Smart House Strategy empowered by ECHONET Lite, device oriented approach

July 2013

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Fellow, ECHONET Consortium
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Who we are? JSCA

- JSCA is government-industry collaboration for addressing Smart house as national strategy in Japan.
- Membership exceeds 350 organizations in Japan and overseas, diversified to IT integration, automobile, telecommunication, home appliance, network device, utility, academia, and government.
- Masao Isshiki [masao@keio.w3.org] is chairman of Smart House and Building Committee and in charge of interoperability test center.
- Masaki Umejima [umejima@autoid.sfc.keio.ac.jp] is deputy chairman and in charge of int’l strategy and specification development.
Organizational structure in JSCA, government–industry liaison

Japan Smart Community Alliance [JSCA]

Board Meeting

- International Strategy
- International Standardization
- Roadmap
- Smart House and Building Committee

Members
- Electric Utility
- Gas Utility
- Heavy Electric Industry
- Home Electronics Industry
- IT Company
- Developer

Total 350 companies and associations

Support and Cooperation
Who we are? ECHONET Consortium

Since 1970’s

For saving energy

Since 2010’s

For generate energy

Since 2010’s

For storing energy

High expectation to connect home appliances by common and trustful interface.

In 2012, ECHONET Consortium announced ECHONET Lite as open standardized interface.

Technical specification is downloaded at http://www.echonet.gr.jp/english/spec/index.htm
Since launching in 1997, ECHONET has expanded membership, exceeding 200 companies and institutions including overseas institutions such as IBM and TI.
Malaysian national research institution has joined ECHONET Consortium
“ECHONET Lite” for connecting all home appliances

ECHONET-Lite, owned by ECHONET Consortium, has become open interface since on Dec 21, 2011. ECHNET Lite has provided network access to over 80 devices, including home appliances, power meter, EV, and PV.

- ECHONET-Lite is recommended as the standard interface for connecting appliances and smart meter.
- Communication protocol between HEMS and devices should be based on IP.
Scope of ECHONET Lite Specifications

- ECHONET Lite is IP based and media free

**ECHONET Lite**
- Specifies OSI Layer **5 - 7**
- Communication Address is “**MAC Address**” or “**IP Address**”.

**Application**

- ECHONET Lite Communication Processing Block

**Lower Communication Block**
- (IEEE802.15.4 etc.)
- Transmission Medium

**OSI Layer**

- Layer 5-7
- Layer 1-4
Message structure of ECHONET Lite device

Example: ECHONET Lite over UDP/IP

**Media header** | **IP header** | **UDP header** | **UDP Payload** | **footer**

**EHD1** | **EHD2** | **TID** | **EDATA**

**SEOJ** | **DEOJ** | **ESV** | **OPC** | **EPC 1** | **PDC 1** | **EDT 1** | ... | **EPC n** | **PDC n** | **EDT n**

The kind of device
- Source device
- Destination device

Service
- control
- monitor
- notify

EPC: function
PDC: data size of EDT
EDT: setting or monitoring data

※: It’s possible to use TCP
Exercise 1 Monitor your air conditioner

(1) Monitoring request

(2) response

Media header | IP header | UDP header | UDP Payload | footer

<table>
<thead>
<tr>
<th>EHD1</th>
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<th>TID</th>
<th>SEOJ</th>
<th>DEOJ</th>
<th>ESV</th>
<th>OPC</th>
<th>EPC 1</th>
<th>PDC 1</th>
<th>EDT 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 81</td>
<td>01</td>
<td>01</td>
<td>05 FF 01</td>
<td>01 30 01</td>
<td>62</td>
<td>01</td>
<td>B3</td>
<td>00</td>
<td></td>
</tr>
</tbody>
</table>

controller | air conditioner | monitor | “setting temperature”

10 81 | 01 | 01 30 01 | 05 FF 01 | 72 | 01 | B3 | 01 | 1C | (28°C)

monitor | response

controller | air conditioner | monitor | “setting temperature”

