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

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Welcome to the IEEE Standards Education e-Magazine

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What are Standards?

Technical standards are formal documents that establish uniform engineeering 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.

Join us as we explore the dynamic world of standards!

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Letter from the Editor-in-Chief

Yatin Trivedi

Standards Education in China: Looking Inside Out and Outside In

China, revered for its ancient culture and marveled for its prowess in modern manufacturing, is often times a land of contrasts to outsiders. Consider the mysteries of the dragons, the wisdom of Tao and Confucius, and gargantuan volume of iGadgets! Nearly every electronic gadget sold in the world, not just the iPad, is made in China. As you dig deeper, you find that technology development is the key focus – be it in manufacturing and testing or in design and packaging.

Of course, with the growing demand for a skilled workforce, the need for standards education and awareness in China is greater now than ever before. This is what motivated the members of the eZine Editorial Board to invite our *standards* colleagues in China to this issue to write about the state of standards education in the country. At the same time, IEEE and several international Standards Development Organizations (SDOs) are collaborating with their counterparts and the industry in China to address creation, adoption, and proliferation of standards in their respective fields. This topic should be as much of interest to academics and practitioners of standards in China as it should be to those on the outside engaged in business with their Chinese counterparts. After all, as a community we all benefit by sharing our problems and embracing new and innovative solutions.

Here is what we present to you for your reading pleasure:

- IEEE Standards Association (IEEE-SA) President Steve Mills and Managing Director Judy Gorman share the insights from their recent visit to China and importance of standards education.
- Mr. Zhongmin Wang, Director General of China National Institute of Standardization (CNIS) and colleagues share their views in their article 'On Education Standardization and Standardization Education in China.' The title says it all, needs no explanation!
- Ms. Wenhui Zhao, a researcher at CNIS, takes a different approach from Mr. Wang to looking at the barriers to standards and standardization education and proposed solutions in her article 'The Bottleneck in Standardized Education & Solution.'
- Professor Song Mingshun and his researchers from China Jiliang University analyze the development of standardization education from the perspective of constructing standardization science discipline.
- Mr. Liu Dong, Chair of IEEE Std 1888, shares an insightful case study in development and education of a specific standardization effort in 'IEEE Std 1888: Green

Community Infrastructure and Protocol, Promoting Green ICT and Smart Energy Management.'
- Design contests have always been popular for conveying one's commitment to education. Mr. Liu Fei, Chief Representative of ASTM, describes their involvement in standards education and the results of an Acoustics Design Contest it co-sponsored with Armstrong World Industries.
- Elise Owen, Director of International Development at ANSI, shares her thoughts on collaboration and information sharing at the government level in her article 'Building Cooperation and Mutual Information Sharing with the Chinese Government.'

Finally, a word of special thanks to Dr. Ning Hua, Chief of IEEE operations in China who was instrumental in connecting us with all the authors and helped us receive the contributions for this issue. He provides a broad perspective on IEEE standards development activities in China, including close ties with several standards bodies.

On a personal note, in the first week of June, I will be attending IEEE Standards Association Standards Board (SASB) series of governance meetings in Beijing. I hope to meet with many of the contributors in person and have engaging discussions. One of our hosts will be Dr. Yu Yuan, a member of the SASB and a Member of the Research Staff at IBM China, with whom I have already exchanged many ideas for collaboration in standards education. I am looking forward to continuing our dialogue in Beijing.

With so much going on, it is difficult to say whether these are opinions and observations of outside people looking in or insiders looking out? You be the judge.

Of course, similar to our prior issues, this issue also has three invited articles on standardization and education.

- Wael Diab, Editorial Board member of this eZine and member of the Standards Education Committee (SEC) provides an interesting way of looking at the 'Lifecycle of a Standard.'
- Professor Francisco J. Bellido, University of Cordoba, Spain, shares his experience of 'How to Teach Standards in Engineering School.' Professor Bellido served as the mentor and project guide for Francisco Domingo Perez whose Final Student Application paper "Remote Street Lighting Management System with Low-Rate Wireless Personal Area Networks" is published in this eZine.
- Professor Ken Krechmer, University of Colorado, Boulder, shares an article 'Creating a Strategic Standards Course' based on his research and teaching experience.

I hope you all enjoy reading this issue of eZine. As always, pass along the link for this eZine to your colleagues and share the knowledge. Your comments on this issue and suggestions for future issues are very much appreciated.

Yatin Trivedi
Editor-in-Chief

The IEEE Standards Education eZine Editorial Board welcomes your comments and suggestions. Please write to us at: ezine-eb@listserv.ieee.org.

About the Editor-in-Chief

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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Importance of Standards

In part three of the three-part interview, IEEE Standards Association 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 focused on Standards Education in China

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Global Standards for Global Markets: Chinese Technologists in the World Standards Community

By Steve Mills, President, IEEE Standards Association and Judith Gorman, Former Managing Director, IEEE Standards Association

Second Quarter 2012

A new international standards paradigm is taking shape. The current model, in which countries drive the adoption of standards by bodies with national representation, is giving way to a growing trend that sees global markets deploying international standards regardless of their formal status.

As China broadens its presence in global markets, the country will increasingly need to influence standards that drive these markets.
A critical component of achieving standards objectives is the people who write standards and deliver this valuable intellectual property to the world.
How then do budding engineers and technology specialists fit into this paradigm? Do they have a role? Are they being nurtured and coached to participate? Is their intellectual capital being put to its best use? Here's what we suggest:
To be successful, individuals need to be educated on and prepared to appropriately consider the tradeoff between the requirements of the global market and technology choices. Today's most productive and accomplished standards participants are those who can combine a depth of business experience with their technical expertise. Additionally, these standards participants are able to engage and contribute in an environment that is dynamic, open, and consensus-oriented. This must include an ability to accept peer-level critique and constructively contribute to an optimal solution.

It is the responsibility of educators and business leaders to ensure that tomorrow's standards developers are prepared to contribute effectively in this environment.

Steve Mills is the President of the IEEE Standards Association where he has actively contributed to the governance of standards development activities at the IEEE since 2001. Mr. Mills has worked at Hewlett-Packard (HP) for 29 years in the research and development of products for the computer and telecommunications industries. He is currently Senior Architect in the Industry Standards Program Office, where he leads HP's participation in industry consortia and standards development organizations. Prior to moving into the Standards Program Office, Mr. Mills managed an R&D team responsible for the development of hardware, operating systems, and middleware of continuously available platforms for use in the telecommunications industry. He also spent several years as manager of a research team composed of business and technology professionals performing mid-range market and technology research. Other contributions include: the development of networking products for HP's commercial servers, launching of the HP Openview Network Management Program, and the development of the strategy to move HP servers to a standards based I/O subsystem architecture.

Judith Gorman was the Managing Director of the IEEE Standards Association (IEEE-SA) from 1998 until her retirement in April 2012. A member of the IEEE staff since 1984, her educational background in the Liberal Arts prepared her for an early career in the publishing industry, migrating from the magazine industry, to education publishing, and finally to the technical environment of the IEEE. She began her IEEE career directing Standards publishing and marketing. Years of engagement in Standards publishing provided strong exposure to and related knowledge-building of the international standards environment. In 1991, she became Associate Staff Director of Standards, and in 1995, Staff Director. The 2004 establishment of the IEEE-SA Corporate Program, in which Ms. Gorman played a pivotal role, provided a turning point for IEEE standards strategy and development. The co-mingling of direct corporate participants and individual technical experts enables the IEEE to have a comprehensive, authentic view of current and future standards challenges, and a dynamic industry engagement.

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On Education Standardization and Standardization Education in China

By Zhongmin Wang, Director General, China National Institute of Standardization

Second Quarter 2012

(**Chinese Translation**)

The national education departments in China are in the process of studying and formulating national quality standards in teaching of 100 undergraduate disciplines. Some media reports suggests that "The movement shall provide a 'cloud' standard for the undergraduate teaching and a larger space for universities and colleges to take the initiatives in enriching disciplines in future." Moreover, "The Ministry of Education is encouraging provincial education administrative departments, industrial organizations and universities and colleges to jointly formulate quality standards in teaching in an effort to form Chinese higher education teaching quality standards system."

Having such concepts as standards, standardization and standards system introduced into the national education is an innovation both in education and standardization. As we all know, standard and standardization thrived with the Industrial Revolution in Europe, and were thus only applied to the industrial area. Since the 1970s when standards began to be applied to modern management, they have developed in an all-round way.

China hasn't resorted to standard, standardization, standard system and standardized management to regulate education quality in the past, and to my knowledge, few professional organizations for standardization in developed countries have done that. Without a doubt, it's a significant move. What needs further consideration are how to understand the relationship between education quality, standards and standardization, how to establish a standard system in education quality in accordance with standardized principles and methodologies, how to translate the system into fact later, and how to test or evaluate the effects. All these questions have to be designed and tested in a careful and gradual way in the innovative process.

As a professional worker in standardization, I am concerned more with standardized education itself. However, it's a pity that so far, the formal standardization education hasn't found its space in the Chinese national education system. China is not the only country in such a situation which exists in other countries too.

So why? One reason lies in that the application of standardization has long been limited to the research of applied technologies. Most of the standardization experts are engineers who set up standards mainly for practical applications. In the past, the standardized work was mainly in the secondary industry, and there was no such need in agriculture and service industries. Therefore, the standardization workers mainly learned the required knowledge through training or continuing education.

The times are different now. The demand for standards and standardization in modern society has far surpassed that in the era of the Industrial Revolution. Not only do the industrial companies need white collar and blue collar workers who can understand standards and execute standardization, but the primary industry, the tertiary industry and all other areas of the society saw a soaring need for interdisciplinary talents who knows about standardization. The education area is no exception. In such a circumstance, we have every reason to call for including standardization education on the agenda of the education. For example, it is suggested that primary and middle school students should have knowledge about standards and quality; the university students should take courses about standardization, especially for engineering or business majors; while in some professional masters degrees, like such as Master of Engineering, it is encouraged to set a major or research area on standardization.

Realizing the importance of standards theory and education, and also considering the characteristics of China's economical and educational system, China National Institute of Standardization will promote the visibility and importance of standards education among Chinese academic community, and help Chinese educators to include it into the education curriculum

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Zhongmin Wang is Director General of China National Institute of Standardization, Researcher, and Director General of China Standardization and Technical Consortium for Energy Conservation and Emission Reduction. He has earned the Master of Laws and Master of Science. He has served as the president of a large state-owned metallurgical factory, deputy mayor of Huludao City, the chief of Liaoning Bureau of Quality & Technical Supervision, the director of Northeast China Measurement and Testing Center, and deputy president of Liaoning Law Society.

Wang Zhongmin has been in the position of deputy director of Standardization Administration of the People's Republic of China in 2001, the council chairman and vice president of China Special Equipment Inspection and Research Institute, chief in National Logistics Standardization Technical Committee, vice chairman of OriGIn, standing director of China Certification and Accreditation Association, and vice president of China Association for Standardization. He was also a member of ISO council from 2003 to 2005.

As a senior expert on standardization, Mr. Wang has conducted in-depth research in business management, macroeconomic management and standardization, with works of Business Management Handbook, New Theory on Standardization, A Textbook of Basic Introduction to Standardization, International Standardization Textbook, China Technical Standards Development Strategy Research Report, and over 140 published papers and articles.

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The Bottleneck in Standardization Education and the Solution of China National Institute of Standardization

By Wenhui Zhao, China National Institute of Standardization

Second Quarter 2012

(Chinese Translation)

In 2010, with the authorization and support of the department in charge of standardization in China, China National Institute of Standardization (CNIS) established a sub-institute of Standardization Theory and Education engaged in theory study, textbook compiling and career training to promote the development of standardized education in China.

Based on their work, the sub-institute of Standardization Theory and Education has found some bottlenecks in the standardization education in China and has been trying to remove the bottlenecks by combining theory construction with innovative practices. The main problems and their solutions are listed as follows:

Bottleneck 1: The contents of standardization education are not so systematic.

Despite standardization experts' consistent efforts to develop new textbooks and aiding materials, teachers have to educate students in accordance with their own interest in practice, which is quite limited. For example, many teachers talk about the connotations of ISO 9000 in the class of quality management, while ignoring the formulating technical process of ISO 9000 and how China translates them into national standards. In this way, students only know about the standards themselves. The fact that they don't know how to participate in standardization activities is not good for the continuous improvement of standards. To solve the problem, CNIS promotes the establishment of "Knowledge System of Standardization" in a systematic way based on its theory study results and continues to improve the details. It may serve as a "map" for people engaged in standardization education who may get an overview of standardization education and provide more comprehensive knowledge to students.

Bottleneck 2: The education circle doesn't pay enough attention to standardization education.

In a school, teachers and managers are facing difficulty in choice—all disciplines are important. There's a natural contradiction between numerous disciplines and limited teaching resources. How to prove it's necessary to invest in standardization education and its rewards? CNIS collaborated with colleges and universities and other educational institutions to establish pilot programs and showcase the achievement of standardization education through the open and measurable teaching process and results. For example, the CNIS is working with the Beijing Institute of Technology in Master of Engineering. It is planning to give a course named “Basic Introduction to Standardization” to students who major in Industrial Engineering in the fall of 2012. At that time, the number of students is expected be nearly one hundred. This pilot program results will regularly report to “China National Educational Guidance Committee for the Master’s Degree of Engineering,” aiming to attract more institutions to join in.

Meanwhile, CNIS actively assists the education department to carry out “standardization of education,” such as the standardization of facilities on campus, encouraging people participating in the standardization activities and strengthening the knowledge and acceptance pf standardization in the education circle thorough practice.

Bottleneck 3: Standardization Education is out of line with the market needs.

Companies want their staff responsible for standardization work to be good at technology and familiar with basic standards in the industry and the methods to participate in standardization. This requires the knowledge framework for students to match with it so that it will be easier for students to find a job and for companies to get qualified employees.

Proceeding from the reality, CNIS has convened standardization experts, industrial professionals and professors to work together and discuss how to carry out the education and evaluation of basic industrial standards, basic standardization knowledge and performances, and how to execute work relating to certifications. CNIS has been making efforts to combine the education of the Master of Engineering with “standardization certification system.” By then, the schools could apply to participate in such programs and adjust their teaching materials, and students receiving standardization education could apply for “professional qualification certification” which shall play an authoritative role in the job hunting.

Standardization is closely connected with modern civilization. The rapid change of the society also leads to some new features in standardization. Standardization education has become a trend. In this area, CNIS is exploring education models and methodology in, but not limited to, the above-mentioned three areas. We’re open to any opinions and suggestions from all walks of life so that we can jointly commit to improving standardization work and promoting the harmonious development between economy and society through standardization education.

Wenhui Zhao is Assistant Researcher in Sub-Institute of Standardization Theory and Education, CNIS. She is engaged in the work of standardization education and discipline construction, and is a member of SAC/TC 443 (National Technical Committee 443 on Educational Service of Standardization Administration of China) and International Cooperation for Education about Standardization（ICES).

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Analysis of the Development Status of Standardization Education in China

By Yu Xiao, Song Mingshun, Zhou Lijun, and Zhang Yueyi
China Jiliang University, Hangzhou, China

Second Quarter 2012

Abstract: Carrying out standardization education is an inevitable choice to meet the needs of economic and social development, and to improve the level of developing standardization talents. This paper analyzes the development status of standardization education from the perspectives of the construction of a standardization science discipline and standardization talents training system as well as international cooperation for standardization education, and finally reaches the corresponding conclusion.

Keywords: standardization education; talents training; standardization science; international cooperation

In the context of the global economic integration, the role of standardization becomes significant in the promotion of trade, exchange, and technological progress. However, there is a problem worldwide that the quality and quantity of standardization talents fails to keep up with the actual needs. This issue drew the attention of standardization research and educational institutions and industry in China. Therefore, relevant departments carry out a series of measures and methods designed to increase the quantity of standardization talents and to raise the quality of talents by a training mode through advancing standardization science discipline construction and dynamically building standardization talents, as well as strengthening international cooperation for standardization education.

I. Valuing and developing the construction of Standardization Science Discipline gradually

Verman put forward a requirement that standardization is in need of learning professional knowledge as a discipline in 1973 (Verman, 1973) [1]. The discipline of standardization science mainly studies standards and standardization activities and conducts research through the theories and methods of standardization as well as and the mechanism of standards. From the demand of establishing a discipline, the knowledge system of standardization science discipline should include the concepts, general knowledge, basic theory, methodology, applied technology knowledge, specialized domain knowledge and specific standard knowledge involved in standards and standardization activities (Dianyi Bai, 2010) [2]. The body of knowledge of standardization science discipline has not been completely established globally, therefore, as a discipline, the standardization science discipline is developing at the elementary stage.

As for the research on standardization science discipline, the Institute for Standardization Theory and Strategic Studies of the Chinese National Institute of Standardization (CNIS) carried out the "Feasibility Study on Standardization Science Discipline Construction" in 2007, defining the connotation and study contents of standard science, discussing the basic theory and framework of the construction and development of a standardization science discipline, and building the ideal model of standardization education according to the development process of knowledge system such as standardization theories and methods. China National Institute of Standardization also set up a Theory and Education Institute for the country's most outstanding professionals to commit to the compiling and planning of standardization teaching materials. As for the establishment of the standardization science discipline, China Jiliang University has launched a series of practical activities. It opened its doors in 1996 to enroll full-time undergraduates of standardization and quality management, set up the Standardization College in April 2008 which became the first standardization secondary college built in university and is mainly responsible for the cultivation and training of standardization specialized talents of various levels such as undergraduates, graduate students and continuing education of serving officers, and embarks on the standardization undergraduate reporting, standardization discipline construction as well as the compilation and publication of a standardization series textbooks. On this basis, China Jiliang University was formally approved by the Ministry of Education to set up a "Standardization Engineering" undergraduate major in 2010 after continuous efforts. This is the first time China officially added a "Standardization Engineering" undergraduate major to a higher education undergraduate course catalog, becoming an important achievement of standardization discipline construction standard.

