IEEE Standards Education e-Magazine

The IEEE Standards Education e-Magazine: A publication for those who learn, teach, use, deploy, develop and enjoy Standards! Sponsored by the Standards Education Committee IEEE is committed to: promoting the importance of standards in meeting technical, economic, environmental, and societal challenges; disseminating learning materials on the application of standards in the design and development aspects of educational programs; actively promoting the integration of standards into academic programs; providing short courses about standards needed in the design and development phases of professional practice. Serving the community of students, educators, practitioners, developers and standards users, we are building a community of standards education for the benefit of humanity. Join us as we explore the three fundamental dynamics of standards--technology, economics and politics, and enjoy our feature articles about the use, deployment, implementation and creation of technical standards.

The IEEE Standards Education e-Magazine
2nd Quarter 2013, Vol. 3, No. 2

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Welcome to the IEEE Standards Education e-Magazine

A publication for those who learn, teach, use, deploy, develop and enjoy Standards!

Technical standards are formal documents that establish uniform engineering or technical criteria, methods, processes and practices developed through an accredited consensus process.

Standards are:

- developed based on guiding principles of openness, balance, consensus, and due process;
- established in order to meet technical, safety, regulatory, societal and market needs;
- catalysts for technological innovation and global market competition.
- Knowledge of standards can help facilitate the transition from classroom to professional practice by aligning educational concepts with real-world applications.

IEEE is committed to:

- promoting the importance of standards in meeting technical, economic, environmental, and societal challenges;
- disseminating learning materials on the application of standards in the design and development aspects of educational programs;
- actively promoting the integration of standards into academic programs;
- providing short courses about standards needed in the design and development phases of professional practice.

Serving the community of students, educators, practitioners, developers and standards users, we are building a community of standards education for the benefit of humanity.
Join us as we explore the dynamic world of standards!

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Letter from the Editor-in-Chief

Yatin Trivedi

2nd Quarter 2013

Health, Internet and Standards

Many times, play on words is very entertaining. For example, when I try to explain the role of Standards Education Committee (SEC), invariably a question comes up about education(al) standards. I politely explain the difference, and play on words, between standard of education vs education of standards.

As I was reviewing the articles submitted for this issue, I sensed similar play on words with health and internet, and the role standards play in that game! Many engineers worry about the health of the internet in terms of accessibility, reliability, authentication, security, etc. These are all very important issues to maintain the clear dependence on internet we all have grown accustomed to in the past decade or two. Most of the work related to the health of the internet happens in the background without disrupting our daily lives, as it should. Many technologists worry about the impact of viruses and malware have on the health of the internet and the havoc it can create on everyday life as evident from the recent attacks on Korean public media and banks. Of course, communication standards have played important role in making of the internet, and will continue to do so in future as the use of internet through various gadgets permeates our life.

Unless you are a healthcare professional, you may not know about the current and future impact of internet on your health. Perhaps you have seen your doctor use a tablet to view your medical history, scribble notes for your diagnosis or order your prescription while you are still in the exam room; you may have even used one of the wrist-watch like gadgets to monitor your blood pressure, heart rate and oxygen levels and have the data uploaded to your computer; or may have filled your prescriptions from one of the on-line pharmacies. All these applications require that data about your health – your personal medical information – be communicated between devices over the internet. That brings us to internet of health, or eHealth.

Just as healthy internet is necessary, so is the internet of health. It will be increasingly important to have standards for all health-related transactions to ensure authenticated usage of information that affect your well-being. As a professional as well as a student seeking career in healthcare field it is important to learn about these standards. Several members of the standards community have taken time to point us in this direction where we can learn more about these standards. Excellent overview (link Pete's article), interdisciplinary interaction (Bill Ash), and eHealth certification (Lloyd) are sure to educate everyone about the importance of standards in this emerging technology.

If you need any proof about the widespread interest in eHealth standards and their applications, read the student paper Wireless Wearable Body Area Network (WWBAN) for Elderly People Long-Term Health Montoring by Amr Abd El-Aty at Arab Academy for Science, Technology & Maritime Transport (AASTMT), Alexandria, Egypt. As explained by his advisors Prof. El-Nasr and Prof. Shaban, Ambient Assisted Living (AAL) homecare will become a larger issue with growing population of elderly. It will also create career opportunities for today's students.

One final note – I am deeply honored to include a special paper from James Moore, IEEE Fellow and the recipient of 2011 IEEE Charles Proteus Steinmetz award for his leadership and contribution to the software and systems engineering standards development. With growing use of personal health gadgets that share information in the cloud and analyze information that affect your well-being, numerous new applications are expected. If you call yourself a software engineer, you ought to read Mr. Moore's "The Creation of a Profession of Software Engineering."
As always, comments and contributions are welcome.
Happy reading, stay healthy and standardize!

Yatin Trivedi, Editor-in-Chief, is Director of Standards and Interoperability Programs at Synopsys. He is a member of the IEEE Standards Association Standards Board (SASB), Standards Education Committee (SEC), Corporate Advisory Group (CAG), New Standards Committee (NesCom), Audit Committee (AudCom) and serves as vice-chair for Design Automation Standards Committee (DASC). For 2012, Yatin was appointed as the Standards Board representative to IEEE Education Activities Board (EAB). He represents Synopsys on the Board of Directors of the IEEE-ISTO and on the Board of Directors of Accellera. He represents Synopsys on several standards committees (working groups) and manages interoperability initiatives under the corporate strategic marketing group. He also works closely with the Synopsys University program.

In 1992, Yatin co-founded Seva Technologies as one of the early Design Services companies in Silicon Valley. He co-authored the first book on Verilog HDL in 1990 and was the Editor of IEEE Std 1364-1995™ and IEEE Std 1364-2001™. He also started, managed and taught courses in VLSI Design Engineering curriculum at UC Santa Cruz extension (1990-2001). Yatin started his career at AMD and also worked at Sun Microsystems. Yatin received his B.E. (Hons) EEE from BITS, Pilani and the M.S. Computer Engineering from Case Western Reserve University, Cleveland. He is a Senior Member of the IEEE.

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Video Series: Discussions about the Importance of Standards and Standards Education

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Part three of the three part interview series

President of the IEEE Standards Association, Karen Bartleson talks with eZine Editor-in-Chief Yatin Trivedi about Global Collaboration and Standards Education (2:57).

Part one in three part series (2:48)
Part two in three part series (2:41)

Previous Video Series

IEEE Standards Association Past President Steve Mills and our Editor-in-Chief Yatin Trivedi discuss three fundamental dynamics of standards--technology, economics and politics, and address the importance of having a strong foundation in understanding standards and their impact on innovation.

Part three in the three-part series (5:44)
Part two in the three-part series (4:59)
Part one in the three-part series (5:53)

Videos will launch in You Tube.

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Feature Articles

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eHealth Sector Standardization: Simplifying the Complex through Education

By Pete Palmer, Director, Information Security, Surescripts

Edited by Joni Brennan, Senior Program Manager, ISTO

2nd Quarter 2013

The healthcare industry is undergoing a revolution in the adoption information technology. The rate of growth over the past few years have been nothing short of outstanding. This growth has big implications for eHealth digital identity standardization. The concepts and inter dependencies of the evolving regulations and standards discussed in this article are not being taught in academic curriculum.

Exposing students to eHealth concepts, initiative and standards discussed in this article would help to create more qualified and competent graduates that will have familiarity with the evolving nature of eHealth regulation and standards. Graduates will be able to provide more value to the industry and communities with their front line industry knowledge. They will grasp the difficult concepts associated with industry and standards development with more ease. Understanding navigation of bureaucratic constructs will also open more graduate employment opportunities.

"Active Concepts"

- **Drug Enforcement Agency's electronic prescribing of controlled substances (EPCS) interim final rule** – The Drug Enforcement Agency (DEA) prescribes requirements for valid two-factor credentials that can be used for E-prescribing controlled substances. This means that the 300+ electronic health record technology vendors are racing to support this requirement as there are close to a half million of prescribers doing E-Prescribing.

- **Accountable Care Organizations (ACOs)** – these are entities formed by the cooperation of providers, payers (both government and private insurers), and businesses and other organizations with an insured population. ACOs may change healthcare delivery, as we know it, because rewards are earned

keeping the risk pool as healthy as possible, replacing the traditional fee-for-service only model.

- **Healthcare Information Exchanges (HIEs)** – The HIEs are considered crucial infrastructure to support initiatives such as ACOs and public health reporting. The Department of Health and Human Services (HHS) has provided planning grants to individual states in the U.S. and is working collaboratively to ensure national interoperability, eventually resulting in a Nationwide Health Information Network (NwHIN).

- **"Meaningful Use"** requirements (criteria to receive the significant incentive dollars from the federal government for Health IT adoption) for interoperability include the need for "directed exchange" of information amongst stakeholders. This implies once again the need for strong, interoperable digital identities.

Electronic Healthcare Sector Incentives

A health care provider's identity is tied to each clinical and administrative system they use. Single sign-on solutions exist for some large organizations. These solutions do not necessarily scale beyond the walls of the organization. In this 'extended' environment, point-to-point integration and agreements must exist between organizations in order to provide system access to individuals. Traditional fee-for-service healthcare delivery had little or no need for a nation wide interoperable, federated identity ecosystem. Incentive models are changing with the advent of Accountable Care Organizations and Community-based healthcare delivery.

Trust Standardization Compliance

As described in this article, there are numerous initiatives in the health care sector that require standardization of strong identity management to ensure security, privacy, and trust. The era of strong, interoperable digital identities in eHealth has arrived. The Trust Framework compliance programs of the Kantara Initiative, a non-profit 501(c)(6) under IEEE-ISTO, provide the basic elements needed to verify trust in Identity Ecosystems components.

Conclusion

Electronic health record software vendors, primarily to support EPCS, are now implementing the standards defined in the Kantara Initiative Identity Assurance Framework. These vendors have received education directly from security consulting firms, via public-private partnerships, and industry sponsored events and initiatives. Engagement of Universities and Research and Education Networks (RENs) participating in government and industry initiatives bolsters the current professional activities and prepares a highly skilled "next generation" of leaders. Over time, identity management standardization will no doubt become a horizontal slice included in every informatics education curriculum.

