

# The ECHONET Lite Specifications and the Work of the ECHONET Consortium

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## 1. Introduction

To realize a sustainable society, it is important to take on the household sector where energy consumption is continuing to increase. In recent years, there have also been rapid advances in the spread of systems that can help reduce energy consumption. These include not only energy-saving appliances, but also energy-creation systems such as photovoltaic solar panels and fuel cells, and energy-storage devices such as batteries. This is adding to the complexity of using energy efficiently in the home.

It is therefore essential to introduce HEMS (Home Energy Management Systems) that can control these devices to achieve efficient operation, which means it is vital that all manufacturers provide controllers and appliances that use a standardized interface.

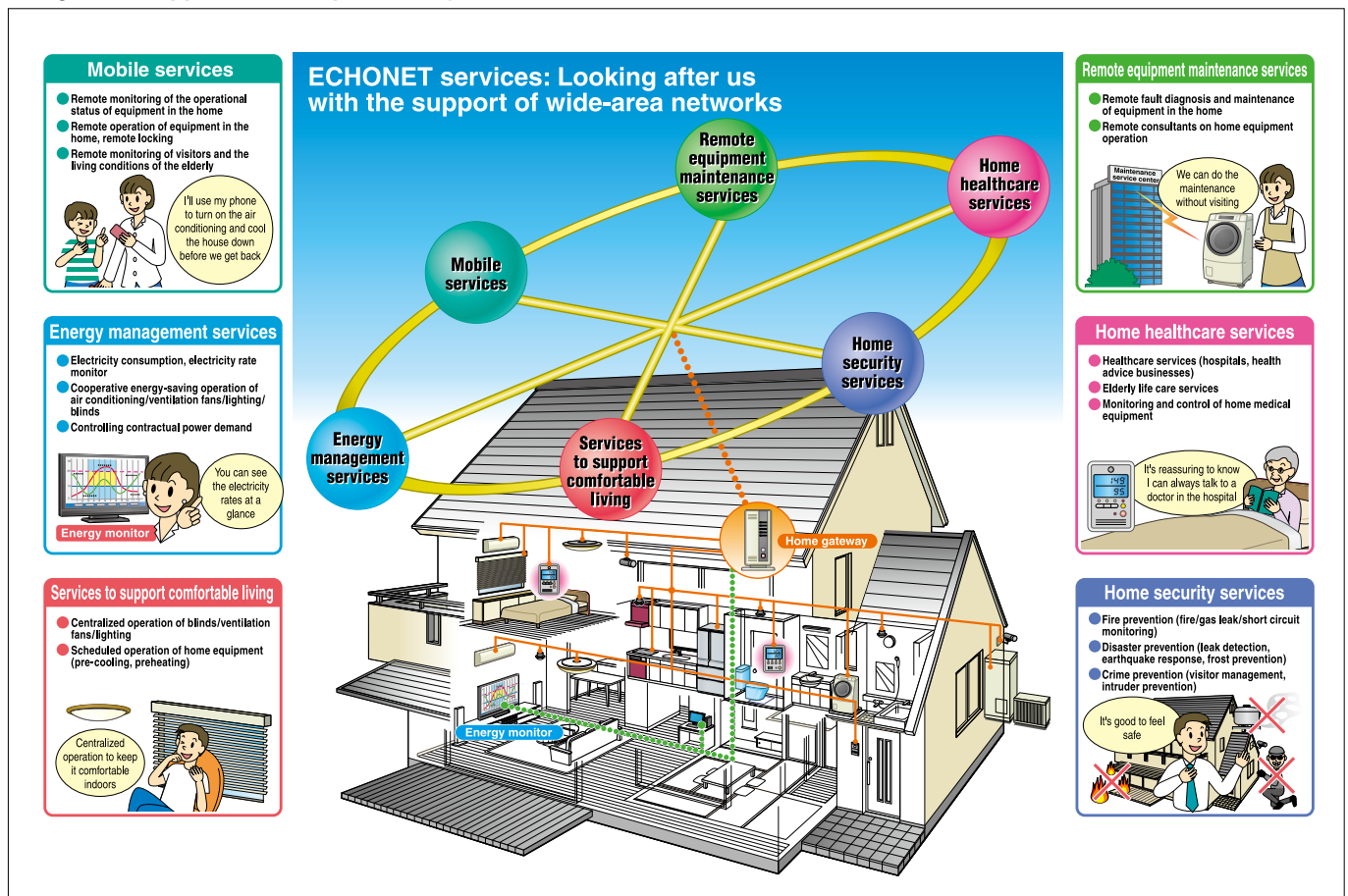
This article presents an overview of the ECHONET Lite specifications,<sup>[1]</sup> which define an open standard interface for smart

