The Department of Energy
Office of Energy Efficiency and Renewable Energy
BUILDING TECHNOLOGIES OFFICE

Technical Meeting on Data/Communication Standards and Interoperability of Building Appliances, Equipment, and Systems

Meeting Purpose: Review the craft of integrating today's automated building devices and systems to identify areas where stakeholder alignment on standards, policies, and processes can enable interoperability and thereby realize emerging value streams for the benefit of the buildings community. The scope of integration includes supporting information exchange within buildings and with external parties (other buildings, and service provider systems such as the electric grid).

Summary: Advancements in sensors, automation, and controls at all levels of building devices and systems promise to enable new capabilities and operational efficiency. However, realizing the benefits of coordination, data analytics, and the resulting efficiencies is proving far too difficult as the level of effort required to specify, integrate, maintain, and extend building systems to incorporate new technologies over time is overly complex and expensive. While some progress has been made, today's building systems often have proprietary connectivity with information frequently stored in exclusive formats and only accessible in batch modes using different protocols. Suppliers offer differing approaches (solutions) to integration with unique interfaces to sensors and devices that can embed control strategies making components difficult to decouple and replace or substitute.

And yet, information and communications technology (ICT) is enabling the integration of computer and audio-visual networks to new levels, leading to unprecedented interactions between various users and entities. By providing the infrastructure to coordinate millions of distributed assets within and across buildings, including variable loads, distributed generation, and energy-storage, ICT has the potential to lead to a similar convergence across building and grid domains.

Identifying and aligning the definition of ICT interfaces, including but not limited to messaging protocols, information models, and business processes that enable interoperability among all entities in the various systems is necessary to realize a market with interactions at different time scales. An approach is needed that is independent of the choice of communication medium used, the suppliers of the technology, and the types of devices. If multiple standards must co-exist on the system, it must bridge the different standards, and avenues must be provided to accommodate legacy components.

Openly available standards and interoperability testing and certification will be required to support equipment from multiple vendors and different providers of services to end-users (buildings) and energy infrastructure (grid) operators. Simple, unambiguous, and widely supported interfaces will enable cost-effective third-party development of software applications that add functionality and enhancements to the system.

This technical meeting will present the interoperability efforts underway, consider what else is needed to enable interoperability with a broad application of ICT, explore steps to address these needs, and discuss how applying ICT to the building and energy services domains, as well as the interfaces between these two domains, could provide new value to stakeholders by facilitating an exchange of services.

Logistics Information

The meeting will be held in the Maxwell Conference Room of the Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory, in Golden Colorado (as indicated on the map at the end of the book). However, guests must first go to the Visitors Center to check in. Guests should park at the Visitor Center Lot.

If you have a multi-day visitor badge, you need to show your visitor badge at the Site Entrance Building, and then you can go directly to the ESIF.

If it is your first day at NREL, you will need to go to the Site Entrance Building to verify that you are on the expected visitor list, then proceed to the Research Support Facility and get your visitor badge. You will then be directed to the ESIF. Someone will be at the ESIF lobby door to let meeting participants in and take them to the conference room.

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Additional Information

*Coffee, tea and a working lunch will be provided during the meeting

For more information about the Energy Systems Integration Facility please visit:
http://www.nrel.gov/esi/esif.html

AGENDA

7:00 AM Registration, continental breakfast, coffee

8:00 AM Introductions and purpose (Sean McDonald, Joe Hagerman)

8:30 AM Types of interactions (Rob Pratt, Steve Widergren – PNNL)
- Framework for describing interactions
- Intra-building
- Building to third party
- Building to electric grid
- Societal services

9:15 AM Standards convergence efforts
- ANSI EESCC Standardization Roadmap (Joe Hagerman - DOE)
- SGIP (David Hardin - consultant)

9:45 AM Break

10:00 AM Standards-based deployment initiatives
- BACnet (Carl Neilson – Delta Controls)
- LonMark Intnl – (Barry Haaser)
- OpenADR (Ed Koch – Honeywell)
- CSEP - (Tobin Richardson –Zigbee Alliance)
- USNAP (Chris Kotting)

10:45 AM Relevant standards bodies
- ASHRAE (Chris Kotting – EISA)
- NEMA (Patrick Hughes – NEMA)
- CEA (Bill Rose – WR Consulting)
- AHRI (Aniruddh Roy – AHRI)
- CEE (Don Brundage – Southern Co, Robert Wilkins – Danfoss)
- IEC PC118 Smart Grid User Interface (Dave Hardin – Consultant)
- OASIS (Bill Cox – Cox Software Architects, Toby Considine – TC9)

12:00 PM Working lunch (Wendy Seltzer – W3C)

1:15 PM Facilitated Discussion Questions (Sean McDonald)

4:00 PM Summary and next steps

4:30 PM Adjourn

Standards Convergence Efforts

ANSI EESCC Standardization – Joe Hagerman

What is the ANSI Energy Efficiency Standardization Coordination Collaborative (EESCC)?

The EESCC is a cross-sector group of energy efficiency stakeholders working together to develop a standardization roadmap to advance energy efficiency in the built environment. The main goals of the roadmap are to: identify what standards, codes, and conformance programs are available or under development, what gaps exist, and what additional standardization activities may be needed and increase awareness, adoption, and implementation of standards, codes, and conformance activities among policy makers and the market

What will the EESCC Roadmap do to help advance energy efficiency in the built environment?

- Articulate the value and benefit of standards, codes, and conformance programs, and help support their adoption and implementation at the federal and state levels
- Identify where gaps exist, so that the private-sector-led standardization community can respond with appropriate standards-based solutions
- Help federal agencies zero in on where they may be able to assist the standardization community

Who is involved?

