

# HOME ELECTRONIC SYSTEM

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The Home Electronic System (HES) is a family of international standards for home systems under development by experts from Asia, Europe, and North America. The experts are organized into a formal Working Group<sup>1</sup> that writes the standards and submits them for approval by the member nations. Member nations are either Participating members or Observer members. The following 23 countries are Participating: Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, The Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and the United States. Each Participating member nation is entitled to submit proposals, select experts for a delegation, and vote the national position. The following countries have Observer status: Argentina, Austria, Brazil, China, Cuba, Iceland, Indonesia, Malaysia, Mexico, Philippines, Romania, Singapore, and Yugoslavia.

## Goals of HES

A primary goal of HES is to specify hardware and software that enable a manufacturer to offer one version of a product for connection to a variety of home automation networks. To accomplish this, the Working Group has published an architecture that specifies the following components for HES:

- Universal Interface: An interface module to be incorporated into an appliance for communicating over a variety of home automation networks.
- HomeGate: A residential gateway to link home control networks with external service provider networks.
- Application Interoperability methods and models

The HES Working Group is also chartered to investigate applications of networks for

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<sup>1</sup> The *Home Electronic System* is the name of the international standards committee officially designated as ISO/IEC JTC1/SC25/WG1:

ISO = International Organization for Standardization  
IEC = International Electrotechnical Commission  
JTC1 = Joint Technical Committee 1, responsible primarily for information standards  
SC25 = Subcommittee 25, Interconnection of Information Technology Equipment  
WG1 = Working Group 1, entitled *Home Electronic System*

The missions of the ISO and IEC are to foster international trade and commerce.

command, control, and communications in commercial and mixed-use buildings. Mixed-use buildings may be apartment houses with retail shops and offices.

SC25/WG1 is actively engaged in writing standards in the following areas:

- The residential gateway
- Application interoperability
- Broadband home network
- Security, privacy, and safety in home networks
- Structured cabling

### **HomeGate, the Residential Gateway**

*HomeGate* is the proposed international standard for the residential gateway that links external networks with home networks. The first part of this standard, the architecture of HomeGate, has been completed. We are now planning the internal features of HomeGate. The primary goal of the residential gateway is to translate between the communications protocol of a WAN (Wide Area Network) and a LAN (Local Area Network). Translation consist of re-coding commands, event reports, and data from one protocol (WAN or LAN) into the other. We are considering a proposal for an RGIP, Residential Gateway Internal Protocol, to help this translation.

For many years, national and international standards bodies sought an agreement on a common communications protocol. Unfortunately, developers of competing protocols refused to compromise. Each developer was determined to corner the market with a proprietary protocol. Consumers don't care about protocols, so it is important that we find a method for linking home system products that do not use the same communications protocol. We are considering a proposal for providing such a linkage via a "Bridge Link." The control messages for each home network technology would be translated to a common intermediary format via a "Half Bridge."

### **Application Interoperability**

A standard intended to promote interoperability among home system applications is under development. The first part of the three-part interoperability standard describing the methodology for accomplishing interoperability is complete and approved. HES models of popular home systems, already written and published, will be incorporated into this standard. These systems include lighting control, security, energy management, and others. Models of these systems will be incorporated into the interoperability standard using a common classification (called a *taxonomy*) and dictionary (called a *lexicon*). Key functions will be classified and described with XML schema (software tools for managing World Wide Web data).

A proposal for the lexicon and taxonomy is being debated. The objective is to allow applications created by different manufacturers to communication with each other. This is essential for subsystems from diverse sources, such as lighting, security, energy management, and entertainment, to provide an integrated home system.

## **Broadband Home Network**

The HES Committee is developing a standard for a broadband home network based on a U.S. standard called the Versatile Home Network (EIA-851). The committee approved a new section of this standard for IP (Internet Protocol) digital telephony as a technical report, currently being balloted.

## **Security and Privacy**

A home network connected to the Internet affords convenient access for service delivery and for remote control of the home. Unfortunately, it also makes the home occupants vulnerable to hacking, theft, and loss of privacy. Two proposals were offered and provisionally accepted to add encryption and authentication to communications both within the house and via the Internet. We decided to combine these proposals into one standard.

## **Functional Safety**

The HES Working Group has been asked by the IEC to examine issues of functional safety. The Advisory Committee of Safety (ACOS) of the IEC has requested that the HES Working Group develop guidelines for safety on home automation networks.

All safety-critical messages sent over the network must be confirmed. Operation of an appliance via the network must not compromise the safety aspects of the device. Thus, if the network fails, the device must maintain appropriate safety levels. There are IEC safety standards for many devices when operating individually. The concern of ACOS is that product interaction via a home control network requires a harmonization of safety requirements.

## **Structured Cabling**

A Joint Protect Team of SC25/WG1 and SC25/WG3 (Building Wiring) is writing a standard for integrated residential wiring, commonly called Structured Cabling, to accommodate:

- Broadband Internet access from multiple locations in the house
- Home theater and distributed audio/video
- Home automation, such as lighting, comfort control, energy management, and security

About 40% of new houses in North America are being wired with structured cabling. The cabling typically includes coaxial cables and twisted-pair wiring. However, there can be significant differences in performance of an installed system. Some builders use poor quality cables. Others buy the proper materials but their contractors use poor installation practices. For example, Category 5 twisted-pair wires are rated at 100 MHz. However, if the wires are bent too sharply or pulled too severely during installation, the effective bandwidth and resulting data rate may be reduced.

## **Topology of Structured Cabling**

An important decision in the standard was to require star wiring from a single distribution panel called the Home Distributor to each room regardless of the application. The wiring within

the room is described below for each application category. The standard mandates at least one outlet per room, and more for large rooms of more than 10 square meters (100 square feet).

Star wiring in general uses more cabling material than bus or loop-through wiring. However, signal quality is better controlled with star wiring. Also, less drilling through wood studs in the wall is required when installing star wiring.

### **Applications of Structured Cabling**

The international standard defines three categories of applications and correspondingly three networking technologies:

- Command and control network

Command and control applications include home automation, characterized by relatively low data rates (a few thousand bits per second). The standard allows for *ad hoc* wiring within a room, although star wiring is required to the room from the Home Distributor. The free form topology within the room accommodates permanent connections to sensors and switches.

- Information network

Wiring to support computer networks and distribution of audio and telephony is based on Category 5 or better cabling. Typical installations deliver four or eight pairs to an outlet terminated with an RJ-45 jack, as used for Ethernet connections.

- Broadcast network

The standard allows two technologies for broadband: high-quality coaxial cables (RG-6) or shielded twisted pair wires (Category 7). The maximum length of cabling specified is 100 meters (300 feet) with a maximum bandwidth of 2.4 GHz.

### **Development of the Structure Cabling Standard**

The international standard takes two approaches to specifying structured cabling: prescriptive and descriptive. The specification of the communications channel from the Home Distributor to a room outlet constitutes the descriptive approach. Manufacturers are free to invent wires and connectors that meet the channel performance. The prescriptive approach names specific cables and connector types that, when installed properly, meet the performance standard.