house equipment, and introduces the activities of the ECHONET Consortium, which drew up these specifications and is working to spread and promote smart house systems.

## 2. Past work of the ECHONET Consortium

ECHONET Lite is an open communication protocol that supports smart houses and HEMS. Although there had previously been means-based discussions on how equipment could be connected over a network, these resulted in standards based applications and needs, and standardization was promoted from discussions on what sort of world we were trying to create, and how to go about realizing it. In fact, six application domains such as energy management and home healthcare were established, and the aim was to devise specifications that enable the provision of services that can resolve social issues in these domains. Figure 1 shows the

**Figure 1: Support services provided by ECHONET**



support services that are provided by ECHONET.

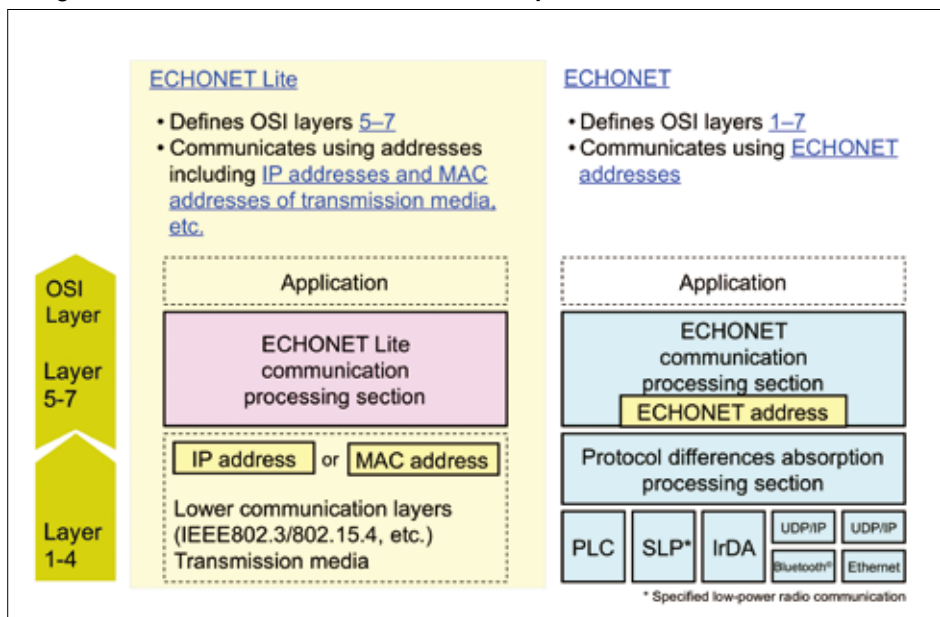
The origins of the ECHONET Consortium can be traced back to the Scientific Research Committee on 21st Century Home Networks (October 1996 – May 1997), which consisted of businesses in the electrical and domestic appliance sectors. In June 1997, it asked the Ministry of Economy, Trade and Industry (then known as the Ministry of International Trade and Industry) to promote the development and international standardization of networks supporting equipment from multiple vendors. The ECHONET Consortium was founded in December 1997 in order to carry out this work. Since then, with the nation's support behind it, the Consortium has continued to work on drafting specifications and promoting the spread of smart house technology. Today its membership comprises over 240 companies.

