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Information technology – Home electronic system (HES) architecture – Part 4-1: Communication layers – Application layer for network enhanced control devices of HES Class 1

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FOREWORD

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International Standard ISO/IEC 14543-4-1 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title *Information technology – Home electronic system (HES) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

INTRODUCTION

This part of ISO/IEC 14543 specifies the services and protocol of the application layer for usage in Home Electronic System. Some services are targeted to field level communication between devices. Other services are exclusively reserved for management purposes. Some services can be used for both management and run-time communication. This part of ISO/IEC 14543 is based on ECHONET [1].

ISO/IEC 14543 *Information technology – Home Electronic System (HES) architecture,* currently consists of 14 parts:

Part 2-1: *Introduction and device modularity*

Part 3-1: *Communication layers – Application layer for network based control of HES Class 1*

Part 3-2: *Communication layers – Transport, network and general parts of data link layer for network based control of HES Class 1*

Part 3-3: *User process for network based control of HES Class 1*

Part 3-4: *System management – Management procedures for network based control of HES Class 1*

Part 3-5: *Media and media dependent layers – Powerline for network based control of HES Class 1*

Part 3-6: *Media and media dependent layers – Twisted pair for network based control of HES Class 1*

Part 3-7: *Media and media dependent layers – Radio frequency for network based control of HES Class 1*

Part 4: *Home and building automation in a mixed-use building (technical report)*

Part 4-1: *Communication layers – Application layer for network enhanced control devices of HES Class 1 (this standard)*

Part 4-2: *Communication layers – Transport, network and general parts of data link layer for network enhanced control devices of HES Class 1*

Part 5-1: *Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Core protocol (under consideration)*

Part 5-2: *Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Device certification (under consideration)*

Additional parts are under preparation.

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1 Echonet TM is the trade name of a product supplied by ECHONET Consortium. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC or ISO of the product named. Equivalent products may be used if they can be shown lo lead to the same results.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 4-1: Communication layers – Application layer for network enhanced control devices of HES Class 1

1 Scope

This part of ISO/IEC 14543 specifies the services and protocol of the application layer for usage in network enhanced home electronic system Class 1. It provides the services and the interface to the user process. This procedure is based on the services and the protocol is provided by the transport layer, network layer and data link layer as specified in ISO/IEC 14543-4-2.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14543-2-1, *Information technology – Home electronic system (HES) architecture – Part 2-1: Introduction and device modularity*

ISO/IEC 14543-4-2, *Information technology – Home electronic system (HES) architecture – Part 4-2: Communication layers – Transport, network and general parts of data link layer for network enhanced control devices of HES Class 1*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document the terms and definitions given in ISO/IEC 14543-2-1 and the following apply.

3.1.1
application data (ADATA)
data region for messages exchanged by communication middleware

NOTE Maximum size is 256 bytes.

3.1.2
application data counter (ADC)
indicates the size of the ADATA region

NOTE The size is variable in 1-byte increments.

3.1.3
application object (AOJ)
model of information to be disclosed to the network from information owned by the communications processing block, or an access procedure model

NOTE 1 The information or control target owned by each device is specified as a property and the operating method (setting, browsing) for this is specified as a service.

NOTE 2 AOJs are used when class or instance is not considered.

3.1.4
application programming interface (API)
assembly of interface functions for middleware

NOTE API makes it easy to operate middleware for designers.

3.1.5
application property code (APC)
code value related to application property

3.1.6
application property value data (APD)
data value related to application property code (APC), such as status notification or specific setting and control by an application service code (ASC)

NOTE Detailed specifications are provided for the size, code value, etc. of the APD for each APC.

3.1.7
application service code (ASC)
code value related to application service

3.1.8
communication middleware block
this middleware is arranged from data link layer to application layer and performs communications processing according to the protocol specified in ISO/IEC 14543-4-1 and ISO/IEC 14543-4-2.

NOTE The major features of ISO/IEC 14543-4 are implemented by communications middleware.