Acronyms

ACO: Accountable Care Organization
DEA: Drug Enforcement Agency
EPCS: electronic prescribing of controlled substances
HIE: Healthcare Information Exchange
HHS: U.S. Department of Health and Human Services
NwHIN: Nationwide Health Information Network
REN: Research and Education Networks

Pete Palmer is the Information Security Director for Surescripts. He has over a decade and a half designing and implementing security and identity management systems in the healthcare industry. Mr. Palmer currently Chairs the Kantara Initiative's Healthcare Identity Assurance Work Group and Leadership Council. More information: http://kantarainitiative.org.

Joni Brennan is the Kantara Initiative Executive Director focusing on Trust Framework Identity Assurance Accreditation and Interoperability Certification. Deeply embedded in Privacy and Identity standards for a decade, Joni has provided guidance and support for varying technical, policy, requirements, and compliance committees. An avid public speaker and communicator, Joni seeks to continually build diplomatic and collaborative relationships within and across communities of interest. She has served as the NSTIC / IDESG Trust Framework WG Chair and participates in international organizations and industry standards committees including: OECD ITAC, ISOC, IEEE, OASIS SSTC, ISO SC27 WG5, and ITU-T SG17 Q6.

Additionally, she has over a decade of service to the IEEE Standards Association (SA) and Industry Standards and Technology Organization (ISTO) as a Senior Program Manager. She is a member in good standing of the American Society for Association Executives (ASAE) and an honors graduate of Rutgers University Information Technology and Informatics (ITI) programme at the School of Communication and Information (SC&I).

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At the Intersection of M2M, Smart Energy and eHealth

By Bill Ash, Strategic Program Manager, IEEE Standards Association, and Sam Sciacca, Co-Chair IEEE P2030 Task Force 1, CEO, SCS Consulting

2nd Quarter 2013

How will machine-to-machine (M2M) communications and smart energy impact eHealth? The answers to that question figure to roll out in multiple directions over the next decades, but one thing today is clear: IEEE expertise already is helping define the pathways of innovation.

Whether the application is an advanced metering infrastructure (AMI) system having the connectivity to home monitoring devices or the capability of communicating through a cloud service via smart-grid technology, IEEE is the one global organization that crosses the full breadth of the technologies at play in the innovations that M2M, smart energy and eHealth together will undergird.

Data privacy and security comprise one critical example. While eHealth, smart energy and M2M are different fields, the burning need for protection and security of data and electronics is shared across all three disciplines. Equipment and data must not be tampered with, and communications must not transmit faulty information. These requirements—obviously rigorous in eHealth, given the array of critical patient-care, payment and personal information that is being shared—are already being addressed in IEEE activities in the smart-energy and M2M spaces.

The crucial frontier of development today for eHealth is even one layer higher: interoperability. Seamless, end-to-end interoperability—spanning common data formats, content understandings and measurement units and M2M communications—is required across disparate geographic markets in order for the greatest potential benefits of eHealth to be realized. And, here again, many of the lessons learned in IEEE standards development for smart-grid communications can be leveraged in defining how to support the interoperable exchange of data that will be required in the eHealth realm. IEEE 2030® "IEEE Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with

the Electric Power System (EPS), End-Use Applications, and Loads," for example, presents—interface by interface—alternative approaches and best practices for achieving interoperability across the next-generation smart grid.

The area where the M2M, smart-energy and eHealth technology spaces are already clearly coming together is ambient assisted living (AAL), which seeks to leverage communications and information technology (IT) to support safe, independent living by people later into their lives and sometimes even with chronic diseases.

For example, there has long been a manual record system in place whereby utilities keep track of customer homes with potentially life-giving technologies that are dependent on electricity. This system is used to prioritize service calls in the event of a power-outage incident, but, because these manual systems (essentially paper maps with pins) can fall out of date or easily be misread, their effectiveness is limited.

The linkage of AAL and smart-grid technology and concepts promises a dramatic leap forward. In the future, AAL technology could directly interface with AMI and/or Distribution Automation (DA) systems to provide real-time, wide-ranging status of life-essential technology (the amount of battery power remaining in a given device, the location of a person who relies on the device, etc.) in order to provide further granularity so a utility is equipped to more intelligently prioritize their efforts to restore service in the event of an interruption. Similarly, the criticality for the AAL patient to know when power is expected to be restored or whether power is currently available at home while the individual is away or in transit would be much higher than what is needed for the non-AAL utility customer. The next-generation smart grid—ultimately envisioned as a seamless, boundary-crossing network of two-way power and information flow—would help address such needs.

In AAL—just as in smart energy and M2M communications—systems need to be able to talk seamlessly with one other. A connection to the home would enable some sort of critical care function to be delivered to a patient. This might entail monitoring pacemakers or recognizing an instance when somebody has fallen down but cannot reach a phone. Equipment might sense a patient's heart rate and alert caregivers of anomalies. The utility network and emergency service network must be linked, and data privacy and communications security are of primary importance. Not only are such requirements mirrored in smart energy and M2M communications, but many of the technologies that are being developed in this area for the smart grid are directly applicable to AAL.

IEEE expertise is at work today defining innovation across all of the technology spaces that will enable tomorrow's eHealth applications for improving and saving people's lives.

Bill Ash received his BSEE from Rutgers University School of the Engineering. His background is in the RF industry as he worked as an applications engineer on wireless communications systems. Bill has been with the IEEE Standards Association (IEEE-SA) for over 10 years working with standards development groups covering technologies such as RF emissions, distributive generation and the National Electrical Safety Code®. He is currently leading the smart grid strategy and implementation for the IEEE-SA.

Samuel Sciacca is a registered Professional Engineer and an active Senior Member in the IEEE and the IEC in the areas of utility automation. He has more than 25 years of engineering, marketing, and sales experience in the domestic and international electric utility industries. Samuel currently serves as chair of two IEEE working groups that deal with cyber-security for electric utilities: the Substations Working Group C1, which is working on P1686; and the Power System Relay Committee Working Group H13, which is working on PC37.240.

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eHealth Certification

By Lloyd Green, Marketing Director, IEEE Conformity Assessment Program,
and Ravi Subramaniam, Technical Director, IEEE Conformity Assessment Program

2nd Quarter 2013

To many, it is unfathomable that our lives are heavily impacted by standards. From a baby's crib to the many consumer devices that we use daily - numerous standards are implemented. In some cases this is to meet some form of regulatory requirements. In other cases, it is because an industry believes that the standard will provide it the best opportunity to compete or benefit in a space - whether that advantage be based on user safety, product features enabled by standard implementation, or hospital building codes. No matter the driver, standards are pervasive. So, as our lives begin to depend more and more on the standards that the latest gadgets are built upon, the value of understanding the technical and economic impact of standards becomes that much more important. As global economies continue to compete on:

- standards through implemented products
- national and regional policies
- the tradeoff between local trade versus free trade

the risk of dollars lost due to lack of standards interoperability is real. Thus, a comprehensive view of standards will increasingly benefit industry. Establishing certification programs and standards education programs provide three important mechanisms to aid in marketplace adoption and awareness:

1. Solutions Certification;
2. Standards Education (e.g., Training, Workshops, Personnel Credentialing);
3. Market Communications & Community Outreach.

Consider the electronic Health industry for example. In a world where life or death hangs in the balance, there is a projected trend for the number of medical professionals to decrease. With increasing capabilities and enhanced expectations of intelligent mobile devices, the likelihood of each of us to having to become more proficient and proactive in managing our health increases. For example, the quality of images provided to a physician via your smart device may be utilized to diagnose a specific condition and its necessary treatment. This is where understanding the critical elements of implementing a standard plays an important role for the manufacturer.

Providing clear guidelines and criteria to gauge standards implementation has always played a critical role. The importance increases exponentially when the health of the user is put at risk by the same devices that are expected to aid in improving their health. This is where the value of a known and trusted certification mark comes into play.

By having a mark that communicates trust of performance and safety coupled with a strong standards implementation training program, users have the potential to play a greater role in advancing the future of healthcare. Many certification programs utilizing a certification mark have a level of accountability to ensure that devices continue to meet meet the requirements of the certification program over the lifespan of the product. Just as important is the need to have a clearly articulated communications approach that ensures that end users are aware of what the mark represents. The other key aspect of having a strongly integrated approach is that it may help to reduce the counterfeiting of healthcare devices; an incredibly important role as lives are depending on the solution's integrity.

With the clarity of a successful standard and certification program, comes the importance of ongoing education of the global marketplace. These are heavily interdependent concepts that reinforce a successful technology and marketplace adoption. Whether it is a Standard Development Organization (SDO) alone, an industry effort through consortia or a variation of relationships. Ultimately, the successful adoption is usually more than just about the standard itself. The roles of certification and standards education are critical - especially as technologies evolve and integrate into the future of healthcare. A continued measurement of the effectiveness of standards, certification programs, communications and community outreach will be crucial in improving healthcare.

The IEEE-SA provides the full consensus lifecycle support, including marketplace communication & community building. To learn more about how we can help your efforts grow, please contact the IEEE conformity assessment team: castaff@standards.ieee.org.

Lloyd Green is Marketing Director for the IEEE Conformity Assessment Program (ICAP). Previously, he was Director of Marketing and Customer Support at Brilliant Telecommunications. Brilliant developed highly accurate end-to-end timing and synchronization solutions, which addressed the Mobile Backhaul Picocell and Femtocell market. In 2011, Juniper Networks acquired Brilliant. At Juniper Networks, Lloyd assisted with the customer support and product integration efforts. Prior to Juniper Networks, Lloyd held technical, marketing and business development roles at Altamar Networks, Network Equipment Technologies (N.E.T) and British Telecom International (BTI). Lloyd holds at B.S. in Telecommunications from South East London Technical College.

