National Institute of Standards and Technology
U.S. Department of Commerce

Industry-Academic Teaching Support Workshops:

November 20-21, 2014 ● Pittsburgh, PA

Standards Challenges and Cybersecurity:
Implications for Distributed Systems (Business Infrastructure, Cloud Computing, Smart Grid/Smart Cities) and User Privacy

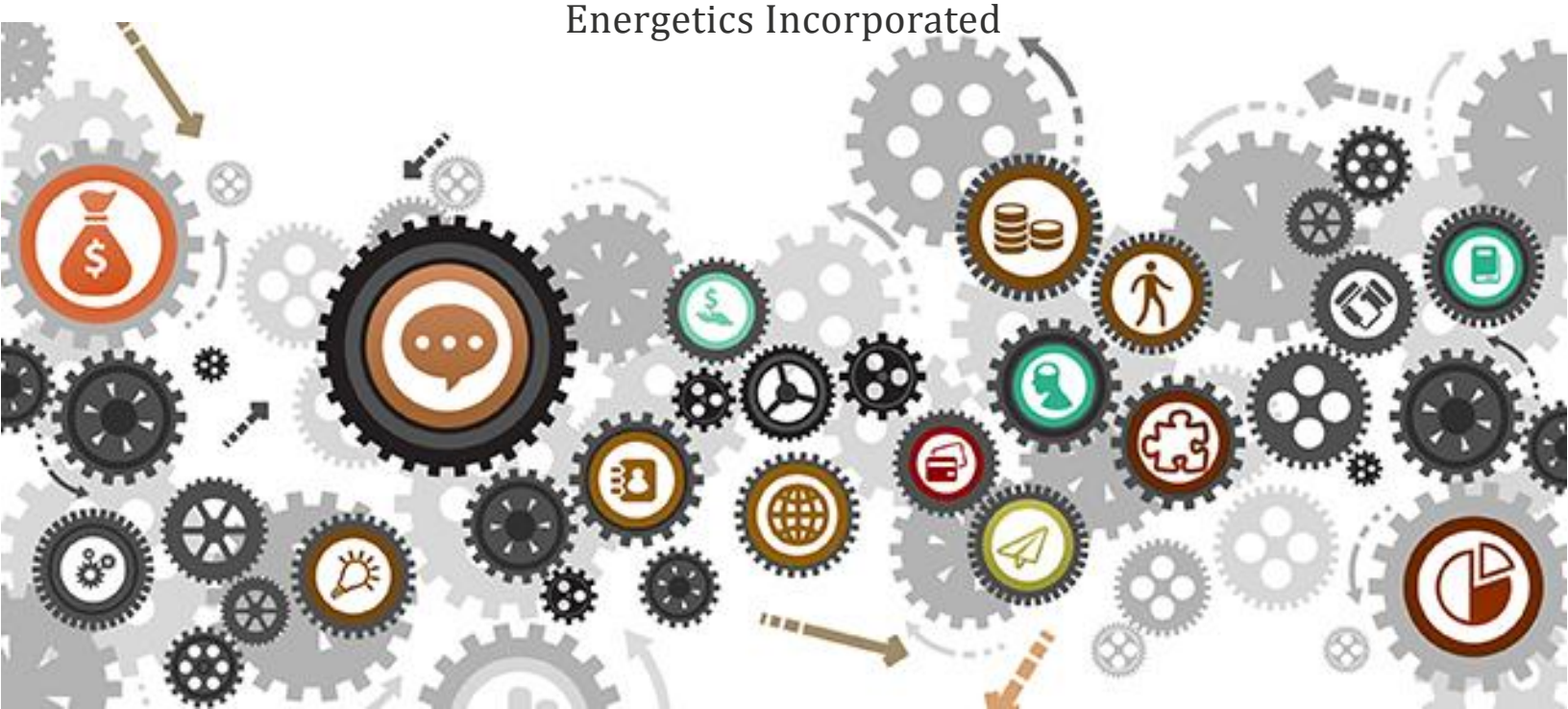
May 18-19, 2015 ● Washington, DC

Supply Chain:
Operations, Strategy, and Infrastructure Development in a Global Economy

Summary Report

July 2015

Submitted by
Energetics Incorporated



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Industry-Academic Teaching Support Workshops

Sponsored by the National Institute of Standards and Technology (NIST)

November 20-21, 2014 ● Pittsburgh, PA

Standards Challenges and Cybersecurity:
Implications for Distributed Systems (Business Infrastructure, Cloud Computing, Smart Grid/Smart Cities) and User Privacy

- *Hosted by the University of Pittsburgh in collaboration with Northwestern University Buffett Institute*

May 18-19, 2015 ● Washington, DC

Supply Chain:
Operations, Strategy, and Infrastructure Development in a Global Economy

- *Hosted by Georgetown University in collaboration with Northwestern University Buffett Institute*

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Acknowledgements

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Pittsburgh Workshop on Standards Challenges and Cybersecurity: Implications for Distributed Systems and User Privacy
November 20-21, 2014

Host and Collaborators

Michael Spring, University of Pittsburgh
Jeffrey Strauss, Northwestern University Buffett Institute

Speakers and Panelists

Patrick Gallagher, Chancellor, University of Pittsburgh
Linda Garcia, Georgetown University
Gordon Gillerman, National Institute of Standards and Technology (NIST)
Heather Kreger, IBM
Ronald Larsen, University of Pittsburgh
Erik Puskar, NIST
Michael Spring, University of Pittsburgh
Jeffrey Strauss, Northwestern University
Jeffery Stutzman, Wapack Labs Corporation
David Thaw, University of Pittsburgh
David Tipper, University of Pittsburgh
Victoria Yan Pillitteri, NIST

Washington DC Workshop on Supply Chain: Operations, Strategy, and Infrastructure Development in a Global Economy
May 18-19, 2015

Host and Collaborators

Linda Garcia, Georgetown University
Jeffrey Strauss, Northwestern University Buffett Institute

Speakers and Panelists

Vikrum Aiyer, White House National Economic Council
Evan Barba, Georgetown University
Sandor Boyson, University of Maryland
Carl Cargill, Adobe Systems
Dieter Ernst, East-West Center
Gordon Gillerman, National Institute of Standards and Technology (NIST)
Jim Haddow, Howard University School of Business
Chaodong Han, Towson University
Patricia Harris, NIST
Stephen Kwan, San Jose State University
David Lightfoot, Georgetown University
Bruce Mahone, SAE International
Alexander McMillan, Rockwell International
Joseph Mohorovic, U.S. Consumer Product Safety Commission
Tobin Porterfield, Towson University
Erik Puskar, NIST
Robert Ryan, IBM Global Business Services
Jeffrey Strauss, Northwestern University

Thanks also go to the hospitality sponsors, including Underwriters Laboratories Inc. at the Pittsburgh workshop, and ASTM International, IBM, NSF International, SAE International, and The IAPMO Group at the Washington, DC workshop.

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1. Introduction and Overview

The National Institute of Standards and Technology (NIST) seeks to raise awareness of the importance of standards to the U.S. economy, health, safety, and prosperity. Standards support product development and innovation by giving confidence that new products, technologies and processes are interoperable, compatible with legacy systems, infrastructure and vendor capabilities, and will be accepted in the market. Successful standards can help create opportunity for further product differentiation and more choices for users and consumers, and be influential in determining which technologies and approaches become market leaders.

To advance awareness and understanding of the role of standards, one approach employed by NIST is to integrate standards into educational curriculum via participation by universities in standards development processes.