3.1.9
communication processing block
one processing block for the communications middleware; this block performs communication protocol processing to facilitate remote device control/monitoring processing for application software, stores information for the above and controls various information on the self-device as well as other device statuses

3.1.10
DA data
node address of the destination of messages between lower-layer communications software

3.1.11
data link address (DLA)
address permitting unique identification of a node in a home network

NOTE This is a logical address that is defined separately from the node address native to lower-layer communication software; it consists of a NetID and NodeID.

3.1.12
data link data
data that is composed of DHD, SDLA, DDLA, ADC and ADATA

3.1.13
data link frame
frame that is composed of DDC, DHD, SDLA, DDLA, ADC and ADATA

3.1.14
data link data counter (DDC)
specifies order of split message, indicates end split of message and stipulates split-transmission message identifier

3.1.15
data link header (DHD)
four kinds of data are included:
- first data is the message format for the ADATA/PADATA section;
- second data specifies secure message or plain message;
- third data specifies DDLA is a broadcast address or an individual address;
- fourth data constitutes a routing hop counter

3.1.16
data link split frame
messages that are exchanged between protocol difference absorption processing blocks

3.1.17
device ID
unique number assigned to each node

NOTE The device ID is retained and managed by the communications middleware block and normally assigned by application software.

3.1.18
domain
range on the network within which information transmission is logically guaranteed

NOTE Generally, it is thought that property and security control, including homes and stores, use the same range as a domain, but the domain can be defined by system.

3.1.19
hardware address
address defined based on a medium-specific addressing scheme, like IEE802 address; this is a unique value for a node among the same kind of the transmission medium

3.1.20
NetID
SUBNET identifier that is also a component of a data link address

3.1.21
node
communication node conforming to ISO/IEC 14543-4

NOTE In ISO/IEC 14543-4, this is a communications function to be uniquely identified by a data link address. There is no distinction between the application functions of nodes. The term node is used to describe the function of one communication terminal.

3.1.22
node address
address to implement layer-2 communication in transmission media

NOTE In ISO/IEC 14543-4, this corresponds to the own hardware address.

3.1.23
NodeID
identifier used to identify a node uniquely within the SUBNET

NOTE This is a logical address converted from the node address native to the lower-layer communications software. This is also a component of data link address.

3.1.24
SA data
node address of the source of messages between lower-layer communications software

3.1.25
SUBNET
group of nodes using the same lower-layer communications protocol

NOTE Each SUBNET has a NetID; different SUBNETS can be connected by a data link router.

3.2 Abbreviations

For the purposes of this document abbreviations given in ISO/IEC 14543-2-1 and the following apply.

ADATA	Application Data
ADC	Application Data Counter
APC	Application Property Code
APD	Application Property Value Data
API	Application Programming Interface
ASC	Application Service Code
AOJ	Application Object
DDLA	Destination Data Link Address
DDC	Data Link Data Counter
DHD	Data Link Header
DLA	Data Link Address
DSDATA	Data Link Split Data
PADATA	Plain Application Data
SDLA	Source Data Link Address

4 Conformance

For conformance to this International Standard the following applies.

- Application layer protocol data unit shall conform to the specifications described in Clause 6.
- Application service shall conform to the specifications described in 7.2 and 7.3 The implementation of each service depends on the application.
- Communication processing block state transitions shall conform to the specifications described in Clause 9.

5 Services of the application layer

5.1 Communication modes

The application layer shall provide a large variety of application services to the application process. Application processes in different devices interoperate by using services of application layer over communication modes. According to the transport layer, the following different types of communication modes shall exist.

- Unicast communication
  - One to one communication with specifying destination node adores.
- Broadcast communication
  - An intra-domain broadcast: In all SUBNETs within a domain, a broadcast is sent to the nodes stipulated by the broadcast target requirement code.

