Ultra Low Power Physical Layer" defines physical layers operating at sub-1 and 2.4 gigahertz that support data rates up to 1 megabyte per second.

IEEE P802.3bt

"IEEE Standard for Ethernet Amendment: Physical Layer and Management Parameters for DTE Power Via MDI Over 4-Pair" highlights the capabilities of connecting data terminal equipment (DTE)—used to convert user information into electronic signals and to reconvert received signals—with Ethernet interfaces, while ensuring compatibility with existing equipment.

For more information, visit http://standards.ieee.org.

IEEE

EIT ICT LABS

Smart Cities PROFILE

Gilles Betis: Building Smarter Cities

Creating a systemic approach to improving urban communities BY SUSAN KARLIN

AT THE FOREFRONT of the IEEE Smart Cities Initiative, which seeks to apply technology to improve cities and the quality of life for their residents, is IEEE Member Gilles Betis. He and his steering committee are in the process of selecting 10 cities around the world for "smartification."

That term refers to the process of improving urban living by implementing technologies throughout a city's infrastructure. It can include automating payments for services such as public transportation, providing more efficient ways to dispose of waste, or alerting first responders in case of an emergency.

"Developing a smart city is not just a matter of following a recipe," Betis says. "It's a never-ending process. But once the elements are in place, there's no good reason *not* to start."

The effort requires cooperation among the city's government and its universities and businesses, as well as guidance from the local IEEE chapters involved in the IEEE effort.

"Through the Smart Cities initiative, we try to select the technologies that can solve problems cities must confront, such as traffic congestion or poor air quality, and then create a network of participating cities so ideas for progress can be shared," Betis says. One example of applying technology is to use smart sensors to monitor water and air quality. Intelligent transportation systems, the Internet of Things, crowdsourcing information, and big data are other tools that will help solve societal issues.

"Technology can also help make cities more resilient to natural disasters," Betis adds. For example, simulations and serious games can help with planning and training for emergencies. Distributed crowd-based communications networks can overcome the failure or saturation of cellular networks.

Betis was recently named the action line leader for the new Future Urban Life and Mobility project at the European Institute for Innovation and Technology and its Information Communication Technology (EIT ICT) Labs, in Paris. The project brings together researchers and business leaders to solve urban problems using technology. Betis is also the mobility and smart-city product line manager at the Thales Group, another company in Paris with divisions focused on aerospace, defense and security, and transportation.

UP FOR THE CHALLENGE

The first municipality selected by the Smart Cities initiative is Guadalajara [see p. 8]. Considered Mexico's Silicon Valley, Guadalajara has an ambitious development plan, Ciudad Creativa Digital, that aims to advance the city's already strong position in the media industries. The CCD will use technology to create a high-quality, socially integrated urban environment to attract those working in advertising, gaming, movies, television, and related fields. The smart-city project includes housing, recreational areas, educational and cultural institutions, retail stores, restaurants, and hotels.

It is hoped this project will generate more than 20 000 high-tech jobs, stimulate many millions of dollars of investment in the state of Jalisco, and raise Guadalajara to another level of competition. It will house local software companies, but the Mexican government also wants to attract international giants such as Comcast, News Corp., Sony, Viacom, and Walt Disney. According to ProMéxico, a government agency that seeks to strengthen Mexico's role in the international economy, the project will generate US $10 billion of investment in Guadalajara over the next 5 to 10 years.

To help educate engineers about making smart cities a reality, Betis and others will be working with some of the local universities to develop master's and Ph.D. programs, as well as massive open online courses on smart cities. "You can't speak about the future without involving education," he says.

He and his team are developing metrics to help the other, soon-to-be selected cities gauge their progress in the smartification process.

A SMART CAREER

Betis's efforts in smartification build on numerous aspects of his career. He earned an electrical engineering degree in automatics in 1987 from École Supérieure d'Électricité (Supélec), in Gif-sur-Yvette, France—the equivalent of a master's degree in the United States. After graduating, he joined Thales, where he began as a systems engineer in radar and sonar systems, working his way up by 2001 to head of advanced engineering for the company's weapons- and missile-system efforts. Four years later, he moved to the transportation systems department, where he worked on integrated communications, electronic ticketing, and toll road systems. Along the way, he served as product line and marketing manager and became the design leader of some of Thales's most innovative products. He has been there for 25 years.

"My goal was always to link up societal needs with innovative technological solutions," he says. "For example, behavioral change in transportation habits is key to fostering new mobility usage. Offering tools and mobile applications that simplify and extend trip planning will help the adoption of new mobility practices like carpooling or vehicle sharing as well as measure how much money drivers are saving."

In September, EIT ICT Labs tapped Betis to help it connect communications technology, urbanization, and mobility in education with new business sectors as well as define new ways that people use interactive technologies in their daily lives.

IEEE is working with Betis to create a repository of best technology practices and comparability metrics to share with cities developing their own smart-city programs.

Throughout his career, he says, he has kept an eye out for new ways to apply technology, and planning smart cities is a natural fit for the way his mind works.

"When I shifted from transportation to smart-city planning, I started to think about how to provide new solutions to people on the go, helping them to use their cars less as well as to look for new ways of transporting goods and sharing information on such things as traffic jams and disruptions in public transit systems," he says. "I also spent a lot of time thinking about how technology affects commuters' behavior, be it with money, stress, or time."

But despite his knowledge and experience, he acknowledges that building a smart city has to be done from the inside out.

