

WS-SMH/ANEC_27/INF-0503

Extract from the ANEC¹ Consumer Requirements in Standardisation relating to the Information Society January 2003

5.9 SMART HOUSES

A Smart House is a dwelling that incorporates a communications network that connects the key electrical appliances and services and allows them to be remotely controlled or accessed. Electrical appliances and services would include items such as environmental controls (heating and lighting), security devices (alarms, motion detectors), home entertainment, cooking appliances, cleaning appliances, and communication systems.

The Smart House can be considered as the combination of three elements: home automation, a communications network and intelligent control. The communications network can be based on a physical cable (copper or optical fibre) or a wireless network or a combination of both. The intelligent control can be based a centralised computer or it can be based on distributed intelligence consisting of several local and remote computing devices. Remote access and control of the system may be available through a 'gateway'. This could be used by the homeowner and/or by service providers.

Developments in home electronics indicate that all houses in the future could be Smart Houses. Provided that consumer aspects are properly addressed, this can mean increased comfort, convenience, security and energy savings for most groups of consumers. Different groups of consumers may achieve different benefits (e.g. physically disabled people can use remote control to operate all devices in the home, as opposed to having to move to individual devices round the home to control them).

There is a trend towards the consumer being increasingly interested in secure and safe houses, especially in the most rapidly growing consumer group, the elderly. Most elderly people prefer to live in their own home as long as possible (as opposed to being placed in care). Security, safety and comfort are important issues for independent living by elderly people.

Smart Houses can help address these issues, and thereby contribute to individual consumer satisfaction. In addition to this individual aspect, society at large can benefit through the increased independence and satisfaction of the elderly. Soon one European in four will be over 50 years of age, but the number of *older* elderly is growing more rapidly than the group of *younger* elderly. Care services are experiencing increased pressure to deliver care to the dependent elderly. Smart Houses can decrease the pressure on the care services, provided that Smart House systems are flexible, standardised and easy to use.

Smart Houses represent an entirely new way of using the electrical installations and appliances in a house, which the consumers are unaccustomed to *and* unfamiliar with. If the technology is difficult for consumers to operate and maintain, some consumers will be disadvantaged, i.e. will not be able to enjoy the potential benefits (energy savings, integrated alarms) offered by the

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system. Ironically the groups (elderly) who might gain the most benefit from such systems might be the very ones who cannot operate them. If Smart House technology is going to be beneficial to the consumer, standards must ensure ease of installation and operation.

Consumers are major stakeholders in Smart Houses, and yet they are under-represented at the industrial and political levels (with a few exceptions). In the short and medium term, consumers will have to decide whether they want to embrace this technology or whether they will opt-out. It will not be a simple decision such as purchasing a new appliance. There is unlikely to be any financial benefit to completely re-equipping and re-wiring their house to convert it to a Smart House. The fully functional Smart House will most likely be a newly built home. However, they could decide on a retrofit solution employing computer control and radio frequency networking.

Such Smart House solutions are likely to be made financially attractive by consortia of companies consisting of equipment, software and service providers who will bring Smart House technology into the home by subsidy and subscription. It is therefore important to establish technical standards so that these different systems offer the consumer interoperability, compatibility and simplicity.

From a consumer's point of view, solutions should not be proprietary, because companies 'owning' the infrastructure will dictate the preconditions. In reality, the cost and complexity of a Smart House system will inevitably result in a number of proprietary systems together with a degree of commercial vertical integration. Consumers may therefore find themselves financially or physically 'tied-in' to a system. It is important for operational and technical standards to exist to ensure that a consumer can change their system or service without major redesign and appliance replacement for their home.

A key consideration is the possibility of different Smart House systems, for the internal communications and infrastructure (e.g. HomeRF, European Installation Bus, Echelon, BATIBUS, CE-Bus) to be compatible. If one particular system achieves the de-facto standard, excluding the others, there is a strong possibility of problems for consumers who have chosen another system at an early stage. For consumers, it is therefore vital that the major Smart House internal communications systems should work towards standards that allow interoperability.

Smart Houses will also govern the way consumers and service providers communicate and interact with the outside world via the home 'gateway'. Again, they could find themselves locked into a particular system or service hierarchy, depending on who controls their particular gateway. Standards need to ensure that these systems are interoperable so that a consumer can change their service provider without loss of functionality or safety.