To this end, NIST sponsored two Industry-Academic Teaching Support Workshops focused on standards curriculum in FY 2015. The first was hosted by the University of Pittsburgh on November 20-21, 2014, and the second was hosted by Georgetown University on May 18-19, 2015. The overall goal of the workshops was to increase attention to standards in business and engineering curriculum at the college and university level. The workshops sought to attract participants and enhance interest in standards coverage in courses by positioning standards in the context of topics already receiving attention in business and engineering schools. The workshops aimed for participation from industry as well as academia, with presentations from both sectors. Participant evaluations confirmed the industry pull—along with contextual focus, high profile hosts, and workshop structure—were key factors in the success of both workshops in attracting a strong audience and active engagement. The Georgetown workshop, given its location, also drew significant representations from the public sector, which stimulated useful discussion of policy and resources. A further goal of the workshops was to stimulate the evolution of an industry-academic community that would continue the dialogue and help to advance standards education.

Both workshops followed a similar two-day format. Day one began with presentations that laid out the need for greater attention to standards, as well as the challenges in doing so in higher education. Day two presentations delved deeper into models and pedagogical considerations. Discussion following presentations on both days gave participants a chance to contribute and exchange insights and concerns. Day two also featured a standards negotiation exercise that received high marks for getting participants engaged and achieving shared understanding of subtleties in the standards development process and related strategy. It also presented a potential teaching tool. Though based on the same model, the exercise was modified for the Georgetown Workshop to explicitly address supply chain issues.

These two workshops are further discussed below, followed by summary sections on the outcomes of the workshops and lessons learned that will strengthen these workshops in the future. Agendas, evaluation forms, and attendee lists are found in Appendix A for the Pittsburgh Workshop and Appendix B for the Washington, DC Workshop.

2. Workshop at the University of Pittsburgh

Standards Challenges and Cybersecurity: Implications for Distributed Systems (Business Infrastructure, Cloud Computing, Smart Grid/Smart Cities) and User Privacy
November 20-21, 2014
University of Pittsburgh
Pittsburgh, PA
http://gsi.nist.gov/global/index.cfm/L1-8/L2-55/A-755

Standards are especially important for new technology areas and challenges, such as those that exist in the cybersecurity realm. The profound prominence of the Internet, exemplified by the emergence of massive fields such as smart grid/smart cities and cloud computing, requires increased attention to the underlying role of standards and how emerging systems interoperate. Not only do companies and industry need to appreciate the competitive implications of cybersecurity standards, so does the U.S. higher education system. Particularly in the focus domains of this workshop, engineering and business schools at the undergraduate and graduate level teaching need to understand the significance of standards, their technical aspects, and implications for operations and planning, as well as strategic challenges of appropriate participation in their development.

This workshop looked at cybersecurity and the increasing importance of related standards, given the dependence of today's modern systems on information technology. The private and public sectors increasingly operate through complex, large-scale, highly distributed, and highly interconnected cyber-physical systems. Though emerging technologies allow continuous monitoring and powerful analytic tools and help to rapidly identify, assess, and even predict threats—threats are increasing and evolving. Even major companies with robust internal risk management processes, appropriate and timely information exchange, and collaboration across supply chains and mission critical functions find this difficult. It is a challenge to maintain confidentiality and privacy. While standards have been developed to help assure adequate encryption and digital signatures, they are not widely used. Students educated in business, engineering, and technical fields are often unaware of existing and potential new standards and best practices for security in the systems they build and manage.

Attention to standards and standardization in cybersecurity planning and operations in business and engineering courses is called for but may be challenging to faculty. This program looks at standardization in cybersecurity and emerging technologies and applications to complex "systems of systems." It is intended to support faculty in increasing coverage of standards in course curriculum.

2.1 Cybersecurity and Distributed Systems

U.S. industry is facing new opportunities and new threats that challenge technology operations and strategic, technological, and innovation decisions—particularly in the areas of safety and security. Companies, operation managers, and strategic and cybersecurity professionals need to appreciate the competitive implications of how standards develop domestically and internationally and the value of participation in the standardization process.

For the purpose of this workshop, distributed systems are described below.

Distributed Systems

Smart Grid (SG) responds to the pressing need for enhanced energy grid reliability, improved precision of monitoring and control, greater flexibility in energy sources, and allocation, ability to manage energy use more dynamically and overall reduction in energy cost. There are numerous stakeholders with varying perspectives and demands, and optimization of the overall grid may conflict with requirements of user segments. SG is highly complex and dynamic and must be continually reconfigured as new technology is developed and incorporated.

Smart Cities (SC), a broader concept, varies in definition but generally refers to the use of innovative technologies, particularly information and communication technologies, to manage complex urban and resources and physical, cyber and knowledge infrastructures in a sustainable and growth-enabling way. As in smart grid initiatives, smart cities require standards that respond to these characteristics and support interoperability and agility.

Cloud Computing services, loosely defined, provide ubiquitous, virtual on-demand internet/network-based access to digitized information, storage, servers, software, and applications. Smart Grid/Smart Cities (SG/SC) apply collaborative clouds that not only share facility and software resources but also share data and information for business and societal purposes. This is the case for individual businesses, municipalities, and utilities. They have the potential to significantly reduce capital expenditures and leverage in-house expertise with increased flexibility in terms of media, work location, and collaboration. However, there are lingering concerns over migration paths, participation and choice, security, intellectual property, implied interoperability, and portability across varying global infrastructure and regulatory frameworks. Related investment planning with changing technologies and inherent supply chain coordination issues further calls for carefully designed standards**.**

2.2 Workshop Structure

This action-oriented workshop was structured to emphasize discussion and interactive exercises, with presentations by both industry and academic experts on the contextual areas and potential teaching models. With active industry involvement throughout, the workshop had two interrelated components:

- Day one included an overview leading into presentations by industry stakeholders, with standards experts adding commentary and perspective; and,
- Day two (half-day) targeted workforce education and training, related curriculum and pedagogy and featured an experiential standards negotiation exercise (with content modified to fit targeted domain concerns) to enhance workshop participants' appreciation of subtle issues and suggest potential class approaches.

Both days featured breakout sessions, with day one stressing industry challenges, requirements, and implications for teaching, and day two looking at curriculum/course challenges and approaches.

2.2.1 Plenary Presentations, Panels, and Facilitators

The plenary session on the first day included presentations on cybersecurity in distributed systems by industry stakeholders (from Adobe Systems, Smart Grid Cybersecurity Committee, IBM, and Wapack Labs), with standards experts providing further commentary.

- **Ronald Larsen,** Dean and Professor, School of Information Science, University of Pittsburgh: ***Welcoming remarks and stage-setting***
- **Gordon Gillerman**, Acting Director, Standards Coordination Office, National Institute of Standards and Technology (NIST): ***Laying out the challenges, why are we here***
- **Jeffrey Strauss,** Acting Director, Northwestern BCICS CTIM: ***Overview of agenda***
- **Carl Cargill,** Standards Principal, Adobe Systems: ***Keynote call to action***
- **Panels Facilitator: Michael Spring**, Associate Professor, Information Science, University of Pittsburgh and NIST curriculum development grantee
- **Panel 1**: **Industry/government stakeholder (domain and standards issues) Challenge to Education**
  - ***NIST Smart Grid, Smart Cities and Cybersecurity initiatives and frameworks perspectives:*** **Victoria Yan Pillitteri**, Advisor for Information Systems Security, NIST; Chair, Smart Grid Interoperability Panel (SGIP) Smart Grid Cybersecurity Committee (SGCC)
  - ***Distributed Systems Industry perspectives:*** **Heather Kreger**, Distinguished Engineer, CTO International Standards, IBM; and, **Jeffery Stutzman**, President, Wapack Labs Corporation
- **Panel 2: Academic Perspectives**
  - ***Cybersecurity for Smart Grid Communications:*** **David Tipper**, Chair, Telecommunications Program & Associate Professor, Information Science, University of Pittsburgh
  - ***Efficacy of Cybersecurity Regulation and Challenge in Standards Development:*** **David Thaw**, Asst. Professor, Law, and Information Science, University of Pittsburgh
- **Erik Puskar**, Group Leader, Global Standards & Information, Standards Coordination Office, National Institute of Standards & Technology (NIST): ***International and U.S. standards education initiatives competition and models***
- **Patrick Gallagher**, Chancellor, University of Pittsburgh, former Deputy Secretary of the U.S. Department of Commerce and Director of the National Institute of Standards and Technology

All presentations as well as the negotiation exercise described in section 2.2.3 below are available through the NIST workshop website.

