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Home and Building Electronic Systems (HBES) Part 4-1: Media independent layers – Application layer for HBES Class 1

Systèmes électroniques pour les foyers domestiques et les bâtiments (HBES)
Partie 4-1: Couches indépendantes des media –
Couche application pour HBES Classe 1

Elektrische Systemtechnik für Heim und Gebäude (ESHG)
Teil 4-1: Medienunabhängige Schicht –
Anwendungsschicht für ESHG Klasse 1

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Contents

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 205, Home and Building Electronic Systems (HBES) with the help of CENELEC co-operation partner Konnex Association (formerly EHBESA).

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50090-4-1 on 2003-12-02.

This European Standard supersedes R205-007:1996.

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Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights other than those identified above. CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2004-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2006-12-01

EN 50090-4-1 is part of the EN 50090 series of European Standards, which will comprise the following parts:

Part 1: Standardization structure

Part 2: System overview

Part 3: Aspects of application

Part 4: Media independent layers

Part 5: Media and media dependent layers

Part 6: Interfaces

Part 7: System management

Part 8: Conformity assessment of products

Part 9: Installation requirements

Introduction

This document specifies the services and protocol of the application layer for usage in Home and Building 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.

1 Scope

This part of the EN 50090 specifies the services and protocol of the application layer for usage in Home and Building Electronic Systems. It provides the services and the interface to the user process as defined in EN 50090-3-2. 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 EN 50090-4-2.

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.

EN 50090-1 [1)] *Home and Building Electronic Systems (HBES) – Part 1: Standardization structure*

EN 50090-3-2:2004 *Home and Building Electronic Systems (HBES) – Part 3-2: Aspects of application – User process for HBES Class 1*

EN 50090-4-2:2004 *Home and Building Electronic Systems (HBES) – Part 4-2 Media independent layers – Transport layer, network layer and general parts of data link layer for HBES Class 1*

EN 50090-7-1:2004 *Home and Building Electronic Systems (HBES) – Part 7-1: System management – Management procedures*

EN 50173-1:2002 *Information technology - Generic cabling systems*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this part the terms and definitions given in EN 50090-1 and the following apply.

3.1.1
application (in the sense of network application)
a system with its associated transmission method which is supported by telecommunications cabling

[EN 50173-1:2002, definition 3.1.2]

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

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1) At draft stage.

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
HBES Class 1	refers to simple control and command
HBES Class 2	refers to Class 1 plus simple voice and stable picture transmission
HBES 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 Services of the application layer

4.1 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 transport layer, the following different types of communication modes shall exist:

a) point-to-multipoint, connection-less (multicast);

b) point-to-domain, connection-less (broadcast);

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

d) point-to-point, connection-less;

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 connection-less communication mode, although application layer services shall always be mapped to transport layer services depending on the type of the communication mode.

4.2 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).