Although the development of a standardization science discipline has made certain progress, including developing clearly-defined objectives of study, building a main framework with specific theories and research methods that are based upon the needs and requirements from society, the development of a discipline requires a certain period and the development of standardization science discipline is still at an initial stage in our country. Therefore it is in need of further research in the foundation of knowledge systems and methodologies.

II. Building the Training System of Standardization Talents from the Perspective of Lifelong Education

The formation of talents competence is a dynamic and systematic process. Standardization talents need to have a good knowledge of diverse knowledge systems including professional and standardization knowledge which is extremely practical and applicable. Therefore, interdisciplinary should be an important consideration in the process of talents training and all links from basic theory, professional practice to the practice in the field should be emphasized to solve the problem of crossing the boundaries from university to industry, from major to profession in the process of competence formation. Based on this concept, drawing on the experience of the United States, South Korea and other countries, China has built the talents training systems of standardization education at the different stages of formal education and continuing education of universities.

There are more than seven colleges which have carried out standardization undergraduate education and 11 colleges which have set research of this direction at the postgraduate stage in China. Meanwhile, an institution has set up Dr. graduate education of standardization direction and 21 colleges and universities have launched relevant education which are mainly related to majors of economic management, engineering, agriculture, law and so on (Zhongmin Wang, 2010) [3]. In fact, many students of engineering majors have applied a lot of standards in the process of study and research. Currently, curriculum education is one of the main ways in formal education of universities. Curriculum education is a course of standardization direction opened in public class and elective courses, serving as a knowledge supplement for management and engineering students; another important way is double degrees, it is a talent training model of double majors or degrees for those who have professional engineering background or management background. On the basis of the original major, students reach the corresponding competence requirements of theoretical knowledge and practical training of standardization major direction through certain additional credits. However, in the future development trend, the standardization major training of undergraduate will gradually become the mainstream. Colleges and universities in China have made certain achievements in promoting standardization education and have obtained recognition by the international organization for standardization. In 2007, the “Undergraduate Project of Standardization Education in China Jiliang University” of the China Jiliang University obtained the “ISO Standardization Higher Education Award."

The training in higher education has laid the foundation for further improving the theoretical system of standardization discipline and cultivating basic standardization talents for related industries. The demand for talents originated from the needs of industries, so the training in continuing education stage started earlier than formal education in the aspect of standardization education in China. The departments carrying out standardization continuing education in China are mainly the Standardization Administration of the People's Republic of China (SAC) and the other standard associations which employ a more flexible way such as short-term training courses, seminars, etc. The main objects are also standardization administrative department, the standardization professional and technical committee, various research institutions, associations and corporate staff. In order to further promote the development of standardization professional education, the Shanghai Municipal Bureau of Quality and Technical Supervision and the Shanghai Personnel Bureau launched a standardization engineer professional qualification certification exam in 2005 for the talents to obtain the qualification of standardization engineers. This action has not only enhanced the power for standardization professional education from the source, but also laid a good foundation for the future standardization professional qualification system.

The full combination of formal education and vocational education, with formal education concerning knowledge-oriented learning and understanding and vocational education focusing mostly on skills-oriented learning practice and business practice, enables more people to equip themselves with employable skills in the field of standardization.

III. Promoting and Advancing the International Cooperation of Standardization Education

Internationalization is a significant nature of standardization talents, especially the high-level standardization talents who must possess an international outlook. Since 2006 when the international organization for standardization, industry, education and research communities established the International Cooperation for Education about Standardization (ICES), as a member China has established wide-range and close exchange and cooperation with ICES and undertook a number of seminars and workshops on international cooperation for standardization education. Meanwhile, China has established long-term cooperative relations with major international standardization organizations, ISO, IEC, ITU, etc. China is also an active participant in APEC Strategic Education, Program on Standards and Conformance, Asian Link Project on Standardization Education and EU Asia-Link project on Standardization Education. Through these meetings and carrying out cooperative projects, China has further strengthened contacts and exchanges with foreign standardization educational institutions and countries and to some extent also ensured the synchronization of teaching framework establishment, teaching materials, teaching cases selection, curriculum development and other aspects of standardization education.

In addition to establishing long-term cooperation with international standardization organizations, taking the diversity, integration and practicality of required knowledge for standardization talents into consideration and that the knowledge, competence, and literacy training need not only be systematic training during a higher education stage, but also involve more targeted intensive training and practical exercises during the professional education stage, domestic standardization bodies have opened a series of international training aimed to enhance standardization talents. For example, SAC opened English training courses of the international standardization knowledge; in 2011 SAC and the International Organization for Standardization (ISO) signed the 2012-2015 Memorandum of Co-operative Training for annual selection of high-level talents in the field of standardization to participate in the ISO/SAC secretary week training course, thereby substantially enhancing competence and level of our standardization to participate in international standardization.

IV. Conclusion

In the scene of rapid development of a knowledge economy and Information Technology, industry pays more attention to the strategic guidance and management function of standardization, and it also makes higher requirements on the professional level and comprehensive competence of talents, which drives us to further expand the breadth and depth of standardization education. The urgency of the need for standardization education has been stressed, but nurturing the social consciousness of standardization and cultivating top-notch standardization talents still needs further attention and strengthening. For example, those questions that need to be constantly reinforced in the future standardization education are: from the perspective of lifelong education, how to learn from South Korea and other countries and regions to inculcate and implant the related concept of standardization in the K-12 basic education stage, and strengthen it in public education and universal education; from the perspective of practical education, how to integrate graduates trained in colleges and universities as soon as possible into the standardization practice of various industries to realize the connection between theoretical knowledge and practical experience; from the perspective of training top-notch talents, how to cultivate high-end standardization talents who are equipped with a solid theoretical foundation and rich practical experience and not only proficient in foreign languages but also familiar with the international standardization policies and procedures as well as international business practices.

V. References

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Yu Xiao, an associate professor in the College of Economics and Management, China Jiliang University. She received the Ph. D in Educational Economics and Administration from the Research Center for Science, Technology and Education Policy, Zhejiang University. Her research interests include intellectual property management, engineering education and Human Resources in Science and Technology (HRST). Her current research focuses on standardization education. She has participated in different national and international congresses and published more than twenty papers in her fields of research, including Research in Higher Education of Engineering, China Standardization, Science and Technology Management Research, among others.

Song Mingshun currently holds a post as a Professor and the Vice President of China Jiliang University. He is also the Chair of the International Cooperation for Education about Standardization (ICES). His current research focuses on quality management and standardization. He has participated in different national and international congresses

(China national technical committee for quality management standardization, China national technical committee for certification and accreditation, ISO/CASCO/WG33, among others). He has published different articles in journals in his fields of research, including ISO Focus, the Journal of Asian Quality, China Standardization. He is as a main member participating in the EU-Asia Project: Standardization in Markets and Companies, APEC Sub-Committee on Standards and Conformance (SCSC) Education Projects.

Zhou Lijun currently holds a post as an Assistant Professor and Vice Dean of the College of Economics and Management, China Jiliang University. She has the Ph.D in Management from Zhejiang University, China. Her current research interests focus on standardization, quality management and enterprises social responsibility. She has participated in many national level projects, ministry level projects and international collaboration projects. She is also one of the editors of teaching materials, including base of standardization, Social responsibility standard and Certification, etc.

Zhang Yueyi received the Ph.D from Nangjing Polytechnic University. He is now an Associate Professor at China Jiliang University for standardization and quality management teaching and research work. He has hosted and participated in more than 10 subjects at provincial and ministerial level and above and published more than 20 academic papers. On the aspect of social part-time work, he works as provincial government quality award assessor, quality management system auditor, quality manager and quality professional technical personnel trainer.

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IEEE Standards Development in China

By Ning Hua, Director of China Operations, IEEE

Second Quarter 2012

(**Chinese Translation**)

IEEE is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity. IEEE has more than 400,000 members in 160 countries. IEEE and its members inspire a global community through IEEE's highly cited publications, conferences, technology standards, and professional and educational activities.

I. IEEE in China

Today, IEEE has more than 9,000 members in China, including 2,500 student members. Most of the members come from top universities, research institutes and well-respected corporations. China has more than 60 IEEE Fellows, who are involved in many cutting–edge industries. Since 1984, after the formation of the first IEEE section, the Beijing Section, a total of seven sections have been formed as of the end of 2011, including Beijing Section, Chengdu Section, Harbin Section, Nanjing Section, Shanghai Section, Wuhan Section and Xi'an Section. Additionally, four subsections have been formed as well. By 2011, approximately 100 chapters and 25 student branches have been formed in China.

From 2007 to 2012, the number of IEEE conferences in China increased dramatically from around 50 to over 200. The IEEE conferences provide an international and authoritative platform for Chinese authors and speakers to present their work and exchange ideas. Many sections, chapters and student branches also provide its members and volunteers with networking and interaction opportunities through local meetings and events.

In 2010, IEEE announced that Jinan University in Guangzhou, China, became the 100th university in the nation to sign on with IEEE to provide the IEEE/IET Electronic Library (IEL) to its students. The event capped two years of dramatic growth among the IEEE Xplore user community at Chinese universities as China continues to pursue its commitment to advanced education.

To ensure the growth of skills and knowledge among professionals, IEEE a hosted Teacher In-Service Program (TISP) workshop in Shenzhen and Technical English Program (TEP) workshop in Beijing in 2009 and 2010 separately. Those workshops attracted a lot of teachers and students to facilitate enhancements in science and technology. In addition, collaborating with Chinese local associations and governmental agencies, IEEE held a couple of accreditation workshops in China to encourage China to become a member of international accreditation community and follow international standards.

Approved by the IEEE Board of Directors in 2006, the IEEE China Office was officially inaugurated as the legal representative office of IEEE in China on 21 January 2007. The IEEE China office has the commitment to increase visibility of the IEEE and its members in China, further local engagement of and collaboration with IEEE Members, industry, government, academia and related organizations, to maximize IEEE influence and impact locally through valued programs, products and services. The office is located in Haidian district of Beijing, and at present, there are 5 staff people in the office.

II. The Development of IEEE Standards in China

From 2007 to 2012, activities related to IEEE standards have been rapidly developing in China. By the end of 2011, IEEE-Standards Association (IEEE-SA) corporate membership reached 13 while individual IEEE-SA membership is about 100.

The IEEE corporate members include:

- Beijing Jiaotong University
- Beijing University of Posts and Telecommunications
- BII Group Holdings Ltd.
- China Telecommunications Corporation
- FiberHome Technologies
- Hightem Technologies Co., Ltd.
- Huawei Technologies Co., Ltd.
- Qingdao Gaoxiao Information Industry Co. Ltd.
- State Grid Corporation of China
- Singhua University
- ZTE Corporation
- Institute of Electrical Engineering Chinese Academy of Sciences
- Research Institute of Telecommunications Transmission of Ministry of Industry and Information Technology

III. Developing international standards

IEEE Std 1888™-2011, Standard for Ubiquitous Green Community Control Network Protocol, the first standard development initiated by BII Group, China Telecom, Tsinghua University, Beijing Jiaotong University, and supported by other organizations around the world was approved on March 2011. Inspired by Chinese innovation and involving global collaboration, IEEE Std 1888 is a remarkable international standards development achievement in the energy sector.

IEEE 1903™-2011 Standard for Functional Architecture of Next Generation Service Overlay Networks (NGSON), another standard development initiated by China Mobile and Huawei and RITT has been approved on December 2011.

Other IEEE standards development initiated or actively participated in by China companies include the following:

- IEEE P2030.3, Draft Standard for Test Procedures for Electric Energy Storage Equipment and Systems for Electric Power Systems Applications, which is initiated by State Grid Corporation of China.
- IEEE P1862, Standard for Overvoltage and Insulation Coordination of 1000kV or Greater (Ultra High Voltage) AC Transmission Projects, which is initiated by State Grid Corporation of China.
- IEEE P1860, Standard for Voltage and Reactive Power in 1000kV or Greater (Ultra High Voltage) AC Systems, which is initiated by State Grid Corporation of China.
- IEEE P1861, Standard for Acceptance Tests on Sitehand-Over Test of 1000kV or Greater (Ultra High Voltage) AC Electric Equipment and Commissioning Procedures, which is initiated by State Grid Corporation of China.
- IEEE P1851 - IEEE Draft Standard for Design Criteria of Integrated Sensor-based Test Applications for Household Appliances, which is initiated by Qingdao Gaoxiao Information Industry Co. Ltd.
- IEEE P1904.1- Standard for Conformance Test Procedures for Service Interoperability in Ethernet Passive Optical Networks, which is active participated by China Telecom.
- IEEE 802 LAN/MAN Standards are actively participated by China Mobile, China Telecom, Huawei, ZTE, FiberHome and other china companies.

In addition, IEEE has built a good relationship with China's national standards organizations. In 2007, 2009, and 2011, IEEE signed MOUs with China National Institute of Standardization, China Electronics Standardization Institute, and China Communications Standards Association respectively. These MOUs mark the beginning of deep cooperation between IEEE and china national standards organizations, leading global standards development collaboration and market implementation.

IV. IEEE's Standards Education Activities in China

As the world's leading standards developer, recognizing the important role standards play within the engineering, technology and computing fields, IEEE has established a joint committee of IEEE Educational Activities Board and IEEE Standards Association, the IEEE Standards Education Committee (SEC). Since then, IEEE has begun to provide resources to help introduce and teach undergraduate and graduate students, as well as professors and educators, about technical standards by providing free online tutorials and case studies. The program aims to help facilitate the transition from classroom to professional practice by aligning educational concepts with real-world applications.

In 2010, IEEE SEC and China National Institute of Standardization (CNIS) held a joint IEEE-CNIS Standards Education Workshop in Beijing. The workshop covered the practice of education on standards by IEEE and CNIS, reviewed the experience about standards education and trends in standards education and desired directions for developing the field. Experts from China, America, Korea and European countries delivered speeches at the workshop. Over 80 attendees participated and had a lively discussion, which promoted the knowledge of technical standards and encouraged extensive development of education about technical standards in academia and industry.

The SEC makes available US $500 grants for college and university students (with additional honoraria for faculty mentors) to help with design, development or research projects in which industry technical standards are applied to complete the project. The SEC recently approved two grants for students at the School of Electrical Engineering, Xian Jiaotong University, Shaanxi, China, and at the Institute of Mechatronics, Schools of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, China. More information on how to apply can be found in the FAQ's of Student Application Papers section.

Ning Hua is the Chief Representative of the IEEE's China Office. In his current role, he is responsible for planning, organizing and managing IEEE activities in China; developing and fostering direct and ongoing relationships and exchanges with government, industry, and academic organizations; identifying and developing new opportunities in emerging markets; providing productive and positive visibility of IEEE to Chinese enterprises and other organizations; and promoting IEEE products and services in China.

Mr. Hua previously served for 6 years as Vice President and CTO of BII Group, a pioneering Internet and Telecom research and consulting company in Beijing. BII is one of the leading companies in developing IPv6, WiMAX and UWB in China. He earned the Masters Degree of Electronics Engineering in Beijing University of Posts&Telecom.

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ASTM International Standards in Education in China

By Liu Fei and James P. Olshefsky, ASTM International

Second Quarter 2012

At the very beginning, ASTM International was aware of the significance of standards in the university education programs. Over the years, ASTM International has been active in working with the universities and academies to promote the knowledge of technical information as provided by standards, and of the standards development process itself. ASTM educational models include the engagement of students and professors of universities and academies in the standards development, incorporation of standards in curricula and student graduate design, and some scholarship and awarding programs. ASTM has further carried the models on to some campaigns including Year of the Student in 2007, Year of the Professor in 2009 and Jumpstart Your Career in 2011. Those activities have been undertaken not only in the educational communities in the United States but also in the global marketplaces including the Chinese universities. The significance of ASTM standards in education programs is to help the students and professors better understand why it is necessary to incorporate standards into class curricula, how standards will fit into the bigger picture of engineering practice, and where standards are needed.

In recent years, ASTM International has been making efforts to bring the standards knowledge to the engineering and technology universities in China. Every year, ASTM staff and/or its committee members visit the different schools, give lectures, conduct seminars, and sponsor some special technical projects in school courses or student designs in many sectors. Among those programs, one project "Student Competition for School Acoustical Design" can be taken below as a significant example to illustrate how ASTM technical standards are used in teaching courses.

In 2011, Armstrong (China) Investment Co., Ltd. co-sponsored the first Student Competition for School Acoustical Design with Tongji University in Shanghai and Tsinghua University in Beijing with the goal of encouraging students to collaborate in teams to design a primary/middle school with superior acoustics. This competition was conceived by Armstrong during the application and promotion of its acoustic technologies for buildings in China. It was targeted to undergraduates and graduates majoring in Architecture, Engineering, Physics or other curriculums that involve building design and/or acoustics. See announcement of competition below:

At the beginning, Armstrong (China) approached its long-term educational partners – Tongji University and Tsinghua University to raise the idea of holding a technical design competition for students with the resulting proposal for this competition program being formed in 2010. After receiving positive feedback from the two universities Armstrong (China) and ASTM conducted a training session with the students from the architectural acoustic research program of Tongji University in January 2011, as an introduction to implementation of this competition. Armstrong then continued working with the two universities to shape the details and process of the competition. The competition was launched in April 2011 with team registration due by June. A total of seven teams - four teams with 12 students from Tongji University and 3 teams with 11 students from Tsinghua University - participated in the competition. The competition was concluded in December of 2011 and one team from each university was awarded first place.

The Tongji University winning team's submission entitled "Primary School Design" used an 8-step strategy to design the school while considering the sound absorption, vibration and insulation for a location next to a busy highway and close to a subway station.

The Tsinghua University winning team's creation entitled "Slope-School" incorporated a park next to a busy highway while locating the school under a sloped grassland or "park" in accordance to local and international building standards with an emphasis on "environmentally sustainable" design.

As recognition for their excellent performance, the two winning teams received an all-expenses-paid trip to the Joint Meeting of the Acoustical Society of America and Acoustical Society of China in Hong Kong in May 2012, where they are invited to make a "lecture style" presentation of their projects in a special session on school design.