Consumer priorities

- *Interoperability between communication systems (internal and external) and between individual components (appliances)*
- *Reliability and Quality of Service (QOS) standards for implementation and maintenance*
- *Cost benefit over a period of time that justify installation cost*
- *Safety of the Smart House system and appliances*
- *Security and privacy*

- *Comfort and convenience*
- *Standard, easy user interfaces for the main Smart House control systems*
- *Easy to understand and operate the complete system*

Recommendations for standardisation

Standardised definitions of basic services: It is easier for the consumer to choose the desired services and options according to the desired functionality and his/her own personal wishes if there is a standardised list of choices. This is particularly true because the concept of a Smart House is new;

Consistent user interface for different BUS systems: This is necessary if consumers are to choose confidently between the different BUS systems;

Standardising the user interfaces of the Smart House systems: Assuming that Smart House systems are compatible, the main consumer issue is ease of use. This can be achieved by standardising the user interfaces;

Interoperability between BUS systems: Interoperability should be standard between components, appliances and systems. This should also include ordinary home electronics that could be BUS compatible. Otherwise the consumer must buy conversion devices or software that can sometimes cost as much as the product itself;

Flexibility and modularity: The technology needs to be easily upgraded, modified and reprogrammed, (preferably by the user him/herself with average PC knowledge) as needs change through a life cycle. Modularity is one of the benefits of Smart Houses that provide flexibility. If the user cannot do it service contracts should be standard;

Standards for installation aspects of Smart Houses: This will ease the decision processes in each project, and ensure the basic requirements for a consumer-friendly installation with a minimum of ugly components showing. This is particularly important when installing BUS systems with cables. A standard position for the conduits (either by the floor, by the ceiling or at a certain height on the wall) makes the cable accessible for future installations and servicing;

Standardised training for installers: This should include understanding user aspects and co-operating with user representatives;

Control devices: Consumers have different requirements regarding the control devices necessary to operate their Smart House. The variations can be in vision, dexterity, reaction time and ability to understand interfaces (cognition). The control devices are vital for the consumers' perception of function and ability to use Smart Houses, because they are what the user meets. Different suppliers deliver completely different switches and other control devices, and they have shown little interest in standardising them. There should be standard basic switches that are tested and easy to understand and use for different user groups (Design for All).

Standardised (local language) text and or symbols to indicate functions on switches and on displays would assist. These should be compatible with other consumer electronic symbols;

Reliability: Consumers are often (and quite rightly so) sceptical about new systems that they have not used before. The systems should be fail-safe to allow the consumers to rely on their systems and components. This is of importance to homes as well as for commercial buildings. In the event of a power failure, uninterrupted power supply (UPS) or some other backup system should be installed as a standard to secure heating, light and other vital

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functions. This is particularly important in hospitals, nursing homes and houses for elderly and disabled people. In addition **manual override** must be standard;

Safety: One particular concern relates to how individual products will function when linked into a complex control system. At present, no one 'standard' form of communication or system control has been agreed upon, so although individual items may be safe in themselves, their safety systems may be compromised when they become connected to a particular control system. The risk that appliances and devices controlled by a Smart House may presently lie in the following areas:

- Heat (burning and scalding)
- Water control (flooding/scalding)
- Gas control (explosion, asphyxiation)
- Mechanical (unexpected operation or movement of appliances/devices)
- Fire (alarm control)
- Physical access (door and window lock control);

Safety systems concerning **unauthorised access** (e.g. hacking into a domestic gateway) needs to be standardised;

Interference: The system as a whole, and its individual components, should not cause electrical interference and should be immune from electrical interference to a level that guarantees satisfactory and safe performance;

Performance standards: Performance standards for signal transmission quality over cabling, hand-held remote controls, radio links need to be enforced so consumers can be confident that an installation will work as expected;

Standardised and compulsory quality assurance procedures before systems are set in operation This includes standardised procedures for testing each function and component before the system is delivered to the consumer and for testing each component for compatibility with other manufacturers systems or components. The providers and installers of the systems should have an interest in and knowledge about the particular consumer's' needs, and respect these throughout the planning and implementation process. These professions should require such knowledge as a standard part of certification requirements;

Consistent and user-friendly documentation and service procedures: Information, documentation and training in user aspects and operation of the systems must be standard procedure on implementation and before operation. This is particularly important to the consumers because Smart House technology represents an entirely new way of using your electrical appliances;

Standardise the interface between remote receptors and environmental controls: This can save expensive double installations in the homes of people who need IR environmental controls (e.g. physically handicapped), because the BUS installation can communicate with the IR sender;

Mechanical access: With respect to external access, Smart Houses may incorporate a mechanical system to allow the delivery of goods without the occupants being present. For example, this could be a locked compartment accessible from the outside by the suppliers

and accessible from the inside by the occupants. The system could be operated with a simple locking system or with some alternative interlocking mechanism that provides a secure system. A standardised system needs to be defined.

