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Information technology – Home Electronic System (HES) architecture – Part 4-301: Application protocols for home air conditioners and controllers

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

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FOREWORD

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International Standard ISO/IEC 14543-4-301 has been 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 and ISO websites.

The text of this document is based on the following documents:

CDV	Report on voting
JTC1-SC25/2929/CDV	JTC1-SC25/2952/RVC

Full information on the voting for the approval of this document can be found in the report on voting indicated in the above table.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document specifies the message structure, sequences and protocol of the application layer for networked enhanced control devices used in the Home Electronic System. Some services are targeted for communications between devices. Other services are exclusively reserved for management purposes. Some services can be used for both management and run-time communications. This document is applicable for energy management services, mobile access, remote appliance maintenance services, home healthcare services, home security services and comfort control.

This document specifies the detailed procedures and behaviours of both home air conditioners and controllers at the application level communication based on ISO/IEC 14543-4-3.

Figure 1 shows the relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543−4−301. The existing ISO/IEC 14543-4-3 specifies the message structure, sequences and protocol for a general-purpose communication for use in network enhanced control devices of the Home Electronic System (HES) Class 1. ISO/IEC 14543-4-3 provides the common interfaces for the use-level process and the services such as energy management, remote maintenance, and other services for easily building a system consisting of multi-vendor devices and equipment. The existing IEC 62394 specifies the detailed lists of control commands on NECD objects. Annex A shows terms and NECD frame format on ISO/IEC 14543-4-3 and IEC 62394.

Since ISO/IEC 14543-4-3 is a general-purpose communication specification that applies to a variety of devices, it does not focus on the detailed procedures and behaviours for each device such as a home air conditioner.

In order to enhance interoperability, it is necessary to specify how to implement ISO/IEC 14543−4-3 for each device or controller at the application level: command sequences, timeout requirements, required combinations of acceptable commands, etc.

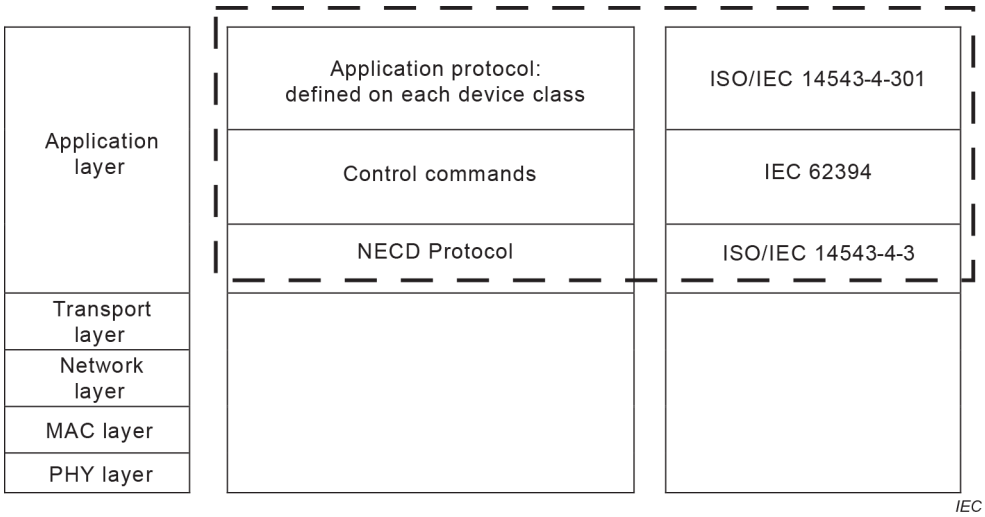


Figure 1 – Relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543-4-301

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 4-301: Application protocols for home air conditioners and controllers