- An intra-own-SUBNET broadcast: Within own SUBNET, a broadcast is sent to the nodes stipulated by the broadcast target requirement code.
- A general broadcast within a specified SUBNET: A broadcast is sent to all nodes within the SUBNET stipulated by the broadcast target requirement code.
- An intra-domain group multicast: In all SUBNET within a domain, a broadcast is sent to the nodes stipulated by the broadcast target requirement code.
- An intra-own-SUBNET broadcast to a node group: Within own SUBNET, a broadcast is sent to the nodes stipulated by the broadcast target requirement code.

5.2 Service primitives of the application layer

5.2.1 General

Application software can access to one or multiple remote node by utilizing services of application layer. Control from application software using APIs is described for the main three cases listed below, with a focus on how the application objects are perceived.

Case 1: Obtain other node status.
Case 2: Control other node functions.
Case 3: Notify other nodes of self-node status.

5.2.2 Case 1: Application objects when obtaining other node status

This standard provides two methods for obtaining the status of another node. These methods are shown in Figure 1 and Figure 2. In the method shown in Figure 1, when a request is received from an application, an obtain status request is issued to objects in the specified other node (Node B), with the results notified to the application. With this method, object data for the other node need not be stored in the communication middleware for the node (Node A in Figure 1) making the request. In the second method, shown in Figure 2, even when no request is received from an application, the communication middleware catches and holds the notified status of objects in other nodes in advance and then returns them to an application when it receives a request.

In this method, objects copied to application objects in other nodes actually exist within the communication middleware. In the former method, because the access is performed from an application, a virtual copy of the application objects in the other node exists in the communication middleware. In both cases, in order to set the desired application object instance via the API, not only the application object class code but also an instance code and data specifying the node (data link address, etc.) are necessary. From the viewpoint of the application, therefore, application objects are seen in the relationship shown in Figure 3 within the communication middleware.

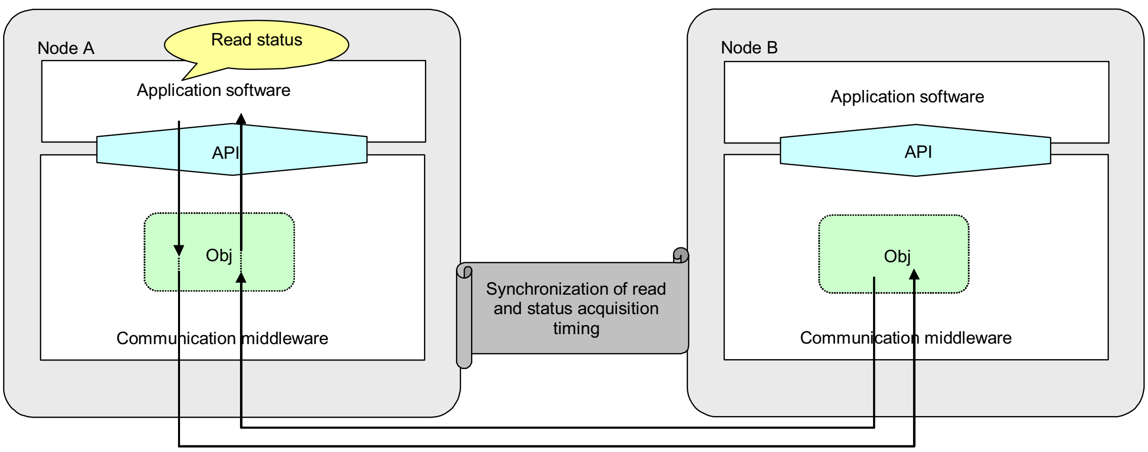

Figure 1 – Service primitive (obtain other node status: synchronous type)

