

iHOMES and BUILDINGS

THE MAGAZINE OF THE CONTINENTAL AUTOMATED BUILDINGS ASSOCIATION



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Cybersecurity for Smart Buildings

Unlocking the smart home opportunity demands 'ecosystem' collaboration

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Utility consumer engagement platforms

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Autumn 2019, Volume 16, Number 3



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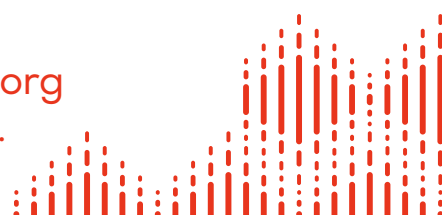
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IoT Standards for Homes and Buildings

By Ken Wacks

Introduction

In the winter 2018 issue of *iHomes and Buildings*, I introduced the options for companies to develop IoT engineering specifications for use in the home systems and building automation industries. A single company might publish specifications hoping to dominate a market as the first with a conforming product. Companies might collaborate in a consortium formed to foster market expansion. These approaches depend on one company or the consortium to support these specifications. Adoption of these specifications may be limited by licensing agreements or restricted to consortium members. Maintenance procedures to correct and improve these specifications may be limited.

The well-established route is to propose an official standard, produced by a Standards Developing Organization (SDO) where participation is open to the public and formal maintenance procedures have been published. As I explained in the previous article, some SDOs were established more than a century ago with broad support worldwide. In this article I introduce the North American and international SDOs responsible for IoT standards applicable to home and building systems.

North American standards

North American SDOs are authorized by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC). An important requirement for SDOs is public notice of all activities so affected

companies have the opportunity to offer technical protocols and comments on proposed specifications. Thus, an official standards organization provides a public forum, open to any product maker or subject-expert to develop and reach consensus on common specifications.

ANSI strives to ensure that participants in standards development include representatives from product developers, users, and those with general interest. ANSI defines these participant categories as:

- **Producers:** participants whose companies supply consumer electronics equipment covered by the standard.
- **Users:** participants whose companies utilize consumer electronics equipment covered by the standard to provide services to an end user.
- **General Interest:** participants who are neither producers nor users. This category includes, but is not limited to, regulatory agencies (state and federal), researchers, other organizations and associations, end-users, and consumers.

Some of the SDOs prominent in IoT for home systems and building automation include:

CTA (Consumer Technology Association)

This trade association represents the consumer electronics industry and produces the International CES (Consumer Electronics Show), the largest trade show in the US, held in Las Vegas each January since 1967. I chair the CTA standards committee responsible for energy management standards. We have published American National Standards for interfacing home devices such as thermostats and water heaters to a home network for managing energy consumption.

TIA (Telecommunications Industry Association)

TIA is a trade association for information and communications technology (ICT). Engineering committees hosted by the TIA develop standards for wired and wireless public and private networks. These standards range from telephones to structured cabling in buildings to cars to satellites. TIA also hosts the US Technical Advisory Committee to recommend US positions for the international Home Electronic System (HES) committee described below.

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

ASHRAE has 56,000 members from 132 countries. The ASHRAE library lists 193 standards such as *Green Construction Code, Building Energy Performance, Cooling and Heating Load Calculations in Buildings, and Testing Solar Collectors*. One of the most famous ASHRAE standards for building automation systems is *BACnet – A Data Communication Protocol for Building Automation and Control Networks*. This standard specifies abstract application models for devices that are constituents in building heating and cooling systems. These devices are modeled in terms of objects. A set of messages is defined for accessing parameters (such as names and values) of these objects by other objects, possibly in other devices.

BICSI (Building Industry Consulting Service International, Inc.)

BICSI is a professional association that develops standards in ICT design, implementation, and installation covering voice, data, and IoT. BICSI has issued standards for Electronic Safety and Security (ESS) System Design and Implementation Best Practices, Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises, and Building Information Modeling (BIM) Practices for Information Technology Systems.

International industrial standards

The two major industrial standards bodies are:

- IEC: International Electrotechnical Commission
- ISO: International Organization for Standardization



The IEC was established in 1906 to develop electrical technology standards (www.iec.ch). ISO was created in 1946 “to facilitate the international coordination and unification of industrial standards,” as explained at www.iso.org. In the spirit of world harmony the abbreviation ISO does not match the word order of the title either in English or French, but is derived from the Greek word ISOS meaning equal. Both organizations are based in Geneva, Switzerland and are funded by member nations, who each have one vote in the standards approval process. About 80% of the world countries are members of ISO and/or IEC. Because of the one-country/one-vote rule, negotiations and compromises are essential for harmony and progress.

The missions of ISO and IEC are to foster world trade, economic growth, and innovation. To ensure that standards have broad support, a super-majority of at least two-thirds YES and less than one-quarter NO votes from the voting nations are required for approval of

Published ² and Proposed HES Standards and Reports		
Category	Subject	Document Numbers
System design	HES architecture	ISO/IEC 14543-2, ISO/IEC15044
	Home and building automation in a mixed-use building	ISO/IEC TR 14543-4
IoT Communication Protocols	Communications protocol based on KNX	ISO/IEC 14543-3 series of 7 standards
	Communications protocol based on Echonet	ISO/IEC 14543-4 series of 3 standards
	Communications protocol based on IGRS (Intelligent Grouping and Resource Sharing)	ISO/IEC 14543-5 series of 14 standards
	Communications protocol for wireless short-packets generated by energy harvesting devices ³	ISO/IEC 14543-3-10 for AM signals ISO/IEC 14543-3-11 for FM signals
	Wireless Beacon-enabled Energy Efficient Mesh (WiBEEM) network	ISO/IEC 29145 series of 3 standards for devices that communicate using radios conforming to IEEE 802.15.4-2011 (the radio used by ZigBee)

