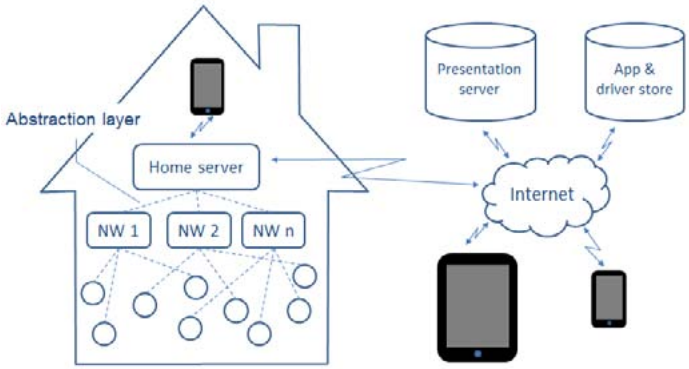
Project result

Cluster for Application and Technology Research in Europe on NanoElectronics

CA103 | Energy-Efficient Home Networks [HERTZ]

Hertz
Energy Efficient Home Networks

Energy efficiency is high on the European agenda. However, even with the arrival of regulations to phase out incandescent lamps and the introduction of various forms of energy-efficient lighting, a significant amount of energy continues to be wasted in homes and offices. The main contributor to this situation is that lights or other appliances are often left on when they are not required. The CATRENE HERTZ project has taken the first steps towards the introduction of auto-adaptive networking devices that limit energy wastage in both domestic and commercial equipment, without human intervention.



Auto-adaptive consumer networks lead the way in energy saving

For many years, it was thought that the home automation market was on the verge of centralised control or networking of all electrical appliances, from the washing machine to the refrigerator to the television to lighting. It has long been acknowledged that true energy efficiency requires automatic control systems.

However, in order to help the expansion of the market for such consumer networks, the members of the HERTZ consortium identified key challenges that had to be confronted. Firstly, it was essential to analyse the power consumption of such a network and to demonstrate that the amount of energy saved was greater than the amount of energy needed to make the saving. The consortium then worked towards a solution that is easy to use and can be installed by an ordinary consumer without having to rely on a professional. Finally, they addressed the issue of compatibility between proprietary devices and the risk that their presence in isolated clusters would hinder market development. All of these challenges were examined by the consortium while, at the same time, aiming to minimise the cost for the consumer.

The results of the Hertz project have led to substantial progress in this domain (sometimes called the Internet of Things), with the establishment of a set of standards that will form the basis of a compatible home automation network of the future.

A comprehensive solution

Over the three-year duration of the project, the consortium members worked together to establish a scenario that will serve as the European basis for the future energy-efficient networking of home appliances. The goal was to provide the means of controlling the functionality of disparate devices in such a way that overall efficiency is substantially improved.

The first stage in this process was to address the use of lighting energy. A large step was already taken with the phasing out of low-efficiency incandescent light bulbs. The next step has to be the efficient use of the new low-energy light sources and especially solid-state lighting (SSL). In fact, the efficiency of SSL lighting is already so good that it's a challenge to see how existing wireless networks could be used to control lighting without wasting energy. This is very much the case with

Partners:

ADD Semiconductor (acquired by Atmel)
Dialog Semiconductor
DS2 (acquired by Marvell)
Infineon Research
Infineon Wireline Division (spun out as Lantiq)
Iquadrat
Philips Consumer Electronics (spun out as TPVision)
Philips Lighting
Philips Research
Quintor

Project leader:

Henk Schepers
Royal Philips Electronics

Key project dates:

Start: October 2009
End: September 2012

Countries involved:

Austria
Spain
The Netherlands

PROJECT CONTRIBUTES TO

Communication	✓
Automotive and transport	
Health and aging society	
Safety and security	✓
Energy efficiency	✓
Digital lifestyle	✓
Design technology	
Sensors and actuators	✓
Process development	
Manufacturing science	✓
More than Moore	
More Moore	
Technology node	45/32 nm

WiFi systems, which have been shown to waste 80% of the energy in protocol maintenance while only 20% is used for data transfer. Providing SSL users at home or in the office with more comfort and safety without wasting energy is not easy using existing WiFi protocols.

Consumer acceptance dictates 'no new wires'. Where possible the existing electrical infrastructure will be used to power a sensor or to exchange information between system components (power-line communication) but, preferably, wireless control and mains-free power is required. The challenge was, therefore, to first of all devise new wireless methods of connectivity that are substantially more energy-efficient. To enable battery-free operation and to avoid frequent battery replacements, a second challenge was to develop much more precise sensors. Furthermore, the accuracy of those sensors had to be improved to ensure consumer satisfaction.

Dedicated components

The HERTZ project has successfully addressed component-level technology concerns, by creating an energy-efficient true presence sensor, a fully-harvesting powered daylight sensor and a wireless clip-on power sensor allowing disaggregated power measurements.

To achieve much more energy-efficient wireless networking, the HERTZ project has brought about the development of:

- a bi-state receiver concept with a wake-up sensitivity of -90 dBm at only 5 μWatt
- an ultra-low energy (ULE) variant for DECT with a sleep-mode consumption of 3 μA instead of the continuous 2.2 mA for normal DECT and a burst-mode consumption of only 2 mC
- an energy-efficient wireless local area network (WLAN) stack that performs up to 90% more efficiently in specific use cases
- a power adjustment scheme for the ZigBee wireless specification that leads to a 27% reduction in consumption.

The HERTZ project has also defined a gateway interface specifically tailored to the integration of different network technologies. As the various HERTZ members are leaders in their respective fields, the expectation is that this interface will help to give a realistic boost to the development of the home energy-control market.

Finally, the introduction of a self-configuring application and driver store provides for simple plug-and-play system installation.

The basic infrastructure

As a result of the HERTZ project, the control and/or monitoring of energy consuming appliances, in the home or in a commercial environment, has become a reality. The true presence sensor provides the means of determining a human presence in a room, even if the subject is motionless. The HERTZ gateway offers a means of wirelessly interfacing to a wide range of other devices that can signal their status over the network. The network protocols developed in the HERTZ project set standards that appliance manufacturers can use to enable their products to communicate, eliminating the incompatibilities that restrict the average consumer.

Overall, the HERTZ project has created the basic infrastructure for a comprehensive network control system that will greatly improve the efficiency of energy consumption in homes and commercial premises. It is confidently expected that electrical appliance manufacturers will, in future, follow the trend of providing their products with external interfaces conforming to the standards developed in the HERTZ project.

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