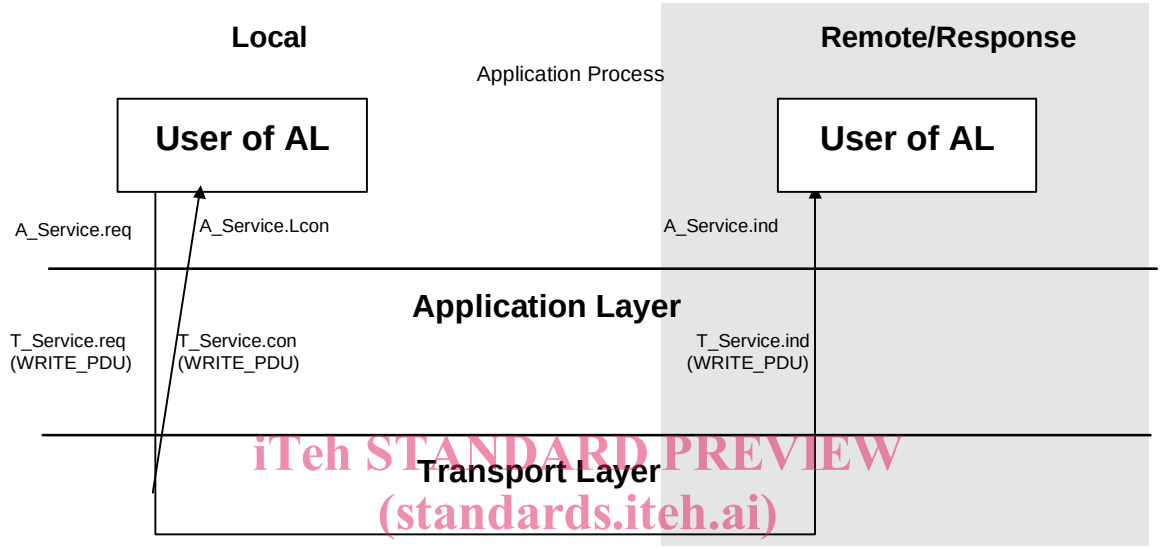

Figure 1 – Interaction of the application layer for services that are not remote confirmed

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.

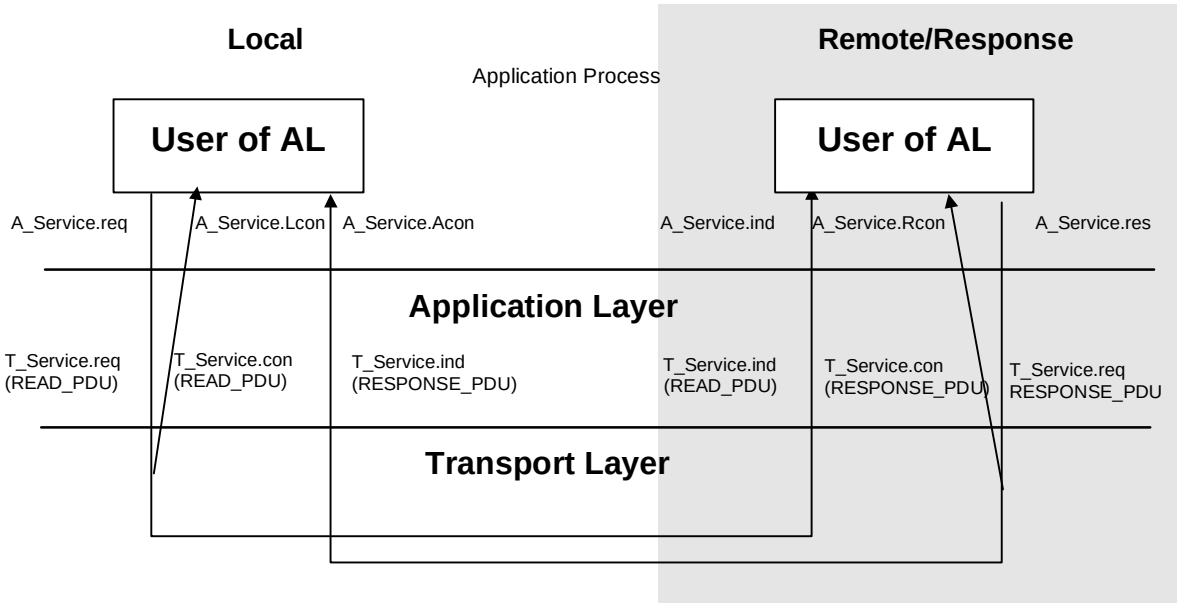

Figure 2 – Interaction of the application layer for services that are remote confirmed

5 Application layer Protocol Data Unit (APDU)

An example of an APDU that can be used is shown in Figure 3.

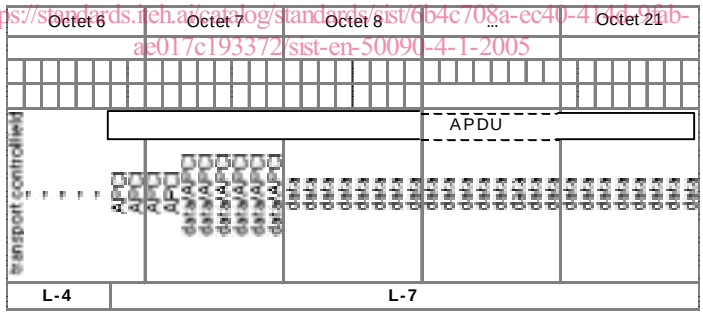

Figure 3 – APDU (example)

Table 1 – APCI overview

APCI (bit position)																Application layer Service	Allowed communication mode(s)				
Octet n								Octet n+1									Multicast	Broadcast	Point-to-all-points connection-less	Point-to-point connection-less	Point-to-point connection-oriented
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1						
						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	1	0	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 – APCI overview *(continued)*

APCI (bit position)																Application layer Service	Allowed communication mode(s)				
Octet n								Octet n+1									Multicast	Broadcast	Point-to-all-point connection-less	Point-to-point connection-less	Point-to-point connection-oriented
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1						
						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	0	1	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 6.