2.2.2 Breakout Session Discussions

Two rounds of concurrent breakout sessions engaged participants in interactive discussion of two sets of focus questions.

Round one focused on industry challenges and implications for teaching. Principal questions discussed were:

- What are key cybersecurity challenges facing industry in distributed systems that have standards underpinnings? How will standards affect them?
- What are related implications/requirements for education? What needs to be covered in courses?
- What specific knowledge and skills will professionals need to support the target domains and related standardization?

In round two, participants discussed pedagogy challenges and approaches, focusing on these questions:

- What are challenges to related teaching (materials, faculty knowledge, course content, etc.)? How can these be overcome?
- How might standards content be incorporated into the curriculum? Considering business, engineering, and other possible "homes" and specific courses, what are course/discipline-specific issues and how can they be addressed?

2.2.3 Standards Negotiation Exercise

Day two of the workshop begun with a standards negotiation exercise that was intended to help produce experientially the multiple dimensions and complex motivations often involved in standards negotiation— subtleties which are difficult to convey otherwise. Participation in standards development is important to influence the outcome and help advance fields and key systems. It also helps build strategic relationships and provides opportunities for participants to learn high-level indicators of future directions, such as competitors' positions, emerging alliances, technology development paths, and research directions.

Participants were grouped by hypothetical countries A through E, each of which had a distinct market position in the technology area that was subject to the standards being negotiated. That is: Country A was a market leader, Country B was a follower, Country C was innovative but small compared to A and B, Company D was a customer, and Country E had significant industry but was struggling globally. Each had their own distinct standards negotiation goals.

The exercise offered compressed segments for each group to prepare for and conduct formal negotiation among all groups. It was a lively exercise that gave participants a taste of the process and ideas for taking this or similar exercises back to the classroom.

2.3 Workshop Goals and Key Takeaways

By working together during the workshop to identify standardization issues within the domains, the overarching goals of the workshop were to promote:

- Actions by participants to more fully incorporate standards and standardization issues in their courses and training; and
- Movement, advanced through breakout discussion, toward an ongoing industry-university support community.

For the final breakout session, these additional questions were introduced to help promote specific take-aways by participants.

- What specific knowledge and skills will professionals need to support the target domains and related standardization?
- How does this enhance or detract from course/curriculum goals and university mission?
- What types of support and assistance could better enable the integration of education standards in cybersecurity-related curriculum?
- What are specific initiatives and actions that universities and educators can do immediately to promote educational standards in cybersecurity curriculum?
- What will you do individually following this workshop?

The consensus conclusions expressed by participants are summarized below.

Key Takeaways:

- More university faculty needs to be made aware of the importance of cybersecurity standards. The faculty needs to appreciate the nuances in what "standards" mean and how they vary and evolve. With the contextual focus on cybersecurity in distributed systems as an example, teaching must address the three domains of what is a standard, what is cybersecurity, and what is a cyber-security standard.
- Standards is an inherently cross-disciplinary topic, which adds to the challenge of including it in curriculum; standards education cannot be relegated only to engineers or only viewed in connection to technology, but must also consider strategic implications, including contribution to the bottom line.
- Standards also have important legal, social, economic, and political underpinnings. Multiple stakeholder perspectives need to be addressed. Therefore, while it may seem that the key target audience is cybersecurity students, aspects of standards should be included in core courses offered to all students.
- A key challenge is how to teach standards in a way that it is meaningful and has a major impact on the students. Teaching standards in a relevant context would help. Faculty needs to find ways to demonstrate the importance of the topics, define associated skills, and measure performance.
- A community of practice is needed to elevate the importance of standards and support teaching, as well as to train the next generation workforce (and train teachers/trainers) to understand and develop standards. A key gap is suitable materials (supporting integration in curriculum) and teaching guides.

2.4 Participants and Evaluations

Workshop participants included 29 academic, nine industry, and five government representatives. As intended, some 50% of participants had little or no prior experience in developing standards and only a few participants currently covered (beyond brief mention) standards issues in courses. Engagement with more experienced industry and faculty was stimulating and useful.

The evaluations received as well as conversations held during the workshop reflected strong interest in the topic and positive response to the program. On a scale of one being low and seven being very high, the workshop scored an average 5.9 in terms of effectiveness in raising awareness of the need and enhancing capability to do more. Nearly all participants indicated specific ways the program affected them and plans to implement what they learned. A full 100% of respondents expressed interest in being part of an evolving practice community. Evaluation results are provided in Appendix A.

3. Workshop at Georgetown University

Supply Chain Operations, Strategy, and Infrastructure Development in a Global Economy
May 18-19, 2015
Georgetown University
Washington, DC
http://gsi.nist.gov/global/index.cfm/L1-4/L2-14/A-764

Supply chain is integral to business and its study is increasingly prominent in higher education curriculum. Standards and conformity assessment are increasingly important in addressing many supply chain issues. Globalization has dramatically increased the strategic importance of these standards. The focus of this workshop was on introducing and connecting standards and conformity assessment to critical supply chain issues that are being taught by academic educators today.

This workshop considered standardization as a key component of global supply chain operations, strategy, and infrastructure development in a global economy to illustrate where standards might be more fully incorporated into academic teaching—and why it matters. Many perspectives were presented, ranging from industrial "pull" for standards, practitioner experience with standards, and academic approaches and opportunities for standards education.

In the context of supply chain operations, the workshop considered the value of standards in providing a common risk vocabulary, consistency, and quality of data flow and formats to support data aggregation and analysis. Discussion and evaluation comments confirmed the relevance and importance of this focus. The hope was that, beyond its immediate impact on teaching, the workshop would contribute to the formation of an ongoing industry-university support community in standards education beyond what began in the Pittsburgh program. Follow-up contacts with participants indicate there is evidence of such progress.

3.1 Supply Chain Issues

Globalization has led to increased integration and interdependency of economies, markets, and industries, as well as cultures and public policy. Today, U.S. industry faces new opportunities, challenges, and threats to technology and innovation operations, strategy, and innovation. Implications for the supply chain and the underlying standards that support the global supply chain system are significant.

Increased supply chain management, risk vulnerability, and complexity are exacerbated by a wide array of factors, such as intensifying global competition, demand volatility, shortening product life cycles service/delivery expectations, cost pressures with resulting shifts to lean manufacturing and outsourcing, globally extended value chains, and disruptions due to unexpected events. Suppliers are increasingly expected to be partners in global planning and operations. At the same time, they may find themselves pressured to adopt costly new systems and to relinquish control over processes and data, weakening their competitiveness.

3.2 Workshop Structure

This workshop had two interrelated components:

- Day one (half day) began with a keynote address, followed by multiple presentations and a panel reflecting perspectives of industry, government, and academia on the challenges facing

industry, including sector variations in supply chain concerns and the implications of globalization and extended networks. Participants also had open discussion to consider standards-supporting supply chain operations as well as curriculum relevance.

- Day two featured more presentations and an academic panel on research and teaching perspectives aimed at digging deeper into education, training, and pedagogy. Participants also undertook the same experiential exercise in standards development and negotiation as the Pittsburgh workshop, though focused on supply chain concerns.

All presentations as well as the slides for the negotiation exercise are available through the NIST workshop website.

3.2.1 Plenary Presentations, Panel, and Facilitator

As described above, the plenary presentations were a rich resource for acquainting participants with the relevance of standards to curriculum. The plenary speakers are listed below, along with their affiliation and the topic of their talk.

