Hybrid Box Application

Functional Requirement
For
Home Energy Management

Version 1

January 18th, 2012
Japan Cable Laboratories

Revision History

Version	Date	Remarks
1	2012.1.18	Issuance of Version 1

Contents

1. Purpose

This portion is normative.

This document describes a functional requirement for home energy management, one of home ICT services (see Figure 1 below) planned by cable operators in Japan. This document is provided for the application development using the hybrid box (next generation Set-Top Box).

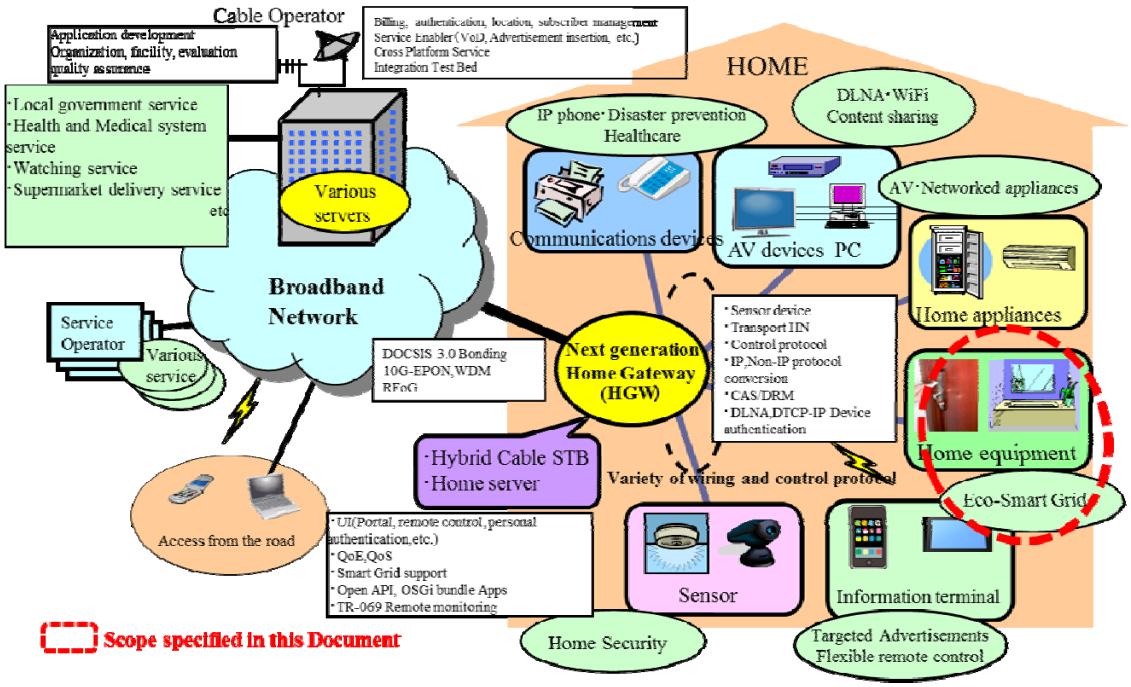


Figure 1: Home ICT Services

The home energy management service includes display of consumed electric power and generated electric power, control of power consumption, calculation of selling/buying power, display of associate information, etc. In this document, the service is limited to displaying consumed and generated electric power, fee of electric power to be paid and its associated information (support of energy saving, maintenance, etc.)

The hybrid box acts a home gateway (HGW) in the above figure in the service of home energy management.

2. Conventions

This portion is normative.

In this Document:

The keywords "**is required to"** indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed. The keywords "**is recommended"** indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance. The keywords "**is prohibited from"** indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed. The keywords "**can optionally"** indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

In the body of this document, the words *shall*, *shall not*, *should*, and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to*, *is prohibited from*, *is recommended*, and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

3. General

This portion is normative.

This document describes necessary network environment, equipment, device and their functional interface based on past use case study in Japan Cable Laboratories. This document does not exclude any use cases developed further.

A total service aspect for home energy management is shown in Figure 2.