- The EESCC is coordinated by the American National Standards Institute (ANSI) and led by co-chairs from the U.S. Department of Energy and Schneider Electric
- More than 50 member organizations involving over 130 experts from industry, standards and codes developing organizations, energy efficiency-focused organizations, educational institutions, and others

How can my organization become engaged?

- Visit www.ansi.org/eescc for more information and to join
- Provide relevant input on your organization's standards, codes, guidelines, and conformance programs for consideration in the roadmap via easy-to-use EESCC Inventory forms at www.ansi.org/eescc

Why should my organization contribute to the EESCC Inventory?

- The EESCC Inventory is gathering critical information on relevant standards, codes, guidelines, and conformance programs that will be considered in developing the standardization roadmap

- Providing relevant information will help to ensure an organization's standard, code, guideline, or conformance program is characterized appropriately

What are the benefits of joining the EESCC?

- Access early information on key energy efficiency initiatives and technologies
- Help promote the adoption of energy efficiency solutions through standardization, and influence the standardization strategies that impact emerging energy efficiency services and technologies
- Take part in crafting input to policy makers and the market to articulate the value and benefit of standards, codes, and conformance programs
- Leverage cross-industry and global networking opportunities and collaborations
- Demonstrate your organization's commitment to U.S. energy independence and economic growth

For more details and to join, visit www.ansi.org/eescc.

About ANSI

- ANSI is a private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system. In this role, the Institute oversees the development and use of voluntary consensus standards by accrediting the procedures used by standards developing organizations (SDOs), and approving their finished documents as American National Standards. ANSI does not itself develop standards – that is the role of SDOs.
- Internationally, ANSI is the official U.S. representative to the International Organization for Standardization (ISO) and, via the U.S. National Committee, the International Electrotechnical Commission (IEC), as well as other international and regional standardization and accreditation forums.
- ANSI is also a third-party accreditor. We assess the competence of organizations that certify products and personnel; validation/verification bodies engaged in the reduction and removal of greenhouse gases; and organizations that issue education and training certificates to U.S. workers.

Joseph Hagerman is a Senior Advisor at the U.S. Department of Energy's (DOE) Energy Efficiency and Renewable Energy Office focusing on building energy efficiency and new building technology development. He is at the forefront of the effort to develop clean, healthy, competitive building technologies for the 21st century. Formerly, Mr. Hagerman was the Team Leader for the Commercial Building Initiative (CBI) team within the Building Technologies Program at DOE. The CBI team is aggressively working to improve the performance and decrease the energy consumption of commercial buildings. Mr. Hagerman is leading the accelerated adoption of clean and efficient domestic energy technologies in commercial buildings. Before joining DOE, Mr. Hagerman was the project manager for the

Building Technologies group at the Federation of American Scientists (FAS). As project manager, Mr. Hagerman conducted research in new building technologies while demonstrating these technologies in the public sector. His efforts helped address environmental and energy injustice in affordable housing through the development of energy efficient advanced wall systems.

In 2005, Mr. Hagerman won the Metropolis Next Generation Design prize for developing a manufacturing strategy to cost-effectively deliver bio-remediating plant material inside open cell interlocking concrete pavers entitled “biopavers” He was also awarded the 2005 Rafael Vinoly Fellowship giving him the opportunity to conduct architectural based research with Rafael Vinoly Architects (RVA), an internationally renowned design firm. During his fellowship, Mr. Hagerman researched new environmentally high performance building materials and demonstrated new green roofing technologies.

Mr. Hagerman received his Bachelor of Architecture from Mississippi State University and his Masters in Civil Engineering at the Fu Foundation School of Engineering at Columbia University. His academic work focused on engineering mechanics and construction technology.

The Smart Grid Interoperability Panel (SGIP) – David Hardin

The Smart Grid Interoperability Panel (SGIP) is a public-private, global, non-profit collaborative working to identify requirements for technical Smart Grid standards. SGIP members work together to accelerate interoperability, testing and certification so that efficient, secure electrical power can reliably maintain and increase standards of living around the world. Members also have privileged access to the collected knowledge and expertise of all the domains in the Smart Grid ecosystem.

WHAT ARE THE BENEFITS TO JOINING SGIP?

SGIP is an inexpensive way to help an organization track and understand Smart Grid interoperable technologies. Successful implementation of interoperable technologies is the ultimate goal of SGIP members because it creates benefits and adds value to all stakeholders: utilities, manufacturers, consumers and regulators. Implementation is integral to the acceleration aspect of our mission and necessary for members to clarify and realize their value propositions. SGIP members stay competitive, informed and well-connected.

BACKGROUND

The pervasiveness of communications and information technology is transforming the way we interact with electricity. Greater coordination within the electric infrastructure and in our end-use systems opens the door to greater efficiencies and new services. But to unlock these advances, smart devices and systems need to simply and reliably connect and operate. Interoperability is all about providing remedies to our integration challenges. Tying together legacy – and often proprietary – systems with newer technologies poses one such challenge. Technology upgrades promise new capabilities, but widespread modernization will be unnecessarily complex and more expensive if components lack interoperable characteristics. As more types of electric power devices and sub-systems connect to the electric grid and each other, the need for careful evaluation of cybersecurity risks is vital.

WHY ARE INTEROPERABILITY STANDARDS IMPORTANT?

The U.S. Energy Independence and Security Act (EISA) directs the Federal Energy Regulatory Commission (FERC), after sufficient consensus is achieved, to institute a rulemaking proceeding to adopt standards necessary to ensure Smart Grid functionality and interoperability in the interstate transmission of electric power and regional and wholesale electricity markets.