With respect to internal access, internal door and window locks may be controlled automatically (e.g. bathroom door may automatically lock when a person is present). Such systems need to be standardised for fail-safe use and allow for emergency access;

Personalised controls: Smart House systems and appliances may be personalised for individual occupants. Standardisation in the means of occupant identification, the configuration of the system and the security and privacy of the occupant's data will be required. Such systems should also be fail-safe, for example if an occupant loses their identity tag;

Standardise the control and metering of gas, water and electricity supply: This can make it easier to save energy through using Smart House systems. If metering is done remotely, standards are a help;

Energy: Standards or targets for total energy consumption need to be set for the Smart House system as a whole (not necessarily for individual components);

Transparency of costs and contracts: A standardised form of presenting costs and services provided is necessary to allow consumers to compare systems in an easy to understand form.

Part 2

5.9 SMART HOUSES	Rationale
Standardised definitions of basic services:	It is easier for the consumer to choose the desired services and options according to the desired functionality and his/her own personal wishes if there is a standardised list of choices. This is particularly true because the concept of a Smart House is new.
Consistent user interface for different BUS systems:	This is necessary if consumers are to choose confidently between the different BUS systems.
Standardising the user interfaces of the Smart House systems:	Assuming that Smart House systems are compatible, the main consumer issue is ease of use. This can be achieved by standardising the user interfaces.
Interoperability between BUS systems:	Interoperability should be standard between components, appliances and systems. This should also include ordinary home electronics that could be BUS compatible. Otherwise the consumer must buy conversion devices or software that can sometimes cost as much as the product itself.
Flexibility and modularity:	The technology needs to be easily upgraded, modified and reprogrammed, (preferably by the user him/herself with average PC knowledge) as needs change through a life cycle. Modularity is one of the benefits of Smart Houses that provide flexibility. If the user cannot do it service contracts should be standard.
Standards for installation aspects of Smart House s:	This will ease the decision processes in each project, and ensure the basic requirements

	for a consumer-friendly installation with a minimum of ugly components showing. This is particularly important when installing BUS systems with cables. A standard position for the conduits (either by the floor, by the ceiling or at a certain height on the wall) makes the cable accessible for future installations and servicing.
Standardised training for installers:	This should include understanding user aspects and co-operating with user representatives.
Control devices:	Consumers have different requirements regarding the control devices necessary to operate their Smart House. The variations can be in vision, dexterity, reaction time and ability to understand interfaces (cognition). The control devices are vital for the consumers' perception of function and ability to use Smart Houses, because they are what the user meets. Different suppliers deliver completely different switches and other control devices, and they have shown little interest in standardising them. There should be standard basic switches that are tested and easy to understand and use for different user groups (Design for All). Standardised (local language) text and or symbols to indicate functions on switches and on displays would assist. These should be compatible with other consumer electronic symbols;
Reliability:	Consumers are often (and quite rightly so) sceptical about new systems that they have not used before. The systems should be fail-safe to allow the consumers to rely on their systems and components. This is of importance to homes as well as for commercial buildings. In the event of a power failure, uninterrupt power supply (UPS) or some other backup system should be installed as a standard to secure heating, light and other vital functions. This is particularly important in hospitals, nursing homes and houses for elderly and disabled people. In addition manual override must be standard.
<ul style="list-style-type: none"> • Safety: 	One particular concern relates to how individual products will function when linked into a complex control system. At present, no one 'standard' form of communication or system control has been agreed upon, so although individual items may be safe in themselves, their safety systems may be compromised when they become connected to a particular control system. The risk that

	<p>appliances and devices controlled by a Smart House may presently lie in the following areas:</p> <ul style="list-style-type: none"> • Heat (burning and scalding) • Water control (flooding/scalding) • Gas control (explosion, asphyxiation) • Mechanical (unexpected operation or movement of appliances/devices) • Fire (alarm control) <p>Physical access (door and window lock control);</p>
Access protection	Safety systems concerning unauthorised access (e.g. hacking into a domestic gateway) needs to be standardized
Interference:	The system as a whole, and its individual components, should not cause electrical interference and should be immune from electrical interference to a level that guarantees satisfactory and safe performance.
Performance standards:	Performance standards for signal transmission quality over cabling, hand-held remote controls, radio links need to be enforced so consumers can be confident that an installation will work as expected.
Standardised and compulsory quality assurance procedures before systems are set in operation about the particular consumer's' needs, and respect these throughout the planning and implementation process. These professions should require such knowledge as a standard part of certification requirements.	This includes standardised procedures for testing each function and component before the system is delivered to the consumer and for testing each component for compatibility with other manufacturers systems or components. The providers and installers of the systems should have an interest in and knowledge
Consistent and user-friendly documentation and service procedures:	Information, documentation and training in user aspects and operation of the systems must be standard procedure on implementation and before operation. This is particularly important to the consumers because Smart House technology represents an entirely new way of using your electrical appliances.
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	<p>alternative interlocking mechanism that provides a secure system. A standardised system needs to be defined.</p> <p>With respect to internal access, internal door and window locks may be controlled automatically (e.g. bathroom door may automatically lock when a person is present). Such systems need to be standardised for fail-safe use and allow for emergency access.</p>
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