The codes that shall be used 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 ignored by the application layer.

6 Application layer services

6.1 Application layer services on multicast communication mode

6.1.1 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. It is specified in 6.1.3 how this shall be done.

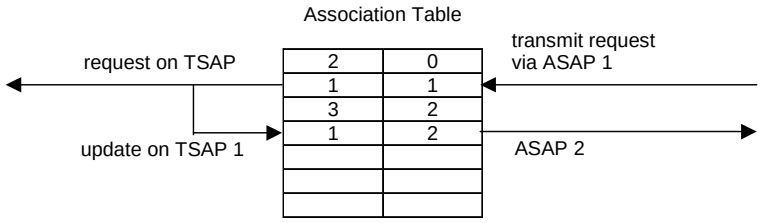

Figure 4 – Mapping the ASAP to the TSAP (example)

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. It is specified in 6.1.2 how this shall be done.

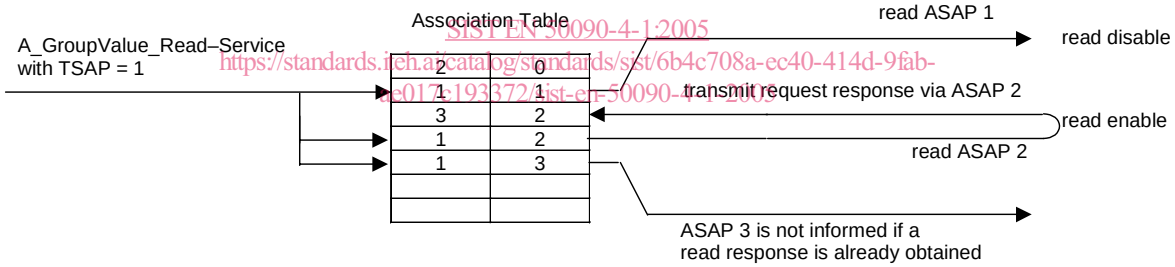

Figure 5 – Mapping a TSAP to an ASAP

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.

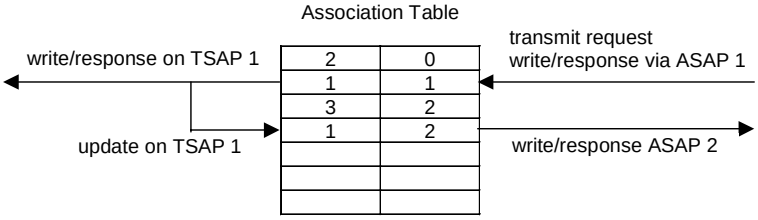

Figure 6 – Handling requests and responses

6.1.2 A_GroupValue_Read Service

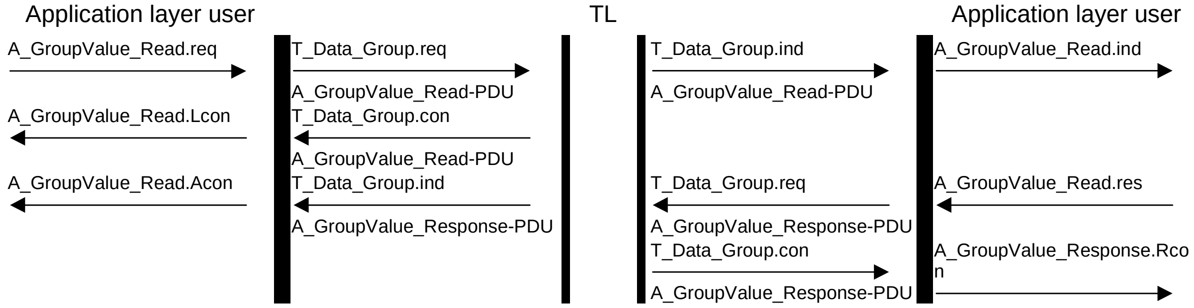

Figure 7 – Message flow for the A_Group_Value_Read service

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 A_GroupValue_Read.res, i.e. the service shall be confirmed by the remote application process. The ASAP shall be associated to the TSAP, i.e. with a group address, as specified in EN 50090-4-2. All other group members shall receive the A_GroupValue_Response-PDU as well.