Our specifications can be broadly classified into two types: the ECHONET specifications and the ECHONET Lite specifications. Figure 2 shows their respective protocol stacks.

The first version of the ECHONET specifications was drawn up in 1999, and by 2009 it finally became an international standard. This process models consumer electrical equipment and facilities as objects and standardizes the protocols to form a basic framework for ECHONET. At that time, there were no communication media that could be used in the home without carrying out installation work, so we developed our own communication media using specified low-power radio communication and power line communication, and specified its structure for all seven layers of the OSI model.

But since then, substantial developments were made with various forms of communication media, and there were also many calls for adding Internet Protocol support and allowing free use of communication media. As a result, the specification was pulled back to define only layers 5 through 7 of the OSI model, and the transport layer was left free so that IP addresses can be used. [2] To facilitate the installation of greater numbers of devices, we also drew up the ECHONET Lite specifications with a slimmed-down middleware section. These were published

Figure 2: The ECHONET Lite and ECHONET specifications



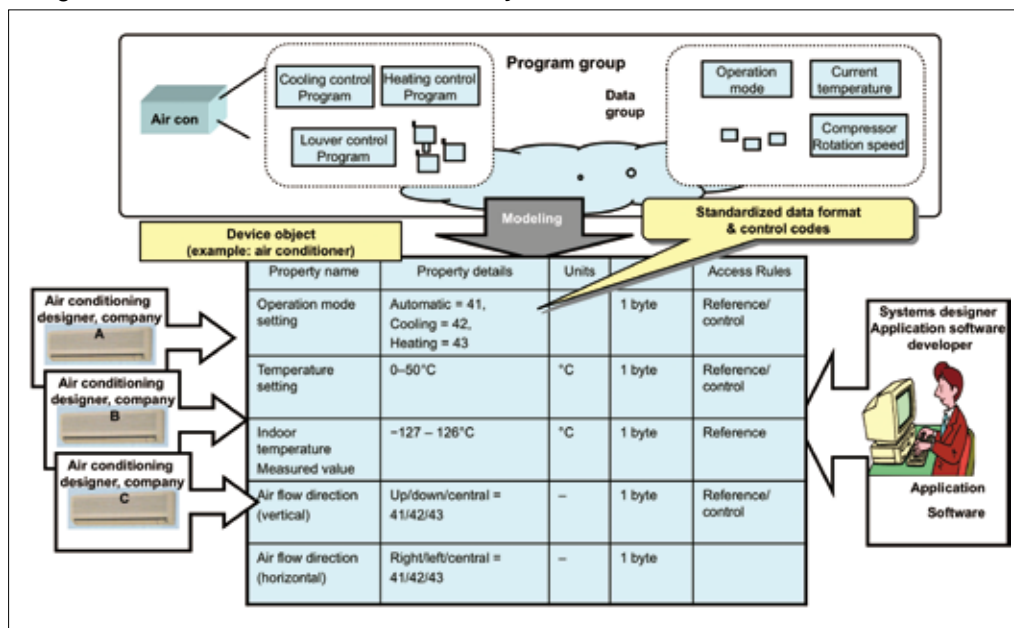
by the committee in July 2011. In the following December, the ECHONET Lite specifications were opened to the general public, making it an open standard both by name and by nature.