The National Association of Regulatory Utility Commissions (NARUC) adopted a resolution in 2011 recognizing that interoperable standards have the potential to reduce the cost and risk of Smart Grid investments. A significant portion of these investments will be in distribution and end-use applications that are under the purview of state

regulatory agencies, which may elect to adopt standards identified by NIST and SGIP. Additionally, SGIP undertakes assessments that have important business and regulatory policy implications, including:

- Preparing guidance for the protection of consumer privacy and consumer access to electricity usage data;
- Developing cybersecurity guidelines for standards that may be incorporated in Smart Grid applications; and
- Identifying performance and reliability requirements for Smart Grid communications.

SGIP's work impacts a wide range of energy, environmental, consumer, and telecommunications issues.

Dave Hardin, Upperbay Systems, has more than 30 years of experience designing and integrating information technology and automation systems in industrial process manufacturing and energy management. He has held senior technical and management positions at EnerNOC, Invensys, Shell and Texaco. Dave has been active in a number of Smart Grid initiatives since 2006 including serving on the OpenADR Alliance Board of Directors, the Smart Grid Interoperability Panel (SGIP) Board of Directors, co-chair of the SGIP Architecture Committee, chair of the SGIP Industrial-to-Grid Domain Expert Working Group and member of the OPC Foundation Technical Advisory Council. Dave is also a member emeritus of the GridWise Architecture Council (GWAC). He is a Registered Professional Engineer (PE) (DE/MD), Project Management Institute Project Management Professional (PMP), and an IEEE Certified Software Development Professional (CSDP).

Standards-based Deployment Initiatives

BACnet – Carl Neilson

BACnet is a data communication protocol for building automation and control systems, developed within ASHRAE in cooperation with ANSI and the ISO. Developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), BACnet is an American national standard, a European standard, a national standard in more than 30 countries, and an ISO global standard. The protocol is supported and maintained by ASHRAE Standing Standard Project Committee 135.

The BACnet standard (ANSI/ASHRAE 135-2012) is maintained and enhanced by the ASHRAE Standing Standards Project Committee 135 (SSPC 135), also known as the BACnet Committee. SSPC 135 is charged with the maintenance and enhancement of the BACnet standard and also forms a collective of experts that can be called upon to answer questions, render interpretations, and, respond to requests for change from the public at large.

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry. Through research, standards writing, publishing and continuing education, ASHRAE shapes tomorrow's built environment today. ASHRAE was formed as the American Society of Heating, Refrigerating and Air-Conditioning Engineers by the merger in 1959 of American Society of Heating and Air-Conditioning Engineers (ASHAE) founded in 1894 and The American Society of Refrigerating Engineers (ASRE) founded in 1904.

Carl Neilson works at Delta Controls as a Project Manager in Product Development. In 1996, he joined ASHRAE SSPC 135 (a.k.a. the BACnet Committee) and is currently the Chair. As a member of BACnet International's BACnet Testing Laboratories Working Group, he helps to drive the industry's testing process for BACnet products. In order to bridge the BACnet communities of Europe and North America, Carl is a member of BACnet Interest Group Europe's Advisory Board and its Working Group Technique.

LonMark International – Barry Haaser

LonMark International is celebrating its 20th anniversary as a member-based trade association supporting the development, adoption, promotion, and education of open, interoperable systems. Members of LonMark International include the world's leading manufacturers, integrators and users of control systems in a variety of industries, including building automation, quick service restaurants, indoor and outdoor lighting, and energy.

LonMark International is widely recognized for its Interoperability Guidelines that provide detailed design guidelines for creating interoperable products. LonMark guidelines have evolved over two decades of producing an installed base of millions interoperable network products based on the ISO/IEC 14908-1 protocol standard for control networking.

A LonMark control network consists of intelligent devices—such as sensors, actuators, and controllers—that communicate with each other using the ISO/IEC 14908-1 protocol standard. LonMark devices contain applications that interact with each other through a set of standard interfaces. These interfaces, ***called LonMark Profiles***, are created and maintained via a committee work process of industry experts, end-users, integrators, and other stakeholders.

LonMark profiles define interoperable interfaces for products operating within control networks. The LonMark was originally designed to be a "multi-industry" interoperability standard with an eye towards the eventual connected world, or the IoT as it's called today. Today IoT open systems require, multivendor, multi-industry, multi-transport integration. LonMark International interoperability guidelines are designed to support smart grid interfaces as easily as smart buildings, smart street lights, smart kitchen equipment, and seamlessly provide integration between all.

LonMark International tests and certifies products for conformance to its Interoperability Guidelines. Over 900 products have been tested and certified by LonMark International for conformance to the guidelines. LonMark International has also certified over 700 industry professionals for their familiarity with the ISO/IEC 14908 standard as well as the LonMark Interoperability Guidelines.

LonMark International is expanding its interoperability guidelines and device profile architecture to support the rapidly growing market for the Industrial Internet of Things (IIOT). This architecture will enable companies to support traditional control networks based on the ISO/IEC 14908 standard or migrate them toward IP-based networks utilizing popular wired and wireless transport protocols such as Ethernet, IEEE 802.11, IEEE 802.15.4 and IEEE 1901.

Barry Haaser is the President of the Lakeview Group, a provider of marketing, consulting and association management services. Barry currently serves as the Executive Director of LonMark International and Managing Director of the OpenADR Alliance. Prior to forming

the Lakeview Group, Barry worked for Echelon Corporation (ELON) where he held a number of marketing and business development positions in the US and Europe. Barry was previously Vice President of Marketing at Alacritech and Director of Marketing at Saratoga Systems. Barry holds a Bachelor of Science degree in Business Administration from San Jose State University. Barry serves on the Board of Directors of SGIP.

OpenADR – Ed Koch

Open Automated Demand Response (OpenADR) is an open and standardized way for electricity providers and system operators to communicate DR signals with each other and with their customers using a common language over any existing IP-based communications network, such as the Internet. The OpenADR 2.0 profile specification is a subset of a standard called Energy Interoperation 1.0 created by OASIS (Organization for the Advancement of Structured Information Standards).

