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INTERNATIONAL STANDARD

Information technology – Home electronic system (HES) architecture – Part 3-1: Communication layers – Application layer for network based control of HES Class 1

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CONTENTS

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

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

FOREWORD

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International Standard ISO/IEC 14543-3-1 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This International Standard together with ISO/IEC 14543-3-2 cancels and replaces ISO/IEC TR 14543-3, published in 2000. It constitutes a complete revision of the principles outlined in ISO/IEC TR 14543-3 and provides the specifications essential for an international standard.

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

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 title page.

INTRODUCTION

This part of ISO/IEC 14543 specifies the services and protocol of the application layer for usage in Home Electronic Systems. 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.

Currently, ISO/IEC 14543, *Information technology – Home Electronic System (HES) architecture*, consists of the following 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 (under consideration)*
Part 3-4: *System management – Management procedures for network based control of HES Class 1 (under consideration)*
Part 3-5: *Media and media dependent layers – Power line for network based control of HES Class 1 (under consideration)*
Part 3-6: *Media and media dependent layers – Twisted pair for network based control of HES Class 1 (under consideration)*
Part 3-7: *Media and media dependent layers – Radio frequency for network based control of HES Class 1 (under consideration)*
Part 4: *Home and building automation in a mixed-use building (technical report)*
Additional parts may be added later.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

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

1 Scope

This part of the ISO/IEC 14543 specifies the services and protocol of the application layer for usage in Home Electronic Systems. It provides the services and the interface to the user process as defined in ISO/IEC 14543-3-3 (EN 50090-3-2). This procedure is based on the services and the protocol as provided by the transport layer, the network layer and the data link layer as specified in ISO/IEC 14543-3-2.

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 11801, *Information technology – Generic cabling for customer premises*

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

ISO/IEC 14543-3-2, *Information technology – Home electronic system (HES) – Part 3-2: Communication layers – Transport, network and general parts of data link layer for network based control of HES class 1*

EN 50090-3-2:2003, *Home and Building Electronic Systems (HBES) – Part 3-2: Aspects of application – User process for HBES Class 1*

NOTE 1 Reference to this standard will be replaced by reference to International Standard ISO/IEC 14543-3-3 which is currently under consideration. Please refer to bibliography.

EN 50090-7-1:2003, *Home and Building Electronic Systems (HBES) – Part 7-1: System Management – Management procedures*

NOTE 2 Reference to this standard will be replaced by reference to International Standard ISO/IEC 14543-3-4 which is currently under consideration. Please refer to bibliography.

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 (in the sense of network application)
system, including its associated transmission method, which is supported by telecommunications cabling

[ISO/IEC 11801:2002, definition 3.1.2]

3.1.2
user application
software functionality, the control algorithm that runs in one single device

3.2 Abbreviations

AL	Application Layer
AD-converter	Analog-to-Digital-converter
APDU	Application layer Protocol Data Unit
APCI	Application layer Protocol Control Information
ASAP	Application layer Service Access Point
Acon	Application layer confirmation
con	confirmation
CPU	Central Processing Unit
HES Class 1	refers to simple control and command
HES Class 2	refers to Class 1 plus simple voice and stable picture transmission
HES Class 3	refers to Class 2 plus complex video transfers
ind	indication
Lcon	Local confirmation
PDU	Protocol Data Unit
Rcon	Remote confirmation
req	request
res	response
TL	Transport Layer
TPDU	Transport layer Protocol Data Unit
TSAP	Transport layer Service Access Point
USERMSG	User Message

4 Conformance

An entity of operational exchange conforming to this International Standard shall meet the requirements of 7.1, 7.2.1, 7.2.2, 7.3.5, 7.4.3, 7.4.4, 7.4.7 and clause 8.

All services shall be implemented according to the provisions of clauses 5 and 6.

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:

a) point-to-multipoint, connectionless (multicast);

b) point-to-domain, connectionless (broadcast);

c) point-to-all-points, connectionless (system broadcast);

d) point-to-point, connectionless;

e) point-to-point, connection-oriented.

The application layer services that are offered shall depend on the communication mode. An application layer service shall not be applied on a communication mode for which it is not specified.

Some services may be used on the point-to-point connection-oriented, as well as the point-to-point connectionless communication mode, although application layer services shall always be mapped to transport layer services depending on the type of the communication mode.

5.2 Service primitives of the application layer

Each specified application layer service shall be invoked by the transport layer primitives request (req), indication (ind) and confirmation (con). For a remote confirmed service, the remote device shall use the same transport layer primitives to respond to the service.