1 Scope

This part of ISO/IEC 14543 specifies an application-layer protocol necessary for ensuring interoperability among the products of various manufacturers regarding communications between home air conditioners and controllers, using a protocol called network enhanced communications device (NECD) as specified in ISO/IEC 14543-4-3. This protocol is based on user datagram protocol (UDP) using IPv4 or IPv6 (TCP is optional).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14543-4-3, *Information technology – Home Electronic System (HES) architecture – Part 4-3: Application layer interface to lower communications layers for network enhanced control devices of HES Class 1*

IEC 62394, *Service diagnostic interface for consumer electronics products and networks – Implementation for ECHONET*

3 Terms, definitions and abbreviated terms

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
controller
function embedded on unspecified devices for controlling home air conditioners

3.1.2
device object
NECD object other than node profile object

Note 1 to entry: In this document, it refers to home air conditioner object only.

3.1.3
home air conditioner
air conditioning device for home use including a communications interface that supports the NECD protocol

Note 1 to entry: As used in this document, this term means the home air conditioner includes a communications interface that supports the NECD protocol.

3.1.4
NECD communication middleware
middleware between the lower communication layers and the application layer that performs communications processing according to the protocol specified in this document

3.1.5
NECD communication processing block
processing block for the communication middleware

Note 1 to entry: This block performs communications protocol processing to facilitate remote device control and monitoring processing for application software, stores information for the above and controls various data on the device as well as the status of other devices.

3.1.6
NECD data
NDATA
data region for a message exchanged by NECD communication middleware

3.1.7
NECD header
NHD
data containing the protocol type and message format for the NDATA section

3.1.8
NECD object
NOJ
model of information to be disclosed to the network from information owned by the NECD communication processing block, or an access procedure model

Note 1 to entry: 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.

3.1.9
NECD property code
NPC
code value related to the NECD property

3.1.10
NECD protocol
communication protocol used in NECD communication specified in ISO/IEC 14543-4-3

3.1.11
NECD service
NSV
code value related to the NECD service

3.1.12
NECD frame
frame composed of NHD1, NHD2, TID and NDATA

3.1.13
node profile
description of objects implemented in each node

3.1.14
property data counter
PDC
indication of the size of the NDT region

3.1.15
property value data
data value related to the NECD property code (NPC)

EXAMPLE Status notification or specific setting.

Note 1 to entry: Property value data is controlled by the NECD service (NSV).

3.1.16
remote control
control from outside the home

3.1.17
response wait timer
timer that counts the time from a controller request until a response from a targeted home air conditioner

3.1.18
transaction ID
TID
parameter to link a sent request with a received response

3.1.19
super class
set of properties that are inherited to and implemented in all device object classes

3.2 Abbreviated terms

DNOJ	destination NECD object
IP	internet protocol
NDATA	NECD DATA
NDT	NECD Data
NECD	network enhanced control device
NHD	NECD header
NPC	NECD property code
NSV	NECD service
OPC	processing object property counter
PDC	property data counter
SNOJ	source NECD object
TID	transaction ID
UDP	user datagram protocol

4 Conformance

Home air conditioners and controllers of HES Class 1 that claim conformance to this document shall:

- send, receive and process sequences and procedures as specified in Clause 7;
- provide application services and properties specified in 6.2, 6.3 and 6.4 that may be needed by home air conditioners and controllers for which the application is intended.

5 Connection configuration

This document specifies matters necessary for ensuring interoperability between the products of different manufacturers in connection with application communication between home air conditioners and controllers, using NECD protocol as an application protocol via UDP(TCP)/IPv6 communications.

Figure 2 shows the configurations assumed under these specifications.