Overall, the students were given almost six months to develop their projects, which gave them sufficient time to research the standards and learn more about acoustics. During the design development phase, over the summer, Armstrong Senior Principle Scientist and ASTM E33 member Dr. Kenneth Roy conducted acoustic workshops at both universities. In most areas of the school, but especially for classrooms, good speech intelligibility is a requirement both for teaching and learning. Designing for speech intelligibility requires both architectural acoustic design for speech clarity, and architectural noise control design to limit the intrusion of noise so that the speech can be understood. Both the Chinese GB standards and worldwide standards address these issues with maximum acceptable 'reverberation time' and 'background noise'. These factors are considered performance requirements, and these are in-turn specified by material and system choices. In the design of these schools, the students had to consider the sound absorptive treatments used on the ceiling and walls of the rooms as specified for sound absorption per ASTM C423. This standard provides a measure of the random incidence sound absorption performance of any material where a value of NRC = 0.0 is full reflective and 1.00 is fully absorptive. The students considered the noise intrusion between the building exterior or adjacent spaces such as corridors, into the classrooms according to the wall STC per ASTM E90. In this case an STC = 35 is a poor performing wall system, and 55-60 is a high performance wall system.

Figure 1 – The materials chosen by author

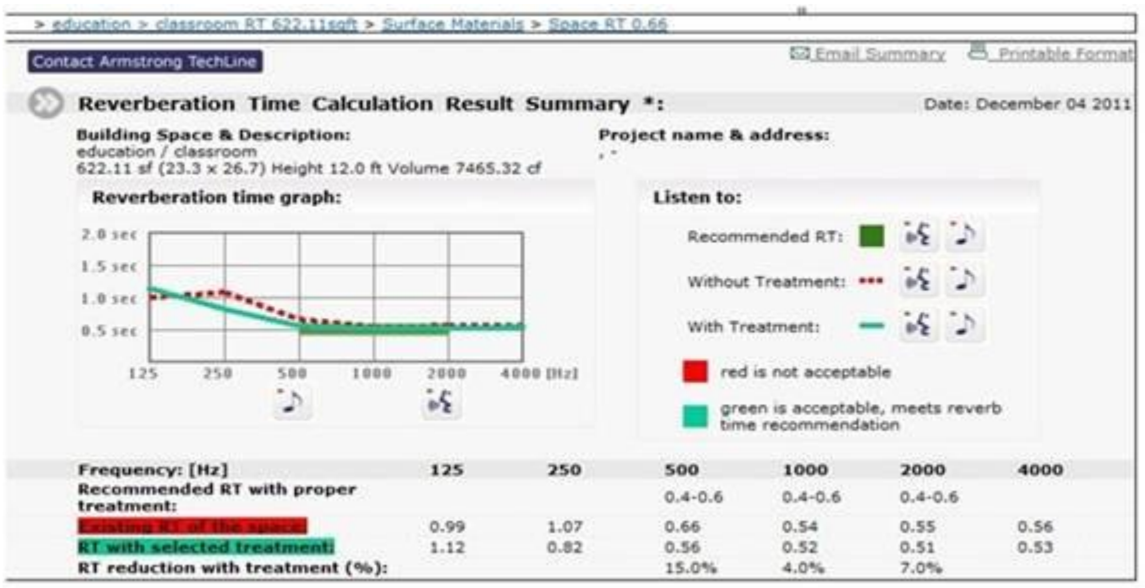

Figure 2 – The comparison between before and after treatment to the classroom

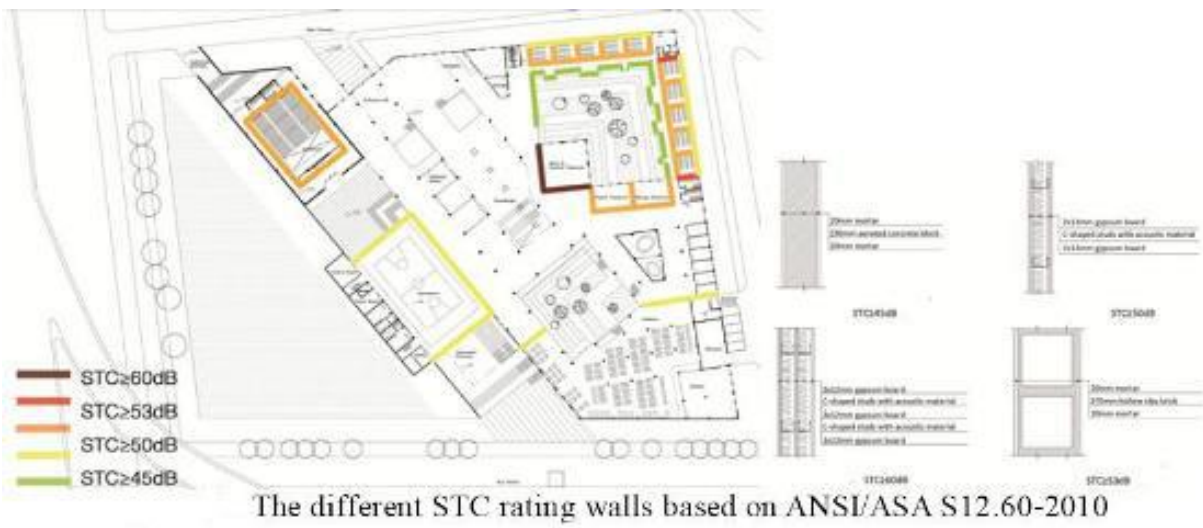

Figure 3--Typical Presentation Poster during Design Judging at Tongji University in Shanghai

In the end, a panel of judges including one professor from each university's Architecture Department and two senior designers from leading architecture firms in Shanghai and Beijing made the final decision and announced the award winners in December 2011. Appropriate use of ASTM International standards for building acoustics was one of eight aspects used as criteria to judge the submissions. This student design competition, as the first of its kind for Armstrong (China) Investment Co., Ltd.'s education campaign with the university students in China, not only enhanced the understanding of various ASTM standards, but it also has encouraged the students to incorporate standards in their future projects that Armstrong (China) is planning to continue in the coming years.

Figure 4--Another Presentation Poster from Design Judging at Tongji University in Shanghai

ASTM International supports Armstrong (China)'s initiatives to succeed in training students about ASTM standards and Armstrong's acoustic technology in the Chinese universities. The success of this first competition emphasized to the participating students the need to prepare for their future engineering careers and also pioneered the activities of standards in education for other companies and universities. As one professor put it, "In so doing, we lay open the profession of engineering to students and provide them with a vision of their future so they can better plan for it."

ASTM International will continue the support to the global efforts of its member companies in standards education with universities. ASTM also welcomes and encourages the industries and universities based in China to join the efforts of promoting standards used in education. For further information about ASTM standards in education, please feel free to contact ASTM staff: Liu Fei at fliu@astm.org in China; and Jim Olshefsky at jolshefs@astm.org at the Head Office.

About ASTM
ASTM International is one of the largest international standards development and delivery systems in the world. ASTM International meets the World Trade Organization (WTO) principles for the development of international standards: coherence, consensus, development dimension, effectiveness, impartiality, openness, relevance and transparency.

ASTM standards are accepted and used in research and development, product testing, quality systems and commercial transactions.

Mr. Fei LIU is the Chief Representative of ASTM International China Office, responsible for the overall affairs including ASTM International operations and marketing in China and Asia, promoting the acceptance and use of its standards in China and Asia, engaging the technical and standards experts form the region in ASTM's technical committees, dedicated to applying ASTM international standards in serving the Chinese standards development system and the global market access of both Chinese and non-Chinese industries, and enhancing the cooperation between ASTM International and the standards and industry sectors throughout China and its neighboring countries in Asia to facilitate the international and regional trade.

Mr. Liu holds BA in International Business from the Shanghai Institute of Foreign Trade and MA in Sociology from the Peking University. He has been involved in international economy and commerce for about 20 years. He worked with the Chinese Embassy in Ethiopia and the U.S. Embassy in China, in charge of WTO-related affairs of market access, IPR, distribution and supply chain, product safety, etc. to promote the bilateral and multilateral economic and trade cooperation.

James P. Olshefsky is Director, External Relations at ASTM International where he manages, supports, and promotes ASTM's international outreach and academic initiatives within ASTM's Global Cooperation Division. Jim Olshefsky has worked at ASTM International for 13 years supporting the development and promotion of voluntary consensus standards for materials, products, systems and services. Prior to moving to Global Cooperation, he directed ASTM's Committee Services Department in the Technical Committee Operations Division. Mr. Olshefsky also spent several years as a Staff Manager of various ASTM technical committees. Other contributions include speaking to students, educators, and international audiences on the importance of standardization and global use of ASTM International standards.

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ANSI Works to Strengthen Cooperation and Information Sharing with China

By Elise M. Owen, Director of International Development, American National Standards Institute

Second Quarter 2012

As part of its mission to raise awareness and promote the use of voluntary standards and conformity assessment around the world, the American National Standards Institute (ANSI) is committed to facilitating dialogue and cooperation between the U.S. and China. And one of the key ways that ANSI does this is through the Institute's ongoing Manufacturer Member Roundtable in China.

Participants at the year-end Roundtable celebration in Beijing

A decade after its entry into the World Trade Organization (WTO), China has become the United States' fastest-growing export market and one of the nation's largest trading partners. The ANSI Manufacturer Member Roundtable in China Roundtable provides a forum for ANSI full member manufacturing companies to discuss challenges and strategies, exchange information across industry sectors, and provide perspectives on issues that affect their ability to do business in China.

Monthly meetings of the Roundtable frequently feature briefings from Chinese government officials and other top experts. Now, as Chinese universities and academic organizations increasingly take on standardization work, we are seeing more and more standards and certification programs that originate in the academic world. As a result, the Roundtable plans to increases its engagement with Chinese universities, while continuing its strong engagement with the Chinese government. This will not only provide greater information access to ANSI members on upcoming developments in standardization in China, but will also provide new opportunities for U.S.-China collaboration.

By holding discussions in Mandarin Chinese with local company representatives, alternating between Beijing and Shanghai, the Roundtable has created a cooperative and comfortable venue for U.S. companies to exchange ideas with Chinese officials. The inclusion of academic representatives in this collaborative environment will provide even greater opportunities for sharing of expertise and perspectives on the Chinese business landscape. And more, it will foster greater understanding of the importance of standards education and information sharing.

Roundtable briefings have featured leaders from the Standardization Administration of China (SAC); the Certification and Accreditation Administration of China (CNCA); the General Administration for Quality Supervision, Inspection and Quality (AQSIQ); the Ministry of Industry and Information Technology (MIIT); the China National Institute of Standardization (CNIS); the China Electronics Standardization Institute (CESI); the China Association for Standardization (CAS); the China Quality Certification Centre (CQC); the Shanghai branch of China Inspection and Quarantine (CIQ); the Shanghai Quality and Technical Supervision Bureau (TSB); and the Shanghai Association of Standardization (SAS).

Topics of discussion have included:

- China's 5-year plan for standardization
- China Compulsory Certification (CCC) regulations
- Dealing with China's Restriction of Hazardous Substances (RoHS)
- China's new energy efficiency requirements
- Chinese special equipment regulations
- China's proposed Information Security certification requirements
- Participation in Chinese standards development

The meetings build upon the dialogue established through senior ANSI leadership meetings with Chinese officials, and reinforce working relationships between ANSI, its members and constituents, and Chinese government and industry. The Roundtable also serves the broader ANSI community by providing front-line insights and early warning on developments in China related to standards and conformance, and monthly reports from the ANSI Manufacturer Member Roundtable in China are made available as a benefit to all ANSI full members.

Learn more at http://www.standardsportal.org/chinaroundtable.

Elise Owen is the director of international development at the American National Standards Institute (ANSI). She is responsible for building and maintaining relations with the Institute's counterparts in China and facilitates coordination and cooperation among ANSI's private- and public-sector contacts that are engaged in China-related activities. Ms. Owen is proficient in Mandarin Chinese and Japanese, and holds an MBA from the University of Hawaii at Manoa.

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IEEE Standard 1888™: Green Community Infrastructure and Protocol, Promoting Green ICT and Smart Energy Management

by Liu Dong, Chair of IEEE 1888 Working Group and President & CEO of Bll Group Holdings Ltd, and Gu Chen, Manager and Chief Engineer, Technology & Standards Department, Bll Group Holdings Ltd.

Second Quarter 2012

(**Chinese Translation**)

Abstract

In March 2011, the Institute of Electrical and Electronics Engineers (IEEE), the world's largest professional association, announced that the IEEE Standard Association had officially approved and published the IEEE 1888™ Standard for Ubiquitous Green Community Control Network Protocol, which originates from innovative technologies of China. As an advanced global standard in the Internet of Things (IoT) field, IEEE Std 1888 aimes at energy saving, and is a Chinese breakthrough in developing international standards about Green and Energy Conservation.
This paper first introduces the IEEE Std 1888 development process, promotion status and future plans, then describes the IEEE1888 standard technology system in terms of system architecture, protocol framework, technical innovations and so on. Finally a brief introduction to the application of IEEE1888 is presented. IEEE Std 1888 has attracted wide attention and obtained support from global industry since its publication. With the large-scale deployment, IEEE Std 1888 will certainly contribute to global energy conservation and emission reduction.

Keywords: IEEE Std 1888, Ubiquitous Green Community, IPv6, Information and Communication Technology (ICT), Energy Conservation and Emission Reduction

1. Introduction

As the global energy resource crisis and environmental deterioration have become more and more serious, it is important to construct the next generation green energy management system, based on Internet-oriented information and communication technology (ICT) technology. The novel energy management should be comprehensive, widespread and intelligent, with its scope extended to energy consumption visualization, energy waste diagnostics and improvement suggestions, energy efficiency improvements, comfort index (CI) automatic control, energy supply-demand balance control and so on. Now it is recognized that the effective solution for energy management is to deploy facility network within the community. However, the practical deployed energy management systems are usually exclusive and closed, possessing separate databases, independent protocols, standards and platforms, which are incompatible with each other. In addition, next generation energy management involves a large scale of building groups, communities, areas, cities, and even larger scope. This requires new protocol architecture for comprehensive energy management within wide areas.

Considering the drawback of traditional management framework, in order to enable systems cooperation, large-scale deployment and remote control, IEEE Std 1888 was proposed to establish a standardized and open energy management system. IEEE Std 1888 took thorough consideration about cooperation among different facilities, data mining, error handling and applications development during the design period. IEEE 1888 established a standardized, novel system by applying IPv6 and Internet of Things (IoT) to building groups, for the purpose of energy management. IEEE 1888 enabled facilities to networking, on-line management, centralized monitoring, visualization, optimized management and remote control.

IEEE Std 1888 is the first innovative standard led by Chinese Corporations within the field of ICT and energy conservation. With high attention and support from many global manufacturers and research institutions, IEEE 1888 established three serial sub-groups in June 2011, focused on network management and operations, integration of heterogeneous networks, and network security. The three serial standards are still in development.

2. IEEE Std 1888 Technology System

IEEE Std 1888 employs advanced ICT technologies describing a remote control architecture of digital community, intelligent building groups and digital metropolitan networks connected based on ubiquitous network, specifying interactive data formats between devices and systems, and giving a standardized definition of equipment, services, signals, and interactive messages in this digital community network.

2.1 IEEE Std 1888 Architecture

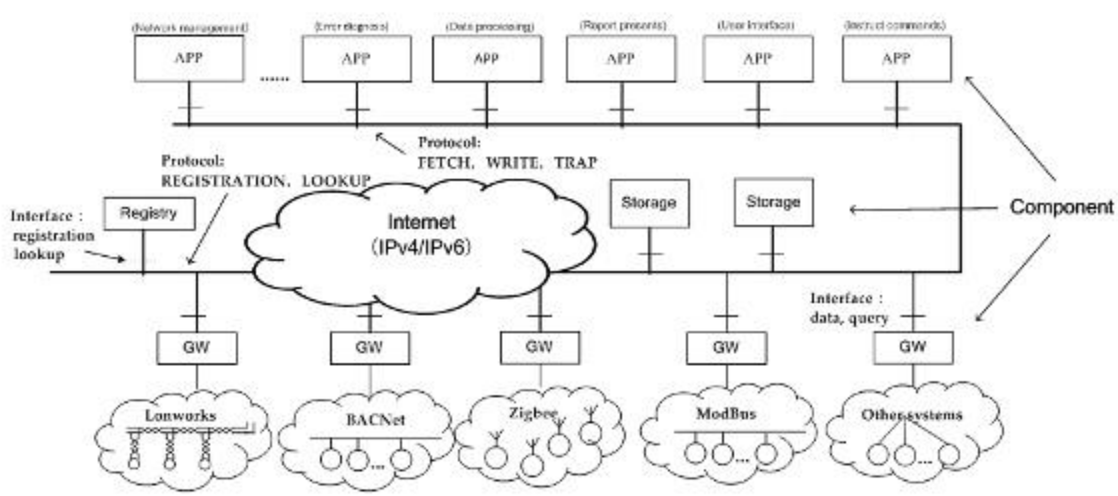

Figure 1--IEEE Std 1888 System Architecture

As shown in Figure 1, IEEE 1888 applies to a TCP/IP-based facility networking architecture, and transmits messages by IP networking equipment. This system is data-oriented, consisting of gateway, storage, application (APP), and register. The gateway (GW) has physical sensors and actuators. It encapsulates and generalizes the physical data model and access method for those devices. GW acts on its actuator according to the written value from a component, and it provides physical sensor readings for other components.

The Storage archives the history of data sequences. The written values from other components should be permanently stored in the backend disks. It provides the archived values to the components that have requested them. The APP provides some particular works on sensor readings and actuator commands. It can have user interface to display the latest environmental state. It can also allow a user to input some schedules of actuator settings, and it can as well analyze some sensor data in real time and provide the result as a virtual device. GW, storage and APP are generalized to “component”. Registry works as a broker of Components. It manages meta information.