The local application layer shall accept the service request, map the ASAP to the TSAP and pass it with a T_Data_Group.req to the local transport layer. The parameters TSAP and priority shall be mapped to the corresponding parameters of the T_Data_Group.req primitive, the TSDU shall be an A_GroupValue_Read-PDU.

The user of the HBES system can during configuration decide about this mapping between ASAPs and TSAPs.

The remote application layer shall map a T_Data_Group.ind primitive with TSDU = A_GroupValue_Read-PDU to an A_GroupValue_Read.ind primitive. The arguments TSAP and priority shall be mapped to the corresponding arguments ASAP and priority of the A_GroupValue_Read.ind primitive. One A_GroupValue_Read.ind primitive shall be generated per ASAP that is assigned to the corresponding TSAP.

The remote application process shall evaluate the received A_Group_Value_Read-PDU and use the argument ASAP to obtain the response. It shall respond to the A_GroupValue_Read.ind primitive with an A_GroupValue_Read.res primitive containing the obtained response.

The user of the HBES system can decide during configuration, whether or not the A_GroupValue_Read.res primitive is generated, although exactly one ASAP should generate the A_GroupValue_Read.res primitive.

It is left to the user application programmer to decide whether an A_GroupValue_Read.Acon time-out supervision is necessary.

Two different formats of the A_GroupValue_Response-PDU are used depending on the length of the value. The maximum length of the value shall be 14 octets. Unused data bits shall be set to zero.

Octet 6								Octet 7							
						APCI									
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
						APCI	APCI	APCI	APCI						
						0	0	0	0	0	0	0	0	0	0

Figure 8 – A_GroupValue_Read-PDU (example)

Octet 6								Octet 7								Octet 8...Octet 21							
						APCI										Value (up to 14 octets)							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
						APCI	APCI	APCI	APCI														
						0	0	0	1	0	0	0	0	0	0	D	D	D	D	D	D	D	D

Figure 9 – A_GroupValue_Response-PDU (example), length of ASAP data is more than 6 bit

Values that only consist of 6 bits or less shall have the following optimized A_GroupValue_Response-PDU format:

Octet 6						Octet 7								
						APCI								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
						APCI	APCI	APCI	APCI						
						0	0	0	1	D	D	D	D	D	D	Data

Figure 10 – A_GroupValue_Response-PDU (example) length of ASAP data is 6 bit or less

The remote application layer shall accept the service response, map the ASAP to the TSAP and pass it with a T_Data_Group.req to the local transport layer. The parameters ack_request, TSAP, hop_count_type and priority shall be mapped to the corresponding parameters of the T_Data_Group.req primitive, the TSDU shall be a A_GroupValue_Response-PDU.

The local application layer shall map a T_Data_Group.ind primitive with TSDU = A_GroupValue_Response-PDU to an A_GroupValue_Read.Acon primitive. The arguments TSAP and priority shall be mapped to the corresponding arguments ASAP and priority of the A_GroupValue_Read. Acon primitive. More than one A_GroupValue_Read.Acon primitive may occur depending on the number of group members that have been configured to respond.

A_GroupValue_Read.req(ack_request, ASAP, priority, hop_count_type)

ack_request:	this parameter shall be used to indicate whether a layer-2 acknowledge is mandatory or optional
ASAP:	this parameter shall be used to contain the service access point
hop_count_type:	this parameter shall be used to indicate whether the hop_count shall be set to 7 or if the network layer parameter shall be used
priority:	this parameter shall be used to contain the priority that shall be used to transmit the requested service; it shall be “system”, “urgent”, “normal” or “low”