Ravi Subramaniam is Technical Director for the IEEE Conformity Assessment Program. In this role Ravi is responsible for establishing and supporting conformity assessment activities based on IEEE standards. Prior to joining the IEEE, he served as Director, International and Smart Grid Operations at MET Laboratories where he has spent over 12 years. His background encompasses testing various products to multiple national and international standards, including NEBS requirements. He worked closely with all international clients, providing technical consultations and seminars covering NEBS product compliance and RFID. Ravi also served at General Manager for MET's Asian Operations from 2006-2009 where he was responsible for setting up and managing MET's Asia branch in Shenzhen, China and other satellite offices in Seoul, Korea and Taipei, Taiwan. He has focused on expanding MET's scope of business into Photovoltaic, RFID, Energy Star, Alternative Energy, Smart grid and Smart Meter Testing. He worked closely with nationwide utilities and public utility commissions to study testing concerns and monitor problems with AMI deployment. He also successfully built relationships and initiated MoUs with test laboratories worldwide.

Previous to joining IEEE, Ravi also worked as a Research and Development Engineer at Honeywell and Ericsson's Blue Ridge Labs. He also served as a consultant to Ericsson in Hildesheim, Germany. Ravi received his bachelors' degree in Electrical Engineering, with emphasis in telecommunications and solid-state physics from Arizona State University, and also completed some graduate coursework in Electrical Engineering at Johns Hopkins University. He participates in the ANSI CAPC committee, selected IEEE working groups, Smart Grid Interoperability Panel, SGTCC and is a certified ISO 17025 auditor.

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Introduction to Student Application Paper

Wireless Wearable Body Area Network (WWBAN) for Elderly People Long-Term Health Montoring

Student: Amr Abd El-Aty

Institution: Arab Academy for Science, Technology & Maritime Transport (AASTMT), Abu Kir Campus, Alexandria, Egypt

By Advisors: Dr. Mohamad Abou El-Nasr, Professor of Computing Engineering and Dean of Educational Affairs and Dr. Heba Shaban, Assistant Professor of Electronics and Communications Engineering

2nd Quarter 2013

According to the European Union, around nineteen million persons around the world give primary assistance with daily activities to their elderly. Moreover, most of these elderly people prefer to live independently in their homes. Nevertheless, formal healthcare services are insufficient, thus employing modern technological solutions can enable older people to manage their daily activities independently in their homes. The goal of ambient assisted living (AAL) homecare for the elderly is to enable older people to live independently in their preferred environments, to enhance the quality of their lives and to reduce costs for society and public healthcare systems.

The work presented in the student application paper "Wireless Wearable Body Area Network for Elderly People Long-Term Health Monitoring" is a part of a research project on Homecare: Ambient Assisted Living for Patients and The Elderly carried out by the members of Wireless Networks and Communication Group (WiNCG) at Arab Academy for Science, Technology and Maritime Transport (AASTMT), Alexandria, Egypt. The aim of the project is to implement a prototype for an ambient assisted living homecare for patients and the elderly. The project is divided into two-phases. The first phase includes the design and implementation of the proposed prototype, where each implemented sensor will have a Bluetooth circuit that will be used later on for real-time data transmission. The prototype measures various physiological parameters as well as ambient sensing platforms. Physiological parameter measurement prototypes include Electrocardiogram (ECG), acceleration, body temperature, blood pressure, blood oxygen, and heart rate sensors. Whereas, ambient sensing will include a wireless camera and passive infra red motion detector. The prototype will wirelessly transmit the collected data to doctors for medical support, and relatives for emergency cases. A key challenge of this phase is the integration of these sensors into a single wireless personal area network

(WPAN) to synchronously take measurements, and transmit the measured data to a laptop or smart-phone. The transmitted data will be secured via means of encryption techniques to maintain the privacy of the patient/elderly. The second phase will include the processing of the measurement data, and providing a life-risk alert system via means of specialized software design. The technical industrial standards employed in this work are the IEEE 802.15.6a and IEEE 802.15.1.

***Go to student application paper, "Wireless Wearable Body Area Network for Elderly People Long-Term Health Monitoring."

Mohamad Abou El-Nasr is a professor of Computer Engineering, and Dean of Educational Affairs, Arab Academy for Science, Technology and Maritime Transport (AASTMT)—Alexandria, Egypt. He is also affiliated with Virginia Polytechnic Institute and State University where he works as an adjunct professor in the Bradley Department of Electrical and Computer Engineering—VTMENA program.

Prof. Abou El-Nasr received the B.Sc. in Electronics and Communications from the AASTMT, Alexandria, Egypt in 1995. He earned both his Ph.D. and M.Sc. in Electrical and Computer Engineering in March 2003 and December 1999 respectively, from Georgia Institute of Technology, Atlanta GA. He joined the faculty at the Arab Academy for Science and Technology in June 2003 where his research group is currently working on projects related to UWB systems, physical and MAC layer issues in wireless networks.

Prof. Abou El-Nasr received many awards for his distinguished research including, the third place in the wireless design contest that was held by Lantronix at the Embedded system Design conference CA in 2007, Computer Engineering Department at AASTMT distinction award in 2004, AASTMT outstanding scientific research award for distinguished publications in international and highly recognized periodicals (seven times), AASTMT college of engineering graduation project competition (received 2nd place out of 63 projects admitted to the competition) in 2011, and he was the supervisor of two recipients of the Young Scientist awards at the URSI general assembly in 2008 and 2011. He received the 2011 Young Scientist award by TWAS-AAS-Microsoft for his contributions in the area of Body Area Networks and their use in e-Health systems.

Prof. Abou El-Nasr currently serves as the editor-in-chief for the E-Health Telecommunication Systems and Networks (ETSN) journal, and has recently been appointed as the co-editor of the highly ranked Journal of Electromagnetic Waves and Applications (JEMWA). He is a Senior Member of IEEE Communications and Computer societies and a member of ACM.

Heba Shaban received the B.Sc. and M.Sc. (with Honors) degrees in electronics and communications engineering in 2000 and 2003, respectively from the Arab Academy for Science and Technology (AAST), Alexandria, Egypt. She received the Ph.D. from Virginia Tech in 2010.

Dr. Shaban is an Assistant Professor with the department of Electronics and Communications Engineering, Arab Academy for Science, Technology, and Maritime Transport (AASTMT), Alexandria, Egypt. Her research interests include Body area networks (BANs), gait analysis, multicarrier CDMA, public-key data encryption and authentication, and Ultra Wideband (UWB) receiver design, ranging, and tracking.

Dr. Shaban received multiple awards for her distinguished research. She received the young scientist award at the XXXth URSI General Assembly and Scientific Symposium in 2011. She also received AASTMT outstanding scientific research award for distinguished publications in international and highly recognized periodicals, and AASTMT College of Engineering incentive award for distinguished academic research on the Remembering and Engineering days in 2011 and 2012. She is currently a Member of IEEE, IEEE Communications, IEEE Engineering in Medicine and Biology, and IEEE Computer societies. She is also a member of ICST, and senior member of IACSIT and APCBEES.

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In each issue we will publish selected examples of final application papers from students who received IEEE Standards Education Grants to help with projects that include technical standards.

Wireless Wearable Body Area Network (WWBAN) for Elderly People Long-Term Health Montoring

Student: Amr Abd El-Aty

Institution: Arab Academy for Science, Technology & Maritime Transport (AASTMT), Abu Kir Campus, Alexandria, Egypt

Advisors: Dr. Mohamad Abou El-Nasr, Professor of Computing Engineering and Dean of Educational Affairs and Dr. Heba Shaban, Assistant Professor of Electronics and Communications Engineering

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Abstract

This project proposes and implements a prototype for a wireless system for elderly people longterm health-monitoring. The system is composed of two main components namely, a wireless wearable body area network (WWBAN) and a smart-phone based on Andoid-platform. The WWBAN sensors and smart-phone are connected wirelessly via Bluetooth connection based on the IEEE 802.15.1 standard. The project provides a platform for day-to-day long-term health monitoring of elderly people, and consequently minimizes risks that can threat their lives.

I. Introduction

Wireless Wearable Body area networks (WWBANs) are the systems of sensors that operate in close proximity to a person's body to provide a benefit to the user. There are a wide variety of applications of WWBANs, particularly in the field of biomedical engineering. These applications typically use biomedical sensors to monitor the physiological signals and vital signs of patients, such as electrocardiogram (ECG), blood oxygen level, blood pressures, blood glucose, body weight, heart-rate, oxygen saturation, etc [1, 2].

Long-term health-monitoring requires intensive and repetitive assessment that could last for months or even years to regain the lost functions, such as in the case of rehabilitation and elderly people health-monitoring [3]. Typically, WWBANs provide a promising solution for such situations, however, currently WWBAN

technology is evolving, and there are many challenges to address. One of these challenges is the integration and coordination of multiple sensors with different applications.

II. Overview of Project

The objective of this project is to design and implement a wireless system for elderly people long-term health-monitoring that is composed if a WWBAN and a smart-phone. The proposed WWBAN uses two non-invasive wireless wearable sensors. Theses sensors communicate wirelessly, and transmit real-time measurement data via means of Bluetooth connections to a smart-phone. Each sensor has a Bluetooth circuit that is used for real-time data transmission. A key advantage of this project is providing a life-risk alert system via means of specialized mobile based application design.

III. System Architecture

The proposed system is designed to monitor the elderly health status, and is based on two main components. The first component is an on body wireless wearable body area network (WWBAN). The second component is a smart-phone that will work as a gateway for the transmission of data to medical specialists and family members via means of internet connection.

The proposed wireless WWBAN consists of two non-invasive sensors namely, heart-rate and blood oxygen sensors. The two sensors are placed on the body of patient, where they measure the appropriate data. The sensors transmit the measured data to the second component of the proposed system namely, the smart-phone via Bluetooth communication protocol. A block diagram of the proposed WWBAN for elderly people health-monitoring is shown in Figure 1.