The transport layer confirmation primitive shall only be a confirmation from the transport layer instance and shall include all data from the request plus the state which indicates whether the service was sent successfully or not. The application layer shall map the transport layer confirmation primitive to a local application layer confirmation (Lcon). See Figure 1 and Figure 2 for the interaction of the application layer.

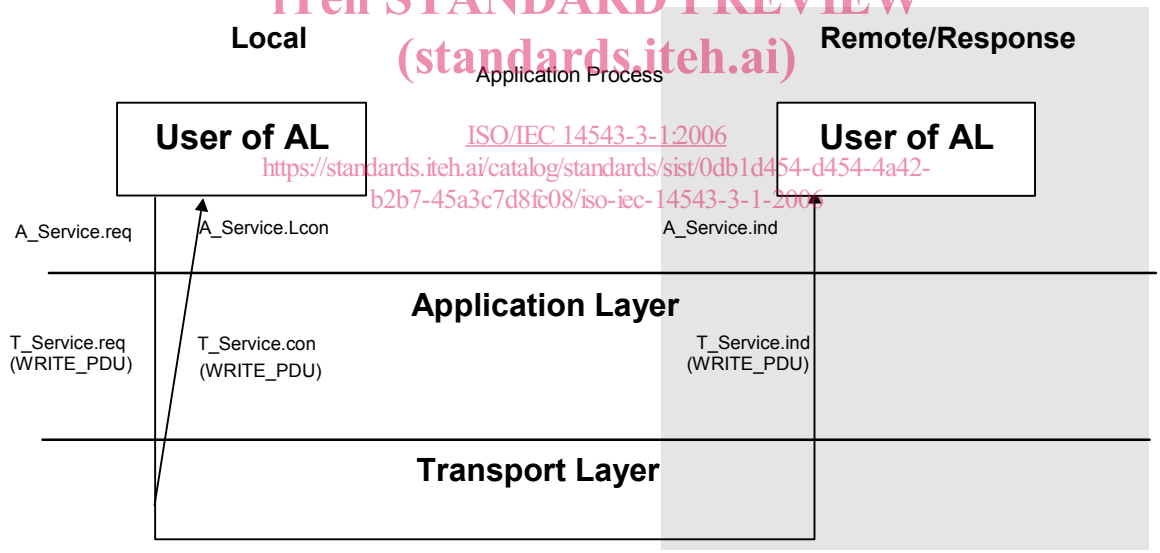

Figure 1 – Interaction of the application layer for services that are not remote confirmed

In case of a remote confirmed service the remote device shall initiate the response (res) primitive and the application layer shall map this service primitive to a transport layer request primitive. The local application layer shall receive the transport layer indication primitive and shall map it to an application layer confirmation (Acon). The transport layer confirmation in the remote device shall be mapped by the remote application layer to a remote confirmation (Rcon).

NOTE In the following service specifications the local application layer confirmation and the remote confirmation (Rcon) are not always described.

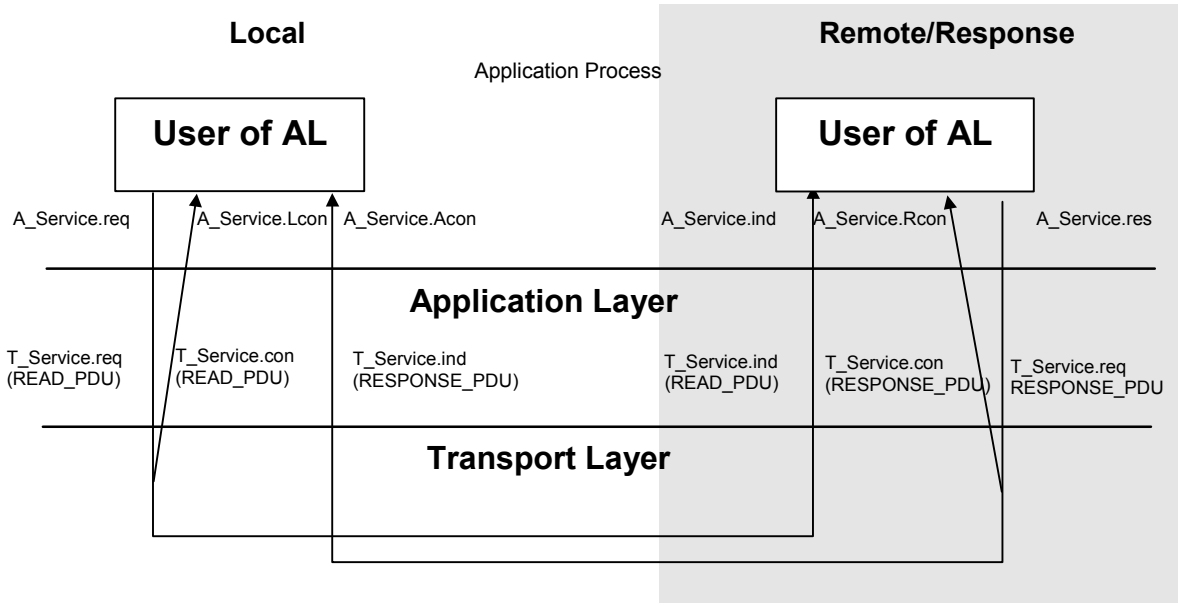

Figure 2 – Interaction of the application layer for services that are remote confirmed