- **David Lightfoot**, Professor and Director, Communication, Culture & Technology Program, Georgetown University: ***Welcome***
- **Gordon Gillerman**, Acting Director, Standards Coordination Office, National Institute of Standards and Technology (NIST): ***NIST perspectives on the importance of connecting standards to education***
- **Dieter Ernst**, Senior Fellow and Professor, East-West Center: ***Innovation in Global Networks—The Challenge for Technical Standards and Related Policies***
- **Jeffrey Strauss,** Acting Director, Northwestern University Buffett Institute: ***Overview***
- **Joseph Mohorovic**, Commissioner of the U.S. Consumer Product Safety Commission: ***Special Presentation: From Innovation-Incubator to Force-Multiplier: The Key Roles Voluntary Standards Play in Achieving Mission-Critical Public Health and Safety Objectives***
- **Sandor Boyson**, Robert H. Smith School of Business, University of Maryland: ***Response and Academia Call to Action***
- **Vikrum Aiyer**, Senior Advisor, White House National Economic Council: ***Special Presentation: White House Supply Chain Innovation Initiative***
- **Tobin Porterfield**, Associate Professor, Supply Chain Management, Towson University; Roundtable Education Chair, Academic Strategies Committee Member, Council of Supply Chain Management Professionals: ***Activities of the Council of Supply Chain Professionals***
- **Erik Puskar**, Manager, Global Standards & Information, Standards Services, NIST: ***Overview of Government Standards Programs and Resources; Note on International (competitor) Initiatives***
- **Panel Facilitator: D. Linda Garcia**, Associate Professor, Communication, Culture & Technology, Georgetown University, former Senior Associate and Project Director, Office of Technology Assessment, U.S. Congress
- **Academic Panel: Research and Teaching Perspectives**
  - **Evan Barba**, Georgetown University
  - **Chaodong Han**, Towson University

- **Jim Haddow**, Howard University School of Business
- **Stephen K. Kwan**, San Jose State University

3.2.2 Group Discussions

At this workshop, presentations and discussion ran beyond allotted time and, rather than abandoning what was clearly valuable, the decision was made to incorporate shorter and broader interactive discussions in plenary session in lieu of breakouts.

3.2.3 Standards Negotiation Exercise

The standards negotiation exercise was conducted in the same way as at the Pittsburgh workshop (see section 2.2.2), though tailored to the global supply chain focus. It was a popular activity that actively engaged students, graduate students, professors, industry executives, and government agency officials in experiencing the standards negotiation process.

3.3 Workshop Goals and Key Takeaways

By listening to a wide variety of perspectives via the presentations and discussions outlined above, participants were able to engage with the role and potential of standardization to affect the supply chain environment. During the closing session, there was much excitement over ways and opportunities to incorporate standards into academic curriculum and training. Plans were discussed for continued interaction and sharing of tools, case studies, and activities like the standards negotiation exercise.

Some of the key take-aways expressed by participants at the conclusion of the workshop are summarized below.

Key takeaways:

- It was confirmed by supply chain instructors that there is a clear disconnect between what is learned in school and what jobs require including the coverage (or lack of coverage) of standards.
- Standards professionals are also often disconnected from the parts of the company that deal with teaching and research.
- In considering critical data flow through the supply chain, data must be available, reliable, understandable, managed, rigorous and flexible, and employ consistent terminology—all pointing to standards—versus varying formats and terminology in different organizations within the supply chain.
- Better data about standardization are needed for research and teaching.
- We need to maintain a competitive position and avoid falling behind countries that are increasing in power/influence and are learning fast. For example, China is applying a unique and pragmatic blend of European and U.S. approaches in standards development. China and Korea may also be ahead of the U.S. in the extent to which standards are covered in the educational system.
- A strong industry push to have standards be part of the university curriculum is essential. Furthermore, case studies are needed as a way to teach standards.
- Negotiation is a key skill conveyed well through the simulation exercise used in the workshop; standards work requires broad cross-disciplinary approaches.

3.4 Participants and Evaluations

The audience was a mix of academics (42% – 25 from 16 institutions), industry (37% – 22 representatives), and government (22% – 12 representatives). Only 36% of the audience reported a high level of experience with standards. The evaluation questionnaire and results are furnished in Appendix B.

Based on the workshop evaluations received, 82.6% of the participants were clearly attracted to the workshop by both its focus on the target contexts and on standards. Forty-three and a half percent indicated standards as the top reason for coming. The third highest rated factor was the connection to organizing institutions. Eighty-eight percent of the audience indicated the workshop was effective in raising awareness of standards and/or increasing capability to address standards issues.

The aspect of the program deemed of highest value was the involvement of both industry and academia, followed by the presentations and the negotiation exercise. The valuation of networking was widely distributed with comments confirming that the program did not allow much time for networking. The decision to have open discussion in lieu of breakouts stimulated useful discussion that continued beyond the workshop.

Comments reinforced the quantitative evaluations. Several participants plan specific new initiatives stemming from their participation. Six participants plan to use the negotiation exercise. One noted that he or she will "have a conversation about how standards can be covered in our graduate programs." Others indicated plans to: "Introduce one class in each supply chain course that focuses on standards;" "try and introduce some relevant case studies in Operations Research classes"; or simply, "work with standards bodies" and "incorporate some of what I learned in my work." Others, already active in the topic areas, noted that the workshop "expanded my knowledge" and "reinforced my thinking on the importance of standards in education." Eighty-three percent of the participants said they would be interested in staying involved/building an ongoing community to further stimulate and support education about standards.

Following the workshop, there has been significant give and take between participants, with particular input from academic participants in further developing the concepts and tactical approaches from the workshop. Dieter Ernst provided useful lists of potential guiding questions for policy and research (both sets copyrighted by Ernst and included with his permission) that are summarized below and will also be posted to the NIST supported Strategic Standards Management website (http://www.northwestern.edu/standards-management/).

Questions for Policy

1. What combination of private solutions, law, legal practice, and public policy might be needed to keep both the process of standardization and the standards open, flexible, and extendable?
2. How important is the role of competition policy, and what adjustments might be needed in patent law?
3. What forms of public-private partnerships and cooperation between NIST, ANSI and SDOs might help to
    - Improve access to robust quantitative measures of useful standards, their quality, and value?
    - Reduce uncertainty about how "standard-essential" those patents really are which are alleged or believed to be essential?

- Standardize key concepts used in standards development, such as guiding documents, explanatory documents, workshop agreements, roadmaps, instructions, public company processes;
- Reduce double counting of standards which show up under different owners but with (more or less) identical content, e.g. ISO, EN/ISO, DIN/EN/ISO, BSI/EN/ISO, GB, JIS, ASTM;
- Create the interoperability standards needed to improve the integration of increasingly complex global networks and technology systems?

4. As national standards systems and policies continue to differ, what might be realistic approaches to trade diplomacy and international cooperation to gradually enhance the "harmonization" of international standards? And, what might be promising priority areas for efforts to reduce the current "Balkanization" of standard-setting?
5. What changes in the governance and procedures of standard development organizations and private standards consortia would help to reduce the use of standard-essential patents (SEPs) as entry deterrents? Specifically, how will the recent Institute of Electrical and Electronics Engineers (IEEE) policy amendments affect the implementation of "fair, reasonable, and nondiscriminatory" (FRAND) licensing terms? Will other standard-setting organizations, such as the European Telecommunications Standards Institute (ETSI), follow suit? What role can competition policy play?

Questions for Research

1. Case studies to determine how "standard-essential" patents really are which are alleged or believed to be essential.
2. As many standards become obsolete very fast, what are realistic estimates of required investments needed to maintain and upgrade existing standards?
3. Develop a taxonomy of tasks and capabilities required for developing open, flexible, and extendable standards and standardization processes.
4. Case studies of success and failure of diverse approaches to develop interoperability standards for complex technology systems (such as Smart Grid, Integrated Health system).
5. Develop updated cost estimates of ineffective or incomplete global network integration, drawing on NIST's 2004 estimate.
6. Comparative case studies of standards consortia which seek to develop and implement global network integration (e.g. RosettaNet; IBM's Open industry standards for global supply chains; etc.)
7. In-depth comparative case studies of diverse standards systems and policies, in OECD countries as well as in emerging economies and developing countries.