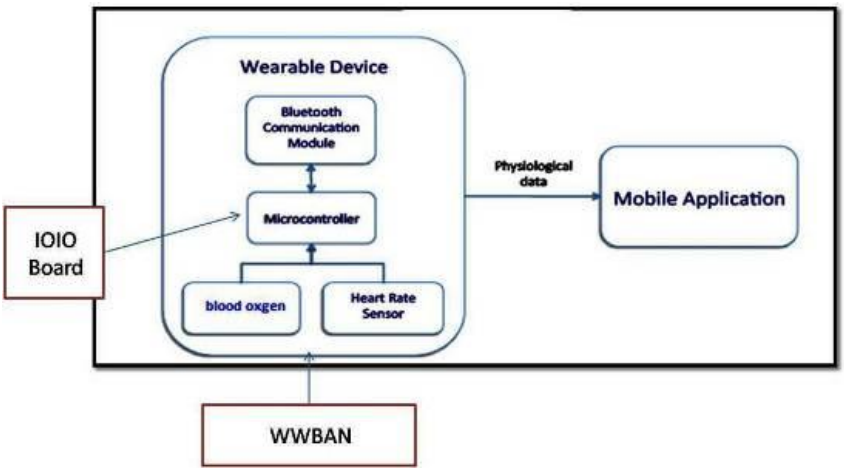

Figure 1: Proposed WWBAN Architecture

The proposed WWBAN is based on the star-topology, which implies a centralized architecture where the intelligence (IOIO board) of the system is concentrated on a central-node which is superior to the peripheral sensors in terms of resources such as processing. A schematic diagram of the on-body WWBAN sensor connection is depicted in Figure 2. As was previously mentioned, the proposed WWBAN consists of two types of sensors, heart-rate and blood oxygen sensor. Description of the employed sensors is as follows.

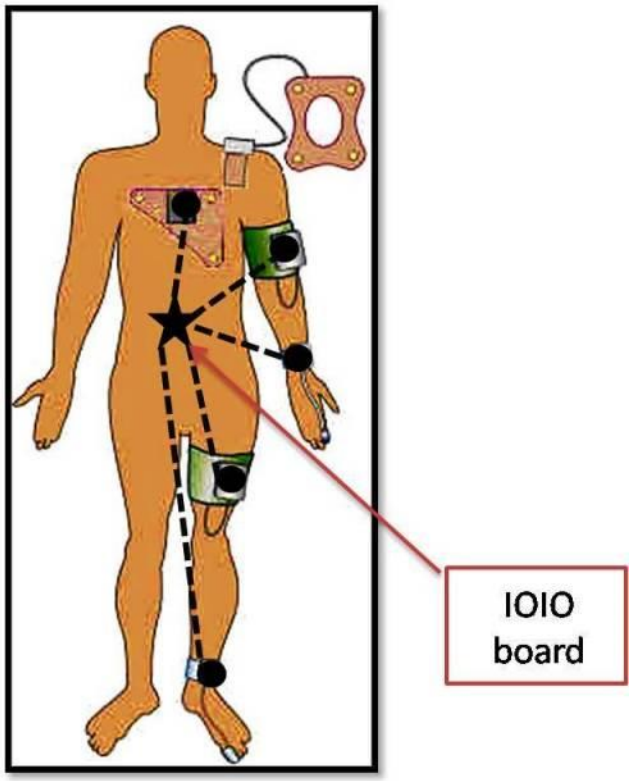

Figure 2: Proposed WWBAN Connection Diagram

A. Heart-rate Sensor

Heart-rate is defined as the number of heart beats recorded per minute, and is measured in Beats per minute (Bpm). In particular, we selected the heart-rate sensor for our proposed WWBAN, as the measurement of heart-rate reflects both activity and heart performance of the elderly test subject. In addition, it is a very important metric in long-term health-monitoring of elder people.

B. Blood Oxygen Sensor

Oxygen present in the blood is found attached to hemoglobin molecules. The amount of oxygen in the blood is measured in the form of oxygen saturation. Oxygen saturation is a measure of the maximum percentage of oxygen carried in the blood. Typically, one hemoglobin molecule can carry up to four molecules of Oxygen. Then,

if a hemoglobin molecule carries three molecules of oxygen, then it is said to carry 3/4 or 75% of the maximum amount of oxygen it can carry. Sometimes, Oxygen saturation is referred to as SpO2 [4].

IV. Selection of IEEE Standard

Generally, medical WWBANs are supposed to support a low-complexity, low-cost, ultra-lower power, and highly-reliable wireless communication connection. Common IEEE standards used in WWBANs include Bluetooth (IEEE 802.15.1) and Zigbee (IEEE 802.15.4) standards. IEEE 802.15.1 standard supports data-rates up to 250 Kbps, and cover ranges 1-10 m. On the other hand, IEEE 802.15.4 standard supports data-rates up to 2.1 Mbps, and cover ranges 1-100 m [6]. For our project, we select the IEEE 802.15.1standard for two main reasons. The first reason is that our proposed WWBAN is supposed to communicate with a smart-phone, and currently almost all modern smart-phones are equipped with Bluetooth connections. The second reason is the low data-rate requirements of the employed sensors in our WWBAN. Typical data-rate requirements of heat-rate and blood oxygen sensors are 128 bps and 80 bps, respectively [7].

V. Practical Implementation

The main hardware components of our WWBAN are as follows. We use IOIO board for Bluetooth connection from sensors to Android-based smart-phone. For heart-rate sensing, we use a polar heart-rate transmitter and receiver. For blood oxygen saturation sensing, we use pulse oximeter sensor. The details of the hardware components are as follows.

A. IOIO Board

The IOIO is a Bluetooth board that works with Android-based smart-phones. The IOIO board provides robust connectivity to any Android-based device via means of USB or Bluetooth connection. In our case, we consider the Bluetooth connection. Figures 3 (a) and (b) show the IOIO board and a schematic diagram of the internal board hardware.

Figure 3a: Commercial IOIO Board

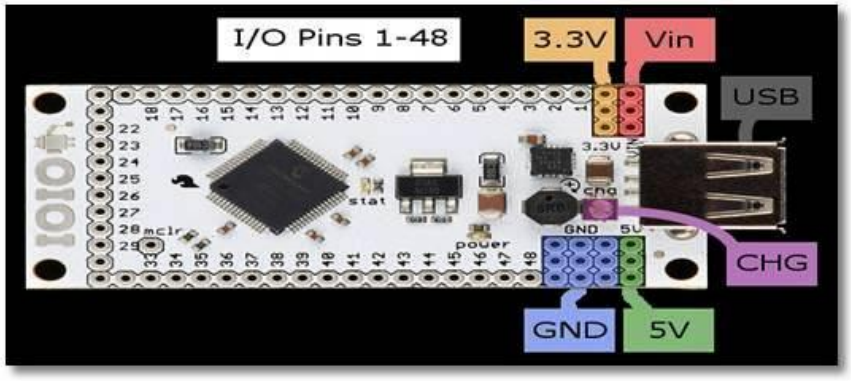

Figure 3b: Hardware of IOIO Board

B. Polar Heart-Rate Transmitter

Polar is a commercial heart-rate transmitter that transmits heart-rate data wirelessly to a corresponding heart-rate receiver. One of the advantages of polar heart-rate transmitter is that it does not require conductive gel, as shown in Figure 4.

Figure 4: Polar Heart-Rate Transmitter

C. Polar Heart-Rate Receiver

Heart-rate receiver receives heart-beat signals from a compatible transmitter. It indicates a received heart-beat signal using a low/high output-signal. The wireless interface between the receiver and compatible transmitter can cover a range of up to four feets. Figure 5 shows the polar heart-rate receiver board. Figure 6 shows a diagram of the heart-rate sensor connection to an IOIO board and a smart-phone.

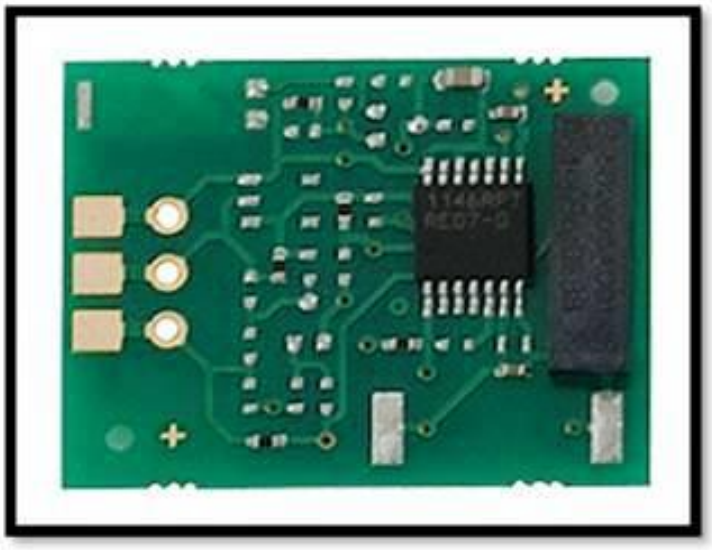

Figure 5: Polar Heart-Rate Receiver

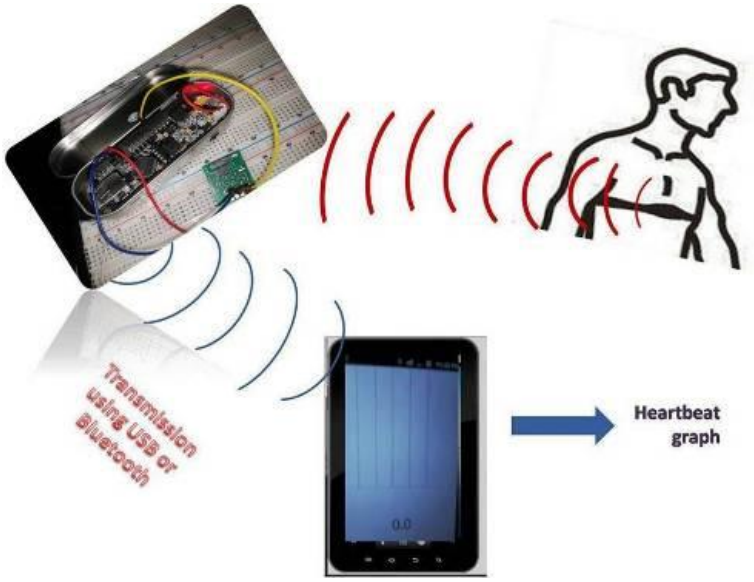

Figure 6: Schematic Diagram of Heart-Rate Transceiver Sensor Connection to Smart Phone

D. Blood Oxygen (Pulse-Oximeter) Sensor

We consider a pulse oximeter for blood saturation measurement. The sensor is integrated with an e-health sensor platform for Arduino and Raspberry Pi boards. It is specially designed for medical applications. The pulse oximeter and e-health platform board are associated with specially designed phone application that works on Android-platform. The board, pulse oximeter and snap-shot of phone application are shown in Figure 7.