2.2 IEEE Std 1888 Protocol Framework

IEEE Std 1888 adopts a four-layer model of OSI architecture, locating itself in the application layer. Physical and data link layer are not subject to the different local technologies, supporting varieties of underlying transport protocol. Network and Transport Layer employ all-IP architecture and support IPv6. Application layer supports mainstream protocols, adopting XML to describe data, providing an open interface to users by equipment generalization.

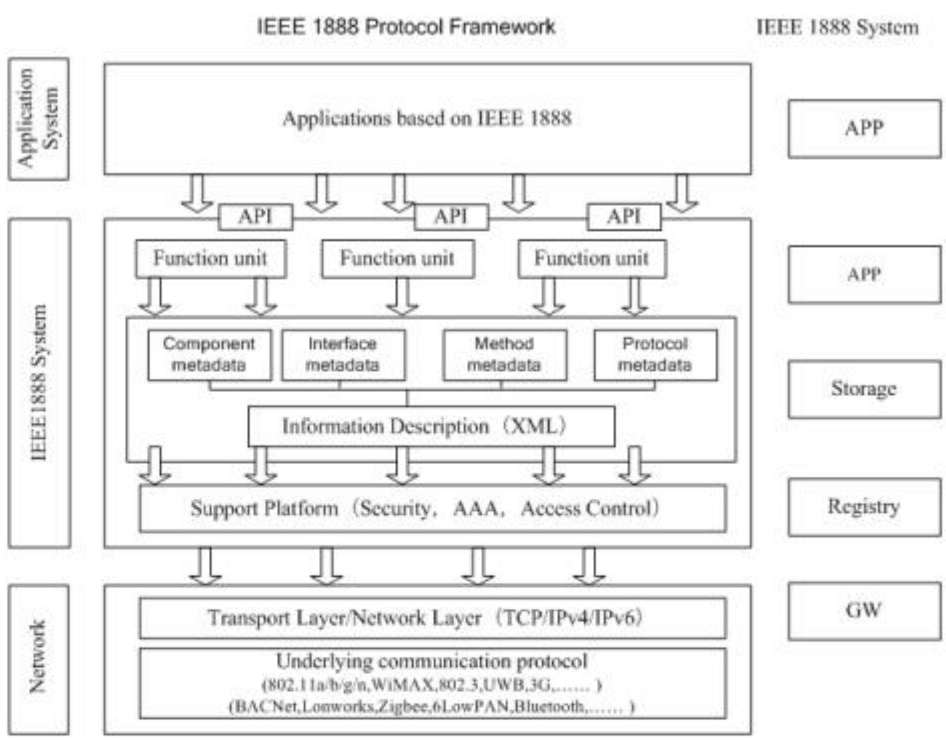

Figure 2-- IEEE Std 1888 Protocol Framework

IEEE Std 1888 sets up model for functional entities, and defines the information exchange process between communication peers, enabling remote synchronous and asynchronous communications.

In IEEE 1888 system, GW, storage and APP, are generalized as "component," with the same data and query interfaces, providing the same communication protocols of FETCH, WRITE and TRAP. FETCH protocol is for obtaining data from the component, supporting division of messages. WRITE protocol is for pushing data to the component. TRAP protocol supports event-based trigger, enabling asynchronous communication.Registry is distinguished from components, offering registration and lookup interfaces. The communication protocol between component and registry are REGISTRATION and LOOKUP. REGISTRATION is for registering component information and role information, while LOOKUP protocol is for inquirying the component information.

IEEE 1888 communication protocol shall be implemented by RPC. Requester invokes the API method of responder, and responder-data is returned from responder. The data structure of request and response is the same, with tree data model to describe point information. By describing all the messages in XML format, IEEE 1888 defined a standard data structure and implementation method.

2.3 IEEE Std 1888 Technical Innovation

All-IP architecture is based on multi-protocol gateway, compatible with BACNet, Lonworks, Modbus and other industrial bus technologies, supporting 6LowPAN, WiFi, Zigbee, 2G, 3G and other wireless access technologies.
Open architecture. Data are transmitted over IP. IEEE Std 1888 generalized functional entities, defined standard communication interface and protocols, described message in XML format, constructing an open system.
Database oriented information sharing. Based on database, IEEE Std 1888 enabled data mining, data processing, comparison, service providing and so on.
Cloud Computing-based platform. This supports processing for a huge number of data, establishing optimized solutions, and offers open interface for the third-party service provider.

3. IEEE Std 1888 Application

The IEEE 1888 standard is based on an open architecture, so it can be applied into various fields such as building, energy, transportation, commercial, industrial, agricultural and so on.Since publication, IEEE 1888 has obtained wide approval. Today, some demonstration projects have already been deployed. This prompts the whole industry chain including chip and device manufacturers, network service and other parts. In addition, IEEE 1888 deployed in large-scale would make an important contribution to global energy conservation and emission reduction.

4. Conclusion

The IEEE Std 1888 adopts TCP/IP architecture, employs mature and emerging technologies in ICT, supports different access technologies, and enables integration with next-generation network convergence. By basic methods such as monitoring and controlling, IEEE 1888 cooperatively manages various facilities, makes full use of energy sources, and achieves energy flow control by means of controlling information flow. The ultimate goal of IEEE 1888 is not only for energy saving, but also for energy efficiency improvement, which constructs a novel energy management system. By adopting a standardized general architecture, IEEE 1888 integrates existing local energy management systems, and supports new applications that may appear in the future. Aimed at ubiquitous network equipment and infrastructures, IEEE 1888 can achieve intelligent interconnection, collaboration services, remote control and central management, providing remote control and collaborative management solutions for operators, community administrators, public service providers, government departments and individual users.

5. Reference

[1] IEEE Std 1888 "IEEE Standard for Ubiquitous Green Community Control Network Protocol," 13 April 2011. http://standards.ieee.org/findstds/standard/1888-2011.html.

Liu Dong is President and CEO of Bll Group Holdings Ltd; Co-founder and Board, China Internet Society; Chair, China Mobile Internet and Wireless City Professional Committee; Member, China Next Generation Internet Expert Committee; Member of Expert Consultative Committee, "Telecommunication Law" Committee of State Council Law Office; Chair, Next Generation Internet Industry Alliance (Z-Park); Vice Chair, Internet of Things Alliance (Z-Park); Vice President, Ubiquitous Network Technology and Development Forum; IPv6 Forum Board, Chair of China IPv6 Council; and Chair, IEEE 1888 Working Group (Ubiquitous Green Community Control Network Protocol).

Gu Chen (Ph.D) is Manager and Chief Engineer in the Technology and Standards Department, Bll Group Holdings Ltd. She is also the Technical drafter, for the IEEE 1888 Working Group (Ubiquitous Green Community Control Network Protocol).

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How to Teach Standards in Engineering School: A Practical Approach

By Francisco J. Bellido, Ph.D, and Jose-Maria Flores-Arias, Department of Computer Architecture, Electronics and Electronic Technology, University of Cordoba, Spain

Second Quarter 2012

The different existing standards and their interaction make up an exciting new challenge for the future engineer, which students must begin to face early in training at the University. A great challenge for the engineer: optimize heterogeneous solution. That is, to deal with heterogeneous standards for a common scenario. So, the problem statement arises from the role of standards for engineers and practitioners:

A challenge for the integration of services
or
The paradigm of the integration of services

Active learning strategies to teach standards

Standards learning and training is the responsibility for engineers and practitioners under the LLL umbrella (Life Long Learning), and as an extension for both professors and students. LLL requires active learning and a proactive formation too. Active learning focuses the responsibility of learning on learners and comprises a wide set of methodological activities and experiences. Our proposal in active learning for Standards teaching include the following activities:

- Think-pair-share activities.
- Class discussions that may be held in person or in an online environment.
- Short written exercises are a good way to review materials; better if they are proposed as worked-examples.
- Teaching the new contents in class at a study or work group or by means of a forum or a Wikiplace.

In our opinion, the first activities related are more formal than the last ones and requires a more structured teaching procedure, so they are more complex to be carried out. Discussions, short exercises (guided or proposed), and peer teaching are in fact more flexible and allows the teacher to adapt the learning flow to learners. Anyway, as seen in the aforementioned activities, in order to ensure efficient instructional strategy teacher guidance must be an essential part of active learning.

Moreover, practice after initial learning is of vital importance to a student’s education. Its importance lies in the fact that students who practice discovery learning are more likely to recall information later on. Many activities described are able to be applied to experiences in a discovery learning way but in a more deep data mining also. Learners work in pairs during sessions. They discuss materials while role-playing, debating, engaging in case studies, take part in cooperative learning, or produce short written exercises, etc. The reinforcement of learning lies on discovery activities or application problems.

The last activity listed is not always recommended especially if the matter is their first approach to a subject in the syllabus. Guided or worked-examples could then be the best choice.

A case study: Smart Home scenarios

The challenge, or paradigm, of Smart Homes arises from the convergence of multiple technologies, applications, settings and needs which have gradually been incorporated into our homes.

The practical case exposed is the analysis of those standards which are involved in a Smart Home scenario – a very common case study in Electronic & Automation Engineering. We find out that main services are those related to security, comfort and energy management (plus Internet of Things -IoT and Ambient Assistant Living (AAL) which are growing rapidly).

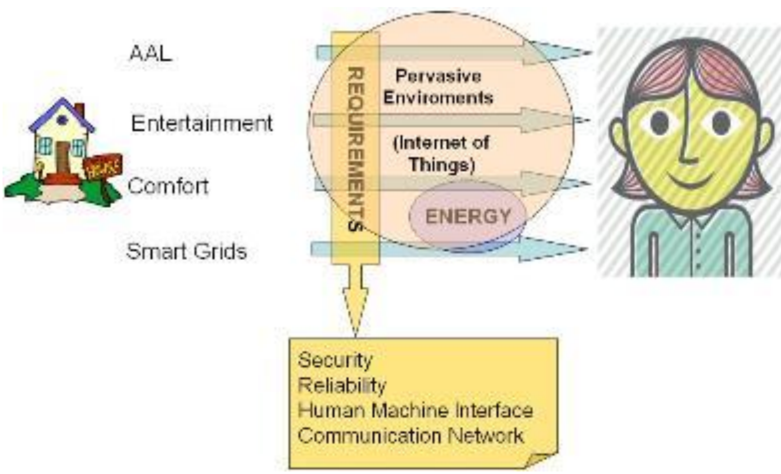

Figure 1: Standards interaction in a Smart Home Scenario

All the categories analyzed require at least these common technical requirements:

- Embedded Hardware;
- Infrastructure for homogenized mobile and fixed communications;
- Dynamic device networks and massively distributed;
- Interfaces of natural human interaction;
- Reliability and security systems.

But all of them are affected mostly by different standards and other regulatory frameworks. So, how to do? Nowadays, the proposed approaches fail to completely offer a generic, scalable and flexible architecture supporting both evolving context models and evolving services and applications for smart homes services. Each category or domain advance isolated from the others. There are too many requirements in each standard to try to consider a global specification. But it might be possible to achieve certain interoperability channels and to minimize the cluster of technologies and interfaces to deal with for both: the engineer/designer and the end user in any scenarios.

Then discussion and case study are launched by a set of activities categorized under the aforementioned ones.

The proposal is to select the kind of applications to be analyzed in depth, i.e., to propose a Smart Home scenario with comfort facilities related to energy like lighting control, integration of renewable sources, smart meters, energy saving and control, temperature regulation or plug-in electric vehicles for example.

SmartGrid and comfort share applications on energy facilities. We must make a distinction between them to determine which are affected by the requirements of the Smart Grid framework and operation modes. In other words, strictly and formally determine the border between the comfort –user designed facility - and power management ones.

The problem statement, as a first approach can be discussed in Think-pair-share activities plus a class discussion with the main conclusions of each group. The moderator (professor) must guide the discussion, taking special care in avoiding a widespread set of conclusions. For this scenario, a standalone search among the main Standards is proposed to students/practitioners. Some websites are shown in advance to guide them, such as IEEE Standards Association, IEC or NIST. Also, security issues must be considered in terms of privacy, reliability and robustness.

The desirable scenario is the convergence of these categories to the end user. Although internally each application can roll in under different technological specifications. The key is interoperability. If we don't move toward in this integration, we will have only a patchwork of technologies, inefficient, and disaggregated.

In some cases, existing standards may work just fine in the Smart Grid or AAL or IoT. In other cases, however, new standards must be developed for the new interactions made possible by these actors or domains (Smart Grid –AAL –IoT >EndUser<). Also several Alliances are emerging to try to lead a common framework for these actors, like Zigbee, EMerge, or Continua Health Alliance for example.

So, once again, the key is the interoperability. It enables integration, effective cooperation, and two-way communication among the many interconnected elements at home or at the electric power grid. To achieve effective interoperability, we must build a unifying framework of interfaces, protocols, and the other consensus standards. So, the challenge – or paradigm of Smart Homes compels us to tackle new projects and designs to provide new breakthroughs for the development of society and wellness.

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He has had a long-standing interest in the role and applications of newest wireless technologies and standards in a broad scope of facilities, from home networking, to energy management, Smart Grids or AAL. He is the responsible for several subjects related to Communications, Industrial Electronics and Instrumentation in different courses of Bachelor and Ms.C in his University.

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Creating a Strategic Standards Course [i]

By Ken Krechmer, University of Colorado, Boulder

Second Quarter 2012

The problem with teaching isology today

There are basic rules that systematize the discipline of standards. If this is true the study of standards is a science and may be termed isology - the science of references. The current focus of most standards and standardization education is on standardization, the process of creating, implementing or using a standard, usually with examples of different standardization processes. Such courses do not offer the student a theoretical basis to understand standards or standardization. A "standard" is an established reference which may be studied in two forms: a concept or a realization. Studying standards as a concept and its impact on standardization is largely an academic endeavor, while the actual realization (creation, implementation or use) of a standard requires mostly practical skills.

While learning about standardization is desirable, as it offers insight into the importance of standards in every technical and commercial field, this short paper argues that academic courses would be more useful teaching the theoretical rules that underlie standards and use specific standardization examples to demonstrate that the rules are accurate and increase understanding.

The possible effects of standards are very broad and include expanded communications, increased quality and decreased cost (for the manufacturer, service provider and consumer), increased trade (local, regional and international), increased uniformity, new markets (innovation or location), information dispersion, market control and regulation. The widespread use of standards increases compatibility, interchangeability, interoperation and usability. Some describe standards as limiting innovation and others describe standards as enhancing innovation. In micro-economics literature, the impacts of different standards have been identified as coordination, scaling and learning, network, and gateway effects (Arthur, 1988). Each of these different effects may have significant ramifications on society. And these effects increase as technology becomes more critical to society. Trying to comprehend such a broad range of effects without an effective model of the causes is not realistic. This is major reason for the low interest in existing standardization courses; they do not offer a way to understand standards.

Teaching standards: Current Status

Rigorous theory that applies to all standards and every standardization process exists. Recognizing that every standardization process can be seen as anticipatory, participatory or responsive relative to the appearance of products and services is just beginning to be supported in the literature (Bartlett, 1986). The idea that standards can be seen as a series of successions over recorded history with each succession having a different form of economic impact is emerging (Krechmer, 2006). Recognizing that the concept of a standard can be defined in mathematical terms is new (Krechmer, 2005). These theories need to be evaluated, evolved and taught. Currently, the lack of accepted models and rules that offer insight into the field seriously diminishes the value of academic training in the discipline. Isology "will never truly establish itself as an academic discipline in its own right until those that profess the subject demonstrate that it is capable of developing, and has developed, its own theoretical foundations" (de Vries, 2002).

The lack of agreement on the models and rules underlying standards and standardization has many ramifications:

- Definitions of the terms standard and standardization are not agreed or rigorous.
- Reference standards, metrology standards, manufacturing standards, and Information and Communications Technology (ICT) standards are not linked together as a unified discipline.
- The relationship between economic theory and standards theory is not developed.
- The necessity of a priori agreements, which may be standards, for any communications is not widely understood.
- There is no broadly accepted theory explaining the layered nature of standards.

The lack of basic definitions, rules and models is a major reason that:

- There is no text book addressing all the different standards including reference, metrology, manufacturing, and ICT which introduces a unifying theory, develops common rules and models, offers examples of how the theory applies to all different standards and provides problem sets for the student.
- Standards concepts are often not included in the other disciplines they strongly impact including: business, strategic management, engineering, science, micro-economics, patent law, history of technology, public policy and social sciences.
- There is no succinct understanding of the importance of standards and standardization in the general population.

The Process of standardization: CONCERNS

Hayek (1973) notes that established references may occur by accident, assumption, convention, committee or fiat. When committees create established references it is termed standardization. The give and take of standardization under the procedures of a specific committee is a practical art learned by reviewing the committee's training materials or attending meetings.

Standardization is the selection part of a system which creates variations and makes selections - just like an evolutionary system. Evolutionary systems function to increase the likelihood of survival by minimizing risk, not by reducing the total energy used. In the standardization process different standards proposals are often combined into a final standard so that each proposal "survives," which is not always energy efficient but may be standardization efficient.

Currently engineers are trained to create energy efficient designs, not minimize risk. Minimizing risk requires a very different approach from creating efficient designs. Teaching engineers the need to balance these different goals is an important task of isology education - important enough that students are likely to recognize the need to learn it.

Balancing the multiple interests represented in a standardization committee requires some form of fair standardization. Each standardization participant must find their interest acceptably represented before they can agree to a new standard. In this light, the concept of the "best" standard does not really exist. Standardizing two or more ways to achieve the same result (where the standard is imbedded in a programmable micro-computer), while less energy efficient, may minimize both short term risk (meaning that the standard is more likely to be completed) and long term risk (meaning that two or more ways to achieve the same result provides options should one way turn out to be less desirable in the future, e.g., due to higher royalties). Determining how to balance multi-party interests and single standard efficiency is often the most difficult task in a standardization process. Existing standardization courses do not address this issue.

An example of the need to balance efficiency and interest is a "standards war," when two different technical approaches to a standard vie to be defined in the standard. Standards wars usually occur when the different technical approaches represent economic value to different organizations or groups of organizations. The public does not care about who wins a standards war. The public only cares about receiving the product or service that a needed standard helps define (Shapiro, 1999).