### 3. ECHONET device objects

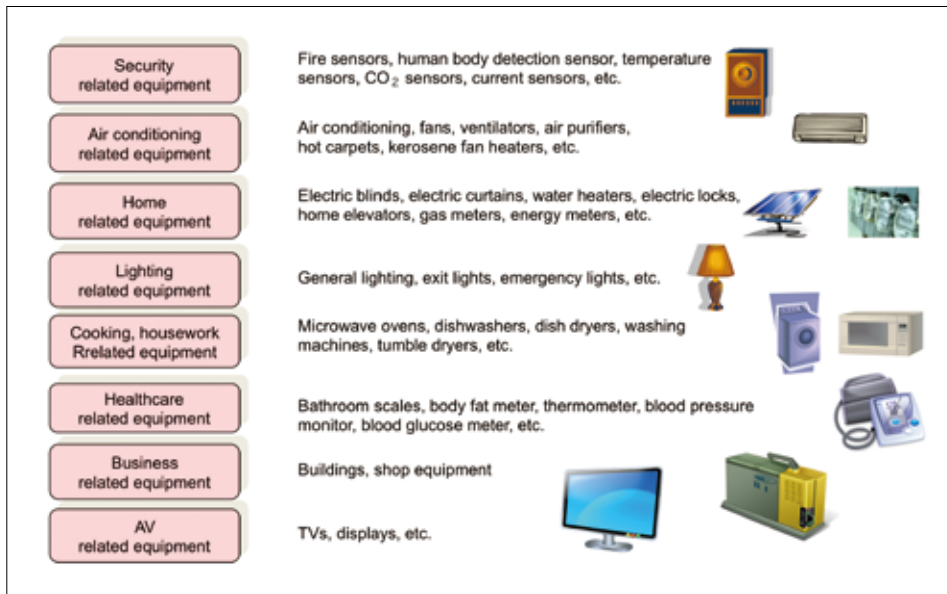
The basis of the ECHONET specifications is the idea of a device object, which is described below.

It is envisaged that household networks will be used to connect a wide variety of equipment sold by many different manufacturers, so what is actually needed is compatibility between diverse systems. This is harder to achieve than with business systems, which are easier to manage. Take air conditioners, for example. The methods used to implement functions with embedded software based on measurement data from a group of sensors will differ from one manufacturer to the next, and even from one product to the next.

Figure 3: Overview of ECHONET device object



**Figure 4: ECHONET device object types**



To enable all air conditioners to be represented in a common manner, they have to be standardized as device objects based on an abstract model. By accessing and controlling the property values of this standardized object, an application program can provide compatibility with all air conditioners without any modifications. Figure 3 shows an outline of an ECHONET device object.

ECHONET device objects offer more than just simple interaction at the remote control command level (like “ON/OFF” buttons), but also standardize the functions of highly sophisticated equipment, making it possible to implement the advanced control needed by energy management applications.

Figure 4 shows an example of a defined device object.<sup>[3]</sup> Currently, over 90 different kinds of ECHONET device objects have been defined. These include security-related devices such as fire sensors and human detection sensors, energy-consuming domestic equipment such as air conditioners and lighting, and equipment for the creation and storage of energy, such as photovoltaic power generation systems, domestic fuel cells and domestic storage batteries. Members of the ECHONET Consortium have proposed revisions to the device object in order to adapt to new devices, and a permanent working group of experts for drafting new functions has been proposed and is continuing to expand.

#### 4. International standardization

Figure 5 shows the progress made in international standardization of the ECHONET Lite specifications. The ECHONET Consortium is engaged in de jure standardization activities sanctioned by the ISO (International

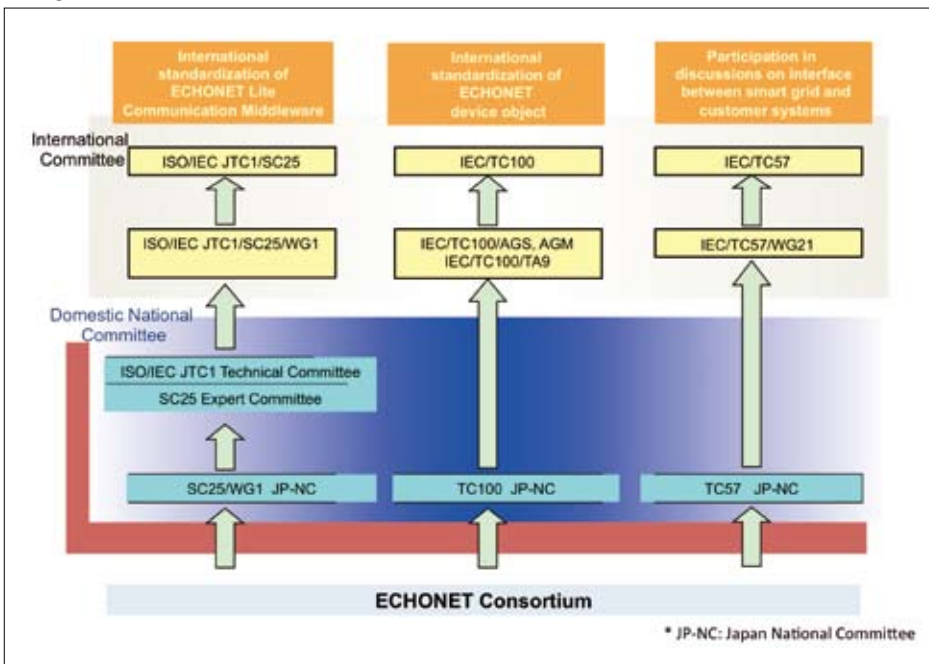
Organization for Standardization) and IEC (International Electrotechnical Commission). Specifically, the ECHONET specifications are divided into six parts, and are proposed via two routes: IEC TC100, and ISO/IEC JTC1/SC25/WG1. The ECHONET device object became an international standard in October 2013, and work on the ECHONET Lite protocol is also continuing with a view to achieving standardization early in the 2015 business year.