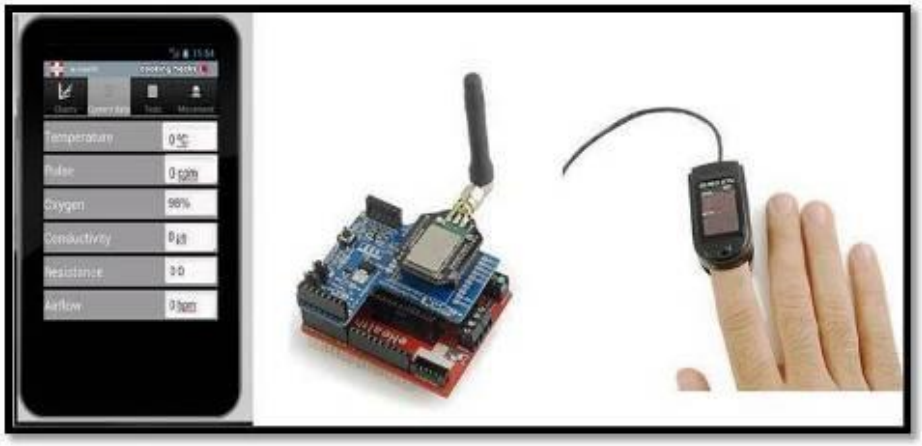

Figure 7: Pulse Oximeter Sensor

VI. Test Results

The proposed WWBAN prototype has been implemented and integrated with a smart-phone. In addition, a specially designed smart-phone application based on Android-platform has been designed to display the measured heart-rate on the smart-phone. Figure 8 shows the hardware implementation of the proposed system; the WWBAN is connected wirelessly to a smart-phone. The figure also shows a comparison of the measured heart-rate by the employed sensor to a commercial device, and both give approaching values.

Figure 8: Actual Hardware Implementation

VII. Summary

This project proposed and implemented a prototype of a system consisting of a WWBAN integrated with a smart-phone for elderly people long-term health-monitoring. The proposed WWBAN consists of two wearable non-invasive sensors namely, heart-rate and blood oxygen sensors. The measured data via the proposed WWBAN is transmitted in real-time to a smart-phone based on Android-platform. Also, a smart-phone application based on Android-platform has been developed to record the measured data in real-time. The wireless connection is based on the IEEE 802.15.1 standard. The implemented WWBAN was tested against a commercial device, and both gave approaching results.

Acknowledgement

The authors would like to thank the IEEE standard Education Committee for partially funding the work of this project.

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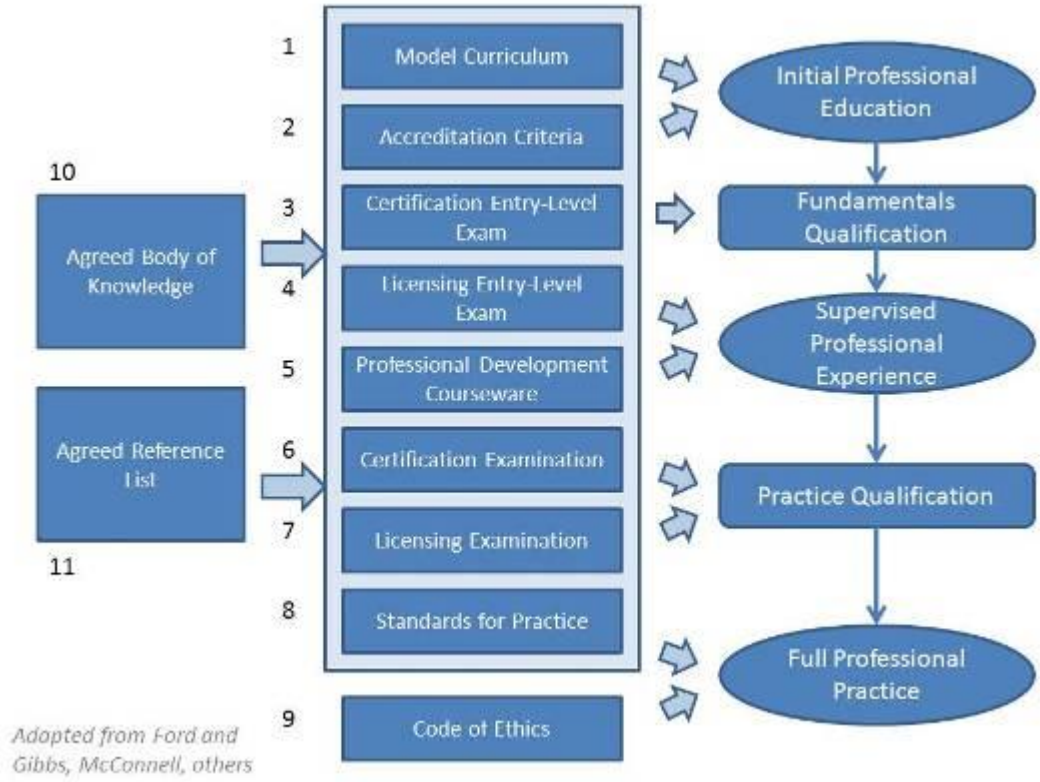
The Creation of a Profession of Software Engineering

By James W. Moore, Fellow, IEEE

2nd Quarter 2013

Fifteen years ago, Leonard Tripp, then President of the IEEE Computer Society, initiated a number of projects that are now culminating in the creation of a profession of "software engineering," recognized as a legitimate engineering discipline. For the past several years, I've pursued this goal. I did not participate in all of the work that I will describe in this article, but I was fortunate to play a part in much of it. In 2011, I was honored with the IEEE's Charles Proteus Steinmetz award for the work. This article expands upon my remarks upon receiving the award, providing the opportunity to describe the progress of the profession.

In Steve McConnell's excellent 1999 book [14], After the Gold Rush, he provides a diagram of the career model of a practicing professional, based on earlier work done by Ford and Gibbs of the Software Engineering Institute. I've adapted his diagram for the purpose of my remarks.



On the right side of the chart is a depiction of the path that one follows to become a practicing professional:

- First, one has to get an appropriate education.
- Then, there is often a preliminary examination regarding fundamentals. Sometimes, it's a capstone exam given by the university. Sometimes, the exam is administered by a professional society or a regulator.
- Then, there is a period of time when one gains practical experience by working under the supervision of professionals.
- When all this has been accomplished, the candidate takes another exam. In engineering, we call it a Principles and Practice Exam; it's customized to the specialty that the engineer plans to undertake.
- When that's all completed, one enters full professional practice. One usually puts some initials after their name. Engineers get to add "PE" – "Professional Engineer" – to their name.

Some of you will recognize the path as the steps to becoming a licensed engineer, but it's really common to nearly all professions – law, medicine, accounting, whatever – the jargon is different but the steps are essentially similar.

The other eleven items in the chart are all of the resources that are needed to make it possible for individuals to follow that path. In 1995, a few of us set out to create a profession of software engineering. I want to emphasize the "e" word – "engineering". We were determined that software engineering should become a recognized branch of engineering. Fifteen years ago, when we started, NONE of the eleven resources shown on the chart existed. Today, ALL of them exist or will soon exist.

To pursue any of the other items in a systematic manner, one has to agree on the body of knowledge that underlies the discipline. Absent that agreement, the other products can be created but will be inconsistent, and occasionally even contradictory. The Computer Society's Guide to the Software Engineering Body of Knowledge [10] now fills that role. The original 2004 Guide was developed by resolving 10,000 comments received from more than 600 practitioners in 42 countries to reach consensus.

At roughly the same time, the joint IEEE-ACM model curriculum for undergraduate software engineering [1] was being completed and the Computer Society's Certified Software Development Professional certification [6] was being developed. (Licensing was not yet on the horizon, so certification of professionals was the best that could be offered.) It was initially a disappointment when we found that the certification specification and the model curriculum expressed the scope of software engineering in a manner very different from the SWEBOK Guide. However, deeper analysis demonstrated that, despite superficial differences, the three instruments agreed to about the 95% level. It's like doing an experiment three different ways and coming up with the same answer. It served as powerful confirmation that there was,

in fact, agreement on the body of knowledge. By the way, the certification exam has been revised, and the SWEBOK Guide is being revised to deal with the small remaining differences. The new Guide is expected to be published in 2013.

Also at roughly the same time, CSAB (the group that accredits Computer Science degree programs) and ABET (the group that accredits engineering degree programs) figured out a way to work together to accredit [2] software engineering programs. The last time I checked (a few years ago), there were 51 bachelor's level software engineering programs in the US and 18 of them had received accreditation. (Accreditation always lags program creation because the program must graduate students before it can be considered for accreditation.)

I've already mentioned the certification exam. In order to prepare candidates for the exam, one needs a professional development program that provides courses and training [5] in relevant subjects. This presented the next big challenge to the SWEBOK Guide. You see, the SWEBOK Guide is just that, a guide. It doesn't contain the body of literature; its 200 or so pages merely refer to the body of literature. We quickly realized that the drafters of the SWEBOK Guide had referenced their favorite books, the writers of exam questions based it on their favorite books, and the writers of instructional material used, guess what, their favorite books. In all, the book count totaled more than 100. In a new discipline, like software engineering, this can lead to contradictions in detail. More importantly, from a practical point of view, though, the situation made it impossible for us to provide candidates with a reading list for study purposes.