6 Application layer protocol data unit (APDU)

An example of an APDU is shown in Figure 3.

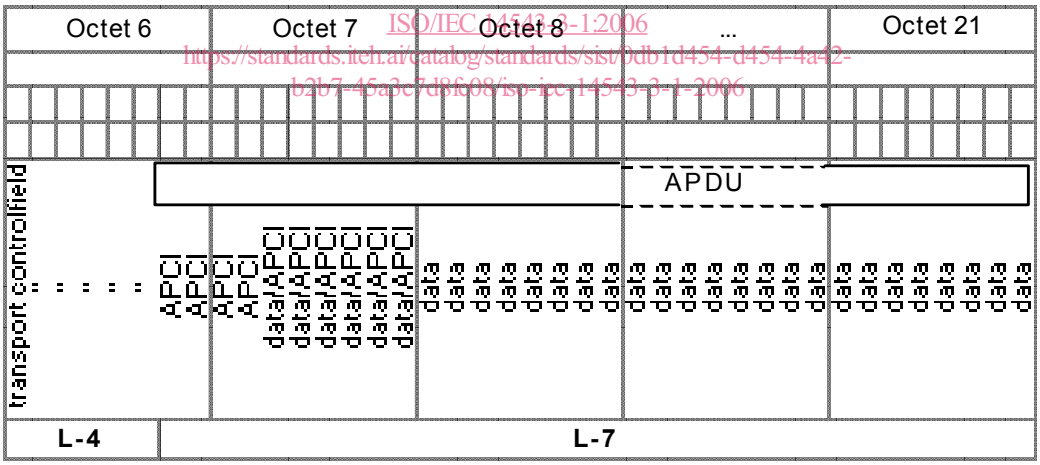

Figure 3 – APDU (Example)

Table 1 – APCI overview

APCI (bit position) Octet n 8	7	6	5	4	3	2	1	Octet n+1 8	7	6	5	4	3	2	1	Application layer Service	Allowed communication mode(s) Multicast	Broadcast	Point-to-all-points connectionless	Point-to-point connectionless	Point-to-point connection-oriented
						APCI	APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI						
						0	0	0	0	0	0	0	0	0	0	A_GroupValue_Read	X				
						0	0	0	1							A_GroupValue_Response	X				
						0	0	1	0							A_GroupValue_Write	X				
						0	0	1	1	0	0	0	0	0	0	A_IndividualAddress_Write		X			
						0	1	0	0	0	0	0	0	0	0	A_IndividualAddress_Read		X			
						0	1	0	1	0	0	0	0	0	0	A_IndividualAddress_Response		X			
						1	1	1	1	0	1	1	1	0	0	A_IndividualAddressSerialNumber_Read		X			
						1	1	1	1	0	1	1	1	0	1	A_IndividualAddressSerialNumber_Response		X			
						1	1	1	1	0	1	1	1	1	0	A_IndividualAddressSerialNumber_Write		X			
						1	1	1	1	0	1	1	1	1	1	A_ServiceInformation_Indication_Write		X			
						1	1	1	1	0	1	1	0	1	0	A_NetworkParameter_Read		X			
						1	1	1	1	0	1	1	0	1	1	A_NetworkParameter_Response			X	X	
						1	1	1	1	1	0	0	1	0	0	A_NetworkParameter_Write		X		X	
						1	1	1	1	0	1	0	1	0	1	A_PropertyValue_Read				X	X
						1	1	1	1	0	1	0	1	1	0	A_PropertyValue_Response				X	X
						1	1	1	1	0	1	0	1	1	1	A_PropertyValue_Write				X	X
						1	1	1	1	0	1	1	0	0	0	A_PropertyDescription_Read				X	X
						1	1	1	1	0	1	1	0	0	1	A_PropertyDescription_Response				X	X
						1	1	1	1	1	0	0	1	0	1	A_Link_Read				X	X
						1	1	1	1	1	0	0	1	1	0	A_Link_Response				X	X
						1	1	1	1	1	0	0	1	1	1	A_Link_Write				X	X
						0	1	1	0							A_ADC_Read					X
						0	1	1	1							A_ADC_Response					X
						1	0	0	0	0	0					A_Memory_Read					X
						1	0	0	1	0	0					A_Memory_Response					X
						1	0	1	0	0	0					A_Memory_Write					X
						1	0	1	1	0	0	0	0	0	0	A_UserMemory_Read					X
						1	0	1	1	0	0	0	0	0	1	A_UserMemory_Response					X
						1	0	1	1	0	0	0	0	1	0	A_UserMemory_Write					X
						1	0	1	1	0	0	0	1	0	0	A_UserMemoryBit_Write (not for future use)					X
						1	0	1	1	0	0	0	1	0	1	A_UserManufacturerInfo_Read					X
						1	0	1	1	0	0	0	1	1	0	A_UserManufacturerInfo_Response					X
						1	0	1	1	0	0	0	1	1	1						X
														..	..	Reserved USERMSG					
						1	0	1	1	1	1	0	1	1	1						X
						1	0	1	1	1	1	1	0	0	0						X
														..	..	manufacturer specific area for USERMSG					
						1	0	1	1	1	1	1	1	1	0						X