The OpenADR 2.0 profile specification, published by the OpenADR Alliance, is a flexible data model used to facilitate common information exchange between electricity service providers, aggregators, and end users. The concept of the open specification is intended to allow anyone to implement secure, two-way communications between an energy providers' server and customer equipment. OpenADR servers are called Virtual Top Nodes or VTNs. The VTN's send information over the Internet to customer equipment called Virtual End Nodes, or VENs.

The OpenADR 2.0a and b profile specifications describe the information model used between VTNs and VENs (or VTN/VEN pairs). The services contained in the OpenADR 2.0 specifications provide information that is pertinent to DR, pricing, and Distributed Energy Resources (DER) communication requirements. The OpenADR services leave the specific electric load control strategies to customers to tailor to their specific needs.

The OpenADR Alliance was formed in 2010 to foster the development, adoption, and compliance of the OpenADR standard through collaboration, education, training, testing, and certification. The OpenADR Alliance is recognized by SGIP as an Independent Testing and Conformance Agency (ITCA).

Recently, the International Electrotechnical Commission (IEC) approved the OpenADR 2.0b Profile Specification as a Publicly Available Specification (PAS) IEC/PAS 62746-10-1. Also, SGIP approved the OpenADR 2.0a and b Profile Specifications for inclusion in the Catalog of Standards.

Ed Koch is currently a Senior Fellow at Honeywell and CTO/Co-Founder of Akuacom, a wholly owned subsidiary of Honeywell. Ed was the leader of the workgroup at LBNL that drafted the OpenADR 1.0 specification and was instrumental in creating the OpenADR 2.0 specification. Ed currently sits on the Board of Directors of the OpenADR Alliance and is actively involved in a number of Smart Grid standardization efforts including the SGIP Building to Grid, Industrial to Grid and Vehicle to Grid Domain Expert Working Groups, IEC TC57 and PC 118, and the OASIS Energy Interoperation Technical Committee. Ed has over 25 years of experience in developing demand side energy management systems and technologies, specializing in communications networks for distributed control systems. To date Ed has been issued 18 patents.

CSEP – Tobin Richardson

The Consortium is an inclusive and communications technology-agnostic forum formed to unify and accelerate the realization of interoperable SEP 2 products. The Consortium was formed in 2011 by the HomePlug Alliance, Wi-Fi Alliance and ZigBee Alliance. Membership is open to eligible organizations with a business interest in SEP 2. Visit www.csep.org for complete membership details.

ZigBee offers green and global wireless standards, connecting the widest range of devices to work together intelligently and help you control your world. The ZigBee Alliance is an open, non-profit association of approximately 400 members driving development of innovative, reliable and easy-to-use ZigBee standards. The Alliance promotes worldwide adoption of ZigBee as the leading wirelessly networked, sensing and control standard for use in consumer, commercial and industrial areas. For more information, visit: www.zigbee.org.

Tobin Richardson is President & CEO of the ZigBee Alliance. In this role he leads the Alliance's efforts to develop and promote world-leading device-to-device wireless sensor and control networking standards. Tobin works closely with the Alliance Board of Directors to set strategy and implement programs designed to advance the adoption of ZigBee standards. Tobin joined the Alliance in 2008 as the Director for Smart Energy, where he was championed adoption of ZigBee standards in key smart energy markets.

Tobin has two decades of experience in leadership and strategy roles for technology firms and organizations. In 2007, he directed PG&E's smart meter upgrade RFP, following three years with the California utility executing the company's transformation process. Prior to PG&E, Tobin directed and led business development and stakeholder management for a broad spectrum of technology and large-scale companies, including Affiliated Computer Services (ACS), CenterBeam, Pandesic, numerous U.S. federal agencies and Georgetown University. His projects have involved turnarounds of key business units and organizations, driving inter-agency initiatives for the U.S. Customs Service and other federal agencies and leading new business development and strategic partnerships for technology firms based in Silicon Valley. Tobin has built his significant experience in cutting edge licensing, pricing and marketing initiatives with the world's leading technology firms such as CenterBeam and Microsoft where he helped pioneer the first implementation of software as a service (SaaS) pricing.

Tobin serves in a number of industry leadership roles, including Co-Chair of NAESB's Energy Usage Information Standard Committee, NEMA's Smart Grid Task Force and the CEA's Smart Grid Working Group. Tobin holds a master's from Georgetown University, and a bachelor's degree from the University of California, Davis.

USNAP Alliance – Chris Kotting

USNAP Alliance formed in 2009 to develop and formalize a specification for connecting customer owned equipment to Utility communication systems for Demand Response.

In 2011, the USNAP Alliance partnered with the Electric Power Research Institute to harmonize ongoing development of USNAP with a similar project at EPRI, and develop a common platform.

By September of 2011, the harmonized specification was passed to the Consumer Electronics Association for formal publication as an ANSI Standard. In December of 2012, the result was published as ANSI/CEA-2045.

In the process, the scope and applicability of CEA-2045 expanded, so that it currently enables any intelligent device to handle energy management, demand response, and pricing communications with other devices in the home and with utility systems, either directly or through a gateway.

The USNAP Alliance manages marketing, promotion and branding, testing and certification, and performs ongoing research and development of the CEA-2045 standard.

USNAP (ANSI/CEA-2045) - Technical Overview

The USNAP (ANSI/CEA-2045) standard defines the hardware interface, physical dimensions, data transfer, message contents and protocol specifics for interconnecting consumer products to multiple communications platforms. The root of the specification relies on the Serial Peripheral Interface (SPI) port found on most chips as the transport layer.