We solved this problem by inviting representatives from the various projects—SWEBOK, certification, curriculum, and training—to a three-day meeting at the Computer Society. We provided them with twenty linear feet of books and told them to settle on 10,000 pages—entire books or selected chapters—that would comprise, not only our reading list, but would also be used as the references for the SWEBOK Guide, and the source materials for examinations and training. We almost hit our goal. We ended up with 45 references [11] totaling 13,000 pages. Possibly the best day of my professional career was when one of the participants said to me, "Coming into this meeting, I thought this would be impossible, but we did it."

Let me emphasize that this Consolidated List of References is not meant to exclude all the other good books that exist in the field of software engineering. Its role is to provide new professionals with a bounded and consistent set of study materials.

Two years ago, led by the Texas Board of Professional Engineers and an informal consortium of several engineering societies, ten state licensing boards petitioned for the creation of a Principles and Practices Examination [7] to provide software engineers with a path to licensure. That examination is currently being developed. The test specification is very similar to the SWEBOK Guide and the Computer Society's certification examination, but with additional emphasis in the areas of

safety, security, and privacy—as one might expect in a licensing exam. The exam is scheduled for roll-out in 2013.

The entry-level examination [4] for engineering graduates planning on the PE license will continue to be the Fundamentals of Engineering examination. For other software engineering professionals, the entry-level examination is the Certified Software Development Associate examination [3], developed a few years by the Computer Society to provide a preparation for those planning on sitting for the CSDP certification.

I think I've mentioned all but two of the items on the chart – Code of Ethics [9] and Standards [8]. I've left those for last because those are areas in which Dr. Steinmetz was active.

If Steinmetz were here now, you would probably be able to pick him out of the crowd. He was born with a crippling deformity that rendered him short of five-feet tall. Also, he was never without a cigar; there is even a photo of him smoking his cigar while swimming. His career led him to become the chief engineer of General Electric, a professor at Union University, a president of AIEE (a predecessor of IEEE) and an AIEE Fellow. He is credited with inventing the concept of the modern applied research laboratory. His own research dealt with lightning, magnetism (including the laws governing hysteresis loss) and alternating current. This last area is particularly instructive regarding software engineering.

You see, prior to Steinmetz, engineers successfully designed alternating current devices based on past experience, making conservative changes, and relying on trial and error to sort out success from failure. Of course, that's exactly what we do now in software engineering—even well-practiced software engineering. Steinmetz provided a mathematical basis for characterizing AC circuits hence making it possible to quantitatively predict the characteristics of an AC device. Software is still waiting for its Steinmetz.

As a leader in both GE and in AIEE, Steinmetz had to balance the needs of the two organizations in dealing with professional practice. "He believed that a Code of Ethics would increase the professional status of the electrical engineer, but realized that an acceptable code had to consider employment customs in industry." [12] A code drafted in AIEE in 1907 had been defeated under industry pressure because it provided that engineers should resign if their employers failed to correct defective machinery. Steinmetz proposed a revision to the draft, eventually accepted in 1912, that recognized obligations to both the employer and the client in dealing with defects. I think it's fair to say that this issue is still in play today. Today, a software engineer can refer to two Codes of Ethics. The IEEE has one and a joint ACM/IEEE committee developed a code specific to software engineering in 1996 [9]. Neither provides clear prescriptions for balancing the responsibilities to employer and client in disclosing problems.

Steinmetz was active in the development of electrical engineering standards. He "believed that a professional engineer should … specify standard equipment whenever possible. Specifying contracts on the basis of the more exact engineering definitions in the standards would make the engineer more professional. It would encourage him to assist the corporation in its evolution by specifying its standard lines of electrical apparatus." [12]

So this brings me to the final resource that my chart depicts as vital to the practice of professional software engineering—standards [8].

When I began the program of "harmonizing" software engineering standards, IEEE had a collection of nearly 50 standards in that area. Most of them were developed by committees whose chairs or editors were famous people in the field. Each was a gem of technical excellence in its own particular niche. And none of them could be used together easily because each had its own unique terminology, concepts and models. Furthermore, the new international committee, ISO/IEC JTC 1/SC 7, was making new, important standards in the area, and these standards had little to do with the IEEE standards. Because there was no agreed body of knowledge and few shared concepts or models, there was no mechanism to ensure consistency among these standards, hence no way that a user could bring the entire corpus of standards to bear on the industrial engineering of software development.

The first step – one for which I still hear criticism – was to get rid of the guides. We were in the situation where we had standards on software engineering and guides on the same subjects—and they didn't agree. That's because they were written by different experts and agreed by different balloting groups with no underlying framework for commonality. We couldn't tolerate contradiction in our own collection, so we allowed the guides to be withdrawn. Next, we commissioned a book, published in 1997 [13] (and revised in 2006 [14]), that tried to rationalize the connections that did exist among the various IEEE and international standards, despite how eclectic those connections might be. Most importantly, though, we worked with the international committee to develop a key international standard on software processes [16] and applied that standard as a magnet for evolving the collection toward consistency. We made rules that every new standard had to be consistent with the process standard and with the then-draft Guide to the Software Engineering Body of Knowledge. We entered into an informal agreement with the international committee (an agreement eventually formalized by the ISO-IEEE Partner Standards Development Organization agreement) providing mechanisms for making our collections consistent. In subsequent years, we adopted additional requirements for consistency. We've developed a common vocabulary database for standards. We have common descriptions of the content of documentation. We expanded our scope to include systems engineering, at least, for systems with substantial software content.

We've made some progress but the job is not yet completed. My "stoplight" chart for 1996 was nearly all red; in nearly every topic area, the IEEE standards for software

engineering were inconsistent with each other and/or inconsistent with the relevant international standards. My most recent stoplight chart has only one red square out of 30. That remaining red square illustrates the difficulties in harmonization. You see, that red square is assigned to an IEEE standard that, all agree, is the very best standard in the world on that particular subject. It's going to be very difficult to rephrase that standard using the common terminology and conventions without compromising its high value.

As of today, more than half of the nearly 50 standards in our software and systems engineering standards collection are shared with the international committee—either because we adopted their standard, they adopted our standard, or we worked together to create a single standard. Work continues on reconciling another dozen standards.

Some problems remain. We have been slow to package our standards into products that make software engineering standards affordable to the individual practitioners. So the big corporations have access to these standards, but consultants and many university students do not. Both of those groups are important agents for technology adoption and our lack of mindshare in those communities hampers uptake. For those reasons, the people who write our training courses and our certification exam questions are reluctant to incorporate standards-based material because they regard them as inaccessible to the intended audience. I hope that recent developments will serve to improve this situation.

Despite the problems, though, one outcome is clear. We have succeeded in developing the infrastructure for a profession of software engineering based on a commonly accepted body of knowledge and supporting all of the resources necessary to support the career path of a licensed software engineer. When the first professional software engineer gains her license by passing the new P&P exam in 2013, we will know that IEEE made it possible.

References:

The first 11 references listed below are keyed to the diagram.
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[3] Certified Software Engineering Associate, IEEE Computer Society, http://www.computer.org/portal/web/certification/csda.

[4] Fundamentals of Engineering examination, NCEES, http://ncees.org/exams/fe-exam/.

[5] Professional development courseware is available from many sources. One is the IEEE Computer Society, http://www.computer.org/portal/web/certification/csdp/prepare.

[6] Certified Software Development Professional, IEEE Computer Society, http://www.computer.org/portal/web/certification/csdp.

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[8] The primary sources of software engineering standards are: the IEEE Software and Systems Engineering Standards Committee, http://www.computer.org/portal/web/s2esc and ISO/IEC JTC 1/SC 7 (Software and Systems Engineering), http://www.jtc1-sc7.org/.

[9] Software Engineering Code of Ethics, http://seeri.etsu.edu/Codes/default.shtm.

[10] Guide to the Software Engineering Body of Knowledge, IEEE Computer Society, http://www.computer.org/portal/web/swebok.

[11] SWEBOK Version 3 Consolidated Reference List, http://www.computer.org/portal/web/swebok/consolidated_reference_list.

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[15] Steve McConnell, After the Gold Rush, Microsoft Press, Redmond, WA, 1999.

[16] ISO/IEC/IEEE 12207:2008, Software Life Cycle Processes, http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4475822.

Jim Moore, a Fellow Member of the IEEE, is currently the owner of By the Numbers Consulting, LLC, specializing in strategies for the development and application of standards for software and systems engineering. Before retiring, he was a Senior Principal Engineer of The MITRE Corporation, a non-profit "think tank" working in the public interest for the US federal government, where he did research on high confidence software engineering. Prior to joining MITRE, he worked for the IBM Corporation in the commercial sector—with contributions to seminal computing technologies such as CMOS computer architectures, microprogramming and Token Ring networks—and the defense sector—focusing on software engineering technologies such as structured programming, clean room software development, formalized process definition and software reuse. He has participated in IEEE, INCITS, and ISO/IEC standards efforts including Ada, POSIX, software engineering, and computing security. He served as an Executive Editor of the 2004 Computer Society Guide to the Software Engineering Body of Knowledge and as a member of the Editorial Board of the 2002 Encyclopedia of Software Engineering. He has written two books on software engineering standards and is the recipient of the IEEE 2011 Charles Proteus Steinmetz Award and the Computer Society's 2009 Hans Karlsson Award.

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Grants, Grants, Grants!

A Review of IEEE Standards Education Grants: 99 approved and climbing

By Jennifer McClain, Program Manager, IEEE Standards Education

2nd Quarter 2013

The IEEE Standards Education Committee (SEC) offers grants of US $500 for students (per project) and US $300 for faculty mentors to help complete senior, undergraduate or graduate projects. Projects may be for design, capstone, development or research in which an industry technical standard(s) was applied to complete the project.

Students who receive the IEEE Standards Education Grants must submit a final paper called a Student Application Paper. The final papers detail which industry technical standard(s) were applied (analyzed and implemented). Each paper highlights specific design choices in the application of various technical standards and describes the resulting product, process, or service.