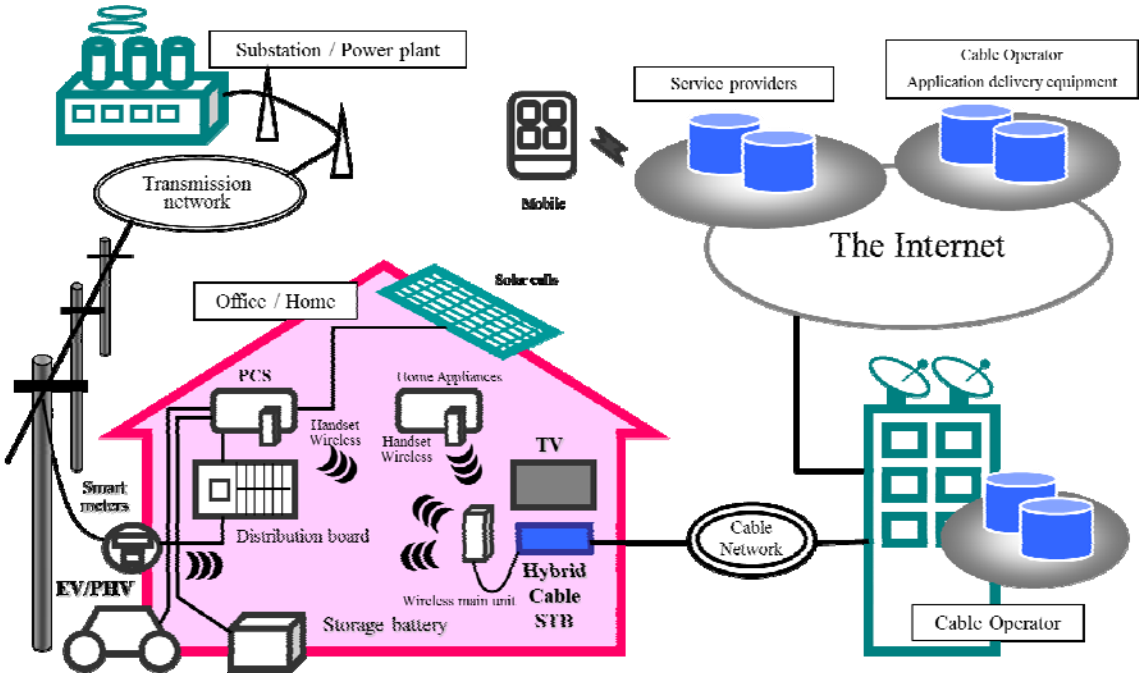


Figure 2: Total service aspect for home energy management

The hybrid box is required to access current censers attached to devices to be controlled (refer to the description in Clause 8), to collect current value and to display the consumed power or generated power on the control terminal device which is pre-set by the application. Also the hybrid box is required to access the collection server of censer information (refer to Clause 5), to get past accumulated data, fees, information from electric power company and cable operator and present them on the control terminal.

The Home Energy Management System (HEMS) by MITI of Japan aims at power consumption control, and its information system is similar to the Cable home network (Cable HN) service planned by Japan Cable Laboratories. In the Cable HN, IP connection is required to communicate devices under the control of the hybrid box. The possible protocol is Echonet light, and HEMS uses the same. It is required to connect HEMS system without any additional protocols.

4. Description of Service

This portion is normative.

4.1 Visualization service of consumed power

The system is required to measure the consumed electric power of each distributer,

breaker and consent, the generated power by solar cells, to calculate the fee of power and to inform the cable customer of the result. Current sensor is required to transmit measured data (consumed or generated electric power) to the radio terminal device by ZigBee or WiFi radio chip. The hybrid box is required to store the data temporarily (one day for example) and to upload the data to the collection server of sensor information.

The system is also required to present the cable customer regional power saving period, power saving announcement, information on power balance from municipal office or power company, not only displaying consumed/generated power. The system can provide recommend services for power saving and cost saving, optionally in line with customer's power consumption pattern.

The system can optionally provide any additional support including regional ranking information of power saving or additional incentive service. The system is required to be operated on the hybrid box in home and on smart phone or tablet terminal in out-door environment through the cable portal function. The system is required to send the information by an e-mail to the assigned address.

4.2 Solar power cell maintenance service

This is an information service to cable customer on the maintenance of solar power cell. The system is required to report cable customer the necessity of surface cleaning, existence of malfunction through monitoring past power generation record and comparison with regional standard generation value.

In general, the failure detection of solar panel module is difficult and hence it is left as it is, without maintenance even in guarantee period. It is useful for customer to be informed that the trouble is caused by climate change or stain/malfunction of solar panel. The system is required to report the cable customer the result. In case of home battery, it is also required to inform appropriate exchange date or advice of economical usage of the battery based on past operation record. The system is required to send the information by an e-mail to the assigned address.

4.3 Presentation Items

The presentation items are shown below to realize afore mentioned services.

(1) Electric power consumption (real-time, every hour, past record, regional ranking)
(2) Electric power generation (real-time, every hour, past record, regional ranking)
(3) Electric power fee (time zone, this month, comparison with previous year)

(4) Battery status (real-time, charge/discharge record) and exchange date
(5) Usage report by power company (regional power balance)
(6) Malfunction of solar power panel and/or necessity of cleaning
(7) Setting threshold of power consumption and control
(8) Alert indication over threshold, usage recommendation, sending e-mail
(9) Power saving schedule in region
(10) Economical usage information
(11) Contract detail with power company
(12) Setting of presentation

5. Collection server of sensor information

This portion is normative.