In addition to the materials posted on the workshop website and the site just noted, discussion during and following the workshop identified resources for participants to support standards work and related teaching. These included Northwestern University's Searle Center Database of Technology Standards and Standard Setting Organizations, NIST support for class speakers, and the Council of Supply Chain Professionals (represented in the workshop and described by Tobin Porterfield.)

4. Summary Findings from the Two Workshops

Workshop evaluations and discussion confirmed that university faculty needs to be made more aware of the importance of standards. They also underscored the value of presenting standards in problem and decision contexts, with strong industry involvement and through exercises. Specific findings were:

- Faculty need to appreciate the nuances in what "standards" mean and how they vary and evolve. As further reinforced in the focus on globalization along with supply chain in the Georgetown program, standards have important legal, social, economic, and political underpinnings. Multiple stakeholder perspectives need to be addressed.
- Aspects of standards should be included not only in courses covering domains in which standards have particularly clear relevance, but also in core courses offered to all students.
- There is a need for a significant and high level (ideally communicated directly to deans) industry push to have standards be part of the university curriculum. Workshops such as this need active industry involvement that goes beyond the usual industry presentations to help provide “pull” increasing faculty attention to standards.
- In addition to exercises that reflect the content of courses in which they are used while enhancing recognition of subtle issues in standards development best achieved through experience, deep teaching cases are needed that include discussion-stimulating questions, teaching guides, and analysis of failures as well as successes.
- Better data about standardization-supporting research and teaching, broad-based publishing, and presentations in academic conferences can all usefully contribute to enhance standards as an accepted academic field.

5. Recommendations for Future Programs

The Industry-Academic Teach Support Workshops project has been successful, with workshops earning praise and already leading to action. Some lessons were learned in the process of conducting the workshops that will help further refine and enhance the experience and results of future ones.

- **Agenda**
  - **Presentation format:** Short and snappy presentations with plenty of time for questions and answers plus interactive breakout sessions were more effective than long lectures with less time for active audience participation.
  - **Schedule flexibility:** The schedule needs to allow for informal networking that energizes participants and can lead to future collaborations.
  - **Networking emphasis**: Add the term "networking" to meals/breaks on the agenda to emphasize the opportunity to develop relationships and community during the workshop.
- **Speakers**. Speakers require *a priori* instruction to emphasize:
  - The importance of the agenda structure to achieving workshop outcomes;
  - Time available for each talk and when Q&A will take place; and,
  - Time management during the lecture. Specifically, someone will be in front of the lectern area with timing cards to count down the last minutes of their talk.
- **Community Building**
  - **Pre-workshop information:** Inform the participants in advance of the "themes" and possible objectives for networking discussion to help create a "self-fulfilling prophecy."
  - **Social opportunities**: Promote in advance no-host social opportunities, e.g., provide a list of restaurants as suggestions for networking locations.
- **Attendance**
  - There will always be no-shows, but to get a reasonably close count of expected workshop attendance, send out a "Please confirm your attendance at the workshop…" email shortly before. This will enable a more accurate attendance list, as well as help reduce catering cost and wasted food.
  - Do not cut off registration. You may exclude an important contributor.
  - Note that second day attendance is always smaller and should be planned for accordingly.
- **Post-Workshop Evaluation**
  - Hand out the evaluation form in advance and request if from those leaving early.
  - Think about ahead of time what information is desired to glean from the evaluation. Maybe "analyze attendance by sector" or "track no-shows."
  - Follow up if possible to ask the evaluators who gave a low rating what you could do better.
- **Plan and Execute Leveraging Follow-Up**
  - Invite continued communication and plan and budget for follow-up monitoring of participant activity on the topic.
  - Promote post-meeting preparation of papers to be published or presented at conferences.
  - On any specific actions discussed with attendees, be proactive in providing follow-up NIST support, such as speakers or conference attendance.

Appendix A: University of Pittsburgh Workshop Material

AN INDUSTRY-ACADEMIC WORKSHOP
Standards Challenges and Cybersecurity: Implications for Distributed Systems (Business Infrastructure, Cloud Computing, Smart Grid/Smart Cities) and User Privacy
Hosted by the University of Pittsburgh
Sponsored by the National Institute of Standards and Technology (NIST)
Workshop Design by University of Pittsburgh, Energetics, and Northwestern University
Hospitality Sponsored by:
Underwriters Laboratories Inc.
November 20-21, 2014

WORKSHOP AGENDA

Day 1 (9:00am – 5:15pm)

(8:30 doors open)

9:00 **Welcome**
Ronald Larsen, Dean and Professor, School of Information Science, University of Pittsburgh

9:10 **Laying out the challenges, why are we here**
Gordon Gillerman, Acting Director, Standards Coordination Office, National Institute of Standards and Technology (NIST)

9:25 **Overview of agenda**
Jeffrey Strauss, Acting Director, Northwestern BCICS CTIM

9:35 **Keynote: Call to Action**
Carl Cargill, Standards Principal at Adobe Systems / Advanced Technology Labs, previously Senior Director, Corporate Standards at Sun Microsystems

10:10 **BREAK.** ***Sponsored by Underwriters Laboratories Inc.***

10:20 **Panel 1**: **Industry/government stakeholder (domain and standards issues) Challenge to Education**

- NIST Smart Grid, Smart Cities and Cybersecurity initiatives and frameworks
  Victoria Yan Pillitteri, Advisor for Information Systems Security, NIST; Chair, Smart Grid Interoperability Panel (SGIP) Smart Grid Cybersecurity Committee (SGCC)
- Distributed Systems Industry perspectives
  Heather Kreger, Distinguished Engineer, CTO International Standards, IBM
  Jeffery Stutzman, President, Wapack Labs Corporation

Discussion/Q&A

Panels Facilitator: **Michael Spring**, Associate Professor, Information Science, University of Pittsburgh and NIST curriculum development grantee

Noon Lunch

1:00 **Panel 2: Academic Perspectives**

- **David Tipper**, Chair, Telecommunications Program & Associate Professor, Information Science, University of Pittsburgh
  - *Cybersecurity for Smart Grid Communications*
- **David Thaw**, Asst. Professor, Law, and Information Science, University of Pittsburgh
  - *Efficacy of Cybersecurity Regulation and Challenge in Standards Development*

2:00 **Breakouts: industry challenges and implications for teaching**

2:00-2:15 Introductions and expectations – discussion will continue in day 2 breakouts
Charles Chen, Director, Renewable Energy, Energetics, Inc.

2:15-4:00 **Focal Questions**

- What are key cybersecurity challenges facing industry in distributed systems that have standards underpinnings; how will standards impact?
- What are related implications/requirements for education? What needs to be covered in courses?
- What specific knowledge and skills will professionals need to support the target domains and related standardization?

4:00 **Reports, open discussion**

4:40 **Summary of day 1 lessons learned**
Linda Garcia, Associate Professor, Communication, Culture and Technology, Georgetown University, former Project Director, Office of Technology Assessment, U.S. Congress

5:00 **Lead into Day 2**
Jeffrey Strauss

5:15 **ADJOURN; OPEN DISCUSSION**

Day 2 (8:15am – 2:30pm)

(8:00 doors open)

8:15 **Exercise:** Cross-country/cross agenda Standards Negotiation (**Jeff Strauss**)

9:45 BREAK. Sponsored by Underwriters Laboratories Inc.