The Standards Education Grants directly support the SEC goal of actively promoting the integration of standards into academic programs. The volunteers on the SEC spend a significant amount of time reviewing grant applications and final paper submissions. Funding for the grants originated as part of an NSF Grant. The NSF grant expired in 2009 and the IEEE Educational Activities Board has provided funding for the program ever since.

Between 2009 and 2012, 145 grant applications were received from students at 74 different colleges and universities worldwide. 92 grants were approved from 2009 to 2012 and 56 Final Student Application Papers have been accepted so far and posted to the Student Application Papers website. Of course, many students are still working on their design projects and new final papers based on their work will be added once approved by the SEC.

Total Submitted Applications versus Approved between 2009 and 2012

	2009	2010	2011	2012	Totals
Number of Applications	45	29	30	41	145
Approved	28	16	24	24	92
Disapproved	17	13	6	17	53
Approval Percentage	62%	55%	80%	59%	63%

As of April 2013, 24 new applications have been received, 7 are approved and 11 more are currently under consideration by the SEC. 20 of the new applications have come from students in India.

Below is a table tracking the applications by IEEE Region. The number of applications from students in Region 10 has increased significantly over the past two years, with students from India making up the majority of those applying for standards education grants.

Number of Grant Applications Received per Region 2009 to 2013	
Region 1 (Northeast US)	6
Region 2 (Eastern US)	7
Region 3 (Southeastern US)	4
Region 4 (Central US)	25
Region 5 (Southwestern US)	20
Region 6 (Western US)	5
Region 7 (Canada)	11
Region 8 (Europe, Middle East, Africa)	24
Region 9 (Latin America)	2
Region 10 (Asia and Pacific)	65
Total	169

Survey on Impact of IEEE Standards Education Grants

A survey was conducted in 2012 for faculty advisors/mentors whose students received grants between 2009 and 2011. The survey attempted to assess whether the grants had any impact on including technical standards education in their curriculum. The same survey will be repeated in 2013. It was sent to 68 faculty advisors/mentors of student projects that received an IEEE Standards Education Grant. 34 responses were received.

Some key questions and results:

- Did the opportunity to apply for IEEE Standards Education Grant funds have an impact on whether the students applied technical standards to their projects?

  Yes: 82.4% (28 responses)
  No: 14.7% (5 responses)

- Do you regularly teach about technical standards as part of the coursework at your college/university?

  Yes: 45.5% (15 responses)
  No: 9.1% (3 responses)
  Sometimes: 42.4% (14 responses)

- Did the receipt of the IEEE Standards Education Grant influence whether you will continue to encourage students to include technical standards in their design projects?

  Yes: 76.5% (26 responses)
  No: 11.8% (4 responses)
  Not sure: 11.8% (4 responses)

- Is the availability of a US $300 honorarium for faculty advisors/mentors of student projects of value to you?

  Yes: 81.8% (27 responses)
  No: 12.1% (4 responses)

Colleges & Universities with students who have received IEEE Standards Education Grants

The following is a list of institutions whose students successfully applied for and received IEEE Standards Education Grants for projects that included the use and application of technical standards. Several of the schools have had multiple grant recipients for multiple student projects.

List of Schools with IEEE Standards Education Grant Recipients (2009-2013)	
Amrita School of Engineering, India	Arab Academy for Science, Technology & Maritime Transport, Egypt
Princess Sumaya University for Technology, Jordan	Basaveshwar Engineering College, Karnataka, India
Purdue University, Fort Wayne, IN	Blenkinge Inst of Technology, Sweden
Reva Institute of Technology & Managemebt, Bangalore, India	CA State University at Northridge
Shanghai Jiao Tong University, China	Colorado State University
Siddharth Institute of Eng & Technology, India	Cooper Union for Advancement of Science & Art
Simon Fraser University, Burnaby, BC, Canada	Concordia University, Montreal, Canada
Swarthmore College, Swarthmore, PA	Delhi Technological University, India
Tennessee Tech University	Drexel University, Philadelphia, PA
Texas A&M University	Faculty of Sciences of Sfax, Tunisia

ToH Institute of Science & Technology, Kerala, India	Graphic Era University, India
Tufts University, Boston	Higher Institute of Electronic and Communication of Sfax, Tunisia
University of Alberta, Canada	Hohai University, China
Universidad Autonoma del Caribe, Colombia	Howard University, Washington, DC
University of Buffalo, New York	IES College of Engineering, Kerala, India
University of Cordoba, Spain	Indiana University - Purdue University Fort Wayne
University of New Mexico	Iowa State
University of New Orleans	Khulna Univiversity of Engineering & Technology, Bangladesh
University of Wisconsin-Madison	LNM Institute of Information Technology, Jaipur, India
University of Detroit-Mercy	Louisiana State, Baton Rouge, LA
University of Illinois	Mississippi State University
University of Indiana-Purdue	Univ-Fort Wayne
Model Engineering College, India	University of North Carolina @ Charlotte
National Engineering School of Sfax, Tunisia	University of Nebraska
National Inst of Electronics & Info Technology, Kerala, India	University of New Orleans
National Technical University of Ukraine	University of Pennsylvania
Netaji Subhas Instit of Technology, India	University of Sao Paulo, Brazil
Nirma Univeristy, India	University of Strathclyde, Glasgow, Scotland
Northeastern University, Boston	University of Texas at El Paso
Ohio Northern University, Ada, OH	Vivekanand Education Society Instit of Tech, India
Penn State	Xian Jiaotong University, China

More Information

The IEEE Standards Education Grants will continue to be available through 2013. Applications may be submitted at any time during the year.

For more information about the IEEE Standards Education Grants and how to apply, please visit the IEEE Standards Education website, but first read the following helpful articles from previous issues of this eZine for some guidance:

- Introduction to IEEE Standards Education Grants and Student Application Papers
- Applying for IEEE Standards Education Grants.

Each issue of the IEEE Standards Education eZine contains a "Best of Student Application Paper." Don't miss this issue's featured paper from student Amr Abd El-Aty from the Arab Academy for Science, Technology & Maritime Transport in Alexandria, Egypt. All successfully accepted final papers are posted to the IEEE Student Application Papers website.

Jennifer McClain has been with the IEEE for fifteen years. She spent eight years with the IEEE Standards Association aiding working groups with the standards development process, editing standards, and as the Managing Editor of the Standards Information Network, publishing handbooks and guides to help with the implementation and understanding of standards. She is currently the Program Manager for IEEE Standards Education. Ms. McClain holds a B.A. in History and English from Western Michigan University, Kalamazoo, MI.

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Easing Access to IEEE Standards for Educators & Students

By Jennifer McClain, Program Manager, IEEE Standards Education

2nd Quarter 2013

IEEE encourages the introduction and use of standards in engineering curricula. A common request from educators is that standards be made more easily available to students and faculty at little to no cost.

Accessing standards through your university's library system

One easy way to access standards for hundreds of colleges and universities is through their own institutions' existing subscription to the IEEE Xplore Digital Library. These subscriptions include access to IEEE Standards, journals, transactions, letters, magazines and conference proceedings, IEEE educational courses and more. **If your institution appears on our list**, contact your school's librarian to obtain your subscription access and for more information. You can then log in to IEEE Xplore® to search for standards in your interest area.

Standards available for no-cost

Another way to access standards is through the IEEE Standards Association's "IEEE Get Program." This program grants public access to view and download current individual standards at no charge. There are many standards in this program, including the IEEE 802® Standards, which are available 6 months after publication.

Additional standards available include:

- IEEE C95™ standards: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields
- IEEE 2600™ standards: Hardcopy Device and System Security
- IEEE 1622™ standards: Electronic Distribution of Blank Ballots for Voting Systems
- IEEE 1666™ standards: Open System C Language Reference Manual
- AND MORE!

Making use of your institution's subscription to the IEEE's digital library or accessing no-cost standards are great ways to expose students to standards in the classroom, and perhaps even use them for student design projects.

Jennifer McClain has been with the IEEE for fifteen years. She spent eight years with the IEEE Standards Association aiding working groups with the standards development process, editing standards, and as the Managing Editor of the Standards Information Network, publishing handbooks and guides to help with the implementation and understanding of standards. She is currently the Program Manager for IEEE Standards Education. Ms. McClain holds a B.A. in History and English from Western Michigan University, Kalamazoo, MI.

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IEEE Standards Education Funny Pages...

This cartoon appears in the book "Ten Commandments of Effective Standards" by Karen Bartleson. Reproduced with permission from Rick Jamison. © Rick Jamison.

Contributions

Have something amusing (cartoon, video) related to standards you'd like to share? Contact our IEEE eZine staff editor Jennifer McClain at j.mcclain@ieee.org.

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Upcoming Standards Education Opportunities

Register now for IEEE-SIIT 2013!

Online registration for IEEE-SIIT 2013--the 8th International Conference on Standardization and Innovation in Information Technology--is now open.

Visit http://ieee-siit.org/ for full details.

The 8th International Conference on Standardization and Innovation in Information Technology (IEEE-SIIT 2013) will take place 24-26 September 2013 at the headquarters of the European Telecommunications Standards Institute (ETSI) located in Sophia Antipolis, France. This year marks the first time in its 16-year history that the SIIT event will be an IEEE Conference. Bringing together practitioners from around the world to share insights and views on all issues surrounding ICT standards and standardization, IEEE-SIIT 2013 is targeted at researchers, policy makers, standard organizations, standards developers, and standards users in industry and academia.

IEEE 802 University Outreach Program Opportunity in Geneva, 16 July 2013

IEEE 802® standards are part of a suite of standards that are the foundation for the Internet, with standards such as IEEE 802.3TM (Ethernet) and IEEE 802.11TM (commonly known as Wi-Fi®) the primary way users reach the Internet. These standards have been essential for the growth of a global economic and social model that has touched billions of lives. Many other leading edge activities with similar potential impacts are currently underway in IEEE 802.