The collection server of sensor information to be located in a service delivery platform (SDP) is required to collect sensor information through the hybrid box and stored them. The server is required to store the process result by the application and transfer the data at the time of request by cable customer, or at the pre-set time toward the display device (ex. Tablet device, smart phone) assigned via the hybrid box.

6. Access Network

This portion is normative.

The WAN network for the home energy management service must be internet. The cable operator network must be used between head end equipment and the hybrid box.

7. Home Network and Hybrid Box

This portion is normative.

The wireless communication method can be optionally chosen from WiFi, ZigBee, Z-wave, Bluetooth and specific small power radio considering propagation, power consumption, location and operational condition. The radio terminal must be connected with the hybrid box. The hybrid box is required to provide following functions by the application described in Clause 11.

(1) Registration, provisioning, setting of communication for sensor device
(2) Installation and deletion of sensor device
(3) Accessing sensor device at pre-set time or periodically and display the information obtained.
(4) Informing display device that there is no response from target device within pre-set

period.

(5) Displaying data of (3), (5), (7)-(11) in Clause 4 on assigned display terminal in response to customer request after accessing sensor information collection server and other related data base.

(6) Informing display device that there is no response from above mentioned server or database within pre-set period.

(7) Echonet lite protocol can be optionally used for the communication between the hybrid box and target devices. If it is not, open and standardized protocol must be chosen.

(8) IPv6 can be optionally used considering remote control of home appliance.

8. Target Device

This portion is normative.

The target device is shown below and Figure 3, but it is not limited to.

- Home appliance: Air conditioner, Refrigerator, Electric range, Rice cooker, etc.
- Power distribution: Distributer, Hot water supply (outside plant), etc.
- Power generation: Solar power equipment, Bio-electric generation, Fuel battery, etc.
- Power storage: Battery, Car battery（Electric Vehicle、Plug-in Hybrid Vehicle）, etc.

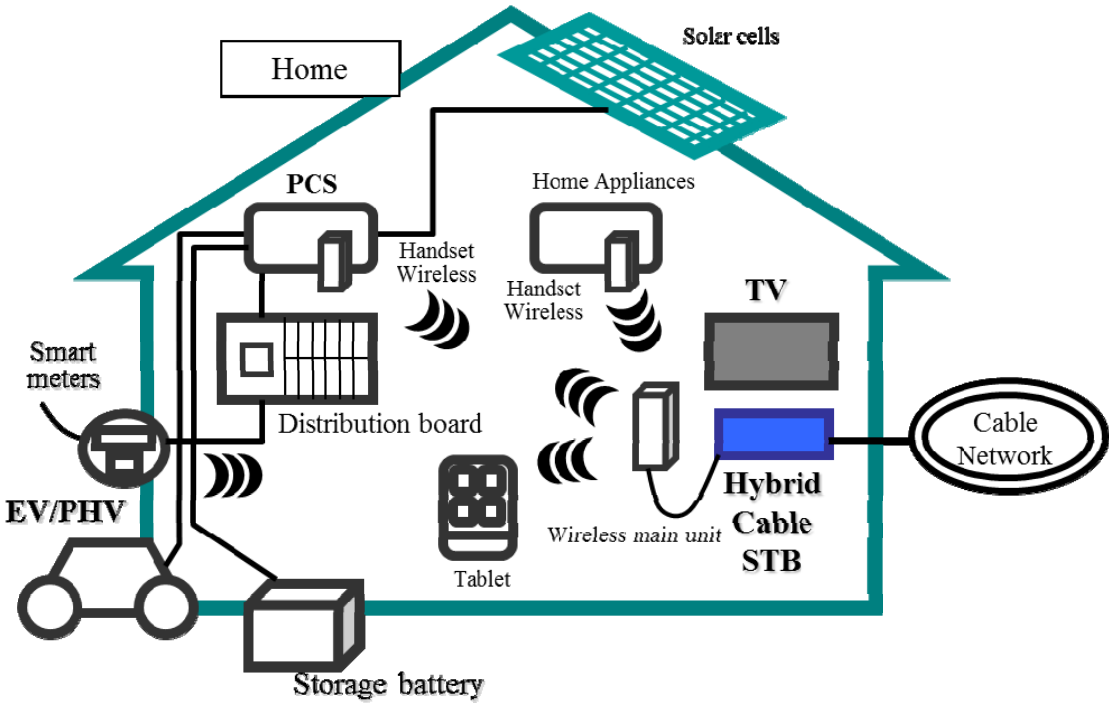


Figure 3: Target Device for Healthcare Srrvice

9. Operation and Display Device

This portion is normative.