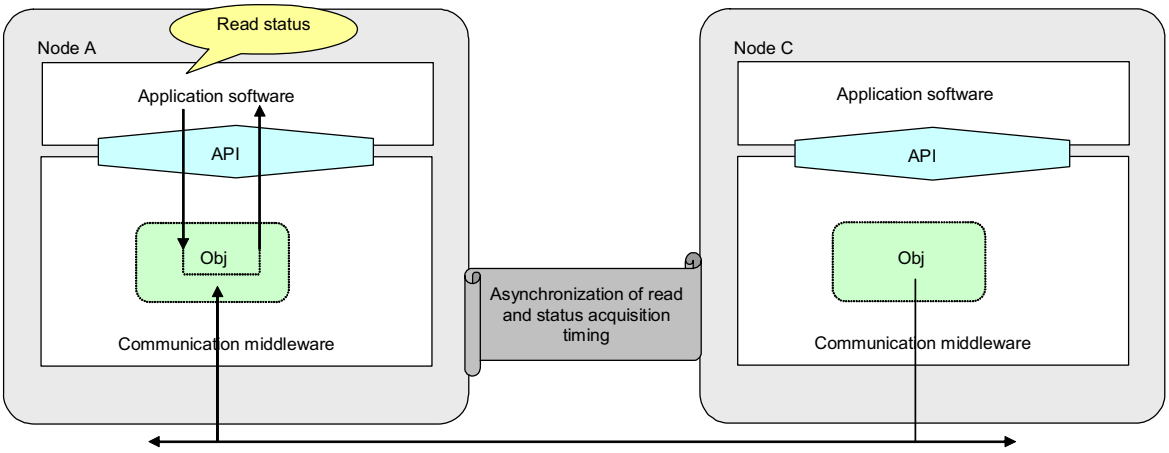

Figure 2 – Service primitive (obtain other node status: asynchronous type)

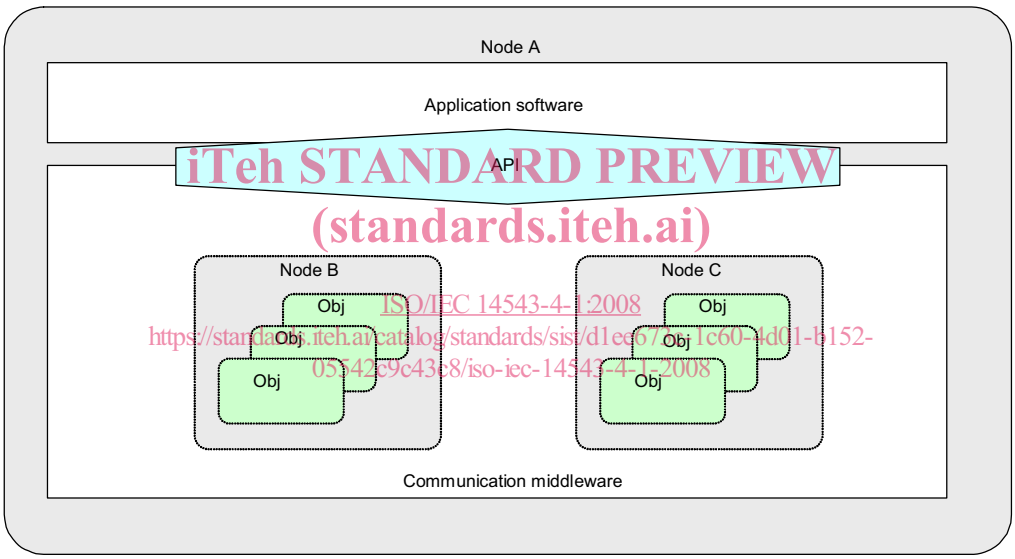

Figure 3 – Example of object view

5.2.3 Case 2: Application objects when controlling other node functions

This standard provides a method for controlling the functions of other nodes, as shown in Figure 4. Just as in Figure 1, however, a request for control (property value setting) is issued to objects in the specified other node (Node B) and the application is then notified of the results (although there are exceptions to this). Basically, therefore, property data for objects in the other node (Node B) need not be present in the communication middleware for the node (Node A) making the request. To indicate the desired application object instance via the API, a data link address, an application object class code and its instance code are required. From the viewpoint of the application, application objects are seen in the relationship shown by Node B in Figure 4 and Figure 5 within the communication middleware.