Inherent in a standards war, a single standard is considered the goal to reduce inefficiency and cost. However computers (e.g., in cell phones, tablets or PCs) are changeable and therefore allow multiple choices. One example is support for both the Mozilla and Microsoft Internet Explorer browsers in a single personal computer. Where it is economically practical to support multiple implementations of the same function, when a standardization organization deadlocks over the technical approaches or when different nations (or groups of nations) wish different implementations, the choice should be to include all the economically acceptable variations. Such a choice eliminates standards wars.

Successful standardization entails a recognition that the "best" may be what is politically possible rather than what is technically most efficient. In standardization today the idea of "the politically possible" is fraught with negative connotations. It is more productive to understand "political possible" as the solution that provides the lowest risk to the largest number of participants.

Teaching standards: A PROPOSAL

Some standardization courses are fragmented by attempts to address three real, but separate, needs in a single course:

1. Teaching a non-technical audience the importance of standards. Attendance demonstrates that teaching a non-technical audience the importance of standards is often unsuccessful. Non-technical students usually do not see a need to learn about standards. As technical students become increasingly interested in isology other students will recognize the value in understanding the discipline.
2. Teaching technical students what they need to know about standards in their field. This requires a technical course. Such courses currently seem to be the most successful. Serious technical students are often not interested in non-technical courses.
3. Teaching the policy and procedures of individual standardization committees. This is only valuable to people who are planning to attend specific standardization committees in the near future.

Teaching technical students about isology should occur in two phases. First, an introduction to the subject should be a part of existing technical courses. The largest problem of isology education is the paucity of discussion of the general field in secondary and undergraduate technical courses. Few physics courses emphasize the importance of standards for mass, time and space to the understanding and use of all physical phenomena. Trade and technical courses often do not address the importance of specific standards in each trade or technology. Standards are perceived much like air, necessary but not noticed, in technical education today. It is in such trade and technical classes that a recognition of standards and their impact on modern society must be first presented.

Second, with an introduction to isology in existing technical courses it is reasonable to expect an increased interest in higher level, specific courses on isology. These higher level specific courses on isology would present the theory of standards in historical, technical, economic, legal and mathematical forms using examples in the practice of standardization to validate the theory. The first people to take the higher level course should be the lower level technical instructors. Only when they understand the importance of standards will their students become interested.

isology: the disipline

Once the theory underlying isology is recognized, the scientific nature of the field becomes clear. Now an area that has been seen mostly as an application, rightfully becomes a discipline of its own. This opens the discipline to new, more rigorous and much needed research as well as attracting students who find the challenge of technical subjects interesting and desirable. As the current researchers understand isology the field will gain a recognized theoretical basis. This basis may then be imparted to educators in the technical fields. When isology is a recognized part of each technical course, the value of studying isology will be clear to many academic students.

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[i] This paper was previously included in survey titled, "The Strategic Value of Standards Education," conducted by The Center for Global Standards Analysis, editor Donald E. Purcell, August 2008. A more extensive version of these ideas was published as Teaching Standards to Engineers, Ken Krechmer, International Journal of IT Standards and Standardization Research Vol 5 No. 2, p. 17-26, Idea Group Publishing, Hersey, July - December, 2007.

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He was a founder and the technical editor of Communications Standards Review and Communications Standards Summary 1990 -2002. In 1995 and 2000 he won first prize at the World Standards Day paper competition. In 2006 he received a joint second prize in the IEC Centenary Challenge paper competition. He was Program Chair of the Standards and Innovation in Information Technology (SIIT) conference in 2001 (Boulder, CO), 2003 (Delft, Netherlands) and 2007 (Calgary, Canada) and is a co- Program Chair of SIIT 2009 (Tokyo, Japan). He is an adjunct lecturer at the University of Colorado, Boulder, CO, USA, where he has taught a three credit unit course on standards, and a Senior Member of the IEEE.

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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.

The following paper is an example of a successful project with good applications and a well-written final report.

Remote Street Lighting Management System with Low-Rate Wireless Personal Area Networks

By Francisco Domingo Perez, Department of Computer Architecture, Electronics and Electronic Technology, Univeristy of Cordoba, Spain

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Abstract—The project entitled "Remote Street Lighting Management System with Low-Rate Wireless Personal Area Networks" is an application of the new wireless communication technologies to the current street lighting system. The project goal is the implementation of a wireless prototype to be used in a remote management system. The prototype is able to control electronic ballasts in order to perform dimming in street lamps, it is also able to control any single light point individually and get some lamp parameters (like actual dimming level, power failures, etc.). The dimming functions allow us to save energy consumption, whereas the individual light point wireless monitorization and control allow us to save in installation and maintenance cost. When it comes to implementing the remote management system we needed a lighting control protocol and a communication protocol. The selected lighting control protocol has been DALI (IEC Standard 62386), since it is a very simple and easy to implement protocol (only two control wires) and it allows us to dim the lamps' light level and also to get a feedback from the lamps. As for the communication protocol we have chosen IEEE 802.15.4, since it is a well-standardized low-energy consuming wireless protocol. This paper shows how the two standards were applied to create the prototype.

I. INTRODUCTION

We start from the fact that street lighting is one the most energy consuming services in a city, reaching heights between 5 – 60 %, in consonance with the city's size and the services the city's government is able to offer [1]. In accordance with several studies carried out by some agencies and companies [2], [3] there exists a huge potential to save energy consumption by investing in new technologies and switching the older lighting. On the other hand, as part of the electrical power grid, the new emerging Smart Grid paradigm not only requires a control, but also to monitor and perform a smart dimming according to demand and need of the end user. This last concept makes necessary the use of a two-way communication protocol, either full or half duplex, in order to know the current set dimming value and some other parameters about both ballast and lamp.

There are some traditional energy saving techniques like total or partial shutdown, but those techniques involve a reduction in the uniformity of light intensity and moreover, they have a very negative impact on lamp life expectancy, increasing maintenance and replacement costs.

As for achieving a reduction in the energy consumption there are some recommended measures [4]. Since street lighting is only active at night hours, one of the proposed measures is the adoption of special tariffs for the street lighting. Another measure is the application of a standardized classification of streets and roads which regulates the light level. In case of Spain, Spanish Order in Council "RD 1890/2008" deals with energy efficiency in street lighting. More technical measures involve the lighting duration control, making use of photocell or astronomical time relays. The most innovative measure is the application of smart electronic dimming ballasts which are provided with a two-way communication lighting control protocol.

There also exist remote management systems which allow an individual remote control and monitoring of any single light point. As it was previously stated, for both monitoring and control it is necessary to use a bidirectional protocol. Toward the implementation of the remote management system only two elements are necessary, the lighting control protocol and the communication protocol.

Taking into consideration the previous comments, this paper focuses on the development of a wireless lighting control prototype to be used in a remote management system for street lighting. The following sections describe and justify the chosen standards (DALI and IEEE 802.15.4) for the lighting control and communication protocols. A description of the implemented prototype is also presented along with some comments about laboratory tests.

II. STANDARDS SELECTION

A. Lighting Control Protocol

When it comes to selecting the lighting control protocol there are two mandatory requirements it must satisfy:

1) Dimming functions
2) Bidirectionality

Other interesting but not mandatory characteristics are the protocol standardization and the simplicity of the control implementation.

The main lighting control protocols are [5]:

- 0-10V
- X-10 AC phase control dimming
- DMX512
- LonWorks
- BACnet
- DALI

0-10V protocol makes light output vary with control voltage; it is approved by ANSI as standard E1.3-2001. It is a one-way communication protocol, so ballasts cannot provide a feedback of the lamp. The standard has not been adopted by ballast manufacturers, so ballast's behavior among different manufacturers is not consistent.

X-10 uses power line wiring for signaling and control. It has been adopted by several manufacturers as a well-established standard. However, its lack of bidirectionality along with the reduced command set (it cannot even send a direct dim level) make it useless for our remote management system.

AC phase control dimming has not any specification or standard, it has the same disadvantages than 0-10V. It is not recommended to be used in a large installation due to power quality problems, since phase-cut technology involves power factor imbalance and harmonic distortion.

DMX512 is a standard for digital communication which is commonly used in theatrical lighting control systems. It is not supported by ballast manufacturers, since its control circuit is too much expensive to be included in the ballast design. In addition, it is a one-way communication protocol, so it cannot be used in a remote management system.

LonWorks is recognized as a global standard for building automation and it is supported by many control device manufacturers. However, its installation is very complex and it is very expensive for applications with a large number of points of control. Consequently, it has not been adopted by major ballasts suppliers.

BACNet is an open protocol, recognized as a global standard for home automation control devices. It was designed as a HVAC protocol, although lighting protocol attributes are going to be adopted into the standard. As LonWorks, it is very expensive for applications with a large number of nodes such as street lighting and its installation is not simple.

DALI stands for Digital Addressable Lighting Interface. It is a two-way communication protocol; ballasts can send operational parameters and some other information concerning both lamp and ballast, like ballast or lamp failures, status, etc. It also allows performing dimming, using direct level commands (in which the desired dimming level is sent) and indirect level commands (where a dim up or dim down command is sent and the ballast sets the lamp arc input power to the next or previous step). DALI control circuit is very easy and cheap to build, using a microcontroller we only need to design a voltage adapter circuit. These characteristics make DALI a suitable option for the street lighting control system.

DALI was defined in annex E.4 of standard IEC 60929 as control by digital signals of electronic control gears (controllable ballasts). The standard is only applied to electronic ballasts for tubular fluorescent lamps. It first version dates from 1990, after two amendments (1994 and 1996) digital signal control of electronic ballasts was introduced in 2003 [6].

This part of the standard was modified by IEC 62386 in 2009. The IEC 62386 series consist of two parts, the first part is the 62386-1xx (general requirements [7], [8]), which is divided in two parts:

- IEC 62386-101:2009: General requirements. System.
- IEC 62386-102:2009: General requirements. Control gear.

The second part is composed of the IEC 62386-200 series, which are particular requirements for control gear, they are applied to fluorescent, incandescent, discharge, emergency, etc. lamps.

Section III explains how the DALI protocol is applied.

B. Communication Protocol

Our intention is to create a network in which any light point of the street lighting system is a node. Since lamp posts separation is only 20-30 m and we do not need to transmit large data packets we can use wireless personal area networks (WPANs). The main WPAN communication protocols are:

- Bluetooth (IEEE 802.15.1) [9] IEEE 802.15.4 [10]
- ZigBee [11]
- 6LoWPAN [12]

Bluetooth only uses a reduced number of network nodes and moreover, the energy consumption is bigger than IEEE 802.15.4. On the other hand, IEEE 802.15.4 deals with low-rate wireless personal area networks; its aim is the standardization of the two lower layers of OSI protocol stack (physical and MAC layers). As it does not define the network layer it does not include any routing mechanism, so the only available network topologies are star and peer-to-peer. This lack of routing mechanism becomes a problem in street lighting, since there is a big presence of obstacles like buildings and we need to cover a wide area with the network. ZigBee implements the network and application layers over the physical layer and medium access control (MAC) defined by IEEE 802.15.4. ZigBee enables IEEE 802.15.4 to form mesh, tree and cluster networks. On the other hand, 6LoWPAN defines encapsulation and header compression mechanisms that allow IPv6 packets to travel over IEEE 802.15.4 networks. Our street lighting application does not need to interface with IP devices and the packet size is very small. Taking into account these characteristics ZigBee can achieve better performance in such an application [13]. The main ZigBee disadvantage is that it is not an interoperable protocol among different manufacturers. As we needed at least a tree network topology we opted for the implementation of our own network layer based on ZigBee working with an IEEE 802.15.4 network. The development of our own ZigBee-based routing mechanism provides us with a proprietary network layer which can be implemented with IEEE 802.15.4-compliant devices from several manufacturers, achieving interoperability.

The next section describes the materials we used during the project and how the standards were applied.

III. SYSTEM COMPONENTS AND METHODOLOGY

A. Components

The selected wireless module has been the DZ-ZB-Gx, manufactured by DiZiC [14]. The module integrates the STMicroelectronics STM32W108 system-on-chip, which integrates a 2.4 GHz, IEEE 802.15.4-compliant transceiver, an ARM Cortex-M3 microprocessor and other peripherals to design 802.15.4-based systems. Apart from being 802.15.4-compliant, DZ-ZB-Gx has been selected because it has a RF power amplifier, achieving a Tx power of +20 dBm (100 mW). We have taken this issue into consideration because the street lighting application may require a strong RF penetration, in order to transmit successfully inside a lamp post or through buildings.

As for the DALI ballast, we have chosen a high intensity discharge (HID) lamp ballast with DALI control interface. We have used HID lamps because most lamps used in street lighting are high pressure sodium (HPS) lamps. Ballasts used were OSRAM Powertronic® PTo DALI 70/220-240 3DIM with Philips SON 70W/220 I E27 1CT. Ballasts are able to perform dimming from 60 % to 100 % of the lamp input power.

B. Methods

Fig. 1 shows the block diagram of the remote management system. The operator controls the light points with a PC SCADA interface. A DZ-ZB-Gx is connected to the PC through the serial port acting as a PC-802.15.4 gateway. Using this gateway we can send data packets to the 802.15.4 transceivers which are mounted in every light point. The microcontroller unit (MCU) processes the data packet and sends the corresponding DALI command to the DALI ballast. The MCU can also receive a response from the ballast regarding the actual dimming level, lamp status, etc.

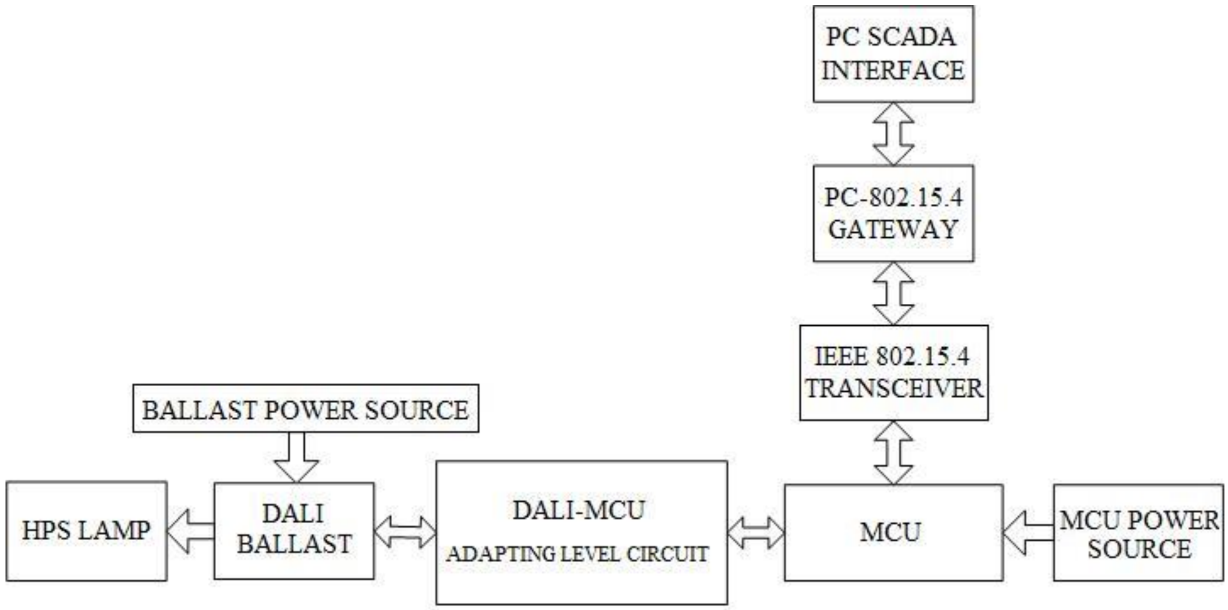

Figure 1: Street lighting remote management system's block diagram

DALI is a master/slave protocol; the master (a DALI controller) sends messages to any slave device (DALI ballast) in the system. Those messages consist of an address field and a command field. Using the address field we can control any single ballast individually. A message sent by the master is called a forward frame; it consists of 19 bits at 1200 bps using a bi-phase encoding (Manchester Differential). The first bit is a start bit, the next 8 bits are the slave address and the next 8 are the command. There last two stop bits are not in Manchester code. There are query commands that makes the ballast enter into active mode and send a backward frame to the master, this is an 11 bits frame with the same characteristic than the forward frame, one start bit, 8 bits with the data response (ballast status, actual dimming level, etc.) and two stop bits. In the address byte of the forward frame only six bits are used for individual addressing. The address byte has the following structure (each letter represents a single bit): YAAAAAAS, where Y takes the value '0' when a short address is used and the value '1' for a group address or broadcast; A is the significant address bit and S is '0' when the command is a direct dim level command (a dimming value) or '1' when it is a DALI command. A master can only have 64 slaves as it can only address 64 directions (six A bits).

DALI is mainly used in home automation since it can only control 64 ballasts. It cannot be used the same way in street lighting due to that reason. Our approach consists of implementing the DALI master controller in an IEEE 802.15.4-based wireless network. We have the DALI ballasts as slaves and the nodes as masters. Nodes are controlled by the PAN coordinator, which is attached to a PC host with the SCADA interface. The coordinator controls any DALI ballast using the node MAC (EUI-64, 8 bytes) or network (2 bytes) addresses instead of the DALI slave device short address, expanding the number of connected devices. When the coordinator message reaches the addressed node the frame is sent from the node to the ballast, one node is only connected to one ballast, so the address byte of the forward frame can be let in broadcast mode (1111111S), allowing us to forget about DALI addresses and to overcome the 64 devices constraint.

A voltage adapter circuit from microcontroller to DALI has been built. A DALI control interface must consider a voltage between 9.5 V and 22.5 V a logical high signal, whereas a voltage in the ±6.5 V interval is taken as a logical low signal. As the microcontroller digital outputs are 0–3.3 V it is necessary to design a voltage adapter circuit to take the 3.3 V to the corresponding interval of a high signal. Fig. 2 shows this circuit. PC1 is set as an output, whereas PB0 is an input.