10:00 **Reports, Discussion of exercise, value and potential use/further adaptation in different courses/ institutional contexts**

10:40 **International and U.S. standards education initiatives competition and models**

Erik Puskar, Group Leader, Global Standards & Information, Standards Coordination Office, National Institute of Standards & Technology (NIST)

11:00 **Open discussion/audience member examples of relevant initiatives**

11:15 **Breakouts (same groups as on day 1): Pedagogy challenges and approaches**
Introductions and expectations

Charles Chen

Focal questions:

- What are challenges to related teaching (materials, faculty knowledge, course content, etc.)? How can these be overcome?
- How might standards content be incorporated into the curriculum (fit)? Consider business, engineering and other possible "homes" and specific courses; what are course/discipline specific issues and how can they be addressed?

Other questions for consideration

- What specific knowledge and skills will professionals need to support the target domains and related standardization?
- How does this enhance or detract from course/curriculum goals and university mission?
- What types of support and assistance could help better enable the integration of education standards in cybersecurity related curriculum?
- What are specific initiatives and actions that universities and educators can do immediately to promote educational standards in cybersecurity curriculum?
- What will each of you do individually following this workshop?

12:30 **Lunch**

Patrick Gallagher, Chancellor, University of Pittsburgh, former Deputy Secretary of the U.S. Department of Commerce and Director of the National Institute of Standards and Technology (NIST); Introduced by Michael Spring

1:30 **Break out reports, discussion**

2:15 **Wrap-up discussion: Next Steps** (Moderator: **Jeff Strauss)**

2:30 **ADJOURN**

EVALUATION FORM

NOVEMBER 20-21, 2014 NIST-UNIVERSITY OF PITTSBURGH STANDARDS EDUCATION WORKSHOP

NAME (optional):_____

What attracted you to this workshop (<u>if more than one factor, please rank</u>):

_____ interest in the target context domain (Cybersecurity - Distributed Systems (Business Infrastructure, Cloud Computing, Smart Grid/Smart Cities) and User Privacy

_____ standards focus

_____ referral / introduction

_____ Pitt, Northwestern, Energetics, other connection

_____ other (please specify:)

_____

_____

_____

<u>On a scale of 1 to 7, please rate the following:</u>

A. Prior experience/exposure related to standards

not at all extensive

1 2 3 4 5 6 7

Please describe:_____

_____

B. Current coverage of the target context domains in your teaching, research or industry/commercial activity

None extensive

1 2 3 4 5 6 7

Please describe:_____

_____

C. Current coverage of standards in your teaching, research or industry/commercial activity

None extensive

1 2 3 4 5 6 7

Please describe:_____

_____

How would you rate the effectiveness of the workshop in raising your awareness of standards and/or increasing your capability to cover/address standards issues?

1 2 3 4 5 6 7

low high

What were the most valuable/least valuable parts of the program? (rank order all that apply)

____ focus/context

____ industry/academic involvement

____ negotiation exercise

____ presentations

____ discussion of pedagogical approaches and initiatives that could be leveraged

____ breakouts

____ networking with other participants

____ other (please specify)

_____

_____

_____

What specific questions or issues were not addressed?

_____

_____

_____

Did the workshop change your thinking and if so, how?

_____

_____

_____

Are there categories of people that were missing as participants?

_____

_____

_____

Can you suggest specific individuals who should become involved (and contact information) as we build community and plan other events? if we can use your name please email the referrals to us (j-strauss@northwestern.edu)

_____

_____

_____

Can you recommend relevant programs, cases or other resources?

_____

_____

_____

What key next steps would you suggest?

_____

_____

_____

What do YOU plan to do as a result of the workshop?

_____

_____

_____

What support would be useful?

_____

_____

_____

Would you be interested in staying involved/building an ongoing community?

_____ yes _____no

Other comments?

_____

_____

_____

_____

EVALUATION RESULTS

NOVEMBER 20-21, 2014 NIST-UNIVERSITY OF PITTSBURGH STANDARDS EDUCATION WORKSHOP

What attracted participants to this workshop?	1	2	3	4	5
Interest in the target context domain and user privacy	6	5	2		
standards focus	2	3	3		
referral/introduction	2	3			
Pitt, Northwestern, Energetics, other connection	2		1	1	
other (specify reason)	1		1		

Workshop Ratings	1	2	3	4	5	6	7
Prior experience/exposure related to standards		4	3	3	1	2	1
Current coverage of the target context domains in your teaching, research, or industry/commercial activity	2	1	1	1	4	2	3
Current coverage of standards in your teaching, research, or industry/commercial activity	2	2	2	1	1	2	2
How would you rate the effectiveness of the workshop in raising your awareness of standards and/or increasing your capability to cover/address standards issues					4	6	3

Rating Explanations	
Prior experience/exposure related to standards	Significant exposure to network protocol and related standards.
	Senior vice president, Asme Standards & Certification (June 2011 - June 2014).
	Not much experience with standards!
	Not familiar with standards.
	Course work.
	I have been involved with trying to consolidate the cybersecurity standard with a requirement specific for our product at Eaton.
	Only had readings.
	Worked with 800-S3 extensively & participated in ISO standards development (incident response).
	Have led standards bodies for business process.
	Exposed to common technical standards (E.g. communications & security protocols).
Current coverage of the target context domains in your teaching, research, or industry/commercial activity	Cybersecurity researcher.
	Teach course "Case Studies in Nuclear Codes and Standards" in Pitt's Nuclear Engineering Program in the Simpson School
	I don't encounter standards in my teaching.
	Cybersecurity background.
	Smart grid, cybersecurity research.
	Driving requirement standard with our critical infrastructure product.
	When doing cybersecurity-related research, it is essential to read and understand standards.
	Weighted towards cybersecurity, I felt.
	Lots of good coverage.
	IT professional; cybersecurity professional; DoD secure systems
Current coverage of standards in your teaching, research, or industry/commercial activity	Little beyond protocol definitions.
	Teach course "Case Studies in Nuclear Codes and Standards" in Pitt's Nuclear Engineering Program in the Simpson School of Engineering since Jan. 2010.
	I don't encounter standards in my teaching.
	IEEE, IEC, NIST Standards for Smart Grid, Cybersecurity
	Driving requirement standard with our critical infrastructure product.
	When doing cybersecurity-related research, it is essential to read and understand standards.
	Cryptography, A&A standards, etc. well developed, understood, & accepted. Standards for platform hardening, incident detection & response, etc. are lacking.
	I don't research or lecture on standards, I just use them as reference.
	US and international accounting standards, IT standards relavent to auditing, governance, & compliance.

Most valuable/least valuable parts of the program	1	2	3	4	5	6	7	8
focus/context		1	3	2	1			
industry/academic involvement	4	1	1	2		1		
negotiation exercise	4	5		1	1	1		
presentations	3	2	3		1			
discussion of pedagogical approaches and initiatives that could be leveraged	3			1	1		2	
breakouts	1	1	2		1			
networking with other participants	1	3	2					
other								

ATTENDEE LIST

NOVEMBER 20-21, 2014 NIST-UNIVERSITY OF PITTSBURGH STANDARDS EDUCATION WORKSHOP

First Name	Last Name	Position	Organization
ACADEMIC			
John	Bagby	Professor, College of Information Sciences and Technology	Pennsylvania State University
Ken	Balkey	Adjunct Faculty Lecturer, Swanson School of Engineering	University of Pittsburgh
James	Cebula	Technical Manager, Cyber Risk Management	Software Engineering Institute (CERT)
Weifeng	Chen	Associate Professor, Department of Mathematics, Computer Science and Information Systems	California University of PA
Martha	Dodge	Director, Energy Systems Engineering, Rossin College of Engineering & Applied Science	Lehigh University
Roger	Flynn	Associate Professor, Information Science	University of Pittsburgh
Dorothy Linda	Garcia	Associate Professor, Communication, Culture and Technology	Georgetown University
Eric	Hatleback	Associate Research Professor	University of Pittsburgh; adjunct faculty, Duquesne University
Velin	Kounev	Phd Candidate, School of Information Sciences	University of Pittsburgh
Ronald	Larsen	Dean and Professor, School of Information Sciences	University of Pittsburgh
Yanlin	Li	Research Scientist, CyLab	Carnegie Mellon University
Michael	Lisanti	Associate Director, CyLab	Carnegie Mellon University
Juan	Manfredi	Vice Provost	University of Pittsburgh
Michael	McCarthy	Associate Professor, Information Systems	Carnegie Mellon University
David	McIntire	Information Systems Security Analyst	Software Engineering Institute (CERT)
Bonnie	Morris	Associate Professor, Accounting Palumbo Donahue School of Business	Duquesne University
Carol	Ovon	Research Assistant, Engineering & Public Policy	Carnegie Mellon University
Konstantinos	Pelechrinis	Assistant Professor, Information Sciences	University of Pittsburgh
Meaghan	Renkey	Network Intelligence Analyst Intern at CERT Division at the Software Engineering Institute	Software Engineering Institute (CERT)
Abhay	Sesha	Graduate student in information security	Carnegie Mellon University