"We can't come into a city and tell it how to become smart," he says. "Only those who live and work there can understand its needs.

"IEEE is a catalyst to help cities that want to become more intelligent and to share knowledge and best practices with them."

James Docherty

En Garde

PASSION
Fencing

OCCUPATION
Computer software engineer

HOMETOWN
Newcastle Upon Tyne, England

IT WAS AN Olympic dream come true—only it happened by accident. After stumbling upon the sport of fencing in high school, and then rediscovering it a decade later in graduate school, IEEE Member James Docherty [above, right] found himself on the support staff for the fencing competition at the 2012 Summer Olympics in London.

There he served as an armorer, ensuring that the fencers' equipment met regulations and solving technical problems that occurred during matches. Armorers also help maintain the fencing equipment and the electronic scoring system.

Docherty, 34, is a senior engineer at Hyperdrive Innovation, in Sunderland, England, which develops powertrain systems for electric, hybrid, and conventional vehicles. He is set to earn his Ph.D. in electrical and electronic engineering in microelectronic systems next month from Newcastle University, in England.

His engineering expertise got him interested in the technical side of the sport, such as using wireless technology to keep score. When a fencer's sword tip or blade touches the opponent, an electric circuit is closed or opened, depending on the weapon—a foil, épée, or saber. That triggers a signal sent wirelessly by a radio transmitter in the fencer's mask, indicating to the referee that the fencer has hit his opponent.

He joined the British Fencing Guild of Armourers and worked as an armorer at the national championships leading up to the Olympics.

"I was the only IEEE member on the 24-member armory, but there were a half dozen fencers with electrical engineering backgrounds," he says. "Being an armorer is very much about logical thinking, understanding circuits, solving problems, and fixing the equipment on the spot."

At the Olympics, Docherty managed to watch some of the matches despite working 14-hour days. He got to see two of his fencing idols—Peter Joppich, a four-time individual world champion from Germany, and Yuki Ota, a two-time Olympic silver medalist from Japan—face each other. "Watching them was a highlight of the games," he says. "When the athletes were competing, it was a rocking atmosphere. Every hit was met with a deafening roar."

Docherty returned to fencing himself in 2009 while earning his master's degree. Within two weeks, he was competing in the British Universities and Colleges Sport league, which is equivalent to the U.S. National Collegiate Athletic Association. He spent two nights a week practicing with the university team and more than a dozen days competing during the academic year, except when a torn tendon last year kept him out for seven months. Once he graduates, he'll continue fencing competitively, he says, but for his own U.K.-wide ranking.

"Someone once described fencing as a game of physical chess," he says. "Both engineering and fencing require you to plan a couple of moves ahead."

He says fencing has returned the favor for all his hard work by helping him relax and think more clearly. "When I put on the mask, I can shut off everything else," he says. "It's a different kind of thinking and so physically demanding that it fires off my endorphins. I've actually had a few good engineering ideas on the way home from fencing."

— Susan Karlin

Frank Gekat

Bull's-eye

PASSION
Archery

OCCUPATION
Electrical engineer

HOMETOWN
Rösrath, Germany

ELEVEN YEARS AGO, IEEE Senior Member Frank Gekat was just another dad taking his two kids to archery class. One day, rather than sit on the sidelines, he decided to try a bow and arrow himself. He was surprised to find he not only enjoyed it but also was really good at it.

Today, Gekat, 56, averages an hour of practice a day. He participates in competitions, too—about 16 a year for two different national archery organizations: the German Archery Association and the German Shooting Sport Federation. His three-member team has won two German Championship Master Class competitions for archers age 45 and older. He is the top-ranked archer in the 55 and older class for Germany's North Rhine–Westphalia region, in western Germany.

Gekat uses a recurve bow, the type favored in the Olympics. It comes with a sight and stabilization system for steadier aim and better accuracy. Its two limb tips curve away from the archer when drawn, giving the shot greater power and speed. Gekat's model, the American-made Hoyt Formula RX, weighs 3 kilograms and requires a pulling force of 24 kg on the bow—comparable to the force required of Olympic archers.

"The stabilization dampens the micromovements, or involuntary trembling, of the archer during the final aiming and controls the movement of the bow immediately after the release," he says. "The bow provides the best compromise between technical support and pure ancient archery."

He's motivated more by the meditative aspects of the sport than the competitive ones.

"With engineering, particularly in research and development, it's difficult to stop thinking about the problems you're facing. And sometimes you really should stop," says Gekat, director of development at Selex ES, a product and service provider in telecommunications, weather radar, and meteorological sensors, in Neuss, Germany.

"Archery requires concentration. It helps me shut my mind off from everything else going on," he says. "Afterward, my mind is completely blank." He often finds, he adds, that the solution to an engineering problem comes to him when driving home after practice or a competition.

"It might even happen while I'm shooting," he says, "but if I don't concentrate on the task at hand, I risk losing my arrow."

And they cost up to US $30 apiece. A professional-level bow of carbon foam composite runs about $2000. It can propel the aluminum-and-carbon-fiber composite arrows up to 90 meters—nearly the length of a European football field.

"The sport helps me meet people who have nothing to do with my job," he adds. But engineers are unavoidable. "There are several in my club, and we're always discussing ways to improve the technical aspects of the equipment. We can't help it." *—S.K.*

TOP: JAMES DOCHERTY; BOTTOM: MALTE GEKAT

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