The objectives of the IEEE 802 university outreach program is are expose both students and faculty members to IEEE 802 standards development so that they may increase their understanding of the importance that standards play within engineering technology, may feel more comfortable in participating in the process if they do in the future during their academic careers, or as practicing engineers, encourage participation in the IEEE Standards Education Committee programs such as applying for grants for Student Application Papers, and to create interest in including the role of standards in engineering in the academic curriculum.

IEEE 802 plenary meetings are held three times per year, in March, July, and November and the next IEEE 802 university outreach day will occur on Tuesday

16th July 2013 at the IEEE 802 plenary meeting taking place at the ITU, Geneva, Switzerland. The IEEE 802 university outreach program enables a maximum of 30 students and faculty member to attend at a special registration fee of only $25.00, the normal registration fee for the week is $500.00.

The day starts with an orientation session about one hour long giving a brief overview of the current IEEE 802 projects as well as the standards development process they will observe. IEEE 802 University Outreach students and faculty attendees are then free to observe sessions in progress so long as there is adequate space in the room. A list of meetings recommended for observation is supplied. The day then ends with a closing session to provide the opportunity for the IEEE 802 University Outreach participants to ask questions about what they have observed.

The day is however not only an opportunity to observe and learn about standards development, it is also an opportunity to make contacts in industry. For more information about the IEEE 802 university outreach program please see http://802world.org/plenary/university-outreach/.

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Online Standards Education Courses

IEEE Educational Activities and and the IEEE Standards Education Committee have collaborated with IP Shield to extend this offering of high-quality educational tutorials at a discount to visitors from the IEEE.

The Standards Aware Series is similar to taking a **Standards 101** course at the university level. To learn more about the courses, watch a brief video.

Courses in the series:

- What are Standards?
- Why are Standards Used?
- Standards Development Organizations
- Standards Development Process
- Standards and Trade
- Conformity Assessment
- Strategic Standardization
- Finding Standards
- Copyright Aware

More information and pricing.

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Call for IEEE Standards Education eZine Contributions

The IEEE Standards Education eZine Editorial Board invites contributions from industry practitioners, educators and students on topics related to education about technical standards.

Interested parties may submit an inquiry or article abstract for consideration to the Editorial Board at any time throughout the year via email to: ezine-eb@listserv.ieee.org.

Abstracts should be no longer than 500 words and final articles should be no more than 2,000 words.

Particular areas of interest include, but are not limited to:

- impact and development of standards in various regions of the world;
- best practices and ideas for incorporating standards into the classroom and curricula.

Final contributions should include a 100 word biography of the author(s) and a high-resolution (JPEG) picture. All illustrations must be provided in a high-resolution (JPEG) format. References to all copyrighted material must be properly cited.

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Subscribe to the eZine and we'll notify you when a new issue is available.

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IEEE Standards Education eZine Editorial Board

Yatin Trivedi, Editor-in-Chief, is Director of Standards and Interoperability Programs at Synopsys. He is a member of the IEEE Standards Association Standards Board (SASB), Standards Education Committee (SEC), Corporate Advisory Group (CAG), New Standards Committee (NesCom), Audit Committee (AudCom) and serves as vice-chair for Design Automation Standards Committee (DASC). For 2012, Yatin was appointed as the Standards Board representative to IEEE Education Activities Board (EAB). He represents Synopsys on the Board of Directors of the IEEE-ISTO and on the Board of Directors of Accellera. He represents Synopsys on several standards committees (working groups) and manages interoperability initiatives under the corporate strategic marketing group. He also works closely with the Synopsys University program.

In 1992, Yatin co-founded Seva Technologies as one of the early Design Services companies in Silicon Valley. He co-authored the first book on Verilog HDL in 1990 and was the Editor of IEEE Std 1364-1995™ and IEEE Std 1364-2001™. He also started, managed and taught courses in VLSI Design Engineering curriculum at UC Santa Cruz extension (1990-2001). Yatin started his career at AMD and also worked at Sun Microsystems.

Yatin received his B.E. (Hons) EEE from BITS, Pilani and the M.S. Computer Engineering from Case Western Reserve University, Cleveland. He is a Senior Member of the IEEE.

Amin Karim is a visiting professor at the college of engineering and information science at DeVry University. Prior to this position, he served as the national Dean of the College of Technology at DeVry. He is a past Chair of the Electronics and Computer Engineering Technology Department Heads Association of the American Society for Engineering Education and served as a TAC of ABET evaluator for engineering technology programs. He is a member of the IEEE Standards Education Committee.

Wael William Diab serves as Senior Technical Director in the Office of the CTO at Broadcom Corporation. In this role, Diab is responsible for defining the technical strategy for the Infrastructure & Networking Group (ING). Prior to Broadcom, Diab served at Cisco in various technical, architectural, and business leadership roles, focused on next-generation networking products and technologies. Diab holds BS and MS degrees in Electrical Engineering from Stanford University, a BA degree in Economics from Stanford, and an MBA with honors from the Wharton School of Business. He has developed over 300 patents and patents-pending in the networking space, with over 75 issued patents in the United States.

Diab also is a Senior Member of the IEEE and was unanimously elected and reelected as the Vice-Chair of the IEEE 802.3 Ethernet Working Group, serving in that position since 2008. Diab is a member of the IEEE-SA Standards Board, a member of the IEEE Standards Education Committee (SEC), was elected to the IEEE-SA Corporate Advisory Group (CAG) in 2010 and has served as its Vice-Chair since March 2012. He also serves as the IEEE-MGA liaison to the IEEE-SA and participated on a number of efforts on the IEEE-SA Board of Governors (BoG) sub-committees.

Named winner of the 2011 TechAmerica Innovator Awards for his leadership in Green Technology, Diab was recognized by the David Packard Medal of Achievement and Innovator Awards for his leadership in the development of Broadcom's Energy Efficient Networking solutions.

Bruce Harding is professor of mechanical engineering technology and coordinator of professional practice at Purdue University.

Professor Harding's scholarship and engagement activities revolve around the development and application of American National and ISO standards dealing with Technical Product Documentation (TPD) as it broadly relates to product realization, green manufacturing and other technical aspects of product lifecycle management (PLM).
He is active on a number of American National standards developing committees, and chairs the US Technical Activities Group (TAG) to ISO. He is ASME vice-president for Standardization and Testing, overseeing development of American National Standards for fasteners, geometric dimensioning and tolerancing, metrology, tools, pallets, threads, gaging, plumbing fixtures, metal mill products, chemical pumps, instrumentation, performance test codes and others.

Internationally, he has served as a US Delegate to APEC and has served as the Head of Delegation to ISO Technical Committee meetings in North America, Asia, Oceania,

and Europe. Currently he chairs the 62-country ISO/TC10 committee on Technical Product Documentation, whose Secretariat is based in Sweden. The committee writes worldwide standards for technical product documentation for PLM.

Dr. James Irvine is a Reader in the EEE Department at Strathclyde University in Glasgow. His research interests include resource management and security for wireless systems, and he works as Academic Co-ordinator within the Mobile VCE programme. Prior to this he worked on the ACTS MOSTRAIN project providing communication services to high speed trains. He holds four patents, with three more being pursued, and has authored two books. Technical Programme Chair of VTC2004-Spring in Milan, Dr Irvine was elected in 2002 to the Board of the IEEE VTS, where he is chair of the VTS Technical Advisory Committee, and President for 2008-9.

Editorial Board Corresponding Members:

David Law is a Distinguished Engineer at Hewlett-Packard Networking and has worked on the specification and development of Ethernet products since 1989. Throughout that time he has been a member of the IEEE 802.3 Ethernet Working Group where he has held a number of leadership positions. He served as the Vice-Chair of IEEE 802.3 from 1996 to 2008 and in 2008 was elected to Chair of IEEE 802.3. David has been a member of the IEEE-SA Standards Board since 2005, currently he serves as the Vice-Chair of the IEEE-SA Standards Board, and is Chair of the IEEE-SA Standards Board Patent Committee (PatCom).

In 2000 he received the IEEE-SA Standards Medallion for 'leadership and technical contributions to Ethernet networking standards' and in 2009 he received the IEEE Standards Association Standards Board Distinguished Service award 'For long term service to improve the operation and integrity of IEEE-SA governance'. David has a BEng (hons) in Electrical and Electronic Engineering from Strathclyde University, Glasgow, Scotland.

Donald Heirman is president of Don HEIRMAN Consultants which is a training, standards, and educational electromagnetic compatibility (EMC) consultation corporation. Previously he was with Bell Laboratories for over 30 years in many EMC roles including Manager of Lucent Technologies (Bell Labs) Global Product Compliance Laboratory, which he founded, and where he was in charge of the Corporation's major EMC and regulatory test facility and its participation in ANSI accredited standards and international EMC standardization committees.

He chairs, or is a principal technical contributor to, US and international EMC standards organizations including ANSI ASC C63® (immediate past chairman), the Institute of Electrical and Electronics Engineers (IEEE), and the International Electrotechnical Commission's (IEC) International Special Committee on Radio Interference (CISPR). He was named chairman of CISPR in October 2007. He is a member of the IEC's Advisory Committee on EMC (ACEC) and the Technical Management Committee of the US National Committee of the IEC.

In November 2008 he was presented with the prestigious IEC Lord Kelvin award at the IEC General Meeting in Sao Paulo, Brazil. This is the highest award in the IEC and recognizes Don's many contributions to global electrotechnical standardization in the field of EMC. He is a life Fellow of the IEEE and an honored life member of the IEEE EMC Society (EMCS) and member of its Board of Directors, chair of its technical committees on EMC measurements and Smart Grid, vice president for standards, past EMCS president, and past chair of its standards development committee. He is also past president of the IEEE Standards Association (SA), past member of the SA Board of Governors and past member of the IEEE's Board of Directors and Executive Committee. He is also the Associate Director for Wireless EMC at the University of Oklahoma Center for the Study of Wireless EMC. Currently he is a voting member of the Smart Grid Interoperability Panel and its Testing and Certification Committee. In addition he is a focus leader on the NIST Electromagnetic Interoperability Issues Working Group which is providing EMC recommendations for Smart Grid equipment and systems.

IEEE Standards Education eZine Editor: Jennifer McClain

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