IEC TC57 is also working to standardize the interface specifications between smart grids and customers, and is raising the international profile of ECHONET Lite by proposing use cases that involve these specifications.

#### 5. Promotion of ECHONET Lite

The Ministry of Economy, Trade and Industry is promoting standardization relating to smart houses to respond to calls from society for greater energy savings, and has therefore started up the “JSCA International Standardization WG Smart House Standardization Working Group”. At the third study meeting held in February 2012, ECHONET Lite was recommended as the standard interface between HEMS (controllers) and domestic equipment, and between HEMS and smart meters.<sup>[4]</sup> Thus, since April 2012, each manufacturer has started investing in the market for ECHONET Lite equipment. After that, a “JSCA Smart House/Building Standards/Business Promotion Study Group” (the successor of the abovementioned committee) was established in June 2012. This Study Group defines eight key equipment

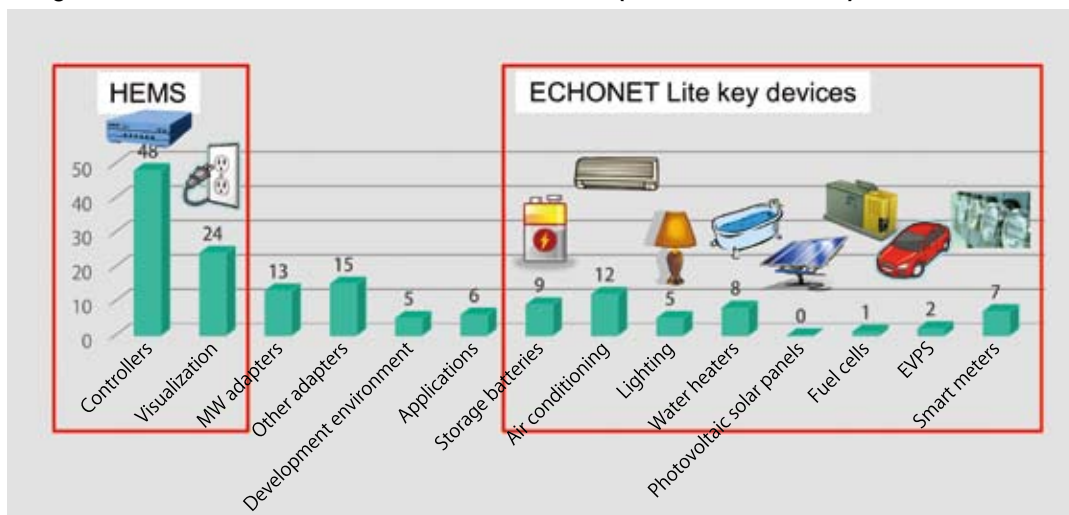
**Figure 5: International standardization activities**





categories for smart houses (smart meters, photovoltaic solar panels, storage batteries, fuel cell, electric vehicle charging systems, air conditioners, lighting, and water heaters), formulates operational guidelines for this equipment,<sup>[5]</sup> and promotes the spread of HEMS equipment. To support product development in each company, the HEMS (ECHONET Lite) Certification Support

■ Figure 6: Number of certified ECHONET Lite devices (as of December 2014)



Center was established in the Kanagawa Institute of Technology to support certification applications for equipment developed using the ECHONET Lite specifications, and to provide a product development environment and interconnection environment.