The goal is to provide a very inexpensive interface to enable virtually any consumer product to be connected together. The connector and plastic housing are expected to cost less than $0.10. Adding a communication chip and support circuitry will add another $5 to $10 in cost depending on the technology of choice. The card itself is approximately 1.5 inches square (3.81cm), making it small enough to fit into virtually any energy consuming product.

Since the ANSI/CEA-2045 standard is protocol agnostic, it can support a wide range of current and future device protocols. There are several USNAP cards available now through traditional retail channels, supporting ZigBee, Z-Wave, RDS (Radio Data System), WiFi, FlexNe and Trilliant. USNAP cards for other industry protocols are under development.

The USNAP standard supports a variety of device classes to enable a full-range of energy-aware consumer products to be attached to a network. Members of the USNAP Alliance will evolve the ANSI/CEA-2045 standard to include other popular device classes over time, as needed.

Chris Kotting is the Executive Director of the USNAP Alliance, and works with various standards-setting bodies and industry alliances, such as the American Society of Heating Refrigeration and Air Conditioning Engineers [ASHRAE], North American Energy Standards Board [NAESB](where he serves on the Board of Directors), and the Smart Grid Interoperability Panel [SGIP]. Prior to this Chris was an Administrator at the Public Utilities Commission of Ohio (PUCO), with responsibility for the development of Energy Assurance and Critical Infrastructure protection plans, including Smart Grid policy development. In this position, he provided policy guidance to both the PUCO and the National Association of Regulatory Utility Commissioners (NARUC).

Relevant standards Bodies

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) – Allen Jones

ASHRAE is an organization of over 53,000 members that "seeks to advance human well-being through sustainable technology for the built environment." Although its name may lead some to believe that is strictly a US organization, ASHRAE is actually a global society with chapters in 27 countries. ASHRAE is heavily involved in both research and standards development. A number of its standards have gained attention both nationally and internationally including:

ANSI/ASHRAE 135 (ISO 16484-5) – BACnet - A Data Communication Protocol for Building Automation and Control Networks, which is the dominant standard worldwide for building automation systems. ASHRAE 135 is maintained by SSPC 135 which is chaired by Carl Neilson (cneilson@deltacontrols.com).

ANSI/ASHRAE/IES 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings, which has been adopted as the energy standard for commercial buildings in most parts of the US. ASHRAE 90.1 is maintained by SSPC 90.1 which is chaired by Stephen Skalko (svskalko@cox.net).

ASHRAE/NEMA 201P (ISO/WD 17800) – Facility Smart Grid Information Model, which is being developed to provide "an abstract, object-oriented information model to enable appliances and control systems in homes, buildings, and industrial facilities to manage electrical loads and generation sources in response to communication with a 'smart' electrical grid and to communicate information about those electrical loads to utility and other electrical service providers." ASHRAE 201P is being developed by SPC 201P which is chaired by Steven Bushby (steven.bushby@nist.gov).

Additional information about ASHRAE can be found at www.ashrae.org/about-ashrae/.

Allen Jones is a Senior Technical Expert for Schneider Electric's Buildings line of business focusing on building automation, Smart Grid, and energy efficiency standards as they relate to large buildings. He is a member of the ASHRAE/NEMA SPC201P Facility Smart Grid Information Model (FSGIM) committee, the US Technical Advisory Group to ISO/TC 205 – Building Environment Design and the US Technical Advisory Group to IEC/PC 118 – Smart Grid User Interface. He represents Schneider Electric in meetings of the OpenADR Alliance. Allen has a degree in Electrical Engineering from Virginia Tech.

The National Electrical Manufacturers Association (NEMA) – Patrick Hughes

The National Electrical Manufacturers Association (NEMA) is the association of electrical equipment and medical imaging manufacturers. Founded in 1926 and headquartered in Rosslyn, Virginia, its 400-plus member companies manufacture a diverse set of products used in the generation, transmission, distribution, and end use of electricity as well as medical diagnostic imaging. Worldwide annual sales of products in the NEMA scope exceed $140 billion.

NEMA provides a forum for the development of over 600 technical standards, application guides, white papers, and technical papers that are in the best interests of the industry and users, advocacy of industry policies on legislative and regulatory matters, and collection, analysis, and dissemination of industry data. In addition to its headquarters in Rosslyn, Virginia, NEMA also has offices in Beijing and Mexico City.

Patrick Hughes is the Policy Director for High-Performance Buildings at the National Electrical Manufacturers Association (NEMA) where he directs the NEMA High-Performance Building Council. His work is focused on promoting federal, state, and local policies that encourage energy efficiency, sustainability, and safety in commercial, public, and industrial facilities. Before joining NEMA, Patrick was a Senior Associate at the Energy Future Coalition, an initiative of the United Nations Foundation, where he focused on developing new policies and finance mechanisms to increase energy efficiency investments in commercial buildings, as well as advocating for policies that encourage the build-out of the electric grid to interconnect remote renewable energy resources. Prior to that, he worked in the office of Congresswoman Grace F. Napolitano (D-California). Patrick is a M.Sc. candidate in Energy Policy and Climate Science at Johns Hopkins University and received a B.A. in Political Science from the University of Rochester.

The Consumer Electronics Association – Bill Rose

The Consumer Electronics Association (CEA) is the technology trade association representing the $203 billion U.S. consumer technology industry. More than 2,000 companies enjoy the benefits of CEA membership, including legislative advocacy, market research, technical training and education, industry promotion, standards development and the fostering of business and strategic relationships. CEA also owns and produces the International CES – The Global Stage for Innovation. All profits from CES are reinvested into CEA's industry services. CEA produces the International CES ®, the world's largest annual innovation event. It unites more than 150,000 retail buyers, distributors, manufacturers, market analysts, importers, exporters, and press from 150 countries. CEA member companies receive discounted floor space and other benefits when they exhibit at CES.