Table 1 *(continued)*

APCI (bit position) Octet *n* 8	7	6	5	4	3	2	1	Octet *n*+1 8	7	6	5	4	3	2	1	Application layer service	Allowed communication mode(s) Multicast	Broadcast	Point-to-all-point connectionless	Point-to-point connectionless	Point-to-point connection-oriented
						APCI	APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI	data/APCI						
						1	1	0	0	0	0	0	0	0	0	A_DeviceDescriptor_Read				X	
						1	1	0	1	0	0	0	0	0	0	A_DeviceDescriptor_Response				X	
						1	1	1	0	0	0	0	0	0	0	A_Restart				X	
Coupler specific services																					
						1	1	1	1	0	0	0	0	0	0	A_Open_Routing_Table_Req (not for future use)					X
						1	1	1	1	0	0	0	0	0	1	A_Read_Routing_Table_Req (not for future use)					X
						1	1	1	1	0	0	0	0	1	0	A_Read_Routing_Table__Res (not for future use)					X
						1	1	1	1	0	0	0	0	1	1	A_Write_Routing_Table_Req (not for future use)					X
						1	1	1	1	0	0	1	0	0	0	A_Read_Router_Memory_Res (not for future use)					X
						1	1	1	1	0	0	1	0	0	1	A_Read_Router_Memory_Res (not for future use)					X
						1	1	1	1	0	0	1	0	1	0	A_Write_Router_Memory_Req (not for future use)					X
						1	1	1	1	0	0	1	1	0	1	A_Read_Router_Status_Req (not for future use)					X
						1	1	1	1	0	0	1	1	1	0	A_Read_Router_Status_Res (not for future use)					X
						1	1	1	1	0	0	1	1	1	1	A_Write_Router_Status_Req (not for future use)					X
						1	1	1	1	0	1	0	0	0	0	A_MemoryBit_Write (not for future use)					X
						1	1	1	1	0	1	0	0	0	1	A_Authorize_Request					X
						1	1	1	1	0	1	0	0	1	0	A_Authorize_Response					X
						1	1	1	1	0	1	0	0	1	1	A_Key_Write					X
						1	1	1	1	0	1	0	1	0	0	A_Key_Response					X
Open Media Specific Services																					
						1	1	1	1	1	0	0	0	0	0	A_DomainAddress_Write		X			
						1	1	1	1	1	0	0	0	0	1	A_DomainAddress_Read		X			
						1	1	1	1	1	0	0	0	1	0	A_DomainAddress_Response		X			
						1	1	1	1	1	0	0	0	1	1	A_DomainAddressSelective_Read		X			

The APDU shall correspond to the transport layer protocol data unit (TPDU), but shall be reduced by the transport control field. The application control field shall be encoded and decoded by application layer and shall contain the application layer service codes (APCI). The application control field shall have a length of either 4 bit or 10 bit, as specified for each application layer service, in Clause 7.

The codes for the application control field are shown in Table 1. The complete protocol data unit (PDU) for each service primitive is shown in the description of every service.

Not defined and not supported application layer services shall be ignored by the application layer.

7 Application layer services

7.1 Application layer services on multicast communication mode

7.1.1 General

A multicast communication mode shall connect transport layer service access points (TSAP) to application layer service access points (ASAP). When one device sends an A_GroupValue-Service each device which is member of this group shall receive the A_GroupValue_Service.