Operation devices in this service shall be RCU of the hybrid box, tablet device and smart phone, etc. Display devices shall be TV, tablet device and smart phone, etc. Appropriate user interface (UI) is required for each display device and for elderly person in stress-free operation.

10. Sensor Device (Radio Chip)

This portion is normative.

The system is required to assign identification code to sensor device to be associated with target device. The radio chip must respond to the access request from the hybrid box. The chip must be installed simply and maintenance-free for considerably long period.

11. Application

This portion is normative.

The application must be tested and guaranteed its operation by Japan Cable Laboratories. The application must process the items described in Clause 4 and display the results. The application must be capable for customization of display method considering customer age. The application is required to register identification code (can be set by the customer) of target device.

12. Obtaining Application

This portion is normative.

The hybrid box is required to obtain application via cable operator through application distribution system provided by Japan Cable Laboratories.

13. Security

This portion is normative.

The system is required to provide following countermeasures (see Table 1) to maintain appropriate security level.

Table 1: Countermeasure for Security in Healthcare Service

Object	Countermeasure

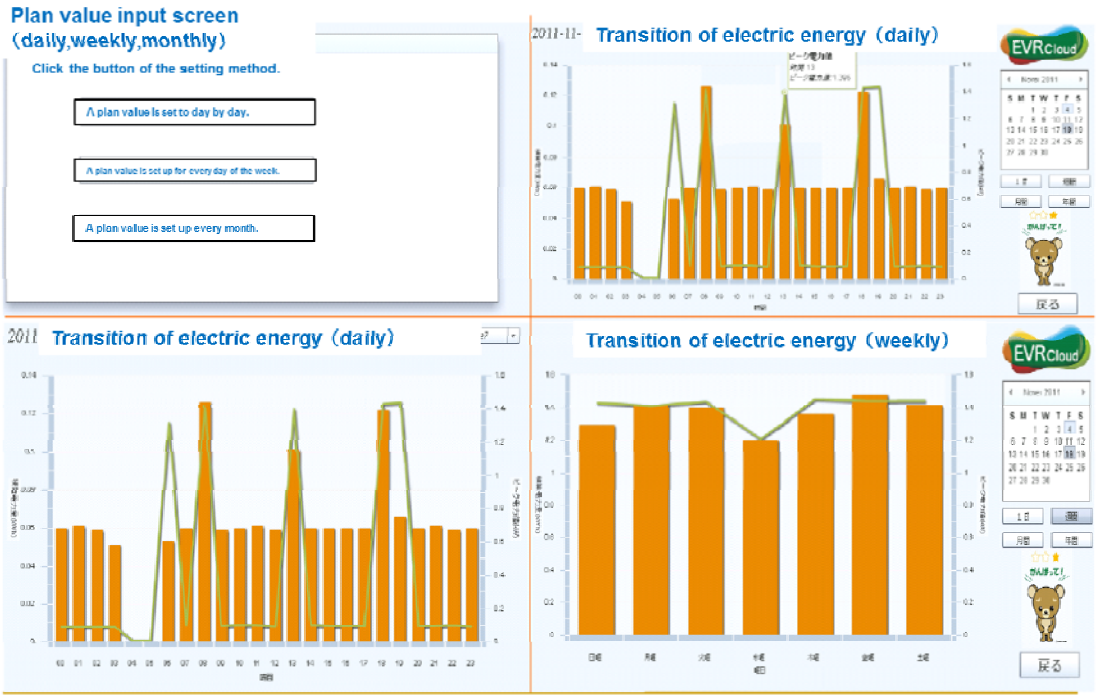
Hybrid Box(HGW)	Body	Prevention of illegal access, Detection of DoS attack
	Application	Prevention of alteration
Operator Server	System （HP site, Database, etc.）	Prevention of illegal access, Detection of DoS attack, Prevention of alteration
Communication	LAN	Prevention of tapping and alteration over transaction
	WAN	Prevention of tapping and alteration over transaction
	Sensor	Prevention of tapping and alteration over transaction
Target Device		Prevention of negative effect to other device (malicious operation, induction to error operation), Prevention of unexpected observation from outside

The system must provide following methods for device and customer authentication.
(1) Device authentication: Device specific method (MAC address, etc.) in home network connection, SSID in WiFi connection must be used. Customer authentication described in (2) shall be used alternatively for the device authentication without home network connection.
(2) Customer authentication: Pre-assigned password and ID must be used.

15. Operational Issue

This portion is informative.
Following issue is the outside scope of this document, however it shall be described in operation document.

- Charging method, relation to subscriber management system (SMS)



The example of an electric power visualization Cloud service screen