CEA Standards Development Organization – CEA Technology & Standards

With more than 70 committees, subcommittees and working groups and roughly 1,100 participants, the CEA Technology & Standards program maintains an unmatched reputation as a credible and flexible standards making body accredited by the American National Standards Institute (ANSI).

Contacts

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References

- Find CEA online at www.CE.org, www.DeclareInnovation.com and through social media.
- Gather with other CE professionals to develop industry standards. Visit http://standards.CE.org/apps/group_public/
- Find CEA standards, bulletins and other documents at https://standards.ce.org/kwspub/published_docs/

Bill Rose, the founder of WJR Consulting, has been active in the CE industry for over 30 years. During his career Bill has developed over 100 products, been awarded 17 patents and held numerous influential positions including:

- Chairman of the CEA Technology and Standards Council, and the Home Networking Committee (R7)
- Board Member CEA Home Networking and IT Division
- Chairman, IEEE 802.22., TV Broadcast spectrum
- Board Member, 1394 Trade Association
- President, High Definition A/V Networking Alliance (HANA) and Chairman of the Marketing and Technical WGs
- Member of 10 NIST/Smart Grid Interoperability Panel (SGIP) committees and WGs

Panel Report on AHRI and CEE Collaboration in Smart/Connected HVAC and Water Heating Equipment – Don Brundage, Aniruddh Roy, Robert Wilkins

The panel will discuss collaboration among leading manufacturers in the air-conditioning, heating, refrigeration and water heating sectors and leading electric utilities regarding enhanced energy efficiency and demand response performance and communication capabilities.

The collaborators recognize the heightened needs for both energy efficiency and enhanced demand response capabilities to manage utilities' growing summer peak loads. Since air-conditioning and electric water heating can contribute up to three-fourths of utilities' summer peak loads, especially in the South, and since those applications are readily accessible with direct communications systems, those applications are the primary focus.

The application base in focus consists of single-family homes and small commercial buildings with one or more discrete unitary air-conditioning systems not controlled by a building energy management system. Such applications are prime targets for utility demand response and peak load pricing programs since they number in the millions in the service territories of major utilities, and can be controlled with standardized utility programs within the purview of utility regulators.

The initial stages of this work focused on variable capacity air-conditioning systems, which include units with multi-stage or variable speed compressors. Variable capacity systems' energy efficiency increases as they are unloaded, so they reduce power (kW) more sharply than they reduce cooling during a DR event, meaning that occupant comfort is less affected by a DR event. Furthermore these units have on-board controllers capable of being programmed to act on DR or peak-load pricing signals and to return confirmation signals. Specific recommendations are now being developed and reviewed among both AHRI and CEE members for further refinement.

Recommendations for connected electric water heaters will also be developed in the near future.

The panel will discuss the roles of both AHRI and CEE, the findings and results of the collaboration, and next steps.

Don Brundage, Southern Company, representing the Consortium for Energy Efficiency (CEE)

Southern Company is the parent firm of four electric utilities, Alabama Power, Georgia Power, Gulf Power and Mississippi Power, which serve 4.4 million customers across 120,000 square miles. It has 4.4 million smart meters installed and has extensive load control programs for all types of customers. Southern is an active participant in CEE, and regularly provides comments to DOE on proposed energy efficiency standards.

CEE is an award-winning consortium of efficiency program administrators from the United States and Canada. Members work to unify program approaches across jurisdictions to increase the success of DSM in markets. By joining forces through CEE, individual electric and gas efficiency programs are able to partner not only with each other, but also with other industries, trade associations, and government agencies. Working together, administrators leverage the effect of their ratepayer funding, exchange information on successful practices and, by doing so, and achieve greater energy efficiency for the public good. CEE members establish a set of common efficiency specifications for initiatives that address marketing of high efficiency products. These specifications form a basis for transforming markets for more than 20 specific product categories in the residential, commercial and industrial sectors.

Don Brundage is a principal engineer in the Customer Analytics and Marketing Research Department of Southern Company Services, concentrating on energy efficiency. He participates in a number of different energy efficiency activities in ASHRAE, including ASHRAE's commercial energy code (Standard 90.1). He is active in CEE and also participates in Department of Energy hearings which set minimum appliance standards, and also Energy Star hearings to update Energy Star appliance standards.
Mr. Brundage has a Bachelor of Industrial Engineering degree from Georgia Tech, a Masters of Business Administration degree from Georgia State University, and is a registered engineer in the state of Georgia and a Certified Energy Manager (CEM).

Aniruddh Roy, The Air-Conditioning, Heating and Refrigeration Institute (AHRI)

AHRI is one of the nation's largest trade associations, representing over 300 manufacturers of heating, cooling, water heating and commercial refrigeration equipment. AHRI consists of 39 product sections, administers 40 rigorous certification programs and has established nearly 100 industry standards and guidelines. The Institute represents its industries domestically and globally, engaging in shaping of public policies.

The annual output of the North American HVACR industry is valued at more than $20 billion. In the US alone, AHRI members employ approximately 130,000 people and support some 800,000 dealers, contractors and technicians.

Aniruddh Roy is Engineering Manager of Regulatory Affairs at AHRI. His responsibilities include interacting with US Federal, State and Canadian regulatory agencies on issues that pertain to the HVACR and water heating industry; monitoring building code change proposals; working with industry on the development of policies on various issues through a consensus process; and serving as an industry representative on various standards developing organizations in the US and Canada.

Aniruddh has a bachelor's and a master's degree in Mechanical Engineering from Virginia Tech, and has been with AHRI for six years.

