

This is a preview - click here to buy the full publication



ISO/IEC 14543-4-1

Edition 1.0 2008-05

# INTERNATIONAL STANDARD

---

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

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE

**XA**

---

ICS 35.200

ISBN 2-8318-9816-1

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references .....	8
3 Terms, definitions and abbreviations .....	8
3.1 Terms and definitions .....	8
3.2 Abbreviations .....	11
4 Conformance.....	11
5 Services of the application layer .....	11
5.1 Communication modes .....	11
5.2 Service primitives of the application layer.....	12
5.2.1 General .....	12
5.2.2 Case 1: Application objects when obtaining other node status .....	12
5.2.3 Case 2: Application objects when controlling other node functions.....	13
5.2.4 Case 3: Application objects when notifying another node of self-node status .....	14
6 Application layer protocol data unit (APDU).....	16
6.1 Overview .....	16
6.2 Data link header (DHD) .....	18
6.3 Source/destination data link address (SDLA/DDLA).....	18
6.4 Application data counter (ADC) .....	18
6.5 Application data (ADATA).....	19
6.6 Object message header (OHD).....	19
6.7 Application object (AOJ).....	19
6.8 Application property code (APC).....	20
6.9 Application service code (ASC) .....	21
6.10 Application property value data (APD).....	21
6.11 Compound application service code (CpASC).....	21
7 Application layer services.....	22
7.1 General.....	22
7.2 Basic application service .....	22
7.2.1 Basic application .....	22
7.2.2 Property value write service.....	27
7.2.3 Property value read service .....	27
7.2.4 Property value notification service .....	28
7.2.5 Property value element-stipulated write service .....	28
7.2.6 Property value element-stipulated read service.....	29
7.2.7 Property value element-stipulated notification service.....	30
7.2.8 Property value element-stipulated addition service .....	31
7.2.9 Property value element-stipulated deletion service .....	32
7.2.10 Property value element-stipulated existence confirmation service.....	33
7.2.11 Property value element addition service .....	33
7.2.12 Property value notification (response required) service.....	34

7.2.13	Property value element-stipulated notification (response required) service .....	34
7.3	Compound application service .....	35
7.3.1	General .....	35
7.3.2	Property value write request (requiring no response) service .....	37
7.3.3	Property value write request (requiring a response) service .....	38
7.3.4	Property value read request service .....	39
7.3.5	Property value notification service .....	40
7.3.6	Property value notification (requiring a response) service .....	41
7.4	Access limitation .....	41
8	Application object .....	42
8.1	General .....	42
8.2	Types of objects .....	43
8.2.1	Device objects .....	43
8.2.2	Profile objects .....	43
8.2.3	Communications definition objects .....	44
8.2.4	Service objects .....	44
8.3	Application property value data types .....	44
8.3.1	APD range .....	44
8.3.2	Class-specific mandatory properties .....	45
8.3.3	Properties that must have a status change announcement function .....	45
8.3.4	Array .....	45
9	Communication processing block state transitions .....	48
9.1	General .....	48
9.2	State transitions .....	48
9.2.1	Halt state .....	48
9.2.2	Cold start (1) state .....	48
9.2.3	Cold start (2) state .....	48
9.2.4	Cold start (3) state .....	48
9.2.5	Warm start state .....	49
9.2.6	Communication stop state .....	49
9.2.7	Normal operation state .....	49
9.2.8	Temporary halt state .....	49
9.2.9	Error stop state .....	49
Annex A (informative) Guidelines for application design .....		51
A.1	System architecture .....	51
A.2	System entry, exit, registration and deletion .....	52
A.3	Confirming the node existence .....	53
Annex B (informative) API functions .....		54
B.1	API function for transport and network layer .....	54
B.2	API functions for application layer .....	54
B.2.1	General .....	54
B.2.2	Constant specifications .....	54
B.2.3	Detail API functions .....	58
Bibliography .....		114

