Japan's Power Meter Deployment with ECHONET Lite over IPv6

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1. Discussions in JSCA regarding the deployment of an open standard interface

The Information Economy Committee of the Ministry of Economy, Trade and Industry's Industrial Structure Council held architecture-level discussions on the system theory aspects of Home Energy Management Systems (HEMS) and on the overall strategy regarding smart houses.

An energy management system is a system that implements Demand Side Management (DSM) to improve the efficiency with which energy is used at the customer side. There was a discussion on the subject of whether the system architecture should be vertically integrated with a closed interface, or should be horizontally specialized with an open interface.

A review of the published proceedings will show that a lively debate took place, but through these architecture-level discussions, it was resolved that new participants should be encouraged to realize innovation in relation to smart houses, emphasis should be placed on increasing the potential for added-value creation not limited solely to energy management, and the design of smart houses by horizontally specialized architecture based on known standard interfaces should be promoted.

With a horizontally specialized architecture, the overall system is built by using predetermined interfaces to assemble together smaller systems (subsystems). This results in a configuration with redundancy in the connections between subsystems (Carliss Y. Baldwin, Kim B. Clark, 2000).

Conversely, in a closed system that can be easily customized, it is easy to obtain a streamlined design that has little redundancy. Nevertheless, open systems that are wasteful in various aspects are used because of the larger incentives for the construction of many diverse systems at the same time.

In an open system, the interface selection is done in advance. Pre-selection of the interface is therefore essential. Another important is implementation. In gathering key players on demand side management such as Toshiba, Panasonic, NTT, Japanese Government has launched Smart House and Building Committee in JSCA.

2. Decision to recommend ECHONET Lite based on a public-private partnership

ECHONET is a home network communication protocol created by the ECHONET Consortium, which was founded in 1997 by a group mainly comprised of Japanese manufacturers of consumer electrical products with the aim of standardizing the implementation of home automation.

The distinguishing feature of this protocol is that it facilitates detailed control of Japanese consumer electrical products. On the other hand, since it defines interfaces for everything from physical media to application software, it is unable to adapt to the global trend towards the increasing use of IP at the network layer.

In particular, the presence of ECHONET addresses, which are intended to facilitate seamless connections to various physical layers, presents a major barrier to the formation of an international strategy. In response to requests from the public and private sectors, the ECHONET Consortium investigated the idea of abolishing ECHONET addresses and switching to a new communication protocol consisting of the ECHONET protocol superimposed on a physical layer using ordinary IP addresses.

This culminated in ECHONET Lite, which was released by the ECHONET Consortium on in July 2011. This specification has a new interface definition that does not define the physical layer and only defines parts of applications and the command systems of domestic electrical appliances and facilities.

Table 1: The leading smart house interfaces used in Japan and overseas

Type	Name of specification	Summary
Japan	ECHONET Lite	IP-based. Compatible with XML, etc. Defined for over 80 different devices. Allows detailed control
U.S.	SEP	IP-based. Predominantly offers superficial access to crude controls
Europe	KNX	Considerable experience of implementations in places on a larger scale than residential buildings (e.g., BEMS)

The two changes made by the ECHONET Consortium to the technical specifications (synchronizing with IP and leaving the physical layer unspecified) have had a major impact. This is because it facilitated cooperation with other protocols that have already been deployed and achieved international standardization. It could also be said that these changes made the protocol easier for new businesses and overseas businesses to use.

Although ECHONET Lite is sometimes criticized for being a Japan-only specification, this is not actually true. There are still many things that could be improved — for example, there are no training systems in place (even for engineers), no SDK or software development environment has been set up, and the only countries with equipment certification systems in place are Japan and Malaysia. However, it would be incorrect to call ECHONET Lite a national standard.

First, it has been ratified as an IEC standard. Second, the ECHONET Lite specification is an open standard. Third, it synchronizes with the direction of architectural maintenance of the international M2M network maintenance. And fourthly, it is being used in a growing number of implementations. The

simultaneous promotion of these four factors is bringing ECHONET Lite to a firm international standing.

The ECHONET Consortium has received the support of the JSCA Smart House/Building Standardization and Business Promotion Study Group (established as a public/private partnership in Japan), and selected the IEC as the stage for the acquisition of international standardization, and has been steadily promoting de jure international standardization.