Robert Wilkins, Danfoss & AHRI

Danfoss is a leading global manufacturer of compressors, controls, heat exchangers, valves and variable frequency drives for high-efficiency air-conditioning, heating, refrigeration and motion systems. It operates in approximately 100 countries and employs over 25,000 globally, including 3,000 based in twelve US facilities.

Robert Wilkins is vice president public affairs and previously served as president of Danfoss North America, and in other leadership positions. Earlier he was vice president marketing at Florida Power and Light Company where he led energy efficiency, demand response, customer service and key account programs. He is a former chairman of the Air-Conditioning, Heating and Refrigeration Institute (AHRI) and currently serves on its Board of Directors and chairs its Committee for Smart/Connected Equipment. He also serves as chairman of the Alliance for Responsible Atmospheric Policy, and is a frequent speaker on policy and technology aspects of energy efficiency and refrigerant fluids.

Robert has a bachelor degree in electrical engineering from Vanderbilt University and an MBA in finance from the Wharton School of the University of Pennsylvania

International Electrotechnical Commission Project Committee 118: Smart Grid User Interface (SGUI) – Dave Hardin

Project Committee 118 was established by the IEC to address "Standardization in the field of information exchange for demand response and in connecting demand side equipment and/or systems into the smart grid". The primary deliverable from PC118 is a Technical Report (TR). This Technical Report presents the information exchange and interface requirements leading to standards to support effective integration of consumer systems and devices into the smart grid.

PC 118 has liaisons with TC 57, TC 8, TC 100, and IEC/ISO JTC1 SC 25. PC 118 draws on the input of IEC TCs (technical committees) to have a coherent IEC perspective on the customer interface, developing a set of standards (or mapping to existing standards) to ensure that IEC standards meet the needs of customer smart grid interactions.

The recommendations in this report will be used to guide work in IEC related to the customer interface to smart grid. This technical report presents an international consensus perspective on the vision for a smart grid user interface (SGUI) including: SGUI requirements distilled from use cases for communications across the customer interface (the SGUI); an analysis of existing IEC and other international standards that relate to the SGUI; and an identification of standards gaps that need to be filled and might become potential work items for IEC/PC 118.

The smart grid user interface is a logical, abstract interface that supports appropriately secure communications of information between an entity within the customer domain (e.g., home or building energy management system, electrical load, energy storage system or generation source) and an external energy service provider. Devices and applications will implement the SGUI between service providers and customers for the purpose of facilitating machine-to-machine communications. The SGUI needs to meet the needs of today's grid interactions (e.g., demand response, grid-aware energy management, EV charging equipment interactions) and those of the future (e.g., retail market transactions).

In practice, the SGUI will be one interface within a hierarchy consisting of potentially multiple interfaces which may include aggregation, both inside and outside of the customer facility. Implementations will have variations arising from complex system inter-relationships: diverse customer business and usage models with different types of equipment in different types of customer facilities controlled by a range of energy management systems.

IEC: http://www.iec.ch

PC118: http://www.iec.ch/dyn/www/f?p=103:7:0::::FSP_ORG_ID:8701

OASIS – Toby Considine and Bill Cox

OASIS is a non-profit consortium that drives the development, convergence and adoption of open standards for the global information society. OASIS promotes industry consensus and produces worldwide standards for security, Cloud computing, SOA, Web services, the Smart Grid, electronic publishing, emergency management, and other areas. OASIS open standards offer the potential to lower cost, stimulate innovation, grow global markets, and protect the right of free choice of technology. OASIS members broadly represent the marketplace of public and private sector technology leaders, users and influencers. The consortium has more than 5,000 participants representing over 600 organizations and individual members in more than 65 countries. OASIS is distinguished by its transparent governance and operating procedures. Members themselves set the OASIS technical agenda, using a lightweight process expressly designed to promote industry consensus and unite disparate efforts. Completed work is ratified by open ballot. Governance is accountable and unrestricted. Officers of both the OASIS Board of Directors and Technical Advisory Board are chosen by democratic election to serve two-year terms. Consortium leadership is based on individual merit and is not tied to financial contribution, corporate standing, or special appointment. OASIS Member Sections include AMQP, CGM Open, eGov, Emergency, IDtrust, LegalXML, Open CSA, OSLC, and WS-I.

OASIS has a distinctive character that contrasts with other standards organizations:

1. The OASIS technical agenda is set by its members, who are free to start, and advance efforts to meet the needs of the marketplace; this is in contrast to organizations where direction is centrally managed.

2. OASIS governance is responsive to the members — half of the Board are elected each year by the members for two-year terms, allowing the members to indicate annually the direction they would like to see OASIS go. Likewise, OASIS Committee chairs are elected by Committee members through an open, democratic process. Communication between Staff, the Board and Technical Committees is open and collaborative, not prescriptive. This differs from organizations where Board participation and working group leadership are tied to financial contribution, corporate standing, or staff appointment.

3. OASIS encourages but does not mandate convergence. This enables adoption to take place by reducing barriers caused by duplicate, contradictory and inconsistent concepts and specifications. OASIS values creativity and consensus over conformity and control, leaving it to groups of members who voluntarily agree to coordinate their standards development to ensure more convergence inside or outside OASIS or to the marketplace to evaluate overlapping efforts and determine the viability of any given approach. This is in contrast to assigning a single working group to address a standardization topic.

4. OASIS draws on a diverse membership base that spans industries and geographies, where researchers and practitioners, vendors and users, government agencies and academic institutions, individuals and multi-national corporations all come together; many other standards bodies only represent the interests of homogeneous communities.

5. The combination of the OASIS process, which is periodically revised by the Board in accordance with the wishes of the OASIS technical community, and the various OASIS IPR modes, which evolve according to marketplace needs and represent the collective IP wisdom of OASIS' stakeholders, makes for a highly effective standards development environment. Its effectiveness is periodically examined for potential flaws. This is in contrast to cumbersome standards processes that result from an accumulation of compromises.