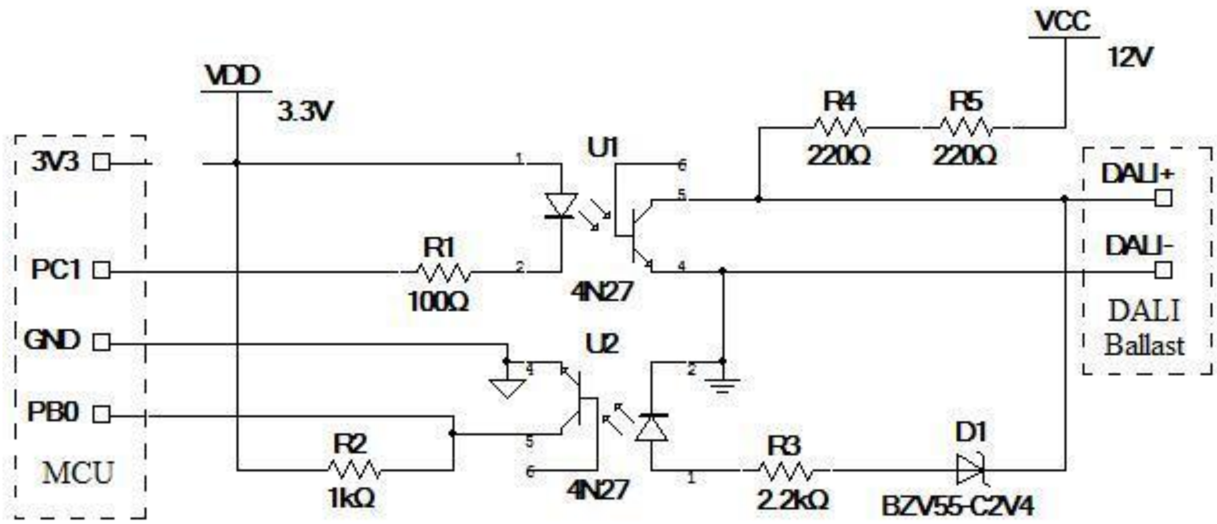

Figure 2: Voltage adapter circuit

Optocoupler U1 deals with the transmission from the node to the ballast, whereas U2 is left in charge of receiving the backward frame when a query message has been sent. PC1 is put in high to transmit a high signal level, so the LED diode in U1 is not biased and its phototransistor is open, hence DALI terminals are in a high logical state. When PC1 is configured as a low level the LED is biased and the transistor is closed. After receiving a query frame the ballast enter into active mode and response with the backward frame, this time a high logical level from DALI terminals turns into a low level in the microcontroller digital input PB0. The microcontroller program is responsible of inverting this value when reckoning the ballast answer. An example of DALI command can be seen in Fig. 3. A query status command has been sent, the figure shows both forward and backward frames and it explains what any bit means.

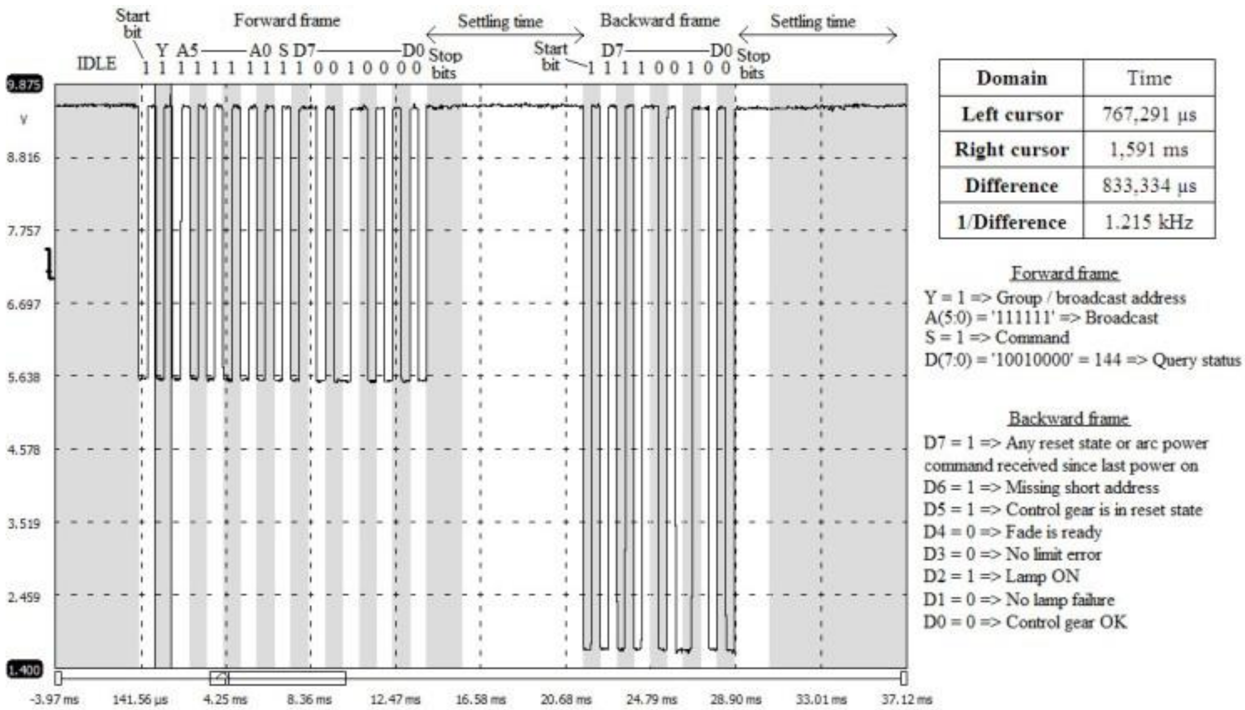

Figure 3: DALI query status command, forward and backward frames

The system is able to send any direct dim level and DALI command from 0 to 255, this command set includes indirect arc power level commands, query commands and configuration commands. Commands beyond 255 are not implemented, since they are used to generate DALI short addresses and we do not need them.

After developing the DALI master with wireless nodes we focused on the ZigBee-based network layer. In order to reach any light point we need a tree or mesh topology. As a tree topology is easier to design we chose this one. The coordinator, which is connected to the PC, is the root of the tree. The coordinator acts as a parent device and is associated to other devices in the network, called children. We have considered that any child can act as a router, i.e. it can act as a parent device too. The tree topology has been designed implementing ZigBee address allocation mechanism. This mechanism is called default distributed address allocation. We set the maximum length of the tree and the maximum number of children a parent can be directly associated. Address number 0 belongs to the coordinator, the address of the rest of the devices are determined with a function which uses the network maximum depth, the maximum number of children per parent and the depth of the device in the network. When this function becomes 0 we have reached the end of the network. Once the addresses are allocated, the network address of the selected node is reckoned with another function. This function only needs the origin address, the destination address and the previous function. References [15] and [16] explain this address allocation method and the mathematical functions.

Nodes' deployment is static and known, so we can use the MAC address (EUI 64) of any node to identify its position in the street lighting system. The coordinator, when it is discovering nodes and addressing the network addresses with the previous method, saves every MAC and its associated network address. The user only needs to know which MAC address corresponds to a light point, the software implemented in the microcontroller will do the rest and the packet will travel through the tree and reach its destination.

Finally, a SCADA interface (Fig. 4) has been implemented using LabVIEW. By using this interface the user is able to create the tree network and send a DALI command or direct dim level to the selected node. Direct dim levels set the lamp's arc input power and not the light intensity level. The interface only contemplates the more usual commands; scenes and so on are not included as they are not necessary in street lighting, but the developed microcontroller software is able to use them.

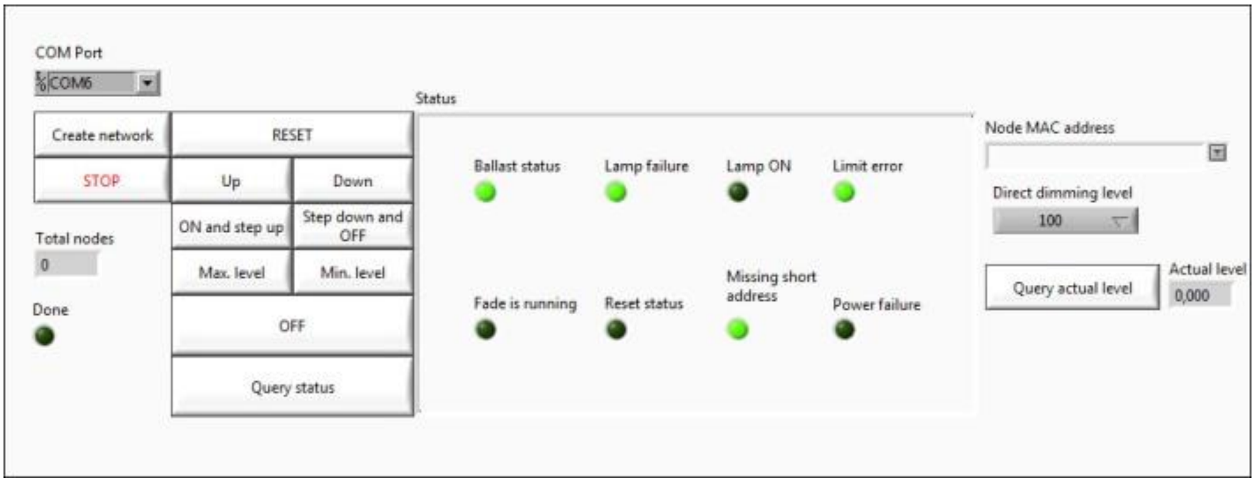

Figure 4: SCADA interface

IV. RESULTS

The system has been tested in laboratory. We have created a small tree network with only a coordinator and three children, forming a tree topology with a length of two depth levels. The coordinator is connected to one child which acts as a router, connected to the two other nodes. Using the SCADA interface it was possible to reach all the nodes and control their attached ballasts. Fig. 5 shows how the lamp input parameters (voltage, current and power) fulfills the expected results. The three graphs show the lower (a) and higher (c) dimming levels and they also show one of the middle levels (76 %, b). Maximum lamp's input power is 70 W, so the wireless network is able to dim as it was specified by the ballast manufacturer and DALI standard.

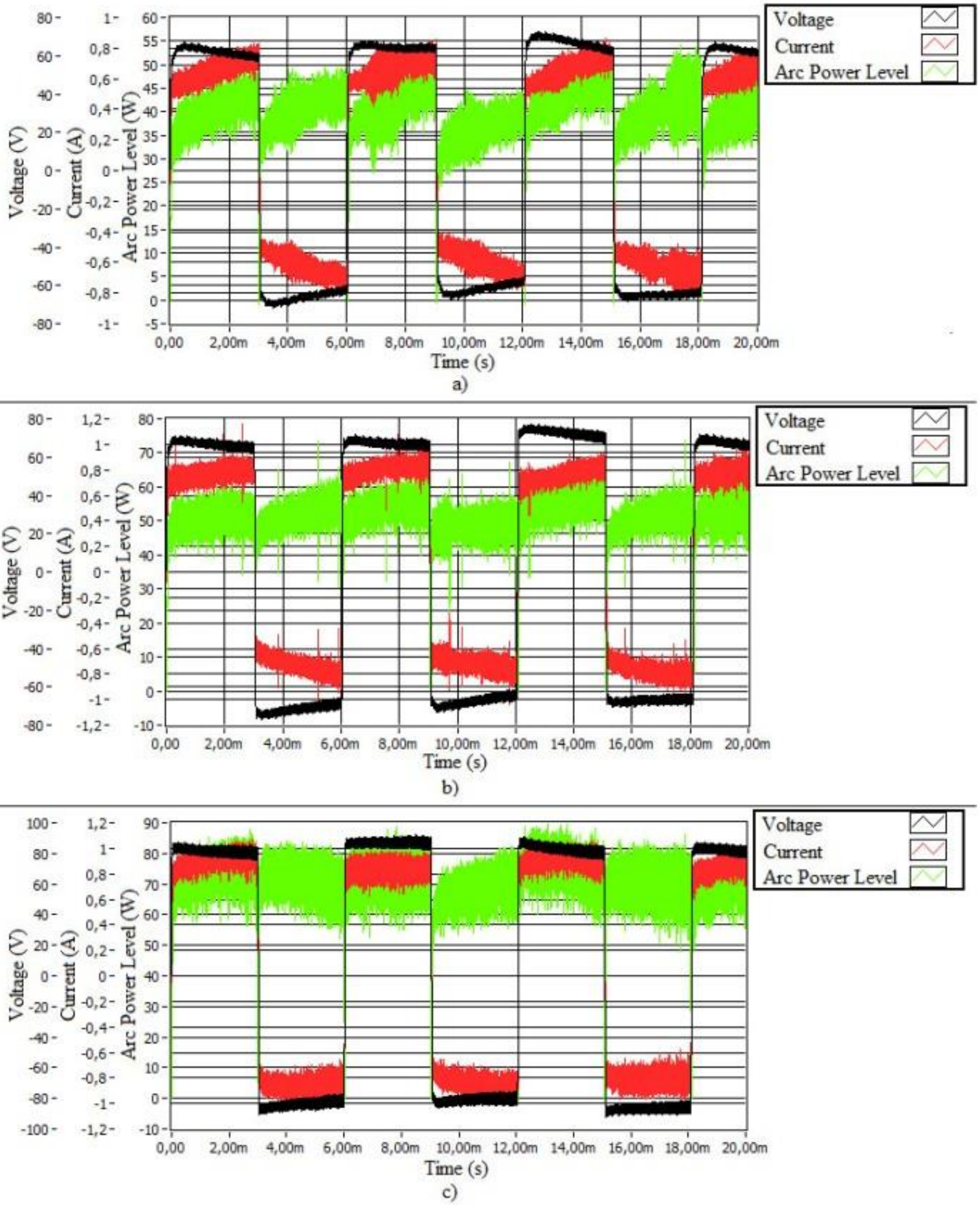

Figure 5: Lamp input voltage; current and power (ballast output).
a) 59,5 % ; b) 71,1 % ; c) 100 %

Another test was performed in order to know the maximum distance a node can reach. The test was performed in the university facilities, with the existence of Wi-Fi (IEEE 802.11) and Bluetooth networks. Both of them work in the same frequency as IEEE 802.15.4 (2,4

GHz), being an important interference source. This test proves that the system can coexist with Wi-Fi and Bluetooth networks. In this environment the nodes could reach a distance of more than 150 m. Separation between light poles is only 20-30 m, so the nodes are suitable for the application.

V. CONCLUSION

A new system for controlling IEC 62386 ballasts has been built using an IEEE 802.15.4-based wireless network. Any commercial ballast which has been built according to DALI standard should be controllable by the nodes. Not only is the system suitable for street lighting, but it also can be applied to indoor lighting and building automation.
Since we have created our own proprietary network layer (even though it is based on ZigBee) over IEEE 802.15.4 we can use any 2.4 GHz full 802.15.4-compliant device and implement the same network layer, whereas if we had used a ZigBee-based device we would have been bound to use that single device. Working over IEEE 802.15.4 physical and MAC layers assures interoperability among different manufacturers.

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IEEE Standards Education Grants and Student Application Papers

by David Law

Knowledge of industry standards helps facilitate the transition from classroom to workplace by aligning educational concepts with real-world applications and market constraints. IEEE encourages the introduction and use of technical standards in the classroom.

In support of the IEEE Standards Education Committee's (SEC) mission, in particular to actively promote the integration of standards into academic programs, the IEEE SEC is offering grants to both students (500 USD) and faculty mentors (300 USD) to promote the use of industry standards in projects.

These grants are offered to students in all stages of their study (e.g., undergraduate, post graduate, doctoral) and for all types of projects (e.g., design, development, research). The grant requires submission of a paper on completion of the project describing the design choices driven by, and the application of, industry standards in meeting the project goal. This provides the applicant(s) the additional opportunity of having a paper published by the IEEE.

The application process is reasonably lightweight and so far the success rate of application has been high, with the main reason for rejection being meeting the requirement to use industry standards in projects. The key to a successful application is to have a project that is based on the investigation or application of industry standards.

Simply using components that conform to a particular standard, for example using an IEEE 802.11™ WiFi Router to communicate a WiFi connected laptop as part of the project, is not sufficient. What we wish to see is a paper that highlights specific design choices in the project driven by an understanding, and application, of the industry standard(s) used.

To learn more and to apply for a grant visit http://standardseducation.org/applications/.

Also, don't miss our FAQ section in this eZine, which is quite helpful.

The SEC reviews each final paper carefully and the accepted final papers are published to our Student Application Papers website. Please take some time to read through the successful papers for some inspiration.

We are also publishing "Best of Student Application Papers" in each issue of the Standards Education eZine. Don't miss the paper, "Remote Street Lighting Management System with Low-Rate Wireless Personal Area Networks," by Francisco Domingo Perez, University of Cordoba, Spain.

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, has served as the Chair of IEEE-SA Standards Board Review Committee (RevCom) since 2008, and is currently serving as the Vice-Chair of the IEEE Standards Education Committee. 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.

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More about Applying for IEEE Standards Education Grants and Student Application Papers

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 report on the results of these projects by writing and submitting a Student Application Paper. The papers detail which industry technical standard(s) was 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. Final papers accepted by the SEC are published to our Student Application Papers website.

The IEEE Standards Education Committee (SEC) offers grants of $500 for students and $300 for faculty mentors to help with graduate and capstone design projects that include an industry standards component. Students report on the results of these projects by writing and submitting Student Application Papers. The SEC reviews each final paper carefully and the accepted final papers are published to our Student Application Papers website.

Applications for the grants may be submitted at any time throughout the year, however the next upcoming deadlines are 15 June 2012 and 15 October 2012.

Frequently asked questions about the IEEE grants

1. **What are the grants for?** The grants are to help support students at colleges and universities worldwide with their design projects. The funds are generally used to purchase much needed materials to help students' projects succeed. The one absolute requirement is the projects include the application of industry standards.

2. **Who can apply?** Any college-level student planning to incorporate industry standards or specifications into their projects, and are in need of additional financial support. Keep in mind that students must produce a final paper, a Student Application Paper, that will be submitted to the Standards Education Committee (SEC) for review. If the SEC accepts the paper, it is published to the IEEE's website.