First Name	Last Name	Position	Organization
		policy and management	
David	Shepard	Software Engineer, SEI	Carnegie Mellon University
Jonathan	Spring	Analyst	Software Engineering Institute (CERT)
Michael	Spring	Associate Professor, Information Sciences	University of Pittsburgh
Jeffrey	Strauss	Acting Director, BCICS Center for Technology and Innovation Management	Northwestern University
David	Thaw	Asst. Professor, Law, & Information Science	University of Pittsburgh
David	Tipper	Chair, Telecommunications Program & Associate Professor, Information Sciences	University of Pittsburgh
Robert	Walls	Postdoctoral scholar, Computer Science and Engineering Department	Pennsylvania State University
Peter	Wu	Professor, Computer and Information Systems	Robert Morris University
Jun	Zhao	PhD Candidate, Computer Engineering	Carnegie Mellon University
INDUSTRY			
Carl	Cargill	Standards Principal	Adobe Systems
Charles	Chen	Director, Renewable Energy	Energetics, Inc
Mariana	Hentea	Security Systems Engineer	Internet Access Solutions
Heather	Kreger	CTO International Standards	IBM
Bruce	Orosz	Senior Staff Engineer	Lockheed Martin
Scott	Palmer	Director	S4E Inc
Brian	Scarpelli	Director, Gov't Affairs	Telecommunications Industry Association
Jeffery	Stutzman	CEO	Red Sky Alliance and Wapack Labs
Max	Wandera	Sr. Eng. Manager Cybersecurity CoE	Eaton Corp
GOVERNMENT			
Sean	Brooks	Privacy Engineer	NIST
Victoria Yan	Pillitteri	Advisor for Information Systems Security	NIST
Erik	Puskar	Group Leader, Global Standards & Information	NIST
Aya	Fukami	Digital Forensic Investigator	National Police Agency of Japan
Gordon	Gillerman	Director, Standards Coordination Office	NIST

Appendix B: Georgetown University Workshop Material

AN INDUSTRY-ACADEMIC TEACHING SUPPORT WORKSHOP
Supply Chain Operations, Strategy, and Infrastructure Development in a Global Economy
Georgetown University in collaboration with Northwestern University Buffett Institute
Sponsored by the National Institute of Standards and Technology (NIST)
Hospitality Sponsored by:
ASTM International, IBM, NSF International, SAE International, and
The IAPMO Group
May 18-19, 2015

WORKSHOP AGENDA

Day 1 (11:30am– 6:00pm)

11:30 a.m. Registration

12 Noon LUNCH
Sponsored by ASTM International

Welcome

David Lightfoot, Professor and Director, Communication, Culture & Technology Program, Georgetown University

Gordon Gillerman, Acting Director, Standards Coordination Office, National Institute of Standards and Technology (NIST)

Keynote address:

The Challenge for Technical Standards and Related Policies
Dieter Ernst, Senior Fellow and Professor, East-West Center

1:30 p.m. **Overview of Agenda**

Jeffrey Strauss, Acting Director, Northwestern University Buffett Center CTIM

1:40 p.m. **Laying Out the Problems - Industry/Government Panel: Global Supply Chain Perspectives and Challenges**

Facilitator: **Charles Y. Chen**, Director, Renewable Energy & Advanced Manufacturing, Energetics Incorporated
Alexander McMillan, Rockwell International
Bruce Mahone, SAE International
Robert Ryan, IBM Global Business Services
Carl Cargill, Adobe Systems

2:55 p.m. BREAK
Sponsored by IBM

3:10 p.m. **Special Presentation: From Innovation-Incubator to Force-Multiplier: The Key Roles Voluntary Standards Play in Achieving Mission-Critical Public Health and Safety Objectives**
Joseph Mohorovic, Commissioner of the U.S. Consumer Product Safety Commission

3:40 pm **Response and Academia Call to Action**
Sandor Boyson, Robert H. Smith School of Business, University of Maryland

4:00 p.m. **Breakout Introduction and Expectations**
Patricia Harris, International Standards Specialist, NIST

4:10 p.m. **Breakouts: Implications for Course Content**

Identify breakout group spokesperson and populate PowerPoint template slide

Focus Questions:

- *What are the most critical globalization/supply chain challenges facing industry with significant standards requirements; how will standards impact?*
- *What specific knowledge and skills will professionals need to support supply chain operations and related standardization?*
- *What are related implications/requirements for education? What needs to be covered in courses? How should/can the desired supply chain challenges and standards underpinnings be effectively captured and conveyed in current or new courses?*
- *What are challenges to related teaching (materials, faculty knowledge, course content, etc.)?*

5:00 p.m. **Reports, Open Discussion**

5:45 p.m. **Lead into Day 2**
Jeff Strauss

6:00 p.m. **ADJOURN**

<u>Day 2 (8:00am – 3:45pm)</u>

8:00 a.m. CONTINENTAL BREAKFAST/COFFEE
Sponsored by NSF International and SAE International

8:30 a.m. **Exercise:** Working in assigned groups (includes working breaks)

10:00 a.m. BREAK

10:15 a.m. **Group Reports, Discussion of exercise, value and potential use/further adaptation in different courses/ institutional contexts**

11:00 a.m. **Special Presentation: White House Supply Chain Innovation Initiative**
Vikrum Aiyer, Senior Advisor, White House National Economic Council

11:20 a.m. **Activities of the Council of Supply Chain Professionals**

Tobin Porterfield, Associate Professor, Supply Chain Management, Towson University; Roundtable Education Chair, Academic Strategies Committee Member, Council of Supply Chain Management Professionals

Resources:

Overview of Government Standards Programs and Resources; Note on International (competitor) Initiatives

Erik Puskar, Manager, Global Standards & Information, Standards Services, NIST

11:45 a.m. LUNCH

Sponsored by The IAPMO Group

12:30 p.m. **Academic Panel: Research and Teaching Perspectives**

Facilitator: **D. Linda Garcia**, Associate Professor, Communication, Culture & Technology, Georgetown University, former Senior Associate and Project Director, Office of Technology Assessment, U.S. Congress
Evan Barba, Georgetown University
Chaodong Han, Towson University
Jim Haddow, Howard University School of Business
Stephen K. Kwan, San Jose State University

1:45 p.m. **Breakouts (same groups as day 1): Pedagogy challenges and approaches**
Identify breakout group spokesperson and populate PowerPoint template slides

Focal Questions:

- *How can the challenges to globalization/supply chain related teaching identified earlier be overcome?*
- *More broadly, how might standards content be incorporated into the curriculum (fit)? Consider business, engineering and other possible "homes" and specific courses; what are course/discipline specific issues and how can they be addressed? How might this enhance or detract from course/curriculum goals and university mission?*

Other Questions for Consideration

- *What types of support and assistance could help better enable the integration of education standards in cybersecurity related curriculum?*
- *What are specific initiatives and actions that universities and educators can do immediately to promote educational standards in supply chain curriculum?*
- *What will each of you do individually following this workshop?*

