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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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Part 4-3: Application layer interface to lower communications layers for network enhanced control devices of HES Class 1

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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 and ISO 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.

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 part of ISO/IEC 14543 specifies the message structure, sequences and protocol of the application layer for use 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 standard is applicable for energy management services, mobile access, remote appliance maintenance services, home healthcare services, home security services and comfort control. This standard focuses on the application layers (5th layer to 7th layer of the OSI reference model). This standard specifies a message structure that differs from the 12 message structures specified in ISO/IEC 14543-4-1. This standard allows the use of IP addressing or MAC addressing, while ISO/IEC 14543-4-1 specifies a different non-IP address structure. This part depends on routing functions provided by an external IP layer. ISO/IEC 14543-4-1 uses the routing functions specified in ISO/IEC 14543-4-2. Therefore Part 4-3 is an alternative to Part 3-1 plus Part 3-2.

ISO/IEC 14543, *Information technology – Home Electronic System (HES) architecture, provides*

an introduction to specifications for Home Electronic System (HES):

Part 2-1: Introduction and device modularity

and specifications for three types of HES devices:

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Parts 3-x Specifications for network based control of HES Class 1

Parts 4-x Specifications for network enhanced control of HES Class 1

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Parts 5-x Specifications for intelligent grouping and resource sharing for HES Class 2 and Class 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

1 Scope

This part of ISO/IEC 14543 specifies the message structure, sequences and protocol of the application layer for use in network enhanced control devices of the Home Electronic System (HES) Class 1. It provides the services and the interface for the user-level process. This application layer protocol is independent of lower communications layers, which support MAC addressing or IP addressing. The communications sequence is based on the application services.

2 Normative references

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

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

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ISO/IEC 14543-4-1, *Information technology – Home electronic system (HES) architecture – Part 4-1: Communication layers – Application layer for the network enhanced control devices of HES Class 1*

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
NECD communications middleware
middleware between the lower communications layers to the application layer that performs communications processing according to the protocol specified in this standard

3.1.2
NECD communications processing block
processing block for the communications middleware

Note 1 to entry: This block performs communications protocol processing to facilitate remote device control / 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.

3.1.3
NECD data
NDATA
data region for message exchanged by NECD communications middleware

3.1.4
NECD header
NHD
data containing the protocol type and message format for the NDATA section

3.1.5
NECD object
NOJ
model of information to be disclosed to the network from information owned by the NECD communications 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.

3.1.6
NECD property code
NPC
code value related to the NECD property

3.1.7
NECD service
NSV
code value related to the NECD service

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3.1.8
NECD frames
frame composed of NHD1, NHD2, TID and NDATA

3.1.9
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).

3.1.10
transaction ID
TID
parameter to link a sent request with a received response

3.1.11
property data counter
PDC
indication of the size of the NDT region

3.2 Abbreviations

DNOJ	Destination NECD ObJect
IP	Internet Protocol
NDATA	NECD DATA
NDT	NECD DaTa
NECD	Network Enhanced Control Device
NHD	NECD HeaDer
NPC	NECD Property Counters
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

Enhanced control devices of HES Class 1 that claim conformance to this International Standard shall:

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- send, receive and process application layer protocol data units as specified in Clause 6;
- provide application services specified in 6.6 that may be needed by devices for which the application is intended.

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5 Services of the application layer

5.1 Positioning in communications layers

5.1.1 General

The NECD communications processing block is positioned between application and lower communications layers. This standard provides the specifications of “NECD communications processing block”. In Figure 1, the shaded area shows the communications middleware block to be specified.

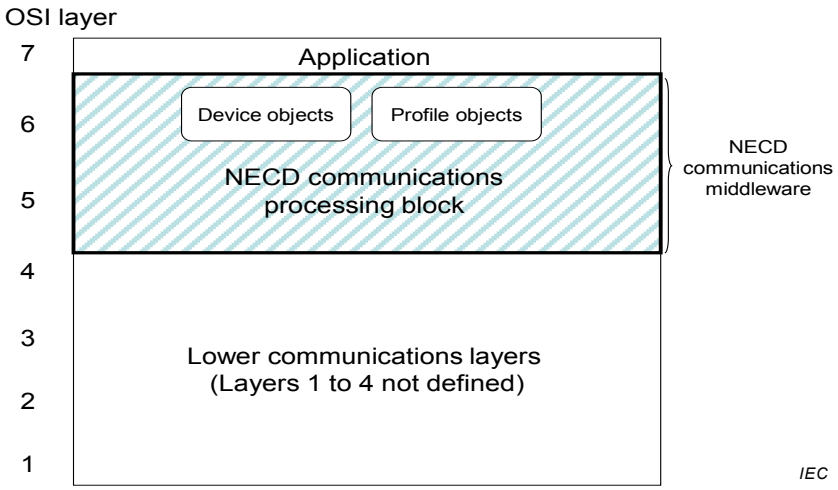

Figure 1 – Communications middleware

As Figure 1 shows, the NECD communications middleware block specified in this standard corresponds to the NECD communications processing block, which is specified as a function that is independent of layers 1 to 4. The NECD communications processing block sends and receives a NECD frame specified in Clause 6. There are two kinds of messages: unicast and broadcast.