If the application layer of a device receives an A_GroupValue_Write-Service, it shall map the contained ASAP to exactly one TSAP; it shall search for other associations between ASAPs and the found TSAP informs all these associated ASAPs, as specified in 7.1.3, see Figure 4.

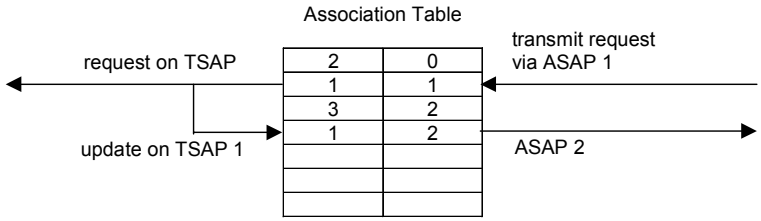

Figure 4 – Mapping the ASAP to the TSAP (example)

If the application layer of a device receives an A_GroupValue_Read-Service, it shall search for all ASAPs associated to this TSAP and shall inform all the associated ASAPs. Only one read response shall be generated by the user as specified in 7.1.2, see Figure 5.

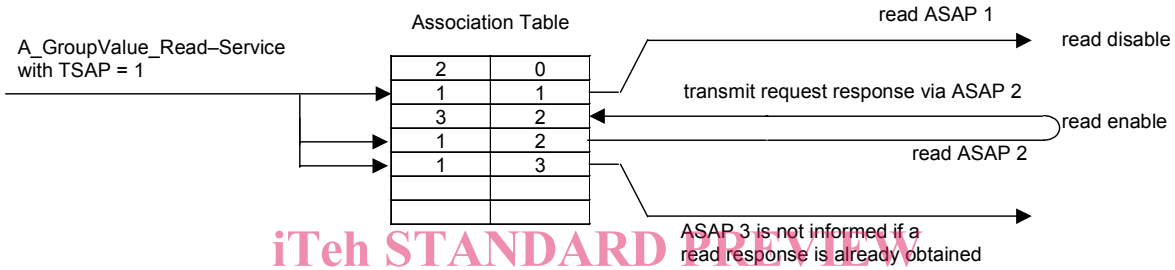

Figure 5 – Mapping a TSAP to an ASAP

If a transmission is requested (read response or write) via an ASAP, the application layer shall take the associated TSAP, update all the ASAPs with the same TSAP and generate an A_Group-Service-Request, see Figure 6.

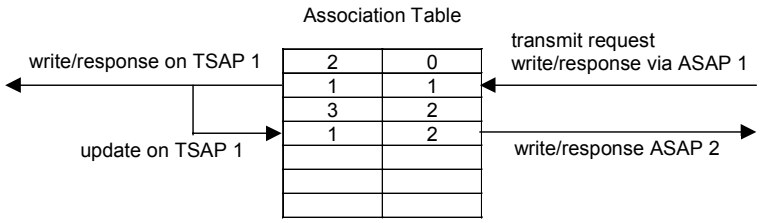

Figure 6 – Handling requests and responses

7.1.2 A_GroupValue_Read Service

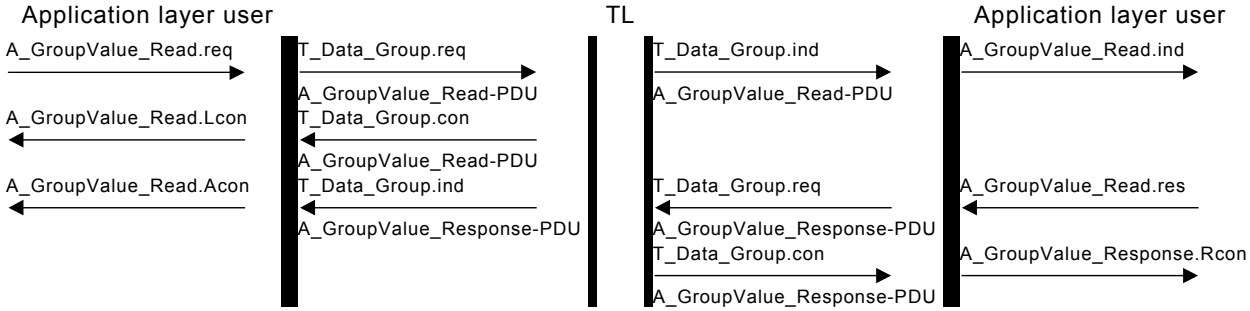

Figure 7 – Message flow for the A_Group_Value_Read service

The A_GroupValue_Read.req primitive shall be applied by the user of application layer, to receive an update of the value of its ASAP by making a communication partner respond with an