10 81 | 01 | 05 FF 01 | 01 30 01 | 62 | 01 | B3 | 00 |       |
Exercise 2 Control your air conditioner

(1) Control request

(2) response

Media header | IP header | UDP header | UDP Payload | footer

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controller | air conditioner | control | “setting temperature” (26°C) |

header

response

header
List of ECHONET Lite devices

- 88 kinds of devices is ready to speak ECHONET Lite over IP in Japan. This move is expanding to overseas from Japan.
  - FY 2011-2012, several device objects, mainly “energy storage devices” and “energy generation devices”, were newly specified or revised.

Sensor Related

HVAC Related
- Air Conditioner, Fan, Ventilator, Air Cleaner, Carpet, Fan Heater, etc.

Facility Related
- Blind, Curtain, Boiler, Lock, Storage battery, Fuel cell, Photovoltaic system, Gas Meter, Watt-Hour Meter, EV/PHV, etc.

Cocking Related
- Refrigerator, Microwave, Washing Machine, Rice Cooker, Coffee Mill, etc.

Health Related
- Weighing scales, Clinical thermometer, Blood Pressure Meter, Blood Sugar Meter, etc.

Controller Related
- Controller, switch, etc.
Accomplishment:

10 million Toshiba’s air conditioners are ready to speak ECHONET Lite

- In attaching ECHONET Lite middleware adopter, Toshiba’s air conditioner enables to get network access.
- ECHONET Lite middleware adopter is such a communication card, enabling network access.
Accomplishment:
All Japan’s power meter can speak ECHONET Lite over IP

○ Japanese Power meter has two interfaces: A root is to connect meter and utility and B root is to connect meter and demand side such as user’s home.
○ B roots must be applicable to IP and ECHONET Lite and talk ampere[real time], Voltage[real time], backward flow, and electricity consumption for pricing [30 minutes]
Accomplishment:
Smart House is commercialized -1-

Mitsui Home Group
Misawa Homes
Daiwa House
Sekisui Chemical
Accomplishment: Smart House is commercialized -2-

Panasonic

Toshiba

Sharp

Hitachi
ECHONET Lite enables Smart house over standardized interface
International Liaison of ECHONET Lite

- ECHONET lite has addressed international standardization having allied with Japanese government and industry [JSCA],
  - Ongoing discussion in TC57 WG21, IEC
  - Ongoing liaison with other standardization bodies and research institutions: W3C [WEB], IETF, APAN [IP], and so on.
Launched HEMS Interoperability Test Center in 2012

① For the companies providing service: HEMS equipment, a place for actual examination, opportunities of information dissemination

② For the companies developing equipment: permanent Plug Festa location, software development kit, introduction of technical consultants or certification bodies

Image of the center
Basic test network diagram

Smart House Research Center
Kanagawa Institute of Technology, JAPAN

Log accumulation
Test confirmation terminal

To the certification test support system server

Controller
Mirroring hub
Adapter
Ready device

Test operation
Conforming tests
Filling out results

IP packet monitor + router (DHCP)
IP packet communication log acquisition

Log acquisition

Digital oscilloscope
Communication waveform log acquisition
Application deployment to control ECHONET Lite device

GUI

Application for controller

Controller -in House-

Application for controller

Home Area Network

Controller -Outside-

Transmission Module, attached to appliance

ECHONET Lite Protocol Stack

GUI

Application for controller

Apppliance

Application for middleware adopter

Device apprication

ECHONET Lite Protocol Stack

ECHONET Lite Middleware Adopter for transmission

ECHONET Lite Middleware Adopter for transmission

UART

IP

Appliance

Wireless Module, attached to appliance

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Expectation to compatibility ECHONET lite and Web is high. Web based smart house has become real?
ECHONET Lite delivers network connection to all appliances

- ECHONET Lite offers Services by Correlating Home Appliances, Facility Devices and Sensors.
- ECHONET Lite offers Various Services via World Wide Network