Specifically, it is participating in ISO/IEC JTC1 SC25 WG21, IEC TC57 WG21 and IEC TC100 in order to ascertain the trends in international standardization and engage in consultations with experts from around the world. Its main activities are outlined below. First, with regard to the standardization of ECHONET Lite, progress is being made in establishing the ECHONET Lite specification (ISO/IEC14543-4-3) as a communication standard in the form of a supplement to the ECHONET specification (ISO/IEC14543-4-1,2) that has already become an international standard. Second, an expanded proposal is also being prepared whereby control target objects (also usable in ECHONET Lite) are added to the ECHONET specification (IEC62394).

The ECHONET Lite specification (which is the unique intellectual property of the ECHONET Consortium) also plays a large role in open standard decision-making. All the technical specifications can currently be obtained via the ECHONET Consortium's public web site (http://www.echonet.gr.jp/spec/index.htm).

With regard to this decision-making, the ECHONET Consortium's Representative Director Morio Hirahara has stated the following:

> *"ECHONET Lite will only become valuable when everyone is using it and a market has grown around it. There is no point in guarding it jealously. In manufacturing, a leading manufacturer can make anything from scratch, but in networks, one should remember that value is expressed by connecting diverse equipment together. I hope that we can create products with the participation of people from as many different business fields as possible."*

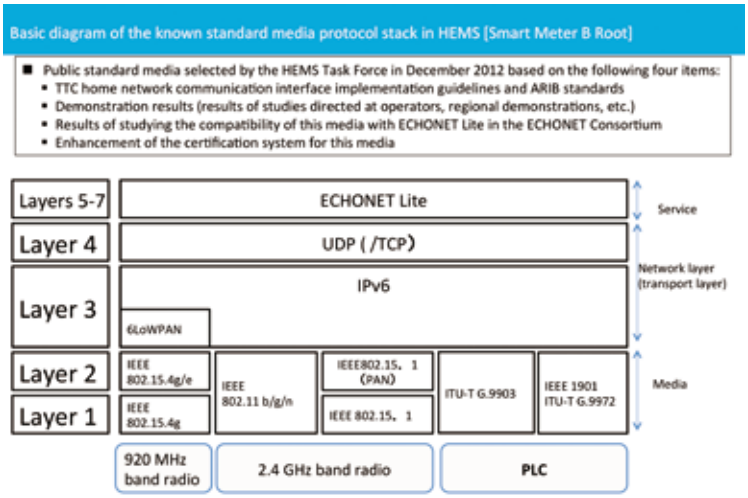
In practice, since the "four decision-making", the members of the ECHONET Consortium rapidly increased from 20 companies to over 200, stimulating the activity of participation in the ECHONET Consortium. (Figure 1)

The number of devices compatible with ECHONET Lite is continuing to grow steadily. At present, devices for which the specifications have been fixed account for not just consumer electrical products but over 90 different types of equipment.

Conventionally, the properties of air conditioners, lighting and other devices that use energy are defined, but the properties of photovoltaic solar cells, fuel cells and storage batteries are defined. In addition to consumer electrical products that use electricity, it is also intended that the same ECHONET Lite protocol should be used to connect devices that create or store electricity in the home.

By using ECHONET Lite, a well-known standard interface, to connect diverse types of domestic appliances to a network, we arrived at the implementation of an environment in which they can be integrally operated as a Home Energy Management System (HEMS).

Figure 1: The ECHONET Lite protocol stack



I also hear from overseas manufacturers that they are studying the writing of their own country's specifications for consumer electrical equipment and sensor devices. By paying a registration fee of just ¥300,000 (less than $3000 in U.S. dollars), anyone in the world can help write the specifications for new ECHONET Lite equipment.

3. Leading implementation of "B Route" smart meters

In March 2012, the Ministry of Economy, Trade and Industry Smart Meter System Investigation Committee announced that users of electric power usage information would be introducing the "B-route" technical specifications acquired directly from smart meters. This smart meter specification, which required the implementation of an IPv6 single stack and ECHONET Lite, has achieved global recognition as an advanced architecture.

The author gained the opportunity to lead the development of this specification, but in fact before the announcement of this specification, the smart meters had become a symbol of Japan's closed architecture, but since this announcement there has been a lot less criticism of this sort, especially from overseas.

At present, the implementation of smart meters using B-route is progressing smoothly. This stepped up a gear with the opportunities presented by the July 2014 publication of smart meter specifications for the Tokyo area (TEPCO) and Nagoya area (Chubu Electric Power). The US media company Bloomberg has reported that by 2020, 85% of Japan's demand for electricity will be obtained through smart meters. New smart meters are being installed in every home in Japan ahead of the rest of the world, and it is expected that Japan will lead the world in the innovation of smart meters and the IOT (Internet of Things).

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