3. **Do I need to be an IEEE member and do the standards we use have to be IEEE standards?** The answer to both of these questions is no. The standards education grants are for all students worldwide, and as long as your project is using the appropriate technical standards for your project, the SEC requirements have been met.

4. **How are the grant applications evaluated?** The SEC carefully evaluates each application package and according to the following criteria: (a) completeness of submittal package; (b) quality of student abstract; (c) quality of faculty endorsement; (d) whether the project meets the intent of the Standards Education Grant.

5. **How do I apply?** Visit our Student Application Papers website: http://standardseducation.org/applications/ for more information. The application and instructions are also linked below.

Application and Instructions (DOC, 82 KB)

The next upcoming deadline for applications is 15 June 2012 and the one after that is 15 October 2012.

Read successful final Student Application Papers.

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IEEE Standards Life Cycle

By Wael Diab

Second Quarter 2012

Pre-Standardization Phase

Much like one would think of taking a product to market, the life cycle starts prior to design with inception. In the case of a standard the idea would be to explore a potential area for standardization. While the output may eventually be a standard, the deliverable may be different, such as a white paper that assesses the concept, market, and technical viability.

Within the IEEE Standards Association (IEEE-SA), one such tool is a program called industry connections (IC). IC provides some structure to this pre-standardization process while retaining the flexibility to evolve the concept.

The pre-standardization phase is often called the “Exploration” phase.

Standardization Phase

The standardization phase is perhaps the most familiar to people and can be broken down into 6 major areas:

1. Initiate: This is the sub-phase that marks the start and involves defining what the project will do.
2. Mobilize: This is the sub-phase that brings together the stakeholders with their proposals to address the project scope.
3. Draft: This is the sub-phase that involves translating the ideas into a document that would eventually turn into a standards interoperability document otherwise known as the standard.
4. Ballot: This is the sub-phase that deals with building consensus around the document through a review process that allows the participants to comment on the document. This phase is typically associated with participants casting ballots and submitting comments, with the group working on the standard considering those comments and making adjustments to the draft as needed.
5. Approve: This is the sub-phase of the standard that involves the process for gaining approval of the document. The process involves a review of the process that the document development went through to ensure that the policies and procedures applicable were properly followed.
6. Maintain: This is the sub-phase of the process that involves the maintenance of the document. This could include anything from revising the document, dealing with errata, doing a corrigenda or amendment to the base document as the need arises. Some of these steps may cause a re-start of the steps highlighted above (e.g., to do a revision, corrigendum or amendment).

Each one of the above steps can take on a life of its own, and in future eZine articles we will delve into each of them giving examples and relating them to the process that exists within IEEE.

Post-Standardization Phase

The post-standardization phase has to do with market acceptance of the standard and from a product perspective can often be characterized by seeing a plethora of standards implementations. Within that context, a number of programs can help catalyze the acceptance and adoption. For instance, the ability to assess conformity of a product to the standard can come in very handy throughout the value chain of product development for both emerging standards and established ones.

Other Areas

It is important to recognize that there are other parts of the process and lifecycle that overlay on what was described above and may not immediately come to mind. A good example of this may be the intellectual property involved in the standard. A strong process to deal with such areas can help make standards more successful in the market place.

IEEE-SA Website

The IEEE-SA website has recently gone through a major set of changes and now has a brand new look. As part of that effort, the underlying lifecycle related pages now appear under the lifecycle diagram that you see below making it very easy to explore and learn about it. I would strongly encourage you to visit the site and take a look at the lifecycle.

Final Thoughts

As noted above, in future editions of the eZine we will delve into more details of the various phases providing examples and tying it back to the lifecycle website.

The IEEE and the IEEE-SA is a unique organization when it comes to the governance and participation in the standards lifecycle as it is open to virtually any volunteer to participate making a truly international organization for participation and governance. This concept is reinforced through the implementation of the lifecycle.

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.

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Standards Development 101

Getting involved in the development of IEEE standards provides you the opportunity to network with industry peers, broaden your understanding of industry and technology, and gain familiarity with the content of standards in which you are involved—facilitating early compliance and anticipating market requirements.

There are many ways to get involved in IEEE standards. You can:

- Submit project request—to start a new standard.
- Join working groups—to develop standards.
- Join invitation pools—to express your interest in voting or balloting on standards.
- Become a member of a balloting group—to vote on the technical integrity of the standard.
- Become an individual or corporate member of the IEEE-SA—to get connected to a community of standards developers and users.
- Become a member of our governance—to ensure the standards process has been followed and to help set the direction of the IEEE-SA.
  » IEEE-SA Standards Board
  » IEEE-SA Board of Governors

Each IEEE standard follows a set path from concept to completion, which adheres to the principles of due process, openness and consensus. These principles allow for equity and fair play so no one interest category dominates the process, and any organization or person with a desire to participate in a proposed standard can do so.

Visit the IEEE Standards Association Second Life site to learn more about the IEEE Standards Association and development process.

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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.

Contributions

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

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Recent and Upcoming Standards Education Events

ANNOUNCEMENT OF U.S. FEDERAL FUNDING OPPORTUNITY FOR THE NIST MEASUREMENT SCIENCE AND ENGINEERING (MSE) RESEARCH GRANT PROGRAMS STANDARD SERVICES GROUP (SSG) GRANT PROGRAM

The Education Challenge Grants are a special funding opportunity offered by the NIST Standards Services Group to strengthen education and learning about standards and standardization and support the integration of standards education into the undergraduate or graduate course curriculum in a meaningful way.

These small grants are intended to encourage programs of higher education in the fields of business, engineering, and information technology and information science to design, test, and evaluate specific innovations in the teaching methods, curricula, class assignments, student projects (including capstone projects). The goal is to educate students about the impact and nature of standards and standardization so that they enter the workforce and or continue their academic studies with a strong understanding and appreciation for the value and benefits of standards and standardization. A secondary goal of this Program is to identify new approaches, methods, and models that can be replicated or built-on by other educational programs.

More information.

Save the Date! Tuesday, 10 July 2012 - Frankfurt/Offenbach - Germany

STANDARDIZATION: Living in the Smart Cities of the Future
eLife, eWork, eMobility and Connecting to Smart Grids

IEEE and DKE are partnering for a one-day workshop to promote the importance of standardization to practicing engineers and to highlight their key activities relating to the Smart Grid technology field, specifically eMobility and other aspects of Smart Cities. Please join us...

More information

ANSI Launches First Student Paper Competition

In an effort to raise awareness of the strategic importance of standards and conformance among students at the university level, the American National Standards Institute (ANSI), in conjunction with its Committee on Education (CoE), is pleased to announce its first student paper competition. Entries are due by August, 1, 2012. First prize is $2,500.

The theme of the 2012 ANSI Student Paper Competition, How Standards Facilitate Innovation and Benefit Society, seeks differing perspectives from a wide range of disciplines on how standards facilitate innovation and how society as a whole can benefit.

View the flyer for all the details and to learn how to apply.

Conferences & Workshops

2012 Capstone Design Conference, 30 May-1 June 2012, Champaign-Urbana, IL USA

Conference will provide a forum for engineering and applied science faculty to share ideas about improving design-based capstone courses. The conference theme will be Industry Involvement.

2012 IEEE/PES Transmission and Distribution Conference and Exposition (T&D), 7-10 May 2012, Orlando, FL USA

Transmission and Distribution Conference and Exposition is the largest Power Engineering Society Conference in the USA. Designed to cover all aspects of the Power Industry, Transmission, Distribution, Substations, Metering, Controls and all aspects of Power Systems.

2012 IEEE 38th Photovoltaic Specialists Conference (PVSC), 3-8 June 2012, Austin, TX USA

Premier technical conference covering all aspects of Photovoltaics (PV) technology from basic material science to installed system performance. We also continue our vibrant Industrial Exhibition that brings our PV scientist and engineers together with the PV industry.

2012 IEEE Power & Energy Society General Meeting, 22-26 July 2012, San Diego, CA USA

The annual IEEE Power & Energy Society General Meeting will bring together over 2000 attendees for technical sessions, student program, awards ceremony, committee meetings, and tutorials.

If you would like to share information or announcements about any recent or upcoming events related to Standards Education, please contact our IEEE eZine staff editor Jennifer McClain at j.mcclain@ieee.org.

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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:

- standardization activities in technical areas such as Networking Standards;
- 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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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.

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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.

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, has served as the Chair of IEEE-SA Standards Board Review Committee (RevCom) since 2008, and is currently serving as the Vice-Chair of the IEEE Standards Education Committee. 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.

Geoffrey O. Thompson is the Principal of GraCaSI Advisory Services and a senior member of the IEEE and IEEE-SA. He is Member Emeritus of the IEEE 802 Executive Committee and former chair of 802.23 and 802.3. He has served has served in numerous IEEE-SA governance positions and is a member of the Registration Authority Committee. He has over 40 years of business experience with Xerox and Nortel and has worked in Manufacturing, Field Service, Research and Development, and Standards Development. He received the BSEE from Purdue University in 1964 and has 12 U.S. patents. Mr. Thompson has been awarded the IEEE Standards Medallion and the IEEE Standards Board Distinguished Service Award.

IEEE Standards Education eZine Editor: Jennifer McClain

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On Education Standardization and Standardization Education in China

By Zhongmin Wang, Director General, China National Institute of Standardization

Second Quarter 2012

Chinese Translation

关于中国的教育标准化和标准化教育

在中国，国家教育部门正在组织研究制定 100 个本科专业类教学质量的国家标准。有媒体报道说："此举将为本科专业教学提供一个'云层'范围的标准，可能为未来高校扩大专业设置自主权提供更大的空间。"另外，"教育部正在推动省级教育行政部门、行业组织和高校联合制定相应的专业教学质量标准，以形成中国高等教育教学质量标准体系。"

将标准、标准化、标准体系等概念和方法引入国民教育领域，这肯定是一项创新的举措，既是教育的创新，也是标准化的创新。正如大家所知，标准和标准化的兴盛发达是伴随着欧洲工业革命的进程发展起来的，在很长一段时间内，其应用范围主要局限在工业领域。只是从上个世纪七十年代开始，标准才以现代管理领域为突破口，逐渐实现了全方位的发展。

用标准、标准化和建立标准体系、实行标准化管理等手段和方法规范教育质量，过去在中国没有这样做过，而且据我目前掌握的信息，也鲜见发达国家的专业标准化组织曾经这样做过。这无疑是一种很有意义的尝试。值得思考的是，如何理解教育质量和标准、标准化之间的关系；如何运用标准化的原理和方法建立教育质量方面的标准体系；建立之后如何实施；实施后怎样检验或评价效果等等。这些问题都需要在创新过程中认真设计，认真尝试，循序渐进。

作为专业的标准化工作者，其实我更关心的标准化教育本身。遗憾的是，到目前为止标准化教育在中国国民教育体系中还找不到应有的一席之地。这种情况不单在中国如此，在全世界其他国家的情况也相仿。

为什么会这样？这与标准化长期以来一直是以研究应用技术的定位是分不开的。标准化工作者本身也大都具有工程师背景，他们制定标准的目的主要是为了实际应用。由于过去标准化工作的领域主要集中在第二产业，农业和服务业以及其他方面还没有出现这种需求，所以标准化工作者的专业知识主要是依靠业内组织的培训或再教育来完成的。

现在不同了，现代社会对标准和标准化的需求已经远远超出了工业革命时代，不但工业企业需要懂标准和实施标准化的白领和蓝领，第一产业、第三产业和社会各个方面，都产生了对掌握标准化知识的复合人才的广泛需求，就连教育界本身也是如此。在这样的情况下，我们完全有理由大声呼吁：标准化教育理应提上国民教育的日程中了。比如，从儿童教育开始，应该在教学内容中增加一些标准、质量方面的知识；在大学教育中，为工程类、管理类专业学生增设标准化课程等，为各专业学生推荐并提供基础标准供其应用。中国标准化研究院将基于中国特色和标准化基础理论，不仅帮助教育界提高标准化水平，更持续推动标准化教育的持续发展。

作者简介

王忠敏，现任中国标准化研究院院长兼党委副书记，研究员，中国节能减排标准化技术联盟理事长。法学研究生学历、拥有工学硕士。曾任国有大型冶金企业厂长、葫芦岛市政府常务副市长、辽宁省质量技术监督局局长、中国东北大区计量测试中心主任、中国辽宁法学会副会长等职。

王忠敏先生曾于 2001 年任中国国家标准化管理委员会副主任，后任中国特种设备检测研究院党委书记兼副院长、兼任中国物流标准化技术委员会主任、国际地理标志网络组织（OriGIn）副主席、中国认证认可协会常务理事、中国标准化协会副会长等职务。并曾于 2003 年至 2005 年任国际标准化组织 ISO 理事会理事。

王忠敏先生作为资深标准化专家，多年来对企业管理、宏观经济管理和标准化工作有较深研究，著有及主编《企业管理手册》、《标准化新论》、《标准化基础知识实用教程

》、《国际标准化教程》、《中国技术标准发展战略研究课题研究报告》等，发表各种论文和文章 140 多篇。

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The Bottleneck in Standardization Education and the Solution of China National Institute of Standardization

By Wenhui Zhao, China National Institute of Standardization

Second Quarter 2012

Chinese Translation

标准化教育的瓶颈与中国标准化研究院的破解之道

2010 年，在中国政府标准化主管部门的授权与支持下，CNIS 成立了标准化理论与教育研究所，专门从事理论研究、教材编写、职业培训等系列工作，系统推动中国标准化教育的开展。

在工作过程中，标准化理论与教育研究所敏锐地发现了中国标准化教育存在的若干瓶颈，并不断尝试通过理论建设与创新实践相结合的方式来解决。问题主要集中在以下三个方面：

瓶颈之一：现有标准化教育内容的系统性不强

尽管标准化界专家不断尝试开发教材教辅，但在具体的学校教育中，教师主要根据自身兴趣开展教学，具有一定的局限性。比如，很多学校都在质量管理课上讲授 ISO 9000 系列标准的内涵，却不介绍 ISO 标准的制定过程以及中国如何将 ISO 标准转化为国家标准的过程。这使得学生只了解标准本身，而不知道参加标准化活动的方法，不利于标准的持续改进。为解决这方面的问题，CNIS 结合理论研究的成果，从系统化的高度推动建设“标准化知识体系”并不断完善细节。这相当于给从事标准化教育的人员一张“地图”，可以观察到标准化教育的全貌，从而为接受教育者提供更加全面的知识。

瓶颈之二：教育界对标准化教育重视程度不够

在学校教育中，教学人员和管理者面临选择困难—每门学科都有其重要性，众多学科分类与有限的教学资源有着天然的矛盾。如何证明为标准化教育进行投入的必要性和价值回报呢？为此，CNIS 与合作高校等教育机构展开紧密合作，设立教育试点，用公开和可衡量的教学过程与成果展示标准化教育带来的成效；例如，CNIS 正在与北京理工大学

在工业工程专业 “工程硕士”的教学中进行标准化方向培养的试点，共同研发教学方案，拟在 2012 年秋季入学的硕士生中讲授“标准化基础知识”的课程，这一试点结果将定时向“工程硕士教育指导委员会”报告，吸引更多院校参与。

同时，CNIS 还积极协助教育部门开展“教育的标准化”，如校园设施等领域的标准化，让教育群体自身参与到标准化活动中，用实践来加强教育界对标准化的认知和接受程度。

瓶颈之三：学校教育与市场认可之间存在脱节

企业希望内部从事标准化工作的人员能掌握行业技术、熟悉相关行业的基础标准，了解参与标准化的方法。这就需要在校接受教育的学生在知识结构上高度吻合，既便于学生求职，也利于企业更容易找到合适的人才。

从实际情况出发，CNIS 组织标准化专家、行业专家和大学教授一同工作，共同研讨如何开展相关专业涉及的行业基础标准、标准化基础知识以及工作能力的教育和评估，并拟就上述内容展开认证等工作。CNIS 力争通过一段时期的努力，使“工程硕士”教育相关专业教育与“标准化职业资格认证制度”结合起来。届时，学校可以自愿申请参加此类认证项目，调整教学内容，接受标准化教育的学生在毕业时可拥有申请相关“职业资格”的资格，成为学生在该领域求职时的权威认证。

标准与现代文明的传承密不可分，全球社会快速变化也导致标准化活动本身表现出了一些新特征，推动标准化教育正成为大趋势。在该领域，CNIS 正在探索包括但不限于上述三方面在内的教育模式和教育方法。我们愿意听取各界人士对此的意见和建议，共同致力于通过标准化教育来提高标准化工作的成效，推动经济与社会的和谐发展。

作者介绍：

赵文慧，现任中国标准化研究院理论与教育研究所助理研究员，长期从事标准化教育和学科建设的工作。是中国全国教育服务标准化技术委员会（SAC/TC 443）委员、国际标准化教育合作组织（ICES）的成员。

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IEEE Standard 1888™: Green Community Infrastructure and Protocol, Promoting Green ICT and Smart Energy Management

by Liu Dong, Chair of IEEE 1888 Working Group and President & CEO of Bll Group Holdings Ltd, and Gu Chen, Manager and Chief Engineer, Technology & Standards Department, Bll Group Holdings Ltd.