Figure 6 shows the number of items of ECHONET Lite equipment that have so far been certified (as of December 2014). Through the above-mentioned cooperative efforts of industry, government and academia to promote the spread of smart houses, it can be seen that the market penetration of HEMS equipment (controllers and energy visualization) is being promoted. Thus, the introduction of HEMS equipment is currently being advanced as a step towards the spread of smart houses.

However, realizing true smart houses involves more than just energy savings through visualization. It is also necessary to optimally control the energy creation equipment and energy storage equipment for an even greater effect, and to offer services that enable the user to feel the benefits of this technology. In the future, as the next step, we will strengthen our efforts to facilitate contributions to the promotion of commercialization by member companies, such as rapid investment in the market for equipment on the controlled side, and support for commercialization of the eight key equipment categories.

It is also essential to ensure interoperability in order to promote the spread of these devices. At the ECHONET Consortium, we are working on a certification system for ECHONET Lite by drawing up certification specifications and accrediting third-party certification organizations. We are also working on to help member companies with product development and certification by holding regular events called Plugfests that give people the opportunity to actually try out interconnectivity with equipment from multiple vendors.

## 6. Conclusion

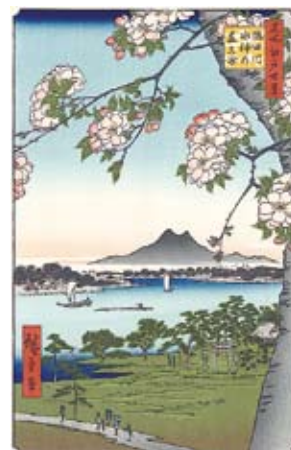
In this article, I have introduced the ECHONET Lite specification, which provides an open standard interface for smart houses, and the activities of the ECHONET Consortium. In April 2014, the ECHONET Consortium changed from a private organization into a general incorporated association. As we strengthen our systems, we intend to work harder than ever to

respond to the needs of companies over a wide range of activities. Through our efforts to spread ECHONET Lite specifications and products, we hope that the consortium will contribute to the realization of a smart, sustainable society by exploiting the benefits of consumer electrical equipment and household facilities that have been cultivated in Japan so far in order to promote international business development.

### REFERENCES

- [1] ECHONET Consortium: ECHONET Lite Specification Ver.1.11, <http://www.echonet.gr.jp/spec/>
- [2] The Telecommunication Technology Committee: TR-1043 home network communication interface implementation guidelines
- [3] ECHONET Consortium: APPENDIX, Detailed Requirements for ECHONET Device Objects, Release F, <http://www.echonet.gr.jp/spec/>
- [4] Ministry of Economy, Trade and Industry: Collected publications of the JSCA International Standardization WG, Smart House Standardization Study Group, <http://www.meti.go.jp/pres/2011/02/20120224007/20120224007.html>
- [5] Ministry of Economy, Trade and Industry: Smart House Building Standards and Business Promotion Study Group (4th) handouts, [http://www.meti.go.jp/committee/kenkyukai/shoujo/smart\\_house/004\\_haifu.html](http://www.meti.go.jp/committee/kenkyukai/shoujo/smart_house/004_haifu.html)

## Cover Art



**Meisho Edo Hyakkei  
Sumidagawa Suijin no  
mori Massaki**  
(Suijin Shrine and Massaki  
on the Sumida River,  
from the series One Hundred  
Famous Views of Edo)

Utagawa Hiroshige (1797-1858)

Woodblock print:  
Courtesy of Sakai Kokodo Gallery