Figure 1 – Service primitive (obtain other node status: synchronous type) .....	12
Figure 2 – Service primitive (obtain other node status: asynchronous type) .....	13
Figure 3 – Example of object view .....	13
Figure 4 – Service primitive (control other node functions).....	14
Figure 5 – Example of object view .....	14
Figure 6 – Service primitive (notify other nodes of self-node status: synchronous type) .....	15
Figure 7 – Service primitive (notify other nodes of self-node status: asynchronous type) .....	15
Figure 8 – Example of object view .....	15
Figure 9 – Example of application object configuration in a node .....	16
Figure 10 – Application data frame for plain data format (ADATA area).....	17
Figure 11 – Application data frame for secure message (PADATA area).....	18
Figure 12 – Configuration of OHD .....	19
Figure 13 – Configuration of AOJ .....	19
Figure 14 – Definition of X1, X2 and X3 of AOJ.....	20
Figure 15 – Configuration of APC .....	20
Figure 16 – Configuration of ASC .....	21
Figure 17 – Configuration of CpASC .....	22
Figure 18 – Basic service sequence.....	26
Figure 19 – Access rules .....	26
Figure 20 – Relationship among property value write request, property value write accepted response and property value write process not possible response .....	27
Figure 21 – Relationship among property value read request, property value read “accepted” response and property value read “process not possible” response .....	27
Figure 22 – Relationship among property value notification request, property value notification “accepted” response and property value notification “process not possible” response.....	28
Figure 23 – Relationship among property value element-stipulated write request, property value element-stipulated write accepted response and property value element-stipulated write process not possible response .....	29
Figure 24 – Relationship among property value element-stipulated read request, property value element-stipulated read “accepted” response and Property value element-stipulated read “process not possible” response .....	30
Figure 25 – Relationship among property value element-stipulated notification request, property value element-stipulated notification “accepted” response and property value element-stipulated notification “process not possible” response .....	31
Figure 26 – Relationship among property value element-stipulated addition request, property value element-stipulated addition “accepted” response and property value element-stipulated addition “process not possible” response.....	32
Figure 27 – Relationship among property value element-stipulated deletion request, property value element-stipulated deletion “accepted” response and property value element-stipulated deletion “process not possible” response.....	32
Figure 28 – Relationship among property value element-stipulated existence confirmation request, property value element-stipulated existence confirmation “accepted” response and property value element-stipulated existence confirmation “process not possible” response .....	33
Figure 29 – Relationship among property value element addition request, property value element addition “accepted” response and property value element addition “process not possible” response .....	34

Figure 30 – Relationship between property value notification (requiring a response) and property value notification response .....	34
Figure 31 – Relationship between property value element-stipulated notification (requiring a response) and property value element-stipulated notification response .....	35
Figure 32 – Compound service sequence .....	37
Figure 33 – Relationship between write request (requiring no response) and write process not possible response .....	38
Figure 34 – Relationship among write request (requiring a response), write accepted response and write process not possible response .....	39
Figure 35 – Relationship among read request (requiring a response), read accepted response and read process not possible response .....	40
Figure 36 – Notification request .....	41
Figure 37 – Relationship between property value notification (requiring a response) and property value notification response .....	41
Figure 38 – Example of array element numbers 1 .....	46
Figure 39 – Example of array element number 2 .....	46
Figure 40 – Example of array element number 3 .....	46
Figure 41 – Example of array element number 4 .....	47
Figure 42 – Example of array element number 5 .....	47
Figure 43 – Example of array element number 6 .....	47
Figure 44 – Communications processing block state transition diagram .....	50
Figure A.1 – System configuration for distributed management system .....	51
Figure B.1 – Configuration of authentication .....	66
Table 1 – APC allocation table .....	21
Table 2 – List of ASCs for request .....	24
Table 3 – List of ASCs for response/notification .....	24
Table 4 – List of ASCs for response not possible responses .....	25
Table 5 – List of CpASC codes for request/notification .....	36
Table 6 – List of CpASC codes for accepted response .....	36
Table 7 – List of CpASC codes for process not possible response .....	37
Table 8 – Format of the application object .....	43
Table 9 – Data types, data sizes and overflow/underflow codes .....	45
Table B.1 – List of basic API functions .....	58

## **INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –**

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

#### **FOREWORD**

- 1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards. Their preparation is entrusted to technical committees; any ISO and IEC member body interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with ISO and IEC also participate in this preparation.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
- 3) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO member bodies.
- 4) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 5) In order to promote international uniformity, IEC and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 6) ISO and IEC provide no marking procedure to indicate their approval and cannot be rendered responsible for any equipment declared to be in conformity with an ISO/IEC publication.
- 7) All users should ensure that they have the latest edition of this publication.
- 8) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.
- 9) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 10) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

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<sup>1</sup>.

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.

---

<sup>1</sup> Echonet™ 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 to 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*