Second Quarter 2012

Chinese Translation

IEEE1888 国际标准：
绿色社区基础架构和协议，助力绿色 ICT 产业，实现智慧能源管理

摘要：2011 年 3 月，全球最大的专业技术协会美国电气和电子工程师协会(IEEE)宣布，IEEE 标准化协会正式批准并发布了源自中国创新技术的泛在绿色社区控制网络协议标准，即 IEEE 1888 标准。IEEE 1888 以绿色节能为宗旨，是 IEEE 在节能减排和物联网领域具有标志性的全球标准，也标志着我国在绿色节能国际标准制定方面取得了重大突破。

本文从 IEEE 1888 的发展历程、推进状态以及发展计划入手，从系统架构、协议框架以及技术创新点等方面深入阐述了 IEEE 1888 标准的技术体系，最后对 IEEE 1888 标准的应用情况做了简明的介绍。IEEE 1888 标准自发布以来，得到了全球产业界的广泛关注和支持，随着 IEEE 1888 的广泛采用和大规模部署，必将为全球的节能减排作出贡献。

关键字：IEEE 1888，泛在绿色社区，IPv6，信息通信技术，节能减排

1 前言

随着全球能源资源危机以及环境恶化问题的日益凸显，如何基于以互联网为中心的 ICT 技术，实现下一代绿色能源管理成为了全球性的问题。新型的能源管理应该是综合的，广域的，智慧的，其涵盖范围扩展到了能源消耗的可视化、能源浪费和改进的诊断、能源效率的提升、舒适度自动控制、能源供需平衡控制等各方面。目前普遍认为，在区域内部部署设施网络是实现能源管理的有效工具。但在实际的部署推广中，现有的能源管理系统通常拥有独立的数据库，独立的协议、标准和平台，呈现专有封闭的形态，很难实现彼此的兼容。除此之外，新型能源管理已经扩展到建筑群、社区、区域、城市等更大范围，急需新兴的协议架构，来实现广域范围的综合能源管理。

在此背景下，为了打破传统控制管理框架的限制，解决各能源管理系统的协同、大规模部署、远程操作等问题，实现易于开发和使用的标准化开放能源管理系统，IEEE 1888 协议标准应运而生。作为泛在绿色社区网络控制协议，IEEE 1888 标准在设计之初就充分考虑了不同设施之间的协同问题、能源管理时的数据挖掘问题、设施维护期间的异常处理问题、开放应用的引入问题等。基于以上设计考虑，IEEE 1888 深度融合了基于 IPv6 的下一代互联网技术以及物联网技术，将其应用于大规模建筑系统，融入能源管理以及节能环保领域，建立了标准的、网络化的、开放

的、智能的新型能源管理系统。通过 IEEE 1888，各种规模的耗能设施可实现自由联网，设备及能源信息可实现互联网在线管理，实现广域范围的集中监测、可视化、优化管理、远程控制等。

作为 IEEE 标准协会支持的首个由中国企业主导的，以绿色节能为宗旨的，信息通信技术与节能减排融合的创新型技术标准，IEEE 1888 得到了 IEEE 以及全球众多厂商、研究机构的高度支持和关注。在此基础之上，2011 年 6 月份成立了 IEEE 1888 系列标准的三个子工作组，分别关注于网络管理与运营、异构网络融合以及网络安全方面，相应标准正在加速制定中。

2 IEEE 1888 技术体系

IEEE 1888 标准采用了先进的信息通信技术，描述了一种基于泛网连接的数字社区、智能建筑群、数字化城市网络的远程控制框架结构，对泛在绿色社区的设备、服务、命令和通信过程给出了标准的定义，并规范了设备和系统之间的通信接口以及消息交互的格式和流程。

2.1 IEEE 1888 的系统架构

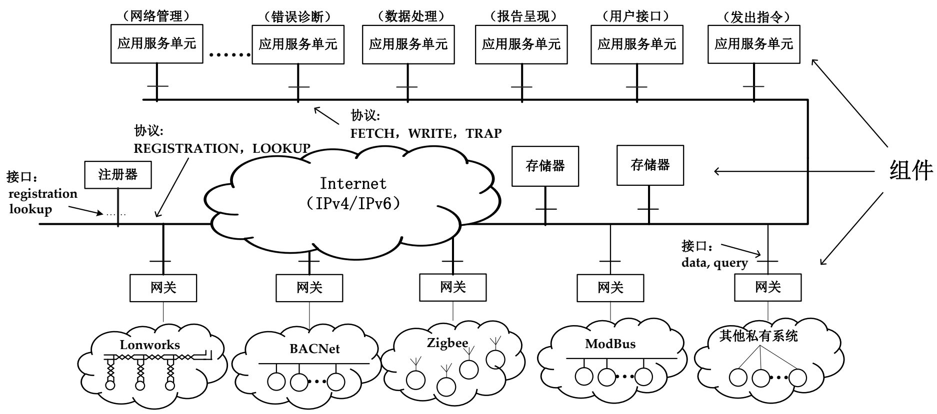

图 1 IEEE1888 系统架构

如图 1 所示，IEEE 1888 系统基于开放的 TCP/IP 网络架构，利用 IP 网络互联设备，传输报文。系统包括了网关、存储器、应用单元以及注册器，采用以数据存储为核心的架构。网关连接不同类型的设备，获取数据并按照 IEEE 1888 标准进行抽象和封装，按照 IEEE 1888 标准格式发出指令。存储器长期存储大量标准格式的数据序列，对外提供数据的读写功能，体现了面向数据的组网思想。应用单元支持多种功能，如为用户提供可视化接口，向网关发送指令，进行数据分析等。网关、存储器和应用单元统一抽象为“组件”。注册器是组件的代理，管理元信息，负责组件之间的绑定关系。

2.2 IEEE 1888 的协议框架

IEEE 1888 协议遵从 OSI 简化模型的分层体系结构，属于 OSI 简化模型中应用层的协议体系。物理层和数据链路层不受各种局域网技术的限制，可以采用各种广泛应用的底层传输协议。网络层和传输层采用全 IP 结构，支持 IPv6。应用层支持各种主流的控制信令协议，采用 XML 对应用数据格式进行统一规范，通过标准化的设备抽象并为最终用户的应用系统提供开放的接口。

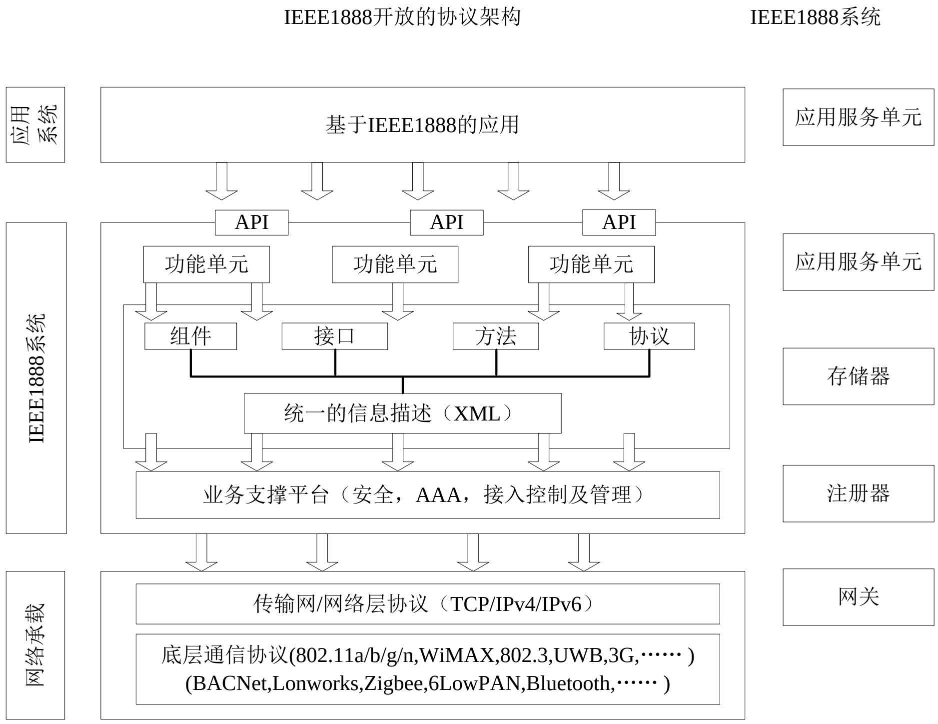

图 2 IEEE 1888 协议框架

IEEE 1888 对功能实体进行抽象建模，定义了通信发起方和通信响应方之间的信息交互过程，实现功能实体之间远程的同步通信和异步通信。

在 IEEE 1888 系统中，网关、存储器和应用服务器统一抽象为“组件”，对外提供数据写入接口和数据查询接口，支持统一的通信协议，包括 FETCH 协议、WRITE 协议和 TRAP 协议。FETCH 协议用于从组件获取数据，支持分包传输。WRITE 协议用于向组件写入数据。TRAP 协议支持异步通信，实现基于事件的信息交互。

注册器是不同于组件的功能实体，对外提供组件注册接口和组件查询接口。组件与注册器之间的通信协议包括 REGISTRATION 协议和 LOOKUP 协议。REGISTRATION 用于注册组件信息和角色信息，LOOKUP 协议用于向注册器查询其他组件的信息。

IEEE 1888 系统的通信协议通过对接口采用远程过程调用方法实现，消息发起方请求调用消息响应方的 API 方法，响应方返回相应消息。请求消息和响应消息具有相同的格式，其数据模型以树状数据结构描述。通过主流的 XML 方法描述消息格式，IEEE 1888 统一定义通信协议的数据结构及实现方式。

2.3 IEEE 1888 的技术创新点

1) 基于多协议网关的全 IP 架构，兼容 BACNet、Lonworks、Modbus 等主流的工业控制总线系统，支持 6LowPAN、WiFi、Zgibee、2G、3G 等多种无线接入技术。
2) 开放的体系架构。基于 IP 进行数据传输，通过对能耗设备的建模，定义标准的通信接口和通信协议，并基于 XML 描述以及传输消息。
3) 以数据库为中心，实现信息共享，支持数据挖掘、加工处理、参考比照以及业务生成。
4) 基于云的能源管理平台，实现大量设备以及海量数据的快速处理，支持个性化的优化方案，作为透明平台支持多样的第三方应用开发。

3 IEEE 1888 应用

IEEE 1888 标准采用开放体系，可广泛应用于建筑、能源、交通、工商业、农业等各种领域。IEEE 1888 标准得到了产学研的联合认可，目前已在部分地区进行了试点应用，带动了包括芯片、设备制造、网络服务等多个价值链环节的发展，有力带动了物联网产业价值链的增长。此外，基

于 IEEE 1888 标准的大规模部署，将为全球的节能减排作出重要贡献。

4 总结

IEEE 1888 标准基于开放的 TCP/IP 体系，采用了信息通信领域内成熟和新兴技术，支持不同的物理接入技术，并可以与下一代融合网络完美集成。IEEE 1888 借助于监测、控制等基本手段，对各类设施进行协同管理，充分利用各种能源，通过信息流最终控制能源流，其表现形式不仅为能源的节约，更注重于能效的提升。IEEE 1888 的最终目标是通过新型的能源管理，实现高效舒适的生活。

作为一种融合标准，IEEE 1888 提供了标准化的通用系统架构，极大地支持现在已有的分散的、局部的能源管理应用，以及可能在未来提供给终端用户的多种多样的新型应用。借助于 IEEE 1888，可以实现泛在网络设备和基础设施的智能互联、协同服务、远程控制和统一管理，为运营商、社区管理员、公共服务提供商、政府部门和个人用户提供远程控制和协同管理的解决方案，提供能耗监测，能源节约等服务，缓解能源危机，实现有效的节能环保。

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IEEE Standards Development in China

By Ning Hua, Director of China Operations, IEEE

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Chinese Translation

IEEE标准在中国的发展

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IEEE 是世界最大的专业技术协会，它致力于通过推进技术创新而造福人类。目前，IEEE 在全球 160 个国家共有 40 多万会员。IEEE 和其会员正通过高引用率的出版物、会议、技术标准以及各种专业和教育活动来鼓舞和激励一个全球性团体。

I. IEEE在中国

现在，IEEE在中国有9000多名会员，其中2500名为学生会员。大部分会员来自中国一流的高校、研究院所和优秀的公司。此外，中国还有60多名来自众多前沿科技产业的IEEE会士。1984年，IEEE在中国的第一个分会—北京分会成立。到2011年年底，IEEE在中国的7个分会全部成立，包括北京分会、成都分会、哈尔滨分会、南京分会、上海分会、武汉分会和西安分会。同时，还成立了4个IEEE支分会。到2011年为止，中国共成立了约100个专业技术委员会和25个学生分会。

2007年到2012年间，IEEE在中国举办的会议数量飞速增长，从原来的约50场迅速增至了200多场。IEEE会议为中国的作者和演讲嘉宾提供了一个展示成果、交流观点的国际性权威平台。许多IEEE分会、专业技术委员会和学生分会也积极举办各类地方性活动和会议，为其会员和志愿者提供交流合作的机会。

2010年，IEEE宣布：广州的暨南大学成为中国第100所与IEEE签署协议订购IEEE电子图书馆的学校。这也标志着随着中国一直致力于推动教育发展，IEEE Xplore在中国高校中的用户群体在两年间获得了极速发展。

为确保专业技术人员的技能获得提高，知识得到增长，IEEE于2009年在深圳举办了在职教师培训项目（TISP），2010年在北京举办了科技英语研讨会（TEP）。这些活动吸引了很多师生前来参加，促进了他们在科技领域知识能力的提高。此外，为鼓励中国成为国际认证机构的成员并遵循国际标准，IEEE还和中国当地的协会及政府机构合作在中国举办了几场有关认证的研讨会。

2006年经IEEE董事会批准，IEEE中国代表处于2008年1月21日举行开业庆典，正式成为IEEE在中国的法定代表机构。IEEE中国代表处负责扩大IEEE在中国的认知度，增加会员人数，进一步加强与当地会员、产业界、政府、学术机构以及相关部门的联系和合作，通过有价值的各种活动、产品和服务最大程度地扩大IEEE的影响和作用。目前，IEEE中国代表处坐落于北京海淀，共有五名工作人员。

II. IEEE标准在中国的发展

从2007年到2012年，IEEE标准活动在中国得到了迅速的发展。2011年底，IEEE标准协会在中国的公司会员达到13家，个人会员近百人。

IEEE公司会员包括:

北京交通大学

北京邮电大学

天地互连信息技术有限公司

中国电信

烽火通信科技股份有限公司

天津海润恒通科技有限公司

华为技术有限公司

青岛高校信息产业有限公司

国家电网

清华大学

中兴通讯股份有限公司

中科院电工研究所

工信部通信标准研究所

III. 国际标准制定

IEEE 1888™-2011“泛在绿色控制网络协议标准”由天地互连、中国电信、清华大学、北京交通大学发起制定，并得到了其他国家成员的支持。2011年3月，该标准获得批准发布。IEEE 1888 源自中国的创新技术，通过全球协作实现，是IEEE在能源领域具有标志性的全球标准。

IEEE 1903™-2011“下一代服务重叠网络的功能架构（NGSON）标准” 是由中国移动、华为和工信部通信标准研究所发起制定的，于2011年12月获得批准。

中国公司参与制定或发起的其他IEEE标准包括:

IEEE P2030.3“电力储能设备测试和电力系统应用标准草案”由中国国家电网公司发起制定。

IEEE P1862 “1000KV下超电压和绝缘配合或特高压交流输电工程标准” 是中国国家电网公司发起制定的另一标准。

IEEE P1860 “在1000KV下的电压和无功功率或特高压交流系统标准”也是由中国国家电网公司发起制定的。

IEEE P1861 “在1000kV下对Sitehand-Over的验收测试或特高压交流电设备和调试程序的标准” 由中国国家电网公司发起制定的。

IEEE P1851 “基于传感器的家电集成测试应用软件设计草案标准”由青岛高校信息产业有限公司发起制定。

IEEE P1904.1 “以太网无源光网络服务互操作性一致性测试标准草案” 的制定开发获得了中国电信的积极支持和参与。

IEEE 802 局域网/城域网标准得到了中国移动、中国电信、华为、中兴和烽火等中国公司的积极参与。

此外，IEEE还与众多中国的国家标准组织建立了良好的关系。在2007年、2009年和2011年，IEEE分别与中国标准化研究院、中国电子技术标准化研究院以及中国通信标准化协会分别签署了合作备忘录。这些合作备忘录的签署标志着IEEE与中国国家标准机构的合作开始深化，也标志着IEEE在全球标准制定合作和市场执行方面走在了前列。

IV. IEEE标准教育活动在中国的开展

作为世界重要的标准制定机构，IEEE意识到了标准在工程、技术和计算领域的重要作用，因此，IEEE 教育活动委员会和IEEE标准协会联合成立了IEEE标准教育委员会(SEC)。随后

，IEEE通过为本科生、研究生、教师及其他教育工作者提供免费的技术标准在线辅导课程和案例研究来介绍和教授相关标准教育资源。该项目旨在通过将教育理念聚焦实际应用来促进课堂教学向专业实践的转变。

2010年，IEEE标准教育委员会和中国标准化研究院(CNIS) 联合在北京举办了IEEE-CNIS标准教育论坛。论坛围绕IEEE和CNIS在标准教育方面的实践展开讨论，回顾了标准教育的经验，标准教育的发展趋势，以及该领域发展所需的指导意见。来自中国、美国、韩国和欧洲各国的专家出席了论坛，并发表了演讲。80多名与会者进行了热烈的讨论。此次论坛推广了技术标准知识，在学术界和产业界同时推动了技术标准教育活动的广泛开展。

IEEE标准教育委员会还为大学生提供了$500的助学金（同时也为其导师额外提供一定金额的补助）用于科研项目的设计和开展，以帮助其通过运用产业技术标准来完成项目。IEEE标准教育委员会最近批准了中国两所高校在校生的助学金申请，分别是西安交通大学电气工程学院和上海交通大学机械工程学院。更多申请信息可以通过访问“学生申请常见问题”获得。.

华宁是IEEE中国代表处首席代表，中国区总监。　目前，他负责IEEE在中国活动的策划，组织和管理的工作；负责发展同中国政府，企业和学术界的交流与合作；负责在新兴市场国家，特别是在中国，寻求和发展IEEE新的机会和增长点；维护和发展IEEE在中国企业和学术界中的知名度和形象；推广IEEE的产品和服务

之前，华宁在天地互连信息技术有限公司(BII)服务 6 年，担当副总裁兼 CTO 一职。BII 是在中国领先的互联网和电信行业的研发和咨询公司，是在下一代互联网，WiMaX，UWB 等技术的应用和推广中起先锋和领导作用 。

华宁在北京邮电大学获硕士学位。

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