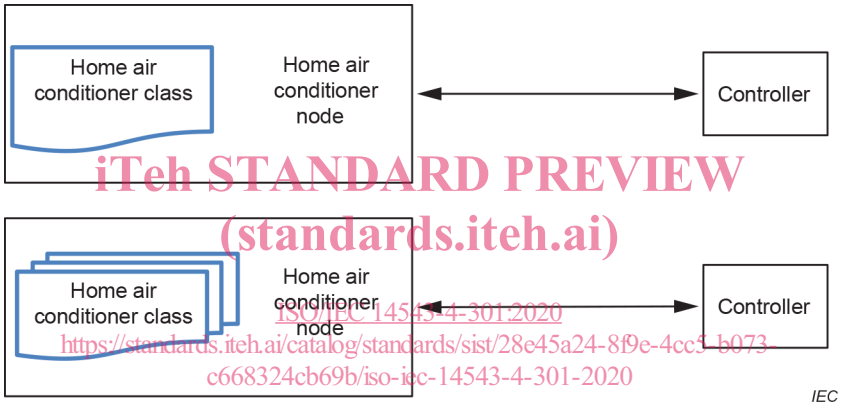
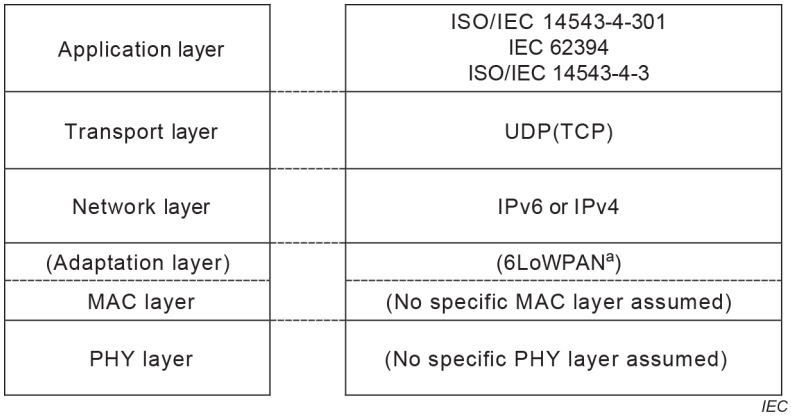


Figure 2 – Connection configurations

The upper illustration in Figure 2 shows the case where a single device object is installed in a single node. The lower illustration shows the case where multiple device objects are installed in a single node. The latter case occurs when multiple indoor units are attached to a single outdoor unit, such as a so-called multi-split packaged air conditioner. In this case, there are multiple home air conditioner class objects in a single home air conditioner node (i.e. at a single IP address). Controllers are required to support nodes that configure multiple device objects in a single node.

Controllers are required to be capable of handling multiple nodes and objects. The maximal number of nodes and objects to be handled is implementation-dependent of the controllers. In case that multiple controllers are connected to a single system, this would not be recognized by the home air conditioner. In other words, the home air conditioner shall be controlled by the last write request if multiple requests from multiple controllers arrive continuously before responding.

Figure 3 shows the assumed network stack for operating NECD protocol in this document. NECD protocol operation is assumed as an application protocol on UDP(TCP)/IPv6. Note that TCP installation is optional. As a rule, the stack uses IPv6; however, IPv4 is allowed depending on the market trends for migration from IPv4 to IPv6.



[a] Depends on transmission media using IPv6

Figure 3 – Assumed network stack

Connection processing specific to each lower layer communication medium that is necessary in advance of the start of NECD communication is out of the scope of this document. In this document, application communication using NECD protocol is described on the assumption that connection processing specific to those communication media is complete.

6 Application layer

6.1 General

NECD protocol shall be used at the application layer. All nodes that conform to this document shall support all mandatory functions specified in ISO/IEC 14543-4-3.

6.2 NECD objects

Home air conditioners and controllers shall have the NECD objects shown in Table 1.

Table 1 – NECD objects

NECD object	Class group code	Class code	Class name	Instance code
Home air conditioner	0x01	0x30	Home air conditioner	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01
Controller	0x05	0xFF	Controller	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01

NOTE Instance code 0x00 is designated to specify all instances of the same class in a node.

6.3 NECD services

Home air conditioners and controllers shall support the NECD services shown in Table 2.