2:45 p.m. **Break out Reports, Discussion**

3:15 p.m. **Wrap-up Discussion; Next Steps**

Moderators: **Erik Puskar**, **Jeff Strauss**

3:45 p.m. **ADJOURN**

EVALUATION FORM

MAY 18-19, 2015 NIST-GEORGETOWN UNIVERSITY STANDARDS EDUCATION WORKSHOP

NAME (optional):_____
What attracted you to this workshop (<u>if more than one factor, please rank</u>):
_____ interest in the target context domain (globalization, supply chain operations, strategy and infrastructure)
_____ standards focus
_____ referral / introduction
_____ Georgetown, Northwestern, Energetics, other connection
_____ other (please specify:)

_____
_____
_____

<u>On a scale of 1 to 7, please rate the following:</u>
A. Prior experience/exposure related to standards
not at all extensive
1 2 3 4 5 6 7
Please describe:_____
_____
B. Current coverage of the target context domains in your teaching, research or industry/commercial activity
None extensive
1 2 3 4 5 6 7
Please describe:_____
_____

C. Current coverage of standards in your teaching, research or industry/commercial activity
None extensive
1 2 3 4 5 6 7
Please describe:_____
_____
How would you rate the effectiveness of the workshop in raising your awareness of standards and/or increasing your capability to cover/address standards issues?
1 2 3 4 5 6 7
low high
What were the most valuable/least valuable parts of the program? (<u>rank order</u> all that apply)
____ focus/context
____ industry/academic involvement
____ negotiation exercise
____ presentations
____ discussion of pedagogical approaches and initiatives that could be leveraged
____ breakouts
____ networking with other participants
____ other (please specify)

_____
_____
_____

What specific questions or issues were not addressed?

_____
_____
_____

Did the workshop change your thinking and if so, how?

_____
_____
_____

Are there categories of people that were missing as participants?

_____
_____
_____

Can you suggest specific individuals who should become involved (and contact information) as we build community and plan other events? if we can use your name please email the referrals to us (j-strauss@northwestern.edu)

_____
_____
_____

Can you recommend relevant programs, cases or other resources?

_____
_____
_____

What key next steps would you suggest?

_____
_____
_____

What do YOU plan to do as a result of the workshop?

_____
_____
_____

What support would be useful?

_____
_____
_____

Would you be interested in staying involved/building an ongoing community?
_____ yes _____no

Other comments?

_____
_____
_____
_____

EVALUATION RESULTS

MAY 18-19, 2015 NIST-GEORGETOWN UNIVERSITY STANDARDS EDUCATION WORKSHOP

What attracted participants to this workshop?	1	2	3	4	5
Interest in the target context domain (globalization, supply chain operations, strategy and infrastructure)	8	3			
standards focus	6	5			
referral/introduction		2	1		
pedagogical interest	1	2	2		
Georgetown, Northwestern, NIST, Energetics, other connection			5		
other (please specify)	1 (ANSI)				

Workshop Ratings	1	2	3	4	5	6	7
Prior experience/exposure related to standards		2			5	4	5
Current coverage of the target context domains (globalization, supply chain) in your teaching, research or industry/commercial activity	1			2	2	5	6
Current coverage of standards in your teaching, research, or industry/commercial activity	1		2	3	2	2	5
How would you rate the effectiveness of the workshop in raising your awareness of standards and/or increasing your capability to cover/address standards issues			1		3	7	4

Rating Explanations	
Prior experience/exposure related to standards	Interagency work with agencies and standards in the regulatory process
	My dissertation is focused on the role of quality management standards in globalization
	Work for an SDO
	I've been working with standards for a total of 6 years
	1) Developed ACMP Change Measurement Standards 2) Was SME on ASIM Standard 3) Help ORSS credit 17024 & E2659
	Worked as technical director for an ANSI accredited standards developer
	Have worked with national & int'l standards for 25 years
	Industry project work
	Lacking hands-on experience
	Not fully aware of the relevance and importance of standards in graduate programs
	Whole research paper & taught a course.
Current coverage of the target context domains (globalization, supply chain) in your teaching, research or industry/commercial activity	Work with trade agreements
	Core teaching focus
	All courses focus on supply chain activities - domestic and global
Current coverage of standards in your teaching, research, or industry/commercial activity	Standards in 90% of work we do on daily basis
	Basic information on different standards that apply to supply chain activities
	I am working on foundations for information modeling for interoperability
	Some coverage but not in an explicit or systematic manner

Most valuable/least valuable parts of the program	1	2	3	4	5	6	7	8
focus/context	4	4	1	2	1			
industry/academic involvement	8	3	2	3				
negotiation exercise	1	4	4	3	1			
presentations	2	4	5	3				
discussion of pedagogical approaches and initiatives that could be leveraged			3	2	3	1	2	
breakouts		1				3	1	
networking with other participants	2	1	1	1	4	1	1	
other (please specify)			1					

ATTENDEE LIST

MAY 18-19, 2015 NIST-GEORGETOWN UNIVERSITY STANDARDS EDUCATION WORKSHOP

First Name	Last Name	Organization
Michael	Aisenberg	The MITRE Corp/ODNI
Fazleena	Badurdeen	University of Kentucky
Suman	Balasubramanian	DePauw University
Evan	Barba	Georgetown University
Monte	Bogatz	The IAPMO Group
Mark	Bohannon	Red Hat, Inc.
Patrice	Boulanger	NIST
Jon	Boyens	NIST
Sandor	Boyson	R.H. Smith School Of Business
Dawn	Brown	U.S. International Trade Commission
Harold	Chase	NSF International
Charles	Chen	Energetics
Major	Clark	Office of Advocacy/SBA
Michael	Clauser	Fujitsu
Scott	Cooper	ANSI
Cody	Davidson	Radford University
Don	Davidson	DCIO-Cybersecurity (CS)
Judith	Deane	TraCCC/GMU
Greg	Elin	GovReady PBC
Dieter	Ernst	East-West Center
D. Linda	Garcia	Georgetown University
Gordon	Gillerman	NIST
Basil	Gray	Gray Areas, LLC
James	Haddow	Howard University School of Business
Chaodong	Han	Towson University
David	Hannah	Jet Propulsion Laboratory
Patricia	Harris	NIST, Standards Coordination Office
Brian	Higginbotham	George Mason University
Meghan	Housewright	National Fire Protection Association
Nenad	Ivezic	NIST
Kasey	Kinnard	George Mason University; Terrorism, Transnational Crime, and Corruption Center

First Name	Last Name	Organization
Frank	Kitzantides	Kitzantides Consulting
Naouma	Kourti	European Commission
Marianna	Kramarikova	TIA
Gary	Kushnier	Formerly ANSI
Stephen	Kwan	San Jose State University
David	Lightfoot	Georgetown University
Christopher	Lindsay	The IAPMO Group
Bruce	Mahone	SAE International
Alexander	McMillan	IEC USNC
Joseph	Mohorovic	U.S. Consumer Product Safety Commission
Michele	Moss	Booz Allen Hamilton
Mike	Ogle	UNC Charlotte
James	Olshefsky	ASTM International
Tobin	Porterfield	Towson University
Don	Purcell	Catholic University of America
Erik	Puskar	NIST
Abirami	Radhakrishnan	Morgan State University
Bob	Ryan	IBM Corportion
Katherine	Schoenfelder	The MITRE Corp.
Michael	Spring	University of Pittsburgh
Manfred	Straehle	Assessment, Education, and Research Experts
Jeffrey	Strauss	Buffet Institute, Northwestern University
Esuaran	Subrahmanian	Carnegie Melon University
Janis	Tabor	Energetics Incorporated
Jeffrey	Weiss	Department of Commerce
Anne	Wilcock	University of Guelph
Steve	Williams	U.S. Consumer Product Safety Commission