Toby Considine is an internationally recognized leader in smart energy and smart buildings. He has been active in BIM standards for operations for more than a decade. Toby was a member of the EPRI Team that wrote the US National Smart Grid Roadmap for NIST, and then a member of the Enernex team that implemented it. He serves as chair or editor of multiple standards that are used to connect business operations and decisions to the machine world of operations and energy, including OBIX (generic web services for control systems), WS-Calendar (service oriented schedule negotiations compatible with RFC 5545), EMIX (schedule dependent energy market product information exchange), and Energy Interoperation. He was, for a while, a "FIATECH Roadmap Champion" for the self-maintaining, self-repairing building. Toby has more than 25 years of experience in IT to support facilities operations and was for a while on the faculty of the APAP Institute of Facilities Management. He holds a BS from the University of North Carolina, Chapel Hill, and has completed the Kenan-Flagler Program in Entrepreneurship.

William Cox is a leader in Smart Grid interoperability and information model issues. He is a consulting software architect, focused on service-oriented architectures and the related information exchanges to assure mutual understanding. He is co-chair of OASIS Energy Interoperation and Energy Market Information Exchange, is leading the WS-Calendar Platform-Independent Model, and is a technical expert in IEC working on international standards related to energy interoperation. He is a member of the SGIP Smart Grid Architecture Committee, and was part of the small group that created the NIST Smart Grid Conceptual Model. Current work includes the business value and deployment of transactive energy, use of transactive energy for microgrid and facility management, automated grid resilience, and information models for expressing schedule and facility information exchanges.

Bill is an OASIS Distinguished Contributor, and received the Object Management Group Achievement Award. He earned a PhD and MS in Computer Sciences from the University of Wisconsin-Madison.

W3C – Wendy Seltzer

The World Wide Web Consortium (W3C) is an international consortium where Member organizations, a full-time staff, and the public work together to develop and promote open, global architectural and engineering standards for the World Wide Web. Founded in 1994 by the Web's original architect Tim Berners-Lee, W3C pursues its mission, to lead the Web to its full potential, primarily through the creation of Web standards and guidelines designed to ensure long-term growth and interoperability for the Web.

Over 375 organizations are Members of the Consortium. W3C is jointly run by the MIT Computer Science and Artificial Intelligence Laboratory (MIT CSAIL) in the USA, the European Research Consortium for Informatics and Mathematics (ERCIM) headquartered in France, Keio University in Japan, and Beihang University in China, and has additional Offices worldwide.

W3C will host a workshop on the *Web of Things, Enablers and Services for an Open Web of Devices,* 25-26 June, 2014, in Berlin, Germany. http://www.w3.org/2014/02/wot/

Continuing advances in electronics have dramatically reduced the cost for devices functioning as tags, sensors and actuators for the physical environment, i.e. the Internet of Things (IoT). The market potential for the IoT is currently held back by fragmentation due to a plethora of communication technologies and the lack of a common approach to enabling services.

This workshop will examine the potential for open standards as a basis for services, either between devices, at the network edge, e.g. in home hubs, or in the cloud. It will discuss the use of web protocols and scripting languages for implementing services, the need for APIs for implementing drivers for specific IoT technologies, a shared approach to describing services as a basis for interoperability, and the underlying use of HTTP/COAP, Web Sockets, and EXI/JSON for RESTful services.

For more information about W3C, please contact: Wendy Seltzer, Policy Counsel and Technology & Society Domain Lead, wseltzer@w3.org +1.617.715.4883; or Karen Myers, W3C Business Development Lead, Americas and Australia, karen@w3.org +1.617.253.5509. On W3C's Web of Things work, contact Dave Raggett, dsr@w3.org +44.1225.866240. For more information see http://www.w3.org/

Wendy Seltzer is Policy Counsel to the World Wide Web Consortium (W3C), where she leads the Technology & Society Domain's focus on privacy, security, and social web standards. As a Fellow with Harvard's Berkman Center for Internet & Society, Wendy founded and leads the Chilling Effects Clearinghouse, helping Internet users to understand their rights online. She serves on the Board of Directors of The Tor Project, promoting privacy and anonymity research, education, and technology, and the World Wide Web Foundation. Wendy has an A.B. from Harvard College and a J.D. from Harvard Law School.

Facilitated Discussion Questions

Q1: Biggest challenge to integration – For information exchange to prosper between buildings devices, systems, and outside parties, such as other buildings and electric system operators, technology must integrate easily and reliably to support the various types of interaction scenarios envisaged. Are standards consistently interpreted or are there ambiguities? Are products from multiple vendors certified to work with each other? Is communications performance and reliability an issue for some applications? Is translation between technologies a barrier to deployment? These and other issues are explored in this discussion with a wrap up to try and prioritize the biggest issues we face.

Q2: Standards gaps – Given the results from the previous question's discussion, what is missing from the portfolio of existing information exchange standards? Are new features needed? Is optionality making integration more difficult by introducing confusion and can reducing the number of options help? Is there redundancy in standards where we can benefit from a convergence on smaller number of approaches? Do different standards create conflicts to deploying new technology with legacy components and can standards be revised to at least support co-existence? A discussion of these and other gaps can spawn activities that improve our ability to support new buildings interactions.

Q3: Steps to fill gap or address challenge – Given the results from the previous question's discussion, what actions can we take to fill identified standards gaps and enable the kinds of buildings interactions we envisage? What existing standards need to be revised to address a gap? In what areas do we need new standards? What information exchange and communications technologies are emerging to support future buildings interactions that will ease integration with other business functions (such as Internet-based connectivity) and what steps can be taken to adapt them for our building interaction scenarios?

Q4: Who needs to be involved?