Unicast transmission specifies a destination address that is in layer 4 or lower, and transmits the NECD frame to a specific NECD node. Broadcast transmission specifies a destination address that is in layer 4 or lower, and transmits the NECD frame to all the NECD nodes in a subnet. In case of UDP/IP, refer to 5.1.2.

When the transmission system of layer 4 or lower layer corresponds to neither multicasting nor broadcasting, it shall transmit to all the NECD nodes in a subnet using multiple unicast transmissions to achieve the equivalence of a broadcast transmission. The destination address and the method for setting it are not specified, but shall be defined for every lower communications layer.

Security is not specified in the NECD communications processing block. Security standard technologies in layer 4 or lower can be applied as necessary.

5.1.2 When using UDP in layer 4 and IP in layer 3

When using UDP/IP, the following addresses and ports shall be supported.

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Each NECD node has an IP address. The IP address range and acquisition method are not specified. If NECD frames are transferred by UDP packets, the destination port number of UDP packets shall be 3 610. The source port number is not specified. For general broadcast (simultaneous transmission), NECD frames are mapped on IP multicast packets and transferred. For IPv4, the destination multicast address value shall be 224.0.23.0. For IPv6, ff02::1 (all-node multicast address) shall be used.

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5.2 Service primitives of the application layer

5.2.1 General

The NECD objects are introduced with two objectives:

- compartmentalisation of the functions of devices connected to the NECD network;
- modularisation of communications between devices to enable application software developers to utilise NECD communications without having to consider detailed specifications.

The NECD objects are processed in the NECD communications processing block. Control content exchanged in communications can be classified into those relating to functions unique to each device and those relating to data profiling other than the functions unique to each device. In NECD, all of these are specified as NECD objects, and control and data exchange are achieved to enable their manipulation.

Each NECD object has some properties. The various unique functions possessed by an NECD node are represented as NECD properties. Devices are operated by reading or writing the NECD properties of the NECD object in the relevant NECD node.

NECD objects are defined by the following specifications: object type (codes are specified in 6.5 as NOJ); the properties possessed by each object (codes are specified in 6.8 as NPC); and the services for those properties (codes are specified in 6.6 as NSV).

NOTE It is assumed that each NECD node would have more than one NECD object of the same type (e.g., two human detection sensor objects in the same node), and that identification could be performed by stipulating a specific code.

5.2.2 NECD objects from the viewpoint of application software

Control from application software is described for the three main cases listed below, with a focus on how the NECD objects are perceived.

- Case 1: Obtaining the status of another node
- Case 2: Controlling the functions of other nodes
- Case 3: Notifying own node status to other nodes

5.2.3 Case 1: Obtaining the status of another node

This standard provides two methods: synchronous type and asynchronous type for obtaining the status of another node. Each device can select the synchronous type or asynchronous type. These methods are shown in Figure 2 (synchronous type) and Figure 3 (asynchronous type). In the method shown in Figure 2, when the NECD communications middleware receives a request from an application, the NECD communications middleware sends the request to obtain the status of another node to the target node (Node B). After that NECD communications middleware receives the results, NECD communications middleware notifies the application of the status. With this method, object data for the other node need not be stored in the NECD communications middleware for the node (Node A in Figure 2 and Figure 3), which sends the request. In the second method, shown in Figure 3, even when the NECD communications middleware does not receive any request from an application, it receives 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 NECD objects in other nodes actually exist within the NECD communications middleware.

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In the former method (Figure 2), a virtual copy of the NECD objects in the other nodes exists in the NECD communications middleware because access is performed from an application. In the latter method (Figure 3), a copy of each property of the NECD objects in the other nodes exists in the NECD communications middleware. In both cases, in order to set the desired NECD object instance, not only the NECD object class code, but also an instance code and data that is specifying the node are necessary. From the viewpoint of the application, therefore, NECD objects are represented using the relationship shown in Figure 4 within the NECD communications middleware.

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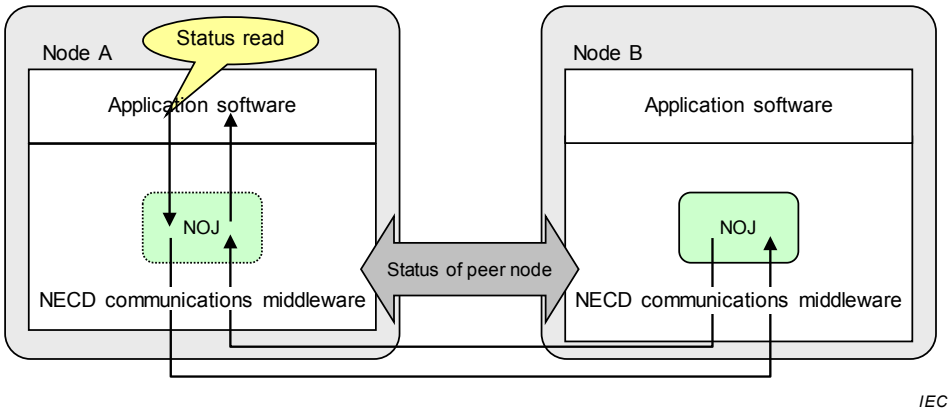

Figure 2 – Acquisition of status of another node (synchronous type)