Published ² and Proposed HES Standards and Reports		
Category	Subject	Document Numbers
Device and Network Interfaces	Numeric keyboard for HES	IEC 60948
	Simple Interfaces	ISO/IEC TR 10192-2
	Universal Interface Class 1	ISO/IEC 10192-1
	Residential gateway	ISO/IEC 15045 series of 2 standards
User Interfaces	Numeric keyboard for HES	IEC 60948
	Common user interface	ISO/IEC 10192-4-1
Interoperability	Product interoperability	ISO/IEC 18012 series of 3 standards
	Home network resource management	ISO/IEC 30100 series of 3 standards
Cybersecurity	Security requirements and services	ISO/IEC 24767 series of 2 standards
	Gateway sentry services	ISO/IEC 15045 series of 2 standards
Physical security & safety	Security model for HES	ISO/IEC TR 15067-4
	Functional safety	ISO/IEC 14762
Energy management	Energy management demand response (DR) including distributed energy resources (DER) and Energy Management Agent (EMA) functions	ISO/IEC 15067-3
	Protocol and interacting EMAs for energy management in an apartment complex	ISO/IEC 15067-3-1 ISO/IEC 15067-3-3
	Artificial intelligence (AI)-based device controller framework for EMA functions	ISO/IEC 15067-3-5
	GridWise Architecture Council (GWAC) Interoperability Context-Setting Framework	ISO/IEC TR 15067-3-2
	GWAC Transactive Energy Roadmap	ISO/IEC TR 15067-3-4
	Modular Communication Interface (MCI) for energy management	ISO/IEC 10192-3
Lighting	Lighting model for HES	ISO/IEC TR 15067-2

new standards. Both organizations have procedures for committee experts to seek an amicable resolution of technical differences where possible.

International IoT standards

ISO and IEC have established a joint committee for the establishment of information technology (IT) standards, including those for home systems and building automation (also called IoT for homes and buildings). Standards for homes and buildings are technical specifications for the construction or interconnection of manufactured components, software, systems, and communication networks. These components are usually sensors (for

detecting physical phenomena), actuators (for operating physical devices), user interfaces (for gathering user preferences and informing users), and controllers (for processing sensor, actuator, and user interface data). User interfaces range from wall switches to keypads to touch panels to voice-recognition systems.

International IoT standards development for homes and buildings are within the scope of the ISO/IEC committee, that I chair. We have been developing a family of standards called the *Home Electronic System (HES)*¹ for more than 20 years. The primary markets for our standards are developers, manufacturers, and installers of these products and related services.

HES standards enable home and building occupants:

- To live more comfortably in the home
- To be more protected and feel safe in the home
- To work productively in smart buildings
- To live and work more economically by reducing energy consumption and/or producing and storing or selling excess energy

HES standards facilitate consumer electronic products, networks, and services to interoperate or to operate, where feasible, as a single coherent system. This system benefits all stakeholders including product developers, manufacturers, service providers, installers, utilities, and consumers. HES consists of a network of networks that enables interoperation among consumer products, sensors, control devices, and user interfaces in homes and buildings with the potential for access to external services.

Applications of products and services based on HES standards include entertainment, lighting, comfort control, life safety, health, and energy management. The HES standards may become integral to related standards for smart cities, electric mobility (such as electric vehicles, also known as E-mobility), and Active Assisted Living (AAL).

Essential standards for IoT

The ISO/IEC committee for HES has developed about 50 standards since inception in 1987. The list in Table 1 illustrates the range of these standards related to home systems and building automation. Interface specifications include specific physical dimensions and protocol parameters in order to ensure seamless connectivity. However, these system specifications provide frameworks within which manufacturers have significant latitude to offer unique features and performance.

Conclusion

About 40 countries are members of the international committee developing IoT standards for home systems and building automation. Companies send experts to debate specifications for world standards at semi-annual ISO/IEC committee meetings. Although these are ostensibly technical meetings, they offer a marketing benefit with opportunities to preview and gauge emerging markets through discussions about anticipated product features. ●

- 1 The Home Electronic System is a family of standards developed by the committee officially designated:
ISO/IEC JTC 1/SC 25/WG 1
JTC 1 = Joint Technical Committee 1, entitled Information Technology
SC 25 = Subcommittee 25, entitled Interconnection of Information Technology Equipment
WG 1 = Working Group 1, entitled Home Electronic System (HES)
- 2 International standards may be purchased in North America at:
Canada: <https://store.csagroup.org>
US: <https://webstore.ansi.org>
- 3 An energy harvesting device is typically a sensor that absorbs a small amount of environmental energy from light, heat, or vibration and uses this energy to make a measurement such as temperature, occupancy, or light level and sends the measurement data to a controller.

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Dr. Kenneth Wacks has been a pioneer in establishing the home systems industry. He delivers clear and practical advice to manufacturers and utilities worldwide on business opportunities, network alternatives, and product developments in home and building systems. He chairs the ISO/IEC committee that develops world IoT standards for homes and buildings. The United States Department of Energy appointed him to the GridWise® Architecture Council to guide the electric industry toward smart grids. For further information, please contact Ken at 781-662-6211; kenn@alum.mit.edu; www.kenwacks.com

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